Contents

Методическая записка

Цель данного курса – приобретение и дальнейшее развитие профессиональной иноязычной компетентности магистрантов, необходимой для адекватного и эффективного общения в различных областях профессиональной и научной деятельности. Пособие составлено в полном соответствии с Федеральными государственными стандартами (ФГОС) третьего поколения для технических направлений подготовки магистрантов. Согласно изложенным в ФГОСах основным положениям компетентностного подхода, магистранты технических направлений подготовки ориентированы на развитие общекультурной компетенции владения иностранным языком как средством делового общения, что подразумевает:

- Способность формулировать устно и письменно свою точку зрения, владеть навыками ведения научной и общекультурной дискуссии на русском и английском языках;
- Способность к коммуникации в научной, производственной и социально-общественной сферах деятельности;
- Способность к активной социальной мобильности;
- Способность к ведению переписки и документооборота; подготовке презентаций, докладов, написанию отчетов, в т.ч. и на иностранном языке;
- Способность участвовать в работе семинаров и конференций на иностранном языке.

Дисциплина «иностранный язык» входит в состав базовой части общенаучного цикла всех направлений подготовки, и по окончании ее изучения выпускник-магистрант должен:

- уметь использовать знание иностранного языка в профессиональной деятельности, в профессиональной коммуникации и межличностном общении.
- знать лексический минимум в объеме, необходимом для профессиональных устных и письменных коммуникаций и для работы с информацией профессионального содержания.
- знать иностранный язык в объеме, необходимом для получения информации профессионального содержания из зарубежных источников; владеть деловым профессионально-ориентированным иностранным языком.
- владеть диалогической и монологической речью на иностранном языке с использованием наиболее употребительных лексико-грамматических средств в коммуникативных ситуациях, характерных для научной деятельности.
- уметь свободно читать научные журналы, проводить презентации и дискуссии на международных конференциях на английском языке как международном языке общения науки и техники.

Предлагая актуальные направления обучения магистрантов в рамках компетентностного подхода, мы хорошо осознаем то, что после двухлетнего перерыва в изучении иностранного языка в бакалавриате им необходимо, прежде всего, восстановить приобретенные ранее языковые, речевые и коммуникативные компетенции. В связи с этим все предлагаемые ниже возможности совершенствования курса обучения магистрантов рекомендуется реализовывать на фоне превалирующей коммуникативной направленности обучения, которая актуализируется на

общепрофессиональной, научно-технической и междисциплинарной тематике текстового материала.

Первая часть пособия для магистрантов состоит из текстов, посвященных современным общетехническим и научным проблемам, представление о которых поможет выпускникам вузов стать по-настоящему успешными коммуникантами. Каждый урок включает ряд дискуссионных упражнений и задания по аудированию, а также упражнения по переводу с русского языка на английский и задания по анализу текстов. В приложениях даны дополнительные материалы, релевантные тематике текстов основной части, которые предоставляют преподавателям дополнительные возможности обогащения текстового материала уроков.

Поскольку в большинстве ФГОСов по техническим направлениям указано знание делового иностранного языка как одна из важнейших целей обучения, данное пособие учитывает указанное требование. В каждом уроке имеется раздел Business English Writing, в котором прорабатываются основные форматы деловых документов: отчет, информационный запрос, CV, жалоба и т.д. Представляя наибольшую сложность для обучающихся, письменная практика является доминирующим дидактическим наполнением делового аспекта. Таким образом, деловой аспект интегрирован в профессионально-ориентированную учебную иноязычную деятельность, так что в итоге синтеза деятельностных компонентов на занятиях по иностранному языку, магистранты занимаются *научно-деловой* деятельностью.

Научно-деловая деятельность является интегративным или синтетическим видом деятельности, включающим такие важные для будущих ученых компоненты как умение устанавливать контакты с коллегами, как в устном, так и в письменном формате, навыки информационного поиска необходимых сведений о профильных научных конференциях и стажировках, знание важных для общения с иностранцами межкультурных особенностей. В связи с этим научная деятельность требует от молодых ученых знания основ публичных выступлений, создания презентаций, невербального общения, умений проведения дискуссии по специальности и работы в команде, а также умения проводить интернет-конференции, т.е. виды деятельности, в процессе выполнения которых происходит формирование проектной компетенции. Зачастую магистранты участвуют в различных конкурсах и грантах, что требует от них знания формата заявки на грант и хотя бы небольшого опыта в ее составлении. Подобная *научно-деловая* деятельность в процессе обучения магистранта способствует формированию ученого, владеющего современными информационными технологиями, готового к социальной мобильности, открытого к международному сотрудничеству.

Тренировка письменной речи продолжается также во второй части пособия, которая посвящена обучению письменной речи. Данная часть представляет собой теоретическую информацию и задания, нацеленные на написание различных документов по грантовому сопровождению, а также на создание научных статей как по основной специальности магистрантов, так и по междисциплинарным исследованиям. Выбор грантового сопровождения в качестве сквозной линии учебной работы представляется нам необходимым, так как данный вид деятельности в настоящее время становится все более перспективным для молодых ученых. Мы считаем допустимым гибкий подход к выбору тематики текстового материала, которая определяется по согласованию с магистрантами. Создание грантовых документов, способствующее развитию навыков составления профессионально-ориентированных текстов, может выполняться небольшими

исследовательскими группами магистрантов в качестве семестрового проекта. Приобретаемая таким образом интегративная проектная компетенция, объединяющая коммуникативную, поисковую и организационную деятельность будет востребована в дальнейшем в научной работе. Примеры грантовых материалов представлены в приложении (см. приложение 6).

В третьей части представлены тексты, описывающие различные ***междисциплинарные*** исследования, которые становятся в настоящее время наиболее инновационными и значимыми для общего интеграционного развития всех отраслей науки. Представление о междисциплинарном подходе как источнике обогащения различных наук новыми идеями является важным для магистрантов всех направлений, и именно поэтому они были включены в данное пособие для тренировки навыков реферативного перевода. Эти тексты предназначены также для перевода и составления глоссария с применением программ-конкордансов.

Реферативный перевод представляет собой сокращенный перевод текстов, построенный на смысловой компрессии излагаемого материала. Грамотное свертывание фактографической информации при сохранении наиболее существенных содержательных аспектов – основная цель данного вида перевода, который стал сейчас весьма распространенным. В качестве характерной черты реферата выступает его объективность, возникающая из тщательной предварительной обработки материала подлинника для выделения важных в смысловом плане текстовых фрагментов. Поскольку обучение непрофильных магистрантов полнотекстовому переводу, к сожалению, не представляется возможным в связи с малым количеством учебного времени, именно реферативный перевод, как менее трудоемкий, но не менее полезный для обучающихся, наиболее целесообразно практиковать в группах магистрантов. Написание и перевод индикативных и информативных рефератов, а также аналогичных аннотаций по междисциплинарно-ориентированным дискурсам является одним из наиболее востребованных видов иноязычной деятельности в сфере науки. Правила реферативного перевода даны в приложении (см. приложение 10).

Развитие ***межкультурного*** аспекта основывается на изучении различных случаев из «практики неудач» в сфере межкультурной коммуникации (см. приложение 12). Тренировка монологической речи сочетается при этом с парной работой и интерактивным полилогическим обсуждением случаев из жизненной практики межкультурного общения и обсуждением возможностей избежания неудач. Для тренировки презентационных навыков магистрантам предлагается изучить прилагаемые в пособии рекомендации и подготовить собственные выступления релевантные изучаемым темам.

Все предлагаемые в рамках ***информационного*** направления факультативные поисковые задания существенно отличаются от обычных языковых, речевых и коммуникативных упражнений, поскольку для их выполнения магистрант должен применить полученные ранее знания по использованию Интернета и компьютерных программных ресурсов. Ему предстоит проделать заданный объем работы и представить результаты в определенном формате, то есть создать «продукт» своей учебной деятельности, например, презентацию по грантовой тематике.

Задания, требующие работы с компьютером, могут быть выполнены также на занятии, поскольку использование ноутбука в аудитории становится уже привычным явлением. Однако в домашних условиях магистранты будут иметь еще больший стимул для

самостоятельного выполнения задания по иностранному языку, если оно связано с использованием компьютера. Нам представляется, что реализация предлагаемого нами информационного направления в компьютерной обучающей среде будет в значительной мере способствовать более эффективной подготовке магистрантов к применению иностранного языка в исследовательской работе.

Сформированная таким образом иноязычная лингвокомпьютерная компетенция, то есть способность и готовность магистрантов применять свои знания компьютерных ресурсов для совершенствования знаний иностранного языка, а также для поиска и анализа текстов по специальности на английском языке, будет особенно востребована в научной сфере их профессиональной деятельности. Приобретенные с помощью информационных технологий новые знания и умения как в сфере изучаемого иностранного языка, так и в профессиональной сфере магистрантов будут востребованы в их научно-практической деятельности.

Поскольку в пособии синтезируются различные виды поурочной деятельности, совпадающие с общеизвестными дисциплинарными направлениями, его можно назвать междисциплинарным. Диаграмма пособия, в котором представлены научно-техническое, деловое, информационное, межкультурное и междисциплинарное направления аудиторной и самостоятельной работы, представлена ниже.

Диаграмма междисциплинарного пособия по английскому языку

В формируемое таким образом единое поле профессиональных знаний и умений магистрантов входят указанные когнитивные компоненты, развивающиеся на основе иностранного языка. Отметим также, что если научно-технический, междисциплинарный и межкультурный компоненты обеспечивают необходимое содержательное варьирование, то информационный или компьютерный компонент в большей степени отвечает за процессуальный аспект пособия. Иностранный язык используется как средство делового, профессионального и межличностного общения,

что вносит весомый вклад в развитие единого поля профессиональных знаний и умений магистрантов технического профиля. Предлагаются также примерные тексты устных тем для аспирантского экзамена (см. часть 4).

Пособие рассчитано на два семестра учебного времени и снабжено диском для аудирования аутентичных материалов. Упражнения со знаком «*» содержат ключи для самоконтроля, представленные в приложении (см. приложение 14). Книга для преподавателей дополняет все виды поурочной деятельности магистрантов, в ней даны скрипты предлагающихся для аудирования материалов, а также ключи к большинству упражнений и тестам.

Part 1. Discussing scientific issues

Unit 1. Modern system of higher education in Russia

Warm-up

Bachelor of Arts (BA)	Бакалавр гуманитарных наук
Master of Arts (MA)	Магистр гуманитарных наук
Bachelor of science (BSc)	Бакалавр естественных наук
Master of science (MSc)	Магистр естественных наук
Undergraduate student	Студент младших курсов
Doctor of Philosophy (Ph.D)	Кандидат наук
Thesis	Диссертация
Syllabus (plural: -i)	Программа дисциплины
Unified national test	ЕГЭ
Two-tier degree structure	Двухступенчатая модель высшего образования
Quality assessment	Оценка качества
Faculty members	Преподавательский состав
Applicant	Абитуриент
Dean	Декан
Head of department	Заведующий кафедрой
Faculty	Факультет
Faculty office	Деканат
Department (full-time / part time / correspondence)	Отделение (дневное / вечернее / заочное)
First-year student	Студент первого курса
Get in to university	Поступать в университет
Graduate from a university	Окончить университет
State Attestation Commission (SAC)	Государственная экзаменационная комиссия (ГЭК)

1. What is the role of education nowadays?
2. Are you satisfied with what and how you have been taught at Polytechnical University?
3. Have you had a chance to compare Russian system of higher education with the system of higher education abroad? What are strengths and weaknesses of our system in your opinion?
4. Do you know the aim of reforms of higher education in Russia which are under way at the moment?
5. Have you ever heard about Bologna process? Can you describe this system?
6. What are the differences between traditional and new educational systems?

Reading

System of education in Russia

Russians have always shown a great concern for education. The right to education is stated in the constitution of the Russia Federation.

Basic general education lasts for nine years. Graduates of this level may continue their education at senior high school to receive secondary general education. They may also enter an initial vocational school or non-university level higher education institutions. Initial vocational schools may offer one-and-a-half to two years' purely professional education joint professional and secondary general education for three to four years and skilled workers' training at different levels. Non-university level higher education institutions also offer three- to four-year professional and secondary general education and two-year vocational training. Secondary general education on the basis of basic general education continues for two years and ends when students are 17-18. Graduates from a secondary general school may apply for entrance to a higher education institution. Secondary education leads to the award of the Certificate of Secondary Complete General Education.

At present, there are some five hundred Cadet schools, military boarding schools, vocational schools and gymnasiums and a great number of Cadet classes in Russia.

Higher education is provided by public and non-public (non-State) accredited higher education institutions. Since 1992, Russian higher education has had a multi-level structure. The term "multi-level" indicates that degrees now maybe obtained on three levels instead of an only one level, as in the former Soviet Union. Nowadays, higher education institutions may confer the following degrees and diplomas:

Level 1 comprises the first two years of studies and is concentrated on compulsory fundamental courses in the given speciality. After this period, students may either continue their studies or, if they do not want to do so, leave the institution with an Intermediate Diploma. The Diploma gives its holder the right to exercise a professional activity in accordance with the level of education it represents. The Diploma supplement lists the results of normal examinations taken during the first two years of study.

Level 2 is a continuation of studies for the Bachelor degree during at least another two years; it leads to the four-year Bachelor degree. The function of the Bachelor degree is to provide a more academically rather than professionally oriented education. Each Bachelor programme contains a defined portion of fundamental education with courses taken from the humanities, the social sciences and economics, and natural sciences. Following a successful attestation, a State Diploma is issued attesting conferral of the Bachelor degree. The supplement to the Diploma includes disciplines taught, number of hours, the grades, the practical training, the results of final state examinations.

Level 3 represents two options after the second level – master and specialist. The traditional qualification of Specialist Diploma has two functions: it opens access to professional practice (e.g. to engineers, teachers, etc.), and it is also the traditional prerequisite for admission to doctoral studies. The qualification of Diploma Specialist is conferred after studies lasting five to six years. State final attestation for a Specialist Diploma covers the defence of a project or a thesis and State final examinations.

Graduates of higher education institutions with a bent for research work may pursue their education as postgraduates attending educational programmes of postgraduate professional education. The hierarchy of advanced degrees in Russia traditionally includes two-stage system of doctoral degrees: the Candidate of Science (Ph.D. degree) and the Doctor of Science (D. Sc.degree).

Both university level higher education institutions and research institutions have the right to set up doctoral study programs. Two national bodies, the Ministry of Education of the Russian Federation and the Russian Academy of Sciences are responsible for the general supervision of doctoral studies in higher education institutions and research institutions, respectively. Educational programs of postgraduate professional education can be implemented in those educational and research establishments which dispose high-quality academic staff, sufficient financial provision and research capacities.

The main route leading to the Ph.d. degree is the postgraduate study which is aimed at imparting in-depth theoretical, special and social education and of training scientific and teaching staff through the mastery of means and methods of scientific study so that they may be able to carry out independent research and educational work with great skill. The general prerequisites for admission to postgraduate study are completion of a full course of study at a university level higher education institution and award of the Specialist Diploma or of the Master degree, proof of creative thinking in practical work or study, and an age limit of up to 35 years for full-time and up to 45 years for part-time doctoral students.

In order to be awarded the Ph.D. degree, a student must complete, present and defend a dissertation (thesis). Dissertation topics should generally correspond to the scientific areas of the basic projects undertaken by the awarding institutions and be approved by its Academic Council for each doctoral student. A Doctor of Science or a professor specializing in the subject area is appointed as a supervisor for each Ph. D. student as soon as he or she joins a postgraduate department.

Today the new edition of the federal state educational standard of high professional education in planning (the third generation of educational standards) is still at the stage of development and implementation in the educational process. The third generation of the Federal State Educational Standard for Higher Professional Education raises the questions of the didactical component of learning disciplines, in particular, document studies, in the related state educational standards, as well as calls for cooperation and integration of the universities methodological departments. These activities are founded institutionally through the operation of the federal agencies of the Ministry of Culture and Mass Communications of the Russian Federation. These agencies formulate competence requirements to professional activities of graduates (namely, document managers, librarians, publishers, booksellers, archivists). The work on this document has raised the question about systematization of the competences, which should be possessed by the graduates of high education.

http://russian-crafts.com/customs/education.html

http://www.voyagesphotosmanu.com/russian_education.html

http://www.universitieseducation.com/about/

http://izvestija.kgasu.ru/files/1_2009/Krasheninnikov_59_65.pdf

http://www.gpntb.ru/win/inter-events/crimea2008/disk/185.pdf

http://www.studyrussian.com/MGU/russian-education-system.html

Building-up vocabulary

1) Complete these sentences with the key vocabulary words in the form required

Postgraduate; quality assessment; disciplines; curriculum; prerequisite; education services; to enroll; faculty members (2); confer; tertiary education; curricular (2); enrolment; to re-enrol; undergraduates

1. Some knowledge of the French language is a …….. for employment there.
2. It is important to develop outcome measures as tools for …….. .
3. The Young Engineers Clubs aim to encourage a greater number of Scotland's more able youngsters to continue with subjects which give them the option of …… in science or engineering.
4. All students are required …….. initially at the beginning of their course of study at the University, and …… annually, at the beginning of each academic year.
5. At the time of …… you will also be given a timetable of lectures and practicals, and details of Faculty and campus induction programmes, which you are expected to attend.
6. Because the national ..... cannot be properly taught without new textbooks, we will earmark funds for class and library books.
7. …… considerations are therefore at the centre of the decision-making process.
8. Such testing is only indirectly related to providing a measure of particular competencies or …… objectives and not at all to providing a description of them.
9. The Centre was established in 1984 to support …….. in developing research projects and to house large-scale multi-disciplinary research projects.
10. Some …… have taken early retirement and left, so a lot of subjects have lost some of their most able people.
11. The Oxford …… student has hit on a novel way of studying moths on his forthcoming trip to Sumatra.
12. The university has already …….. honorary degrees on several prime ministers.
13. There are many opportunities for students from all …….. to enhance and make use of their computing skills while they are …….. .
14. …….. similarly went through a phase of detailed examination of their weaknesses and future potential.

2) Choose one of the words to complete the sentences

1. What …… are you studying at university?
a) objects b) topics c) subjects

2. Many students go on to …… education at university when they finish school.
a) further b) upper c) higher

3. I decided to …… my IELTS exam in order to get a higher score.
a) resist b) remake c) redo

4. She hasn't finished her university course yet: she's still a / an …… .
a) postgraduate b) undergraduate c) pregraduate

5. I had to go to work during the day, but was able to go to …… school after work.
a) night b) post c) evening

6. Most children go to a state school, which is funded by the government. A privileged few, however, benefit from going to a …… school.
a) personal b) private c) privileged

7. As far as I am concerned, we need to make the most of every …… to learn.
a) possibility b) availability c) opportunity

8. Before you join a course at a college or university, you first need to …….. .
a) engage b) enroll c) enlist

9. I believe that the main aim of education should be to help us learn new …….. .
a) abilities b) tasks c) skills

10. The more knowledge you are able to ……, the better your chances of success in life.
a) reach b) acquire c) achieve

3)* This text is from informational booklet about a college. Choose one of two variants in every case.

1. The College welcomes part-time students, whether they are working towards a qualification or attending a recreational education class.
a) Part-time students must choose between studying for a qualification and following a recreational course.
b) Courses both for qualifications and for recreation are offered at the college.

2. If you need any advice, your first point of contact is your tutor, and you can always access other people through him or her.
a) Your tutor can arrange for you to speak to other people if necessary.
b) Your tutor will be able to advise you on anything related to your studies.

3. The College café is open from 8.30 am to 4 pm and from 5 to 8 pm. Outside these hours, a range of food and drinks is available for purchase from vending outlets.
a) Food and drinks can be bought from machines at any time.
b) Food and drinks are only available when the café is open.

4. If you wish to attend a class in English for Speakers of Other Languages, you will need to take our test before you enroll.
a) Students can only attend ESOL classes if they wish to prepare for a test.
b) Students can only attend ESOL classes after they have taken a College test.

5. A senior member of staff is on duty each evening between 6.30 and 9.30, and may be contacted via Reception.

a) A senior member of staff can be found in Reception every evening.
b) If you wish to speak to a senior member of staff in the evening, you should go to Reception.

6. Students claiming concessions for tuition fee payments must still pay the registration fees in full.
a) Certain students are allowed to pay reduced tuition and registration fees.
b) No reduction is available on registration fees.

7. Examination entry fees are additional to the tuition fee paid at enrolment on a course.
a) The cost of taking a course does not include the cost of entering for the exam.
b) The cost of entering for an exam is included in the cost of taking a course.

Translation

Translate these passages from the article about the peculiarities of training engineers in the USA and Europe and do one of the computer-assisted tasks below.

Американская модель инженерного образования и подготовки специалистов в области техники и технологий сегодня весьма авторитетна и популярна в мире. Она включает обучение в университете после 12-летней средней школы по аккредитованной инженерной программе не менее четырех лет и получение академической степени «бакалавр» с последующим лицензированием, регистрацией (сертификацией) и присвоением статуса «профессиональный инженер» по истечении определенного срока успешной работы по специальности. Такая модель подготовки инженеров реализуется во многих странах, в первую очередь в странах – участниках Washington Accord (WA) и Engineers Mobility Forum (EMF): США, Канаде, Японии, Южной Корее, Австралии и др.

Следует отметить, что при двухуровневой структуре высшего образования в этих странах степень «магистр» в области инженерных наук не является принципиально важной при занятиях практической инженерной деятельностью. Она рассматривается скорее как свидетельство более глубокой специализации. Гораздо важнее накопленный положительный опыт практической инженерной работы, который требуется для допуска к экзаменам на статус профессионального инженера, – до 7 лет согласно требованиям EMF.

Сопоставление формальных требований к знаниям и умениям выпускников инженерных программ первого и второго циклов показывает, что в отличие от американской модели бакалавра- инженера болонская модель предусматривает сформированную готовность к комплексной инженерной деятельности у магистра-инженера. То есть «болонский» бакалавр-инженер, судя по планируемым результатам обучения, действительно «отстает» от «американского» бакалавра-инженера.

В американской модели специалисты со степенью «бакалавр» являются основой инженерного корпуса. Согласно болонским принципам бакалавр, подготовленный в области техники и технологии, как выпускник программы первого цикла должен иметь достаточную квалификацию для того, чтобы «войти» в инженерную профессию и найти себе соответствующее место на рынке труда. Профессиональное развитие инженера до уровня самостоятельного творчества предусматривается последующей магистерской подготовкой по программе второго цикла. *(Чучалин А.И. Американская и болонская модели инженера: сравнительный анализ компетенций)*

Text analysis

Read text 1 and text 2 for Unit 1 from *the appendix 1* about the system of higher education in the USA and Great Britain. Answer comprehension check questions while reading. Then try to compare and contrast systems of HE in the two English-speaking countries. What will they have in common with Russian system of higher education after the completion of the reform of HE in Russia? In which aspects will Russian system of HE remain different from the systems of HE in the USA and Great Britain?

1) Visit the annotated sites below describing competences the professional engineer in the USA and Europe should have. Make up lists of competences a professional engineer should have according to these documents. Can you see similarities and differences in requirements to engineers in different countries? Translate your lists into Russian. Compare your translation with the abridged lists from the same sites given in the *appendix 1* (Text 3).

Требования EMF к компетенциям профессиональных инженеров в США изложены достаточно четко и ясно Engineers Mobility Forum: **http://www.ieagreements.com/EMF.**

С учетом требований EMF к компетенциям профессиональных инженеров атрибутами выпускников университетов в странах – подписантах Washington Accord являются следующие: Graduate Attributes and Professional Competencies:

http://www.ieagree-ments.com/GradProfiles.cfm.

Европейской организацией FEANI сформулированы следующие требования к профессиональным инженерам, претендующим на присвоение звания EurIng в соответствии с Болонской моделью инженера: European Federation of National Engineering Associations: **http://www.feani.org.**

2) Compare engineering educational systems in different countries. Visit the website http://www.answers.com/topic/engineer http://en.wikipedia.org/wiki/Engineer%27s_degree and fill in the table.

	General information	System of education	Interesting facts
Canada			
Finland			
France			
Germany			
United Kingdom			

Visit the website given below and compose a short presentation about ways of becoming a successful lifelong learner. Use *appendix 4* to evaluate your groupmate's presentation every time he/she makes it.

http://www.pickthebrain.com/blog/the-7-keys-to-becoming-a-more-effective-lifelong-learner/

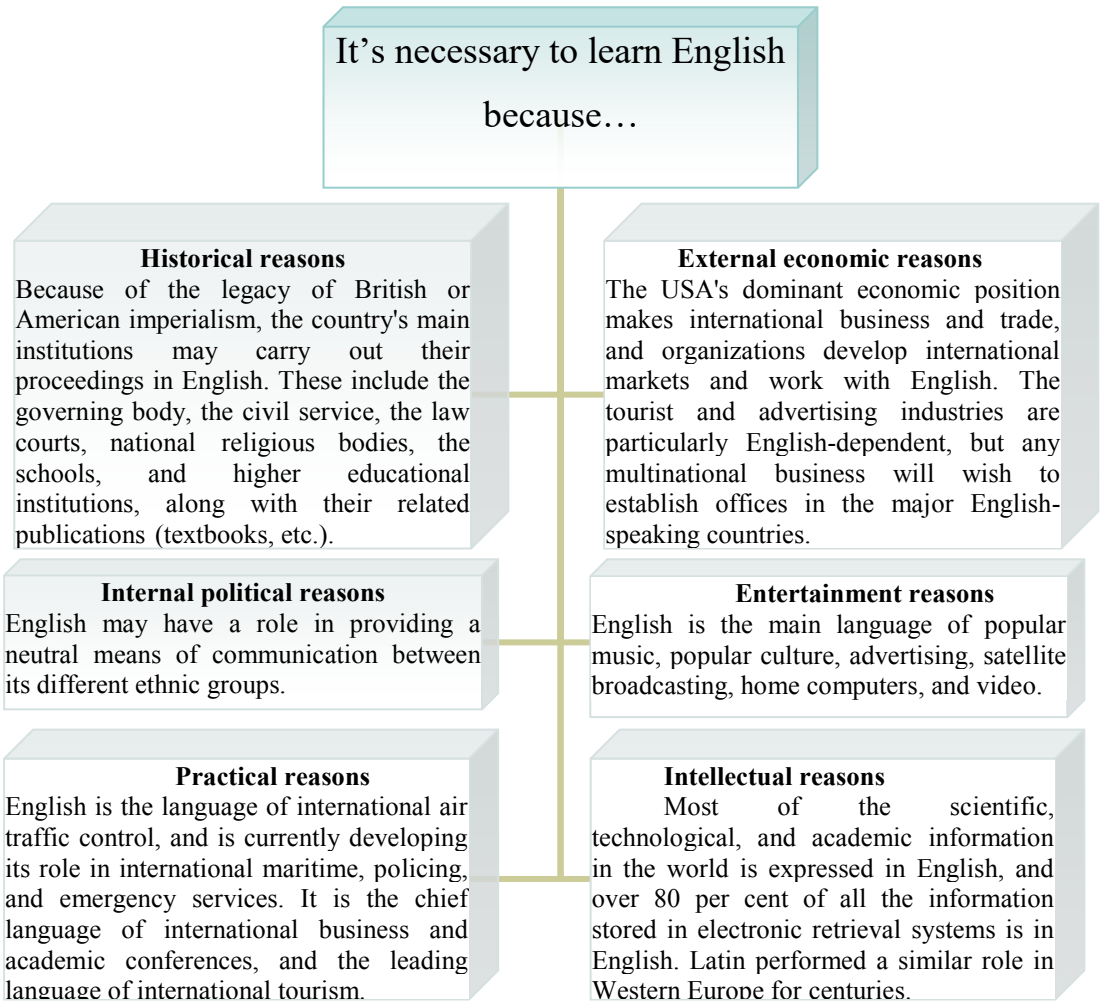
Listening

Importance of learning English

1) Discuss the necessity of learning English in pairs or in small groups

1. Why is it important to know English in Russia today?
2. Is it possible to say that the English is the world language? Why?
3. Does knowledge of English crucial for your sphere of science/future work? Why do you think so?
4. Do you think you have enough knowledge of English for communication with a native speaker/professional needs?

2) Study the following reasons of importance of learning English and discuss them in pairs or in small groups



3) Visit the website given below to listen to two students, who are discussing their English lessons and their preferences in learning the language

http://www.learnenglish.org.uk/prof_mp3/Learning_English.mp3

4) Listen to the conversation again and fill in the gaps

Sam: I'm not 1. _____ in the present perfect! I need to 2. _____ more words. It doesn't really matter if my tenses aren't quite right as long as people understand me.

Jo: She did give us some new words though.

Sam: I know but she didn't 3. _____ any of them on the board. She was too busy talking.

Jo: I wrote them in my book if you want to copy them. I know that if I don't write new 4. _____ down I'll never remember them.

Sam: Thanks. I'll give your book back to you tomorrow. If I don't see a word written down I can never 5. _____ it either and I need to write it down myself to help my 6._____.

Jo: What about the phonemic chart? Did you find that useful?

Sam: Yes, although I found it really 7. _____ to hear the difference in the sounds she made.

Jo: Yes, I'll need to practise them too. If we use the chart every lesson though I think it might help you to
remember new words. If you can 'see' the 8. _____ you need to make it might be 9. _____.

Sam: Yeah, I think you're right. Maybe you should be my 10. _____ !

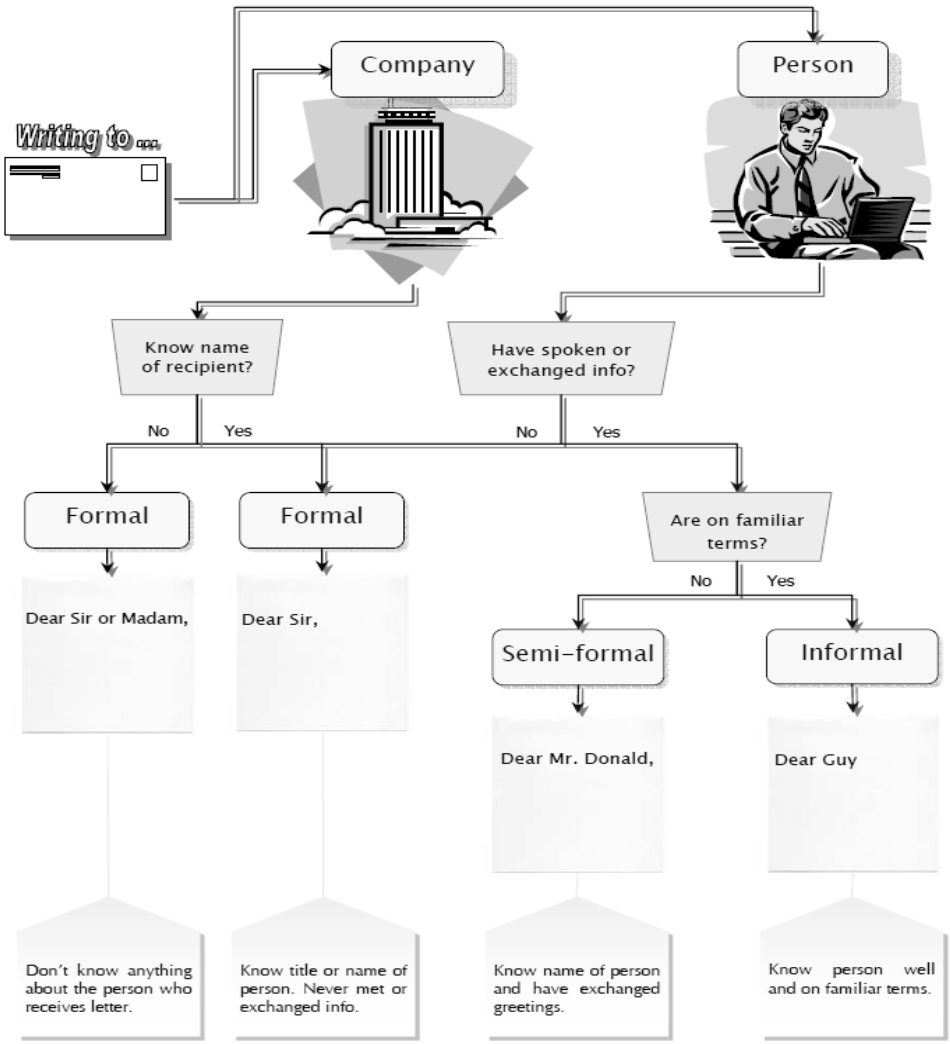
5) Discuss the following questions in pairs or in small groups

1. What do you think about your English lessons? Speak about your English classes at school / university? What lessons are better/worse? Why do you think so?
2. What would you improve in your English classes?
3. Would you like to read/speak/write/listen more?

Business English writing

Letter writing

There are different types of letters such as: reports, letters of complaint, letters of request, letters giving information, CV, letters of application, cover letters, reference letters, and etc. There are also several styles of letters. Each style has its own distinctive features and characteristics. Here is a diagram of rules of language styles.



Here are the characteristics of formal and informal styles.

The characteristics of formal style are:

- No slang
- No abbreviated forms
- No phrasal verbs and short forms
- Frequent use of passive

The characteristics of informal style are:

- Slang, idioms, colloquial language
- Short forms
- Abbreviated forms
- Pronouns omitted

1) The following sentences are mixed formal and informal. Write F (formal) or I (informal) after each sentence and prove your answer.

	F / I	Proof
1. The project will be completed next year.		
2. I showed that his arguments didn't hold water.		
3. I wonder why he put up with those terrible conditions for so long.		
4. Five more tests will be necessary before the experiment can be concluded.		
5. It is possible to consider the results from a different viewpoint.		
6. It has been proved that the arguments so far are without foundation.		
7. He'll have to do another five tests before he can stop the experiment.		
8. It is not clear why such terrible conditions were tolerated for so long.		
9. There are a number of reasons why the questionnaire should be revised.		
10. We'll finish the job next year.		

2) Fill in the gaps of the tables given below with an appropriate word

Formal	Informal
	Help
Commence	
Demonstrate	
	Go
	Want

Formal	Informal
Retain	
Finally	
	At first
	Next
Therefore	

Enquire	
Inform	
	Get
	Need

Comprehension	
	Chance
	Enough
Responsible	

Quiz

3) Visit the website given below and do a quiz "Formal letter vocabulary"
http://www.bbc.co.uk/apps/ifl/worldservice/quiznet/quizengine?quiz=1121_formal_letters

4) Correct the mistakes in the following business letter

February 21th

Dear Alan Green,

Thank you for your letter from February 18 and for your interest in our products. I am sorry to hear that you won't be able to attend our presentation on March but I hope we can to arrange a later date. We're planning another presentation for April 11. I attach a copy of our latest catalogue and prize list. Contact me again if you need any more information.
I look forward to hear from you.
Your sinsirely
Paul Kominsky

5) Study *appendix 7* for samples of formal and informal letters and its components. Imagine that you have found a good solution for a challenging scientific problem in your sphere of knowledge. Write a formal and an informal letters to your boss and a friend correspondingly to tell them about your solution. You can use exercise 2) for formal and informal words.

Writing for grant

a) Many breakthroughs have been made with the help of foundation grants. Sometimes it is necessary we get financial support to make a scientific discovery. Read a short article about grants and discuss it in pairs or in small groups.

Grant

Grants are funding programs created by one party (Grant Makers), often a Government Department, Corporation, Foundation or Trust, to a recipient, often (but not always) a nonprofit entity, educational institution, business or an individual. Most grants are competitive, although some are awarded through non-competitive and/or less-competitive processes.

When applying for a grant, the applicant prepares a well thought-out document, known as a proposal. The proposal clearly and concisely states why a project is being proposed, what will be accomplished, who or what and how the project will provide a needed benefit or change

and, of course, how much is being requested. Most grants are made to fund a specific project and require some level of compliance and reporting. The Grant Writing process involves an applicant submitting a proposal (or submission) to a potential funder, either on the applicant's own initiative or in response to a Request for Proposal from the funder. Other grants can be given to individuals, such as victims of natural disasters or individuals such as people who seek to open a small business. Government grants, which you don't have to repay back, are available for almost anybody. These are money programs that are offered to you by your county and state which you never have to repay. Project related funding to governments, business, communities and individuals is often arranged by application either in writing or on-line.

Tips for finding your grant:

Here are some tips to help you search for your own free government grant:

- Use the internet to search the government grants available to you. When you enter the free money related keywords the search engines take your search words and then find documents and return websites that are related to that keyword you searched for.
- When searching for free government money information, you should try to search for a variety of terms related to free government grants, such as applications, free scholarship, housing grants. Fine tune your keywords while using the search and use specific keywords.
- It would take long to see all the grants from the government available to you, so the more specific your keywords to narrow your search, the better the results.

By searching you can find information about receiving free grant money for yourself. Just by spending a little time online doing some research you could be on the way to receiving a nice check in the mail.

Answer the questions

1. What does the notion "grant" mean?
2. What are the ways of finding a grant?
3. Would you like to apply for a grant? Why? Why not?
4. What kind of grant would you like to apply for?

2) Visit the website given below, look through the list of different grants for different categories of students, for example, grants for undergraduate students, graduate students, etc. Follow program guidelines and choose the grant you would like to apply for. Make a short presentation about it. Use *appendix 2* for the tips how to make a Power Point presentation, *appendix 3* for strategies for oral presentations, and *appendix 5* for rules of body language. Use *appendix 4* to evaluate your groupmate's presentation.

http://www.nsf.gov/funding/

Your presentation should include following points:

- Important information
- Summary of program requirements
- Requirements to submit a proposal
- Why have you chosen this grant?

b) You are a young promising scientist. You are going to conduct a very important scientific research but the only problem you have is lack of money. You are going to participate in the grant competition together with your colleagues. It's necessary you compose a project proposal to take part in this grant competition. Read the information of the second part of the textbook "Academic writing practice" about writing a grant and compose the first part of proposal – <u>cover sheet</u>. Use *appendix 6* to follow the sample of cover sheet of the grant proposal.

Use unit 1 of appendix 11 for written practice exercises

Unit 2. Universities as research centers. My university.

Warm-up

(Scientific) research centre	Научно-исследовательский центр
Research laboratory	Научно-исследовательская лаборатория
Experimental design bureau	Опытно-конструкторское бюро
To conduct/perform/carry out/do an experiment	Проводить эксперимент
Conduct/do research	Проводить исследование
Discovery and breakthrough	Открытие и прорыв
Pioneering work	Пионерская работа (в определенной области)
To present findings	Представлять результаты
Submit a paper/ an article	Представлять статью для публикации
Peer-reviewed journal	Рецензируемый журнал
To hold conference/ seminar /congress	Проводить конференцию/семинар
Organizing committee	Оргкомитет
Proceedings of the conference	Материалы конференции
Publishing house	Издательство
Postgraduate study/student	Аспирантура/ аспирант
To defend thesis/dissertation	Защитить диссертацию
Doctoral studies	Докторантура
International cooperation in solving scientific problems	Международное сотрудничество в решении научных проблем
Programs of support of young scientists	Программы поддержки молодых ученых

1. What do you know about your university / its history and traditions? When was it found?
2. Why was it difficult for you to enter the Polytechnic University? Why not?
3. In what way is university life different from school life?
4. Why do you like the system of education at the Polytechnic University? Why not? What would you like to change in the educational system of your university?

Reading

The Massachusetts Institute of Technology (MIT)

Background

MIT is a private research university located in Cambridge, Massachusetts. MIT has five schools and one college, containing a total of 32 academic departments, with a strong emphasis on scientific and technological research.

Founded in 1861 in response to the increasing industrialization of the United States, the institute adopted the European polytechnic university model and emphasized laboratory instruction from an early date. MIT's early emphasis on applied technology at the undergraduate and graduate levels led to close cooperation with industry but curricular reforms under Karl Compton and Vannevar Bush in the 1930s re-emphasized basic scientific research. MIT was elected to the Association of American Universities in 1934 and researchers were involved in efforts to develop computers, radar, and inertial guidance in connection with defense research during World War II and the Cold War. Post-war defense research contributed to the rapid expansion of the faculty and campus under James Killian.

MIT enrolled 4,232 undergraduates and 6,152 graduate students for 2009–2010. It employs about 1,009 faculty members. 76 Nobel Laureates, 50 National Medal of Science recipients, and 35 MacArthur Fellows are currently or have previously been affiliated with the university. MIT has a strong entrepreneurial culture and the aggregated revenues of companies founded by MIT alumni would be the seventeenth largest economy in the world. MIT managed $718.2 million in research expenditures and an $8.0 billion endowment in 2009.

The Engineers sponsor 33 sports, most teams of which compete in the NCAA Division III's New England Women's and Men's Athletic Conference; the Division I rowing programs compete as part of the EARC and EAWRC.

Research

MIT was elected to the Association of American Universities in 1934 and remains a research university with a very high level of research activity; research expenditures totaled $718.2 million in 2009.

In electronics, magnetic core memory, radar, single electron transistors, and inertial guidance controls were invented or substantially developed by MIT researchers. In the domain of computer science, MIT faculty and researchers made fundamental contributions to cybernetics, artificial intelligence, computer languages, machine learning, robotics, and cryptography.

Current and previous physics faculty have won eight Nobel Prizes, four Dirac Medals, and three Wolf Prizes predominantly for their contributions to subatomic and quantum theory. In the domain of humanities, arts, and social sciences, MIT economists have been awarded five

Nobel Prizes and nine John Bates Clark Medals Linguists Noam Chomsky and Morris Halle authored seminal texts on generative grammar and phonology. The MIT Media Lab, founded in 1985 within the School of Architecture and Planning and known for its unconventional research has been home to influential researchers such as constructivist educator and Logo creator Seymour Papert.

Activities

MIT has over 380 recognized student activity groups, including a campus radio station, *The Tech* student newspaper, an annual entrepreneurship competition, and weekly screenings of popular films by the Lecture Series Committee. Less traditional activities include the "world's largest open-shelf collection of science fiction" in English, a model railroad club, and a vibrant folk dance scene. Students, faculty, and staff are involved in over 50 educational outreach and public service programs through the MIT Museum, Edgerton Center, and MIT Public Service Center. The Independent Activities Period is a four-week long "term" offering hundreds of optional classes, lectures, demonstrations, and other activities throughout the month of January between the Fall and Spring semesters. Some of the most popular recurring IAP activities are the 6.270, 6.370, and MasLab competitions, the annual "mystery hunt", and Charm School. Students also have the opportunity of pursuing externships at companies in the U.S. and abroad. Many MIT students also engage in "hacking," which encompasses both the physical exploration of areas that are generally off-limits (such as rooftops and steam tunnels), as well as elaborate practical jokes. Recent hacks have included the theft of Caltech's cannon, reconstructing a Wright Flyer atop the Great Dome, and adorning the John Harvard statue with the Master Chief's Spartan Helmet. It is a popular misconception and myth though that MIT students have the hobby of creatively editing Wikipedia articles.

http://en.wikipedia.org/wiki/Massachusetts_Institute_of_Technology

Building-up vocabulary

Insert the missing prepositions if necessary

1. At Mallia, a similarly designed suite was located …….. the north-west corner of the temple.
2. A government department may place emphasis …….. careful administration and attention to detail, to research and to political maneuvering.
3. The combination of all these factors led …….. the tragedy on pad 34.
4. Japan contributed …… the cost of the research.
5. It can also be argued that as human beings, while engaged …….. decision-making, we often ignore our fully conscious preferences.
6. Large, colorful graphs and charts will adorn …… the walls of most offices and factories of the workplace of the future.
7. Moreover, students in colleges encompass …….. a wide age range and exhibit very varying academic abilities and communication skills.
8. A further disadvantage is the work involved …… returning the manure to the field.

2) Fill in the gaps with the words and phrases from the box

Bachelor's fresher's Doctor of Philosophy prestigious term sandwich lecture science

1. Universities in the UK usually have three _____ in a year.
2. The first degree most students study at university is also known as a _____degree.
3. What does PhD mean? _____
4. If a degree course includes a one-year industry placement, it's also known as a _____ course.
5. Imperial College in London is famous for its teaching and research in _____.
6. Oxford and Cambridge universities are two of the most _____ universities in the country.
7. The first week of your first year at university is called _____ Week.
8. A lesson at university which takes place in a big hall with lots of students and one teacher is called a _____.

3) Look at the idioms below. Each one is in some way connected to university life. Match each idiom with its definition.

1.	To fly the nest	A	Not to be aware of the realities of everyday life
2.	Saved by the bell	B	Learning from daily life and work rather than going to university
3.	To live in an ivory tower	C	To leave your parents' home for the first time in order to live somewhere else
4.	The university of life	D	Something that you say when a difficult situation is ended suddenly before you have to do or say something that you do not want to

4) Complete the sentences below by using one of the idioms above. Some of them can be used more than once.

1. Now that the kids have _____, I'm thinking about taking a job abroad.
2. My grandfather began to work in the print shop when he was fifteen and learned everything from _____.
3. We were _____ when the fire alarm went before we had to give a very badly-prepared presentation.
4. Like most professors, Jason seems _____. He has no idea how ordinary people cope with life.
5. Parents give their children thousands of pounds to help them _____ and get a foot on the property ladder.

Listening

Education in different countries

1) Discuss education in different countries in pairs or in small groups and read short students' interviews about studying in the UK

1. Do you know anything about universities in European/Asian countries?
2. Have you ever heard about "Fresher's week"? What does this notion mean?

3. What do you think about getting education abroad? What are the advantages and disadvantages of education in other countries?

a) Lin:
I'm from China and I've been studying in Bristol for 4 years. I've just finished my MA degree. When I first arrived in the UK I found it very difficult as I didn't know anybody here, but I soon met other Chinese people studying at the university, and as my English improved I made friends with more people on my course.
Studying in the UK has been a very positive experience for me. I've met a lot of interesting people and travelled around Europe in the holidays. For me the most difficult aspect was having the confidence to take part in tutorials, and when I was told I would have to give a presentation to the rest of the class, I was very nervous. My tutor helped me a lot, however, and said that for someone using their second language I did very well.

b) Tomas:

I came to Leicester on the Erasmus scheme a year ago. I had a choice of universities and I chose this one because it's in a multicultural area. In the Czech Republic I had never come across foreigners, so I was interested in living in a place with people from many different cultures.
The social life here is great, and I will really miss the good friends I've made when I go back home next week. There aren't many other Czech people here so I've had to make friends with people from other countries. That's been very good for my English – some Erasmus students stay mostly with people from the same country and they don't get the same experience. The worst thing has been that everything is so expensive. I had to get a part-time job and borrow from my parents to afford to live here.

c) Syed

I won a scholarship to do an MSc in Telecommunications at Manchester University. The course was excellent and enabled me to get a good job when I finished. Now I'm thinking of doing a PhD before I return to India. I enjoyed the way the course was taught. We were encouraged to think for ourselves rather than read piles of textbooks. It's a different approach to the way I'd studied before, and one that I would recommend.
I would also recommend living in student accommodation – it's the cheapest option and although the rooms are small they have everything you need, and you get to know other people very easily. For me, the only problem was that the social life centres around alcohol, and I don't drink.

2)* Decide if the following statements are true or false

	True	False
1. Lin already had Chinese friends in Bristol.		
2. Lin has been to other parts of Europe.		
3. Lin found it difficult when she had to speak in class.		
4. Tomas chose his university because of the courses it offered.		

5. Tomas enjoyed the social life.		
6. Tomas had to work as well as study.		
7. Syed is trying to get a job now.		
8. Syed liked the way of teaching on the course.		
9. Syed didn't like the student accommodation.		

3) Listen to George Stewart, Dean of Science at the University of Western Australia, talking about the growing relationship with Chinese universities and students to ensure Australia retains its excellence in science.

4) Listen to the recording once again and match words and phrases with their meaning

1.	Outclass	A	To make someone feel afraid or less confident about something
2.	Eligible	B	Used by or popular with most ordinary people
3.	To daunt	C	A system of links or connections
4.	Target	D	To make jokes or say funny things about someone in a friendly way
5.	Demotic	E	To be or do something much better than someone or something else
6.	To kid	F	Something that you are trying to achieve, such as a total, an amount, or a time
7.	Linkage	G	When you work together with another person or group to achieve something, especially in science or art
8.	Collaboration	H	To be able or allowed to do it, for example because they are the right age

5) Discuss the following questions in pairs or in small groups

1. Does collaboration between universities is a good way of increasing students' interest to education?
2. What are the advantages and disadvantages of universities' collaboration?
3. Would you like to study at university in another country? Why? Why not?
4. What foreign university would you prefer to study?
5. What are the ways of winning a chance of getting education abroad?

Outline

Overview
Introduction and main objectives

Background
Explain reasons and subject of the report

Discussion
Results of the report with subheadings

Conclusion
Closing remarks and recommendations

Business English writing

Writing a report

1) Study the following information about ways of writing a report

A report is a presentation of facts and findings, usually as a basis for recommendations; written for a specific readership, and probably intended to be kept as a record. All sections of the report should be clearly defined and structured. Report writing begins with being asked to write a report. Reports are almost always asked for, and are documents - short or substantial in size.

The following should roughly be the structure of a report. Note that these are just *guidelines*, not *rules*. You have to use your intelligence in working out the details of your specific writing. The report has the following structure:

1. overview
2. background
3. discussion
4. conclusion

1. The overview is a brief summary which tells the reader quickly what the report is all about. Begin with a brief summary of the main points of your report. In this part briefly tell what the report is going to tell and then state the objectives of the report. You should identify the purpose and the most important features of the report, states the main conclusion, and sometimes makes recommendations. It does this in as few words as possible, condensing the report to several key sentences.

2. The background sets the scene for your reader. There is no need to confuse the overview with the background if you remember that the overview provides a brief summary of the entire report, whereas the background introduces the subject and explains the reason for the report. According to the requirements of your report, the background should try to answer such questions as Who? What? Why? Where? And When? The background information should place your reader mentally in the picture before he/she has to consider your findings and conclusions.

3. The discussion presents your findings. You should have as much evidence (facts, arguments, details, data, and results) as a reader will need to understand the subject. You must develop these findings in an organized, logical manner to avoid confusing your reader. You should also present your findings imaginatively to hold his/her interest. During the discussion, you may want to use headings and subheadings if you are discussing different aspects of the subject. Each heading or subheading must be an informative mini-title, summarizing the material covered in the paragraphs it is meant to introduce.

4. Conclusions briefly state the major points that can be drawn from the discussion. If there is more than one conclusion, state the main conclusion first, and the remaining conclusions in decreasing order of importance. Although recommendations are not a necessary part of a report, you may include a discussion of your recommendations in this part of the report.

Useful language for report	
Opening remarks	I recently visited and have prepared the following report for your consideration / further to my visit to / the following report relates to my resent visit to…
General comments	On the whole, I found that … / although …, I should point out that…/ It is a fact that …
Comparing places or facilities	One of the most differences between X and Y is that… / X is completely / entirely totally different from Y in that … / Unlike X, Y is … / While / whereas / although X is …, Y is … / X is a little / slightly / somewhat / a great deal that Y / X is not quite / nearly / as (good, convenient) as Y because… / X is virtually / exactly the same as Y when it comes to…
Closing remarks	All things considered, I believe that… / Taking all these points into consideration, I would recommend… / I recommend that we look into the possibility of…

2) You would like to get familiarized with *Purchase College, State University of New York* (SUNY), in order to have some idea about it before you possibly decide to enrol there. Study the http://www.purchase.edu/ site and inform your classmates on the following subjects:

- Undergraduate Credit Courses
- Hybrid and Online Courses
- School of Liberal Studies and Continuing Education
- School of Humanities
- Interdisciplinary Majors and Minors
- Personal Enrichment Courses

You would like to know about the minimum number of hours for getting credits, content and expectations, tuition fees, enrolment policies and any relevant additional information.
Write a report sharing this information and expressing your opinion on the available choice. Use *appendix 7* for samples of report.

Writing for grant

Read the information of the second part of the textbook "Academic writing practice" about writing a grant and compose the preliminary table of contents of the proposal.
Use *appendix 6* to follow the sample of the table of contents of the project proposal.

Use unit 2 of appendix 11 for written practice exercises

1) Visit the website of the Polytechnical University http://www.spbstu-eng.ru/ and compose a short presentation about students' international activities. Use *appendix 4* to evaluate your groupmate's presentation.

2) Find synonyms to the following words from the text: *research, industrialization, revenue, entrepreneur, to contribute.* When looking for the synonyms compare at least two Internet resources which might be helpful to you, e.g. *Wordsmyth* & *Webster* dictionary or any others usually called *thesauruses*. Which of the sources turns out to be most efficient?

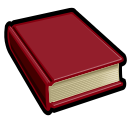
Unit 3. The History of science and engineering

Warm-up

Computer science	Вычислительная техника
Applied science	Прикладная наука
Computer communication science	Теория систем передачи данных
Mechanical engineering	Машиностроение
Civil engineering	Гражданское строительство
Sanitary engineering	Коммунальные службы
Software engineering environment	Средства поддержки программирования
Construction engineering	Строительная техника
The art of the soluble	Искусство решаемого
Simultaneous discoveries	Одновременные открытия
'Inevitability' of discoveries	«неизбежность» открытий
A pattern of innovation	образец нововведений
The steam engine	паровой двигатель
Breadth of application	широта применений
A novel idea	новая идея
Grind scores of lenses	шлифовать множество линз
An aperture stop	апертурная диафрагма
The concave lenses for the myopic	вогнутые линзы для близоруких
Magnification	увеличение
SI	система СИ

1. What do you know about history of your branch of science? How has it developed? What do you know about its roots?
2. Can you name the most outstanding achievement in your sphere of science?
3. What is the current situation in your branch of science?
4. What do would you like to change in your sphere of science to make it more advanced and modern?
5. What do you know about interdisciplinary research of your branch of science?
6. What ways of commemorating great men of science do you know? Give your examples.
7. Which SI units are named after great scientists of the past?

Reading 1



Two short texts below discuss two features which are typical of the history of science. Which are they? Can you give other examples from the history of science and engineering which illustrate the features? Are there similar examples in your branch of science?

The Art of the Soluble

...Science is, in Peter Medawar's words, the art of the soluble. A good scientist knows that the trick is to choose a problem that is ripe for solution, both because the technology is there and because the concepts are in place.

This explains the abundance of examples of simultaneous discoveries in the history of science: Adams and Leverrier found Neptune at the same time and accused each other of plagiarism, contributing mightily to a mood of Anglo-French dislike. Newton and Leibnitz; Darwin and Wallace; Gallo and Montagnier: the list is long.

Scientists speak of the 'inevitability' of discoveries in sharp contrast to other historical events. The structure of DNA would not have remained mysterious for long if Francis Crick and James Watson had not existed. James Watt was not indispensable to progress, though the steam engine was. There is irony here.

Check your comprehension

~ If you plagiarize someone or something, you _ _ _ _ them.

~ Are inevitable events avoidable?

~ Would progress have been made without Crick, Faraday, Watson, and Watt?

The Shock of the Not Quite New

It is a commonplace that technologies move only slowly from first invention to widespread use. What is striking in the history of technological innovation, however, is that the dispersion of a new technology is not just slow but extraordinarily uncertain even after its first commercial applications have been realised.

This runs against the conventional wisdom, which holds that the uncertainties are much reduced after the first commercial use. The evidence to refute that view comes not just from any old technologies, but from many of the most important innovations of this century.

Check your comprehension

~ If something is a commonplace, is it unusual?

~ Is the conventional wisdom a minority view?

~ If an opinion is refuted, is it disproved?

Consider the laser, a comparatively young technology with more development in store. Beyond uses in measurement, navigation and chemical research, applications have expanded to include the reproduction of music (to make the laser a household product); surgery; printing; the cutting of cloth and other materials; and, its most significant use to date, telecommunications.

Together with fibre optics, the laser has revolutionised the telephone business, yet lawyers at Bell Labs were initially unwilling even to apply for a patent for their invention, believing it had no relevance to the telephone industry.

If that story sounds familiar, there is a reason: such a pattern of innovation is not exceptional, nor even quite common, but typical. The steam engine was invented in the eighteenth century as a way of pumping water out of mines; it remained nothing more than a pump for many years. Then it became a source of power for industry, then a source of power for transport, then a way to generate electricity. The first inventors never dreamed of such a breadth of application (or of electricity, for that matter). ...

Check your comprehension

~Has the laser reached the end of its development?

~ If something follows a pattern, have similar events already happened?

~ These inventors never dreamed the applications would be so w i d e _ _ _ _ _ _ .

Reading 2

Read the text about the early evolution of the telescope. Which of the two features typical of the history of science does it illustrate?

The early evolution of the telescope

by Philip Morrison

The American Philosophical Society proved/revealed Galileo was not one quick to rush into print. Eighteen years a professor in Padua, he had published only two books, one an instruction manual for a geometrical instrument he had invented and sold out of his own private workshop, the other a witty polemic against a Padovan student who had sought to rip off that very instruction book! But from the time Galileo first heard of the spyglass of "a certain Fleming" until his book *The Starry Messenger* opened the Copernican universe to our extended senses, just 10 months elapsed. He was onto a good thing and he published it first, in March of 1610.

There were probably three men who had telescopes by early in October of 1608. At the autumn fair in Frankfurt that year a Dutchman was offering one for a high price. And it was not a novel idea to look through such an instrument at the stars. The first printed account from the Hague mentions that the glass showed new stars in the Pleiades, months before any telescope came to Paris, Milan, Venice or Naples. But Galileo worked hard and well, he had the help of a master craftsman in his own shop, he had access to selected lots of the best Venice glass, he ground scores of lenses and chose the best of them, he grasped the importance of a steady mount and he invented an aperture stop to correct the faults of his high-powered lenses. There is no doubt that his was a magnificent and purposeful development, even though it was not an invention; he described the new cosmos, beating out Thomas Harriot, Simon Marius, Christoph Scheiner and the wonderful Paris amateur Nicolas de Peirese, all of whom were gazing at the sky through telescopes at about the same time.

Check your comprehension

~ Did Galileo have a lot of publications?

~ Was Galileo the first man to look through a telescope at the stars?

Professor Van Helden's fascinating and learned little monograph *The Invention of the Telescope* includes Galileo; it focuses, however, not on him but on the "certain Fleming," whoever he was. We see the main evidence in this long detective story: 30-odd key passages from books, letters, journals and official documents, in the original Latin, English, Italian, French and Dutch, all with clear translations. The documents begin with Roger Racon, who wrote in about 1250 of "Glasses so cast, that...starres shine in what place you please." They end with a long passage of 1655 from a book seeking "the true inventor of the telescope" and finding him in an artisan of Middelburg in Zeeland.

One reads the 1609 letter of Giovan-baptista della Porta himself, who says of the new Dutch wonder: "I have seen it, and it is a hoax, and it is taken from the ninth book of my *De*

refractione." Nevertheless, the noble Girolamo Sirtori pursued the glass over ail Europe, seeking experts who could grind usable lenses. He examined and measured Galileo's own tube and lenses at that famous dinner of the Academy of Lynxes in Rome where the word "telescope" was coined in the spring of 1611, yet he was not able to duplicate the success of the Tuscan artist.

There is a famous journal entry that cites a statement (against self interest) made by the son of Sacharias Janssen, the strongest candidate for the designation of inventor, suggesting that the father (an unsavory character, convicted counterfeiter) "made the first telescope in this country in the year 1604, after one belonging to an Italian which bore the date *anno* 190." (Stillman Drake thinks the error was for 1590; since the text clearly intends a date, 1590 is hard to fault.) Another claimant is a Florentine. Raffael Gualterotti, who wrote Galileo in April 1610, asserting that he, and no Dutchman, was the inventor: "It is now twelve years since I made an instrument ... for the benefit of a cavalry soldier … A feeble thing."

Check your comprehension

~ What does the author refer to as 'long detective story'? What is the main evidence in it?

~ When and where did the word "telescope" first appear?

How can all this be true? How can the telescope have become the cynosure of Europe in a year or two after 1608 and yet have remained unknown for a decade or more before that? Professor Van Helden, a historian at Rice University, offers a persuasive explanation. The erect-image two-lens instrument was indeed not very new. It had been found quite naturally during the 1590's by combining the then common lenses of the spectacle makers. It was of some help to myopics, but its lower power and poor lenses made it a thing of no great virtue. The early optical experimenters, on the other hand, were hoping for wonders like the glass of Roger Bacon's dreams. There was no excitement in "a feeble thing" with magnification well under two diameters. But the concave lenses for the myopic grew better, their focal lengths shorter, the glass clearer; and one of those clever Middelburg artisans, or more than one, saw a new potential. The magnification, close to threefold, was striking.

We can see now, however, that in a way "telescopes" existed before anyone, *including the men who made them*, were aware of them." The key point was the development of effective higher magnification. That began near Middelburg when the utility came clear. The rich, the curious and the military seized on the device. Galileo speedily developed the concept, pushed the workable power up to near 30 in a few months and put it to work penetratingly. Once the news got around more than one man realized he had already long possessed the same device, but with low magnification and used in a very different way. Quantity is the hero of this story, as it is of much science in the post-Galilean years.

Check your comprehension

~ What magnification did the early erect-image two-lens instruments have?

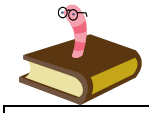
~ Who or what is the hero of the story about the invention of the telescope?

1. What did a Padovan student want to do with the first book by Galileo published in Padua?
2. What does the expression "extended senses" mean?
3. What did Galileo do to improve remarkably the early telescope?

4. Was his book *The Starry Messenger* published earlier than the accounts of scientists and famous amateurs who were gazing at the sky through telescopes at about the same time?
5. Does Prof. Van Helden imply that readers of his book know Latin and Medieval English, French, Italian and Dutch?
6. Did the noble Girolamo Sirtory manage to make a better telescope than Galileo's?
7. Why were the first telescopes things of no great value? Who used them?
8. What was magnification of the first telescopes? Which magnification seemed striking to people of that time?
9. What was magnification of Galileo's telescope? Who is the hero of this story?
10. What has happened many times in the history of science in the post-Galilean years?

Building-up vocabulary

1) Complete these sentences with the key vocabulary words in the form required



a) breadth of application b) develop the concept c) 'Art of the Soluble' d) magnification e) the steam engine f) pattern g) scores of h) a novel idea i) simultaneous j) focal length k) purposeful development l) well under m) inevitability

1. With an instinct for what was later called the ……, most biochemists confined themselves to more manageable topics.
2. Re-engineering has been embraced publicly by …… companies, including AT&T, Texas Instruments, Ford, Citicorp, Aetna Life and IBM.
3. All other aspects of the training situation were radically altered in the shift from the …… to the successive procedure.
4. The steady and …… of pupils' language and of their skill in its use should be a constant aim of education at all stages and levels.
5. Britain's car manufacturers and oil companies now accept the …… of lead-free petrol.
6. The group award should be designed to allow …… and reflect the needs associated with problem solving and task management.
7. An examination of the historical …… of change serves four main purposes.
8. With a …… factor of eight and an objective lens diameter of thirty millimetres the binoculars are compact, lightweight and rugged, classic all-purpose glasses.
9. For a given visual angle, image size depends on …… .
10. This was the invention of ……, originally devised for draining water from the tin mines, but then adapted by James Watt for driving factory machinery.
11. In the 1960s *British Rail* came up with …… for a faster train.
12. This led to an especially sharp decline during the 1960s, from over half a million to …… 300,000.
13. He hopes to …… further.

2) Study ГОСТ 8.417-2002. ЕДИНИЦЫ ВЕЛИЧИН: http://nolik.ru/systems/gost.htm
How many physical units are named after great scientists?

3) Match the name of the physical unit (column A) with its обозначение (column B) and the scientist whose name was given to the unit (Column C)

A	B	C
1. A unit for measuring the frequency of sound waves	a) C	a) *Nicola Tesla*
2. A unit for measuring dynamic viscosity	b) F	b) *Alessandro Volta*
3. A unit for measuring heat capacity	c) dB	c) *James Clerk Maxwell*
4. A unit for measuring electric charge	d) Gs	d) *Michael Faraday*
5. A unit for measuring magnetic flux	e) V/m	e) *James Prescott Joule; William Thomson, 1st Baron Kelvin*
6. A unit for measuring magnetic induction	f) T	f) *Alexander Graham Bell*
7. A unit for measuring electric field intensity	g) Hz	g) *Blaise Pascal*
8. A unit for measuring capacitance	h) Pa•s	h) *Charles-Augustin de Coulomb*
9. A unit for measuring magnetic-flux density	i) Mx	i) *Heinrich Rudolf Hertz*
10. A logarithmic unit that is widely known as a measure of sound pressure level, but is also used for a wide variety of other measurements in science and engineering, most prominently in acoustics, electronics, and control theory.	j) J/K	j) *Karl Friedrich Gauss*

Translation

Translate these passages about some things typical of the history of science. The history of developing systems of machine translation (MP) is under author's consideration.

Марчук Ю.Н. Компьютерная лингвистика: учебное пособие. М.: АСТ: Восток – Запад, 2007.

С.95

Теперь, когда проблема машинного перевода насчитывает уже пять десятков лет, можно уверенно оценить то, что было когда-то сделано. Как бывает в истории науки, многие концепции оказались тупиковыми и не дали положительных результатов в решении проблемы, другие даже уводили куда-то в сторону от нее и служили трамплином для погружения в море совсем других идей и концепций. В то же время идеи контекстного разрешения лексической многозначности и принцип контекстологического словаря показали свою действенность и дали возможность ввести системы машинного перевода с английского и немецкого языков на русский в промышленную эксплуатацию.

С.263

Переоценка возможностей компьютера дорого обошлась науке и значительно задержала исследования и разработки практически ориентированных систем. Трудности перехода на язык смысла от нормального естественного языка чрезвычайно велики. Десятилетия

работ в области МП показали, что обращение к смыслу переводимого, такое вроде бы простое и естественное для человека-переводчика, в машинном моделировании чрезвычайно сложно…

С.245
Если вспомнить появление самой идеи МП и связанных с этим сенсаций, когда компьютеры, только что появившиеся в научной практике, были окутаны ореолом какой-то тайны и с ними обращались лишь посвященные, то приходится признать, что эта идея произвела огромное влияние на лингвистику. Появилось множество новых наук: математическая, статистическая, алгоритмическая, вычислительная, инженерная, квантитативная лингвистика и другие. Все они отражали новое направление в языке, новые взгляды на объект, предмет, методы и результаты теоретических изысканий в области естественного языка. Возникли предположения о возможности математического моделирования языка.

Text analysis

a) Read text 1 for Unit 3 from the *appendix 1 of supplementary file* about the Hubble telescope. Which features typical of the history of science does it illustrate?

b) Read text 2 for Unit 3 from the *appendix 1 of supplementary file* which discusses briefly the history of engineering. For which field of engineering have you been trained for? Do you know the names of legendary engineers in your field?

Search the Internet for collecting information about them. Prepare short presentations and share your findings with your groupmates.

1) Choose the scientist from the list you don't know much about. Collect some information about him, prepare a short presentation and share your findings with your groupmates.

2) Visit sites of US Metric Association (USMA) http://lamar.colostate.edu/~hillger/links.htm#educational and The Metric System A reference to the world's most widely used system of measurement http://www.krysstal.com/metric.html#metric and acquaint with metric systems

Listening

Telecommunication

1) Read a short article about history of telecommunication and discuss it in pairs or in small groups

Telecommunication *is the transmission of messages, over significant distances, for the purpose of communication.*

In earlier times, telecommunications involved the use of visual signals, such as beacons, smoke, semaphore telegraphs, signal flags, and optical heliographs, or audio messages via coded drumbeats, lung-blown horns, or sent by loud whistles, for example.

In the modern age of electricity and electronics, telecommunications now also includes the use of electrical devices such as telegraphs, telephones, and teletypes, the use of radio and microwave communications, as well as fiber optics and their associated electronics, plus the use of the orbiting satellites and the Internet. The first breakthrough into modern electrical telecommunications came with the push to fully develop the telegraph starting in the 1830s. The use of these electrical means of communications exploded into use on all of the continents of the world during the 19th century, and these also connected the continents via cables on the floors of the ocean. The use of the first three popular systems of electrical telecommunications, the telegraph, telephone and teletype, all required the use of conducting metal wires.

A revolution in wireless telecommunications began in the first decade of the 20th century, with Guglielmo Marconi winning the Nobel Prize in Physics in 1909 for his pioneering developments in wireless radio communications. Other highly notable pioneering inventors and developers in the field of electrical and electronic telecommunications include Charles Wheatstone and Samuel Morse (telegraph), Alexander Graham Bell (telephone), Nikola Tesla, Edwin Armstrong, and Lee de Forest (radio), as well as John Logie Baird and Philo Farnsworth (television). Telecommunications play an important role in the world economy and the worldwide telecommunication industry's revenue was estimated to be $3.85 trillion in 2008. The service revenue of the global telecommunications industry was estimated to be $1.7 trillion in 2008, and is expected to touch $2.7 trillion by 2013.

2) Match words and phrases from the text with their meaning

1.	Transmission	A	To suddenly increase greatly in number, amount, or degree
2.	Telegraph	B	Money that a business or organization receives over a period of time, especially from selling goods or services
3.	To explode	C	An important new discovery in something you are studying, especially one made after trying for a long time
4.	Satellite	D	To try to judge the value, size, speed, cost etc of something, without calculating it exactly
5.	Revenue	E	Thin metal in the form of a thread, or a piece of this
6.	To estimate	F	A machine that has been sent into space and goes around the Earth, moon etc, used for radio, television, and other electronic communication
7.	Wire	G	The process of sending out electronic signals, messages etc, using radio, television, or other similar equipment
8.	Breakthrough	H	An old-fashioned method of sending messages using radio or electrical signals

3) Visit the website given below and listen to a telecommunications expert talking about the most recent developments and current situation in this sector.
http://podcasts.britishcouncil.org/podcasts/prof-Web_telephony.mp3

4)* Listen to the recording once again and decide whether the statements are true or false

	True	False
1. Paul Carr is an expert in the IT sector.		
2. Until Skype arrived VOIP technology was difficult to use.		
3. Skype claims 85 million customers globally.		

4. Skype spends a lot of money on advertising.		
5. Skype has no competitors.		
6. It is not possible to use Skype in the UK.		
7. Fibre optics will change Internet use.		

