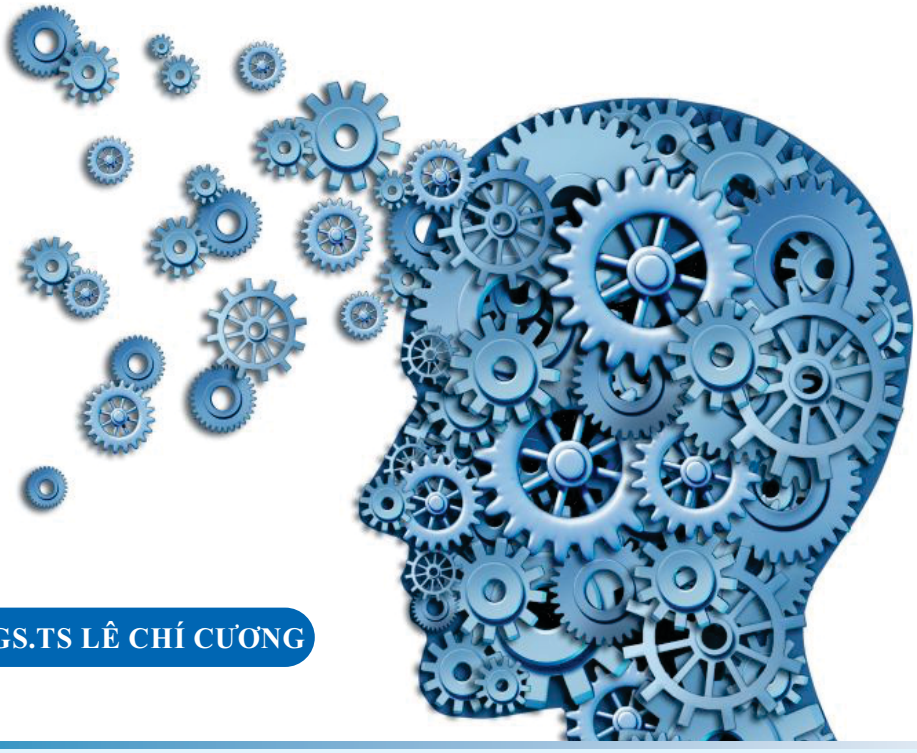
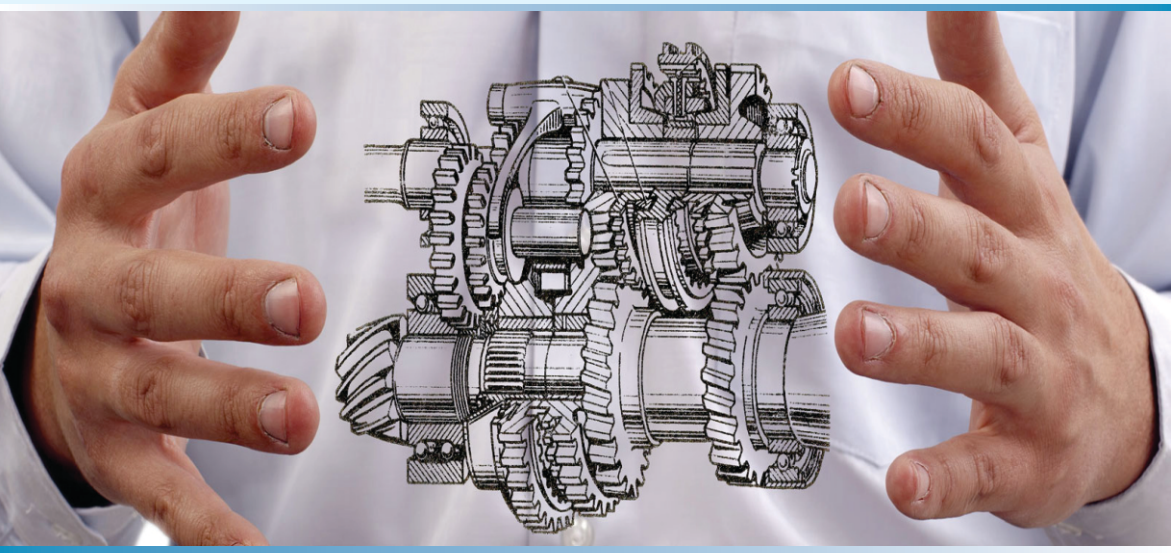


PGS.TS LÊ CHÍ CƯƠNG

GIÁO TRÌNH

ANH VĂN CHUYÊN NGÀNH CƠ KHÍ



NHÀ XUẤT BẢN
ĐẠI HỌC QUỐC GIA TP. HỒ CHÍ MINH

PGS.TS LÊ CHÍ CƯƠNG

GIÁO TRÌNH
ANH VĂN CHUYÊN NGÀNH CƠ KHÍ

NHÀ XUẤT BẢN ĐẠI HỌC QUỐC GIA
THÀNH PHỐ HỒ CHÍ MINH – 2016

LỜI NÓI ĐẦU

Việt Nam đang trong quá trình hội nhập kinh tế toàn cầu, trong đó nhiều lãnh vực sản xuất mũi nhọn của nền kinh tế quốc dân đang có nhu cầu cấp thiết về cập nhật và chuyển giao công nghệ, đáng kể nhất là cơ khí, vật liệu học và tự động hóa. Song song với quá trình học tập và nghiên cứu chuyên môn, việc nâng cao năng lực tiếng Anh cho sinh viên hệ ngành cơ khí và trang bị cho kỹ sư mới ra trường khả năng sẵn sàng làm việc để đáp ứng nhu cầu hội nhập và nâng cao khả năng cạnh tranh của nguồn nhân lực trong nước là một công việc quan trọng và cần thiết.

Trước nhu cầu đó, nhóm tác giả, với kinh nghiệm nghiên cứu, làm việc trong lãnh vực chuyên ngành và ngôn ngữ dịch thuật đã mạnh dạn biên soạn **Giáo trình Anh văn Chuyên ngành Cơ khí** cho sinh viên đại học và cao đẳng thuộc nhóm ngành cơ khí để nâng cao khả năng ngoại ngữ. Cuốn sách cũng nhằm muốn chia sẻ, trao đổi kiến thức và ngôn ngữ với đông đảo bạn đọc có nhu cầu học thêm tiếng Anh về cơ khí.

Giáo trình bao gồm 13 bài với các phần từ vựng, bài đọc, luyện tập cấu trúc câu và ngữ pháp được biên soạn theo hình thức vừa là bài giảng cho giảng viên, vừa là phần tự học cho sinh viên. Các cấu trúc và văn phạm được luyện tập là những cấu trúc rất cơ bản và thường gặp trong lãnh vực kỹ thuật mà người kỹ sư ra trường cần trang bị.

Dù giáo trình đã được biên soạn công phu, cập nhật, nhưng vẫn không khỏi những sai sót. Chúng tôi mong nhận được những ý kiến bổ sung, đóng góp để cuốn sách ngày càng hoàn thiện và bổ ích cho các bạn đọc. Mọi ý kiến đóng góp xin gửi về:

PGS.TS Lê Chí Cương

Khoa Cơ khí Chế tạo máy

Trường Đại học Sư phạm Kỹ thuật TP HCM

lccuong@hcmute.edu.vn hoặc lccuong@gmail.com

MỤC LỤC

Unit 1

ENGINEERING - WHAT'S IT ALL ABOUT?

Task 1. ***Warm-up***

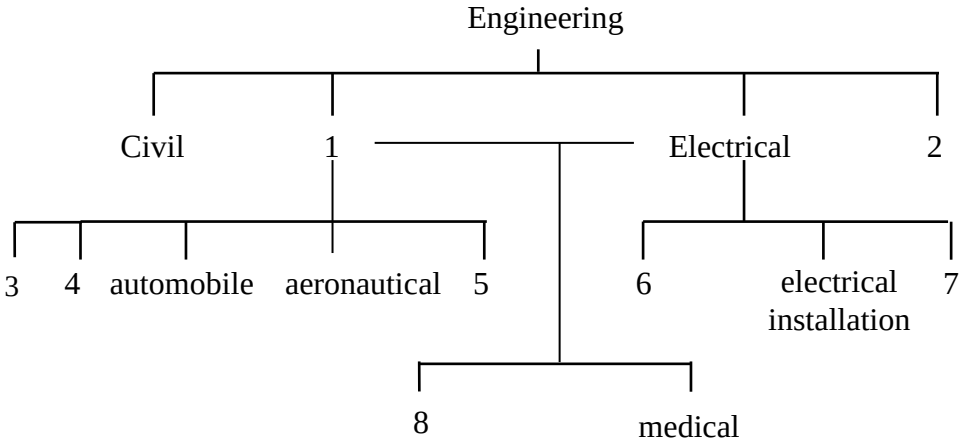
1. What is your major?
2. Discuss with your friends and make a list of technical majors in HCMC University of Technology and Education.

Task 2. ***List main branches of engineering. Combine your list with others in your group. Then read this text to find out how many branches listed are mentioned.***

Engineering is largely a practical activity. It is about putting ideas into action. Civil engineering is concerned with making bridges, roads, airports, etc. Mechanical engineering deals with the design and manufacture of tools and machines. Electrical engineering is about the generation and distribution of electricity and its many applications. Electronic engineering is concerned with developing components and equipment for communications, computing, and so on.

Mechanical engineering includes marine, automobile, aeronautical, heating and ventilating, and others. Electrical engineering includes electricity generating, electrical installation, lighting, etc. Mining and medical engineering belong partly to mechanical and partly to electrical.

Task 3. ***Complete this diagram using the information from the text above.***



Reading Introduction

In your study and work, it is important to think about what you are going to read before reading. This helps you to link old and new knowledge and make guesses the content and meaning of new words in the text. It is also important to have a clear purpose so that you can choose the best way to read. In this book, you will find tasks to make you think before you read and tasks to help you to have a clear purpose when you read.

Task 4. ***Study these illustrations. They show some of the areas in which engineers work. Can you identify them? What kinds of engineers are concerned with these areas - electrical, mechanical, and both?***

Figure 1. *Fields of engineering*

Task 5. ***Now read the following texts to check your answers to Task 4. Match each text to one of the illustrations above.***

Transport: Cars, trains, ships, and planes are all products of mechanical engineering. Mechanical engineers are also involved in support services such as roads, rail track, harbours, and bridges.

5 **Food processing**: Mechanical engineers design, develop, and make the machines and the processing equipment for harvesting, preparing and preserving the foods and drinks that fill the supermarkets.

Medical engineering: Body scanners, X-ray machines, life-support systems, and other high-tech equipment result from mechanical and electrical engineers combining with medical experts to convert ideas into life-saving and preserving products.

Building services: Electrical engineers provide all the services we need in our homes and places of work, including lighting, heating, ventilation, air-conditioning, refrigeration, and lifts.

Energy and power: Electrical engineers are concerned with the production and distribution of electricity to homes, offices, industry, hospitals, colleges and schools, and the installation and maintenance of the equipment involved in these processes.

Task 6. ***Answer these following questions.***

1. What are the products of mechanical engineering in transport?
2. What do mechanical engineers do in food processing?
3. How is mechanical engineering applied in medical engineering?
4. What is the role of electrical engineer in building services?
5. What is the concern of electrical engineers in energy and power sectors?

Language study

deal with / be concerned with

What is the link between column A and column B?

A	**B**
Mechanical	Machines
Electrical	Electricity

Column A lists branches of engineering or types of engineer. Column B lists things they are concerned with. We can show the link between them in a number of ways:

1. Mechanical engineering **deals with** machines.
2. Mechanical engineers **deal with** machines.
3. Mechanical engineering **is concerned with** machines
4. Mechanical engineers **are concerned with** machines.
5. Machines **are the concern of** mechanical engineers.

Task 7. ***Match each item in column A with an appropriate item from column B and link them to make a sentence.***

A	**B**
marine	air-conditioning
aeronautical	roads and bridges
heating and ventilating	body scanners
electricity generating	cables and switchgear
automobile	communications and equipment
civil	ships
electronic	planes
electrical installation	cars and trucks
medical	power stations

Task 8. ***Building your vocabulary.***

Noun	**Verb**	**Adjective**
1. machine/machinery	_____	_____
2._____	_____	electrical/ electric
3. practice	_____	_____
4. industry	_____	_____
5._____	produce	_____
6. installation	_____	
7._____	maintain	_____
8. process/processing	_____	_____
9. ventilation	_____	_____
10._____	distribute	_____

Task 9. ***Fill in the gaps in the following text which describes different branches of engineering. (Use words of the diagram in Task 3 and languages you have studied in this unit.)***

The main branches of engineering are civil, [1]_____, [2]_____, and electronic. Mechanical engineering is [3]_____ [4]_____machinery of all kinds. This branch of engineering includes [5]_____, automobile [6]_____, and heating and ventilating. The first three are concerned with transport: [7]_____, cars and planes. The last [8]_____ with air-conditioning, refrigeration, etc.

Electrical engineering deals with [9]_____ from generation to use. Electricity generating is concerned with [10]_____ stations. Electrical installation deals [11]_____ cables, switchgear, and connecting up electrical equipment.

Two branches of engineering include both [12]_____ and [13]_____ engineers. These are mining and [14]_____ engineering. The former deals with mines and mining equipment, the latter with hospital [15]_____ of all kinds.

VOCABULARY

–	to act	(v)	/ækt/	hành động
	activity	(n)	/æk'tɪ vɪ ti/	hoạt động
	active	(adj)	/'æktɪ v/	năng động
	action	(n)	/'ækʃn/	hành động, hành vi; hoạt động
–	aeronautical	(adj)	/ˌ eərəˈ nɔ ː tɪ kl/	(thuộc) hàng không
–	application	(n)	/ˌ æplɪ ˈ keɪ ʃ n/	sự áp dụng, sự ứng dụng
–	automobile	(n)	/ˈ ɔ ː təməbiː l/	xe ô tô
–	branch	(n)	/brɑ ː ntʃ /	nhánh, ngành
–	bridge	(n)	/brɪ dʒ /	cầu
–	cable	(n)	/ˈ keɪ bl/	cáp
–	civil	(adj)	/ˈ sɪ vl/	thuộc công dân, dân dụng
–	to combine	(v)	/kəmˈ baɪ n/	kết hợp, phối hợp
–	to communicate	(v)	/kəˈ mjuː .nɪ .keɪ t/	liên lạc, giao tiếp

	communication	(n)	/kəˌ mjuː nɪ ˈ keɪ ʃ n/	sự liên lạc
	communications	(n)		những phương tiện liên lạc
–	component	(n)	/kəmˈ pəʊ nənt/	thành phần
–	to compute	(n)	/kəmˈ pjuː t/	tính toán
–	to be concerned	(v)	/kənˈ sɜ ː nd/	liên quan
–	to be about			liên quan, về
–	to deal with	(v)	/diː l/	đề cập đến
–	to design	(v)	/dɪ ˈ zaɪ n/	thiết kế
–	to develop	(v)	/dɪ ˈ veləp/	phát triển
–	to distribute	(v)	/dɪ ˈ strɪ bjuː t/	phân phối
	distribution	(n)	/ˌ dɪ strɪ ˈ bjuː ʃ n/	sự phân phối
–	electrify	(v)	/ɪ 'lektrɪ faɪ /	điện khí hóa
	electricity	(n)	/ɪ ˌ lekˈ trɪ səti/	điện lực
	electrical	(adj)	/ɪ ˈ lektrɪ kl/	thuộc về điện
	electric	(adj)	/ɪ 'lektrɪ k/	dùng điện, chạy bằng điện
	electronic	(adj)	/ɪ ˌ lekˈ trɒ nɪ k/	thuộc về điện tử
–	engine	(n)	/ˈ en.dʒ ɪ n/	máy, động cơ
	engineer	(n)	/ˌ endʒ ɪ ˈ nɪ ə(r)/	kỹ sư
	engineering	(n)	/ˌ endʒ ɪ ˈ nɪ ərɪ ŋ/	kỹ thuật
–	equipment	(n)	/ɪ ˈ kwɪ pmənt/	đồ trang bị, trang thiết bị
–	former	(adj)	/ˈ fɔ ː mə(r)/	trước
–	food processing	(n)	/'prousesɪ ŋ/	chế biến thực phẩm
–	to generate	(v)	/ˈ dʒ enəreɪ t/	phát, phát ra
	generation	(n)	/ˌ dʒ enəˈ reɪ ʃ n/	sự phát điện
	generator	(n)	/'dʒ enəreɪ tə/	máy phát điện
–	harbour	(n)	/ˈ hɑ ː bə(r)/	bến cảng
–	to harvest	(v)	/ˈ hɑ ː vɪ st/	gặt hái, thu hoạch
–	idea	(n)	/aɪ ˈ dɪ ə/	ý tưởng
–	to install	(v)	/in'stɔ :l/	lắp đặt

installation	(n)	/ˌɪnstəˈleɪʃn/	sự lắp đặt hoặc được lắp đặt
– to involve	(v)	/ɪnˈvɒlv/	gồm, bao hàm
– latter	(adj)	/ˈlætə(r)/	sau cùng
– machine	(n)	/məˈʃiːn/	máy, cỗ máy
mechanical	(adj)	/məˈkæn.ɪ .kl/	thuộc về cơ khí
– maintenance	(n)	/ˈmeɪntənəns/	sự bảo dưỡng, bảo trì
– to manufacture	(v, n)	/ˌmænjuˈfæktʃə(r)/	sản xuất, chế tạo
– marine	(adj)	/məˈriːn/	(thuộc) ngành hàng hải
– medical	(adj)	/ˈmedɪkl/	thuộc về y tế, y học
– mining	(n)	/ˈmaɪnɪŋ/	sự khai mỏ
– to prepare	(v)	/prɪˈpeə(r)/	chuẩn bị
– to preserve	(v)	/prɪˈzɜːv/	bảo quản, giữ gìn
– process	(n)	/ˈprəʊses/	quá trình; quy trình
– to produce	(v)	/prəˈdjuːs/	làm, sản xuất, chế tạo
product	(n)	/ˈprɒdʌkt/	sản vật, sản phẩm
production	(n)	/prə'dʌkʃn/	sự sản xuất, sự chế tạo
– to provide	(v)	/prəˈvaɪd/	cung cấp; cung ứng
– service	(n)	/ˈsɜːvɪs/	sự phục vụ
– to support	(v)	/səˈpɔːt/	cung cấp, hỗ trợ
– system	(n)	/ˈsɪstəm/	hệ thống
– tool	(n)	/tuːl/	công cụ, dụng cụ
– to ventilate	(v)	/ˈventɪleɪt/	làm cho thông gió, thông hơi

REVIEW

Choose the best answer for the following sentences.

1. Engineering, which is about putting _____ into action, is largely a practical activity.

   A. generation B. distributions

   C. ideas D. equipment

2. _____ is concerned with making bridges, roads, airports, etc.

   A. Mechanical engineering B. Electrical engineering

   C. Electronic engineering D. Civil engineering

3. Electrical engineering _____ electricity generating, electrical installation, lighting, etc.

   A. generates B. produces C. includes D. makes

4. Mining and medical engineering belong partly to _____ and partly to electrical

   A. electronic B. civil

   C. aeronautical D. mechanical

5. Cars, trains, ships and planes are all _____ of mechanical engineering.

   A. serves B. systems C. components D. products

6. The main _____ of engineering are civil, mechanical, electrical and electronic.

   A. systems B. offices C. branches D. services

7. Mechanical engineering _____ with design and manufacture of tool and machines.

   A. concerned B. is C. is concern D. deals

8. Electrical engineering is concerned with electricity from _____ to use.

   A. generation B. installation

   C. transportation D. communication

9. Two branches of engineering including both mechanical and electrical engineers are mining and medical engineering _____ deals with mines and mining equipment, _____ with hospital equipment of all kinds.

   A. The former/ the latter B. A former/ a latter

   C. The latter/ the former D. A latter/ a former

10. Electricity generating is concerned with _____.

   A. products B. services

   C. supply D. power stations

11. The aim of design engineers is to ____ new components to make the product cheaper or stronger.

A. repair B. install C. introduce D. fit

Translate into Vietnamese

Mechanics is, in the most general sense, the study of *forces* and *their effect upon matter*. Typically, engineering mechanics is used to analyze and predict the *deformation process* (both elastic and plastic) of objects under known loads or stresses.

Structural analysis is the branch of mechanical engineering (and also civil engineering) devoted to examining *why and how objects fail* and to fix the objects and their performance. Structural failures occur in two general modes: static failure and fatigue failure.

Thermodynamics is an applied science used in several branches of engineering, including mechanical and chemical engineering. Thermodynamics is the *study of energy*, its use and transformation through a system. Typically, engineering thermodynamics is concerned with *changing energy from one form to another*. As an example, automotive engines convert chemical energy (enthalpy) from the fuel into heat, and then into mechanical work that actually turns the wheels.

Drafting or technical drawing is the means by which mechanical engineers design products and create instructions for manufacturing parts. A technical drawing can be a *computer model* or *hand-drawn schematic* showing all the dimensions necessary to manufacture a part, as well as assembly notes, a list of required materials, and other pertinent information.

Acoustical engineering is one of many other sub disciplines of mechanical engineering and is the application of acoustics. Acoustical engineering is the study of *Sound* and *Vibration*. These engineers work effectively to reduce noise pollution in mechanical devices and in buildings by soundproofing or removing sources of unwanted noise.

Mechatronics is the *combination of mechanics and electronics*. It is an interdisciplinary branch of mechanical engineering, electrical engineering and software engineering that is concerned with integrating electrical and mechanical engineering to create hybrid systems.

Unit 2
ENGINEERING MATERIALS

Task 1. ***Warm-up***

What materials do you know? Make a list and compare with your classmates.

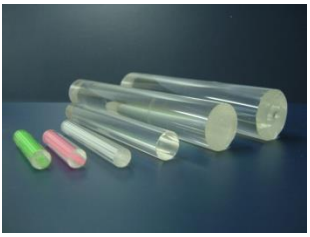
Task 2. ***Identify the materials below.***

Brass, ABS, Aluminium, Stainless steel, Copper, Epoxy resin, Nylon, Urea formaldehyde, Acrylic

_____

_____

_____



_____

_____

_____

_____

_____

_____

Reading: ***Scanning tables***

In engineering it is important to practise reading tables, charts, diagrams, and graphs because so much information is presented in these ways. We will start this unit with a table.

Scanning is the best strategy for finding information in a table. With scanning, you can know what sort of information you are searching for before reading. To scan a table, you move your eyes up and down the columns until you find the word or words you want. To scan quickly, you must learn to ignore any information which will not help you with your task.

Task 3: ***Scan the table below to find the material which is …***

1. soft
2. ductile
3. malleable
4. tough
5. scratch-resistant
6. conductive and malleable
7. durable and hard
8. stiff and brittle
9. ductile and corrosion-resistant
10. heat-resistant and chemical-resistant

Materials	Properties	Uses
Metals		
Aluminium	Light, soft, ductile, highly conductive, corrosion-resistant.	Aircraft, engine components, foil, cooking utensils.
Copper	Very malleable, tough and ductile, highly conductive, corrosion-resistant.	Electric wiring, PCBs, tubing.
Brass (65% copper, 35% zinc)	Very corrosion-resistant, casts well, easily machined. Can be hardened. Good conductor.	Valves, taps castings, ship fittings, electrical contacts.

Mild steel (iron with 0.15% to 0.3% carbon)	High strength, ductile, tough, fairly malleable. Cannot be hardened and tempered. Low cost. Poor corrosion resistance.	General purpose
High carbon steel (iron with 0.7% to 1.4% carbon)	Hardest of the carbon steels but less ductile and malleable. Can be hardened and tempered.	Cutting tools such as drills, files, saws
Thermoplastics		
ABS	High impact strength and toughness, scratch-resistant, light and durable.	Safety helmets, car components, telephones, kitchenware.
Acrylic	Stiff, hard, very durable, clear. Can be polished easily. Can be formed easily.	Aircraft canopies, baths, double glazing
Nylon	Hard, tough, wear-resistant, self-lubricating.	Bearings, gears, casings for power tools
Thermosetting plastics		
Epoxy resin	High strength when reinforced, good chemical and wear resistance.	Adhesives, encapsulation of electronic components
Polyester resin	Stiff, hard, brittle. Good chemical and heat resistance.	Molding, boat and car bodies
Urea formaldehyde	Stiff, hard, strong, brittle, heat-resistant, and a good electrical insulator.	Electrical fittings, adhesives

Grammar

Be + used to + V_0
Be + made of
Be + used for + Noun/Gerund (V-ing)

Language study:

Making definitions and describing materials using "which"

Study these facts from the table about aluminium:

1. Aluminium is a light metal.
2. Aluminium ***is used to*** make aircraft.

We can link these facts to make a definition of aluminium:

(1+2) *Aluminium is a light metal* ***which*** *is used to make aircraft.*

or we can describe aircraft:

Aircraft ***are made of*** *aluminium, which is a light metal.*

or: *Aluminium,* ***which*** *is a light metal, is used for making aircraft.*

Task 4. ***Define each of the materials in column A (see the table above). Choose the correct information in columns B and C to describe the materials in column A.***

A	B	C
1. An alloy		allows heat or current to flow easily
2. A thermoplastic		remains rigid at high temperatures
3. Mild steel	a metal	does not allow heat or current to flow easily
4. A conductor	a material	contains iron and 0.7% to 1.4% carbon
5. An insulator	an alloy	becomes plastic when heated
6. High carbon steel		contains iron and 0.15% to 0.3% carbon
7. Brass		formed by mixing other metals or elements
8. A thermosetting plastic		consists of copper and zinc

Task 5. ***Complete the sentences.***

a. Epoxy resin, which is ……, is used to…….. ……..…….

b. Brass, which ……..……., is used for ……..……..

c. Thermosetting plastic, which ……..……., is used for…….

d. Mild steel, which is an alloy containing ……..…… ……, is used for…….... …….

e. Urea formaldehyde, which is ……..……, is used to make…….. ……such as ……..….

Task 6. ***What materials make these things? Use is/are made of.***

Ex: *Safety helmets* ***are made of*** *ABS.*

1. Bearings
2. A cam
3. Car bodies
4. Cutting tool
5. Wirings
6. A file
7. A valve

Writing. ***Adding information to a text***

Study this text about aluminium.

Aluminium is used to make aircraft, engine components, and many items for the kitchen.

Or we can add extra information to the text:

Aluminium, ***which is light, soft, and ductile****, is used to make aircraft, engine components –* ***for example, cylinder heads –*** *and many items for the kitchen,* ***such as pots****.*

Note that the extra information is marked with commas or dashes,

and linked by ***which, for example, such as.***

Task 7. ***Add this extra information to the following texts of plastics.***

Extra information

1. Plastics can be molded into plates, car components, and medical aids.
2. Thermoplastics soften when heated many times.
3. Thermosetting plastics set hard and do not alter if heated again.
4. ABS is used for safety helmets.
5. Nylon is self-lubricating.
6. Nylon is used for motorized drives in cameras.
7. Acrylic is a clear thermoplastic.
8. Acrylic is used for aircraft canopies and double glazing.
9. Polyester resin is used for boat and car bodies.
10. Polyester resin is hard and has good chemical and heat resistance.

Texts of plastics

Plastics are synthetic materials. They can be softened and molded into useful articles. They have many applications in engineering. There are two types of plastics: thermoplastics and thermosetting plastics.

ABS is a thermoplastic which is tough and durable. Because it has high impact strength, it has applications where sudden loads may occur.

Nylon is a hard, tough thermoplastic. It is used when silent, low-friction operation is required.

Acrylic can be formed in several ways. It is hard, durable, and has many uses.

Polyester resin is a thermosetting plastic used for castings. It has a number of useful properties.

Task 8. ***Using suffixes -ness -ity -ility to make Nouns.***

Adjectives	**Nouns**
hard	***hardness***
soft	……
rough	.....

stiff	.....
tough	.....
damp	.....
ductile	***ductility***
elastic	.....
plastic	.....
flexible	.....
available	.....
intense	.....
humid	.....
compatible	.....
visco	.....

Task 9. ***Match each material in column A with its properties from column B.***

A	**B**
Wood	Plastic, easily molded
Metal	Good total properties
Glass	Strong, conductive
Plastics	Brittle, clear
Composite	Light, stiff

Task 10. ***How is it? Match the sentences to find the answers.***

1. It's flexible.	a. When you heat it, it doesn't burn or deform.
2. It's rigid.	b. When you drop or strike it, it doesn't break.
3. It's hard.	c. When you compress it, it doesn't break or deform.
4. It's tough.	d. When you twist it, it doesn't break or deform.
5. It's elastic.	e. You can't bend it.
6. It's heat-resistant.	f. You can bend it as it doesn't break.

7. It's strong in tension.	g. You can stretch it and make it longer as it doesn't break.
8. It's strong in compression	h. When you pull it, it doesn't stretch or break.
9. It has torsional strength	i. You can't scratch or cut it.

