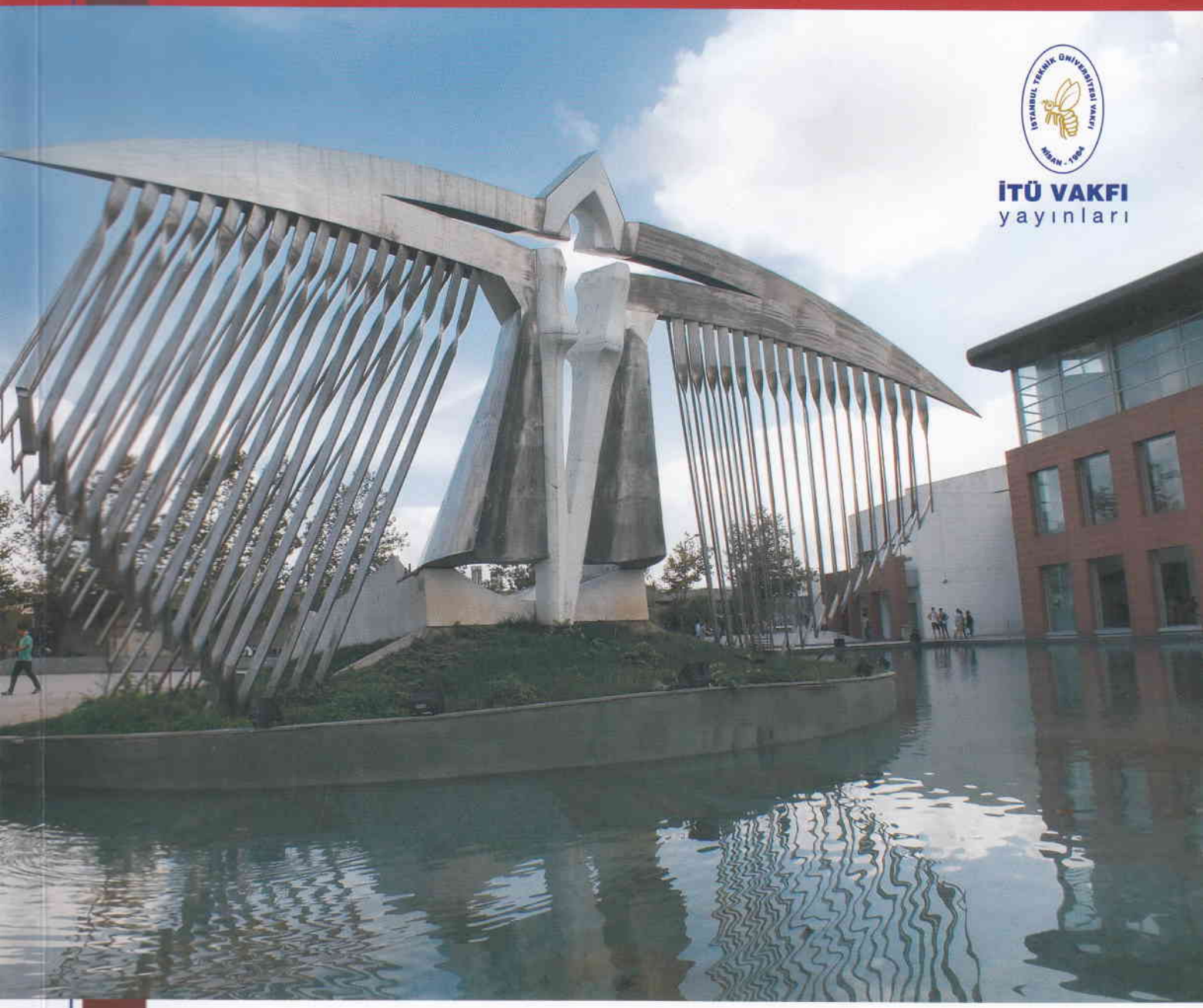


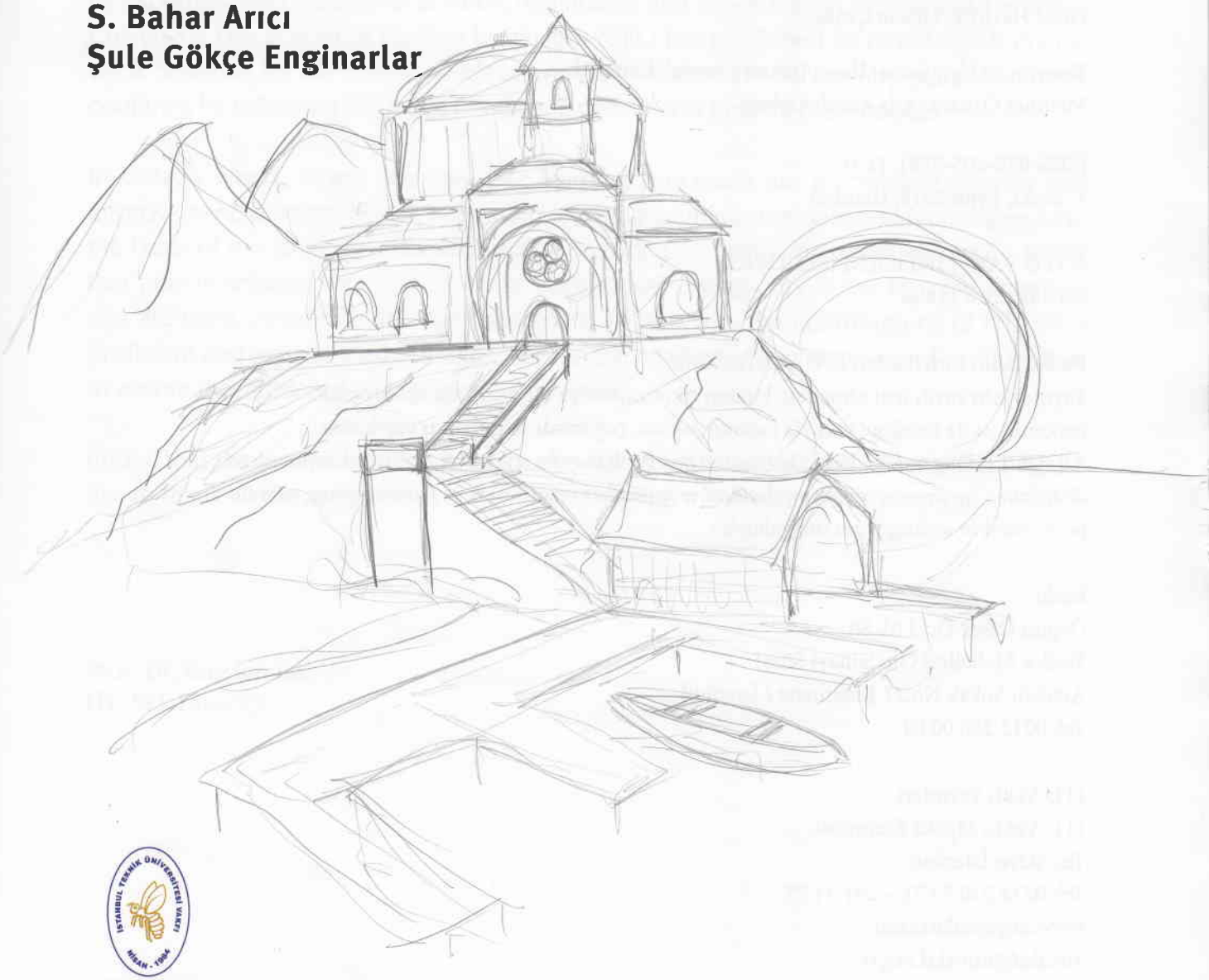
İTÜ VAKFI
yayınları

ACADEMIC WRITING FRAMEWORK

ASLI AKÇALI ÖZKARA
FULYA KAMA ÖZELKAN
S. BAHAR ARICI
ŞULE GÖKÇE ENGİNARLAR

Academic Writing Framework

Aslı Akçalı Özkara
Fulya Kama Özelkan
S. Bahar Arıcı
Şule Gökçe Enginarlar



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Aslı Akçalı Özkara / Fulya Kama Özelkan
S. Bahar Arıcı / Şule Gökçe Enginarlar

Academic Writing Framework

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PREFACE

In accordance with the mission - to expand the borders of knowledge and its applications in science, technology and art for contributing to the sustainable community - and vision - to become a leading, international university through its expertise and creativity in science, technology and art - adopted by Istanbul Technical University, ITU School of Foreign Languages (SFL) has published its new English course book designed for the current needs of university students in our country but also in other countries by following the latest trends in language teaching methodologies.

In today's world, where the language learning processes are in constant change and improvement, learners' needs, habits and teaching-learning strategies and techniques form the basis of the language education to be provided for them. The most important factor that affects achieved success levels in educational endeavours is the learning materials that are used. *Academic Writing Framework,* written with the contributions of ITU SFL's proficient and experienced academic staff, is the product of an intensive and careful effort to ensure that students' changing needs are met.

I hope that the book will be of assistance to our students and all other users, and I would like to thank all the academic and administrative staff involved in its production.

Prof. Dr. Burçkin Dal
ITU SFL Director

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Authors also would like to express their appreciation to the academic and administrative members of Istanbul Technical University as well as Advanced English instructors at the School of Foreign Languages/ITU for providing their valuable feedback, articles and many sources to be used as reference materials.

The authors would also like to express their deepest gratitude to their families. The completion of this work would not have been possible without their support, patience and encouragement.

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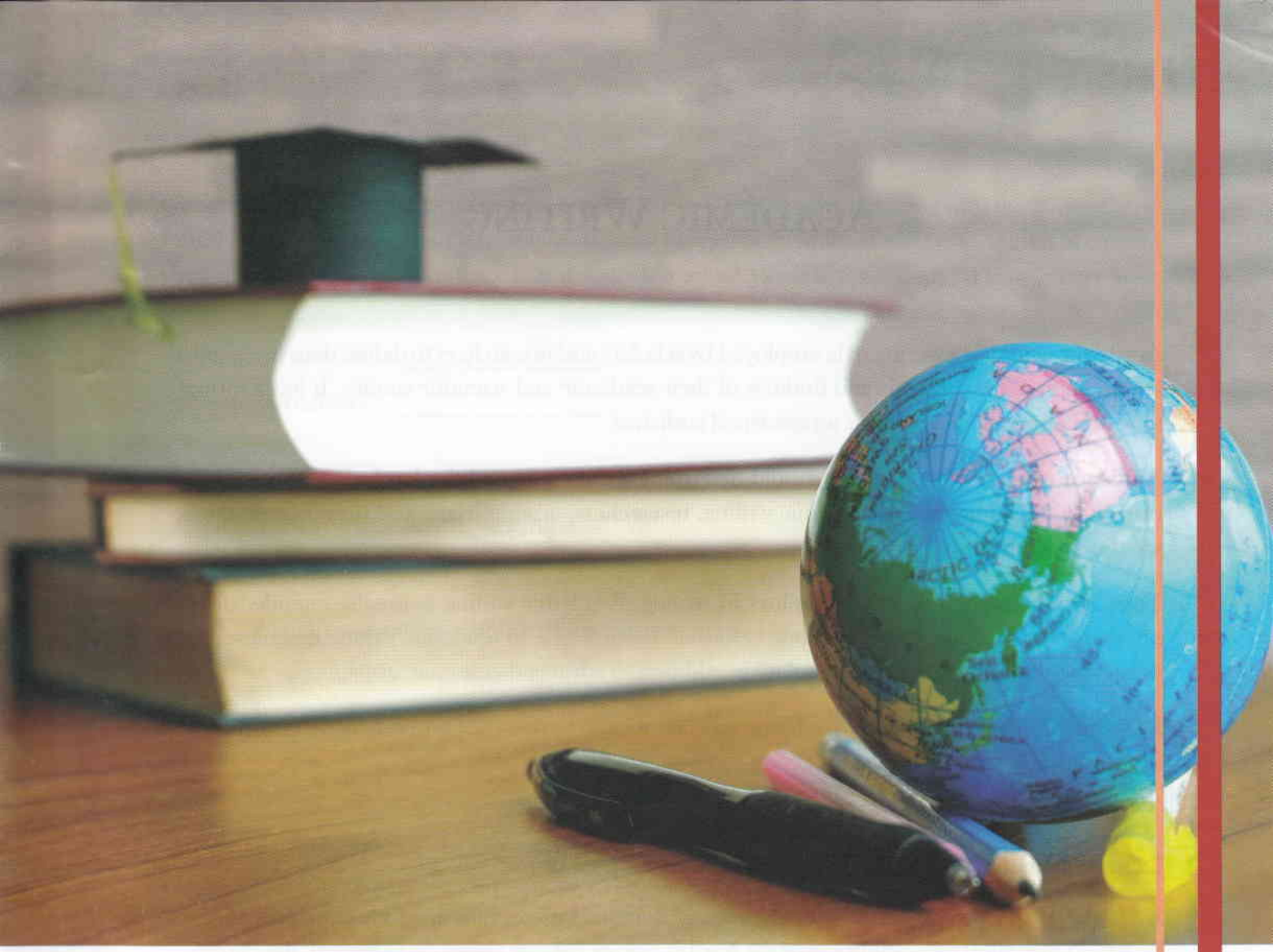

UNIT I

ACADEMIC WRITING

Academic writing is a writing style employed by scholars and researchers to define their **disciplines** and to express the methods and findings of their academic and scientific studies. It has **a formal** tone and a specific purpose for an informed audience.

Audience is the reader. A writer should determine the content and the level of the **writing with** respect to the audience. In academic writing, researchers, academicians and university **students** are the main audience.

Tone is the attitude the writer employs in writing. Academic writing is usually intended **for a** scholarly audience; therefore, the tone is formal. Formal tone in academic writing is **achieved by** using scientific and technical vocabulary in addition to advanced grammar structures.

Purpose is the reason to write. Academic texts are written to provide comprehensive **information** supported with scientific data and expert opinion.

Exercise 1: Identify the tone and the audience of the texts below.

1. "In the 1970s, discussion of "geoengineering", a radical strategy for arresting climate **change** by intentional, direct manipulation of the Earth's energy balance, began to appear in the **climate** science literature. With growing international concern about the pace of climate change, the scientific and public discourse on the feasibility of geoengineering has recently grown more sophisticated and more energetic" (Hemming & Hangler, 2011).

Tone: _____

Audience: _____

2. This week's conference drew attention to the huge risks involved. "Geoengineering is not a quick fix for climate change" experts warned the President. After the conference, leading researchers and campaigners expressed concern that geoengineering research could be used as an excuse not to reduce CO2 emissions.

Tone: _____

Audience: _____

3. Geoengineering is an insane attempt at fixing the climate change by tinkering with the atmosphere. I think, it bites off more than it can chew. It is not likely that technology will be a solution to climate change. Am I wrong for thinking that it sounds insane? What do you think? Please, share your comments.

   Tone: _____

   Audience: _____

Guidelines for academic writing

The criteria for academic writing are listed below:

1. **Avoid contractions, abbreviations and acronyms.**

   A **contraction** is the combination of two words in a shorter form using an apostrophe ('). Instead of contractions, full words should be written in academic texts. For example, instead of using "don't", you should use "do not"; instead of "he's", you should use "he has" or "he is".

   An **abbreviation** is the shortened version of words or phrases. Abbreviations are commonly used in everyday language or informal texts. In academic writing, complete words should be preferred. For instance, you should use "Professor" instead of "Prof." if you are writing an e-mail to your professor, and there is a preference for "that is" instead of writing "i.e." in academic texts.

   An **acronym** is the abbreviated form of a series of separate words using their initial letters, such as WHO for World Health Organization or IT for Information Technology. When first used, the full name should be written and the acronym should also be given in parentheses. For the rest of the text the acronym can be used on its own. The title of an academic text should not be an abbreviation or an acronym.

   Weaker use: For this course, the reference list in student papers should follow APA style.

   Better use: For the academic writing course, the guidelines of the American Psychological Association (APA) citation manual should be applied while writing the reference list.

2. **Avoid using informal phrasal verbs, idioms, slang, clichés and emotional language.**

   In academic texts, a statement like "I can't put up with all this nonsense about bullying in schools. Someone must do something about it!" would not be acceptable. A more formal version might be "The problem of bullying in schools should be eliminated through a series of precautions taken by the administration."

   Words like "stuff" and "thing" are also avoided in academic writing. These words can refer to many different objects and concepts and therefore lack any specific meaning. Good academic writing involves the careful choice of words with specific meanings. For example, instead of writing "stuff", you can use words like "belongings, possessions, goods".

   The use of clichés is also not encouraged in academic writing. For instance, when you are introducing your topic in an essay, avoid clichés like "Throughout history" or "In today's world".

   You should also avoid using words or phrases that are emotive such as "terrible news", "poor child". Try to use language in a neutral, less emotional way.

   Weaker use: It is extremely disappointing to see those poor freshman students who committed plagiarism.

   Better use: Certain freshman students failed to follow the rules of academic writing and committed plagiarism.

3. **Avoid a personal tone.**

   Academic texts have polite and impersonal tone that provides a more objective approach where the focus is the topic of discussion rather than the writer or the audience. Hence, the first and the second person narration (I / you / we) are not encouraged.

Weaker use: I think you must leave aside your prejudice against women's involvement in science.

Better use: The gendered prejudice against women's involvement in science should be abandoned.

4. **Use proper punctuation and capitalization.**

In academic texts, colons (:) and semi-colons (;) are preferred instead of brackets ([ ]), parentheses (( )) and dashes (-) in order to add information. Exclamation marks (!) are also avoided in academic writing.

Weaker use: In order to avoid plagiarism in academic texts, students should use citation methods (Harvard, Chicago, and Oxford).

Better use: In order to avoid plagiarism in academic texts, students should use citation methods such as Harvard, Chicago, and Oxford.

5. **Avoid questions, commands and announcements.**

In academic writing, statements are encouraged rather than questions, commands and announcements because formal texts are commonly used to inform, report, argue and critique.

Weaker use: What kind of measures can be taken to prevent students from plagiarizing in their academic work? This is very important for us.

Better use: The major concern is to find possible solutions to the problem of plagiarism among students in their academic work.

6. **Avoid using short and simple sentences.**

Short and simple sentences are commonly used in spoken language, whereas academic texts tend to have longer, more complex sentences. Although short and simple sentences can be used effectively in academic texts, complex ideas may sometimes require lengthy, detailed sentences.

Weaker use: Ada Lovelace was an English mathematician and a writer. She is an important figure in the history of computers. She is the writer of the first computer program. It was an algorithm. She designed it to be carried out by a machine as early as the 19th century.

Better use: An English mathematician and writer, Ada Lovelace is an important figure in the history of computers. She is known to be the writer of the first computer program which she designed as an algorithm to be carried out by a machine as early as the 19th century.

7. **Avoid using simple, colloquial, vague, and unnecessary vocabulary.**

Technical and scientific words should be preferred to simple and colloquial vocabulary. Likewise, the use of vague or unnecessary words should be avoided. Vague expressions should be elaborated, but sentences should always be clear.

Weaker use: Since aluminum and its alloys are cheap and not so heavy, they are good to be used in many industries due to their unique properties.

Better use: Aluminum and its alloys are cost-effective and lightweight metals used in the automotive, textile, and electronic industries due to their durability, high density ratio and corrosion resistance properties.

8. **Use suitable collocations.**

A collocation is a group of words that are used together. For example, the noun "research" is combined with the verbs "carry out", "do", "conduct" and "undertake". In other words, these verbs are collocations of "research".

conduct / carry out / do / perform / design / report an experiment

a successful / simple / controlled / scientific / psychological experiment

during / in the experiment

to experiment with something

9. **Prefer passive voice.**

The use of passive voice is common in academic texts. Since passive voice allows the writer to highlight the action itself rather than the doer of the action, it is often preferred in laboratory reports and scientific research papers. Notice the use of passive voice in the description below.

SOURCE: Adapted from ITU, *Cell Biology laboratory booklet,* 2015, p. 18

Different steps are required for extracting DNA from the kiwi fruit. First, 50 ml ethanol is cooled in ice bath. DNA extraction solution is prepared by dissolving 2 g NaCl in 90 ml water. 10 ml of liquid detergent is added to the salt solution. This mixture is stirred on the stirrer. After peeling the kiwi, it is cut into pieces. 30 g of kiwi is mashed, and then it is placed into 200-ml beaker. The DNA extraction solution is added to this mashed kiwi. The mixture is transferred to 50-ml test tube and this step is repeated.

Exercise 2: Rewrite the experiment below using passive voice.

SOURCE: Adapted from ITU, *Physical Chemistry laboratory booklet for chemical engineers,* 2014, p. 7

Measure the surface tension of various liquids using both capillary and ring methods. In the capillary method, you should measure the rise of the liquid in capillary. Then, calculate the surface tension. In the ring method, use Du Nouy tensiometer. From the readings of the tensiometer, first, plot a calibration graph and second, calculate the surface tension of various liquids. Finally, compare the experimental results obtained from the measurements with the theoretical results.

_____

_____

_____

_____

_____

Exercise 3: Match the informal words with their formal equivalents.

INFORMAL		FORMAL
1. good	___	a. children
2. bad	___	b. favorable / beneficial
3. lots of/a lot of	___	c. in conclusion
4. kids	___	d. highly
5. day by day	___	e. gradually / in time
6. right	___	f. correct / accurate
7. to sum up	___	g. much / many
8. a bit	___	h. adverse / poor
9. really	___	i. a little
10. stuff	___	j. goods / possessions

INFORMAL		FORMAL
1. think about	___	a. manage
2. work out	___	b. follow / proceed
3. look like	___	c. continue
4. come after	___	d. consider
5. give up	___	e. solve
6. carry on	___	f. resign / leave / stop
7. cut down	___	g. reduce
8. deal with	___	h. resemble
9. look at	___	i. examine / regard

Exercise 4: Read the text. Choose the best alternative to make the paragraph more formal.

SOURCE: Adapted from Korel Eraybar, Kenji Okazaki & Alper Ilki, 2009, p. 71

İstanbul is one of the world's most vulnerable cities to seismic events. According to seismologists, the probability of a **bad** (1) earthquake in the next thirty years is **more or less** (2) forty percent. Following an outline of the seismicity of this vital Turkish city and a summary of **ongoing** (3) seismic risks and mitigation studies, this paper **tells** (4) the results of a survey **done** (5) in two districts of İstanbul, Avcılar and Bakırköy. The survey comprised 60 questions on the seismic risk perceptions of **guys** (6) and requested basic personal data, such as age, education level, **work** (7) type, financial income, and gender. Despite various differences among the survey population, such as academic background and level of financial income, responses were surprisingly **very much alike** (8), especially in terms of having no plan for a safer house. The data may help those planning mitigation programs and public awareness campaigns on preparedness and particularly mitigation in **very** (9) vulnerable regions.

1.	a. severe	b. negative	c. awful
2.	a. just about	b. mostly	c. approximately
3.	a. current	b. popular	c. present-day
4.	a. lays out	b. makes known	c. presents
5.	a. happened	b. conducted	c. handled
6.	a. individuals	b. folks	c. our society
7.	a. job	b. career	c. employment
8.	a. the same	b. twin	c. similar
9.	a. highly	b. a lot of	c. really

Exercise 5: Choose the best alternative from the box below to make the sentences more formal.

conduct	consume	discover	reduce	initiate	search for

1. The funds allocated to the new research project have been **cut down** due to the economic instability in the country. reduced
2. Astronomers have been **hunting down** superclusters for years and finally **came across** Vela Supercluster, one of the biggest superclusters near the Milky Way. searching for / discovered
3. A team of scientists have **set up** the first natural selection study among Inuits to trace the origins of their adaptations to extreme cold weather conditions. To **work on** the research, they compared the genomic data of Greenlandic Inuits with ancient hominids, the Neanderthals and Denisovans. initiated / conduct
4. An international team of scientists made a rare discovery of a planetary system with a host star, HIP68468, which most probably **ate up** some of its planets. consume

Exercise 6: Rewrite the sentences to avoid the use of personal pronouns using the words given in parentheses.

1. Moreover, I will describe early warning systems for earthquakes. (described)

   Moreover, early warning systems for earthquakes will be described.

2. Before I proceed to the use of early warning systems in earthquake detection, let's provide some background information. (proceeding / provided)

   Before proceeding to the use of early... some background information will be provided.

3. After the earthquake, authorities did not inform us properly about the number of casualties. (information)

   ... authorities did not give proper information about ....

4. We could not recover from the post traumatic effects of the earthquake for years. (recovery / lasted)

   The recovery from the post traumatic effects of the earthquake lasted for years.

Exercise 7: Rewrite the sentences following the rules of academic writing.

1. The results of the tests we made during the treatment were extremely encouraging, so we planned to move to the next stage of the therapy.

The results of the tests we made during the treatment were highly positive; thus, the next stage of the therapy was planned.

2. After years of delay, it is very nice to see that Ethiopia's government got things rolling. They opened the tallest dam of the country, Gibe III (243 m). The dam has a hydroelectric plant that can double the country's tiny energy output.

After years of delay, Ethiopia's government developed. They constructed the tallest dam of the country, Gibe III which has a hydroelectric plant...

3. Don't you think that wind farms made a mind-blowing impact on decreasing the carbon emissions coming out of burning coal and gas?

Wind farmers made a significant impact on decreasing the carbon emissions caused by burning coal and gas.

4. Nanorockets with temperature responsive brakes and a steering wheel! It's unbelievable that chemists can now deliver medicine in the human body with the help of these soft nanosystems.

Chemists can now deliver medicine in the human body with the help of soft nanosystems, called nanorockets...

Unity

Unity in writing refers to developing a single paragraph or a whole essay around one central idea. In other words, each sentence in a paragraph or each paragraph in an essay should contribute to the main idea. In a unified paragraph, all sentences function as supports to illustrate, clarify or explain the main idea put forward in the topic sentence. Moreover, in a unified essay, all paragraphs should be discussing the ideas related to the thesis statement. Since irrelevant information disrupts the understanding of the reader, any information that does not directly support the topic will destroy the unity. For instance, an essay about the advantages of using solar energy should not focus on the advantages of wind power.

Exercise 8: Read the paragraph below written on the effects of surfing the Internet in class. Find the sentence that disrupts the unity of the paragraph.

SOURCE: Adapted from Susan Ravizza & Andy Henion, "Internet use in class tied to lower test scores", 2016

Surfing the Internet in class is linked to poorer test scores, even among the most intelligent and motivated students. Michigan State University researchers studied laptop use in an introductory psychology course and found the average time spent browsing the web for non-class-related purposes was 37 minutes. Taking notes on a laptop is not as beneficial for learning as writing notes by hand. Once students open their laptop, it is probably tempting to do other sorts of Internet-based tasks that are not class-relevant. Students spent the most time on social media, reading email, shopping for items such as clothes and watching videos. Therefore, their academic performance suffered.

Exercise 9: Read the paragraph below written on heat transfer. Find the sentences that disrupt the unity of the paragraph.

SOURCE: Adapted from ITU, *General Physics experiments Physics 106 EL*, n.d., p. 40

Conduction is a heat transfer mechanism that occurs as a result of the kinetic energy exchange between the atoms or molecules. In conduction, less energetic molecules gain kinetic energy by colliding with more energetic molecules. Molecules are a group of atoms held together by chemical bonds. As an example, if one end of a metal rod is heated, the temperature of the other end of the rod increases in time. Radiation is another heat transfer mechanism by means of electromagnetic waves. Heat transfer by conduction can only occur when there is a temperature difference in the material. If the whole material is at the same temperature heat transfer stops. This is because all the electrons and atoms have the same average kinetic energy.

conduction (n): transmission of heat through solids

energetic (adj): having or involving energy

collide (v): to hit with a forceful impact

rod (n): a long slender bar

radiation (n): energy in the form of heat occurring as waves

WORD FORMS

Complete the table with the word forms.

VERB	NOUN	ADJECTIVE	ADVERB
conduct	conduction/conductor	conductive	-
energize	energy	energetic	energetically
collide	collision/collider	colliding	-
radiate	radiation	radiative	-

VOCABULARY FOCUS

to occur: [It has NO PASSIVE form!]

1. to happen, to take place (especially accidents or unexpected events)
   e.g. Some errors occurred in computer program after the software update.
   e.g. Railroad accidents occur frequently in India because of high passenger population.
2. to exist, to be present, to be found
   e.g. A large proportion of Uranium deposits occur in Australia.
3. to occur *to* somebody: (idiom) to come to mind
   e.g. It did not occur to him to call his lawyer when he was arrested by the police.

Check the common mistakes regarding the usage of "**occur**" in writing:

× They overcame the difficulties that <u>were occurred</u> during the research.
✓ They overcame the difficulties that <u>occurred during</u> the research.

× Explosions underground might <u>occur</u> minor earthquakes.
✓ Explosions underground might <u>generate</u> minor earthquakes.

× The surface of the planet <u>occurred</u> a new crater.
✓ New crater <u>occurred</u> on the surface of the planet

Exercise 10: Circle the correct word.

1. Age difference may **cause** / **happen** communication problems among employees.
2. Scientists cannot explain what has **happened** / **generated** to the meteoroid after entering the atmosphere.
3. Texting while driving leads to manual and visual distractions that **occur** / **generate** traffic accidents.
4. Tornadoes might **occur** / **cause** in any season, but mostly in spring and summer months.

Coherence

Coherence is the logical flow of ideas. In other words, each sentence in a paragraph and each paragraph in an essay is linked to the previous and following ones, so they are not isolated thoughts. In order to achieve the logical flow of ideas in a paragraph or in an essay, transition signals that connect ideas from one sentence to the next or one paragraph to another can be used. Additionally, arranging thoughts in sequential order can help the reader follow the flow of ideas from one point to the next. This might involve organizing ideas from least to most important, or according to a logical argument or chronological order. Using pronouns instead of repeating the same words is another way to achieve coherence. Coherence can also be ensured by the repetition of key words. All of these will help give a smooth flow to the text.

Exercise 11: Read the paragraph below and provide the correct transition signals to secure coherence.

in order to	so that	as the second step		in the following step
first of all	once	finally	then	the next step is

Calibration of a pH meter is an easy process in which standard solutions with pH levels of 7.10 and 4 are used. Calibrating a pH meter is essential for accurate measurement of the acidity or alkalinity of a solution. _____ achieve accurate measurements, _____, the pH meter is turned on 30 minutes prior to its use. _____, the electrode is placed into the first standard solution with a pH 7 and if the reading is more or less than 7, the CALIB button is pressed. The electrode is, _____, cleaned with dH2O and dried as it is taken out from the first standard solution. _____, the electrode is placed in the second standard solution with pH4 or

pH10. _____ pressing the SLOPE button _____ the pH meter can be calibrated. _____ the calibration is complete, the electrode is cleaned with dH2O and dried. _____, the pH meter is ready to be used.

Adapted from *General Biology II laboratory booklet BIO 112E*, n.d., p.11

Exercise 12: Rearrange the sentences to provide a coherent text.

1. (a) Each element used in an electrical circuit is called a circuit element. (b) If two or more circuit elements meet in a terminal, it is called a node. (c) Each conducting end coming out from a circuit element that provides an external connection is called a terminal. (d) Any closed conducting path has to include at least two nodes in order to be considered a loop.

Adapted from ITU, *General Physics experiments Physics 102 EL*, n.d., p. 13

2. (a) In addition, an ohmmeter is used to directly measure the resistance of a resistor. (b) The most commonly used equipment in electric laboratories is ampere meters, voltmeters, and the ohmmeter. (c) To measure the current the ampere meter has to be connected in series. (d) A voltmeter is used for measuring the potential difference between two points in any circuit. (e) The internal resistance of a voltmeter should be very high. (f) An ampere meter is used to measure the current flowing through a conductor. (g) This equipment is based on Ohm's Law. (h) These devices are combined into one instrument called a multimeter or AVOmeter (ampere-volt-ohm meter).

Adapted from ITU, *General Physics experiments Physics 102 EL*, n.d., p. 2

b, f, c, d, e, a, g, h

Exercise 13: Join the sentences using necessary transition words and relative pronouns to form a coherent paragraph.