5) Discuss the following questions in pairs or in small groups

1. What do you think about development and current state of telecommunications?
2. Is it possible to say that telecommunications in Russia keep up to date?
3. How wide do you use telecommunications in everyday life / for education / in your sphere of science?
4. What do you think about possible innovations in telecommunications in the future?

Business English writing

Letter of request

1) Study the following information about ways of writing a letter of request

A request letter is written to ask for a favor. Hence the language should be simple and polite. Introduce yourself and tactfully address the reader. Put forward reasonable demands as polite requests. Mention the exact point and be brief in communication.

Outline

Introduction
Paragraph 1
State reason(s) for writing

Main body
Paragraphs 2-3
Explain reasons for making the request

Paragraphs 4-5
State expected results / consequences

Conclusion

The first paragraph should contain reason(s) for writing. **The next several paragraphs** explain reasons for making the request and possible results of this request. **The last paragraph(s)** should have information where the person can contact you for further details. If asking for a favor, mention your ways of returning it. Do not apologize for asking for the favor. Make it look like it will return another good turn. Ask for an appointment or a personal meeting if the favor is too big and requires the involvement of people in higher positions. Mention alternatives if the favor is too big or according to you maybe beyond the means of the addressee. Don't forget to thank the person.

2) Imagine that you are a young scientist. You have been studying abroad for several years and now you have returned to Russia. Write a letter of request to your scientific supervisor and ask him / her about the changes occurred and current state in your sphere of science. Use *appendix 7* for sample of letter of request and useful language given below.

Useful language for letters of request		
Opening remarks	**Formal**	**Informal**
	I am writing to inquire about / in connection with / could you possibly / I would be grateful if you could / would it possible for you / I would appreciate some information about / another matter I need / I wondered if you could possibly do me a favour / I would be most grateful if you could	I want you to tell me / can you let me know / can you also find out / could you do something for me

Closing remarks	I look forward to receiving / I would appreciate it if you could inform me as soon as possible / I hope it is not so much trouble / thank you in advance for your assistance in this matter	Please let me know / tell me soon / I hope you can help me out

3) Work in pairs and check your groupmate's letter using the criteria for assessment of *appendix 8*

4) You would like to get familiarized with the site of *St. Olaf College***,** Northfield, Minnesota, http://www.stolaf.edu/catalog/1011/academiclife/bmcomprehensive-requirements.html/ in order to compare it with Purchase College (see above) concerning the studies of humanities. You would like to know about the disciplines included in the Bachelor curriculum and their syllabi, the minimum number of hours for getting credits, content and expectations, tuition fees, enrolment policies and any relevant additional information. Write a letter to your friend sharing this information and expressing your opinion on the available choice.
Write a report and compare St. Olaf and Purchase Colleges in terms of at least five comparable parameters.

Writing for grant

Read the information of the second part of the textbook "Academic writing practice" about writing a grant and compose project summary. Use *appendix 6* to follow the sample of the project description of the project proposal.

Use unit 3 of appendix 11 for written practice exercises

Unit 4. Science and engineering in the modern world

Warm-up

Artificial intelligence	Искусственный интеллект
Digital revolution	Цифровая революция
Software	Программное обеспечение
Hard disk	Жесткий диск
Hardware	Аппаратное обеспечение
Disk drive	Дисковод
Satellite	Спутник
Milky Way	Млечный путь
Computer hacking	Хакерство
Floppy disk	Дискета

1. What is the main technological event of the 21st century? Can you name the main technological achievements for several last years?

2. What do you think about computer influence on the developments in technology and science?
3. Is it possible to say that space exploration is important for science?
4. What are the possible dangers from space?
5. What are the advantages and disadvantages of space explorations?

Reading

1. Why is it necessary to conduct space explorations? Why? Why not?
2. Is it reasonable or mot to spend great amounts of money for space explorations?
3. What country made the first breakthrough in space exploration?
4. What outstanding events in the space exploration history can you name?
5. Do you know what «Space Race» means?

The beginning of space race

Space exploration is the investigation of physical conditions in space and on stars, planets, and other celestial bodies through the use of artificial satellites (spacecraft orbiting the earth), space probes (spacecraft that pass through the solar system and that may or may not orbit another celestial body), and spacecraft with human crews. The Space Race was a heated competition between the United States and the Soviet Union, as each side tried to match or better the other's accomplishments in exploring outer space. It involved the efforts to explore outer space with artificial satellites, to send man into space, and to land him on the Moon.

The Space Race effectively began after the Soviet launch of Sputnik 1 on October 4, 1957. The term originated as an analogy to the arms race. The Space Race became an important part of the cultural, technological, and ideological rivalry between the United States and the Soviet Union during the Cold War. Space technology became a particularly important arena in this conflict, because of both its potential military applications and the morale-boosting social benefits. After the Second World War, the US and the USSR, once wartime allies, became involved in a Cold War (1945–91) of espionage and propaganda. The United States defence strategy included a large air-refuelable, strategic bomber air force and advance bases in countries close to Soviet airspace. Having neither an equivalent air force, nor analogous advance bases near the continental United States, the USSR countered with long-range rockets and missiles.

On July 29, 1957, in recognition of the 1957-1958 International Geophysical Year, the White House announced that the U.S. intended to launch satellites by the spring of 1958. This became known as Project Vanguard. On July 31, the Soviets announced that they intended to launch a satellite by the fall of 1957. On 4 October 1957, the Soviet Union successfully launched Sputnik 1 into space, the first artificial satellite to orbit the Earth, thus beginning the Space Race and making the USSR the first space power. A month later, the USSR successfully orbited Sputnik 2, with the first living passenger, a dog named Laika.

In the Soviet Union, a country recovering from a devastating war, the launch of Sputnik and the following program of space exploration were met with great interest from the public. It was also important and encouraging for Soviet citizens to see the proof of technical prowess in the new era. But nearly four months after the launch of Sputnik 1, the United States successfully launched its first satellite, Explorer 1, with an alternate program on an accelerated schedule, becoming the second "space power". Within a year,

the United States Congress passed the legislation creating NASA. When it began operations on 1 October 1958, NASA consisted mainly of the four laboratories and some 8,000 employees of the government's 46-year-old research agency for aeronautics.

Apart from their political value as technological achievements, these first satellites had real scientific value. Sputnik helped to determine the density of the upper atmosphere, through measurement from the ground of the satellite's orbital changes. It also provided data on radio-signal distribution in the ionosphere. Pressurized nitrogen, in the satellite's body, provided the first opportunity for meteoroid detection. If a meteoroid penetrated the satellite's outer hull, it would be detected by the temperature data sent back to Earth. Engineering and biological data from Sputnik 2 and the dog Laika were transmitted back to Earth. Two photometers were on board for measuring solar radiation (ultraviolet and x-ray emissions) and cosmic rays.

Explorer 1 flight data led to the discovery of the Van Allen radiation belt by James Van Allen, considered one of the outstanding discoveries of the International Geophysical Year. The first animal to orbit the earth, the dog Laika (in English, "Barker"), traveled in the Soviet Union's Sputnik 2 in 1957. The dog was not meant to be returned back to Earth, and died five to seven hours after launch from overheating and stress. In 1960 Soviet space dogs Belka and Strelka orbited the earth and successfully returned.

The U.S. space program imported chimpanzees from Africa and sent at least two into space before launching their first human orbiter. The Soviet Union launched tortoises, flies, and mealworms in 1968 on *Zond 5*, which became the first animals to fly around the Moon. The Soviet cosmonaut Yuri Gagarin became the first human in space when he entered orbit in the Soviet Union's *Vostok 1* on April 12, 1961, a day now celebrated as a holiday in Russia and in many other countries. He orbited the Earth for 108 minutes. Twenty-three days later, in the Mercury capsule *Freedom 7*, Alan Shepard became the first American in space. Though he did not achieve orbit, unlike Gagarin he was able to exercise manual control of his spacecraft's attitude and retro-rocket firing. On 20 February 1962 John Glenn became the first American to orbit Earth, completing three orbits in *Friendship 7*. His capability of manual attitude control became crucial when the automatic system failed.

Technology, especially in aerospace engineering and electronic communication, advanced greatly during this period. The effects of the Space Race, however, went far beyond rocketry, physics, and astronomy. "Space age technology" extended to fields as diverse as home economics and forest defoliation studies, and the push to win the race changed the very ways in which students learned science. Today over a thousand artificial satellites orbit earth, relaying communications data around the planet and facilitating remote sensing of data on weather, vegetation, and human movements to nations who employ them. In addition, much of the micro-technology which fuels everyday activities from time-keeping to enjoying music derives from research initially driven by the Space Race.

Sum up the information on space exploration development in the USSR and the USA and fill in the table.

	First satellite in space	First animals in space	First men in space
The USSR			
The USA			

Building-up vocabulary

1) Translate the following words and phrases from English into Russian

Celestial bodies; artificial satellite; space probe; solar system; outer space; accomplishment; arms race; rivalry; military application; allies; long-range rocket; devastating war; prowess; density; upper atmosphere; nitrogen; to penetrate; x-ray emission; cosmic rays; manual attitude control; rocketry; home economy; remote sensing; vegetation.

2) Read the short text below. Use the words given in CAPITALS below the passage to form the new words fitting the corresponding spaces in the text.

The Sun

Fortunately for life on Earth, the Sun's production of heat is remarkably consistent. But scientists are aware that even a small change would have grave (1)_____ for the future, triggering either a new ice age, or runaway global warming. There is (2)_____ that this has happened before. In 17th century England, for example, the River Thames in London was regularly (3)_____ over. Scientists now think that fluctuations in the Sun's temperature caused a 'Little Ice Age' at that time. Indeed, the latest theory is that the processes going on in the centre of the Sun are inherently (4)_____. If the experts are right, there could be many changes in the Sun's (5)_____ this century and the (6)_____ is that the temperature here on Earth will get (7)_____ hotter and hotter.

1. SEQUENCE
2. EVIDENT
3. FREEZE
4. STABLE
5. BRIGHT
6. LIKELY
7. STEADY

Translation

Translate the following article from Russian into English

Европейская наука

«Евросайенс» – это европейский аналог американской ассоциации AAAS (American Association for Advancement of Science), которая известна в России новостным интернет-ресурсом EurekAlert! и своим журналом Science. AAAS старый и очень опытный игрок, ведущий свою историю с 1848 года. Сегодня в ее рядах 262 научных общества и академии и сотни тысяч членов, в том числе несколько тысяч из Европы. Огромный бюджет, выделяемый правительством США на науку, а также обилие американских научных новостей во всех изданиях мира – все это, и не без оснований, AAAS ставит себе в заслугу. «Евросайенс» пока еще младенец – всего полторы тысячи членов из 40 стран. Но желание догнать своего заокеанского собрата велико. К тому же в Европе накопилось слишком много проблем – малые бюджеты на науку, миграция ученых в США, спад интереса молодежи к науке и многое другое, что хорошо знакомо и нам в России. Однако решать проблемы в Европе, объединяющей разные страны, языки и культуру, труднее.

Сегодня европейская наука как никогда нуждается в открытом и продуктивном диалоге ученых с обывателями, поскольку она не может развиваться без поддержки общества. «Европа должна действовать быстро, если не хочет оказаться на задворках мировой научной арены и превратиться в музей науки, прославляющий свое доблестное прошлое», – сказал Карл Сандберг. Основания для озабоченности есть: 61,3%

европейцев считают, что наука слишком быстро меняет нашу жизнь, 63,2% полагают, что наука несет опасные знания, а 80,5% утверждают, что ученые пренебрегают этикой. Еще более беспокоит европейцев негативное отношение молодежи к науке. Любопытные данные обнародовал на форуме Свен Сёберг из Университета Осло и Копенгагена, руководитель проекта ROSE (The Relevance of Science Education). Цель проекта, объединяющего исследователей из 30 стран мира, – выяснить отношение 15-летних подростков к науке. В каждой стране было опрошено в среднем несколько сотен школьников – по одному классу в не менее чем 25 школах. Оказалось, что чем более развиты страны, тем пессимистичнее подростки. Самые негативные оценки дали подростки из Японии, считающие, что от науки скорее больше вреда, чем пользы, а самыми оптимистичными оказались подростки из Уганды, которые видят в науке одни плюсы и хотят стать учеными. Российские школьники более позитивны, чем европейцы, однако перспектива работать исследователями их не вдохновляет так же, как и европейских подростков.
http://www.strf.ru/material.aspx?CatalogId=221&d_no=32799
http://www.runtech.ru/node/2933

Text analysis

Read text 1 and text 2 for Unit 4 from the *appendix 1* and analyze them from the point of view of variety of science branches.

Listening

The URL and searching information

1) Read a short article about URL and discuss it in pairs or in small groups

What can a URL tell us?

URL *stands for "Uniform Resource Locator" and is the address of the page you are accessing. You usually see one at the top of your browser when you have a web page open. They look something like this:* http://www.bbc.co.uk

URLs may look tricky to unravel, but the best way to work out "who" and "where" is to break down the URL into its component parts. Let's look at the following web address in detail: http://www.law.bris.ac.uk/research/interests.html

URL	What's this?	Tell me more…
http://	Transfer Protocol	The first part of the URL is called the protocol. It tells your browser how to deal with the file that it is about to open. The most common you will see is HTTP, or Hypertext Transfer Protocol.
www.law.bris	Server Name	This refers to the computer (or server) where the web pages or files you want to view are hosted. It usually contains the name of the organization responsible for the site; in this case, the Law department at the University of Bristol.

ac	Top Level Domain /Organisational Code	This tells you something about the type of organization responsible for the site (see below for more information).
Uk	Country Code	This tells you in which country the site is hosted (find out more below).
Research	Directory	This is a specific folder of information on the server (although it's not always given). There can be any number of these in a URL, indicated by "/" characters.
Interests.html	File Name / File Type	This is the file you are, or will be viewing. In this case, .html is the file extension. This can change depending on the type of file: e.g. .mov is a video file; .doc is a document; .gif is an image.

You can often find out more about the nature of the organization that owns the server from the organization code. For example:

- **.ac, .edu** academic or educational servers
- **.co, .com** commercial servers
- **.gov** government servers
- **.org** non-governmental, non-profit making organizations

You can sometimes find out more information about the country in which the server is based from the country code. For example:

- **.au** Australia
- **.ca** Canada
- **.de** Germany
- **.fr** France
- **.uk** United kingdom

2) Analyze the website addresses given below from the point of view of their structural components (See exercise 1 for reference)
http://www.ariadne.ac.uk/issue13/music/
http://www.cofe.anglican.org/lifeevents/funerals/
http://www.sharp.arts.gla.ac.uk
http://www.intute.ac.uk/socialsciences

3) Listen to Jason Hadington, an expert in Internet search and discuss the ways of finding information in pairs or in small groups
1. Have you ever heard and used the mentioned websites?
2. What websites do you consider useful and important? Why?
2. What kind of information do you usually look for?
4. What other web-resources do you recommend for getting information?

4) Are the following sentences true or false?

	True	False
1. All search engines follow the same rules.		
2. Google is considered to be one the best search tools.		
3. Yahoo has more categories than Google.		
4. There are surprisingly few online dictionaries.		
5. Nowadays most libraries are online.		
6. Google has more than a billion pictures.		
7. Kidsclick was designed by school teachers.		
8. Intute was set up by American universities.		

5)* Match the websites with the information that can be got from them

1.	www.google.com, www.yahoo.com	A	A search engine designed to provide specific answers to questions
2.	www.factbites.com	B	A website provides current affairs
3.	www.dictionary.com, www.thefreedictionary.com	C	Internet sites for kids
4.	www.youtube.com	D	An online dictionary and encyclopedia that gathers information from a variety of sources
5.	www.kidsclick.com, www.yahooligans.com	E	Free online service that helps you to find the best web resources for your studies and research
6.	www.bbc.co.uk	F	Search engines
7.	www.intute.ac.uk, www.vts.intute.ac.uk	G	A collection of more than 100 million video clips
8.	www.ask.com	H	A website provides answers to specific questions

6) Visit the websites for students www.intute.ac.uk, www.vts.intute.ac.uk **and describe them.**

1. What kind of information can you find there?
2. Can you say that the site has a convenient interface?
3. What information can be useful for you and your scientific work?
4. What advantages and disadvantages of this site can you name?
5. Will you use it in future?

7) Prepare a report to compare the information you heard about websites www.intute.ac.uk, www.vts.intute.ac.uk **and your own attitude to these web-resources**

Business English writing

Letter giving information

1) Study the following information about ways of writing a letter giving information

Begin your letter by stating who you are and giving your status or position (such as student, researcher, interested consumer, etc.), and tell how you found out about the individual or entity that you are writing to. Specifically indicate the inquiry that was made, as you understand it. Express your appreciation for the person's interest. You might want to include with your response letter any brochures, catalogs, reports, or other helpful information available.

Then give required information in detail. **The next several paragraphs** should provide additional information about the subject you are interested in. If appropriate, you might want to include additional information about your organization, the products or services you sell, or the subject matter of the inquiry, beyond the scope of the original inquiry.

Close by saying that you would be happy to help the reader in the future if he/she needs further assistance or by wishing him/her well in his/her endeavor or project, etc.

Outline

Introduction
Paragraph 1
State reason(s) for writing

Main body
Paragraphs 2-3
Give information required

Paragraphs 4-5
Provide further explanations / suggestions / opinions

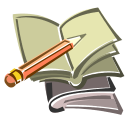
Conclusion
Final paragraph
Closing remarks
Full name

2) Imagine that after publishing a paper which contained a detailed description of the experimental set you received a letter from a colleague who tried to repeat your experiment in his laboratory but failed. Think about what he could have done wrong and write him a letter giving information on conducting the experiment in question. Use *appendix 7* for sample of letter giving information and useful language given below.

Useful language for letters giving information		
Opening remarks	**Formal**	**Informal**
	I am writing in reply to your letter asking for information about / I am writing to inform you about / in reply to your query / I would like to let you know that	This is what I found out / remember the information you wanted? / you wanted me to tell you some things about
Closing remarks	I hope that I have been of some assistance to you / please inform me if I can be of any further assistance / I hope I have answered all your questions / please do not hesitate to contact me if you require any further information	I hope this will help you / let me know if you need any more help

3) Work in pairs and check your groupmate's letter using the Criteria for assessment of *appendix 8*

Writing for grant



Read the information of the second part of the textbook "Academic writing practice" about writing a grant and compose project description.

Use unit 4 of appendix 11 for written practice exercises

SMS language

1) Study brief information about SMS / e-mail language and SMS / e-mail symbols and compose your SMS or e-mail using SMS / e-mail language for your classmates.

SMS language *or* ***Textese*** *is a term for the abbreviations and slang most commonly used due to the necessary brevity of mobile phone text messaging, in particular the widespread SMS (short message standard) communication protocol. SMS language is also common on the Internet, including in e-mail and instant messaging.*

Abbreviation	Meaning	Translation
RU OK?	Are you OK?	Ты в порядке?
Y NY?	Yes and you?	Да, а ты?
OK CU2DAY?	OK. See you today?	Я в порядке. Сегодня встречаемся?
NO 2MORO WER?	No. Tomorrow. Where?	Нет, давай завтра. Но где?
@J'S, CUL8TR	At John's. See you later.	У Джона. Увидимся позже.
LUV B / ILY	Love Bob / I love you.	Люблю тебя. Твой Боб / Я тебя люблю
F2T?	Free to talk?	Ты можешь общаться сейчас?
N. WER RU?	No. Where are you?	Нет, а ты где?
@WK.NU?	At work. And you?	На работе. А ты?
@HM. CU L8TR?	At home. See you later?	Я дома. Ну что, позже увидимся?
Y. WEN?	Yes. When?	Да, во сколько?
@7. TA4N. CU	At 7 o'clock. That's all for now. See you.	Давай в 7. Все, пока. До встречи.
OK. B4N	OK. Bye for now.	Ну, договорились. Пока.
BTW	By the way	Кстати
IMO	In my opinion	По моему мнению
TTFN	Ta ta for now (bye for now)	Ну, все, пока

2) But sometimes it's inappropriate to use this e-mail language (especially if it's formal or business style). Visit the website given below and learn the information about e-mail etiquette. Compose an e-mail message according to the rules and have it checked by one of your classmates. http://www.dynamoo.com/technical/etiquette.htm

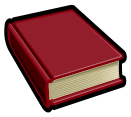
Unit 5. My scientific interests

Warm-up

Degree work / research / thesis /	Дипломная работа
Paper Scientific / research project	Научный / исследовательский проект
Research laboratory	Исследовательская лаборатория
Scientific adviser	Научный руководитель
To conduct an experiment	Проводить эксперимент
Theoretical study	Теоретическое изучение
The purpose of my work is…	Цель моей работы – …

1. What branch of science are you interested in most? Why?
2. What is the value of science?
3. What does the science serve for?
4. How has science changed our / your life?
5. Have you ever made a presentation based on topics of your spheres of science?

Reading



1. When did you start being interested in science?
2. Who or what can you thank for your scientific interests?
3. What are the main qualities a person needs to become a scientist?

Ask Dr. H: "Who Do You Credit For Your Scientific Interests?"

Dr. Holdren delivered the 9th Annual Peter M. Wege Lecture on Sustainability at the University of Michigan, March 22, 2010 (*John P. Holdren is Assistant to the President for Science and Technology and Director of the White House Office of Science and Technology Policy).*

From the earliest age about which I can remember much—three and a half or four—I was curious about how machines work, how nature works, and how society works. My mother, Virginia Holdren, was a voracious reader of both fiction and nonfiction and turned me into the same. (She made a weekly trip to the library, returning each time with a large shopping bag of books for both of us.) My parents bought me the 1953 edition of the World Book Encyclopedia when I was nine, and over the next two years I read it all from A to Z. I had some superb teachers in the public schools I attended growing up in San Mateo, California, starting with the Beresford Park elementary school where my sixth grade teacher, in particular, Mrs. Azevedo, had an effect on my intellectual growth and ambitions second only to that of my mother. Both

of them told me that any career I might want was open to me except music (because I couldn't hold a tune) and medicine (because I couldn't stand the sight of blood).

In high school my most inspiring teachers were an algebra teacher, an English teacher, and a Latin teacher. All of them were great at communicating their excitement about their fields in a way that got the students excited about learning … and got some of us, including me, interested in the idea that we might one day want to teach, too. But the high school experience that most shaped my career trajectory was reading two books as a sophomore—C. P. Snow's THE TWO CULTURES and Harrison Brown's THE CHALLENGE OF MAN'S FUTURE—

that opened my eyes to the proposition that many of the most important challenges facing society could only be understood—and thus could only be met—by combining knowledge from the natural sciences and engineering, from the social sciences, and from the humanities. The challenges they were writing about were poverty, hunger, disease, resource scarcity, conflict, and weapons of mass destruction. It struck me then, and I never changed my mind thereafter, that the most rewarding thing somebody interested equally in natural and social science, technology, and the humanities could do is try to learn enough about all of them to be able to contribute to "putting the pieces together" in the way Snow and Brown argued was needed to address these great, interdisciplinary challenges.

So I ended up at MIT with an aerospace engineering major and a humanities minor in German literature and philosophy, while also taking all the courses for a physics degree but for one lab course. (I had decided, based on a number of exciting experiences, that taking lab courses was dangerous to my health AND to that of my classmates.) I had great professors at MIT in all the fields I was interested in, and one of the many things I learned from them was that university teaching is a great job—you get the rewards of teaching combined with opportunities to team with industry on practical problems and to get involved in policy in advisory roles for government.

For my PhD at Stanford I worked on a problem in theoretical plasma physics that was germane both to astrophysics and to harnessing fusion energy; I chose that field and that problem both because of the challenging math and physics involved and because there was an application to one of the great societal challenges—providing abundant energy for civilization—that I had become interested in. Through a series of coincidences I also ended up working in parallel with biologists at Stanford (on the causes and consequences of global environmental change) and, through them, meeting life scientists and Earth scientists and social scientists from all around the country who were working on this set of problems in an interdisciplinary way.

After getting my PhD, I worked on fusion energy at the Lawrence Livermore National Lab for a couple of years and then worked at Caltech on problems of energy, environment, and development for a year or so, before getting the chance to start up and teach in an interdisciplinary graduate program in Energy and Resources at the University of California in Berkeley. I spent 23 years there studying and teaching about the scientific and technological and policy dimensions of the challenges the world faces around energy, environment, and international security—just what I'd hoped, when I was in high school, that I could find a way to get paid for doing. I then spent another 13 years doing similar things at Harvard University and the Woods Hole Research Center before having the great good fortune to be tapped by the newly elected President Obama as his science and technology advisor.

I had many more great mentors along the way than I've taken the space to mention here, and I'm grateful to all of them. The career advice that came from all of the them was the same, and I'm happy to pass it along here: "Think about what you'd really like to do, don't assume it's out of reach, work hard to equip yourself for doing it ... and it probably will happen."

John P. Holdren is Assistant to the President for Science and Technology and Director of the White House Office of Science and Technology Policy

http://www.whitehouse.gov/blog/2010/05/21/ask-dr-h-who-do-you-credit-your-scientific-interests

1. Who had the greatest effect on Dr. Holdren's intellectual growth and ambitions in his childhood?
2. What course didn't Dr. Holdren take at MIT and why?
3. Why does Dr. Holdren think that teaching is a great job? Can you agree with him?
4. What problem did Dr. Holdren work on for his PhD?
5. What universities did Dr. Holdren worked at after getting his PhD?
6. What was he studying and teaching about before being appointed the Assistant to the President for Science and Technology?
7. How do you understand the career advice Dr. Holdren finishes his lecture with? Do you agree with it?

Building-up vocabulary

1) Match words and their meaning

1.	Public school	A	The sciences involved in the study of physical world and its phenomena
2.	Elementary school	B	The principal field of study of a student at a university
3.	High-school	C	A second-year undergraduate
4.	Natural sciences	D	A school for young children; usually the first8 or 8 grades
5.	Major	E	A public secondary school usually including grades 9 through 12
6.	Minor	F	A tuition free school in the United States supported by taxes and controlled by a school board
7.	Sophomore	G	The non-principal field of study of a student at a university.

2) Explain the following abbreviations and acronyms, translate them in Russian

a) Mrs.
b) MIT
c) PhD
d) lab
e) math

3) Find the words and phrases in the text which are synonymic to the following once:

a) greedy, gluttonous (reader)
b) excellent (teacher)
c) encouraging (teacher)
d) causing danger, perilous
e) thrilling, stirring (experience)

4)* Read a short article about nanotechnology and fill in the gaps with the correct word or phrase from the box

Consensus	engage	tyres	risks	empirical	peers	coolant	benefits

Nanotechnology

So is the public afraid of nanotechnology? No, they are not. The 1) ..... findings that we have show that the public is still fairly neutral about nanotechnology, in part because little is known about it. So that's where the public stands at the moment. I did work that looked at public willingness to use a new commercial product containing nanotechnology, and in fact I studied four different commercial products. One was a drug product, another was skin lotion, the third was automobile 2) ..... containing nanotechnology, and a fourth was a refrigerator gas 3) ..... containing nanotechnology, all of which were claimed to have both risks and benefits.

I just want to talk briefly about some results that we found from the Centre for Nanotechnology in Society at Arizona State University. The current project scores how public perceptions match up, or don't match up actually, with scientific 4) ..... on nanotechnology. One of the most interesting findings is that nanotechnology may be one of the first emerging technologies where scientists are more concerned about some of the risks than the public, particularly in the areas of environment and human health. Another interesting finding is that, not surprisingly, scientists thought that nanotechnology was more useful for society and more morally acceptable than the public, but the need for regulation is pretty similar across the scientists and public. Their sense for the need for regulation in the nanotechnology area was quite similar, with only 22% of the public and 13% of scientists thinking that it was more important to advance nanotechnology quickly than to protect the public from unknown 5) ....., so pretty low numbers there. Then the last finding that I just want to emphasise is we asked scientists who had the highest level of expertise to communicate with the public about potential risks and 6) ..... of nanotechnology. And their response was they overwhelmingly supported university scientists. When we asked the public who they trusted most to actually communicate with them about the risks and benefits of nanotechnology, they trusted the university scientists the most. So we actually think this a policy-relevant finding, that university scientists don't often 7) ..... in this sort of dialogue with the public but they do seem to have high levels of trust from the public as well as high levels of expertise according to their 8) ..... .

Translation

Translate the following article from Russian into English

Билл Гейтс (Уильям Генри Гейтс III) – богатейший человек в мире, компьютерный магнат, основатель и владелец корпорации Microsoft. Свою первую компьютерную программу Билл Гейтс создал в 13 лет. Билл Гейтс родился 28 октября 1955 года в Сиэтле, штат Вашингтон, США. В 1973 году он поступил в Гарвардский университет, но был отчислен спустя 2 года, так как Гейтс уже стал заниматься созданием программного обеспечения. Так, вместо диплома Гарвардского университета на свет появилась компания "Майкрософт". Новая компания стала создавать программное обеспечение для входивших в моду персональных компьютеров. В

декабре 1974 года Билл Гейтс увидел компьютер за $397, который, по словам его друга Аллена, мог бы собрать любой. Единственное, чего не хватало машине было программное обеспечение.

Билл Гейтс и Аллен связались с представителями фирмы M.I.T.S, предложив им программное обеспечение (версию BASIC) для их компьютера Altair 8800. Этот вариант устроил менеджеров, которые предложили молодым людям работать над написанием языков программирования. Они уехали в Нью-Мехико, где и началась история Micro-soft. Первые пять заказчиков Microsoft обанкротились, но Гейтс не отчаивался и в 1979 году возвратились в Сиэтл. Билл Гейтс приобрел систему QDOS (Quick and Dirty Operating System) за $50.000, изменил название на MS-DOS и продал лицензию IBM. Вырученные деньги позволили Microsoft работать в течение нескольких лет. Презентация нового компьютера IBM с программным обеспечением Microsoft создала настоящую сенсацию на рынке. Многие компании начали обращаться к Microsoft за лицензией. В течение многих лет Microsoft продолжал захватывать мировой рынок, выпустив приложения Microsoft Word и Microsoft Excel.

http://allfaces.ru/?p=12, http://www.buffett.ru/buffett/rich/untitled.php

Text analysis

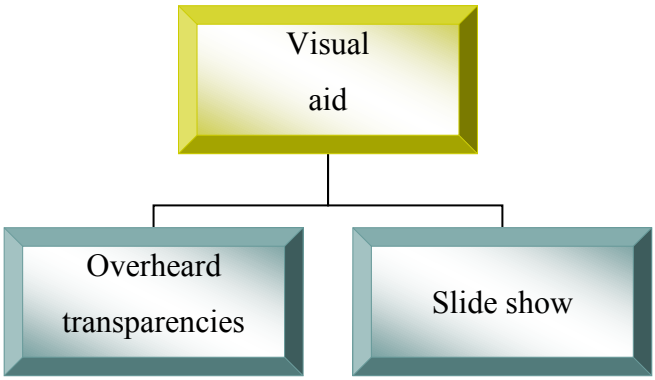
Read text for Unit 5 from the *appendix 1* and analyze the importance of physics

Listening

Visual aid

1) Read a short article about visual aid

Visual aids help to make a presentation more lively. They can also help the audience to follow your presentation and help you to present information that would be difficult to follow through speech alone.



Objects that can be displayed or passed round the audience can also be very effective and often help to relax the audience. Some speakers give printed handouts to the audience to follow as they speak. Others prefer to give their handouts at the end of the talk, because they can distract the audience from the presentation.

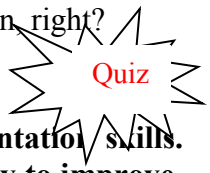
A **slide show** is a display of a series of chosen pictures, which is done for artistic or instructional purposes. Slide shows are conducted by a presenter using an apparatus, such as a carousel slide projector, an overhead projector or in more recent years, a computer running presentation software. A well organized slide show allows a presenter to fit visual images to an oral presentation. The old adage "A picture is worth a thousand words" holds true, in that a single image can save a presenter from speaking a paragraph of descriptive details. As with any public speaking or lecturing, a certain amount of talent, experience, and rehearsal is required to make a successful slide show presentation. Presentation software is most commonly used for instructional purposes, usually with the intention of creating a dynamic, audiovisual

presentation. The relevant points to the entire presentation are put on slides, and accompany a spoken monologue.

2) Listen to the conversation about using visuals in a presentation

3) Listen to the conversation again and fill in the gaps

Rosa: Thanks a lot for offering to give me some 1. …… on how to use visuals for my presentation.
Milo: What do you 2. …… to use?
Rosa: Well, I plan to show these 3. …… for the first part of the talk.
Milo: Then, for this bar chart, I'd make sure to tell the audience what the 4. …….. and 5. …… stand for, and what each increment represents.
Rosa: I think it's a little confusing, but your 6. …… on the other charts are really helpful.
Milo: The second half of the presentation includes some 7. …… participation, right?
Rosa: I don't think so. You've been so 8. …… .



4) To be a more effective presenter, it is useful to evaluate your own presentation skills. The following self-evaluation form can help you identify areas you should try to improve. Please read each item below and rank yourself from 1 to 5 based on how frequently you believe you adhere to the item (1=never and 5=always). Then concentrate on the points that you have ranked with low numbers when you are trying to improve your oral presentation skills.

Question	**Rank**
1) I determine some basic objectives before planning a presentation.	
2) I analyze the values, needs and constraints of my audience.	
3) I write down some main ideas first, in order to build a presentation around them.	
4) I incorporate both a preview and review of the main ideas as my presentation is organized.	
5) I develop an introduction that will catch the attention of my audience and still provide the necessary background information.	
6) My conclusion refers back to the introduction and, if appropriate, contains a call-to-action statement.	
7) The visual aids I use are carefully prepared, simple, easy to read, and have impact.	
8) The number of visual aids will enhance, not detract, from my presentation.	
9) If my presentation is persuasive, arguments are used that are logical and that support my assertions.	
10) I use anxiety to fuel the enthusiasm of my presentation, not hold me back.	
11) I ensure the benefits suggested to my audience are clear and compelling.	
12) I communicate ideas with enthusiasm.	
13) I rehearse so there is a minimum focus on notes and maximum attention paid to my audience.	
14) My notes contain only "key words" so I avoid read up from a manuscript or technical paper.	

15) My presentations are rehearsed standing up and using visual aids.	
16) I prepare answers to anticipated questions, and practice responding to them.	
17) I arrange seating (if appropriate) and check audio-visual equipment in advance of the presentation.	
18) I maintain good eye contact with the audience at all times.	
19) My gestures are natural and not constrained by anxiety.	
20) My voice is strong and clear and is not a monotone.	

Evaluate your score:

- If you scored between 80-100, you are an accomplished speaker who simply needs to maintain basic skills through practice.
- If your total score was between 60-80, you have the potential to become a highly effective presenter.
- If your score was between 40 and 60, this resource can help you significantly.
- If you scored between 30 and 40, you should show dramatic improvement with practice.
- If your total was below 30, roll up your sleeves and dig in. It may not be easy - but you can make excellent progress if you try.

At the end of the course, take this evaluation again and compare your scores. You should be pleased with the progress you have made.

5) Discuss the following questions in pairs or in small group?

1. Do you agree with the statement that ability to make presentations is an important part of scientific part? Why do you think so? Prove you point of view.
2. How do you evaluate your skills in making presentations?
3. What are the advantages and disadvantages of your presentations can you name? How can you improve your disadvantages?

Business English writing

Letter of apology

1) Study the following information about ways of writing a letter of apology

An apology letter shows that you are sorry and says that you value your relationship with the other party. The sooner an apology letter is written and sent out the better it is for the relationship. Depending on the nature of the letter, it can either be written in the friendly or the business letter format.

If this is a personal letter you should **start the letter** by saying that you are sorry to the recipient. **Next** you should admit your fault and take responsibility for your actions. Next you should volunteer or ask if there is any way that you can help out to resolve the situation. Then you should let the recipient that you will try to make sure that the situation will not happen again. **To close off the letter** you should apologize again. When writing a personal apology letter it should come from the heart and be sincere.

If this is a business letter you should start the letter by

Outline

Introduction
Paragraph 1
State reason(s) for writing

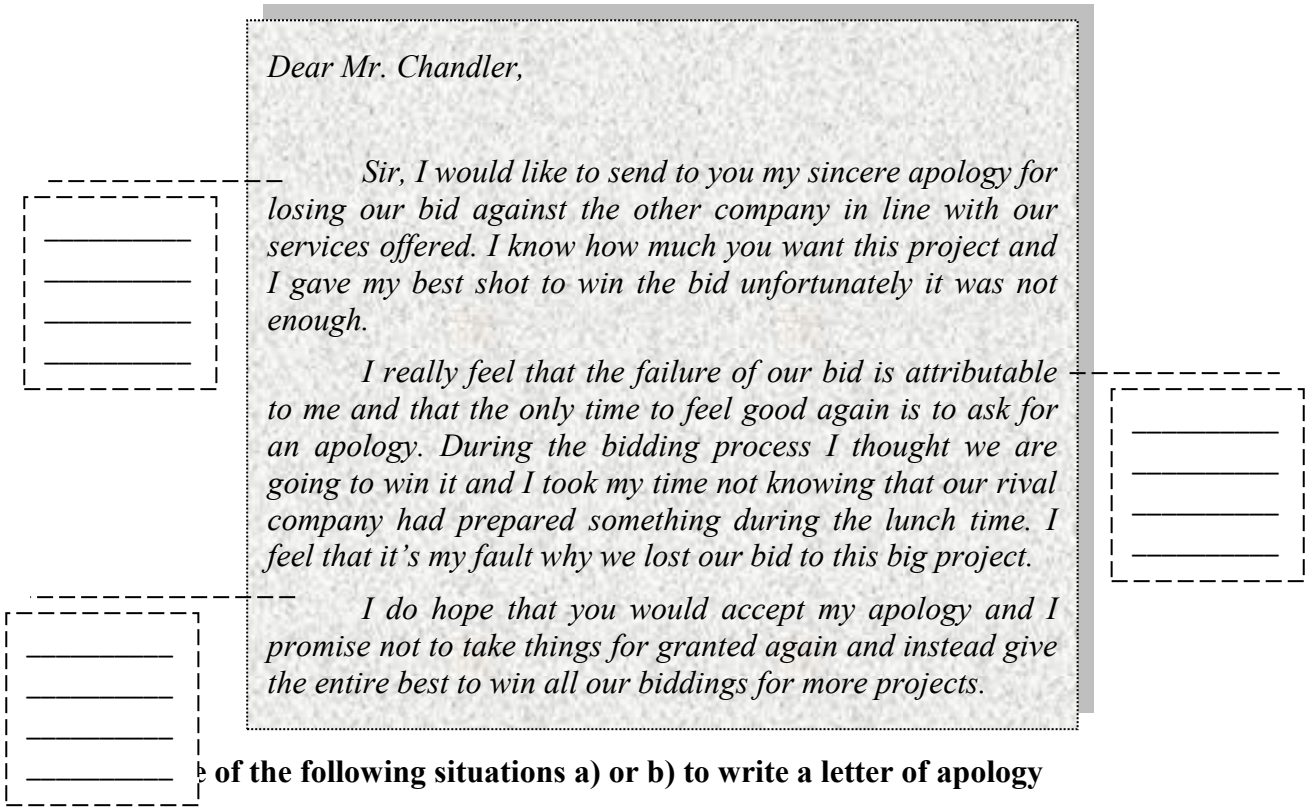
Main body
Paragraphs 2-3
Give explanations

Paragraphs 4
Suggest compensation

Conclusion
Final paragraph
Closing remarks
Full name

saying that you are sorry to the recipient. Next you should give an explanation as to what went wrong. Then you should try to rectify the problem. To close off the letter you should apologize again.

2) Look through the letter of apology given below and define a topic of each paragraph



Dear Mr. Chandler,

Sir, I would like to send to you my sincere apology for losing our bid against the other company in line with our services offered. I know how much you want this project and I gave my best shot to win the bid unfortunately it was not enough.

I really feel that the failure of our bid is attributable to me and that the only time to feel good again is to ask for an apology. During the bidding process I thought we are going to win it and I took my time not knowing that our rival company had prepared something during the lunch time. I feel that it's my fault why we lost our bid to this big project.

I do hope that you would accept my apology and I promise not to take things for granted again and instead give the entire best to win all our biddings for more projects.

_____
_____
_____
_____

_____
_____
_____
_____

_____
_____
_____
_____

of the following situations a) or b) to write a letter of apology

a) Imagine that you are a young scientist. You conduct a scientific experiment with a senior colleague, your scientific adviser, who asked you to process the results of the experiment to present them at the international conference. You were terribly short of time and interpreted some data incorrectly. You discovered your mistake when your boss had already left for the conference. Write a letter of apology to him.

b) Imagine that you are a member of international research team. You have a detailed plan of work, but due to some reason you can't complete your part of the work in time. Write a letter of apology to the manager of the project explaining the reason for being behind the schedule and negotiate a new deadline.

Use *appendix 7* for more samples and tasks of letter of apology and useful language given below.

Useful language for letters of apology		
Opening remarks	**Formal**	**Informal**
	I am writing to apology for / I must apology for / please accept my sincerest apologies for / how can I apology enough for / I must apologise profusely for	I hope you will understand when I say that / what can I say, except I'm sorry that / I'm sorry for / I owe you an apology / I'm sorry if I upset you in any way / I can't describe how sorry I am and how guilty I feel
Closing	Once again, my sincerest apologies	I hope you believe me when I say how sorry I am

remarks	for / I hope you will accept my apologies / I hope my apologies will be / are accepted	/ I can't tell you how sorry I am / I beg you to forgive me for / there is no excuse for… and I hope you'll forgive me

4) Work in pairs and check your groupmate's letter using the Criteria for assessment of *appendix 8*

5) You are planning *a trip to the USA*. Choose your destination, for example, San-Diego, CA or Kansas, MO and find out as many details as possible in your price range. Compare any two sites on the USA travel, for example http://www.tripadvisor.com/ and http://www.expedia.com/daily/home/?affcid=cj2477067 or any others to be found on http://www.allmyfaves.com/ under the rubric TRAVEL. Which of the two travel sites you have compared provides more *information*, has better *access* to it, is more *user-friendly* (offering, for example, some information in Russian, but not only in English), etc.
Write a report on the results of your comparison, with its paragraphs corresponding to the words italicized in the previous sentence of this task.

Writing for grant

Read the information of the second part of the textbook "Academic writing practice" about writing a grant and compose reference cited. Another option for you is to find a sample of reference cited on the Internet. Whatever the choice, make sure you come to mutual agreement with all the members of your research group.

Use unit 5 of appendix 11 for written practice exercises

1) ***Academic Earth*** is an organization founded with the goal of giving everyone on earth access to a world-class education. At Academic Earth, people are working to identify barriers and find innovative ways to use technology to increase the ease of learning. Academic Earth is a user-friendly educational ecosystem that will give Internet users around the world the ability to easily find, interact with, and learn from full video courses and lectures from the world's leading scholars. The goal of Academic Earth is to bring the best content together in one place and create an environment in which that content is remarkably easy to use and where user contributions make existing content increasingly valuable.

Visit the website of Academic Earth (http://www.academicearth.org/), choose a subject you are interested in from the list, listen to a lecture of your subject and analyze it and compose brief presentation about its content.

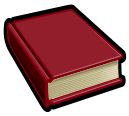
Unit 6. My career and future job

Warm-up

Employer	Наниматель, работодатель
Employee	Служащий, работающий по найму
Salary	Зарплата
Trade union	Профсоюз
Retirement	Выход в отставку, уход на пенсию
Fringe benefits	Дополнительные внезарплатные льготы
Redundancy	Сокращение
Part-time job	Работа на полставки
Full-time worker	Работник, занятый полный рабочий день
Staff	Штат служащих

1. Do you think it is difficult to be a real professional in the 21st century?
2. What traits of character are necessary for a successful career?
3. Which is more important: high salary or job satisfaction?
4. Do you think women have the same career opportunities as men?
5. What are advantages and disadvantages of your future profession?

Reading



1. Have you ever tried to find a job in accordance with your speciality?
2. What skills and qualifications are necessary to have to find a good job of your speciality?

How to Find Mechanical Engineering Jobs

(Source: http://www.ehow.com/how_2068806_find-mechanical-engineering-jobs.html)

Engineering is one of the hottest majors on college campuses today. The allure of high starting salaries and being in demand among employers is great. Mechanical engineers are sought after in today's job market. This demand is fueled by the continuing development of and reliance on increasingly complicated forms of technology in society. For those with a degree in this area, it isn't hard to find mechanical engineering jobs.

Things You'll Need:

1. Attend job fairs. If you are in college, the engineering department at your school will almost certainly hold one or more job fairs each year. These fairs are excellent opportunities to find out what companies are hiring, what your job would involve and any special qualifications you might need. You can also talk to the people who will be doing the hiring, which gives you the chance to impress them in person.

2. Get an internship. Internships in mechanical engineering provide invaluable experience that you can use when you start your career. Internships also allow you to make personal contacts in the industry and to establish relationships at the firm where you are interning. You can use these contacts and relationships to secure a job for yourself after graduation. In fact, many companies hire their interns outright after those interns graduate.

3. Network with engineering professionals. Join local engineering groups and attend their meetings. This gives you the opportunity to meet others who are working in the field. These personal contacts can lead to job offers down the road.

4. Look in the classified ads of the newspaper in the town in which you want to work. Engineering firms do place want ads, just like other companies. The job you want may be listed today. If it's not, keep looking until you see something that appeals to you. New engineering jobs open up every day in this country.

5. Go to MechanicalEngineeringJobs.com to search jobs in mechanical engineering all over the world.

The future of engineering in Russia

The system of engineering education should provide formation and establish conditions for evolutional new generation nurture of highly educated professionals in the engineering sphere, who are able to support stable dynamic economics development, and innovation development of various spheres of practical work on the basis of high-end technologies; specialists for whom self-development and professional skill, elaboration of individual activity style are priority guidelines during the whole life. Engineers of the new generation should be professionally and socially protected by the education quality from the real risk of conversion of a person into plug-in technologies material. There are some factors that determine the development of engineering education in the future:

- analysis of fundamental reformist improvements in scientific and technical, and socio-economic spheres on the threshold of the 21st century (stable development, mankind survival imperative, technological development, society of education formation, development of practically-oriented complex multidisciplinary sciences, society informatization and mediatization etc.);
- forecast of conceptual and structural manufacture alterations; country's science and culture, as well as people's educational needs;
- investigation of the country's multiform economics establishment processes and orientations of regional economics;
- systemic objectives and values concept of engineering of tomorrow;
- taking into account the emerging professional education philosophy;
- state and dynamics study of engineering labor-market and intellectual produce on the regional, interregional, national and international levels;
- taking into account the role of professional engineers' personal organization in formation of the engineering type of thinking, his own choice of integration into engineering culture, his aim at self-development and professional creative work.

1. Describe the ways of finding mechanical engineering jobs
2. What are the factors that determine the development of engineering in future?
3. How do you see the future of engineering?
3. Would it be more difficult to become an engineer in the future?
4. What would be the goals and responsibilities for an engineer of a new generation?
5. What changes do you think should be introduced nowadays to make engineering more successful in the future?

Building-up vocabulary

1) Translate the following words and phrases from Russian into English

Специализация; привлекательно зарплаты; ярмарка вакансий; практика; бесценный опыт; окончание учебного заведения; высококачественные технологии; превращение; включать в розетку; на пороге 21 века; стабильное развитие; междисциплинарные науки; рынок труда; межрегиональный уровень; принимать во внимание; саморазвитие.

2)* Insert the missing prepositions if necessary

1. He was a successful lecturer, much …… demand.
2. His spiritual advisers were none too happy with his reliance ..... pagan practices, nor probably was his court favourite Buckingham.
3. He just had to hope he'd get away with it and that nobody would find …… .
4. Game theory provides …… the appropriate vehicle of study.
5. A 24-hour ceasefire allowed the two armies …… reach a solution to the conflict.
6. The combination of all these factors led …… the tragedy on pad 34.
7. The water company appealed …… everyone to reduce the amount of water used.
8. He thought he was …… the threshold of some awful enlightenment, an initiation of unimaginable pain.

3) Fill the gaps with the words and phrases from the box. The meaning of the missing word or phrase is in the brackets.

Temporary	part-time	steady	quit	holding down	out of	applied for	get

1. After all, it was the first …… job I'd ever had. (regular)
2. But I didn't listen - I thought I would …… a new job easily. (find)
3. I've always had problems …… a job. (keeping),
4. so everybody told me not to …… my job. (leave)
5. or maybe I can find a ……. job. (not permanent)
6. I've …… over thirty jobs, but with no success. (write to ask for)
7. I've now been …… a job for over three months. (unemployed)
8. Perhaps I'll just have to accept a …… job. (not full-time)

Translation

Translate the following article from Russian into English

"Очевидно, каждый хочет добиться успеха, но я хочу, чтобы обо мне думали как о крупном новаторе, человеке высоконравственном, заслуживающем доверия и, в конечном счете, принесшем в этот мир большие перемены." – Сергей Брин, создатель поисковой системы GOOGLE. Сергей Брик является ученым, разработавшим новую революционную технологию поиска информации в Интернете, бизнесменом, создавшим за короткий срок одну из самых успешных IT компаний в мире, автором двенадцати академических трудов.

Вы смогли бы повторить свой успех, останься вы в России, как считаете?

о: Мне очень везет. Повезло в том, что я получил то образование, которое получил. Повезло, что мой интерес к компьютерам во что-то претворился. Повезло, что я начал заниматься поиском и, наконец, что моя компания стала такой успешной. Если бы можно было все начать с начала, я бы ничего менять не стал. Впрочем, вполне возможно, мне кажется, создать крупную компанию и в России.

В каждой стране есть специфические условия ведения бизнеса. Вы уже сформулировали для себя, что такое бизнес по-русски? На что надо обратить особое внимание?

о: Мы уже многое освоили и постоянно узнаем что-то новое. Россия меняется. Когда я здесь был пять лет назад, условия для ведения бизнеса были другими. Стандарты финансовой отчетности теперь стали более похожими на то, что у нас есть в США. Да и интернет стал быстрее, что очень важно. Я вообще считаю, что следующие пару лет будут годами бурного развития мобильного интернета.

в: В чем секрет успеха Google? Ведь за то время, что вы существуете, много компаний успело возникнуть и исчезнуть.

о: Мы стали компанией в 1998 году. Как раз в это время компании, которые раньше занимались поиском, решили, что поиск уже не важен. Они все старались стать порталами, в то время как мы сосредоточились на поиске, совершенствуя его. Мы постоянно улучшаем наши технологии. Только за последний год ввели универсальный поиск, когда можно искать не только текст, но и картинки, видео.

в: То есть в будущем только поиск? Никаких других направлений деятельности?

о: Почему? Мы вкладываем деньги, к примеру, в энергетические проекты - чтобы производство чистой энергии стало дешевле производства обычной. В конце концов компания и сама в этом заинтересована, ведь наши компьютеры "пожирают" много энергии.

в: Кто для вас авторитет в мире бизнеса?

о: Уоррен Баффет, к примеру, известный инвестор. Когда мы выходили на IPO, мы написали такое же письмо, какие он пишет своим акционерам. Стив Джобс (один из основателей Apple). Много таких людей, в общем.

в: Недавно Microsoft чуть было не купил поисковик Yahoo! Появился бы новый гигант. Как вы к этому относитесь?

о: А что, правда, чуть не купил? (Смеется.) Конечно, мы следили за этим процессом. Интернет стал великим, потому что он открыт для всех. Чем больше ресурсов, тем лучше. Поэтому было бы, конечно, плохо, если бы Microsoft купил этот поисковик.

http://www.e-prof.ru/jurnal/kariera_injenera/breen_google.htm

http://torgchel.ru/biznesmenyi/sergey-brin-osnovatel-google.html

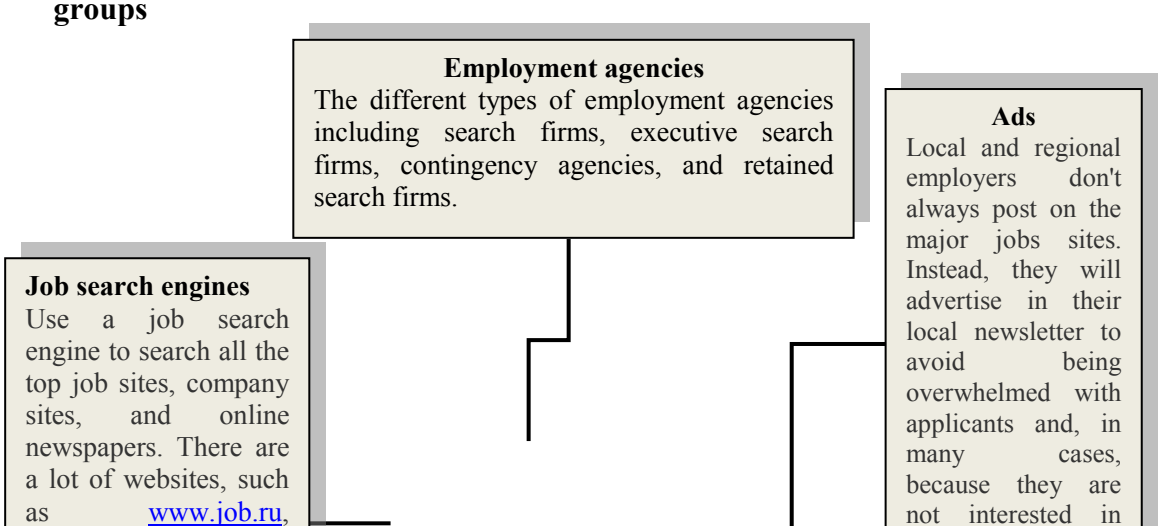
Text analysis

Read text for Unit 6 from *appendix 1* and analyze the perspective of career of engineer

Listening

Job hunting

1) **Study the diagram of ways of finding a job and discuss it in pairs or in small groups**



How to find a

JOB?

Job fair
is a fair or exposition for employers, recruiters and schools to meet with prospective job seekers. Expos usually include company or organization tables or booths where resumes can be collected and business cards can be exchanged.

Network is the practice of meeting other people involved in the same kind of work, sharing information, supporting each other. Career networking should become a part of your daily work and career-related endeavors. Your career network should be in place for when you need it, both for job searching and for moving along the career ladder. Since you never know when you might need it, it makes sense to have an active career network, even if you don't need it today.

Answer the questions

1. What other ways of getting a job can you name? Add
2. What are advantages and disadvantages of each way?
3. What way would you choose if you needed to find a job? Why? Explain your point of view.
4. What way is the most difficult to follow?

2) Listen to the tips of successful job interview

3) Listen to the tape once again and fill in the gaps

Tips for successful job search	
Tips	***Definition***
Always Begin With Self-Assessment	
Research The Job Market	
Choosing a Career Field	
Improve Your Job Search Skills	
Job Search Campaign	

3) Discuss the following questions in pairs or in small groups

1. Have you ever tried to use some of the methods given above?
2. What tips do you find useful for your future job hunting?
3. What tips do you think are appropriate for your speciality? Why do you think so? Prove your point of view.
4. Do you know any other useful tips for finding a job?
5. Do you know any examples a person shouldn't follow in the process of job hunting?

Business English writing

CV (Curriculum Vitae)

1) Study the following information about ways of writing

Curriculum Vitae: an outline of a person's educational and professional history, usually prepared for job applications. Another name for a CV is a *résumé*. A CV should include:

Personal details

Normally these would be your name, address, date of birth (although with age discrimination laws now in force this isn't essential), telephone number and email.

Education and qualifications

Your degree subject and university. Mention grades unless poor!

Work experience

- Use action words such as developed, planned and organised.
- Even work in a shop, bar or restaurant will involve working in a team, providing a quality service to customers, and dealing tactfully with complaints. Don't mention the routine, non-people tasks (cleaning the tables) unless you are applying for a casual summer job in a restaurant or similar.
- Try to relate the skills to the job. A finance job will involve numeracy, analytical and problem solving skills so focus on these whereas for a marketing role you would place a bit more emphasis on persuading and negotiating skills.

Interests and achievements

- Keep this section short and to the point. As you grow older, your employment record will take precedence and interests will typically diminish greatly in length and importance.
- Bullets can be used to separate interests into different types: sporting, creative etc.
- Don't use the old boring cliches here: "socialising with friends".
- Don't put many passive, solitary hobbies (reading, watching TV, stamp collecting) or you may be perceived as lacking people skills. If you do put these, than say what you read or watch: *"I particularly enjoy Dickens, for the vivid insights you get into life in Victorian times"*.
- Show a range of interests to avoid coming across as narrow: if everything centres around sport they may

Outline

Name

Date of birth

Address / phone number

Education / qualifications

Work experience

Interests

Other information

Referees

wonder if you could hold a conversation with a client who wasn't interested in sport.

- Hobbies that are a little out of the ordinary can help you to stand out from the crowd: skydiving or mountaineering can show a sense of wanting to stretch yourself and an ability to rely on yourself in demanding situations
- Any interests relevant to the job are worth mentioning: current affairs if you wish to be a journalist; a fantasy share portfolio such as Bullbearings if you want to work in finance.
- Any evidence of leadership is important to mention: captain or coach of a sports team, course representative, chair of a student society, scout leader
- Anything showing evidence of employability skills such as teamworking, organising, planning, persuading, negotiating etc.

Skills

The usual ones to mention are languages (good conversational French, basic Spanish), computing (e.g. "good working knowledge of MS Access and Excel, plus basic web page design skills" and driving ("full current clean driving licence").

Referees

Normally two referees are sufficient: one academic (perhaps your tutor or project supervisor) and one of an employer.

2) Imagine you have seen a job advertisement and really want to apply for this job. Prepare your CV, use *appendix 7* for sample of CV.

3) Study the site of the American government http://www.usa.gov to get familiarized with its structure and alphabetical index. Get some information about the *Administration for native Americans* on http://www.acf.hhs.gov/programs/ana/about/about.html#icnaa.
Learn about its mission, goals, priorities, partnerships, etc. and write a report on the site structure on the request of your employer.

Writing for grant

Read the information of the second part of the textbook "Academic writing practice" about writing a grant and compose biographical sketches. Use *appendix 6* to follow the sample of biographical sketches of the grant proposal.

Use unit 6 of appendix 11 for written practice exercises

1) Visit the website given below and a job advertisement for engineers you are interested in. Prepare your CV for this advertisement.
http://www.engcen.com/engineering.asp

2) Prepare a list of sentences (up to 15) for translation from the British National Corpus with the use of the following words from the text: *internship, generation, multidisciplinary* and use one of them for making up your own concordance. Use the site http://info.ox.ac.uk/bnc and an example of this task in the *appendix 9.*

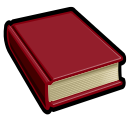
Unit 7. Research, discoveries and innovations in Russia

Warm-up

To rivet	Приковывать (внимание)
Impetus	Толчок, стимул
Pinnacle	Апофеоз
Quark-gluon plasma	Кварк-глюонная плазма
Beam	Луч
Charged-particle acceleration	Ускорение заряженных частиц
Cryogenic	Криогенный
To upgrade	Усовершенствовать
Exodus	Переселение, отъезд
To renovate	Обновлять

1. Do you know any of the Russian inventions? Can you name the most outstanding and important one?
2. Can you name Russian inventions in your sphere of science? What invention is considered to be the most meaningful for the development of your sphere of science?
3. Has the advance of technology brought only benefits?
4. What are some of the major technical advances of the twentieth century?

Reading



Is it possible to make inventions nowadays? What sphere of science is the most popular today? Why?

Moscow Region to get its own collider

MOSCOW. Yury Zaitsev for RIA Novosti

The attention of physicists worldwide is currently riveted on the European Organization for Nuclear Research (CERN), which is operating the Large Hadron Collider (LHC). The LHC is expected to become the main impetus and pinnacle of achievement in high-energy physics research; however, it is already clear that answers to many questions will not come via the LHC. For example, it will be impossible to observe the process of the transition of very dense nuclear material to a new state - quark-gluon plasma - a mixed phase existing in the first moments after the Big Bang. There is a theory that that was when quarks existed in a free state.

Then they grouped together and protons and neutrons appeared. In the LHC, this process is skipped because the energy of the particles' interaction is too high.

Alexei Sisakyan, director of the Joint Institute for Nuclear Research (JINR) at the international scientific center in Dubna, says that this may be compared to boiling water. If we can see how water (heavy nuclei) changes into steam (quark-gluons) at 100 degrees, then at 1000 degrees, this process is invisible - it takes a fraction of a second for the water to evaporate and observing it is impossible.

Scientists hope to register the transition of quarks into protons and neutrons in the collider that is planned to be built in the Moscow-region town of Dubna. The new physical device has been named NIKA (a high-energy heavy ion collider). A one-of-a-kind accelerator complex will be created. It will consist of a cascade of four accelerators, one of which is already built and activated - the superconductive ion synchrotron-nuclotron. The collider developers intended for the particles to be accelerated in several of its coils in one direction, picking up more and more speed. In the final stage, they will travel in the opposite direction in the two coils. Collision points for particle beams are anticipated in several places along these coils. It is expected that free quarks will be seen during the time of their collision (currently quarks exist only in clusters of three) and it will be possible to observe the process of their attractive interaction with one another.

Scientists are counting on being able to use the new installation to research the properties of the transition of matter from one phase state to another, as well as the conditions associated with the transition to this phase (if indeed such a transition takes place), during which the nuclear and quark-gluon material may coexist. It is not improbable that such conditions currently exist in the cores of neutron stars.

In the NIKA collider, particles of the nuclei of gold molecules will be collided, accelerated towards one another at energy of 5.5 gigaelectronvolts. Scientists will study the consequences of the collision with the aid of a Multi Purpose Detector (ÌÐD) installed at the "point of collision" of the beams. While the length of CERN's LDC is 27 kilometers, the NIKA is only 251 meters long. The basis for its design was the synchrophasotron built in Dubna back in 1957 - one of the largest charged-particle accelerators in the world.

It was specifically in the Soviet Union that the idea of building a collider was first aired. The first prototype was built in Novosibirsk and had a capacity of tens of gigaelectronvolts. This accelerator is still used in research.

Today in Dubna, the updating of the nuclotron is in full swing - the vacuum in the coil has been fundamentally improved; the cryogenic unit, which is the heart of the superconducting accelerator, has been fully renovated; the power system has been upgraded; modern diagnostic equipment is being installed and a new ion source is being made.

NIKA will be a one-of-a-kind world-class installation and will be of interest to other physics centers. The development of NIKA will enable the return of many scientists to Russia, particularly those young scientists that participated in the development of the LHC. The construction of modern experimental installations is impossible without detailed technical planning, for which qualified design engineers are needed. There was a mass exodus of such experts to the West when the Russian scientific community fell apart. Today, their high qualifications are in demand again in Russia.

1. Describe the work of a collider

2. Do you any more facts about development of a collider?

Building-up vocabulary

1) Read the article once again, find international words, and fill up the following table

Thematic group	Word	Translation
Sciences	Physics …	Физика …
Devices		
Particles		
Units of measurements		
Common scientific words		
Other		

2) Using a dictionary translate the following words and explain their meaning

Co-exist *Co-owner*
Co-author *Co-worker*

What is the meaning of the prefix co-? What Russian prefixes correspond to the English prefix co-? Give some more examples of English words with this prefix and translate them into Russian.

3) Highlight the following words in the text:

One-of-a-kind *Quark-gluon*
World-class *Charged-particle*
High-energy

Translation

Translate the following article from Russian into English

До сих пор все новое создавалось по формуле «от большого к малому». Примером того могут быть видеокассеты, которые сегодня постепенно уходят в прошлое, а на их место приходят DVD-диски. При этом вместимость DVD может быть значительно выше, чем видеокассеты. Существенны отличия и в качестве записи изображения на носителях. Другой пример – телевизоры или радиоприемники. Многие из нас помнят, какой громоздкой была эта аппаратура еще в 80-90-х годах прошлого века, и какая она сейчас. Достаточно увидеть жидкокристаллический или плазменный телевизор, которые можно не только поставить на полку, но и без проблем повесить на стену.

Теперь наука идет по обратному пути «снизу вверх», от малого к большому. Но это не означает, что мы вернемся к крупногабаритным вещам. Просто одна, может быть, совсем миниатюрная вещь будет содержать в себе огромное количество различных свойств. Иначе говоря, свойства того или иного предмета, материала будут закладываться уже на атомном, молекулярном уровне. К примеру, нанотехнологии могут решить проблему

энергодефицита на земле. Одно из направлений в этой работе – перевод освещения на светодиоды, которые позволяют производить свет большой яркости при малом употреблении энергии. Такое революционное снижение энергопотребления не потребует строительства новых генераций, а сократит на порядок расходы энергии на освещение.

Будут созданы новые бактерицидные и противовирусные средства для лучшего заживления ран. Ученые предполагают, что возможно создание молекулярных роботов-врачей, которые внутри организма человека смогут самостоятельно устранять возникающие повреждения или не допускать их появления, тем самым наука не отрицает, что молекулярные роботы будут способны предотвращать старение клеток. Конечно, о бессмертии говорить пока рано, но перспективы в работе по достижению замедления старения человеческого организма есть.

Нанотехнологическое вооружение сравнивают с ядерным оружием, создание которого и обогащение которым двух супердержав – Советского Союза и Соединенных штатов Америки – привело к холодной войне. Но оружие, созданное по нанотехнологиям с одной стороны, значительно более мощное и эффективное, нежели ядерное, с другой, оно не несет таких глобальных и долгосрочных негативных последствий, оно может быть точно нацелено на конкретную цель. Возможности нанотехнологий могут быть использованы и в деятельности военной разведки, органов безопасности – это устройства сверхплотной записи информации, суперкомпьютеры и т.д.

Пока все нанотехнологические материалы стоят очень дорого. Но, как и в случае компьютерной отрасли, массовое производство приведет к резкому снижению цены. В невидимой борьбе за те прибыли, и влияние, которое даст нанотехнология, основными игроками являются США, Китай, и Россия. Израиль, Европейские страны, и страны Латинской Америки стремительно наращивают свой потенциал в этой области.

http://nanodigest.ru/; http://www.rus-nano.ru/

Text analysis

Read text 1 and text 2 for Unit 7 from *appendix 1* and the situation in Russian science

Listening

1) Read a short article about electrical engineering and its inventions and answer the questions given below.

Electrical engineering is a field of engineering that generally deals with the study and application of electricity, electronics and electromagnetism.

The field of electrical engineering first became an identifiable occupation in the late nineteenth century after commercialization of the electric telegraph and electrical power supply. It now covers a range of subtopics including power, electronics, control systems, signal processing and telecommunications. During the development of radio, many scientists and inventors contributed to radio technology and electronics. In his classic UHF experiments of 1888, Heinrich Hertz transmitted (via a spark-gap transmitter) and detected radio waves using electrical equipment. In 1895, Nikola Tesla was able to detect signals from the transmissions of his New York lab at West Point (a distance of 80.4 km). In 1896, Alexander Popov made

wireless transmissions across 60 m and Guglielmo Marconi, around the same time, made a transmission across 2.4 km. John Fleming invented the first radio tube, the diode, in 1904.

Reginald Fessenden recognized that a continuous wave needed to be generated to make speech transmission possible, and he continued the work of Nikola Tesla, John Stone Stone, and Elihu Thomson on this subject. By the end of 1906, Fessenden sent the first radio broadcast of voice. Also in 1906, Robert von Lieben and Lee De Forest independently developed the amplifier tube, called the triode. Edwin Howard Armstrong enabling technology for electronic television, in 1931. The second world war saw tremendous advances in the field of electronics; especially in RADAR and with the invention of the magnetron by Randall and Boot at the University of Birmingham in 1940. The invention of the transistor in 1947 by William B. Shockley, John Bardeen and Walter Brattain opened the door for more compact devices and led to the development of the integrated circuit in 1958 by Jack Kilby.

Answer the questions

1. Compare Russian and foreign inventions in this field of engineering.
2. What inventions of electrical engineering can be considered to the most meaningful for people? Why do you think so?
3. What other Russian inventions in the sphere of electrical engineering can you name?

2) Visit the following website http://podcasts.britishcouncil.org/podcasts/prof-engineering-projects.mp3 **to listen to an excerpt of a talk given by an electrical engineer speaking about new inventions in sphere of motor technology**

3)* Are the following sentences true or false?

1. Recently great advances have been made in motor technology.
   a) True b) False
2. Engineers are constantly looking for new ways to use existing models.
   a) True b) False
3. Engineers have more freedom for experimentation than in Faraday's times.
   a) True b) False
4. The newest motors lose more heat than the traditional motors.
   a) True b) False
5. The newest motors are more compact than they used to be.
   a) True b) False
6. A new motor developed by Omron may replace motors currently used in hydraulic systems.
   a) True b) False

Business English writing

Letter of application

1) Study the following information about ways of writing a letter of application

Application usually goes with a cover letter. Job seekers frequently send résumés or employment applications as attachments to a cover letter, by way of introducing themselves to recruiters or prospective employers and

Outline

Introduction
Paragraph 1
State reason(s) for writing

Main body
Paragraphs 2-5
Education and qualifications, previous experience, personal qualities, suitability

Conclusion
Final paragraph
Closing remarks

Full name

indicating their interest in the positions. Employers may look for individualized and thoughtfully written cover letters to weed out applicants who are not sufficiently interested in their position or who lack the required writing skills. The job application letter's purpose is to get the recipient to read your CV. It should be clear, concise and straight to the point. Here you are simply telling the employer that you are worth having a look at. The application letter should be brief, no more than one page in length. It should be easy to read and flow through. It should include only the absolute necessary information.

The style you choose is not important, there are many different styles of job applications and professional letters, this comes down to personal preference. However somewhere on the top, whether it is on the right or left hand sides, there should be your address and the date. Following this, on the left hand side you should address it. Ensure you include the name of the person, their title, company name, address and any position reference number.

The introductory paragraph should simply state why you are writing to them. If it is an advertised position, mention the position title and where it was advertised.

