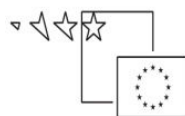




REPUBLIKA SLOVENIJA
MINISTRSTVO ZA ŠOLSTVO IN ŠPORT



Naložba v vašo prihodnost
OPERACIJO DELNO FINANCIRA EVROPSKA UNIJA
Evropski socialni sklad

STROKOVNA TERMINOLOGIJA V ANGLEŠČINI ZA STROJNIKE

ENGINEERING YOUR FUTURE

NIKA ZALAZNIK

Višješolski strokovni program: Strojništvo
Učbenik: Strokovna terminologija v angleščini za strojnike - Engineering Your Future
Gradivo za 1. letnik

Avtorica:

Nika Zalaznik, prof. slov.
Izobraževalni zavod Hera
Višja strokovna šola



Strokovna recenzentka:
mag. Bernarda Kosel, prof. angl. in fran.

Lektor:
Chris Bishop, BEd (Hons)

CIP - Kataložni zapis o publikaciji
Narodna in univerzitetna knjižnica, Ljubljana

811.111'373.46:621(075.8)(0.034.2)

ZALAZNIK, Nika

Strokovna terminologija v angleščini za strojnike [Elektronski vir] : engineering your future : gradivo za 1. letnik / Nika Zalaznik. - El. knjiga. - Ljubljana : Zavod IRC, 2009. - (Višješolski strokovni program Strojništvo / Zavod IRC)

Način dostopa (URL): http://www.zavod-irc.si/docs/Skriti_dokumenti/Strokovna_terminologija_v_angleščini_za_strojnike-Zalaznik.pdf. - Projekt Impletum

ISBN 978-961-6824-47-7
251899392

Izdajatelj: Konzorcij višjih strokovnih šol za izvedbo projekta IMPLETUM
Založnik: Zavod IRC, Ljubljana.
Ljubljana, 2009

Strokovni svet RS za poklicno in strokovno izobraževanje je na svoji 124. seji dne 9. 7. 2010 na podlagi 26. člena Zakona o organizaciji in financiranju vzgoje in izobraževanja (Ur. l. RS, št. 16/07-ZOFVI-UPB5, 36/08 in 58/09) sprejel sklep št. 01301-4/2010/11 -2 o potrditvi tega učbenika za uporabo v višješolskem izobraževanju.

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Gradivo je sofinancirano iz sredstev projekta Impletum 'Uvajanje novih izobraževalnih programov na področju višjega strokovnega izobraževanja v obdobju 2008-11'.

Projekt oz. operacijo delno financira Evropska unija iz Evropskega socialnega sklada ter Ministrstvo RS za šolstvo in šport. Operacija se izvaja v okviru Operativnega programa razvoja človeških virov za obdobje 2007-2013, razvojne prioritete 'Razvoj človeških virov in vseživljenjskega učenja' in prednostne usmeritve 'Izboljšanje kakovosti in učinkovitosti sistemov izobraževanja in usposabljanja'.

Vsebina tega dokumenta v nobenem primeru ne odraža mnenja Evropske unije. Odgovornost za vsebino dokumenta nosi avtor.

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PREDGOVOR

Večina sodobne strojniške literature je v angleščini. Znanje angleščine, s katerim prihaja v višje šole večina študentov, pokriva splošne komunikacijske potrebe. Nemogoče je pričakovati, da bi na tej stopnji usvojili tudi vso strokovno terminologijo danes tako razvejanih študijskih programov. Vrzal na tem področju naj izpolni učbenik za študente strojništva na višješolski ravni »Engineering Your Future«.

Tematski in jezikovni koncept je prilagojen osnovnemu študiju strojništva in sicer v dveh pogledih:

Strokovna angleščina je zelo svojska in tako bogata, da bi celota predmetov študija strojništva dosegla za ta učbenik nesprejemljiv obseg. Tu vključenih dvanajst poglavij pokriva splošne potrebe strojniškega študija.

Jezik kot stroka ni sam sebi v namen. Tu je funkcionalno povezan s strojno stroko in vključuje tiste glavne termine tehniških disciplin, ki so v strojništvu potrebni in so del študijskega programa. V učbeniku je zato zelo malo jezikovne teorije, večina besedil in vaj pa je izbrana z namenom razumevanja in uporabe strokovnega jezika. Cilj pri delu z besedili je postavljen tako, da študente postopno vodi k razumevanju strokovnega angleškega besedila, potem pa k osvajanju osnovnih oblik prenosa informacij v tehničnem registru: deskripcija (opis procesa), dajanje navodil in iskanje informacij (postavljanje vprašanj).

Upam, da bo učbenik v pomoč in spodbudo.

Ljubljana, oktober 2009

Avtorica

MECHANICAL ENGINEERING: What is it all about?

Mechanical Engineering is an exciting subject. As a mechanical engineer you can help solve some of the world's most pressing issues. Energy and health engineering are just two examples from a long list of challenges facing our society.

Mechanical Engineering is about design, analysis and simulation techniques to realize ideas and dreams - **how to create and realize next generation products and organizations.**



Fig. 1: http://soe.stanford.edu/me/experience_me.html (online). 13. 9. 2009

1 GENERAL ENGINEERING

The first unit will give you some information about engineering in general. Notice how GE is divided into different branches, equipments and processes. You will also start building your own engineering-related vocabulary.

Engineering is the **practical application of science** and math to **solve problems**, and it is everywhere in the world around you. From the start to the end **of each day**, engineering technologies improve the ways in which we communicate, work, travel, stay healthy, and entertain ourselves.

The word *engineering* comes from the Latin word *ingeniare*, which means *to design* or *to create*. The field of engineering includes a wide variety of activities. For example, engineering projects range from the construction of huge dams to the design of tiny electronic circuits.

Engineering is based principally on **physics, chemistry and mathematics**, and their extensions into **materials science**, solid and fluid mechanics, thermodynamics and rate processes and systems analysis. Engineering as a profession involves different tasks. It can refer to engines, machine tools and machine parts.

Do you agree with the following statements:

1. Engineering as a profession puts scientific knowledge to practical use.
2. Engineering is the process of inventing, creating and building the world around us.

Different branches of engineering require different *equipment* and are based on different *processes*.

Branches of engineering

The following words/ phrases are followed by “engineering”

chemical	⊕	civil	⊕	electrical	⊕	electronic
highway	⊕	industrial	⊕	mechanical	⊕	mining
petroleum production			⊕	production	⊕	structural

Equipment in engineering

boiler	⊕	crane	⊕	gas engine	⊕	machine tool	⊕
pump	⊕	turbine	⊕	electrical motor			

Processes in treating metals

anneal	⊕	electroplate	⊕	forge	⊕	found	⊕	galvanize
grind	⊕	harden	⊕	soften	⊕	roll	⊕	temper

Non-conventional processes in material processing

plasma-jet machining	⊕	ultrasonic machining	⊕
chemical etchin	⊕	laser machining	

Notice:

- ❖ adjective endings
 - al: chemical, mechanical, structural
 - ial: industrial
 - ic: electronic, hydraulic
- ❖ verb endings
 - en: harden, soften
 - ize(-ise, BrE): anodize, galvanize
- ❖ noun endings (gerunds)
 - ing: machining, broaching

Language focus:	Word forms
------------------------	-------------------

When you are reading, you will come across unknown words. It is always possible to guess the meaning of these words if you understand the way words in English are generally formed. Forming new words is a process which cannot be learned entirely by heart; a good (technical) dictionary may be of great help. Practice can help as well.

An *ending* is what is attached to the root of the word, and it can change the word from one part of speech to another. For example, *-ly* added to the adjective “quick” gives the adverb “quickly”.

First study this chart, then read the text below and complete the table.

VERB (action)	NOUN (thing)	ADJECTIVE (describes noun)	ADVERB (describes verb)
to rise	a rise	sharp	sharply
to fall	a fall	slight	slightly
to increase	an increase	steady	steadily
to decrease	a decrease	dramatic	dramatically

1.1 THE FIELD OF ENGINEERING

Practice makes perfect. **Review of endings**

Read the following paragraph and as you read it, underline the endings and complete the table below.

The field of engineering has been constantly developing to ensure industrial and economic growth. An increasing number of engineers are needed to widen the technological basis especially where new technologies are concerned. There are four types of engineering.

Mechanical engineering is involved in design, development and creation of products, and maintenance of components that support the system and the structure of modern life. It also combines the latest technology such as automation industry, advanced manufacturing system, computer integrated manufacturing, condition monitoring and maintenance management.

Civil engineering solves many complex problems. It plays an important part in the construction of buildings and houses. It involves planning, design, construction, building and maintenance of bridges, harbors, dams, electrical substations, highways, railways, airports, water supply and distribution, waste water management, flood and landslides mitigation, etc.

Electronic and telecommunication engineering applies to the usage of the latest components of Information Technology and electronic gadgets. This engineering concentrates on the connection between electronic and telecommunication. The technology of electronic and telecommunication engineering is very useful

Computer technology affects many areas of our lives and is not only about the controls and operations of computer hardware and software. The engineering related to computer technology combines the study of computerisation, telecommunications and electronics technologies. Today, the usage of the computer is most important for people working in the office or at home.

Noun	Adjective	Adverb	Verb
constancy	constant	constant ~~ly~~	-----
electronics	electron ~~ic~~	electronical ~~ly~~	-----
design	design ~~ing~~	designing ~~ly~~	design

Language study: deals with/is concerned with

Mechanical engineering **deals with** machines.

Mechanical engineers **deal with** machines.

Mechanical engineering **is concerned with** machines.

Mechanical engineers **are concerned with** machines.

Machines **are the concern of** mechanical engineers.

Task – make sentences to show similar links:

A

Electrical engineering

B

electricity

1.2 DIFFERENT AREAS OF MECHANICAL ENGINEERING

Read the text first, and then find matches in the table.

Transport:

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

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 are products made by mechanical and electrical engineers in cooperation with medical experts who convert ideas into life-saving and life-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, schools, and the installation and maintenance of the equipment involved in these processes.

Match each item in column A with an appropriate item in column B and link the two into a sentence.

A	B
1. marine	a. air-conditioning
2. aeronautical	b. roads and bridges
3. heating and ventilating	c. body scanners
4. electricity generating	d. cables and switchgear
5. automobile	e. communications and equipment
6. civil	f. ships
7. electronic	g. planes
8. electrical installation	h. cars and trucks
9. medical	i. power stations

1.3 COMMON VERBS IN ENGINEERING

Study this list of common verbs in engineering. They all have the sense of “make something happen”.

lower	make low
raise	make high
heat	make hot
release	make free
compress	make smaller volume
reduce	make smaller
increase	make larger

Practice ^{makes perfect}: Fill in the blanks in these sentences with suitable verbs from the list above.