SOURCE: Adapted from ITU, *General Biology II laboratory booklet BIO 112E*, n.d., p. 17

Protein concentrations can be measured by different methods. Bradford assay is one of the methods. Bradford assay will be used in this laboratory session. Reagent is an acidic stain including Coomassie Blue G-250 in phosphoric acid and ethanol. This dye has brownish color under acidic conditions. The dye turns blue with protein addition. Solution is best measured at 595nm. The Bradford assay is widely used. Bradford assay has sensitive and reliable properties. The Bradford assay can be used in 96-well plates instead of UV-capable spectrophotometer cuvettes.

Protein concentrations can be measured by different methods. Bradford assay is one of these methods that will be used in this laboratory session. _____

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UNIT II

SOURCE ANALYSIS

While writing an academic paper, incorporating support from outside sources into the writing is essential. The borrowed information from other sources will act as evidence to support the writer's ideas as well as making his/her writing more reliable and credible. The length or the amount of the borrowed parts may vary; however, because this information has been borrowed from other academic sources, the actual owners of the ideas must be credited.

Citing is crediting the actual owners of the ideas. Citing is not only a way to make a text more credible and reliable but also as a signpost that guides the reader to the original sources. It also enables borrowing information legally. Otherwise, you will commit **plagiarism**, which is using someone else's work without crediting the source. That is to say, it is stealing intellectual property.

What should be cited?

Every idea, claim, illustration, detail and example borrowed from other sources require citation. The wording and the sentence structure may belong to you; however, it is still essential to acknowledge the fact that the original idea belongs to someone else, by citing the original author.

Common knowledge is based on acquired knowledge, general information, and facts. When the information is well-known among other people, it does not need to be cited. However, **specific knowledge** such as statistics, data, figures, and illustrations can only be conveyed by citing the source since it is not likely that the writer knows it without research.

Example:

Common knowledge: A solar car is an electrical vehicle that runs mainly on the solar power. (This information is commonly known by general public and does not need to be cited.)

Common knowledge: ITU Solar Car Team (ITUSCT) has been successfully participating in international solar car races.

(This information may be common knowledge for ITU engineering students and does not include any specific details to be cited either.)

Specific knowledge: The eight solar cars that ITUSCT built were presented with 19 cups in different competitions in addition to the two international awards between 2005 and 2016.

(This information is specific because only a certain group of people know how many cups and awards ITUSCT has been presented with; therefore, this information must be cited.)

This sentence must therefore be cited correctly when used in a text:

> As expressed by ITU Solar Car Team (ITUSCT), the eight solar cars that ITUSCT built were presented with 19 cups in different competitions in addition to the two international awards between 2005 and 2016 (2016).

Exercise 1: **Read the following paragraph and underline specific knowledge that should be cited when borrowed.**

SOURCE: Adapted from Colin W. P. Lewis, "Morgan Stanley - The economic benefits of driverless cars", 2014

Autonomous or driverless cars have been on the roads for some time now and their arrival has been more than welcomed by many with the expectation that these cars will prevent accidents and save lives. The reasoning behind this is the assumption that autonomous cars have faster reflexes and lack the flaws of human drivers. However, a further expectation from autonomous cars is that they will also bring along economic benefits, especially in four key areas. It is estimated that, in the USA, annually the reductions regarding fuel cost and accident cost will be $158 billion and $488 billion respectively. In addition to these economic benefits, autonomous cars are also expected to increase productivity by $422 billion as it is claimed that people will be able to work or read in their cars when commuting to and from work, meetings, etc.

autonomous (adj): (of a vehicle) acting independently without human control or intervention

reasoning (n): act of thinking in a logical way to form conclusions

annually (adv): yearly

respectively (adv): in the given order; sequentially

commute (v): to travel to work

Tips for citing

In-text citations and **reference lists** are two aspects of citation. In-text citations are used within the text in author-date style. On the other hand, the reference list is placed at the end of the whole work in alphabetical order to present all the publication information for each source used in the text.

IN-TEXT CITATION	REFERENCES
Takes place in the paragraph, right after the borrowed part	Takes place at the end of the whole text
Source information takes place in parentheses	All sources take place as a list, in alphabetical order
Includes only the writer information, date and page number(s)	Includes all publication information related to the source
Parts of the information given are separated by commas	Parts of the information given are separated by full stops

Among different writing styles, ITU has adopted the American Psychological Association referencing style, commonly known as APA, to standardize presentation of academic materials in terms of page layout and citation although some faculties have adapted the APA style to the needs of their own departments.

APA PAGE FORMATTING

- **FONT TYPE and SIZE:** Use Times New Roman, 12 point font.
- **SPACING:** Double space the lines.
- **MARGINS:** Leave a 2.4 cm (1 inch) margin on all sides of the paper. Left justify.
- **PAGE NUMBERING:** Number all pages (including the cover page), putting the page number in the top right corner.
- **PRINTING:** Print only on one side of the paper.

In-text citations

In-text citations are presented in parentheses and include **author SURNAME, publication year,** and **page number** (only for printed sources). Remember that each part of the information needs to be separated from the text by a comma.

> "The future of a universe that expanded forever would be rather boring" **(Hawking, 1991, p. 18).**

Sandwich method

When only one sentence is borrowed from the original source, a parenthetical citation may be presented immediately after the borrowed sentence. However, this method does not specifically help the reader to understand where the borrowed information starts and ends when there are multiple sentences. Therefore, for the sake of clarity and coherence, a **"sandwich method"** should be used. In this method, the citation starts with the surname of the author and a reporting verb marking the beginning of the in-text citation. Then, the date and the page number(s) are presented at the end of the borrowed information in parentheses.

> **Hawking argues that** "the future of a universe that expanded forever would be rather boring. But it is by no means certain that the universe will expand forever" **(1991, p. 18).**

Reporting verbs and phrases

To introduce the information borrowed from outside sources, reporting verbs should be chosen appropriately. These can be used to comment on the cited statements, to disagree or agree with the premise, or to evaluate the author's ideas. There is a long list of reporting verbs which indicate a variety of functions. An element of good writing style involves the thoughtful use of these reporting verbs, rather than the repetition of one verb throughout the paper. Note that the verbs listed on the next page all differ in meaning and cannot be used interchangeably. The writer must choose the most suitable reporting verb for his/her argument.

In academic writing, in order to achieve a neutral and objective tone, verbs such as believe, feel, think, try, want, love, like, tell, etc. should be avoided.

COMMON REPORTING VERBS

FUNCTION	LIST
Advice / Agreement	accept / admit / acknowledge / advise / agree / confirm / recognize/ support
Argument / Persuasion	argue / assert / assure / claim / contend / convince / emphasize / express / insist / maintain / persuade / warn
Conclusion	conclude / infer / realize
Disagreement / Questioning	criticize / deny / disagree / doubt / object to / oppose / question / reject
Discussion	comment / discuss / reason
Emphasis	emphasize / highlight / stress
Evaluation	analyze / assess / blame / compare / complain / consider / contrast/ evaluate / examine / understand / verify
Explanation	clarify / explain
Presentation	comment / define / describe / identify / illustrate / inform / list / mention / point out / present / report / show / state

Below are some examples of phrases used to incorporate outside sources into a text:

a. To introduce the author's views on a topic:

Hawking states / claims / points out / emphasizes / notes **that** ...
As Hawking states / claims / points out / emphasizes / notes, ...
According to Hawking, ...

·Write article title if there is no author information

b. To refer to the author's work (article / book):

·No Date (Yalinates, n.d., p.18)

Based on Hawking's article "Why does the universe inflate?", ...
Based on the article "Why does the universe inflate?", ...
Based on the book *A Brief History of Time*, ...
It is stated in Hawking's article that ...
It is explained in the article "Why does the universe inflate?" that ...
It is discussed in *A Brief History of Time* that ...

If there is no author information

Source Unesco, "Will the children be obese" 2018
Unesco argues that a high percentage of children will have obesity in the following years (2018).

APA STYLE AND MECHANICS
When citing a source in text, author surname, publication date, and page number(s) must be given. Some sources are co-authored. In those cases, all surnames are written; however, if sandwich method is used, the last surname is separated by **"and"**, whereas if surnames are presented in parentheses, **"&"** is used instead of "and".
In some sources, author information may not be present. In those cases, the institution or the organization that owns the source should be acknowledged.
If neither the author nor the institution is known, then the title of the source is written.
Remember that book, newspaper and journal names are ***italicized***, whereas article, essay, short story, poem and chapter names should be written within **"quotation marks"**.
Note that the website address is never presented in the paragraph or the parenthetical information when citing. In other words, if some information has been borrowed from the website of a university or an organization, then the name of the university or the organization should be presented in the text citation, not the web address.
If the publication date of the source is not known, remember to clearly state this fact by writing the abbreviation **"n.d."** for "no date".
Note that the publication date for an article from a journal needs to be presented as year and month, whereas an article from a newspaper needs to be presented as year, month and day.
Use **"p."** for single page and **"pp."** for multiple pages.
For further detail regarding APA citation rules, refer to **http://www.apa.org** or **http://www.apastyle.org**

→ We are citing 2 or more sentences from one author:

- Author surname + Reporting Verb + that + "....." (Date, page number)
- According to Hawking, "....." (Date, page number)
- As Hawking states, "....." (Date, page number)

"Article Title" / Book title

Citation within citation

Sometimes the source you use may have borrowed information from another source. For example, you are reading Stephen Hawking's *A Brief History of Time*, printed in 1988 and on page 31 of the book, the writer is quoting from the German scientist, Max Planck. Because the original idea belongs to Planck, you have to refer to him, as well. Remember that both sources need to be cited.

The source you have found: Stephen Hawking, *A Brief History of Time,* 1988, p. 31.

The source that has been referred to by the one you are reading: Max Planck, 1900.

- Remember to cite the source that you have read (Hawking).
- Remember to introduce the citation using the original owner of the idea (Planck).
- Remember to use the date and page number(s) of the source that you have read (1988, p. 31).

The cited part should read:

> **As cited by Hawking, Planck stated that** emission of X ray and light, as well as other waves, could not take place randomly and that they could only be emitted in quanta **(1988, p. 31).**

OR

> **Planck (cited in Hawking, 1988)** stated that emission of X ray and light, as well as other waves, could not take place randomly and that they could only be emitted in quanta **(p. 31).**

Exercise 2: Complete the citations with proper reporting verbs and phrases.

1. **SOURCE:** Mike Smithson, "Balanced coverage is a trap", May 12, 2011, p. 12

   a. Although querying the data is the basic goal of science, it is ignored because mass media validates all different perspectives as scientifically equal (Smithson, 2011, p.12).

   b. According to Smithson although querying the data is the basic goal of science, it is ignored because mass media validates all different perspectives as scientifically equal (2011, p.12).

2. **SOURCE:** V. Kumarasuriar, G. Pangiras, S. Sinnapan & S. Koran, 2011 International Conference on Humanities, Society and Culture

   a. The time spent playing violent video games is a significant predictor of aggressive behavior among adolescents aged 13 to 17 (Kumarasuriar, Pangiras, Sinnapan & Koran, 2011).

   b. Surnames --- claim that the time spent playing violent video games is a significant predictor of aggressive behavior among adolescents aged 13 to 17 _____.

3. **SOURCE:** Joanna M. Norton, "Ocean acidification", n.d.

   a. Pteropods are the main reason for all carbon export from the surface in some Antarctic regions, so their extinction would damage the food cycle in these regions (Norton, n.d.).

   b. Norton explains in her article "Ocean --- " that pteropods are the main reason for all carbon export from the surface in some Antarctic regions, so their extinction would damage the food cycle in these regions (n.d.).

TYPES OF CITATION	IN-TEXT CITATION
One author One sentence	• The size of the universe at the Big Bang was thought to be zero, causing the universe to be infinitely hot (Hawking, 1988, p. 61). • Hawking (1988, p. 61) states that size of the universe at the Big Bang was thought to be zero, causing the universe to be infinitely hot. • Hawking states that size of the universe at the Big Bang was thought to be zero, causing the universe to be infinitely hot (1988, p. 61). • Hawking (1988) states that size of the universe at the Big Bang was thought to be zero, causing the universe to be infinitely hot (p. 61).
One author Multiple sentences	• Hawking states that size of the universe at the Big Bang was thought to be zero, causing the universe to be infinitely hot. He continues to explain that with this expansion, a decline to a 10,000 million degrees in radiation temperature took place one second after the Big Bang amounting to thousand times of the temperature at the center of the Sun (1988, p. 61).
Multiple authors One sentence	• Hawking and Mlodinow (2010, p. 65) explain that according to equations of Maxwell, the travelling speed of electromagnetic waves in a second is 300,000 kilometers, which equals to 670 million miles in 60 minutes. • Hawking and Mlodinow explain that according to equations of Maxwell, the travelling speed of electromagnetic waves in a second is 300,000 kilometers, which equals to 670 million miles in 60 minutes (2010, p. 65). • Hawking and Mlodinow (2010) explain that according to equations of Maxwell, the travelling speed of electromagnetic waves in a second is 300,000 kilometers, which equals to 670 million miles in 60 minutes (p. 65). • According to equations of Maxwell, the travelling speed of electromagnetic waves in a second is 300,000 kilometers, which equals to 670 million miles in 60 minutes (Hawking & Mlodinow, 2010, p. 65). • The use of a specifically designed five-fingered Robovie R3 has proven to be significantly effective in teaching sign language to children with hearing impairment (Uluer, Akalın & Köse, 2015, p. 571). • Uluer, Akalın and Köse report that the use of a specifically designed five-fingered Robovie R3 has proven to be significantly effective in teaching sign language to children with hearing impairment (2015, p. 571).

Multiple authors Multiple sentences	• Uluer, Akalın and Köse report that the use of a specifically designed five-fingered Robovie R3 has proven to be significantly effective in teaching sign language to children with hearing impairment. They emphasize that previously used robot platforms had hands with three dependent fingers, hence had a more restricted kinematic performance (2015, pp. 571, 576).
Institution One sentence	• It is estimated that about 2/3 of the students starting primary school will most probably work in jobs that are not present today (World Economic Forum [WEF] 2016). • World Economic Forum (WEF) (2016) estimates that about 2/3 of the students starting primary school will most probably work in jobs that are not present today. • World Economic Forum (WEF) estimates that about 2/3 of the students starting primary school will most probably work in jobs that are not present today (2016).
Institution Multiple sentences	• World Economic Forum (WEF) estimates that about 2/3 of the students starting primary school will most probably work in jobs that are not present today. Hence, social and emotional skills including problem-solving and adaptability will be essential for future jobs (2016).
No author or institution Title of the source	• **When neither the author nor the institution is known, the title of the source is used.**
Website	Original sentence taken from the iLumen European Solar Challenge (iESC) website, with the URL extension http://europeansolarchallenge.eu • Istanbul Technical University Solar Car Team ranking first in the "Single Person Car" category of iLumen European Solar Challenge was selected the "Best Team Reflecting the Solar Spirit"(iLumen European Solar Challenge, 2016). • As stated by iLumen European Solar Challenge Istanbul Technical University Solar Car Team ranking first in the "Single Person Car" category of iLumen European Solar Challenge was selected the "Best Team Reflecting the Solar Spirit" (2016). • As stated by iLumen European Solar Challenge (2016), ITU Solar Car Team ranking first in the "Single Person Car" category of European Solar Challenge was selected the "Best Team Reflecting the Solar Spirit". • **Note that the website address is not used for in-text citation!**

Quotations, paraphrases and summaries

In academic writing the writer's ideas need to be supported and proven with the help of outside sources. A reference to an authority makes an argument more convincing and reliable. However, the voice of the writer should be dominant in an academic essay despite presentation and incorporation of the information from outside sources. Incorporating the right material at the right time adds to the quality of an academic paper.

Three methods for borrowing information from an outside source are:

- **direct quoting**
- **paraphrasing**
- **summarizing**

To clarify and signal the information that has been borrowed from other sources, direct quotes, paraphrases and summaries are usually introduced with reporting verbs or phrases (as presented on page 28). This helps smooth incorporation of borrowed ideas in a paragraph.

Remember! All three methods necessitate citing the sources to avoid plagiarism.

Direct quotations

In academic texts, direct quotations are usually preferred when the borrowed text is powerful and memorable. In those cases, changing the words and the sentence structure may risk losing the meaning of the borrowed statement. However, it should also be noted that in technical writing, direct quotations should be used scarcely.

Tips for incorporating direct quotations into paragraphs

1. Present two or three supporting sentences before introducing the quotation.
2. Introduce the quotation with a reporting verb or phrase and incorporate the directly quoted material into the paragraph. Remember to put **quotation marks** (**“ ”**) at the beginning and at the end of the quoted material.
3. Copy the original sentence exactly, keeping the words, the sentence structure and the punctuation the same.
4. Cite the source according to APA citation rules.
5. Make sure to present the page or paragraph number for direct quotations.

Example:

> "Bear in mind that many of the key ideas of calculus are novel, and were introduced, somewhat reluctantly, only after it gradually dawned on mathematicians that they were actually indispensable" (Silverman, 1985, p. xvi).

This direct quotation is an isolated direct quotation. However, the quoted material should be smoothly integrated into the paragraph with the help of a reporting verb or phrase.

Example:

> Engineering students may be discouraged during their challenging studies. They complain about the complexity of the subjects in the courses. In order to have a complete grasp of the engineering courses, they need to not only study but also practise the applications of their curriculum. In addition to the complexity of the courses, students tend to criticize the course materials. Especially, the Calculus is found to be extra demanding among engineering students who find the topics difficult to understand and feel the necessity to solve problems repeatedly. However, it is not just students who have found calculus troublesome. **Silverman advises engineering students to "Bear in mind that many of the key ideas of calculus are novel, and were introduced, somewhat reluctantly, only after it gradually dawned on mathematicians that they were actually indispensable" (1985, p. xvi).** Briefly, engineering students will learn to embrace the complexity of their studies to explore the principles of engineering.

Shortened quote with ellipsis:

The part you want to borrow may be quite long and include unnecessary details. In such cases, irrelevant parts of the text can be omitted; however, the meaning of the original text is kept the same. Use of **ellipsis (...)** in the place of the omitted words shows that you have deliberately left out some words, phrases or sentences.

When using ellipsis, accuracy and the meaning of the remaining sentence should be ensured.

Example:

> Engineering students may be discouraged during their challenging studies. They complain about the complexity of the subjects in the courses. In order to have a complete grasp of the engineering courses, they need to not only study but also practise the applications of their curriculum. In addition to the complexity of the courses, students tend to criticize the course materials. Especially, the Calculus is found to be extra demanding among engineering students who find the topics difficult to understand and feel the necessity to solve problems repeatedly. However, it is not just students who have found calculus troublesome. **Silverman advises engineering students to "Bear in mind that many of the key ideas of calculus ... were introduced ... only after it gradually dawned on mathematicians that they were actually indispensable" (1985, p. xvi).** Briefly, engineering students will learn to embrace the complexity of their studies to explore the principles of engineering.

Exercise 3: Read the sentences below and decide if they are appropriate for direct quotation or not. Cite the appropriate ones.

1. **SOURCE:** Stephen Hawking and George Francis Rayner Ellis, *The large scale structure of space-time,* 1973

"The subject of this book is the structure of space-time on length-scales from 10^{-13}cm, the radius of an elementary particle, up to 10^{28}cm, the radius of the universe."

✗

2. **SOURCE:** Muhammad Ali. n.d.

"He who is not courageous enough to take risks will accomplish nothing in life."

M.Ali states that " ↓ " (n.d.).

3. **SOURCE:** Elon Musk, NASA Post-Launch News Conference, April 8, 2016

"SpaceX's got 5,000 people."

✗

4. **SOURCE:** Elon Musk, 2012

"In terms of the Internet, it's like humanity acquiring a collective nervous system."

Elon Musk defines Internet with the words " ↓ " (2012).

5. **SOURCE:** Richard A. Silverman, *Calculus with analytical geometry,* 1985, p. xvi

"Calculus is the brainchild of two men of genius, Sir Isaac Newton (1642-1727) and Gottfried Wilhelm Leibniz (1646-1716)."

Silverman explains that "..." (1985, p.xvi)

Exercise 4: Read the source below and decide which part would be suitable for a direct quotation. Complete the given paragraph and incorporate a direct quotation based on the APA rules.

SOURCE: Division for Sustainable Development UN-DESA, n.d.

This Agenda is a plan of action for people, planet and prosperity. It also seeks to strengthen universal peace in larger freedom. We recognize that eradicating poverty in all its forms and dimensions, including extreme poverty, is the greatest global challenge and an indispensable requirement for sustainable development. All countries and all stakeholders, acting in collaborative partnership, will implement this plan. We are resolved to free the human race from the tyranny of poverty ... and to heal and secure our planet. We are determined to take the bold and transformative steps which are urgently needed to shift the world onto a sustainable and resilient path.

prosperity (n): being successful and wealthy

eradicate (v): to destroy or wipe out something completely

indispensable (adj): essential

sustainable (adj): able to continue for a long period of time

stakeholder (n): a person who has a share in a business or enterprise

implement (v): to start using a plan or procedure

resolved (adj): determined

tyranny (n): despotism

resilient (adj): tough; strong and unlikely to fail

Sustainable development is a contemporary concept which can be basically defined as fulfilment of basic needs without abusing natural assets. In other words, the purpose of this trend is to end poverty without damaging natural habitat. United Nations Sustainable Development Knowledge Platform is one of the foundations working towards this goal by declaring that they "recognize that eradicating poverty in all its forms _____ " (n.d.). However, in order to adopt the requirements of sustainable development, each member of the society should take responsibility. To achieve this, all nations and individuals should work together.

Paraphrase

Paraphrasing is rewriting the original text by changing the grammatical structure and vocabulary but keeping the meaning the same. The original text to be paraphrased should not be longer than two or three sentences.

Replacing a few words with their synonyms while still keeping the exact order of author's wording will not make it a paraphrase. Therefore, in order to avoid plagiarism, the grammatical structure should also be changed.

Tips for paraphrasing

1. Select relevant sentences from the source to be paraphrased.
2. Make sure that you understand the original text correctly.
3. Close the original text and write down what you have understood in your own words.
4. Change the sentence structure and find synonyms of the words.
5. Keep the original meaning. Avoid adding any ideas of your own and omitting any information from the original text.
6. Remember to cite correctly.
7. Reread your sentence to be sure that you have not copied the original words or structure from the source.

Example: Read the original sentence below. Compare it with the paraphrased version.

SOURCE: Hubblesite, "Hubble detects giant 'cannonballs' shooting from star", 2016

Original Sentence: "NASA's Hubble Space Telescope has detected superhot blobs of gas, each twice as massive as the planet Mars, being ejected near a dying star."

Paraphrased sentence: As released by Hubblesite, one of the discoveries of the Hubble Space Telescope of NASA is the ejection of giant masses of gas close to a dying star, each of which is extremely hot and double the size of Mars **(2016).**

red giant (n): a very large cool star giving out red light

blob (n): something without regular shape

eject (v): to send out by force

Exercise 5: Read more original sentences about the "Giant cannonballs" from Hubblesite. Choose the acceptable paraphrase for each sentence. Explain your reasons.

1. "V Hydrae is a bloated red giant, residing 1,200 light-years away."

   a. As indicated in Hubblesite, V Hydrae is a swollen ruby colossus, which is 1,200 light-years distant from the Earth (2016).

   b. As indicated in Hubblesite, V Hydrae with a distance of 1,200 light-years is a massively bulked red giant (2016).

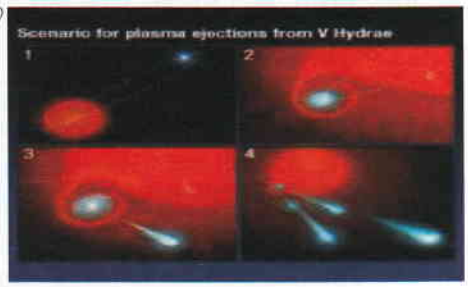


Figure 1: the illustration of a red giant, V Hydrae

2. "The data collected from Hubble showed that blobs are superhot, each with a temperature of more than 17,000 degrees Fahrenheit."

   a. According to the released Hubble data, the temperature of each blob is over 17,000 degrees Fahrenheit making them 'superhot' (Hubblesite, 2016).

   b. According to the released data by Hubble, superhot blobs are 17,000 degrees Fahrenheit in temperature (Hubblesite, 2016).

3. "The plasma balls are zooming so fast through space that it would take only 30 minutes for them to travel from the Earth to the Moon."

   a. According to Hubblesite, the blobs are moving so quickly in space that from the Earth to the Moon it would take merely 30 minutes to travel (2016).

   b. According to Hubblesite, the speed of the plasma blobs is extremely high, such that the distance between the Earth and the Moon would be travelled in just half an hour (2016).

4. "This stellar 'cannon fire' has continued once every 8.5 years for at least the past 400 years, astronomers estimate."

   a. As stated by Hubblesite, astronomers guess that for at least 400 years this cosmic 'cannon fire' will be observed recurring every 8.5 years (2016).

   b. As stated by Hubblesite, astronomers think this cosmic 'cannon fire' has been happening for a minimum of 400 years, recurring every 8.5 years (2016).

Exercise 6: Fill in the paraphrased sentences with the words in the box.

SOURCE: Hubblesite, "Hubble reveals observable universe contains 10 times more galaxies than previously thought", 2016

estimation	detected (v)	scope (n)	diverse	minimum	comprise

1. **Original Sentence:** "At least 10 times more galaxies exist in the observable universe than astronomers thought."
   Paraphrased Sentence: Contrary to astronomers' estimation, the scope of the universe that can be observed consists of a minimum of ten times more than the suspected number of galaxies (Hubblesite, 2016).

2. **Original Sentence:** "The Hubble Ultra Deep Field ... revealed 10,000 galaxies of various shapes, sizes, colors, and ages ... which represent merely 10 percent of the universe's total galaxy population."
   Paraphrased Sentence: Ten thousand galaxies detected by the Hubble Ultra Deep Field with diverse shapes, sizes, and colors as well as differing ages comprise only ten percent of the total number of galaxies in the universe (Hubblesite, 2016).

Exercise 7: Complete the paragraph by choosing the two most appropriate pieces of source information from the options listed below. Paraphrase the source sentences and add proper citations.

Hubble is a space telescope which was launched in 1990 by NASA. Hubble can shoot exceptional images with higher resolution when compared to ground-based telescopes. By sending thousands of detailed images, it ultimately transformed the former assumptions and theories of astronomers about the universe. For example, one of the latest findings is about the expansion rate of the universe. As indicated by Hubblesite, unlike the expectations of astronomers predictions, on of the discoveries of the Hubble Space Telescope is that the expansion rate of the universe is 5-9% more (2015)

Moreover, Hubble significantly contributed to the exploration of new planets beyond the solar system. These planets might serve as new habitats for human race. For instance, as Hubblesite mentions, Trappist 1b and Trappist 1c, the discoveries of Nasa astronomers located at 40 light years away do not possibly have puffy, atmospheres which is composed high amount of H as expected from

Knowing that the wider universe is far beyond the limits of current human reach, Hubble is the best use of technology for the furthering of astronomical science.

1. **SOURCE:** Hubblesite, "NASA's Hubble finds universe is expanding faster than expected", 2016

   "Astronomers using NASA's Hubble Space Telescope have discovered that the universe is expanding 5 percent to 9 percent faster than expected."

2. **SOURCE:** Hubblesite, "NASA's Hubble finds universe is expanding faster than expected", 2016

   "Now, the latest measurements of our runaway universe suggest that it is expanding faster than astronomers thought."

3. **SOURCE:** Hubblesite, "NASA's Hubble telescope makes first atmospheric study of Earth-sized exoplanets", 2016

   "NASA's Hubble Space Telescope has also made some unique contributions to the planet hunt."

4. **SOURCE:** Hubblesite, "NASA's Hubble telescope makes first atmospheric study of Earth-sized exoplanets", 2016

   "They discovered that the exoplanets TRAPPIST-1b and TRAPPIST-1c, approximately 40 light-years away, are unlikely to have puffy, hydrogen-dominated atmospheres usually found on gaseous worlds."

stereotypical
compared
evident
sustain
altering
layout
insert

resistance
remain
combating
approach
pursuing
abuse
engage
attribute
rival

"studies reveal that"

Summary

A **summary** is a shortened version of borrowed information. When summarizing a text, only the relevant information is restated without giving unnecessary details. In a summary, the structure and the vocabulary of the original text should be changed. However, the meaning should be kept the same. A summary can be a few sentences or a paragraph long depending on the material, but it should be much shorter than the original text.

Tips for writing a summary

1. Make sure that you understand the original text correctly.
2. Underline / highlight the parts that are relevant for your argument.
3. Exclude the unnecessary details and repetitions. Make sure that you do not change the meaning when omitting parts.
4. Write the underlined / highlighted parts in your own words by changing the sentence structure.
5. Do not add your own ideas.
6. Remember to cite correctly.
7. Do not forget to check your summary to be sure that you have not copied the original words or structure.

Sample summary

1. Read the source.

SOURCE: Adapted from Maxine Anderson, 2006, pp. 77-78

da Vinci glider

to flap - flapped

sketching

Leonardo was fascinated by the idea of flying and gliding, and spent years drawing designs for gliders, flying machines, and flapping wings. He was the first person to study flight in a scientific manner: he spent hours and hours watching birds in the air, sketching the way they dove and swooped, studying the angles of their wings at different points in flight, and observing how they turned and rode air currents to keep aloft. He also dissected birds and bats and studied their anatomy, focusing on the structure of their wings. Many of his sketches mimic the construction of a bat or bird's wing spread in flight. Leonardo also sketched the way other things moved in air: he drew falling leaves and a glider... . There is no record that any of Leonardo's flying machines worked, and in fact, most of them couldn't have been successful: they were designed to mimic the flapping of birds' wings, which would have required more strength than any human could manage. However, many of his flying machine sketches show devices that are now common on most airplanes, including moveable wing flaps to change altitude or speed, as well as landing gear.

aloft (adv) (adj): high above the ground; up in the air

dissect (v): to cut apart and examine the body of a dead animal or plant

mimic (v): to copy, imitate

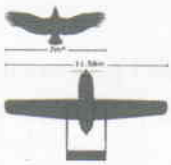
construction (n): a structure or a pattern

device (n): machine; tool; gadget

altitude (n): height above sea level

to dive – dived/dove

to swoop - swooped



wing spread

landing gear

2. Examine the highlighted sentences.

Leonardo was fascinated by the idea of flying and gliding, and spent years drawing designs for gliders, flying machines, and flapping wings. He was the first person to study flight in a scientific manner: he spent hours and hours watching birds in the air, sketching the way they dove and swooped, studying the angles of their wings at different points in flight, and observing how they turned and rode air currents to keep aloft. He also dissected birds and bats and studied their anatomy, focusing on the structure of their wings. Many of his sketches mimic the construction of a bat or bird's wing spread in flight. Leonardo also sketched the way other things moved in air: he drew falling leaves and a glider ... . There is no record that any of Leonardo's flying machines worked, and in fact, most of them couldn't have been successful: they were designed to mimic the flapping of birds' wings, which would have required more strength than any human could manage. However, many of his flying machine sketches show devices that are now common on most airplanes, including moveable wing flaps to change altitude or speed, as well as landing gear.