The main body of job application letters should be two to three paragraphs at the most, if it is too long it may be skipped. When I reader begins to skip text, it is hard to get them to re-focus. Here is where you tell them what you have to offer and why they should read your CV. This is a good time to read the job advertisement again. In one paragraph (two at the most) you need to summarise your experience and skills, at the same time, you need to respond to the position requirements as per the advertisement. Analyse your career and summarise it in a few sentences, highlight what you specialise in, or how many years in the industry you might have, or even the level that you have reached. This paragraph should direct the reader to your CV and should sell you on some unique points that you might have. A good way to start this paragraph is with a statement like this: "You will see from my enclosed CV...." then go ahead and tell them something about your career which will immediately get their interest.

The next part of the body of the letter should be a brief description of your personal skills. Again read the advertisement and respond to their needs. If they are asking for someone with good co-ordination skills, then ensure you mention something to that effect. If it is communication or perhaps leadership skills they value, then tell them that you have these.

Job application letters closing paragraph should ask for some action from the recipient. This is where you ask for an interview. It should also state where and how they can reach you, and it should thank the recipient for giving you the opportunity to apply. You can include things like "should you require further information....."

2) Arrange the following extracts from a letter of application

a I am presently employed by a small computer company, but I feel that I am not using my knowledge of software engineering to the full. I am looking for a more challenging position where my field of specialization could be exploited in a more stimulating environment. As you will notice on my enclosed CV, the job you are offering suits both my personal and professional interests.

g Carry Johansson
12 Hamilton Street
Brighton
FH2 6KX

f 31 Bloomington Street
London
SK45 BX123

c Dear Ms Johansson

h Peter Sellers

b I would be pleased to discuss my curriculum vitae with you in more detail. Please do not hesitate to contact me if you require further information. I look forward to hearing from you.

e I am writing to apply for the position of Director of Software Development which was advertised on your company website.

i Yours sincerely

d 12 January 2004

1)_____

2)_____

3)_____

4)_____

5)_____

6)_____

7)_____

8)_____

9)_____

and prepare a letter of application. Use *appendix 7* for sample of letter of application.

Издательский Дом

Independent Media

приглашает

SanomaMagazines

менеджера проектов
The St.Petersburg Times

Должностные обязанности:
- разработка идеи проекта и написание концепции
- организация и проведение всех мероприятий в рамках проекта
- работа с партнерами и спонсорами
- обеспечение финансовых показателей по проектам

Требования к кандидатам:
- высшее образование
- успешный опыт проектной работы не менее 2 лет
- успешный опыт в продажах
- навыки командной работы
- умение работать на результат и вести несколько проектов одновременно
- свободное владение английским языком
- приветствуется опыт успешной реализации собственных проектов

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Резюме и сопроводительное письмо присылать на имя Татьяны Туриковой: Turikova@sptimes.ru

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- Large outside event sales experience required
- External social networking skills required
- Fluent in English
- Passion for exciting events and banquets

CORPORATE SALES MANAGER
- Past experience in local & international corporate Sales required
- Willing to travel extensively for trade shows
- Fluent in English
- Passion for superior Guest Service

CHEF SOMMELIER
- Qualified Sommelier to head the entire Wine program
- Train with a "Master of Wine" on site
- Ability to control quality, variety, costs and sales volume requireda
- Knowledge of Old and New world wines
- Fluent in English
- Passion for food, coffee and of course wine

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Tel: 329 6869 Fax: 329 6864

by ORIENT-EXPRESS

4) You have applied for a job as a market research specialist and the first probation task you are given is to prepare a report on American, European and Japanese *Upscale Midsize Cars* as represented at http://usnews.rankingsandreviews.com/cars-trucks/BMW_3-Series/. You are

supposed to prepare a table illustrating the main characteristics of at least 5 luxury cars of the same class: Buick Regal, Chevrolet Volt, Cadillac CTS, Lexus ES and BMW-3 Series.

Write a report and compare such rankings of these cars as MPG (miles per gallon), prices and pros and cons, analyze the differences and choose the best value for money.

Writing for grant

Read the information of the second part of the textbook "Academic writing practice" about writing a grant and compose another part of the grant proposal – budget, or try to find a budget sample of the grant proposal on the Internet.

Use unit 7 of appendix 11 for written practice exercises

1) Prepare for the conference on *the contribution of Russian people* into the USA development in all spheres. You may choose, for example, *Sergey Mikhaylovich Brin* (Серге́й Миха́йлович Брин; born 08.21.1973, http://en.wikipedia.org/wiki/Sergey_Brin), a Russian American computer scientist and industrialist who, along with Larry Page, is best known as the co-founder of Google, Inc., the world's largest Internet company, based on its search engine and online advertising technology.

2) Imagine that you are a young scientist and have made a very important invention. But how to patent it? Compose a brief presentation «How to patent an invention/idea» using the following website

http://www.bizmove.com/starting/m1n.htm

3) Find synonyms to the following words from the text: *modern, installation, to intend, to participate.* When looking for the synonyms compare at least two Internet resources which might be helpful to you, e.g. *Wordsmyth* & *Webster* dictionary or any others usually called *thesauruses*. Which of the sources turns out to be most efficient?

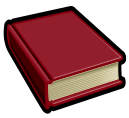
Unit 8. Research, discoveries and innovations in English-speaking countries

Warm-up

Eddy	Вихревое движение
Wave function	Амплитуда вероятности, волновая функция
Power station	Электростанция
Thermal equilibrium	Тепловое равновесие
To decouple	Разъединять
Solid-state devices	Твердотельный прибор, элемент
Ultrafast	Сверхбыстрый
To swirl	Вращаться
Perpetual	Непрекращающийся
Heat up / cool down	Нагревать / охлаждать

1. What are some of the major technical advances of the twentieth century? Which of them first appeared in the English-speaking countries?
2. How do inventions change people's life?
3. The United States is considered to be one of the leaders of modern scientific and research world. Do you agree with this point of view? Prove your opinion.
4. Has the advance of technology brought only benefits?
5. What is the most useful invention for the past twenty years, in your opinion?

Reading



Do you know any achievements in the sphere of quantum mechanics?

Turning up the heat on quantum mechanics

David Bradley

Scientists have made a startling prediction about the quantum world that seems to show that simply taking the temperature of certain types of quantum systems at frequent intervals causes such systems to break one of the hard and fast rules of thermodynamics. Anyone who has dabbled in quantum mechanics will know just how slippery is the atomic and sub-atomic world of probability wave-functions where particles eddy and swirl like waves. One of the underlying rules of the quantum world is the Time-Energy Uncertainty Principle. Wrapped up in this apparently simple phrase is the notion that it is impossible to know both the precise duration of any process and its exact energy cost in an atomic or subatomic particle with 100 % certainty; the very act of observing one or the other somehow disturbing the counterpart property. The quantum world is spooky, to say the least. Now, the laws of thermodynamics are apparently irrefutable, after all they allow sceptics to see straight through the claims of those inventors who claim perpetual motion machines, they allow us to build power stations, and ultimately they will take us to the ends of the universe.

One law reveals that the interaction between a large heat source and a cluster of smaller systems will, on average, move progressively towards thermal equilibrium – hot moves to cold to even out the temperature, in other words; this is the so-called zero'th law of thermodynamics. But, it isn't necessarily so in the quantum world claim Weizmann chemists Gershon Kurizki, Noam Erez and Goren Gordon of the Weizmann Institute in Rehovot, Israel, working with Mathias Nest of Potsdam University, Germany. They have shown that an

ensemble of quantum systems in thermal contact with a large heat source could buck this thermodynamic trend.

Their predictions suggest that such a quantum ensemble could actually heat up even if it is hotter than a neighbouring large heat source or if it is colder, it could get colder still, but only under certain conditions. The scientists showed that if the energy of these systems is measured repeatedly, both systems and large heat source will undergo a temperature increase or decrease, and this change depends only on the rate of measurement, not on the results of the measurements themselves. In the classical world, a thermometer does not interfere with the laws of thermodynamics no matter how hot or cold a system nor how often the thermometer is read, but taking the temperature of a quantum system somehow decouples it from the neighbouring heat source. This decoupling, followed by recoupling of the two when measurement ceases, introduces energy (at the expense of the measuring apparatus into the systems and the heat source alike, and so heats them up. Depending on whether the measurements are repeated at short or long intervals, it should be possible to heat up or cool down the systems. The predicted effects may be the key to developing novel heating and cooling schemes for microscopic solid-state devices, such as quantum computer chips or in allowing ultrafast temperature control for fast optical measurements in the chemistry laboratory.

(Source: http://www.intute.ac.uk, June 9th, 2008)

1. What are scientists' predictions about development of quantum mechanics?
2. Is it possible to say that an ensemble of quantum systems in thermal contact with a large heat source could buck this thermodynamic trend?
3. What is the reaction of thermometer with the laws of thermodynamics in the classical world?

Building-up vocabulary

1)* Match words and phrases from the text with their meaning

1.	To startle	A	The ability of a machine to always continue moving without getting energy from anywhere else, which is not considered possible
2.	Eddy	B	A building where electricity is produced to supply a large area
3.	Irrefutable	C	A circular movement
4.	Perpetual motion	D	To do something or be involved in something in a way that is not very serious
5.	Interaction	E	Argument cannot be proved to be wrong, and must be accepted
6.	To dabble	F	To make someone suddenly surprised or slightly shocked
7.	Power station	G	Finally, after everything else has been done or considered
8.	Ultimately	H	A process by which two or more things affect each other

2) Insert the missing prepositions if necessary

1. Now on to Dan O'Brien with a wrap-…… of today's games.

2. The results of these experiments were, to say …… the least, puzzling to the researchers.

3. The course was hard, but I wanted to see it …… .

4. As the gas heats ……, it expands.

5. Laser vaporization in a heated tube provides a means for synthesizing fullerenes by carbon condensation …… controlled conditions.

6. Its importance is that the other parts depend …… its results for their complete explanations.

7. If the engine overheats, switch it off and do not start it again until it has cooled …….. .

8. Under these conditions many solids undergo …… phase changes, and the nature of the accompanying changes in structure can be studied.

Translation

Translate the following article from Russian into English

Плавящийся при охлаждении кремний создан учёными

Созданный учёными Массачусетского технологического института (Massachusetts Institute of Technology, MIT, USA) сплав, плавящийся при охлаждении, можно использовать для очистки промышленного кремния. Подобно ледышке в жаркий день, большинство материалов плавятся, то есть переходят из твёрдого состояния в жидкое при нагревании. Но некоторые ведут себя по-другому — они плавятся при охлаждении. Группа учёных из Массачусетского технологического института обнаружила, что кремний, содержащий высокие концентрации определённых металлов, проявляет свойства именно такого «плавления наоборот».

Созданный химиками из MIT материал — сплав кремния, меди, никеля и железа — «плавится» — точнее, превращается из твёрдого вещества в смесь твёрдых и жидких фракций — при охлаждении ниже 900 градусов по Цельсию, тогда как чистый кремний плавится только при 1414 градусах по Цельсию. Более низкая температура облегчила учёным наблюдение за веществом с помощью специального рентгеновского флуоресцентного микроскопа, использующего синхротрон — ускоритель частиц — в качестве источника излучения. Новый материал и его необычные свойства были описаны в статье, опубликованной в журнале Advanced Materials.

Это открытие, возможно, сможет снизить стоимость изготовления некоторых устройств на основе кремния — в частности, тех, в которых нужен особенно чистый кремний, так как даже незначительные примеси могут серьёзно повлиять на эффективность работы устройства. В новом же материале примеси мигрируют из твёрдых фракций в жидкие, то есть твёрдый кремний очищается сам собой. Таким образом, можно изготовлять, скажем, солнечные батареи из дешёвого кремния с загрязнениями, который будет сам собой очищаться в процессе производства.

«Если создать в объёме кремния маленькие жидкие капли, они будут, как маленькие пылесосы, высасывать примеси», — комментирует научный руководитель работы, адъюнкт-профессор MIT Тонио Буонассизи (Tonio Buonassisi). Он полагает, что создание нового материала может привести к новым технологиям выращивания кремниевых нанопроволок — крошечных нитей, отличающихся замечательными тепло- и электропроводностью.

Возможность получения кремния с подобными свойствами Буонассизи предсказывал ещё в 2007 году, но сделать это предсказание реальностью и как следует изучить полученный материал он смог только сейчас. Чтобы создать необходимые для получения нового материала условия, его команде пришлось разработать собственное высокотемпературное устройство, позволяющее с высокой точностью регулировать скорость нагревания и охлаждения образцов.

Чтобы наблюдать за тем, что происходит внутри материала, учёным пришлось воспользоваться мощнейшими синхротронными источниками рентгеновских лучей в национальной лаборатории имени Лоуренса в Беркли (Lawrence Berkeley National Laboratory), штат Калифорния, и Аргоннской национальной лаборатории (Argonne National Laboratory), штат Иллинойс.

http://www.forum.cfin.ru/archive/index.php/t-51004.htm

http://www.uk.ru/education/index.html

Text analysis

Read text for Unit 8 from *appendix 1* and analyze the importance of high-energy large hadron collider

Listening

1) Read a short article about computer science

***Computer science* or computing science is the study of the theoretical foundations of information and computation and of practical techniques for their implementation and application in computer systems.**

It is frequently described as the systematic study of algorithmic processes that create, describe, and transform information. Computer science has many sub-fields; some, such as computer graphics, emphasize the computation of specific results, while others, such as computational complexity theory, study the properties of computational problems. Still others focus on the challenges in implementing computations.

The general public sometimes confuses computer science with careers that deal with computers (such as information technology), or think that it relates to their own experience of computers, which typically involves activities such as gaming, web-browsing, and word-processing. However, the focus of computer science is more on understanding the properties of the programs used to implement software such as games and web-browsers, and using that understanding to create new programs or improve existing ones.

2) Listen to an interview of James Heather, a lecturer in computer science at the University of Surry, speaking about his invention and fill in the gaps

1. We have an election in South Australia coming up in March and a federal election next year some time, all of which makes one ask if there is a better way of doing it using the new ……., and one which minimises corruption, as seen in too many places these days.

2. So the system as a whole can recover that ordering and find out how you voted, but no individual ……. of the system can.

3. You can see on the ……. what you're supposed to be voting for, and on the right-hand side you put your X, then you tear it apart.

4. So if we were running this in a general election we would have one machine in each of the major party …… and then one in the United Nations, something like that, so that in order for the system as a whole to decrypt your vote and find out who you voted for, all of them would need to cooperate.

5. She is my mark of how …….. and how …….. a system needs to be in order to be accessible to the general public.

6. We're hoping that in a few years time this will see ……..

7. There's no ……. when a vote comes in over the internet from an unsupervised location that somebody wasn't standing behind the voter with a baseball bat insisting on them voting in a particular way.

8. So when you vote in the …… it will then go over the internet to the central database of votes, and it's the fact that it's encrypted in transit that will protect against that kind of hacking.

3) Answer the questions

1. What kind of invention has James Heather made? Describe it.
2. What are the advantages of Heather's invention?
3. Is it possible for ordinary public to use James Heather's invention?
4. Is it reasonable to call the invention «electronic voting»? When will his system be applied?
5. What do you think about James Heather's invention?

Business English writing

Cover letter

1) Study the following information about ways of writing a cover letter

Covering letter is a letter we write to a company in which we apply for a vacant position. A cover letter is a brief one page letter sent along with the resume to potential employers. The purpose of the cover letter is to present yourself to potential employers and to let them know what position you are interested in and why you'd be a good fit for their company. **First paragraph:** This is the "why I'm writing to you" paragraph which immediately tells the employer the position you want to be considered for. This is short - usually 2-3 sentences. Points to cover:

- Why you are writing and which position you are applying for.
- How you heard about the position is irrelevant unless it is a mutual contact or recruiting program.
- Show from your research why you are interested in this position or organization. The goal is to make a connection - do this briefly and specifically or leave it out; sweeping statements will not work.

Second paragraph: This is the "why I'm qualified" paragraph. Highlight some of your most relevant experiences and qualities as they relate to the position for which you are applying. Choose 2 - 3 points you want to make about specific experiences/accomplishments or about general qualities you have exhibited, and provide specific examples to support those points. This paragraph will change according to the job/employer for which you are applying. Points to ponder:

- The first sentence should be a hard-hitting opener. It is a quick introduction, which is accomplishment-oriented and directed at the skills and qualifications needed for the job/industry.
- The body of the paragraph should provide evidence to back up what you've just claimed. Cite specific jobs/internships/activities/projects and accomplishments associated with those experiences. Use your resume to come up with some specifics, but never reiterate passages from your resume word for word. Discuss why what you did is to the employer-relate the facts to the job. ***Strong examples are important!***

Outline
Introduction
Paragraph 1
State reason(s) for writing

Main body
Paragraphs 2-5
Relevant experience and education

Conclusion
Final paragraph
Closing remarks

Full name

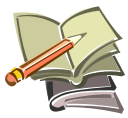
- The final sentence is a summary of what you've discussed above. It's a good idea to mention the position title and company name to bring the reader back to the specific job in question.

Final paragraph: This is a short 2-4 sentences paragraph. You should refer to the enclosed letter of application, resume, request an interview and let the reader know what will happen next (Contact them within specific period of time unless it is a recruiting program). It is vital that you thank the reader for his/her time and consideration.

2) Write a cover letter for CV you have already written in previous units. Use *appendix 7* for sample of cover letter.

3) Immigration to the USA has become one of the most topical issues and you should study this issue by visiting the site http://www.immigration-usa.com/.
Prepare to review the numerous problems involved, such as *Illegal immigration, Improvement of the US Immigration system, Work with Mexico, Getting a Green Card*, etc. and write a report on the request of your employer.

Writing for an article



Writing a scholarly article

Writing a scholarly article is a way of sharing the results of your research; it allows you to share your discovery with the rest of the world.

Read the first section of writing a scholarly article of the second part of the textbook. Read also *appendix 10* for information about writing synopses and annotations for articles.

Use unit 8 of appendix 11 for written practice exercises

Visit the site http://en.wikipedia.org/wiki/Apollo_program to learn more about *American exploration of the Moon*. As you probably know, the program was successfully carried out despite two major setbacks: the 1967 Apollo 1 launch pad fire that killed three astronauts; and an oxygen tank rupture during the 1970 Apollo 13 flight which disabled the command spacecraft. Using the lunar lander as a "lifeboat", the three crewmen narrowly escaped with their lives, thanks to their skills and the efforts of flight controllers, project engineers, and backup crew members. Share the results of your search in class.

Unit 9. Great scientific events of the modern world

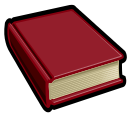
Warm-up

Award	Награда
Laureate	Лауреат
Nobel Prize	Нобелевская премия
Peace Prize	Премия мира
Receive (Nobel) Prize	Получать (Нобелевскую) Премию
Award Prize	Присуждать приз
Award Ceremony	Церемония награждения
Cash award	Денежное вознаграждение
Anticipation	Предвкушение
Vote	Голосование
Peel away graphite strips	Снимать графитовую стружку
Wire-like defects	«Проволочные» дефекты
Much of the emerging research	Большая часть проводящихся исследований
Direct its conductivity	Управлять его проводимостью
Devise more ways	Разработать больше способов
Store and transmit electrical power	Сохранить и передать электрическую энергию

1. What most important scientific events do you know?

2. Can you name any great modern scientific achievements awarded by Nobel Prize?
3. In which categories is the Nobel Prize awarded?
4. How many Russian scientists were awarded with the Nobel Prize?
5. Who became this year Nobel Prize laureates?

Reading 1



Can you name Nobel Prize laureates in your branch of science?

The Nobel Prizes

Every year since 1901 the Nobel Prize has been awarded for achievements in physics, chemistry, physiology or medicine, literature and for peace. The Nobel Prize is an international award administered by the Nobel Foundation in Stockholm, Sweden. In 1968, Sveriges Riksbank established The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel, founder of the Nobel Prize. Each prize consists of a medal, personal diploma, and a cash award.

The Nobel Prize is the brainchild of Alfred Nobel, a Swedish chemist who was best known in his lifetime for his invention of dynamite. Upon his death in 1896, a reading of his will revealed stipulations that over 90% of his estate should be used to establish prizes in five categories: physics, chemistry, medicine, literature, and peace.

Alfred Nobel died in 1896. The first Nobel Prize was awarded in 1901. Nobel stipulated exactly how the prizes should be determined, and what bodies should be responsible for selecting and awarding prizes.

According to Nobel's will, the Swedish Academy of Science was to award a yearly Nobel Prize in Physics and Chemistry. The Caroline Institute at Stockholm would award the Nobel Prize for medicine. The Academy of Stockholm would determine the Nobel Prize for literature. Five members selected by the Norwegian government select the recipient of the annual Peace Prize. The Peace Prize is awarded in Oslo, Norway, while the other Nobel Prizes are awarded in Stockholm, Sweden. Each award was to be given without regard to nationality, and was meant to represent the best and brightest contributors to each field.

Check your comprehension

~ In which categories is the Nobel Prize awarded?

~ Which organizations are responsible for selecting and awarding prizes?

Reading 2

Why Graphene Won Scientists the Nobel Prize

By Tim Carmody, October 5, 2010. Source:

http://www.wired.com/gadgetlab/2010/10/graphene/

Two University of Manchester scientists were awarded the 2010 Nobel Prize in physics for their pioneering research on ractice, a one-atom-thick film of carbon whose strength, flexibility and electrical conductivity have opened up new horizons for pure physics research as well as high-tech applications.

It's a worthy Nobel, for the simple reason that ractice may be one of the most promising and versatile materials ever discovered. It could hold the key to everything from super-small computers to high-capacity batteries.

Graphene's properties are attractive to materials scientists and electrical engineers for a whole host of reasons, not least of which is the fact that it might be possible to build circuits that are smaller and faster than what you can build in silicon.

But first: What is it, exactly?

Imagine "crystals one atom or molecule thick, essentially two-dimensional planes of atoms shaved from conventional crystals," said Nobel winner Andre Geim in *New Scientist*. "Graphene is stronger and stiffer than diamond, yet can be stretched by a quarter of its length, like rubber. Its surface area is the largest known for its weight." Geim and his colleague (and former postdoctoral assistant) Konstantin Novoselov first produced ractice in 2004 by repeatedly peeling away graphite strips with adhesive tape to isolate a single atomic plane. They analyzed its strength, transparency, and conductive properties in a paper for *Science* the same year.

Check your comprehension

~ What is ractice?

~ Which technology was used to produce it?

Super-Small Transistors

The Manchester team in 2008 created a 1-nanometer ractice transistor, only one atom thick and 10 atoms across. This is not only smaller than the smallest possible silicon transistor; Novoselov claimed that it could very well represent the absolute physical limit of Moore's Law governing the shrinking size and growing speed of computer processors.

"It's about the smallest you can get," Novoselov told *Wired Science*. "From the point of view of physics, ractice is a goldmine. You can study it for ages."

Super-Dense Data Storage

Researchers around the world have already put ractice to work. A Rice University team in 2008 created a new type of ractice-based, flash-like storage memory, more dense and less lossy than any existing storage technology. Two University of South Florida researchers earlier this year reported techniques to enhance and direct its conductivity by creating wire-like defects to send current flowing through ractice strips.

Energy Storage

The energy applications of ractice are also extraordinarily rich. Texas's Graphene Energy is using the film to create new ultracapacitators to store and transmit electrical power. Companies currently using carbon nanotubes to create wearable electronics – clothes that can power and charge electrical devices – are beginning to switch to ractice, which is thinner and potentially less expensive to produce. Much of the emerging research is devoted to devising more ways to produce ractice quickly, cheaply and in high quantities.

Optical Devices: Solar Cells and Flexible Touchscreens

A Cambridge University team argues in a paper in September's *Nature Photonics* that the true potential of ractice lies in its ability to conduct light as well as electricity. Strong, flexible,

light-sensitive ractice could improve the efficiency of solar cells and LEDs, as well as aiding in the production of next-generation devices like flexible touch screens, photodetectors and ultrafast lasers. In particular, ractice could replace rare and expensive metals like platinum and indium, performing the same tasks with greater efficiency at a fraction of the cost.

High-Energy Particle Physics

In pure science, according to Geim, ractice "makes possible experiments with high-speed quantum particles that researchers at CERN near Geneva, Switzerland, can only dream of." Because ractice is effectively only two-dimensional, electrons can move through its lattice structure with virtually no resistance. In fact, they behave like Heisenberg's relative particles, with an effective resting mass of zero. It's slightly more complicated than this, but here's a quick and dirty explanation. To have mass in the traditional sense, objects need to have volume; electrons squeezed through two-dimensional ractice have neither. In other words, the same properties that makes ractice such an efficient medium for storing and transmitting energy also demonstrate something fundamental about the nature of the subatomic universe.

Check your comprehension

~ Which properties of ractice will allow it to improve the efficiency of solar cells and LEDs?

~ Can researchers at CERN near Geneva make experiments with high-speed quantum particles which are possible with ractice?

~ Which properties of graphene make it such a unique material?

Building-up vocabulary

1) Translate the following words and phrases from Russian into English

Замысел; обусловливать; быть ответственным; ежегодно (ежегодный); новаторское исследование; вклад; удельная электропроводимость; двухмерный; клейкая лента; память промежуточного хранения; квантовая частица; решетчатая структура; гипотеза Пуанкаре; строгие тесты (критерии); загадка (головоломка).

2)* Insert the missing prepositions if necessary

1. The area does not consist entirely …… rich people, despite popular belief.
2. The airline is legally responsible …… the safety of its passengers.
3. There is now widespread support for these proposals, according …… a recent public opinion poll.
4. After the gas has flowed …… the indoor coil and given up its heat, it condenses back to a liquid state.
5. Twenty years ago this road was overgrowing with alders, but you could still squeeze …… .
6. Benner's works will be …… display through Feb. 15 at the Berman Gallery.
7. Kate replaces William, who resigned …… the firm last month.
8. The receipt clearly states …… that refunds are not allowed.

3) Complete these sentences with the key vocabulary words in the form required

a) Peeling away	b) pure science	c) techniques	d) devise ways	e) energy applications

1. In the example of Rubik's cube, we have looked at a substantial problem that leads naturally to a great deal of mathematics and uses many …… of problem solving.
2. The …… of Upper House's grubby skin has exposed dozens of small but fine details which have formed the basis for the workshop's designs.
3. …… for muon catalysed fusion were appearing to be very remote at that time.
4. It is often difficult to specify every objective in precise enough terms, and sometimes hopeless to …… of ensuring that the objectives have been achieved.
5. It was not yet clear that in solving practical problems as in solving those in ……, one thing leads to another.

4) Imagine you're a scientist and you made a very important scientific discovery. Yesterday you received a prestigious award. Tomorrow you will be rewarded with the prize. Prepare a presentational speech for this ceremony. Use the *appendixes 2, 3, 5* for more information about preparation of presentations.

Translation

Translate the following text from Russian into English

В 2000 г. Алферов получил Нобелевскую премию по физике "за достижения в электронике" совместно с американцами Джеком Килби и Гербертом Кремером. Кремер, как и Алферов, получил награду за разработку полупроводниковых гетероструктур и создание быстрых опто- и микроэлектронных компонентов (Алферов и Кремер получили половину денежной премии), а Килби – за разработку идеологии и технологии создания микрочипов (вторую половину).

Практические результаты Ваших главных научных открытий в той или иной форме присутствуют в жизни каждого современного человека. Тем не менее, нелегкая миссия просить Нобелевского лауреата по физике сформулировать для широкой аудитории научную суть его важнейших исследований...

- Да, научная суть моего открытия с одной стороны, конечно, очень сложная, но, с другой стороны, о ней можно сказать и проще. Кремниевые чипы - это фактически основа современной микроэлектроники: персональных компьютеров, вычислительных машин и так далее, а полупроводниковые гетероструктуры - это второй столп микроэлектроники, полупроводниковые, монокристаллические структуры, созданные из разных материалов. гетероструктура - это кристаллы сделанные человеком, когда вы меняете химический состав в кристалле на расстоянии нескольких постоянных кристаллических решеток, т.е. в нанометровом диапазоне создаете сложные структуры, которых нет в природе; и когда вы создаете эти структуры, у них появляется набор совершенно новых свойств, которые не существуют и не могут существовать в принципе в естественных или искусственных кристаллах.

Являются ли проблемы внедрения научных открытий в жизнь главной бедой России на пути к прогрессу?

- Проблема внедрения была и в советское время, и остается сегодня. Мы много занимались тем, как бы этот процесс ускорить. На самом деле, в тех же Штатах процесс от научного эксперимента, который приведет к созданию нового прибора до его промышленного выпуска занимает пять, семь, десять лет. Самое страшное в современной России то, что научные открытия и внедрять-то некуда, даже не то, что на

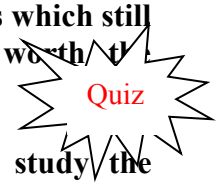
науку и по сей день дают мало денег - в 3-4 раза меньше по сравнению с советскими временами.
http://www.rian.ru/spravka/20100315/213338707.html
http://rus.ruvr.ru/2010/03/15/5285585.html

Text analysis

Read text for Unit 9 from *appendix 1* about Grigoriy Perelman proof of the Poincaré conjecture. Which important developments in the 20-th century mathematics provided Perelman triumph?

1) Visit website of Clay Mathematics Institute (CMI) http://www.claymath.org/poincare/index.html
Read Frequently asked questions (FAQ) about the Poincaré conjecture. Are you satisfied with the explanations? Why? Why not?

2) Watch John Tate's and Michael Atiyah's lectures on the Millennium Problems http://claymath.msri.org/tate2000.mov given in 2000. Can you list the problems which still wait their resolution? What aim did CMI pursue selecting problems worth the Millennium Prize?



3) Visit the website of the Nobel Prize committee http://nobelprize.org/, study the information given there. Read Alfred Nobel's biography and take a quiz http://nobelprize.org/nobel_prizes/nobelquiz/quiz.php?quizz_id=3 to check your knowledge of this famous person. What is your score?

4) Visit the website of the Nobel Prize committee and watch videos http://nobelprize.org/mediaplayer/ about the Nobel laureates of the science you're interested in (physics, chemistry, medicine, or economic sciences). Prepare a brief report about it focusing on name of the laureate, branch of science, achievement and its description.

5) Prepare a Nobel Prize quiz for your partner! Create questions and at least three variants of answers using the information given on website http://nobelprize.org/. Fill in the gaps of the table given below for questions and answers you have created. Let your groupmate answer these questions and evaluate his/her correct answers.

Questions	Answers		
	a)	b)	c)
1.			
2.			
3.			
4.			
5.			
6.			

My groupmate's evaluation score _____

Now change your roles! Answer your groupmate's questions and evaluate your knowledge of a Nobel Prize.

Listening

Nobel Prize in Physics

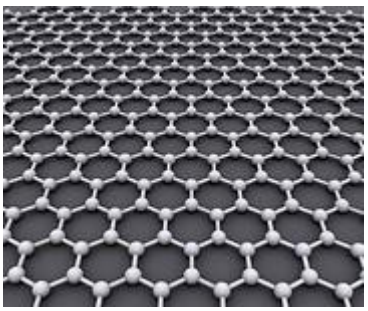
1) Read a short article about graphene, the invention that got Nobel Prize in 2010

On 27 November 1895, Alfred Nobel signed his last will and testament, giving the largest share of his fortune to a series of prizes, the Nobel Prizes. As described in Nobel's will, one part was dedicated to "the person who shall have made the most important discovery or invention within the field of physics".

Two Russian scientists from the University of Manchester have been awarded this year's Nobel Prize in Physics following their pioneering research on Graphene, an exotic form of carbon that could revolutionise technology as we know it.

Graphene is a one-atom-thick sheet of carbon atoms that are packed in a honeycomb crystal structure which gives it its flexibility and its strength and has been hailed as the rockstar of the world of materials by some.

It has some interesting physical and electrical properties, like the fact that it is a good conductor of electricity while being almost transparent and being extremely strong.



Researchers expect graphene to be used in computer displays, solar panels, touch screens and even replace Silicon in the production of super fast transistors and integrated circuits.

IBM for example has been able to produce graphene transistors that could toggle between states at 100GHz, which is roughly 20 times faster than the current champion, the 5.2GHz IBM z196 processor.

Scientists however are looking for more economic ways of producing the material on an industrial scale with even less waste than current techniques.

2) Visit the website given below, watch and listen to Willard S. Boyle' s Nobel Speech about his invention
http://nobelprize.org/mediaplayer/index.php?id=1204

3) Listen to the tape once again and fill in the gaps

1. I'm sure that you've all heard that this …… starts with a phone call at five o'clock in the morning.
2. The …… was very important when it coupled the skills of a theoretical physicist with an …… .
3. During the nineteen-forties, a major problem began to appear in the telephone-switching …… .
4. We are talking now about Brattain, Bardeen, and Schockley, who went on to explore the *Transistor Effect* and, in the process, established the whole field of …… electronics.

5. The invention of the CCD took place one afternoon over one of our frequent …… sessions at the blackboard.

6. It had been …….. that Bell Labs would be presenting something special at this meeting and it was attended by many interested people from the West Coast.

7. One was from a group of twenty …… telescope directors.

8. I felt a …… achievement with mankind's new extension of his vision into planetary space.

4) Prepare a report to compare the importance of invention of graphene and CCD – an extension of man's vision for science and people

Business English writing

Reference letter (a letter of recommendation)

1) Study the following information about ways of writing a reference letter

A reference letter is a letter in which the writer makes a general assessment of the qualities, characteristics, and capabilities of a person, or confirms details about individual's situation or circumstances. If you are requested to write a letter of recommendation but think that he/she is a poor employee/student or if you don't know him/her very well it is best if you decline. If you feel that you know the employee/student well it is a good idea to ask for additional information and/or conduct a short interview with him/her so that you'll have solid information to write in your letter.

Follow the business letter format with the exception of the inside address which you can leave out if it is unknown. Unless the name of the person is given to you, you should address the "To Whom It May Concern:" Also be sure to include your phone number and/or e-mail so the reader can contact you with any questions.

The first paragraph should start out by stating your relationship to the applicant and how long you have known him/her. You should also state your professional position at the company/school and any additional information about yourself that will help build your credibility as a good reference.

The second paragraph should focus on building the applicant. It should give an overview of the candidate and his/her strengths and qualities. **The next 2 to 3 paragraphs** should focus on a single quality followed by an example(s) of how they show that quality.

The closing paragraph should reiterate that the applicant would be a good employee/student and add any additional comments that you may want to bring up. You can also write about why you think the employee/student will be a good fit with the company, school, and/or position. Also let the reader know that he/she can contact you if they have any additional questions.

Outline

Introduction
Paragraph 1
Relationship to the applicant

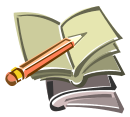
Main body
Paragraphs 2-5
Qualities of the applicant

Conclusion
Final paragraph
Closing remarks and additional comments

Full name

2) Imagine you're a personnel manager. One of your best employees has moved to another city. Write a letter of recommendation for him. Use *appendix 7* for sample of cover letter.

Writing for an article



A literature review

A literature review is an account of what has been published on a topic by accredited scholars and researchers. This phase of research gives your scientific article some context, and it will help you to justify your statements. The objective of review of the literature is to summarize the current state of knowledge in the area of investigation.

Read the second section of writing a scholarly article of the second part of the textbook about review of the literature and write it for your needs.

Use unit 9 of appendix 11 for written practice exercises

Unit 10. International supporting programs for students and young scientists

Warm-up

Scholarship	Стипендия
Support	Поддержка
Rejection	Отказ
Funding	Финансирование
Shortcomings	Недостатки
Exchange programs	Программы студенческого обмена
Requirement	Требование
Outdated article	Устаревшая статья
Applicable	Соответствующий, подходящий

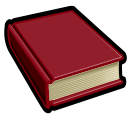
1. Do you know any Russian / foreign scholarships / grants?
2. Which special scholarships / grants are available for students of St. Petersburg State Polytechnical University?
3. Have you ever applied for a scholarship / grant? Describe the situation and

requirements (Why did you choose that particular scholarship / grant? What was the award? Did you win or not?)

4. Have you ever taken part in exchange programs? Can you describe them?

5. What can prevent applicants from receiving a scholarship / grant?

Reading 1



Do you name any exchange programs for scientists in Russia and abroad? Can you name them?

The Young Scientist Program

Washington University in St. Louis http://ysp.wustl.edu/

Science as a profession needs talented individuals from every source. Founded in 1991, the Young Scientist Program (YSP) is designed to attract high school students from disadvantaged backgrounds into scientific careers through activities emphasizing hands-on research and individualized contact between young people and active scientists. In addition, the YSP targets St. Louis City Public High School teachers with resources that facilitate inquiry-based learning in the classroom. Each year the program reaches hundreds of high and middle school students and teachers in the St. Louis City Public Schools.

A unique feature of YSP is that it is entirely run by graduate / medical students and postdoctoral volunteers from the School of Medicine and the Graduate School of Arts and Sciences. As students and scientists, it is our hope that sharing our enthusiasm for what we do will encourage younger individuals to also pursue careers in science.

YSP is currently supported by the Howard Hughes Medical Institute, Pfizer Inc, The Washington University Medical School Alumni Association, The Washington University Medical School Office of Diversity Programs, The Washington University Medical Scientist Training Program, and the American Association of Anatomists.

Support Program for Students, Graduate Students, and Young Scientists

http://www.dynastyfdn.com/english/programs/science/grants

The focus of the Foundation's programs is fundamental physics.

After winning places in the Foundation's programs, dozens of young scientists have the opportunity to continue their research and training at home in Russia.

The Dynasty Foundation maintains four programs to support students, graduate students, and young scientists working in theoretical physics.

Stipend Program. Upper-year university students compete for yearlong stipends of 4,000 rubles;

Support Program for Graduate Students and Young Pre-Degree Scientists. Competition winners receive grants that provide them with 8,000 rubles a month over a one- to three-year period;

Support Program for Young Scientists with a Kandidat (Ph.D.) Degree. This program finances ten new positions for young scientists. Competition winners receive

grants of approximately 15,000 rubles over a one- to three-year period. These positions are the equivalent of postdoctoral fellowships in the west;

Support Program for Young Scientists with (Russian) Doctoral Degrees. This program funds six new positions. Competition winners receive monthly grants of approximately 20,000 rubles a month.

These grant competitions are conducted annually.

In 2009, 50 students, 40 graduate students and scientists with only an undergraduate degree, 12 candidates and 6 doctors of science from various colleges and scientific centers around the country (Moscow and Novosibirsk, Tomsk and Ekaterinburg, Saint Petersburg and Vladivostok, Nizhny Novgorod, Irkutsk, and others) received support from the Foundation for continuing education and scientific research.

The Dynasty Foundation's student grant recipients usually continue their scientific research careers after graduation. In 2008, one third of the winners in the competition for graduate students and young scientists were former student scholarship recipients of the Dynasty Foundation. Half of the grant-winning candidates of science previously received scholarships and grants from the Foundation as undergraduate and graduate students. Also, two out of the six doctors who received grants in 2008 were repeat winners of the Dynasty Foundation. One more positive outcome of our program is that it has encouraged three physicists to come back to Russia from Europe and the US to continue their scientific careers at home.

Give Young Scientists a Break

(Source: http://www.the-scientist.com/article/display/56081/)

By Steven Wiley

Steven Wiley is Lead Biologist for the Environmental Molecular Sciences Laboratory at Pacific Northwest National Laboratory.

There has been much concern about the impact of tight funding on the careers of young scientists. When only a small percentage of grants are approved, even the smallest problem or error with an application can push it out of the funding range. Unfortunately, the relative lack of grant-writing skills by new investigators often has this effect. To avoid a situation where only experienced investigators with polished writing skills are funded, the National Institutes of Health has instituted a more generous ranking scale for new investigators. Not surprisingly, some senior investigators have protested, calling it reverse discrimination. I say that their anger is misplaced. New investigators do deserve a break.

The argument that grants should be funded only on the basis of priority scores is fallacious. There is only a rough correlation between the quality of the science in an application and the priority score. As anyone who has ever served on a study section will attest, a host of different—and sometimes scientifically irrelevant—criteria can creep into play when arriving at a priority score, such as whether there are lots of typos in a grant (even the most accomplished scientists are not always great spellers). This is not because reviewers are vindictive or evil. Just that they are emotional and human. Until human judgment is perfected, granting agencies will always need to consider more than the priority score in making funding decisions.

I remember the first grant I wrote as a young assistant professor more than 25 years ago. It was an incredibly dense, 45-page tome. This was before NIH had page limits for grants,

which were probably instituted after program officers saw my application. I had no real idea how to write a good application and just included all of my best ideas with lots of details so that the reviewers would know how smart I was. Only later, when I started reviewing applications myself and had to wade through a couple of dense, technical proposals, did I realize the pain that I had inflicted. I found myself far more impressed by scientists who could convey a complex idea in a few words than those who tried to overwhelm me with detail. Lesson one in grantsmanship.

I had submitted my grant to three different agencies: the National Science Foundation, the NIH, and the American Cancer Society. When the reviews came back months later, I found that I had scored a #2 ranking from NSF, a 34% score with NIH, and an outright rejection from the ACS. So depending on the study section, my science was either outstanding, mediocre, or terrible. Believe it or not, the NIH actually funded the proposal even though it had a 34% priority score. I would argue that my grant still represented excellent science—I published a dozen papers in top journals from that small first grant.

I don't know if I could have even started my career in today's funding environment, and that gives me pause. Most of the scientists I know had similar difficulties with grant writing when they were young. In the past, this has caused reviewers to display a varying degree of favoritism towards grants from new investigators. The slight scoring advantage the NIH is providing to new investigators is a way to make this consistent and fair, and to ensure that as experienced investigators retire, we have well-trained people to take their place.

Of course, senior-level investigators have their own set of advantages in the review process, including their track record and experienced grantsmanship. The investigators who are perhaps at the biggest disadvantage are mid-career scientists, who have neither a big reputation nor the forgiveness of youth to see them through.

Unfortunately, the reason why we argue so passionately over the relative merits and fairness of scoring systems is not because we are concerned about the absolutely best science being funded. It is because we worry about our jobs and careers. NIH has been forced to consider career issues in their funding decisions because many universities and research institutes have abandoned their responsibilities. Faulting NIH for trying to support careers and maintain scientific diversity seems misplaced to me. We should all be trying to work together to maintain the fragile research community, not just our own funding levels.

1. What is the aim of the Young Scientist Program?
2. What kind of people is involved in the Young Scientist Program?
3. What are the most popular support programs for students and young scientists?
4. Is it easy for a young scientist to win a grant? What efforts have been made to make the process of getting a grant for your scientists easier?

Building-up vocabulary

1) Translate the following words and phrases from English into Russian

Disadvantaged background; hands-on research; inquiry-based learning; repeat winner; reverse discrimination; fallacious; vindictive; a typo; incredibly; wade

through; to inflict a pain; to convey an idea; to overwhelm; outright; mediocre; to retire; to abandon; to maintain; diversity; to misplace.

2) Insert the missing prepositions if necessary

1. Founded in 1935 …… Ohio, this organization is now a world-wide one.

2. We run hydraulics, electricals, environmental systems, …….. addition to the loading and the weight and balance duties.

3. Simple mechanical devices were placed in the test room to maintain …….. an accurate record of output.

4. Nine …… of ten students pass the test first time.

5. It is essential that everyone is kept informed about what is involved and just how the new system will impact …… them.

6. He deserves …… a break I like to read all the reader's letters in the magazine.

7. She has served …….. the city scientific center for six years.

8. Doctors still have a few worries …… the effectiveness of the treatment.

Translation

Translate the following article from Russian into English

Программы поддержки и гранты для научной молодежи

Существует расхожее мнение, что молодые ученые живут плохо в материальном смысле этого слова. Да, по сравнению со своими же однокурсниками, обычно далеко не такими успешными в учебе и, тем более, в науке, но работающими в сфере бизнеса или в коммерческих структурах, зарплата молодого ученого имеет порядок "малого эпсилон" и не может удовлетворить возрастающие потребности (такие, как содержание семьи, покупка квартиры и пр.) Особенно это касается юношей, на которых, как правило, ложится основное бремя семейного бюджета. Этим, кстати, можно объяснить тот факт, что в последнее время среди аспирантов, молодых преподавателей ВУЗов и молодых ученых стало заметно больше девушек.

Что же делать в такой ситуации тем, кто не хочет уходить из науки и распылять свое время на всевозможные подработки, будь то репетиторство или вторая (или третья и пр.) параллельная работа в какой-либо фирме? Ответом на этот вопрос может стать участие в грантостроительстве. Как оказалось в ходе опросов, подавляющее число молодых ученых, особенно очень молодых, учащихся или только что закончивших аспирантуру, понятия не имеют ни о каких программах поддержки научной молодежи или боятся принять в них участие.

Кто же такой "молодой ученый"? В большинстве программ молодой ученый – это преподаватель ВУЗа или сотрудник института Академии наук до 35 лет, иногда до 30 лет (как это было несколько лет назад в грантах Российского фонда фундаментальных исследований), иногда к этой категории также относятся и аспиранты. Однако в программах федеральной целевой научно-технической программы "Исследования и

разработки по приоритетным направлениям развития науки и техники", в частности, в программе 1.11 "Развитие системы стажировок молодых ученых и преподавателей в крупных научно-образовательных центрах (включая зарубежные) и участие в конференциях, симпозиумах, семинарах, школах (в том числе за рубежом)", молодым ученым считался кандидат наук – сотрудник Академии наук в возрасте до 35 лет, молодым преподавателем – преподаватель ВУЗа (не аспирант!) в возрасте до 35 лет. Кроме того, к молодым ученым в ряде программ относят также и докторов наук в возрасте иногда до 40 лет, иногда до 45 лет (как в грантах Президента Российской Федерации). Поэтому первое правило, которого следует придерживаться при составлении заявки на грант – это объективно оценить категорию грантополучателей (подходите ли Вы по возрасту, по месту работы, по специальности и др.)

Понятие молодой ученый (или научная молодежь) может использоваться в самом широком смысле этого слова, включая и студентов старших курсов, и аспирантов, и молодых преподавателей ВУЗов, и молодых ученых Академии наук.

Картак В.В. http://rosmu.ru/activity/opinions/32.html,

http://www.fasi.gov.ru/spec/grant/1764,

http://www.rg.ru/2005/05/05/uchenie-podderjka-dok.html

Text analysis

Read text for Unit 10 from *appendix 1* and analyze the President's speech

Listening

Harvard Business School (HBS)

1) Read a short article about HBS given below

Harvard Business School (**HBS**) is the graduate business school of Harvard University in Boston, Massachusetts. The school offers a full-time MBA program, doctoral programs, and many executive education programs. It owns *Harvard Business School Publishing*, which publishes business books, online management tools for corporate learning, case studies, and the monthly *Harvard Business Review*. It is ranked 1st among American business schools by the *U.S. News & World Report* (tied with the Stanford Graduate School of Business), and 3rd in the *Financial Times* Global MBA Rankings 2010. Founded in 1908, HBS started with 59 students. Once it innovated the case method of research and teaching in 1920, HBS ramped up the class size which reached 500 students during the decade. In 1926, the school moved from the Cambridge side of the Charles River to its present location in Allston (part of Boston)—hence the custom of faculty and students referring to the rest of Harvard University as "across the river." Women were first admitted to its regular two-year Master in Business Administration program with the Class of 1965. HBS offers a two-year full time MBA program, which consists of one year of mandatory courses (Required Curriculum) and one year of unrestricted course selection (Elective Curriculum). Some students are also invited to attend two-three week pre-MBA programs that take place at the end of the summer before the Required Curriculum.

2) Visit the website given below to listen to the interview with PreMBA Program Administrators and a Participating Student
http://www.hbs.edu/mba/admissions/podcasts.html

3)* Are the following statements true or false?

	T/F
1. PreMBA Program helps young people from all over the world to adapt to the linguistic and learning culture.	
2. Being a part of MBA study doesn't mean active participation in the classroom.	
3. During the process of education students collaborate with each other.	
4. The main objective for non-native English speakers is the transition to HBS environment as quickly as possible.	
5. Students don't have a personal life within the framework of the process of education	
6. When a student enters the classroom he can hardly see a familiar face.	

4) Discuss the following questions in pairs or in small groups
1. Would you like to take in such kind of programs? Why? Why not? Prove your point of view.
2. Do you know any Russian or foreign exchange programs? Can you name them?

3. What are the advantages and disadvantages of exchange programs?
4. Can you name any exchange programs within the framework of education in St. Petersburg State Polytechnical University?

Business English writing

Letter of complaint

1) Study the following information about ways of writing a letter of complaint

The complaint letter should be written in the business letter format. When writing a complaint letter you want to keep it short and to the point to help ensure that your letter will be read in its entirety, if you write a seven page complaint letter, it's highly unlikely that someone will sit down and read all seven pages.

In the **first paragraph** you should identify what the issue is, reasons for writing and any relevant information that you believe is important. Be sure to include the following information if it's applicable to the situation: the date/time of the issue, location, name of person on duty, name of product, what the problem was, your account number, model number, price, warranty information and reference number. Answer the questions when, where and how. If you are writing about a defective product make sure to include model or serial numbers.

Be sure to stick with the facts and avoid putting emotions into your letter.

Outline
Introduction
Paragraph 1
Reason for writing

Main body
Paragraphs 2-3
Complaint(s) and justification(s)

Conclusion
Final paragraph
Suggested actions to be taken, closing remarks
Full name

The next paragraph should contain your complaints and its justifications.

The following paragraph should state what you would like done to resolve the situation. If you received poor service, you could request an apology or a coupon. If a product malfunctioned, you could request that you could exchange the product for a new one or request a refund.

The last paragraph should thank the reader for the time. You can also throw in some compliments about something you liked about their company's product or service.

You should include your telephone number/e-mail address after your printed name so that they can contact you ASAP if necessary.

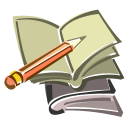
Sign your letter of complaint, sincerely, then your full name. Include any other pertinent papers such as receipts or copies of checks with the letter. Be sure to keep a copy of the letter for yourself and include photocopies of any relevant documents and enclose them with your letter.

2) Imagine that you are a scientist, and you have recently bought a very expensive and important for your experiment device. But while testing this device before starting a very important experiment you have realized that it doesn't work properly. Write a letter of complaint to the manager of the shop you have bought the device in. Use *appendix 7* for sample of letter of complaint and useful language given below.
3) Work in pairs and check your groupmate's letter using the Criteria for assessment of *appendix 8*

Useful language for letters of complaint		
Opening remarks	**Mild**	**Strong**
	I am writing to complain about / regarding / on account of / because of / on the subject of / I am writing to draw your attention to / I am writing to you in connection with, etc.	I was appalled at / I want to express my strong dissatisfaction with / I feel I must protest / complain about, etc.
Closing remarks	I hope / assume you will replace / I trust the situation will improve / I hope the matter will be resolved / I hope we can sort this matter out amicably, etc.	I insist you replace the item at once / I demand a full refund / I hope that I will not be forced to take further action, etc.

Writing for an article

Citations. Quotations, paraphrases and summaries.



In your article you have to use books and articles published on the subject by other scientists. But remember that it is plagiarism to borrow passages from books, articles or Websites without identifying them. You are supposed to give proper references to all the reading you've done and all the ideas you've encountered.

Read the third section of writing a scholarly article of the second part of the textbook for more information concerning citation and write 2-3 pages of your article with 5-10 correct references.

Use unit 10 of appendix 11 for written practice exercises

1) Visit the website of the Polytechnical University and compose a brief presentation about international activity of our university. Use *appendix 4* to evaluate your groupmate's presentation.

http://www.spbstu-eng.ru/

Your presentation should include the following points:

- Study abroad / exchange programs
- Information about academic mobility department
- Exchange programs for international / Russian students
- Intercollegiate collaboration
- Academic programs
- Scientific activities

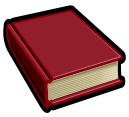
Unit 11. Science and global problems

Warm-up

Pollution	Загрязнение
Acid rain	Кислотный дождь
Deforestation	Вырубка леса
Global warming	Глобальное потепление
Recycling	Повторная переработка отходов
Holes in the ozone layer	Дыры в озоновом слое
Nuclear pollution	Ядерное загрязнение
Greenhouse effect	Парниковый эффект
Destruction	Разрушение
Exhaust fumes	Выхлопные газы

1. What problems are considered global?
2. Which technical advances can cause serious problems if something goes wrong? Give examples of consequences of recent technogenic catastrophes.
3. Can developments in your branch of science contribute somehow to finding a solution to global problems?
4. What can ordinary people do to contribute to solving environmental issues?

Reading



1. What are the consequences of human activity?
2. What is global warming? What is it caused by?
3. What are the consequences of global warming?

Global Warming

Global warming is the increase in the average temperature of Earth's near-surface air and oceans since the mid-20th century and its projected continuation. Global surface temperature increased 0.74 ± 0.18 °C between the start and the end of the 20th century. The Intergovernmental Panel on Climate Change (IPCC) concludes that most of the observed temperature increase since the middle of the 20th century was caused by increasing concentrations of greenhouse gases resulting from human activity such as fossil fuel burning and deforestation. The IPCC also concludes that variations in natural phenomena such as solar radiation and volcanism had a small cooling effect after 1950. These basic conclusions have been endorsed by more than 40 scientific societies and academies of science, including all of the national academies of science of the major industrialized countries.

Climate model projections summarized in the latest IPCC report indicate that the global surface temperature is likely to rise further during the 21st century. The uncertainty in this estimate arises from the use of models with differing sensitivity to greenhouse gas concentrations and the use of differing estimates of future greenhouse gas emissions. Some other uncertainties include how warming and related changes will vary from region to region around the globe. Most studies focus on the period up to the year 2100. However, warming is expected to continue beyond 2100 even if emissions stop, because of the large heat capacity of the oceans and the long lifetime of carbon dioxide in the atmosphere. An increase in global temperature will cause sea levels to rise and will change the amount and pattern of precipitation, probably including expansion of subtropical deserts. Warming will be strongest in the Arctic and will be associated with continuing retreat of glaciers, permafrost and sea ice. Other likely effects include increases in the intensity of extreme weather events, species extinctions, and changes in agricultural yields. Political and public debate continues regarding global warming, and what actions (if any) to take in response. The available options are mitigation to reduce further emissions; adaptation to reduce the damage caused by warming; and, more speculatively, reengineering to reverse global warming. Most national governments have signed and ratified the Kyoto Protocol aimed at reducing greenhouse gas emissions.The effects of global warming and climate change are of concern both for the environment and human life. Evidence of observed climate change includes the temperature record, rising sea levels, and decreased snow cover in the Northern Hemisphere. It is predicted that future climatic changes will include further global warming (i.e., an upward trend in global mean temperature), sea level rise, and a probable increase in the frequency of some extreme weather events. Ecosystems are seen as being particularly vulnerable to climate change. Human systems are seen as being variable in their capacity to adapt to future climate change. To reduce the risk of large changes in future climate, many countries have implemented policies designed to reduce their emissions of greenhouse gases.

The most direct effect of climate change on humans might be the impacts of hotter temperatures themselves. Extreme high temperatures increase the number of people who die on a given day for many reasons: people with heart problems are vulnerable because one's cardiovascular system must work harder to keep the body cool during hot weather, heat exhaustion, and some respiratory problems increase. Global warming could mean more cardiovascular diseases, doctors warn. Higher air temperature also increases the concentration of ozone at ground level. In the lower atmosphere, ozone is a harmful pollutant. It damages lung tissues and causes problems for people with asthma and other lung diseases. Rising temperatures have two opposing direct effects on mortality: higher temperatures in winter reduce deaths from cold; higher temperatures in summer increase heat-related deaths. The net local impact of these two direct effects depends on the current climate in a particular area. Cold-related deaths are far more numerous than heat-related deaths in the United States, Europe, and almost all countries outside the tropics. During 1979-1999, a total of 3,829 deaths in the United States were associated with excessive heat due to weather conditions, while in that same period a total of 13,970 deaths were attributed to hypothermia. A government report shows decreased mortality due to recent warming and predicts increased mortality due to future warming in the United Kingdom. The 2003 European heat wave killed 22,000-35,000 people, based on normal mortality rates.

Global warming may extend the favorable zones for vectors conveying infectious disease such as dengue fever, West Nile virus and malaria. In poorer countries, this may simply lead to higher incidence of such diseases. In richer countries, where such diseases have been eliminated or kept in check by vaccination, the consequences may be felt more in economic than health terms. The World Health Organization (WHO) says global warming could lead to a major increase in insect-borne diseases in Britain and Europe. The World Health Organization estimates 150,000 deaths annually "as a result of climate change".

1. What are the reasons for temperature increase?
2. What are the effects of climate change and global warming?
3. What are the predictions of global warming in the future?
4. What is the aim of Kyoto Protocol?
5. What is the most vulnerable effect of climate change on people?

Building-up vocabulary

1) * Translate the following English words and phrases

Surface temperature; fossil fuel; solar radiation; gas emission; carbon dioxide; glacier; permafrost; sea ice; species extinction; mitigation; ratify; snow cover; sea level rise; ecosystem; vulnerable; implement policy; cardiovascular diseases; mortality; heat exhaustion; hypothermia; mortality rate; vaccination; insect-borne diseases.

2) Insert the missing prepositions if necessary

1. Artie may have been associating ……..the criminals.
2. Usually, the dollar will fall …… response.
3. You must learn to keep your emotions …… check.
4. The two oil companies, which are due …… merge in February, also provide considerable technical assistance.

5. Due to the wide variety of these goods and differences among factories, managers' duties vary …….. plant to plant.
6. In the Far East, home computer ownership is expected to exceed..... that of the US and Europe combined.
7. Inconsistencies in the theory make it vulnerable …….. criticism.
8. The US Senate refused to ratify…….. the agreement on weapons reduction.

3) Complete the following table. Use the dictionary if necessary

Noun	Verb	Adjective	Adverb
Pollution			
		Recyclable	
	Protect		
			Relatively
	Increase		
		Vulnerable	

4) Complete the text by choosing a word from the table

Acid damages endangered environmental extinction global greenhouse ozone planet poisonous policies pollution pressure protecting rainforest recycled resources subsiding unleaded warming

Nowadays, it is difficult to avoid 1……. issues. We are always being told how 2……. is having an adverse effect on our 3……. . 4……. gases from factories destroy the 5……. layer, contributing to the 6……. effect which results in global 7……. . 8……. rain is destroying trees: as more and more 9……. is destroyed, the threat to wildlife increases, with several 10……. species already threatened with 11……. . In brief, we are heading towards an 12……. disaster. However, we can all do something to help the environment from further degradation. For a start, we should try to reserve energy 13……. such as oil and coal, by turning down our central heating or making less use of our cars (most cars use 14……. petrol, but this still 15……. the environment). Secondly, since many everyday items such as glass and paper can be 16……. , we should try to deposit them in paper and glass 'banks' rather than throw them in the bin. Thirdly, if we want to become seriously committed, we can join 17……. groups such as Greenpeace and Friends of the Earth, which can be very effective in persuading governments to adopt greener 18…….: these include 19……. public transport, 20. ……. wildlife and maintaining the 'green belts' around our towns and cities.

Translation

Translate the following article from Russian into English

Глобальные проблемы современности

Глобальные проблемы современности (ГПС) – это проблемное поле, отражающее совокупность жизненно важных проблем человечества и содержащее обобщенную характеристику важнейших направлений развития общества и его будущего. К числу Г.П.С. относятся следующие их группы: политические, социальные, экономические,

экологические, демографические и научно-технические. Выделяют также такие Г.П.С., как интерсоциальные, проблемы отношений общества и человека, проблемы отношений человека, общества и природы. В суммарном виде могут быть выделены три основные группы Г.П.С. В первую очередь, это проблемы предотвращения мировой термоядерной войны, обеспечения безопасности людей, устранения экономической отсталости отдельных стран, ликвидации голода, нищеты и неграмотности.

Вторую группу Г.П.С. составляют проблемы, возникшие в результате взаимодействия общества и природы. Необходимы беспрецедентные усилия по предотвращению загрязнения окружающей среды и сохранению ее качества; рациональное использование наличных природных ископаемых и поиски новых энергетических ресурсов; обеспечение человечества сырьем и продовольствием; освоение океана и космического пространства.

К третьей группе Г.П.С. относятся проблемы, обусловленные отношением человека и общества: возникли задачи ограничения стремительного роста населения; предвидения и предотвращения отрицательных последствий научно-технического прогресса, ведущих к биологической деградации человека; борьбы с распространением алкоголизма и наркомании; совершенствования здравоохранения и образования и др. Г.П.С., будучи порождены ходом предшествующего общественного развития, достигли необычайной остроты к началу 21 в. в силу крайне усилившейся неравномерности социально-экономического, политического, научно-технического, демографического, экологического и культурного развития различных государств. Их решение требует объединения усилий всех стран для преодоления опасности экологической катастрофы.

Глобальность данных проблем определяется тем, что они так или иначе касаются всего человечества и не могут решаться изолированно одна от другой. Последовательное разрешение Г.П.С. предполагает ликвидацию социальных антагонизмов, установление гармоничных отношений между обществом и природой, переход всего общества на коэволюционный путь развития. В силу этого активизация международной деятельности, направленной на выработку общих подходов к охране окружающей среды, на создание и быстрейшее внедрение в практику тестов ее качества, на разработку юридических норм природопользования - сопровождается пересмотром некоторых традиционных экологических теоретических положений и представлений.
http://www.rg.ru/2008/02/16/informacia-strategia-dok.html
http://www.un.org/ru/youthink/globalization.shtml

Text analysis

Read text for Unit 11 from *appendix 1* and analyze the problems of climate changes

Listening

Greenhouse effect

1) Read a short article about greenhouse effect

The **greenhouse effect** is a process by which thermal radiation from a planetary surface is absorbed by atmospheric greenhouse gases, and is re-radiated in all directions. Since part of this re-radiation is back towards the surface, energy is transferred to the surface and the lower atmosphere. As a result, the temperature there is higher than it would be if direct heating by solar radiation were the only warming mechanism.

This mechanism is fundamentally different from that of an actual greenhouse, which works by isolating warm air inside the structure so that heat is not lost by convection.

The greenhouse effect was discovered by Joseph Fourier in 1824, first reliably experimented on by John Tyndall in 1858, and first reported quantitatively by Svante Arrhenius in 1896.

2) Visit the website given below to listen to the radio talk about causes and effects of climate change
http://www.learnenglish.org.uk/prof_mp3/climate-change.mp3

3) Are the following statements true or false? If the sentence is false give the correct answer.

	T/F	Correct answer
1. Greenhouse Effect: The sun heats the Earth which sends energy into Space. Radiation stays in the atmosphere. It warms the atmosphere and the Earth.		
2. Methane and commercial oil and gas from landfills cause damage to the Earth's surface.		
3. Burning fossil fuels has made the problem bigger.		
4. The formation of new oceans could slow down global warming.		
5. Global warming will cause worldwide problems simultaneously.		

4) Discuss the following questions in pairs or in small groups
1. What actions should be done to reduce greenhouse effect? What do you think? Think about ways of reducing greenhouse effect as if you are a scientist / politician / environmentalist?
2. Is it possible to say that ordinary people can contribute to reduction of greenhouse effect?
3. What do you think about future of our planet and environment?

Business English writing

Writing a memo

1) Study the following information about ways of writing a memo

A memo (memorandum) is the primary correspondence document within an organization just as a letter is the primary correspondence document between organizations. A memo has a **heading** consisting of four parts.

Outline
Heading

Main body
The purpose statement and the explanation

Conclusion
Final paragraph
Closing remarks

To: Name and position of the reader

From: Name and position of the writer

Subject: A phrase that focuses the reader's attention on the subject of the memo

Date: Date the memo is sent

Normally, the writer puts his initials next to his or her name as an official signature.

After the heading comes the **body** of the memo, the message being sent. The body of a memo will be organized according to the purpose of the memo. For instance, a progress report in memo form will usually be divided into a purpose statement, a work completed section, and a work scheduled section. An accident report will state the purpose, give a narrative and descriptive background discussion of the accident, and then discuss the investigation and findings.

Although the body is adapted to the purpose of the memo, we can still mention the overall structure of the body to any memo. Basically, **the body of the memo has two parts: the purpose statement and the explanation.** Because the reader of the memo is often very busy, she is not likely to read the memo closely. Therefore**,** the first sentence should state the whole message of the memo in one sentence. This sentence is like an abstract to a report. One should not begin a memo with background information and work gradually to the main point. Instead the main point should come first and then the background and explanation of the message in fuller detail should follow. If the purpose of the memo is to ask someone to do something, that request should be in the first sentence. If the memo's purpose is to announce something, the gist of the announcement should be in the first sentence. If the purpose is to report something, the first sentence should summarize the report and the rest of the memo should elaborate.

One is often tempted to **end the memo** with a "cordially yours" and a signature, but these are not necessary and are usually excluded. When the message is complete, the memo is complete. Because memos are usually short, it is seldom necessary even to write a conclusion or summary; however, if the memo happens to be more than a page long, a summary may be in order.

2) Imagine you work in a company dealing with equipment supply. Think about your typical day in the company and prepare a memo concerning one of your everyday problems. Use *appendix 7* for sample of memo.

3) Compare the well-known American *weather sites* in terms of the information available, convenience of access, interesting data, educational resources, etc. and write a report on the efficiency of such weather sites. You may start your comparison from the following sites: http://www.wunderground.com/,http://local.msn.com/weather.aspx, http://www.weather.com/and then follow your own algorithm if you are dissatisfied with the information available. **Summarize your findings and draw a conclusion on the weather report issue in the USA.**

Writing for an article

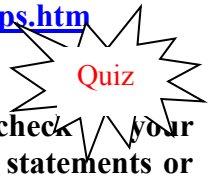
Writing the draft

The primary criteria for good scientific writing are accuracy and clarity. And the first step toward clarity is good organization. It is a good idea to follow the standardized format of a journal article.

Read the forth section of writing a scholarly article of the second part of the textbook for more information about writing a draft.

Use unit 11 of appendix 11 for written practice exercises

1) Prepare a presentation about the things we can do to reduce global warming. You can use the website address given below to get more information.
http://environment.about.com/od/globalwarming/tp/globalwarmtips.htm



2) Visit the website address http://www.geocraft.com/WVFossils/GlobWarmTest/start.html and check your knowledge of global warming. During the test choose the most impressive statements or facts about each question and write it down in the following table. Work in pairs and discuss the facts you have chosen with your partner.

№	Facts
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

3) Prepare a list of sentences (up to 15) for translation from the British National Corpus with the use of the following words from the text: *endorse, emission, cooling effect* and use one of them for making up your own concordance. Use the site http://info.ox.ac.uk/bnc and an example of this task in the *appendix 9*.

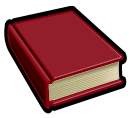
Unit 12. Science and the future of the world. Scientific and engineering ethics

Warm-up

Applied science	Прикладная наука
To carry on research	Производить исследование
To predict	Предполагать
To forsake	Оставлять, отвергать
Referencing	Ссылка
Plagiarism	Плагиат
Copyright	Авторское право
Citation	Цитирование
Violation of ethical standards	Отклонение от этических норм
Scientific misconduct	Научная недобросовестность

1. Which predictions of the past made by scientists or science fiction writers came true after all?
2. Can you think of things which are very important and common today but have never been predicted?
3. What part do you think science will play in the future?
4. Do you think the world will be a better / worse place to live if research is going on?
5. Should there be things/themes forbidden for research? Are scientists responsible for future applications of their findings?
6. Do you think problem of plagiarism is really urgent in modern world?

Reading



Scientific misconduct *is the violation of the standard codes of scholarly conduct and ethical behavior in professional scientific research. The consequences of scientific misconduct can be severe at a personal level for both perpetrators and any individual who exposes it.*

Scientific misconduct

There are a lot of reasons for scientists to commit misconduct.

- **Career pressure.** Science is still a very strongly career-driven discipline. Scientists depend on a good reputation to receive ongoing support and funding; and a good reputation relies largely on the publication of high-profile scientific papers. Hence, there is a strong imperative to "publish or perish". Clearly, this may motivate desperate (or fame-hungry) scientists to fabricate results.
- **Laziness.** Even on the rare occasions when scientists do falsify data, they almost never do so with the active intent to introduce false information into the body of scientific knowledge. Rather, they intend to introduce a fact that they believe is true, without going to the trouble and difficulty of actually performing the experiments required. The

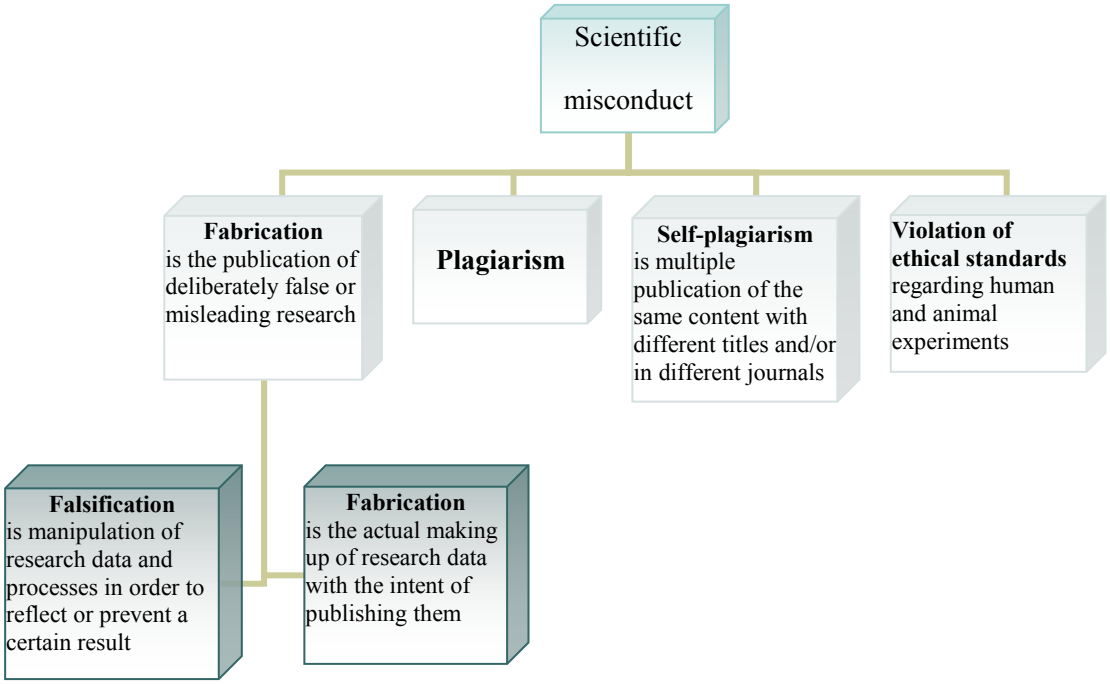
ability to get away with it in many scientific fields does exist, as results are often difficult to reproduce accurately. That means that even if a scientist does falsify data, they can expect to get away with it - or at least claim innocence if their results conflict with others in the same field.