Task 11. ***Read these descriptions of tests and write the right figure number in its gap.***

Materials-testing: ***Destructive tests***

Fig. 1

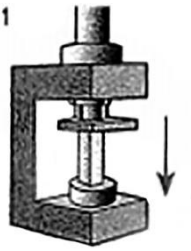


Fig. 2

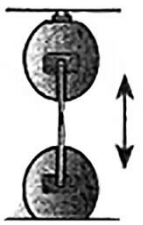


Fig. 3

The purpose of the tensile strength test (Fig……) is to discover whether a material will deform (change shape) or break when it is pulled apart. The material is secured with two clamps, one at each end. The clamps are pulled apart with specified force. The yield point (the point where the material deforms) and/or the breaking point (the point where the material breaks) is measured. This measurement shows you the tensile strength of the material.

The aim of the impact-resistance test (Fig…….) is to find out whether a material will bend or break when it is struck with force. The bottom of the material is placed in a clamp, so it stands vertically. A hammer strikes the material with a specified force. The yield point and/or the breaking point are measured. This indicates the impact resistance of the material.

The objective of the compressive strength test (Fig……) is to find out if a material will deform or break when it is compressed. The material is secured in a clamp between a fixed head and a moving head. The moving head presses down on the material and the load is increased. The yield point and/or the breaking point are measured. This indicates the compressive strength of the material.

VOCABULARY

– Acrylic	(n)	/əˈ krɪ lɪ k/	nhựa Acrylic
– aircraft	(n)	/ˈ eəkrɑ ː ft/	máy bay
– Aluminium	(n)	/ˌ æljəˈ mɪ niəm/	nhôm
– bearing	(n)	/ˈ beərɪ ŋ/	ổ đỡ
– Brass	(n), (adj)	/brɑ ː s/	đồng thau; bằng đồng thau
– brittle	(adj)	/ˈ brɪ tl/	giòn, dễ gãy, dễ vỡ
– carbon	(n)	/ˈ kɑ ː bən/	các-bon
– to conduct	(v)	/kən'dʌ kt/	dẫn điện, dẫn nhiệt
conductive	(adj)	/kənˈ dʌ ktɪ v/	có tính dẫn điện
conductor	(n)	/kənˈ dʌ ktə(r)/	chất dẫn (điện, nhiệt)
conductivity	(n)	/kɑ ː ndʌ k'tɪ vɪ ti/	dẫn suất
– contact	(n)	/ˈ kɒ ntækt/	công tắc
– Copper	(n), (adj)	/ˈ kɒ pə(r)/	đồng đỏ, bằng đồng đỏ
– to corrode	(v)	/kə'roud/	ăn mòn
corrosive	(adj)	/kə'rousɪ v/	tính ăn mòn
corrosion	(n)	/kəˈ rəʊ ʒ n/	sự ăn mòn
– ductile	(adj)	/ˈ dʌ ktaɪ l/	mềm, dễ uốn; dễ kéo sợi
– durable	(adj)	/ˈ djʊ ərəbl/	có tính bền
– engine	(n)	/ˈ endʒ ɪ n/	máy, động cơ
– to file	(v)	/faɪ l/	dũa
file	(n)	/faɪ l/	cái dũa
– saw	(n), (v)	/sɔ ː /	cái cưa, cưa
– to machine	(v)	/məˈ ʃ i:n/	gia công (bằng cắt gọt)
– to lathe (to turn)	(v)	/leɪ ð/	tiện
– to mill	(v)	/mɪ l/	phay
– to plane	(v)	/pleɪ n/	bào
– to grind	(v)	/grɪ n/	mài

–	to drill	(n), (v)	/drɪ l/	khoan, mũi khoan, máy khoan
–	to bore	(v)	/bɔ :/	doa
–	to temper	(v)	/ˈ tempə(r)/	ram (thép...)
–	to quench	(v)	/kwen*t*ʃ /	tôi (thép...)
–	to anneal	(v)	/əˈ ni:l/	ủ
–	to form	(v)	/fɔ :m/	tạo hình
–	to deform	(v)	/dɪ ˈ fɔ :m/	biến dạng
–	to fit	(v)	/fɪ t/	lắp ghép, kết nối
–	fitting	(n)	/ˈ fɪ tɪ ŋ/	sự lắp ráp; (số nhiều) máy móc
–	foil	(n)	/fɔ ɪ l/	lá (kim loại)
–	to harden	(v)	/ˈ hɑ ː dn/	làm cứng (bằng cơ), tôi (bằng nhiệt)
	hardness	(n)	/ˈ hɑ ː d.nəs/	cứng (chống biến dạng dẻo cục bộ)
–	to insulate	(v)	/'ɪ nsjuleɪ t/	cách nhiệt, cách điện
	insulation	(n)	/ɪ nsju'leɪ ʃn/	sự cách nhiệt, cách điện
	insulator	(n)	/ˈ ɪ nsjuleɪ tə(r)	/vật cách điện
–	malleable	(adj)	/ˈ mæliəbl/	dễ dát mỏng, dễ uốn
–	material	(n)	/məˈ tɪ əriəl/	vật liệu, vật chất
–	metal	(n)	/'metl/	kim loại
–	nylon	(n)	/ˈ naɪ lɒ n/	nhựa nylon
–	property	(n)	/'prɔ pəti/	đặc tính, tính chất
–	purpose	(n)	/ˈ pɜ ː pəs/	mục đích, ý định
–	resist	(v)	/rɪ 'zɪ st/	chống lại
	resistance	(n)	/ri'zɪ stəns/	điện trở
	resistant	(adj)	/rɪ ˈ zɪ stənt/	chịu được
–	soft	(adj)	/sɒ ft/	mềm
	soften	(v)	/'sɔ fn/	làm mềm
	softness	(n)	/'sɔ ftnəs/	độ cứng
–	stiff	(adj)	/stɪ f/	cứng (không dễ uốn, gấp…)

stiffness (n) /ˈ stɪ f.nəs/ cứng vững (đàn hồi toàn phần)

– strength (n) /streŋθ/ sức bền; độ bền

– thermoplastic (n), (adj) /ˌ θɜ ː məʊ ˈ plæstɪ k/ nhựa dẻo nóng

– thermosetting plastic (n), (adj) nhựa nhiệt rắn

– clear (adj) /klɪ ər/ trong suốt

– transparent (adj) /træn ˈ spærnt/ trong suốt

transparency (n) /træn ˈ spærnsi/ sự trong suốt

– tough (adj) /tʌ f/ chắc, bền, dai

toughness (n) /ˈ tʌ f.nəs/ độ bền, dai

– tubing (n) /ˈ tjuː bɪ ŋ/ tuốc-bin

– utensil (n) /juː ˈ tensl/ đồ dùng, dụng cụ (trong gia đình)

– valve (n) /vælv/ van

– wiring (n) /ˈ waɪ ərɪ ŋ/ dây điện, hệ thống dây điện

REVIEW

Choose the best answer.

1. Aluminium, which is a light, _____ and ductile metal, is used to make aircraft, engine components, foil, and cooking utensils.

   A. tough B. soft C. clear D. hard

2. Copper, which is very _____, tough and ductile and highly conductive, is used to make electric wiring, PCBs and tubing.

   A. less conductive B. malleable

   C. hard D. tough

3. Safety helmet, car components, telephones and kitchen wares are made of ABS, which has high _____ and toughness.

   A. contacts B. impact strength

   C. plastics D. high conductive

4. Manufacturers use acrylic, which is stiff, hard, very durable and _____ to make aircraft, canopies, baths, and double glazing.

   A. clear B. clean C. malleable D. ductile

5. Acrylic can be polished and _____ easily.

   A. performed B. restrained C. reinforced D. formed

6. Bearing, gears and casings for power tools are made of nylon, which is hard, tough and _____.

   A. tear-resistant B. clean

   C. rusted D. wear-resistant

7. Epoxy, polyester resin and urea formaldehyde are called _____.

   A. thermosetting plastics B. thermoplastics

   C. carbon steel D. power tools

8. Mild steel is a metal which contains iron and _____ carbon.

   A. 0.3% to 4.5% B. 0.7% to 1.4%

   C. 0.15% to 0.3% D. 0.15% to 0.35%

9. Aluminium _____ to make aircraft is light, soft, and ductile.

   A. is used B. uses C. which used D. used

10. Plastics are _____ materials which can be softened and _____ into useful articles.

    A. synthetic/ molded B. complex/ molded

    C. complex/ helpful D. synthetic/ helpful

Translate into Vietnamese

PLASTICS

There are two types of plastics: Thermoplastic, which softens when heated many times, and thermosetting plastic, which sets hard and does not alter if heated again. Nylon, which is self-lubricating, is a hard, tough thermoplastic. It is used where silent, friction free operation is required – for example, motorized drives in cameras.

ALUMINIUM

Aluminium is the most common metallic element on earth, making up about 8% of the earth's crust, concentrated in the outer 16 km. It is the most widely used non-ferrous metal today. Aluminium never occurs in its

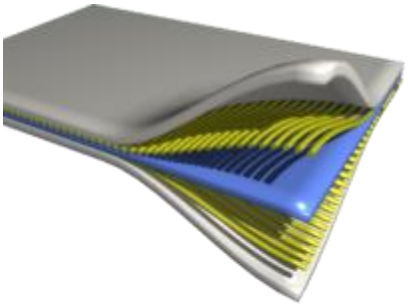
metallic form in nature. It occurs in various forms in most rocks and soils and is also present in gemstones like topaz and garnet. It can be found in vegetation and in all of the earth's water. Aluminium is also present in all clays, so it has been a constituent of cooking vessels since earliest civilisations.

COPPER

Copper is a chemical element with the symbol Cu and having atomic number 29. It is a ductile metal, with very high thermal and electrical conductivity. Pure copper is rather soft and malleable, and a freshly exposed surface has a reddish-orange color. It is used as a thermal conductor, an electrical conductor, a building material, and a constituent of various metal alloys.

COMPOSITES

Composite materials (also called **composition materials** or shortened to **composites**) are materials made from two or more constituent materials with significantly different physical, chemical or mechanical properties, that when combined, produce a material with characteristics different from the individual components.



CUTTING TOOL MATERIALS

(*Society of Manufacturing Engineers – SME*)

Carbide is used in solid round tools or in the form of replaceable inserts. Every manufacturer of carbide tools offers a variety for specific applications. The proper choice can double tool life or double the cutting speed of the same tool. Shock-resistant types are used for interrupted cutting. Harder, chemically-stable types are required for high speed finishing of steel. More heat-resistant tools are needed for machining the super alloys, like Inconel and Hastelloy.

There are no effective standards for choosing carbide grade specifications so it is necessary to rely on the carbide suppliers to

recommend grades for given applications. Manufacturers do use an ANSI code to identify their proprietary carbide product line.

Two-thirds of all carbide tools are coated. Coated tools should be considered for most applications because of their longer life and faster machining. Coating broadens the applications of a specific carbide tool. These coatings are applied in multiple layers of under .001 of an inch thickness. The main carbide insert and cutting tool coating materials are titanium carbide, titanium nitride, aluminium oxide, and titanium carbonitride.

Ceramic cutting tools are harder and more heat-resistant than carbides, but more brittle. They are well suited for machining cast iron, hard steels, and the super alloys. Two types of ceramic cutting tools are available: the alumina-based and the silicon nitride-based ceramics. The alumina-based ceramics are used for high speed semi- and final-finishing of ferrous and some non-ferrous materials. The silicon nitride-based ceramics are generally used for rougher and heavier machining of cast iron and the super alloys.

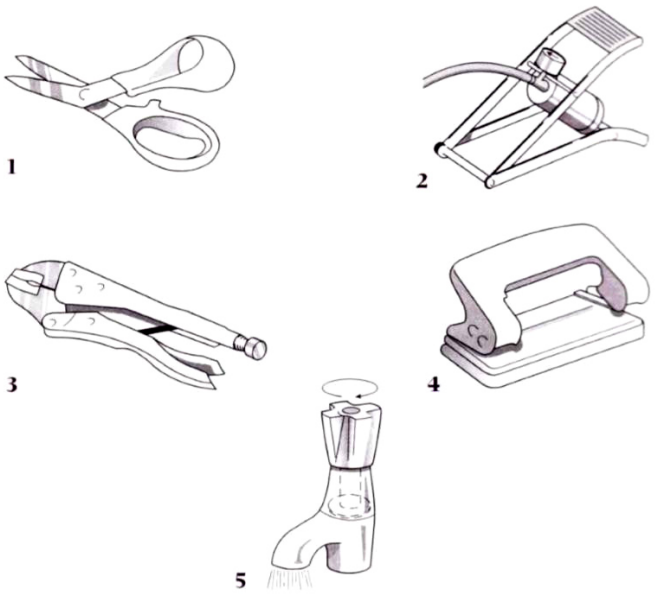
Translate into English

Khoa học vật liệu là một ngành nghiên cứu quan trọng và đang được khuyến khích phát triển tại Việt Nam. Tuy nhiên, việc này cần đầu tư nhiều thiết bị phức tạp và đắt tiền. Việc phát triển các vật liệu tiên tiến là cần thiết bởi vì ngành này liên quan đến rất nhiều lãnh vực công nghiệp quan trọng như cơ khí, xây dựng, điện-điện tử, và các ngành công nghiệp phụ trợ khác.

Khoa học vật liệu cần các kiến thức nền tảng vững chắc về các ngành vật lý ứng dụng, hóa học, toán học kết hợp với các kiến thức chuyên ngành. Trong ngành cơ khí, ngoài các vật liệu thông dụng như thép, hợp kim nhôm, hợp kim đồng, ni-ken… các vật liệu như composite, gốm, và polymer cũng đang được nghiên cứu mạnh mẽ.

Unit 3
MECHANISMS

Task 1. ***Identify these simple mechanisms. Explain the principles on which they operate.***



Reading: ***Scanning a text***

Scanning is the best strategy to search specific information in a text. Move your eyes up and down the text until you find the word or words you want. Again, try to ignore the information which does not help you with your task.

Task 2. ***Scan the text opposite quickly to find out which of these mechanisms are mentioned.***

1. cam
2. tap
3. pendulum
4. foot pump
5. escalator

Mechanisms

Mechanisms are an important part of everyday life. They allow us to do simple things like switch on lights, turn taps, and open doors. They also make it possible to use escalators and lifts, travel in cars, and fly from continent to continent.

Mechanisms play a vital role in industry. While many industrial processes have electronic control systems, it is still mechanisms that deliver the power to do the work. They provide the forces to press steel sheets into car body panels, to lift large components from place to place, to force plastic through dies to make pipes.

All mechanisms involve some kinds of motion. The four basic kinds of motion are:

Rotary: Wheels, gears, and rollers involve rotary movement.

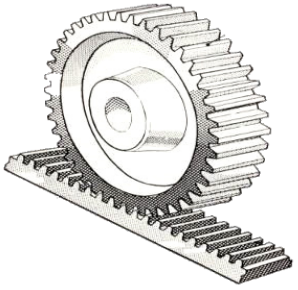
Oscillating: The pendulum of a clock oscillates – it swings backwards and forwards.

Linear: The linear movement of a paper trimmer is used to cut the edge of the paper.

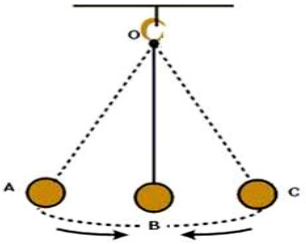
Reciprocating: The piston in a combustion engine reciprocates.

Many mechanisms involve changing one kind of motion into another type. For example, the reciprocating motion of a piston is changed into a rotary motion by the crankshaft, while a cam converts the rotary motion of the engine into the reciprocating motion required operate the valves.

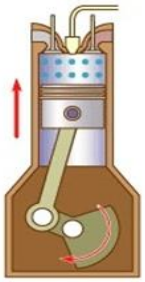
Task 3. ***Identify what kind of motion.***



1



2



3 4

1_____ 2_____

3_____ 4_____

Task 4. ***Now read the text and find the answers to these questions.***

1. What does a cam do?
2. What does oscillating mean?
3. How are plastic pipes formed?
4. What simple mechanisms in the home are mentioned directly or indirectly?
5. What is the function of a crankshaft?
6. Give an example of a device which can produce a linear movement.
7. How are car body panels formed?
8. What do mechanisms provide in industry?

Grammar: ***Passive Voice***

Be + V-ed (Past participle)

Example:

The rotary motion ***is converted*** *to reciprocating by a cam*

Weight ***is measured*** *in newtons.*

Machines ***are designed*** *by engineers*

Task 5. ***Make passive sentences by using subjects and verbs provided.***

1. Technicians, educate
2. Motions, convert
3. Volume, measure
4. Goods, manufacture
5. ABS, use
6. A drill, make

Writing: ***Ways of linking ideas***

When we write, we may have to describe, argue, persuade, something, etc. In all these forms of writing, we use ideas. To make our writing more effective, we have to make sure our readers can follow our ideas. So it's useful to use links between the ideas in our writing. What is the link of meaning of the 2 sentences below? What words are used for the connection?

1. Mechanisms are important to us.
2. They allow us to travel.

Sentence 2 is the *reason* of Sentence 1

So, they can be linked like this:

The mechanisms are important to us ***because*** *they allow us to travel.*

Effect	Conjunctions	Cause
The mechanisms are important to us	**because** **since** **as**	they allow us to travel.
The football match has been cancelled	**because of** **due to** **owing to**	the rain.

3. Mechanisms deliver the power to do work.
4. They play a vital role in industry.

Sentence 4 is the *result* of Sentence 3.

So, they can be linked like this:

*Mechanisms deliver power to do work**; therefore,** they play a vital role in industry.*

Cause	Connectors	Effect
Mechanisms deliver power to do work;	**therefore,** **accordingly,** **as a consequence/result,** **because of this,** **consequently,** **hence,** **so,** **that's why,** **thus,**	they play a vital role in industry.

5. Friction is sometimes a help.
6. It is often a hindrance.

Sentence 6 *contrasts* with Sentence 5.

So, they can be linked like this:

*Friction is sometimes a help **but** it is often a hindrance.*

Clause 1	Connector	Clause 2
Friction is sometimes a help, Friction is sometimes a help;	**but/yet/still** **however,** **nevertheless,** **all the same,**	it is often a hindrance.

Task 6. ***Connect these pairs of sentences by using proper linking words.***

1. Copper is highly conductive.
   It is used for electric wiring.
2. Weight is measured in newtons.
   Mass is measured in kilograms.
3. Nylon is used for bearings.
   It is self-lubricating.

4. ABS has high impact strength.

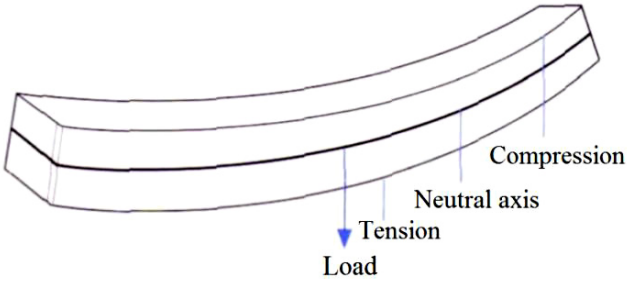
   It is used for safety helmets.

5. The foot pump is a class 2 lever.

   The load is between the effort and the fulcrum.

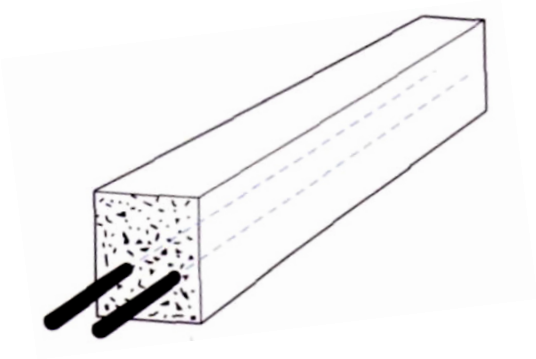
6. Friction is essential in brakes.

   Friction is a nuisance in an engine.



7. The upper surface of a beam is in compression.

   The lower surface is in tension.



8. Concrete beams have steel rods near the lower surface.

   Concrete is weak in tension.

Language study: ***Technical terms solving***

One of the difficult things about the field of engineering in English is that there are many technical terms to learn. Newer terms may be the same, or almost the same, in your own language. But many terms will be quite different and you may not always remember them.

When this happens, you will have to use whatever English you know to make your meaning clear.

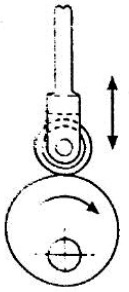
The same thing may happen in reverse when you know a technical term but the person you are communicating with does not recognize it. This may happen in the *Speaking practice* tasks in this book. Again, when this happens, you will have to make your meaning clear by using other words.

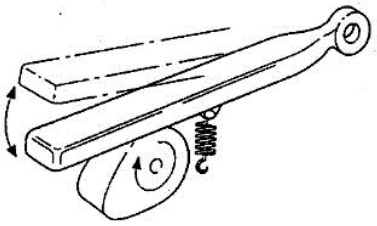
Task 7. Match the meaning between *the technical words in column A and the more general English in column B.*

A	B
1. oscillates	a. changes
2. rotates	b. large, thin, flat pieces
3. reciprocates	c. moving stairs
4. has a linear motion	d. goes round and round
5. converts	e. movement
6. motion	f. goes in a line
7. escalator	g. swings backwards and forwards
8. sheets	h. goes up and down

Task 8. *Work in pairs.*

Cams are shaped pieces of metal or plastic fixed to, or part of, a rotating shaft. A "follower" is held against the cam, either by its own weight or by a spring. As the cam rotates, the follower moves. The way in which it moves and the distance it moves depends on the shape of the cam. Rotary cams are the most common type. They are used to change rotary motion into either reciprocating or oscillating motion.





……

Kind of motion: ……

VOCABULARY

– beam (n) /biː m/ rầm, chùm (tia)

– brake (n) /breɪ k/ cái hãm, cái phanh

– cam (n) /kæm/ cam, bánh lệch tâm

– combustion engine (n) /kəmˈ bʌ ʃ n ˈ endʒ ɪ n/ động cơ đốt trong

– to compress(v) /kəmˈ pres/ nén

compression (n) /kəmˈ preʃ n/ sự nén

compressive (adj) /kəm´presiv/ nén

compressive strength (n) độ bền nén

– concrete (n, adj) /ˈ kɒ ŋkriː t/ bê tông

– conjunction (n) /kənˈ dʒ ʌ ŋkʃ n/ sự kết hợp; liên từ

– continent (n) /ˈ kɒ ntɪ nənt/ lục địa

– to convert (v) /kənˈ vɜ ː t/ đổi, biến đổi

– crankshaft (n) /ˈ kræŋkʃ ɑ ː ft/ trục khuỷu

– to deliver (v) /dɪ ˈ lɪ və(r)/ phân phát; giao

– die (n) /daɪ / khuôn kéo sợi

– directly (adv) /dɪ 'rektli/ trực tiếp

– indirectly (adv) /ˌɪ ndɪ 'rektli/ gián tiếp

– edge (n) /edʒ / cạnh, lề

– escalator (n) /ˈ eskəleɪ tə(r)/ thang cuốn

– essential (adj) /ɪ ˈ senʃ l/ cần thiết, thiết yếu

– force (n) /fɔ ː s/ lực

– function (n) /ˈ fʌ ŋkʃ n/ chức năng

– hindrance (n) /ˈ hɪ ndrəns/ sự cản trở

– line (n) /laɪ n/ dòng, đường thẳng

linear (adj) /ˈ lɪ niə(r)/ thẳng, tịnh tiến, tuyến tính

– lever (n) /'li:və/ cái đòn bẩy, cần gạt

– mechanism (n) /ˈ mekənɪ zəm/ máy móc, cơ cấu

– motion	(n)	/ˈ məʊʃ n/	sự vận động, sự chuyển động
– move	(v)	/mu:v/	chuyển động, di chuyển
movement	(n)	/'mu:vmənt/	sự vận động; sự cử động
– nuisance	(n)	/'nju:sns/	nguy hại
– to oscillate	(v)	/ˈ ɒ sɪ leɪ t/	dao động
oscillation	(n)	/ˌɒ sɪ 'leɪ ʃn/	sự dao động
– panel	(n)	/ˈ pænl/	pa-nô; bảng
– car body panel	(n)		thân xe
– pendulum	(n)	/ˈ pendjələm/	con lắc, quả lắc
– pipe	(n)	/paɪ p/	ống
– piston	(n)	/ˈ pɪ stən/	pít-tông
– pump	(n)	/pʌ mp/	bơm
– puncher	(n)	/ˈ pʌ ntʃə(r)/	dụng cụ bấm lỗ, đột lỗ
– to reciprocate	(v)	/rɪ ˈ sɪ prəkeɪ t/	chuyển động qua lại
reciprocation	(n)	/rɪ ˌsɪ prə'keɪ ʃn/	sự chuyển động qua lại
– rod	(n)	/rɒ d/	thanh, cần, thanh kéo, tay đòn
– role	(n)	/rəʊ l/	vai trò
– to play a vital role			đóng vai trò quan trọng
– roller	(n)	/ˈ rəʊ lə(r)/	trục lăn, con lăn
– rotate	(v)	/rou'teɪ t/	làm quay, làm xoay quanh
rotation	(n)	/rou'teɪ ʃn/	sự quay, sự xoay vòng
rotary	(adj)	/ˈ rəʊ təri/	quay
rotor	(n)	/'routə/	rô-to, cánh quạt
– scissors	(n)	/'sɪ zəz/	cái kéo
a pair of scissors			một cái kéo
– sheet	(n)	/ʃ iː t/	lá, tấm, phiến, tờ
– switch on = turn on			mở
– switch off = turn off			tắt

– tap	(n)	/tæp/	vòi, khoá (nước)
– tension	(n)	/ˈ tenʃ n/	sức ép, áp lực; ứng suất
tensile	(adj)	/ˈ ten.saɪ l/	bị kéo, chịu kéo
tensile strength	(n)		độ bền kéo
– to trim	(v)	/trɪ m/	cắt
trimmer	(n)	/ˈ trɪ mə(r)/	máy xén
– wheel	(n)	/wiː l/	bánh xe
– wrench	(n)	/rentʃ/	chìa vặn đai ốc; cờ lê

REVIEW

Choose the best answer for the following sentences.

1. Mechanisms are an important _____ of everyday life. They allow us to do simple things like switch on lights, turn taps, and open doors.

   A. system B. partly C. part D. role

2. Mechanisms also make it possible to use _____ and lifts, travel in cars, and fly from continent to continent.

   A. escalators B. motors C. insulators D. contacts

3. Mechanisms provide the _____ to press steel sheets into car body panels, to lift large component from place to place, to force plastic through die to make pipes.

   A. processes B. things C. forces D. systems

4. All mechanisms _____ some kind of motion. The four basic kinds of motion are rotary, oscillating, linear and reciprocating.

   A. revolve B. preserve C. involve D. conserve

5. A _____ converts the reciprocating motion of piston into the rotary motion.

   A. cam B. crankshaft C. driveshaft D. piston

6. Choosing the right lubricant is essential to reduce _____.

   A. friction B. mass C. cost D. weight

7. Mechanisms deliver the _____ to do work so they play a vital role industry.

   A. electricity B. power C. system D. method

8. Friction is sometimes a help but it is often a _____.

   A. force B. gravity C. buoyancy D. hindrance

9. Oscillating means _____.

   A. swing backwards and forwards B. moving up and down

   C. going around and around D. going in a line

10. The foot pump is a class 2 lever since the load is between the effort and the _____.

    A. fulcrum B. cam C. crankshaft D. lever

Translate into Vietnamese

MECHANISMS

The word *mechanism* came into the English language in the 17th century by way of the Latin word *mechanismus*, which traces back to the Greek word *mekhane*, meaning "device" or "means" together with their relation during working process. *Mechanism* still carries with it the meaning of "device" and can be used to describe a machine. Nowadays, it also is used to describe a way or process for getting something done in the social areas, such as "a *mechanism* for generating revenue" or "a crisis-resolution *mechanism*."

Translate into English

Cơ cấu là một hoặc một số bộ phận của máy nhằm thực hiện các nhiệm vụ cơ khí như nâng và vận chuyển các đồ vật và đối tượng. Chúng hiện diện trong hầu hết các thiết bị trong nhà máy, bệnh viện, trường học, nhà ở, văn phòng… Các chuyển động của cơ cấu bao gồm chuyển động quay, chuyển động thẳng, hoặc/và chuyển động đã được lập trình. Các cơ cấu ngày càng được phát triển và được mô-đun hóa nhằm thực hiện những nhiệm vụ phức tạp, nặng nhọc, nguy hiểm cho con người và giảm chi phí sản xuất.