- 1 When thermoplastics are heated they soften.
- 2 If a gas is _____, it heats up.
- 3 Refrigeration preserves food by _____ its temperature.
- 4 A heater _____ the temperature of the water.
- 5 The rising piston _____ the fuel mixture.
- 6 Designers try to _____ the weight of a structure.
- 7 When the push button is _____, the valve spring pushes up the spool.
- 8 Pumping fluid into the main cylinder gradually _____ the jack.
- 9 Aerodynamic design _____ wind resistance.
- 10 The motor starts up slowly, then gradually increases speed.
- 11 At intermediate substations, power is _____ to 11 kV for light industry.
- 12 When the child _____ the handle, the seat swings back under the weight.

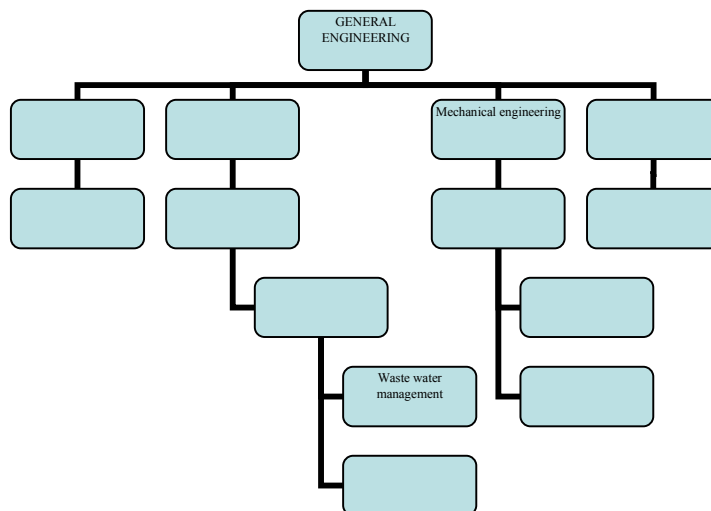
Build your own (technical) glossary

Use the dictionary and find Slovenian translations.

English word

Slovenian translation

Follow up set: Use the texts you have studied so far to complete the following diagram:



Summary

In the first chapter we discussed the practical and professional side of being an engineer. Of the many engineering disciplines, mechanical engineering is the broadest, encompassing a wide variety of engineering fields and many specialties. Vocabulary assignment required students to check in their dictionaries the meanings of different types of engineering and start building their own list of technical terms.

2 COMPANY OF THE FUTURE: Customers, Competence & Concentration

In this unit, you will be reading about some engineering companies. The new vocabulary will help you describe the company you work for, and talk about the different types of companies and their history.

2.1 EXPLAINING STRUCTURE AND HISTORY

Write down the names of two well-known companies in your city or region.

- What do you know about each company's activities:
 - Where do they operate?
 - How important are they?
 - If you could choose, which would you like to work for?

Companies are involved in many activities, e.g. buying, selling, marketing, **production**, in a range of different industries, such as **IT**, **telecommunications**, film, **car manufacture**.

Businesses vary in size, from the **self-employed** person working alone, through the **small** or **medium sized enterprise** to the large **multinational** with activities in several countries.

Multinationals often have a complicated structure. There is usually a **parent** or **holding company**. This company owns other companies or parts of their companies. Theirs other companies are called **subsidiaries**. Company's activities may be spread over different **sites**.

Types of companies

- Firm, USA corporation
- Multinational
- Conglomerate
- Family business
- Organisation

Divisions

- Subsidiary
- Parent/daughter, sister company
- Division
- Branch
- Head office (GB), Home office (USA)
- Department
- Section
- Office

Employees

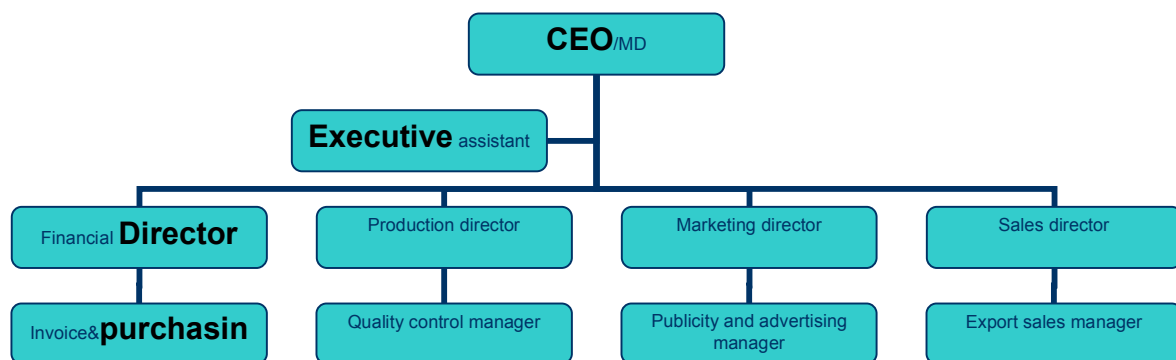
- Head of department
- Director
- CEO – chief executive officer (USA)
- MD – managing director (GB)
- Supervisor
- Assistant
- Team leader
- Staff

Write down Slovenian words for the above terms.

Organisational chart

Most companies are made up of three groups of people: the shareholders (who provide the capital), the management and the workforce. The management structure of atypical company is shown in this organizational chart.

At the top of the company hierarchy is the Board of Directors, headed by the Chairperson or President. The Board is responsible for policy decisions and strategy. It will usually appoint a Managing Director or Chief Executive Officer (CEO, AmE), who has overall responsibility for the running of the business. Senior managers or Company Officers head the various departments or functions within the company.



Discuss

- Does your company have a clear structure as in the above organisational chart?
- Do people in your company work in teams?
- What changes do you think there will be in the future?

Now describe the structure of your company.

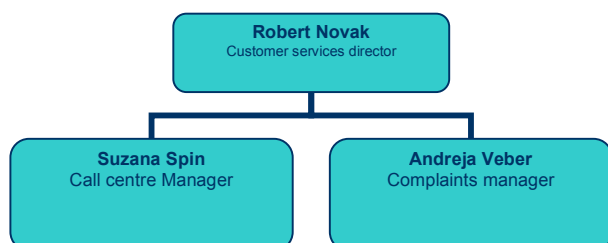
Company law

Founding a company

- notice that the verb is *to found a company*
- this regular verb (found-founded-founded) should not be confused with the irregular verb *to find* (find-found-found)

Practice makes perfect

Look at the chart and answer the questions



- What is Andreja's job?
- Which department is Suzana responsible for?
- Who does Suzana report to?
- What is Robert?

Find matches.

- is owned by shareholders
- **is at least 51% owned by another company**
- only administers other companies in the group
- has a controlling stake in another company
- is completely owned by another company

- **subsidiary**
- public limited company
- parent company
- wholly-owned subsidiary
- holding company

Related vocabulary

Clock-in system
Full-time job, part-time job
Permanent, temporary job
Working time: fixed, flexible

Write down Slovenian words for these terms:

Practice makes perfect:**Building new vocabulary**

Which verbs do not go with the nouns?

- a company: **stop**, found, take over, set up
- a subsidiary: own, found, produce, open
- production: continue, stop, begin, make

Match the verbs with the nouns.

- | | |
|---|--|
| <ul style="list-style-type: none"> ▪ research ▪ recruit ▪ draw up ▪ set up ▪ make ▪ locate ▪ invest in ▪ get | <ul style="list-style-type: none"> ○ equipment ○ the market ○ a profit ○ a business plan ○ a company ○ staff ○ funding ○ premises |
|---|--|

Business organisation. Find synonyms – use a dictionary!

AMERICAN		BRITISH	
a.	general manager	1.	ordinary partnership
b.	proprietor	2.	shareholders' meeting
c.	manager	3.	trader
d.	stockholders' meeting	4.	director
e.	stock corporation	5.	shareholder/member
f.	sole proprietor	6.	public limited company
g.	closed corporation	7.	managing director
h.	stockholder	8.	private limited company
i.	general partnership	9.	sole trader

Write down Slovenian words for the above terms.

_____	_____	_____
_____	_____	_____
_____	_____	_____

2.2 COMPANY PROFILE

Read the article about the company and then answer the questions below.

We are a multinational company with more than one hundred thousand employees and there are over a hundred and twenty subsidiaries worldwide. Royal Philips Electronics of the Netherlands is a Health and Well-being company, focused on improving people's lives through innovations. As a world leader in healthcare, lifestyle and lighting, Philips integrates technologies and design into new solutions.

Headquartered in the Netherlands, Philips operates in more than 60 countries worldwide. With sales of EUR 26 billion in 2008, the company is a market leader in cardiac care, acute care and home healthcare, energy efficient lighting solutions and new lighting applications, as well as lifestyle products for personal well-being and pleasure with strong leadership positions in flat TV, male shaving and grooming, portable entertainment and oral healthcare.

We are strengthening our position in emerging markets. Together with our increasing resource investment, we are producing appropriate and relevant solutions. We are developing innovative

technologies and approaches for healthcare and lighting.



Adapted from Annual report 2008; online; 13.9.2009

Answer the questions:

1. **What's the company's turnover?**
2. **How many employees are there?**
3. **What's happening in the company at the moment?**

Are these statements true or false according to the text?

1. **The company is entering a new market.**
2. **They are building new facilities.**
3. **They are introducing new technology.**

Notice

We use The Present Continuous tense to talk about actions that are going on at the moment.

2.3 HISTORY OF A COMPANY

Read the article about the company which looks ahead and has committed itself to growth, productivity and employee development.

From workshop to a worldwide group

The beginnings were modest. In 1941, 26-year-old Martin Hilti and his brother Eugen founded a mechanical workshop

that employed five people in Liechtenstein village of Schaan. The workshop quickly developed into a worldwide group. Today there are some 20,000 people working around the globe

for Hilti. They develop, manufacture and sell leading technological products and systems for measuring, positioning, chiselling, drilling, fastening, installing, cutting, grinding and sealing.

Martin Hilti used intuition and energy in creating and developing a significant company that is now being led by the

Executive Board with the most modern management methods. Today Hilti is present in more than 120 countries and operates production facilities and research and development centres in Europe and Asia. Two-thirds of all team members work directly in sales or in customer services.

Adapted from Company Report 2008

Do you understand all the words?

Read the text again and underline the unknown words you don't understand.

- a. Try to guess the meaning of the underlined words from the context.
- b. Now use a dictionary and find Slovenian translations.

Answer the questions:

1. What is Hilti famous for?
2. What are the main areas of Hilti trades?

Are these statements true or false, according to the text?

1. Hilti is focused on the future.
2. They are close to their owners.
3. They promote new technologies.

Follow up set: Work in pairs. Ask and answer questions about the RENK company. For information on the Past Simple see Grammar Point.

RENK

STANDS FOR PROGRESS – FOR MORE THAN 135 YEARS.