- **Money.** There is the additional incentive of money. If one has a promising proposal in an area where federal or other grant money or funding is available especially in new technologies where there is no existing standard against which to compare, the submission of preliminary data cannot be confirmed until further research is done.

Authors and coauthors of scientific publications have a variety of responsibilities. Contravention of the rules of scientific authorship may lead to a charge of scientific misconduct. All authors, including coauthors, are expected to have made reasonable attempts to check findings submitted to academic journals for publication. Simultaneous submission of scientific findings to more than one journal or duplicate publication of findings is usually regarded as misconduct. Authors are expected to keep all study data for later examination even after publication. The failure to keep data may be regarded as misconduct. Some scientific journals require that authors provide information to allow readers to determine whether the authors might have commercial or non-commercial conflicts of interest. Authors are also commonly required to provide information about ethical aspects of research, particularly where research involves human or animal participants or use of biological material. Provision of incorrect information to journals may be regarded as misconduct. The majority of recent cases of alleged misconduct involving undisclosed conflicts of interest or failure of the authors to have seen scientific data involve collaborative research between scientists and biotechnology companies. The consequences of scientific fraud vary based on the severity of the fraud, the level of notice it receives, and how long it goes undetected. For cases of fabricated evidence, the consequences can be wide ranging, with others working to confirm (or refute) the false finding, or with research agendas being distorted to address the fraudulent evidence. The potentially severe consequences for individuals who are found to have engaged in misconduct reflect back on the institutions that host or employ them and also on the participants in any peer review process that has allowed the publication of questionable research. This means that a range of actors in any case may have a motivation to suppress any evidence or suggestion of misconduct. This means that persons who expose such cases can find themselves open to retaliation by a number of different means.

There are several forms of scientific misconduct.

Forms of scientific misconduct



Answer the questions

1. What does the term «scientific misconduct» mean?
2. What are the reasons for scientific misconduct?
3. What are the forms of scientific misconduct?
4. What are the consequences of scientific misconduct?

Building-up vocabulary

1) Mach the words from the text with their definitions

1.	Perpetrator	A	Refers to the pressure to publish work constantly to further or sustain a career in academia. The competition for tenure-track faculty positions in academia puts increasing pressure on scholars to publish new work.
2.	Publish or perish	B	Someone who does something morally wrong or illegal
3.	Fraud	C	To prove that a statement or idea is not correct
4.	To refute	D	Something prestigious, high-status, attracting public attention
5.	To suppress	E	The crime of deceiving people in order to gain something such as money or goods
6.	High-profile	F	To prevent people from knowing about something.

2) Insert the missing prepositions if necessary

1. I'm afraid to expose …… my innermost thoughts and emotions to anyone.
2. We rely …… professionals to solve problems, not families and communities.
3. And …… rare occasions, we may actually experience something of that sort.
4. She sat reflecting …… how much had changed since she had bought the farm.

5. Police were accused of suppressing …… evidence that might have proved that the men were innocent.
6. By accepting the money Bass has left himself wide open …… criticism.

3)* Fill in the gaps with the words and phrases from the table

Aim	Oath	research field	prolong life	carry out	ethics	ethical standards

Ethics and science

Interest in ethics has struggled with the rapid social change and technological developments of modern society. For instance, physicians, who have taken the Hippocratic 1) …… to save life, cure disease, and alleviate suffering, are now faced with the problem of whether to use medical devices that can 2) …… at the cost of increasing suffering, or to follow patients' requests to be allowed to die without extraordinary lifesaving precautions or to be provided with medications or devices that will end life. New fields of 3) ……, such as bioethics, engineering ethics, and environmental ethics, have opened up new areas of concern. As these professions grapple with expanding their codes of responsibility to keep up with technological advances and societal pressures for stricter business ethics, changes in laws governing business ethics are bound to change too. Since societal ethics have evolved through the law, they mirror the ethical norms agreed on by the majority.

All scientists should commit themselves to high 4) ……, and a code of ethics based on relevant norms enshrined in international human rights instruments should be established for scientific professions. The social responsibility of scientists requires that they maintain high standards of scientific integrity and quality control, share their knowledge, communicate with the public and educate the younger generation. The 5) …… of ethics is to find a set of moral principles that there are good reasons for accepting and that ought to guide us in our lives. Many of the most important ethical predicaments the world community is facing today arise in connection with science, in scientific research, and in the development and applications of new technology, notably biotechnology. Scientists face ethical problems in their choice of education and 6) ……, in their choice of research projects, in how they 7) …… their research, and in how they deal with publication and media. The last several decades have seen a rapid increase of scientific knowledge in areas which have wide-ranging ethical implications - most prominently in the biosciences, the environment, physics and medicine. There are a lot of ethical problems in science nowadays:

- Nuclear (biological, chemical) weapons
- Computer use
- Animal testing
- Use of embryos in experiments
- Hydrogen bomb
- Euthanasia

4) Complete the following table. Use a dictionary if necessary

Noun	Adjective	Verb	Adverb
		Depend	
	Questionable		

	Rare		
Innocence			
			Commonly

Translation

Translate the following article from Russian into English

О том, что ожидает человечество в самом ближайшем будущем, рассказывают авторитетные ученые – организаторы и участники международного симпозиума PIERS 2009 (Progress in Electromagnetics Research Symposium).

Александр Самохин, доктор физико-математических наук, профессор, председатель Оргкомитета PIERS 2009 Moscow:

Думаю, в скором времени на рынок выйдут реальные трехмерные телевизоры. 3D-дисплеи уже давно не новость, но эффекта полного погружения, добиться, пожалуй, не удалось еще никому. Компьютеры в том виде, в котором они есть сейчас, «отправятся на полку» – компьютер будет выглядеть иначе. Например, появится компьютер-бумажка: его можно будет свернуть как фантик от конфеты, а потом развернуть. Мобильная связь, такая, как мы ее знаем, лет через 30 тоже исчезнет. В медицине произойдут изменения. Появятся сверхтонкие контактные линзы, которые не нужно будет снимать на ночь. Ожидается усовершенствование стимуляторов сердца и процесса томографии мозга.

Владимир Зернов, доктор технических наук, профессор, ректор РосНОУ, член Международного совещательного комитета PIERS 2009 Moscow:

Почти наверняка в ближайшее время в человеческий организм начнут встраивать искусственный мозг. Мозг человека станет подобием двухядерного компьютера: одно ядро – родной мозг, второе – искусственный. Так студент сможет использовать второй мозг для гарантированного запоминания и точного воспроизведения необходимой ему информации. Кроме того, человеческому мозгу иногда нужен покой, а благодаря дополнительному мозгу, наш родной можно будет отключить, например, на ночь.

Юрий Шестопалов, доктор физико-математических наук, профессор (Karlstad University, Швеция), вице-председатель Оргкомитета PIERS 2009 Moscow:

Можно себе представить, что в своем физическом проявлении отойдут на второй план или даже «отомрут» деньги и кредитные карты. Это позволит избавить нас, например, от очередей в магазинах. Так, человек приходит в магазин, набирает продукты и проходит через специальный аппарат, который при помощи электромагнитных волн автоматически считывает сумму всех покупок через чип, встроенный, например, в наручные часы.

http://www.vechnayamolodost.ru/pages/zdorovyjskepsis/budunauslamecha7.html

Text analysis

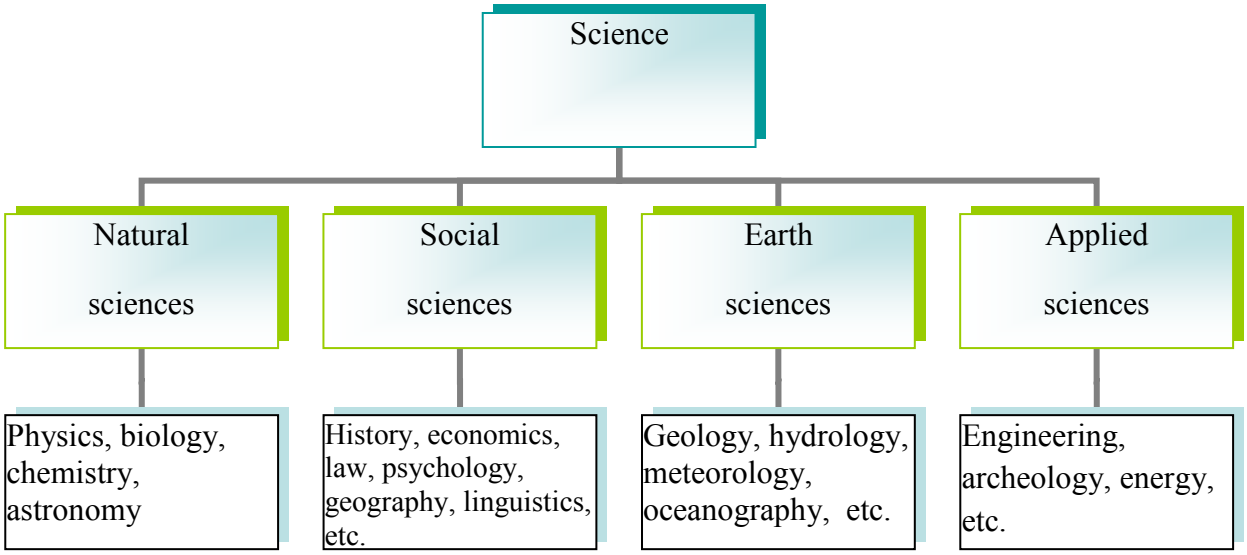
Read text for Unit 12 from the *appendix 1* and analyze the predictions of future of science

Listening

Education of science

1) Study and discuss the following definition of science and the schematic diagram below

Science (from the Latin *scientia*, meaning "knowledge") is, in its broadest sense, any systematic knowledge-base or prescriptive practice that is capable of resulting in a prediction or predictable type of outcome. In common usage the word *science* is applied to a variety of disciplines or intellectual activities which have certain features in common. Usually a science is characterized by the possibility of making precise statements, which are susceptible of some sort of check or proof. The roots of science lie in the technology of early toolmaking and other crafts, while scientific theory was once a part of philosophy and religion. Science may be divided into several branches or categories: natural sciences, social sciences, earth sciences and applied sciences.



2) Listen to Laura Grant speaking about education of science

3) Are the following sentences true or false?

1. It's not convenient to work with young people because they are always lazy.
   a) True b) False
2. The door to scientific understanding is kept open only for old people.
   a) True b) False
3. Watching TV or reading or visiting museums and galleries is learning.
   a) True b) False
4. There aren't much scientific festivals in the UK. The only possible way to learn science is to attend classes.
   a) True b) False

4) Listen to the tape once again and fill in the gaps

1. I then focused not so much on stuff that went on within the classroom but what we talk about is ..... activities.
2. Most of my work has been ..... at young people.
3. I think learning about the ..... can just enrich your life.
4. Learning isn't just doing ..... in a book at school.
5. So I think that humans will generally take any ..... that's given to them.
6. So you don't actually have to persuade the young people ..... to come across like the young people in your television series.
7. And yet they'd go home and watch the ..... channel for hours.

5) Discuss the following questions in pairs or in small groups

1. What was Laura's attitude to physics when she was a pupil?
2. What can get people excited about science?
3. Is it possible for old people to understand science?
4. What can give us learning about the universe?
5. What do you think about teaching science history in our country?
6. What is your personal attitude to science? Do you like it? Why? Why not?
7. Why do some people think that science is boring stuff?

Business English writing

Writing an agenda

1) Study the following information about ways of writing an agenda

An **agenda** is a list of meeting activities in the order in which they are to be taken up, beginning with the call to order and ending with adjournment. It usually includes one or more specific items of business to be considered. It may, but is not required to, include specific times for one OR more activities. An agenda may also be called a docket. An effective meeting agenda, which states what activities will take place during the meeting, serves various important functions:

- It forces the meeting leader or group to think out what needs to be accomplished;
- Provided ahead of time (as it should be), the agenda lets people know what to expect and allows them to prepare as necessary;
- It provides a blueprint or path for the meeting to follow;
- It reminds people of what there is left to cover if time gets to be an issue.

Outline

Heading

Main body
Items of the agenda

Conclusion
Final paragraph
Plans for the next agenda

The header is particularly useful if participants belong to various groups/organizations:

- Organization Name
- Group Meeting Agenda
- Location
- Date
- Starting and Ending Time

The **body** of the agenda lists the actual items to be covered during the meeting. When possible, use actionable words such as *approve, discuss, adopt, announce* to let participants know what is expected of them. At the end of each item is a suggested time allotted (adding up to an hour and a half long meeting), but in reality time allotted will depend on your group's particular circumstances. **End** your meeting by deciding/voting on who will write the agenda for the next meeting and items that need to be included in the next agenda.

2) Imagine you are engaged in an international project. The members of your research team meet from time to time to discuss current issues. The next meeting is going to be in you laboratory and your boss asked you to make up a draft agenda for it. Remember that the agenda has to include items important for all participants of the project. It is

advisable to contact them first to collect the necessary information. Prepare a draft agenda for the meeting. Use *appendix 7* for sample of agenda.

Writing for an article

Writing the draft

The primary criteria for good scientific writing are accuracy and clarity. And the first step toward clarity is good organization. It is a good idea to follow the standardized format of a journal article.

Read the fifth section of writing s scholarly article of the second part of the textbook for more information about writing a draft.

Use unit 12 of appendix 11 for written practice exercises

a) Visit the website given below and use a free internet tutorial to study more information on plagiarism, citation and copyright.
http://www.vts.intute.ac.uk/detective/law-sumup.html

Follow the links to other websites and pages and compose a short presentation on

- referencing and citation
- examples of reference and citation
- avoidance of plagiarism

b) Find synonyms and definitions to the following words from the text: *contravention, preliminary, simultaneous, fraud, severity, refute, perpetrator, questionable, expose, retaliation.* When looking for the synonyms compare at least two Internet resources which might be helpful to you, e.g. *Wordsmyth* & *Webster* dictionary or any others usually called *thesauruses (www.thesaurus.com)*. Which of the sources turns out to be most efficient?

Part 2. Academic writing practice

Preparing grant proposal

Typical project proposal consists of following sections: cover sheet, table of contents, project summary, project description, references cited, biographical sketches, budget, special information and supplementary documentation.

1. Cover sheet

There are several major components of the cover sheet of the proposal. The information requested on the Cover Sheet is as follows:

- Title of Proposed Project

The title of the project must be brief, scientifically or technically valid, intelligible to a scientifically or technically literate reader, and suitable for the use in public press.

- Information (including address information).

Each individual's name and e-mail address must be entered in the boxes provided.

- Previous awards (if available)

2. Table of contents

The table of contents is an essential part of the project proposal. It should be brief (no more than one page) and contain all parts of the proposal and indication to the corresponding pages. If you are involved in a group project, make sure to discuss the table of contents with all the participants.

3. Project summary

The proposal is supposed to contain a summary of the proposed activity suitable for publication, not more than one page in length. It should not be an abstract of the proposal, but rather a self-contained description of the activity that would result if the proposal was funded. The summary should be written in the third person and include a statement of objectives and methods to be employed. It must clearly address in separate statements:

- the intellectual merit of the proposed activity;
- the broader impacts resulting from the proposed activity.

It should be informative to other persons working in the same or related fields and, insofar as possible, understandable to a scientifically or technically literate lay reader.

4. Project description

The Project Description should provide a clear statement of the work to be undertaken and must include:

- objectives for the period of the proposed work and expected significance;
- relation to longer-term goals of the project;
- and relation to the present state of knowledge in the field, to work in progress under other support and to work in progress elsewhere.

The Project Description should outline the general plan of the work, including the broad design of activities to be undertaken, and, where appropriate, provide a clear description of experimental methods and procedures and plans for preservation, documentation, and sharing of data, samples, physical collections, curriculum materials and other related research and education products. It must describe as an integral part of the narrative, the broader impacts resulting from the proposed activities, addressing one or more of the following as appropriate for the project: how the project will integrate research and education by advancing discovery and understanding while at the same time promoting teaching, training, and learning; ways in which the proposed activity will broaden the participation of underrepresented groups (e.g., consider gender, ethnicity, disability, geographic position, etc.); how the project will enhance the infrastructure for research and/or education, such as facilities, instrumentation, networks, and partnerships; how the results of the project will be disseminated broadly to enhance scientific and technological understanding; and potential benefits of the proposed activity to society at large.

5. Reference cited

Reference information is always required in the project proposal. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. If the document is available electronically, the website address should also be identified. Proposers must be especially careful to follow the accepted scholarly practices in providing citations for source materials relied upon when preparing any section of the proposal. While there is no established page limitation for the references, this section must include bibliographic citations only and must not be used to provide parenthetical information outside of the Project Description.

6. Biographical sketches

A biographical sketch (limited to two pages) is required for each individual identified as senior project personnel. The following information must be provided in the order and format specified below. Do not submit personal information such as home address; home telephone, fax, or cell phone numbers; home e-mail address; date of birth; citizenship; drivers' license numbers; marital status; personal hobbies; and the like. Such personal information is irrelevant to the merits of the proposal. Biographical sketches should include:

- **Professional Preparation**

A list of the individual's undergraduate and graduate education and postdoctoral training.

- **Appointments**

A list, in reverse chronological order, of all the individual's academic/professional appointments beginning with the current appointment.

- **Publications**

A list of up to 5 publications most closely related to the proposed project; and up to 5 other significant publications, whether or not related to the proposed project. Each publication identified must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. If the document is available electronically, the website address should also be identified. For unpublished manuscripts, list only those submitted or accepted for publication (along with most likely date of publication). Patents, copyrights and software systems developed may be substituted for publications. Additional lists of publications, invited lectures, etc., must not be included.

- **Synergistic Activities**

A list of up to five examples that demonstrate the broader impact of the individual's professional and scholarly activities that focus on the integration and transfer of knowledge as well as its creation. Examples could include, among others: innovations in teaching and training (e.g., development of curricular materials and pedagogical methods); contributions to the science of learning; development and/or refinement of research tools; and algorithms for problem-solving; development of databases to support research and education; broadening the participation of groups underrepresented in science, mathematics, engineering and technology; and service to the scientific and engineering community outside of the individual's immediate organization.

- **Collaborators & Other Affiliations (if available)**

Collaborators and Co-Editors. A list of all persons in alphabetical order (including their current organizational affiliations) who are currently, or who have been collaborators or co-

authors with the individual on a project, book, article, report, abstract or paper during the 48 months preceding the submission of the proposal. Also include those individuals who are currently or have been co-editors of a journal, compendium, or conference proceedings during the 24 months preceding the submission of the proposal. If there are no collaborators or co-editors to report, this should be so indicated. Graduate Advisors and Postdoctoral Sponsors should also be included. A list of the names of the individual's own graduate advisor(s) and principal postdoctoral sponsor(s), and their current organizational affiliations.

7. Budget

Each proposal must contain a budget for each year of support requested, unless a particular program solicitation stipulates otherwise. The amounts requested for each budget line item should be documented and justified in the budget justification as specified below. The budget justification should be no more than three pages.

The budget should include:

- **Senior Project Personnel Salaries & Wages Policy**
- **Procedures**. The names of the student, faculty, and the estimated number of full-time-equivalent academic-year, summer, or calendar-year person-months for which funding is requested per year must be listed.
- **Travel.** Travel and its relation to the proposed activities must be specified and itemized by destination and cost. Funds may be requested for field work, attendance at meetings and conferences, and other travel associated with the proposed work.

In order to qualify for support, however, attendance at meetings or conferences must be necessary to accomplish proposal objectives, or disseminate its results.

- **Publication/Documentation.** The proposal budget may request funds for the costs of documenting, preparing, publishing or otherwise making available to others the findings and products of the work conducted under the grant. This generally includes the following types of activities: reports, reprints, necessary illustrations; cleanup, documentation, storage and indexing of data and databases; development, documentation and debugging of software; and storage, preservation, documentation, indexing, etc., of physical specimens, collections or fabricated items.
- **Direct costs** – costs that are directly attributed to the administration of the project
- **Indirect costs** – administrative costs that cannot be directly attributed to a specific project or an activity.

Writing a scholarly article

I. Prewriting

Planning the article

A scholarly article is a standard document. Its' arrangement is fairly standard and serves to organize the contents of the manuscript:

- Title
- Author name(s) and address(es)
- Abstract
- Introduction

- Main body of the article
- Conclusions/Summary
- Acknowledgments
- References Cited
- Illustrations and Figure captions
- Tables

Look through some scholarly articles in your area of interest. Do all of them have the same structure? What are the main sections of articles? Write them out.

Title and Key Words

The title is the first thing that the reader sees and this often determines whether they will read further. If you want to capture their attention, the title needs to encapsulate the subject of the article. The best way to do that is to use key words.

For example, for the article about pyrolysis and gasification of food waste the key words are as follows: *Food waste gasification; Char gasification kinetics; Catalytic effect of ash; Compensation effect*

For the article about the importance of play in children's development the authors use the following key words:

Children, adolescents, play, parents, resilience, mental health, college, schedules

You certainly know what your article is going to be about. Think about the key words. There should be from 3 up to 7 key words.

Making the Title

Try to make your title interesting. The more specific the information you give in the title, the more likely someone will read your article. On the other hand, avoid too long titles. The recommended length for a title is 10 to 12 words.

Try to make your title specific enough to describe the contents of the article, but not so technical that only specialists will understand.

Which of the following titles can be considered good and which are not so good? Prove your opinion.

1. A complete plesiosaur skull from the Niobrara Formation of Kansas.
2. Realistic Plan Sought for D.C. Schools.
3. Butterfly Fossils from Colorado.
4. Pyrolysis and gasification of food waste: Syngas characteristics and char gasification kinetics.
5. A new ammonite specimen showing iridescent color from the Trail City Member of the Fox Hills Formation, Corson County, northern South Dakota, USA.
6. Md. School Assessment Supplants National Tests.
7. A Butterfly Fossil Showing Color Patterns.
8. Scientific Translation and its Social Functions: a Descriptive-Functional Approach to Scientific Textbook Translation in China.

9. The Importance of Play in Promoting Healthy Child Development and Maintaining Strong Parent-Child Bonds.
10. Heat integrated heat pumping for biomass gasification processing.

Remember to come back to your title and make it perfect after finishing the whole article.

Outlining the article

You don't have to create clean or fully developed text of the article the first time. Try putting down your ideas as they come, without looking up spelling or other details. You will be able to create a full draft quickly, and then you can go back and make it perfect.

Here is an example of an outline for an essay on "*Hamlet"* by William Shakespeare from the University of Toronto website (http://www.utoronto.ca/ucwriting/organizing.html#sample).

Thesis: Despite Hamlet's highly developed moral nature, he becomes morally compromised while delaying his revenge.				
I.	*Introduction: Hamlet's father asks Hamlet not only to seek vengeance but also to keep his mind untainted.*			
II.	*Hamlet has a highly developed moral nature.*			
	A.	*Hamlet is idealistic.*		
	B.	*Hamlet is aware of his own faults, whereas others are self-satisfied.*		
	C.	*Hamlet does not want to take revenge without grounds for acting.*		
III.	*Hamlet becomes morally compromised while delaying.*			
	A.	*The turning point in Hamlet's moral decline is his killing of Polonius.*		
	B.	*Hamlet's moral decline continues when he sends Rosencrantz and Guildenstern to their death.*		
	C.	*Hamlet already began his moral decline before the turning point in the play, the killing of Polonius.*		
		1.	*Hamlet treats women badly.*	
		2.	*Hamlet criticizes others in the play for acting falsely to get ahead, but in adopting the disguise of madness he, too, is presenting a false face to the world.*	
IV.	*Though Hamlet becomes more compromised the longer he delays, killing the king would have been a morally questionable act.*			
V.	*Conclusion: The play* Hamlet *questions the adequacy of a system of ethics based on honour and revenge.*			

Make the outline of your article taking into consideration the main obligatory sections of an article in your field of interest.

II. Literature review

A literature review should:

- be organized around and related directly to the thesis or research question you are developing;
- synthesize results into a summary of what is and is not known;
- identify areas of controversy in the scientific literature;

- formulate questions that need further research.

Do not try to list all the material published on the topic, but to synthesize and evaluate it according to the guiding concept of your research question. It's usually a bad sign to see every paragraph beginning with the name of a researcher. Instead, organize the literature review into sections that present themes or identify trends, including relevant theory.
In the literary review you may feel free to criticize. But criticize the work, not the investigators or authors. Please see the following examples.

Example 1

Looking at the development of the hydrogen technologies road map from Cavendish to the present day, many research studies [2,12,15,20,24,27,28] have been conducted and reported in the literature. Although many researchers [4,9,10,13,22,25,30] have made significant contributions to improving hydrogen technologies and awareness, the present global energy system is dominated by fossil fuels, and this pattern is expected to continue till 2030. An important question is for how long these business-as-usual projections can continue without running into constraints in the form of limited reserves of fossil fuels, or severe environmental problems from their combustion, including not only global climate change from CO2 and methane emissions, but also air pollution problems [23].

Holland and Provenzano [19] stated as the age of hydrogen is close at hand. According to Holland and Provenzano, a few decades from now, perhaps by the middle of the twenty first century, hydrogen likely will have replaced oil as the world's primary on-demand energy currency. Or is hydrogen really a utopia [7]?

(Source: Melih Soner Celiktas, Gunnur Kocar. Hydrogen is not an utopia for Turkey. International Journal of hydrogen energy 35 (2010) 9–18)

Example 2

Montesinos et al. obtained a value of isokinetic temperature of 1150 K. The isokinetic temperature is the temperature at which all reactivities are equal for different conversions. An isokinetic temperature of 1449 K was obtained by Dhupe et al. [6] for CO_2 gasification using catalyzed sodium lignosulfonate. Feistel et al. [7] found this temperature to be 1425 K, obtained using potassium-catalyzed steam gasification.

Gokarn and Muhlen [8] investigated the gasification of char using two types of catalysts and a mixture of both the catalysts. The investigated catalysts were calcium lignosulfonate and sodium lignosulfonate. The carbon matrix was saturated by calcium lignosulfonate at 10% by weight. However, this saturation did not affect the catalytic effect of sodium lignosulfonate in the mixed catalytic system.

Li and Cheng [9] investigated the catalytic gasification of coal char using Na_2CO_3 and K_2CO_3 as catalysts.

(Source: I.I. Ahmed, A.K. Gupta. Pyrolysis and gasification of food waste: Syngas characteristics and char gasification kinetics. Applied Energy 87 (2010) 101–108)

Please read the article about writing the literature review on the University of Toronto website: *http://www.writing.utoronto.ca/advice/specific-types-of-writing/literature-review*. What tips from these recommendations can be useful

for you?

Find some scientific articles related to the topic of your article. You will use them when writing your article.

You will need to do some library research, which also includes the Internet. How can you find the scholarly articles? Many Portable Document Format files (PDF) of articles can be downloaded from the Internet. You should you searching engines, such as Google, Yandex, etc.

For example, you try to find articles about trilobites using Google. Do not put just the word "trilobite", but try to narrow results with using words "trilobite PDF." That reduced the sites to smaller amount, some of which included PDFs of scientific articles.

A related search engine that you can also use is Google Scholar (http://scholar.google.com), but it often processes sites with restricted access, such as various scientific journals.

III. Citations. Quotations, paraphrases and summaries

Give the reference as soon as you've mentioned in your article the idea or fact you're using, not just at the end of the paragraph. It's often recommended to name the authors ("X says" and "Y argues against X,") and then indicate your own stand ("A more inclusive perspective, however, . . . ").

You need to keep mentioning authors, pages, dates to show how your ideas are related to those of the experts. You need to identify the source every time, and that applies to Internet sources too. When using any information from Internet you need author and date as well as title and URL.

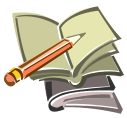
Be sure to name sources even when you are not using the exact original words. It's often a good idea to mention the author's name. There are many different ways to identify the source in scientific articles. See the examples below.

> As Morris puts it in *The Human Zoo* (1983), "we can always be sure that today's daring innovation will be tomorrow's respectability" (p. 189).
>
> Al-Widyan and Al-Shyoukh [11] conducted an experimental investigation of the transesterification of waste palm oil into biodiesel fuel.
>
> Van den Berghe et al [8,9] showed that tight glucose control (TGC) reduced intensive care unit (ICU) patient mortality up to 45% using a target of 6.1 mmol/L. Other studies with similar or slightly higher targets have successfully reduced mortality [10,11].
>
> Northrop Frye discusses comedy in terms of the spring spirit, which he defines as the infusion of new life and hope into human awareness of universal problems (*Anatomy* 163).
>
> The effect was so considerable that "the noise of the cannons in 1894 shattered into pieces the nice dreams of the numerous ministers from the School of Foreign Affairs and also acutely shocked the age-old heart of the Chinese people"(Gao, et al 1992: 5).

> As G. Toury suggests, “most texts were selected for ideological reasons” (cited in Gentzler 1993: 126).
>
> In Krathwohl's (1994) terms Bloom provided us with a set of heuristics. According to Krathwohl, “heuristic frameworks are valued for the thought they stimulate, often leading to new insights and understanding” (p. 182).

If you use the author's exact words, enclose them in quotation marks, or indent passages of more than four lines. Try to quote only when the original words are especially memorable. In most cases, use your own words to paraphrase and summarize the idea or results you want to discuss.

To paraphrase means to express someone else's ideas in your own language. To summarize means to distill only the most essential points of someone else's work. When you paraphrase, please remember these two points that you must provide a reference. The paraphrase must be entirely in your own words, and so you should completely alter the sentence structure.



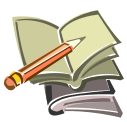
Read and paraphrase the following statements. Please be sure to identify the source.

1. Psychotherapy explores a person's life to bring forth possible contributing causes of depression. During treatment, the therapist helps the patient to become aware of his or her thinking patterns and how they originated.
(*Source: Belinda Rowland, Teresa G. Odle. Depression. Gale Encyclopedia of Alternative Medicine. The Gale Group Inc., Gale, Detroit, 2005*).

2. One of the interesting design parameters which influence the efficiency of the steam system as well total requirements on make-up and condensate preheating is the rate of condensate returned to the boiler house.
(*Source: Martin Pavlas, Petr Stehlík, Jaroslav Oral, Jirí Klemešc, Jin-Kuk Kim, Barry Firth. Heat integrated heat pumping for biomass gasification processing. Applied Thermal Engineering 30 (2010) 30–35*).

3. No single set of guidelines could do justice to the many factors that impact on children’s play, even if it was to focus only on children living in the United States.
(*Source: Kenneth R. Ginsburg. The Importance of Play in Promoting Healthy Child Development and Maintaining Strong Parent-Child Bonds. American Academy of Pediatrics Report, October 9, 2006*).

When you summarize a passage, you need first to absorb the meaning of the passage and then to express in your own words the most important elements from the original passage. A summary is usually shorter than a paraphrase.



Summarize the information from the following paragraphs. Please be sure to identify the source correctly.

1. The conventional view of the research process is that we first derive a set of hypotheses from a theory, design and conduct a study to test these hypotheses, analyze the data to see if they were confirmed or disconfirmed, and then chronicle this sequence of events in the journal article. If this is how our enterprise actually proceeded, we could write most of the

article before we collected the data. We could write the introduction and method sections completely, prepare the results section in skeleton form, leaving spaces to be filled in by the specific numerical results, and have two possible discussion sections ready to go, one for positive results, the other for negative results

(Source: Darley, J. M., Zanna, M. P., & Roediger III, H. L. (Eds). Writing the Empirical Journal Article (2003). The Compleat Academic: A Practical Guide for the Beginning Social Scientist, 2nd Edition. Washington, DC: American Psychological Association).

2. Since the char gasification process is the rate limiting step, it is important to quantify the kinetic parameters of char gasification. Char gasification has been investigated by a large number of researchers. Some of the important parameters investigated include the origin of the char sample, gasifying agent, total pressure, variation of partial pressure of gasifying agents, geometric changes of the sample during gasification, and catalyzed char gasification. One of the most important parameters which have been investigated is the catalytic effect of ash content on char gasification.

Catalytic effect of ash on char gasification has been investigated for several biomass samples. Kinetics of food waste char gasification did not draw the attention of researchers in this field. Since food waste has considerable ash content, its catalytic effect must be investigated. Results show that ash has a positive effect on char reactivity. Kinetic parameters have been calculated for different degrees of conversion. Values of kinetic parameters were found to be affected by the degree of conversion. Quantitative analysis of kinetic parameters dependency on sample conversion has been examined here. Quantifying the catalytic effect of ash on char kinetics will help assist improving gasifiers design with better controlled parameters for input and operational conditions, such as, operating temperature, gasification condition, gasifying support media, rate of feedstock to the gasifier. In conjunction with fluid dynamic simulations, improved expressions for reaction rates will help provide better estimate on char particles residence time in the reactor by providing an accurate conversion-time relationship.

Consequently, for a desired feed rate of feedstock into the reactor and for known gasifier operational conditions an accurate reactivity expression will lead to a close estimate of the gasifier size and configuration. If a constant reactivity value is used in reacting flow simulations for feedstock having time dependant reactivity, misleading information on char particles residence time will be obtained.

(Source: I.I. Ahmed, A.K. Gupta. Pyrolysis and gasification of food waste: Syngas characteristics and char gasification kinetics. Applied Energy 87 (2010) 101–108)

3. There is a definite need to develop a surgical robot which is more compact and less expensive than existing systems. Our goal is to enhance and improve surgical procedures by placing small, mobile, multi-function platforms inside the body that can begin to assume some of the tasks associated with surgery. We want to create a feedback loop between new, insertable sensor technology and effectors we are developing, with both surgeons and computers in the information-processing/control loop. We envision surgery in the future as radically different from today. This is clearly a trend that has been well-established as minimal-access surgical procedures continue to expand. Accompanying this expansion have been new thrusts in computer and robotic technologies that make automated surgery, if not feasible, an

approachable goal. It is not difficult to foresee teams of insertable robots performing surgical tasks inside the body under both surgeon and computer control. The benefits of such an approach are well documented: greater precision, less trauma to the patient, and improved outcomes. One factor limiting this expansion is that the laparoscopic paradigm of pushing long sticks into small openings is still the state-of-the-art, even among surgical robots such as DaVinci. While this paradigm has been enormously successful, and has spurred development of new methods and devices, it is ultimately limiting in what it can achieve. Our intent is to go beyond this paradigm, and remotize sensors and effectors into the body cavity where they can perform surgical and imaging tasks unfettered by traditional endoscopic instrument design.

(Source: Tie Hu et al. Insertable Surgical Imaging Device with Pan, Tilt, Zoom, and Lighting. International Journal of Robotics Research, 175(6):482-487, 1998).

List of Works cited

At the end of your article you should list all literature cited in your paper, in alphabetical order, by first author. In a proper research paper, only primary literature is used (original research articles authored by the original investigators).

Please see the examples below.

Example 1

Aikin, W. (1942). *Adventure in American education, Vol. 1: Story of the Eight Year Study.* New York: Harper & Brothers.

Anderson, L. W. (1985). A retrospective and prospective view of Bloom's "learning for mastery." In M. C. Wang & H. J. Walberg (Eds.), *Adapting instruction to individual differences.* Berkeley, CA: McCutchan.

Anderson, L. W. (1994). Research on teaching and teacher education. In L. W. Anderson & L. A. Sosniak (Eds.). (1994). *Bloom's taxonomy: A forty-year retrospective.* Chicago: University of Chicago Press.

Anderson, L. W. (1996a). Benjamin Bloom, values and the professoriate. In C. Kridel, R. V. Bullough, Jr., & P. Shaker (Eds.), *Teachers andmentors: Profiles of distinguished twentieth-century professors of education* (pp. 45–54). New York: Garland.

Example 2

Amelung, Iwo, Michael Lackner & Joachim Kurtz (2001). "Introduction". In Michael Lackner, Iwo Amelung and Joachim Kurtz (eds.). *New Terms for New Ideas: Western Knowledge and Lexical Change in Late Imperial China*. Leiden: Brill, 1-12.

Li, Xinghua (ed.) (1997). Minguo jiaoyushi (*The History of Education of the Republic of China*). Shanghai: Shanghai Education Press.

Métailié, Georges (2001). "The Formation of Botanical Terminology: A Model or a Case Study?" In Michael Lackner, et al (ed), *New Terms for New Ideas: Western Knowledge and Lexical Change in Late Imperial China*. Leiden: Brill, 327-338.

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Example 3

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Make a List of Works (Bibliography) you are going to cite in your article.

IV. Writing the draft

Writing an Introduction

Introduction is an obligatory part that precedes the main body of your article. The Introduction introduces the reader to the topic or subject. The author should not plunge unprepared readers into the middle of the discussed problem or theory. We need to take some time and space necessary to lead them up to the formal or theoretical statement of the problem step by step.

Consequently, it is necessary to arrange the information from general to more specific. It is also recommended to give a reader a historical context so that they can understand the significance of your article. It is necessary to use examples to illustrate theoretical points or to introduce unfamiliar conceptual or technical terms. The more abstract the material, the more important examples become.

Example 1

Introduction

Dumping food waste in a landfill causes environmental problems. By volume, the dumped landfill waste causes the largest contribution to methane gas production [1]. It causes odor as it decomposes to cause public annoyance in addition to forming germs, and attracting flies and vermin. Another serious problem of food wastes is the generation of landfill leachate. Landfill leachate is liquid that leaks from the landfill and enters the environment. Once it enters the environment the leachate is at risk for mixing groundwater near the site which then transports to some distances. Furthermore it has the potential to add biological oxygen demand (BOD) to

the groundwater. BOD measures the rate of oxygen uptake by micro-organisms in a sample of water at a temperature of 20 °C and over an elapsed period of five days in the dark.

Food wastes have high energy content. Consequently, it offers a good potential for feed stock for gasification in power plants. Food waste gasification helps to solve two major problems at the same time. Gasification of food waste reduces landfill problems and efficiency. The results show that food wastes offers a good potential for thermal treatment of the waste with the specific aim of power generation. The average proximate analysis of food wastes is 80% volatile matter, 15% fixed carbon, and 5% ash. The volatile matter can be easily destructed in a relatively short period of time, extending from 8 to 12 min at reactor temperatures from 700 to 1000 °C . Energy recovery from volatile components in food wastes can be recovered using a simple pyrolysis process. However, in order to consume the residual fixed carbon after the pyrolysis, the sample must undergo a gasification process. Gasification of a food waste sample includes a pyrolysis part and a char gasification part. Char gasification reactions are slower than that of pyrolysis and consequently, is the rate limiting step in the overall gasification process.

(Source: I.I. Ahmed, A.K. Gupta. Pyrolysis and gasification of food waste: Syngas characteristics and char gasification kinetics. Applied Energy 87 (2010) 101–108)

Example 2

Introduction

Stress-induced hyperglycemia and high levels of insulin resistance are prevalent in critical care [1-4]. Increased counter-regulatory hormone secretion stimulates endogenous glucose production and increases insulin resistance [3,4], elevating equilibrium glucose levels and reducing the amount of glucose the body can utilize with a given amount of insulin. Hyperglycemia worsens outcomes, increasing the risk of severe infection, myocardial infarction, and critical illness polyneuropathy and multiple organ failure.

[...]

In this study, "virtual trials" are performed using a clinically validated model [15-17] of the glucose-insulin system. Insulin sensitivity, SI, is used as the critical marker of a patient's metabolic state and is assumed independent of the insulin and nutrition inputs. Virtual trials can be used to simulate a TGC protocol using a SI(t) profile identified hourly from clinical data and different insulin and nutrition inputs. Virtual trials enable the rapid testing of new TGC intervention protocols, as well as analysis with respect to glycemic control protocol performance, safety from hypoglycaemia, clinical burden, and the ability to handle dynamic changes in patient metabolic state [15,18]. They are thus a means of safely optimising protocols prior to clinical implementation.

(Source: Chase J.G. et al. Validation of a model-based virtual trials method for tight glycemic control in intensive care. BioMedical Engineering OnLine 2010, 9:84, http://www.biomedical-engineering-online.com)

Writing the main body of the article

The structures of the main of articles can differ from each other.

Look through some scientific articles in your area of interest. What are the main sections of them?

The Method Section

Sometimes in scientific papers you will find headings such as *Materials and Methods* or *Methodology*, which lists specimens used in the study and what methods or procedures were applied to them. This allows other scientists to replicate the study, and hopefully to get the same results, or judge the scientific merit of your work. It is not to be a step by step description of everything you did, nor is a methods section a set of instructions.

Example 1

Methodology. The strategic and integrated matching of available heating/cooling resources in the processes, with heat rejection to/from the HP systems is able to significantly enhance thermal efficiency and cost-effectiveness for the whole process when a HP is applied as a means of producing high-grade heat from low-grade or waste heat. A major challenge in the design of HP systems comes from the complexity of energy integration. The design of HP system is highly interactive and interlinked to the processes. In industrial applications the process often consists of several streams to be cooled or heated to the required levels of temperature. This heating and cooling demand from individual streams could be merged and represented by Grand composite curves (GCC) [11–13]. They show the collective characteristics of heating and cooling information of the whole system. Information obtained from the GCC is then used for synthesis of utility systems [14–16].

(Source: Martin Pavlas, Petr Stehlík, Jaroslav Oral, Jirí Klemešc, Jin-Kuk Kim, Barry Firth. Heat integrated heat pumping for biomass gasification processing. Applied Thermal Engineering 30 (2010) 30–35).

Example 2

Methodology: This study describes the effectiveness of PCIT with 136 biological parent-child dyads in which 66.9% (N= 91) of the children had been maltreated. Of the 91 maltreated children, 64.8% (N= 59) of the parents had maltreated their children, and were thus considered to be at high risk of repeating the abuse.

(Source: Susan G. Timmer, Anthony J. Urquiza, Nancy M. Zebell, Jean M. McGrath. Parent-Child Interaction Therapy: Application to maltreating parent-child dyads. Child Abuse & Neglect 29 (2005) 825–842)

Example 3

In this study, data was used from 350 patients (175 in each arm) treated using the Glucontrol protocol at CHU de Liege, Belgium, between March 2004 and April 2005. Thus, the Glucontrol data used in this study is from only one centre out of the full study [26]. The selection criteria for patients used in this analysis to generate virtual patients with sufficient data density [15,16,27] are shown in Figure 1. Patients were eliminated from the analysis if they received no insulin for their entire stay (per protocol), had less than 5 BG measurements or received little or no (recorded) carbohydrate administration (in any form) for more than 48 hours of their stay.

(Source: Chase J.G. et al. Validation of a model-based virtual trials method for tight glycemic control in intensive care. BioMedical Engineering OnLine 2010, 9:84, http://www.biomedical-engineering-online.com)

The Results Section

In this section you should present evidence that your study successfully set up the conditions for testing your hypotheses or answering your questions. The page length of this section is set by the amount and types of data to be reported. Continue to be concise, using figures and tables, if appropriate, to present results most effectively. Do not draw conclusions in the Results section, reserve data interpretation for the Discussion section.

Example 1

Table 1 shows the results of the analyses for determining predictors of early termination from treatment. Coefficients presented in Table 1 are odds ratios. They reflect the degree to which the odds of an event occurring (i.e., dropping out of treatment) are increased by each unit increase in the predictor variable. For example, in Model 1, when only demographic variables are entered into the model, African American children were twice as likely as Caucasian children to end treatment early. When measures of psychological functioning were added in Model 2, higher levels of psychological symptoms in parents and not completing the measure of parents' psychological functioning (SCL-90R) predicted early treatment termination. Children's severity of behavior problems did not significantly predict attrition. However, when interaction terms between children's maltreatment history and measures of psychological functioning were added in Model 3, we found that the likelihood that children with severe behavior problems would stay in treatment varied by the their history of maltreatment.

(Source: Susan G. Timmer, Anthony J. Urquiza, Nancy M. Zebell, Jean M. McGrath. Parent-Child Interaction Therapy: Application to maltreating parent-child dyads. Child Abuse & Neglect 29 (2005) 825–842)

Example 2

The majority of the Delphi survey respondents were from 26 different universities (63%), automotive, textile, consultant, gas distributor, electricity generation industries (13%), six different governmental organizations (12%) research institutions (5%) and other institutions (7%) (Fig. 1). The respondents were classified into 5 different age groups (Fig. 2) and the gender distribution was 76.7% male and 23.3% female.

The time of occurrence was evaluated on the data from the first and second round of the Delphi results which is presented in Fig. 3. The Delphi statements and their time of occurrence were assessed by all participants. The number of the respondents and the distribution (%) were displayed on the left side of the figure. A slight shift towards a later time of occurrence between the first and second round was observed for the majority of the statements which is a typical outcome of the Delphi technique and can be interpreted as a greater degree of consensus among the respondents.

(Source: Melih Soner Celiktas, Gunnur Kocar. Hydrogen is not an utopia for Turkey. International Journal of hydrogen energy 35 (2010) 9–18)

The Discussion Section

The Discussion section can either be combined with the Results section or appear separately. The objective of the Discussion section is to provide an interpretation of your results and support for all of your conclusions, using evidence from your experiment and generally accepted knowledge, if appropriate. The Discussion explains the meaning of the results. The significance of findings should be clearly described.

Example 1

In terms of the impact, it should be noted that the statement ''Nanocomposite catalysts developed for hydrogen generation by methane reforming processes are manufactured in industrial scale'' had a very low wealth creation score compared to the statement ''Hydrogen production from biomass has been realised in industrial scale'' which was ranked with the highest score. However, the ranking based on environmental impact and quality of life differed somewhat from the total impact ranking. While the lowest ranked is the same statement of the total impact ranked, but the top ranked was different. On the other hand, the statement ''Continuous bioprocesses have been developed for hydrogen production via microorganisms and solar energy'' was ranked as the highest for both environmental impact and quality of life. Statements 6, 9 and 10 were all ranked higher in the ranking based on all impact measures. ''Hydrogen is used in energy systems as a common practice'' received the highest ranking in terms of security of supply. On the other hand, statement 13 was ranked very low for all impact measures except security of supply and Statement 7 was relatively low in regards to security of supply compared to the total ranking list.

(Source: Melih Soner Celiktas, Gunnur Kocar. Hydrogen is not an utopia for Turkey. International Journal of hydrogen energy 35 (2010) 9–18)

Example 2

The primary goal of this study was to determine whether PCIT was an effective intervention for maltreated children and their offending or non-offending parents. The first step in testing PCIT's effectiveness was to determine whether the therapy was engaging and rewarding enough to keep high-risk dyads in treatment. Results of our analyses predicting early treatment termination showed that among maltreated children, the more behavior problems parents reported, the less likely they were to complete treatment. These findings suggest that characteristics of children unique to their maltreatment history influence their parents' engagement in PCIT. For example, it is possible that when parents of abused children report more extreme behavior problems, they are signaling their perception that these children did not want to be with them. Alternately, they could be communicating their own inability to work with the child. Since these high-risk parent-child dyads are judged to have an urgent need for mental health services to diminish the children's risk of reabuse, we find these results disturbing. We hope that future work investigating the effectiveness of PCIT in high-risk populations will also develop and test different methods for keeping these clients in treatment.

(Source: Susan G. Timmer, Anthony J. Urquiza, Nancy M. Zebell, Jean M. McGrath. Parent-Child Interaction Therapy: Application to maltreating parent-child dyads. Child Abuse & Neglect 29 (2005) 825–842)

Not every article will have Materials, Methods, Results, or Discussion sections, especially if your article is descriptive. Regardless of how many sections you have, you need some sort of title so that the reader knows that they are no longer reading the Introduction.

Writing a Conclusion/Summary

The objective of the Conclusion or Summary is to wrap-up your article by either summarizing the main points (Summary) or by interpreting the significance of your article (Conclusion). The Conclusion is a good place to set your results in a bigger picture, which might help the reader understand the significance of your article.

Example 1

Conclusions

Gasification yielded enhanced production of syngas, hydrogen and energy as that obtained from pyrolysis. However the time required for gasification is more as compared to pyrolysis. As compared to paper gasification at the same conditions, food waste needed more time to complete the gasification process. Inorganic constituents in food char were found to have a catalytic effect. Char reactivity increased with degree of conversion. In the conversion range from 0.1 to 0.9 the increase in reactivity was accompanied by an increase in pre-exponential factor, suggesting an increase in gasifying agent adsorption rate to char surface. However, in the conversion range from 0.93 to 0.98 the increase in reactivity was accompanied by a decrease in activation energy. A compensation effect was observed in this range of conversion, from 0.93 to 0.98. Isokinetic temperature obtained from Arrhenius plots for X from 0.93 to 0.98 was 1001C.

(Source: I.I. Ahmed, A.K. Gupta. Pyrolysis and gasification of food waste: Syngas characteristics and char gasification kinetics. Applied Energy 87 (2010) 101–108).

Example 2

Conclusions

Play is a cherished part of childhood that offers children important developmental benefits and parents the opportunity to fully engage with their children. However, multiple forces are interacting to effectively reduce many children's ability to reap the benefits of play. As we strive to create the optimal developmental milieu for children, it remains imperative that play is included along with academic and social enrichment opportunities and that safe environments are made available to all children. Further research is needed to explore the appropriate balance of play, academic enrichment, and organized activities for children with different temperaments and social, emotional, intellectual, and environmental needs.

(Source: Kenneth R. Ginsburg. The Importance of Play in Promoting Healthy Child Development and Maintaining Strong Parent-Child Bonds. American Academy of Pediatrics Report, October 9, 2006).

Example 3

Conclusions

This paper presented the analysis and validation of an in silico virtual patient and model-based virtual trials methodology. The validation approach, as presented, is readily generalized. It takes advantage of a set of independent clinical data comprised of two clinically matched cohorts treated with two different TGC protocols with two different glycemic targets. Three main conclusions can be drawn:

• Self validation indicated a clinically insignificant error in these virtual patient methods due to model and/or clinical compliance. They also showed the impact of some non-compliance independent of model error.

• Cross validation clearly showed that the virtual patient methods and models enabled by patient-specific $S_I(t)$ *profiles are effective and the assumption that the* $S_I(t)$ *profiles are independent of the clinical inputs used to generate them holds.*

• Thus, the virtual patients and in silico virtual trial methods presented are validated in their ability to accurately simulate, in advance, the clinical results of an independent TGC protocol, directly enabling rapid design and optimisation of safe and effective TGC protocols with high confidence of clinical success.

Overall, this study further shows the potential and capability of model-based, data driven in silico methods to aid protocol design, as well as the potential for models to provide accurate, safe and effective real-time TGC.

(Source: Chase J.G. et al. Validation of a model-based virtual trials method for tight glycemic control in intensive care. BioMedical Engineering OnLine *2010, 9:84, http://www.biomedical-engineering-online.com)*

V. Revision of the final draft

Here some general recommendations you are advised to follow while writing and revising your scientific article:

- Use normal English language including articles.
- Stay focused on the research topic of the paper.
- Use paragraphs to separate each important point (except for the abstract).
- Present your points in logical order.
- Use present tense to report well accepted facts - for example, 'the grass is green'.
- Use past tense to describe specific results - for example, 'When weed killer was applied, the grass was brown'.
- Avoid informal wording, don't use jargon or slang terms.

Use a spell checker as a final touch to your editing. They catch not only spelling errors but also typos. If a spell checker flags a word as wrong when you are sure it isn't (this happens with names and technical words), then add that word to your "personal dictionary" so the computer recognizes it next time. Keep in mind, though, that the computer won't tell you that you've mistyped *form* for *from*, *principle* for *principal or perfect* for *prefect*.

You can do your own style checking by making the most of the simple Search function. For instance, if you know you have overused or misused a certain word or phrase, let the Search call up each instance and then you can look at it in context. This can even work with types of words: try searching *ion[space]* or *ment[space]* to notice how many abstract words you have been using. Even looking at each use of *and[space], but,* or *which* can show up some habits of sentence structuring.

Writing an Abstract

Having made your article perfect you may write an Abstract. Remember that the title and abstract of your article permit your potential readers to get a quick overview of your study and to decide if they wish to read the article itself. Titles and abstracts are also indexed and compiled in reference works and computerized databases. For this reason they should accurately reflect the content of the article and include key words that will ensure their retrieval from a database. You should compose the title and abstract after you have completed the article and have a firm view of its structure and content. So revise the title of the article and check the key words.

The abstract briefly (in 150-350 words) conveys the essential information of your article, including its purpose, the results and conclusion.

Example1

ABSTRACT. Play is essential to development as it contributes to the cognitive, physical, social, and emotional well-being of children and youth. Play also offers an ideal opportunity for parents to engage fully with their children. Despite the benefits derived from play for both children and parents, time for free play has been markedly reduced for some children. This report addresses a variety of factors that have reduced play, including a hurried lifestyle, changes in family structure, and increased attention to academics and enrichment activities at the expense of recess or free child-centered play. This report offers guidelines on how pediatricians can advocate for children by helping families, school systems, and communities consider how best to ensure play is protected as they seek the balance in children's lives to create the optimal developmental milieu.

(Source: Kenneth R. Ginsburg. The Importance of Play in Promoting Healthy Child Development and Maintaining Strong Parent-Child Bonds. American Academy of Pediatrics Report, October 9, 2006).

Example 2

Characteristics of syngas from the pyrolysis and gasification of food waste has been investigated. Characteristic differences in syngas properties and overall yields from pyrolysis and gasification were determined at two distinct high temperatures of 800 and 900C. Pyrolysis and gasification behavior were evaluated in terms of syngas flow rate, hydrogen flow rate, output power, total syngas yield, total hydrogen yield, total energy yield, and apparent thermal efficiency. Gasification was more beneficial than pyrolysis based on investigated criteria, but longer time was needed to finish the gasification process. Longer time of gasification is attributed to slow reactions between the residual char and gasifying agent. Consequently, the char gasification kinetics was investigated. Inorganic constituents of food char were found to have a catalytic effect. Char reactivity increased with increased degree of conversion. In the conversion range from 0.1 to 0.9 the increase in reactivity was accompanied by an increase in pre-exponential factor, which suggested an increase in gasifying agent adsorption rate to char surface. However, in the conversion range from 0.93 to 0.98 the increase in reactivity was accompanied by a decrease in activation energy. A compensation effect was observed in this range of conversion of 0.93–0.98.

(Source: I.I. Ahmed, A.K. Gupta. Pyrolysis and gasification of food waste: Syngas characteristics and char gasification kinetics. Applied Energy 87 (2010) 101–108).

Read the following abstract. It is more detailed than the examples presented above. Look through the articles of the third part of the textbook and define what article it corresponds to. Write the abstract to one of the articles you've read.

Background

In-silico virtual patients and trials offer significant advantages in cost, time and safety for designing effective tight glycemic control (TGC) protocols. However, no such method has fully validated the independence of virtual patients (or resulting clinical trial predictions) from the data used to create them. This study uses matched cohorts from a TGC clinical trial to validate virtual patients and in-silico virtual trial models and methods.

Methods

Data from a 211 patient subset of the Glucontrol trial in Liege, Belgium. Glucontrol-A (N = 142) targeted 4.4-6.1 mmol/L and Glucontrol-B (N = 69) targeted 7.8-10.0 mmol/L. Cohorts were matched by APACHE II score, initial BG, age, weight, BMI and sex (p > 0.25). Virtual patients are created by fitting a clinically validated model to clinical data, yielding time varying insulin sensitivity profiles (SI(t)) that drives in-silico patients.

Model fit and intra-patient (forward) prediction errors are used to validate individual in-silico virtual patients. Self-validation (tests A protocol on Group-A virtual patients; and B protocol on B virtual patients) and cross-validation (tests A protocol on Group-B virtual patients; and B protocol on A virtual patients) are used in comparison to clinical data to assess ability to predict clinical trial results.

Results

Model fit errors were small (<0.25%) for all patients, indicating model fitness. Median forward prediction errors were: 4.3, 2.8 and 3.5% for Group-A, Group-B and Overall (A+B), indicating individual virtual patients were accurate representations of real patients. SI and its variability were similar between cohorts indicating they were metabolically similar.

Self and cross validation results were within 1-10% of the clinical data for both Group-A and Group-B. Self-validation indicated clinically insignificant errors due to model and/or clinical compliance. Cross-validation clearly showed that virtual patients enabled by identified patient-specific SI(t) profiles can accurately predict the performance of independent and different TGC protocols.

Conclusions

This study fully validates these virtual patients and in silico virtual trial methods, and clearly shows they can accurately simulate, in advance, the clinical results of a TGC protocol, enabling rapid in silico protocol design and optimization. These outcomes provide the first rigorous validation of a virtual in-silico patient and virtual trials methodology.

Acknowledgments

This section is not an obligatory one. This is where you can thank your co-workers or sponsors for their support. You can thank those who either helped with the experiments, or made other important contributions, such as discussing the protocol, commenting on the manuscript.

Example1

Acknowledgement

This project was supported by the Research Fund of Ege University (07GEE001). We would also like to acknowledge all participants involved in the Delphi survey.

(Source: Melih Soner Celiktas, Gunnur Kocar. Hydrogen is not an utopia for Turkey. International Journal of hydrogen energy 35 (2010) 9–18)

Example 2

Acknowledgements

A support from the EC Project SHERHPA – Sustainable Heat and Energy Research for Heat Pump Applications FP6 Horizontal Research Activities Involving SMEs Collective Research Project 500229-2 H has been gratefully acknowledged.

(Source: Martin Pavlas, Petr Stehlík, Jaroslav Oral, Jirí Klemešc, Jin-Kuk Kim, Barry Firth. Heat integrated heat pumping for biomass gasification processing Applied Thermal Engineering 30 (2010) 30–35).

Example 3

Authors thank Elizabeth Allen, Carole Girard, Annie Guichard, and Sara Ladd for data collection assistance and to Sally Osberg, Tom Nielsen, Jenni Martin, Koen Liem, and Cheryl Blumenfeld at the Children's Discovery Museum of San Jose.

(Source: Kevin Crowley et al. Shared Scientific Thinking in Everyday Parent - Child Activity. 2001. http://upclose.lrdc.pitt.edu/publications/pdfs/shared_science.pdf)

are usually on the top"

Main point: "being too big can be a disadvantage"

Example 4

Financial support provided by:

Aaron LE COMPTE: New Zealand Tertiary Education Commission and NZ Foundation for Research Science and Technology Post-Doctoral Fellowship Grant

Jessica LIN: NZ Foundation for Research Science and Technology Post-Doctoral Fellowship Grant

Sophie PENNING: FNRS (Fonds Nationale de la Recherche Scientifique) Research Fellow Katherine MOORHEAD: University of Liege Post-Doctoral Fellowship Grant

(Source: Chase J.G. et al. Validation of a model-based virtual trials method for tight glycemic control in intensive care. BioMedical Engineering OnLine 2010, 9:84, http://www.biomedical-engineering-online.com)

Summary:

Though height may connote slowness to some people, in the business world, it is almost universally associated with success. For example, taller men are more likely to be hired and to have greater salaries. Further, those in top positions within a company are more likely to work on the top floors of office buildings (Locker, 2003).

Part 3. Texts on interdisciplinary research for abstracting and annotating

Interdisciplinary research (IDR) now receives a great deal of attention because of the rich, creative contributions it often generates. But a host of factors — institutional, interpersonal, and intellectual — also make a daunting challenge of conducting research outside one's usual domain. This selection of the texts on interdisciplinary research is our brief guide to the most effective avenues for collaborative and integrative research in different spheres of knowledge.

It provides answers to questions such as what the best way is to conduct interdisciplinary research on topics related to humanitarian issues. Which are the most successful interdisciplinary research programs in these areas? How do you identify appropriate collaborators? How do you find dedicated funding streams? How do you overcome peer-review and publishing challenges? The selection outlines the lessons that can be taken from the IDR study, and presents a series of informative texts revealing the most successful interdisciplinary research ideas and programs. These programs provide a variety of models of how best to undertake interdisciplinary research.

TASKS

- Write synopses and/or annotations in Russian for each of the texts referring to the *guidelines for synopses and annotations* ***(appendix 10)***.
- Discuss the benefits of interdisciplinary research and the central strategies required to achieve them.
- Propose interdisciplinary research in your sphere of knowledge.

Carbon nanotubes: strengths, weaknesses, opportunities and threats

NANO Magazine, Wednesday, 13 October 2010, Issue 20 (http://www.nanomagazine.co.uk/)

Carbon nanotubes hold great promise for adding functionality, conductivity and strength to many existing and future products. For that reason they've become a hot topic for industry, with promised applications across a broad range sectors.

What are Carbon nanotubes?

Carbon nanotubes (CNTs) are allotropes of carbon. A single wall carbon nanotube is a one-atom thick sheet of graphite (called graphene) rolled up into a seamless cylinder with diameter of the order of a nanometer. This results in a nanostructure where the length-to-diameter ratio exceeds 10,000.

Such cylindrical carbon molecules have novel properties that make them potentially useful in many applications in nanotechnology, electronics, optics and other fields of materials science. They exhibit extraordinary strength and unique electrical properties, and are efficient conductors of heat. Inorganic nanotubes have also been synthesized. Nanotubes are members of the fullerene structural family, which also includes buckyballs. Whereas buckyballs are spherical in shape, a nanotube is cylindrical, with at least one end typically capped with a hemisphere of the buckyball structure. Their name is derived from their size, since the diameter of a nanotube is on the order of a few nanometers (approximately 50,000 times smaller than the width of a human hair), while they can be up to several millimeters in length.

There are two main types of nanotubes: single-walled nanotubes (SWNTs) and multi-walled nanotubes (MWNTs). Single-walled carbon nanotubes consist of one graphite sheet tube of carbon atom hexagons, while multi-walled carbon nanotubes are characterized by multiple concentric tubes both have a diameter of 1 to 100 nanometres, but average at just a few nanometres. Although not a hollow tube, carbon nanofibers (CNF) represent a third type of tubular structure. The ends of nanotubes are either open or capped with fullerenes.

The nature of the bonding of a nanotube is described by applied quantum chemistry, specifically, orbital hybridization. The chemical bonding of nanotubes are composed entirely of sp2 bonds, similar to those of graphite. This bonding structure, which is stronger than the sp3 bonds found in diamond, provides the molecules with their unique strength. Nanotubes naturally align themselves into "ropes" held together by Van der Waals forces. Under high pressure, nanotubes can merge together, trading some sp2 bonds for sp3 bonds, giving great possibility for producing strong, unlimited-length wires through high-pressure nanotube linking.

They are not unlike other carbon materials, such as diamond or the carbon black that can be found in pencils or car tyres. They have a completely different structure, however, which gives them interesting and very promising properties. Normal graphite is built of sheets with a honeycomb structure of carbon atoms. These sheets are very strong, stable and flexible, but adjoining sheets lack a strong cohesion. In nanotubes, however, these sheets are larger and are “rolled-up” to form long, thin spiral patterns. The significant interest in the production, research and development of carbon nanotubes stems from the unique chemical, mechanical, and physical properties inherent in these materials as. These desired properties include high tensile strength, high electric and thermal conductivity, lightweight, high surface area per gram, advantages in hydrogen storing and catalyzing, absorbency, and flexibility.

The tensile strength of single-walled nanotubes is 100 times greater than that of steel, at only one sixth of steel weight. In terms of thermal conductivity, carbon nanotubes at 1,200-3,000 W/mK exceed that for diamonds at 700-2,000 W/mK. Because of these properties, many researchers and product developers have been attracted to carbon nanotubes for a broad array of potential applications including composites, displays, sensors, fuel and solar cells, batteries, and pharmaceutical materials.

Production and Synthesis

The Chemical Vapor Deposition (CVD) technique is the most commonly used for making nanotubes. Companies such as CNRI, Nanocyl, NanoLab, Nanoamor, and Shenzhen Nanotech use CVD; MER, Nanocarblab, NanoLedge use arc discharge; ILJIN uses both CVD and arc discharge. The production methods have not yet been mastered and thus nanotubes have yet to be produced in mass quantities. Some SWNT producers may be moving away from the older methods and using fluidized beds and other high throughput methods, in order to scale production with relatively low costs.

Raymor Industries utilises a hybrid of existing CVD and Arc processes which uses specially designed plasma torch (design cannot be revealed for competitive reasons) to explode molecules in highly efficient way. It is a clean process; there is no emission of toxic gas. Hydrogen molecules can be recycled for environmental purposes. The process creates a large quantity of nanotubes compared to the original mass. The single-walled nanotubes formed are of a high quality and high purity.

Depending on the method of synthesis, impurities in the form of catalyst particles, amorphous carbon, and non-tubular fullerenes are also produced. Thus, subsequent purification steps are required to separate the tubes from other forms of non-tubular carbon. Purification involves chemical processes like acid reflux, filtration, centrifugation, and repeated washes with solvents and water. Typical nanotube diameters range from 0.4 to 3 nm for SWNTs, and from 1.4 to more than 100 nm for MWNTs. It has been established that a nanotube's properties can be tuned by changing its diameter.

Market Hype

The main driving force for investment in carbon nanotubes R&D is their promise to offer improvements in materials capabilities across a wide range of applications. This is of huge strategic importance to sectors which historically leverage technological advancements. Carbon nanotubes enable radical design changes for a wide variety of markets by permitting combinations of properties not previously possible in materials design and affording multi-functionality for increased efficiency. The challenge is translating the excellent combination of nanotubes properties on the nanoscale to structural properties on the macroscale. Current hindrances include: inconsistent quality of carbon nanotubes supply; dispersion; characterization of carbon nanotubes nanocomposites; and scaling down processing equipment to work around the low CNT supply.

The majority of current global revenues for carbon nanotubes are generated by relatively large-scale manufacturing of bulk materials for applications where electrical conductivity, increased mechanical performance and flame retardancy are primary design drivers. Composites, field emission devices and batteries are the most prominent and commercially viable current applications. Next generation products will incorporate sensing capabilities and multi-functionality and lead to greatly increased revenues over the next 3-10 years. Prices will also fall over the next few years as large companies begin to produce commercial-scale volumes of nanotubes. Large multi-nationals such as Arkema, Bayer and Showa Denko have significantly ramped up production levels; companies in China and Russia are also producing significantly cheaper nanotubes.

Main markets at present for nanotubes are aerospace, automotive, defence and electronics & data storage; generally as multi-purpose compound enhancers. In aerospace, nanotubes already find application as additives for ESD and EMI shielding; as electrostatic coatings and component reinforcement additives in the automotive sector; in various defence applications; and as conductive polymers and composites for field emission displays. This represents the first generation of nanotubes products; the next generation will be based on controlled fabrications leading to multi-functional and sensory capabilities.

The electronics and data storage market is likely to see the biggest penetration to 2015, with the performance enhancing properties of carbon nanotubes allowing electronics manufacturers to meet demanding market needs across a variety of applications. Their incorporation into the displays applications will also increase demand, with a conservative revenue forecast of $1.07 billion by 2015.

There is a great demand in the market for carbon nanotubes, especially in the electronics and polymers sectors; production and price are restraints at present but this is changing. A kilogram of carbon nanotubes used to cost up to $1,000, but now, as a result of targeted research and development activities, companies has managed to significantly lower the price-per-kilogram, thereby enabling the development of new, industrial applications. For example, the automotive industry will soon be able to reduce the cost of painting plastic fenders: adding just minimal amounts makes the semi-finished parts electrically conductive, and this new material property supports more efficient and environmentally friendly coating processes based on counter charged, solvent-free powder coating particles.

In most cases, CNTs are used as an additive to add value to existing products or to develop new products such as Field Emission Displays displays. The advantage as an additive is usually an enhancement of the properties with a low loading of nanotubes. This low loading

also offers new possibilities like transparency in coatings. Other advantages can be lower manufacturing cost using a CNT-based technology.

One of the biggest challenges facing the carbon nanotube producers is the ability to obtain significant quantities of the desired type of carbon nanotube. High throughput experimentation is one possible approach that holds promise for searching the best catalyst for growing the desired nanotube. Other issues that assume significant importance is identifying the most likely nanomaterial and then setting up a large infrastructure for a scalable mass-manufacturing process. Some techniques that are used to build electronic components with carbon nanotubes are inappropriate for mass production.

Expensive, small scale production of nanotubes as well as clumping, lack of binding to the bulk material, and temperature effects are therefore key barriers to their application in the industry. Although there are challenges ahead, carbon nanotubes have opened up a host of practical applications in the nanometre scale.

Applications of CNTs

Examples of carbon nanotube-based applications are illustrated in the roadmap. The main markets for nanotubes at present are aerospace, automotive, defence and electronics & data storage; generally as multi-purpose compound enhancers. In aerospace, nanotubes already find application as additives for ESD and EMI shielding. The automotive sector uses them as electrostatic coatings and component reinforcement additives. in various defence applications; and as conductive polymers and in consumer electronics such as composites for FED. This represents the first generation of nanotubes products; the next generation will be based on controlled fabrications.

The ITC market is likely to see the biggest penetration to 2015, with the performance enhancing properties allowing electronics manufacturers to meet demanding market needs. Their incorporation into the displays market will increase demand by 2010, with a revenue forecast in the ITC market of $1.096 billion by 2015. While in the longer run, electronics will continue to dominate nanotube applications as broader use in semiconductors occurs, strong opportunities are also expected from CNT-based products using chemical vapour deposition technology.

It seems the possibilities for carbon nanotubes will continue to develop in the future as research continues to develop on their possibilities. Researchers at the University of Cincinnati (UC) have developed a process to build extremely long aligned carbon nanotube arrays. They've been able to produce 18-mm-long carbon nanotubes which might be spun into nanofibers.

New studies on the strength of these submicroscopic cylinders of carbon from the University of Southern California, LA, indicate that on an ounce-for-ounce basis they are at least 117 times stronger than steel and 30 times stronger than Kevlar, the material used in bulletproof vests and other products. That's twice as strong as they were once thought to be – it seems the future's brighter and stronger for carbon nanotubes.