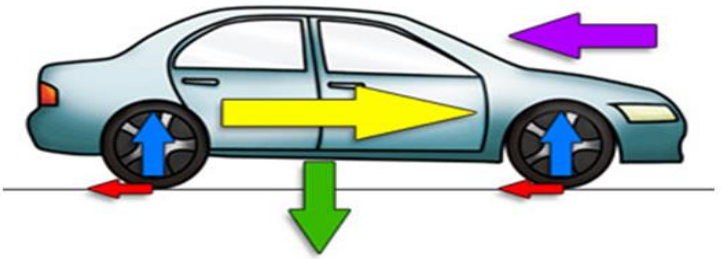
Unit 4
FORCES IN ENGINEERING

Task 1. ***Warm-up***

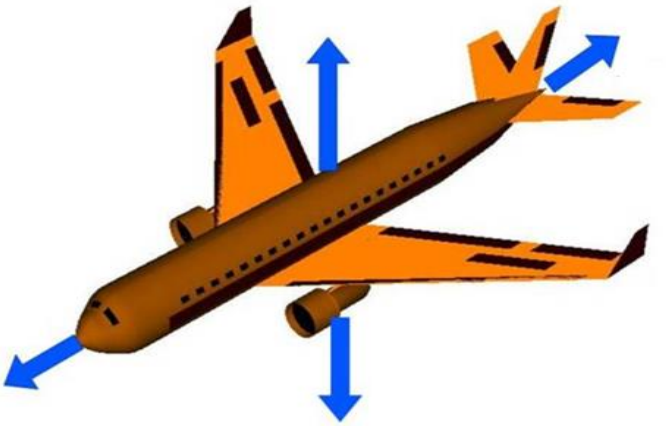
Work in groups

1. Define what a force is.
2. Identify forces acting on the car and the airplane below.

Driving force / Weight / Air resistance / Friction / Reaction force



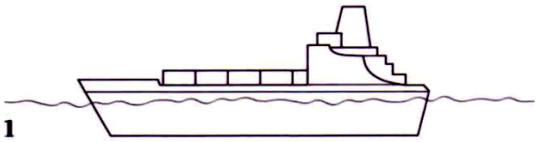
Lift / Weight / Drag / Thrust

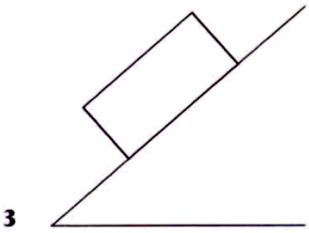


Task 2. ***Working in your group, try to explain these problems.***

1. Why doesn't the ship sink?
2. What makes the spring stretch and what keeps the weight up?

3. Why doesn't the box slide down the slope?





Reading 1 Predicting

As you have learnt in Unit 1, it is important to think about what you are going to read in advance. Do not start to read a text immediately. One way that supports your reading is to think about the words which might appear in the text. The title might help to focus your thoughts. Which words might appear in a text with the title *Forces in engineering*?

Task 3. ***You are going to read "Forces in engineering". Here are some of the words in the reading. Can you explain the link between each word and the title?***

weight	buoyancy	equilibrium
elasticity	magnitude	resultant
newton	gravity	

Task 4. ***Now read the text to check your explanations are appropriate in Task 2.***

Forces in engineering

To solve the ship problem, we must look at the forces on the ship (Fig. 4.1). The weight, W, acts downwards. That is the gravity force. The buoyancy force, B, acts upwards. Since the ship is in equilibrium, the resultant force is zero, so the magnitudes of B and W must be the same.

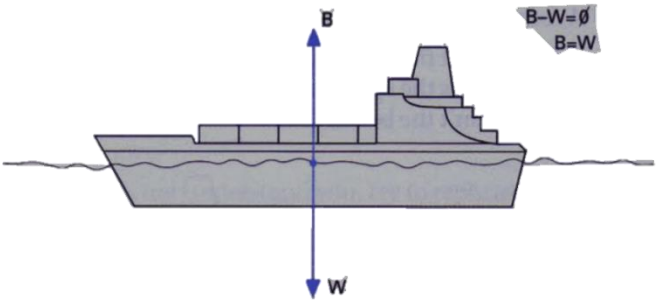


Figure 4.1

5 Another very important force in engineering is the one caused by elasticity. A good example of this is a spring. Springs exert more force the more they are stretched. This property provides a way of measuring force. A spring balance can be calibrated in newtons, the unit of force. The block in Fig. 4.2 has a weight of 10 newtons. The weight on the balance pulls the spring down. To give equilibrium, the spring pulls up to oppose that weight. This upward force, F1, equals the weight of the block, W.

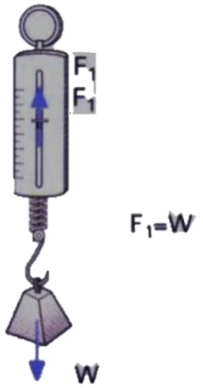


Figure 4.2

10 It is important to get the distinction between mass and weight absolutely clear. Mass is the quantity of matter in an object. Weight is the force on that object due to gravity. Mass is measured in kilograms, whereas weight, being a force, is measured in newtons.

15 We have looked at buoyancy, elasticity, and gravity. There is the fourth force important in engineering, That is friction. Friction is a help in some circumstances but a hindrance in others. Let us examine the forces on the box (Fig. 4.3). Firstly, there is its weight, W, the gravity force, then there is the reaction, R, normal to the plane. R and W have a

resultant force trying to pull the box down the slope. It is the friction force, F, acting up the slope that stops it sliding down.

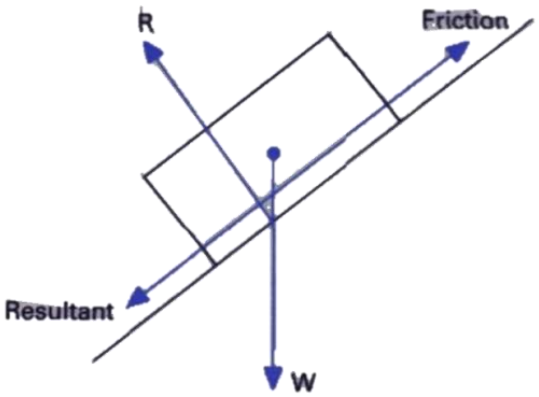


Figure 4.3

Reading 2: ***Grammar links in texts***

One of the ways in which sentences in a text are held together is by grammar links. In this extract, note how each expression in italics links with an earlier expression.

Another very important force in engineering is *the one* caused by elasticity. A spring is an example. Springs exert more force the more *they* are stretched. *This property* provides a way of measuring force.

Sometimes these links cause problems for readers because they cannot put the right words in different parts of a text.

Study these common grammar links:

1. A repeated noun becomes **a pronoun**.

   Springs → *they*

2. A word replaces **an earlier expression**.

   Force in engineering → *one*

3. A word replaces **a whole sentence or clause**.

   Springs exert more force the more they are stretched → *This property*

Language study: ***The Present Passive***

To be + V3/ Past participle

Study these instructions for a simple experiment on friction.

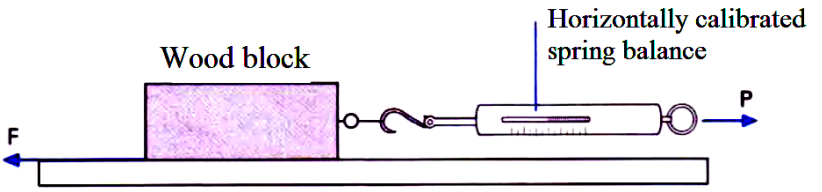


Figure 4.4

1. Place a block of wood on a flat surface.
2. Attach a spring balance to one end of the block.
3. Apply a gradually increasing force to the balance.
4. Note the force at which the block just begins to move.
5. Pull the block along so that it moves at a steady speed.
6. Note the force required to maintain movement.
7. Compare the two forces.

Task 5. ***Complete this description of the experiment by using the present passive.***

A block of wood [1]_____ on a flat surface. A spring balance [2]_____ to one end of the block. A gradually increasing force [3]_____ to the balance. The force at which the block just begins to move [4]_____. The block [5]_____ along at a steady speed. The force required to maintain movement [6]_____. The two force [7]_____. It is found that the first force is greater than the second.

Task 6. ***What are the words in italics replaced? Point them out.***

Friction in machines is destructive and wasteful. ***It*** causes the moving parts to wear and ***it*** produces heat where ***it*** is not wanted. Engineers reduce friction by using very highly polished materials and by lubricating ***their*** surfaces with oil and grease. ***They*** also use ball bearings and roller bearings because rolling objects cause less friction than sliding ***ones***.

Language study.

Usage of "It is…"

1. It is used to give opinions in an impersonal way.

It is + Adj …

It is difficult to operate this machine.

It is vital to follow safety regulations.

Translate into English

Thật là tiện lợi khi sử dụng remote.

…….....

Thật là dễ chịu/mát mẻ khi có máy điều hòa.

……..

Sẽ nhanh hơn khi sử dụng ô tô thay vì xe máy.

……..

2. It is used to emphasize any part of a sentence.

It is + Noun that/who

It is friction force that stops the box sliding down.

It is the mechanism that delivers the power to do the work.

Translate into English

Chính là Jack, người đã sửa máy in, máy scan và máy photocopy trong văn phòng.

……

Chính là bạn Nam, người đã đoạt giải "Sinh viên của năm".

……..

3. It is used in passive when the speaker wants to maintain objective view.

It is + V-ed/ V3 that …

It is found that the accident was due to the driver's carelessness.

It is known that the Earth rotates around the Sun.

Translate into English

Người ta nói rằng Việt Nam có một lịch sử lâu đời.

…….……..

Người ta tin rằng bức tranh ấy được vẽ bởi Leonard De Vinci.

……

Người ta đồn rằng trong ngôi nhà ấy có ma.

……..……..

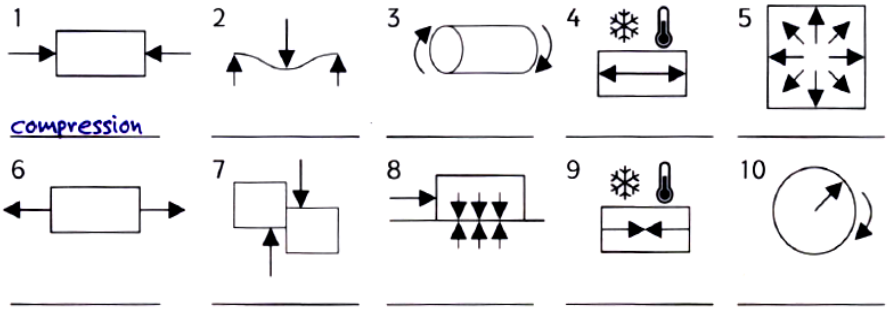
Người ta chứng minh được là nước sôi ở 100^{o}C.

……..……..

Task 7. ***Vocabulary Enlargement***

Forces in Engineering:

bending	shear	compression	contraction	expansion
Friction	centrifugal force	pressure	tension	torsion/torque



REVIEW

1. Match the diagrams with (a) the names of the forces and (b) their descriptions.

(a) bending, compression, shear, tension, torsion

(b) squeezing or pressing together; sliding in opposite directions; stretching or pulling apart; twisting; squeezing on side + stretching the other side.

A group of verbs contain the meaning of "cause something to happen" . They have the suffix **'*-en*'**.

For example *strengthen* (= to cause something to be stronger).

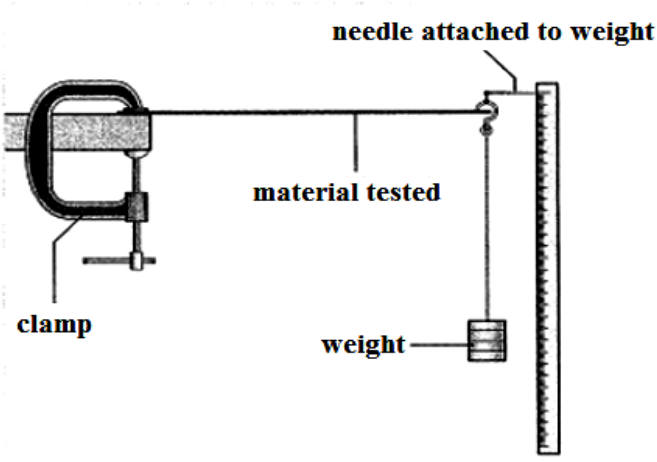
Here is a list: *harden - soften; lengthen - shorten; lighten - darken; strengthen - weaken; tighten - loosen; widen - flatten; sharpen - straighten.*

2. Replace the phrases in italics with phrases by using verbs from the above list.

Example: The torsion forces in the storm must have ~~*made the bridge weaker*~~/ weakened the bridge.

1) The purpose of adding carbon to steel is to *make it stronger*.
2) Long ago, humans used stones *to make their knife blades sharper and straighter.*
3) In forging, metal is heated to make it *softer*. Then it is put in water to *make it hard again.*
4) Hot weather *makes railway lines longer* and cold *weather makes them shorter.*
5) If the race has *made the bike saddle looser*, you should *make it tight with a spanner.*

3. Fill in the gaps.

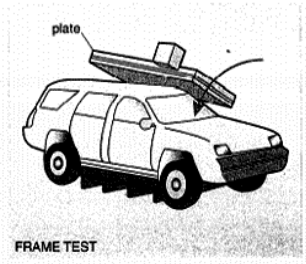


The aim of the rigidity test is (1)…..…… (discover/to discover) if a material (2)…… (deform/deforms) or (3)…… (breaking/breaks) when it (4)……..…. (is bending/is bent) by a force. One end of the material (5)……..…. (secures/is secured) in the clamp, so that the material (6)……..….. (hold/is held) horizontally with one end

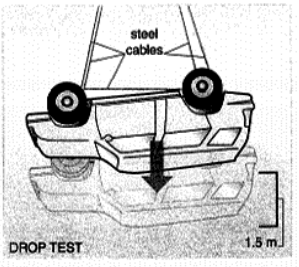
free. A weight (7)…….. (attaches/is attached) to the free end, and then the load (8)…… (is increasing/is increased) by adding more weights. The breaking point (9)……..…….. (measures/is measured). This (10)…… (show/shows) us the rigidity of the material.

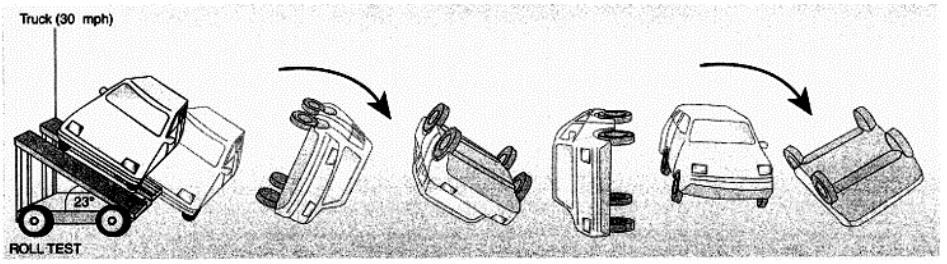
4. Work in groups: ***Discuss these questions about the three car tests below.***

- What is the purpose of each tested?
- Which parts of the car are tested?
- What properties are tested?
- What is the procedure for each test? How is each test done?
- How does a car pass the test? What is a good result for the car?
- If a car fails a test, what will you recommend?



Average weight of a car:	1440 kg
Average weight of the plate:	2120 kg (50% more than car)
TEST RESULT:	
the roof must not bend more than 12.5 cm	





VOCABULARY

– absolute	(adj)	/'æbsəlu:t/	tuyệt đối, hoàn toàn
absolutely	(adv)	/'æbsəlu:tli/	tuyệt đối, hoàn toàn
– balance	(n)	/ˈ bæləns/	sự cân bằng

–	to bend	(v)	/bend/	uốn cong, làm cong
	bend	(n)	/bend/	lực uốn
–	to buoy	(v)	/bɔ ɪ /	đặt phao
	buoyancy	(n)	/ˈ bɔ ɪ ənsi/	sự nổi; sức nổi
–	block	(n)	/blɔ k/	khối, tảng
–	to calibrate	(v)	/'kælɪ breɪ t/	kiểm tra
–	centrifugal	(adj)	/ˌ sentrɪ ˈ fjuː g l/	ly tâm
–	circumstance	(n)	/'sɜ ː kəmstəns/	hoàn cảnh, trường hợp
–	to contract	(v)	/kənˈ trækt/	co lại
	contraction	(n)	/kənˈ trækʃ n/	sự co rút
–	distinction	(n)	/dɪ ˈ stɪ ŋkʃ n/	sự khác biệt hoặc tương phản
–	to drag	(v)	/dræg /	kéo
	drag	(n)	/dræg /	lực cản
–	to destroy	(v)	/dɪ 'strɔ ɪ /	phá hoại, phá hủy
	destruction	(n)	/dɪ s'trʌ kʃn/	sự phá hoại, sự phá hủy
	destructive	(adj)	/dɪ 'strʌ ktɪ v/	phá hoại, phá hủy
–	elastic	(adj)	/ɪ 'læstɪ k/	co giãn, đàn hồi
	elasticity	(n)	/iː læˈ stɪ səti/	đàn hồi
–	to equal	(v)	/'i:kwəl/	bằng nhau
	equality	(n)	/ɪ 'kwɔ lɪ ti/	trạng thái bằng nhau
	equally	(adv)	/'i:kwəli/	bằng nhau, đều nhau
–	equilibrium	(n)	/ˌ iː kwɪ ˈ lɪ briəm/	trạng thái cân bằng
–	to examine	(v)	/ɪ g'zæmɪ n/	khảo sát; nghiên cứu
–	to exert	(v)	/ ɪ ɡ ˈ zɜ ː t /	tác dụng
–	to act	(v)	/ækt/	tác dụng
–	to apply	(v)	/ə'plaɪ /	tác dụng
–	to expand	(v)	/ɪ ksˈ pænd/	giãn nở
	expansion	(n)	/ɪ ksˈ pænʃ n/	sự giãn, sự nở

–	force	(n)	/fɔ ː s/	lực
–	friction	(n)	/ˈ frɪ kʃ n/	lực ma sát
–	gradually	(adv)	/ˈ ɡ rædʒ uəli/	dần dần, từ từ
–	gravity	(n)	/ˈ ɡ rævəti/	trọng lực
–	magnitude	(n)	/'mægnɪ tju:d/	độ lớn, lượng
–	matter	(n)	/ˈ mætə(r)/	vật chất
–	to measure	(v)	/ˈ meʒ ə(r)/	ước lượng, đo lường
–	to oppose	(v)	/əˈ pəʊ z/	chống đối, chống lại
–	pressure	(n)	/ˈ preʃ ə(r)/	sức ép, áp suất, áp lực
–	property	(n)	/ˈ prɒ pəti/	thuộc tính; đặc tính
–	to pull	(v)	/pʊ l/	lôi, kéo
–	quantity	(n)	/ˈ kwɒ ntəti/	lượng, số lượng
–	reaction	(n)	/riˈ ækʃ n/	sự phản ứng lại, phản lực
–	resultant	(a)	/rɪ ˈ zʌ ltənt/	hợp (lực)
	result	(n)	/ri'zʌ lt/	kết quả
–	relative	(adj)	/'relətiv/	tương đối
–	shear	(n)	/ʃ ɪ ə(r)/	sự trượt, sự dịch chuyển
–	to sink	(v)	/sɪ ŋk/	chìm
–	to slide	(v)	/slaɪ d/	trượt
–	spring	(n)	/sprɪ ŋ/	lò xo
–	to solve	(v)	/sɔ lv/	giải quyết
	solution	(n)	/sə'lu:ʃn/	sự giải quyết; giải pháp
–	steady	(adj)	/ˈ stedi/	đều đều; không thay đổi
–	to stretch	(v)	/stretʃ /	giãn ra, rộng ra; co giãn
–	to thrust	(v)	/θrʌ st/	đẩy, ấn mạnh
	thrust	(n)	/θrʌ st/	lực đẩy
–	torque	(n)	/tɔ ː k/	mô-men xoắn, mô-men quay

Translate into Vietnamese

FORCES

Forces are any physical influence or power trying to change the movement of moving parts or the shape of objects. The change may be an either acceleration or deceleration of speeds and even from stationary state, change the direction. It may also be deforming machine parts or cutting materials. They can be applied loads or reaction forces. In engineering, they are described as vectors, so they have origins, directions and magnitudes.

Translate into English

Lực tác dụng từ bên ngoài vật thể có thể được chia làm bốn loại thông dụng theo phương tác dụng, bao gồm lực kéo, lực nén, lực uốn và lực cắt xoắn. Chúng gây ra phản lực hoặc ứng suất kéo, ứng suất nén, ứng suất uốn và ứng suất cắt (còn gọi là ứng suất tiếp tuyến) trong vật liệu.

Ngoài ra, lực tác dụng theo chu kỳ sẽ gây ra ứng suất mỏi, hư hỏng mỏi và hiện tượng dão trong vật liệu. Hư hỏng này xảy ra ngay cả khi ứng suất mỏi là nhỏ so với ứng suất đàn hồi.

Unit 5
WASHING MACHINE

Task 1. ***Warm-up***

What devices in your home operate automatically? List them all.

In your opinion, why can they operate like that?

Task 2. ***List some of the factors the control system of a washing machine must handle. This diagram may help you.***

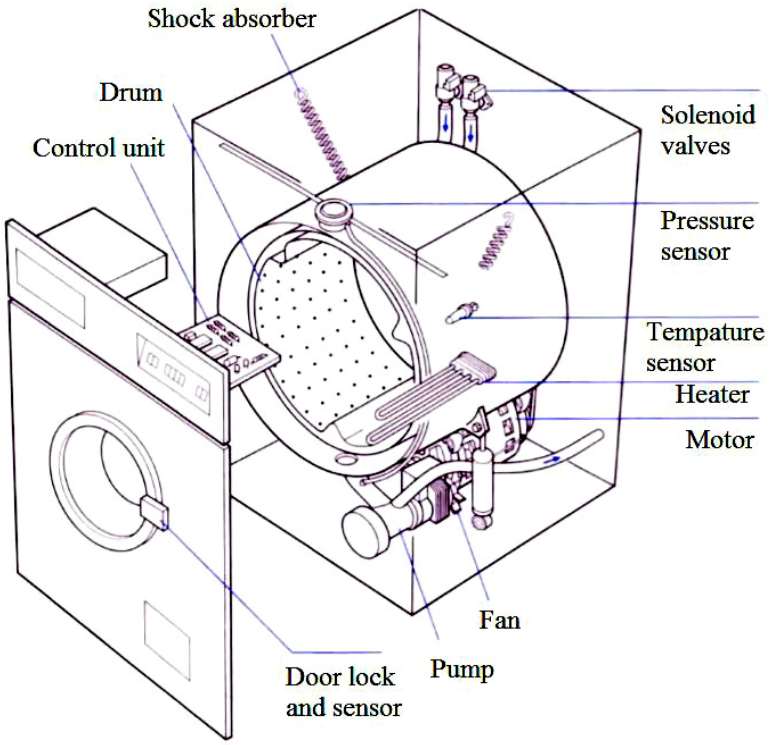


Figure 5.1. *Washing machine*

Reading: ***Reading diagrams***

In engineering, diagrams carry a great deal of information. They can also help you to understand the accompanying text. For this reason, it is helpful to try to understand the diagram provided before reading the text.

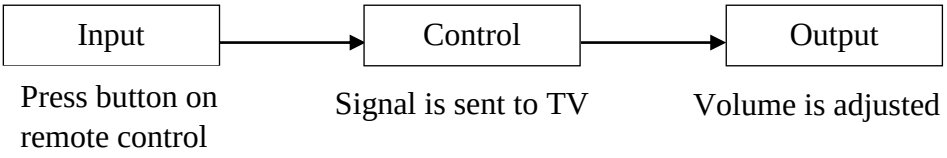
Task 3. ***Study the diagram again. Match the items with their proper functions.***

Items	Functions
1 Pump 2 Motor 3 Shock absorber 4 Solenoid valves 5 Heater 6 Pressure sensor 7 Door lock and sensor 8 Temperature sensor 9 Fan	a. Measures the water temperature and reports it to the control unit b. Cools the pump motor c. Controls the flow of water into the machine d. Senses when the drum is full of water and reports it to the control unit e. Pumps water out of the drum f. Rotates the drum g. Absorbs the shock of the spinning drum when loaded h. Senses whether the door is open or shut and reports it to the control unit i. Raises the temperature of the water

Task 4. ***Read this text to check your answers to Task 2.***

Control systems in the home

Most devices in the home have some sort of control. For example, you can control the volume of a TV by using a remote control. The building blocks of a control system are:



5 The input can be any movement or any change in the environment. For example, a drop in temperature may cause a heating system to come on.

The control may change the size of the output (for example, adjusting the sound of a TV). Often this involves changing one kind of input into different kind of output. For example, opening a window may set off a burglar alarm.

10 The outputs can be of many kinds. An alarm system may ring a bell, flash lights, and send a telephone message to the police.

Most control systems are closed loops. That means they incorporate a way of checking that the output is correct. In other words, they have feedback. The thermostat in a central heating system (Fig. 5.2) provides constant feedback to the control unit.

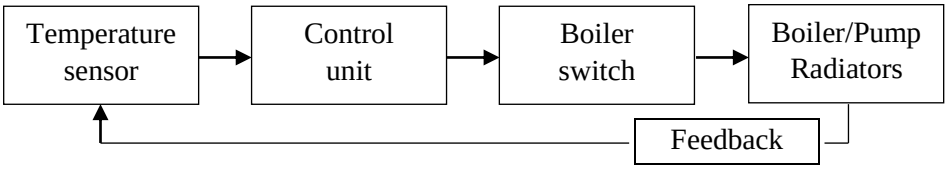


Figure 5.2. *Closed loop*

The control system of a modern washing machine has to take into account several different factors. These are door position, water level, water temperature, wash and spin time, and drum speeds. Most of them are decided when you select which washing program to use.

Fig. 5.3 shows a block diagram of a washing machine control system. You can see that this is quite a complex closed loop system using feedback to keep a check on water level, water temperature, and drum speeds.

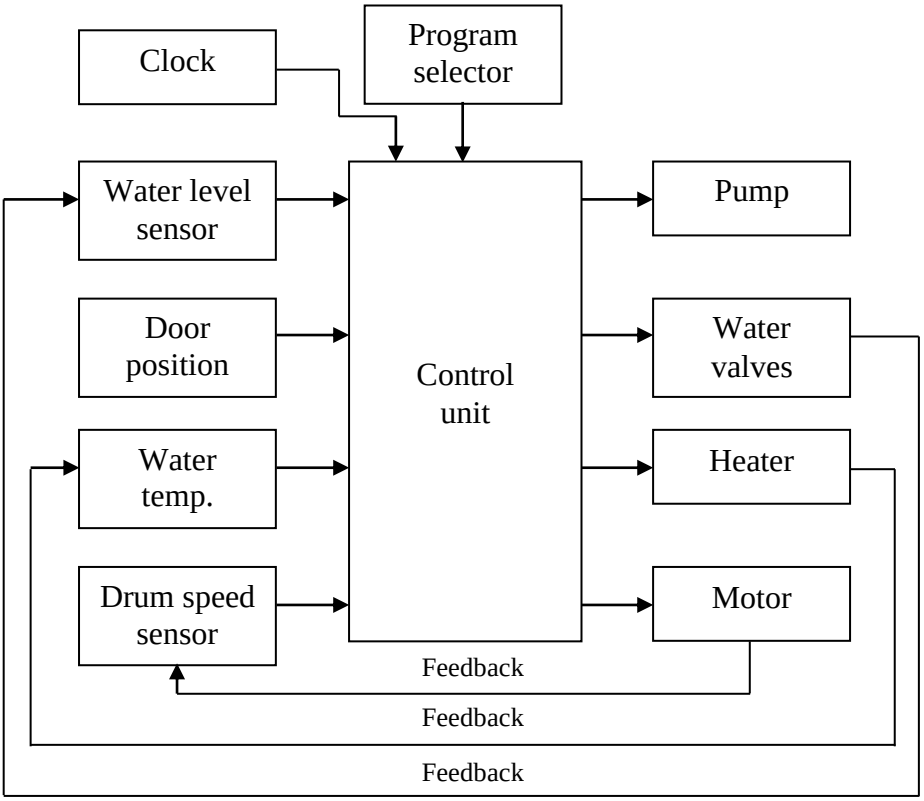


Figure 5.3. *Modern control system*

The control unit is the heart of the system. It receives and sends out signals which control all the activities of the machine. It is also capable of diagnosing faults which may occur, stopping the program, and informing the service engineer what is wrong. It is a small, dedicated computer which, like other computers, uses the language of logic.

Task 5. ***Answer these questions.***

1. What are elements of the building blocks of a control system?
2. What are inputs and outputs?
3. What is a closed loop? Find out closed loops in Fig 6.3, then redraw them.
4. Explain how a control system operates.