3. Read the sample summary.

As indicated by Anderson, Leonardo was a pioneer in examining the principles of flight scientifically for which he spent most of his life observing and sketching birds and bats as well as designing flying machines. It is unknown whether his machines worked or not but they introduced elements like wing flaps and landing gear used in contemporary flying vehicles (2006).

pioneer (in) (n): a person who is the first doer of an action, invention, study, etc.

contemporary (adj): up to date, modern; existing now

Collocations

1. **current (n):** a flow of water, air, or electricity
   air current / *electric* current / *swim against the* current / *carry with the* current
   current (adj): recent, present; popular [currently (adv)]
   in current *use*
   current *example / issue / events / exchange ratio / research*

2. **device (n):** an object produced for a particular purpose
   simple / complex / sophisticated / clever / labor-saving / useful / hand sized device
   mechanical / electronic / electrical / medical / nuclear / hi-tech device
   measuring / timing / safety / security / explosive / incendiary / automatic device

Exercise 8: **Read the text below and choose the correct summary to complete the paragraph on the next page.**

SOURCE: Y. Nakayama & R. Boucher, *Introduction to fluid mechanics,* 1999, pp. 1-2

Hydraulics developed as a purely empirical science with practical techniques beginning in prehistoric times. As our ancestors settled to engage in farming and their hamlets developed into villages, the continuous supply of a proper quantity of water and the transport of essential food and materials posed the most important problems. In this sense, it is believed that hydraulics was born in the utilization of water channels and ships. Prehistoric relics of irrigation canals were discovered in Egypt and Mesopotamia, and it has been confirmed that canals had been constructed more than 4000 years BC. Water in cities is said to have begun in Jerusalem, where a reservoir to store water and a masonry channel to guide the water were constructed. Water canals were also constructed in Greece and other places. Above all, however, it was the Romans who constructed channels throughout the Roman Empire. Even today their remains are still visible in many places in Europe. As stated above, the history of the city water system is very old. But in the development process of city water systems, in order to transport water effectively, the shape and size of the water conduit had to be designed and its inclination or supply pressure had to be adjusted to overcome friction with the wall of the conduit. This gave rise to much invention and progress in overcoming hydraulic problems.

empirical (adj): depending on observation or experiment

settle (v): to start to live somewhere

engage in (v): to become involved

quantity (n): an amount or measure of something

pose (v): to cause or present (e.g. a question or a difficulty)

utilization (n): using something

irrigation (n): supply land with water

remains (n): parts or pieces that still exist

visible (adj): something that can be seen

Collocations

1. pose (v): to cause a situation; to state

   to pose *a challenge / a danger / a difficulty / a problem / a risk / a threat*

2. construct (v): to form; to build

   to construct *a bridge / a building / a channel / a pipeline*
   to construct *an argument / a sentence / a story*
   to construct *an angle / a line / a figure (in geometry)*

1. Hydraulics evolved as an experimental science with functional techniques in prehistoric times where ancient people utilized water (Nakayama & Boucher, 1999, pp. 1-2).
2. As Nakayama and Boucher emphasize, the earliest irrigation canals were constructed in Egypt and Mesopotamia before 4000 BC, and then were utilized in Jerusalem, by the ancient Greeks and throughout the Roman Empire (1999, pp. 1-2).
3. As Nakayama and Boucher explain, hydraulics emerged through ancient people's experiences and practices when they started a settled life. In order to supply water, food and other necessary materials, they began to make use of water channels and ships (1999, pp. 1-2).

Water has played a huge part in the advancement of humankind and has been a powerful source for people to control for thousands of years. Harnessing this power has enabled people to utilize water for production and transportation. In order to successfully fulfill these tasks, people made use of irrigation canals, which is also seen as the birth of hydraulics. The proof of first attempts to control water through irrigation canals can be observed in prehistoric relics. ____ _____. Since then, hydraulics has been employed in daily life in various forms.

Exercise 9: Write a summary of the text below with proper citations.

SOURCE: Adapted from S. Perkowitz & E. Von Mueller, "Communicating real science through Hollywood science", 2010, pp. 81-82

Hollywood's science fiction films can ... be a remarkable resource to convey both science and a healthy critical perspective to students and the general public. Since Georges Méliès's pioneering 1902 effort *Le Voyage dans la Lune* (*Voyage to the Moon*, based on Jules Verne's story about a cannon that shoots a space capsule to the moon), more than 1,400 science fiction feature films covering most areas of science and technology have been released in the United States. These films have become a cultural force, ranking among the most widely seen and most profitable of movies. Science fiction works such as *2001: A Space Odyssey* (1968) and the original *Star Wars* (1977) appear on lists of all-time best films. They inspire young people to become scientists. From "wormholes" to "Beam me up, Scotty", the ideas and vocabulary of science fiction films have entered our thought and language. And these films reflect contemporary issues of science and society – from Cold War anxieties about nuclear disaster to today's concerns about genetic engineering.

convey (v): to communicate or express a message or information
cannon (n): a heavy large gun to shoot bombs or big objects
release (v): to broadcast a film in cinemas
rank (v): to hold a position or level as higher or lower in something
profitable (adj): beneficial, useful; advantageous; producing money
inspire (v): to produce strong feelings or encouragement; to give an idea
reflect (v): to show, express; mirror
anxiety (n): fear, worry or distress, especially for the uncertainty in the future

WORD FORMS

Complete the table with the word forms.

VERB	NOUN	ADJECTIVE	ADVERB
convey			-
release	release	releasable	-
profit	profit	profitable	
inspire	inspiration	inspirational	
reflect	reflection	reflective	
-	anxiety	anxious	anxiously

Collocations

1. **convey** *information / a message / an idea / a feeling / meaning / sense adequately / accurately / effectively / clearly / successfully* **convey**

   e.g. Some science fiction films effectively convey a sense of horror about the future of the world.

2. **rank** *above / below / among / high / low / first, second, etc. / in the top / in the bottom*
   e.g. The film ranks *among* the best ones of all times.
   e.g. He ranked *the second* in the race.
   e.g. She ranked *in the top* 100 students in the exam.

Summary:

Science fiction films can serve as a tool to communicate a positive understanding of science and technology to people. It is certain that science fiction movies affect people not only through their visual power but also their ideas. For instance, as Perkowitz and Mueller emphasize in their artical "Communicating real science through Hollywood science", the concepts and vocabulary such as "wormholes" and "Beam me up, scotty" have entered people's life and language from scientifically significant movies 2001 A space odyssey and star wars . . . . . .

Therefore, this repertoire of scientific vocabulary acts as an influencial instrument in conveying scientific concepts to people.

REVISION

DIRECT QUOTATION	PARAPHRASE	SUMMARY
• It is using the exact words of the author without making any changes in the original text. • It is used if the text you borrow is powerful and you cannot rephrase it in a better way or the essence of the text is lost in translation. • Exactly copy the original text. • It is rarely used in technical writing. • You need to cite your source.	• It is rephrasing the ideas or opinions of the author in your own words without changing the meaning of the original text. • You should replace items of vocabulary with their synonyms and change the sentence structure. • Keep the technical jargon the same. • It has approximately the same length as the original text. • You need to cite your source.	• It is a short restatement of the main ideas and main points of a lengthy text in your own words without changing the meaning of the original text. • You need to omit irrelevant details in your summary. • Keep the technical jargon the same. • It is significantly shorter than the original text. • You need to cite your source.

$3,800.00
Site
Decorations
Publicity
Miscellaneous
Refreshments
Program
Estimated
Actual
Jan
Jul
Aug
Oct

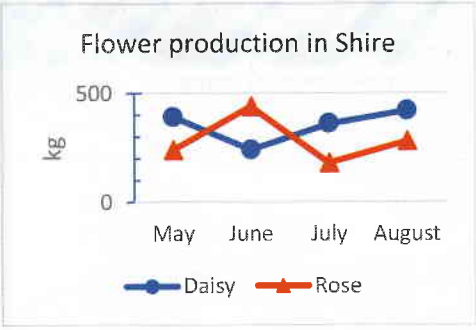
UNIT III

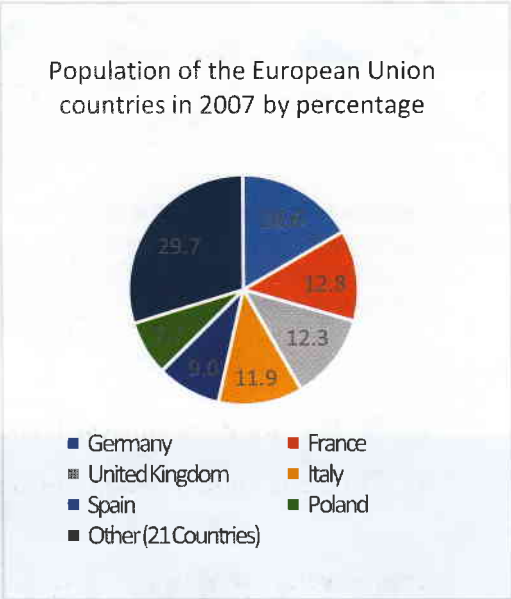
INTERPRETING DATA

In all forms of technical writing, analysis of measurements and interpretation of data is essential to justify the ideas elaborated. Especially in engineering, presenting information through graphs and charts is usually preferred because it is often easier to explain statistical data by visualization. Therefore, one should be able to decode a graph or a chart visually, and then interpret the information and statistics for easy reference.

Graphs and charts display relationships or trends between variables in the form of comparisons, distributions, percentages, and proportions. The most common forms are line graphs, bar graphs, and pie charts.

A **line graph** highlights trends and shows changes of data over time. Horizontal (x) axis presents the independent data while the vertical (y) axis is labeled with dependent data. A **bar graph** is used to compare data among categories. The data displayed in a bar graph are independent of each other. In other words, a change in one variable does not affect the others. A bar graph might have horizontal or vertical bars, either in single or stacked forms. A **pie chart** demonstrates dependent data unlike bar graphs. In a pie chart, there are proportions of a meaningful whole where the sum of the slices should add up to a hundred per cent.





Writing about graphs and charts

Use of tenses

When the graphs and charts present facts in the present, the simple present tense is used. When the data presents information from the past, then the simple past tense is used. When there is a connection between the past and the present, the present perfect tense is used.

For example, when a bar graph of different age groups receiving a driver's license of the current year is analyzed, the simple present is used.

When commenting on the data indicating different age groups of people who received a driver's license in the previous year, the simple past is used.

However, if you need to compare and contrast the data regarding age groups of people who have received a driver's license over the past three years, the present perfect is used.

Describing trends

Trends are the increases, decreases, or fluctuations over a period of time. Therefore, you should notice the highest - lowest, the biggest - smallest, the most - least, or the stable - changing data. To present trends, generally line graphs and bar graphs are used. In order to identify trends, you can ask questions such as:

1. What does the information in the vertical axis represent?
2. What does the information in the horizontal axis represent?
3. When do the numbers reach the highest point?
4. When do the numbers sink to the bottom?
5. Do the numbers shift back and forth over a certain period?
6. Do the numbers remain the same over a certain period?

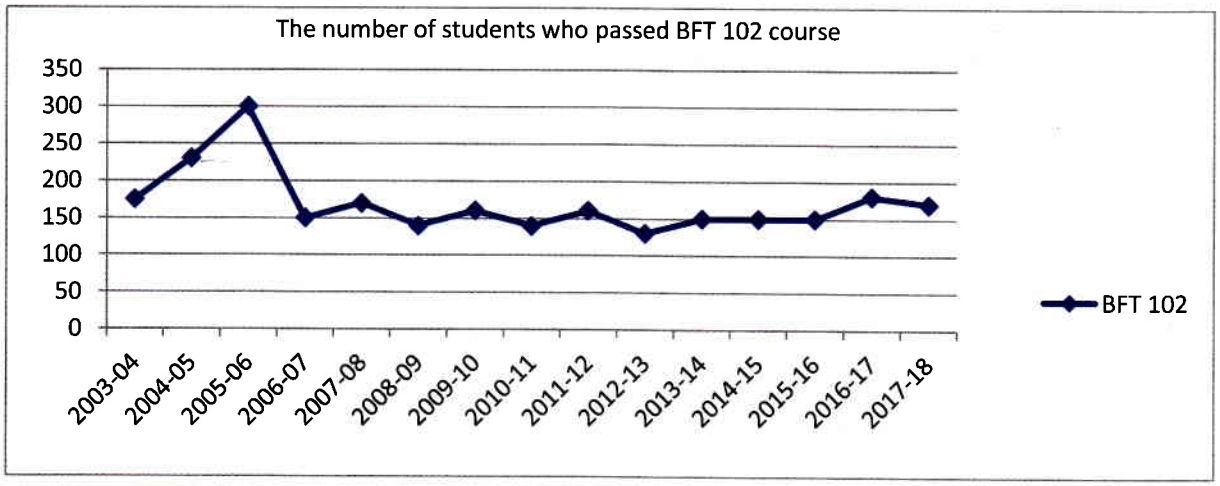
A variety of verbs, nouns, and phrases can be used to describe different trends. Some of the most commonly used ones are presented in the following table:

		VERB	NOUN
UPWARD TREND	↗	climb / go up / increase / lift / rise / grow by	increase / growth / rise / upswing
		double / triple / boom / jump / skyrocket / soar	boom / jump
		peak / reach a peak / reach the highest point / reach an all-time high	peak the highest point
DOWNWARD TREND	↘	decline / decrease /dip / drop fall / go down / reduce / sink by	decline / decrease / dip / drop / fall / reduction / downswing
		collapse / plunge	collapse / plunge
		hit the bottom / plummet reach the lowest point	bottom the lowest point
NO CHANGE	→	level out (off) / not change maintain the same level / stabilize keep ... stable / hold ... constant remain steady / remain stable stay constant / stay the same stop falling / rising	stability the same level steadiness
CONTINUOUS CHANGE	~↗	change constantly change continuously fluctuate shift up and down	constant change fluctuation

However, it is not enough to describe only the direction of the movement, so some adverbs and adjectives are also required to describe the degree or the speed of the change.

DEGREE of CHANGE		SPEED of CHANGE	
ADJECTIVE	ADVERB	ADJECTIVE	ADVERB
gentle / moderate / slight / small / minimal / marked	gently / moderately / slightly / minimally / markedly	gradual slow steady	gradually slowly steadily
dramatic / enormous huge / sharp significant / steep substantial / vast	dramatically /enormously / hugely / sharply / significantly / steeply / substantially / vastly	quick rapid sudden swift	quickly rapidly suddenly swiftly

Exercise 1: The statistics in the line graph below are about an imaginary course, BFT 102, with a total number of 350 students each academic year. The number of students who passed their course varies in different academic years. Using the graph, fill in the blanks in the sentences below with suitable verbs, nouns, or phrases given in the box.

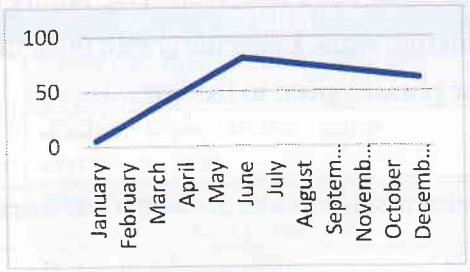


a fluctuation	a sudden fall	a steadiness	a rise	reached a peak
	dropped slightly	increased dramatically		

1. The number of students who passed BFT 102 course increased dramatically between the 2003-04 and 2005-06 academic years.
2. The number of BFT 102 students who passed the course reached a peak in the 2005-06 academic year.
3. There was a sudden fall in the number of BFT 102 students who passed the course in the 2006-2007 academic year.
4. Between the academic years 2006-07 and 2013-14 a fluctuation is observed in the number of students who passed the course BFT 102.
5. Between 2013-14 and 2015-16, for two academic years a steadiness is seen in the number of students who passed BFT 102.
6. There was a rise in the number of students who passed BFT 102 course in the academic year 2016-17.
7. The number of BFT 102 students who passed dropped slightly in the 2017-18 academic year.

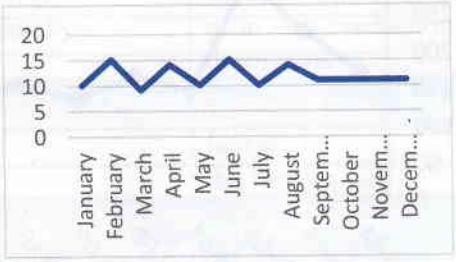
Exercise 2: Match the line graphs with their descriptions.

1.

2.


3.

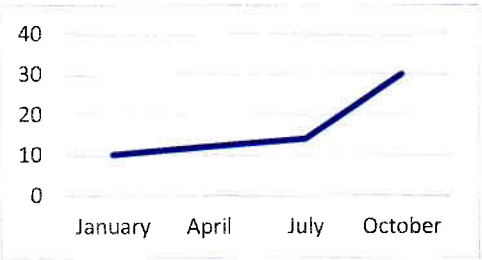
4.

5.


a. Sales reached a peak, then levelled out after dropping slightly. → 2
b. Sales have stabilised in the final quarter. → 5
c. After an abrupt fall in June, sales showed a steady increase again. → 4
d. Although the sales increased markedly from January to June, there was a gradual decline in the second half of the year. → 1
e. Sales plunged a fifth in the third quarter of the year. → 3

Exercise 3: Describe the trends shown in the line graphs below.

1. There was a steady increase in sales in the first half of the year. There was a fluctuation in the sales in the second half of the year. The sales reached a peak three times in the months june, August and October.



2. The sales increased between january and june. The sales increased dramatically betwen july and Oct. and they reached at peak in Oct.

skyrocket

Making comparisons

Comparisons are the estimations of similarities and differences of two or more items or concepts with reference to the other(s). To present comparisons, generally bar graphs and pie charts are drawn. Bar graphs are basically beneficial when it is required to depict the changes that occur over time. The bigger the change, the more applicable the bar graph is. On the other hand, pie charts are mainly used to emphasize percentages or to compare the parts of a whole. They are not applicable for changes over time. When interpreting a bar graph or a pie chart, you can ask questions such as:

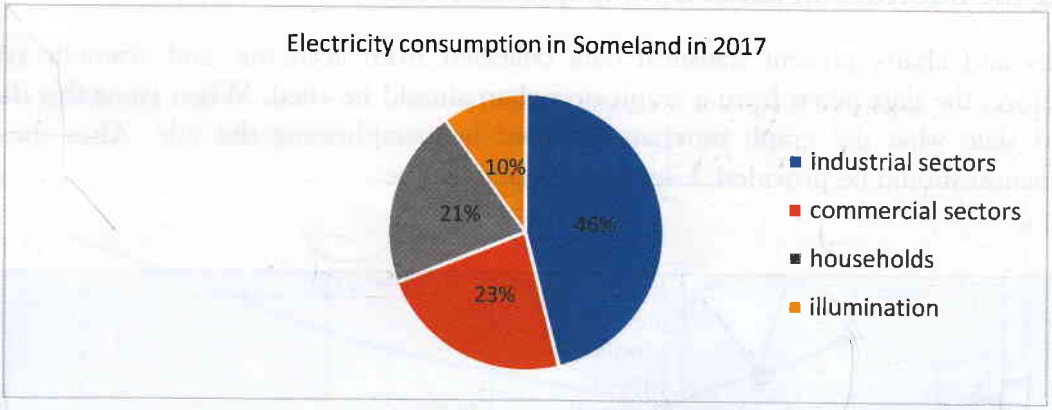
1. What sets of data are compared?
2. What are the differences in the heights / lengths of the bars?
3. What are the differences in the percentages of each slice?
4. Which is the highest / lowest bar?
5. Which is the largest / smallest slice?
6. Which bars / slices have equal or similar values?
7. What is the percentage of each part to the whole?

To write a comparison about the information shown in a bar graph or a pie chart, several adjectival and adverbial structures are used. Some of these are presented in the table below:

COMPARATIVES	slightly twice / three times far / significantly more / less than	 more / less than half / a quarter / a third / 30 %
SUPERLATIVES	the highest / the lowest the most / the least amount of the most / the least percentage of the largest / the smallest percentage of	
AS ..... AS	as large / small as as high / low as almost as much / many as twice as much / many as twice as big / small as	
THE SAME AS THE SAME ..... AS LIKE	approximately / nearly / almost the same as the same amount / number / percentage of ... as like	
FRACTIONS PERCENTAGES RATIOS	half of / a quarter of / one third of twenty percent of the ratio of ... to ... is 3 to 1 the majority / minority of	
COMPARISON & CONTRAST EXPRESSIONS	compared to → Compared to X, Y is ... in comparison (with) → In Comparison with X, Y is ... while / whereas on the other hand in contrast (to) → In contrast to A, B is	

24

Exercise 4: Based on the pie chart below, fill in the blanks with the expressions given in the box.



almost one fifth of	like	less than half	twice as high as
	the same percentage		

1. The consumption of electricity for illumination was less than half of the electricity consumed by commercial sectors.
2. Illumination accounted for almost one fifth of the consumption by industrial sectors.
3. Commercial sectors consume approximately the same percentage of electricity as households.
4. Electricity consumption by industrial sectors was twice as high as the consumption by commercial sectors.
5. Like households, commercial sectors consumed almost one fifth of the total electricity.

Exercise 5: Based on the pie chart above, write two more sentences comparing the data.

1. _____

_____

2. _____

_____

Citing the information taken from graphs and charts

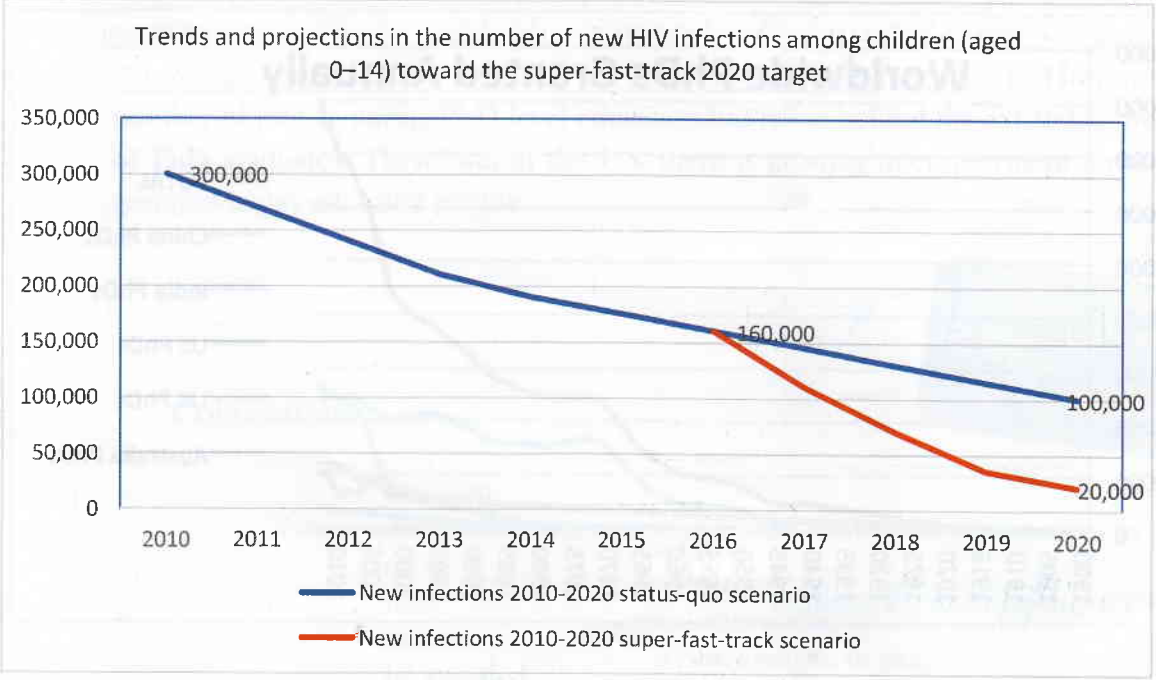
Graphs and charts present statistical data collected from academic and scientific research. Therefore, the data taken from a graph or a chart should be cited. When citing this data, you should state what the graph or chart is about by paraphrasing the title. Also, the source information should be provided. Useful language might be:

The line graph The bar graph The pie chart	on about showing presenting focusing on illustrating depicting	[paraphrased title of the graph / chart]	given / presented / provided by ... [author's surname] presented in / taken from / published in ... [title of a book / an article] presented in / taken from / published on the webpage of ... [name of institution / organization / university, etc.]	presents shows depicts illustrates is about gives information on / about	... [relevant interpretation of graph / chart] [exemplary items of data selected from the graph /chart]	(date, page number).

According to As presented in As illustrated in As depicted in In	the bar graph the line graph the pie chart	on about showing presenting focusing on illustrating depicting	[paraphrased title of the graph / chart]	given / presented / provided by ... [author's surname] presented in / taken from / published in ... [title of a book / an article] presented in / taken from / published on the webpage of ... [name of institution / organization / university, etc.]	... [relevant interpretation of graph / chart] [exemplary items of data selected from the graph /chart]	(date, page number).

Example:

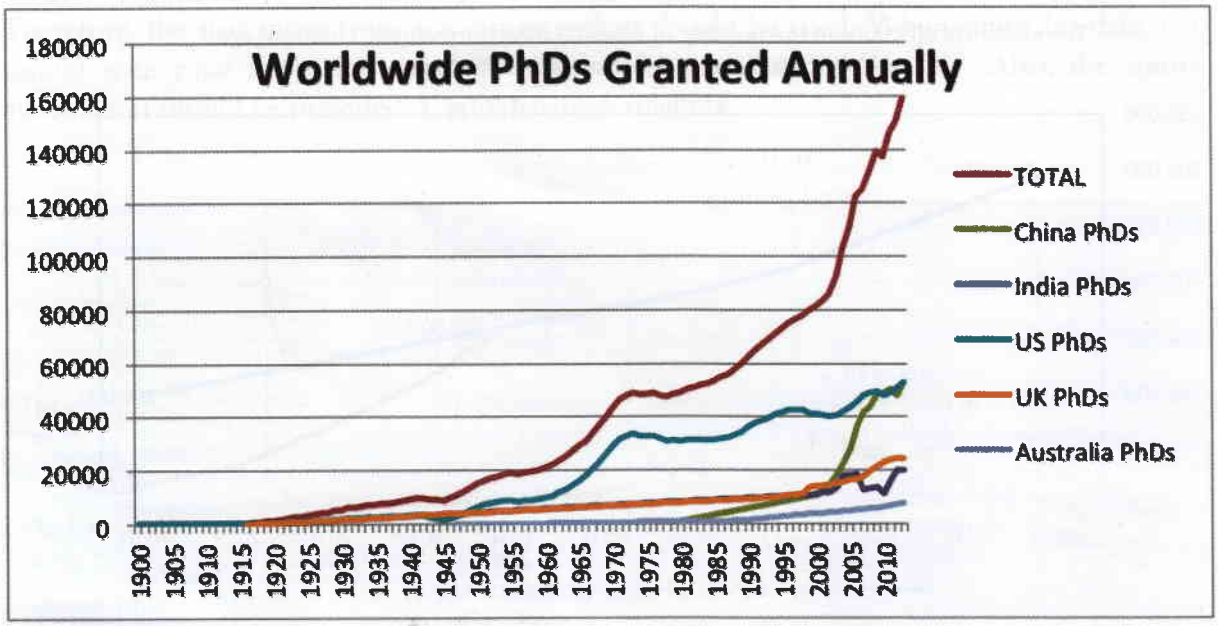
SOURCE: UNICEF, *Children and AIDS: statistical update report,* 2017



In the fight against AIDS, there have been significant global achievements in reducing the number of HIV infections in the last decade. This has been achieved by integrated efforts of governments introducing new public health services that try to prevent mother-to-child transmission of HIV. However, although there has been significant reduction in infection rates, the current situation can still be improved. As presented in the line graph taken from a recent report on children and AIDS published on the webpage of UNICEF, the projections and trends show that the number of HIV infected children aged 0 to14 will still be 100,000 by 2020 unless an accelerated action program is taken. In order to eliminate HIV transmission in children, the number of newly infected children must be reduced from 100,000 to 20,000 with a super-fast-track scenario (2017). If this target is achieved, AIDS can no longer be considered as an epidemic threatening world populations.

Exercise 6: **Complete the sentences by interpreting the line graph below. Remember to cite correctly.**

SOURCE: Eric Gastfriend, "90% of all the scientists that ever lived are alive today", 2015



1. There has been a rise in the number of PhD graduates across the globe. For example, in the line graph showing the annual numbers of PhDs granted worldwide illustrated by Gastfriend, totally 160000 students earned their Phd's in the year 2010 (2015) (2015). However, this huge increase in doctoral studies has led to debates questioning the quality and diversification in PhD studies.

2. After the end of the Cultural Revolution in China in the middle of the 1970s, doctoral programs expanded largely throughout the nation. China started to put emphasis on increasing the number of postgraduate studies. This effort brought about a sudden rise in the number of PhDs granted. The line graph taken from Gastfriend illustrating the number of people who get a PhD in different contries around the world shows that in approximeun 35 years betwe 1975-2010 the (2015). Moreover, in order to prevent unemployment with the growing number of doctors, the government led a policy to channel research into industry.

number of Chinese doctor has rised from 0 to 50.000

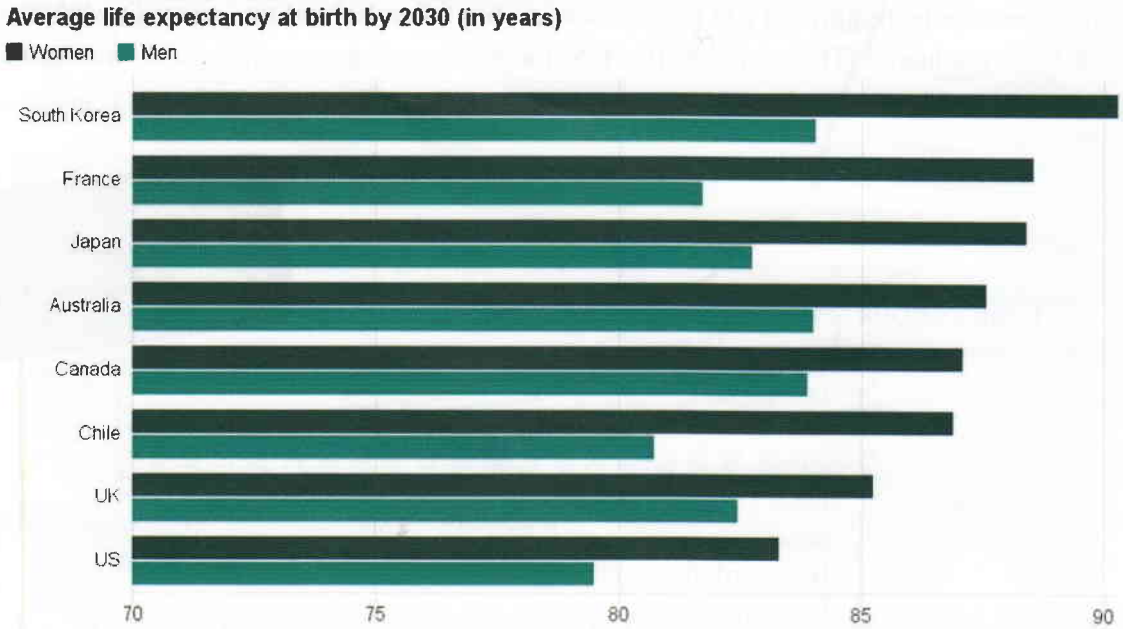
3. In the US, after the 1950s, doctoral studies gained more importance among university graduates who wanted better job opportunities. According to the line graph presented in Gastfriend's Article "---" showing the number of Phd graduates around the world, the number of people who aced a PhD increased (2015). However, the number of jobs requiring PhD level education has fallen behind the expanding number of PhD graduates. Therefore, in the US, there is growing unemployment among this group of highly educated people.

Collocations

to	complete do earn have receive be awarded be granted	a PhD a doctorate a doctoral degree a postgraduate degree
to be a	doctoral student postgraduate (UK) graduate (US) PhD graduate	
a	doctoral postgraduate	study degree program education
to have a PhD		from ITU in architecture on architectural history

Exercise 7: Based on the bar graph below, write compare and contrast statements. Do not forget to cite.