1873 Foundation of the Augsburg plant by Johann Julius Renk.

1897 Conversion into a joint stock company trading as "Zahnradfabrik Augsburg, vorm. Joh. Renk (Act. Ges.)".

1916 Construction of the largest gear cutting machine with a diameter of 7 meters.

1923 Integration of the company into the GHH group of companies, now MAN group.

1926 Production of the first wheels with ground tooth profiles.

1939 With 36,000 r.p.m., the production of the world's "fastest" gear transmission for the aircraft industry.

1943 Invention of the hydrostatic superimposition steering systems for track vehicles.

1956 Production of the first turbine gear unit with the highest pitch circle velocity (185 m/s).

1961 Development of the world's first electronic control system for an automatic vehicle transmission.

1965 Invention of the hydrostatic-hydraulic steering drive for track vehicles.

1971 First vehicle braking system with friction brake and retarder, also functioning for the first time as an operating brake, integrated into a vehicle gear transmission.

1975 Acquisition of the slide bearings and couplings division of Eisenwerke Wülfel, Hannover.

1976 RENK becomes the first manufacturer to harden and grind gear wheels measuring over 3,000 mm in diameter.

1982 Construction of the most powerful marine gear for ice-strengthened ships with diesel engines.

1986 The company's Augsburg based industrial and marine gear division is spun off and integrated into RENK TACKE GmbH. Foundation of the company's Control and Test System division.

1987 Change of the company's name into "RENK Aktiengesellschaft". Product areas: Automatic vehicles transmissions, gear unit elements, test systems.

1989 With 75,000 kW, RENK provides a high-speed gear unit with the highest power rating ever transmitted by gears in mesh.

1992 Construction of the world's most powerful epicyclic gear unit (20,600 kW) for a marine propulsion system with counter-rotating propellers.

1995 Merger of RENK TACKE GmbH into RENK AG.

1997 First type of the most powerful turbo gear unit worldwide; gas turbine output 100 MW.

1998 Bevel-planetary KPAV 280 gear unit for one of the largest vertical cement/raw-flour mills developing 4,800 kW at a speed of 21 r.p.m.. The 1 000 000th curved-tooth coupling is manufactured and delivered in Rheine.

1999 First type of the most powerful turbo gear unit worldwide; gas turbine output 140 MW. Delivery of a bevel planetary gear unit with a weight of 110 tons for the largest and most powerful vertical roller mill in a cement plant in Argentina; transmission power 5,400 kW.

2000 Presentation of the newly developed etaX® gear unit with energy profit. For the test system division RENK acquires the activities of the US American company LABECO. Acquisition of the slide bearing activities from A. Friedr. Flender AG for the RENK Hannover plant.

2001 First CODAG installation worldwide for a naval application, 38 MW total power.

2002 Development of a 5 MW AEROGear for a windpower plant.

2004 First type of the high-capacity marine propulsion gears for COGAG arrangement with the lowest specific weight worldwide, 6,300 kW total power output. Outsourcing of the product area Test Systems and establishment of RENK Test System GmbH.

2007 Foundation of RENK-MAAG GmbH. Acquisition of the MAAG turbo series as well as the global services for turbo and ship gear units.

Summary

In companies of the future you will learn about the importance of teamwork. Companies have begun reconnecting with their employees in order to recapture the energy and effort.

Various kinds of exercises in this chapter can be used to elicit valuable data concerning students' grasp of English language structures. Vocabulary assignment encouraged students to check in their dictionaries for the unknown words and consult grammar pages for new structures.

3 CAREER OUTLOOK

This unit covers some aspects of a career in engineering and focuses on applying for a new or different job. The texts provide an introduction to real life engineering career experiences. The new vocabulary will help you advocate that engineering is not just about big machines and oily rags. The last section introduces and practices skills required to deal with the writing tasks and covers layout and style of a business letter.

3.1 AN ENGINEERING STUDENT

Study this list of points to consider when deciding whether to study engineering. Tick ✓ the statements which refer to you. Then ask you partner which statements refer to him/her.

- | | |
|---|--|
| 1 | You enjoy practical projects – creating and investigating things. |
| 2 | You like finding out how things work. |
| 3 | You are interested in improving the environment. |
| 4 | You like helping people. |
| 5 | You enjoy solving problems. |
| 6 | You enjoy organising activities. |
| 7 | You enjoy science programmes on TV. |
| 8 | You sometimes read articles on scientific or engineering topics. |
| 9 | You have a lot of determination and stamina. |

If you have ticked most of these statements, engineering is the right course of study for you.

Here are the main areas of study that mechanical engineering looks into:

Design	Heat-related Studies
Drafting and analysis	Thermodynamics
Design of various mechanisms	Heat Transfer
Manufacture	Energy Conversion
Solid Mechanics	Refrigeration and Air Conditioning
Strength of Materials	Fluid Mechanics, Hydraulics and
Statics and Dynamics	Pneumatics
	Instrumentation and Measurement

List some of the subjects you study and try to find English terms.

English

_____	_____
_____	_____
_____	_____
_____	_____

Find out what these terms mean in education.

Pass	_____	- a school fee, a scholarship
Resist	_____	- the rector, faculty, faculties
Assessment	_____	- the dean, the staff
Fail	_____	- a lecture (a talk given by a lecturer to a group of students)
Drop out	_____	- lecture room, consultation hours
Period	_____	- post graduate study
Full time	<u>redni (študent)</u>	- B(A)SC. – Bachelor of (Applied) Science, M.SC. – master of science, Ph. D. SC. – doctor of science
Module	_____	- entrance exams (pass entrance exams, fail entrance exams)

Answer these questions – discuss them with your partner:

- 1 What time do you start your class?
- 2 When do you finish?
- 3 How long is a class?
- 4 How many students are in your class?
- 5 How many classes do you have each week?
- 6 What is the title of your course?
- 7 How many weeks of teaching do you have left?
- 8 How is the course assessed?
- 9 What happens if you fail the test once?
- 10 What are you going to do after the certificate?

Read the article about ROBOTICS ENGINEERING and answer the questions below. Match your answers with your partner.**Robotics engineering is a career choice.**

The field of robotics engineering is a sub-field of mechanical engineering. Robotics engineers design robots and develop new applications for them for use in a wide range of industries. With new possibilities for robotics due to advances in computer sciences, robotics engineering is growing rapidly. From production line robots to experimental robotics for the medical, military, and automotive industries, the future of robotics engineering will certainly offer a range of opportunities for professionals entering the field .

1. What is a robotics engineer?
2. What two disciplines work closely together in robotics engineering?
3. How is robotics used in manufacturing?
4. What types of technologies do robotics engineers work on?
5. In what ways have robots improved the safety and health for workers in manufacturing industries?

3.2 JOBS AND CAREERS

What are the attractions of the job of a mechanical engineer?

Has mechanical engineering changed over the years?

Read the text first, and then state your own opinion on the following statements.

1. Mechanical engineers are eager to take advantage of advanced materials.
2. The real action in mechanical engineering jobs today is in electronics and software.
3. A degreed mechanical engineer is highly prized and in high demand.

Use some of the phrases below:

The way I look at it is ...

I think that

I strongly (dis)agree (with the idea) ...

I believe that ...

It's generally believed that ...

That's not the way I see ...

Engineers are problem-solvers who want to make things work more efficiently and quickly and less expensively. From computer chips and satellites to medical devices and renewable energy technologies, engineering makes our modern life possible. In particular, electrical engineers and computer engineers have a wide range of study options and career paths that let them design, build, and manage those ideas into reality.

The engineer's primary role is to develop practical solutions to society's needs. Engineering work requires creativity, a knack for problem solving, and lots of training; it is seldom boring and can be highly rewarding. For some engineers, the challenge may be to maintain clean and healthy water conditions. For others, the work they do may be isolated from public view and involve the cutting edge of technology.

Discuss these questions:

- What kind of work do you do? What do you enjoy about your job? What do you dislike?
- What are the most important things for you in your work?

Practice makes perfect

Talking about your job: match the phrases:

- | | |
|-------------------------------|--|
| ▪ I work as | ❖ questions people have about machines. |
| ▪ I'm responsible for | ❖ a civil engineer with BBS. |
| ▪ My job also involves | ❖ deal with cables and switchers. |
| ▪ I deal with | ❖ consider communications and equipment. |
| ▪ As part of my job I have to | ❖ Reading, not far from London. |
| ▪ I'm based in | ❖ giving advice on air-conditioning. |

Match these jobs to their descriptions.

- | | | | |
|---|----------------------------|---|----------------------|
| A | a development engineer | E | a production planner |
| B | a geologist | F | a quality controller |
| C | a field service engineer | G | a mechanist |
| D | a software engineer | H | an architect |

- 1 **Works for an IT company. Writes code, updates and debugs programmes.**
- 2 Repairs and services machines and equipment. Works for a steel producer.
- 3 Works for an oil company. Analyses rocks and minerals from the sea bed
- 4 Works for a car producer. Checks and inspects the finished cars and writes reports.
- 5 Designs new parts and products. Works with CAD/CAM technology. Works for an aerospace company.
- 6 Works for a construction company. Is responsible for planning and designing new factories and buildings.
- 7 Works for an engineering company. Organises and checks production schedules.
- 8 Works for a telecommunications company. Spends a lot of time travelling to companies to repair and replace or install telephone systems.

Some verbs (action) and nouns (things) have similar forms. Write the verb forms of these nouns.

- | | | | |
|---|---------------------|----|---------------------------|
| 1 | negotiation _____ | 6 | test _____ |
| 2 | inspection _____ | 7 | production <u>produce</u> |
| 3 | equipment _____ | 8 | construction _____ |
| 4 | specification _____ | 9 | security _____ |
| 5 | maintenance _____ | 10 | analysis _____ |

Self-study and exam practice

1. Answer these questions and write down your answers in full sentences.

- 1 What are your duties at the moment?
- 2 What is your present salary?
- 3 Why did you leave your last job?
- 4 Do you speak any foreign languages?
- 5 Are you familiar with Microsoft Office XP, Vista?
- 6 What do you like about the job?

2. Match the verbs with the nouns then use them in the correct form to complete the sentences below. Use a dictionary.

The first one is done for you: apply for a job

turn down	your resignation
take on	salary levels
select	vacancies
fill in	staff
review	a candidate
hand in	an offer
advertise	an application form

- 1 *There's no way we can interview all the candidates who apply for the job.*
- 2 Congratulations on the job offer. The boss is going to get a shock when you _____ . I'd love to see his face when you do it!
- 3 We normally _____ from a shortlist of about four or five people.
- 4 The company's been doing very well recently and is now looking to expand and _____ sometime early next year.
- 5 We're finding it very hard to keep our IT people at the moment, so I think we're going to have to _____ to try and keep them with the company.
- 6 I got a letter from the Personnel Manager asking me to _____ and return it with my CV and a photograph.
- 7 If it's the Web department, it's only really natural to _____ on the Internet. That way we get people who are really familiar with using the Internet.
- 8 The job market is so good that graduates are prepared to wait for the right job. Over 20% of them have already _____ since leaving university.