Prizewinning nanoparticle based ‘sharkskin’ for aeroplanes, ships and wind energy plants

NANO Magazine, 2010, Issue 18 (http://www.nanomagazine.co.uk/)

To lower the fuel consumption of airplanes and ships, it is necessary to reduce their flow resistance, or drag. An innovative paint system makes this possible. This not only lowers costs, it also reduces CO2 emissions.

The inspiration – and model – for the paint‘s structure comes from nature: The scales of fast-swimming sharks have evolved in a manner that significantly diminishes drag, or their resistance to the flow of currents. The challenge was to apply this knowledge to a paint that could withstand the extreme demands of aviation. Temperature fluctuations of -55 to +70 degrees Celsius; intensive UV radiation and high speeds. Yvonne Wilke, Dr. Volkmar Stenzel and Manfred Peschka of the Fraunhofer Institute for Manufacturing Engineering and Applied Materials Research IFAM in Bremen developed not only a paint that reduces aerodynamic drag, but also the associated manufacturing technology. In recognition of their achievement, the team is awarded the 2010 Joseph von Fraunhofer Prize.

The paint involves of a sophisticated formulation. An integral part of the recipe: the nanoparticles, which ensure that the paint withstands UV radiation, temperature change and mechanical loads, on an enduring basis. „Paint offers more advantages," explains Dr. Volkmar Stenzel. „It is applied as the outermost coating on the plane, so that no other layer of material is required. It adds no additional weight, and even when the airplane is stripped – about every five years, the paint has to be completely removed and reapplied – no additional costs are incurred. In addition, it can be applied to complex three-dimensional surfaces without a problem." The next step was to clarify how the paint could be put to practical use on a production scale. „Our solution consisted of not applying the paint directly, but instead through a stencil," says Manfred Peschka. This gives the paint its sharkskin structure. The unique challenge was to apply the fluid paint evenly in a thin layer on the stencil, and at the same time ensure that it can again be detached from the base even after UV radiation, which is required for hardening.

Yvonne Wilke, Dr. Volkmar Stenzel and Manfred Peschka engineered a paint system that can reduce the fl ow resistance of airplanes and ships. That saves fuel.

When applied to every airplane every year throughout the world, the paint could save a volume of 4.48 million tons of fuel. This also applies to ships: The team was able to reduce wall friction by more than five percent in a test with a ship construction testing facility. Extrapolated over one year, that means a potential savings of 2,000 tons of fuel for a large container ship. With this application, the algae or muscles that attach to the hull of a ship

only complicate things further. Researchers are working on two solutions for the problem. Yvonne Wilke explains: „One possibility exists in structuring the paint in such a way that fouling organisms cannot get a firm grasp and are simply washed away at high speeds, for example. The second option aims at integrating an anti-fouling element – which is incompatible for nature."

Irrespective of the fuel savings, there are even more interesting applications – for instance, with wind energy farms. Here as well, air resistance has a negative effect on the rotor blades. The new paint would improve the degree of efficiency of the systems – and thus the energy gain.

Pyrolysis and gasification of food waste: syngas characteristics and char gasification kinetics

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Keywords: *Food waste gasification; Char gasification kinetics; Catalytic effect of ash; Compensation effect*

Abstract

Characteristics of syngas from the pyrolysis and gasification of food waste has been investigated. Characteristic differences in syngas properties and overall yields from pyrolysis and gasification were determined at two distinct high temperatures of 800 and 900 ^{o}C . Pyrolysis and gasification behavior were evaluated in terms of syngas flow rate, hydrogen flow rate, output power, total syngas yield, total hydrogen yield, total energy yield, and apparent thermal efficiency. Gasification was more beneficial than pyrolysis based on investigated criteria, but longer time was needed to finish the gasification process. Longer time of gasification is attributed to slow reactions between the residual char and gasifying agent. Consequently, the char gasification kinetics was investigated. Inorganic constituents of food char were found to have a catalytic effect. Char reactivity increased with increased degree of conversion. In the conversion range from 0.1 to 0.9 the increase in reactivity was accompanied by an increase in prexponential factor, which suggested an increase in gasifying agent adsorption rate to char surface. However, in the conversion range from 0.93 to 0.98 the increase in reactivity was accompanied by a decrease in activation energy. A compensation effect was observed in this range of conversion of 0.93–0.98.

1. Introduction

Dumping food waste in a landfill causes environmental problems. By volume, the dumped landfill waste causes the largest contribution to methane gas production [1]. It causes odor as it decomposes to cause public annoyance in addition to forming germs, and attracting flies and vermin. Another serious problem of food wastes is the generation of landfill leachate. Landfill leachate is liquid that leaks from the landfill and enters the environment. Once it enters the environment the leachate is at risk for mixing groundwater near the site which then transports to some distances. Furthermore it has the potential to add biological oxygen demand (BOD) to the groundwater. BOD measures the rate of oxygen uptake by micro-organisms in a sample of water at a temperature of 20 ^{o}C and over an elapsed period of five days in the dark.

Food wastes have high energy content. Consequently, it offers a good potential for feed stock for gasification in power plants. Food waste gasification helps to solve two major problems at the same time. Gasification of food waste reduces landfill problems and efficiency. The results show that food wastes offers a good potential for thermal treatment of the waste with the specific aim of power generation. The average proximate analysis of food wastes is 80% volatile matter, 15% fixed carbon, and 5% ash. The volatile matter can be easily destructed in a relatively short period of time, extending from 8 to 12 min at reactor temperatures from 700 to 1000 ºC . Energy recovery from volatile components in food wastes can be recovered using a simple pyrolysis process. However, in order to consume the residual fixed carbon after the pyrolysis, the sample must undergo a gasification process. Gasification of a food waste sample includes a pyrolysis part and a char gasification part. Char gasification reactions are slower than that of pyrolysis and consequently, is the rate limiting step in the overall gasification process.

The ash present in the sample does not react with the gasifying agent. The ash can be collected after cooling and cleaning the syngas, and then recycled for its further use in industrial processes.

Since the char gasification process is the rate limiting step, it is important to quantify the kinetic parameters of char gasification. Char gasification has been investigated by a large number of researchers. Some of the important parameters investigated include the origin of the char sample, gasifying agent, total pressure, variation of partial pressure of gasifying agents, geometric changes of the sample during gasification, and catalyzed char gasification. One of the most important parameters which have been investigated is the catalytic effect of ash content on char gasification.

[Some details are omitted]

Consequently, for a desired feed rate of feedstock into the reactor and for known gasifier operational conditions an accurate reactivity expression will lead to a close estimate of the gasifier size and configuration. If a constant reactivity value is used in reacting flow simulations for feedstock having time dependant reactivity, misleading information on char particles residence time will be obtained.

This will consequently result in a departure gasifier size from the true design size and configuration. For example, if a constant reactivity value is used for chars having ash catalytic effect, such as the case examined here, the designed gasifier size will be over estimated since the reactivity of char was fond to increase with the degree of conversion.

2. Background

Tancredi et al. [2] investigated the catalytic effect of ash on char gasification for eucalyptus wood chars. The ash content in char was of the order of 1.45% on mass basis. The reactivity of the char increases monotonically with conversion. At low and intermediate conversion, it can be attributed to the increase in surface area as gasification proceeds. At high conversion levels a steeper increase in reactivity has been observed, which cannot be explained by the development of surface area. This region of the reactivity/conversion curves can be better explained as the result of an increase in catalytic effect of the metallic constituents (mainly Na and K) present as inorganic matter in the chars. Here CO_2 was used as the gasifying agent. Activation energies determined were found to vary within a narrow range of 230–257 kJ/mol. Arrhenius plots showed parallel lines for different degrees of conversion. Parallel line of Arrhenius plot indicates similar activation energies. The increase in reactivity was mainly due to an increase in

pre-exponential factor. In a similar study by Montesinos et al. [3], steam gasification and CO_2 gasification of grape fruit skin char were investigated. They also observed an increase in reactivity at high values of conversion. However, a different trend of activation energies values was observed; in the case of CO_2 gasification, as the conversion increased, a decrease in activation energy was observed.

On the other hand an increase in activation energy was observed in case of steam gasification. This increase in activation energy was also, observed by Marsh et al. [4]. The decrease in activation energy values in the case of CO_2 gasification was accompanied by a decrease in pre-exponential factor as well. This behavior is called the compensation effect [5]. Montesinos et al. obtained a value of isokinetic temperature of 1150 K. The isokinetic temperature is the temperature at which all reactivities are equal for different conversions. An isokinetic temperature of 1449 K was obtained by Dhupe et al. [6] for CO_2 gasification using catalyzed sodium lignosulfonate. Feistel et al. [7] found this temperature to be 1425 K, obtained using potassium-catalyzed steam gasification.

[Some details are omitted]

Food wastes, especially which have high percentage of vegetable oil and animal fat, provide a good potential for production of liquid fuels though transesterification. Transesterification is the process of exchanging the organic group R00 of an ester with the organic group R0 of an alcohol. The process is widely used to produce biodiesel fuels from vegetable oils and animal fats. The process is often catalyzed by an acid or a base.

Other than acid or base catalysts, enzyme or heterogeneous catalysts might be used as well. Among the mentioned catalysts, alkali catalysts are more effective. However, if the oil has high free fatty acid (FFA) content, higher than 3% (approximately), acid catalyzed transesterification is used rather than a base catalyst [10,11].

[Some details are omitted]

3. Experimental

Fig. 1 shows a photograph of the laboratory scale experimental facility used to examine the pyrolysis and gasification of food wastes. Steam is generated from the stoichiometric combustion of hydrogen and oxygen. Steam generated is then introduced into the superheater section to form the gasifying agent at the desired condition. The temperature of the gasifying agent heater is kept at the same temperature as that of the main reactor in which sample material was allowed to undergo gasification. Steam is then introduced into the main reaction chamber that contained the hydrocarbon sample. The syngas flowing out from the main reaction chamber is sub-divided into two paths; one passes to the sampling line while the other is passed through the exhaust system.

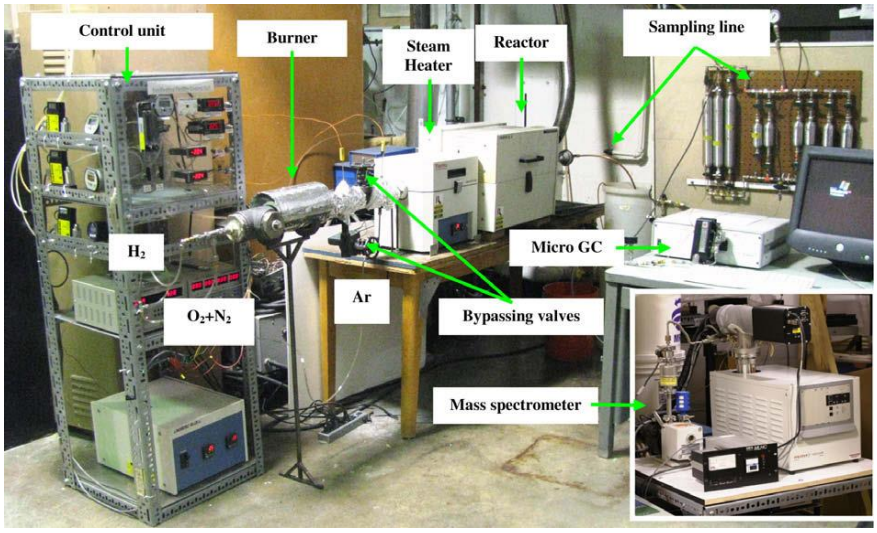

Fig. 1. A photograph of the experimental facility.

The bypass line has a non-return valve and a flow meter to assure the desired unidirectional flow out from the reactor. The syngas sample is then introduced to a condenser followed by a low pressure filter and a moister absorber (anhydrous calcium sulfate). This procedure assured that the sample is dry prior to its introduction into a gas analyzer. The filtered and dried syngas is then analyzed using a GC or a mass spectrometer.

[The description of the experiment is omitted]

4. Results and discussion

The characteristic of syngas from food waste pyrolysis and gasification have been investigated. Food waste is a char-based sample. Results from char-based samples (samples containing volatile matter and char, such as paper [13], cardboard [14,15], woodchips and food waste) follow, qualitatively similar trend. Syngas is characterized by a high flow rate initially, due to pyrolysis, and then followed by a small flow rate which lasts for longer period, which is due to char gasification.

[Some details are omitted]

5. Conclusions

Gasification yielded enhanced production of syngas, hydrogen and energy as that obtained from pyrolysis. However the time required for gasification is more as compared to pyrolysis. As compared to paper gasification at the same conditions, food waste needed more time to complete the gasification process. Inorganic constituents in food char were found to have a catalytic effect. Char reactivity increased with degree of conversion. In the conversion range from 0.1 to 0.9 the increase in reactivity was accompanied by an increase in pre-exponential factor, suggesting an increase in gasifying agent adsorption rate to char surface. However, in the conversion range from 0.93 to 0.98 the increase in reactivity was accompanied by a decrease in activation energy. A compensation effect was observed in this range of conversion, from 0.93 to 0.98. Isokinetic temperature obtained from Arrhenius plots for X from 0.93 to 0.98 was 1001 ºC.

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Validation of a model-based virtual trials method for tight glycemic control in intensive care

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Introduction

Stress-induced hyperglycemia and high levels of insulin resistance are prevalent in critical care [1-4]. Increased counter-regulatory hormone secretion stimulates endogenous glucose production and increases insulin resistance [3,4], elevating equilibrium glucose levels and reducing the amount of glucose the body can utilize with a given amount of insulin. Hyperglycemia worsens outcomes, increasing the risk of severe infection, myocardial infarction, and critical illness polyneuropathy and multiple organ failure.

The occurrence of hyperglycemia, particularly severe hyperglycemia, is associated with increased morbidity and mortality [2]. Glycemic variability and poor control are independently associated with increased mortality [5-7]. Van den Berghe et al [8,9] showed that tight glucose

control (TGC) reduced intensive care unit (ICU) patient mortality up to 45% using a target of 6.1 mmol/L. Other studies with similar or slightly higher targets have successfully reduced mortality [10,11]. Hence, despite some difficulty repeating these results [12], the data indicate that a control algorithm that safely provides TGC to reduce hyperglycemia and glycemic variability can reduce mortality and cost [13,14].

In this study, "virtual trials" are performed using a clinically validated model [15-17] of the glucose-insulin system. Insulin sensitivity, SI, is used as the critical marker of a patient's metabolic state and is assumed independent of the insulin and nutrition inputs. Virtual trials can be used to simulate a TGC protocol using a SI(t) profile identified hourly from clinical data and different insulin and nutrition inputs. Virtual trials enable the rapid testing of new TGC intervention protocols, as well as analysis with respect to glycemic control protocol performance, safety from hypoglycaemia, clinical burden, and the ability to handle dynamic changes in patient metabolic state [15,18]. They are thus a means of safely optimising protocols prior to clinical implementation.

[Some details are omitted]

Thus, the performance of virtual trials on separate matched cohorts has not yet been evaluated. In addition, the assumption of the independence of a virtual patient's insulin sensitivity SI(t) profile from the insulin and nutrition inputs used to identify it from clinical blood glucose (BG) data has never been validated. This study tests these assumptions using clinically matched (virtual) cohorts based on clinical data from an independent ICU, who were treated with two different glycemic control protocols in a randomised trial. The independence of the ICU ensures a cohort who may be different in treatment, insulin sensitivity or other factors [25] from patients in the Christchurch ICU whose data underlie the development of the models and methods [16,19-21] validated in this study. Hence, there is no link between the patients used in this study and the development of the models and methods being tested here. Hence, these clinically matched cohorts allow this assumption of independence to be tested, as well as the assessment of model errors in this virtual trial approach.

Methods

Glucontrol Protocol and Patient Cohorts

The Glucontrol trial [26] randomised patients into two groups: Group A and Group B. Group A received intensive insulin therapy and Group B received conventional insulin therapy, with target ranges of 4.4-6.1 mmol/L and 7.8-10 mmol/L, respectively. Insulin was administered as a continuous intravenous (IV) infusion. Hourly blood glucose (BG) measurements were recorded when the glycemic level was not within the target range. Otherwise, 2-hourly measurements were taken in the case of limited variation of glycemia, defined as less than a 50% change from the previous glycaemia in 2-hour range. Finally, 4-hourly measurements were taken when the glycemic level was less than 50% of the highest glycemia of the four last hours. If other BG measurements were taken, they were not recorded and did not result in changes to the insulin infusion rate.

[Some details are omitted]

In this study, data was used from 350 patients (175 in each arm) treated using the Glucontrol protocol at CHU de Liege, Belgium, between March 2004 and April 2005. Thus, the Glucontrol data used in this study is from only one centre out of the full study [26]. The selection criteria for patients used in this analysis to generate virtual patients with sufficient

data density [15,16,27] are shown in Figure 1. Patients were eliminated from the analysis if they received no insulin for their entire stay (per protocol), had less than 5 BG measurements or received little or no (recorded) carbohydrate administration (in any form) for more than 48 hours of their stay.

[Some details are omitted]

Patients in Group A were slightly older than Group B. However, there were no significant differences in sex, weight, BMI, severity of illness as measured by APACHE II score or initial BG level. Group B received less insulin and more carbohydrate, in alignment with its higher glycemic target.

[Some details are omitted]

Validation Analysis

This study performs three major forms of validation using virtual trials. These three tests provide both per-patient and cohort-wide validation of this in silico approach.

[Some details are omitted]

Results

[Some details are omitted]

Discussion

[Some details are omitted]

The virtual trials approach here treats each group as being treated differently, including the carbohydrate and glucose infusions administered. These infusions were patient-specific and specified based on local and individual clinician standards, rather than per a protocol of any type. Thus, they were kept for each patient. As a result, Glucontrol B patients with the higher target had 2.6× higher glucose administration, which in cross validation was offset by 3.2× more insulin in the virtual trials. Differences in insulin rates between per protocol (as the cross validation was done) and per actual measurement rates makes these differences almost equal at 2.6× higher glucose administration and 2.4× greater insulin required to achieve the almost identical glycemic outcomes. Hence, the patients display similar overall insulin sensitivity, and the virtual trials took independently treated, matched patients and achieved the same outcome despite different initial treatments in the clinical data used to create the virtual patient. More specifically, nutritional treatment differences, within reason, did not affect or influence the results outside of expectations.

More importantly, the relatively small differences show the strength of model-fitted insulin sensitivity as a description of patient metabolic state, rather than as a therapy-specific parameter value. Other causes for remaining differences may also be a function of remaining model approximations or errors. As noted, inter-patient variability in some fixed model parameters is at least one cause of model limitations and errors. However, the limited glucose data with no added or real time insulin data limits the ability to uniquely identify these parameters [27,32].

Finally, this paper shows the potential for TGC protocols to be readily optimised and implemented using model based TGC. The low prediction errors indicate an ability to minimize the risk of hypoglycaemia as well as provide tight control. Even though some TGC clinical trials have not achieved any benefit from TGC [12,38], only 2 protocols have been first

optimized with virtual trials [11,17,21]. Both delivered safe, effective TGC with reduced or zero hypoglycaemia.

Conclusions

This paper presented the analysis and validation of an in silico virtual patient and model-based virtual trials methodology. The validation approach, as presented, is readily generalized. It takes advantage of a set of independent clinical data comprised of two clinically matched cohorts treated with two different TGC protocols with two different glycemic targets. Three main conclusions can be drawn:

• Self validation indicated a clinically insignificant error in these virtual patient methods due to model and/or clinical compliance. They also showed the impact of some non-compliance independent of model error.

• Cross validation clearly showed that the virtual patient methods and models enabled by patient-specific $S_I(t)$ profiles are effective and the assumption that the $S_I(t)$ profiles are independent of the clinical inputs used to generate them holds.

• Thus, the virtual patients and in silico virtual trial methods presented are validated in their ability to accurately simulate, in advance, the clinical results of an independent TGC protocol, directly enabling rapid design and optimisation of safe and effective TGC protocols with high confidence of clinical success.

Overall, this study further shows the potential and capability of model-based, data driven in silico methods to aid protocol design, as well as the potential for models to provide accurate, safe and effective real-time TGC.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

JGC, FS, GS, ALC and JL conceived and developed the models and this analysis. FS, SP and ALC did most of the computational analysis with input from JGC, CGP, TD and KTM. J-CP supplied the data and Glucontrol protocol information. JGC, FS, ALC drafted the manuscript primarily although all authors made contributions. All authors approved the final manuscript.

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Abstract of this article

Background

In-silico virtual patients and trials offer significant advantages in cost, time and safety for designing effective tight glycemic control (TGC) protocols. However, no such method has fully validated the independence of virtual patients (or resulting clinical trial predictions) from the data used to create them. This study uses matched cohorts from a TGC clinical trial to validate virtual patients and in-silico virtual trial models and methods.

Methods

Data from a 211 patient subset of the Glucontrol trial in Liege, Belgium. Glucontrol-A (N = 142) targeted 4.4-6.1 mmol/L and Glucontrol-B (N = 69) targeted 7.8-10.0 mmol/L. Cohorts were matched by APACHE II score, initial BG, age, weight, BMI and sex ($p > 0.25$). Virtual patients are created by fitting a clinically validated model to clinical data, yielding time varying insulin sensitivity profiles (SI(t)) that drives *in-silico* patients.

Model fit and intra-patient (forward) prediction errors are used to validate individual *in-silico* virtual patients. Self-validation (tests A protocol on Group-A virtual patients; and B

protocol on B virtual patients) and cross-validation (tests A protocol on Group-B virtual patients; and B protocol on A virtual patients) are used in comparison to clinical data to assess ability to predict clinical trial results.

Results

Model fit errors were small (<0.25%) for all patients, indicating model fitness. Median forward prediction errors were: 4.3, 2.8 and 3.5% for Group-A, Group-B and Overall (A+B), indicating individual virtual patients were accurate representations of real patients. SI and its variability were similar between cohorts indicating they were metabolically similar.

Self and cross validation results were within 1-10% of the clinical data for both Group-A and Group-B. Self-validation indicated clinically insignificant errors due to model and/or clinical compliance. Cross-validation clearly showed that virtual patients enabled by identified patient-specific SI(t) profiles can accurately predict the performance of independent and different TGC protocols.

Conclusions

This study fully validates these virtual patients and *in silico* virtual trial methods, and clearly shows they can accurately simulate, in advance, the clinical results of a TGC protocol, enabling rapid in silico protocol design and optimization. These outcomes provide the first rigorous validation of a virtual *in-silico* patient and virtual trials methodology.

International Journal of Robotics Research, 175(6):482-487, 1998.

Insertable surgical imaging device with pan, tilt, zoom, and lighting

Tie Hu, Peter K. Allen, Nancy J. Hogle and Dennis L. Fowler

Abstract—This paper describes work we have done in developing an insertable surgical imaging device with multiple degrees-of-freedom for minimally invasive surgery. The device is fully insertable into the abdomen using standard 12mm trocars. It consists of a modular camera and lens system which has pan and tilt capability provided by 2 small DC servo motors. It also has its own integrated lighting system that is part of the camera assembly. Once the camera is inserted into the abdomen, the insertion port is available for additional tooling, motivating the idea of single port surgery. A third zoom axis has been designed for the camera as well, allowing close-up and far-away imaging of surgical sites with a single camera unit.

In animal tests with the device we have performed surgical procedures including cholecystectomy, appendectomy, running (measuring) the bowel, suturing, and nephrectomy. The tests show that the new device is:

Easier and more intuitive to use than a standard laparoscope.

Joystick operation requires no specialized operator training.

Field of view and access to relevant regions of the body were superior to a standard laparoscope using a single port.

Time to perform procedures was better or equivalent to a standard laparoscope.

We believe these insertable platforms will be an integral part of future surgical systems. The platforms can be used with tooling as well as imaging systems, allowing many surgical procedures to be done using such a platform.

I. Introduction

Minimally Invasive Surgery (MIS) encompasses la-paroscopy, thoracoscopy, arthroscopy, intraluminal en-doscopy, endovascular techniques, catheter-based cardiac techniques, and interventional radiology[2], and has grown rapidly over the last two decades. In 1992, 70% of all cholecystectomies (gall bladder removal) in the United States, Europe, and Japan were performed using laparoscopic techniques [1]. In laparoscopic surgery, the surgeon first cuts several small incisions in the abdomen, and inserts trocars (small tubes) through the incisions. Carbon dioxide gas is pumped into the abdomen to create a larger volume of space for the operation and visualization. By viewing the image from the laparoscope which is inserted into the body through the trocar, the surgeon operates the laparoscopic tools to perform surgery. Laparoscopic surgery has many benefits, such as small incisions, less pain and trauma to the patients, faster recovery time, and lower health care cost. However, this technique drastically increases the complexity of a surgeons' task because of the rigid, sticklike instruments, impaired depth perception, loss of sense of touch (haptics) and the difficulty in varying the perspective view of the operative field[1].

Robotic surgery is considered as the future of surgery[13]. Robots for MIS could greatly increase the dexterity and fine motion capabilities of a surgeon during an operation, decrease the tremor of a surgeon's hand, and enable remote operation[12], [18], [11], [9], [7]. Robotic surgery still comprises only a very small portion of all minimally invasive surgery. Current surgical robots tend to be extremely expensive with the price of a da Vinci robot (Intuitive Surgical) being typically over a million dollars. In addition, the size of many current surgical robots is extremely large, tending to occupy a large portion of the sterile field of an operating room.

There is a definite need to develop a surgical robot which is more compact and less expensive than existing systems. Our goal is to enhance and improve surgical procedures by placing small, mobile, multi-function platforms inside the body that can begin to assume some of the tasks associated with surgery. We want to create a feedback loop between new, insertable sensor technology and effectors we are developing, with both surgeons and computers in the information-processing/control loop. We envision surgery in the future as radically different from today. This is clearly a trend that has been well-established as minimal-access surgical procedures continue to expand. Accompanying this expansion have been new thrusts in computer and robotic technologies that make automated surgery, if not feasible, an approachable goal. It is not difficult to foresee teams of insertable robots performing surgical tasks inside the body under both surgeon and computer control. The benefits of such an approach are well documented: greater precision, less trauma to the patient, and improved outcomes. One factor limiting this expansion is that the laparoscopic paradigm of pushing long sticks into small openings is still the state-of-the-art, even among surgical robots such as DaVinci. While this paradigm has been enormously successful, and has spurred development of new methods and devices, it is ultimately limiting in what it can achieve. Our intent is to go beyond this paradigm, and remotize sensors and effectors into the body cavity where they can perform surgical and imaging tasks unfettered by traditional endoscopic instrument design.

[Some details are omitted]

We have been focusing on developing an inexpensive, insertable endoscopic camera with multiple degrees-of-freedoms (DOFs). In this paper, we describe our insertable Pan/Tilt endoscope with integrated light source that we have built and and tested in five *in vivo* animal tests. Surgeons have used this device to perform laparoscopic appendectomy, cholecystectomy,

running (measuring) the bowel, suturing, and nephrectomy. The results show that the device is easier to use and control than a standard laparoscope. Our imaging device only requires a single access port and has more flexibility, as it is inside the body cavity and can obtain images from a number of controllable directions. There is no need for extensive training with this device as with a standard laparoscope since it is operated by a simple joystick. Standard laparoscopes have counter-intuitive motions due to the pivoting about the insertion point (e.g. to move the laparoscope to the right, the external part of the unit is moved to the left, pivoting on the insertion point). This can cause confusion for untrained operators. Our device can image a larger field of view than traditional laparoscopes, allowing the surgeon greater flexibility in seeing the inside of the abdominal cavity. Our tests have also shown that zooming capabilities are desirable for such a device, and we also present a design for a zooming capability that will add an extra DOF to our device, extending its utility during surgery.

II. Prototype Device

A. New Prototype Imaging Device

Our initial work [24] in designing such an imaging system created a device with 2 cameras and 5-DOF (independent pan and translation axes for each of two cameras plus a common tilt axis). A single camera, 3-DOF version was successfully tested with surgical fellows in a laparoscopic trainer mockup. These quantitative tests using the MISTELS (McGill Inanimate System for the Training and Evaluation of Laparoscopic Skill) tasks [28] showed the device was able to carry out typical minimally invasive surgical tasks equivalent to using a standard laparoscope, with no loss of function[25]. Based upon this design, we have designed a second generation device that improves upon the design of our initial device described above. Our design goals for the new prototype included reducing the device size (from 22mm to 11mm in diameter) and the inclusion of an integrated light source. To reduce the device size to allow it to be inserted through a 12mm trocar, we removed 1 camera and the translation axis. We have also added an LED light source to the device[14]. The total length of the device is about 110mm, and the diameter is about 1 1mm and can be inserted into a standard 12mm trocar.

We make use of modular design to make the device components interchangeable and extendable. The current system includes a user-friendly interface, making it easier to control the camera's DOF using natural motions. It consists of a Pan/Tilt motorized CCD camera with illumination components, control interface driver, PC, and Joystick controller. After the surgeon anchors the camera onto the abdomen wall, he can use the Joystick to position the camera to the desired surgical viewpoint using the Pan and Tilt motions. The intensity of illumination can be adjusted manually through the control panel. Figure 1 shows images of the implemented prototype device, with integrated lighting and pan/tilt axes.

[Some details are omitted]

B. Zoom Mechanism

[Some details are omitted]

Our zoom mechanism is designed to manipulate the camera forward and backward. A rack and pinion mechanism was chosen as the basic mechanical structure for zooming to achieve a compact size (Side View of Figure 3). A 4.5mm miniature stepper motor (0.08mNm maximum torque) is used as the actuator to drive the pinion. The zooming distance is 20mm. The entire zoom package is 12 mm in diameter and 56mm in length. Figure 3 shows the CAD model of the zoom mechanism. It is constructed of a camera module, zoom components and an external

shell. To maximize the output torque, 3 sets of gears are used in the design. The 1st gear is a spur gear with 120 Diametral Pitch and 40 teeth. It rotates on a rack, which is mounted on a support which is attached to the external shell. When the motor rotates, the pinion gear travels along the rack, moving the camera module forward and backward along the external shell. A pinion with 120 Diametral Pitch and 12 teeth is matched with 1st gear. 2nd gear(120 Diametral Pitch, 30 teeth) is mounted on the same shaft with this pinion. A pinion with 120 Diametral Pitch and 12 teeth is mounted on the same shaft as the worm. This pinion is matched with 2nd gear. The worm is mounted on the shaft of motor. The ratio of worm gear is 16:1. Finally, we get a total speed reduction of 133:1 with this design, which we are currently testing in animal trials.

III. Experiments and Results

We have performed five *in vivo* porcine animal tests with our device. A laparoscopic surgeon (Fowler) used this device to perform a number of surgical procedures, including cholecystectomy, appendectomy, running (measuring) the bowel, suturing, and nephrectomy (kidney removal). Since this test animal species does not have an appendix as a human, resecting part of the colon was used to simulate an appendectomy. We present results from two of the tests below.

[Some details are omitted]

IV. Conclusions and future work

This paper describes a new fully insertable robotic surgical imaging device. The device is part of an effort to create totally insertable surgical imaging systems which do not require a dedicated surgical port, and allow more flexibility and DOF's for viewing. The device has controllable pan/tilt axes, and has been used *in-vivo* animal experiments which included cholecystectomy, appendectomy, running the bowel, suturing, and nephrectomy. The results suggest that the device is:

- Easier and more intuitive to use than a standard laparoscope.
- Joystick operation requires no specialized operator training.
- Field of view and access to relevant regions of the body superior to a standard laparoscope using a single port.

Time to perform procedures was better or equivalent to a standard laparoscope.

We believe these insertable platforms will be an integral part of future surgical systems. The platforms can be used with tooling as well as imaging systems, allowing many surgical procedures to be done using such a platform. The system can be extended to a multi-functional surgical robot with detachable end-effectors (grasper, cutting, dissection and scissor). Because the systems are insertable, a single surgical port can be used to introduce multiple imaging and tooling platforms into a patient. In addition, we have built our camera/lens/lighting package in a modular manner, allowing us to design a 2 camera system that can provide stereo 3D views of the site.

One of our design goals is to simplify the operation and control of the imaging system. One possible approach to controlling the cameras would be to use a hybrid controller, which allows the surgeon to control some of the degrees-of-freedom (DOF) of the device and an autonomous system, which controls the remaining DOF. For example, the autonomous system can control pan/tilt on the camera to keep a surgeon-identified organ in view, while the surgeon

simultaneously may translate the camera to obtain a better viewing angle - all the while keeping the organ centered in the viewing field. We have developed hybrid controllers and mechanisms similar to this for robotic work-cell inspection [27] and believe we can transfer these methods for use with this device.

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Instability of pump-turbines during start-up in turbine mode

Thomas Staubli, Florian Senn, Manfred Sallaberger

Introduction

During the last decade the deregulation in the European electricity market has resulted in rapidly changing conditions on the market. Due to the growing demand for balancing power and frequency control an investment in increased pumped storage capacity became economically feasible. Reversible pump-turbines seem to be in many cases the most cost-effective solution. Occasionally torque fluctuations of reversible pump-turbines are encountered in power plants during start-up in turbine mode operation. Such fluctuations can slow down the process of synchronization what is highly undesirable when fast peak power production is required. During start up there is practically no load on the turbine shaft and the turbine operates close to the runaway characteristic. The guide vanes are opened only a few degrees during this phase.

A first case study of such oscillations on a model pump-turbine was presented by Yamabe [1] and [2]. He observed oscillations with pronounced hysteretic behavior which interacted with unsteady cavitation patterns. A case study and a simple cure of the problem by detuning some guide vanes are given by Klemm [3]. A linear stability analysis to predict the occurrence of the oscillations was successfully introduced by Martin [4] and [5]. Also Doerfler [6] presented a case study on how stable operation could be achieved in spite of the instability at no load.

Recent experiences with single stage reversible pump turbines are published by Billdal and Wedmark [7]. They propagandize multiflow guide vanes (MGV) to overcome difficulties with synchronization and to obtain stable speed after load rejection. All authors agree that the so-called S-shape of the four quadrant characteristic of the pump turbines is responsible for the oscillations at no load operation.

[Some details are omitted]

In the following a numerical study will be presented which focuses on the prediction of the characteristic near runaway and on the flow phenomena leading to the instability. To do so, tools were developed to analyze local and time-dependent flow, momentum and energy exchange in each of the runner and guide vane channels and in the vaneless spaces. For

validation of a model of a reversible pump-turbine with a known unstable behavior and well documented model test data was chosen.

1. Numerical flow simulation

The flow near the no load operation of turbines becomes very complex in a sense that the flow is dominated by backflow regions and vortex formations in all parts of the turbine. Furthermore, partial pumping flows start to build up in some or all runner channels. Additionally, the flow becomes vigorously unsteady. Recirculation zones build up and disappear, vortical flows are swept away. To predict such flows - at least qualitatively correct - grid generation must be carried out carefully. The grids used in this study were generated using only hexaedra elements. Grid generation was done with the commercial software ICEMCFD v11.0.

2. Validation

For validation the numerical flow simulations for operation near the runaway point experimental data from model test were used. The validation was carried out in two steps. In a first step stationary simulations were performed. The demand with respect to computational power is much lower for stationary simulations compared to unsteady, transient simulations. However, the expectations in the accuracy of the results of the stationary simulations are low, since the flow is certainly not stationary near runaway.

[Some details are omitted]

3. Procedures to analyze fluxes

During mesh generation mesh-regions were defined for evaluation of local fluxes. This definition of mesh region which can be surfaces or volumes allows the analysis of local time variations of fluxes and balances, e.g. in each guide vane or rotor cannel.

[Some details are omitted]

4. Results

The process of energy dissipation for operating points near runaway involves in- and outflows from the runner. The high energy flow is entering the runner from the guide vanes and drives the runner up to speed where parts of the channel start to pump flow outwards. The equilibrium of energy input and dissipation by pumping results to zero torque at the shaft.

The discharge being pumped out of the runner has to reenter the runner. This increases the inflow into the runner above the flow rate given at the inlet to the turbine scroll. This process of pumping seems to be an unsteady process for the investigated model turbine for an operating point slightly above runaway.

[Some details are omitted]

The question arises now how these flows lead to energy transfer to the vaneless space and how the in- and outflows look like in detail. Figure 9 clearly demonstrates the existence of enhanced vortices transporting fluid outwards. These vortices exit the runner channels in front of the leading edges of the runner vanes into the vaneless space. The vortex strength varies in time and space. For the chosen operating point, which is slightly above the runaway point, the variation in time is dominant, which results in the global flow rate fluctuation through the surface A. It can be assumed that with decreasing flow rate Q at the inlet to the turbine the

effect of the spatial variation of the vortex formation will more and more dominate and that rotating stall will be observed for operating points below runaway, as it was experimentally observed for a pump turbine e.g. by Staubli [8].

The difference between the in- and out-energy fluxes through the surface A indicates that a large amount of the energy dissipation occurs in the vaneless space between guide vanes and runner for operating points near runaway.

5. Conclusions

The characteristics of the pump turbine close to runaway could be well predicted with transient flow simulations. Unstable flow fields were predicted for the simulations in the so called S-shaped portion of the characteristic.

This simulated instability shows time-varying in- and outflow from the runner into the vaneless space. For the investigated operating point, slightly above runaway, the band of the fluctuations corresponded to about 50 percent of the main inflow to the turbine. The existence of unstable operation is confirmed by the model test where also instability was observed in this range of operation.

With detailed information available in the simulated flow field local flow effects could be analyzed. It could be concluded that local vortices forming in the runner channels close to the leading edge is the source for the unsteady in- and outflow from the runner into the vaneless space between guide vanes and runner. Therefore, the vortices and the induced outflow can be considered as the origin of the instability. Most of the energy dissipation for operating points near runaway occurs in the vaneless space between guide vanes and runner.

Acknowledgement

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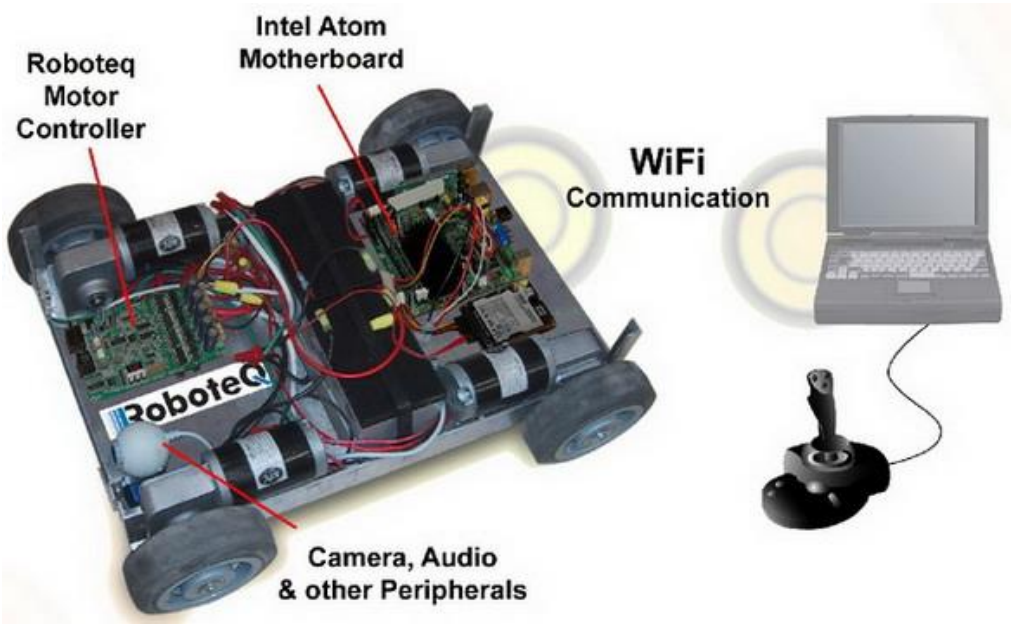
Сделай сам: четырехколесный WiFi Robot на базе Mini-ITX «материнки»

Артем Терехов (http://www.prorobot.ru, 28.12.2010)

Компания Roboteq, позиционирующая себя как ведущего производителя контроллеров в области мобильной роботехники, придумала оригинальный способ продвижения своей продукции – выложить в свободный доступ всю необходимую документацию для создания компактного четырехколесного WiFi Robot. CAD-чертежи, монтажные схемы, программное обеспечение и детальные инструкции по сборке можно найти на страничке роботехнической платформы. Аппарат использует Wi-Fi для передачи видео, аудио и телеметрии на компьютер, таким же образом принимая с него управляющие команды. Предусмотрена также программа, которая позволит управлять роботом из любой точки земного шара, где есть подключение к Сети. Основными компонентами машины являются контроллер электромотора Roboteq AX3500 и материнская плата Intel D510MO. Небольшие размеры «материнки» позволяют разместить ее в прочном алюминиевом шасси, а также дополнить конструктив веб-камерой, источником звука и другой периферией.



Двухъядерного процессора Atom D510 с частотой 1,66 ГГц вполне достаточно для работы WiFi Robot и выполнения всех базовых функций, заложенных в конструкцию. В качестве «домашнего задания» для энтузиастов Roboteq предлагает подумать над некоторыми улучшениями робо-машинки:

- Убрать жесткий диск, заменив его загрузкой с флешки;
- Добавить навигационное оборудование, такое как сонар, компас или GPS;
- Использовать встроенную звуковую карту для придания роботу «голоса»;
- Установить управляемую конечность-манипулятор;
- Добавить возможность распознавания различных объектов в транслируемом видеопотоке.

Ученые создали имплантируемую биологическую антенну для мониторинга организма

Артем Терехов (http://www.prorobot.ru, 10.12.2010)

Золото и шелк – обычно такое сочетание можно встретить на миланских показах мод, но уж никак не в научной медицинской работе. Однако наша новость относится как раз к последней области.

Ученые из Университета Тафтса (Tufts University) создали антенну-биосенсор, имплантируемую в организм человека для «присмотра» за протеинами и различными химическими соединениями. Одно из возможных применений изобретения заключается в автономном мониторинге уровня глюкозы больного диабетом, уведомляя пациента, когда показатели отклоняются от нормы. Впрочем, создатели говорят о гораздо большем практическом потенциале инновации.

Шелк выбран неслучайно. Этот природный материал прочнее кевлара, тоньше человеческого волоса, а главное – он биосовместим с организмом человека (не вызывает реакции иммунной системы). Антенна создана с тем расчетом, что каждый биологический агент в теле человека резонирует на своей, уникальной частоте из терагерцевого диапазона. Ученые надеются, что их изобретение сможет принимать эти сигналы, различать их и транслировать на компьютер беспроводным способом. В планах создателей значатся испытания на тканях живых организмов, так что этот материал о «биологической антенне» явно не будет последним.

Проблема создания нанороботов

Кухарев В.Н (http://www.transhumanism-russia.ru)

Целью создания нанороботов является создание устройства, способного к манипулированию отдельными атомами. Таким образом, можно будет создавать структуры любой сложности с требуемыми свойствами. Нужно только писать соответствующие программы. Кроме того, запрограммировав одного нанобота на копирование самого себя, мы получим практически бесплатное производство. Эти роботы смогут складывать из атомов и уникальные изделия, и предметы повседневного пользования, и чинить поломки человеческого организма.

Однако, чтобы достичь всего этого, нужно ответить на множество вопросов. До сих пор неизвестен чертеж наноробота с детальной расстановкой всех его атомов. Неизвестно как сделать этот чертеж, чтобы атомы при сборке попросту не разлетелись. Общая схема ясна - робот должен иметь двигатель, располагать манипуляторами для перестановки атомов и иметь некоторый контейнер для переноски груза. Отдельные части этих конструкций уже созданы. Но как собрать их все вместе, да и создать

недостающие элементы, пока непонятно - строгие методы проектирования не дают ответа, а экспериментальные требуют значительных финансовых затрат.

Современные методы проектирования нанороботов представляют собой либо набор итераций по экспоненциально сходящимся алгоритмам, которые имеют чрезмерно большую трудоемкость, иногда требующую миллионы лет расчетов, либо набор экспериментальных методов, требующих больших финансовых и временных затрат. А для создания проекта наноробота с минимальными временными и финансовыми затратами необходимо создание полиномиального по времени алгоритма с соответствующим программным обеспечением. Таким образом, оптимальное решение задачи необходимо определять на основе компромисса точных и вероятностных методов.

Вибрационные ветровые панели как альтернатива ветровым турбинам

(http://mobipower.ru, 02.12.2010)

В обсуждении проблемы глобального потепления и воздействия выбросов углерода на нашу планету внимание специалистов обращено к возобновляемым источникам энергии. Ветровая энергия занимает среди них одно из первых мест.

Для получения столь необходимой электрической энергии, правительства, организации и отдельные люди инвестируют значительные средства в создание ветровых турбин. Однако преобразование энергии ветра в электрическую энергию связано с огромными затратами на приобретение турбин, их установку и обслуживание.

Исследователи нашли другой путь преобразования энергии ветра с помощью вибрационных преобразователей, которые дешевле, занимают меньше места и проще в обслуживании.

Преобразование механической энергии ветра в электрическую возможно с помощью панелей вибрационных пьезоэлектрических преобразователей. Такие панели, подобно солнечным батареям, будут устанавливаться на верхней части здания. В отличие от ветровых турбин, виброветровые панели при одинаковой эффективности потребуют намного меньше места для установки. Проект использования виброветровых панелей выполняется инженерами совместно с архитекторами, чтобы избежать нежелательной вибрации зданий.

Преобразователь энергии выполняется из керамики, или даже из полимера. Действует он на принципе эмиссии электронов при механическом сжатии. Однако ученые и исследователи ищут и альтернативные способы преобразования энергии. В частности, рассматривается вариант использования индуктивных преобразователей. Для принятия окончательного решения будет учтены все достоинства и недостатки таких преобразователей. Этот способ получения электроэнергии можно считать идеальным, поскольку отличается чистотой, возобновляемостью и отсутствием каких либо минимальных выбросов в окружающую среду. После завершения этот проект может обеспечить электроснабжение жилых домов экологически чистой энергией.

Графен: материал будущего, или головная боль для ученых?

(http://facepla.net, 26.08.2010)

Ни для кого не секрет, что автомобильные двигатели, работающие на водороде – уже реальность. Проблема машины, работающей на водороде, заключается в том, что надежного места для хранения этого водорода пока не изобрели.

В настоящее время для хранения «автомобильного» водорода используются баллоны. Эти баллоны – громоздкие и очень тяжелые. А все потому, что плотность водорода – очень низкая. Его приходится закачивать в баллоны под огромным давлением. И все бы ничего, если бы закачанный водород не утекал сквозь стенки баллона. В результате – абсолютно герметичного хранилища для водорода в природе просто не существует.

Но как известно, ничто не стоит на месте. Совсем недавно американские ученые из института NIST, что в штате Пенсильвания, сделали одно интересное заявление: хранилищем для водорода может стать графен.

Материал – уникален, и многие его свойства по сей день не изучены до конца. Однако ученые выяснили, что графен имеет отличную теплопроводность и высокую жесткость. Частицы углерода в графене – невероятно подвижны. И это важное обстоятельство дает ученым повод предположить, что сфера применения этого материала может быть очень широка. Этот прогноз не замедлил подтвердиться: относительно недавно были изобретены графеновые наноленты, а на основе этих нанолент – был получен уникальный транзистор, аналогов которому в мире нет.

Но говорить о его промышленном применении – пока преждевременно, так как существует еще масса проблем, решить которые ученым пока не удалось.

О возможности оптимизации инвестиционной политики при замене электрооборудования

Попов Г.В., Крюкова А.В., Комков Е.Ю.

(Журнал «Электро», №1, 2009, С. 13)

Характерной чертой многих промышленных, энергетических, транспортных предприятий современной России является достаточно изношенное состояние основных производственных фондов, которые, несмотря на это, продолжают эксплуатироваться.

Различают два вида износа. Физический износ оборудования вызывается его активной работой и физико-химическими процессами, происходящими при этом; он имеет место также и в то время, когда оборудование не работает (под действием природных факторов, влаги, изменения температуры и т.п.). Физический износ вызывает ухудшение эксплуатационных качеств оборудования — снижение производительности, повышение расхода топлива, эксплуатационных материалов и т.д. При определенном уровне физического износа оборудования дальнейшая его эксплуатация становится экономически нецелесообразной. Появляется опасность внезапного (аварийного) выхода оборудования из рабочего состояния с вытекающими отсюда потерями от нарушений производственного режима и расходов на последующий ремонт.

Моральный износ заключается в снижении экономичности действующего физически годного оборудования как следствие внедрения новой техники, появления более совершенных и экономичных машин. Моральный износ наступает, как правило, раньше физического. Экономическая целесообразность замены морально устаревшего оборудования раньше срока физического его износа определяется специальными

расчетами.При плановой экономике существовал строгий подход к замене стареющих основных фондов. Так в энергетике, в соответствии с планом, ежегодной замене подвергался определенный процент оборудования, отработавшего свой нормативный ресурс, независимо от возможностей этого оборудования продолжать свое функционирование.

В переходный период для руководителей производства главной заботой стало сохранение основных производственных фондов от полного исчезновения, и, естественно, ни о какой замене оборудования речь не заходила. Это привело к тому, что во всех сферах производства, транспорта и энергетике доля устаревшего оборудования существенно возросла. В некоторых отраслях она достигает 50 и более процентов. Сегодня основная проблема состоит в том, что собственники производственных фондов в условиях рыночной экономики стремятся «выжать из них все», зачастую не принимая во внимание тот факт, что такая позиция не оправдана с точки зрения национальных интересов, поскольку тормозит технический прогресс, да и с чисто экономических позиций она далеко не безупречна.

Part 4. Topics for postgraduate exam

List of topics for post-graduate exam

1. Мои научные интересы / мой исследовательский дипломный проект.
2. Глобальные проблемы и пути их решения (экологические, демографические и др.).
3. Современная система высшего образования в России (бакалавриат, магистратура, аспирантура).
4. СПбГПУ как научный центр. Мой факультет/ кафедра.
5. Актуальные научные события современного общества за последний год (присуждение почетных премий за достижения в науке и др.).
6. Исследования, открытия и инновации в странах изучаемого языка.
7. Исследования, открытия и инновации в России.
8. Перспективы работы по специальности.

1. My scientific interests. My research diploma project.

Evolutionary dynamics of the Earth-Moon system

The aim of this work is to apply one of the little-known phenomena of the solid dynamics – their evolutionary behavior – due to the forces of internal dissipation to the description of the Earth-Moon system. In terrestrial systems these forces appear under free or induced vibrations of deformable bodies, accompanied by dissipation of energy due to mechanical hysteresis. Capacity of such dispersion is comparable to capacity of forces of external friction so process of dissipation is "fast" (duration of attenuation of free oscillations is estimated in tens periods of oscillations). A different mechanism of internal dissipation takes place in outer space, where there is no external friction, and activators of hysteresis phenomena in the body are the forces of inertia when it is non-uniform rotation, and also the external gravitational field, if present.

It is known that the distance between the Earth and the Moon is not constant but slowly changing time function. The question of the limit state of the system is interesting to be looked into, as the influence of the Moon on the life on the Earth can not be disregarded. It is proposed to use the model of the dissipative rigid body to describe the behavior of the Earth-Moon system.

At this stage, the problem of the effect on the energy dissipation of the field's of volume forces and the forces of inertia changes over time in the case of two dissipative disks linked by a massless rod has been solved. The dissipation function, which allows deriving equations of motion with a small parameter at the highest (third) derivative of the generalized coordinates, has been designed. Numerical solution of these equations is a separate problem which was also solved successfully. The solution obtained showed that the model of a dissipative body is consistent and can be used in further studies.

To model the Earth-Moon system a similar problem but without a massless rod, which will allow the disks representing the Earth and the Moon to get either away from each other or close to each other, is to be considered. The solution will require rather complex numerical study as well as analytical work. Provided that at least 6 months and sufficient funding is given it is quite possible to approach to the answer of the question mentioned above.

2. Global problems and ways of their solution

The debate about genetically modified crops rages on. Those excited about this new development claim that it's the only way to solve the problem of food supply to parts of the world where at present people are dying of starvation. Special strains of plants can be created that are e.g. resistant to drought or to particularly high temperatures or certain pests, which allows them to flourish where other crops fail. At the same time, they say, chemical pesticides are no longer needed, so it's better for environment too. Opponents are first and foremost worried about the unknown effects of GM food on our health. While in the short-term eating GM food appears to do no harm, it is not yet possible to predict how future generations may be affected. They also fear that even if GM crops are grown in clearly defined and fenced-off areas, seeds from GM plantations will unavoidably pollinate the surrounding vegetation, which may end up being genetically modified too. Playing around with genes, they argue, isn't a game, and may result in untold damage to the human race and to the environment.

As medical science progresses, we are becoming an increasingly elderly society and, although living to a ripe old age can only be a good thing, it brings with it a large number of

problems that we have yet to deal with properly. One such problem is that the burden of financing care for the elderly is falling on a reduced percentage of the working population. The gradual but steady trend towards smaller families means a smaller number of people to pay for the requirements of an increasingly elderly population. The services needed by the elderly are currently stretched to breaking point. Nursing homes, homecare, meals on wheels etc. all need more investment if we wish our elderly to live as fulfilled and independent life as possible. Young people today are encouraged to start saving with personal pension schemes as early as possible to ensure an adequately financed retirement, since it's predicted that state pension levels in the future won't be enough to guarantee a continuation of the lifestyle the have become used to, but at the moment we still have to cope with an expanding older population who are discovering too late that the steps they had taken to guarantee an income for their later years were not sufficient. Obviously, the pressure on public funds to subsidise this shortfall is enormous.

3. Modern system of higher education in Russia

The Specialist's degree was the first academic distinction in the Soviet Union, awarded to students upon completion of 5-year studies at the University level. The degree can be compared both to the Bachelor's and Master's degree. In the early 1990s, Bachelor's degree was introduced in all the countries of the Commonwealth of Independent States, except Turkmenistan. After Bachelor's degree, one can get a Master's degree (another 1–2 years) while preserving the old 5-year Specialist scheme. Specialist degree is now being discontinued in universities that take part in the Bologna process, so new students do not always have this option.

A bachelor's degree is usually an academic degree awarded for an undergraduate course or major that generally lasts for four years, but can range from two to six years depending on the region of the world.

A master's degree is an academic degree granted to individuals who have undergone study demonstrating a mastery or high-order overview of a specific field of study or area of professional practice. Within the area studied, graduates possess advanced knowledge of a specialized body of theoretical and applied topics; high order skills in analysis, critical evaluation and professional application; and the ability to solve complex problems and think rigorously and independently.

Many post-Soviet countries, including Russian Federation, have a two-stage research degree obtaining path, generally similar to the doctorate system in Europe. The first stage is named "Candidate of Sciences", which is usually recognised as an equivalent of Philosophy Doctor (Ph.D.) degree and requires at least (and typically more than) three years of post-graduate research which is finished by defence of a thesis. Additionally, a seeker of the degree has to pass three examinations: in his special field, in a foreign language, and in the history and philosophy of science. After additional certification by the corresponding experts, the "Candidate of Science" degree may be recognized internationally as an equivalent of Ph.D.

4. St. Petersburg State Polytechnical University as a scientific center. My department.

Saint Petersburg Polytechnical Institute was founded in 1899 as the most advanced engineering school in Russia. The main person promoting the creation of this University was the Finance Minister Count Sergei Witte who saw establishing a first-class engineering school

loosely modeled by the French École Polytechnique as an important step towards the industrialization of Russia. The idea was advanced by Agricultural scientist and Deputy Finance Minister Vladimir Kovalevsky and the great chemist Dmitri Mendeleev who are often considered to be the founders of the school. The first Director of the Institute became Prince Andrey Gagarin. Unlike École Polytechnique the Polytechnical institute was always considered to be a civilian establishment. In tsarist Russia it was subordinated to the Ministry of Finance and its students and faculty wore the uniform of the Ministry.

The Chair of Theoretical Mechanics (department of Physics and Mechanics) is one of the oldest chairs of the Saint Petersburg State Polytechnical University. It was founded by Professor Ivan Vsevolodovich Meshchersky, one of the greatest Russian scientists of the end of 19th century, who laid the corner stone in mechanics of the motion of bodies with variable mass.

Professor Anton Miroslavovich Krivtsov (b. 1967) is the head of this chair since 2007. Prof. Krivtsov is a member of the Russian National Committee for Theoretical and Applied Mechanics, and also the head of the Laboratory "Discrete models of mechanics" of the Institute for Problems of Mechanical Engineering RAS. His scientific work is devoted to mathematical modeling of phenomena and processes from various areas of mechanics and physics: rigid body dynamics, solid mechanics, theory of media with microstructure, nanomechanics, theory of vibrations, astrophysics. His main research interest is mathematical and computer modeling of media with microstructure based on methods of molecular and particle dynamics. Development and enhancement of methods for particle dynamics in the works of Prof. Krivtsov allowed investigating processes, which are difficult to describe by means of continuum mechanics.

The Chair of Theoretical Mechanics supports scientific cooperation with leading institutions and scientific organizations from all over the world, such as

- University of Aberdeen, Great Britain, Department of Engineering
- Brown University, USA, Department of Engineering
- Martin Luther University, Germany, Halle-Vittenberg, Department of Mechanical Engineering
- Sevilla University, Spain, Department of Electronics and Electromagnetism
- University of Florida, USA, Department of Mechanical and Aerospace Engineering
- University of California, USA
- Sandia National Laboratory, Department of Mechanics of Materials, USA
- Hamburg University of Technology, Institute of Solids Process Engineering and Particle Technology, Germany etc.

This allows us to promote research in various branches of science and to work on cutting edge of scientific and technological progress. Research methods which are developed at our chair are applied both to problems of nanoscale level and to astrophysical problems. Nanomechanics, biotechnology, materials processing, deformation and fracture, the formation of planets – all these and many other areas are represented here.

Staff and students of our chair are actively involved in organizing of international summer school-conference "Advanced Problems in Mechanics". This conference is held annually by the Russian Academy of Sciences since 1971. It covers all fields of mechanics, as well as some

interdisciplinary problems. The main objective of the conference is to provide an opportunity of effective interaction between renowned scientists and young professionals from various branches of mechanics.

University graduates with Master's degrees in "Mechanics" (and mathematical modeling) are first of all focused on research work in scientific centers in Russia and abroad, and in the specialized private firms. Also, they can operate successfully in various industrial corporations, Russian and foreign Hi-Tech and IT business establishments, consulting firms etc.

5. Contemporary scientific events

The Nobel Prize in Physics in 2009 was awarded to a Chinese scientist Charles Kao and Americans Willard Boyle and George Smith for research in the field of information technology. Kao was behind the fiber-optic data transmission technology, and Boyle and Smith have invented a semiconductor device that allows you to receive digital photos directly, bypassing the film. Their work led to the first real revolution in applied science, then in knowledge-intensive technologies, and in the last decade they have become part of our everyday lives, making it much more comfortable.

Nobel Prize in Chemistry this year went to biologists: their accomplishment is primarily associated with the use of X-ray diffraction method, widely used in biochemistry and brought to the new level with the active participation of the winners. Award "for studying the structure and operation of the ribosomes" is shared by Ada Yonath**,** Venkatraman Ramakrishnan and Thomas Steitz. Ribosomes are the "protein factory" of cells; it is them, whose work provides synthesis of the protein from amino-acids, which forms the basis of life of all living things. The award-winning achievement has played a significant role in the development of science; it has direct practical applications: in particular, antibiotics, which kill bacteria by "turning off" their ribosomes, are developed and improved.

The Nobel Prize in Physiology or Medicine in 2009 was given to Elizabeth Blackburn, Carol Greider and Jack Szostak "for their discovery of how the enzyme telomerase and telomeres protect chromosomes". The mechanism of protection of chromosomes from shortening when dividing was first predicted in 1971 by A. M. Olovnikov and subsequently his theory was confirmed in practice by experimenters, who were awarded this Nobel Prize. Telomeres play a significant role in age-related changes of cells and whole organism and in the development of malignant diseases. Further investigation of their dynamics and principles of the way the enzyme telomerase lengthens them may help to find new ways to fight aging and cancer.

6. Researches, discoveries and innovations in English-speaking countries

An international team of researchers has developed a new magnetic carbon material that not only acts as a semiconductor but is also magnetic and could help scientists develop the next generation of microelectronic devices.

The new carbon material is based on graphene, which resembles graphite, the form of carbon found in pencil lead**,** but which exists as single sheet-like layers resembling nanoscopic chicken wire fencing. Graphene was first created by scientists in Manchester five years ago and is not only 200 times stronger than steel but because its electrons are highly mobile it has unique electro-optical properties. As such, some researchers think that graphene is the natural successor to silicon and could lead to the advent of spintronic devices that exploit electron spin and charge in computer memory and data processing.

Now, researchers from the Virginia Commonwealth University, USA, Peking University in Beijing, China, the Chinese Academy of Science in Shanghai, and Tohoku University in Sedai, Japan have used computer modelling to design a chemical cousin of graphene which they call graphone. Experiments with the new material confirm the electromagnetic properties predicted by the computer models.

One of the important impacts of this research is that semi-hydrogenation provides a very unique way to tailor magnetism. The resulting ferromagnetic graphone sheet will have unprecedented possibilities for the applications of graphene-based materials.

7. Researches, discoveries and innovations in Russia

As a result of implementing the project, in 2010-2015 RUSNANO Russian company will establish original commercial production of medications that are without parallel in the entire world. The unique technology for fusing the most dissimilar drug substances in phospholipid nanoparticles was developed in the Russian Federation. It will enable the project company to enter the market with innovative and highly effective forms of medications in only one to two years, with minimal risk, and with a minimal budget.

The capsules of drug nanoparticles (micelles) are composed of phospholipids—natural fat molecules that form in cell membranes. Phospholipid nanoparticles easily penetrate the cells and free the active drug ingredients precisely where they are needed. Phagocytes and other cells of the human defense system that imbibe objects foreign to the organism are unable to distinguish the 15-nm to 25-nm drug nanoparticles. Therefore, the nanoparticles circulate in the blood stream longer and leave it largely in those places where the vessel walls are most penetrable. Those most penetrable places—for example, the locus of inflammation or tumor—often require therapeutic intervention.

Drug production and supplies to the drug delivery system is an innovative area of the pharmaceutical industry worldwide. The first series of drugs are expected to enter production and sale in 2011-2012. These will be nanoforms of indometacin (a non-steroid anti-inflammatory drug), prednisolone (a steroid anti-inflammatory drug), and chlorine-E6 (an active ingredient in photosensitizers—medications used to treat a long list of illnesses in oncology, otolaryngology, dermatology, dentistry, and surgery with an innovative method of photodynamic therapy.) In the second series of medication, 2012-2015, the project company plans to issue nanoforms of verospiron (a potassium-sparing diuretic) and the innovative statin nanophospholip (a drug that decreases the level of cholesterol in the blood and helps fight cardiovascular diseases).

8. Prospects of work in my professional field

I have decided to connect my future life with science mainly because I am interested in research. I'm an engineer by profession and I have to conduct research in this sphere. Heat and power engineering is an area of power-engineering dealing with energy generation and energy transformation laws. The problem of the rational energy use in technological process is one of the most important now. Its solution defines a standard of living and future prospects. As market relations in Russian economy and industry are developing and companies are entering the world market, the role of power supply and ecology in the industrial effectiveness will increase.

Deep awareness in the thermal physic theory of all processes and energy laws allows solve complicated problems of energy supply for different sectors of economy, to develop and

implement high-performance equipment and technological processes in order to solve contemporary issues of energy supply. Every graduate in the specialization “Heat-and-power engineering” has so many prospects in their carrier ladder. The young specialists can realized themselves in design organizations as well as in generating companies. Currently not many young people want to work as engineers and develop our power industry. But for me it’s interesting and I want to work in the field of my specialization. And I hope my job will help to support our hydroelectric power stations in good modern conditions.

Supplementary file

Appendix 1. Additional articles

Unit 1

Text 1. Undergraduate Education: Types of Schools

Two main categories of institutions of higher learning are public and private. All schools get money from tuition and from private contributors. However, public schools are also supported by the state in which they’re located. Private schools do not receive state funding. As a result, tuition is generally lower at public schools, especially for permanent residents of that state. A third category is the proprietary (for-profit) school. These usually teach a particular workplace skill. Some of these schools are quite expensive.

Schools can also be grouped by the types of programs and degrees they offer. The three major groups are community colleges, 4-year colleges, and universities. Community colleges (sometimes called junior colleges) offer only the first 2 years of undergraduate studies (the freshman and sophomore years). They enroll about 5 million students a year. Most community colleges are public schools, supported by local and / or state funds. They serve two general types of students: those taking the first 2 years of college before they transfer to a 4-year school for their third and fourth (junior and senior) years and those enrolled n 1- or 2-year job-training programs. Community colleges offer training in many areas, such as health occupations, office skills, computer-science, police work, and automotive repair.

What is the difference between a college and a university? Size is only part of the answer. Some colleges have a student body of just a few hundred, while some state universities serve more than 100,000 students on several campuses? A university is usually bigger than a college because the scope of its programs is much greater. A university offers a wider range of undergraduate programs plus graduate studies. Part of the responsibility of a university is to encourage its faculty and graduate

students to do research to advance human knowledge. Colleges, on the other hand, are primarily undergraduate schools. They have no obligation to conduct research.

Many excellent colleges are liberal arts schools, which means that they offer studies in the humanities, languages, mathematics, social sciences, and sciences. Liberal arts colleges generally do not offer degrees in engineering, business, journalism, education (teacher training), and many other specific vocations that a student can prepare for at a university.

Some colleges specialize in training students for one occupation (as agricultural colleges and teachers' colleges do). Many undergraduate institutions that are not called colleges also provide higher education in one specific occupation – for example, conservatories for music students, seminaries for students of religion, and fine arts schools for artists. For those wishing to prepare for military careers, the U.S. government maintains four military academies.

At colleges and universities, the academic year is about 9 months long (usually from September until early June or from late August until May). After completing 4 academic years with acceptable grades in an approved course of study, the student earns a bachelor's degree. Some students complete college in less than 4 years by attending summer sessions. At most colleges, the academic year is divided into either two semesters or three quarters, excluding the summer session. College grades, from highest to lowest, are usually A, B, C, D, and F (a failing grade). Generally, students must keep a C average to remain in school.

Check your comprehension

~ What are three differences between a college and a university?

Graduate Education

American universities offer three kinds of graduate degrees: master's degrees, Ph.D. degrees, and professional degrees (for example, in medicine, law, or engineering). In most fields, a master's degree can be earned in 1 or 2 academic years of study beyond the B.S. or B.A. Earning a Ph.D. degree (doctor of philosophy) usually takes at least 3 years beyond the master's. To receive a Ph.D. in most fields, students must pass oral and written examinations and produce a long and comprehensive research paper that makes an original contribution to their field. In some fields, Ph.D. candidates must also be able to read one or two foreign languages. Requirements are different for professional degrees.

In recent years, the graduate student population has become much more diverse than ever before. It now includes more women, foreign students, minority group members, older students, and part-time students. Also, the variety of degree programs offered has expanded greatly. Today's graduate students can choose from master's degrees in at least 1,000 fields and Ph.D.s in about 100 fields.

Check your comprehension

~ What are four requirements most Ph.D. applicants must fulfill?

Financing Higher Education

College costs vary quite a bit, depending upon the type of school. At expensive private schools, annual costs (including tuition, room, board, books, travel to and from home, etc.) may exceed $30,000. Public universities are much cheaper. At these schools, tuition is significantly higher for out-of-state students than for permanent residents of that state. Tuition at community colleges averages about $ 1,500, approximately half the in-state tuition at public, 4-year schools.

During the 1990s, the cost of higher education rose about 7.5% a year. Difficulties making ends meet create serious problems for many students. Older students with a family to support may try to work full time while carrying a full academic courseload. They forget to leave themselves time to eat, sleep, and relax.

For those who need financial assistance, help is available. There are three main types of financial aid: (1) scholarships (grants), which are gifts that students do not repay; (2) loans to students and / or their parents; and (3) student employment (work/ study), a part-time job that the school gives the student for the academic year. Most financial aid is need-based; that is, only students who need the money receive it. Financial assistance to excellent students who do not need the money (commonly called merit-based aid) is limited.

Funds for all this aid come from three main sources – the federal government, state governments, and private contributors. Every American college and university has a financial aid office to help students find out what kind of aid they might be eligible for and to assist them in completing the complicated application forms. Aliens who are permanent residents in the U.S. are eligible for government assistance, but foreign students are not.

Check your comprehension

~ What are three kinds of financial aid? Which one do you think students like most?

Standardized Tests and Their Uses

Various standardized tests help students demonstrate their knowledge to college admissions personnel. Adults who have not finished high school can take the GED (Test of General Educational Development). The GED involves five exams – writing skills, social studies, science, literature and the arts, and mathematics. The tests are available in English, French, and Spanish. Students can study for the GED by taking a review course or using a review book on their own. Students who pass the test earn a high school equivalency certificate.

High school seniors wishing to apply to competitive colleges and universities take standardized tests commonly called ACTs and SATs. The tests help students demonstrate the ability to do college level work. Most colleges use these scores plus the students' high school grades to evaluate applicants. These tests are given several times a year throughout the U.S. and in other countries.

Students whose native language is not English will probably be required to take the TOEFL* (Test of English as a Foreign Language) when they apply for admission to a university. Students can study for the TOEFL and many other standardized tests by taking a review course or by working independently with a review book or computer program.

When students come to the U.S. after completing some college work in another country, they should bring a transcript of previous college work and have those credits evaluated by an authorized organization. The transcript will probably need to be translated into English. Students who cannot prove that they have completed certain college courses can take some of the CLEP (College Level Examination Program) tests to demonstrate their knowledge.

Standardized tests are also required to apply for admission to graduate schools. The counseling office of a student's present or prospective school can answer questions about requirements for acceptance to graduate programs.

Check your comprehension

~ What is the general purpose of standardized tests?

Lifelong Learning

In the U.S., the education of adults is a never-ending process going on in many different places for many different reasons. At least 76 million adults are enrolled in some type of classes, mostly as part-time students. The majority of these classes are taken not for credit but for knowledge that the student can use on the job, to pursue a hobby, or for personal growth. Many employees take classes at their workplace. Some companies pay the tuition when an employee goes back to school to learn a skill that the company needs. Noncredit programs, commonly called *adult education* or *continuing education*, are offered in many high schools, colleges, and museums. There are also private learning

centers that offer inexpensive classes covering a wide variety of skills and activities. A typical catalog might have classes in how to cook a Chinese dinner, invest in the stock market, improve spelling, make friends, or even give your partner a massage.