Task 6. ***Read the following text to find the answers to these questions.***

1. What devices are used to lock the door?
2. What provides feedback to the control unit about the door position?

Text 1: ***Door position***

The machine will not start any program unless the door is fully closed and locked. When the door is closed, it completes an electrical circuit which heats up a heat-sensitive pellet. This expands as it gets hot, pushing a mechanical lock into place and closing a switch. The switch signals the control unit that the door is closed and locked. Only when it has received this signal will the control unit start the wash program.

Complete your section of the table below. Then exchange information with your partner to complete the whole table.

Control factor	Operating device	Feedback by
1 Door position	heat-sensitive pellet	Switch
2 Water level	……..……	……..……
3 Water temperature	……..……	……..……
4 Wash and spin time	……..……	……..……
5 Drum speed	……..……	……..……

Text 2: ***Water level***

When a wash program first starts, it has to open the valves which
5 w the water in. There are usually two of these valves, one for hot water and one for cold. Each must be controlled separately depending on the water temperature needed for that program. The valves are solenoid operated, i.e. they are opened and closed electrically.

The rising water level is checked by the water level sensor. This is a pressure sensor. The pressure of the air in the plastic tube rises as it is compressed by the rising water. The pressure sensor keeps the control unit informed of the pressure reached and the control unit uses the information to decide when to close the water inlet valves.

Text 3: ***Water temperature***

5 The temperature sensor, a type of thermometer which fits inside the washer drum, measures the water temperature and signals it to the control unit. The control unit compares it with the temperature needed for the program being used. If the water temperature is too low, the control unit will switch on the heater. The temperature sensor continues to check the temperature and keeps the control unit informed. Once the correct temperature is reached, the control unit switches off the heater and moves on to the next stage of the program.

Text 4: ***Clock***

The control unit includes a memory which tells it how long each stage of a program should last. The time may be different for each program. The electronic clock built into the control unit keeps the memory of the control unit informed so that each stage of each program is timed correctly.

Text 5: ***Drum speed***

5 During the washing and spinning cycles of the program, the drum has to spin at various speeds. Most machines use three different speeds: 53 rpm for washing; 83 rpm for distributing the load before spinning; 100 rpm for spinning.

The control unit signals the motor to produce these speeds. The motor starts up slowly, then gradually increases speed. The speed sensor, a tachogenerator, keeps the control unit informed of the speed that has been reached. The control unit uses the information to control the power of the motor and so controls the speed of the drum at all times.

Language study: ***If/ Unless***

Task 7. ***Fill in the blanks in this table using the information in Fig 5.3 and the texts in Task 6.***

Sensor	Condition	Control unit action
Water	level low	open inlet valves
	level high enough	
Water temperature		switch on heater
	high enough	
Drum speed		
		decrease motor speed

The conditions which the sensors report determine the actions of the control unit. We can link each condition and action like this:

If the water level is low, the inlet valves are opened.

Task 8. ***Write similar sentences for the other five conditions given above.***

Now study this example:

Sensor	Condition	Control unit action
Door	Door open	Machine cannot start
	Door closed	Machine can start

We can link these conditions and actions as follow:

1. ***If*** *the door is open, the machine cannot start.*
2. ***If*** *the door is closed, the machine can start.*
3. ***Unless*** *the door is closed, the machine cannot start.*

We use *unless* when an action cannot or will not happen if a prior condition is not true. In example 3, ***Unless*** means ***If … not***. We can rewrite 3 as:

If *the door is* ***not*** *closed, the machine cannot start.*

Task 9. ***Complete these sentences using Unless and your knowledge of engineering.***

1. Unless the ignition is switched on, a car cannot _____.
2. Unless the pilot light is on, gas central heating will not _____.
3. Unless the diverter valves are switched to central heating, the radiators will not _____.
4. Unless there is current flowing in the primary coil of a transformer, there will be no current in the _____ coil.
5. Unless there is _____ in the cylinders, the petrol engine will not start.
6. Unless the doors are _____, the lift will not operate.
7. Unless mild steel is painted, it will _____.
8. Unless electrical equipment is earthed, it may be _____.

Task 10. ***Connect the sentences using the word/words given. Then join all sentences you have made to build a paragraph.***

1. Which

The temperature sensor measures the water temperature.

The temperature sensor is a type of thermometer.

2. And

The temperature sensor fits inside the washer drum.

The temperature sensor signals the water temperature to the control unit.

3. Which

The control unit compares the water temperature with the temperature.

The temperature is needed for the program being used.

4. If

The water temperature is too low.

The control unit will switch on the heater.

5. And

The temperature sensor continues to check the temperature.

The temperature sensor keeps the control unit informed.

6. When … and

The correct temperature is reached.

The control unit switches off the heater.

The control unit moves on to the next stage of the program.

Language study: ***Ability and Inability***

1. Making someone able or something possible

(make…able, enable, allow, permit)

e.g. That database ***allows*** *you to search for client names and addresses.*

2. Being able or **unable**

(be able/unable to, be capable/incapable of, can/cannot)

e.g. This new monitor ***can*** *display more than two million colours.*

Synthetic fibre ***is unable*** *to replace natural fibre.*

3. Making someone unable or something impossible

(make…unable, stop, prevent, prohibit)

e.g. Friction force ***stops*** *the box sliding down.*

Notes:

* be able/unable to do sth
* be capable/incapable of doing sth/N
* prohibit/stop/prevent sth/sb from doing sth/N
* allow/permit/enable sth/sb to do/not to do sth
* make sth/sb adj/do sth

Complete the sentences

a. _____ ***is not permitted*** in the class.

b. The parents ***protect*** the children ***from*** _____.

c. The machine is equipped with a control unit, thus ***makes*** it ***able*** to _____.

d. The manager ***prohibits*** _____ in the factory.

e. The machine has touch panel to ***make it*** _____ in operation.

f. Normal airplanes ***are incapable of*** _____ at velocity of light.

g. Modern technology ***is*** _____ without computers.

h. Door lock ***enables***_____ when the car moves at _____.

i. A faster processor in the computer _____ solving complicated computations.

Language study: ***have sth done/Adj***

keep sth done/Adj

I have my house cleaned.

I have my hair cut.

I have my computer .....

The pressure sensor *keeps* the control unit *informed* of the pressure reached.

The temperature sensor *keeps* the control unit *informed*.

The machine has damaged. Please have it .....

The wall is dirty. I will have it .....

Translate into English

a. Cảm biến tốc độ luôn kiểm soát vận tốc của động cơ.

.....

b. GPS luôn thông báo vị trí xe hơi.

.....

c. Cảnh sát luôn kiểm tra nồng độ cồn của người lái xe.

.....

d. Hệ thống cảnh báo động đất luôn đo rung động của mặt đất.

.....

e. Mục đích của bảo trì là bảo đảm hệ thống luôn vận hành tốt.

.....

Task 11. ***Match column A with column B to build sentences of ability and inability.***

A	B
1. Improving quality control will enable us	a. the storage of chemicals in plastic containers.
2. Shortage of space prevents us from	b. carrying the volume of data required today.
3. Regulations prohibit	c. see the person you are talking to.
4. A machine breakdown means that we can't	d. producing more product lines.
5. Old copper cables are incapable of	e. now be used to send emails.
6. Using a videophone allows you to	f. to become more profitable.
7. Mobile phones can	g. unauthorized users accessing a network.
8. A firewall is used to stop	h. finish the order this week.

Task 12. ***There is a mistake in each of the following sentences. Underline the mistake then correct it.***

1. All unauthorized personnel are prohibited from entering this area.
2. Building regulations do not allow of the use of asbestos in public buildings.
3. Only fully qualified electricians should be permitted to repair these appliances.
4. Deep pile foundations are able to support a high building.
5. Water is unable to pass through the vapour barrier.
6. Designers can design complex structures using computer-aided design tools.
7. Scientists are not yet able to cure cancer.
8. Aspirin is known to prevent people from having a heart attack.

REVIEW

Task 1. ***Matching the items inside the washing machine (picture shown) with their proper meanings.***

a. Mô tơ chính: Là mô tơ giúp quay lồng máy giặt

b. Núm chọn chế độ giặt

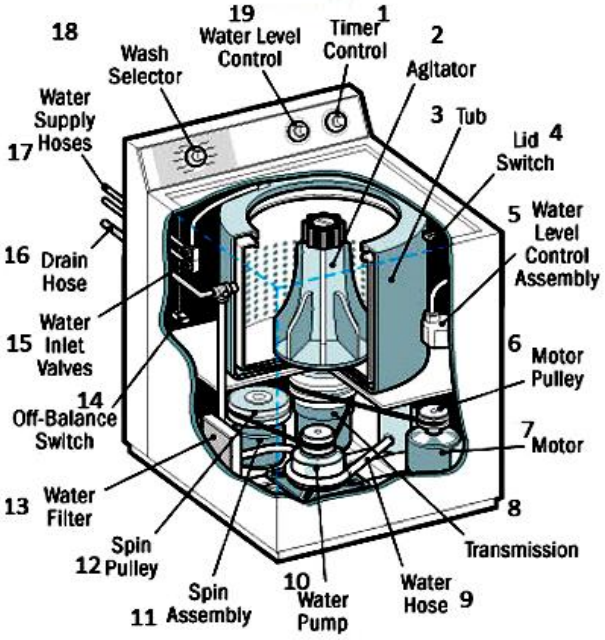
c. Núm kiểm soát mực nước

d. Nút điều khiển thời gian giặt

e. Trục khấy: Dùng để đảo quần áo và đồ dơ trong nước, ngoài ra còn có tác dụng đẩy nước đi qua sợi vải từ trong ra ngoài

f. Gối đỡ tròn

Inside a Washing Machine



g. Đường nước cấp

h. Pu-li có tác dụng truyền lực cho lồng giặt

i. Bộ lọc cặn

j. Công tắc mất thăng bằng: Khi tải trọng máy giặt bị lệch hoặc do máy giặt lệch chân dễ gây hiện tượng mất thăng bằng. Công tắc này thiết kế để tắt máy khi xảy ra sự mất cân bằng

k. Van cấp nước vào

l. Đường nước xả

m. Thùng chứa nước: Dùng để chứa nước trong quá trình giặt

n. Công tắc mức tràn

o. Mức kiểm soát mực nước

p. Pu-li truyền động của mô tơ

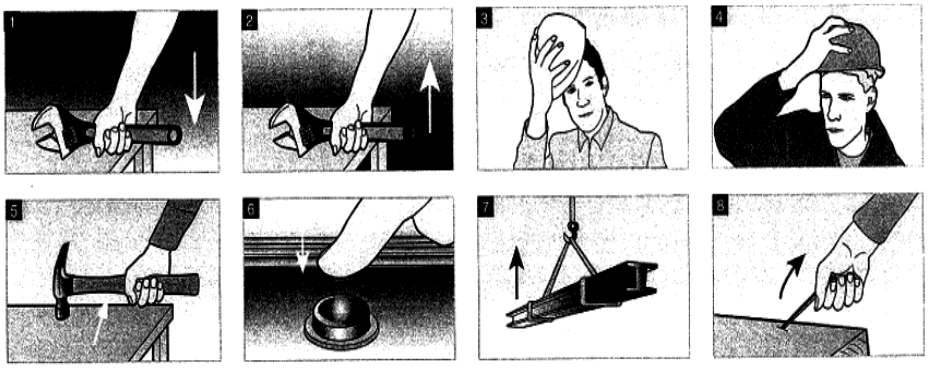
q. Gối đỡ

r. Đường ống nước xả

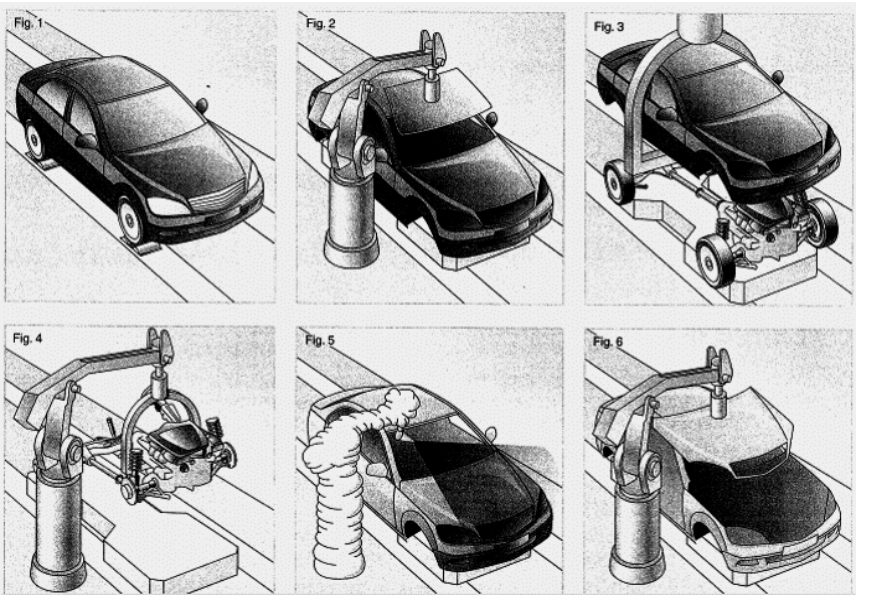
s. Bơm nước xả

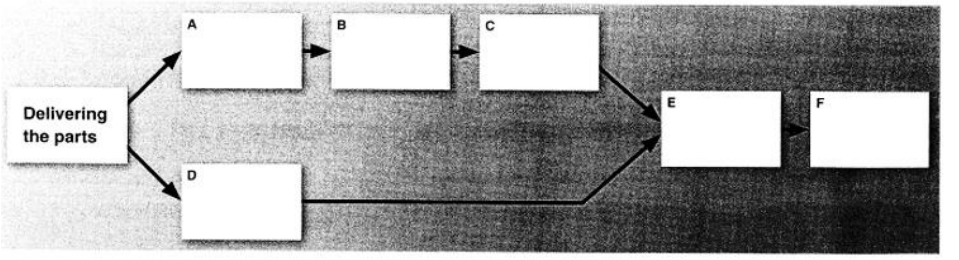
Task 2. ***Match the pictures with the verbs in the box.***

lift up pick up pull out push in put down put on take away take off



Task 3. ***The photos illustrate the main stages in assembling a car, but they are in wrong order. Write the figure numbers in the correct boxes in the chart below.***





Reading

Now read this website of the car company and check your answers to Tasks 2.

ASSEMBLING A CAR

First, the parts are delivered by truck or rail to the delivery area of the car assembly plant. From here, some parts are taken to the body shop, and other parts are transported to the chassis line. The parts are carried around the plant by forklift trucks or conveyor belts.

In the body shop, the panels are welded to the frame to form the body of the car. This is done by more than 400 robots.

Then the body is taken to the paint shop. Here it is cleaned and painted by robots. Special clothing is worn by the robots to project the paint. After this, the body is checked by human workers to look for faults.

Next, the painted body moves along a conveyor belt to the trim

line and many parts are added to it. For example, the instrument panel, the air conditioning system, the heating system and the electrical wiring are all installed here. The windscreen is inserted by robots using laser guides.

Meanwhile, in the chassis, in the line, components are added to the chassis. First, the chasis is turned upside down to make the work easier. Then the fuel system, the axles and the drive shaft are all installed. Next the chassis is turned over (rightside up). The engine is lowered into the chassis and connected to it.

Now, the chassis and the body move simultaneously to the final assembly line. Here the body is attached to the chassis, and all the final parts are added. The tyres and the radiator are added here. The hoses are connected, and the radiator and air conditioner are filled with fluid. The central computer of the car is also installed here.

Lastly, the finished car and all electrical systems are tested. The car is filled with fuel and the engine is started for the first time. The car is put on special rollers to test the engine and the wheels. If it passes the test, the car is finally driven out of the assembly plant.

Task 4. ***Form <u>Adjectives</u> from the proper suffixes below.***

-ful -ic -ous -y -ant -al -able -ial -ive -ible -ent

danger	dirt	magnet	rely	origin	experiment	
wash	flex	expense	excel	resist	use	industry

Task 5. ***Complete the following sentences with the adjectives and adverbs in brackets. Use each word only once.***

1. The system will shut down_____. There is an _____temperature control. (automatic/automatically)
2. New testing methods have made the process much more _____. Quality control runs more_____. (efficient/efficiently)
3. Our aim is to ensure _____operation at the plant. The manufacturing process should run _____. (smooth/smoothly)
4. Demand for electricity is _____ lower in the evening. Statistics show that there is a _____ fall in demand after 10 p.m. (general/generally)

5. People are becoming more interested in _____ friendly products. There is a growing interest in _____ issues. (environmental/environmentally)
6. Safety procedures must be _____observed to avoid accidents. The manager in coal mine must be _____ about activities underground. (strict/strictly)

Task 6. ***Here is a part of a presentation on the textile industry in the UK. Tick the correct words.***

The number of people who work in the textile (a) **manufactured/manufacturing** industry in the UK has fallen (b) **considerable/considerably** over the last 50 years. Today, it employs (c) **approximate/approximately** 130,000 people. Textiles for clothing and carpets have always been (d**) important/importantly** but today there is (e) **increasing/increasingly** trade in fabrics for (f**) industrial/ industrially** applications. Fabrics are used (g) **increasing/increasingly** in the healthcare and automotive industries. The export of wool and (h) **woolen/ wool** products has remained fairly (i) **constant/constantly** over the last 15 years. The UK also has a (j) **significant/significantly** silk industry, which produces over 170 million worth of goods (k) **annual/annually**. The UK linen trade has an (l) **excellent/excellently** reputation for quality and service and British exports remain very (m) **healthy/healthily**. The UK's expertise in chemistry is (n) **extensive/ extensively** and this is (o) **important/importantly** to the (p) **dyed/dying** industry.

The manufacturing of dyestuffs is (q) **relative/relatively** strong. The sale of carpets contributes to the sale of the textile (r) **significant/significantly**. The carpet industry has (s) **particular/ particularly** strengths in the (t) **high/highly** quality end of the market.

a_manufacturing_ b _____ c _____ d _____

e _____ f _____ g _____ h _____

g _____ h _____i _____ k _____

l _____ m _____ n _____ o _____

p _____ r _____ s _____ t _____

Translate into Vietnamese

A washing machine, sometimes called laundry machine, clothes washer or washer, is a machine used to wash laundry, such as clothing, carpet and sheets. In most cases, the machines use water and detergent. Modern washing machines may use dry cleaning techniques (which uses alternative cleaning fluids, and is performed by specialist businesses) or ultrasonic cleaners. *(Source: Mintz, Steven, "Housework in Late 19th Century America", Digital History.)*

Translate into English

Ngày nay, máy giặt là thiết bị không thể thiếu trong các ứng dụng trong gia đình cũng như trong công nghiệp. Nó giúp chúng ta giặt giũ quần áo, ra trải giường và thảm trong nhà hàng ngày, đồng phục trong nhà máy, văn phòng, bệnh viện… Tại các quốc gia lạnh, nước nóng được sử dụng một cách hiệu quả cho máy giặt thay vì nước lạnh như ở các quốc gia nhiệt đới.

VOCABULARY

– to absorb	(v)	/əb'sɔ:b/	hấp thu
absorption coefficient		/əb'sɔ:bʃn koui'fiʃnt/	hệ số hấp thu
– to sense	(v)	/sens/	cảm nhận, hiểu, cảm biến
sensor	(n)	/'sensə/	cảm biến
– to adjust	(v)	/ə'dʒʌst/	điều chỉnh
– to flash	(v)	/flæʃ/	chớp
– loop	(n)	/lu:p/	vòng lặp, chu trình
– detergent	(n)	/di'tə:dʒənt/	chất tẩy, xà bông
– to incorporate	(v)	/in'kɔ:pərit/	liên kết, liên hợp
– to take into account			đưa vào tính toán, tính tới
– to diagnose	(v)	/'daiəgnouz/	chẩn đoán
– pellet	(n)	/'pelit/	viên, thanh, hạt
– solenoid valve	(n)	/'soulənɔid/	van điện từ

- tachogenerator	(n)	/'tækədʒenəreitə(r)/	bộ phát xung
- agitator	(n)	/'ædʒiteitə/	trục khuấy, bộ phận khuấy
to agitate	(v)	/'ædʒiteit/	khuấy
- pulley	(n)	/'puli/	pu-li
- to transmit	(v)	/trænz'mit/	truyền, truyền động
- lid	(n)	/lid/	nắp, vung, mũ
- chassis	(n)	/'tʃæsi/	khung gầm (xe)
- to convey	(v)	/kən'vei/	vận chuyển, tải
- hose	(n)	/houz/	ống dẫn (mềm)
- plant	(n)	/plænt/	xưởng, dự án, công trình

Unit 6
ROBOTICS

Figure 6.1. *Robots*

Task 1. ***Warm-up***

Try to write a definition of robots. Compare with your classmates.

Reading 1 ***Revising skills***

In the tasks below, we will revise some reading skills you have studied.

Task 2. ***The diagram below shows the 3 components of an industrial robot. What are their functions?***

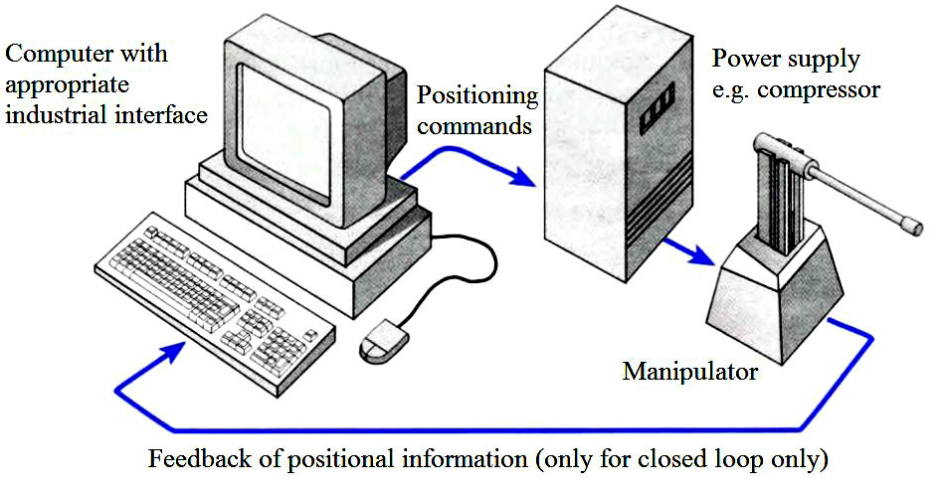


Figure 6.2. *The components of an industrial robot*

Task 3. ***Now read this text to check your answers to Task 2.***

The manipulator

This is the bit which actually does the mechanical work, and in this case it is anthropomorphic (i.e. of human-like form), resembling an arm.

The power supply

For heavy-duty hydraulic or pneumatic machines this will be a compressor. In smaller, lightweight versions which use electrical stepper motors rather than hydraulics or pneumatics, this would be omitted.

The computer

The controlling computer is fitted with appropriate interfaces. These may include digital inputs, digital outputs, ADCs (analogue-to-digital converters), DACs (digital-to-analogue converters), or stepper motor control ports. These control the various compressors, stepper motors, and solenoids, and receive the signals from the manipulator's sensors.

Task 4. ***In your opinion, can robots replace human completely?***

Students make pairs or groups of three or four, and then discuss it.

Task 5. ***Read the following text to find the answers to these questions.***

1. What is the work volume of a manipulator?
2. Why is the work volume of a human greater than that of an industrial robot?
3. What are 'degrees of freedom'?

Work volume

Robots are multifunctional so an important design issue for the manipulator is its 'work volume': the volume of space into which it can be positioned. The greater the work volume, the more extensive the range of tasks it can be programmed to carry out.

5 As a human being, your work volume consists of all the places your hands can reach. Most industrial robots have a much more limited work volume because they are bolted to the floor. Even with the same limitation applied, however, the human body is a very flexible machine with a work volume described – very approximately – by a cylinder about 2.2 m high with a radius about 1.8 m and a domed top.

Degrees of freedom

10 In order to achieve flexibility of motion within a three-dimensional space, a robot manipulator needs to be able to move in at least three dimensions. The technical jargon is that it requires at least three 'degrees of freedom'. Figs. 6.3 a-d show a number of the more common types of robot manipulator mechanisms. Each has the requisite three degrees of freedom, allowing either linear or rotational movement.

Reading 2 ***Transferring information***

Task 6. ***Study the text and the diagram (Fig. 6.3a) below and note how the information has been transferred to Table 1.***

Fig.	Types	Degrees of freedom		Work volume
		Linear	Rotational	
6.3a	Cartesian or rectilinear	3	0	Cube

Common types of manipulator

Fig. 6.3a is the simplest. Its three degrees of freedom are all linear and at right angles to each other, so they correspond to the three Cartesian co-ordinates. Driving it presents no mathematical difficulties, since each degree of freedom controls a single Cartesian co-ordinate without affecting the others. Fairly obviously, the work volume of the Cartesian manipulator is a cube.

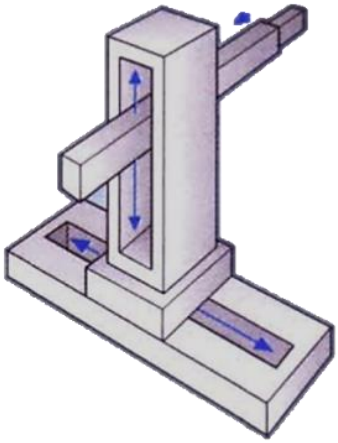


Figure 6.3a. *Cartesian or rectilinear manipulator*

Task 7. ***Work in groups of three. Your teacher will select a text for you. Read the text and the diagram to complete your section of Table 1.***

Text 1

The second type of manipulator, shown in Fig. 6.3b, is called a cylindrical manipulator because of the shape of its work volume. It has one rotational and two linear degrees of freedom. Because of the rotational aspect, however, the maths needed to position it becomes more involved, which means that for a given response speed a faster processor is necessary.

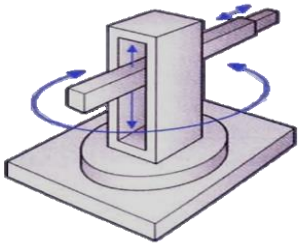


Figure 6.3b. *Cylindrical or post-type manipulator*

Fig.	Types	Degrees of freedom		Work volume
		Linear	Rotational	
6.3b				

Text 2

Fig. 6.3c shows the spherical manipulator which has two rotational and one linear degrees of freedom. The work volume is indeed a sphere, and once again the complexity of positioning the device increases.

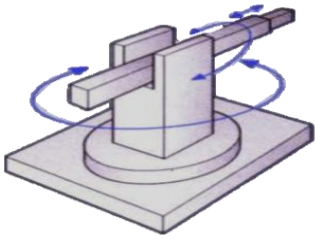


Figure 6.3c. *Spherical or polar manipulator*

Fig.	Types	Degrees of freedom		Work volume
		Linear	Rotational	
6.3c				

Text 3

5 The final type of manipulator has three rotational degrees of freedom. This is the most complex type to control, but it has increased flexibility. Fig. 6.3d shows this type of manipulator – the anthropomorphic arm. The work volume of a practical manipulator of this form is shown in Fig. 6.4. You will notice that it is basically spherical but has missing portions due to the presence of the arm itself and because the rotations cannot achieve a full 360 degrees. The scallops on the inner surface are caused by constraints imposed by the joints.

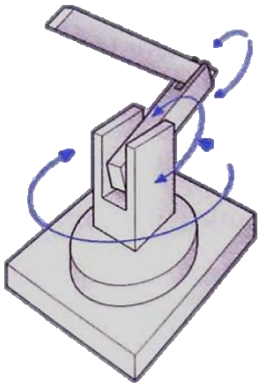


Figure 6.3d. *Anthropomorphic or joint manipulator*

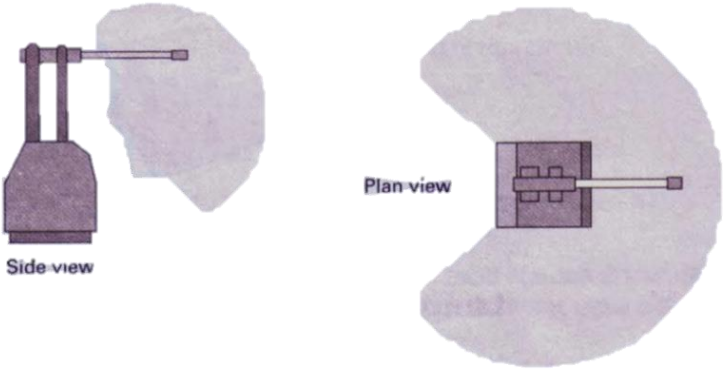


Figure 6.4. *Working volume of anthropomorphic manipulator*

Fig.	Types	Degrees of freedom		Work volume
		Linear	Rotational	
6.3d				

Structure: "*In order to…*"

In order to achieve flexibility of motion within a three-dimensional space, a robot manipulator needs to be able to move in at least three dimensions.

to / in order to	**+ V.inf**
for	**+ Gerund (V.ing)/ N**

To pass the examination, students must study hard.