3. Read the text below and choose the correct word form (A-C) to fill each gap.**Growing with Hilti**

Karsten Wichmann works for Hilti in Tulsa, USA. He works (1) _____ Head of the Latin America Region. He (2) _____ with a large number of small and medium-sized businesses in the Latin American cultures. He (3) _____ them on the best products for their needs. He is only in (4) _____ office in the morning when he discusses clients (5) _____ the Sales Manager.

Adapted from: Company Report 2008

- | | | | |
|---|-------------|------------|-----------|
| 1 | A as | B like | C in |
| 2 | A organises | B provides | C deals |
| 3 | A advise | B advises | C advised |
| 4 | A his | B her | C its |
| 5 | A with | B to | C from |

4. Write a short paragraph about your last business experience and career. Give details about:

- where you went to school, what you did after you left school
- when you started your first job
- what you did, what your responsibilities were

3.3 WRITING 1: CAREER AWARENESS



If Internet access is available share the “Micron for Students” web site (www.micron.com/students) online; 13. 9. 2009.

A career history

Career resume: M.S.KARLSSEN

1984-95	Employed by Institute of Electrical Engineers
1984-96	Consultant in a Malmo Power plant
1975-78	University of Stockholm (majored in Electrical Engineering)

Recent career moves

August 1995	Became self-employed
	Set up own consultancy
October 1995	Opened an office in Malmo
February 1996	Won a major contract with a computer company

How about you?

Answer these questions about yourself.

1. How long ago did you start your present job?
2. How long ago did you start learning English?
3. What was your recent career move?

How to write a well presented CV/resume? Succeed where others fail.

- Keep it simple. Avoid decorative fonts and colours
- Make sure the format of your CV is well laid-out with clear headings.
- Emphasize your most relevant experience and skills to encourage the employer to read on.
- List other skills that could raise you above the competition such as languages (be sure to also include level of fluency) and IT skills.
- Be aware – some employers will check your references for accuracy.
- Note: it is not customary in Slovenia to include a picture with your CV.
- Check thoroughly for errors in spelling or grammar.



An initiative of the European Commission

Go to the following web site, download the English version of Europass CV and fill it in.

<http://europass.cedefop.europa.eu/...> (online; 13. 9. 2009)

CURRICULUM VITAE

Personal details

Name: Jan Novak
Date of birth: 2 August 1975
Address: Huda ulica 12, Veliko mesto 1234
Marital status: single

Education and qualifications

1991-1995 Hera College of Higher Education, Ljubljana
- Diploma in Mechanical Engineering
1985 – 1990 Secondary Technical School, Ljubljana

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

Work experience

1995 to present Inspection Technician
Ben & Hugo Electronics (SI) Ltd.
- responsible for checking incoming components and completed products using a wide range of test equipment including computer-based record system.
1990 – 1995 Apprentice electrical technician
Sturm & Hafner (SI) Ltd.
1990 – 1991 Office junior
Brend & Brend, Car Shop
- basic mechanical duties, telephone receptionist, in a busy car shop.

Interests and activities

Travel, modern dance, swimming.

References

College:	Work
Ms Jelica Car	Mr Jon Minas
Head	Personnel officer
Phone: 4577-56789	phone: 2388-0098

Standard layout of formal letters

BASIC STRUCTURE

INTRODUCTION

- Greetings, salutation

- Terms of reference or objective

BODY / FACTS

- Findings

FINAL SECTION

- Conclusions

Opening / finishing phrases

- ❖ Dear Sir or Madam,
- ❖ Dear Mr / Mrs / Ms / Miss,
- ❖ Dear Jane Bink,

- Yours faithfully,
- Yours sincerely,
- Best wishes,
- Best regards,

AMERICAN ENGLISH

Sincerely yours,
Yours truly,

The body

THE REFERENCE - HEADING

With reference to your advertisement / letter of ..., phone call today, yesterday, ...

THE REASON FOR WRITING

I am writing to enquire about ... apologise for ... confirm ...

Other useful phrases

- I am writing to inform you .../ let you know .../notify you of a change ...
- I understand that these publications are free of charge.
- Thank you for your fax and for your interest in our products.
- In reply to your letter of today ...

GIVING BAD NEWS

Unfortunately, ... I am afraid that ...

Closing remarks

- Thank you for your help / time and consideration.
- Thanking you for your assistance, ...
- Please contact us again if we can help in any way / there are any problems / you have any questions.

Future contacts

- I look forward to

hearing from you soon.

meeting you next Tuesday.

seeing you next week.

Enclosing documents

Enclosures: CV, *references/recommendations*

- Please find enclosed a *copy of clean driving licence*
- I am enclosing a *certificate/report on my passed exams*

Layout of a standard letter

Your address

(no name!)

Date

Writing dates: 4 March 2005, March 4, 2005, 4/3/2005, 3/4/2005 USA

Receiver's Address

Head of Production

ABC

123 Sesame Street

Subject line/Re: Subject: Order No. 456-9A6

Salutation: Dear Sir / Madam

I look forward ...

Complimentary close: Yours faithfully

Jana Novak

Janez Novak

Encl.

Practice makes perfect

Write a letter to ask for information on a course of CAD drawings which interests you. Set out your letter like this:

**Nova ulica 21
1111 Staro Mesto
SLOVENIA**

**30 August 2006
Information centre
CBC Technical Institute
Parlow Street
Manchester
MA2 2KL
UK**

Dear Sir or Madam

Please send me further information on the course Solidworks in Mechanical Engineering.

Yours faithfully,

Pavel Ribnik
Pavel Ribnik

Now write a response from an institute, using the information below:

Course on Technical Certificate in CAD for Mechanical Engineering. One month, full-time. For potential technicians or for those who gain entry to a Higher Diploma in Mechanical Engineering course.

3.4 APPLYING FOR A JOB

When you apply for a job, consider the following:

- ✚ What impression do you try to give in an application letter?
- ✚ Should an application letter be handwritten, or printed?
- ✚ How important is a well-presented CV or resume?
- ✚ Do you always tell the absolute truth in application letters?

Draft an application letter

- Introduce yourself briefly
- Give your reasons for applying
- Describe your relevant experience – or justify your lack of experience
- Describe your skills
- Describe how you meet the requirements of the job
- Say when you're available for an interview

Application letter - vocabulary

- leave/finish school, graduate from university, etc.
- study for a diploma, matura, etc.
- student of Vocational College / Community College, University of Ljubljana, Faculty of Mechanical Engineering
- have/obtain a degree in Mechanical Engineering
- have no/little experience of ... / in...
- gain practical experience/qualifications
- previous/current/working experience
- work attitude, work performance
- knowledge of languages
- duties at the moment

Translate the following phrases into English.

- 1 Videl sem vaš oglas v Strojniškem vestniku prejšnji teden.
- 2 Rad bi se prijavil na mesto vzdrževalca v vašem podjetju.
- 3 Imam že nekaj izkušenj pri delu s CNC stružnicami.
- 4 Lansko leto sem delal kot študent v podjetju za zaključna dela v gradbeništvu.
- 5 Sem strojni tehnik in znam uporabljati program za računalniško podprto risanje.

Application letter - starting

- I'm interested in applying for the post of ... which was advertised in Delo on 25th November ...
- I'm applying for the position of ... as advertised in ...
- I wish to apply for a place at HSE ...
- My reason for applying is that I would like to broaden my experience and also to make a greater use of knowledge of languages ...
- I was interested to see your advertisement in the November issue/edition of Strojniški vestnik (a magazine, etc) for ...
- I noted with interest your advertisement in today's Delo, etc.

Application letter - body

- I feel that my qualifications match your requirements. My qualifications are as follows...
- My educational background enables me to...
- I believe I have the appropriate qualifications...
- As you will see from my CV, which is attached, ...
- As you will see from the enclosed CV, I have three years experience in marketing...
- I feel I would be suitable for the post because ...
- My responsibilities have included all types of administrative work ...
- I can use computer ... I possess PC skills ... I have experience with CAD, etc.

Application letter - ending

- I enclose (I am enclosing) the names and addresses of two references/referees who can testify to my conduct and character...
- A resume giving details of my qualifications is attached.
- I would be glad to attend an interview at any time...I am available for an interview...
- I am looking forward to the opportunity of attending an interview at which I can provide further details...
- I hope to hear from you soon and be given/granted the opportunity of attending an interview...
- I hope that you will take my application into consideration...
- I shall be pleased to provide any further information you may need.
- If there is any further information you require, please contact me by phone/mail.

Apply for a job – use a separate sheet of paper and write a CV and an application letter.



Job: Design Technician – Avionics

Salary: Circa 2,000 EUR + Benefits, Location: Brnik

Posted: 13/03/2009 Closing date: 20/03/2009

Contract: Permanent, Employer: JAM Recruitment, Contact: Yan Yanick

Reference: QN021817, Sector: Engineering

Are you looking to join a leading company specialising in the design and manufacture of aircraft & avionic systems? This great opportunity could be for you. As the Design technician you'll be required to provide technical assistance in respect to design, manufacture and quality issues.

The role:

You'll be working alongside engineers and production teams in bringing projects to completion within time and cost limits. Also to support design engineers in the production of detailed drawings packages.

Key duties:

Assisting in gathering all necessary data, design layouts and investigate individual aspects of design for presentation at project and design review meetings.

Produce manufacturing drawing/documentation sets and effects and to prepare technical data packages.

Skills required:

You'll need to have experience of electro mechanical assemblies including PCB packaging. Knowledge of 2D/3D solid modelling CAD Systems will also be needed in producing assembly and detailed drawings of mechanical parts and manufacturing data.

Having good analysis and problem solving skills along with the ability to communicate effectively with different levels of staff is also required.

To Apply

Please forward your most up-to-date CV together with salary details to y.yanick@jamrecruitment.com, quoting ref no 021817

Source: <http://www.computingcareers.co.uk/employer/...> (online; 13. 9. 2009)

Model letter

Lepa cesta 13
Mirno mesto 1222
SLO

15 March 20__

Mr Yan Yanick
Personnel Department
Administrative Block A
Ljubljana Airport
Brnik 1222, SLO

Dear Mr Yanick,

Re: Design Technician

I would like to apply for the post of Design Technician as advertised in today's issue of the Delo. I enclose my CV with the names of two referees.

You will note from my CV that I have a diploma in Electrical and Electronic Engineering and considerable experience. My work at B & H 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.

I enjoy my work at B & H but would like to broaden my experience, especially in the area of aircraft design. I feel that I can bring considerable skill to the post together with the ability to work well in a team. I am also interested in further improving my qualifications by studying part-time.

I look forward to hearing from you.

Yours sincerely

Jana Novak

Jana Novak

Follow up set: Study the advertisement and write a letter to apply for a position.



Job: Mechanical Engineering Specialist

Source: <http://jobs.guardian.co.uk/?setHome=GB> (online). 13. 9. 2009



An intelligent approach to design

We are now looking to recruit a **Mechanical Engineer** to join our team. An understanding of product development process would be beneficial, but direct experience is not essential in this role. Competitive salaries, together with other benefits and profit related pay are offered.