Education, like everything else, takes advantage of technology. These days, students can be home with the family and go to school at the same time. They can take classes in their living rooms via TV. Many schools also offer distance learning – "attending" class and interacting with professors and classmates via the Internet. One 97-year-old man earned his Ph.D. that way!

In the U.S.A., technology rapidly makes some skills obsolete and new ones essential. Workers at all levels realize that lifelong learning is necessary. Even professional people – doctors, accountants, dentists, and engineers – continue to study to keep up with challenges in their fields. The American dream of becoming professionally and financially successful is most often achieved through higher education.

Text 2 Educating the nation

from McDowall D. Britain in Close-Up. 2002. UK. 208p.

Further and higher education

Further education has traditionally been characterised by part-time vocational courses for those who leave school at the age of 16 but need to acquire a skill, be that in the manual, technical or clerical field. In all, about three million students enrol each year in part-time courses at further education (FE) colleges, some released by their employers and a greater number unemployed. In addition there have always been a much smaller proportion in full-time training. In 1985 this figure was a meagre 400,000, but by 1995 this had doubled. Given Labour's emphasis on improving the skills level of all school-leavers, this expansion will continue. Vocational training, most of which is conducted at the country's 550 further education colleges is bound to be an important component.

Higher education has also undergone a massive expansion. In 1985 only 573,000, 16 per cent of young people, were enrolled in full-time higher education. Ten years later the number was 1,150,000, no less than 30 per cent of their age group.

This massive expansion was achieved by greatly enlarging access to undergraduate courses, but also by authorising the old polytechnics to grant their own degree awards, and also to rename themselves as universities. Thus there are today 90 universities, compared with 47 in 1990, and only seventeen in 1945. They fall into five broad categories: the medieval English foundations, the medieval Scottish ones, the nineteenth-century 'redbrick' ones, the twentieth-century 'plate-glass' ones, and finally the previous polytechnics. They are all private institutions, receiving direct grants from central government.

Check your comprehension

~ Where is most of vocational training is conducted in Great Britain?

~ Which categories do universities in Great Britain fall into?

Oxford and Cambridge, founded in the thirteenth and fourteenth centuries respectively, are easily the most famous of Britain's universities. Today 'Oxbridge', as the two together are known, educate less than one-twentieth of Britain's total university student population. But they continue to attract many of the best brains and to mesmerise an even greater number, partly on account of their prestige, but also on account of the seductive beauty of many of their buildings and surroundings.

Both universities grew gradually, as federations of independent colleges, most of which were founded in the fourteenth, fifteenth and sixteenth centuries. In both universities, however, new colleges are periodically established, for example Green College, Oxford (1979) and Robinson College, Cambridge (1977).

Scotland boasts four ancient universities: Glasgow, Edinburgh, St Andrews and Aberdeen, all founded in the fifteenth and sixteenth centuries. In the Scottish lowlands greater value was placed on education during the sixteenth and later centuries than in much of England. These universities were created with strong links with the ancient universities of continental Europe, and followed their longer and broader course of studies. Even today, Scottish universities provide four-year undergraduate courses, compared with the usual three-year courses in England and Wales.

In the nineteenth century more universities were established to respond to the greatly increased demand for educated people as a result of the Industrial Revolution and the expansion of Britain's overseas empire. Many of these were sited in the industrial centres, for example Birmingham, Manchester, Nottingham, Newcastle, Liverpool and Bristol.

With the expansion of higher education in the 1960s 'plate-glass' universities were established, some named after counties or regions rather than old cities, for example Sussex, Kent, East Anglia and Strathclyde. Over 50 polytechnics and similar higher education institutes acquired university status in 1992. There is also a highly successful Open University, which provides every person in Britain with the opportunity to study for a degree, without leaving their home. It is particularly designed for adults who missed the opportunity for higher education earlier in life. It conducts learning through correspondence, radio and television, and also through local study centres.

Check your comprehension

~ What structure do Oxford and Cambridge Universities have?

~ In what way are Scottish Universities different from English ones?

~ What type of universities was established in the 1960s?

University examinations are for Bachelor of Arts, or of Science (BA or BSc) on completion of the undergraduate course, and Master of Arts or of Science (MA or MSc) on completion of postgraduate work, usually a one- or two-year course involving some original research. Some students continue to complete a three-year period of original research for the degree of Doctor of Philosophy (PhD). The bachelor degree is normally classed, with about 5 per cent normally gaining a First, about 30 per cent gaining an Upper Second, or 2.1, perhaps 40 per cent gaining a Lower Second, or 2.2, and the balance getting either a Third, a Pass or failing. Approximately 15 per cent fail to complete their degree course.

In addition there are a large number of specialist higher education institutions in the realm of the performing and visual arts. For example, there are four leading conservatories: the Royal Academy of Music, the Royal College of Music, Trinity College of Music and the Royal Northern College of Music. There are a large number of art colleges, of which the most famous is the Royal College of Art, where both Henry Moore and David Hockney once studied. Other colleges cater for dance, filmmaking and other specialist areas of artistic study.

In spite of the high fees, Britain's universities, FE colleges and English language schools host a large number of foreign students.

Check your comprehension

~ In what respect does the bachelor degree in Great Britain differ from the bachelor degree in Russia or the USA?

~ Which HEIs are referred to as specialist higher education institutions?

Female undergraduates have greatly increased proportionately in recent years. In the mid-1960s they were only 28 per cent of the intake, became 41 per cent by the early 1980s, and were 51 per cent by 1996. There is still an unfortunate separation of the sexes in fields of chosen study, arising from occupational tradition and social expectations. Caring for others is still a 'proper' career for women; building bridges, it seems, is not. Unless one believes women's brains are better geared to nursing and other forms of caring and men's to bridge-building, one must conclude that social expectations still

hinder women and men from realising their potential. Students from poorer backgrounds are seriously underrepresented in higher education. Although more in social categories C, D and E are now enrolled, it is the more prosperous social categories A and B which have benefited most from university expansion. There are two issues here: equality of opportunities and maximizing all of the society's intellectual potential. Ethnic minorities' representation is growing: 13 per cent in 1996 compared with only 10.7 per cent in 1990. It is noteworthy that their university representation exceeds their proportion within the whole population, a measure of their commitment to higher education.

In 1988 a new funding body, the University Funding Council, was established, with power to require universities to produce a certain number of qualified people in specific fields. It is under the UFC's watchful eye that the universities have been forced to double their student intake, and each university department is assessed on its performance and quality. The fear, of course, is that the greatly increased quantity of students that universities must now take might lead to a loss of academic quality.

Expansion has led to a growing funding gap. Universities have been forced to seek sponsorship from the commercial world, wealthy patrons and also from their alumni. The Conservative Party also decided to reduce maintenance grants but to offer students loans in order to finance their studies. However, the funding gap has continued to grow and Labour shocked many who had voted for it by introducing tuition fees at £1,000 per annum in 1998. Although poorer students were to be exempted it was feared that, even with student loans, up to 10 per cent of those planning to go to university would abandon the idea. One effect of the financial burden is that more students are living at home while continuing their studies: about 50 per cent at the ex-polytechnics, but only 15 per cent at the older universities.

Check your comprehension

~ Do you think if women and men can realize their potential at full? Why?

~ Is the portion of students from poorer backgrounds as big as the portion of people from poorer backgrounds in the society?

~ What power does the University Funding Council have?

Today many university science and technology departments, for example at Oxford, Cambridge, Manchester, Imperial College London, and Strathclyde, are among the best in Europe. The concern is whether they will continue to be so in the future. Academics' pay has fallen so far behind other professions and behind academic salaries elsewhere, that many of the best brains have gone abroad. Adequate pay and sufficient research funding to keep the best in Britain remains a major challenge.

As with the schools system, so also with higher education: there is a real problem about the exclusivity of Britain's two oldest universities. While Oxbridge is no longer the preserve of a social elite, it retains its exclusive, narrow and spell-binding culture. Together with the public school system, it creates a narrow social and intellectual channel from which the nation's leaders are almost exclusively drawn. In 1996 few people were in top jobs in the Civil Service, the armed forces, the law or finance, who had not been either to a public school or Oxbridge, or to both.

The problem is not the quality of education offered either in the independent schools or Oxbridge. The problem is cultural. Can the products of such exclusive establishments remain closely in touch with the remaining 95 per cent of the population? If the expectation is that Oxbridge, particularly, will continue to dominate the controlling positions in the state and economy, is the country ignoring equal talent which does not have the Oxbridge label? As with the specialisation at the age of 16 for A levels, the danger is that Britain's governing elite is too narrow, both in the kind of education and where it was acquired. Significantly fuller popular participation in the controlling institutions of state is overdue.

Check your comprehension

~ What causes the "brain drain' from Great Britain?

~ Why is the exclusivity of Britain's two oldest universities a real problem for the society?

Further information

State education: http://www.dfee.gov.uk

Private education: http://www.isis.org.uk

Text 3

Чучалин А.И. *Американская и болонская модели инженера: сравнительный анализ компетенций*

Анализ требований к компетенциям показывает, что в американской Результаты модели бакалавр-инженер должен обладать «принципиальными анализа знаниями», уметь «анализировать, решать и оценивать результаты решения комплексных инженерных задач», «осуществлять коммуникации и нести ответственность за принятие решений по всему комплексу инженерной деятельности», демонстрировать «знания для решения проблем устойчивого развития», быть «лидером команды».

В болонской модели от бакалавра-инженера требуется лишь обладать «системными профессиональными знаниями в определенной области наук», способностью их применять «для разработки и реализации проектов, удовлетворяющих заданным требованиям», иметь «навыки работы в мастерской и лаборатории», способность «осуществлять подбор и использовать необходимое оборудование, инструменты и методы», «работать как член команды». И только магистр-инженер в болонской модели должен обладать «глубокими принципиальными знаниями», уметь «решать неизвестные ранее задачи», создавать «концептуальные инженерные модели, системы и процессы», применять «инновационные методы для решения инженерных задач», разрабатывать «новые идеи», принимать «неизвестные ранее проектные решения», планировать и проводить «аналитические исследования», «интегрировать знания для решения комплексных практических задач», быть способным «эффективно функционировать в качестве лидера группы».

Unit 2

Science matters! The importance of scientific literacy.

It is well understood that literacy plays a major role in the career and personal life of individuals and in the degree of success they achieve. According to Statistics Canada, "Traditionally, literacy has referred to the ability to read, understand, and use information. But the term has come to take on broader meaning, standing for a range of knowledge, skills and abilities relating to reading, mathematics, science and more. This reflects widespread and deep changes that have taken place in technology and in the organization of work over the past quarter century. The ability to use and apply key mathematics and science concepts is now necessary across a wide range of occupations."

But Exactly How Important is Literacy?

Literacy is fundamental for learning in school. It has an impact on an individual's ability to participate in society and to understand important public issues. And it provides the foundation upon which skills needed in the labour market are built.

Technology, and the science behind it, permeates all aspects of out lives, from how we work and communicate to what we shop for and how we pay out bills. The complexity of today's world means that individuals need to have some level of proficiency in reading, mathematics and science in order to understand and participate fully in economic and social life.

A population's literacy skills also have a bearing on how well a country performs economically. The world we live in today is vastly different from that of a generation ago. Technological change has transformed the way in which work is done; competition in many industries is global in nature; and the industrial structure of the Canadian labour market has rapidly evolved from a manufacturing and agricultural base to one based on services. These changes have, in turn, brought rising skill

requirements. Countries that are successful in endowing their populations with strong skills are usually in a better position to meet the economic challenges of operating in a globalized information economy.

Finally, having a population that has strong literacy skills also places a country in a better position to meet the complex social challenges that it faces. For example, strong literacy skills are linked to better health outcomes for individuals. A highly literate population will be better able to deal with issues of governance in a highly diverse society. And informed debate is needed to help us determine how best we can allocate scarce resources across competing priorities, such as education, health, investment in infrastructure and social programs.

What is Scientific Literacy? Some Definitions

Statistics Canada in their study of the performance of Canada's youth in science, reading and mathematics as part of the Programme for International Student Assessment (PISA) defines scientific literacy as: "An individual's scientific knowledge and use of that knowledge to identify questions, to acquire new knowledge, to explain scientific phenomena, and to draw evidence-based conclusions about science-related issues, understanding of the characteristic features of science as a form of human knowledge and enquiry, awareness of how science and technology shape out material, intellectual, and cultural environments, and willingness to engage in science related issues, and with the ideas of science, as a reflective citizen."

The Council of Ministers of Education defined scientific literacy as "an evolving combination of the science-related attitudes, skills, and knowledge, students need to develop inquiry, problem-solving and decision-making abilities, to become lifelong learners, and to maintain a sense of wonder about the world around them."

Robert Hazen in his paper entitled "Why Should You Be Scientifically Literate" puts it more simply as: "a mix of concepts, history, and philosophy that help you understand the scientific issues of our time". To Hazen, a long-time advocate and leading promoter of scientific literacy, it means a broad understanding of basic concepts (see The Joy of Science, The Teaching Company, 2009). (6) Scientific literacy is definitely not the specialized, jargon-filled esoteric lingo of the experts and Hazen notes that one doesn't have to be able to synthesize new drugs to appreciate the importance of medical advances! Scientific literacy is rooted in the most general scientific principles and broad knowledge of science. Hazen considers the scientifically literate citizen as one who possesses facts and vocabulary sufficient to comprehend the context of the daily news. Put another way, "If you can understand scientific issues in magazines and newspapers (if you can tackle articles about genetic engineering or the ozone hole with the same case that you would sports, politics or the arts) then you are scientifically literate". There are two important but separate aspects of scientific knowledge that should not be confused, doing science, which is the practice of scientists and using science, which in one way or another in actuality or potentially is in the domain of everyone. It is here that scientific literacy plays such a vital role.

Check your comprehension

~ What is scientific literacy?

~ Why is scientific literacy important for science?

http://www.entrepreneur.com/tradejournals/article/198289749_2.html

Unit 3

Text 1. How the Hubble Telescope Will Die

If we do nothing, the Hubble Space Telescope will fall to Earth in 2024.

It is in an orbit roughly 560 km above the Earth and circles the Earth once every 97 minutes. While for most intents and purposes the Hubble Space Telescope can be considered to be in space, it actually lies in what is known as the thermosphere: the largest and most tenuous part of the Earth's

atmosphere. The thernosphere is roughly one million times less dense than the atmosphere at sea level, yet it is enough to affect the orbits of satellites that fly within it.

Any satellites in low Earth orbit experience a small but significant resistance as they fly over the planet's surface, slowing them down and decaying their orbits. If not corrected, or periodically 'pushed back up' by a rocket or the Space Shuttle, the satellites at this altitude are eventually doomed to fall to Earth and burn up in the atmosphere.

The Space Shuttle has its own engines and isn't in orbit long enough to be affected by this drag but the International Space Station and the Hubble Space Telescope are affected, and they must be periodically pushed into higher orbits to correct for their orbital decay.

To complicate matters, the amount of drag on the Hubble as it orbits within the thermosphere isn't constant. It varies with the 11 year sunspot cycle. As the Sun becomes more active, the atmosphere of the Earth swells and reaches farther out into space than it otherwise would. This increases the density of the air that Hubble must fly through, slowing it down further, lowering its orbit and ultimately shortening it's lifespan.

Hubble has no jets or engines of any kind for propulsion, so throughout its life, it has relied on the Space Shuttle to grab onto it and move it to a higher orbit. Now that NASA has suspended the Shuttle program, no more launches are scheduled to service the most powerful telescope ever built. The Hubble Space Telescope is on its own.

That doesn't mean however, that NASA has not planned for its demise. On the last servicing mission, astronauts placed a ring, known as the Soft Capture Mechanism to the back end of the spacecraft. This ring will give future robotic spacecraft an easy place to grab onto.

Because the Hubble is so large and heavy, it will not completely burn up when its orbit decays and it re-enters the Earth's atmosphere. This presents the danger that pieces could fall over populated areas.

To ensure a safe re-entry, the Hubble Robotic and De-orbit mission is building a robotic spacecraft designed to grab onto that ring, attach itself to it and guide the re-entry of the Hubble onto a safe trajectory.

While the details of when this mission will be launched is unclear, one thing IS clear: with the demise of the Space Shuttle program, no more manned missions to boost the Hubble into a higher orbit are imminent and any chances of saving it will probably rest with robotic craft. The last days are in sight for the most important scientific instrument ever constructed.

If we do absolutely nothing, that last day will arrive in 2024. If we have the will, there is plenty of time to arrange an alternative. The Hubble Space Telescope stands at the pinnacle of a pantheon of great space telescopes. It has done more to advance our understanding of our place in the universe than any that has come before or since, and at a cost that is microscopic compared to other budgetary expenses.

Because of public outcry, NASA reversed a previous position not to service the Hubble and managed one more fix. Is it possible to design a robotic spacecraft to grab Hubble and bring it home?

Check your comprehension

~ Why can the Hubble Space Telescope fall to Earth in 2024?

~ Does the Hubble Space Telescope have its engines?

Text 2. A Brief History of Engineering

In the old days, 1325 AD to be more precise, an engineer was defined as “a constructor of military engines”. Back then engineering was divided into two categories: Military Engineering and Civil Engineering. The former involved the construction of fortifications and military engines, the latter

concerned non-military projects, for example bridge building. This definition is now obsolete, as engineering has broadened to include a myriad of disciplines.

The exact origin of the word ‘engineering’ comes from the era when humans applied themselves to skilful inventions. Man evolving further in the world invented devices such as the pulley, the wheel and levers. The word engineer has its root in the word engine, which comes from the Latin word ingenium, which means “innate quality particularly of mental power”. And thus the word engineer emerged as a person who creates nifty and practical inventions.

Today an engineer is described as someone who has acquired and is applying their scientific and technical knowledge to designing, analysing and building useful, helpful and functional works. This would involve structures, machines and apparatus, manufacturing processes as well as forecasting their behaviour in particular environmental conditions. This is all accomplished with functionality, operational economics and safety to life and property forefront in mind.

Check your comprehension

~ What is the origin of the word “engineering”?

~ Is division of engineering into two categories: Military Engineering and Civil Engineering still true today?

Engineering is a broad discipline with many subdisciplines dedicated to various fields of study with regards to particular types of technologies or products.

Engineers may begin their career being trained in a specific discipline, but because of the engineering jobs they take-on, they often become multi-disciplined having worked in a variety of different fields.

The field of engineering has traditionally been divided into the following engineering job categories:

- Aerospace Engineering
- Chemical Engineering
- Civil Engineering
- Electrical Engineering, and
- Mechanical Engineering.

However, since the human race has been swiftly advancing with regards to technology, new branches of engineering are being developed. Engineering jobs can now also be found in the following fields:

- Computer Engineering,
- Software Engineering,
- Nanotechnology,
- Molecular Engineering,
- Mechatronics and many more!

Although all these fields may be defined differently, there is generally a great overlap, particularly in the fields of physics, chemistry and mathematics. Engineering jobs usually entail applying physics and mathematics to problems in order to discover viable solutions or to make improvements. Where a number of different solutions are available, engineers evaluate these options and the required outcome in order to identify the best route to follow.

The earliest recorded civil engineer was an Egyptian known as Imhotep. It is believed that Imhotep designed and built the great pyramid of Djoser, also known as the Step Pyramid. Imhotep was one of Pharaoh Djoser’s officials and it is possible that he was the first person to make use of columns in

architecture. The Step Pyramid was built in Egypt in about the time period 2630 – 2611 BC and can be found at Saqqara.

Imhotep would probably be absolutely fascinated with the leaps and bounds engineering has taken in the last 4000 years – although he might have a few secrets to share himself!

Check your comprehension

~ Knowledge of which subjects is crucial for engineers in different fields?

~ Who was the earliest civil engineer?

(http://www.articlesbase.com/careers-articles/a-brief-history-of-engineering-355572.html)

Unit 4

Text 1. Computer and computer science

Computer science is the study of the theoretical foundations of information and computation, and of practical techniques for their implementation and application in computer systems. It is frequently described as the systematic study of algorithmic processes that create, describe, and transform information.

The early foundations of what would become computer science predate the invention of the modern digital computer. The first use of the word "computer" was recorded in 1613, referring to a person who carried out calculations, or computations, and the word continued to be used in that sense until the middle of the 20th century. From the end of the 19th century onwards though, the word began to take on its more familiar meaning, describing a machine that carries out computations. During the 1940s, as newer and more powerful computing machines were developed, the term *computer* came to refer to the machines rather than their human predecessors. As it became clear that computers could be used for more than just mathematical calculations, the field of computer science broadened to study computation in general.

Computer science began to be established as a distinct academic discipline in the 1950s and early 1960s. The focus of computer science is more on understanding the properties of the programs used to implement software such as games and web-browsers, and using that understanding to create new programs or improve existing ones. As a discipline, computer science spans a range of topics from theoretical studies of algorithms and the limits of computation to the practical issues of implementing computing systems in hardware and software.

There are four areas that it considers crucial to the discipline of computer science: *theory of computation*, *algorithms and data structures*, *programming methodology and languages*, and *computer elements and architecture*. In addition to these four areas, software engineering, artificial intelligence, computer networking and communication, database systems, parallel computation, distributed computation, computer-human interaction, computer graphics, operating systems, and numerical and symbolic computation are important areas of computer science.

Despite its short history as a formal academic discipline, computer science has made a number of fundamental contributions to science and society. These include:

- The start of the "digital revolution," which includes the current Information Age and the Internet.
- A formal definition of computation and computability, and proof that there are computationally unsolvable and intractable problems.
- The concept of a programming language, a tool for the precise expression of methodological information at various levels of abstraction.
- Scientific computing enabled advanced study of the mind, and mapping of the human genome became possible with the Human Genome Project.

- Algorithmic trading has increased the efficiency and liquidity of financial markets by using artificial intelligence, machine learning, and other statistical and numerical techniques on a large scale.

Check your comprehension

~ What does the term "Computer science" mean?

~ What are the crucial areas of computer science?

The history of the modern computer begins with two separate technologies—automated calculation and programmability—but no single device can be identified as the earliest computer, partly because of the inconsistent application of that term. Examples of early mechanical calculating devices include the abacus, the slide rule and arguably the astrolabe and the Antikythera mechanism (which dates from about 150–100 BC).

Although mechanical examples of computers have existed through much of recorded human history, the first electronic computers were developed in the mid-20th century (1940–1945). These were the size of a large room, consuming as much power as several hundred modern personal computers. Modern computers based on integrated circuits are millions to billions of times more capable than the early machines, and occupy a fraction of the space. Simple computers are small enough to fit into small pocket devices, and can be powered by a small battery. Personal computers in their various forms are icons of the Information Age and are what most people think of as "computers". However, the embedded computers found in many devices from MP3 players and toys to industrial robots are the most numerous.

The ability to store and execute lists of instructions called programs makes computers extremely versatile, distinguishing them from calculators.

Computers have been used to coordinate information between multiple locations since the 1950s. In the 1970s, computer engineers at research institutions throughout the United States began to link their computers together using telecommunications technology.

In time, the network spread beyond academic institutions and became known as the Internet. The emergence of networking involved a redefinition of the nature and boundaries of the computer. Computer operating systems and applications were modified to include the ability to define and access the resources of other computers on the network, such as peripheral devices, stored information, and the like, as extensions of the resources of an individual computer. Initially these facilities were available primarily to people working in high-tech environments, but in the 1990s the spread of applications like e-mail and the World Wide Web, combined with the development of cheap, fast networking technologies like ADSL saw computer networking become almost ubiquitous. In fact, the number of computers that are networked is growing phenomenally. A very large proportion of personal computers regularly connect to the Internet to communicate and receive information. "Wireless" networking, often utilizing mobile phone networks, has meant networking is becoming increasingly ubiquitous even in mobile computing environments.

Check your comprehension

~ When were the first computers developed?

~ What did the emergence of networking involve?

Text 2. The century-old artifact that defines the kilogram, the fundamental unit of mass, is to be replaced by a more accurate standards based on an invariant property of nature

Weighty Matters. By: Robinson, Ian, Scientific American, 00368733, Dec2006, Vol. 295, Issue 6

In an age when technologies typically grow obsolete in a few years, it is ironic that almost all the world's measurements of mass (and related phenomena such as energy) depend on a 117-year-old object stored in the vaults of a small laboratory outside Paris, the International Bureau of Weights and

Measures. According to the International System of Units (SI), often referred to as the metric system, the kilogram is equal to the mass of this "international prototype of the kilogram" (or IPK) – ***a precision-fabricated cylinder of platinum-iridium*** alloy that stands 39 millimeters high and is the same in diameter.

The SI is administered by the General Conference on Weights and Measures and the International Committee for Weights and Measures. During the past several decades the conference has redefined other base SI units (those set by convention and from which all other quantities are derived) to vastly improve their accuracy and thus keep them in step with the advancement of scientific and technological understanding. The standards for the meter and the second, for example, are now founded ***on natural phenomena***. The meter is tied to the speed of light, whereas the second has been related to the frequency of microwaves emitted by a specific element during a certain transition between energy states.

Today the kilogram is the last remaining SI unit still based on a unique man-made object. Reliance on such an artifact poses problems for science as measurement techniques become more precise. Metrologists (specialists in measurement) are therefore striving to define mass using techniques depending only on unchanging properties of nature. Two approaches seem most promising – one based on the concept underlying the Avogadro constant, the number of atoms in 12 grams of carbon 12, and the other involving Planck's constant, the fundamental value physicists use, for example, to calculate a photon's energy from its frequency. Because scientists measure constants in SI units (including the kilogram), any drift in the IPK's real mass will give rise to a drift in the value of a measured constant – a seeming paradox for what is commonly considered an immutable phenomenon. In the process of more accurately redefining the kilogram independently of the IPK, however, scientists will choose a best estimate of the constant's value and thus "fix" it.

Check your comprehension

~ What natural phenomena are the standards for the meter and the second based on?

~ Which SI units are based on unique man-made objects?

Web of Measurements

THE PRESENT DEFINITION of the kilogram requires that all SI mass measurements carried out in the world be related to the mass of the IPK. ("Mass" is commonly equated with "weight," but technically the "mass" of an object refers to the amount of matter in it, whereas its "weight" is caused by the gravitational attraction between the object and the earth.) To forge this link, metrologists remove the IPK from its sanctuary every 40 years or so to calibrate the copies of the IPK that are sent to the International Bureau of Weights and Measures by the 51 national signatories of the "Meter Convention" – the treaty that governs the SI. Once equilibrated, these copies are used to calibrate all other mass standards of the member states in a long, unbroken sequence that propagates down to the weighing scales and other instruments employed in laboratories and factories around the globe.

It makes economic sense to have a stable, unchanging standard of mass, but evidence indicates that the mass of the IPK drifts with time. By observing relative changes of the other mass standards fabricated at the same time as the IPK and by analyzing old and new measurements of mass-related fundamental constants (which are thought not to change significantly over time), scientists have shown that the mass of the IPK could have grown or shrunk by 50 micrograms or more over the past 100 years. The drift could have been caused by such things as accumulated contamination from the air or loss from abrasion. Because the base units of the SI underpin worldwide science and industry (via the national standard calibration chains), ensuring that they do not vary with time is critical.

Based on Nature

THE SAME INCONSTANCY that plagues the definition of the kilogram previously affected the second and the meter. Scientists once defined the second in terms of the rate of rotation of the earth. In 1967, however, they redefined it to be "the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium 133 atom." Metrologists introduced this change because the rotation rate of our planet is not constant, whereas the wavelength of the radiation emitted by cesium 133 during a specific transition – that is, the ticking of an atomic clock – does not alter with time and the measurement can be reproduced anywhere in the world.

Although the definition of the second is not based on an artifact, it suffers from its dependence on a particular transition of a specific atom, which unfortunately turns out to be more sensitive to electromagnetic fields than is desirable. The definition may need to be changed in the future to accommodate the even more precise optical clocks that physicists are now developing.

The definition of the meter, on the other hand, is firmer. The SI originally based the meter on an artifact – the distance between two lines inscribed on a highly stable platinum-iridium bar. In 1983 the meter definition was switched to "the length of the path traveled by light in vacuum during a time interval of 1/299,792,458 of a second." This definition should also be resilient because it fixed the value of a key physical constant, the speed of light, at exactly 299,792,458 meters a second. Thus, progress in the control and measurement of the frequency of electromagnetic radiation (the number of sinusoidal vibrations a second) will merely improve the accuracy with which scientists can measure the meter – with no change in the unit's definition required.

Check your comprehension

~ What is the difference between the notions of "mass" and "weight"?

~ What could cause drift of the mass of the IPK with time?

~ What influences a particular transition of a specific atom (the cesium 133 atom)?

Atomic Accounting

TO REDEFINE THE KILOGRAM in terms of a physical constant, metrologists measure the value of the constant as accurately as possible using the existing definition of the mass unit. This number can then be incorporated into the new definition to ensure a seamless transition between the old and new ones. Researchers can then employ the measurement method, in conjunction with the now fixed value of the constant, to determine mass according to the new definition.

One promising approach relates the kilogram to the mass of an atom by quantifying the kilogram as the mass of a certain number of atoms of a selected element. This route would fix the value of the Avogadro constant, which is defined as the number of atoms of a specific element in a mole – about 6.02 x 1023 atoms. (A mole is the amount of an element that has a mass in grams equal to the element's atomic weight; a mole of carbon 12 has a mass of 12 grams.) The problem with this strategy, however, is that it requires one to count enough atoms to make a weighable quantity of material for comparison with a kilogram mass. Because several physical effects limit the accuracy and resolution of balances to around 100 nanograms, a minimum of five grams of material would be needed to approach the target accuracy of approximately two parts in 100 million. Sadly, physicists cannot count out atoms rapidly enough; even if a counter capable of tallying individual atoms at a rate of one trillion a second could be produced, the device would take about seven millennia to tally enough carbon 12 atoms.

Scientists could, however, determine the number of atoms in a perfect crystal by dividing the volume of the crystal by the volume occupied by a single atom. If the crystal is then weighed and the mass of the atomic species that makes up the crystal is known relative to that of carbon 12, they can calculate the Avogadro constant from these data, thereby providing a path to the redefinition of the kilogram.

This more practical method, which is now being pursued, first measures the volume occupied by an atom by determining the regular spacing of atoms within a nearly perfect crystal (with a known number of atoms per unit cell) of known weight, close to one kilogram. Then, by determining the dimensions of the crystal, scientists can find the total volume, from which the mass of an atom in the sample can be calculated. The Avogadro constant, which is calculated from the ratio of the molar mass of an element to the mass of an atom, could then be derived from the results.

Although this plan is simple in concept, researchers have difficulty implementing it because of the extreme degree of precision it entails. Indeed, the high complexity and cost of this project mean that no one facility can hope to carry it out alone. Consequently, the load is being shared among a consortium of laboratories in Australia, Belgium, Germany, Italy, Japan, the U.K. and the U.S. – the International Avogadro Coordination. For this technique to work, the crystal must have an almost perfect structure; it must contain few voids or impurities. Project scientists chose to make the crystal out of silicon because the semiconductor industry has studied it closely and has developed procedures to grow large, practically perfect, single crystals. Once researchers had completed all the measurements of the crystal, they could relate the results to the carbon 12 definition of the mole using the extremely precise relative atomic masses of silicon and carbon obtained from mass spectrometers.

Check your comprehension

~ How is the Avogadro constant defined?

~ Why was it necessary to establish the International Avogadro Coordination?

To begin the procedure, they cut several samples from a raw crystal. One was polished to form a one-kilogram sphere to measure. Planners selected a rounded shape because a ball has no corners that could get knocked off and because craftsmen already knew how to hone silicon into a close approximation of a perfect sphere. Australian technicians fabricated a sphere with a diameter of 93.6 millimeters that departs from the ideal by no more than 50 nanometers. If each silicon atom were the size of a large marble[1] (about 20 millimeters across), the sphere would equal the approximate size of the earth, and the distance between the highest and lowest “altitude” on its surface would be about seven meters (about 350 marbles in length).

To find the volume of the silicon sphere, researchers had to determine its average diameter to within the diameter of an atom. They first carefully reflected laser light of a known frequency off opposite sides of the sphere in a vacuum and gauged the difference in light paths (in wavelengths) with the sphere present and absent. This step enabled them to find its diameter in meters, as the wavelength of the light is equal to the (fixed) speed of light divided by the known laser frequency. Scientists then calculated the volume from the diameter, together with a few small corrections related to the slightly imperfect shape of the crystal and the optical properties of the surfaces.

Researchers obtained the volume occupied by one atom using combined x-ray and optical interferometry to find the distance between atomic planes in a sample cut from the raw crystal. Technicians machined several slots into the sample so that one part of the crystal could be moved reproducibly with respect to the rest of it while maintaining the angular alignment of the atomic planes. The sample was placed in a vacuum and illuminated with x-rays having a wavelength small enough to reflect easily from the atomic planes in the crystal. They then used the strength of this reflection, which varies according to the relative position of the atomic planes in the moving and stationary parts of the crystal, to count the number of plane spacings the repositioned part of the crystal had shifted. Scientists simultaneously measured the translation distance using a laser interferometer that used light of a known frequency. This technique determined the interplane spacing in meters. Using knowledge of the crystal structure, they then found the volume occupied by an atom.

Metrologists ascertained the mass of the crystal sphere by “substitution weighing” using a conventional balance and a “tare mass,” whose mass must be stable but need not be known. They placed the sphere on a balance and compared it against a separate one-kilogram tare mass sitting on the other arm of the balance. They then substituted the sphere with a mass known in terms of the IPK mass

standard and repeated the weighing process. Because the substitution was carried out so that the balance remained unaffected by the switch, the difference in the two readings gave the difference in mass between the sphere and the mass standard, which revealed the mass of the sphere. This method eliminated error arising from factors such as unequal lengths of the balance arms.

The researchers also analyzed other samples of the silicon material to establish the relative abundance of the various isotopes to account for their differing contributions to the molar mass of the sphere. To accomplish this task, they had to determine the proportion of the three isotopes – silicon 28, silicon 29 and silicon 30 – present in the natural silicon crystal. For this step they used mass spectroscopy, which separates charged isotopes according to their different charge-to-mass ratios.

The IAC has nearly completed work on the natural silicon spheres, having thus determined the number of atoms in a one-kilogram sphere with an accuracy close to three parts in 10 million. But this accuracy is not good enough. To achieve higher levels, the group is producing a sphere that consists almost entirely of a single isotope, silicon 28. Making such an object will cost between $1.25 million and $2.5 million. Gas centrifuges in Russia that were once employed to refine weapons-grade uranium are purifying the material for the new sphere. The consortium is aiming for an uncertainty in the final result of about two parts in 100 million.

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[1]A *marble* is a small ball made of hard material, e.g. glass used in some children's games.

Check your comprehension

~ How did scientists define the volume of the silicon sphere?

~ How "substitution weighing" was conducting?

~ How will the accuracy of determining the number of atoms in a one-kilogram sphere increase after gas centrifuges in Russia have been used?

Weighing Equivalent Energy

THE OTHER PATH to redefining the kilogram is based on the ***concept of measuring mass in terms of its equivalent energy***, a principle that Albert Einstein explained using his famous equation $\mathbf{E = mc^2}$, which relates mass and energy at the most fundamental level. Investigators would thus define mass in terms of the amount of energy into which it could (potentially) be converted. As is true of counting atoms, though, the techniques involved have considerable disadvantages. For example, large releases of atomic energy result when mass is converted into energy directly. Luckily, easier methods that compare conventional electrical and mechanical energy or power are feasible, provided that researchers can overcome problems associated with energy losses.

To get a sense of the obstacles to this type of approach, imagine using an electric motor to lift an object having mass **m** (against gravity). In an ideal situation, all the energy supplied to the motor would go into increasing the potential energy of the object. The mass could then be calculated from the electrical energy **E** supplied to the motor, the vertical distance **d** traveled by the object and the acceleration from gravity **g**, using the formula $\mathbf{m = E/gd}$. (The acceleration caused by gravity would have to be gauged very accurately using a precision gravimeter.) In the real world, however, energy losses in the motor and other parts of the system would make an accurate measurement almost impossible. Although researchers have attempted similar experiments using superconducting levitated masses, accuracies better than one part in a million are hard to achieve.

About 30 years ago Bryan Kibble of the U.K.'s National Physical Laboratory (NPL) devised the method now known as ***the watt balance***, which avoids energy-loss problems by measuring "virtual power". In other words, by designing a sufficiently clever, two-part procedure, scientists can sidestep the inevitable losses. The method links the standard kilogram, the meter and the second to highly accurate practical realizations of electrical resistance (in ohms) and electric potential (in volts) derived from two quantum-mechanical phenomena – the Josephson effect and the quantum Hall effect, both of

which incorporate Planck's constant. In the process, the technique allows the value of the Planck constant to be measured very accurately.

In the watt balance, an object having mass **m** is weighed by suspending it from the arm of a conventional balance to which a coil of wire is also attached with a total length L hanging in a strong magnetic field B. A current **i** is passed through the coil to generate a force BLi, which is adjusted to exactly balance the weight **mg** of the mass (that is, **mg = BLi**). The mass and current are then removed, and in a second part of the experiment, the coil is moved through the field at a measured velocity **u** while the induced voltage **V** (**V = BLu**) is monitored. This second phase finds the value of the **BL** product, which is difficult to determine in any other way. If the magnet and coil are sufficiently stable, so that the **BL** product is the same in both parts of the procedure, the results can be combined to give **mgu = Vi**, which states the equality of mechanical power (force times velocity, **mg** times **u**) to electrical power (voltage **V** times current **i**). By separating the measurements of **V** and **i** as well as **mg** and **u**, the technique yields a result that is not sensitive to the loss of real power in either part of the experiment (that is, heat dissipated in the coil during weighing or frictional losses during moving), so the apparatus can be said to have measured "virtual" power.

Scientists determine the electric current in the weighing phase of the watt balance procedure by passing it through a resistor. This resistance is specially gauged using the quantum Hall effect, which permits it to be described in quantum-mechanical terms. The voltage across the resistor and the coil voltage are measured in terms of quantum mechanics using the Josephson effect. This last result allows researchers to express the electrical power in terms of Planck's constant and frequency. Because the other terms in the equation depend only on time and length, researchers can then quantify the mass **m** in terms of Planck's constant plus the meter and the second, both of which are based on constants of nature.

The method's principle is relatively straightforward, but to achieve the desired accuracy of approximately one part in 100 million, scientists must determine the major contributing quantities with an accuracy at the limit of many of the best available techniques. Besides measuring **g** very accurately, they have to perform all the procedures in a vacuum to eliminate the effects of both air buoyancy during the weighing process and the air's refractive index during the velocity measurement (which uses a laser interferometer). Researchers must also precisely align the force from the coil to the vertical direction and perform angular and linear alignments of the apparatus to a precision of at least 50 microradians and 10 microns, respectively. Finally, the magnetic field has to be predictable between the two modes of the watt balance, a condition requiring that the temperature of the permanent magnet vary slowly and smoothly.

Three laboratories have developed watt balances: the Swiss Federal Office of Metrology, the National Institute of Standards and Technology (NIST) in the U.S., and the NPL. Meanwhile the staff of the French National Bureau of Metrology is assembling prototype equipment, and that of the International Bureau of Weights and Measures is designing an apparatus. Ultimately these efforts will yield five independent instruments with varying designs, so the extent to which their results agree will indicate how well researchers have identified and eliminated systematic errors in each case. The long-term goal of these groups is to measure Planck's constant to around one part in 100 million, with the possibility of approaching five parts in a billion.

Check your comprehension

~ What are the obstacles to using an electric motor to lift an object having mass **m** in order to define mass in terms of the amount of energy in the real world?

~ Which SI units does the watt balance method link?

~ Is it possible to achieve the desired accuracy with the best available techniques?

~ Why must all the procedures be performed in a vacuum?

~ What will the degree of agreement of results of the three laboratories engaged in developing watt balances method indicate?

Weighty Future

THE LATEST RESULTS from the work on the Avogadro constant and those from the NPL and NIST watt balances differ by more than one part in a million. Researchers must reconcile this discrepancy before a redefinition of the kilogram will be possible.

Redefinition in terms of the Avogadro constant or Planck's constant will have widespread effects, reducing reported uncertainties associated with those constants. Moreover, if Planck's constant and the elementary electric charge are fixed (by combining, for example, watt balance and calculable capacitor measurements), many other important constants would also be fixed.

The International Committee for Weights and Measures has recommended that national measurement laboratories continue their efforts aimed at measuring the fundamental constants that support the redefinition process. Researchers hope that these steps will lead to new standards not only for the kilogram but the ampere, the kelvin and the mole by 2011.

Once the redefinition is complete, a few nations will build or maintain the equipment necessary for implementing the definition directly. Those that do not will have their standards calibrated using a consensus value for the kilogram derived from the laboratory work. Still, fears of damaging or contaminating a single **master reference standard** should fall away because comparisons between national standards and a working standard based on the new definition could be performed as needed. The new definition would allow authorities to adjust the world mass scale in tiny steps every so often to keep it free of drift and fully locked to the best – the latest consensus and independently confirmed – value of the SI unit of mass. Such a system would be robust and stable, allowing scientific and technological progress to continue unabated.

Check your comprehension

~ Which other important constants would be fixed after a redefinition of the kilogram?

~ Will fears of damaging or contaminating a single master reference standard remain after a redefinition of the kilogram?

Unit 5

The importance of physics: breakthroughs drive economy, quality of life

By MICHAEL PRAVICA
SPECIAL TO THE REVIEW-JOURNAL

The year 2005 has been designated the World Year of Physics to recognize physics as a foundation of not only science, but also society. The designation coincides with the 100th anniversary of Albert Einstein's "miraculous year" of 1905, during which he published papers on the theory of relativity, quantum theory and the theory of Brownian motion, ideas that have profoundly influenced all of modern physics. We are deeply indebted to generations of physicists for the world we understand, our security, our livelihoods and our economic prowess.

The fruits resulting from the sacrifices of these intellectual giants are ubiquitous, yet too often taken for granted. Many of our leaders no longer seem to respect or abide by the opinions of scientists, and yet they depend on the technology developed by scientists. They frequently make decisions without understanding nature, the technology we all use, and the planet-wide consequences of abusing technology.

In addition, these leaders are reducing investment in scientific research, as evident in the recent budget reduction for the National Science Foundation, which will ultimately reduce our competitiveness

by frustrating our capacity to innovate and develop novel technology that is mostly initiated from scientific research.

Physics endeavors to understand the underlying laws governing our universe. By better understanding those laws, we can better interact with and harness our environment. To gain perspective into how much physics has contributed to our livelihoods, consider the following miracles from physicists: alternating current, hydroelectric power, electric motors, radio, microwave ovens, satellites, radar, modern rocketry, the solution of the DNA structure, nuclear magnetic resonance, magnetic resonance imaging, X-rays, lasers, transistors, light-emitting diodes, oscilloscopes, television, holography, and the World Wide Web (originally developed for high-energy physicists), among many others. Physicists studying fundamental natural principles, such as quantum mechanics, often invented new devices by applying these principles serendipitously or by design.

Examples of this are the transistor (miniature switch/amplifier) and diode (one-way switch), used in electronic watches, calculators, pacemakers, hearing aids, cellular phones, global positioning systems, radios, computers and LEDs. They are fundamental building blocks upon which our entire society is constructed. Applications of the laser (an optical amplifier) include bar code readers, micro/eye surgery, compact disc players and information retrieval and storage, fiber optics (most modern phone lines and medical aids use this), machining, surveying, laser printers, semiconductor fabrication, holography, and perhaps the greatest potential use, fusion.

Nuclear magnetic resonance identifies chemical species in chemistry and biology. Magnetic resonance imaging is an extension of NMR that has been vital for noninvasive glimpses into the body to find tumors, study thinking processes and understand blood flow based upon the precession of protons in a magnetic field.

The insatiable human quest for knowledge and understanding of the natural world leads to scientific theories. From these theories, new technology is created that, in turn, allows more accurate, expanded and novel experimental observations to prove or disprove theories (for example, the telescope). Thus, there is a deep symbiosis between discovery in physics (and the rest of science) and new technology.

We all benefit from the priceless contributions of physics; a small number of them are mentioned here. Economists Edward C. Prescott and Finn E. Kydland won the 2004 Nobel Prize for economics in part for pointing out that new technology drives booms in economies. Contributions from physics generate many trillions of dollars for the world economy and aid our existence immeasurably.

Only science, with physics as its foundation, can solve many of the impending crises facing our society, such as global warming, overpopulation, waning energy and other natural resources, and the poisoning of our planet. Our leaders need to consult scientists in their decision making. There should be more recognition and celebration of the importance of science and scientific research by our business, social and political leaders. The public should seek leaders who are better versed in science.

Scientists need to be more vocal and strive to explain science and its deep relevance to humanity. And students should take more science courses and learn about the physical world we live in.

Now, more than ever, we need to resurrect respect and strong support for science.

Check your comprehension

~ What does physics endeavor to understand?

~ What global problems can physics solve?

http://www.reviewjournal.com/lvrj_home/2005/Mar-06-Sun-2005/opinion/682710.html

Unit 6

Career of engineer

If you want to have a career in engineering, you have two options from which to choose. You can be **an engineer** or **an engineering technician**. Each of these has different educational and licensing requirements, as well as different duties and salaries. See the chart below for a quick look at the differences between these two career choices. Both engineers and engineering technicians can also choose from a variety of specialties which are discussed in the individual career profiles.

Engineers apply the theories and principles of science and mathematics in researching and developing solutions to technical problems. To become an engineer one must earn a bachelor's degree in engineering. Some jobs are available for those who have earned a bachelor's degree in physical science or mathematics. Engineers who offer their services directly to the public must be licensed. Engineers held 1.6 million jobs in 2008. The highest number of these jobs were in civil engineering (278,400), mechanical engineering (238,700), industrial engineering (214,800), electrical engineering (157,800) and electronic engineering, not including computer engineering (143,700).

Educational Requirements for Engineers:

To get an entry-level engineering job, one usually needs a bachelor's degree in engineering. Sometimes a bachelor's degree in physical science or mathematics may suffice, especially in high-demand specialties. Generally engineering students specialize in a particular branch of engineering but may eventually work in a related branch.

How Do Engineers Advance?

As entry level engineers gain experience and knowledge, they may work more independently, making decisions, developing designs, and solving problems. With further experience, engineers may become technical specialists or supervisors over a staff or team of engineers or technicians. Eventually, they may become engineering managers, or may move into other managerial or sales jobs.

Job Outlook for Engineers:

In general, engineering employment is expected to grow about as fast as the average for all occupations through 2018, although outlook will vary by branch.

The U.S. Bureau of Labor Statistics predicts that biomedical, environmental and civil engineering will experience much faster than average growth, while employment in petroleum engineering, industrial engineering and geological and mining engineering will grow at a faster than average rate.

Other branches will grow either as fast as the average or slower than the average for all occupations, or will see a decline in employment.

Engineering Technician

Engineering technicians often assist engineers and scientists, using science, engineering and mathematical principles to solve technical problems in research and development, manufacturing, sales, construction, inspection, and maintenance. The work of engineering technicians is more application oriented and more limited in scope than that of engineers. To become an engineering technician one must generally earn an associate degree in engineering technology. Engineering technicians held 497,300 jobs in 2008. There were 164,000 electrical and electronic engineering technicians, 91,700 civil engineering technicians, 72,600 industrial engineering technicians, 46,100 mechanical engineering technicians, 21,200 environmental engineering technicians, 16,400 electro-mechanical technicians, and 8,700 aerospace engineering and operations technicians.

Educational Requirements for Engineering Technicians:

Those who want to work as engineering technicians should have at least an associate degree in engineering technology, although some employers will hire candidates who don't have formal training. Those who plan to become engineering technicians can expect to take courses in college algebra and trigonometry and basic science. Other coursework depends on specialty. For example, those who want

to become electrical engineering technicians will take classes in electrical circuits, microprocessors and digital electronics.

Advancement for Engineering Technicians:

Engineering technicians initially work under the supervision of more experienced technicians, technologists, engineers or scientists. As they gain experience they are given more difficult assignments with limited supervision. Eventually they may become supervisors.

Job Outlook for Engineering Technicians:

Employment of engineering technicians, across all disciplines, is expected to grow more slowly than the average for all occupations through 2018. The outlook, however, will vary by specialty. For example, job growth for environmental engineering technicians is projected to be faster, through 2018, than it will be for other occupations requiring post-secondary training or an associate degree. Civil engineering technicians will also see an increase in employment as it grows faster than the average for all occupations. Employment of electro-mechanical engineering technicians will decline.

Check your comprehension

~ Do engineers usually assist engineer technicians?

~ What are job predictions for engineers and engineer technicians?

http://careerplanning.about.com/od/occupations/p/engineer_tech.htm

http://careerplanning.about.com/od/occupations/a/careers_in_eng.htm

Unit 7

Text 1. Science in Russia

Ever since the Soviet Union fell apart in 1991, Russian leaders have been vowing to transform their old-line, industrial society into a modern, knowledge-based economy driven by innovative science and technology. The current Russian president, Dmitry Medvedev, has repeated that ambition frequently — not least as a way to overcome Russia's dependence on oil and gas exports. Unfortunately, that transformation continues to be hobbled by outdated attitudes at the top of Russia's academic hierarchy.

A small, but telling example came to light last month when the popular online newspaper gazeta.ru published an interview with Yuri Osipov (in Russian), president of the Russian Academy of Sciences in Moscow. Pressed by the reporter about the very low citation rate for articles published in Russian-language science journals, Osipov dismissed the relevance of citation indices, questioned the need for Russian scientists to publish in foreign journals and said that any top-level specialist "will also study Russian and read papers in Russian".

From anyone else, such a response might be dismissed as an off-hand comment, perhaps reflecting a bit of stung national pride. But Osipov is head of the largest and most powerful research organization in Russia, the employer of around 50,000 scientists in more than 400 research institutes, and the publisher of some 150 Russian-language research journals. What he says and thinks has a big effect on Russian science. Moreover, the undercurrent of scientific nationalism in his remarks is widely shared by other senior members of the academic establishment — many of whom are products of Soviet times, when Russian science was pretty much an all-Russian affair.

According to the US National Science Foundation (NSF) Science and Engineering Indicators 2010 report, even 20 years later there is a still steady decrease in the number of scientists in Russia. What is also eye-catching, number of domestic researchers draws level with Europe and the United States. Where as China continues to show very strong grow. China has approximately as many researchers as either the United States or the European Union (EU)!

According to the citation-analysis company Thomson Scientific, Russia is eighteenth among countries ranked by citations in the scientific literature over the past 10 years. That is a result not just of

low overall funding but because management of basic science still stands on the concepts of a closed society, with a centralized administration inherited from the days of the Soviet Union. This leads to the absence of international peer review and to little motivation for scientists to produce international-level scientific results — they do not really need them to get funding from national sources. In addition, centralized funding of institutions, rather than of individual scientists, leads to resources being wasted.

Between 2004 and 2008, Thomson Reuters indexed 125,778 papers that listed at least one author address in Russia. Of those papers, the highest percentage appeared in journals categorized in the field of physics, followed by space science. As the right-hand column shows, the citations-per-paper (impact) average for physics papers from Russia during 2004-08 was 14% below the world impact figure for the field (3.57 citations per paper for Russia, versus a world figure of 4.16 cites).

Russian science is already lagging behind that of other nations. According to an analysis published in January by Thomson Reuters, Russia produced just 2.6% of the research papers published between 2004 and 2008 and indexed by the firm — fewer than China (8.4%) and India (2.9%) and only slightly more than the Netherlands (2.5%). Moreover, Russia's publication output has remained almost flat since 1981, even as the output of nations such as India, Brazil and China was exploding. The situation is so bleak that in October last year, 185 Russian expatriate scientists signed an open letter to Medvedev and Prime Minister Vladimir Putin warning of an imminent collapse of Russian science unless something was done to improve the inadequate funding, strategic planning and teaching of science.

The Russian Academy of Sciences, founded in 1725, is the chief coordinating body for scientific research in Russia through its science councils and commissions. It has sections of physical, technical, and mathematical sciences; chemical, technological, and biological sciences, and earth sciences, and controls a network of nearly 300 research institutes. The Russian Academy of Agricultural Sciences, founded in 1929, has departments of plant breeding and genetics; arable farming and the use of agricultural chemicals; feed and fodder crops production; plant protection; livestock production; veterinary science; mechanization, electrification, and automation in farming; forestry; the economics and management of agricultural production; land reform and the organization of land use; land reclamation and water resources; and the storage and processing of agricultural products. It controls a network of nearly 100 research institutes. It supervises a number of research institutes, experimental and breeding stations, dendraria and arboreta. The Russian Academy of Medical Sciences, founded in 1944, has departments of preventive medicine, clinical medicine, and medical and biological sciences, and controls a network of nearly 100 research institutes.

The Russian Federation in 2002 had 3,415 scientists and engineers, and 579 technicians engaged in research and development (R and D) per million people. In the same period, R and D expenditures totaled $14,733.916 million, or 1.24% of GDP. Of that amount, the largest portion, 58.4%, came from government sources, while business accounted for 30.8%. Higher education, private nonprofit organizations and foreign sources accounted for 0.3%, 0.1% and 8%, respectively. High technology exports in 2002 totaled $2.897 billion, or 13% of the country's manufactured exports.

Russia has nearly 250 universities and institutes offering courses in basic and applied sciences. In 1987-97, science and engineering students accounted for 50% of university enrollment.

Check your comprehension

~ What are the results of US National Science Foundation (NSF) Science and Engineering Indicators 2010 report

~ When was the Russian Academy of Sciences founded?

http://olexandrisayev.com/2010/science-in-russia

http://library.by/portalus/modules/english_russia/referat_readme.php?subaction=showfull&id=1188910373&archive=&start_from=&ucat=28&

Text 2. Smart Russia

Owen Mathews

«Newsweek», May 18th, 2010

Medvedev's vision of Russia's future is about brains, not the power of oil, bombs, or the Kremlin.

When president Dmitry Medvedev speaks about restoring Russia's greatness he talks about building an "innovation city" in the Moscow suburb of Skolkovo, where the state will leave the nation's best minds free to pursue the scientific and technological breakthroughs that are the bedrock of a 21st-century "knowledge economy." Medvedev's vision is designed to liberate Russia from what he calls a "humiliating" reliance on oil and gas exports, and to revive the greatness of a nation once known for scientific and technological achievement. "The success of the 'Smart Russia' movement is a question of life and death for Russia," says Zhores Alferov, the only Nobel Prize winner still living in Russia, who was chosen by Medvedev last month as overall head of the Skolkovo project. "The idea of Skolkovo is like Noah's ark – all our ideas of hope and survival are pinned on it."

Whether Russia reemerges as a great power may well be determined by Medvedev's campaign to revive its smart side. For all its inefficiencies, the Soviet state was a generous supporter of science and technology, building the world's first artificial satellite and the capsule that put the first man in space. After the fall of the Soviet Union in 1991, state support for the sciences collapsed, scientists fled for posts overseas, and the state itself evolved into a predator – committed in theory to the free market, but too often in practice to plundering private enterprise for profit. In the generation that separated Yuri Gagarin's spaceflight from Putin's election in 2000, Russia's GDP and industrial production fell by nearly 50 percent, and with them investment in science fell from 6 percent of GDP to just 1.5 percent, where it stagnates today. The brain drain began in the 1970s as educated Soviet Jews – like the parents of young Sergey Brin, who went on to become a co-inventor of Google – headed to the free West. By the turn of the century it had robbed Russia of more than a half million of its most talented people. Putin and Medvedev both believe that the state can solve Russia's problems – but while Putin sees the bureaucracy as the source of his power, Medvedev sees it as a corrupt obstacle to creating a post-oil economy.

Check your comprehension

~ What does president Dmitry Medvedev want to liberate Russia from? How is he going to pursue his goal?

~ Why did Russia loose more than a half million of its most talented people?

Skolkovo is the centerpiece of Medvedev's drive to create a new kind of economy. A nondescript Soviet-era suburb 40 kilometers outside Moscow, Skolkovo is already home to Russia's leading business school, which is (crucially) private but receives some state research money. The new innovation city is inspired by the relationship between Stanford University and Silicon Valley, or the Massachusetts Institute of Technology and the Route 128 tech firms outside Boston: a place where academic brains can find the private and government money they need to launch startup companies. The new Skolkovo will be "a real city of the future," says oil baron Viktor Vekselberg, Russia's 10th-richest man and Medvedev's choice to organize the business side of Skolkovo, selecting the best ideas for the state to back as startups. Construction is already underway on a 300-hectare plot that will be protected by walls and gates. If all goes as planned, by 2014 the new city will house 30,000 to 40,000 people. Viktor Ustinov, one of Russia's top physicists and a former pupil of Alferov's, says Skolkovo will be a "Russian Silicon Valley" devoted to innovation in communications and biomedicine, as well as in space, nuclear, and information technologies. According to Vladislav Surkov, the Kremlin's chief ideologue, "Only the best people will go there, and they will be carefully protected … The best people will be given the very best conditions."

Many nations have also tried to build their own Silicon Valleys. But Medvedev, however belatedly, has declared that the project is Russia's last best hope. His 2008 blueprint for the Russian

economy, called “Strategy 2020,” calls for the tech sector to make up 15 percent of exports, or 8 to 10 percent of GDP, by 2020. Currently it’s about 1.1 percent of GDP, and much of that is in military hardware. So Medvedev is pumping billions in state funds into projects including Skolkovo, the world’s biggest nanotechnology-investment fund, and a program designed to lure Russian émigrés and their companies back to the homeland. Medvedev has sent top officials on the road to drum up money for innovation bonds, and earmarked more than $10 billion for tech investment. That lags behind others – China has allocated $26 billion toward tech investment for 2010 alone – but is nonetheless a sign of seriousness.

Skolkovo’s main chance of success is that its businesses will be protected from rapacious state bureaucrats and police. Today the subsidies and special privileges that the Soviet state once lavished on science and business projects have given way to plain theft. In a recent PricewaterhouseCoopers survey of global economic crimes, 71 percent of Russian enterprises reported being the target of such abuses by police or bureaucrats in 2009 (the worst of 33 countries in the study). Medvedev himself has publicly blasted Russia’s culture of state corruption and has attempted to seal off Skolkovo, which will have simplified laws on businesses, a simpler visa regime, tax benefits, and no thieving bureaucrats.

Check your comprehension

~ Which factors pare crucial for success of Silicon Valley and the like “smart cities”?

~ What are financial sources for the world’s biggest nanotechnology-investment fund?

~ What can cause failure of Skolkovo’s project?

But the trend lines are running against Smart Russia. In a couple of decades the cream of the Soviet intelligentsia will be dead, leaving behind a rotten education system. Most of Russia’s traditional research institutes long ago lost many of their best people to better-funded universities in the West, and now there’s not a single Russian university in the world’s top 100. Just as the Russian state was plundered by its servants after the fall of communism, so the assets of its academic institutions were sold off, rented out, and systematically stolen by its administrators. In 2009 the country published fewer scholarly papers and journals than India or China, and Russians won only four Nobel Prizes in the last decade, compared with 67 for the U.S. (and only one, Mikhail Gorbachev’s peace prize, in the 1990s). In the World Economic Forum’s rankings of the world’s most competitive nations, Russia has slipped 12 places, to 63rd, since Medvedev became president in 2008, and its information-technology sector has slipped four places in as many years, to a dismal 74th out of 134 countries. Some Russian businessmen, like antivirus-software designer Yevgeny Kaspersky, complain that what talent remains seems disproportionately focused on illegal activity, like the creation of the “Storm” Trojan horse that spawned a worldwide botnet infecting 1.5 million computers last year. “Russia is a nation of super hackers,” says Kaspersky, whose Kaspersky Labs is one of Russia’s few global tech businesses – devoted to blocking hackers.

Check your comprehension

~ What are reasons for and signs of Russian science lagging behind many other countries?

In some ways Medvedev’s plan to create a legitimate outlet for tech talent is quintessentially Soviet. The idea of a city for scientists harks back to Stalin’s purpose-built tech cities within the Gulag where selected scientists worked in conditions of privilege – and hatched such breakthroughs as the Soviet atom bomb. But in this era “you can’t have a centrally planned innovative economy,” warns Vladislav Inozemtsev, director of the Moscow-based Center for Post-Industrial Studies. “Nowhere in the world has a Silicon Valley blossomed because of decrees issued by bureaucrats, even if the decrees are backed up by government financing.”

The failure of central planning does not necessarily spell doom for Skolkovo, because Medvedev is guided by a more modern vision of how to use subsidies to steer business development. Already there are some success stories. One of Alferov’s former students, Alexei Kovsh, is moving his energy-efficient-lighting company from Germany to St. Petersburg, because Alferov convinced him that he

could get better funding in Russia, with lower costs than in the West, and better protection from technology copycats than in China. Kovsh recently sold stakes in his company, *Optogan*, to the state-owned Rusnanotech and to the metals tycoon Mikhail Prokhorov. With the state as a third partner, Kovsh feels protected. Alferov hopes to repeat the experience to draw similar businesses to Skolkovo. Ranged against Smart Russia are the bureaucrats who prefer Russia to stay dumb – because they make so much money from it. Medvedev is pushing innovation as one of his "four I's," or pillars of modernization, the others being institutions, infrastructure, and investment. But truth be told, he's not making much progress. Russia built just 1,000 kilometers of roads last year, compared with the 47,000 kilometers built by China. Former opposition legislator Vladimir Ryzhkov complains that the real four I's of Russian modernization are "illusion, inefficiency, instability, and incompetence." Yevgeny Gontmakher, a leading member of Medvedev's favorite think tank, the Institute of Contemporary Development, says the flaw in the president's strategy is that "they expect scientists to come and invent everything for them so there will be no need to reform political institutions." No, Medvedev is not out to reform the political system top to bottom, but it's also clear he understands the forces of Dumb Russia. "Corrupt officials … do not want development, and fear it," he wrote in his 2009 manifesto, "Forward Russia." "But the future does not belong to them – it belongs to us. We will overcome backwardness and corruption." May the smart Russians win.

Check your comprehension

~ In what way does Medvedev's plan differ from Soviet central planning approach?

~ Why do the bureaucrats prefer Russia to stay unintelligent?

Unit 8

High-energy Large Hadron Collider results published

By Jason Palmer

Science and technology reporter, BBC News (http://news.bbc.co.uk/2/hi/8505203.stm)

The results from the highest-energy particle experiments carried out at the Large Hadron Collider (LHC) in December have begun to yield their secrets.

Scientists from the LHC's Compact Muon Solenoid (CMS) detector has now totted up all of the resulting particle interactions. They wrote in the Journal of High Energy Physics that the run created more particles than theory predicted.

However, the glut of particles should not affect results as the experiment runs to even higher energies this year.

The LHC is designed to smash together particles and atoms circling its 27km-tunnel in a bid to find evidence of further particles that underpin the field of physics as it is currently formulated.

The December announcement of particle beam energies in excess of one trillion electron volts made the LHC the world's highest-energy particle accelerator.

That makes the new results a unique look at the field of high-energy physics. The experiments, smashing protons into each other, produced a few more subatomic particles known as pions and kaons than the team was expecting.

"The level is somewhat higher than the most popular models had predicted, and it looks like it is going to increase with energy a little bit more steeply than we expected," said Gunther Roland, a CMS collaboration scientist from the Massachusetts Institute of Technology in the US.

"I think it's not going to be a problem, but it is one of the many things that we need to know as we move toward searches for the most rare particles and new physics," Professor Roland told BBC News.

He added that the "extra" particles will be more of an issue when, later in 2010, the LHC dedicates itself to collisions involving ions of the element lead, a markedly heavier pair of targets resulting in an even larger array of particles on impact.

"We'll know much more about that in two or three months when we look at the next higher energy of 7 TeV (trillion electron volts)."

Check your comprehension

~ What is the LHC designed for?

~ What are “pions” and “kaons”?

Unit 9

The Millennium Prize for resolution of the Poincaré conjecture

History and Background

In the latter part of the nineteenth century, the French mathematician Henri Poincaré was studying the problem of whether the solar system is stable. Do the planets and asteroids in the solar system continue in regular orbits for all time, or will some of them be ejected into the far reaches of the galaxy or, alternatively, crash into the sun? In this work he was led to topology, a still new kind of mathematics related to geometry, and to the study of shapes (compact manifolds) of all dimensions.

The simplest such shape was the circle, or distorted versions of it such as the ellipse or something much wilder: lay a piece of string on the table, tie one end to the other to make a loop, and then move it around at random, making sure that the string does not touch itself. The next simplest shape is the two-sphere, which we find in nature as the idealized skin of an orange, the surface of a baseball, or the surface of the earth, and which we find in Greek geometry and philosophy as the "perfect shape." Again, there are distorted versions of the shape, such as the surface of an egg, as well as still wilder objects. Both the circle and the two-sphere can be described in words or in equations as the set of points at a fixed distance from a given point (the center). Thus it makes sense to talk about the three-sphere, the four-sphere, etc. These shapes are hard to visualize, since they naturally are contained in four-dimensional space, five-dimensional space, and so on, whereas we live in three-dimensional space. Nonetheless, with mathematical training, shapes in higher-dimensional spaces can be studied just as well as shapes in dimensions two and three.

In topology, two shapes are considered the same if the points of one correspond to the points of another in a continuous way. Thus the circle, the ellipse, and the wild piece of string are considered the same. This is much like what happens in the geometry of Euclid. Suppose that one shape can be moved, without changing lengths or angles, onto another shape. Then the two shapes are considered the same (think of congruent triangles). A round, perfect two-sphere, like the surface of a ping-pong ball, is topologically the same as the surface of an egg.

In 1904 Poincaré asked whether a three-dimensional shape that satisfies the "simple connectivity test" is the same, topologically, as the ordinary round three-sphere. The round three-sphere is the set of points equidistant from a given point in four-dimensional space. His test is something that can be performed by an imaginary being who lives inside the three-dimensional shape and cannot see it from "outside." The test is that every loop in the shape can be drawn back to the point of departure without leaving the shape. This can be done for the two-sphere and the three-sphere. But it cannot be done for the surface of a doughnut, where a loop may get stuck around the hole in the doughnut.

Check your comprehension

~ What is the subject of topology?

~ Which shapes are considered the same in topology?

~ What is the ‘simple connectivity test’?

The question raised became known as **the Poincaré conjecture**. Over the years, many outstanding mathematicians tried to solve it--Poincaré himself, Whitehead, Bing, Papakirioukopolos, Stallings, and others. While their efforts frequently led to the creation of significant new mathematics, each time a flaw was found in the proof. In 1961 came astonishing news. Stephen Smale, then of the University of California at Berkeley (now at the City University of Hong Kong) proved that the analogue of the Poincaré conjecture was true for spheres of five or more dimensions. The higher-dimensional version of the conjecture required a more stringent version of Poincaré's test; it asks whether a so-called homotopy sphere is a true sphere. Smale's theorem was an achievement of extraordinary proportions. It did not, however, answer Poincaré's original question. The search for an answer became all the more alluring.

Smale's theorem suggested that the theory of spheres of dimensions three and four was unlike the theory of spheres in higher dimension. This notion was confirmed a decade later, when Michael Freedman, then at the University of California, San Diego, now of Microsoft Research Station Q, announced a proof of the Poincaré conjecture in dimension four. His work used techniques quite different from those of Smale. Freedman also gave a classification, or kind of species list, of all simply connected four-dimensional manifolds.

Both Smale (in 1966) and Freedman (in 1986) received Fields medals for their work.

There remained the original conjecture of Poincaré in dimension three. It seemed to be the most difficult of all, as the continuing series of failed efforts, both to prove and to disprove it, showed. In the meantime, however, there came three developments that would play crucial roles in Perelman's solution of the conjecture.

Check your comprehension

~ For spheres of which dimensions the Poincaré conjecture was first proved?

~ What did continuing attempts to prove or disprove the original Poincaré conjecture show?

Geometrization

The first of these developments was William Thurston's geometrization conjecture. It laid out a program for understanding all three-dimensional shapes in a coherent way, much as had been done for two-dimensional shapes in the latter half of the nineteenth century. According to Thurston, three-dimensional shapes could be broken down into pieces governed by one of eight geometries, somewhat as a molecule can be broken into its constituent, much simpler atoms. This is the origin of the name, "geometrization conjecture."

A remarkable feature of the geometrization conjecture was that it implied the Poincaré conjecture as a special case. Such a bold assertion was accordingly thought to be far, far out of reach--perhaps a subject of research for the twenty-second century. Nonetheless, in an imaginative tour de force that drew on many fields of mathematics, Thurston was able to prove the geometrization conjecture for a wide class of shapes (Haken manifolds) that have a sufficient degree of complexity. While these methods did not apply to the three-sphere, Thurston's work shed new light on the central role of Poincaré's conjecture and placed it in a far broader mathematical context.

Check your comprehension

~ What does the geometrization conjecture state?

Limits of spaces

The second current of ideas did not appear to have a connection with the Poincaré conjecture until much later. While technical in nature, the work, in which the names of Cheeger and Perelman

figure prominently, has to do with how one can take limits of geometric shapes, just as we learned to take limits in beginning calculus class. Think of Zeno and his paradox: you walk half the distance from where you are standing to the wall of your living room. Then you walk half the remaining distance. And so on. With each step you get closer to the wall. The wall is your "limiting position," but you never reach it in a finite number of steps. Now imagine a shape changing with time. With each "step" it changes shape, but can nonetheless be a "nice" shape at each step-- smooth, as the mathematicians say. For the limiting shape the situation is different. It may be nice and smooth, or it may have special points that are different from all the others, that is, singular points, or "singularities." Imagine a Y-shaped piece of tubing that is collapsing: as time increases, the diameter of the tube gets smaller and smaller. Imagine further that one second after the tube begins its collapse, the diameter has gone to zero. Now the shape is different: it is a Y shape of infinitely thin wire. The point where the arms of the Y meet is different from all the others. It is the singular point of this shape. The kinds of shapes that can occur as limits are called Aleksandrov spaces, named after the Russian mathematician A. D. Aleksandrov who initiated and developed their theory.