SOURCE: James Gallagher, "Life expectancy to break 90 barrier by 2030", 2017



diction
speaking or
in speech
dict- say]
dictionary /'dikfəner
that lists (usu. in
the words of a la
another langua
the items of w

UNIT IV

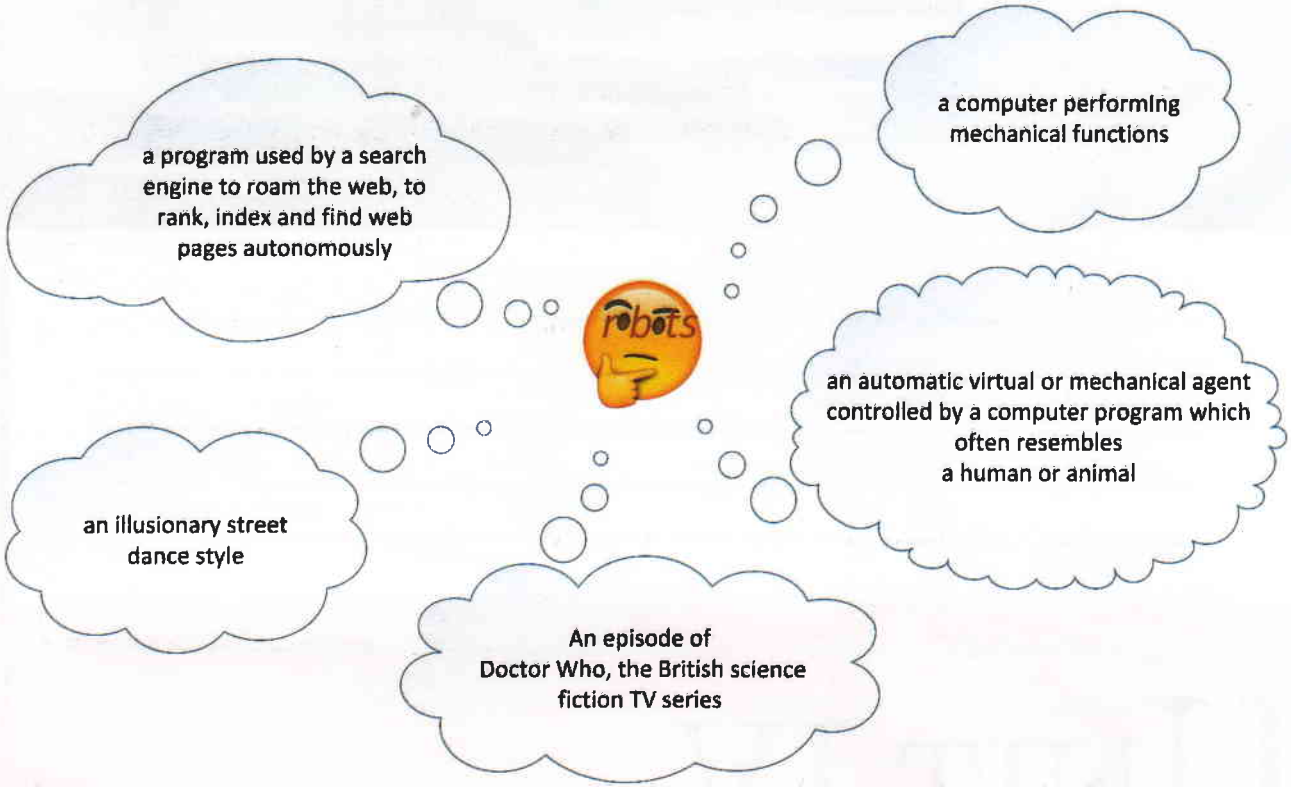
DEFINITIONS

Writing definitions and explaining the meanings of terms is an essential component of technical and formal writing. A definition helps the reader clearly understand the message by providing a unified understanding and eliminating any probable confusion.

Why do you need a definition?

- Providing a definition is essential when a key term might be unfamiliar for the audience. The definition will make sure that you and your audience have a unified understanding.
- Providing a definition is also necessary when a common word is used to convey a different meaning.

For example, if you are using the word "robot" in different circumstances for different audiences, you may want to clarify the meaning as it may have different connotations.



Some may understand the word as "a program used by a search engine to roam the web, to rank, index and find web pages autonomously" whereas others may understand it as **"a computer performing mechanical functions such as spraying assembly line workers"**. The majority of the audience may infer the meaning of a robot as "an automatic virtual or mechanical agent which often resembles a human or animal, controlled by a computer program"; however, by another group a robot might even be interpreted as **"a person acting without thinking"**. In a different group the term robot may be understood as **"an illusionary street dance style"** while a different audience may think of an "episode of Doctor Who, the British science fiction TV series", when the word "robot" is uttered. It is therefore necessary to form a unified understanding by defining the term clearly for the context.

Sentence definition

A **sentence definition** is an explanation of a term in one complete sentence. It is also called a **formal definition.**

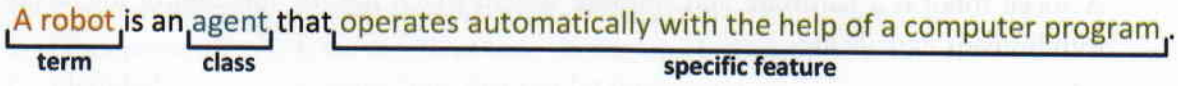
A sentence definition consists of three parts:

1. **the term** to be defined,
2. **the class** which the term belongs to,
3. **the specific feature or features** that distinguish the term from other members of the same class.

For example, in order to define a robot to an audience, first you need to name the class. Based on different definitions of robot above, the class can be "an agent", "a program", or even "a dance style". After finding the class, you need to write the qualities that distinguish a "robot" from other possible members of the same group.

To further illustrate, if you decide to name the class "an agent" you need to write the features that make a robot different from other agents.

Therefore, a possible definition for a robot would be:



In this example, the term to be defined is "robot". "Agent" is the class and the fact that a robot "operates automatically with the help of a computer program" is the specific feature that distinguishes robots from other "agents".

Remember

- The class that the term belongs to and/or the specific features should not be too general or too specific.
- The term and the verb provided in the definition should be different and not a repetition of each other. To illustrate, avoid definitions like "A board marker is a marker that marks on the board".
- The present tense is typically used in definitions. However, when a term related to historical events is defined, the simple past tense should be used.

Exercise 1: Read the sentence definitions below and identify the components. Pay attention to the tense and determine the underlying reason for the tense selection.

1. A humanoid is a kind of robot that has a torso with a head, two arms and two legs.
2. An android is a kind of robot that is designed to act like and resemble a human being in appearance.
3. The Quark epoch was the period which began approximately 10−12 picoseconds after the Big Bang, laying the foundations of gravitation and electromagnetism.
4. Robonaut1 was the first humanoid robot designed as a remotely operated astronaut assistant, which never took part in a space mission.
5. Project M was a proposed NASA initiative which focused on designing, developing and landing a humanoid robot on the Moon.

Exercise 2: Check the following definitions and identify the correct ones. State the problems in the incorrect definitions and correct them.

1. A medical robot is a robot used in medicine and medical institutions.

   A medical robot is an automated machine which is used in surgeries.

2. A social robot is a hardware and software system which has the function of interaction with humans in daily life.

   ✓

3. The National Aeronautics and Space Administration (NASA) is an administration that administers aeronautical and aerospace research.

   NASA is an institution which searches for extraterrestial life.

4. Robot language is a kind of communication that is used to convey robotic expressions that humans should understand.

   A remote control is an electrical device which sends signals to electronical devices such as TV's, projectors or air conditioners.

Exercise 3: Write formal sentence definitions for the following terms.

1. Remote control

_____

_____.

2. Air conditioner

_____

_____.

3. Projector

_____

_____.

4. Love

_____

_____.

VOCABULARY FOCUS

Match the meanings.

1.	vibration (n)	a. spread out or generate
2.	pressure (n)	b. a substance through which a force can be transmitted
3.	propagate (v)	c. the force or weight produced when something pushes another thing
4.	medium (n)	d. being aware of something by means of the physical senses
5.	duration (n)	e. a steady and quick shaking movement
6.	perception (n)	f. the length of time during which something continues
7.	identifiable (adj)	g. something that can be recognized

WORD FORMS

Complete the table with the word forms.

VERB	NOUN	ADJECTIVE	ADVERB
	vibration		-
	pressure		-
propagate			-
	perception		
		identifiable	

Exercise 4: Study the vocabulary focus and word forms above and define the term "sound" in different contexts given below. The first one is done for you.

In Physics:

Sound can be defined as vibration which occurs as a result of a pressure. When vibration occurs, energy is produced. The energy resulting from the vibration propagates through any elastic medium, such as air and water. This propagation is in the form of mechanical waves. Sound waves cannot move in a vacuum, in other words in spaces where there is no air.

Sound is the vibration caused by a pressure producing energy that spreads out as mechanical waves through an elastic medium.

In Music:

Vibrations in musical sounds are regular and periodic. The sounds are produced by musical instruments. Humans can produce musical sounds by using their vocal cords, too. Musical sounds create a pleasant effect on the ear. The organization of sounds creates music.

Sound is _____

_____

In Phonetics (the study of sounds in human speech):

Vocal cords in the human body create sound by vibrating as air comes from the lungs. Sound is produced by speech organs such as the lips, tongue, palates, uvular and glottis, which are generally called articulators. The auditory system is comprised of organs such as the ear, membrane, cochlea, and brain nerves, and is concerned with the perception of sounds. The auditory system is responsible for the sense of hearing. A phone is the smallest identifiable component of human speech. Phones combine to produce the separate words specific for a language.

Sound is _____

_____

Exercise 5: **Read the source and write a sentence definition of "robotic arm".**

SOURCE: Adapted from National Taiwan University of Science and Technology, "Robotic arm", n.d.

The term robot comes from the Czech word *robota*, generally translated as "forced labor." This describes the majority of robots fairly well. Most robots in the world are designed for heavy, repetitive manufacturing work. They handle tasks that are difficult, dangerous or boring for human beings. The most common manufacturing robot is the robotic arm. A typical robotic arm is made up of seven metal segments, joined by six joints. The computer controls the robot by rotating individual step motors connected to each joint (some larger arms use hydraulics or pneumatics). Unlike ordinary motors, step motors move in exact increments. This allows the computer to move the arm very precisely, repeating exactly the same movement over and over again. The robot uses motion sensors to make sure it moves just the right amount.

repetitive (adj): repeating again and again

segment (n): parts, divisions, sections

joint (n): a place in a body or mechanism where two parts connect

rotate (v): to turn in a circular movement

increments (n): a process of small gradual increases

precisely (adv): exactly and accurately

As defined by the National Taiwan University of Science and Technology, a robotic arm is

_____

_____ (n.d.).

WORD FORMS

Complete the table with the word forms.

VERB	NOUN	ADJECTIVE	ADVERB
		repetitive	
	segment		-
rotate			-
-	increment		
-			precisely

Extended definition

Especially in technical writing, based on the purpose of the definition and on the needs of the audience, the amount and type of information will vary. Hence, an **extended definition** is needed.

Extended definitions start with the sentence/formal definition.

An extended definition may employ:

a. the origin of the word,
b. its function,
c. its importance,
d. physical traits including color, size, shape,
e. its history,
f. comparisons with (dis)similar items,
g. explanation of how the item works.

The extended definition does not have to include all this information and the amount of information to be presented depends on the term and the context.

You do not have to follow the given order above; however, the extended definition paragraph should have a logical order. Make sure that your paragraph maintains unity and coherence.

LANGUAGE FOCUS

Parts or components can be expressed using several verbs and structures.

A. Verbs in active form

A typical robotic arm | includes / contains / consists of / comprises | seven metal segments and six joints.

Seven metal segments and six joints | make up / comprise / constitute / compose | a typical robotic arm.

B. Verbs in passive form

A typical robotic arm | is made up of / is comprised of / is composed of | seven metal segments and six joints.

Seven metal segments and six joints | are included in / are contained in | a typical robotic arm.

C. Listing

A typical robotic arm has two | parts / components / sections / elements | : metal segments and joints.

Metal segments and joints are the two | parts / components / sections / elements | of a typical robotic arm.

Exercise 6: **Identify the components of the extended definition in the paragraph below and analyze it in terms of coherence and unity.**

SOURCES: Adapted from Kjernsmo Kjetil, "How to use a compass", n.d.; National Geographic Society, "Compass", n.d.

A magnetic compass is an instrument which determines the direction of North. The compass is essential for navigation and orientation, specifically in the aviation and maritime industries. It also plays a vital role for those who need to know the direction they are facing when traveling or performing outdoor sports. The magnetic compass is composed of the magnetized needle, the dial and the housing. The magnetized metal needle which is placed in a low-friction compass housing aligns itself with the Earth's magnetic field. This magnetic field pulls one end of the needle towards the Earth's North magnetic pole. The needle points to the printed directions on the dial, thus presenting the direction north. As The National Geographic Society indicates, the exact dates of the discovery and applications of principles for the magnetic compass are not clearly known but it is believed that the compass was developed by the Chinese around the 11th century. The device started to be used in Europe in the early 13th century (n.d.). After several adaptations and adjustments over the centuries, the compass has become an indispensable navigation device.

navigation (n): finding the direction to travel; directing a ship, aircraft, etc.

orientation (n): the position or direction something faces, esp. toward the North

aviation (n): the industry and act of flying or aircrafts

maritime (n): related to shipping and seas

align (v): to put into a straight line

application (n): putting something into use for a purpose

adaptation (n): a change in something to suit another situation or purpose

adjustment (n): a small change in something

Collocations

adapt (v): to change in order to fit into new conditions (adapt to / from)

adapt *successfully / quickly / easily / readily / accordingly*

The plants have easily adapted to the harsh desert climate.

Exercise 7: **Identify the problematic parts in the extended definition below and discuss.**

SOURCES: Adapted from ITU, *General Biology II Laboratory BIO 112E*, n.d., pp. 7-11; American Chemical Society, 2004

A pH meter is an electrical instrument that is used to measure the hydrogen ion activity that determines the acidity or alkalinity of a solution. pH stands for "potential of hydrogen ion" and is always spelled with a lowercase p and an uppercase H. A pH meter's function is to measure the difference of electrical potential between the tested solution and the reference solution on a scale of 0 to 14. As presented by the American Chemical Society, the pH meter was invented in 1934, about a quarter century after the development of the glass electrode, by American chemist Arnold Beckman when experimenting on measuring the sourness of lemon. He was granted the patent of the pH meter in 1936 (2004). A typical pH meter comprises a digital or a moving coil meter as the voltmeter, a usually glass pH-responsive electrode and a reference electrode.

When immersed in the solution, these electrodes act as a battery for the voltmeter. An electric potential is formed by the glass electrode, which is directly related to the hydrogen ion (H+) activity in the solution. If the hydrogen ion (H+) concentration is greater than the hydroxyl ion (OH-), the pH value is less than 7 and the material is accepted as acidic. On the other hand, the material will be considered alkaline if the OH- concentration is greater than H+ and the pH value is higher than 7. Equal amounts of H+ and OH- indicate a pH level of 7, hence the material is accepted to be neutral.

acidity (n): the amount of acid in something; sourness

alkalinity (n): the amount of bases in a substance

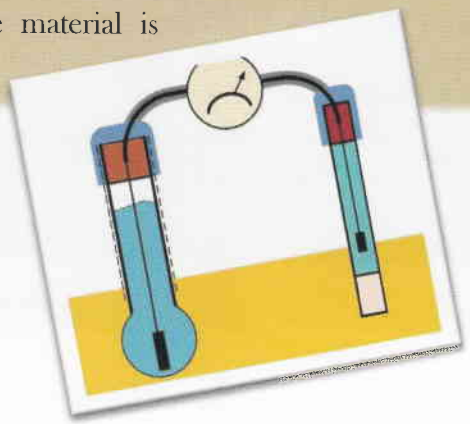
solution (n): a homogeneous mixture of a liquid with a solid or gas

scale (n): numbers or degrees set for measurement

grant (v): to give something (title, permission, license, etc.) officially

immerse (v): to put something completely into a liquid

concentration (n): the given amount of a substance in a solution



Exercise 8: **Read the extended definition of a social robot below. Underline the irrelevant sentences that weaken the unity of the paragraph.**

SOURCES: Adapted from National Taiwan University of Science and Technology, "Robotic arm", n.d.; K. Dautenhahn, & A. Billard, 2016

A social robot is a physically embodied autonomous agent communicating with humans, following the rules of social interaction. A robot is an agent that operates automatically with the help of a computer program. The term "social robot" is quite a recent one and the robots started to be engaged at the social level in the early 1990s. As Dautenhahn and Billard list, JULIA by Lenny Foner, KISMET by Cynthia Breazel and robots of Vygotsky are among the pioneering social robots (1999). Social robot technology is still a focus of attention. Socially interactive robots can have different forms and shapes ranging from "human-like" appearances with faces, torso, arms and legs or they can at least be "creature-like" with the minimum features including an emotive head, eyes,and a mouth. They can express and perceive emotions, and communicate through dialogue to establish social relationships. Therefore, they can be used as educational tools especially for helping autistic children, they can be used as health care aids to help the elderly or disabled or they can even be used as toys. An industrial robot with six joints closely resembles a human arm with the equivalent of a shoulder, an elbow and a wrist. Typically, the shoulder is mounted to a stationary base structure rather than to a movable body. Components of social robots can be categorized under seven headings. These can be counted as main body, end effectors such as hands, actuators which can be considered as muscles, servos enabling robots to receive information, a controller coordinating the motions, a processor acting as the brain, and multimedia.

embodied (adj): given a bodily form

torso (n): body without head, arms, and legs

emotive (adj): expressing emotions

elderly (adj): old

disabled (adj): lacking physical or mental abilities

Exercise 9: Read the source and write an extended definition of a "robotic arm". Choose only the parts relevant for an extended definition.

SOURCE: Adapted from National Taiwan University of Science and Technology, n.d.

The term robot comes from the Czech word *robota*, generally translated as "forced labor." This describes the majority of robots fairly well. Most robots in the world are designed for heavy, repetitive manufacturing work. They handle tasks that are difficult, dangerous or boring for human beings.

The most common manufacturing robot is the robotic arm. A typical robotic arm is made up of seven metal segments, joined by six joints. The computer controls the robot by rotating individual step motors connected to each joint (some larger arms use hydraulics or pneumatics). Unlike ordinary motors, step motors move in exact increments. This allows the computer to move the arm very precisely, repeating exactly the same movement over and over again. The robot uses motion sensors to make sure it moves just the right amount.

A robotic arm with six joints closely resembles a human arm with the equivalent of a shoulder, an elbow and a wrist. Typically, the shoulder is mounted to a stationary base structure rather than to a movable body. This type of robot has six degrees of freedom, meaning it can pivot in six different ways. A human arm, by comparison, has seven degrees of freedom.

Your arm's job is to move your hand from place to place. Similarly, the robotic arm's job is to move an end effector from place to place. You can outfit robotic arms with all sorts of end effectors, which are suited to a particular application. One common end effector is a simplified version of the hand, which can grasp and carry different objects. Robotic hands often have built-in pressure sensors that tell the computer how hard the robot is gripping a particular object. This keeps the robot from dropping or breaking whatever it is carrying. Other end effectors include blowtorches, drills and spray painters.

equivalent (n): having similar properties or value to another thing

pivot (v): to turn or twist on a central point

outfit (v): to provide clothes or equipment for a special purpose

grasp (v): to take hold of something firmly

built-in (adj): being an integral and permanent part of something

grip (v): to have hold of something firmly in your hands

Robotic arms are designed to do exactly the same thing, in a controlled environment, over and over again. For example, a robot might twist the caps onto peanut butter jars coming down an assembly line. To teach a robot how to do its job, the programmer guides the arm through the motions using a handheld controller. The robot stores the exact sequence of movements in its memory, and does it again and again every time a new unit comes down the assembly line.

Most robotic arms work in auto assembly lines, putting cars together. Robots can do a lot of this work more efficiently than human beings because they are so precise. They always drill in exactly the same place, and they always tighten bolts with the same amount of force, no matter how many hours they have been working. Manufacturing robots are also very important in the computer industry. It takes an incredibly precise hand to put together a tiny microchip.

assembly line (n): a moving line in a factory on which machines and workers construct and prepare products

incredibly (adv): extremely; extraordinarily, unbelievably

VOCABULARY FOCUS

If two things are equal, they are similar in all aspects. However, if two things are equivalent, they are similar in particular aspects.

equal (adj): the same in amount, value, qualities

e.g. Women and men do not achieve **equal** payments in work life.

equivalent (adj): having the same amount, value, qualities, etc.

e.g. Women and men working in **equivalent** jobs do not have the same amount of payments.

equivalent (n): something that has the same amount, value, qualities as something else

e.g. There is no direct **equivalent for** the Turkish word *"gönül"* in English.

e.g. The amount of meat a lion eats a day is **the equivalent of** eating forty hamburgers.

Exercise 10: **Read the sources and write an extended definition of a "chemical reaction". Choose only the parts relevant for an extended definition.**

SOURCE: "Stoichiometry and balancing reactions", n.d.

In chemistry, chemical reactions are frequently written as an equation, using chemical symbols. The reactants are displayed on the left side of the equation and the products are shown on the right, with the separation of a single arrow that signifies the direction of the reaction. To balance an equation, it is necessary to have the same number of atoms on the left side of the equation as the right. One can do this by raising the coefficients. The following equation demonstrates the typical format of a chemical equation:

$$2Na(s) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2(g)$$

Based on the Law of Conservation of Mass, which states that matter is neither created nor destroyed in a chemical reaction, every chemical reaction has the same elements in its reactants and products, though the elements they are paired up with often change in a reaction. In this reaction, sodium (Na), hydrogen (H), and chloride (Cl) are the elements present in both reactants, so based on the Law of Conservation of Mass, they are also present on the product side of the equations. Displaying each element is important when using the chemical equation to convert between elements. In a balanced reaction, both sides of the equation have the same number of elements. Therefore, to balance the number of each element on both the reactant and the product sides of the equation, the coefficient is written in front of atoms, ions and molecules.

equation (n): (math) a statement showing that two amounts are equal
display (v): to arrange pictures, words, numbers, etc. to show or to exhibit them
signify (v): to mean; show by signs; show the importance
conservation (n): protection
convert (v): to change something into a different method, system, use

There are 6 basic types of reaction: Combustion is the formation of CO_2 and H_2O from the reaction of a chemical and O_2. Combination is the addition of two or more simple reactants to form a complex product. Decomposition is when complex reactants are broken down into simpler products. Single displacement is when an element from one reactant switches with an element of the other to form two new reactants. Double displacement is when two elements from one reactant are switched with two elements of the other to form two new reactants. Acid-base reactions are when two reactants form salts and water.

SOURCE: Purdue University, "Chemical reactions", n.d.

The first breakthrough in the study of chemical reactions resulted from the work of the French chemist Antoine Lavoisier between 1772 and 1794. Lavoisier found that mass is conserved in a chemical reaction. The total mass of the products of a chemical reaction is always the same as the total mass of the starting materials consumed in the reaction. His results led to one of the fundamental laws of chemical behavior: The Law of Conservation of Mass, which states that matter is conserved in a chemical reaction.

breakthrough (n): an important event or discovery which changes the course of events
consume (v): to use something in large amounts; finish completely

WORD FORMS

Complete the table with the word forms.

VERB	NOUN	ADJECTIVE	ADVERB
	equation		
display			-
signify			-
	conservation		-
convert			
consume			-

A chemical reaction _____

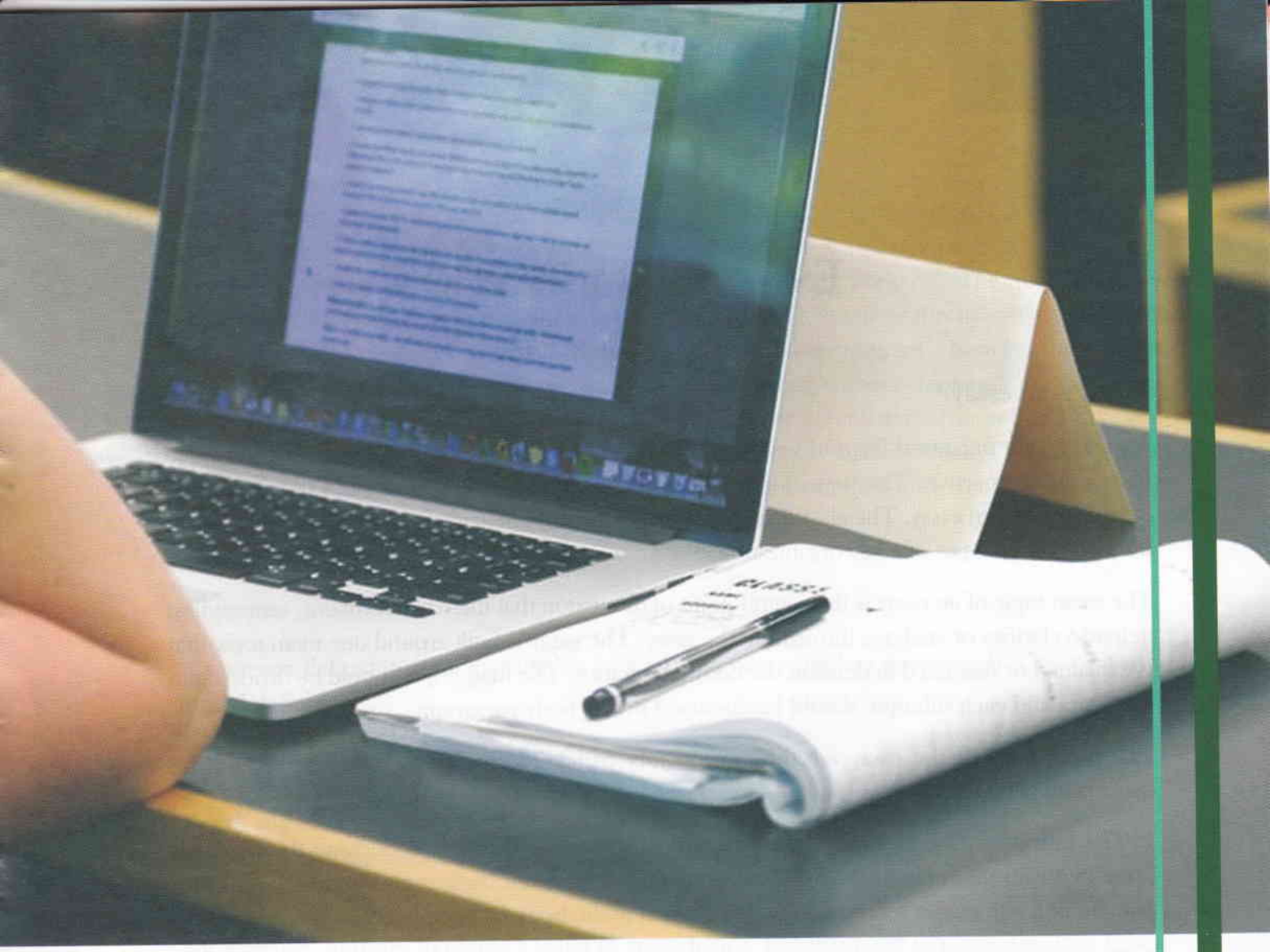
_____

_____

_____

_____

_____



UNIT V

ESSAY ORGANIZATION

What is an essay?

An **essay** is an organized form of writing that methodically analyzes and interprets a main topic from one perspective. The writer's purpose and the contents to be presented determine the organization of an essay. The classification essay and the argumentative essay are two of the most frequently used types of essay organization.

The **main topic** of an essay is the central point of discussion that the writer explains, exemplifies, defends, clarifies or analyzes throughout the essay. The essay is built around one main topic that is explained or discussed in detail in the body paragraphs. The main topic should be divided into **subtopics** and each subtopic should be discussed in one body paragraph.

The three parts of the essay are the introductory paragraph, the body paragraph(s) and the conclusion paragraph.

1. **The introductory paragraph** is the first part of the essay. In the introduction, the reader is presented with the topic to be discussed or analyzed. Relevant background information is also given to help the reader follow the ideas presented in the body paragraphs.

2. **The body** consists of one or more paragraphs. Academic writing demands detailed explanation and research to fully cover the topic, usually requiring more than one body paragraph. In each paragraph, the author develops one subtopic by providing relevant supporting information.

3. **The conclusion paragraph** wraps up and summarizes the main points stated in the body paragraphs and presents the writer's deduction or inference based on these main topics.

Outline

An outline is the plan that presents the method of development and the main features of the essay. Although the outline is not listed among the parts of an essay, it is the starting point for the organization of content and ordering of ideas to be included in the essay.

By writing an outline, the writer can more easily compose a well-structured and unified essay. It enables the writer to detect the strengths and the weaknesses, the adequacy and the variety of points and examples to be included.

Outline formats may change based on the essay type and content; however, a general format may be employed for most academic texts.

Steps of writing an outline

1. Write the **thesis statement**, which presents the main topic and the subtopics to be discussed, analyzed or explained, at the top of the outline. The thesis statement is the only part in the outline that is written as a complete sentence.

2. Present the **subtopics**. The subtopics in an essay can be organized in a variety of ways ranging from the order of importance to chronological order or spatial order. The type of essay determines the method for organizing the content. Each subtopic is presented with a Roman numeral (I, II, III, etc.). Therefore, each Roman numeral represents one body paragraph.

3. Provide **major supports** for each subtopic. Each major support that is presented by a capital letter (A, B, C, etc.) is the expansion of the subtopic through definitions and explanations.

4. Provide at least one **minor support** for each major support. A minor support clearly illustrates and/or proves the major support. It is presented by numbers (1, 2, 3, etc.).

5. **Examples** and **evidence** can also be presented to provide further understanding of the major and minor supports. They are shown with lowercase letters (a, b, c, etc.).

The outline below presents a general format.

Thesis Statement I. Subtopic A. Major Support 1. Minor Support 2. Minor Support a. example / evidence B. Major Support 1. Minor Support a. example / evidence 2. Minor Support II. Subtopic A. Major Support 1. Minor Support 2. Minor Support B. Major Support 1. Minor Support a. example / evidence 2. Minor Support III. Subtopic A. Major Support 1. Minor Support a. example / evidence b. example / evidence 2. Minor Support B. Major Support 1. Minor Support 2. Minor Support	• Thesis statement should be given in a **full sentence.** • Subtopics, major and minor supports, examples and evidence should be given as **phrases.** • Subtopic states the topic of the paragraph. • Major supports are the primary points to explain the topic of the paragraph. • Minor supports are the detailed explanations of the major supports. • Examples / Evidence can be taken from outside sources. • Use Roman numerals (I, II, III ...) for body paragraphs. • Use capital letters (A, B, C ...) for major supports. • Use numbers (1, 2, 3 ...) for minor supports. • Use lowercase letters (a, b, c ...) for examples / evidence. • Pay attention to **indentation!** • Numbers of subtopics, major and minor supports, examples and evidence might change according to essay type and content.

Parts of an Essay

The introductory paragraph

An essay starts with an introductory paragraph which gives the reader the prerequisite initial information. The introduction displays the writing style of the author and the content in general. The writer first introduces the topic, and provides general background information on the topic, which is essential for following the ideas in the body paragraphs.

Avoid using phrases such as "From past to present...", "Since the beginning of time...", "Throughout the history of mankind..." in the introductory paragraph.

Background information may include:

- historical information (where / when / who) regarding the origin and the development,
- definition of the term or concept that will be discussed or analyzed in the essay,
- previous studies and specific information that is related to the topic (outside sources could be used),
- importance of the topic.

The introduction needs to be precise and to the point and needs to include only the essential information on the subject. Long introductory paragraphs with extra and irrelevant information are not encouraged in academic essays. An introductory paragraph should not be longer than the body paragraphs.

The last sentence of the introductory paragraph is usually the **thesis statement** that presents the main topic and the subtopics to be discussed, analyzed or explained. The order of the subtopics written in the thesis statement determines the order of the body paragraphs.

The thesis statement should be precise in its scope. If a thesis statement is too general, it will make the topic too extensive to be discussed in any detail. Conversely, if a thesis statement is too specific, it may limit the scope of discussion, making the essay difficult to develop. Remember that the thesis statement is a full grammatical sentence, and cannot be a question or just a phrase.

For example, if you write "Concrete deteriorates because of many reasons" as the thesis statement, it is not possible to discuss all of those "many" reasons in any detail in one essay. On the other hand, if you write "Aluminum chloride deteriorates concrete", expert knowledge will be required to write a full essay on that one specific topic. Moreover, if the actual main topic is concrete deterioration then the essay should not be limited to just one chemical process. A proper

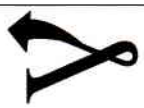
thesis statement might be: "Three basic factors that cause concrete deterioration are freeze-thaw cycles, corrosion of embedded metals, and chemical impacts."

Exercise 1: Study the statements below and point out why they are inadequate thesis statements.