Job title: Design Engineer

Required qualifications: BS or BAS (Mech.Eng.), drafting of engineering drawings, CAD, PROENGINEER, 2 years of work experience.

To apply for this position contact us in the form of a letter at: DCA Design Int. Ltd., 19 Church Street, Warwick, UK.

Apply with CV.

- **Contact:** George Lowi
- **Work:** 020 8992 8648
- **Fax:** 0208 992 5658

Summary

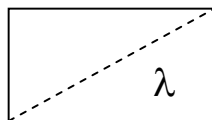
Looking for jobs can become a challenge. In this chapter you have learnt about job- seeking alternatives as well as the career questions that engineers confront. These alternatives are viewed as setting on basic business language. Your new knowledge will be put to the test with a real-world engineering projects, which you will design on your own or with a team.

4 BASIC TECHNICAL TERMS

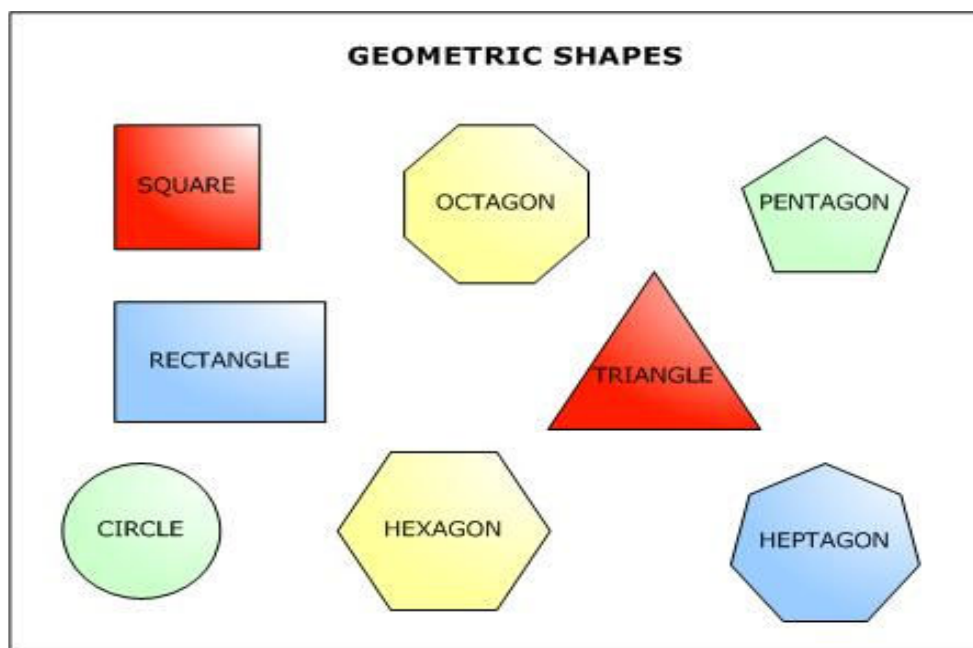
This unit will introduce basic shapes and dimensions terminology related to machining. Pay attention to tables and illustrations, and especially to graphical displays. You will learn a lot of new words which you need to be able to define things more precisely and describe them accurately.

4.1 Shapes

The shape below is a rectangle with the upper and lower side twice as long as the left and the right one. There is a broken line going from the left hand corner to the upper right hand corner, crossing the centre. There is a letter λ turned upside down.



Shapes



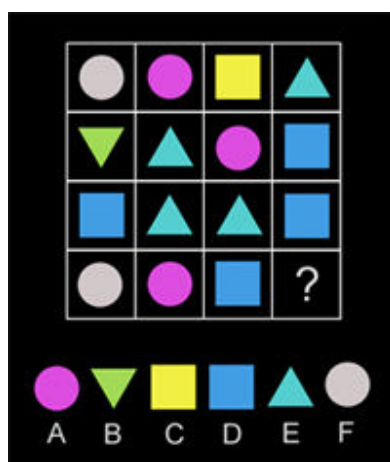
The list of nouns and adjectives.

Noun		Adjective	Slovenian
- a rectangle	→	rectangular	
- a square	→	square	
- a triangle	→	triangular	
- a cone	→	conical	
- a tube	→	tubular	
- a circle	→	circular	
- a semi-circle	→	semi-circular	
- a sphere	→	spherical	

Complete.

Noun	Adjective	Slovenian	Drawing
_____	cylindrical		
_____	cubic, cube-shaped		
oval	_____		
polygon	_____		
rectangular solid	_____		
_____	cylindrical		
pyramid	_____		

Which shape completes this grid: A, B, C, D, E or F?



3D – Shapes or Solids

Name the objects and describe their shapes.

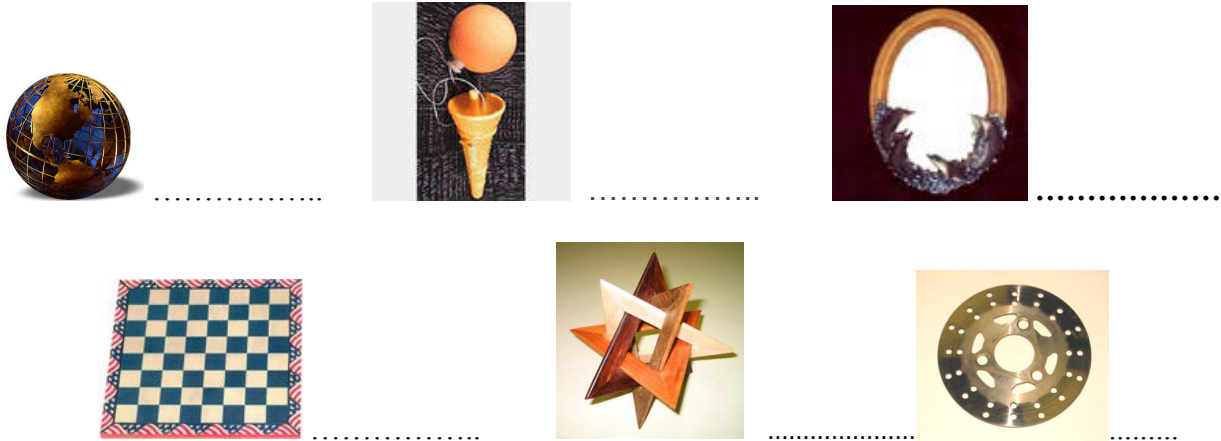


Fig. 2: Geometric shapes
<http://www.gamecenteronline.com/...> 13. 9. 2009.

Draw the geometric shape according to the information provided and fill in the missing word:

1. The total area T of any *right prism* is equal to two times the area of the base plus the lateral area.

Formula: $T = 2B + Ph$

2. A _____ is a polyhedron with a single base and lateral faces that are all triangular. All lateral edges of a pyramid meet at a single point, or *vertex*.

Formula: $V = (1/3)Bh$

3. The volume V of any _____ with radius r and height h is equal to the product of the area of a base and the height.

Formula: $V = (PI)r^2h$

4. The volume V of any _____ cone with radius r and height h is equal to one-third the product of the height and the area of the base.

Formula: $V = (1/3)(PI)r^2h$

5. Volume Formula: $V = (4/3)(PI)r^3$

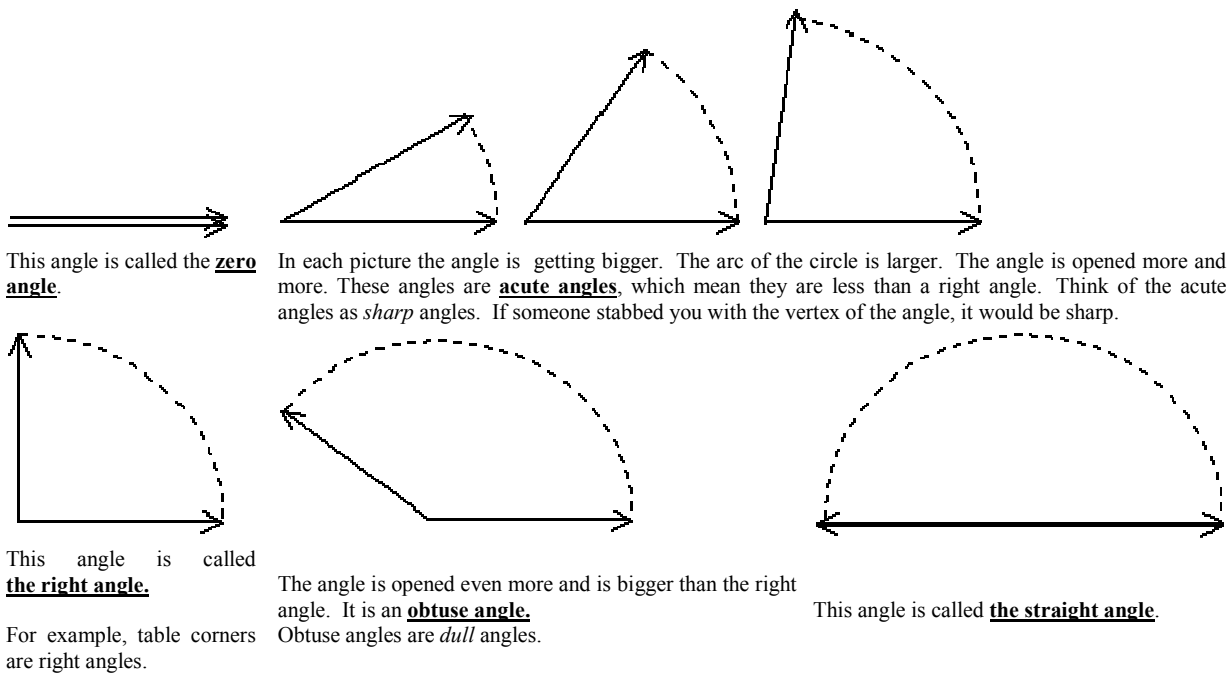
Area Formula: $A = 4(PI)r^2$

Lines and curves

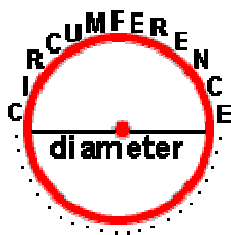
Draw the lines:

- straight line
- broken line
- wavy line
- congruent lines
- dotted line
- dashed line
- perpendicular line
- parallel lines

Angles



Look at the picture and insert the missing words.



A **circle** is a closed curve. The _____ of the circle is the length of all points in a plane at a fixed distance; the _____ of the circle is a straight line from a fixed point, called the centre of the circle, to the outer boundary. The _____ means the length of the circle and the interior of the circle is called a disc/disk.