Check your comprehension

~ What does Zeno's paradox state?

~ What is the limiting shape for a Y-shaped piece of tubing?

~ What are limiting shapes called?

Differential equations

The third development concerns differential equations. These equations involve rates of change in the unknown quantities of the equation, e.g., the rate of change of the position of an apple as it falls from a tree towards the earth's center. Differential equations are expressed in the language of calculus, which Isaac Newton invented in the 1680s in order to explain how material bodies (apples, the moon, and so on) move under the influence of an external force. Nowadays physicists use differential equations to study a great range of phenomena: the motion of galaxies and the stars within them, the flow of air and water, the propagation of sound and light, the conduction of heat, and even the creation, interaction, and annihilation of elementary particles such as electrons, protons, and quarks.

In our story, conduction of heat and change of temperature play a special role. This kind of physics was first treated mathematically by Joseph Fourier in his 1822 book, Théorie Analytique de la Chaleur. The differential equation that governs change of temperature is called the heat equation. It has the remarkable property that as time increases, irregularities in the distribution of temperature decrease.

Differential equations apply to geometric and topological problems as well as to physical ones. But one studies not the rate at which temperature changes, but rather the rate of change in some geometric quantity as it relates to other quantities such as curvature. A piece of paper lying on the table has curvature zero. A sphere has positive curvature. The curvature is a large number for a small sphere, but is a small number for a large sphere such as the surface of the earth. Indeed, the curvature of the earth is so small that its surface has sometimes mistakenly been thought to be flat. For an example of negative curvature, think of a point on the bell of a trumpet. In some directions the metal bends away from your eye; in others it bends towards it.

Check your comprehension

~ Which problems do **d**ifferential equations apply to?

~ Is the earth surface flat? Why was it thought to be flat?

Ricci flow

The differential equation that was to play a key role in solving the Poincaré conjecture is the Ricci flow equation. It was discovered two times, independently. In physics, by Friedan, 1985 and in mathematics by Richard Hamilton in his 1982 paper. The physicists were working on the

renormalization group of quantum field theory, while Hamilton was interested in geometric applications of the Ricci flow equation itself.

On the left-hand side of the Ricci flow equation is a quantity that expresses how the geometry changes with time--the derivative of the metric tensor, as the mathematicians like to say. On the right-hand side is the Ricci tensor, a measure of the extent to which the shape is curved. The Ricci tensor, based on Riemann's theory of geometry (1854), also appears in Einstein's equations for general relativity (1915). Those equations govern the interaction of matter, energy, curvature of space, and the motion of material bodies.

The Ricci flow equation is the analogue, in the geometric context, of Fourier's heat equation. The idea, grosso modo, for its application to geometry is that, just as Fourier's heat equation disperses temperature, the Ricci flow equation disperses curvature. Thus, even if a shape was irregular and distorted, Ricci flow would gradually remove these anomalies, resulting in a very regular shape whose topological nature was evident. Indeed, in 1982 Hamilton showed that for positively curved, simply connected shapes of dimension three (compact three-manifolds) the Ricci flow transforms the shape into one that is ever more like the round three-sphere. In the long run, it becomes almost indistinguishable from this perfect, ideal shape. When the curvature is not strictly positive, however, solutions of the Ricci flow equation behave in a much more complicated way. This is because the equation is nonlinear. While parts of the shape may evolve towards a smoother, more regular state, other parts might develop singularities. This richer behavior posed serious difficulties. But it also held promise: it was conceivable that the formation of singularities could reveal Thurston's decomposition of a shape into its constituent geometric atoms.

Check your comprehension

~ How does Ricci flow transform irregular shapes?

~ Do all parts of a shape evolve alike?

Richard Hamilton

Hamilton was the driving force in developing the theory of Ricci flow in mathematics, both conceptually and technically. Hamilton had established the Ricci flow equation as a tool with the potential to resolve both conjectures as well as other geometric problems. Nevertheless, serious obstacles barred the way to a proof of the Poincaré conjecture. Notable among these obstacles was lack of an adequate understanding of the formation of singularities in Ricci flow, akin to the formation of black holes in the evolution of the cosmos. Indeed, it was not at all clear how or if formation of singularities could be understood. Despite the new front opened by Hamilton, and despite continued work by others using traditional topological tools for either a proof or a disproof, progress on the conjectures came to a standstill.

Such was the state of affairs in 2000, when John Milnor wrote an article describing the Poincaré conjecture and the many attempts to solve it. At that writing, it was not clear whether the conjecture was true or false, and it was not clear which method might decide the issue. Analytic methods (differential equations) were mentioned in a later version (2004).

Check your comprehension

~ Could mathematicians understand and explain the formation of singularities in Ricci flow?

~ Was progress the Poincaré conjecture noticeable at the turn of the 20-21 centuries?

Perelman announces a solution of the Poincaré conjecture

It was thus a huge surprise when Grigoriy Perelman announced, in a series of preprints posted on ArXiv.org in 2002 and 2003, a solution not only of the Poincaré conjecture, but also of Thurston's geometrization conjecture.

The core of Perelman's method of proof is the theory of Ricci flow. To its applications in topology he brought not only great technical virtuosity, but also new ideas. One was to combine collapsing theory in Riemannian geometry with Ricci flow to give an understanding of the parts of the shape that were collapsing onto a lower-dimensional space. Another was the introduction of a new quantity, the entropy, which instead of measuring disorder at the atomic level, as in the classical theory of heat exchange, measures disorder in the global geometry of the space. Perelman's entropy, like the thermodynamic entropy, is increasing in time: there is no turning back. Using his entropy function and a related local version (the L-length functional), Perelman was able to understand the nature of the singularities that formed under Ricci flow. There were just a few kinds, and one could write down simple models of their formation. This was a breakthrough of first importance.

Once the simple models of singularities were understood, it was clear how to cut out the parts of the shape near them as to continue the Ricci flow past the times at which they would otherwise form. With these results in hand, Perelman showed that the formation times of the singularities could not run into Zeno's wall: imagine a singularity that occurs after one second, then after half a second more, then after a quarter of a second more, and so on. If this were to occur, the "wall," which one would reach two seconds after departure, would correspond to a time at which the mathematics of Ricci flow would cease to hold. The proof would be unattainable. But with this new mathematics in hand, attainable it was.

The posting of Perelman's preprints and his subsequent talks at MIT, SUNY-Stony Brook, Princeton, and the University of Pennsylvania set off a worldwide effort to understand and verify his groundbreaking work. In the US, Bruce Kleiner and John Lott wrote a set of detailed notes on Perelman's work. These were posted online as the verification effort proceeded. A final version was posted to ArXiv.org in May 2006, and the refereed article appeared in Geometry and Topology in 2008. This was the first time that work on a problem of such importance was facilitated via a public website. John Morgan and Gang Tian wrote a book-long exposition of Perelman's proof, posted on ArXiv.org in July of 2006, and published by the American Mathematical Society in CMI's monograph series (August 2007). These expositions, those by other teams, and, importantly, the multi-year scrutiny of the mathematical community, provided the needed verification. Perelman had solved the Poincaré conjecture. After a century's wait, it was settled!

Among other articles that appeared following Perelman's work is a paper in the Asian Journal of Mathematics, posted on ArXiv.org in June of 2006 by the American-Chinese team, Huai-Dong Cao (Lehigh University) and Xi-Ping Zhu (Zhongshan University). Another is a paper by the European group of Bessieres, Besson, Boileau, Maillot, and Porti, posted on ArXiv.org in June of 2007. It was accepted for publication by Inventiones Mathematicae in October of 2009. It gives an alternative approach to the last step in Perelman's proof of the geometrization conjecture.

Perelman's proof of the Poincaré and geometrization conjectures is a major mathematical advance. His ideas and methods have already found new applications in analysis and geometry; surely the future will bring many more.

Check your comprehension

~ Which new ideas did Perelman bring to the theory of Ricci flow?

~ Where did Perelman publish his outstanding results?

~ What was the aim of a number of publications following Perelman announcement of finding a solution not only of the Poincaré conjecture, but also of Thurston's geometrization conjecture?

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Unit 10

Meeting with scientists

Dmitry Medvedev discussed developing Russian science's technological base, grants, and social support measures with young scientists.

The meeting's participants included the 2010 laureates of prizes for science and innovation, President of the Russian Academy of Sciences Yury Osipov, and Education Minister Andrei Fursenko.

The meeting took place at the Polytechnic Museum, where the First Russian National Science Festival began today. Dmitry Medvedev addressed brief welcoming remarks to the event's participants.

PRESIDENT OF RUSSIA DMITRY MEDVEDEV: Friends, I congratulate the laureates once again, and everyone here, on Russian Science Day. It is a pleasure to talk with you in an informal setting this time, not in the Kremlin, but at the Polytechnic Museum, which as we have seen, is about to be reborn. We all wish this work success, because this museum is a great support for everyone interested in science and technology. We need to ensure that it retains all of its former qualities, while at the same time moving forward and becoming a technologically advanced centre of interest to today's youth.

Now to the issues before us, namely, the question of attracting talented young people into science and innovation. In December 2009, we discussed this subject in depth with the heads of the Russian Academy of Sciences. I hope that we will come back to it during our discussions today. Here, I am addressing Mr Osipov [Yury Osipov, President of the Russian Academy of Sciences]. Why, because I think that our decisions must be implemented. As far as I know, there is progress, including on the biggest problems, and the biggest problems, even in science, are the issues of everyday life. We said that we must start by resolving young scientists' housing problems. I took the Government to task over this later. I think that did have some effect, and it seems that some apartments are ready now. How many, Mr Osipov?

PRESIDENT OF THE RUSSIAN ACADEMY OF SCIENCES YURY OSIPOV: We have received 150 apartments so far. This was done over January alone. Now it is still February, and the Government is holding constant meetings on the issue.

DMITRY MEDVEDEV: So I don't need to scold anyone anymore? I can take a softer line now?

YURY OSIPOV: Sometimes it can be useful to get a scolding from you, Mr President.

DMITRY MEDVEDEV: Well, I will do so then, what choice do I have?

YURY OSIPOV: But things are moving now.

DMITRY MEDVEDEV: It's good that things are moving, because I remember the bored looks on the faces of some of my colleagues when this was all being discussed, and I had to really make use of my power then. Let's keep up the pace then and get this work finished.

YURY OSIPOV: Thank you.

DMITRY MEDVEDEV: Another matter is that the Russian Academy of Sciences' Youth Commission made available an additional 1,000 salaried positions at the end of last year. I was briefed on this today by the minister. I think this is very good. We are talking about almost half of the Russian Academy of Sciences' existing 400 research centres, am I right?

YURY OSIPOV: Yes, the money has been distributed, and we have kept 70 positions in reserve with the idea that particularly interesting people could emerge, while the rest have been distributed between the different institutes on a tender basis. It is interesting to note that there is competition for these positions, more than two institutes for each position. This is good to see. The money has now been distributed, and the institutes are now organising tenders to select the people to whom it will go to.

Thank you very much for this, Mr President.

DMITRY MEDVEDEV: Good, so things are moving in this area too?

YURY OSIPOV: Yes, things are moving full steam ahead.

DMITRY MEDVEDEV: Good, I remind you that the size of the presidential grants for young Ph.D. and D.Sc. holders was increased substantially and now comes to 600,000 rubles for Ph.D. degree holders, and 1 million rubles for D.Sc. degree holders.

EDUCATION AND SCIENCE MINISTER ANDREI FURSENKO: For a year.

DMITRY MEDVEDEV: For a year, of course.

But this is not all, of course, and we can keep discussing this. I think that the state authorities need to do more to put in place all of the best possible conditions. Of course, this will never be anything completely exceptional, but the authorities in the broad sense – the federal, regional, and even municipal authorities - do need to ensure the minimum essential conditions.

The global world and the world of science know no borders, and we understand this. We therefore invite not only our own scientists to take part in these projects, but foreigners too. I think this is the right approach, because this is what scientific competition is all about, all the more so as our scientists go abroad and also participate – on a competitive basis – in projects abroad. This is just the kind of full-blooded environment that will help us to resolve the more difficult tasks ahead.

We have young people here today, and I want them to take part too in discussing the various issues involved in developing science, and developing education in general in our country and improving the way science is managed. The Youth Coordination Council has already made a shortlist of projects competing for the presidential grants and prizes for young scientists. In the views of senior colleagues, these projects are of high quality, and we shall see what comes of them. It is important to develop the network of regional councils of young scientists and specialists that have been established now in 81 different regions, practically throughout the entire country.

I want you to tell me, of course, about how you see the future of Russian science, what, in your view, are our strong points and weak points. Of course, we all have a fair idea of where our weak points lie at the moment, and in which areas we need to give new impetus.

But in any case, I can say that the situation has started to change of late. It has not changed radically, but things are improving. This is true of education and of science too. As someone who worked for quite a long time in the university system, I will not hide that I am very pleased to see these changes, because everyone who remembers the 1990s, remembers that they were very difficult years and the mood was very pessimistic back then. It was difficult to be optimistic. But this is all changing now.

There are problems. I have been discussing these problems not just here, not just with our young people working in science, but abroad too, with people working there. The last time was in Silicon Valley. That was an interesting discussion. There are very successful people working there, some of them left quite a long time ago, and some only recently. Some of them see their future in America, and others do not. But the conversation was very illustrative.

We should probably look at some additional incentives too. I think these could include the introduction of presidential scholarships for young people, who show promise in terms of developing priority modernisation areas. We will discuss the size of these scholarships, but they should provide decent sums of money for the chosen young people.

So, if you have similar ideas, I am willing to support them, though within reasonable limits. Let’s discuss all of this now.

Check your comprehension

~ Where did this meeting take place?

~ What is the size of presidential grants for young Ph.D. and D.Sc. holders?

http://eng.special.kremlin.ru/news/1742

Unit 11

Climate changes

Global warming has become perhaps the most complicated issue facing world leaders. On the one hand, warnings from the scientific community are becoming louder, as an increasing body of science points to rising dangers from the ongoing buildup of human-related greenhouse gases — produced mainly by the burning of fossil fuels and forests. On the other, the technological, economic and political issues that have to be resolved before a concerted worldwide effort to reduce emissions can begin have gotten no simpler, particularly in the face of a global economic slowdown.

Global talks on climate change opened in Cancún, Mexico, in late 2010 with the toughest issues unresolved, and the conference produced modest agreements. But while the measures adopted in Cancún are likely to have scant near-term impact on the warming of the planet, the international process for dealing with the issue got a significant vote of confidence.

The agreement fell well short of the broad changes scientists say are needed to avoid dangerous climate change in coming decades. But it laid the groundwork for stronger measures in the future, if nations are able to overcome the emotional arguments that have crippled climate change negotiations in recent years. The package, known as the Cancún Agreements, gives the more than 190 countries participating in the conference another year to decide whether to extend the frayed Kyoto Protocol, the 1997 agreement that requires most wealthy nations to trim their emissions while providing assistance to developing countries to pursue a cleaner energy future.

At the heart of the international debate is a momentous tussle between rich and poor countries over who steps up first and who pays most for changed energy menus.

In the United States, on Jan. 2, 2011, the Environmental Protection Agency imposed its first regulations related to greenhouse gas emissions. The immediate effect on utilities, refiners and major manufacturers will be small, with the new rules applying only to those planning to build large new facilities or make major modifications to existing plants. Over the next decade, however, the agency plans to regulate virtually all sources of greenhouse gases, imposing efficiency and emissions requirements on nearly every industry and every region.

President Obama vowed as a candidate that he would put the United States on a path to addressing climate change by reducing emissions of carbon dioxide and other greenhouse gas pollutants. He offered Congress wide latitude to pass climate change legislation, but held in reserve the threat of E.P.A. regulation if it failed to act. The deeply polarized Senate’s refusal to enact climate change legislation essentially called his bluff.

Scientists learned long ago that the earth's climate has powerfully shaped the history of the human species — biologically, culturally and geographically. But only in the last few decades has research revealed that humans can be a powerful influence on the climate as well.

A growing body of scientific evidence indicates that since 1950, the world's climate has been warming, primarily as a result of emissions from unfettered burning of fossil fuels and the razing of tropical forests. Such activity adds to the atmosphere's invisible blanket of carbon dioxide and other heat-trapping "greenhouse" gases. Recent research has shown that methane, which flows from landfills, livestock and oil and gas facilities, is a close second to carbon dioxide in impact on the atmosphere.

That conclusion has emerged through a broad body of analysis in fields as disparate as glaciology, the study of glacial formations, and palynology, the study of the distribution of pollen grains in lake mud. It is based on a host of assessments by the world's leading organizations of climate and earth scientists.

In the last several years, the scientific case that the rising human influence on climate could become disruptive has become particularly robust.

Some fluctuations in the Earth's temperature are inevitable regardless of human activity — because of decades-long ocean cycles, for example. But centuries of rising temperatures and seas lie ahead if the release of emissions from the burning of fossil fuels and deforestation continues unabated, according to the Intergovernmental Panel on Climate Change. The panel shared the 2007 Nobel Peace Prize with former Vice President Al Gore for alerting the world to warming's risks.

Despite the scientific consensus on these basic conclusions, enormously important details remain murky. That reality has been seized upon by some groups and scientists disputing the overall consensus and opposing changes in energy policies.

For example, estimates of the amount of warming that would result from a doubling of greenhouse gas concentrations (compared to the level just before the Industrial Revolution got under way in the early 19th century) range from 3.6 degrees to 8 degrees Fahrenheit. The intergovernmental climate panel said it could not rule out even higher temperatures. While the low end could probably be tolerated, the high end would almost certainly result in calamitous, long-lasting disruptions of ecosystems and economies, a host of studies have concluded. A wide range of economists and earth scientists say that level of risk justifies an aggressive response.

Other questions have persisted despite a century-long accumulation of studies pointing to human-driven warming. The rate and extent at which sea levels will rise in this century as ice sheets erode remains highly uncertain, even as the long-term forecast of centuries of retreating shorelines remains intact. Scientists are struggling more than ever to disentangle how the heat building in the seas and atmosphere will affect the strength and number of tropical cyclones. The latest science suggests there will be more hurricanes and typhoons that reach the most dangerous categories of intensity, but fewer storms over all.

Government figures for the global climate show that 2010 was the wettest year in the historical record, and it tied 2005 as the hottest year since record-keeping began in 1880.

Check your comprehension

~ Can you name any key points of Cancún Agreements?

~ What is palynology?

http://topics.nytimes.com/top/news/science/topics/globalwarming/index.html

Unit 12

Speculations on the future of science

(KEVIN KELLY:) Science will continue to surprise us with what it discovers and creates; then it will astound us by devising new methods to surprises us. At the core of science's self-modification is technology. New tools enable new structures of knowledge and new ways of discovery. The achievement of science is to know new things; the evolution of science is to know them in new ways. What evolves is less the body of what we know and more the nature of our knowing.

I'm willing to bet the scientific method 400 years from now will differ from today's understanding of science more than today's science method differs from the proto-science used 400 years ago. A sensible forecast of technological innovations in the next 400 years is beyond our imaginations (or at least mine), but we can fruitfully envision technological changes that might occur in the next 50 years.

Combinatorial Sweep Exploration – Much of the unknown can be explored by systematically creating random varieties of it at a large scale. You can explore the composition of ceramics (or thin films, or rare-earth conductors) by creating all possible types of ceramic (or thin films, or rare-earth conductors), and then testing them in their millions. You can explore certain realms of proteins by

generating all possible variations of that type of protein and they seeing if they bind to a desired disease-specific site. You can discover new algorithms by automatically generating all possible programs and then running them against the desired problem. Indeed all possible Xs of almost any sort can be summoned and examined as a way to study X. None of this combinatorial exploration was even thinkable before robotics and computers; now both of these technologies permit this brute force style of science. The parameters of the emergent "library" of possibilities yielded by the sweep become the experiment. With sufficient computational power, together with a pool of proper primitive parts, vast territories unknown to science can be probed in this manner.

Evolutionary Search – A combinatorial exploration can be taken even further. If new libraries of variations can be derived from the best of a previous generation of good results, it is possible to evolve solutions. The best results are mutated and bred toward better results. The best testing protein is mutated randomly in thousands of way, and the best of that bunch kept and mutated further, until a lineage of proteins, each one more suited to the task than its ancestors, finally leads to one that works perfectly. This method can be applied to computer programs and even to the generation of better hypothesis.

Multiple Hypothesis Matrix – Instead of proposing a series of single hypothesis, in which each hypothesis is falsified and discarded until one theory finally passes and is verified, a matrix of many hypothesis scenarios are proposed and managed simultaneously. An experiment travels through the matrix of multiple hypothesis, some of which are partially right and partially wrong. Veracity is statistical; more than one thesis is permitted to stand with partial results. Just as data were assigned a margin of error, so too will hypothesis. An explanation may be stated as: 20% is explained by this theory, 35% by this theory, and 65% by this theory. A matrix also permits experiments with more variables and more complexity than before.

Adaptive Real Time Experiments – Results evaluated, and large-scale experiments modified in real time. What we have now is primarily batch-mode science. Traditionally, the experiment starts, the results are collected, and then conclusions reached. After a pause the next experiment is designed in response, and then launched. In adaptive experiments, the analysis happens in parallel with collection, and the intent and design of the test is shifted on the fly. Some medical tests are already stopped or re-evaluated on the basis of early findings; this method would extend that method to other realms. Proper methods would be needed to keep the adaptive experiment objective.

AI Proofs – Artificial intelligence will derive and check the logic of an experiment. Ever more sophisticated and complicated science experiments become ever more difficult to judge. Artificial expert systems will at first evaluate the scientific logic of a paper to ensure the architecture of the argument is valid. It will also ensure it publishes the required types of data. This "proof review" will augment the peer-review of editors and reviewers. Over time, as the protocols for an AI check became standard, AI can score papers and proposals for experiments for certain consistencies and structure. This metric can then be used to categorize experiments, to suggest improvements and further research, and to facilitate comparisons and meta-analysis. A better way to inspect, measure and grade the structure of experiments would also help develop better kinds of experiments.

Wiki-Science – The average number of authors per paper continues to rise. With massive collaborations, the numbers will boom. Experiments involving thousands of investigators collaborating on a "paper" will commonplace. The paper is ongoing, and never finished. It becomes a trail of edits and experiments posted in real time — an ever evolving "document." Contributions are not assigned. Tools for tracking credit and contributions will be vital. Responsibilities for errors will be hard to pin down. Wiki-science will often be the first word on a new area. Some researchers will specialize in refining ideas first proposed by wiki-science.

Check your comprehension

~ How will the scientific experiments be conducted in future?

~ What are the predictions of development of artificial intelligence?

http://www.edge.org/3rd_culture/kelly06/kelly06_index.html

Appendix 2. Power Point presentation

- **Think about the presentation beforehand.** It is short-changing the organizers of the event and your audience if you only think about what you're going to say the day before or while travelling to the event. If necessary, clarify with the organizers exactly what is required of you and what facilities you will require.
- **Be very clear about how much time you have** – and stick to that time in preparing and delivering your presentation. It's very difficult to 'cut' a PowerPoint presentation at the event itself, so it's a great mistake to run out of time.
- **Be very clear about your key message** – and ensure that everything in your presentation is both consistent with, and supportive of, that key message. You should be able to articulate the message in a phrase or a sentence and indeed you might want to use that phrase or sentence in one of your first slides, or one of your last, or even both.
- **Make copies of your slides available**. It is a matter of preference whether you do this at the beginning of your presentation or at the end. If your listeners have copies at the beginning, they can take notes simply by annotating the slides, instead of having to note down all the information on the slides. On the other hand, you might feel that, if they can see in advance the slides you are going to use, you lose the element of control or surprise. It might depend on the content of the presentation: if you are going to show detailed tables or graphs with lots of figures, your audience will probably find it easier to have a copy on their lap. It might depend on the circumstances of the presentation: if there is a large audience, people at the back may not be able to see the screen clearly and would really appreciate having copies of the slides.

- **Ensure that the slides look good.** This does not necessarily mean that they look flashy – although suitable pictures or illustrations are very effective – but it does mean using a consistent format and typeface and readable colors plus giving each slide the logo of the organization you are representing and a chronological number.
- **Don't use italics to emphasize in your PowerPoint presentation**; the effect will be the reverse of what you intend. Underlined words are also hard to read. Use these effects sparingly – if at all!
- **The first slide should announce the title of your presentation**, the event and date, and your name and position. This may seem terribly obvious, but many speakers miss off some of this basic information and then weeks later listeners (or their colleagues back at the organization) are not clear who made the presentation or when. You should try to make the title catchy, so that you immediately have the interest of your audience. A challenging question works well – for instance, a presentation on the global economic crisis might ask: *"Is this the end of capitalism as we've known it?"* Or a play on words works too – for example, a presentation on next generation broadband could be titled *"The Slow Arrival Of Fast Broadband"*.
- **The second slide should seize the attention of your audience for your presentation.** It could be the central proposition of your presentation or a conventional wisdom that you wish to challenge or a relevant or witty quote from a leader in your field. If it is amusing or controversial or both, so much the better.
- **The third slide should set out the structure of your presentation.** The default structure should consist of three themes that you intend to examine. For a very short presentation, there might only be time for two; if you want to look at more than five areas, write a book instead.
- **Each theme should be the subject of a small number of slides.** Again, a good working assumption is that three slides for each theme is about right. Less than two and it isn't substantial enough to be a separate theme; more than five and it should probably be broken up into two themes.
- **Each slide should have a clear heading.** A question is often a good way of winning attention – but, in that case, make sure you answer the question in the body of the slide.
- **Each slide should normally contain around 25-35 words**, unless it is a quote (when you might use more) or contains an illustration (when you will probably use less). Too many words and your audience will have trouble reading the material; too few words and you're likely to be flashing through the slides and spending too much time clicking the mouse.
- **Each bullet point should consist of an intelligible phrase**, rather than merely a word or two that is meaningless on its own or conversely a complete sentence that is better delivered orally. So, for instance, do use *"Focus on profitable and growing markets"* rather than simply *"Focus"* or *"Markets"* or *"It is necessary to focus on those markets which are profitable and growing rather than those which are loss-making and*

declining". Consider this test: your slides should make sense and be useful to someone who was not present at your presentation.

- **Make appropriate use of pictures.** It's a good idea to break up text with illustrations and it is true that a picture is worth a thousand words.
- **The last slide should set out all appropriate contact details:** certainly e-mail address and possibly snail mail address, the web site of your organization, and any personal website or weblog if you have one.

Appendix 3. Strategies for oral presentations

1. Overcome speaker's fright. In order to deal with such bodily symptoms of fear as dry mouth, hands perspiration, adrenalin gushes in veins, faster heart beats, contracting stomach muscles robbing a person of all interest in food you have two things to do:

- convince yourself that the challenge is not a matter of life and death, and therefore does not require that marshalling of forces which once was required for hand-to-hand combat or panic-stricken flight;
- don't starve yourself of air by shallow breathing, as this will only intensify your body's efforts to draw more oxygen to your muscles, thus greatly increasing your general agitation.

First, convince yourself you are going to give an ordinary speech. Don't aim for a brilliant oration; don't try to out-joke anybody; don't aspire to a standing ovation. You're a beginner, and all you're trying to do is a satisfactory job.
Second, remember all the boring, badly constructed speeches you have listened to. That, regrettably, is the norm. All you have to do is to be slightly better than that, and your audience will be grateful – especially if you keep it brief.
Third, the worst that can happen is that you will be as boring and as disjointed as many other speakers — and that's not something to get agitated about or to lose sleep over.
Fourth, human memory for the spoken word is extremely short-especially if the spoken word is boring and uninteresting. So even if you make a hash of things, people will have forgotten your speech within hours – certainly by the next day. It's only remarkable speeches that are remembered. Ordinary ones are quickly forgotten.

2. Avoid reading your speech if at all possible. If at all possible, avoid having a prepared script. That makes you a reader, not a speaker, and you may as well be replaced by a tape recorder. On some occasions you will have to follow a script: if you are delivering a complex scientific paper to a conference; if you are setting out a legally binding arrangement; if you are presenting a politically sensitive decision or any other statement which must be adhered to word for word. There is still much you can do to liven your presentation. If you have to use script, sometimes it's necessary to break the reading. One of the best methods of breaking the reading of a script is to point to a chart or diagram propped on an easel; or to write on the blackboard; or to display an interesting object; or to screen a picture with a slide or overhead projector.

3. Use gesture to liven your performance. Many speakers have trouble knowing what to do with their hands. Your hands are part of your on-stage personality. Use them well, and you will improve the presentation of your speech. Use them badly, and you will seem stiff and stilted.

- Stand erect, shoulders back, arms ready to move in fulsome sweeps.
- Let your left hand sweep out in a long flowing movement that involves the whole arm.

4. Use a parallel case. This two-step strategy seeks to obtain the agreement of the audience to a principle outlined in a context in which they are bound to agree with it; then to use the same principle in a context where they are less likely to agree. If you can get a *Yes* response in a non-threatening situation, you may be able to transfer that *Yes* to a parallel situation. Let's suppose you are to give a speech against capital punishment and you suspect some of your listeners favor it. You could open with a discussion of a form of punishment still used in parts of the

Middle East: severance of a hand for theft. Describe this horror in detail, and the often trivial nature of the crimes it is supposed to deter. The success of this stratagem will depend on how well you draw the analogy. If you can show your audience that the inhuman nature of the death penalty parallels punishment by amputation, you may well win them to your position.

5. Dangle a worse prospect before them. This technique works best when you spend the early part of your speech building up a 'worse prospect' in all its unwholesome detail, then switch to the prospect you favor, emphasizing that it is moderate and reasonable and workable. Use this device adroitly, and you will convert the most obstinate opponent to your point of view. Again, the trick is to give him good reason for abandoning his entrenched opinion.

6. Establish rapport with eye contact and facial expression. Eye contact is one of the most potent skills a speaker has. It is crucial in establishing rapport with the audience. Many speakers recall with wonderment and awe the first time they experienced the feeling of 'holding' the audience. As your eyes rove over the people in front of you, you suddenly ractic that every one of them is gazing at you, and hanging on your next word. You may be a little puzzled at this point. If there are 200 people in the audience, how can you look at all of them? Easy: while you are speaking, let your eyes flow along the front few rows, left to right; then the next few rows, right to left; and so on to the back of the hall. Then work from the back rows to the front again. With experience, eye contact comes naturally. Every person in the audience will then have the feeling that you are speaking directly to him or her. None will feel left out (as they will if you concentrate on a knot of people directly in front of you).

The close partner of eye contact is facial expression. Frozen or twisted features, angry expression, tightly drawn lips, unsmiling eyes can all alienate an audience. Many speakers, when they become worked up, unknowingly adopt alarming expressions. It is much better if you can smile. Use a friendly smile, a tolerant smile, an exasperated smile, a wicked smile, a grim smile – but a smile. Where you want to express anger (say at the brutal killing of a child), try to let your words rather than your expression indicate your disgust. Of course, you will use ringing tones to make plain your abhorrence, but let the words express your loathing, not the fury of your features. This leads me into the perils of vehemence, of over-emphatic speaking.

7. Find funny material. This technique is essential. If you have a speech to give on (say) the need to upgrade local highways, don't go rummaging through joke books hoping to find just the right joke listed under Highways. It won't be there. It may be listed under Personal Insults (that is, an insult that can be adapted to describe the person who designed the present highway system). Or it may be listed under Women's Fashions – a put-down of non-functional dress design which can be adapted for non-functional highway design. This is a fundamental lesson. When looking for humorous material, disregard the subject matter and concentrate on the point made by the joke. And when compiling your own joke file, cross reference each joke both under subject matter and under the point it makes. When you adapt a joke, you usually transfer the point of the joke to a new target. That is, you take the essential point of the joke and you re-aim it. Write down jokes that appeal to you – in a notebook, in a card index, even on scraps of paper. You will come across these especially appealing jokes when rummaging through a book of jokes, listening to TV, leafing through a magazine or chatting with friends. Immediately scribble down the gist of the joke, or at least the punchline, on any old scrap of paper. Later you can transfer these choice items to your own jokefile or jokebook – or you may just clip the scraps of paper together. The main thing is to collect funny material, think about it, rehearse it, use it, ractice adapting it to your needs.

8. Write your own humorous material.

- Go through your speech looking for double meanings of words and phrases; for contrasting relationships between ideas, events, situations and people. All of these are possible sources of humor.
- Try free association. Think about your audience: Who do they dislike and why? Who do they like and why? Who are their rivals? What are the hobbies, occupations, and unusual characteristics of well-known people among them? What recent events in the news affect them? What past events? What common sayings or slogans or advertising headlines do they relate to? Take any of these ingredients and search for contrasts, exaggerations, odd juxtapositions, incongruities, ironies. Remember: a joke that relates to the interests of your audience will work three or four times better than one that does not.

9. Hold a silence to demonstrate mastery. Novices are afraid of pause. And they are terrified of silence. Some gabble frantically to prevent the least hesitation in their speech. Indeed, many talented speakers are ruined by breakneck delivery.

Pausation is one of the most effective tools a speaker can use. Pauses in the right places allow significant statements time to sink in; they give the audience space to applaud or to laugh; they separate ideas; they help develop the structure of the speech. Pauses can come at the end of a 'paragraph' or group of sentences; at the end of a sentence; in the middle of a sentence; several times within a sentence; or even after every word in a sentence. Pauses can last one second or four or five seconds. Or they can be long ringing silences of eight or ten seconds. Pauses always seem much longer to the speaker than to the audience. This is because he cannot see himself. For the audience, the change of the speaker's expression, how he moves his head and body, are events that help fill in the gap. To prove this to yourself, record a speech both on a tape recorder and on a video recorder. When the voice tape is played back, some silences will seem quite long; but when the video tape is screened those silences will probably disappear. Silences become awkward when it is obvious they are unintentional. The speaker stops at an inappropriate point, maybe in mid-sentence, his face shows concern, he fumbles with his notes. It is obvious something has gone wrong.

Awkward silences usually occur when the speaker loses concentration and becomes too self-aware. Instead of focusing on what he should be saying, instead of giving out to his listeners, he becomes too conscious of the audience pressing in upon him – and in the worst situation his 'mind goes blank'. (Actually, it doesn't go blank. Quite simply he starts thinking of the audience, not of his speech.) The remedy for this is: don't panic. Above all, don't look worried. Stay calm as you pick up your thread once more. Generally, however, silences are golden. The ability to hold a long silence and make it seem natural, is the mark of a gifted speaker, which clearly demonstrates his mastery over the audience.

10. Welcome interruptions. Some speakers are terrified that someone will interrupt them with a question or comment. Actually, this is one of the best things that can happen, because it shows that someone in the audience has engaged with what you're saying, and, if you have the time to offer a brief response, it can actually lead to genuine progress on the point you were making. And two-way conversation (assuming you're minimally good at it) is always a tension-reducer.

Appendix 4. Oral presentation evaluation form

Name of Presenter

_____

Topic:

_____

Rate the speaker on each point listed below by using this scale:

Poor 1 Fair 2 Average 3 Good 4 Excellent 5

Content

_____ Extent of coverage
_____ Difficulty level of coverage
_____ Clarity of coverage
_____ Interesting

Organisation

Overall

_____ Coherent, good coordination, easy to follow
_____ Concise
_____ Clear
_____ Appropriate

Introduction

_____ Gained the audience's interest and immediate attention
_____ Stated purpose clearly
_____ Identified the topic and defined the scope of the presentation

Body

_____ The main points were supported with details
_____ Documented facts where necessary
_____ Transitions were made between the main points to enable the listener to follow the development of the presentation
_____ Sounded believable
_____ Sounded persuasive
_____ Informative: something was learnt

Conclusion

_____ Signal the ending

_____ Summarised main points
_____ Closed smoothly

Questions & Discussion
_____ Responded to questions well

Visual aids
_____ Suitable number
_____ Varied
_____ Design: clear and well-made
_____ Relevance: used appropriate visual aids
_____ Used visual aids effectively

Notecards
_____ Used effectively

Delivery
_____ Appearance
_____ Eye contact
_____ Facial expression
_____ Hand control
_____ Body movements
_____ Gesturing
_____ Voice: Loudness & softness (in general & for special effects)
_____ Speed & pacing (in general & appropriacy of pauses)
_____ Humor, relaxed, enthusiasm and interest
_____ Confidence of presenter
_____ Timing

Language
_____ Complexity
_____ Grammar
_____ Pronunciation
_____ Stress & intonation
_____ Vocabulary
_____ Fluency

Overall
What did you like most about this presentation?
How do you suggest this presentation could be improved?

Appendix 5. Body language

Body language is a form of non-verbal communication, which consists of body posture, gestures, facial expressions, and eye movements. Humans send and interpret such signals subconsciously.

- Positive body language

Eye contact

- Keeps audiences' attention (Asian audience might feel aggressed.)
- Facial expressions should be natural and friendly:
  - raise eyebrows to show surprise
  -open eyes wide
  -squint your eyes

The hands

- Gives lots of possibilities to emphasise, to enumerate and to express sincerity or reflexion.
- Be conscious of what you do with your hands. If you are unhappy, hold notes or cards to occupy them arm – movements back and forth to suggest flow. Open arms to include or welcome ideas.

Body movement

- Indicates a change of focus keep audience's attention move forward to emphasize move to side to indicate a transition gesture.
- Up and down head motions are movements to indicate importance or acknowledgement.
- Pen or pointer to indicate part, place (on a transparency)
  shrug shoulder to indicate I don't know or care.

Posture

- Stand straight but relaxed (do not slouch or lean sideways).
- Lean forward to emphasize.
- No hands in pockets.

- Negative body language

- Failing to make eye contact
- Do not look at your notes all the time
- Looking at the screen/board means your back is turned to the audience cutting contact
- Don't stare, or look blankly into people's eyes
- Avoid swaying back and forth like a pendulum
- Avoid leaning against walls
- Be aware of your nervous tics
- Do not fold your arms like a barrier While one hand in a pocket gives a very relaxed pose, both hands in pockets looks too casual and should be avoided
- Avoid an unblinking stare and the same facial expression. Blink normally and nod your head to show agreement, and that you are still alive and not bored to death. If you are bored, don't suffer. Go find someone interesting. Life is relatively short. Make the most of it.
- Avoid touching face when speaking. Rubbing nose, eyes, ears, head, or neck shows doubt in what you are saying or hearing.
- Avoid mumbling. That is an unconscious need to avoid being heard. Do speak up loudly and with confidence in what you have to say.
- Avoid poor pronunciation. Speak a bit slower and get it right. You will attract more people you like being around.
- Avoid extraneous body movements that do not positively support what you are saying. Finger drumming, scratching, twitching, and darting eyes around room all discredit what you are saying and your image as a person good to know.
- Avoid poor posture. Do stand tall and proud to be you and believe in what you are saying. Losers look like losers a block away. Look like a winner!
- Avoid hiding your hands and palms. Evasive people with secrets don't show their hands. (Women show their soft wrist underside to flirt.)
- Avoid touching face when speaking. Rubbing nose, eyes, ears, head, or neck shows doubt in what you are saying or hearing.
- Avoid closed body postures, like arms folded across chest.

Appendix 6. Samples of grant proposal documents

SAMPLE OF COVER SHEET OF THE PROPOSAL

IREX Special Projects in Library and Information Science with Central and Eastern Europe and Eurasia

THE NORTH CAUCASUS AND VOLGA BASIN ACQUISITIONS PROJECT

a proposal submitted by:

Tatjana Lorkovic

Slavic and East European Collections
Sterling Memorial Library
Yale University
New Haven, CT 06520-8240
TEL.: (203) 423-1861
FAX: (203) 423-7231
EMAIL: tlorkov@yalevm.cis.yale.edu

SAMPLE OF TABLE OF CONTENTS OF THE PROPOSAL

The North Caucasus and Volga Basin Acquisitions Project

Contents of this Proposal

SAMPLE OF BIOGRAPHICAL SKETCH OF THE PROPOSAL

BIOGRAPHICAL SKETCH

NAME Hunt, Virginia Lively	POSITION TITLE Associate Professor of Psychology
COMMON USER NAME (credential, e.g., agency login)	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	FIELD OF STUDY
University of California, Berkeley	BSc	Psychology
University of Vermont	Ph.D.	Experimental Psychology
University of California, Berkeley	Postdoctoral	Public Health and Epidemiology

Appointments

Positions and Employment

2005- Associate Professor, Department of Psychology, Washington University
2002-2005 Assistant Professor, Department of Psychology, Washington University
2000-2002 Lecturer, Department of Psychology, Middlebury College, Middlebury
2001-2000 Consultant, Coastal Psychological Services, San Francisco, CA
1998-2000 Fellow, Division of Intramural Research, National Institute of Drug Abuse

Other Experience and Professional Memberships

2005-09 NIH Risk, Adult Addictions Study Section, member
2003-04 NIH Peer Review Committee: Psychobiology of Aging, ad hoc reviewer
2003- Board of Advisors, Senior Services of Eastern Missouri
2000- Associate Editor, Psychology and Aging
1998- Member, American Geriatrics Society
1998- Member, Gerontological Society of America
1995- Member, American Psychological Association

Honors

2008	Award for Best in Interdisciplinary Ethnography, International Ethnographic Society
2005	Excellence in Teaching, Washington University, St. Louis
2003	Outstanding Young Faculty Award, Washington University, St. Louis

Publications

Most relevant to the current application

1. Merryle, R.J. & Hunt, V.L. (2004). Independent living, physical disability and substance abuse among the elderly. Psychology and Aging, 23(4), 10-22.
2. Hunt, V.L, Jensen, J.L. & Crenshaw, W. (2007). Substance abuse and mental health among community-dwelling elderly. International Journal of Geriatric Psychiatry.
3. Hunt, V.L, Wiechelt, S.A. & Merryle, R. (2008). Predicting the substance-abuse treatment needs of an aging population. American Journal of Public Health.
4. Hunt, V.L., Newlin, D.B. & Fishbein, D. (2009). Brain imaging in methamphetamine abusers across the life-span. Gerontology, 122-145.
5. Hunt, V.L. & Sher, K.A. (2009). Successful intervention models for older drug-abusers: Research across the life-span. American Psychologist, in press.

Synergetic activities

We plan to measure changes in cognitive ability and mental and physical health across a five-year period in a group of older drug users and matched controls. I have the expertise, leadership and motivation necessary to successfully carry out the proposed work. I have a broad background in psychology, with specific training and expertise in key research areas for this application. As a postdoctoral fellow at Berkeley, I carried out ethnographic and survey research and secondary data analysis on psychological aspects of drug addiction.

At the Division of Intramural Research at the National Institute on Drug Abuse (NIDA), I expanded my research to include neuropsychological changes associated with addiction. As PI or co-Investigator on several previous university- and NIH-funded grants, I laid the groundwork for the proposed research by developing effective measures of disability, depression, and other psychosocial factors relevant to the aging substance abuser, and by establishing strong ties with community providers that will make it possible to recruit and track participants over time. In addition, I successfully administered the projects (e.g. staffing, research protections, budget), collaborated with other researchers, and produced several peer-reviewed publications from each project. As a result of these previous experiences, I am aware of the importance of frequent communication among project members and of constructing a realistic research plan, timeline, and budget.

The current application builds logically on my prior work, and I have chosen co-investigators (Drs. Gryczynski and Newlin) who provide additional expertise in cognition, gerontology and geriatrics. In summary, I have a demonstrated record of successful and productive research projects in an area of high relevance for our aging population, and my expertise and experience have prepared me to lead the proposed project.

SAMPLE OF PROJECT SUMMARY OF THE PROPOSAL

THE NORTH CAUCASUS & VOLGA BASIN ACQUISITIONS PROJECT

The principle objective of this Project is to increase awareness and disseminate information about libraries in the North Caucasus and Volga Basin (paying particular attention to the non-Russian republics of the region) among the American library and academic community. This Project will accomplish these objectives by conducting two acquisitions workshops, one in Rostov-na-Donu (North Caucasus) and one in Samara (Volga Basin), that will assess the current state of exchange relations with libraries in the area as well as conduct a survey of regional publishing.

The innovative workshop approach to acquisitions survey travel was used with great success in Khabarovsk (Russian Far East) and Irkutsk (Eastern Siberia) under IREX sponsorship in October 1994. These two workshops received outstanding reviews from both the participants and the Russian Ministry of Culture. The lessons learned in organizing workshops in these remote regions of Russia will make the North Caucasus and Volga Basin workshops even better.

Approximately twenty-six representatives from the most important libraries in each region (see attached list of candidate libraries) will be invited to each three-day workshop.

Each workshop will include sessions on: establishing exchange relations with American research libraries, the use of email to improve communications, and American librarianship, as well as one-on-one interviews with representatives of each library on everything from publishing trends in their city to their particular problems. The Russian Ministry of Culture has once again agreed to support these innovative workshops.

SAMPLE OF PROJECT DESCRIPTION OF THE PROPOSAL

Background

The Eclipse Business Intelligence and Reporting Tools Project addresses a broad range of needs in the business intelligence and reporting space using the Eclipse platform.

The business intelligence and reporting space is focused on tools and capabilities that extract data from data sources, process that data, and present the processed information to the end users. The information may be needed to enable the users to perform their operational or analytical job functions, or it may be customer-centric information such as a transaction statement. The capabilities can range from application- and production-level reporting, through ad hoc user-driven query tools, to highly interactive multi-dimensional online analytical processing (OLAP) and data mining tools. While many business intelligence and reporting applications access operational data sources, it is often the case that developers provide specific data warehouses to support the business intelligence and reporting needs of an application. The tools in this space can include facilities to help build these data warehouses.

It should be noted that a given application often needs a range of complementary capabilities in this area to meet the needs of different users of the application. For example, consider components of an online order processing application: The individual order invoices will be printed for inclusion in the shipping box and the shipping clerk will need an online or printed shipping list (both production-level reports); while a product line manager may want to perform ad hoc queries to see which products generate the most returns; while the purchasing agent may use analytics to look for trends and improve stocking levels. Providing a range of coordinated and complementary capabilities under the Eclipse Business Intelligence and Reporting Tools Project is intended to ensure that the developed technology can effectively be used to meet this broad range of needs.

Initial Goals

Initially, the Project will focus on leveraging the Eclipse platform to provide infrastructure and tools for the designing, deploying, generating and viewing of reports in an organization, including ad hoc query and reporting tools. While not an initial focus, the BIRT project scope includes complementing these reporting capabilities with Online Analytical Processing (OLAP) and Business Intelligence dashboard functionality. Over time, but not in the initial scope, the creation of additional projects is anticipated and encouraged to address additional aspects of business intelligence, such as Executive Information Systems (EIS), statistical analysis, modeling capabilities (what-if analysis), Data Mining Tools, Data Warehouse Modeling Tools, Extract Transform and Load (ETL) tools and Data Quality Tools.

The initial deliverable of the Eclipse Business Intelligence and Reporting Tools Project is to provide a robust platform that can be used to quickly and effectively create and deploy reports with any degree of complexity without having the developer create the data access, processing and formatting logic using Java code or components. In the majority of cases, the report developer will design a report within the Eclipse framework using a 100% visual design paradigm. However, in recognition of the fact that the variety of report layouts and complexity of data access is infinite, the project will also support extensive programmatic customization of the report generation processes, including programmatic creation of report designs.

About Reports

Reports extract data from a data source or sources, perform manipulations and calculations on the data to answer business questions, and present the results as information in a formatted and convenient form for the business user to use. This information is then typically used for operational or decision support purposes within an organization. Reports vary dramatically in size, content and complexity and will include or combine characteristics such as:

- Listings of information Example: Transactions in an account.
- Sorting, grouping and aggregation of data with and without subtotals Example: A listing of all product sales for each sales person, grouped by state.
- Charts to present information in easy to understand formats Example: Pie chart showing an investor's portfolio allocation by High Growth/Growth/Income/etc. categories.
- Matrix or cross-tab layouts Example: Financial budget reports with cost codes as rows, columns for each month, and cells containing numerical data for that cost code/month.
- Delivery of information as one or a combination of web pages, PDF files, printed documents, Excel files, etc. Example: Frequent flyer statement delivered as a web page online and a printed document in the mail.
- Precise, highly formatted layouts Examples: Bank statements; utility bills; commission statements; invoices; government forms.
- Page navigation for long reports Examples: Hundreds of pages corporate cell phone usage bill with First Page, Next Page, Go to Page, etc. buttons).
- Table of Contents Example: Multi-page Investment Portfolio summary with Table of Contents to quickly navigate to Account Summary; Fund History; etc.
- Keyword or content search within a report Example: find information on a customer in a 1000 page customer account report.

This can be contrasted with data-driven JSP pages where the data manipulation and presentation needs are more transaction driven and do not include recurring reporting needs such as complex aggregation (performed outside of the database) and highly complex layouts.

Target Users

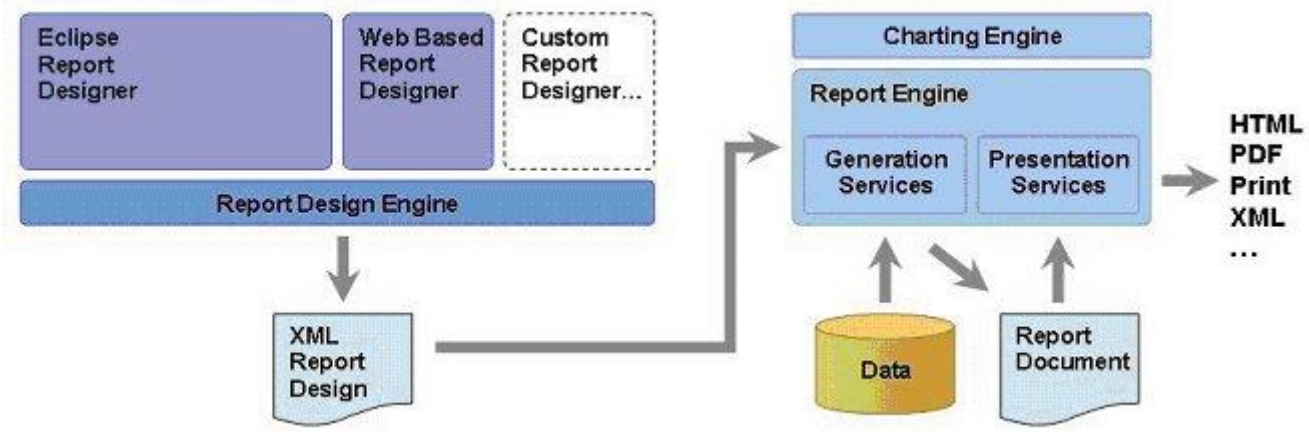
For report development, the project broadly targets three classes of developer:

- **Application Developers** These are Java developers who are creating applications that include the need to retrieve data and present that data in the form of reports. This is likely to be a subset of the overall application and will include many of the characteristics discussed above. In this case, the report generation and viewing will be embedded in the overall application.
- **Report Developers** Report developers are not typically skilled in writing Java code. They expect to use a visual desktop tool to create any type of report - including defining database connections, report content and report layout. These reports may then be deployed as part of an application, or through an easy to use deployment framework.

- **Business Users** Business users often want to create their own report layouts or customize existing reports. They work through a very easy-to-use web-based report creation and editing facility to answer business questions on an ad hoc basis.

Architecture

The project will address both the design time needs of report creation as well as the run-time requirements of report generation and deployment. A high-level architecture diagram is provided below. The project will adopt and support accepted open standards wherever feasible.



The Eclipse Business Intelligence and Reporting Project is divided into a number of sub-projects that reflect the initial focus on the reporting aspects of business intelligence and the high-level architecture of the project. These are discussed in the sub-project section below. As discussed above, the creation of additional sub-projects is anticipated and encouraged to address additional aspects of business intelligence.

Due to the wide variety of potential applications, it is recognized that BIRT cannot meet all the requirements of all applications. It is therefore a core design principle for the projects within BIRT to support a broad range of extension points within the tools and frameworks that allow developers to address additional needs. These extension points may be utilized for adding value in commercial products using BIRT, or may be developed and contributed into the Eclipse open source community.

For example, logging tools can use BIRT's data extension point to plug-in a data query user interface and access logic to read and process log files, use BIRT's report engine to present the information in the log, and extend BIRT's output/rendering adaptor to email or send a short message to a user with the report output in a format targeted for that device.

We expect the Business Intelligence and Reporting Tools Project to produce functional requirements that are more appropriately satisfied through the Eclipse Project or other Eclipse foundational projects. In such cases, the Business Intelligence and Reporting Tools Project PMC will coordinate the corresponding Project PMCs the design and implementation of the corresponding contribution.

http://www.eclipse.org/birt/phoenix/project/description.php

Appendix 7. Samples of business letters

Structure of formal letter

Government of Canada[1]

Office of the

Chairman Public Service

Commission[2]

Ottawa,

Ontario

K1A ON7

Attention: P. Smith[3]

Decembers 8, 1996 [4]

Dear Sir: [5]

Ref: PC Program analyst [6]

Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx[7]

Yours sincerely, [8]

2) Robertson Director[9]

General Services Division

AP/CL [10]

Encl. [11]

cc : D.Dube[12]

1. **Заголовок**
2. **Внутренний адрес.** Адрес того, кому предназначено письмо, размещается вверху. Если Вам известно имя человека, которому предназначено письмо, то его звание и полное имя указываются здесь же.
3. **Строка: внимание.** Включается в тех случаях, когда письмо отправляется, например, в компанию, но адресовано кому-либо лично.
4. **Дата**
5. **Приветствие**
6. **Ссылка**
7. **Основная часть**

8. **Комплементарная концовка.** Обычные окончания:

British	**American**
Yours truly,	Truly yours,
Yours sincerely,	Sincerely yours,
Yours faithfully,	Faithfully yours,

9. **Подпись, должность, отдел.** Подпись, расшифровка подписи, должность следуют друг за другом в строку в левом или в правом углу письма.

10. Посылочные инициалы. Посылочные инициалы указывают на тех, кто писал / печатал / переводил письмо.

11. **Вложения.** Если к письму прилагаются какие-либо материалы, то об этом упоминается после посылочных инициалов.

12. **Копии.** Указания на адресатов копий письма даются в самом конце.

Structure of informal letter

Heading: *316 Indiana Drive*
Glenshaw, Pa. 11651
February 26, 1975

Salutation: *Dear Mary,*

Body: *As you may have heard by now, I'm planning to attend Indiana University in the fall. I'm not certain about my major yet, but I'm very much interested in ecology. Does Indiana have such a major? Maybe I'll have to settle for biology and specialize later. Undoubtedly the catalogue will answer this question and similar ones. Could you send me a copy?*

I have a million questions I would like to ask about dormitory living, social life, etc., but I'll wait till you get home for vacation. Let me know when you're coming. I want to plan a welcome home party.

Love,
Jane

Closing:
Signature:

Sample of report

Site accident report

Executive summary
Damage has been caused to the emergency generator on the Witherby power plant site. It was caused by a fire started by the electrical contractors Mullet & Sons. Although the packing material that caught fire was left by another subcontractor, the personnel from Mullet started work before clearing the waste matter away, in contravention or contract regulation 2.3.8. Mullet & Sons should therefore pay for the replacement of the damaged equipment.

Introduction
This report will look at:
- the sequence of events
- the subcontractors involved
- the responsibilities of the subcontractors
- the financial compensation from the subcontractors
- recommendations to avoid future incidents of this nature

Findings
1. Fire broke out at 17.30 on Friday 13 October in the working area around the emergency generator. Ail personnel were cleared from the site and the fire service informed by 17.45. The fire-service arrived at 18.00 and the blaze was extinguished by 18.30.
2. The electrical contractors Mullet & Sons started the fire accidentally when carrying out the connection work of the generator to the main power line. Packing material left on the ground by another subcontractor Harvest Macdcugail plc caught fire and this quickly spread.
3. Although Harvest Macdcugail are obliged to remove any packaging material they bring with them it seems that the electricians from Mullet told them to just leave it. We assume they wanted to get their own work done as quickly as possible so that they could finish for the weekend. Starting welding work without first making sure there is no inflammable material around is in direct contravention of contract regulation 2.3.8.

Conclusion
Mullet & Sorts must pay for the replacement of the generator (€ 90,000) as they are solely responsible for the damage.

Recommendations
1. Moist & Sons should not be offered any more work on site if they do not accept these terms.
2. Harvest Macdougoil should receive a formal warning.
3. All subcontractors must be reminded of their obligation to follow all fire and safety regulations.

Normal Poole
Site Manager
19 October

Sample of letter of request

Fill in the gaps of the letter of request with the phrases given below

Yours sincerely	I am writing to request	Thank you for your assistance	Dear Mr. Weiner
Please send me			

1) _____,
2) _____ a copy of the current collective bargaining agreement between Local 3 and Overwork Manufacturing Corp.

I have worked at the Overwork Manufacturing Corp. as a machine operator and have been a member of Local 3 for 15 years. I understand that it is my right under the Labor-Management Reporting and Disclosure Act to have a current and true copy of the Collective Bargaining Agreement and all related agreements (signed by both parties) that apply to me.

3) _____ a copy of the collective bargaining agreement between Local 3 and Overwork Manufacturing Corp. to the address below or let me know when I can come to the office to obtain a copy of the agreement. I ask to receive a copy of the contract by April 21, 2000.
4) _____.
5) _____,

L. Cruz

Mr. L. Cruz

Sample of letter giving information

Look through the letter of giving information and do the following tasks:
1) Define the style of the letter
2) Choose the words / phrases in bold which are more appropriate for the style of the letter

Dear Mr. Stone,

1) I am writing in response you your request for / You asked about information regarding steps of scientific method. I have included details of the steps of scientific method as well as a booklet showing these steps in pictures.

2) There are fantastic picture in the booklet / As you can see from the booklet, the starting point of most new research is to formulate a general question about an area of research and begin the process of defining it. This initial question can be very broad, as the later research, observation and narrowing down will hone it into a testable hypothesis.

The research stage, through a process of elimination, will narrow and focus the research area. This will take into account budgetary restrictions, time, available technology and practicality, leading to the proposal of a few realistic hypotheses. Eventually, the researcher will arrive at one fundamental hypothesis around which the experiment can be designed.

3) Now, about experiment, / As far as experiment is concerned, it is the midpoint of the steps of the scientific method and involves observing and recording the results of the research, gathering the findings into raw data. The observation stage involves looking at what effect the manipulated variables have upon the subject, and recording the results.

The scope of the research begins to broaden again, as statistical analyses are performed on the data, and it is organized into an understandable form. The answers given by this step allow the further widening of the research, revealing some trends and answers to the initial questions.

Conclusion stage is where, technically, the hypothesis is stated as proved or disproved.

However, the bulk of research is never as clear-cut as that, and so it is necessary to filter the results and state what happened and why. This stage is where interesting results can be earmarked for further research and adaptation of the initial hypothesis.

4) I trust this information will be of some assistance / I hope this will help you and **5) I look forward to meeting you / I want to meet you** to know about your achievements in science. **6) Tell me if you need any more information / Please do not hesitate to contact me if you require any further information.**

Yours sincerely,
Jack Brown

Sample of letter of apology

Read the letters of apology from hairdressers who put too many chemicals on a client's hair and answer the following questions:
1) Which letter do you think is the best letter?
2) Why did you choose this letter, and not one of the others? Prove your point of view.

Curlz Salon
4846 Main Rd
Tweebultfontein
8252
4 September 2004

Ms Tracy Chapstick
48 Hillside Rd
Tweebultfontein
8252

Dear Ms Chapstick,
Sorry about the hair, or rather the lack of it. These things happen. Don't worry, it will grow back.
Yours faithfully,
K. Miller

Colours Salon
2 Main Rd
Heathstead
8824
4 September 2004

Ms Polly Brown
7 Ambrose Rd
Heathstead
8824
Dear Ms Brown,
Apology for bad service
Please accept my sincere apologies for damaging your hair when you visited our salon yesterday. The mistake was unacceptable and I take full responsibility for what happened. I would like to reassure you that it will never happen again. I am refunding your payment and would like to offer you five free treatments at our salon. I hope we will see you again.
Yours faithfully,
Courtney Welsh

Highlights Salon
7876 Main Rd
Kalkfontein
7943
4 September 2004

Ms Clarabelle Jones
97 Yew Rd
Kalkfontein
7943
Dear Ms Jones,
Apology for bad service
I'm sorry! I'm sorry! I'm sorry! Please accept my profuse and heartfelt apologies. Your hair looks like rats' tails and it's my fault. I feel devastated about what a mess you looked and asked my priest to arrange a special confession session so that I could confess to my Maker. I also prayed that your hair would grow back quickly. I am on my knees, with tears in my eyes, begging your forgiveness for my negligence in not reading the instructions on the bottle; for my stupidity; for not noticing your cries of anguish and pain and for being such a complete mampara. As a token of my heartrending apologies, I have enclosed two tickets to Ratanga Junction.
Yours faithfully,
Celestina Starr

Sample of CV (Curriculum Vitae)

Look though the CV given below and fill in the gaps with names of the parts of the CV

education	**interests**	**objective**	**references**	**summary of qualifications**

Chemical Engineer Sample Resume

Janice Anderson

123 Fredrickson Avenue
Atlanta, Georgia 00000
Home: 000-000-0000
Cell: 000-000-0000
Fax: 000-000-0000
Email: janice@noemailhere.com
Website: www.personalwebsite.com
Blog: www.personalrecipeblog.com

1) _____:

Assume a challenging and rewarding position as a Chemical Engineer with an innovative firm in Dallas, Texas.

2) _____:

- Over eight years of successful planning, developing, and implementing projects in various degrees in North America and South Asia.
- Extensive technical knowledge and experience in planning, budgeting, and implementing chemical engineering projects for public and private sectors including government projects.
- Excellent written and verbal communication skills including presentation and contract negotiations.
- Supervisor experience in managing small teams of five to eight engineers in project development, chemical sampling and testing.
- Facilitates bi-weekly on-site training sessions and workshops for U.V. coating on printed samples for optimal results.
- Produces monthly newsletters for engineering team members on topics including industry developments, trends, and upcoming projects.
- Manages sampling of film shrinkage, ply adhesion, tensile and elongation, and electrocuting.
- International relations experience in South Asia.

3) _____:

Senior Chemical Engineer Consultant: July 2002 - Present, Chemical Engineering Firm, Dallas, TX
Chemical Engineer: January 1999 - July 2002, Franklin & Associates Engineering, Dallas, TX
Chemical Engineer: May 1996 - January 1999, Johnson Engineering Firm, Dallas, TX

4) _____:

University of Texas at Dallas, Dallas, TX
- Bachelor of Science in Engineering (May 1998)
- Minor: Chemistry

Texas Community College at Dallas, Dallas, TX
- Associates in Science in Pre-Engineering (June 1995)
- Concentration: Physics

5) Affiliations:

- Jan. 2002 - Present: Association of Consulting Chemists & Chemical Engineers, Member
- June 1995 - Present: The American Institute of Chemical Engineers, Member
- June 1995 - Present: Society of Chemical Industry, Member

6) _____:

- Frequent contributor to various scholarly journals including Chemical Engineering Process Magazine, AIChE, and Journal of Chemical Engineering Data
- Acting Adjunct Instructor of Biochemistry at Dallas Community College

7) _____:

Available upon request.

Source: http://www.cvtips.com/resumes-and-cvs/chemical-engineer-sample-resume.html

Sample of letter of application

XYZ Company
87 Delaware Road
Hatfield, CA 08065
(909) 555-5555
george.gillhooley@email.com
Date

Dear Mr. Gilhooley,
I am writing to apply for the programmer position advertised in the Times Union. As requested, I am enclosing a completed job application, my certification, my resume and three references.
The opportunity presented in this listing is very interesting, and I believe that my strong technical experience and education will make me a very competitive candidate for this position. The key strengths that I possess for success in this position include:

- I have successfully designed, developed, and supported live use applications
- I strive for continued excellence
- I provide exceptional contributions to customer service for all customers

With a BS degree in Computer Programming, I have a full understanding of the full life cycle of a software development project. I also have experience in learning and excelling at new technologies as needed.
Please see my resume for additional information on my experience.
I can be reached anytime via email at george.gillhooley@email.com or my cell phone, 909-555-5555.
Thank you for your time and consideration. I look forward to speaking with you about this employment opportunity.

Sincerely,
FirstName LastName

(from http://jobsearch.about.com/od/morejobletters/a/jobappletter.htm)

Sample of cover letter

64 Minehead Avenue
Withington
Manchester
M20 1FW
Telephone: 07123 456 789
Email: adam.jones@hotmail.co.uk

Mr. Graham Stoker
Graduate Recruitment Manager
Smith Partners
16 Arlington Road
Manchester
M14 6LZ
25 October 2010
Dear Mr Stoker,
Re: 355/001: Graduate Trainee – Audit

I would like to apply for the graduate trainee - audit programme, currently advertised on WikiJob.co.uk. I enclose my CV for your consideration.

I first became interested in audit during my first year of university, when I attended a presentation by Smith Partners. Audit appeals to my long standing interests in business and mathematics, and I feel is a function that would allow me to see projects through from start to finish, working relatively autonomously.

I am particularly attracted to working at Smith Partners because of the firm‘s excellent reputation, focus on client value, and the opportunity to train for the CIMA qualification, which will help me develop my skills and career. I met with current graduate trainees at the Smith Partners September open day and was impressed by the friendliness of employees and very positive descriptions of working life, at the firm.

I come from an advanced academic and analytical background having completed a degree in finance and mathematics at the University of Manchester and believe I am well qualified to add value to the audit team at Smith Partners. I have extensive experience working as an accounts clerk at Driftbridge Plc, speak several foreign languages and have advanced workplace skills in management, people development and presenting. Having completed a degree and taken a gap year, I feel I am now ready to take up the challenge of full employment.

Thank you for your time and consideration. I am available for interview from 31st October onwards, and look forward to taking the opportunity to talk with you further about my application.

Yours sincerely,
Adam Jones

Sample of letter of recommendation

(From http://jobsearch.about.com/od/referenceletters/a/samplemanager2.htm)

I have known John Smith for the past year while he has worked as an Accounting Assistant in the Company Accounting Office. I have been consistently impressed by both John's attitude towards his work and his performance on the job. His interpersonal and communication skills have allowed him to develop productive working relationships with both our clients and our staff. John has the listening and interviewing skills necessary to extract information from our clientele while performing financial assessments. John possesses solid writing skills which have enabled him to compose quality correspondence. He also has the analytical skills to diagnose problems and devise viable solutions. His ability to remain unflustered during frenzied periods like tax season proves his ability to work well under pressure.

I recommend him for employment without reservation. Please let me know if you need further information.

Jane Doe
Title
Company
Address
Phone
Email

(From http://jobsearch.about.com/od/referenceletters/a/sampleemployer.htm)

To Whom it May Concern:

I highly recommend Jane Doe as a candidate for employment. Jane was employed by Company Name as an Administrative Assistant from 2002 - 2005. Jane was responsible for office support including word processing, scheduling appointments and creating brochures, newsletters, and other office literature. Jane has excellent communication skills. In addition, she is extremely organized, reliable and computer literate. Jane can work independently and is able to follow through to ensure that the job gets done. She is flexible and willing to work on any project that is assigned to her. Jane was quick to volunteer to assist in other areas of company operations, as well.

Jane would be a tremendous asset for your company and has my highest recommendation. If you have any further questions with regard to her background or qualifications, please do not hesitate to call me.

Sincerely,
John Smith
Title
Company

Sample of letter of complaint

Look through the letter of complaint and answer the following questions:
1) What is the topic of each paragraph?
2) Is it formal or informal letter? Is it mild or strong? Prove it.
3) Underline the mild / strong expressions, and then replace them with the appropriate expressions of opposite style. For example, if the letter is strong, underline strong expressions, and then replace them with the appropriate expressions of the mild style.

Dear Sir / Madam,

On Friday 4 October 2002, I travelled on the 09.36 from Woodgreen to Gatwick. The train was due to arrive in Gatwick at 11.00 but was an hour and twenty minutes late on arrival due to the train's engine failing. We had to wait for the arrival of another engine to push us into the next station, where we had to change onto another train.

As a consequence of this late arrival, I was late for my flight check-in and was only allowed onto the plane thanks to the cooperation of the airline staff. Needless to say I was made very distressed and anxious by this failure of your service. The anxiety was made worse by the lack of information we were given by your train staff.

I understand that the engine that failed dates from the 1960s. In spite of maintenance programmes, such old rolling stock must be unreliable. I am very surprised that your company continues to use such old equipment. I think it increases your responsibility for the delay.

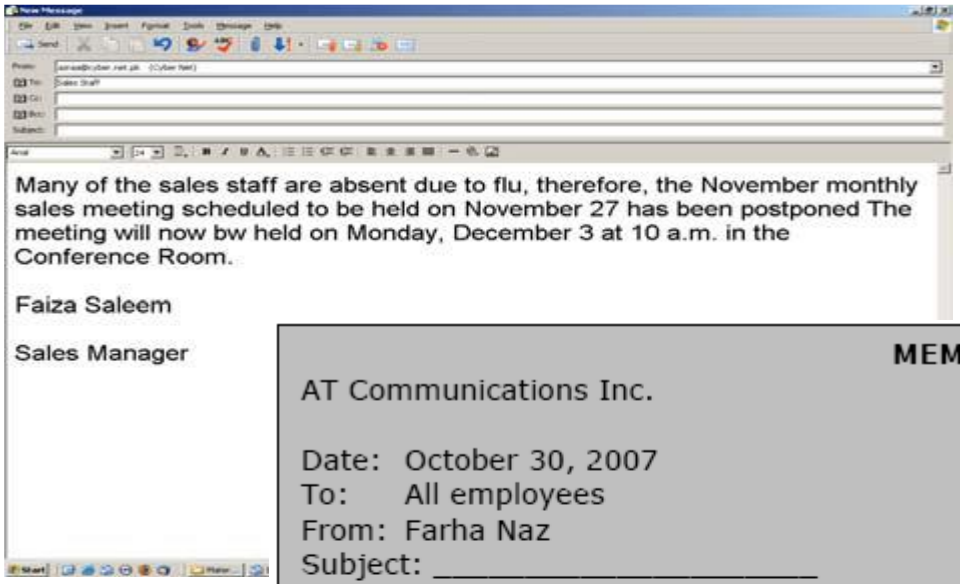
I am enclosing my ticket for the journey. I expect a full refund of the fare and some monetary compensation for the inconvenience and anxiety I suffered as a result of your inadequate service. I shall expect your cheque within fourteen days of this letter.