For higher examination scores, students must study hard.

Complete the sentences

1. ....., the youth must have good health.
2. To become a famous physician, you .....experiments.
3. ....., the teachers work hard.
4. .....a good swimmer, you .....every day.
5. To produce an advanced material, ...
6. ..... for a good job.
7. ..... a good singer, ...

Task 8. ***Complete the blanks in this text.***

Mechanical wrist

It is worth pointing [1]_____ that a human arm has far more freedom [2]_____ the minimum three degrees of freedom, giving very great flexibility in terms [3]_____ positioning, path taken, and angle of approach. Even without a wrist, the redundant degrees of freedom of the [4]_____ body would allow you to carry out most normal operations. Any of the basic manipulators shown [5]_____ Figs. 6.3 a-d, on the other [6]_____, would be virtually useless as they stand. Although they could get to any position, they [7]_____ only approach objects from a single angle.

To take an [8]_____, removing a screw would be impossible [9]_____ the manipulator could not align a screwdriver to fit the screw properly. Even if it was able to, it still would [10]_____ be possible to carry out the necessary rotating action.

A wrist is therefore added to most basic manipulators to [11]_____ the required mechanical flexibility to [12]_____ real jobs. In general, for total flexibility the wrist itself requires three degrees of freedom, thereby bringing the grand total up to six. The [13]_____ common type of wrist has two bending and one rotational degrees of freedom. Fig. 6.5 shows this type of mechanical wrist.

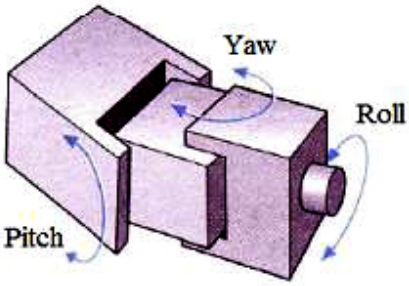


Figure 6.5. *Wrist mechanism*

Task 9. ***Technical reading: Stepper motors***

Read the following text to find the answers to these questions, and then complete the table.

1. Why do you use a stepper motor to position the head of a disk drive unit?
2. Name two components that are present in other electric motor types but absent from stepper motors.
3. For accuracy in positioning, do you select a stepper motor with a large or a small step angle?

Stepper motors are useful wherever accurate control of movement is required. They are used extensively in robotics and in printers, plotters and computer disk drives, all of which require precise positioning or speed. In a plotter, for example, by using two motors running at 90 degrees to each other, they can be used to drive a pen with an exact distance in all directions. In robotics, they are used to position manipulators exactly where required.

A stepper motor does not run in the same way as a normal DC motor, i.e. continuously rotating. Instead, it runs in a series of measured steps. These steps are triggered by pulses from a computer, and each pulse makes the motor turn either in a forward or a reverse direction by

an exact interval, typically 1.8, 2.5, 3.75, 7.5, 15, or 30 degrees. Accuracy is within 3% to 5% of the last step.

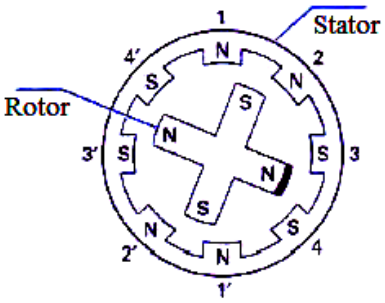


Figure 6.5a

Figure 6.5b

The rotor in a stepper motor is constructed from several permanent magnets with north and south poles. The stator is wound in a series of electromagnets, usually four, which can be switched on and off. Figs.6.5a and b illustrate the operation of a permanent magnet-type stepper motor. When current is applied to the stator coils, it creates the pole arrangement shown in Fig.6.5a. Poles 1 and 2 are north. Hence, the south pole of the rotor is attracted to both of them and settles in the mid position as shown. When the stator currents are changed to produce the pole arrangement shown in Fig.6.5b, pole 1 has south polarity. This repels the rotor which moves to the new position as shown. Each polarity change on the stator causes the rotor to move (in this case) 45 degrees.

Stepper motors can be divided into two groups. The first one works without a permanent magnet. The second one has a permanent magnet, usually located on the rotor.

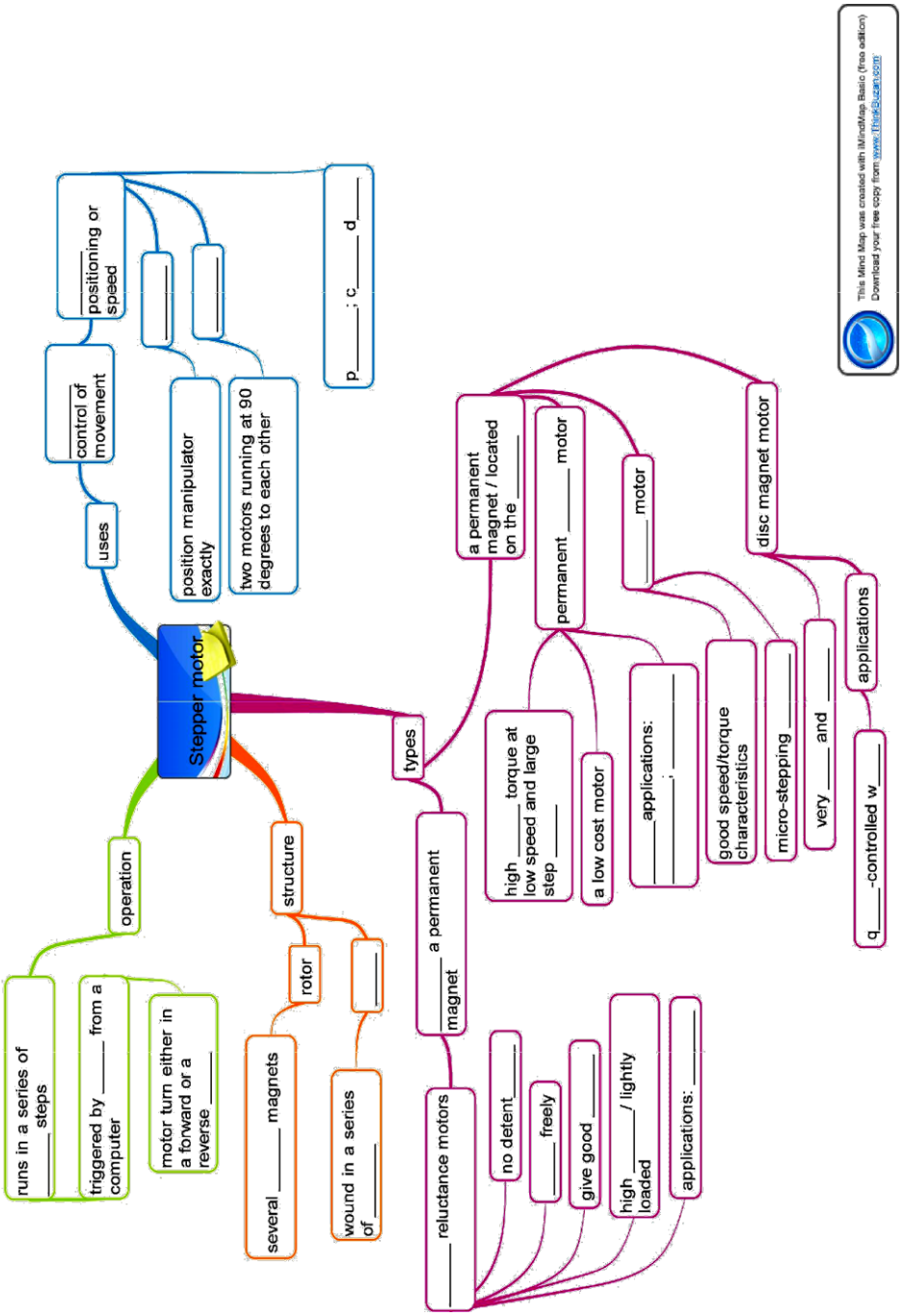
Variable reluctance motors form the first group. As there is no permanent magnet, the variable reluctance motor has practically no detent torque. The rotor spins freely and gives good acceleration and high speed if lightly loaded. Applications include micro positioning tables.

The second group comprises the permanent magnet motor, the hybrid motor, and the disc magnet motor. The permanent magnet type offers high dynamic torque at low speed and large step angles. This is a low cost motor used extensively in low inertia applications such as computer peripherals and printers.

The hybrid type combines features of both types mentioned above. It has good speed/torque characteristics and micro-stepping capability. Steps of 1.8 degrees are possible. Disc magnet motors can be made very small and are very efficient. One of their first applications was in quartz-controlled watches.

Task 10. ***Mind mapping***

Mind mapping is a useful means to make sure you understand main ideas of the reading. Complete the following diagram.



VOCABULARY

– to achieve	(v)	/ə' tʃ iː v/	đạt được, giành được
– accurate	(adj)	/' ækjʊ rət/	chính xác
accuracy	(n)	/' ækjʊ rəsi/	độ chính xác
– to affect	(v)	/ə'fekt/	ảnh hưởng
effect	(n)	/i'fekt/	sự ảnh hưởng
– analogue	(adj)	/' ænəlɒ g /	tín hiệu tương tự
– anthropomorphic	(adj)	/ˌ ænθrəpə' mɔ ː fɪ k/	giống hình người
– appropriate	(adj)	/ə' prəʊ priət/	thích hợp
– approximately	(adv)	/ə' prɒ ksɪ mətli/	khoảng chừng, xấp xỉ
– Cartesian	(adj)	/kɑ ː ' tiː ziən/	(thuộc) thuyết Đề-các
– to command	(v)	/kə' mɑ ː nd/	ra lệnh
command	(n)	/kə' mɑ ː nd/	lệnh
– compressor	(n)	/kəm' presə(r)/	máy nén
– constraint	(n)	/kən'streint/	sự ràng buộc
– to construct	(v)	/kən' strʌ kt/	chế tạo
– to correspond	(v)	/ˌ kɒ rə' spɒ nd/	phù hợp; tương ứng
– cube	(n)	/kjuː b/	hình lập phương
– current	(n)	/' kʌ rənt/	dòng điện
– cylindrical	(adj)	/sə' lɪ ndrɪ kl/	hình trụ
– definition	(n)	/ˌ defɪ ' nɪ ʃ n/	định nghĩa
– digital	(adj)	/' dɪ dʒ ɪ tl/	kỹ thuật số
digital input	(n)		ngõ vào số
digital output	(n)		ngõ ra số
– analogue to digital converter	(n)		bộ chuyển đổi tương tự - số
– flexible	(adj)	/' fleksəbl/	linh động, linh hoạt
flexibility	(n)	/,fleksə'biliti/	tính linh hoạt, tính linh động
– hydraulic	(adj)	/haɪ ' drɔ ː lɪ k/	thủy lực
– hybrid	(n)	/' haɪ .brɪ d/	lai

–	to impose	(v)	/im'pouz/	áp đặt
–	inner	(n)	/'inə/	bên trong
–	interface	(n)	/ˈɪ ntəfeɪ s/	giao diện, cổng giao tiếp
–	inertia	(n)	/ɪ ˈnɜ ː ʃ ə/	mô-ment quán tính tĩnh
–	jargon	(n)	/ˈ dʒ ɑ ː g ən/	từ chuyên môn, thuật ngữ
–	joint	(n)	/dʒ ɔ ɪ nt/	khớp
–	manipulator	(n)	/məˈ nɪ pjuleɪ tə(r)/	tay máy
–	magnet	(n)	/ˈ mægnət/	nam châm
	permanent magnet	(n)	/ˈ pɜ ː mənənt/	nam châm vĩnh cửu
–	to limit	(v)	/'limit/	giới hạn, hạn chế
	limitation	(n)	/,limi'teiʃn/	sự hạn định, sự giới hạn
–	obviously	(adv)	/ˈ ɒ bviəsli/	rõ ràng; hiển nhiên
–	to omit	(v)	/əˈ mɪ t/	quên; bỏ qua
–	pneumatic	(adj)	/nju ː ˈ mætɪ k/	làm việc nhờ khí nén
–	pulse	(n)	/pʌ ls/	xung
–	pole	(n)	/pəʊ l/	cực
	polarity	(n)	/pəʊ ˈ lærəti/	sự phân cực
–	to position	(v)	/pə'ziʃn/	xác định vị trí
–	rectilinear	(adj)	/ˌ rektɪ ˈ lɪ niə(r)/	thẳng
–	requisite	(adj)	/ˈ rekwɪ zɪ t/	cần thiết
–	to resemble	(v)	/rɪ ˈ zembl/	giống với, tương tự với
–	reluctance	(n)	/rɪ ˈ lʌ ktəns/	từ trở
–	robot	(n)	/ˈ rəʊ bɒ t/	người máy
–	sphere	(n)	/sfɪ ə(r)/	hình cầu, khối cầu, mặt cầu
	spherical	(adj)	/ˈ sferɪ kl/	có hình cầu
–	to trigger	(v)	/ˈ trɪ gər/	kích xung
–	torque	(n)	/tɔ ː k/	mô-ment xoắn
	detent torque	(n)		mô-ment hãm
–	volume	(n)	/ˈ vɒ lju ː m/	thể tích; khối lượng

REVIEW

I. Choose the best answer.

1. The _____does the mechanical work. It can be anthropomorphic.

   A. manipulator B. power supply

   C. degrees of freedom D. controller

2. For lightweight duty, the power supply can use _____than hydraulics or pneumatics.

   A. DC motor B. stepper motor

   C. hydraulic motor D. all are incorrect

3. The heart of robot is the controlling computer which is fitted with _____interfaces.

   A. different B. differently

   C. appropriate D. appropriately

4. The _____is an important design issue for the manipulator. The greater the_____, the more tasks it can be programmed to carry out.

   A. work volume/manipulator B. work volume/work volume

   C. degrees of freedom/work volume D. degrees of freedom/manipulator

5. In order to achieve _____ of motion within a three-dimensional space, a robot manipulator needs to be able to move in at least three dimensions.

   A. flexible B. flexibility C. accurate D. accuracy

6. _____is the simplest. Its three degrees of freedom are all linear and at right angles to each other.

   A. Cylindrical manipulator B. Spherical manipulator

   C. Cartesian manipulator D. Joint manipulator

7. _____is the most complex type of manipulator.

   A. Cylindrical manipulator B. Spherical manipulator

   C. Cartesian manipulator D. Joint manipulator

8. _____has one rotational and two linear degrees of freedom.

   A. Cylindrical manipulator B. Spherical manipulator

   C. Cartesian manipulator D. Joint manipulator

9. The work volume of Cartesian manipulator is _____.

   A. a cube B. a sphere C. cylinder D. all are incorrect

10. A manipulator have many joints is flexible but control is _____.

   A. simple B. complex

   C. appropriate D.implemental

II/ Translate the following text into Vietnamese

Robotics is the branch of *mechanical engineering*, *electrical engineering* and *computer science* that deals with the design, construction, operation, and application of *robots*, as well as computer systems for their control, sensory feedback, and information processing.

These technologies deal with automated machines that can take the place of humans in dangerous environments or manufacturing processes, or resemble humans in appearance, behavior, and/or cognition.

The concept of creating machines that can operate *autonomously* dates back to *classical times*, but research into the functionality and potential uses of robots did not grow substantially until the 20th century. Throughout history, robotics has been often seen to mimic human behavior, and often manage tasks in a similar fashion. Today, robotics is a rapidly growing field, as technological advances continue; researching, designing, and building new robots serve various practical purposes, whether *domestically*, *commercially*, or *militarily*. Many robots do jobs that are hazardous to people such as defusing bombs, mines and exploring shipwrecks. *(Source: "Robotics". Oxford Dictionaries, Retrieved 4, February 2011.)*

III/ Translate into English

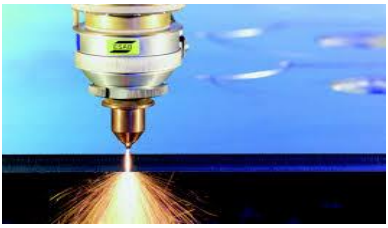
Robot là một dạng thiết bị tự động nhằm thực hiện các công việc giống nhau một cách tự động và lặp đi lặp lại. Điều này giúp làm giảm ảnh hưởng của sai sót từ con người, tăng sản lượng và độ tin cậy của sản phẩm. Robot có thể được lập trình lại nhằm tăng mức độ linh hoạt của nó trong việc sản xuất nhiều loại sản phẩm khác nhau. Kỹ thuật robot kết hợp nhiều lãnh vực khác nhau bao gồm cơ khí, điện-điện tử, kỹ thuật thủy lực-khí nén và công nghệ thông tin.

Unit 7
LASERS

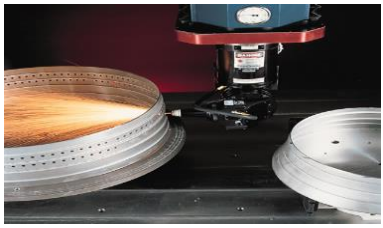
Task 1. ***Warm-up***

What does LASER stand for?

Figure out different applications of lasers.

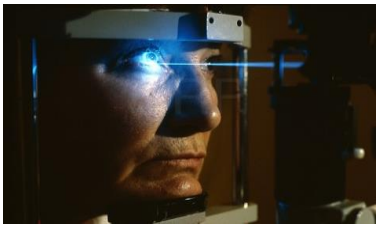


1.....

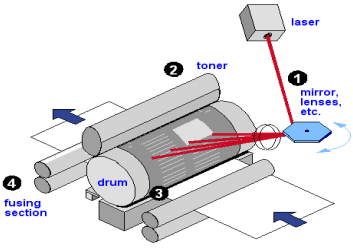


2.....

3.....



4.....



5.....

6.....

7.....

8.....

Task 2. ***Work in groups.***

What are lasers?

List any applications or devices you know about lasers.

Task 3. ***Read this text to check your answers to Task 1.***

Lasers (*Light Amplification by Stimulated Emission of Radiation*) are the devices which amplify light and produce beams of light which are very intense, directional, and pure in colour. They can be in solid state, gas, semiconductor, or liquid.

When lasers were invented in 1960, some people thought they could be used as "death rays". In the 1980s, the United States experimented with lasers as a defence against nuclear missiles. Nowadays, they are used to identify targets. But apart from military uses, they have many applications in engineering, communications, medicine, and the arts.

In engineering, powerful laser beams can be focused on a small area. These beams can heat, melt, or vaporize material in a very precise way. They can be used for drilling diamonds, cutting complex shapes in materials from plastics to steel, for spot welding and for surfacing techniques, such as hardening aircraft engine or turbine blades. Laser beams can also be used to measure and align structures.

Lasers are ideal for communications in space. Laser light can carry many more information channels than microwaves because of its high frequency. In addition, it can travel long distances without losing signal strength. Lasers can also be used for information recording and reading. Compact discs are read by lasers.

In medicine, laser beams can treat damaged tissue in a fraction of a second without harming healthy tissue. They can be used in very precise eye operations.

In the arts, lasers can provide fantastic displays of light. Pop concerts are often accompanied by laser displays.

1. Matching each paragraph with the heading.

i. use of laser in communications

ii. a brief view of laser

iii. lasers in the arts

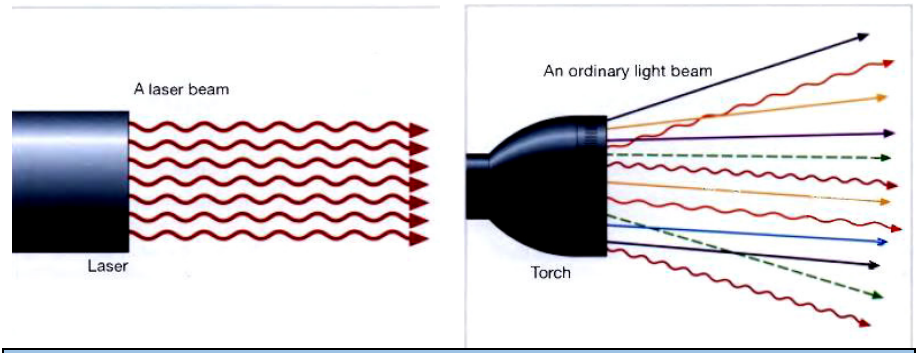
iv. the role of lasers in medicine

v. applications of lasers in engineering

2. Complete the following table with ONE word only.

Applications	How lasers work
Military uses	• _____ targets
Engineering	• _____, melt or _____ materials • drill _____, _____ complex shapes in materials • spot _____ • _____ techniques • _____ and _____ structures
Communications	• carry more information _____ than microwaves • _____ long distances without losing signal strength • _____ and read information
_____	• treat damaged tissue such as eye _____.
Arts	• provide fantastic _____ of light such as pop concerts

Task 4. ***Study the diagram and the words given. Point out the main differences between an ordinary light beam and a laser beam.***

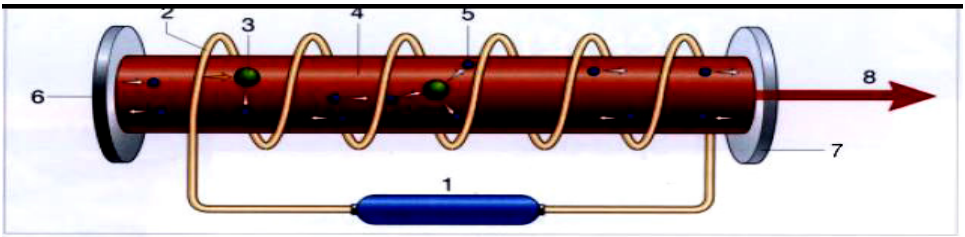


laser ordinary light organized disorganized directional indirectional in one didrection in many directions concentrate photon monochrome polychrome single wavelength various wavelength

Ordinary light beam	Laser beam
disorganized	.....
.....	concentrated
.....	focused
in all directions	.....
....	pure in color monochrome
.....	single wavelength
travel short distance	.....
.....	lose wave strength

Task 5.

A. Label different parts of laser.



Ruby crystal	Atom	Light tube	Mirror	Power source	Photon	Laser beam	Partial mirror
.....	.....	.....	.....	.....	.....	.....	.....

B. Put these notes in the best order:

A escaping photons form a powerful laser beam ☐
B atom absorbs photon – gets excited – calms down – emits new photon ☐
C tube flashes on / off rapidly – pumps energy (photons) into crystal ☐
D partial mirror lets 1% of photons escape ☐
E power source makes tube flash on / off
F new photon hits excited atom – atom emits *two* photons (instead of one) ☐
G photons are reflected by mirror along inside of crystal ☐
H new photons travel inside crystal at speed of light ☐

Writing *Describing a **Process** and a **Sequence***

When we write about a process, we have to:

1. Sequence the stages
2. Locate the stages
3. Describe what happens at each stage
4. Explain what happens at each stage

Consider these stages in the operation of a washing machine:

1. The drum is filled with water.
2. The water is heated to the right temperature.
3. Soap is added and the drum is rotated slowly.
4. The dirty water is pumped out and clean water is added.
5. The drum is rotated much faster and the water is pumped out.
6. The clean clothes are removed.

Instead of marking the numbers, we can show the order by using sequence words.

First, the drum is filled with water.

Second, the water is heated to the right temperature.

Then, soap is added and the drum is rotated slowly.

Next, the dirty water is pumped out and clean water is added.

After that, the drum is rotated much faster and the water is pumped out.

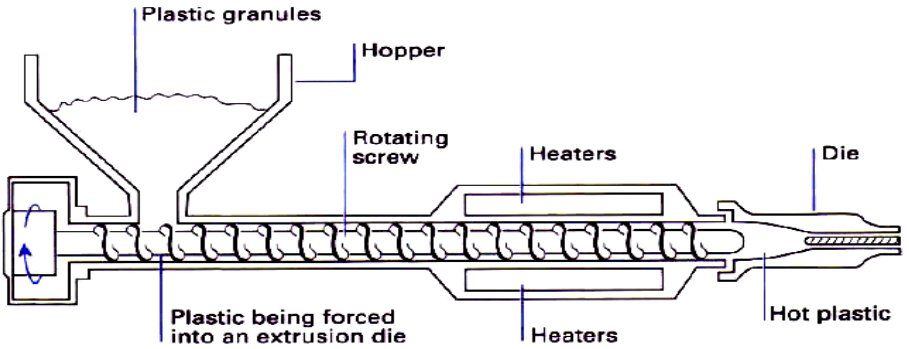
Finally, the clean clothes are removed.

Task 6. ***Adding '-y' to Nouns to have Adjectives.***

N	Adj	
health	***healthy***	*tissue*
fun	***funny***	*story*
noise	***noisy***	*area*
tide	***tidy***	*room*
taste	***tasty***	*dish*
spice	……	……
salt	……..	……

dirt	***dirty***	*clothes*
ease	……	…….
sun	***sunny***	*day*
cloud	……..	…….
rain	……	…….

Task 7. ***Study this diagram which shows an extruder for forming plastic pipes. Describe the extruder.***



Task 8. ***Now put these stages in the process in the correct sequence.***

a. The hot plastic is forced through the die to form a continuous length of pipe.

b. The rotating screw forces the plastic past heaters.

c. The plastic granules are mixed and placed in the hopper.

d. The pipe is cooled and cut to suitable lengths.

e. The plastic melts.

Task 9. ***Fill in the gaps with the words given to describe how a laser works.***

absorb	**atom**	**photon**	**ruby crystal**
concentrated	**partial**	**back and forth**	**emit**

The power source is located below the (1) ..... and makes the tube flash on and off. Every time the tube flashes, the flashes inject

energy into the crystal in the form of (2) ....., which are particles of light.

In the first stage, (3) ..... in the ruby crystal (4) ..... the energy from the light tube. When the atom absorbs a photon, it becomes more excited for a few milliseconds, and then returns to its original state and (5) ..... new photons.

Next, the photons travel at the speed of light (6) ..... inside the ruby crystal. At the far end of the tube, a (7) ..... mirror reflects most of the photons, about 99% of them, back into the crystal, but lets a small number, about 1%, escape from the machine.

Finally, these escaping photons form a very (8) ..... beam of powerful laser light.

REVIEW

Choose the best form of the words given in blankets or the best answer for the following sentences.

1. When lasers (invent) _____ in 1960, some people (think) _____they (be) _____ "death ray".
2. If the seat (occupy) _____, the ignition on and the belt (close) _____, the light (be) ____ off.
3. Laser light can carry ____ information channels than microwaves because of its high frequency.

   A. less B. more C. little D. small

4. Laser beams can be focused on a small area and it can _____, _____, or _____ materials.

   A. heat B. melt C. vaporize D. All are correct

5. Why does a laser beam can treat damaged tissue in a fraction of a second without harming healthy tissue?

   A. Because it can be focused B. Because it can vaporize materials

   C. Because it produces heat D. All are correct

Translate into Vietnamese

When invented in 1960, lasers were called "a solution looking for a problem". Since then, they have found utilities in thousands of applications in every section of modern society, including consumer electronics, information technology, science, medicine, industry, law enforcement, entertainment, and the military. Fiber-optic communication using lasers is a key technology in modern communications, allowing services such as the Internet.

Since the early period of laser history, laser research has produced a variety of improved and specialized laser types, optimized for different performance goals, including:

- new wavelength bands
- maximum average output power
- maximum peak pulse energy
- maximum peak pulse power
- minimum output pulse duration
- maximum power efficiency
- minimum cost

And these researches have been conducted to this day.

Translate into English

Các chất rắn dùng cho laser hồng ngoại dạng rắn bao gồm:

- Yttrium Aluminium Garnet (YAG) cộng thêm 2-5% Neodym có bước sóng 1060nm.
- Hồng ngọc (Rubi): Tinh thể Alluminium có gắn những ion Chrom và có bước sóng 694,3nm.
- Bán dẫn: Loại thông dụng nhất là diot Gallium Arsen và có bước sóng 890nm.

Laser sử dụng chất khí bao gồm:

- He-Ne: hoạt chất là khí Heli và Neon, có bước sóng 632,8nm và công suất nhỏ hơn 100mW. Trong y học được sử dụng làm laser nội mạch, kích thích mạch máu.
- Argon: hoạt chất là khí argon, có bước sóng 488 và 514,5nm.
- CO_2: hoạt chất là CO_2, có bước sóng 10.6μm, và công suất có thể lên tới MW. Trong y học được dùng trong phẫu thuật.