Draw a shape that is:

both a rectangle *and* a rhombus
both a parallelogram *and* a kite

Triangle

Match the types of triangles with the definitions

equilateral triangle

equiangular triangle

isosceles triangle

scalene triangle

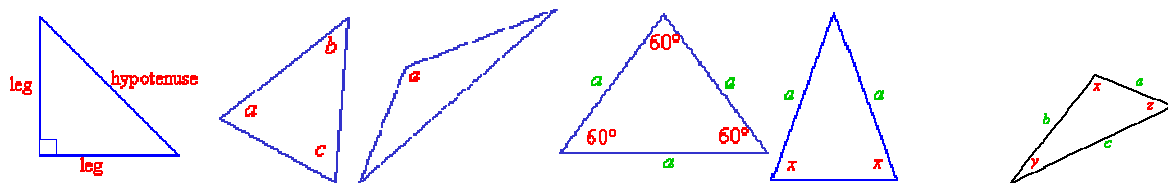
two sides are of equal length; also has two equal internal angles.

in an equilateral triangle all its internal angles are equal—namely, 60° .

all sides are of equal length

all sides have different lengths; the internal angles are all different

Name the triangles below.



Now mark: vertex, perpendicular line, adjacent angles.

Giving descriptions

Study the following descriptions:

Rack and pinion		The rack is the flat, toothed part, the pinion is the gear.
-----------------	---	---

The most basic tools **are simple machines**.

A modern hammer **descends from ancient hand tools**.

A crowbar **functions as a lever**.

Another way is to use the same pattern and also give some distinguishing characteristics:

A tool or device is a piece of equipment **which typically provides a mechanical advantage in accomplishing a physical task**.

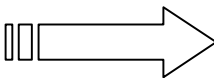
RELATIVE PRONOUNS

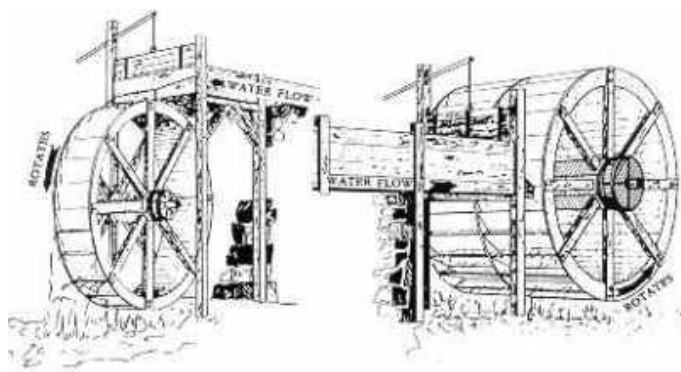
In modern English there are five relative pronouns: that, which, who, whom, and whose.

who ➞ (people)
 that ➞ (things or people)
 which ➞ (things)

Giving an explanation or a definition

There are different ways to define things. Look at this example:

A hygrometer is an instrument  used for measuring relative humidity.
 which is used to measure relative humidity.
 which measures relative humidity



The first waterwheels can be described as a grindstone mounted atop a vertical shaft whose vanes or paddles lower end dipped into a swift stream, the wheel was horizontal. As early as the first century, the horizontal waterwheel, which is terribly inefficient in transferring the power of the current to the milling mechanism, was being replaced by waterwheels of the vertical design.

Source: Adapted from Wikipedia.

Study the following definitions and complete the table.

TERM	GROUP	CHARACTERISTICS
 a screwdriver	is a device	which is designed for the tightening of screws.
silicon	is a non-metallic element	with semiconductor characteristics.
 lever		
ferrite ring		
oscillating piston engine		

Label the parts of a screw, then draw:

- a) a square thread screw
- b) a trapeze thread screw
- c) a triangular thread screw
- d) a slot head screw



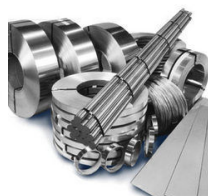
Fig. 3: Parts of a Stainless Steel Screw

Draw:

spiral or watch spring
 helical spring
 semi-elliptical spring
 conical spring
 volute spring

Metal products. Match the pictures with the terms from the box:

crankshaft, camshaft, bars & rods, fittings, butt weld fittings, flanges, coil.



bars and rods

Fig. 4: Metal products

Resemblance: Similarity of appearance

What are Slovenian terms for the phrases below? Write them down to complete the table.

a mushroom-shaped drain valve	
a U-shaped core	
a pan-shaped rivet head	
a U-tube	
rectangular grooves	
a cross head screw	

Language focus

Remember that we can say:

It is

- triangular
- triangle-shaped
- triangular in shape

Contain, consist of, made of

Comprise, made up of

Assembled of, composed of

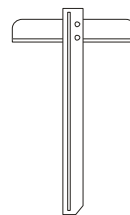
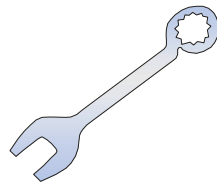
Note the difference:

The water **contains** impurities in it.

What does clay **consist of**?

Compounds **consist of** polymerizable groups. Mixtures **contain** aldehyde.

Name and describe these objects:



Discuss it with your partner and find out the meaning of these words in General and Technical English.

Add some new.

word	General Eng	Technical Eng
apron		
bar		<i>drog, palica - □ prerez</i>
boss		
shank		
bucket	<i>vedro</i>	
butt		
dog		
beam	<i>žarek</i>	
bus		<i>vodilo</i>
sleeve		

The technical words in column A are similar in meaning to the more general English in column B. Match them.

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 backs and forwards
8 sheets	h goes up and down

4.2 READING NUMBERS, MATH EXPRESSIONS, FORMULAE, SYMBOLS

NUMBERS

Even numbers:	2,4,6, ...	-teen:	13-19 (note: <i>fifteen</i>)
Odd numbers:	1,3,5, ...	-ty:	20,30,50 (<i>fifty</i>)

Some ways of reading 0:

- OH: decimal, phone, bus, room, years
- ZERO: number 0, temperature (-7°C : seven degrees Centigrade below/minus zero)
- LOVE: tennis
- NOUGHT: before decimal
- NIL: football

Decimals

- all the digits are read separately, esp. if there are more than two decimals:
 - 0.125 nought point one two five
 - 0.001 nought point oh oh one = 10^{-3} ten to the power (of) minus three

Units

- £1.50 one pound fifty
- 2m18 two metres eighteen

Points and commas

- Use a point (.) and not a comma (,)
- A comma in figures – only with thousands

Saying large numbers

- hundreds
 - 100 one hundred
 - 200 two hundred (*not* two hundreds)
- thousands
 - 1,000 one thousand
 - 2,000 two thousand (*not* two thousands)
- millions
 - 1,000,000 a million
 - 1,000,000,000 a billion

Fractions

- $\frac{1}{2}$ a half
- $\frac{1}{4}$ a quarter
- $\frac{3}{4}$ three quarters
- $\frac{1}{3}$, $\frac{1}{5}$, $\frac{1}{6}$, etc a third, a fifth, a sixth, etc
- $3\frac{1}{2}$ three and a half
- $2\frac{3}{4}$ two and three quarters

Calculating

- $10+6=16$ ten plus six is/equals sixteen
- $10-4=6$ ten minus four is six
 - ten take away four equals six
- $10 \times 6 = 60$ ten times six is/equals sixty
 - ten multiplied by six is/equals sixty
- $10 \div 6 = 1.666$ ten divided by six is one point six recurring

The verbs are:

- + add
- - subtract, deduct
- x multiply
- ÷ divide or per, over

Square, cube and root

- 10^2 ten squared
- 10^3 ten cubed

Raising to the power

$3^2 = 9$ three squared equals nine
 x^{n-1} x (to the) power (of) n minus one

Extraction of Root

- $\sqrt{5}$ the square root of 5
- The cube root of eight is two.
- n -th root: What is the fourth root of sixteen?

=	equals/ is equal to	$x \neq y$	x is not equal to y
$x \cong 10$	x is approximately equal to 10		
<	is less than	>	is more than
5!	factorial of five		
A'	A prime	A"	A second prime
$\int_a^b$	integral from a to b		
$\frac{\partial f}{\partial x}$	partial of f with respect to x		
$\frac{df}{dx}$	dfdx		
B_n	B subscript n		
()	parentheses	[]	square brackets
sin	sine	cos	cosine
		{ }	braces (to put in)

Solving equations

Fill in the missing word

$(a+b)(a-b) = c$ a plus b in _____ times a minus b in _____ equals c
 $F = dp/dt = m dv/dt = m a$ capital F _____ dpdt which _____ m _____ dvdt
 which equals m times a

Dimensions

Word formation: adjectives → nouns

Write in the corresponding nouns

Adjective	Noun
5m high	_____
15m long	_____
7m wide	<u>width</u>
2,5cm thick	_____
22m deep	_____

Word formation: adjectives → verbs

Write in the Slovenian verb

adjective	verb	Slovenian verb
loose	to loosen	
tight	to tighten	
deep	to deepen	
wide	to widen	
short	to shorten	
long	to lengthen	
high	to heighten	
strong	to strengthen	
weighty	to weigh	

Practice makes perfect

Fill in the blanks in these sentences with suitable verbs from the list above.

How do you _____ a sticky pipe fitting?

The torque wrench is designed to be used for tightening certain tube shapes that wouldn't collapse under torque pressure.

Use of small casing severely restricts the opportunities for _____ the well or using the upper part of a hole, which may be composed of loose soil.

Most often, post-tensioning has been applied to steel stringers, floor beams, girders, for _____ of steel bridges.

Simulation enables shipbuilders to _____ their engineering development cycle by troubleshooting designs using virtual prototypes.

Write down some key equations and read them.

Write down the equation for:

- a. vector product: $C = A \times B$
- b. friction force: $F = \mu_k P$
- c. cosine rule

One of the students will dictate an equation, another should write it on the board.



Search the Internet for Greek alphabet and find out which letters are used in math formulae you can find in his chapter.

4.3 SCALES

Complete the table.

Quantity/Force		Unit	Instrument
1	current	_____	_____
2	_____	newton	force gauge
3	velocity	km/mile per hour	_____
4	_____	°C	thermometer
5	thickness	_____	micrometer
6	_____	ohm	ohmmeter
7	voltage	_____	_____
8	pressure	_____	manometer

Note

Like the UK, the USA measures large areas in terms of square miles (m^2).

M.p.g. (=miles per gallon) expresses vehicle fuel consumption in the UK, whereas 1/1000km is the equivalent in France.

Quantities: Scalars and Vectors

PHYSICAL QUANTITY: is a physical property characterizing some aspect of nature that can be measured.

- time, speed, energy

Scalar quantity= a quantity that has magnitude but no direction.

- ✓ temperature, mass, volume, speed

Vector quantity= has a direction as well as a magnitude.

- ✓ velocity, acceleration, lift, thrust are vector quantities.