1. Advantages of concrete.
2. What are the advantages of concrete?
3. Conncrete is a construction material.
4. Concrete is preferred over wood as a construction material.

Methods of writing an introductory paragraph

When writing introductions, the author can use various methods depending on the purpose of the essay. Three main methods that can be employed are funnel, definition and turnabout methods.

The funnel	Narrows down the topic from general to specific.	
The definition	Defines the topic in detail.	
The turnabout	Presents the counter idea initially, then introduces the idea the writer will support.	

Funnel method: Funnel method is narrowing down the topic from general to specific while writing an introduction. In funnel method, the introduction starts with a general statement. Then, progressively more specific and focused statements are written in each following sentence, leading to the thesis statement.

Note that if you start the introduction by writing statements which are too general, it will be difficult to narrow down the general topic to the thesis statement within the limits of an introductory paragraph. For instance, when writing about the topic "skyscrapers", you should not start by discussing "caves as shelter for early humans".

Exercise 2: Read the sample introduction and analyze how the funnel method is applied.

People have been in search of the strongest construction material that they could shape for their sheltering needs in accordance with climatic demands and economic concerns. Among the various construction materials, many were used simply because they were locally available while others were used as they were in cheap supply or easy to shape. These materials included but were not limited to mud, stones, bricks, wood, glass, aluminum, and steel. Portland cement, which was invented in the early 18th century, brought along the introduction of concrete as a new construction material which was then accepted as one of the strongest alternatives. Being economical, safe and sustainable are the three basic factors that make concrete the most common material in construction.

Definition method: This type of introduction starts with the formal definition of the term or the concept that will be discussed or analyzed in the essay. The other components of the introduction in this method may include the history, the function, and the importance of the term or concept as background information.

Exercise 3: Read the sample introduction and analyze how the definition method is applied.

Concrete is a construction substance which includes cement, water, and aggregates that consist of gravel and sand. The early forms of concrete can be traced to the Egyptians about 5000 years ago. Concrete as known today was invented in the early 18th century with the introduction of Portland cement and has been one of the most preferred materials in construction for nearly two centuries. Air and special admixture additives help improve the strength and durability properties of the concrete. Since these properties allow concrete to withstand degradation for a long time, it has become a very cost effective construction material. Therefore, the three basic factors that make concrete an advantageous material in construction are its economy, safety and sustainability.

Turnabout method: Opening the essay with a statement, an idea or an opinion that contrasts with the thesis statement is another method that can be used in writing introductions. In this method, the introduction starts by presenting the opposite idea; then, the focus shifts with a contrasting connective to introduce the main idea.

Contrasting connectives: but/ yet/ however/ on the other hand/ nevertheless/ nonetheless/ still/ etc.

Exercise 4: Read the sample introduction and analyze how the turnabout method is applied.

Concrete is a construction material which is a mixture of cement, water, and aggregates such as sand, pebbles, stones, and rocks. Since concrete is strong and highly durable, it is the most preferred material in constructions. It can withstand harsh weather conditions and degradation for a long period of time. It is resistant to high humidity, storms, ultraviolet, seawater exposure, and abrasion. However, despite the strength and durability qualities it possesses, it still cannot resist deterioration in time. Three basic factors that cause concrete deterioration are freeze-thaw cycles, corrosion of embedded metals, and chemical impacts.

The body paragraphs

An academic essay often has three body paragraphs. Each body paragraph focuses on one of the subtopics given in the thesis statement. It is essential that all subtopics should be related to the main topic of the essay. This will ensure unity and coherence throughout the essay.

A body paragraph largely consists of **a topic sentence** and **the major and minor supporting sentences** that expand, describe, classify, prove or argue the main topic. The paragraph may end with a **concluding sentence** that summarizes the content; however,this is not an absolute necessity.

The **topic sentence** introduces the controlling idea of the paragraph. All the information in the paragraph must be clearly and logically related to the topic sentence, which in turn should obviously relate to the thesis statement. Moreover, to write a coherent essay, each topic sentence should have a proper transition signal. Examples of transition signals might be:

- First(ly) / Second(ly) /Finally, ...
- The first / The second / Another / The next / The final / The last reason / factor / advantage / category / argument is...

Exercise 5: Complete the topic sentences with the help of the given thesis statement.

"The three basic factors that make concrete an advantageous material in construction are being economical, safe and sustainable."

1. _____

   _____ due to low production and maintenance cost.

2. _____

   _____ because of its ductile and fire resistant properties.

3. _____

   _____ because it is durable and it leaves minimal waste.

Major supports help the author to define, explain or prove the subtopic. They are the primary points to explain the topic of the paragraph. To further expand the major supports, **minor supports** provide detailed explanations which may include statistical data, facts, analysis, or quotes.

Remember! A paragraph does not end with a citation.

Exercise 6: Analyze the body paragraph and underline major and minor supports.

The second main advantage of using concrete in construction is the increased safety it provides because it is ductile and fire resistant. To begin with, cast-in-place reinforced concrete that is used in most modern buildings has very high levels of strength and ductility. It can withstand both compressive and tensile forces that may act on it. This enables the design of high-rise structures to be safe against impacts caused by extreme weather conditions. For example, as stated on the website of Florida International University, concrete is highly resistant to winds up to 200 miles per hour (n.d.). It can also exhibit the necessary ductility to absorb the seismic forces of earthquakes. Moreover, concrete has a natural endurance to extreme temperatures caused by fire. Because of the properties of its components, it is non-combustible; and having a slow rate of heat transfer, fire cannot spread to adjacent rooms rapidly. Therefore, it does not require any additional processing to meet the most advanced fire safety codes.

The conclusion paragraph

A conclusion paragraph summarizes the whole essay. It starts with the restatement of the thesis statement preferably with the same order of the subtopics. In order to provide a link to the body paragraphs, the conclusion paragraph should start with a proper transition signal, such as "In conclusion, ..." or "In summary, ...". Remember that transitions such as "To sum up, ..." or "All in all, ..." are informal ways to begin the conclusion paragraph.

After writing the restatement of the thesis, the conclusion paragraph provides a brief summary of the main points discussed in the body paragraphs. It ends with a **final comment** in the form of advice, a suggestion, a prediction, a warning, a call for action, etc.

Note that new information or arguments should not be introduced in the conclusion paragraph. Therefore, make sure that your final comments are consistent with the ideas in your essay.

Exercise 7: Read and analyze the sample conclusion paragraph.

Thesis statement: The three basic factors that make concrete an advantageous material in construction are its economy, safety and sustainability.

> In conclusion, due to financial, safety, and sustainability concerns, concrete is one of the most preferred construction materials. Low-cost maintenance, resistance against harsh weather conditions as well as fire, and ease of production make concrete not only strong and durable but also sustainable. With all these qualities, concrete will remain an essential substance for the construction sector.

UNIT VI

ARGUMENTATIVE ESSAY

What is an argument?

An argument is a process that occurs when two parties disagree on a certain topic. In other words, one party makes a claim and provides valid reasons in support of its point whereas the other party presents a different claim and offers different reasons in support of its own standing point.

Argument in its daily use might mean a heated debate or a polar opposition on a variety of topics such as "I win / you lose", "I am for eating meat / you are against eating meat", etc. However, academic arguments tend to be more complex, detailed and specific.

Most academic arguments are bounded by topics that are considered debatable. Debatable statements are ones that the reader may or may not agree with. To formulate a debatable statement, you should start with a sentence that does not include **personal preferences, impossibilities, beliefs** or **facts** since these are considered non-debatable.

An example to a non-debatable statement would be:

"Many contemporary advertising campaigns use female figures to sell their products." Since this is a fact, it cannot be a debatable statement.

However, a debatable statement using this factual information could be:

"Prevalent use of female figures in contemporary advertising campaigns strengthens gender stereotypes."

Another example of a non-debatable statement would be:

"Hip hop lyrics are more inspirational than pop lyrics." Since this is a preference, it is unlikely to be used as a debatable statement.

On the same topic, a debatable statement could be introduced as follows:

"Hip hop lyrics pose an aggressive attitude."

Exercise 1: Discuss whether the statements below are debatable or non-debatable.

1. Animal testing can be practised. → non-deb.
2. Animal testing is the only way to advance medicine. → deb.
3. Tulips are bulbous plants in the lily family. → non-deb.
4. Tulips are the most beautiful plants in the world. → non-deb.
5. Everybody would like to swim with dolphins. → non-deb.
6. Dolphins should never be used for entertainment. → deb.
7. Electric cars have less environmental impact than conventional vehicles. → non-deb. deb.
8. Electric cars use electrical energy stored in their rechargeable batteries. → non-deb.
9. The use of cloning to reintroduce extinct animals to their natural habitats will benefit the ecosystem. → deb.
10. A human mission to the Sun will provide data on the creation of the Universe. → ?

Argumentative essay

In an argumentative essay, the writer not only presents a debatable topic but also provides information for the reader. The writer should take a clear stand on the argument and try to persuade the opposing reader to adopt new ideas. Thus, the essay needs to be highly convincing and written with a logical framework. So as to persuade the reader, the writer should provide reliable supports. The aim is to present a debatable issue that states the writer's idea as well as discussion of the opposing idea.

There are three elements to consider when organizing an argumentative essay:

1. After choosing a debatable topic, the writer should take a strong stance. In the essay, it is important to clearly express which side the writer is taking. This takes the form of a **main premise,** which will be supported by the writer throughout the essay.

For instance, when discussing the ban on Genetically Modified (GM) foods in children's nutrition, if the writer supports the view saying, "Using GM foods can be hazardous for children's nutrition", it is not a strong stance and the writer fails to have an effective main premise. A stronger stance would look like this: "The use of GM foods should be banned in child nutrition". In this example, the writer formulates a strong and clear main premise.

2. After choosing a strong and a clear main premise, the research materials are analyzed for **the opposing arguments (CONS)** and **supporting arguments (PROS)** for the main premise.

For instance, the statement "GM foods with high nutritional capacity support children's physical development" would be an opposing argument to the main premise indicated above.

On the other hand, a supporting argument would be "The toxicity and allergenicity caused by consumption of GM foods hinder children's physical development". These contradictory statements should be on related topics.

3- After finding the cons and the pros parallel to each other, both arguments should be expanded. Then, these arguments can be backed up with **verifiable facts, statistical data, case studies, examples** and **opinions from experts working in that specific field**. However, remember that evidence in support of the cons will need to be matched or refuted by evidence for the pros in order for the reader to be persuaded of the validity of the writer's claim.

Exercise 2: **Match the words with their meanings below.**

1. argumentation	**a.** a person who disagrees with an idea and argues against it
2. refutation	**b.** drawing conclusions through logical reasoning and applying these reasons to a discussion
3. main premise	**c.** a point or statement that supports the writer's idea
4. opposing/counter argument (con)	**d.** a point or statement that argues against the writer's idea
5. supporting argument/ proposition (pro)	**e.** the process of discrediting the arguments that oppose the writer's idea
6. opponent	**f.** a person who supports an idea and argues in favor of it
7. proponent /supporter	**g.** the idea supported strongly and clearly by the writer

Making for and against list

Before starting to write an argumentative essay, the writer needs to know all the supporting and opposing aspects of the topic; therefore, it is essential to brainstorm on the ideas that are for and against. In this way, the writer is able to organize both the outline and the essay better.

Exercise 3: Decide whether the following sentences are for or against "use of laptops in class". Add ideas of your own.

1. Laptop use encourages online collaboration with other students.
2. Laptop use during lessons is a source of distraction both for the user and their classmates.
3. Note taking on computers is easier and faster.
4. Laptop use facilitates plagiarism due to instant access to online sources.
5. Students get lower grades if they use laptops in their classes.
6. Students remember the lecture better when they take notes by hand.
7. Laptops help students keep track of their assignments and utilize an online school calendar.
8. Students using laptops during lectures waste their class time with non-academic activities.
9. A facilitated learning environment via laptop use leads to higher grades.
10. Laptops make learning more interesting for technology-savvy students.

FOR	AGAINST

Formulating a thesis statement

After all the arguments for and against the debatable topic are listed, the thesis statement should be formulated. Formulating a correct and strong thesis statement is very important because all the opposing and supporting arguments in the essay are structured according to the thesis statement. Below are the steps of writing a thesis statement:

Step 1. The writer should hold a clear stance on the debatable topic. This stance supported throughout the essay is the "main premise". For example:

> "Laptop use in class disrupts the learning practices of students."

Step 2. In the argumentative essay, the opposing argument is also presented in the thesis statement to make it more convincing. The idea opposed throughout the essay is called the **"counter argument (con)"**. The counter argument should be parallel to the main premise in order to provide only one discussion in the entire essay. A counter argument to the main premise above could be:

> "Laptop use in class can facilitate classroom learning experiences."

Step 3. Simply writing two contradictory ideas together does not make an argumentative thesis statement. Two ideas should be separated from each other by using a contrasting connective such as **yet, but, however,** etc. What is more, in order to emphasize that a second party has been introduced to the discussion, employing **"language of discussion"** for the counter argument is necessary.
Phrases such as "it is generally claimed that", "it is widely argued that", "most people contend that", "some people believe that" etc. can be used to introduce language of discussion. Then, the statement would be:

> **"Although it has been contended that laptop use in class can facilitate classroom learning experiences, it disrupts the learning practices of students."**

There are two reasons for using "language of discussion":

First, these phrases weaken the opposing idea. Since it is an argumentative essay, both sides of the debate can be argued for. However, the aim of the writer is to convince the reader that his/her argument is better and stronger. Thus, when the writer implies that the opposing idea is a belief or people's contention rather than a fact, his/her own position becomes stronger. The

use of modal verbs indicating possibility like "can, may, might" rather than verbs showing facts is preferred in the counter argument. By using these modal verbs, the writer weakens the opposing idea.

Second, by using language of discussion, it is ensured that the idea introduced belongs to another person. Without the use of such phrases, it will not be clear whether the idea belongs to the writer or the opponents. For instance, a statement without language of discussion would be:

> "Laptop use in class facilitates classroom learning experiences, yet it disrupts the learning practices of students."

These two contradictory ideas above seem to belong to the same person. In order to make it a discussion, the opposing party needs to be introduced via discussion language.

Step 4. However, presenting both the counter argument and the main premise is not enough. The main premise in a thesis statement should be followed by **supporting reasons (pros)** to present the ideas that will be explored in the body paragraphs.

A sample thesis statement should look like this:

"Although it has been contended that laptop use in class can facilitate classroom learning experiences, it disrupts the learning practices of students since it creates a source of distraction, hinders the learning process and lowers the class performance."

Contrasting connective:	Although
Language of discussion:	it has been contended that
Counter argument (con):	laptop use in class can facilitate classroom learning experiences
Main premise:	it disrupts the learning practices of students
Supporting reasons (3 pros):	since it creates a source of distraction (1), hinders the learning process (2) and lowers the class performance (3).

Note that the counter argument is introduced first and then the main premise follows. The counter arguments usually come before giving the writer's own view. It is also an indicator of the structure of the body paragraphs.

Exercise 4: **Choose the best thesis statement and improve the problematic ones.**

1- It is contended that globalization is a way to exploit the world's limited resources, yet its impact on economic development is undeniable.

yet globalization process should continue since its impact on economic development is undeniable and it unites people from different origins.

2- Young people in Turkey should eliminate regular consumption of junk food as it leads to severe health problems such as diabetes, obesity and heart related problems.

Although it is argued that junk food increases seratonin levels in humans, young people in Turkey....

3- Although it is argued that factory farming threatens human health, damages rural communities and pollutes the environment, it should be supported since it is a way to end malnutrition; it contributes to local economies and these farms have safer methods for waste management.

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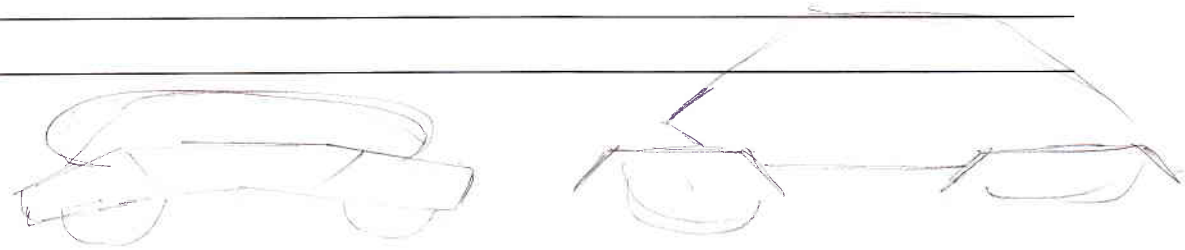
✓

4- Even though recycling is a futile attempt in the protection of environment, it is the best way to preserve nature since it minimizes the amount of waste in landfills, it reduces the energy consumption in manufacturing goods and it guarantees sustainable use of natural resources.

Even though it is maintained that recycling...

5- Electric cars are claimed to be the best alternative means of transportation for reducing global pollution rates; however, they are not as environmentally friendly as suggested since the electricity is often produced by burning fossil fuels, their battery disposal leads to release of toxic chemicals and particles released from the cars are still air pollutants.



Preparing an outline

While outlining an argumentative essay, it is necessary to start with a **thesis statement** in the form of a full sentence. Each body paragraph is dedicated to a single **subtopic** that explores both sides of an issue. Major supports are the expansions of the subtopics through definitions and explanations. Each body paragraph must have two major supports, one is about the **cons** and the other is about the **pros**. At least one **minor support** for each major support should also be provided. Providing **examples** and **evidence** for each body paragraph is also necessary. Such information can be supported by outside sources. If it is an outside source, then the in-text citation information must be indicated in the outline. The order of the subtopics in the outline must be the same as the order in the thesis statement.

Thesis Statement: (full sentence)

I. Subtopic 1
- A. Major support for con
  - 1. Minor support for con
  - 2. Minor support for con
    - a. Example / evidence
- B. Major support for pro
  - 1. Minor support for pro
    - a. Example / evidence
  - 2. Minor support for pro
  - 3. Minor support for pro
  - 4. Minor support for pro

II. Subtopic 2
- A. Major support for con
  - 1. Minor support for con
  - 2. Minor support for con
  - 3. Minor support for con
- B. Major support for pro
  - 1. Minor support for pro
  - 2. Minor support for pro
    - a. Example / evidence
    - b. Example / evidence

III. Subtopic 3
- A. Major support for con
  - 1. Minor support for con
  - 2. Minor support for con
- B. Major support for pro
  - 1. Minor support for pro
    - a. Example / evidence
    - b. Example / evidence
  - 2. Minor support for pro

Writing an introductory paragraph

The function of the introductory paragraph is to familiarize the reader with the topic. It is a kind of road map for the rest of the essay. While writing the introduction, the steps below can be followed:

Step 1. First, the topic can be introduced by providing **background information** to explain and set up the issue for the audience. Such information might consist of a general statement to reveal the topic; definition of the key terms to introduce the reader to an unknown topic as well as specifying a certain meaning for each term; and historical background that is crucial to explain the topic. Additionally, the answers to the questions why discussing this topic is important or where the issue is prevalent tell the reader why she or he should continue reading. To be able to state the significance of the problem, outside sources can be used to support the idea. The writer needs to organize such information to write a coherent and unified introduction.

Step 2. Thesis statement is the sentence where the writer's point of view is explicitly presented to the reader. By doing this, the writer not only tells the reader what she/he thinks about the issue, but signals what she/he intends to prove throughout the body paragraphs. It is placed at the end of the introductory paragraph.

Sample introductory paragraph

Technology has become an indispensable part of daily life in terms of providing ease and comfort. The widespread use of technology in education is a reflection of this development. Contrary to belief that integrating computers in education is a new process, the first laptop use in classrooms took place on February 12, 1990 in the fifth grade of a girls' school in Melbourne, Australia, which then started to change the school, its culture, curriculum and the learning paradigm (Watters, 2015). In the following three decades, the means of education have changed and this process has transformed the class behavior. Today, many educational institutions ranging from primary schools to universities have embedded computer use in their classrooms. Despite some of its benefits, there have also been recent debates about the use of computers in classrooms as education tools. Although it has been contended that laptop use in class can facilitate classroom learning experiences, it disrupts the learning practices of students since it creates a source of distraction, hinders the learning process and lowers the class performance.

Exercise 5: **Below is a disorganized introductory paragraph on e-readers. Put the sentences in correct order to make a unified and coherent introduction.**

a. Apart from being a tool for leisure reading activities, e-readers have also become an educational tool recently.

b. An e-book reader, also known as an e-reader, is a portable device specifically designed for displaying digitalized versions of traditional paper books.

c. Although it is argued that e-readers cannot be adopted for educational activities, the use of e-readers should be encouraged in classrooms since they are more practical with their multiple functions, they cost less and they can easily be adapted with the developing technology.

d. The first introduction of e-readers dates back to the late 1990s. However, with the introduction of Kindle by Amazon in 2007, the popularity of e-readers escalated (Hrala, 2016).

e. Since then, with advanced technical modifications, e-readers have varied in their properties and practicalities and these advantages made them an indispensable device for many people who enjoy reading.

f. However, the use of e-readers in teaching caused controversy among educators for both the ease and distractions they can bring.

Writing a body paragraph

The body paragraph of an argumentative essay discusses both the opposing and supporting sides of an issue. In other words, while the writer supports his/her argument, he/she also discusses the counter argument and refutes it. The statements supporting the counter argument are called **cons** and the reasons that support the main premise are called **pros**. Keep in mind that **cons** and **pros** can be both negative and positive ideas. It depends on the position the writer chooses to take when writing the argumentative essay.

For example, considering the thesis statement below, a possible list of the cons and pros would be as follows:

"Although it has been contended that laptop use in class can facilitate classroom learning experiences, it disrupts the learning practices of students since it creates a source of distraction, hinders the learning process and lowers the class performance."

CONS	PROS
CON 1. Using laptops during class hours motivates students.	PRO 1. Laptops utilized during a lecture are a clear source of distraction.
CON 2. With the help of a laptop, students can achieve a better organization of the course material.	PRO 2. Following the lecture with a laptop hinders the learning process.
CON 3. The use of laptops in class increases the class performance of the students.	PRO 3. Laptop use leads to poor performance and lower grades for many students.

When writing the body paragraphs of an argumentative essay, you can follow the steps given below:

Step 1. The body paragraph of the argumentative essay starts with a **topic sentence** introducing the subject matter to be discussed throughout the paragraph. The topic sentence presents first the counter argument **(con)** and then the supporting argument **(pro)** to be discussed. It is also a guide to the format of the paragraph indicating that cons will be discussed first, and then the pros will be used to refute the cons and to prove the writer's point.

To illustrate, the topic sentence of the first body paragraph would be:

"The first argument in favor of laptop use in classrooms as an educational tool is that using laptops during class hours can motivate students, yet computers utilized during a lecture are a clear source of distraction for students."

Contrasting connective:	yet
Language of discussion:	the first argument in favor of laptop use in classrooms as an educational tool is that
Counter argument (con):	using laptops during class hours can motivate students
Supporting argument (pro):	computers utilized during a lecture are a clear source of distraction for students

Exercise 6: **Write topic sentences for the second and the third body paragraphs.**

CONS	PROS	TOPIC SENTENCES
CON 1.	PRO 1.	The first argument in favor of laptop use in classrooms as an educational tool is that using laptops during class hours can motivate students, yet computers utilized during a lecture are a clear source of distraction for students.
CON 2.	PRO 2.	
CON 3.	PRO 3.	

Step 2. The body paragraph must consist of **two major supports.** The first major support discusses the counter argument **(con)** and the second major support provides the writer's own argument **(pro)**.

a) The first major support (con) discusses the reasons for the counter argument. It is the part where primary points of the opposite idea are explained. The major support must be expanded by at least one **minor support** that gives detailed explanations. It is also possible to use cited information for the counter argument. However, remember that the aim is to refute the opposing party, so if the cited information refers to strong evidence, then it would be more difficult to present a strong refutation. Additionally, keep in mind that the writer should present each of these opposing ideas with **language of discussion.** The highlighted parts below show discussion language added to the counter argument:

> "Proponents of laptop use in classrooms maintain that since the new generation students heavily rely on use of technology in their daily routines, the use of a technological device such as a laptop can increase their motivation **(major support for con).** They further argue that laptops provide increased engagement with the course material, assuming that this active learning process created for students would lead to increased class participation **(minor support for con).**"

b) The second major support (pro) consists of the supporting reasons for refutation. The shift from the first major (con) to the second major (pro) is signalled with **a contrasting connective** such as however, nevertheless, nonetheless, while, yet, still etc. This part needs a

strong **refutation** in order to defend the writer's premise. Therefore, the second major support should be backed up by **minor supports** explaining the reasons why the writer's main premise is more valid than the counter argument. Use of **evidential information** usually obtained from an outside source is highly encouraged in order to make the main premise stronger and more reliable. **Evidence** or **example** provided might involve specific information such as statistical data from fieldwork or research, related factual information and reference to case studies or reports relevant to the topic.

A possible proposition for the counter argument above would look like this:

> "However **(contrasting connective)**, contrary to being a source of motivation, laptops divert students' attention to non-class related activities **(major support for pro).** The problem with laptop use in classrooms is using the class time for non-academic activities **(minor support 1).** As reported by May, according to the research conducted by Michigan University scientists, students spent one third of their class hours on non-academic activities such as checking their social media accounts, e-mails, shopping, reading news, chatting, watching videos, and playing games (2017) **(evidence for pro).** Additionally, as the nature of laptops creates a constant source of distraction for students such as the pop-ups, instant messages, battery warnings and even the light of the screen, all these stimulants coming from the laptop break students' concentration rather than increasing their motivation **(minor support 2).** What is more, it is not only a self-inflicted distraction for the user but also a disturbance for their classmates who are not engaged in laptop use **(minor support 3).**"

Step 3. The body paragraph usually ends with a concluding sentence that summarizes the proposition of the paragraph. Alternatively, it is possible to make an analysis of the evidence provided to make the refutation stronger.

A possible concluding sentence for the body paragraph above would look like this:

> "It is clear that students are not benefiting from laptop use in class since they are spending minimal time on course related activities **(concluding sentence).**"

Some useful vocabulary for language of discussion

While introducing the counter argument (con) in the argumentative essay, the writer needs to make use of some vocabulary to weaken the opposing ideas. Remember that in the body paragraph, the writer should make use of a contrasting connective to signal the shift from con to pro. The table below, shows some of the phrases that signal the counter argument.

If the opposing party disagrees with the subject matter, the counter argument (con) can be introduced as:	Critics of ... Opponents of ... People who disagree with .... People who are against ...	argue / assert / believe / claim / contend / maintain **that ...**
	e.g. "Critics of using laptops in classrooms claim that their extensive use during class hours may cause distraction problems for students."	
If the opposing party defends the subject matter, the counter argument (con) can be introduced as:	Proponents of ... Supporters of ... Advocates of ... People who support ... People who are in favor of ...	argue / assert / believe / claim / contend / maintain **that ...**
	e.g. "Proponents of laptop use in classrooms contend that since the use of a technological device such as a laptop increases student motivation, it makes learning more interesting."	
When the writer introduces another counter argument (con):	It is also It is further	argued / asserted / believed / claimed / contended / maintained **that ...**
	e.g. "It is further argued that laptops provide increased engagement with the course material."	
Contrasting connectives	However / Nevertheless / Nonetheless / On the other hand / While / Whereas / Yet / But / Still / Although / Even though	

Remember

If the writer needs to accept the validity of the counter argument but still has to prove that it is weaker than his/her argument, the following structures can be used:

- Supporters/Opponents of ... have a point in thinking this; however, ...
- To a certain extent, this opinion/suggestion could be right, yet ...
- This position/approach/method/belief is rather mistaken/wrong.
- These views are highly debatable.

Expanding the pros

The table below presents the transition signals that can be used with the supporting ideas:

To add further information	moreover / furthermore / what is more / besides in addition / additionally in fact / in reality / indeed not only... but also... / similarly / in the same way to begin with / in the second place next / then to conclude / lastly
To put the same idea in a different way	that is to say / in other words / rather / or to put it (more) simply
To introduce examples	for example / for instance / such as especially / particularly / in particular / chiefly / mainly to exemplify / to illustrate

Sample body paragraph

The first argument in favor of laptop use in classrooms as an educational tool is that using laptops during class hours can motivate students, yet computers utilized during a lecture are a clear source of distraction for students. Proponents of laptop use in classrooms maintain that since the new generation students heavily rely on use of technology in their daily routines, the use of a technological device such as a laptop can increase their motivation. They further argue that laptops provide increased engagement with the course material, assuming that this active learning process created for students would lead to increased class participation. However, contrary to being a source of motivation, laptops divert students' attention to non-class related activities. The problem with laptop use in classrooms is using the class time for non-academic activities. As reported by May, according to the research conducted by Michigan University scientists, students spent one third of their class hours on non-academic activities such as checking their social media accounts, e-mails, shopping, reading news, chatting, watching videos, and playing games (2017). Additionally, as the nature of laptops creates a constant source of distraction for students such as the pop-ups, instant messages, battery warnings and even the light of the screen, all these stimulants coming from the laptop break students' concentration rather than increasing their motivation. What is more, it is not only a self-inflicted distraction for the user but also a disturbance for their classmates who are not engaged in laptop use. It is clear that students are not benefiting from laptop use in class since they are spending minimal time on course related activities.

Writing a conclusion paragraph

Step 1. The conclusion in an argumentative essay starts with a concluding connective such as **in conclusion, to conclude, in summary, to summarize** etc.

Step 2. After writing the concluding connective, the thesis statement is restated without referring to the counter argument. In other words, since the writer has proven his/her point, there is no need to refer to the counter argument anymore. Instead, all that is required is emphasis of the main premise and its pro arguments.

Step 3. The writer adds a final comment to strengthen the main premise by making general predictions, suggestions, or warning about the issue.

Sample conclusion paragraph

In conclusion, the use of laptops in classrooms as educational tools clearly hinders learning processes by being a source of distraction, by making it difficult to follow a lecture, and by being a significant factor of poor class performance. Technological education tools should not replace traditional education methods but should rather be assistants in the process. Unless students are trained to be informed and attentive users of technology and teachers find a way to monitor students' use of laptops, they will continue to be a source of disruption for education.

Sample outline

Thesis Statement: Although it has been contended that laptop use in class can facilitate classroom learning experiences, it disrupts the learning practices of students since it creates a source of distraction, hinders the learning process and lowers the class performance.

I. Attention
- A. Source of motivation
  - 1. Makes learning more interesting
  - 2. Increased engagement with course material
  - 3. Increased class participation
- B. Source of distraction
  - 1. Wasting time with non-academic activities
    - a. Michigan State University's research (May, 2017)
  - 2. Computers as source of distraction
    - a. Pop-ups, instant messages, battery warnings, light of screen
  - 3. Distraction both for the user and for the classmates

II. Following the lecture
- A. Laptops enhancing learning process
  - 1. Multi-tasking providing better learning
  - 2. Easier and faster note taking on computer
  - 3. Well-outlined notes providing better revision material
- B. traditional methods working better
  - 1. Laptops requiring multitasking
  - 2. Limited human capacity leading to cognitive overload due to multitasking
  - 3. Superiority of pen and paper to note-taking with laptops
  - 4. Handwriting being processed and condensed better
    - a. Experiments in Princeton and University of California (Doyne, 2017)

III. Class performance
- A. Improved class performance
  - 1. Ensuring full participation of the student
  - 2. Facilitated learning environment leading to higher grades
  - 3. Discouraged cheating leading to increased class performance
- B. Poorer class performance
  - 1. Higher use of laptops leading to lower grades
    - a. Experiment carried out in an art school in US (Grove, 2017)
    - b. Scoring 0.27 and 0.38 less grade points (Grove, 2017)
  - 2. The possibility of plagiarism
  - 3. Cheating as a major obstacle for effective learning

Sample essay

The Use of Computers in Education

Technology has become an indispensable part of daily life in terms of providing ease and comfort. The widespread use of technology in education is a reflection of this development. Contrary to belief that integrating computers in education is a new process, the first laptop use in classrooms took place on February 12, 1990 in the fifth grade of a girls' school in Melbourne, Australia, which then started to change the school, its culture, curriculum and the learning paradigm (Watters, 2015). In the following three decades, the means of education have changed and this process has transformed the class behavior. Today, many educational institutions ranging from primary schools to universities have embedded computer use in their classrooms. Despite some of its benefits, there have also been recent debates about the use of computers in classrooms as education tools. Although it has been contended that laptop use in class can facilitate classroom learning experiences, it disrupts the learning practices of students since it creates a source of distraction, hinders the learning process and lowers the class performance.