VOCABULARY

–	active	(a)	/'æktiv/	năng động, có hoạt tính
–	to amplify	(v)	/'æmplifai/	mở rộng, khuếch đại
	amplification	(n)	/,æmplifi'keiʃn/	sự mở rộng, sự khuếch đại
–	to stimulate	(v)	/'stimjuleit/	kích thích, khích động
–	emission	(n)	/i'miʃn/	sự phát ra
–	to radiate	(v)	/'reidieit/	bức xạ
	radiation	(n)	/,reidi'eiʃn/	sự bức xạ, sự phát xạ
–	beam of light		/bi:m əv lait/	chùm sáng
–	intense	(adj)	/in'tens/	mạnh, lớn
	intensity	(n)	/in'tensiti/	độ mạnh, cường độ
–	state	(n)	/steit/	trạng thái, tình trạng
–	solid	(adj, n)	/'sɔ lid/	rắn; chất rắn
–	gas	(n)	/gæs/	khí
–	liquid	(adj, n)	/'likwid/	lỏng, chất lỏng
–	to invent	(v)	/in'vent/	phát minh, sáng chế
–	to die	(v)	/dai/	chết
	death	(n)	/deθ/	sự chết, cái chết
	dead	(adj)	/ded/	chết
	deadly	(adv)	/dedli/	một cách chết chóc, khủng khiếp
–	experiment	(n)	/iks'periment/	cuộc thí nghiệm
–	to defend	(v)	/di'fend/	bảo vệ
	defense	(n)	/di'fens/	sự bảo vệ
–	nuclear	(adj)	/'nju:kliə/	hạt nhân
–	missile	(n)	/'misail/	tên lửa
–	to identify	(v)	/ai'dentifai/	nhận biết, nhận dạng
–	target	(n)	/'tɑ :git/	mục tiêu, đích
–	apart from	(adv)		ngoài ra, trừ ra

–	to melt	(v)	/melt/	tan ra, chảy ra
–	precise	(adj)	/pri'sais/	rõ ràng, chính xác
–	accurate	(adj)	/'ækjərət/	chính xác
–	spot welding	(n)		hàn điểm
–	turbine	(n)	/'tə:bain/	tua-bin
–	to align	(v)	/ə'lain/	sắp xếp, ngắm, định hướng
–	ideal	(adj/n)	/ai'diəl/	lý tưởng
–	health	(n)	/helθ/	sức khoẻ
	healthy	(adj)	/'helθi/	khoẻ mạnh, lành mạnh
–	fantastic	(adj)	/fæn'tæstik/	tuyệt vời
–	to treat	(v)	/tri:t/	điều trị
	treatment	(n)	/'tri:tmənt/	sự điều trị, phép trị bệnh
–	granule	(n)	/'grænju:l/	hột nhỏ
–	atom	(n)	/ˈ ætəm/	nguyên tử
–	photon	(n)	/ˈ fəʊ tɒ n/	quang tử
–	ruby crystal	(n)	/ˈ ruː bi/ /ˈ krɪ stəl/	tinh thể hồng ngọc
–	to concentrate	(v)	/ˈ kɒ nsntreɪ t/	tập trung
–	back and forth	(adv)		(di chuyển) qua lại
–	to inject	(v)	/ɪ nˈ dʒ ekt/	phóng ra
–	particle	(n)	/ˈ pɑ ː tɪ kl □/	hạt

Unit 8
CORROSION

Task 1. ***Match the word with its correct meaning.***

1. ☐	compound	a. hình dạng bên ngoài
2. ☐	intervene	b. hợp chất
3. ☐	be exposed to	c. tiếp xúc với
4. ☐	appearance	d. sự suy giảm
5. ☐	domestic applications	e. sự gỉ sét
6. ☐	rusting	f. đồ gia dụng
7. ☐	cross-section	g. màng kết dính
8. ☐	interaction	h. hạn chế
9. ☐	impurity	i. can thiệp
10. ☐	restrain	j. điều kiện ẩm ướt
11. ☐	physical property	k. tiết diện
12. ☐	adherent film	l. sự tương tác
13. ☐	damp condition	m. lý tính
14. ☐	deterioration	n. hợp chất
15. ☐	humidity	o. độ ẩm

Task 2. Reading: ***Skim the following text to identify the paragraph which contains…***

a. Conditions in which corrosion occurs

b. The need to consider corrosion in design

c. A definition of corrosion

d. Factors which limit corrosion

e. Effects of rust

A major consideration in engineering design is maintenance. One of the commonest causes of failure in the long term is corrosion. This is any deterioration in the component's appearance or physical properties.

Corrosion covers a number of processes whereby a metal changes state as a result of some form of interaction with its environment. It often occurs where water, either in liquid or vapour form in air of high humidity, is present.

In general, corrosion becomes worse when impurities are present in damp conditions. It never starts inside a material, and there will always be surface evidence that indicates corrosion exists, although close examination may be needed.

A common example of corrosion is the rusting of steel where a conversion of metallic iron to a mixture of oxides and other compounds occurs. This not only changes the appearance of the metal but also results in a decrease in its cross-section.

It is imperative that a designer should take into account whether a material will be affected in a particular environment and, if corrosion is likely to occur, at what rate.

Many factors can intervene in a way to restrain its progress. A good example is aluminium and its alloys which perform satisfactorily in many engineering and domestic applications when exposed to air and water. This is due to the rapid production of a tough adherent film of oxide which protects the metal from further attack so that corrosion halts.

Task 3. ***Answer these questions in complete sentences.***

1. In corrosion, why do metals change state?
2. Name the factors which encourage corrosion.
3. Where can signs of corrosion be always found?
4. What is rust?
5. Why is rust dangerous to a structure?
6. What must designers consider?
7. Why does aluminium perform well when exposed to air and water?

Language study: ***Cause and Effect***

We can express the relation between cause and effect in a number of ways:

1. Verb and verb phrase:

Cause + verb linking + Effect

Dampness { *causes* / *accounts for* / *results in* / *brings about* / *gives rise to* / *is responsible for* } corrosion.

Effect + verb linking + Cause

Corrosion { *results from* / *arises from* / *is attributable to* / *stems from* } dampness

****Notes:***

to result to/in: to make something happen

to result from: to happen because of something else that happened first

2. Phrases of cause:

Many accidents in mining happen	*due to* *as a consequence of* *because of* *on account of* *owing to*	poor security procedures.

1. The economic crisis happens .....bad management system.
2. The plane crash was ..... poor maintenance activity.
3. The crack appears ..... overloading operation.
4. National production has grown ..... right policy.
5. The machine works perfectly .....proper maintenance.

Task 4. ***Match the correct Cause in column A with the correct Effect in column B. Then write cause-and-effect sentences.***

A	B
1. reduction in cross-section	a. corrosion
2. insulation breakdown	b. bearing failure
3. overtightening	c. excessive heat
4. overloading a circuit	d. shearing in metal
5. carelessness	e. loss of strength
6. impurities	f. shearing in bolts
7. lack of lubrication	g. blown fuses
8. friction	h. short-circuits
9. repeated bending	i. accidents
10. overrunning an electric motor	j. wear and tear in machinery

Now write cause-and-effect sentences. For example:

Loss of strength ***results from*** *reduction in cross-section.*
Carelessness ***brings about*** *accidents.*

Corrosion ..... reduction in cross-section.
Repeated bending ..... shearing in metal.
Overrunning an electric motor .....
..... short-circuits.
..... bearing failure.
Impurities ..... .
.....
.....
.....
.....…

Task 5. ***Choose the correct phrase in each of the followings.***

1. Just-in-time manufacturing methods ***result from*** / ***result in*** a saving on storage costs.

2. The reject rate has fallen ***as a result of*** / ***giving rise*** to quality control.
3. Poor quality materials ***are responsible for*** / ***stem from*** product defects.
4. The machine broke down ***resulted in*** / ***because of*** poor maintenance.
5. Steel was used in the construction ***caused by*** / ***on account of*** its strength.
6. Data was damaged ***as a result of*** / ***giving rise to*** a virus in the system.
7. Transport costs have increased ***accounting for*** / ***due to*** a rise in oil prices.
8. Stopping the use of certain chemical in the process has ***brought about*** / ***arisen from*** a reduction in the number of cases of allergic skin reactions.
9. Most British coal mines have been closed ***because*** / ***on account of*** they have become uneconomic.
10. The regeneration of plants and wildlife in rivers and waterways ***accounts for*** / ***is attributable to*** new legislation to stop pollution by industry.

Translate into Vietnamese

Stainless steel, also known as *inox steel* or *inox* from French "*inoxydable*", is a steel alloy with a minimum of 10.5% chromium content by mass. Stainless steel does not readily corrode, rust or stain with water as ordinary steel does. There are different grades and surface finishes of stainless steel to suit the environment the alloy must endure. Stainless steel is used where both the properties of steel and corrosion resistance are required.

In 1821, the corrosion resistance of iron-chromium alloys was first recognized by French metallurgist Pierre Berthier, who noted their resistance against attack by some acids and suggested their use in cutlery.

In 1872, the Englishmen Clark and Woods patented an alloy that would today be considered stainless steel.

Between 1904 and 1911 several researchers, particularly Leon Guillet of France, produced alloys that would today be considered stainless steel.

Its resistance to corrosion and staining, low maintenance and familiar mineralogy make stainless steel an ideal material for many applications in architecture, bridges, automotive bodies, passenger rail cars, aircraft, jewelry, dentistry, and so on.

Types of stainless steel

Austenitic stainless steels have an austenitic crystalline structure, which is a face-centered cubic crystal structure. Austenite steels make up over 70% of total stainless steel production. They contain a maximum of 0.15% carbon, a minimum of 16% chromium and sufficient nickel and/or manganese.

Ferritic stainless steels generally have better engineering properties than austenitic grades, but have lower corrosion resistance, because of the lower chromium and nickel contents. They are also less expensive. Ferritic stainless steels have a body-centered cubic and contain between 10.5% and 27% chromium with very little nickel. Most compositions include molybdenum; some, aluminium or titanium. Common ferritic grades include 18Cr - 2Mo, 26Cr - 1Mo, 29Cr - 4Mo, and 29Cr - 4Mo - 2Ni.

Martensitic stainless steels are not as corrosion-resistant as the other two classes but are extremely strong and tough, as well as highly machinable, and can be quenched and magnetized. They contains chromium (12–14%), molybdenum (0.2–1%), nickel (less than 2%), and carbon (about 0.1–1%, giving it more hardness but a little bit more brittle).

Duplex stainless steels have a mixed microstructure of austenite and ferrite with ratio of 50/50, although in commercial alloys the ratio may be 40/60. They have roughly twice the strength compared to austenitic stainless steels and also improved resistance to localized corrosion and stress corrosion cracking. They are characterized by high chromium (19–32%) and molybdenum (up to 5%) and lower nickel contents than austenitic stainless steels.

Translate into English

“Thép không rỉ” không có nghĩa là thép không bao giờ rỉ. Quá trình rỉ sét của thép diễn ra lâu hơn gấp nhiều lần thép carbon, thông thường mất nhiều năm trong điều kiện ẩm ướt hoặc oxy hóa mạnh. Việc gia công và hàn cắt thép không rỉ khó khăn hơn nhiều lần thép carbon thông thường do thành phần hợp kim và cơ tính cao của nó.

REVIEW

Choose the best answer for the following sentences.

1. Which one does NOT have the meaning of "corrode"?

A. oxidize B. rust C. stain D. wear

2. "Damp" means:

A. wet B. high humidity C. moist D. All are correct

3. What is the synonym of "take into account?"

A. calculate B. compute C. account D. All are correct

4. "Convert" means:

A. change B. vary C. shift D. All are correct

5. The first discovery of iron-chromium alloy in corrosion resistance was in:

A. 1821 B. 1871 C. 1904 D. 1911

6. Inox steels:

A. easily oxidized B. hardly rust

C. have the same corrosion resistance as ordinary steel

D. are stainable with water

7. Austenitic stainless steels have _____ crystalline structure.

A. face-centered cubic B. body-centered cubic

C. hexagon D. tetragonal

8. Ferritic stainless steels have _____ Cr and Ni contents and _____ corrosion resistance than austenitic grades.

A. lower/higher B. less/lower

C. more/lower D. higher/lower

9. Martensitic stainless steels are not as corrosion-resistant as austenitic and ferritic stainless steels but are more brittle, because _____.

A. the Cr content is equivalent B. the carbon content is higher

C. they are strong and tough D. All are correct

10. Martensitic stainless steels can be **quenched**.

A. heat-hardened B. welded

C. ground D. cut

11. The strength of duplex stainless steels is roughly **twice** the strength of austenitic stainless steels.

A. the same as B. 150%

C. two times D. three times

VOCABULARY

– to corrode	(v)	/kə'roud/	ăn mòn
corrosion	(n)	/kə'rouʒ n/	sự ăn mòn
corrosive	(adj)	/kə'rousiv/	có tính ăn mòn
– to deteriorate	(v)	/di'tiəriərei/	biến chất, xuống cấp
deterioration	(n)	/di,tiəriə'reiʃn/	sự biến chất, xuống cấp
– whereby	(adv)		bởi đó, tại đó
– to cover	(v)	/'kʌ və/	bao trùm
– interaction	(n)	/,intər'ækʃn/	sự tương tác
– humidity	(n)	/hju:'miditi/	sự ẩm ướt, độ ẩm
– impurity	(n)	/im'pjuəriti/	chất bẩn, tạp chất
– damp	(adj)	/'dæmp/	ẩm ướt
– evidence	(n)	/'evidəns/	chứng cớ, bằng chứng
– examination	(n)	/ig,zæmi'neiʃn/	sự kiểm tra
– close	(adj)	/klous/	chặt chẽ, kỹ càng
– to intervene	(v)	/,intə'vi:n/	xen vào, can thiệp
– to restrain	(v)	/ri'strein/	hạn chế, kiềm chế
– progress	(n)	/'prougres/	sự tiến triển
– satisfactorily	(adv)	/,sætis'fæktərəli/	một cách hài lòng, thỏa đáng
– domestic application			ứng dụng trong gia đình
– film of oxide			lớp ô-xít
– to halt	(v)	/hɔ :lt/	dừng, đứng lại
– insulation breakdown		/insju'leiʃn 'breikdaun/	đánh thủng cách điện, chập
– cutlery	(n)	/'kʌ ləri/	dao, nĩa…
– to mean	(v)	/mi:n/	có ý nghĩa, nghĩa là

Unit 9
PLASTIC INJECTION MOLDING

Task 1. ***Warm-up***

1. Have you got anything made of plastic?
2. Why aren't they made of other materials but of plastic?
3. Can you list some characteristics of plastic?

Reading

Materials such as polystyrene, nylon, polypropylene and polythene can be used in a process called injection molding. These are thermoplastics - this means when they are heated and then pressured in a mold, they can be formed into different shapes. Read the following texts to learn about injection molding process and all its components.

Figure 9.1: *Injection molding machine*

Text 1

What is plastic injection molding?

This is the most common method of producing parts made of plastic. The process includes the injecting or forcing heated molten plastic into a mold which is in the form of the part to be made. Upon cooling and solidification, the part is ejected and the process continues.

The injection molding process is capable of producing an infinite variety of part designs containing an equally infinite variety of details such as threads, springs, and hinges, and all in a single molding operation.

Injection molding machine

An injection molding machine has three basic components: the injection unit, the mold, and the clamping system. The injection unit, also called the plasticator, prepares the proper plastic melt and, via the injection unit, transfers the melt into the next component that is the mold. The clamping system closes and opens the mold. These machines all perform certain essential functions such as:

- *Plasticizing*: heating and melting the plastic in the plasticator;
- *Injection*: injecting a controlled-volume shot of melt from the plasticator under pressure into a closed mold, with solidification of the plastics beginning on the mold's cavity wall;
- *Afterfilling*: maintaining the injected material under pressure for a specified time to prevent back flow of melt and to compensate for the decrease in volume of melt during solidification;
- *Cooling*: cooling the thermoplastic molded part or heating the thermoset molded part in the mold until it is sufficiently rigid to be ejected;
- *Molded-part release*: opening the mold, ejecting the part, and closing the mold so it is ready to start the next cycle with a shot of melt.

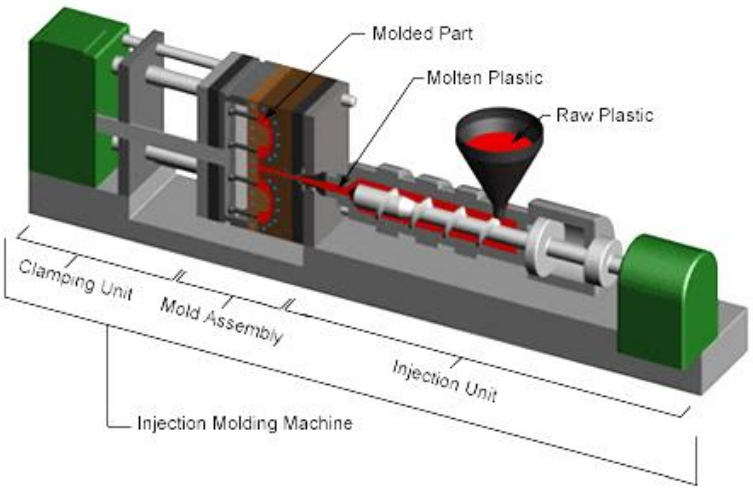


Figure 9.2. *Schematic diagram of an injection molding machine*

Structure study: Complementary phrases with *Past Participle*

(Adv) **Past participle + N**

or **N + Past participle phrase**

Used car *Broken* grass *Damaged* machine

Programmed fuel injection *Controlled* steps *Lost* .....

Discovered ..... *Automated* .....

Newly developed equipment *Carefully checked* parameters

Parts *made of plastic* Parts made of .....

Laws *invented by Einstein* Countries *supported by the USA*

Machine *equipped with* .....

Task 2. *Choose suitable object with each number in Figure 9.3.*

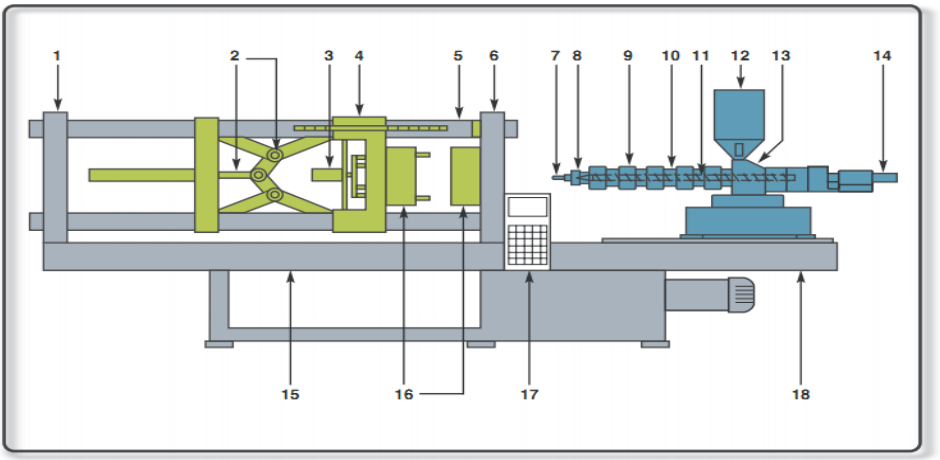


Figure 9.3. *Components of horizontal plastic injection molding machine*

a	Injection barrel (Transfer chamber)	j	Backing plate
b	Barrel head	k	Digital control panel
c	Feed hopper	l	Ejector
d	Movable plate (Floating platen)	m	Feed throat
e	Frame	n	Heater band
f	Mold	o	Nozzle
g	Fixed plate	p	Parts discharge opening
h	Closing mechanism - Toggle lever and cylinder	q	Screw
i	Screw motor	r	Tie bar

Task 3. ***Work in pairs and answer these questions.***

1. What does the clamping system do?
2. What does the mold do?
3. What does the plasticator do?

Task 4. ***Rearrange stages of injection molding process.***

a. A heater heats up the tube and when it reaches a high temperature a screw thread starts turning.

b. Granules of plastic powder are poured or fed into a hopper which stores it until it is needed.

c. The mold then opens and the unit is removed.

d. A motor turns a thread which pushes the granules along the heater section which then melts into liquid. The liquid is forced into a mold where it cools into the shape.

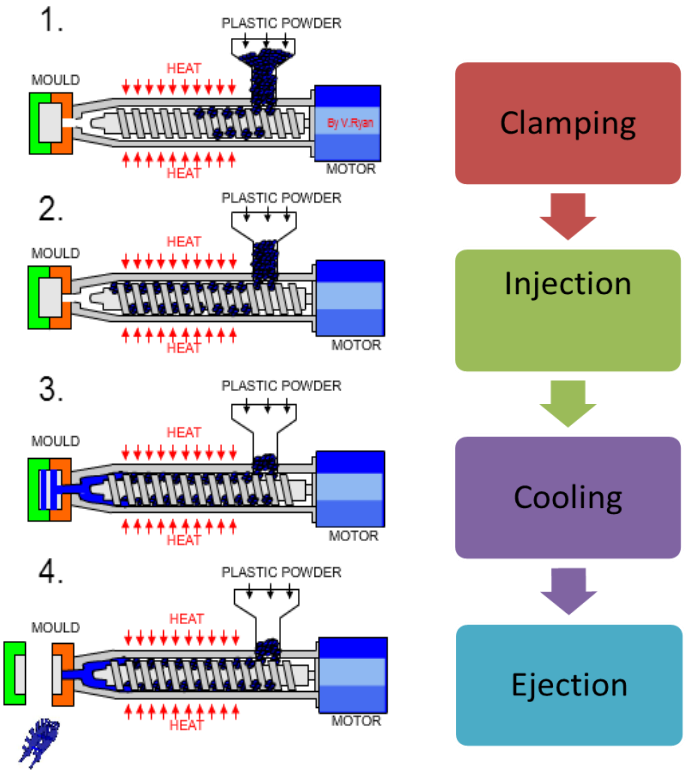


Figure 9.4. *Stages of injection molding process*

Clamping system

The clamping unit is a portion of an injection molding machine in which the mold is mounted on supporting plate and usually guided by four tie-bars. The clamping area is the largest rated molding area the machine can hold closed under full molding pressure. The clamps provide accurately controlled motion and force to close and open the mold. They also hold the mold closed during plastic injection.

Injection unit

There is a barrel, also called a cylinder or a plasticator barrel, which contains a screw or a plunger. Together with a screw, it provides the bearing surface where shear is imparted to the plastic materials. Heating media is housed around it to keep the barrel (and thus the melt) at the desired temperature profile.

Mold

The mold is the space where the plastics are filled, formed and cooled down to make the product. It must be an efficient heat exchanger. The mold is usually made of alloy steel or aluminum. It consists of two halves attached to the plastic injection molding machine; the rear half is movable so that the mold can be opened and closed at the mold's parting line. The mold also consists of a mold core and a mold cavity. A mold can have one cavity or more. A mold cavity is a depression in the mold, the space inside a mold where the plastic forms the product.

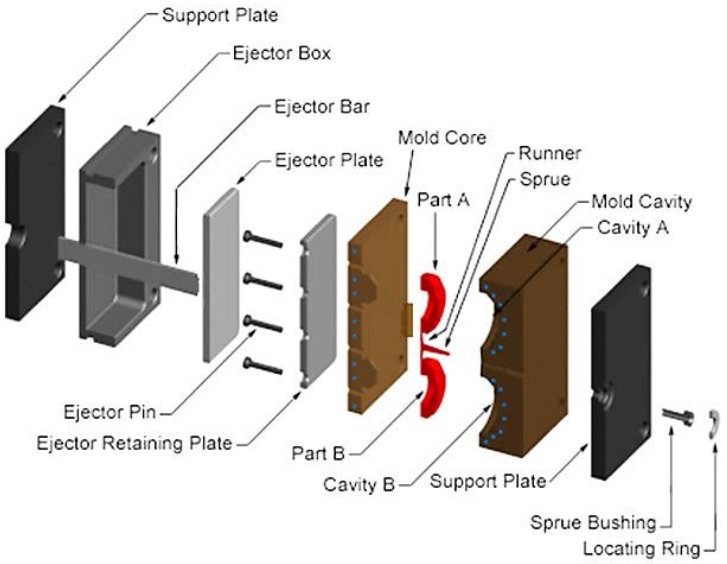
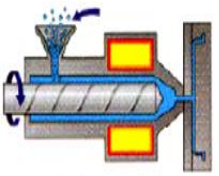


Figure 9.5. *Disassembling parts of a mold*

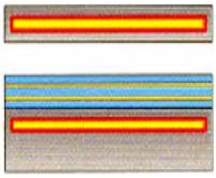
Task 5. ***Answer these questions.***

1. What is the clamping area?
2. How can the injection unit provide melt?
3. Why must a mold be efficiently heat exchanged?
4. How many cavities are there in a mold?

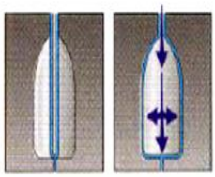
Task 6. ***Put the verbs in brackets in the correct form in the following description of how plastics are shaped.***



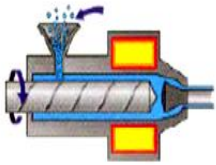
Injection moulding



Laminating



Blow moulding



Tube making - extrusion

There are many ways of shaping plastics. The most common way is by molding. Blow molding (a)_____ (use) to make bottles. In this process air (b)_____ (blow) into a blob of molten plastic inside a hollow mold and the plastic (c)_____ (force) against the side of mold.

Toys and bowls (d)_____ (make) by injection molding. The plastic chips (e)_____ first_____ (heat) until they melt and then forced into a water cooled mold under pressure. This method (f)_____ (suit) to mass production. Laminating (g) _____ (produce) the heat-proof laminate which (h)_____ (use), for example, for work surfaces in kitchens. In this process a kind of sandwich (i)_____ (make) of layers of paper or cloth which (j)_____ (soak) in resin solution. They (k)_____ then _____ (squeeze) together in a heated press. The thermoplastics can (l)_____ (shape) by extrusion. Melted plastic (m)_____ (force) through a shaped hole or die. Fibres for textiles and sheet plastic may (n)_____ (make) by extrusion.

VOCABULARY

– barrel	(n)	/ˈ bærəl/	thùng, bồn chứa
– blow	(v)	/bləʊ /	thổi
– cavity	(n)	/ˈ kævəti/	khoang, lòng khuôn
– clamp	(v)	/klæmp/	kẹp
– core	(n)	/kɔ ː (r)/	lõi
– cylinder	(n)	/ˈ sɪ lɪ ndə(r)/	xi-lanh
– essential	(adj)	/ɪ ˈ senʃ l/	cần thiết, thiết yếu
– extrusion	(n)	/ɪ kˈ struː ʒ n/	sự đẩy ra, sự ấn ra; ép đùn
– feed	(v)	/fiː d/	cung cấp vật liệu, tiến dao
– frame	(n)	/freɪ m/	khung
– granule	(n)	/ˈ g rænjuː l/	hạt nhỏ
– infinite	(adj)	/ˈ ɪ nfɪ nət/	vô tận, vô vàn
– finite	(adj)	/ˈ faɪ naɪ t/	có hạn, hữu hạn
– inject	(v)	/ɪ nˈ dʒ ekt/	tiêm, bơm, phun
– liquid	(n)	/ˈ lɪ kwɪ d/	chất lỏng
– melt	(n)	/melt/	sự nóng chảy, chất nóng chảy
– method	(n)	/ˈ meθəd/	phương pháp
– mold	(n)	/məʊ ld/	khuôn
– molten	(adj)	/ˈ məʊ ltən/	nấu chảy
– nozzle	(n)	/ˈ nɒ zl/	miệng, vòi
– plate	(n)	/pleɪ t/	tấm
– prevent	(v)	/prɪ ˈ vent/	ngăn cản, ngăn chặn
– release	(v)	/rɪ ˈ liː s/	cắt, tháo ra
– runner	(n)	/ˈ rʌ nə(r)/	kênh dẫn
– screw	(n)	/skruː /	vít, vít me
– shape	(n)	/ʃ eɪ p/	hình, hình dạng, hình thù
– solidification	(n)	/səˌ lɪ dɪ fɪ ˈ keɪ ʃ n/	sự rắn lại, sự đông đặc

– sprue (n) /spruː/ cuống phun

– sufficiently (adv) /səˈ fɪ ʃ ntli/ đủ, thích đáng

– toggle (n) /ˈ tɒ g l/ đòn khuỷu

– to assemble (v) /əˈ sembl/ lắp ráp

to disassemble (v) /disəˈ sembl/ tháo ra, rã ra

REVIEW

1. The _____ prepares the proper plastic melt and, via the injection unit, transfers the melt into the next component that is the mold.

A. component B. clamping system

C. plasticator D. hopper

2. _____of the plastic beginning on the mold's cavity wall.

A. Heating B. Solidification

C. Implementation D. Flexibility

3. Pressure is maintained for a specified time to prevent back flow of melt and to compensate for the _____of melt during solidification.