MEASUREMENTS

- The SI is founded on seven *SI base units* for seven *base quantities* assumed to be mutually independent.
- SI – International System of Units

SI base units - complete the list

Base quantity	Name	Symbol
❖ length		
❖ mass		
❖ time		
❖ electric current		
❖ thermodynamic temperature		
❖ amount of substance		
❖ luminous intensity		

Practice makes perfect

1. Name some scalars and vectors.
2. What is the difference between vector and scalar quantities?
3. What is the difference between mass and weight?
4. Try these exercises:

1. ____ is an example of a scalar quantity

- a) velocity
- b) force
- c) volume
- d) acceleration

4. A vector quantity

- a) can be a dimensionless quantity
- b) specifies only magnitude
- c) specifies only direction
- d) specifies both a magnitude and a direction

2. ____ is an example of a vector quantity

- a) mass
- b) force
- c) volume
- d) density

5. The difference between speed and velocity is:

- a) speed has no units
- b) speed shows only magnitude, while velocity represents both magnitude (strength) and direction
- c) they use different units to represent their magnitude
- d) velocity has a higher magnitude

3. A scalar quantity:

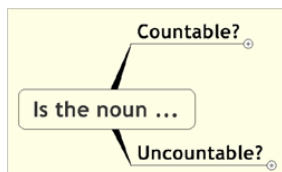
- a) always has mass
- b) is a quantity that is completely specified by its magnitude
- c) shows direction
- d) does not have units

6. Which of the following is not true?

- a) velocity can be negative
- b) velocity is a vector
- c) speed is a scalar
- d) speed can be negative

Language focus: mind the reading of:

- m²
- s²
- a 12 mm bore
- 10%

Forming plural


COUNTABLE NOUNS	UNCOUNTABLE NOUNS
Countable nouns can be either singular or plural: <i>computer / computers</i> <i>idea / ideas</i> <i>information medium / information media</i> Examples A computer can be used for simulation. The students had several ideas for the project. Each group must choose one information medium for the project Most engineers use computers nowadays.	Uncountable nouns appear only in the singular form <i>information (not informations)</i> <i>knowledge (not knowledges)</i> <i>research (not researches)</i> Examples The Internet gives people access to information. The aim of the project is to gain knowledge about Global Positioning Systems. The information I found on the Internet was very useful. There seems to be a lot of research on the topic.

Study the table below and complete it.

Singular (sg)	plural (pl)	Slovenian
analysis	analyses	
basis	bases	
phenomenon	phenomena	
criterion	criteria	
datum	data (is/are)	
erratum	errata	

Many English nouns do not just fall into one category. Certain nouns, sometimes called double-duty nouns, can be either countable or uncountable. Each form is different in meaning.

Is this OK?

Spring will recover its basic form when released.

Iron has a handle and a flat metallic base.

To count or not to count?

Some uncountable nouns can become countable when we mean a certain amount of or kind of that noun

For instance, we can say:

Force is the capacity to do work or cause physical change. (we do not refer to a specific force)

A tensile force can lengthen a body. (a specific force)

Even *water* can become countable under the right circumstances:

The waters of the Pacific Ocean are noticeably colder this year.

Study the table.

■ Count	■ Non-Count
She had many experiences. The lights were bright. Give me three coffees. We study sugars in organic chemistry. The papers were stacked on the table.	Does she have enough experience? Light hurts my eyes. I'd love some coffee. Put sugar in my coffee. We wrote on paper.

Some Notes on Quantifiers

Like articles, **quantifiers** are words that express the amount - tell us how many or how much.

The following quantifiers will work with <u>count nouns</u> :	The following quantifiers will work with <u>non-count nouns</u> :	The following quantifiers will work with <u>both count and non-count nouns</u>
many methods a few methods few methods several methods a couple of methods none of the methods	not much research a little research little research a great deal of research no research	all of the methods/research some methods/research most of the methods/research a lot of methods/research plenty of methods/research

Practice makes perfect

1. Choose the correct answer:

1. Many companies around the world use, or make use of scientific advancements, to manufacture new and improved products every day.
 - a) technologies
 - b) introductions
 - c) technology
2. store huge amounts of information within computer systems that were not in existence 40 years ago.
 - a) advantages
 - b) databases
 - c) databases

2. Fill in the blanks with a / an, the, or no article.

Fluid power users

Most of us barely notice sights and sounds of _____ fluid power around us: _____ / _____ pumps are growing more powerful; _____ valves are smarter; _____ actuators are more precise. Take pneumatic positioning, for example. In 1980, the engineers believed it was impossible to position _____ cylinder using _____ air. _____ air is, after all, hundreds of times more compressible than _____ hydraulic oil. Yet, _____ pneumatic component manufacturers can now repeatedly position _____ load to within three thousandths of an inch. New sealing techniques have also returned _____ water to _____ forefront as _____ fluid power medium. Only a few years ago, _____ / _____ water was viewed as _____ curiosity - _____ outdated technology driving creaky machinery. Now, that too is changing. Manufacturers are dealing with _____ leakage and _____ erosion problems through _____ use of _____ new ceramic materials, such as _____ aluminium oxides and _____ zirconias. Those materials stand up better to _____ higher pressures, exhibit less permanent deformation, corrode less and wear better. Result: manufacturers now employ water hydraulics in such locales as meat-packing plants and pharmaceuticals concerns.

The marriage of fluid power and _____ electronics is also at _____ heart of another dramatic change. Pumps, valves and actuators are now considered smart. Users program acceleration and deceleration profiles directly into actuators. They do the same with pumps. By varying _____ position of a pump's swash plate with _____ control signal, for example, they can vary the pump's output. On assembly lines, smart pneumatic components can now "talk" to personal computers and programmable logic controllers through networks. They describe themselves and relay their date of manufacture. They offer _____ information regarding their working status, such as calibration data, and they decide whether they need replacement.

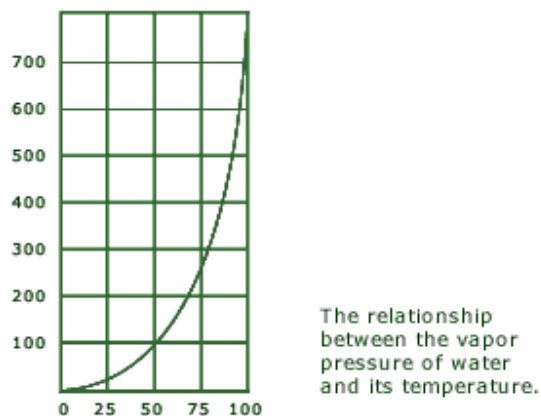
_____ decade ago, _____ noise and leakage were accepted phenomena. No more, though. Now, one manufacturer makes _____ motor-pump so quiet that its valves are said to be _____ noisiest component it makes.

4.4 EXPLAINING & PRESENTING GRAPHICAL DISPLAY

In engineering, graphs and charts are a common way of giving information. They allow a great deal of data to be presented in visual form.

Basic graph forms

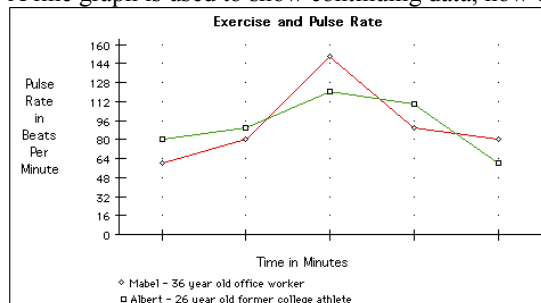
A graph can have the form of a curve, series of bars or lines.



This is a line graph whose x axis is temperature in degrees centigrade, running from zero to one hundred degrees. The y axis is pressure in millimetres of mercury and runs from zero to 800 millimetres. The curve starts at *the origin* and rises so that when x is 25 degrees, y is approximately 40 millimetres. When x is 50, y is 100. When x is 75, y is just under 300. When x is 100, y is about 760.

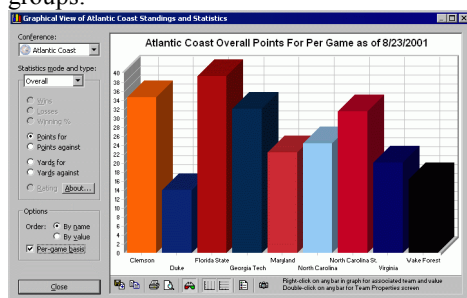
A line graph:

A line graph is used to show continuing data; how one thing is affected by another.



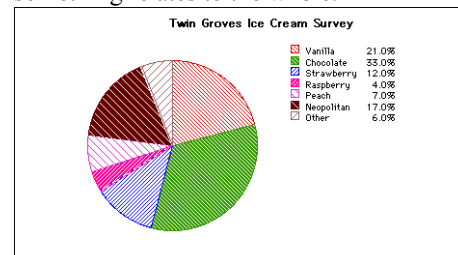
A bar graph:

A bar graph is used to show relationships between groups.



A circle (pie) graph:

A circle graph is used to show how a part of something relates to the whole.

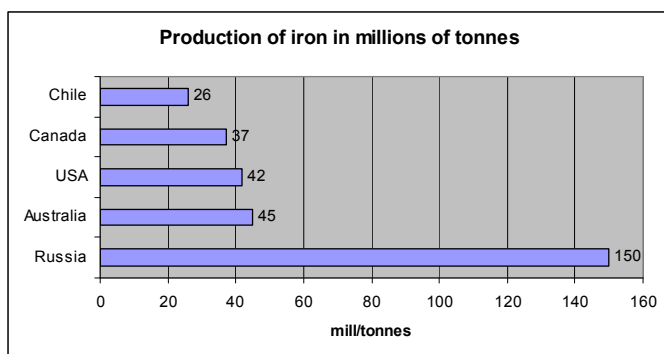


Useful Phrases

This graph shows ... As you can see ... This resulted in ... This resulted from...

The temperature grew **by** 1.75% at The pressure went down **to** 1% of the total

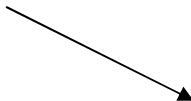
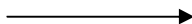
Using the information in the chart, we can say:



- Russia produces the most iron.
- Australia produces a little more than the USA.
- Chile produces a lot less than Russia

Movements

Study this table of verbs and related nouns of change.

 -to go up -to increase/an increase -to rise/a rise	 -to go down -to fall/a fall -to decrease/a decrease	 - to shot up - to rocket	 - to slump - to plummet - to plunge
 - to fluctuate	 -to remain steady, level off	-to reach a peak	- to recover
- to expand - to grow/a growth		- to shrink	

Look at the period from 2 to 3 minutes in the line graph on *Exercise and Pulse Rate* above. We can describe the change in two ways:

- 1 The pulse rises.
- 2 There is a rise in pulse.

To be more accurate, we can make our description like this:

- 3 The pulse rises sharply.
- 4 There is a sharp rise in pulse.

These adjectives and adverbs are used to describe the rate of change. Complete the table:

Adjective	adverb
slight	.....
.....	gradually
steady	.....
steep	.....
.....	sharply
.....	suddenly
fast	.....

Here are some combinations of words used to describe the rate of change for a quantity. Give a corresponding adjective+noun combination:

rise sharply	_____
go up steeply	<u>a steep growth</u>
drop suddenly	_____
decrease stepwise	_____
peak sharply	_____

What do these combinations mean in Slovenian?

a significant amount	_____
a considerable quantity	_____
a tiny fraction of a whole	_____
a negligible portion	_____

Practice makes perfect**1. Use the prepositions from the box in the sentences below:**

to	from	beyond	under	in	within	at
----	------	--------	-------	----	--------	----

When _____ tension, the energy is stored as strain energy.