The first argument in favor of laptop use in classrooms as an educational tool is that using laptops during class hours can motivate students, yet computers utilized during a lecture are a clear source of distraction for students. Proponents of laptop use in classrooms maintain that since the new generation students heavily rely on use of technology in their daily routines, the use of a technological device such as a laptop can increase their motivation. They further argue that laptops provide increased engagement with the course material, assuming that this active learning process created for students would lead to increased class participation. However, contrary to being a source of motivation, laptops divert students' attention to non-class related activities. The problem with laptop use in classrooms is using the class time for non-academic activities. As reported by May, according to the research conducted by Michigan University scientists, students spent one third of their class hours on non-academic activities such as checking their social media accounts, e-mails, shopping, reading news, chatting, watching videos, and playing games (2017). Additionally, as the nature of laptops creates a constant source of distraction for students such as the pop-ups, instant messages, battery warnings and even the light of the screen, all these stimulants coming from the laptop break students' concentration rather than increasing their motivation. What is more, it is not only a self-inflicted distraction for the user but also a disturbance for their classmates who are not engaged in laptop use. It is clear that students are not benefiting from laptop use in class since they are spending minimal time on course related activities.

Another contention supporting laptop use in class hours is that with the help of a computer, students can achieve a better organization of the course material, but following the lesson with a computer instead of traditional methods actually hinders the learning process. Defenders of computer use in classrooms argue that laptops can enhance the learning process. It is maintained that by providing multitasking, laptop use in class may promote a better learning experience for students. Note taking on a computer is said to be faster and easier than handwriting, thus it is believed that the students can have well-outlined notes for the lecture, which can benefit them in terms of proper revision in the coming weeks. Nevertheless, these views are highly debatable as a

student can follow the lecture with traditional methods better. Laptop use in class requires multitasking where students take notes and search from many sources simultaneously. Human capacity to process information is selective and limited and if there are too many sources of information that require multitasking, this can create a cognitive overload for the student hindering the learning process. Computers are surely sources of overload for students. What is more, the use of pen and paper is superior to note taking with laptops in terms of learning the noted material as it helps students concentrate on one task at a time. A student can process and condense the course material more efficiently if she/he is writing by hand. In this way, students are able to absorb the course content better. As stated by Doyne, in the experiments conducted in Princeton University and University of California, Los Angeles where students were either assigned laptops or pen and paper for taking notes during a lecture, it was concluded that students taking notes by hand had significantly better understanding of the lecture than those who had laptops. This was explained by the theory that if students use laptops, they are not using their brains for substantive processing, as typing is faster than writing. Yet, students taking notes down by hand had to understand and summarize the lecture content (2017). In brief, the learning process backed up with traditional methods helps students internalize the course content more.

The final argument supporting the use of laptops in class is that it can increase the class performance of students, but it leads to poor performance and lower grades for many. Advocates of computer use in class contend that employing laptops in the learning process would ensure full participation of the student and since student performance mostly depends on their full participation, it is believed that laptops might support the learning experience by providing instant access to fresh information. Therefore it might be argued that this facilitated learning environment may result in higher grades. It is also maintained that because online materials can be checked by teachers more easily, cheating would be discouraged; as a result, students have to improve their class performance in order to pass the course. This might be true to some extent. Nonetheless, since it is clear that students learn less when they use computers in their lecture, this diminished learning is also reflected in lower grades for students. It is not surprising that the higher use of laptops results in lower scores in the exams. As Grove points out, according to a study conducted with 5600 students in an art college in the US, the male students and low-performing students are affected the most by the use of laptops in lectures. He also refers to another piece of research where based on a four-point grade scale, 0.27 and 0.38 lower grade points were detected among the students with laptops when compared to those who did not. This meant half a grade lower on an alphabetical scale (2017). Additionally, laptop use also provides unlimited sources for the students to plagiarize. If a student is caught plagiarizing, she/he will fail the course. Indeed, cheating is one of the major obstacles to effective learning. Contrary to what is believed, it is clear that laptops harm classroom performance, which is reflected in the overall learning experience and academic performance.

In conclusion, the use of laptops in classrooms as educational tools clearly hinders learning processes by being a source of distraction, by making it difficult to follow a lecture, and by being a significant factor of poor class performance. Technological education tools should not replace traditional education methods but should rather be viewed as assistants in the process. Unless students are trained to be informed and attentive users of technology and teachers find a way to monitor students' use of laptops, they will continue to be a source of disruption for education.

Exercise 7: Read the texts on GM foods below, answer the questions about the texts and complete the outline.

SOURCE 1: Adapted from E. Chivian & A. Bernstein, "Genetically modified foods", 2008

Genetically modified (GM) foods (also called genetically-engineered or transgenic food), hold great promise that they may provide one of the solutions to help feed growing world populations. Also, these foods have natural resistance towards pests and insects, so not many pesticides and insecticides have to be sprayed on them. This makes these foods free from chemicals and environment friendly. Among the major successes cited for the genetic modification of crops are the insertion of Bt genes into maize, potatoes, and cotton to make these crops resistant to certain insect pests, and of herbicide-tolerance genes that allow GM crops to thrive despite being exposed to certain herbicides. However, behind these and other successes of genetic modification, unexpected effects and potential pitfalls exist. The decrease in glutelin levels in modified rice, for example, was associated with an unintended increase in levels of compounds called prolamines, which can affect the nutritional quality of rice and increase its potential to cause an allergic response.

GM foods may also damage biodiversity. Modified organisms can escape from greenhouses and fields and aquaculture cages into natural ecosystems, and disrupt their biodiversity. Promoting greater use of certain pesticides associated with GM crops that are particularly toxic to many species, and introducing exotic genes and organisms into the environment that may disrupt natural plant communities and other ecosystems are two important drawbacks. There are some potential risks for human health too. For example, there are the risks that could come from pharmaceutical production in food crop species. The so-called "pharma crops" are grown according to stringent protocols designed to prevent contamination of the food supply. For instance, corn that has been genetically engineered to produce drugs such as lactoferrin (an antimicrobial, iron-binding protein) is required by the United States Department of Agriculture to be grown at least one mile away from other cornfields. After harvest, such "pharma" corn must be labeled and carefully tracked to avoid mixing it with corn destined for consumption by either humans or livestock. However, contamination of food with "pharma crops" is a likely occurrence.

resistance (n): capacity not to be negatively affected

pesticide (n): chemical used to prevent insects and pests from damaging crops

insecticide (n): substance used for killing insects

insertion (n): addition of extra DNA or RNA into a genetic material

herbicide (n): chemical used to destroy plants

thrive (v): to grow well, develop

pitfall (n): an unsuspected difficulty

stringent (adj): strict, binding

The use of antibiotic resistance genes as markers in GM crops has also raised human health concerns, as such genes could potentially be transferred to bacteria that live in the intestines of cattle and other livestock and in the human gastrointestinal tract and be difficult to treat with antibiotics. Using a gene marker that carries a potentially significant human health risk, particularly at a time when we are facing a growing crisis of antibiotic resistance, should be strongly discouraged. Another possible human health consideration that has been raised is that potential toxins or allergens could be produced via the transgene itself or via other changes in plant chemistry caused by the inserted gene switches.

1. In the first paragraph, what is the argument in favor of GM foods?

_____

_____

2. In the first paragraph, specify the problem about GM rice.

_____

_____

3. What are the two drawbacks of GM foods in terms of damaging biodiversity?

_____

_____

4. What are the three health risks posed by GM foods?

_____

_____

SOURCE 2: Adapted from William Acworth, Alasebu Yainshet & Robert Curtotti, "Economic impacts of GM crops in Australia", 2008

Since the first commercialization of genetically modified (GM) crops in 1996, the planting of GM crops has expanded rapidly and now constitutes a significant proportion of the world's crop output. Benefits the farmers gain include increased crop yield, reduced farm input costs, including the cost of pesticide, herbicide and farm labor, and more efficient farm management. In comparison to non-GM production systems, the adoption of GM crops could reduce yield losses through better protection against insect pests and weeds. Insect resistant GM crops provide their own protection against pests and therefore reduce, or in some cases eliminate, the need for pesticides. Herbicide tolerant crops allow the use of relatively inexpensive broad spectrum herbicides which effectively control most weeds affecting the crop.

yield (n): amount produced

weed (n): wild plant that grows where it is not wanted

spectrum (n): a range of variation

However, farmers opting to grow GM crops are likely to face additional costs in terms of higher seed prices and technology fees. Higher GM seed prices and the imposition of technology fees to users increase the cost of using GM seed compared with non-GM seed. Technology user agreements imposed either by the technology provider or user industry groups could entail additional costs to growers. On-farm segregation arrangements, if required, can mean higher costs because of the need for certified planting seed, various crop management techniques and the need to clean equipment after harvesting, handling, storing and transporting GM grain types.

imposition (n): action of setting something to be fulfilled

entail (v): to involve as a consequence

segregation (n): the act of separating

1. According to the first paragraph, what are the economic benefits of GM crop production?

2. List three economic burdens imposed by GM crop production.

SOURCE 3: Adapted from Ian Murnaghan, "Fact sheet: Pros vs cons", 2018

Another potential downside to GM technology is that other organisms in the ecosystem could be harmed, which would lead to a lower level of biodiversity. By removing one pest that harms the crop, you could be removing a food source for an animal. Also, GM crops could prove toxic to an organism in the environment, leading to reduced numbers or extinction of that organism.

1. How is food chain affected by GM technology?

SOURCE 4: Adapted from S. Wunderlich & M. Vecchione, "Genetically modified food and its impact on the environment", 2014

A related concern to the threat to biodiversity is that GM crops will lead to the development of a monoculture where only one variety of a certain crop is present in large amounts. This is an issue because an insect plague or crop disease can cause vast destruction of the entire crop. Furthermore, planting only one type of crop continually leads to the depletion of soil nutrients and erosion, making the soil unusable for future agricultural use. The development of a monoculture causes a lack of diversity in the availability of foods in the marketplace as well.

monoculture (n): the production of a single crop in an area

plague (n): any serious disease that spreads quickly and kills many

Another concern is the potential impact of the increased use of pesticides like Roundup. Monsanto's "Roundup ready" GM crops allow for large amounts of herbicides to be sprayed on the plants without causing them any harm. However, researchers believe that this will lead to a new generation of pesticide-resistant weeds that could hamper plant growth and grow uncontrollably. According to Food and Water Watch, the number of herbicide-resistant weeds reported by US states in 2012 was higher than in previous years. Also, Owen and Zelaya found that the amount of herbicide-resistant soybeans and maize has been steadily increasing, making this issue a real concern.

depletion (n): reduction in number or strength

hamper (v): to prevent, to hinder

1. List the problems that might occur by producing one type of crop in a large area.

_____

_____

2. What is the result of using large amounts of herbicides?

_____

_____

SOURCE 5: Adapted from Kathleen L. Hefferon, "Nutritionally enhanced food crops; progress and perspectives", 2015

Traditionally, vitamins and minerals have been added to food crops through biofortification practices. The generation of biotech food crops with improved attributes, such as increases in iron storage protein or greater levels of folate can provide sufficient levels of these and other much needed micronutrients that are frequently lacking in the diets of the developing world. Rice has been engineered to combat iron and folate deficiency. Transgenic biofortified rice was produced by improving iron storage and transport proteins in plants. Haas *et al.*, 2005, demonstrated that Filipino women consumed 1.79 mg iron per day in the form of biofortified conventional rice. Rice cultivated from transgenic plants contains 3–4 times as much iron as its conventionally fortified counterparts.

Not only can food crops be biofortified by genetic engineering, they can also be designed to contain bioreactive compounds which have improved health benefits or reduce the risk of chronic diseases, such as cancer and heart disease. Expression in tomato plants of the antioxidant anthocyanin, a compound found in blueberries and cranberries, through metabolic engineering resulted in tomato fruit which could extend the life spans of cancer-susceptible mice by up to thirty percent. These tomatoes, which are also believed to fight cardiovascular disease, have been produced as a juice and are currently being tested on heart patients in Britain.

biofortification (n): the process of growing necessary food with higher levels of nutrients

folate (n): type of vitamin B necessary for cell growth and reproduction

deficiency (n): lack of something that is needed

conventional (adj): traditional

counterpart (n): a person or thing that has the same position or purpose in a different or parallel situation

1. What is the reason for conventional biofortification practices?

_____

_____

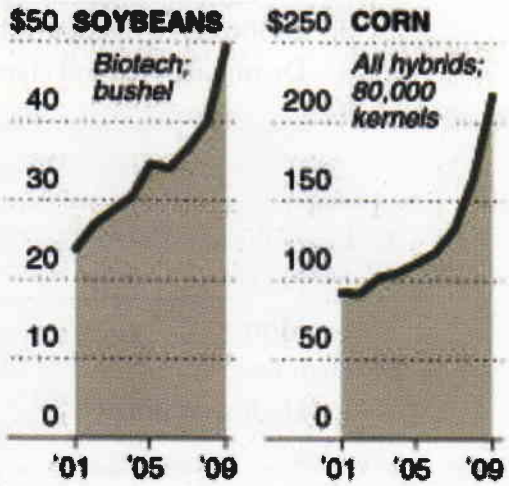
2. What are the positive results of genetically engineered tomatoes?

_____

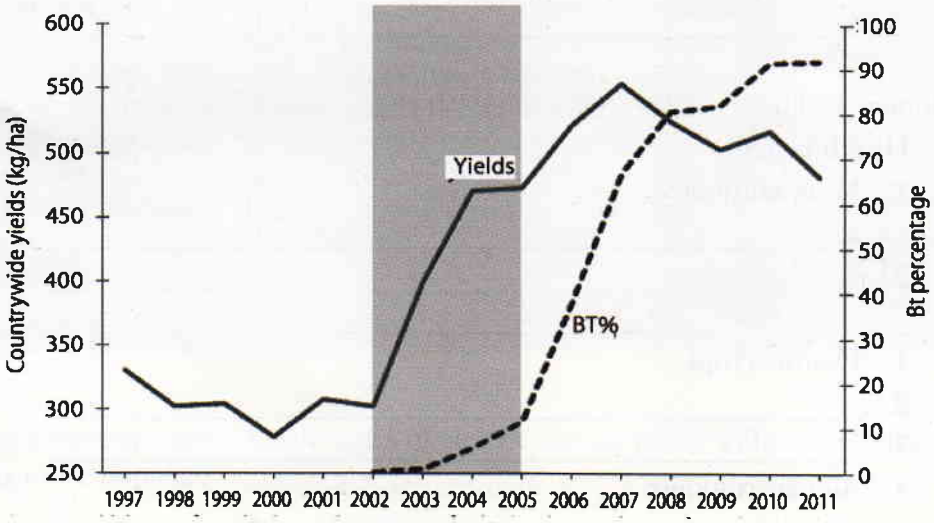
_____

SOURCE 6: Nathanael Johnson, 2014

SEED PRICES
Prices for corn and soybean seeds have risen sharply in recent years. More than 85 percent of both crops are now grown from genetically engineered seed.



SOURCE 7: William Neuman, 2010



Cotton yields and percentage of fields planted to Bt (Biotech) seed

Thesis Statement: Even though genetically modified food is thought to be evolutionary in agriculture, GM food is a curse in terms of the damage it causes to the environment, the burden it places on the economy and the risks it poses to human health.

I. Environment
- A. No chemicals
  - 1. No need for _____
- B. Reduction in biodiversity
  - 1. Toxic GM specific pesticides
    - a. _____(Wunderlich & Vecchione, 2014)
  - 2. Exotic genes disrupting natural communities
  - 3. Disrupting the food chain
  - 4. _____

II. Economy
- A. Economical
  - 1. Less _____
  - 2. More _____
- B. High fees
  - 1. High seed prices
    - a. _____ (_____, _____)
  - 2. _____
  - 3. Loss of yield in the long term
    - a. _____ (_____, _____)

III. Human health
- A. Health benefits
  - 1. More nutritious
    - a. _____ (_____, _____)
  - 2. _____
- B. _____
  - 1. Pharma crops
  - 2. _____
  - 3. _____
  - 4. Allergic response
    - a. _____ (_____, _____)

Exercise 8: "Electric cars are the only solution to global pollution". Discuss.
(1) Read the texts and answer the questions. (2) Write an introduction paragraph leading to the thesis statement given below. (3) List the cons and pros for the first body paragraph. (4) Make an outline for the first body paragraph. (5) Write the first body paragraph and the concluding paragraph.

Thesis Statement: Electric cars are claimed to be the best alternative means of transportation for reducing global pollution rates; however, they are not as environmentally friendly as suggested since the electricity is often produced by burning fossil fuels, their battery disposal leads to release of toxic chemicals and particles released from the cars are still air pollutants.

SOURCE 1: Adapted from Rebecca Matulka, "The history of the electric car", 2014

Introduced more than 100 years ago, electric cars are seeing a rise in popularity today for many of the same reasons they were first popular. Whether it's a hybrid, plug-in hybrid or all-electric, the demand for electric drive vehicles will continue to climb as prices drop and consumers look for ways to save money. Currently, at more than 3 percent of new vehicle sales worldwide electric vehicle sales could grow to nearly 7 percent or 6.6 million per year by 2020. It is hard to pinpoint the invention of the electric car to one inventor or country. Instead it was a series of breakthroughs from the battery to the electric motor in the 1800s that led to the first electric vehicle on the road. However, the true revival of the electric vehicle did not happen until around the start of the 21st century. The first turning point was the introduction of the Toyota Prius, released in Japan in 1997. The other event that helped reshape electric vehicles was the announcement in 2006 that a small Silicon Valley startup, Tesla Motors, would start producing a luxury electric sports car that could go more than 200 miles on a single charge. Today, as gasoline prices continue to rise and the prices of electric vehicles continue to drop, electric vehicles are gaining in popularity. It is hard to tell where the future will take electric vehicles, but it is clear they hold a lot of potential for creating a more sustainable future.

hybrid (n): a vehicle that combines an internal-combustion engine with one or more electric motors powered by a battery

pinpoint (v): to locate or describe exactly or precisely

1. What are the estimations for the sales of electric cars by 2020? Why are electric cars becoming more popular?

_____

_____

SOURCE 2: Adapted from Rinkesh Kukreja, "What is an electric car?", n.d.

The electric car (EV) is a relatively new concept in the world of the automotive industry. Although some companies have based their entire model of cars around being proactive and using electricity, some also offer hybrid vehicles that work off both electricity and gas. An electric car such as Nissan Leaf, Ford Focus Electric or Tesla Model S, Chevrolet Volt is a great way to not only save money, but also help contribute towards a healthy and stable environment. Cars produce a lot of carbon emissions that are ejected into natural atmosphere, leaving people vulnerable to things like pollution and greenhouse. In order to help positively the environment, an electric car is a great step forward. By buying an electric car, one can also receive government subsidies for being environmentally conscious. Although you may end up paying more for your vehicle, the positives greatly overshadow the negatives. EV's get their power from rechargeable batteries installed inside the car. These batteries are not only used to power the car but also used for the functioning of lights and wipers. Electric cars have more batteries than normal gasoline car. It is the same kind of batteries that are commonly used when starting up a gasoline engine. The only difference comes in the fact that in electric vehicles, they have more of them which are used to power the engine.

emission (n): an amount of gas released into the air

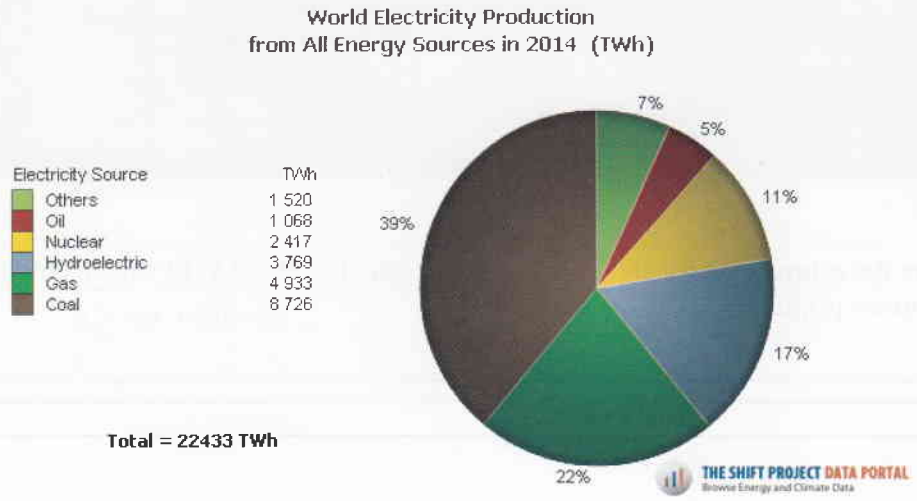
subsidy (n): money given by the government to encourage industry or agriculture

1. What are the advantages of electric cars?

_____

_____

SOURCE 3: The Shift Project Data Portal, "Breakdown of electricity generation", n.d.



SOURCE 4: Adapted from David Biello, "Electric cars are not necessarily clean", 2016

Tesla Motors has received more than 325,000 preorders for its hot new Model 3 electric car even though it will not be available for at least another year. That almost equals to 340,000 electric cars and plug-in hybrids now on American roads. Tesla has advertised its vehicles as having zero emissions, helping fuel the mania for the fun-driving sedan, but that's not necessarily true. Although the battery-powered car itself does not produce any emissions, the power plant that generates the electricity used to charge those batteries certainly does. Cars and trucks are responsible for roughly 24 percent of U.S. greenhouse gas pollution—nearly 1.7 billion metric tons per year. Because those emissions come from hundreds of millions of tailpipes, this source of pollution seems difficult to control. Shifting it to hundreds of smokestacks at power plants that supply electricity to charge electric cars therefore does not seem like a more effective way. Those smokestacks, many attached to coal-fired power plants, are the single-largest source of greenhouse gas pollution in the U.S., at two billion metric tons of CO2 per year. That source would grow as electric cars demand more and more electricity. As it stands, a conventional Toyota Prius hybrid vehicle, which burns gasoline when its batteries are not engaged, and the all-electric Nissan Leaf produce roughly the same amount of greenhouse gas pollution: 200 grams per mile, according to data from the U.S. Department of Energy. That's an average across the U.S. In California, which has one of the highest proportions of clean electricity in the country, the electric vehicle would produce only 100 grams per mile, half that of the hybrid. Ditto for Texas and even Florida. But in the Midwest and South, where coal fuels the bulk of electricity generation, a hybrid produces less CO2 than an electric car. In fossil fuel-dependent Minnesota an electric car would actually emit 300 grams per mile of greenhouse gases. The same argument applies worldwide. Driving an electric car in China, where coal is by far the largest power plant fuel, is a catastrophe for climate change. And if the coal plant lacks pollution controls or fails to turn them on, it can amplify the extent of smog, acid rain, lung-damaging microscopic soot and other ills that arise from burning fossil fuels. The same is true in other major coal-burning countries, such as Australia, India and South Africa.

fuel (v): to make a situation more intense

mania (n): excessive excitement or enthusiasm

tailpipe (n): exhaust pipe located at the rear of a motor vehicle

smokestack (n): a pipe or funnel through which smoke and gases are discharged

ditto (n): a thing mentioned previously or above; the aforesaid

amplify (v): to increase the effect of something

1. Why does the writer argue against the use of electric cars?

_____

_____

2. How would the use of electric cars in California differ from the use of electric cars in Minnesota?

_____

_____

SOURCE 5: Adapted from Office of Energy Efficiency and Renewable Energy, "Reducing pollution with electric vehicles", n.d.

Plug-in electric vehicles, also known as electric cars or EVs, can help keep your town and your world clean. In general, EVs produce fewer emissions that contribute to climate change and smog than conventional vehicles. Direct emissions are emitted through the tailpipe, through evaporation from the fuel system, and during the fuelling process. Direct emissions include smog-forming pollutants such as nitrogen oxides, other pollutants harmful to human health, and greenhouse gases (GHGs), primarily carbon dioxide. All-electric vehicles produce zero direct emissions, which specifically helps improve air quality in urban areas. Plug-in hybrid electric vehicles (PHEVs), which have a gasoline engine in addition to an electric motor, produce evaporative emissions from the fuel system as well as tailpipe emissions when operating on gasoline. However, because most PHEVs are more efficient than comparable conventional vehicles, they still produce fewer tailpipe emissions even when relying on gasoline.

smog (n): smoke or other atmospheric pollutants combined with fog in an unhealthy or irritating mixture

1. Define direct emissions.

_____

_____

2. How can electric cars contribute to eliminating environmental pollution?

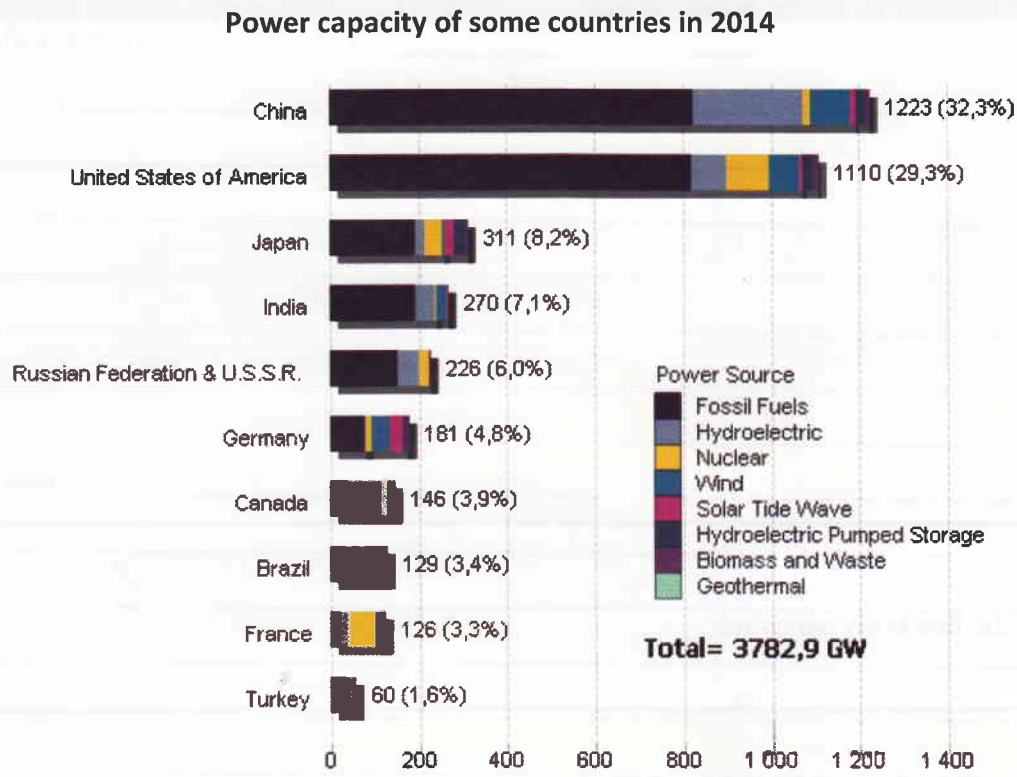
_____

_____

SOURCE 6: Adapted from Jake Richardson, "Electric cars mostly run on electricity", 2018

Some critics of electric vehicles try to claim that the electricity all electric cars use comes from coal power plants, thus implying or directly claiming that they aren't any better than gas-powered vehicles because they are also tied to a source of dirty electricity. This is ridiculous. The majority of electricity in the United States is generated from other sources than coal, and increasingly from renewable energy. Everywhere in the country, a plug-in vehicle is cleaner to drive than a gas or diesel car in the same class. For instance, the main source of electricity in California comes from natural gas plants. In the state of Oregon, about 70% of electricity generated there comes from renewable sources.

SOURCE 7: The Shift Project Data Portal, "Countries with highest electricity generation", n.d.



Introductory paragraph

Electric cars are claimed to be the best alternative means of transportation for reducing global pollution rates; however, they are not as environmentally friendly as suggested since electricity is often produced by burning fossil fuels, their battery disposal leads to release of toxic chemicals and particles released from the cars are still air pollutants.

CONS	PROS

Outline of the first body paragraph

I.

A.

B.

The first body paragraph

The first argument _____

_____

_____

_____

_____

_____

_____

_____

However, _____

_____

_____

_____

_____

_____

_____

_____.

Conclusion paragraph

In conclusion, _____

_____

_____

_____

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_____

_____

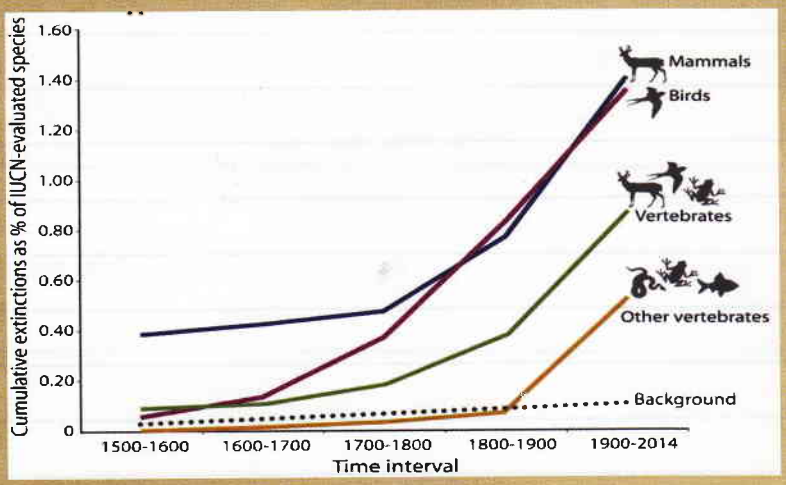
_____.

Exercise 9: (1) Read the texts and answer the questions. (2) Make a for and against list. (3) Make an outline. (4) Write an argumentative essay.

"De-extinction studies should be encouraged." Discuss.

SOURCE 1: Ceballos et al., "Accelerated human-induced species losses: Entering the sixth mass extinction", 2015

This graph illustrates the number of species that have gone extinct due to human populations. The black dashes show the highest possible estimate of background rate.



background rate (n): the standard rate (in this case, of extinctions on Earth before human intervention)

vertebrate (n): any organism having a spine

1. Compare the difference between the extinction rates and the background rate.

_____

_____

SOURCE 2: Adapted from D. Shultz, "Should we bring extinct species back?", 2016

Earth is in the midst of its sixth mass extinction: Somewhere between 30 and 159 species disappear every day, thanks largely to humans, and more than 300 types of mammals, birds, reptiles, and amphibians have vanished since 1500. These rates are not a good sign for the future of life on our planet, but what if extinction was not permanent? There are two main approaches to de-extinction. A first option is cloning. Scientists would take a preserved cell from a recently extinct animal and extract the nucleus. They would then swap this nucleus into an egg cell from the animal's closest living relative and implant the egg into a surrogate host. Cloning may eventually give us basically identical genetic copies of extinct species, but we will be restricted to animals that went extinct more recently and have well-preserved cells with intact nuclei.

swap (v): to exchange

surrogate (adj/n): fulfilling a replacement role

intact (adj): complete, not badly damaged

The second and the newest option is genetic engineering. Here, researchers would line up the genome of an extinct animal with that of its closest living relative. They would then use Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) and other gene-editing tools to swap relevant genes from the extinct animal into the living species and implant the hybrid genome into a surrogate. This approach does not produce genetically identical copies of extinct animals, but rather modern versions of an animal engineered to look and behave like its extinct relatives.