A. decrease in volume B. increase in volume

C. rigid in plastic D. cooling in plastic

4. The _____is the largest rated molding area the machine can hold closed under full molding pressure.

A. clamping force B. clamping area

C. molding area D. molding force

5. Injection unit is a cylinder that contains a _____. Together with _____, it provides the bearing surface where shear is imparted to the plastic materials.

A. plunger/mold B. screw/screw

C. bearing/screw D. mold/mold

6. The clamps provide _____ controlled motion and force to close and open the mold.

A. accurate B. accuracy C. separate D. separately

7. Mold is a complex _____device that must be an efficient heat exchanger.

A. controllable B. programmable

C. modifiable D. differentiate

8. If _____ is not properly handled and maintained, the mold will not operate efficiently.

A. cavity B. clamping unit

C. mold D. heat exchanger

9. _____is the space inside a mold where the plastic forms the product.

A. cavity B. clamping unit

C. mold D. heat exchanger

10. Bottles are made by _____. In this process air is blown into a blob of molten plastic inside a hollow mold and the plastic forces against the side of mold.

A. injection molding B. blow molding

C. extrusion D. production

Translate into Vietnamese

Crude oil is called "black diamond", because variety of items and products surrounding us are made from crude oil. They can be plastic knifes, tables and chairs in homes, electric relays and contactors in hospitals, schools, factories, casing for electric tools, paintings, asphalt in pavement of roads and bridges, and so on. Fuel and gasoline are also produced from crude oil. Nowadays, oil exploitation is considered carefully. Instead, the use of renewable energy such as solar energy and wind power is strongly recommended to save the earth's resources.

Translate into English

Nhựa là một vật liệu tổng hợp làm từ dầu thô, được sử dụng rộng rãi trong dân dụng và trong công nghiệp. Hầu hết các sản phẩm xung quanh ta như chén, đĩa, dao, muỗng, bàn, ghế, đèn… đều được làm từ nhựa. Một số vật liệu kết hợp từ nhựa có tính năng tiên tiến như trọng lượng nhẹ, chịu nước, bền thời gian, bao gồm nhựa-gỗ, nhựa-sợi carbon… đang được nghiên cứu và phát triển.

Unit 10
WELDING TECHNOLOGY

Task 1. ***Warm-up***

Discuss with your friends how many welding methods you know. Make a list and compare with other groups.

Task 2. ***Reading***

Arc welding is a method of joining two metallic pieces or alloy into one solid piece using the heat of an electric arc generated between two electrodes. The metal melts, cools down and finally solidifies into one solid piece.

Figure 10.1

Manual Metal Arc Welding

Manual metal arc (MMA) welding, also known as shielded metal arc welding (SMAW), stick welding, or electric arc welding, which is a constant current drooping arc process. (Figure 10.2)

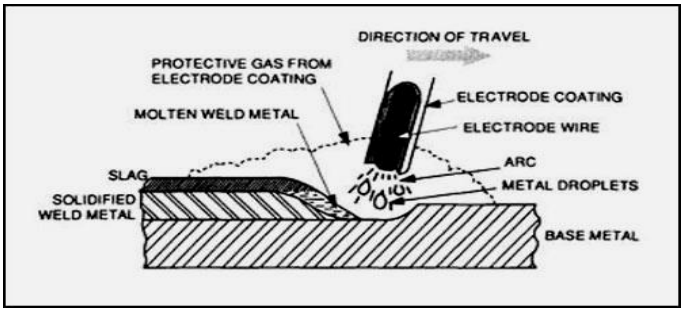


Figure 10.2

In manual metal arc welding the heat source is an electric arc, which is formed between a consumable electrode and the parent plate.

The arc is formed by momentarily touching the tip of the electrode into the plate and then lifting the electrode to give a gap of 3 mm to 6 mm between the tip and the plate. When the electrode touches the plate, current commences to flow and as it is withdrawn, the current continues to flow in the form of a small spark across the gap, which will cause the air in the gap to become ionized, or made conductive. As a result of this, the current continues to flow even when the gap is quite large. The heat generated is sufficient to melt the parent plate and also melt the end of the electrode - the molten metal so formed is transferred as small globules across the arc into the molten pool.

Tungsten Inert Gas Welding

Tungsten inert gas (TIG) welding is a constant current drooping arc process. It is also known as gas tungsten arc welding GTAW, wolfram inert gas (WIG), and under the gas trade names of argon arc and helium arc. (Figure 10.3)

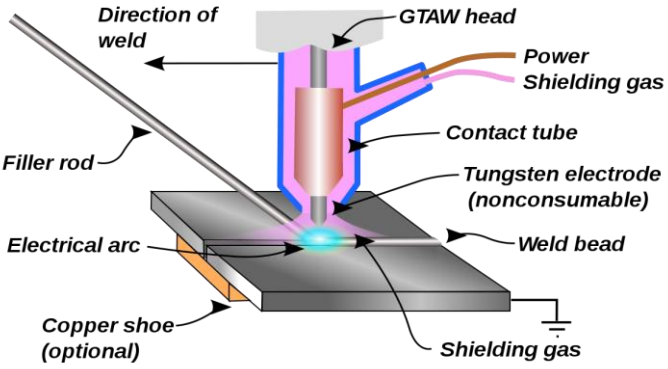


Figure 10.3

An arc is maintained between the end of a tungsten electrode and the work-piece. The electrode is not consumed and the current is controlled by the power source setting. The operator must control the arc length and also add filler metal if needed to obtain the correct weld; consequently, a high degree of skill is needed for the best results. The arc is unstable at low currents.

Metal Inert Gas Welding

Metal Inert Gas (MIG) welding is a 'flat' arc process (constant voltage process). Also known as Metal Active Gas (MAG); CO2; Metal-arc Gas Shielded. MIG can be used on all materials, in all positions, with high productivity and low heat input. There is no CO2 MIG welding with stainless steel. (Figure 10.4)

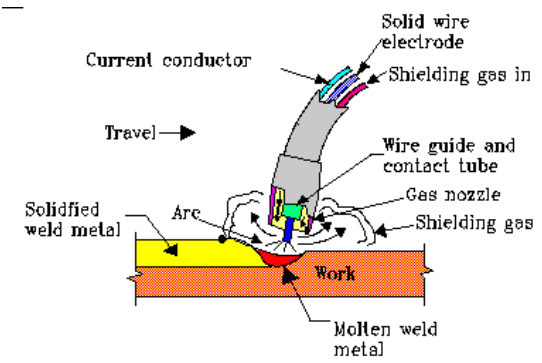


Figure 10.4. *Metal Inert Gas (MIG) Welding*

An arc is maintained between the end of the bare wire electrode and the work piece. The wire is fed at a constant speed, selected to give the required current, and the arc length is controlled by the power source. The operator is not therefore concerned with controlling the arc length and can concentrate on depositing the weld metal in the correct manner. Hence the name 'semi-automatic' for manual operation, in which wire, gas and power are fed to a hand held gun via a flexible conduit.

Nowadays, some modern welding technologies have been developed, including friction stir and rotating welding and ultrasonic welding. In friction welding, the weld is carried out by heat generated during relative movement between two adjoining pieces. In ultrasonic welding, the heat is generated from the mechanical vibration induced by the ultrasonic waves.

Task 3. ***Answer these questions.***

1. Give main ideas of the reading.
2. What is arc welding?
3. Explain the principle of SMAW, MIG/MAG, and TIG.

Task 4. Language Study*: The comparison of adjectives.*

Short adjectives: Most common adjectives are short words (one-syllable adjectives). They form their comparatives and superlatives as shown:

Adjective	Comparative	Superlative
clean	cleaner	cleanest
big	bigger	biggest
strong	stronger	strongest
long	longer	longest

* Notes on **spelling of comparative and superlative forms:**

Short adjectives

- One-syllable adjectives form their comparatives and superlatives like the verb 'clean': ***-er*** and ***-est*** are added (cleaner/cleanest)

- One-syllable adjectives ending with a single consonant after a single vowel. This consonant is doubled. For example: big/bigger/biggest

- One-syllable adjectives ending 'e' like nice or safe. ***-r*** and ***-st*** are added (nicer/nicest; safer/safest)

- Adjectives like dry, ending in -y with a consonant before it. ***-y*** is replaced by ***-i*** before adding ***–er or –est***. (drier/driest)

Long adjectives:

Use **more/less** for comparatives, **the most/the least** for superlatives.

Ex: *This joint is more beautiful than that one*.

This is the most difficult position in welding fabrication.

Structure: Compound noun

Noun + Noun

Class room, nylon gear, polyester resin, water pump, butt joint, lap joint, air conditioner

Task 5. ***Read the paragraph to understand types of welding and types of joints.***

There are welded joints and various positions in which they are arc numerous types welded. Figure 5 shows a variety of these joints as they may appear on welding jobs.

There are four basic welding positions: flat, vertical (V), overhead (OH), horizontal (H). It is possible to weld any type of joint in any of the four positions, but whenever possible joints are placed in the flat position. Welding in the flat position is much faster and easier than any of other positions.

A summary of the basic types of joints and basic types of welds is also shown in figure 5.

In a joint, the adjoining members may contact each other in several ways, as illustrated by the butt, tee, corner, lap and edge joints. These general descriptions of the joint geometry, however, do not define the weld joint configuration, since it can be made in various ways. Thus, a

weld butt joint can be made square, double-square, single-bevel, double-bevel, single-V, double-V, or by four other joint configurations. A T-connection can be made with a double fillet, as shown: or it may be made with a single or double-bevel or single or double J, V and U weld joints are feasible only for butt and corner welds because of the need for the preparation of both surfaces.

1. Types of joints

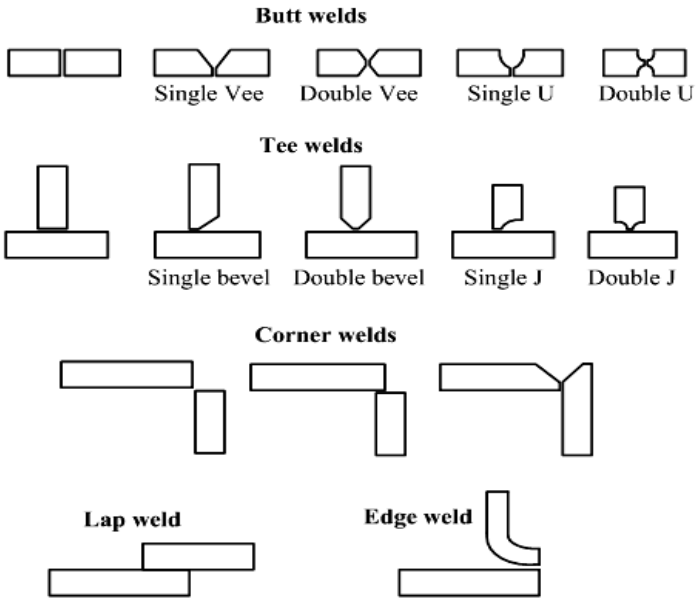


Figure 10.5. *Types of joints*

2. Types of welds

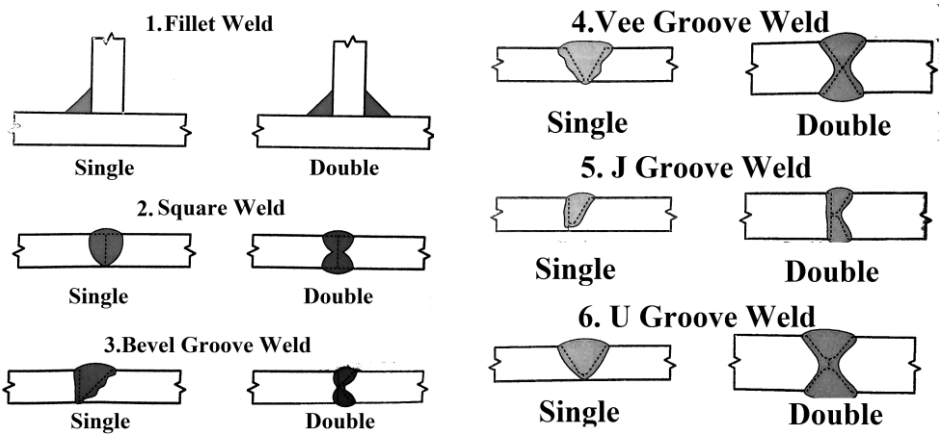


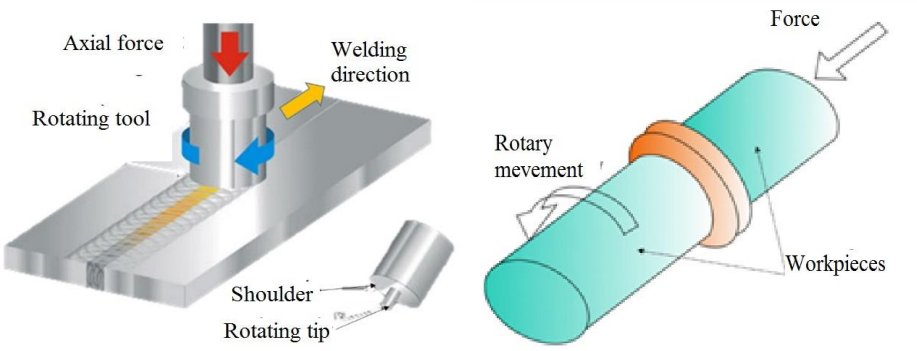
Figure 10.6. *Types of welds*

Translate into Vietnamese

ADVANCED WELDING TECHNIQUES

Advanced welding techniques include friction welding, ultrasonic welding, plasma welding, laser welding, and electronic-beam welding.

Friction welding techniques allow joining two pieces by the heat generating at the contacting areas of the two relatively moving work pieces. They can be friction-stir welding and friction rotating welding as shown in Figs. 10.7 (a) and (b).



(a) (b)

Figure 10.7. Friction-stir welding (a) and friction rotating welding (b)

In laser, plasma and electron-beam welding techniques, power laser, plasma and electron beams, generated between very high-voltage electrodes, are focused down to the work-pieces. The work-pieces melt, fuse and cool down to make a joint.

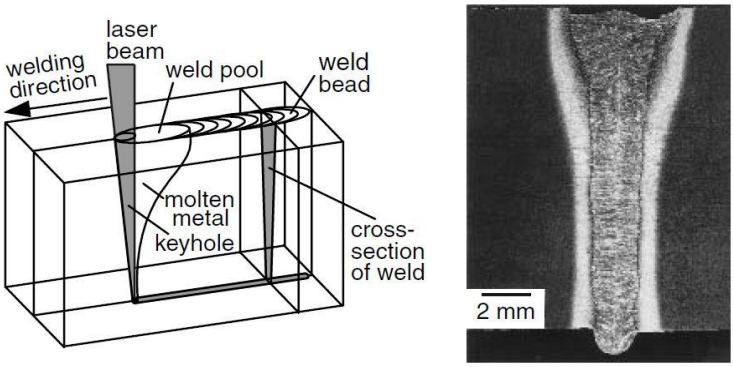


Figure 10.8. *Laser welding*

Ultrasonic welding uses the mechanical vibration to locally heat the material to produce a fusion area between two materials, as shown in Fig.

10.9. This method is effectively applied for such soft materials as clothes, nylon, and even aluminum.

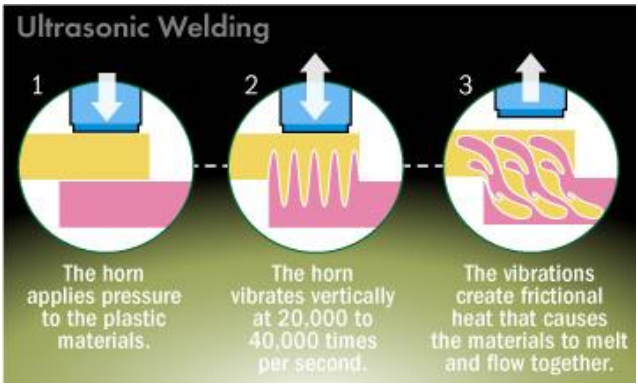


Figure 10.9. *Ultrasonic welding*

Translate into English

Kỹ thuật hàn cho phép kết nối hai phần vật liệu với nhau, bao gồm vật liệu kim loại và vật liệu không kim loại. Đây là kỹ thuật sản xuất không cắt gọt, do đó cho phép tiết kiệm vật liệu. Tuy nhiên, kỹ thuật hàn nóng chảy tạo ra ứng suất hàn lớn và sự biến đổi pha trong vật liệu. Ngày nay, một số kỹ thuật hàn tiên tiến bao gồm hàn laser, hàn siêu âm, hàn bằng tia điện tử và hàn ma sát đã được nghiên cứu và phát triển.

VOCABULARY

- fusion welding technique (n) /fju:ʒən weldɪŋ tek'ni:k/ kỹ thuật hàn nóng chảy
- non-metallic (a) /nɑn mi'tælik/ không kim loại
- arc (n) /ɑ:k/ hồ quang
- joint (n) (v) /ʤɔint/ liên kết hàn
- welding structure (n) /weldɪŋ 'strʌktʃə/ kết cấu hàn
- melt (n) /melt/ sự nung chảy
- clamp (v) /klæmp/ kẹp lại, giữ lại
- circuit (n) /'sə:kit/ mạch điện
- stream (n) /stri:m/ dòng, luồng
- transformer (n) /træns'fɔ:mə/ biến áp

- rectifier (n) /'rektifaiə/ bộ chỉnh lưu
- flat (n) /flæt/ hàn bằng
- vertical (n) /'və:tikəl/ hàn đứng
- overhead (n) /'ouvəhed/ hàn ngửa
- horizontal (n) /hɔri'zɔntl/ hàn ngang
- butt joint (n) /bʌt/ liên kết giáp mối
- corner joint (n) /'kɔ:nə ʤɔint/ liên kết góc
- lap joint (n) /læp/ liên kết chồng
- tee joint (n) /ti:/ liên kết chữ t
- fillet weld (n) /'filit weld/ mối hàn góc
- groove (v) /gru:v/ vát mép
- geometry (n) /ʤi'ɔmitri/ hình học
- configuration (n) /kənfigju'reiʃn/ hình dạng
- weld reinforcement (n) /,ri:in'fɔ:smənt/ độ lồi mối hàn
- weld concavity (n) /kɔn'kæviti/ độ lõm mối hàn
- leg of a fillet weld (n) /leg əv ə 'fɪlɪt weld/ chiều cao mối hàn góc
- inert (adj) /i'nə:t/ trơ
- concentrate (v) /'kɔnsentreit/ tập trung
- gap (n) /gæp/ khe hở
- withdraw (v) /wi 'drɔ:/ rút, hủy bỏ
- globule (n) /'glɔbju:l/ hạt nhỏ, viên nhỏ
- droop (v) /dru:p/ nghiêng xuống, nhỏ giọt xuống
- manner (n) /'mænə/ phương pháp
- weld pool (n) /weld pu:l/ vùng hàn
- shield (n) /ʃi:ld/ lá chắn
- flux (v) /flux/ chảy ra, nóng chảy
- consume (v) /kən'sju:m/ tiêu hao tốn

REVIEW

Choose the most appropriate answer for the following sentences.

1. Arc welding is a method of_____ two pieces of metal into one solid piece.

   A. connecting B. joining C. concerned D. bonding

2. _____welding is a flat arc process (constant voltage process).

   A. SMAW B. Arc C. MIG D. All are correct

3. In major of arc welding, the heat generated is sufficient to melt the parent plate and also melt the end of the _____**.**

   A. electricity B. electrode C. electron D. electric

4. Tungsten inert welding is a constant current drooping arc process. It is also known gas as _____.

   A. MIG B. MAG C. TIG D. All are incorrect

5. The operator must _____ the arc length and also add filler metal if he needs to obtain the correct weld.

   A. controls B. controlled C. controlling D. control

6. Welding in the flat position is much _____ than any of other positions.

   A. better B. faster C. longer D. slower

7. In a joint, the adjoining members may _____ each other in several ways, as illustrated by the butt, corner, lap and edge joints.

   A. contact B. joint C. connect D. All are correct

8. In TIG welding process, an arc is _____ between the end of the bare wire electrode and the work-piece.

   A. maintains B. maintain C. maintained D. maintaining

9. The current have to be controlled because it is _____ at low current.

   A. drop B. unstable C. weak D. stable

10. Four basic welding positions are _____, vertical (V), overhead (OH), horizontal (H).

    A. flat B. upper C. under D. All are incorrect

Unit 11

COMPUTER INTEGRATED MANUFACTURING

Task 1: ***Warm-up***

Look at Fig. 8.1 and answer these following questions.

1. What ways are used to manufacture effectively in the CIM laboratory?
2. Why are computers used?

Figure 11.1. *CIM laboratory*

Task 2. ***Reading***

CIM

Computer-integrated manufacturing (CIM) is the manufacturing approach of using computers to control the entire production process. This integration allows individual processes to exchange information with each other. The advantage of computer integration is making manufacturing process faster with less error-prone. Typically, CIM relies on closed-loop control processes, based on real-time input from sensors. It is also known as flexible design and manufacture.

Definition

The Computer and Automated Systems Association of the Society of Manufacturing Engineers has given the following CIM definition:

CIM is the integration of the total manufacturing enterprise through the use of integrated systems and data communications coupled with new managerial philosophies that improve organizational and personnel efficiency.

Task 3. ***Answer these questions.***

1. What is used to control the entire production process?
2. What does CIM rely on?
3. Where does CIM implement? How does it work?
4. What is another name of CIM?

Text 1 Because CIM concept is very large, so in this lesson we just learn technical aspects of CIM and its components.

Integration

Integration is the key technology of CIM. It has three levels: physical systems, application and business integration. Physical systems integration is concerned with the interconnection to permit interchange data between all devices of CIM system, this is the first integration. Application integration is concerned with the control and integration of applications, permit a system wide access to all relevant information regardless of where the data reside. Business integration is concerned with the integration of those functions that manage, control and monitor business processes.

CAD/CAPP/CAM

CAD/CAPP/CAM stands for Computer Aided Design/ Computer Aided Process Planning/ Computer Aided Manufacturing. CAD/CAPP/CAM subsystem is one of the important factors of CIM system.

- CAD is a process that uses computers to assist in the creation, modification, analysis, or optimization a product design. It refers to the integration of computers into designed activities by providing a close coupling between the designer and the computer.
- CAPP is responsible for detailed plans for the production of a part or an assembly. It acts as a bridge between design and manufacturing.
- CAM is concerned with the preparation of automatic manufacture; including code generation for NC machines, cutting tools, tool

position, tool motion… All these elements must be determined before manufacture.

The integration of CAD/CAPP/CAM is an important way to enhance the product design standards.

Flexibility Manufacturing System (FMS)

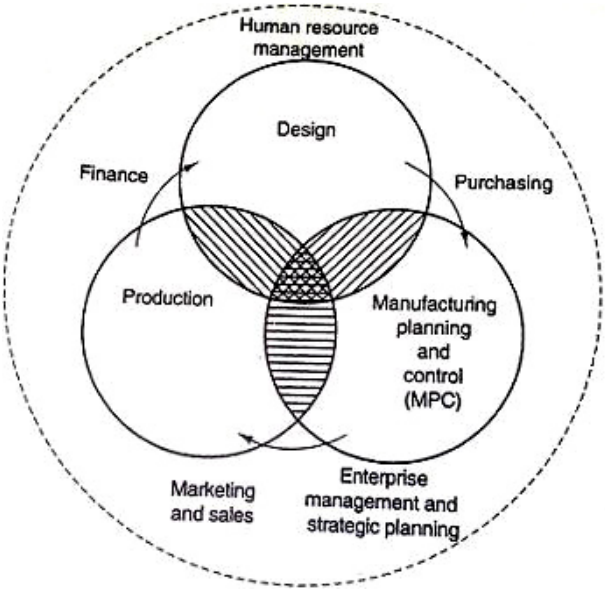
Product flexibility is referred to the ability to change to a new set of products economically and quickly in response to market. It is a very important factor to win the competition. FMS can be defined as "a set of machines in which parts are automatically transported under computer control from machine to machine for processing." In general, FMS can be classified:

- Automated manufacturing devices.
- Automated material handling system.
- Automated tool system.
- Computer control system.

Task 4. ***Match each item in column A with an appropriate item from column B.***

A	B
1. CAPP	a. A set of machines in which parts are automatically transported under computer control from one machine to another for processing.
2. Integration	b. Preparing for automatic manufacture.
3. FMS	c. The ability to change to a new set of products economically and quickly in response to market.
4. Product flexibility	d. One of the important factors of CIM system.
5. CAD	e. The bridge between design and manufacturing.
6. CAM	f. A process that uses computers to assist in the creation, modification, analysis, or optimization a product design.
7.CAD/CAPP/CAM subsystem	**g**. The key technology of CIM.

Task 5. ***Learn Fig. 8.3 and discuss CIM concept.***



Translate into English

Các hệ thống sản xuất có tích hợp máy tính là không thể thiếu được trong nền sản xuất hiện đại. Chúng bao gồm các hoạt động điều tra thị trường, chức năng kinh doanh, thiết kế ý tưởng, thiết kế sản phẩm, lập kế hoạch sản xuất, sản xuất và giám sát sản xuất, tái chế và tái sử dụng. Các hoạt động này được tích hợp với nhau thông qua hệ thống mạng máy tính nhằm trao đổi dữ liệu, chuẩn hóa và lưu trữ dữ liệu. Hệ thống này cũng cho phép việc phát triển sản phẩm mới dễ dàng và linh hoạt.

VOCABULARY

– ability	(n)	/əˈ bɪ ləti/	khả năng, năng lực
– advantage	(n)	/ədˈ vɑ ː ntɪ dʒ /	lợi thế; thúc đẩy
– aid	(v)	/eɪ d/	giúp đỡ
– analysis	(n)	/əˈ næləsɪ s/	sự phân tích
– approach	(n)	/əˈ prəʊ tʃ /	phương pháp

– assembly (n) /əˈ sembli/ hành động hoặc quá trình lắp ráp
– classify (v) /ˈ klæsɪ faɪ / phân loại
– consist of (v) /kənˈ sɪ st/ gồm có
– data (n) /ˈ deɪ tə/ dữ liệu
– detailed (adj) /ˈ diː teɪ ld/ cặn kẽ, tỉ mỉ, nhiều chi tiết
– determined (adj) /dɪ ˈ tɜ ː mɪ nd/ đã được xác định
– efficiency (n) /ɪ ˈ fɪ ʃ nsi/ sự hiệu quả; năng suất
– enterprise (n) /ˈ entəpraɪ z/ doanh nghiệp
– entire (adj) /ɪ nˈ taɪ ə(r)/ toàn bộ
– factor (n) /ˈ fæktə(r)/ yếu tố
– fulfill (v) /fʊ lˈ fɪ l/ hoàn thành, thi hành
– improve (v) /ɪ mˈ pruː v/ cải tiến, cải thiện
– integrate with(v) /ˈ ɪ ntɪ ɡ reɪ t/ kết hợp; tích hợp
– managerial (adj) /mænəˈ dʒ iːrɪ əl/ thuộc về quản lý
– modification(n) /mɒ dɪ fɪ ˈ keɪ ʃ n/ sự biến cải, sự thay đổi
– network (n) /ˈ netwɜ ː k/ mạng lưới
– organizational (adj)/ɔ ː ɡ ənaɪ ˈ zeɪ ʃ ənl/ thuộc về sự tổ chức
– personnel (n) /pɜ ː səˈ nel/ nhân sự
– philosophy (n) /fəˈ lɒ səfi/ học thuyết, triết lý
– production (n) /prəˈ dʌ kʃ n/ sự sản xuất
– transport (v, n) /trænˈ spɔ ː t/ vận tải, chuyên chở

REVIEW

1. CIM is the manufacturing _____ of using computers to control the entire production process.

   A. approach B. way C. method D. All are correct

2. CIM is also known as _____design and manufacture.

   A. flexible B. flexibility C. agility D. agile

3. Integration is the key _____ of CIM. It has three levels: physical systems, application and business integration.

   A. technical B. technology

   C. interconnection D. connection

4. _____is concerned with the interconnection to permit interchange between all devices of CIM system; this is the first integration.

   A. Application integration B. Business integration

   C. Physical systems integration D. All are incorrect

5. _____is a process that uses computers to assist in the creation, modification, analysis, or optimization a product design.

   A. CAPP B. CAM C. FMS D. CAD

6. _____ is a set of machines in which parts are automatically transported under computer control from one machine to another for processing.

   A. CAPP B. CAM C. FMS D. CAD

7. _____ is a very important factor to win the competition.

   A. Product flexibility B. Product economic

   C. Product manufacture D. Product ability

8. Base on _____ of CIM system, there are four functional subsystems.

   A. functions B. information

   C. the technology D. the decomposition

9. CAD has become especially important; it has many benefits such as lower product development costs and a greatly shortened - _____.