Thank you for taking the time to read this letter. I have been a satisfied customer of your company for many years and this is the first time I have encountered a problem. If you need to contact me, you can reach me at (555) 555-5555.

Yours faithfully
J. M. Jones

Sample of memo

Read the memos and write the correct subject on the subject line of each memo. Choose from the subjects given below.



Many of the sales staff are absent due to flu, therefore, the November monthly sales meeting scheduled to be held on November 27 has been postponed The meeting will now bw held on Monday, December 3 at 10 a.m. in the Conference Room.

Faiza Saleem

Sales Manager

MEMO

AT Communications Inc.

Date: October 30, 2007
To: All employees
From: Farha Naz
Subject: _____

The new company health club has been completed and will be open from Monday, November 12. Opening hours will be 7:00 a.m.– 9:00 p.m. and 5:30-9:30 p.m. Monday to Friday.

If you would like to use the health club, please fill out the attached registration form.

a) Company health club
b) New general manager
c) New sales manager
d) Closure of cafeteria
e) Meeting postponed
f) Conference rooms

Raza Optics Ltd

MEMO

Date: October 30, 2007
To: All staff
From: Rehan Ali
Subject: _____

Arifa Rehman has been appointed General Manager following the retirement of Zubeda Hussain. All staff are requested to attend an informal meeting in the cafeteria Monday November 5 at 4:30 p.m. where they will be introduced to Ms Rehman.

Sample of agenda

Our Venture: "Reading Across Ages"
Meeting Agenda, February 1, 2005
Members Present: Keisha, Joe, Tara, Lia, Eli
Purpose: To evaluate our first week of venture implementation and set our next priorities for planning our venture launch.

Facilitator: Keisha
Recorder: Lia
Timekeeper: Joe
Evaluator: Eli

Report: Check-in on last week's priorities and assignments. (10 minutes)
Publicity and Outreach: Tara
Youth Recruitment: Joe
Tutor Recruitment and Training: Eli
School and Teacher Partnerships: Lia
Fund-Raising, Finances and Supplies: Keisha
Evaluation: Joe and Tara

Agenda Items:

1. (Discussion, 10 minutes) Update priority list from last week—cross off work completed, and carry over any work to this week. What needs to happen for next week? How is the work going? Successes and Challenges? Propos to stuff completed!
2. (Check-in, 5 minutes) Update our master calendar—add any new items, cross off work completed, revise some dates as needed.
3. (Discussion, 10 minutes) Challenges with finding enough youth tutors. Need group to brainstorm possible volunteers, different groups and schools to speak to about the program.
4. (Discussion, 10 minutes) Challenges working with one particular teacher—how to address some issues with working in classroom 301 at elementary school.
5. (Decision, 5 minutes) Group needs to approve the draft flyer for advertising program to youth participants.
6. Plan for next week (5 minutes): set preliminary agenda for next week's meeting, solidify individual and/or committee assignments.
7. Evaluate (5 minutes): What worked, what didn't?

Appendix 8. Criteria for letter assessment

Criteria for assessment letter		
Question	**Yes/no**	**Comments**
Content		
1. Is the content appropriate to the audience and purpose of the letter?		
2. Does the letter contain sufficient information?		
3. Is the content relevant?		
Language		
4. Is the language appropriate to the audience and purpose of the letter?		
5. Is the language reasonably grammatical?		
Format and layout		
6. Has the format of a formal letter been used?		
7. Have the layout conventions of formal letters been followed? (spacing, subject, indentation etc)		

Appendix 9. Computer-assisted language learning environment

№	Вид ресурса	Краткое описание
1.	Программы машинного перевода ПРОМТ, Транслейт и др.	Данные интернет-ресурсы знакомят студентов с различными программами машинного перевода, что представляет собой возможность проведения сравнительного анализа использования различных программ-переводчиков (см. приложение 12).
2.	http://www.intute.ac.uk/	Данный ресурс представляет собой обширную базу данных, в которой имеется широкая коллекция разнообразной информации по различным дисциплинам и сферам деятельности. Кроме того, на данном сайте студенты могут найти и другие полезные для себя сервисы, например, internet training,virtual training suite и т.д.
3.	http://www.academicearth.org/	На данном интернет-ресурсе представлена широкая подборка видеоматериалов по различным учебным дисциплинам, представляющих собой подборку лекций. На основе материалов данного ресурса возможно создание презентаций и проведение дискурсивного анализа.
4.	http://www.abc.net.au/rn/scienceshow/ http://www.podfeed.net/ http://www.bbc.co.uk/	Приведенные интернет-ресурсы обладают обширными базами данных по аудированию. На первом сайте имеется аудиозаписи, связанные с научной тематикой. Второй интернет-ресурс представляет собой постоянно обновляемую коллекцию подкастов по самым актуальным темам современности. Третий сайт позволяет аудировать радиопрограммы BBC.
5.	http://info.ox.ac.uk/bnc .	Британский национальный корпус, насчитывающий более ста миллионов слов. Сайт позволяет получить информацию об употреблении любого слова или словосочетания в разных контекстах. После введения искомого слова в поисковый экран пользователь получает до 50 аутентичных предложений

		из БНК, которые могут использоваться для перевода, составления глоссария и т. д. (см. пример ниже).
6	http://www.lextutor.ca/	Сайт содержит большое количество различной информации, полезной для самостоятельного изучения английского языка. С помощью данного сайта можно проверить свои знания, постоянно обогащать лексический запас с помощью различных упражнений и чтения и прослушивания литературных произведений.
7	http://www.thesaurus.com/	Ресурс для поиска определений слов, их синонимов и антонимов
8	http://www.merriam-webster.com/	Ресурс для поиска определений слов, их этимологии и произношения.
9	http://www.multitran.ru/ http://lingvo.abbyyonline.com/	Электронные словари, причем Мультитран является наиболее эффективным ресурсом
10	http://www.concordancesoftware.co.uk/	Программы-конкордансы работают с большими объемами текстов, обеспечивая данные по частотности слов и их сочетаемости, представление заданного слова в контексте и т.д. (см. приложение 12).

Example of the task fulfilled with the use of British National Corpus

The British National Corpus (BNC) is a 100-million-word text corpus of samples of written and spoken English from a wide range of sources. It was compiled as a general corpus (collection of texts) in the field of corpus linguistics. The corpus covers British English of the late twentieth century from a wide variety of genres with the intention that it will be a representative sample of spoken and written British English of that time.

The BNC Simple Search is a quick and simple way to search the full BNC for a word or a phrase. The result of a search is displayed as a list of up to 50 randomly selected instances headed by a note of the total frequency of the search string. A new search for the same string will generate a different set of randomly selected examples. The source of each example can be checked by clicking on the text code preceding each line.

Section 1. Translate the following sentences

1. It crosses two mountain ranges, 561 rivers, 124 km of **permafrost** and more than 1000 km of West Siberian bog and marsh on its journey through five time zones to Western Europe.

2. It was, for example, quite common in the last century for ivory objects to be carved from mammoth tusk that had been preserved in the **permafrost** of the Siberian tundra since the last Ice Age!

3. The region is characterized by **permafrost**, and smectite and kaolinite are the common authigenic clay minerals in the soils.

4. The co-discoverers, fossil hunters John D. Hansom and Roderick Luckey, were inspired to explore the Kilimanjaro glacier by the success of Russian palaeontologists in retrieving whole frozen mammoths from the Siberian **permafrost**.

5. Local thicknesses and effects of **permafrost** are discussed by Tedrow and Brown (1967) for the North American high arctic tundra, Chernov (1985) for the Siberian Arctic, and by papers in Campbell (1966) for Antarctica.

6. The spruce, fir, pine, larch, oak and birch trees cut down will taken centuries to replace because growth is slow on the **permafrost**.

Section 2. Prepare the BNC Concordance of the word «PERMAFROST»

№	Left context	Nuclear word	Right context
1.	miles of the bleak, barren	**permafrost,**	where blindness eventually came
2.	evaporate deposits or	**permafrost**	structures are not known
3.	Fulton lay on the	**permafrost,**	miming a cerebral haemorrhage.
4.	discontinuous or patchy	**permafrost**	underlies much of the Subarctic
5.	Human influence upon	**permafrost**	and upon endogenetic processes.

Appendix 10. Guidelines for synopses and annotations

How to Summarize

A ***summary*** is a shorter version of a longer piece of writing. The summary captures all the most important parts of the original, but expresses them in a shorter space. Summarizing involves putting the main ideas into your own words, including only the main points. Summaries are significantly shorter than the original and take a broad overview of the source material.

Follow the steps outlined below to write a summary:

3. Read the original *carefully* in order to understand it *completely* and *accurately*.
4. Group the original writing into related paragraphs or sections.
5. Write a *one* or *two* sentence summary for each group of related paragraphs. These sentences should reflect the *main idea* of each section accurately.
6. Write *one sentence* which gives the main idea of the entire writing.
7. Start with a *summary introduction*, which includes the *name* of the article or book, the *author* and if appropriate the date and name of the *journal, magazine or newspaper* in which the article appeared. Include in your summary introduction your statement of the overall thesis of the original. Follow this with the sentence you wrote for each group of related paragraphs, keeping them in the order of the original.
8. In your final draft, eliminate repetitions and generally make your summary coherent.

When summarizing, follow the guidelines listed below:

* Include only the main points of the original passage
* Do not worry about following the original order of ideas.
* Keep the length down to no more than half the length of the original.

Here is an example of summarizing provided by Summer Leibensperger (the Academic Center, the University of Houston-Victoria, http://www.uhv.edu/ac/research/write/):

Original Passage:

Height connotes status in many parts of the world. Executive offices are usually on the top floors; the underlings work below. Even being tall can help a person succeed. Studies have shown that employers are more willing to hire men over 6 feet tall than shorter men with the same credentials. Studies of real-world executives and graduates have shown that taller men make more money. In one study, every extra inch of height brought in an extra $1,300 a year. But being too big can be a disadvantage. A tall, brawny football player complained that people found him intimidating off the field and assumed he "had the brains of a Twinkie." (Locker, K.O. (2003). Business and administrative communication, p. 301)

Let's first identify the main points in the original passage.

Topic sentence: "Height connotes status in many parts of the world."
Main point: "Even being tall can help a person succeed."
Main point: "Executive offices are usually on the top"
Main point: "being too big can be a disadvantage"

Summary:

Though height may connote slowness to some people, in the business world, it is almost universally associated with success. For example, taller men are more likely to be hired and

to have greater salaries. Further, those in top positions within a company are more likely to work on the top floors of office buildings (Locker, 2003).

How to Write Annotations

An ***annotation*** is a summary made of information in a book, document, online record, video, software code or other information. Annotated bibliographies give descriptions about how each source is useful to an author in constructing a paper or argument. Creating these comments, usually a few sentences long, establishes a summary for and expresses the relevance of each source prior to writing.

As you read, section by section, chapter by chapter, consider doing the following, if useful or necessary:

* At the end of each chapter or section, briefly summarize the material.

* Title each chapter or section as soon as you finish it, especially if the text does not provide headings for chapters or sections.

* Make a list of vocabulary words on a back page or the inside back cover. Possible ideas for lists include the author's special jargon and new, unknown, or otherwise interesting words. Annotating requires you to think critically about a text.

How to Write an Abstract

The purpose of an ***abstract*** is to serve as a link between the title of a scientific article (research study) which may be only a few words long and the full article which may be 8-10 or more pages long. The abstract is a useful summary of the article that provides justification for the research. The abstract allows the reader to conclude whether the full article is worth reading.

The abstract should outline the objectives of the research study and its rationale. The materials and methods of the study should be stated with the statistical methods used. The results of the research should be concisely stated. A brief interpretation with the supporting statistics should be provided and a conclusion briefly stated.

There are two main types of abstracts: informative and descriptive ones.

An ***informative abstract*** summarizes the entire paper, including the key themes and purpose of the paper, major facts bearing on the conclusion, and a summary of key findings. This is the most common type of abstract.

A ***descriptive abstract***, on the other hand, concentrates on identifying the purpose of the paper, and describing the major areas to be covered in the report. It would be appropriate, for instance, in a review paper reporting on a survey of literature in a particular field.

Task: look through the rules of summarizing, annotating and abstracting given above and prepare informative and descriptive summaries (1200 and 300 symbols accordingly) of the texts on interdisciplinary issues. Prepare informative and descriptive annotations as well.

Appendix 11. Written practice exercises

1) Explain the necessity of using italicized articles in the following passage

Schools can also be grouped by **1)** ***the*** types of programs and degrees they offer. **2)** ***The*** three major groups are community colleges, 4-year colleges, and universities. Community colleges (sometimes called junior colleges) offer only **3)** ***the*** first 2 years of undergraduate studies **4)** **(*the*** freshman and sophomore years). They enroll about 5 million students **5)** ***a*** year. Most community colleges are public schools, supported by local and / or state funds. They serve two general types of students: those taking **6)** ***the*** first 2 years of college before they transfer to **7)** ***a*** 4-year school for their third and fourth (junior and senior) years and those enrolled in 1- or 2-year job-training programs. What is **8)** ***the*** difference between **9)** ***a*** college and **10)** ***a*** university? Size is only part of **11)** ***the*** answer. Some colleges have **12)** ***a*** student body of just **13)** ***a*** few hundred, while some state universities serve more than 100,000 students on several campuses?

2) Fill in the gaps with the correct article where necessary

As with 1) …… schools system, so also with higher education: there is 2) …… real problem about the exclusivity of Britain's two 3) …… oldest universities. While Oxbridge is no longer the preserve of social elite, it retains its exclusive, narrow and spell-binding culture. Together with 4) …… public school system, it creates a narrow social and intellectual channel from which 5) …… nation's leaders are almost exclusively drawn. In 6) …… 1996 few people were in 7) …… top jobs in the Civil Service, the armed forces, 8) …… law or finance, who had not been either to a public school or Oxbridge, or to both.

Education and literacy are 9) …… important parts of modern life. Literacy has 10) …… impact on 11) …… individual's ability to participate in society and to understand important public issues. And it provides 12) …… foundation upon which skills needed in 13) …… labour market are built.

Unit 2

1) Explain the necessity of using italicized linking words and phrases in the following passage

1) For example, estimates of the amount of warming that would result from a doubling of greenhouse gas concentrations range from 3.6 degrees to 8 degrees Fahrenheit. The intergovernmental climate panel said it could not rule out even higher temperatures. ***2) While*** the low end could probably be tolerated, the high end would almost certainly result in calamitous, long-lasting disruptions of ecosystems. ***3) Moreover***, a wide range of economists and earth scientists say that level of risk justifies an aggressive response. ***4) By the way***, some questions have persisted ***5) despite of the fact that*** a century-long accumulation of studies points to human-driven warming. The rate and extent at which sea levels will rise in this century as ice sheets erode remains highly uncertain, ***6) even as*** the long-term forecast of centuries of retreating shorelines remains intact. Scientists are struggling more than ever to disentangle how the heat building in the seas and atmosphere will affect the strength and number of tropical cyclones. ***7) Furthermore,*** the latest science suggests there will be more hurricanes and typhoons that reach the most dangerous categories of intensity, ***8) but*** fewer storms over all.

2) Fill in the gaps with the linking words from the box

In addition so particularly thus for example moreover although furthermore finally also

Science and technology have always been in mutual interaction. 1) ……, there is a deep symbiosis between discovery in science and new technology. 2) …… today scientific collaboration between different countries is considered to be a quite important part of science development. 3) …… scientific collaboration leads to formation of scientific knowledge of ordinary people. 4) ……., having a population that has strong literacy skills also places a country in a better position to meet the complex social challenges that it faces. 5) ……., strong literacy skills are linked to better health outcomes for individuals. 6) …….. highly literate population will be better able to deal with issues of governance in a highly diverse society. Using new technologies in science is quite significant for development of new branches of science as well. 7) ……., since the human race has been swiftly advancing with regards to technology, new branches of engineering are being developed. 8) …….. engineering jobs can now be found in the following fields: computer engineering, software engineering, nanotechnology, molecular engineering, mechatronics and many more. 9) …….. all these fields may be defined differently, there is generally a great overlap, 10) …….. in the fields of physics, chemistry and mathematics.

Unit 3

1) Explain the necessity of using italicized pronouns in the following passage

A university is usually bigger than a college because the scope of **1) *its*** programs is much greater. **2) *It*** offers a wider range of undergraduate programs plus graduate studies. Part of the responsibility of a university is to encourage **3) *its*** faculty and graduate students to do research to advance human knowledge. Colleges, on the other hand, are primarily undergraduate schools. They have no obligation to conduct research. Many excellent colleges are liberal arts schools, **4) *which*** means that **5) *they*** offer studies in the humanities, languages, mathematics, social sciences, and sciences. **6) *They*** generally do not offer degrees in engineering, business, journalism, education (teacher training), and many other specific vocations **7) *that*** a student can prepare for at a university.

2) Fill in the gaps with pronouns from the box. Some of them can be used more than once.

It (4)	this	which (3)	them	its

Why does man use metals still so much today when there are other materials, especially plastics, 1) …… are available? A material is generally used because 2) …… offers the required strength, and other properties, at minimum cost. The main advantage of metals is their strength and toughness.

Plastics are lighter and more corrosion-resistant, but they are not usually as strong. Another problem with plastics is what to do with 3) …… after use. Metal objects can often be recycled; plastics can only be dumped or burned. Not all metals are strong, however. Copper and aluminum, for example, are both fairly weak — but if they are mixed together, the result is an alloy called aluminum bronze, 4) …… is much stronger than either pure copper or pure aluminum.

The properties of a metal can be further improved by use of heat treatment. 5) …… usually consists of heating the metal or alloy to a selected temperature below 6) …… melting point and then cooling 7) …… at a certain rate to obtain those properties which are required. For example, hardening is used to make metals harder. Tempering makes them softer and less brittle. Annealing is carried out to make a metal soft so that 8) …… can be machined more easily. Methods of extracting, producing, and treating metals are being developed all the time to meet engineering requirements. 9) …… means that there is an enormous variety of metals and metallic materials available from 10) ……to choose.

Unit 4

1) Explain the necessity of using italicized articles in the following passage

At ***1) the*** core of science's self-modification is technology. New tools enable new structures of knowledge and new ways of discovery. ***2) The*** achievement of science is to know new things; ***3) the*** evolution of science is to know them in new ways. What evolves is less ***4) the*** body of what we know and more ***5) the*** nature of our knowing. I'm willing to bet ***6) the*** scientific method 400 years from now will differ from today's understanding of science more than today's science method differs from ***7) the*** proto-science used 400 years ago. ***8) A*** sensible forecast of technological innovations in ***9)*** next 400 years is beyond our imaginations (or at least mine), but we can fruitfully envision technological changes that might occur in ***10) the*** next 50 years.

2) Fill in the gaps with the correct article where necessary

Ever since 1) …….. Soviet Union fell apart in 1991, 2) …….. Russian leaders have been vowing to transform their old-line, industrial society into 3) …… modern, knowledge-based economy driven by 4) …… innovative science and technology. Unfortunately, that transformation continues to be hobbled by outdated attitudes at 5) …… top of Russia's academic hierarchy. 6) …….. small, but telling example came to light last month when 7) …….. popular online newspaper gazeta.ru published 8) …… interview with Yuri Osipov (in Russian), president of 9) …… Russian Academy of Sciences in Moscow. Pressed by 10) …… reporter about the very low citation rate for articles published in Russian-language science journals, Osipov dismissed 11) …… relevance of citation indices, questioned 12) …… need for Russian scientists to publish in foreign journals and said that any top-level specialist "will also study Russian and read papers in Russian".

Unit 5

1) Explain the necessity of using italicized linking words and phrases in the following passage

During the past several decades the conference has redefined other base SI units to vastly improve their accuracy and ***1) thus*** keep them in step with the advancement of scientific and technological understanding. The standards for the meter and the second, ***2) for example***, are now founded on natural phenomena. The meter is tied to the speed of light, ***3) whereas*** the second has been related to the frequency of microwaves emitted by a specific element during a certain transition between energy states. Today the kilogram is the last remaining SI unit still based on a unique man-made object. Metrologists (specialists in measurement) are ***4) therefore*** striving to define mass using techniques depending only on unchanging properties of nature. ***5) Because*** scientists measure constants in SI units (including the kilogram), any

drift in the IPK's real mass will give rise to a drift in the value of a measured constant – a seeming paradox for what is commonly considered an immutable phenomenon. In the process of more accurately redefining the kilogram independently of the IPK, ***6) however***, scientists will choose a best estimate of the constant's value and ***7) thus*** "fix" it.

2) Combine sentences wherever possible. Use linking words.

1) A robot is a mechanical device that can perform boring, dangerous, and difficult tasks. 2) First of all, robots can perform repetitive tasks without becoming tired or bored. 3) They are used in automobile factories to weld and paint. 4) Robots can also function in hostile environments. 5) They are useful for exploring the ocean bottom as well as deep outer space. 6) Finally, robots can perform tasks requiring pinpoint accuracy. 7) 1n the operating room, robotic equipment can assist the surgeon. 8) For instance, a robot can kill a brain tumor. 9) It can operate on a fetus with great precision. 10) The field of artificial intelligence is giving robots a limited ability to think and to make decisions. 11) However, robots cannot think conceptually. 12) Robots cannot function independently. 13) Humans have to program them. 14) They are useless. 15) Therefore, humans should not worry that robots will take over the world-at least not yet.

Unit 6

1) Explain the necessity of using italicized pronouns in the following passage

Metrologists ascertained the mass of the crystal sphere by "substitution weighing" using a conventional balance and a "tare mass," ***1) whose*** mass must be stable but need not be known. 2) ***They*** placed the sphere on a balance and compared ***3) it*** against a separate one-kilogram tare mass sitting on the other arm of the balance. ***4) They*** then substituted the sphere with a mass known in terms of the IPK mass standard and repeated the weighing process. Because the substitution was carried out so that the balance remained unaffected by the switch, the difference in the two readings gave the difference in mass between the sphere and the mass standard, ***5) which*** revealed the mass of the sphere. This method eliminated error arising from factors such as unequal lengths of the balance arms. The researchers also analyzed other samples of the silicon material to establish the relative abundance of the various isotopes to account for their differing contributions to the molar mass of the sphere. To accomplish this task, ***6) they*** had to determine the proportion of the three isotopes – silicon 28, silicon 29 and silicon 30 – present in the natural silicon crystal. For this step they used mass spectroscopy, ***7) which*** separates charged isotopes according to their different charge-to-mass ratios.

2) Fill in the gaps with pronouns from the box. Some of them can be used more than once.

It (4)	that (2)	this	its

The Russian Academy of Sciences was founded in 1725. 1) …… is the chief coordinating body for scientific research in Russia through 2) …… science councils and commissions. 3) …… means that it controls network of nearly 100 research institutes. 4) …… has sections of physical, technical, and mathematical sciences; chemical, technological, and biological sciences, and earth sciences, and controls a network of nearly 300 research institutes. The Russian Academy of Agricultural Sciences, 5) …… was founded in 1929, has departments of plant breeding and genetics; arable farming and the use of agricultural chemicals; feed and fodder crops production; plant protection. 6) …… controls a network of nearly 100 research institutes. 7)

…… supervises a number of research institutes, experimental and breeding stations, dendraria and arboreta. The Russian Federation in 2002 had 3,415 scientists and engineers, and 579 technicians engaged in research and development (R and D) per million people. Of 8) …… amount, the largest portion, 58.4%, came from government sources, while business accounted for 30.8%.

Unit 7

1) Explain the necessity of using italicized articles in the following passage

Skolkovo is ***1) the*** centerpiece of Medvedev's drive to create ***2) a*** new kind of economy. ***3) A*** nondescript Soviet-era suburb 40 kilometers outside Moscow, Skolkovo is already home to Russia's leading business school, which is (crucially) private but receives some state research money. ***4) The*** new innovation city is inspired by ***5) the*** relationship between Stanford University and Silicon Valley, or ***6) the*** Massachusetts Institute of Technology and ***7) the*** Route 128 tech firms outside Boston: ***8) a*** place where academic brains can find ***9) the*** private and government money they need to launch startup companies. 10) ***The*** new Skolkovo will be "***11) a*** real city of ***12) the*** future," says oil baron Viktor Vekselberg, Russia's 10th-richest man and Medvedev's choice to organize ***13) the*** business side of Skolkovo, selecting ***14) the*** best ideas for ***15) the*** state to back as startups. Construction is already underway on ***16) a*** 300-hectare plot that will be protected by walls and gates.

2) Fill in the gaps with the correct article where necessary

1) ..... question raised became known as 2) ……. Poincaré conjecture. Over 3) …… years, many outstanding mathematicians tried to solve it--Poincaré himself, Whitehead, Bing, Papakirioukopolos, Stallings, and others. While their efforts frequently led to 4) …… creation of significant new mathematics, each time 5) …… flaw was found in the proof. In 1961 came astonishing news. Stephen Smale, then of the University of California at Berkeley (now at the City University of Hong Kong) proved that 6) …….. analogue of the Poincaré conjecture was 7) …… true for spheres of five or more dimensions. The higher-dimensional version of the conjecture required 8) …… more stringent version of Poincaré's test; it asks whether 9) …… so-called homotopy sphere is 10) …… true sphere. Smale's theorem was 11) ……. achievement of extraordinary proportions. It did not, however, answer Poincaré's original question. The search for an answer became all the more 12) …… alluring.

Unit 8

1) Explain the necessity of using italicized linking words and phrases in the following passage

The inconstancy that plagues the definition of the kilogram previously affected the second and the meter. Scientists once defined the second in terms of the rate of rotation of the earth. In 1967, ***1) however***, they redefined it to be "the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium 133 atom." Metrologists introduced this change because the rotation rate of our planet is not constant, ***2) whereas*** the wavelength of the radiation emitted by cesium 133 during a specific transition. ***3) Although*** this definition is not based on an artifact, it suffers from its dependence on a particular transition of a specific atom, which unfortunately turns out to be more sensitive to electromagnetic fields than is desirable. ***4) Unfortunately***, the definition may need to be changed in the future to accommodate the even more precise optical

clocks that physicists are now developing. The definition of the meter, ***5) on the other hand***, is firmer. ***6) All in all***, this definition should also be resilient because it fixed the value of a key physical constant, the speed of light, at exactly 299,792,458 meters a second. ***7) Thus,*** progress in the control and measurement of the frequency of electromagnetic radiation (the number of sinusoidal vibrations a second) will merely improve the accuracy with which scientists can measure the meter – with no change in the unit's definition required.

2) Fill in the gaps with the linking words from the box

So by the way thus despite of the fact as for example as a consequence as a matter of fact according to while

1) …… that today many university science and technology departments, 2) …… at Oxford, Cambridge, Manchester, Imperial College London, and Strathclyde, are among the best in Europe, there is a concern about its value in the future. 3) …… statistics, Academics' pay has fallen so far behind other professions and behind academic salaries elsewhere, 4) …….. many of the best brains have gone abroad. 5) …….. adequate pay and sufficient research funding to keep the best in Britain remains a major challenge. 6) …… with the schools system, 7) …… also with higher education: there is a real problem about the exclusivity of Britain's two oldest universities. 8) …… Oxbridge is no longer the preserve of a social elite, it retains its exclusive, narrow and spell-binding culture. 9) …… it creates a narrow social and intellectual channel from which the nation's leaders are almost exclusively drawn together with the public school system. 10) ……. in 1996 few people were in top jobs in the Civil Service, the armed forces, the law or finance, who had not been either to a public school or Oxbridge, or to both.

Unit 9

1) Explain the necessity of using italicized pronouns in the following passage

A growing body of scientific evidence indicates that since 1950 the world's climate has been warming. ***1) It's*** a result of emissions from unfettered burning of fossil fuels and the razing of tropical forests. ***2) This*** adds to the atmosphere's invisible blanket of carbon dioxide and other heat-trapping "greenhouse" gases. Recent research has shown that methane, ***3) which*** flows from landfills, livestock and oil and gas facilities, is a close second to carbon dioxide in impact on the atmosphere. Other questions have persisted despite a century-long accumulation of studies ***4) that*** point to human-driven warming. The rate and extent at ***5) which*** sea levels will rise in this century as ice sheets erode remains highly uncertain, even as the long-term forecast of centuries of retreating shorelines remains intact. Scientists are struggling more than ever to disentangle how the heat building in the seas and atmosphere will affect the strength and number of tropical cyclones. The latest science suggests there will be more hurricanes and typhoons ***6) that*** reach the most dangerous categories of intensity, but fewer storms over all. Government figures for the global climate show that 2010 was the wettest year in the historical record, and ***7) it*** tied 2005 as the hottest year since record-keeping began in 1880.

2) Fill in the gaps with pronouns from the box. Some of them can be used more than once.

In addition to that furthermore it (2) those as well as (2) this which

The cooperation program accounts for over 60% of the available funding. 1) …….. allows European researchers to work together on collaborative research projects to advance knowledge, to propose solutions to some of the major issues facing us today and to develop new technologies for the future. 2) …… this fact, 3) …… promotes cooperation among universities, industry and research centers across the European Union, 4) …….. with the rest of the world. 5) …….. this program focuses on research in: health; food, agriculture and biotechnology; information and communication technologies. The ideas program is implemented through a new body, the European Research Council (ERC), 6) …… provides on average 1 billion Euro per year for investigator-driven frontier research in cutting-edge, "risky" areas. The first call for proposals focuses on early-stage independent investigators – 7) …… ready to set up their own team for the first time. Future calls will cater to all experience levels. The people program provides increased funding for Marie Curie actions, 8) ……. promote the training and mobility of researchers at all research career stages. 9) …….. includes fellowships for Europeans wanting to work in another European country; specific international activities to fund non-European researchers to work in Europe and to fund Europeans to work outside Europe; 10) …… reintegration grants for European researchers to return to Europe from abroad.

Unit 10

1) Explain the necessity of using italicized articles in the following passage

In some ways Medvedev's plan to create ***1) a*** legitimate outlet for tech talent is quintessentially Soviet. ***2) The*** idea of ***a*** city for scientists harks back to Stalin's purpose-built tech cities within ***3) the*** Gulag where selected scientists worked in conditions of privilege – and hatched such breakthroughs as ***4) the*** Soviet atom bomb. But in this era "you can't have ***5) a*** centrally planned innovative economy," warns Vladislav Inozemtsev, director of ***6) the*** Moscow-based Center for Post-Industrial Studies. "Nowhere in ***7) the*** world has ***a*** Silicon Valley blossomed because of decrees issued by bureaucrats, even if ***8) the*** decrees are backed up by government financing."

9) The failure of central planning does not necessarily spell doom for Skolkovo, because Medvedev is guided by ***10) a*** more modern vision of how to use subsidies to steer business development. Medvedev is pushing innovation as one of his "four I's," or pillars of modernization, ***11) the*** others being institutions, infrastructure, and investment. But truth be told, he's not making much progress. Russia built just 1,000 kilometers of roads last year, compared with ***12) the*** 47,000 kilometers built by China.

2) Fill in the gaps with the correct article where necessary

Global talks on climate change opened in Cancún, Mexico, in 1) …… late 2010 with 2) …… toughest issues unresolved, and 3) …… conference produced modest agreements. But while 4) …… measures adopted in Cancún are likely to have scant near-term impact on the warming of 5) …… planet, the international process for dealing with the issue got 6) …… significant vote of confidence. In the United States, on Jan. 2, 2011, the Environmental Protection Agency imposed its first regulations related to greenhouse gas emissions. 7) …….. immediate effect on 8) …… utilities, refiners and major manufacturers will be small, with 9) …… new rules applying only to those planning to build large new facilities or make major modifications to existing plants. President Obama vowed as 10) …… candidate that he would put 11) …… United States on 12) …… path to addressing climate change by 13)

…… reducing emissions of carbon dioxide and other greenhouse gas pollutants. He offered Congress wide latitude to pass climate change legislation, but held in reserve 14) …… threat of E.P.A. regulation if it failed to act. The deeply polarized Senate's refusal to enact 15) …… climate change legislation essentially called his bluff.

Unit 11 Revision

1) Explain the necessity of using italicized articles, linking words, and pronouns in the following passage

1) The present definition of ***2) the*** kilogram requires that all SI mass measurements carried out in ***the*** world be related to ***3) the*** mass of the IPK. ("Mass" is commonly equated with "weight," ***4) but*** technically ***5) the*** "mass" of ***6) an*** object refers to ***7) the*** amount of matter in ***8) it***, ***9) whereas 10) its*** "weight" is caused by ***11) the*** gravitational attraction between ***12) the*** object and ***13) the*** earth.) To forge ***14) this*** link, metrologists remove the IPK from ***15) its*** sanctuary every 40 years or so to calibrate ***16) the*** copies of ***17) the*** IPK ***18) that*** are sent to ***19) the*** International Bureau of Weights and Measures by ***20) the*** 51 national signatories of ***21) the*** "Meter Convention" – ***22) the*** treaty ***23) that*** governs the SI. Once equilibrated, ***24) these*** copies are used to calibrate all other mass standards of ***25) the*** member states in ***26) a*** long, unbroken sequence ***27) that*** propagates down to ***28) the*** weighing scales and other instruments employed in laboratories and factories around ***29) the*** globe. ***30) It*** makes economic sense to have ***31) a*** stable, unchanging standard of mass, ***32) but*** evidence indicates that the mass of the IPK drifts with time. By observing relative changes of ***33) the*** other mass standards fabricated at ***34) the*** same time as ***35) the*** IPK and by analyzing old and new measurements of mass-related fundamental constants (***36) which*** are thought not to change significantly over time), scientists have shown that ***37) the*** mass of the IPK could have grown or shrunk by 50 micrograms or more over the past 100 years.

2) Find and correct the sentence structure errors in the following article

In my child development classes, I'm learning about ways of keep girls interested in technology. Studies shows that girls and boys begin their school years equally interested in technology. After elementary school is the time that computers are less of an interest for girls. To sum up, boys keep up with computers and other technology throughout their educations more than girls, they get ahead in these the fields. Experts have come up with some suggestions for teachers and parents of girls to help them.

Girls need opportunities to experiment with computers. Despite of the fact that girls spend time on computers, but they usually just do their assignments then they log off. Since computer games and programs are often aimed at boys. Parents and teachers need to buy computer products that will challenge girls not only in literature and art, but also in math, science, and business is important.

Another suggestion is to put computers in places where girls can socialize. One reason many boys stay interested in technology is that it is something he can do on his own. Girls tend to be more interested in working with others and to share activities. Furthermore computer terminals are placed close to one another, girls work at them for much longer periods of time. To begin with, parents and teachers need to be aware that nothing beats positive role models. Teach them about successful women in the fields of business, scientific, and technology. Otherwise the earlier we start interesting girls in these fields, the better.

Unit 12 Revision

1) Explain the necessity of using italicized articles, linking words, and pronouns in the following passage

Global warming has become perhaps ***1) the*** most complicated issue facing world leaders. ***2) On the one hand***, warnings from ***3) the*** scientific community are becoming louder, as ***4) an*** increasing body of science points to rising dangers from ***5) the*** ongoing buildup of human-related greenhouse gases — produced mainly by ***6) the*** burning of fossil fuels and forests. ***7) On the other***, ***8) the*** technological, economic ***9) and*** political issues ***10) that*** have to be resolved before ***11) a*** concerted worldwide effort to reduce emissions can begin have gotten no simpler, particularly in ***12) the*** face of ***13) a*** global economic slowdown. Global talks on climate change opened in Cancún, Mexico, in late 2010 with ***14) the*** toughest issues unresolved, ***15) and 16) the*** conference produced modest agreements. ***17)*** But ***18) while*** the measures adopted in Cancún are likely to have scant near-term impact on ***19) the*** warming of ***20) the*** planet, ***21) the*** international process for dealing with ***22) the*** issue got ***23) a*** significant vote of confidence. ***24) The*** agreement fell well short of ***25) the*** broad changes scientists say are needed to avoid dangerous climate change in coming decades. But it laid ***26) the*** groundwork for stronger measures in ***27) the*** future, if nations are able to overcome ***28) the*** emotional arguments ***29) that*** have crippled climate change negotiations in recent years.

2) Fill in the gaps with the correct articles, linking words, and pronouns

Computer science began to be established as 1) …… distinct academic discipline in 2) …….. 1950s and early 1960s. 3) …… aim is more on understanding 4) …… properties of the programs used to implement software such as games and web-browsers, and using 5)…… understanding to create new programs or improve existing ones.

6) …… mechanical examples of computers have existed through much of recorded human history, the first electronic computers were developed in the mid-20th century (1940–1945). 7) …….. were the size of 8) …….. large room, consuming as much power as several hundred modern personal computers. Modern computers based on integrated circuits are millions to billions of times more capable than the early machines, and occupy 9) …….. fraction of 10) …….. space. Simple computers are small enough to fit into small pocket devices, and can be powered by 11) …….. small battery. Personal computers in their various forms are icons of 12) …….. Information Age and are what most people think of as “computers”. 13) ……., the embedded computers found in many devices from MP3 players and toys to industrial robots are 14) …….. most numerous. 15) ……., the number of computers that are networked is growing phenomenally. 16) …… very large proportion of personal computers regularly connect to 17) …… Internet to communicate and receive information. “Wireless” networking often utilizing mobile phone networks. 18) …….. has meant networking is becoming increasingly ubiquitous even in mobile computing environments.

Appendix 12. Intercultural communication

Intercultural communication is a very important part of modern world. This term can be explained as a way of how people from different countries and cultures act, communicate and perceive the world around them.

Read short articles about different cultures and try to find the way out of the curious situations given below.

Part 1. The Ring or «OK», this gesture was popularized in the USA during the early nineteenth century, apparently by the newspapers that, at the time, were starting a craze of using initials to shorten common phrases.

There are many different views about what the initials «OK» stand for, some believing it stood for «all correct» while others say that it means the opposite of «knock-out» that is, K.O. Another popular theory is that it is an abbreviation of «Old Kinderhook», from the birthplace of a nineteenth century American president who used the initials as a campaign slogan.

Which theory is the correct one we may never know, but it seems that the ring itself represents the letter «O» in the «OK» signal. The - «OK» meaning is common to all English-speaking countries and, although its meaning is fast spreading across Europe and Asia, it has other origins and meanings in certain places. For example, in France it also means «zero» or «nothing»; in Japan it can mean «money»; in some Mediterranean countries it is an orifice signal, often used to infer that a man is homosexual.

Situation

You have come to the USA on the exchange program. Once you invited a beautiful French girl to lunch. You were discussing your entering university when suddenly you used the sign «okay» to say that you had coped with your entrance exams perfectly. But the girl understood your sign wrong. She thought that you had failed your entrance exams. Try to explain to the girl this misunderstanding.

Answer the questions

1. Do you feel surprised or offended? Why?
2. What would you say to your friend in this situation?
3. What should we do to prevent cultural misunderstandings?
4. Do you know any signs that can lead to misconduct?

Part 2. All cultures can be subdivided into two types: universalist cultures and particularist ones. People from *universalist cultures* believe that there are certain absolutes that apply across the board, regardless of circumstances or the particular situation. What is right is always right. Wherever possible, you should try to apply the same rules to everyone in like situations. People from *particularist cultures* believe that how you behave in a given situation depends on the circumstances. What is right in one situation may not be right in another. You treat family, friends, and your ingroups the best you can, and you let the rest of the world take care of itself. (Their ingroups will protect them.) One's ingroups and outgroups are clearly distinguished. There will always be exceptions made for certain people. No culture, of course, will be exclusively universalist or particularist; all cultures will have elements of both poles – but cultures do tend to be more one than the other.

Situation 1

You are from a particularist culture, but you have emigrated recently to another country (a more universalist culture), where your good friend Mrs. Thompson lives and where you have been offered a job in the company where her husband works. You started work a few months ago, and everything went well until recently when you started having trouble with the day-care arrangements for your daughter. Because of this problem, you have been arriving an hour or more late to work at least twice a week. Yesterday Mr. Thompson, who manages the division you work in, complained to you about your tardiness and explained that you could not continue to come in late or you would get a reprimand in your personnel file.

You asked Mr. Thompson to do what he could to help you, but he explained that this was the standard policy and that to treat you differently would not be fair to the other employees. You are very hurt to be treated just like every other employee. After all, you are not just any employee; you are the friend of Mrs. Thompson and her husband. Friends make exceptions for friends, and other people understand this. You would certainly help them if they were in trouble. What should you do now?

Answer the questions

1. Do you feel surprised or offended? Why?
2. Why do you think Mr. Thomson behaves this way?
3. What would you say to him in this situation?
4. What do you think about match-making?
5. Do you believe the success of work doesn't depend on the match-making?

Situation 2

You are riding in a car driven by a close friend when he hits a pedestrian. There are no other witnesses and the pedestrian is bruised but not badly hurt. The speed limit in this part of town is 20 miles an hour, but you noticed that your friend was driving 35. His lawyer tells you that if you testify under oath that your friend was driving 20, he will suffer no serious consequences.

Answer the questions

1. Would you testify that your friend was driving 20 miles an hour? Why?
2. Would you change your answer if the pedestrian was badly hurt and your friend was going to suffer more serious consequences?
3. Percentage of Americans who said they would not testify that their friend was driving 20 miles an hour: 96%. Percentage of Venezuelans who said they would not: 34%. Why do you think people from the USA and Venezuela answered this way?
4. Do you believe that while life isn't necessarily fair, you can make it more fair by treating everyone the same or by treating everyone as unique? Why?
5. Do you think it is reasonable to lay your personal feelings aside (where possible) and look at situations objectively? Why?
6. What culture – universalist (like Americans) or particularist (like Venezuelans) – would you prefer to live and work, if you had choice? Why?

Situation 3

You come from a universalist culture, but you live and work in a particularist one. You have been asked to fill a vacancy in the division you manage, and you have been reviewing the qualifications of various candidates. You intend to select Mr. Chu, a man who has worked his way up through the organization. He scores the highest on all the criteria against which the candidates are being measured, namely, education, work experience, technical skills, and knowledge of the job and the organization.

You are surprised and disappointed to learn that your boss, who gives final approval, wants to hire the nephew of a certain well-connected family who may be in a position to steer a large government contract to your company. You believe this is very unfair with respect to Mr. Chu and that it is not good in the long run for the company to hire someone who does not have the skills to do the job. What do you do?

Answer the questions

1. Why do you think your boss behaved this way?
2. Would you say anything to your boss in such a situation or prefer to keep silence?
3. What do you think about match-making? What are the advantages and disadvantages of this strategy?
4. What would you prefer – to hire Mr. Chu and make him responsible for the contract involved or not to interfere in this process?

Part 3. One of the most important and frequently troublesome work-related cultural differences involves the phenomenon known as power distance. The significance of power distance actually extends well beyond the workplace, having as its focus the attitude of a society toward inequality—how cultures deal with distinctions between people in their access to power and their level of status—but it manifests especially strongly in work-place relations. In its most conspicuous manifestation, it determines the proper role of managers and subordinates and the nature of their interactions. Brief descriptions of the two poles of this concept, *high* and *low power distance,* are given below.

High Power Distance: These cultures accept that inequalities in power and status are natural or existential. People accept that some among them will have more power and influence than others, in the same way they accept that some people are taller than others. Those with power tend to emphasize it, to hold it close and not delegate or share it, and to distinguish themselves as much as possible from those who do not have power. They are, however, expected to accept the responsibilities that go with power, especially that of looking after those beneath them. Subordinates are not expected to take initiative and are closely supervised.

Low Power Distance: People in these cultures see inequalities in power and status as man-made and largely artificial; it is not natural, though it may be convenient, that some people have power over others. Those with power, therefore, tend to deemphasize it, to minimize the differences between themselves and subordinates, and to delegate and share power to the extent possible. Subordinates are rewarded for taking initiative and do not like close supervision.

No culture, of course, will be exclusively high or low in power distance – all cultures will have elements of both poles—but cultures do tend to be *more* one than the other. As always, individuals in any given culture, because of personal differences, can be anywhere along the continuum, and may very well be at one spot in one set of circumstances and

somewhere else in another set. On the whole, however, you should expect to find most individuals on the same side of the dichotomy as their culture in general.

Situation 1

You have been posted overseas with a nonprofit foreign aid organization. Your area of expertise is environmental cleanup, and the country in which you work is trying to recover from decades of abusing its natural resources, especially water. You are in charge of setting up a demonstration water-filtering plant in a certain district, but you are encountering strong resistance from the district supervisor. He wants to know if this technique has been tried anywhere else in his country, and when you say no, he asks why he should let you "experiment at [his] expense."

You point out that it's very important to see if this technique will work in his country. If it doesn't, then how much better it will be to know that now before going ahead and installing these plants in every district. He will be a hero for sponsoring this trial.

He says he will lose his job if this high-profile experiment fails and asks you why you can't know ahead of time if the plant is going to work. If you're not sure it's going to work, then you should spend more time perfecting the technology. "When the technology is perfect, then you can try it out in my district," he says. What do you do?

Answer the questions

1. Why do you think your supervisor behave this way?
2. Would you continue conduction of the experiment or prefer to stop?
3. What do you think about the improvement of the technology before starting the experiment?
4. What culture – high or low power distant – would you prefer to live and work, if you had choice? Why?

Situation 2

You are a team leader in the technical support division of a company working with new species of plant in a low power distance culture. Your company is famous for its informal and flat organizational culture: there are few layers of management and your engineers work for the most part on their own, only coming to you when they have a problem or a question. Your company has recently entered into an agreement with an offshore partner (in a high power distance culture) to provide you with software programmers for one of your important projects. These programmers will be with you for an eighteen-month period, and now, after the arrival of the first group, there are some problems.

The programmers do not seem willing or able to work without very close supervision and, in fact, seem unwilling to take responsibility for their work. They expect you to make even the most routine decisions, and they always check with you before undertaking even moderately important tasks. In dealing with internal clients (divisions that you and these foreign programmers are developing software for), they always defer to you and do not give these clients answers to their questions or responses to their requests on the spot, although it is well within their job description to do so. All this means you're having to spend a lot more time with these people than you should, so much that you have almost no time for your other employees. What should you do?

Answer the questions

1. Do you feel surprised? Why?
2. Why do you think your colleagues behave this way?
3. How would you cope with this situation?
4. Would you agree to supervise programmers and tell them what they should do?
5. Would you speak with programmers and explain to them what they should do and why and what they are responsible for?

Situation 3

You are an expatriate adviser working in an AIDS education program in a developing country. Your sponsoring organization has designed a peer teaching project that involves training high school seniors in basic AIDS prevention techniques, which they then teach to younger teenagers in special after-school workshops. Research in your own culture has shown that when teens get this particular message from other, older teens, they pay much more attention than when an adult lectures them on this topic.

Your organization has conducted a number of training sessions around the country for the seniors, a cadre of whom has already begun to hold the after-school workshops. At a meeting with an official from the Ministry of Health today, you heard that there have been numerous complaints about these workshops from teachers around the country. The teachers maintain that to have high school seniors holding classes undermines the teachers' respect and credibility. Apparently, there have already been discipline problems in some schools. "We put teachers on a pedestal in our culture," this official explained to you, "because of the high regard we hold for knowledge and a sound education. To have students teaching other students makes our teachers look bad." Now what?

Answer the questions

1. Why do you think Ministry of Health behaves this way? What are the real reasons for it?
2. What would you say to the representative of the Ministry of Health in this situation?
3. Would you continue to implement your project or prefer to quit it?
4. Do you really think that your project could make teachers look bad? Why? Why not?

Situation 4

You are an expatriate from a low power distance culture living in a high power distance country. You were about to return to your home culture when a large corporation in the overseas country hired you. They were looking in particular for the kind of marketing expertise your company is famous for. Now that you have been on board for a few months, you're not having a good time. Although these people say they hired you for your marketing know-how, whenever you try to make suggestions or changes in the way your new company does business, you meet with resistance.

Today your boss has had an unusually frank discussion with you, laying out the reasons for the trouble you're having. He says your problem is that you are too outspoken and don't know your place. You disagree with your superiors in front of others and sometimes correct them in front of others when they say something wrong. You also make too many decisions without checking with other people, even though, as your boss admits, you know more about the subject than those people do.

Now you're confused. You thought you'd been hired for what you know, but whenever you try to put what you know into practice, your supervisors seem offended. What do you do now?

Answer the following questions

1. Why do you think your boss behave this way?
2. What would you answer to your boss?
3. Do you believe it is reasonable to check with your colleagues even if you are sure in the correctness of your decision?
4. What would you do in this situation? Would you like to have a frank discussion with your boss and tell him your vision of situation?

Part 4. All cultures can be subdivided into two types: collectivist cultures and individualist ones. People from *collectivist cultures* believe that their own security and well-being ultimately depend on the well-being and survival of their group. A group is only as strong as its weakest members, so dividing the spoils evenly – increasing the well-being of everyone in the group equally – offers the greatest protection for all members.

People from *individualist cultures* believe rewards should be directly commensurate with one's level of effort.

No culture, of course, will be exclusively individualist or collectivist; all cultures will have elements of both poles – but cultures do tend to be more one than the other.

What culture do you belong to? Why do you think so?

Situation 1

You are a new employee in a company and eager to become a strong professional and a good friend for your coworkers. In dealing with your colleagues, you have tried to work collaboratively, offering assistance wherever you saw it was needed – assistance that was often very much appreciated – and expecting assistance in return. You have noticed, however, that whenever you have asked for help, your colleagues have been somewhat surprised and reluctant. One day you confronted one of your colleagues on this issue. You pointed out that you helped her a few days ago when she was behind on a project, but this week when you asked for her help, she said she was too busy. You asked her why she thought it was okay to take help but not to give it in return. She looked surprised and said, "But I never asked for your help. I thought you were just being kind. I certainly don't expect that kind of help."
What should you do in this situation?

Answer the questions

1. Do you feel surprised or offended? Why?
2. Why do you think your colleague behaved this way?
3. What would you say to the colleague in this situation?
4. Do you believe the success of the team guarantees the well-being of the individual members? Do you think that a group of people is more likely to succeed if they work as a team than if they work independently? Can you prove it with any example?
5. Do you believe it is reasonable to depend on yourself and succeed or fail based on your own individual actions? Why?
6. What culture – collectivist or individualist – would you prefer to live and work, if you had choice? Why?

Situation 2

You are working in a culture where people tend to be more collectivist, especially in the sense that group harmony and saving face are highly valued. You, on the other hand, feel that while harmony and saving face are good things in general, they can sometimes be more trouble than they're worth. You've noticed, for example, that people tend to tell you what they think you want to hear rather than the truth, especially if the truth isn't particularly pleasant. This bothers you because you take people at their word; you assume they mean what they say, or they wouldn't say it. You're not sure anymore if you can trust what people are telling you, if you can act on what they say. At the same time, you're beginning to sense that you may be rubbing some people the wrong way by "telling it like it is." Today, any doubts you had about this were removed when your manager called you into his office. He said several colleagues had complained that you weren't "very careful" in how you spoke, that you said things "more strongly" than was necessary, and that you didn't take people's feelings into account. What would you do if you were in this situation?

Answer the questions

1. Do you feel surprised or offended? Why?
2. What would you say to the manager in this situation?
3. What do you prefer – to tell people the truth in any situation or to tell the truth omitting strong words?
4. How would you continue the conversation with the manager? Would you argue or confess your impoliteness?

Part 5. All cultures can be subdivided into two types: monochrome and polychrome cultures.

Monochrome: Time is a commodity; it is quantifiable and there is a limited amount of it. Therefore, it is necessary to use time wisely and not waste it. There is a premium on efficiency, hence a sense of urgency in many matters. Time is the given and people are the variable; the needs of people are adjusted to suit the demands of time (schedules, deadlines, etc.). It is considered most efficient to do one thing at a time or wait for one person at a time. As far as possible, you shouldn't let circumstances, unforeseen events, interfere with your plans. Interruptions are a nuisance.

Polychrome: Time is limitless and not quantifiable. There is always more time, and people are never too busy. Time is the servant and tool of people and is adjusted to suit the needs of people. Schedules and deadlines often get changed. People may have to do several things simultaneously, as required by circumstances. It's neither necessary to finish one thing before starting another, nor to finish your business with one person before starting it with another. You always have to take circumstances into account and make adjustments. Strictly speaking, there's no such thing as an interruption.

Situation 1

You live in a polychrome culture. One of your colleagues is an immigrant from a monochrome culture and he is having problems adjusting to what he calls "unprofessionalism" in the workplace. He complains about how inefficient people are: they don't come to meetings on time; they come very late to appointments with him or they make him wait a long time when he has an appointment with them; when he is meeting with someone, that person will take telephone calls or talk to people who drop by and interrupt the conversation. "This is not the way to do business," he told you yesterday. Apparently he has

complained to other people in your office as well, for just today some of them have come to you to complain about *him.* You are his closest friend in the office. What should you do?

Answer the questions

1. What would you say to your friend in this situation?
2. Would you try to persuade him to accept this situation or ask him to try to change people who behave in an inappropriate way?
3. Would you ask your colleagues to avoid the things that could be called as «unprofessionalism»?
4. Would you ask your friend to get used to this way of behavior?
5. Would you try to persuade your friend to be more tolerant to the behavior in other cultures? Why?
6. What culture – monochrome or polychrome – do you belong to?
Why do you think so?

Situation 2

Yours is a monochrome culture. A nurse in an elderly-care home where you are the nursing supervisor comes from a more polychrome society, and her work habits are beginning to bother a lot of people, including several physicians and numerous residents. The latter complain that she is always late for her tasks, whether bathing them, helping them to the toilet, or taking them down to the dining room at mealtime. They say she's too friendly, by which they mean she spends too much time chatting with people (who nevertheless appreciate it a lot), and this puts her behind schedule. Physicians and other nurses complain that she's late to meetings and often reports late to work, which means someone on the shift before hers has to stay on until she arrives. Everyone likes this woman—she's outgoing and very compassionate—but she can be exasperating when it comes to managing her time. What's your next move?

Answer the questions

1. Why do you think your colleague behaves this way?
2. What would you say to the colleague in this situation?
3. Would you try to explain to her the difference between countries?
4. Would you make an attempt to explain to her how she has to behave? Do you think she will follow your advice?

Part 6. All cultures can be subdivided into two types: femininity and masculinity cultures. Masculinity and femininity dimension describes how cultures differentiate on not between gender roles. Masculine cultures tend to be ambitious and need to excel. Members of this culture have a tendency to polarize and consider big and fast to be beautiful. In workplaces employees emphasize their work to a great extent (live in order to work) and admire achievers who accomplished their tasks.

Feminine cultures consider quality of life and helping others to be very important. Working is basically to earn money which is necessary for living. In business as well as in private life they strive for consensus and develop sympathy for people who are in trouble. Small and slow are considered to be beautiful.

Situation

You are working in a company which is ruled by a woman. She has no family and children. She devoted her life to this company to flourish and develop. In contrast, you have a small family: a husband and a little baby. You can work only on week-days and at weekends you take care of your family. But your employer isn't satisfied as she needs a worker who is capable of working at weekends. And she is ready to pay more than usual. You are on good terms with your colleagues and you are always ready to help those who are in a difficult situation, that's why everybody respects you in this company. But your boss said you would have to leave your place in the company if you wouldn't agree to work at weekends. What would you do in this situation? Why?

Answer the questions

1. Do you feel surprised or offended in this situation? Why?
2. Why do you think the boss behaves this way?
3. Do you think we should live in order to work or earn money only necessary for living?
4. What culture – feminine or masculine – would you prefer to live and work? Why?
5. Can culture possess both feminine and masculine features at the same time? Specify it.

Part 7. All cultures can be subdivided into two types: achievement and ascription ones. Status describes the positioning of individuals in their society. In achievement culture a person's status is indicated by what someone DOES, and in ascription culture status is indicated by what someone IS. In achievement culture status is taken by people because of their skills, knowledge and talents. In ascription culture people's behavior is measured taking into account the groups into which they were born or attributed to birth right, gender, caste, or age but also to your interpersonal relationships and your ranking in society.

Situation

You are working as a manager of personnel department in a big company. You're reported that there is a vacancy and a new employee required. There would be testing and this place would get a person whose final results would be the best. At the end of the testing it is proved out that two results were equal. One of them was a young talented and erudite person who achieved success in his job, while the other was an older and more experienced person. The main thing is that he was the owner's wife's brother. What candidate would you choose?

Answer the questions

1. Do you believe that people should be measured by how successful they are in their jobs and what an individual has done, or by what they are, and their interpersonal relationships and their ranking in society?
2. Do you think it is reasonable to lay your personal relationships aside and look at the situations objectively? Why?
3. What culture do you prefer to live and work in: achievement or ascription one? Why?
4. What culture do you belong to? Explain why you think so.

Part 8. Cultures differ greatly in their view of the individual's place vis-à-vis the external world, especially on the question of to what degree human beings can control or manipulate forces out themselves and thereby shape their own destiny. While all cultures believe that certain things happen outside of one's control, they differ as to

what extent they believe this and on how much one can do in response. The two poles of this dimension, *internal* and *external,* are defined below.

Internal: The focus of control is largely internal, within the individual. There are very few givens in life, few things or circumstances which have to be accepted as they are and cannot be changed. There are no limits on what you can do or become, so long as you set your mind to it and make the necessary effort. Your success is your own achievement. You are responsible for what happens to you. Life is what you do; hence, these represent more activist cultures.

External: The focus of control is largely external to the individual. Some things in life are predetermined, built into the nature of things. There are limits beyond which one cannot go and certain givens that cannot be changed and must be accepted. ("That's just the way things are.") Your success is a combination of your effort and your good fortune. Life is in large part what happens to you; thus, these represent more fatalist cultures.

Situation

You are an activist working in a fatalistic society. The company you work for has hired you to help it expand its business and get new customers. You have designed a campaign that should result in a 5 percent increase in market share in six months if you can get all the resources you need. You have been spending the last few weeks drumming up enthusiasm and support for your master plan, but to be honest, colleagues and upper management haven't been responding the way you would like. They're quite pessimistic about your estimates; to get that kind of increase, they say, will take a lot longer than six months. "Things just don't happen that fast here," you were told by one manager. Your reply was that things can happen as fast (or slow) as people want them to; they just have to make the necessary effort.

Everyone seems to have a reason why the plan won't work, why the potential stumbling blocks are more serious than you think. You realize there will be some obstacles, of course, but you have faced these kinds of obstacles before and know that if people rise to the occasion, they can overcome them. If the company isn't serious, however, if it doesn't commit the personal and other resources required, this expansion won't happen in six years, much less six months.

You're starting to doubt whether these people are really committed to this effort or if they're just making the right noises. And you weren't encouraged today when your boss told you that some department heads have been complaining about the demands you're making of them, saying that you're not being very realistic. What should you do?

Answer the questions

1. Why do you think your colleagues behave this way?
2. What would you say to your boss in such a situation?
3. Do you think it is reasonable to continue the project?
4. Do you believe it is possible to cope with these obstacles to achieve success?
5. What culture do you belong to? Explain your point of view.

Situation 2

You work for an advertising firm in an activist culture to which you emigrated two years ago. While you like your adopted homeland very much, it has been difficult to adjust your more fatalist inclinations to the prevailing mindset, especially at work. You work as hard as anyone else, but you have been accused of giving up on prospective new accounts when

you might have won them with more effort. You feel that after you have pitched to and courted clients for a certain period, the rest is up to them, that beyond a certain point there's nothing more you can do. You have even been accused of being defeatist for saying that certain goals were unrealistic.

Last week your boss called you in for your yearly performance review. He pointed out that you needed to be more aggressive in pursuing business and not be so eager to adopt a wait-and-see stance after you have pitched to clients. "Things happen because you make them happen," he said, "not because they're *meant* to happen." You don't necessarily agree, but you obviously need to adjust your style if you're going to succeed in this organization.

Answer the questions

1. Why do you think your boss behaved this way?
2. What would you say to your boss? Would you promise to work harder or prefer to explain the situation to him as it was?
3. How would you react? Would you now always try to persuade your clients? Why?
4. What could you do to be more effective in this environment?

Part 9. All cultures can be subdivided into two types: affective and neutral cultures. People from affective culture express their emotions more naturally. Reactions are shown immediately verbally or non-verbally by using mimic and gesture in the form of body signals.

In contrast, people from a neutral culture tend to hide away their emotions and don't show them in public. Neutral cultures don't express precisely and directly what they are really thinking which can lead to misunderstandings and certain emotions are considered to be improper to exhibit in certain situations. It is also considered as important not to let emotions influence objectivity and reason in decision making.

Situation

You and your family have immigrated to another country. You entered university to continue your studies. At the university you were said to choose the subject of the thesis which you would write during the studies and defend it to graduate from the university. For this purpose there was organized a faculty meeting. Unfortunately, your child got ill and you asked your husband to stay with the child. He missed his work day in order that you had a chance to participate in the meeting. When you went to the meeting, there were only several students as the others hadn't come. The professors presented their research and gave some information about it. You were glad to choose the subject you liked. But several days later you found out that the subject you had chosen was transferred to another student who was not even present at the faculty meeting. What would you do?

Answer the questions

1. Would you feel surprised or offended? Why?
2. Why do you think this situation could happen?
3. How would you react? Would you show your emotions or not?
4. Do you think we shouldn't express certain emotions precisely and directly what we think, which can lead to misunderstandings or certain emotions are considered to be an inappropriate way of behavior in certain situations?
5. What culture – affective or neutral – do you belong to? Prove your point of view.

Appendix 13. Tests

Test 1.

I. Match words and phrases with their definitions

1.	Undergraduate	A	Science etc that has a practical use
2.	Applicant	B	An amount of money that is given to someone by an educational organization to help pay for their education
3.	Scholarship	C	The study of how to make computers do intelligent things that people can do, such as think and make decisions
4.	Magnification	D	An organization, usually in a particular trade or profession, that represents workers, especially in meetings with employers
5.	Curriculum	E	A science which involves developing and making extremely small but very powerful machines
6.	Visual aid	F	A student at college or university, who is working for their first degree
7.	Research laboratory	G	A university degree of a very high level, which involves doing advanced
8.	Retirement	H	The process of making something look bigger than it is
9.	Artificial intelligence	I	An additional service or advantage given with a job besides wages
10.	Doctor of Philosophy	J	A workplace for the conduct of scientific research
11.	Trade union	K	The subjects that are taught by a school, college etc, or the things that are studied in a particular subject
12.	Nanotechnology	L	A square piece of plastic that you can store computer information on, and which you can remove from and put into a computer
13.	Applied science	M	Someone who has formally asked, usually in writing, for a job, university place, etc
14.	Floppy disk	N	Something such as a map, picture, or film that helps people understand, learn, or remember information
15.	Fringe benefit	O	When you stop working, usually because of your age

II. Translate the following words and phrases from Russian into English

16. Аспирантура; 17. Оценка качества; 18. Двухступенчатая модель высшего образования; 19. Окончить университет; 20. Декан; 21. Штат служащих; 22. Факультет; 23. “Неизбежность” открытий; 24. Новая идея; 25. Апертурная диафрагма; 26. Сокращение; 27. Спутник; 28. Программное обеспечение; 29. Научный руководитель; 30. Дипломная работа

III. Translate the following words and phrases from English into Russian

31. Solar system; 32. Undergraduate student; 33. Rocketry; 34. Faculty members; 35. A pattern of innovation; 36 Arms race; 37. Correspondence department; 38. Breadth of application; 39. Sanitary engineering; 40. To conduct an experiment; 41. Employer; 42. Employee; 43. Unified national test; 44. Computer communication science; 45. Computer hacking

IV. Fill in the gaps with the words and phrases from the box

Enrol; quitted; graduated from; postgraduate; salary; civil engineering; computer science; dean; steam engine; outer space; thesis adviser

46. Research students are admitted initially as supervised …….. and take a course of study tailored to their individual needs and experience.

47. Before you join a course at a college or university, you first need to …….. .

48. He was a fellow of the University of Bombay, and was elected …… of the faculty of engineering in 1879.

49. Kate …… medical school last year.

50. Coal for the mill's …….. was carried up the steep hill on donkeys.

51. For instance, in …… one learns how to write programs that can perform certain tasks.

52. But his principal contribution was in the field of ……, as a builder of road and railway bridges.

53. Supported by four …… courses covering the biology, entomology and pathology of seeds, and plant breeding.

54. But his aspirations go beyond the global: he envisions …… as his next frontier.

55. You might even end up starting on another project with a new …… .

56. She …….. her job and went traveling in South America.

57. He reportedly earns an annual …….. of $20 million.

V. Answer the questions

58. Why is it necessary to learn English? Give reasons.

59. Speak about telescope (history, evolution).

60. What are the ways of finding mechanical engineering jobs?

Test 2.

I. Match words and phrases with their definitions

1.	Postgraduate	A	The planning, building, and repair of roads, bridges, large buildings etc
2.	Target	B	To officially arrange to join a school, university, or course, or to arrange for someone else to do this
3.	To graduate from university	C	Thin metal in the form of a thread, or a piece of this
4.	Transmission	D	A machine that has been sent into space and goes around the Earth, moon etc, used for radio, television, and other electronic communication
5.	Milky Way	E	Someone who is studying at a university to get a master's degree or a PhD
6.	Slide show	F	The study of the design and production of machines and tools
7.	Civil engineering	G	Someone who is paid to work for someone else
8.	Staff	H	Something that you are trying to achieve, such as a total, an amount, or a time
9.	To enroll	I	A person, company, or organization that employs people
10.	Software	J	A small piece of film in a frame that you shine a light through to show a picture on ascreen or wall
11.	Mechanical engineering	K	To complete your education
12.	Employer	L	The people who work for an organization
13.	Wire	M	The process of sending out electronic signals, messages etc, using radio, television, or other similar equipment
14.	Satellite	N	The pale white band of stars that can be seen across the sky at night
15.	Employee	O	The sets of programs that tell a computer how to do a particular job

II. Translate the following words and phrases from Russian into English

16. Магистр гуманитарных наук; 17. Кандидат наук; 18. Студент первого курса; 19. Вычислительная техника; 20. Машиностроение; 21. Средства поддержки программирования; 22. Образец нововведений; 23. Аппаратное обеспечение; 24. Хакерство; 25. Специализация; 26. Наглядное пособие (визуальное сопровождение); 27. Научный руководитель; 28. Ярмарка вакансий; 29. Исследовательская лаборатория; 30. Рынок труда

III. Translate the following words and phrases from English into Russian

31. Bachelor of science; 32.Upper atmosphere; 33. Scholarship; 34. Construction engineering; 35. Steam engine; 36. Manual attitude control; 37. Applied science; 38. Digital revolution; 39. Floppy disk; 40. Allies; 41. Retirement; 42. Theoretical study; 43. Fringe benefits; 44. Applicant; 45. Scientific adviser

IV. Fill in the gaps with the words and phrases from the box

Distance education; temporary; breakthrough; trade union; hard disk; postgraduate; redundancies; enrolment; steam engine; satellite; sophomore;

46. Effective …… depends on good communications and support for the learners.

47. At the time of …….. you will also be given a timetable of lectures and practicals, and details of Faculty and campus induction programmes, which you are expected to attend.

48. She hasn't finished her university course yet: she's still a / an …… .

49. This was the invention of ……, originally devised for draining water from the tin mines, but then adapted by James Watt for driving factory machinery.

50. Negotiators have made a …….. on the most difficult issue of employment security.

51. In December the United Nations urged governments to get on with setting up a …….. system.

52. In the 1960s *British Rail* came up with …… for a faster train.

53. For example, some viruses display a text string or delete all files on the …….. on a particular date.

54. On the one hand, …… shows are getting better, as some of the third-year shows did before them.

55. The farm worker has himself contributed, though as often as not by leaving the industry rather than by joining a …… .

56. These …… are necessary for the company to be able to survive.

57. However, they particularly affect women with their discontinuous employment patterns and …… jobs.

V. Answer the questions

1. What does the term «Space race» mean?

2. What are the predictions about future of engineering in Russia?

3. Speak about modern system of higher education.

Appendix 14. Key to tasks for self-checking

Unit 1
Building-up vocabulary. Exercise 3) 1. B; 2. A; 3. A; 4. B; 5. B; 6. B; 7. A

Unit 2
Listening. Exercise 2) 1. F; 2. T; 3. T; 4. F; 5. T; 6. T; 7. F; 8. T; 9. F

Unit 3
Listening. Exercise 4) 1. F; 2. T; 3. F; 4. F; 5. F; 6. F; 7. T

Unit 4
Listening. Exercise 5) 1. F; 2. A; 3. D; 4. G; 5. C; 6. B; 7. E; 8. H

Unit 5
Building-up vocabulary. Exercise 4) 1. Empirical; 2. Tyres; 3. Coolant; 4. Consensus; 5. Risks; 6. Benefits; 7. Engage; 8. Peers

Unit 6
Building-up vocabulary. Exercise 2) 1. In; 2. On; 3. Out; 4. –; 5. To; 6. To; 7. To; 8. On

Unit 7
Listening. Exercise 3) 1. T; 2. T; 3. F; 4. F; 5. T; 6. T

Unit 8
Building-up vocabulary. Exercise 1) 1. F; 2. C; 3. E; 4. A; 5. H; 6. D; 7. A; 8. G

Unit 9
Building-up vocabulary. Exercise 2) 1. Of; 2. For; 3. To; 4. Through; 5. Through; 6. On; 7. From; 8. –

Unit 10
Listening. Exercise 3) 1. T; 2. F; 3. T; 4. T; 5. F; 6. F

Unit 11
Building-up vocabulary. Exercise 1) Температура поверхности; ископаемое топливо; солнечная радиация; выделение газа; углекислый газ; ледник; вечная мерзлота; морской лед; вымирание видов; уменьшение; ратифицировать; снежный покров; повышение уровня моря; экосистема; уязвимый; внедрять политику; сердечнососудистые заболевания; смертность; тепловой удар; гипотермия; уровень смертности; вакцинация; болезни, распространяемые насекомыми.

Unit 12
Building-up vocabulary. Exercise 3) 1. Oath; 2. Prolong life; 3. Ethics; 4. Ethical standards; 5. Aim; 6. Research field; 7. Carry out

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