Every animal in an ecosystem has a function: Woolly mammoths were a functionally unique species, and when they went extinct, their habitats changed dramatically. Harvard University's George Church, the lead researcher working to de-extinct the mammoth, says that bringing back the giants could help convert the Arctic tundra back to grasslands that existed during the last ice age. He points to research that shows that mammoths and other large herbivores trampling across the ancient Arctic ecosystems helped maintain the grasslands by knocking down trees and spreading grass seeds in the dung.

genome (n): the whole set og genes in living organisms

herbivore (n): an animal that feeds only on plants

trample (v): to step heavily on something

dung (n): solid animal waste from such as horse, cattle, elephant

1. What are the steps employed in cloning?

_____

_____

2. What is the main difference between cloning and genetic engineering?

_____

_____

3. How can mammoths help the ecosystem?

_____

_____

SOURCE 3: Adapted from Carl Zimmer, "Bringing them back to life", 2013

The species theoretically capable of being revived all disappeared while humanity was rapidly climbing toward world domination. And especially in recent years we humans were the ones who wiped them out, by hunting them, destroying their habitats, or spreading diseases. This suggests another reason for bringing them back. "If we're talking about species we drove extinct, then I think we have an obligation to try to do this," says Michael Archer, a paleontologist at the University of New South Wales. Some people protest that reviving a species that no longer exists is the same as playing God. Archer laughs at the notion. "I think we played God when we exterminated these animals." But for many scientists, de-extinction is a distraction from the pressing work required to prevent mass extinctions. "There is clearly a terrible urgency to saving threatened species and habitats," says John Wiens, an evolutionary biologist at Stony Brook University in New York. "Why invest millions of dollars in bringing a handful of species back from the dead, when there are millions still waiting to be discovered, described, and protected?"

revive (v): to bring back to life
wipe out something (v): to cause something to be completely lost
exterminate (v): to kill or eradicate
urgency (n): requiring immediate attention

1. What is the writer's attitude towards de-extinction?

_____

_____

SOURCE 4: Adapted from Tori Herridge, "Mammoths are a huge part of my life", 2014

In 2013, a remarkably well-preserved mammoth was excavated from the permafrost on Maly Lyakhovsky Island, northern Siberia. Nothing like this had ever been seen before, and hopes ran high that this might hold the key to mammoth cloning. And yet, cloning one would be ethically flawed. Any attempt to clone a mammoth would probably require a living elephant – likely to be Asian – to act as a surrogate that will go through 22 months of pregnancy and carry an animal of a completely different species as part of the experiment. And probably it will not be just one elephant. In reality, many surrogates would be needed before a successful baby mammoth was born. There are very good reasons for using animals in scientific research, and there are also strict ethical codes of practice that demand that the potential benefits of the research outweigh the suffering to the animals involved. Certainly, the potential benefit to humanity of cloning a mammoth does not outweigh the suffering an Asian elephant surrogate mother might experience. Additionally, mammoths were similar to elephants in that they were smart, social animals that learned from their elders how to behave and thrive. But the first cloned mammoth will not have any elders. Like the sad cases of humans who grew up without interacting with their own kind, it would be alone, lost, un-socialized and likely unhappy.

excavate (v): to dig or uncover
permafrost (n): frozen ground under the earth's surface in arctic regions
flawed (adj): having basic problems or weaknesses
outweigh (v): to be greater than another thing

1. List two ethical concerns related to mammoth resurrection.

_____

_____

SOURCE 5: Adapted from H. Devlin, "Woolly mammoth on verge of resurrection", 2017

The woolly mammoth travelled across Europe, Asia, Africa and North America during the last Ice Age and vanished about 4,000 years ago, probably due to a combination of climate change and hunting by humans. Their closest living relative is the Asian elephant. Harvard professor Church, who leads the mammoth resurrection studies, outlined plans to grow the hybrid animal within an artificial womb rather than use a female elephant as a surrogate mother. "We hope to do the entire procedure ex-vivo (outside a living body)," he said. "It would be unreasonable to put female reproduction at risk in an endangered species."

resurrection (n): bring something back into existence

womb (n): organ of female mammals in which baby develops

unreasonable (adj): not fair

1. Why is the Harvard team developing an artificial womb?

_____

_____

SOURCE 6: Adapted from Ben J. Novak, "The passenger pigeon", 2016

Since the passenger pigeon went extinct in 1914, new insights have revealed the passenger pigeon as the most important species for the future of conserving eastern America's woodland biodiversity. The necessary scientific knowledge and genetic material to revive passenger pigeons in large numbers exists because there is usable DNA and a close relative to be a surrogate. The ecological life in eastern forests largely depends on a regime of regeneration. The huge density of passenger pigeon flocks generated two major effects. Firstly, the breaking of branches from overcrowding allows sunlight to reach the forest floor, enabling vegetation to grow under the trees. Reptiles, amphibians and insects take advantage of the warm sunlight, setting the scene for a rich food chain of species. Secondly, the huge deposits of guano kill vegetation on the forest floor and create a rich community of decomposers, which in turn, produce a food chain. As the forest regenerates, the ecological cycle starts once again. This is the incredible ecology that passenger pigeon de-extinction promises to revitalize in eastern North America's forests.

regeneration (n): restoring or bringing back to former levels
flock (n): a group of birds
vegetation (n): plants
guano (n): solid waste of birds and bats
decomposer (n): an organism that breaks down dead animal and plant material
revitalize (v): to give new life

1. What is the importance of the passenger pigeon for the ecosystem?

_____

_____

2. Why is this species a good candidate for de-extinction?

_____

SOURCE 7: Adapted from P. Guernsey, "Why cloning won't save endangered animals?", 2011

Successful populations of wild animals need a certain amount of genetic diversity in order to prevent an epidemic or other environmental stressor from wiping all of them out. If an entire breeding population of endangered or extinct species were scientifically created out of genetic material from just a few individuals then, after a few generations, each individual would end up as a virtual genetic photocopy of every other individual. And, when one animal got sick, either from germs or from some other factor, most of the others would probably get just as sick as well. A lack of genetic diversity has also been shown to lead to birth defects.

epidemic (n): a widespread disease affecting many people

breeding (n): the process in which animals produce offspring

germ (n): very small organism causing disease

1. What is the writer's concern about breeding of endangered species?

_____

_____

SOURCE 8: Adapted from B. Shapiro, "Could we 'de-extinctify' the woolly mammoth?", 2015

The most fascinating reason to consider bringing mammoths back to life is the ecological argument made by Sergey Zimov of the Russian Academy of Science's Northeast Science Station. Zimov highlights an extraordinary and potentially important issue. When large herbivores graze on the grass that are maintained into the winter, they trample down the fallen snow and expose the ground to the cold Siberian air. As a consequence of this exposure, the soil beneath is somewhere between 15-20C colder during the winter months than that beneath ungrazed land. Scientists estimate that there may be as much as 1,400 gigatonnes of carbon currently trapped in the frozen Arctic soil, almost twice the amount of carbon that is in the Earth's atmosphere today. Zimov points out that reintroducing mammoths and other large herbivores into Siberia has the potential to reduce permafrost thaw, potentially slowing the accumulation of greenhouse gases in the Earth's atmosphere. While I cannot come down entirely in favor of mammoth de-extinction, I do appreciate the power of the idea of resurrected mammoths. Far-fetched, crazy ideas stimulate excitement, concern, anger, and – most importantly – creativity. As we face growing threats to global biodiversity, as human populations expand and wild spaces become fewer and further between, we need increasingly creative solutions to conserve and protect living species. Perhaps the technologies behind de-extinction will someday be used, and far more easily, to engineer genetic changes that make extinction less likely.

graze (v): (animals) to eat grass

thaw (v): to change from a frozen state to a softer state by a temperature increase

1. What is the potential risk of permafrost thaw? How can mammoths help eliminate it?

_____

_____

2. What is the writer's attitude towards de-extinction?

_____

_____

SOURCE 9: Adapted from S. Brand, "Opinion: The case for reviving extinct species", 2013

Techniques being developed for de-extinction will also be directly applicable to living species that are close to extinction. Tiny populations can have their genetic variability restored. A species with a genetic Achilles' heel might be totally cured with an adjustment introduced through cloning. For instance, the transmissible cancer on the faces of Tasmanian devils is thought to be caused by a single gene. That gene can be silenced in a generation of the animals released to the wild. The cancer would disappear in the wild soon after, because the immune animals would not transmit it, and they would also out-reproduce the susceptible until the entire population was immune.

The current generation of children will experience the return of some remarkable creatures in their lifetime. It may be part of what defines their generation and their attitude to the natural world. They will drag their parents to zoos to see the woolly mammoth and other de-extinct animals such as passenger pigeons, Carolina parakeets, Labrador ducks, and maybe even dodoes. Entrance fees at zoos provide a good deal of conservation funding, and zoos will be in the thick of extinct species revival and restoration. Humans killed off a lot of species over the last 10,000 years. Some resurrection is in order. A bit of redemption might come with it.

Achilles' heel (n): a small weakness that causes failure
transmissible (adj): something that can be transmitted, or passed on
immune (adj): not affected by a particular disease
out-reproduce (v): to reproduce in greater numbers than
susceptible (adj): easily affected
redemption (n): making up for a mistake and improving morally

1. How can de-extinction studies help endangered species?

_____

_____

2. How will de-extinction affect zoos?

_____

_____

SOURCE 10: Adapted from Paul Ehrlich and Anne H. Ehrlich, "The case against de-extinction: It's a fascinating but dumb idea", 2014

It is much more sensible to put all the limited resources for science and conservation into *preventing* extinctions, by tackling the causes of demise: habitat destruction, climate disruption, pollution, overharvesting, and so on. More important, right now the critical problem humanity faces is not one of species extinction but the extinction of *populations.* There are more populations than species disappearing today. And in most cases, as populations disappear and species extinction becomes more likely, the value of the organism as a service-provider approaches zero, including the aesthetic service of giving us the joy of watching or interacting with it. Resurrecting a population and then re-inserting it into habitats where it could supply the ecosystem services of its predecessor is a monumentally bigger project than recreating a couple of pseudo-mammoths to wander around in a zoo. The passenger pigeon is often mentioned as a target for de-extinction. To create even a single viable population might well require fabricating a million birds or so. And zoos are already overwhelmed trying to breed endangered species for reintroduction and thus facing problems about which species to save and which to let go. Allocating more effort to zoo conservation programs is far more essential than research into restoring a few elements of earth's biodiversity with laboratory-created resurrections.

demise (n): downfall or death

overharvesting (n): gathering more crops than necessary

pseudo (prefix): not real

viable (adj): able to continue to exist

overwhelm (v): to load with too much work to deal with

1. According to the writer, what is the main problem of de-extinction?

_____

_____

UNIT VII

CLASSIFICATION ESSAY

Classification is a process in which related items or concepts are put into groups or classes they belong to. In other words, classification can be defined as the method of separating items into related groups.

The classification essay can be described as an essay in which the writer breaks down the topic into its **types**. Classification essays may also separate a topic into groups based on different criteria such as parts, uses, methods, advantages, etc.; however, this book only focuses on categorizing the general topic into its types.

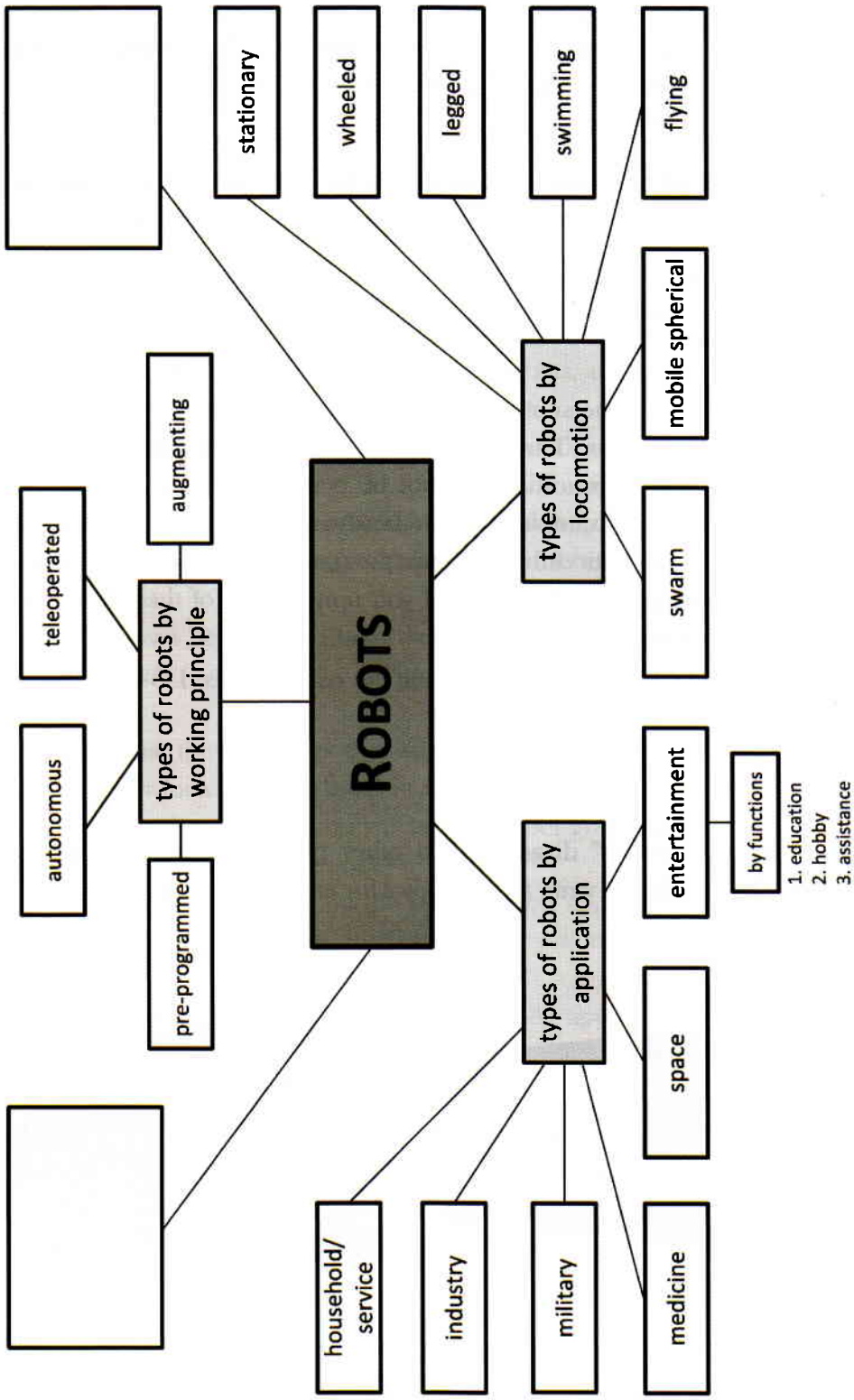
A classification essay is generally used for analyzing topics. When analyzing, the topic is broken into categories so that each group or category can be understood separately with all its own qualifications.

At university, students are required to classify information efficiently. For example, in engineering classes they need to analyze the types of devices or operations, in chemistry classes they need to focus on the types of different solutions, in biology classes they may want to categorize organisms, whereas engineering students in materials science classes categorize materials and metals. As stated by Callister, many times a scientist or an engineer will encounter a design problem which demands selecting the right material among the suggested alternatives. This will necessitate determining the criteria to choose the material by focusing on the properties (1994, p. 3). All of these are different examples of classifications.

In a classification essay, students are expected to analyze topics in categories, as classification comprises dividing the elements of a group into categories based on a principle which is referred to as the **basis of classification** or the **division method**. The basis of classification can be any parameter related to the topic such as the color, altitude, parts, sizes, shapes, etc.

Exercise 1: **Determine different bases of classification for the main topic "sports". Write the basis of classification in each box and list relevant subtopics for each.**

Exercise 2: Study the categorization of types of robots and fill in the empty boxes with different bases of classification.



Classifying information

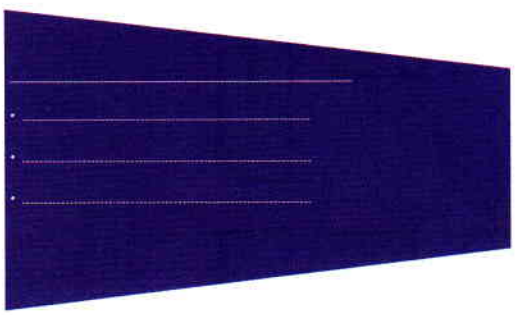
Choose your **main topic**, narrow it down and determine the **categories**. These categories are also called **subtopics**. For example, if you decide to write on types of robots as your main topic, first you need to determine the categories / subtopics. Remember that each category / subtopic has to be created around the same parameter as the **basis of classification**. In the case of types of robots, this parameter may be types of robots by working principle, by application or by locomotion.

For example, types of robots by application can be listed into six subtopics as household / service, military, medicine, space, industry, and entertainment robots.

You could also further categorize one of these subcategories. For instance, entertainment robots can also be divided by function into three subcategories: education, hobby, and assistance robots.

a. When writing the subtopics, remember to include all members of the group in your classification. The subtopics should cover all members / components of the group. The classification will not be correct if any component is excluded or omitted. For example, when classifying robots in terms of their working principle, all four subtopics, pre-programmed, autonomous, teleoperated and augmenting should be listed. If you remove one of these, the classification will be incomplete.
b. Avoid any kind of overlap among the components. Do not mix categories. The categories should be distinct.

Exercise 3: Study the "robots" diagram. Add other parameters to categorize robots in the blanks provided. Remember to write the subtopics for each parameter.



Formulating a thesis statement

The thesis statement of a classification essay comprises the main topic, the basis of classification and each category / subtopic that will be presented in the body paragraphs.

a. Make sure that you classify the main topic by one parameter / basis of classification. For example, the thesis statement classifying robots cannot focus on both the working principle and locomotion. Therefore, it will not be logical if you write a classification essay on robots by focusing on pre-programmed, autonomous, teleoperated, augmenting and legged robot categories, as the subtopic "legged" concerns locomotion, whereas the others are working principles. An example for a correct thesis statement for this would be:

Thesis Statement: The four types of robots in terms of their working principle are pre-programmed robots, autonomous robots, teleoperated robots, and augmenting robots.

b. It may help your reader if you state the number of categories; however, this is not a must. For example:

"The (four) robot types with respect to their working principle are pre-programmed robots, autonomous robots, teleoperated robots, and augmenting robots."

OR

"Entertainment robots can be classified (into three) as education, hobby, and assistance robots based on their functions."

c. Remember that the categories that will be discussed in the paragraphs should follow the order in which they are listed in the thesis statement. In addition, the names of the categories should be presented using parallel grammar structures. Compare the two thesis statement examples below:

(i) "Robots can be categorized into six on the basis of their applications: entertainment robots, service robots, robots used in military, in medicine, space and industry."

(ii) "Robots can be categorized into six on the basis of their applications: entertainment robots, service robots, military robots, medical robots, space robots and industrial robots."

As you have observed, the first thesis statement is less clear, lacking grammatical parallelism in presenting the subtopics.

d. There is no strict rule for the order of the categories; however, it is common to leave the most important category to the last.

Preparing an outline

Make sure that you have a minimum of two major supports for each category / subtopic. Remember to provide minor supports for each major support as well. Please note that, in a TYPES classification essay, the major supports should be the same; however, minor supports do not have to be the same. Also note that minor supports all have to be different in content and should not overlap.

Example: Types of entertainment robots by their functions

Thesis Statement: Entertainment robots can be classified into three types based on function: education, hobby, and assistance robots.

I. Education robots
- A. Design
  - 1. Appealing colors and features
    - a. Clothes, wigs, fur
  - 2. Simple to use
    - a. Children, elderly people
    - b. Disabled people
- B. Practical uses
  - 1. Make learning more fun and easier
  - 2. Learning mates or teachers
  - 3. Enhance creative problem solving techniques
  - 4. Distant learning
    - a. PEBBLES (Cale, 2006)

II. Hobby robots
- A. Design
  - 1. Toy-like
  - 2. Can be created by the user
    - a. Line followers, sumo robots
    - b. Football robots (Robotist, n.d.)
- B. Practical Uses
  - 1. Attract different age groups
  - 2. Various uses from festivals to amusement parks
  - 3. Join competitions

III. Assistance robots
- A. Design
  - 1. Mostly droids
    - a. Asus Zenbo (Gibbs, 2016)
  - 2. Durable and strong material
- B. Practical uses
  - 1. Available constantly
  - 2. Do household chores
    - a. Cooking, cleaning
  - 3. Cost less than a maid

Writing an introductory paragraph

Start the essay with an introductory paragraph. The introduction includes background information and description to present the general topic. It also embodies the thesis statement as the last sentence.

Exercise 4: Study the sample introductory paragraph below. Analyze it and identify the contents.

Sample introductory paragraph

A robot is a programmable machine which can fulfill complex and multiple tasks automatically. As pointed out by Conner-Simmons, although the concept of robot is believed to have been first mentioned in mythology with the Golem centuries ago, its first use as a word was in the 1920s in a Czech play (2016). In the following years, with the developing technology, robots have become an indispensable part of the daily life in many sectors. The applications have varied from service, industry, military, even to entertainment. An entertainment robot is an actively responding computer, fully equipped with sensors to infer and react to its environment reliably and accurately. It develops judgement through learning and exposure to the outside world. Entertainment robots can be classified into three types based on function: education, hobby, and assistance robots.

1. Definition
2. _____
3. _____
4. _____
5. _____

Writing a body paragraph

Present each category / subtopic in a well-developed body paragraph. Each body paragraph should introduce one subtopic. The first sentence of each body paragraph should be the **topic sentence** that introduces the subtopic to be discussed in that paragraph. Also, remember to make use of appropriate transition signals when presenting each topic sentence.

a. It is logical to devote one paragraph for each category. Remember to identify and define the category. List the common characteristics of this category, and provide examples. In the new paragraphs make sure that you distinguish the category from the previously mentioned ones. Presenting the similarities and the differences will help the reader to better understand the listed categories. Incorporating extended definitions in these body paragraphs will help to explain the category in detail.

b. Remember to start each paragraph with a topic sentence that employs the correct transition signal. This will secure the unity and coherence among the paragraphs. Repeating the key words from the thesis statement in the topic sentence will also help ensure unity and coherence.

   e.g. The first category of entertainment robots on the basis of their functions is education robots.

   However, bear in mind that academic writing prefers complex structures. Alternatively, the topic sentence may employ a short definition. This depends on the organization and the content of your paragraph.

   e.g. The first category of entertainment robots on the basis of their functions is education robots specifically designed to combine theoretical information with practical applications.

LANGUAGE FOCUS

Transition signals for classification

Transitions to introduce categories	Transitions to introduce examples
First, Second, Next, Last Another In addition,	A good example is ... An excellent example ... For example, ... is a typical example of ...

Sample body paragraph

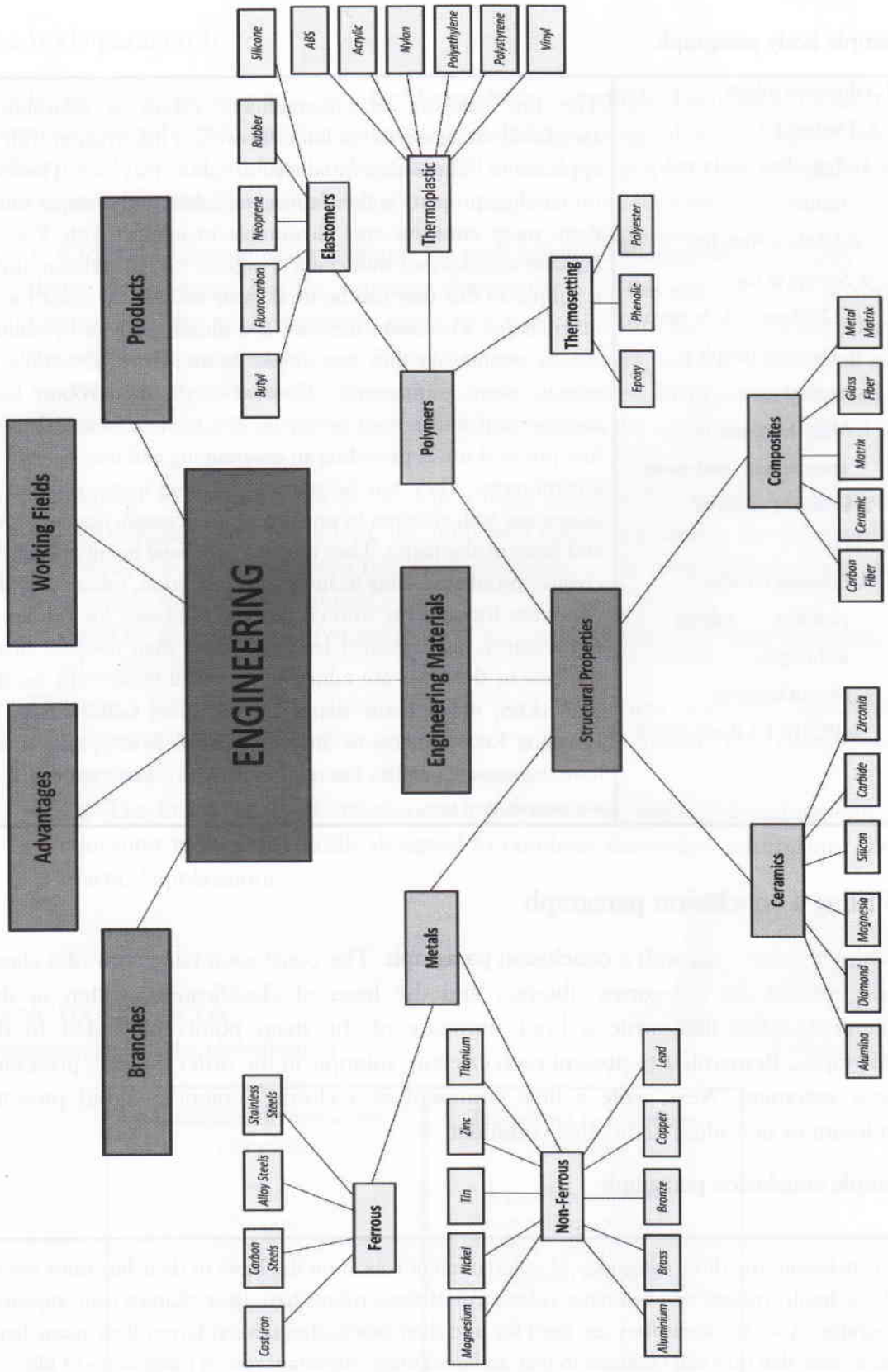
I. Education robots A. Design 1. Appealing colors and features a. Clothes, wigs, fur 2. Simple to use a. Children, elderly people b. Disabled people B. Practical uses 1. Make learning entertaining and easier 2. Learning mates or teachers 3. Enhance creative problem solving techniques 4. Distant learning a. PEBBLES (Cale, 2006)	The first category of entertainment robots is education robots specifically designed to combine theoretical information with practical applications. The design of education robots may vary. However, their outstanding property is their appealing colors and features which make them more attractive and pleasurable to interact with. For example, they are accessorized with clothes, wigs, or fur. In addition, their design is simple so that they can be used easily without the need for complex instructions. Therefore, they are specifically enjoyed by children and elderly people. As they are simple to use, disabled people can also operate them competently. Moreover, education robots have been incorporated into school programs due to their practical uses. Their first practical use is providing an entertaining and user-friendly learning environment. They can be used as learning mates or even teachers interacting with children to practice pronunciation, reading, vocabulary, and basic mathematics. They are also beneficial in enhancing children's creative problem solving techniques. In addition, robots provide distant education for students who cannot attend classes for various reasons. For instance, as explained by Cale, more than 600,000 hospitalized students in the USA are educated in virtual classrooms via the robot PEBBLES, whose name stands for Providing Education by Bringing Learning Environments to Students (2006). Briefly, education robots have various benefits for children with their appealing designs uncomplicated use.

Writing a conclusion paragraph

Complete your essay with a **conclusion paragraph**. The conclusion paragraph of a classification essay restates the categories/subtopics and the basis of classification written in the thesis statement. After that, write a brief summary of the main points presented in the body paragraphs. Remember to present each category/subtopic in the order they are presented in the thesis statement. Next, write a final comment as a closing sentence. Avoid presenting any irrelevant or new ideas in the final comment.

Sample conclusion paragraph

In conclusion, the three categories of entertainment robots on the basis of their functions are education robots, hobby robots, and assistance robots. All of these robots have their characteristic appearances and programs. Also, the areas they are used for and their practical uses vary. Given their many benefits, it is safe to state that they will continue to play an increasingly important role in many areas of life.


ENGINEERING
Working Fields
Advantages
Branches
Products
Engineering Materials
Elastomers
Silicone
Rubber
Neoprene
Fluorocarbon
Butyl
Polymers
Thermoplastic
ABS
Acrylic
Nylon
Polyethylene
Polystyrene
Vinyl
Thermosetting
Polyester
Phenolic
Epoxy
Structural Properties
Composites
Metal Matrix
Glass Fiber
Matrix
Ceramic
Carbon Fiber
Ceramics
Zirconia
Carbide
Silicon
Magnesia
Diamond
Alumina
Metals
Ferrous
Stainless Steels
Alloy Steels
Carbon Steels
Cast iron
Non-Ferrous
Titanium
Zinc
Tin
Nickel
Magnesium
Lead
Copper
Bronze
Brass
Aluminium

Exercise 5: Examine the chart on page 138. Then, study the outline and the classification essay on "Engineering Materials" below. (1) Circle the basis of classification in the thesis statement. (2) Underline the topic sentences in the body paragraphs. (3) Read the body paragraphs. Discuss how the information is presented.

Thesis Statement: The four groups of engineering materials on the basis of their structural properties are metals, polymers, ceramics and composites.

I. Metals

A. Properties

1. Excellent conduction
   a. Silver
2. High stiffness
3. Deformation
4. Toughness
5. Process with melting and cooling

B. Applications

1. Structural applications: in high-rise buildings and bridge constructions
   a. SEAISI findings (SEAISI, 2016)
2. Copper and titanium in tools, electrical appliances, cables, vehicles
3. Low density metals in aerospace industry

II. Polymers

A. Properties

1. Excellent insulation
2. Light weight with low density
3. Flexible, corrosion resistant
4. Inexpensive and easy processing

B. Applications

1. Chemistry
2. Industrial products
   a. Plastic, rubber materials
3. Insulation equipment, pipe-plumbing
   a. PVC
   b. Massel and Kireta report (Massel & Kireta, 2006)
4. Manufacture
   a. Clothes, outdoor equipment, plastic bottles

III. Ceramics

A. Properties

1. Electrical and thermal insulation
2. Superconductivity
   a. Nobel Prize on ceramics (Sempra, n.d.)
3. Porosity
4. Stiffness, corrosion resistance
5. Easy processing with high melting point

B. Applications

1. Oxides, nitrides and carbides in space and nuclear technologies
2. Power transformers and automotive sectors
3. Military industry and laser technology

IV. Composites

A. Properties

1. Matrix and reinforcement components
2. Variety of strength and conductivity
   a. Fiberglass
3. Special production techniques
4. Processing through heating or chemical reaction

B. Applications

1. Military and aerospace industry
2. Construction and civil infrastructure: roads, bridges
3. Consumer products
   a. Tennis rackets, golf clubs, microwave cookware

Types of Materials in Engineering

Engineers and scientists try to invent and develop products meeting the needs and demands of the society. Engineering materials are the substances that are used in a wide variety of applications for manufacturing and many branches of science and engineering more generally. Especially applied scientists or engineers are exposed to many kinds of design or production problems involving materials. As illustrated by Callister, in case of using steel in a vehicle's chassis system, the mechanical engineer will be faced with a static design problem, whereas an electrical engineer will come across an integrated circuit chip problem (1994, p. 3). Hence, any engineering or

chassis (n): the supporting base frame in a vehicle

science student should know that materials in engineering have a wide range of properties with different uses. The four groups of engineering materials on the basis of their structural properties are metals, polymers, ceramics and composites.