   A. design cycle B. product list

   C. product life D. manufacturing time

Unit 12
SPECIAL MACHINING TECHNOLOGY

Task 1. ***Warm-up***

Discuss how many machining methods you know in the mechanical engineering area. Make a list and compare them with other groups.

Task 2. ***Reading***

When people hear the word "machining" they generally think of machines that utilize mechanical energy to remove material from the work piece. Milling machines, saws and lathes are some of the most common machines using mechanical energy to remove material. The tools make contact with the work piece and the resulting shear causes the material to flow over the tool. All traditional forms of metal cutting use shearing stresses as the primary method of material removal. However, there are other sources of energy at work.

Special machining can be thought of as operations that do not use shear as their primary source of energy. For example, abrasive water jet operations use mechanical energy, but material is removed by erosion.

Special machining methods are typically divided into the following categories:

1. Mechanical-Ultrasonic Machining;
2. Electrical-Electrochemical Discharge Grinding, Electrochemical Turning;
3. Thermal- Electrical Discharge Machining, Laser Beam Machining;
4. Chemical-Chemical Milling, Photochemical Machining.

Task 3. ***Answer these questions.***

1. What traditional machining methods are mentioned?
2. In traditional machining methods, how is the material removed?
3. What is the difference between water cutting and other traditional machining?
4. How many types of special machining methods are listed?

Task 4. ***Read the text and try to answer these questions.***

1. What is the cutting tool of water cutting method? How does it work?

2. How is the cutting process improved?

3. What can't material with water cutting method be applied for?

4. What is the most important benefit of water jet cutter?

Water jet cutter is a tool capable of slicing into metal or other materials using a jet of water at high velocity and pressure, or a mixture of water and an abrasive substance. The process is essentially the same as water erosion found in nature but accelerated and concentrated by orders of magnitude. It is often used during fabrication or manufacture of parts for machinery and other devices. It has found applications in a diverse number of industries from mining to aerospace where it is used for operations such as cutting, shaping, carving, and reaming.

The cutter is commonly connected to a high-pressure water pump (a local water main does not supply sufficient pressure) where the water is then ejected out of the nozzle, cutting through the material by bombarding it with the stream of high-speed water. Additives in the form of suspended grit or other abrasives, such as garnet and aluminum oxide, can improve the cutting process. Because the nature of the cutting stream can be easily modified, water jets can be used to cut materials as diverse as fish sticks and titanium. There are few materials that can't be effectively cut with a water jet cutter; one of these is tempered glass which shatters when cut, regardless of the cutting technology used.

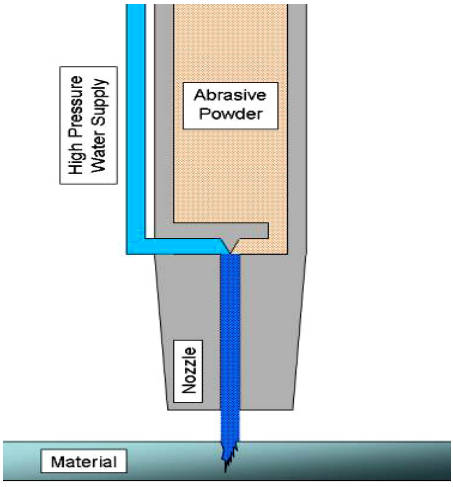


Figure 12.1. *Water jet cutting*

The most important benefit of the water jet cutter is its ability to cut material without interfering with the material's inherent structure as there is no “heat-affected zone” or HAZ. This allows metals to be cut without harming or changing their intrinsic properties.

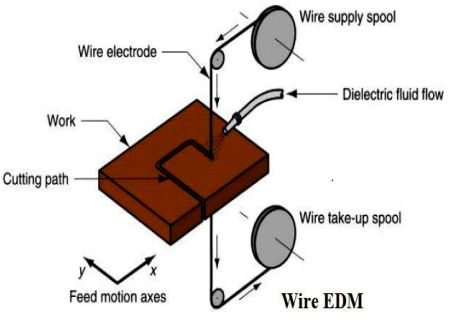
Task 5. ***Read the text and match each item in column A with an appropriate item from column B.***

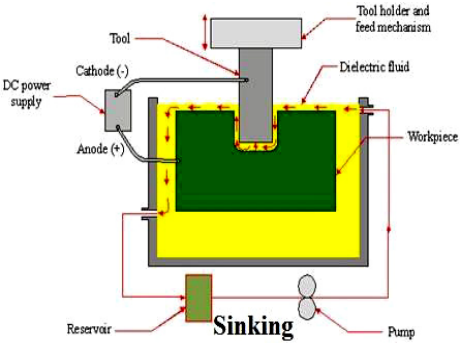
Electrical Discharge Machining, commonly known as EDM, is a process that is used to remove metal through the action of an electrical discharge of short duration and high current density between the tool or electrode and the work-piece. The EDM process can be compared to a miniature version of a lightning bolt striking a surface, creating a localized intense heat, and melting away the work surface.

Electrical discharge machining has proved value and effect in machining of super tough, hard, high strength and temperature resistance of conductive material. These metals would be difficult to be machined by conventional methods.

In drilling hard, tough, high strength and temperature resistance material, people cannot run traditional drilling. Electrical discharge machining (EDM-Drill) is one of the best ways in drilling this kind of material, especially in terms of getting micro-hole. Material is removed by means of rapid and repetitive spark discharge across gap between electrode and work piece.

Nowadays EDM has widely applied in industrial fields, such as applying on dies, molds and manufacturing of tools. Defending on the shape and relative motion of electrode and work-piece can be divided into four types of EDM: Die-sinking, Wire EDM, Milling EDM, ED Grinding.





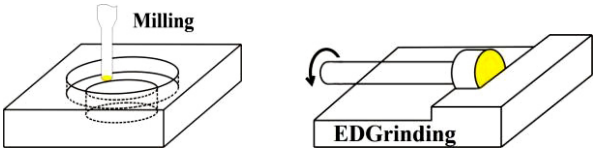


Figure 12.2

In die-sinking EDM, work-piece is engraved with the complementary of shape tool electrode by a shaped tool. In wire EDM, a moving wire which is constantly renewed is used to cut a part through the work-piece. In milling EDM, the desired work-piece shape is machined by using cylindrical and/or simple electrode that traces an NC control path through the work-piece. In EDG, work-piece is machined by rotation electrode.

A	B
1. EDM	a. a moving wire which is constantly renewed is used to cut a part through the work-piece.
2. EDM benefit	b. workpiece is machined by rotation electrode.
3. Die-sinking/ Wire EDM/ Milling EDM/ ED Grinding	c. machining super tough, hard, high strength and temperature resistance of conductive material.
4. Working principle	d. major of applications of EDM.
5. Wire EDM	e. creating a localized intense heat, and melting away the work surface.
6. EDG	f. a process that is used to remove metal through the action of an electrical discharge.

Task 6. ***Read the text below and complete these sentences.***

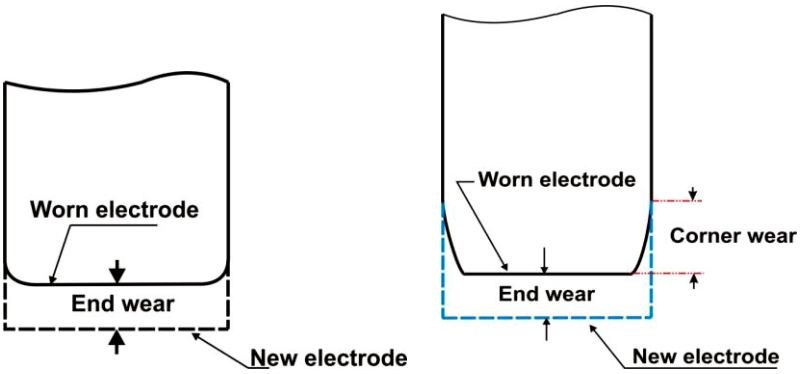
A. Electrode wear was …[1]……. intermittent arc discharges occurring in air between the tool electrode and work-piece.

B. Normally, the electrode wear …[2]…….. two types, end wear and …[3]…….

C. …[4]….. is the ratio of amount of material removed and amount of electrode wear.

D. The end wear volume is usually …[5]…. than the volume of corner wear.

Electrode wear



In electric discharge process, the shape of the electrode is damaged by sparks. This damage is called "electrode wear". The ratio of the amount of machining of the work-piece and the amount of electrode wear is called "electrode wear ratio", and it is important on transcribing the shape of the electrode to the work-piece. Electrode wear ratio changes due to "the combination of electrode and work-piece material", "the polarity of the voltage to apply", "the duration of the spark", and so on. The electrode wear is very important as it affects the precision and the cost of the products. Thus, clearly understanding is a very important thing to control and improve electrode wear; however, it is not easy.

- *End wear*

End wear is the percentage ratio of the amount of electrode material lost from the bottom end of the electrode, to the depth of the cavity burned.

- *Corner wear*

Corner wear is the percentage ratio of the length lost of a 90 degree external corner on the electrode, to the length of the corresponding sharp internal corner produced in the cavity. It should be noted that corner wear is usually significantly greater than end wear, because the corner is being attacked by a multitude of sparks from many directions simultaneously.

Translate into English

Các phương pháp gia công đặc biệt như EDM, gia công bằng tia nước… tập trung vào việc cải thiện chất lượng bề mặt và độ chính xác gia công hơn là năng suất gia công. Các yếu tố này bao gồm độ bóng bề mặt, chiều sâu vùng ảnh hưởng nhiệt, ứng suất bề mặt, dung sai gia công…

VOCABULARY

– roughness	(n)	/ˈ rʌ fnəs/	độ bóng, độ nhám
– utilize	(v)	/ˈ juː tɪ lʌ ɪ z/	sử dụng, tận dụng
– to slice	(v)	/slais/	cắt, xẻ, thái lát, xắt
– workpiece	(n)	/ˈ wəː kpiː s/	chi tiết gia công, phôi gia công
– wear	(n)	/weə/	sự hư mòn, làm mòn
– milling	(n)	/'miliŋ/	sự phay, sự nghiền nhỏ
– lathe	(n)	/leɪ ð/	máy tiện
– shear	(n)	/ʃiə/	sự cắt
– grinding	(n)	/'graindiŋ/	sự mài, sự nghiền
– abrasive	(a, n)	/əˈ breɪ sɪ v/	có tính mài mòn, vật liệu mài mòn
– erosion	(n)	/i'rouʒ ən/	sự xói mòn
– waterjet cutter	(n)	/'wɔ :tə dʒ ɛ t ´kʌ tə/	máy cắt bằng tia nước
– velocity	(n)	/vi'lɔ siti/	tốc độ, vận tốc
– substance	(n)	/'sʌ bstəns/	bản chất, vật chất
– magnitude	(n)	/'mægnitju:d/	độ lớn, kích thước
– fabrication	(n)	/fæbrɪ 'keɪ ʃ ən/	sự chế tạo, sự gia công
– carving	(n)	/'kɑ :viŋ/	bào mòn, chạm trổ
– reaming	(n)	/'ri:miŋ/	sự khoan, sự khoét
– nozzle	(n)	/'nozzəl/	lỗ phun, vòi phun
– bombard	(v)	/bɔ m'ba:d/	bắn phá
– grit	(n)	/grit/	mạt sạn, hạt kim loại
– garnet	(n)	/'ga:nit/	hạt mài bằng ngọc
– shatter	(n)	/ˈ ʃ atə/	mảnh vỡ, mảnh gãy
– miniature	(a)	/'minitʃ ə/	cỡ thu nhỏ
– spark	(n)	/spɑ rk/	tia lửa, tia điện
– die	(n)	/daɪ /	khuôn
– mold	(n)	/moʊ ld/	khuôn đúc

– die-sinking (n) /dʌ ɪ 'siɳ kiɳ/ tạo hình bằng khuôn

– engraved (v) /in'greiv/ chạm, khắc

– ultrasonic machining (n) /'ʌ ltrə'sɔ nik mə'ʃ i:niɳ/

gia công bằng sóng siêu âm

– electrochemical discharge grinding (n) /i'lektrou'kemikl dɪ s'tʃ a:ʤ 'graindiɳ/

mài điện hóa

– electrochemical turning (n) /i'lektrou'kemikl 'tə:niɳ/ sự tiện điện hóa

– laser beam machining (n) /'leizə bi:m mə'ʃ i:niɳ/

gia công bằng chùm tia laser

– photochemical machining (n) /'fouto'kemikl mə'ʃ i:niɳ/ gia công quang hóa

REVIEW

1. Special machining methods can be_____ into four types: Mechanical, Electrical, Thermal, and Chemical.

   A. consist B. included C. concerned D. divided

2. In waterjet cutter, material is _____due to erosion phenomena.

   A. removed B. cut C. tear D. All are correct

3. High-pressure water pump is connected to the - _____

   A. tube B. tool C. cutter D. pipe

4. To improve the cutting process, water is _____ with suspended grit or other abrasives, such as garnet and aluminum oxide.

   A. blended B. mixed C. bonded D. All are incorrect

5. The benefit of waterjet cutter is ability to cut material without - _____ with the material's inherent structure.

   A. affecting B. connecting C. interfering D. impacting

6. EDM is a process that is _____to remove metal by electrical discharge energy.

   A. used B. use C. using D. All are incorrect

7. EDM cannot machining_____ materials.

   A. plastic B. nylon C. acrylic D. All are correct

8. In wire EDM, constantly renewal of a _____ wire is used to cut a part through the work-piece.

   A. rotating B. moving C. oscillating D. linear

9. The advantage of EDM is it can be machining any _____ material.

   A. toughness B. hardness C. conductive D. thermal

10. Electrode wear ratio changes _____ “the combination of electrode and workpiece material”, “the polarity of the voltage to apply”, “the duration of the spark”, and so on.

    A. result B. because C. thus D. due to

Unit 13
APPLYING FOR A JOB

Task 1. ***Warm-up***

1. What sort of engineering job would you like to do in the future?
2. What are you looking forward in your job?
3. How do you get a good job?

Reading

Job description Mechanical Engineer

• Description

Are you a Mechanical Engineer with strong SolidWorks experience?

Do you have a lot of experience with plastic design and New Product Development?

Our client, located in Vista/Carlsbad area, is looking for you to join their successful Engineering team!!!

Mechanical Engineer will be designing parts and assemblies using SolidWorks CAD software, and analyzing part designs using engineering principles, FEA software and the utilization of in-house prototyping methods.

Mechanical Engineer will work as a key member within an engineering team to develop and improve global products for the swimming pool industry.

- Requirements

– Mechanical Engineer must have 10+ years of experience overall, and a very strong plastic design background. New Product Development is a must: from design to production to putting it out on the market, as well as testing design through production.

– Mechanical Engineer must have at least 5 - 7+ years of experience with SolidWorks CAD software.

– Mechanical Engineer should have experience meeting with vendors and suppliers, and working with them to make the best outcome possible.

– Mechanical Engineer is preferred to have working knowledge of plastic gears and bearings, and experience with PDM systems. Also preferred to have strong knowledge of plastics injection molding and tooling, as well as experience with COSMOS FEA software and fluid flow analysis.

– Mechanical Engineer must have great communication and team work skills. Should be able to work with a team, and independently as well.

Volt is an Equal Opportunity Employer.

- Location: Vista, CA
- Type: DIRECT
- Duration: Direct
- Pay Rate:
- Contact:

Volt Workforce Solutions (Southwest Eng)

[Click Here to Email Your Résume]

2401 N. Glassell St.

Orange, CA 92865

PH: 714/921-7460

FX: 714/921-7480

Task 2. ***Answer these questions.***

1. What is the job?
2. What is the required CAD software?
3. List all requirements of the job. What requirements are not related with mechanical knowledge?
4. What does the engineer do in the job?
5. How is experience required?

Task 3. ***Fiona Weaver decides to apply for a vacancy. Study her CV below. Answer these questions.***

1. What is her highest educational qualification?
2. Why do you think the education and experience sections of her CV start with the most recent events?
3. Why does she give two references?
4. Why has she chosen these people to be her referees?
5. Why does she include her interests and activities?

CURRICULUM VITAE

Personal details

Name: Fiona Weaver

Date of birth: 7 April, 1974

Address: 6 Haymarket, Newcastle, NC1 4YU

Marital status: Single

Objective: Electrical Technician

Education and qualifications

1991 – 1995: Faraday college of Further Education, Newcastle

National Certificate in Electrical and Electronic Engineering (day release from S & T (UK) Ltd)

1985 – 1990: George Stephenson Secondary School, Newcastle

I hold a clean driving license. I have been driving for three years.

Working experience

1995 to present:	Inspection Technician Sturner & Thomson (UK) Ltd Responsible for checking incoming components and completed products using a wide range of test equipment including computer-based record systems.
1991 – 1995:	Apprentice electrical technician Sturner & Thomson (UK) Ltd
1990 – 1991:	Office Junior Brent & Wicker, Solicitors Basic secretarial duties – filling, word processing, telephone receptionist, in a busy lawyer's office

Interests and Activities

Travel, modern dance, swimming

References

College:	Work:
Mr. Andrew Wood	Mrs. Joy Milne
Head of Department	Personnel Officer
Electrical Engineering	S & T (UK) Ltd
Faraday College	North Street
Cornwallis Road	NEWCASTLE NC14 7TL
	NEWCASTLE NC2 3PL

Task 4. ***How many parts are there in a CV/résumé?***

Task 5. ***Fill in the gaps below to know how to organize your CV.***

Write three parts for your CV

Beginning: provide personal data and _____.

Middle: List your _____, _____, _____and _____ in the appropriate way.

Ending: Either list the names and details for your _____ or indicate that _____are available upon request.

Task 6. ***Write your own CV.***

Note the followings:

- There is no need to give your gender, date of birth or marital status.
- Two sides are the maximum that most employers want to read.
- Details should be relevant to a particular job you are applying for.
- Avoid clichéd claims such as 'team worker' or 'self-starter'.
- Information such as education details is normally presented in reverse chronological order (i.e. the most recent comes first).
- Details of your early education or hobbies are probably irrelevant to the post.

Task 7. ***Here is an application letter. What information does it add to the CV above?***

(a) 6 Haymarket

Newcastle

NC1 4YU

(b) 15 December, 2015

(c) Miss Denise Dickens

Personnel Department

Administrative Block A

Castleton Airport

Castleton CS21 3SL

(d) Dear Miss Dickens,

(e) Re: Engineering Technicians

(f) I would like to apply for the post of Engineering Technician as advertised in today's issue of the Tribute. I enclose my CV with the names of two referees.

(g) You will note from my CV that I have a National Certificate in Electrical and Electronic Engineering and considerable experience. My work at S&T (UK) means that I am familiar with HVAC plant and systems including electronic system control. As an inspection technician, I have

experience of a wide range of systems for product testing and component evaluation.

(h) I enjoy my work at S&T but would like now to broaden my experience, especially in the area of maintenance. I feel that I can bring considerable skills to the post together with the ability to work well in a team. I am also interested in further improving my qualifications by studying for an HNC, part-time.

(i) I look forward to hearing from you.

(j) Yours sincerely,

Fiona Weaver

Task 7.1. Label parts of a formal business letter with the letters a-j.

( ) Date	( ) Address of recipient
( ) Ending	( ) Address of sender
( ) Request for response	( ) Reason for writing
( ) Greeting	( ) Further details
( ) Signature	( ) Describing qualifications

Task 7.2. Use the job description of task 1 to write an application letter.

Task 7.3. Write your own application letter.

Note the following points:

(a) The example above is addressed to a known individual so the ending is 'Yours sincerely'. However, when you write to a person whose name you do not know, you will use 'Dear Sir/Madam' and 'Yours faithfully'.

(b) A formal letter generally uses the family name in the greeting (Dear Ms. Tan). Certain organisations may, however, use first name with family name or even first name alone (Dear Jane Tan, Dear Jane).

(c) If the sender includes a reference, it is helpful to quote it in your reply.

FURTHER PRACTICE

Based on the following recruitment information, write a cover letter and a CV to apply for this job:

MECHANICAL ENGINEERS

- Vina Kraft Paper Co., Ltd
- NE8 Street, D-6A-CN, My Phuoc 3 Industrial Park, Ben Cat town, Binh Duong province, Vietnam
- Salary: Negotiable

MECHANICAL ENGINEERS

Vina Kraft Paper Co., Ltd

Job descriptions

- To modify production processes.
- To participate in expansion projects.
- To implement systems of TPM, ISO, Kaizen, etc.
- To supervise contractors' jobs.
- Other tasks are assigned by the superior.

Experience / Skills

- Bachelor degree in Mechanical Engineering.
- GPA at least 7.0 or equivalent.
- Fluent in English communication.

Job descriptions

- Ngành nghề việc làm:
  - Kỹ thuật ứng dụng/ Cơ khí
  - Sản xuất/ Vận hành sản xuất
- Cấp bậc: Kỹ thuật viên/ Kỹ sư
- Nơi làm việc:
  - Bình Dương
- Trình độ học vấn: Kỹ sư
- Mức kinh nghiệm: 1 - 2 năm kinh nghiệm
- Loại công việc: Toàn thời gian cố định
- Tuổi: 22 - 28
- Giới tính: Nam

Thông tin liên hệ

- Cách liên hệ: Nộp trực tuyến, gửi kèm file, hoặc trực tiếp
- Mô tả:

Please send your application online, by email or directly to:

- Contact: HR Officer (Recruitment & Training)
- Add: NE8 Street, D-6A-CN, My Phuoc 3 Industrial Park, Ben Cat town, Binh Duong province, Vietnam

***** Nhận hồ sơ ứng viên bằng Tiếng Anh***

Deadline: June 06, 2015

(http://www.careerlink.vn/tim-viec-lam/mechanical-engineers/680238)

VOCABULARY

–	province	(n)	/ˈ provɪ ns/	tỉnh
–	prefecture	(n)	/ˈ pri:fektjʊ ə/	quận, huyện, tỉnh
–	district	(n)	/dɪ sˈ trɪ kt/	quận
–	county	(n)	/ˈ kaʊ nti/	hạt, quận (*Anh*: đơn vị tỉnh lớn nhất, *Mỹ*: khu, huyện)
–	ward	(n)	/wɔ :d/	phường, xã
–	accompany	(v)	/əˈ kʌ mpəni/	đính kèm
–	analysis	(n)	/əˈ næləsɪ s/	sự phân tích
–	analyze	(v)	/ˈ ænəlaɪ z/	phân tích
–	applicant	(n)	/ˈ æplɪ kənt/	người nộp đơn, ứng viên
–	apprentice	(n)	/əˈ prentɪ s/	người tập sự
–	client	(n)	/ˈ klaɪ ənt/	khách hàng
–	considerable	(adj)	/kənˈ sɪ dərəbl/	quan trọng, đáng quan tâm
–	convenience	(n)	/kənˈ vi: niəns/	sự tiện lợi, thuận lợi
–	curriculum vitae	(n)	/kəˈ rɪ kjʊ ləmˈ vi: taɪ /	bản lý lịch
–	department	(n)	/dɪ ˈ pɑ : tmənt/	bộ phận, phòng
–	description	(n)	/dɪ ˈ skrɪ pʃ n/	mô tả
–	enclose	(v)	/ɪ nˈ kləʊ z/	gửi kèm theo
–	evaluation	(n)	/ɪ vælju ˈ eɪ ʃ n/	sự đánh giá
–	experience	(n)	/ɪ kˈ spɪ əriəns/	kinh nghiệm
–	familiar with	(adj)	/fəˈ mɪ liə(r)/	quen thuộc,
–	independently	(adv)	/ɪ ndɪ ˈ pendəntli/	không phụ thuộc, độc lập
–	inspection	(n)	/ɪ nˈ spekʃ n/	sự kiểm tra
–	license	(n)	/ˈ laɪ sns/	giấy phép
–	locate	(v)	/ləʊ ˈ keɪ t/	xác định vị trí
–	outcome	(n)	/ˈ aʊ tkʌ m/	kết quả

– principle (n) /ˈ prɪ nsəpl/ nguyên tắc, nguyên lý
– prototype (n) /ˈ prəʊ tətaɪ p/ nguyên mẫu
– qualification (n) /kwɒ lɪ fɪ ˈ keɪ ʃ n/ bằng cấp
– recipient (n) /rɪ ˈ sɪ piənt/ người nhận
– referee (v) /refəˈ riː / phân xử
– reference (n) /ˈ refrəns/ tham khảo
– requirement (n) /rɪ ˈ kwaɪ əmənt/ yêu cầu, đòi hỏi
– response (n) /rɪ ˈ spɒ ns/ đáp ứng
– software (n) /ˈ sɒ ftweə(r)/ phần mềm
– vendor (n) /ˈ vendə(r)/ người bán hàng

TÀI LIỆU THAM KHẢO

[1] Oxford English for Mechanical and Electrical Engineering, Eric Glendinning and Norman Glendinning, 2006.

[2] Oxford Advanced Learner's Dictionary, A.S. Horby, Oxford University Press, 8th Edition, 2010.

[3] Illustrated Oxford Dictionary, Oxford University Press, 2nd Edition, 2003.

[4] Raymond Murphy, English Grammar in Use, Cambridge University Press, 4th Edition, 2014.

[5] Lê Chí Cương, Lê Văn Ninh, Từ điển Anh Việt Kỹ thuật Cơ Khí-Luyện Kim, NXB Đại học Quốc gia TP HCM, 2013.

[6] Từ điển Kỹ thuật Tổng hợp Anh-Việt, NXB Khoa học và Kỹ thuật, Hà Nội, 1991.

[7] Từ điển Công nghệ Cơ khí-Luyện kim Anh-Việt, NXB Khoa học và Kỹ thuật Hà nội, 2007.

[8] Từ điển Anh-Việt, NXB Khoa học Xã hội, 2010.

[9] Từ điển Luyện kim Anh-Việt, NXB Khoa học và Kỹ thuật, 1978.

[10] http://en.wikipedia.org/wiki/Main_Page

[11] www.vdict.com

GIÁO TRÌNH ANH VĂN CHUYÊN NGÀNH CƠ KHÍ (ENGLISH FOR MECHANICAL ENGINEERING)

LÊ CHÍ CƯỜNG
TRẦN VĂN CHỌN
NGUYỄN TRUNG HIẾU
NGUYỄN VĂN MINH

NHÀ XUẤT BẢN
ĐẠI HỌC QUỐC GIA THÀNH PHỐ HỒ CHÍ MINH
Khu phố 6, Phường Linh Trung, Quận Thủ Đức, TP Hồ Chí Minh
Dãy C, số 10-12 Đinh Tiên Hoàng, Phường Bến Nghé, Quận 1, TP Hồ Chí Minh
ĐT: 08 6272 6361 – 08 6272 6390
E-mail: vnuhp@vnuhcm.edu.vn

PHÒNG PHÁT HÀNH
Dãy C, số 10-12 Đinh Tiên Hoàng, Phường Bến Nghé, Quận 1, TP Hồ Chí Minh
ĐT: 08 6272 6361 – 08 6272 6390
Website: www.nxbdhqghcm.edu.vn

TRUNG TÂM SÁCH ĐẠI HỌC
Tầng hầm, Dãy C, số 10-12 Đinh Tiên Hoàng, Phường Bến Nghé, Quận 1,TP Hồ Chí Minh
ĐT: 08 6272 6350 - 0942810361
Website: www.sachdaihoc.edu.vn

Chịu trách nhiệm xuất bản
NGUYỄN HOÀNG DŨNG

Xuất bản năm 2016

Chịu trách nhiệm nội dung
NGUYỄN HOÀNG DŨNG

Tổ chức bản thảo và chịu trách nhiệm về tác quyền
TRƯỜNG ĐẠI HỌC SƯ PHẠM KỸ THUẬT TP HCM

Biên tập
PHẠM THỊ ANH TÚ

Sửa bản in
CHÂU LOAN

Số lượng 300 cuốn,
Khổ 16 x 24 cm,
ĐKKHXB số: 2376-2016/CXBIPH/03-149/ĐHQGTPHCM,
Quyết định XB số 291/QĐ của NXB ĐHQG-HCM cấp ngày 03-11-2016
In tại: Công ty TNHH In & Bao bì Hưng Phú
Đ/c: 162A/1 - KP1A - P.An Phú - TX Thuận An - Bình Dương
Nộp lưu chiểu: Quý IV/2016

Trình bày bìa
TRƯỜNG ĐẠI HỌC SƯ PHẠM KỸ THUẬT TP HCM

ISBN: 978 – 604 – 73 – 4468 – 0

ISBN: 978-604-73-4468-0
9 NXB ĐHQG-HCM 786047 344680

GIÁO TRÌNH ANH VĂN CHUYÊN NGÀNH CƠ KHÍ (ENGLISH FOR MECHANICAL ENGINEERING)

LÊ CHÍ CƯỜNG
TRẦN VĂN CHỌN
NGUYỄN TRUNG HIẾU
NGUYỄN VĂN MINH

ISBN: 978-604-73-4468-0