Metals are the first group of engineering materials which constitute most of the elements in the periodic table. Metals are known to be excellent conductors. For instance, silver has the highest electrical and thermal conductivity. Another important property of metals is their high stiffness and strength. However, despite their stiffness, they are still deformable. Another property of metals is that they also have toughness which presents the capacity to absorb energy better than any other materials; therefore, they can withstand different levels of impact. Metal processing involves cooling the molten metal in order to form solids. Because of all these qualities, metal alloys have a variety of applications. Metal alloys, such as steel are heavily used in structural applications like high-rise buildings and bridge constructions. To illustrate, according to The South East Asia Iron and Steel Institute (SEAISI), in Southeast Asian Nations, the largest sector to consume steel is the construction sector by 70% (2016). This clearly shows the extensive application of metals in building structures. There are several other applications of metals. For example, copper and titanium are two metals preferred in many tools, electrical appliances, cables and vehicles. Metals with low density, such as aluminum, are used mainly in aerospace applications.

The second category of engineering materials on the basis of their structure is polymers, which are organic compounds based on carbon, hydrogen and other non-metallic elements. Being poor conductors of electricity and heat is a distinguishing property of polymers which makes polymers excellent insulators. Another property of polymers is that these materials are lightweight with low densities. Additionally, they can be extremely flexible and can resist corrosion. They are also inexpensive and easy to process for simple manufacturing applications that do not require heating. Hence, polymers have abundant common uses. One application area in which polymers are commonly used is chemistry where they are essential materials for chemical engineers. Another application area of polymers is industrial products. The most familiar polymers included in this group are plastic and rubber materials, whose applications can range from shopping bags to industrial equipment. Moreover, polymers are used in insulation equipment and piping. Polyvinyl chloride (PVC) is a well-known example with its abundant applications. As Massel and Kireta report, PVC is preferable for use in cold and hot water distribution systems of all kinds, fire suppression and corrosive fluid handling, as it can function continuously under pressure of 100 psi at 180 degrees F. (2006). Similarly, it is used in manufacturing. To illustrate, clothes or outdoor equipment and even plastic bottles are a few examples of polymers.

stiffness (n): quality of being firm and strong; resistance to bending

deformable (adj): having the potential or quality of changing the shape or size because of an applied force or temperature change

appliance (n): device or instrument designed for a specific purpose

lightweight (adj): weighing less than average

corrosion (n): process of deterioration of metals through oxidation or other chemical reactions

abundant (adj): plentiful, in large quantities

The third group of engineering materials is ceramics, which are compounds between metallic and non-metallic materials. Properties of ceramics make them outstanding materials. Ceramics are known to be perfect electrical and thermal insulators due to their different levels of crystallinity. Besides, some ceramics are known to be magnetic materials with superconductivity at low temperatures. As highlighted by Sempra, this has been universally acknowledged with the presentation of the Nobel Prize to J. Georg Bednorz and K. Alex Müller for their "break-through discovery of superconductivity in ceramic materials" in physics in 1993 (n.d.). Moreover, the porous property of ceramics reduces their tensile strength. However, despite being very brittle, they are known for their high stiffness and corrosion resistance. In addition, ceramics have high melting points, and this property makes ceramics easier to process without being affected. Thanks to their exceptional properties, ceramics possess a wide scope of applications. Oxides, nitrides and carbides are ceramics used in space and nuclear technologies. Ceramics are also preferred for power transformers and in automotive sectors. The optical transparent property of ceramics is applied in military industry as well as laser technology.

Composites, the last category of engineering materials, consist of more than one material type and they are designed to present the best characteristics of component materials. An outstanding property of composites is that they consist of two separate components, which are the matrix and the reinforcement. Therefore, the strength and conductivity depend on the matrices and the reinforcements. One example of well-known composites is fiberglass which acquires its strength from glass and flexibility from polymer. Production of composites demands special techniques, hence they are not easy to produce. Additionally, while processing composites, the reinforcement is usually saturated with the matrix so that the matrix can bind together rigidly by heating or with a chemical reaction. This versatile material is known to have several application fields. Composites are especially preferred in military and aerospace applications thanks to their superior properties. They are also used in constructions and civil infrastructures such as roads and bridges. In addition, consumer products including tennis rackets, golf clubs and microwave cookware are other examples of composite applications.

In conclusion, based on their structure and components, metals, polymers, ceramics and composites make up the four groups of engineering materials. Each group has its own properties which determine the applications and which facilitate constant product innovation. Therefore, each scientist or engineer should know these properties to make the careful selection for when and where to use the different engineering materials.

outstanding (adj): better than usual, remarkable

tensile strength (n): resistance of a material to a force or strength without breaking

brittle (adj): easily broken despite being hard

exceptional (adj): not typical, unusual

possess (v): to own

acquire (v): to obtain, get

reinforcement (n): act of strengthening something

versatile (adj): with different functions, use

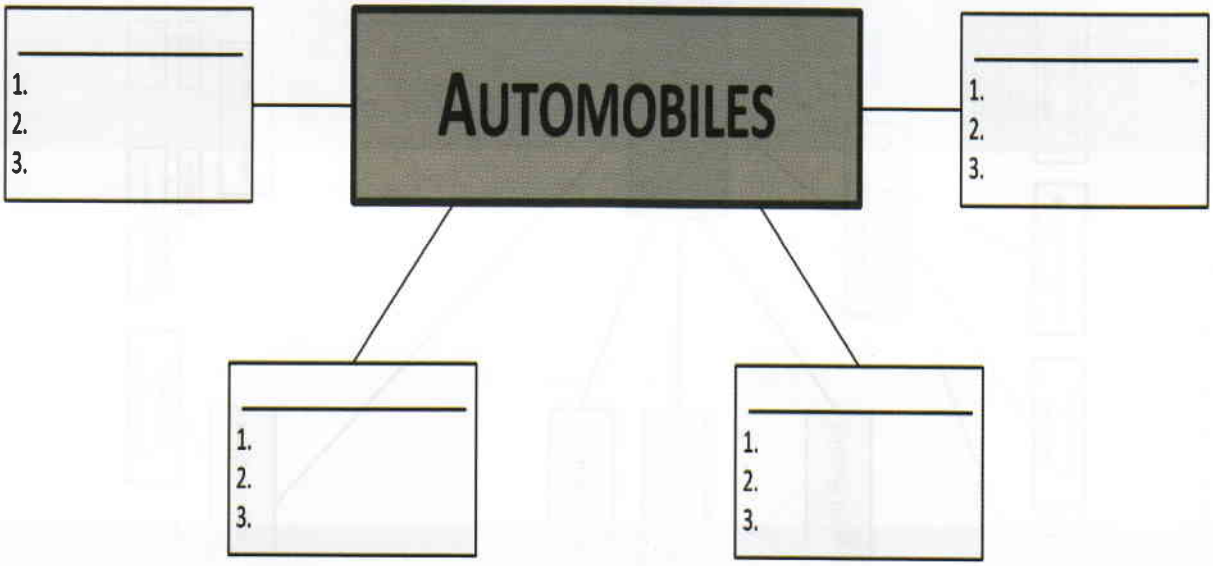
facilitate (v): to make easier

WORD FORMS

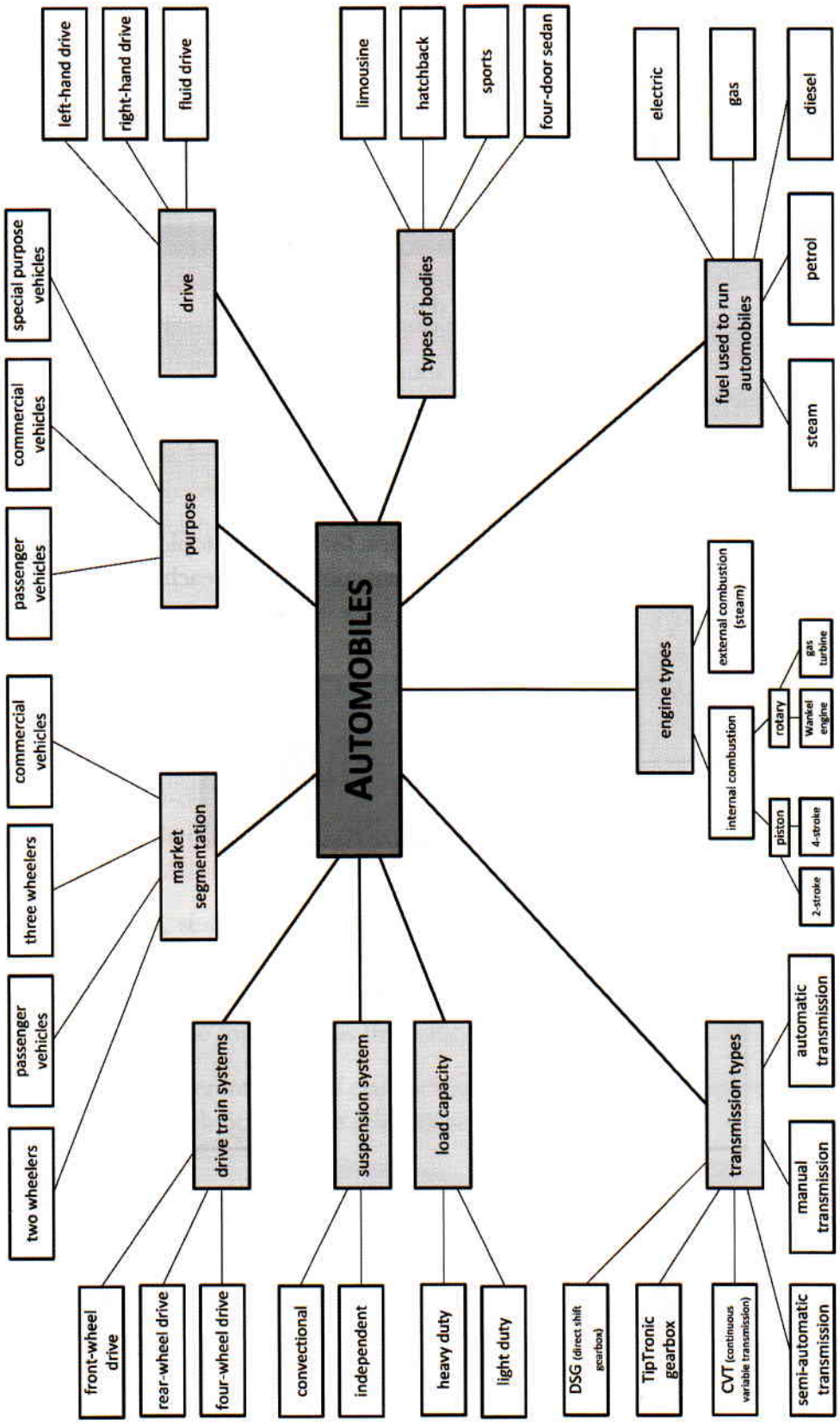
Complete the table with the word forms.

VERB	NOUN	ADJECTIVE	ADVERB
	stiffness		
		deformable	
	corrosion		
		abundant	
possess			
facilitate			

Exercise 6: Determine different bases of classification for the main topic "automobiles". Write the basis of classification in each box and list relevant subtopics for each.



Exercise 7: Now examine the chart on automobiles on the next page and study the different bases of classification and the subtopics.


AUTOMOBILES
drive
left-hand drive
right-hand drive
fluid drive
types of bodies
limousine
hatchback
sports
four-door sedan
fuel used to run automobiles
electric
gas
diesel
petrol
steam
engine types
external combustion (steam)
internal combustion
rotary
gas turbine
Wankel engine
piston
4-stroke
2-stroke
transmission types
automatic transmission
manual transmission
semi-automatic transmission
CVT (continuous variable transmission)
TipTronic gearbox
DSG (direct shift gearbox)
load capacity
heavy duty
light duty
suspension system
convectional
independent
drive train systems
front-wheel drive
rear-wheel drive
four-wheel drive
market segmentation
commercial vehicles
three wheelers
passenger vehicles
two wheelers
purpose
special purpose vehicles
commercial vehicles
passenger vehicles

Exercise 8: Formulate relevant thesis statements for types of automobiles listed in Exercise 7.

1. _____

_____

2. _____

_____

3. _____

_____

Exercise 9: Read the outline and the classification essay on the types of automobiles below.

1. Write a proper thesis statement by using the chart on automobiles and key words in the outline and the introduction.

2. Complete the topic sentences and the missing supporting ideas for each body paragraph.

3. Write a conclusion paragraph for the essay.

Outline

Thesis Statement: _____

_____

_____.

I. Front-Wheel Drive (FWD)
   A. Strengths
      1. Improved traction, less weight, fuel economy
      2. Large interior thanks to engine location
         a. TopGear report (TopGear, n.d.)
      3. Lower cost of maintenance because of fewer components
   B. Weaknesses
      1. Traction loss because of nose-heavy design
      2. Poor traction during acceleration
      3. Loss in adverse road conditions

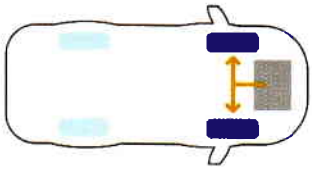
II. Rear-Wheel Drive
   A. Strengths
      1. Simple and straight forward transmission system due to longitudinally oriented engine
      2. More room for larger engines and transmission
      3. Improved traction during acceleration
      4. Centered weight balance
      5. Better handling, sporty performance
   B. Weaknesses
      1. Mastering difficulties
         a. Fun, dynamic but risky
      2. Decreased interior space
      3. Increased weight
      4. Higher purchase price
      5. Higher maintenance price

III. Four -Wheel Drive
   A. Strengths
      1. Excellent traction at both ends
      2. Safer driving, improved performance thanks to sensors
      3. Increased control
         a. TopGear report (TopGear, n.d.)
   B. Weaknesses
      1. Increased cost
         a. Drivetrain, equipment, computerized system
      2. Heavier fuel consumption due to additional weight

Wheel Drives of Vehicles

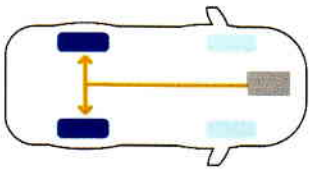
Each automobile has a transmission system that delivers the power produced by the engine to the wheels. The transmission of an automobile is connected to a system which is known as the drivetrain. The drivetrain can be defined as the system which finally rotates the wheels to give motion to the automobile. Since automobiles have different drive train systems, their performances vary. _____ _____.	rear (adj/n): back

_____ in which the power is transferred to the front wheels only, usually via a transversely oriented engine located at the front end. The defining favorable characteristics of the front-wheel drive are improved traction especially on slippery surfaces, less overall vehicle weight compared to other systems, and fuel economy because of the lower weight. Moreover, the interior is larger thanks to the drivetrain's being mounted right next to the engine in the front area as a single unit. As reported in a TopGear review, FWD automobiles have five to twenty centimeters more interior space when compared to other wheel drives (n.d.). Because there are fewer components, lower cost of maintenance is another strength of the Front-Wheel Drive.



Despite several positive attributes, critics of FWDs list some weak specifications as well. A notable weakness of the FWD occurs with aggressive cornering at higher speeds, which may result in losing traction due to the nose-heavy design of such automobiles. The traction may also be relatively poor during acceleration periods as the weight shifts back and weakens the weight pushing down on the front wheels.

_____ in which the engine torque is transferred to the rear axle only. This design usually has a longitudinally oriented engine, resulting in the advantage of presenting a simple and straight forward transmission system without the technical complexities of a FWD. There is more room for larger engines to fit the front of the car, and more room for the transmission. Moreover, _____ _____ as the weight shifts back. Since the driveshaft is at the end of the automobile, the automobile's overall weight balance is much more centered. Because of all these reasons, it can be claimed that RWD vehicles have much better handling and a more sporty performance._____ _____ . Among the flaws of RWD automobiles, their being more difficult to master can be listed. Whereas some drivers find this to be fun and dynamic, other drivers find this to be risky. Decreased interior space can be listed as another handicap because Rear-Wheel Drive automobiles provide less leg room and less trunk space because more space is needed for the



transversely (adv): located across or in a cross direction

traction (n): grip of a tire or wheel on the road

slippery (adj): causing something to slide because of being wet or smooth

maintenance (n): care or upkeep of a car or machine to keep it in good condition

longitudinally (adv): lengthwise, lengthway

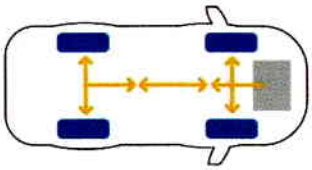
oriented (adj): aligned or positioned in a certain direction

room (n): space

trunk (n): covered storage area at the back of a car

driveshaft and hardware. Because of the increased amount of hardware and drive shaft, the weight increases as well, and many drivers report this to be disadvantageous when compared to a Front-Wheel drive automobile. _____ _____. As a final weak point, _____ _____.

_____ is the combination of FWD and RWD. It merges the positive aspects of both systems, and can deliver excellent traction at both the front and the rear ends under the most demanding conditions where grip is weak. The most acknowledged knack of this drivetrain in automobiles is safer driving and improved performance at all times. The sensors effectively detect front-wheel slippage in case of ice, snow and gravel and engage with the other set of wheels. _____ _____ _____.



A TopGear review reports this additional weight to be approximately fifty to a hundred kilograms heavier than FWD automobiles (n.d.). However, _____ _____. _____.

The drivetrain as well as the equipment needed to secure the comforts of the 4WDs together with their computerized systems increase the purchasing and maintenance costs of these automobiles. _____ _____ _____.

merge (v): combine, blend or unite

Write your conclusion paragraph here:

_____

_____

_____

_____

_____

Exercise 10: Read the information below and make an outline for the body paragraph about pre-programmed robots. Then, write an introduction and a body paragraph. Do not forget to include citations for specific information.

SOURCE 1: Adapted from National Aeronautics and Space Administration, n.d.

A robot can be defined as a programmable, self-controlled device consisting of electronic, electrical, or mechanical units. More generally, it is a machine that functions instead of humans or animals. Robots are especially desirable for certain tasks because, unlike humans, they never get tired; they can endure physical conditions that are uncomfortable or even dangerous; they can operate in airless conditions; they do not get bored by repetition; and they cannot be distracted from the task at hand.

SOURCE 2: Illinois State University, "Pre-programmed robots", n.d.

Pre-programmed robots have a specific set of instructions. They have to be told ahead of time what to do. Thus, the robots can perform only a finite set of instructions. In other words, they cannot change their behavior while they are working. Human intervention during robots' actions is not required in pre-programmed robots. The first modern programmable robot was the *Unimate* which worked in a factory in 1961 in order to move pieces of hot metal. They usually have 5 parts: controller, arm, drive, end effector and sensor. Their sizes and shapes vary depending on the task they perform. Pre-programmed robots are mostly employed in industry where not only human power is a necessity but also precision is a requirement. Especially the automotive sector uses this type of robots. Since they vary in terms of size and shape, they can be gigantic in order to handle a whole automobile or they can be very fragile to make the tiniest weld or spray paint with aesthetic precision. These robots can continue their tasks 24 hours a day for years on end without any failure. Once they are programmed, they will repeat the same action over and over again. Pre-programmed robots are also particularly good for tasks that require a very high level of accuracy at a very fine level, hence they are widely employed in medicine. Types of radiosurgery machines which are preprogrammed robots are needed for the treatment of cancer patients since it is a very delicate procedure to apply a certain amount of radiation to a particular point in the body. For example, if we want to use radiation to kill tumors in cancer patients, we need to be able to deliver the radiation precisely to the tumor. If we miss, we may end up killing healthy tissue near the tumor instead of the tumor itself. The CyberKnife radiosurgery machine is a pre-programmed robot designed to deliver very precise doses of radiation to very precise locations within the human body.

SOURCE 3: Illinois State University, "Pre-programmed robots", n.d.

Another common use of pre-programmed robots is as training simulations, such as the S575 Noelle. These robots are constructed to present medical students with various scenarios in which they must diagnose and treat. The robot is pre-programmed with a possible scenario, and its responses to the students' treatment is also pre-programmed. So you could not, for example, try an experimental treatment because the robot would not know how to respond. You must try one of the treatments that the robot is programmed to respond to.

The concept of robots is a very old one yet the actual word robot was invented in the 20th century from the Czechoslovakian word *robota* or *robotnik* meaning slave, servant, or forced labor. Robots do not have to look or act like humans but they need to be flexible so they can perform different tasks. Early robots handled radioactive materials in atomic labs and were called master /slave manipulators. They were connected with mechanical linkages and steel cables. Remote arm manipulators can now be moved by push buttons, switches or joysticks. Current robots have advanced sensory systems that process information and appear to function as if they have brains. Their "brain" is actually a form of computerized artificial intelligence (AI). AI allows a robot to perceive conditions and decide upon a course of action based on those conditions.

Characteristics that make robots different from regular machinery are that robots usually function by themselves and they are sensitive to their environment. They adapt to variations in the environment or correct the errors detected in prior performances. They are also task oriented so they often have the ability to try different methods to accomplish a task. Common robots that are used in industry are generally heavy rigid devices limited to manufacturing. They operate in precisely structured environments and perform highly repetitive tasks under preprogrammed control. Robots can be used in semi-structured environments such as undersea and nuclear facilities. They perform non-repetitive tasks and have limited real-time control. Robots are also valuable for space exploration. Not only can they travel to environments too hostile or too distant for human explorers, but they can also enhance the work schedule of a manned space mission. They perform non-repetitive tasks in semi-structured to unstructured environments. There is often a variable time delay for instructions between the operator and the robot. These robots need to be dexterous, lightweight and have flexible

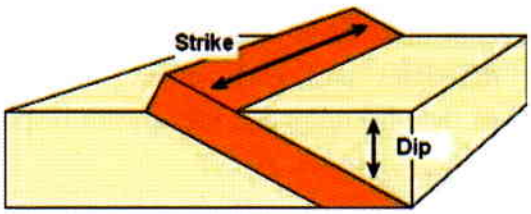
Exercise 11: Read the texts below about earthquakes and write an outline and a classification essay on types of faults.

SOURCE 1: Michigan Technological University, "Where do earthquakes happen?", 2007

Earthquakes occur all the time all over the world, both along plate edges and along faults.
Along Plate Edges: Most earthquakes occur along the edge of the **oceanic** and **continental plates**. The earth's **crust** (the outer layer of the planet) is made up of several pieces, called **plates**. The plates under the oceans are called oceanic plates and the rest are continental plates. The plates are moved around by the motion of a deeper part of the earth (the **mantle**) that lies underneath the crust. These plates are always bumping into each other, pulling away from each other, or past each other. The plates usually move at about the same speed that your fingernails grow. Earthquakes usually occur where two plates are running into each other or sliding past each other.
Along Faults: Earthquakes can also occur far from the edges of plates, along faults. **Faults** are cracks in the earth where sections of a plate (or two plates) are moving in different directions. Faults are caused by all that bumping and sliding the plates do. They are more common near the edges of the plates.

SOURCE 2: Andrew Alden, "Reverse, strike-slip, oblique, and normal faults", 2018

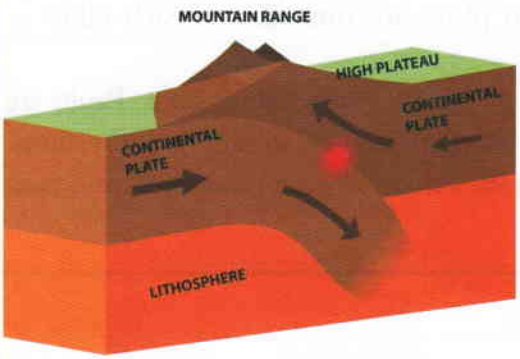
In essence, faults are large cracks in the Earth's surface where parts of the crust move in relation to one another. These movements prove that the Earth has powerful forces that are always working beneath the surface. Faults come in all sizes; some are tiny with offsets of only a few meters, while others are large enough to be seen from space. The main components of a fault are (1) the fault plane, (2) the fault trace, (3) the hanging wall, and (4) the footwall. The **fault plane** is where the action is. It is a flat surface that may be vertical or sloping. The line it makes on the Earth's surface is the **fault trace**. Where the fault plane is sloping, as with normal and reverse faults, the upper side is the **hanging wall** and the lower side is the **footwall**. When the fault plane is vertical, there is no hanging wall or footwall.



Any fault plane can be completely described with two measurements: its strike and its dip. The **strike** is the direction of the fault trace on the Earth's surface. The **dip** is the measurement of how steeply the fault plane slopes.

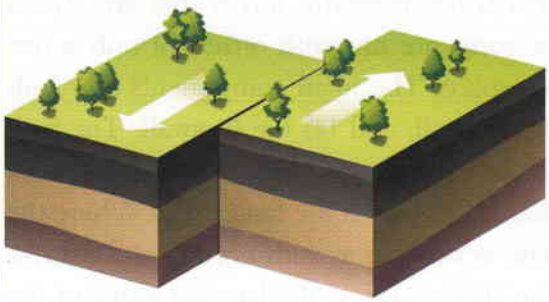
Normal faults form when the hanging wall drops down in relation to the footwall. Extensional forces, those that pull the plates apart, and gravity are the forces that create normal faults. They are most common at **divergent boundaries** (areas where a plate is very slowly splitting apart or where two plates are pulling away from each other).

These faults are "normal" because they follow the gravitational pull of the fault plane, not because they are the most common type. The Sierra Nevada of California and the East African Rift are two examples of normal faults.



In a **reverse fault**, the hanging wall (right) slides over the footwall (left) due to compressional forces. **Reverse faults** form when the hanging wall moves up. The forces creating reverse faults are compressional, pushing the sides together. They are common at **convergent boundaries** (areas where a plate is folding up because it is being compressed by another plate pushing against it). Reverse faults create some of the world's highest mountain chains, including the Himalaya Mountains and the Rocky Mountains.

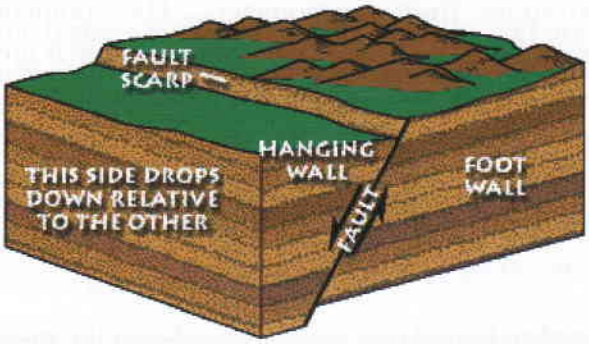
Together, normal and reverse faults are called dip-slip faults, because the movement on them occurs along the dip direction - either down or up, respectively. **Strike-slip faults** occur as plates scrape by each other. Strike-slip faults have walls that move sideways, not up or down. That is, the slip occurs along the strike, not up or down the dip. In these faults, the fault plane is usually vertical so there is no hanging wall or footwall. The forces creating these faults are lateral or horizontal, carrying the sides past each other. They are classified as right-lateral or left lateral with respect to the displacement of the far block.



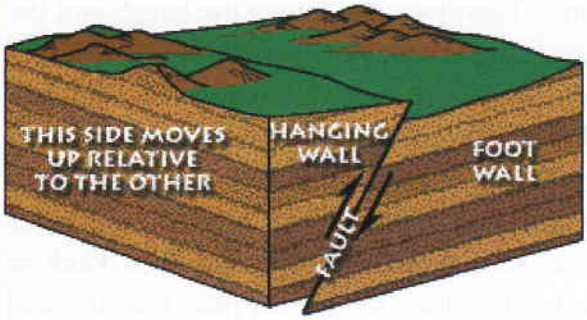
While strike-slip faults occur across the world, the most famous is the San Andreas Fault. The southwestern portion of California is moving northwestward towards Alaska. California will continue moving at about 2 inches per year until, 15 million years from now, Los Angeles will be located right next to San Francisco.

SOURCE 3: United States Geological Survey, 2017

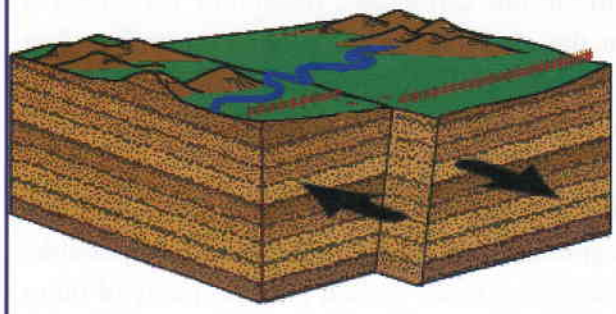
We classify faults by how the two rocky blocks on either side of a fault move relative to each other. A normal fault drops rock on one side of the fault *down* relative to the other side. The block farthest to the right is the foot wall. The block on the other side of the fault is *resting* or *hanging* on top of the foot wall. That's the hanging wall. Movement along the fault has produced an elongate cliff called a *fault scarp*. Faults that move the way you would expect gravity to move them normally are called *normal faults*! The East African Rift (EAR) is an example that is a developing divergent tectonic plate boundary, in which the African Plate is in the process of splitting into two tectonic plates, called the Somali Plate and the Nubian Plate, at a rate of 6–7 mm annually.



Along a reverse fault one rocky block is *pushed up* relative to rock on the other side. When movement along a fault is the *reverse* of what you would expect with normal gravity we call them *reverse faults*!



The rocky blocks on either side of strike-slip faults, scrape along side-by-side. The movement is horizontal and the rock layers beneath the surface have not been moved up or down on either side of the fault.



When the fault ruptures the Earth surface, pure strike-slip faults do not produce *fault scarps*. There are other changes in the landscape that signal strike-slip faulting. Where the two massive blocks on either side of a strike-slip fault grind against each other, rock is weakened. Streams flowing across strike-slip faults are often diverted to flow along this weakened zone.

SOURCE 4: Universidad Nacional Autónoma de México, 2016

An earthquake is the result of a sudden release of energy in the Earth's crust that creates seismic waves. Earthquakes are measured using observations from seismometers. The moment magnitude is the most common scale on which earthquakes larger than approximately 5 are reported for the entire globe. The more numerous earthquakes smaller than magnitude 5 are measured mostly on the local magnitude scale, also referred to as the Richter scale. Magnitude 3 or lower earthquakes are mostly almost imperceptible and magnitude 7 and over potentially cause serious damage over large areas, depending on their depth. The most recent large earthquake was a 9.0 magnitude Tohoku Earthquake in Japan in 2011.

Reverse faults, particularly those along convergent plate boundaries are associated with the most powerful earthquakes, including almost all of those of magnitude 8 or more. Strike-slip faults, particularly continental transforms can produce major earthquakes up to about magnitude 8. Earthquakes associated with normal faults are generally less than magnitude 7.

This is so because the energy released in an earthquake, and thus its magnitude, is proportional to the length and the width of the fault that ruptures. Therefore, the longer the length and the wider the width of the faulted area, the larger the resulting magnitude. The maximum observed lengths of ruptures and mapped faults, which may break in one go are approximately 1000 km. Examples are the earthquakes in Chile, 1960; Alaska, 1957; Sumatra, 2004, all in subduction zones at convergent boundaries. The most powerful earthquake of all modern times is the Valdivia Earthquake in Chili in 1960 with 800 km long rupture. The longest earthquake ruptures on strike-slip faults, like the San Andreas Fault and the North Anatolian Fault in Turkey, are about half to one third as long as the lengths along subducting plate margins, and those along normal faults are even shorter.

The most important parameter controlling the maximum earthquake magnitude on a fault is however not the maximum available length, but the available **width**. Along converging plate margins, the angle of the fault with respect to the surface **(dip)** is very shallow, typically about 10 degrees. Thus the width of the rupture within the top brittle crust of the Earth can become 50 to 100 km making the most powerful earthquakes possible.
Strike-slip faults tend to be oriented near vertically, resulting in an approximate width of 10 km within the brittle crust, thus earthquakes with magnitudes much larger than 8 are not possible. Maximum magnitudes along many normal faults are even more limited because many of them are located along spreading centers, as in Iceland, where the thickness of the brittle layer is only about 6 km.

In addition, there exists a hierarchy of stress level in the three fault types. **Stress** is the quantity describing the forces acting on each rock mass. Reverse faults are generated by the highest, strike slip by intermediate, and normal faults by the lowest stress levels. This can easily be understood by considering the direction of the force that 'pushes' the rock mass during the faulting. In the case of normal faults, the rock mass is pushed down in a vertical direction, thus the pushing force equals the weight of the rock mass itself, making it to have the lowest stress level. In the case of thrusting in reverse faults, the rock mass is lifted up, thus stress level is the highest. Strike-slip faulting is intermediate between the other two types described above.

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