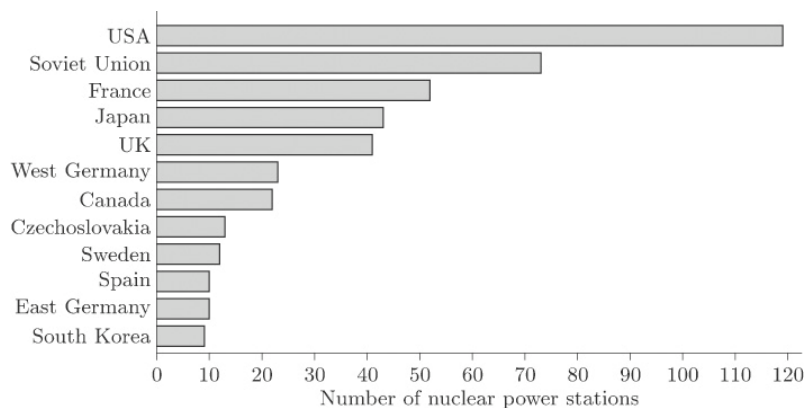
_____ the elastic limit stress is no longer proportional to strain.

_____ a depth of 1 mm the residual stresses fell just under 800 N/mm^2 .

Steel containing _____ *from* _____ 0.05 _____ *to* _____ 0.25% carbon is often used in industry.

The radius of the drill lies _____ the range of from $125 \mu\text{m}$ to 4 mm.

We can observe a steady rise _____ residual stress after hardening.

2. Write five sentences about the number on nuclear power stations using the chart below:

Follow up set: Use new knowledge you have acquired so far and complete the following tasks:

- 1. You are the owner of a small company. Would you want these things to go up or down? Complete the table.**

accidents	energy savings	profit	inventory	waste
productivity	quality	sales	orders	
recycled materials	material costs	emissions		

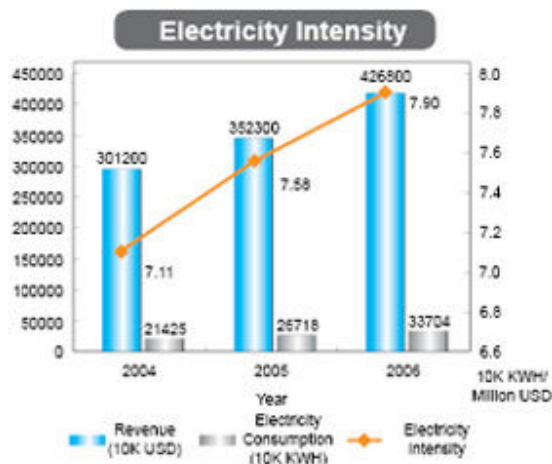
Go up ↑	Go down ↓

- 2. Look at the table and draw a graph.**

	2nd quarter	3rd quarter	percentage change
Days lost	126	119	-5.6%
Accidents	18	22	22.2%
Productivity	10.37	10.14	-2.2%



3. Insert the missing expressions using the words: between, per, grew, to, increase 2x, outgrown



Delta's electricity consumption and intensity trends _____ 2004 to 2006 are shown in the graph. Electricity consumption _____ million USD of production _____ from 71,100KWH in 2004 _____ 79,000KWH in 2006, with the _____ between 2004 and 2005 being higher than the _____ between 2005 and 2006. This indicates that our electricity consumption has _____ our revenues so we must pay attention how efficiently we use electricity.

Source: [http://www.delta.com.tw/...](http://www.delta.com.tw/) (online). 13. 9. 09

4. Describe these flowcharts

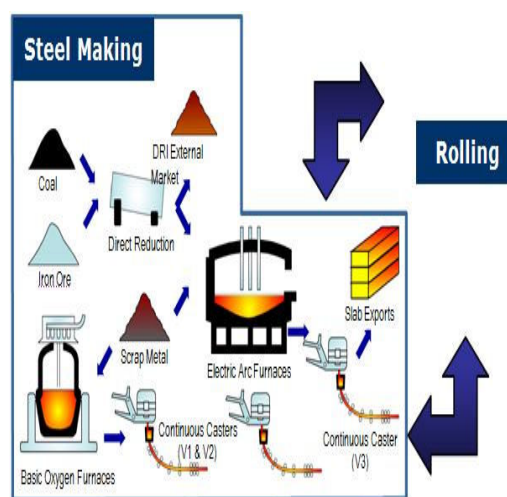
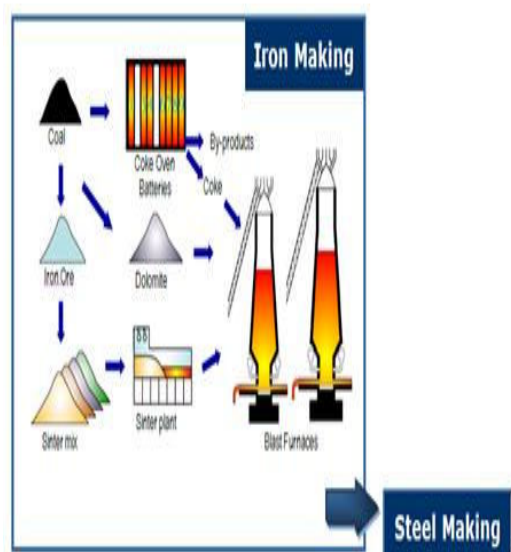


Fig. 5: Iron and Steel Making Process

Summary

Technical English is more complex than it initially appears. We have discussed only four major areas of technical terms and although learners of technical English need to acquire implicit knowledge of numbers, scales, and trends, the approach taken in this chapter is not necessarily incomplete. Vocabulary assignment required students to check in their dictionaries the meanings of the unknown terms and extend their own glossary.

5 MECHANICS OVERVIEW

Mechanics is a very wide area. The texts in this unit serve as an introduction to technical terms and issues regarding how to explain processes and link ideas.

Mechanics is a branch of physics that deals with the study of motion and bodies in the state of rest. Mechanics can be divided into 2 areas - kinematics, dealing with describing motions, and dynamics, dealing with the causes of motion.

Mechanics is the study of the way matter and forces interact with each other, here we are concerned with bodies that you can easily see, in the solid state. Dynamics is a field concerned with forces and matter when a change in momentum does occur. Kinematics is a study of motion without regard to the forces present. It is simply a mathematical way to describe motion.

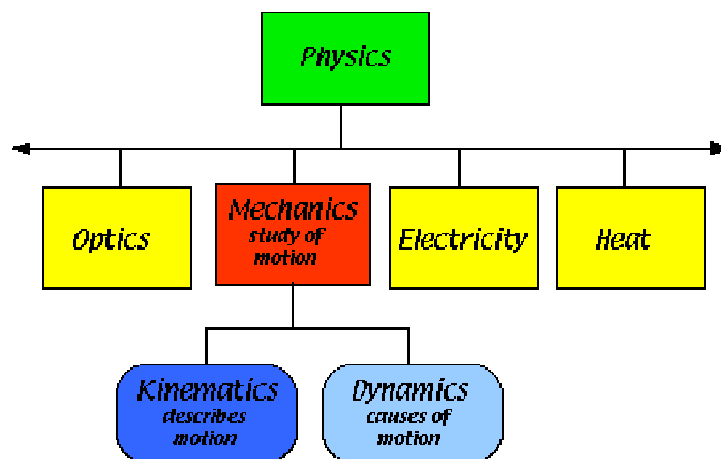


Fig. 6: Mechanics overview

Classifying items

In engineering, we often use classification to express our ideas. When classifying, we divide a general subject → less general level = lower level of generality → types, sorts, classes:

Mechanics can be divided into / can be classified as / into kinematics and dynamics.

Dynamics can be further subdivided into / can be sub classified as/into the study of the Laws of Motion and the Laws of Force and Mass.

Acceleration, momentum and action are examples of the general principles of the Newton's three Laws of Motion.

Here is a list of mixed items. Try to classify them:

Newton's First Law of motion
Constant speed
Uniform motion

Forces
Mass of an object
Newton's Third Law of Motion

Equal force
Opposite force
Reaction force

5.1 MECHANISMS AND MOVEMENT

Mechanisms are used to convert between one type of motion and another. Any machine can be looked on as a group of interconnected mechanisms which convert one type of motion to a variety of other motions.

These changes may be to convert rotary motion to straight line motion or to convert reciprocal (back and forth) motion to intermittent motion. They may also transform a fixed type of motion, for example by magnifying a linear motion or by slowing down a rotary motion.

Motions are divided into six basic types. Write down the appropriate expressions:



Fig. 7: Types of motions

Source: <http://www.flying-pig.co.uk/mechanisms/...> Online. 13. 11. 2009.

Read the text below quickly to find out which mechanisms are mentioned.

There are many varieties of mechanisms but all of them involve some kind of motion. The four 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 to operate the valves.

The rack and pinion is used to convert between rotary and linear motion. Rack and pinion can convert from rotary to linear or from linear to rotary. Rack and pinions are commonly used in the steering system of cars to convert the rotary motion of the steering wheel to the side to side motion in the wheels.

Now read the text again to find the answers to these questions:

- 1 In what devices can mechanisms be found?
- 2 What does oscillating mean?
- 3 What are some simple mechanisms in the home?
- 4 What is the function of a rack and pinion?
- 5 Give an example of a device which can produce a linear movement.

5.2 WAYS OF LINKING IDEAS

When we write or speak, we may have to describe, explain, etc. In all these forms we use ideas. To make our writing or speech effective, we have to make sure our readers or listeners can follow our ideas. One way is to make links between the ideas.

Reason & result

So is used to express the **result**.

Because expresses the **reason** or **cause** of something.

Rack and pinions convert the rotary motion to linear motion **so** they are commonly used in the steering system of cars.

Cause → **Result**

Rack and pinions are commonly used in the steering system of cars **because** they convert the rotary motion to linear motion.

Result → **Cause/reason**

Expressing contrast

But is used to contrast ideas. **However** and **although** can also contrast ideas.

Carbon fibre users have trouble deciding what to do with cut-off from production. **But** we don't have to throw this high-tech material away.

New fibres are expensive to produce; **however**, a great deal of the material is wasted during the production process.

Although resin is a thermoset material that once heated and cooled cannot be remoulded, evaporating allows the fibre to be reclaimed for further moulding.

What words can we use to mark the links? Study these examples.

1. Mechanisms are important to us. 2. They allow us to travel.	Sentence 2 is the reason for sentence 1. We can link them like this: <i>Mechanisms are important to us because/since/as they allow us to travel.</i>
3. Mechanisms deliver the power to do work. 4. They play a vital role in industry.	Sentence 4 is the result of sentence 3. We can link them like this: <i>Mechanisms deliver power to do work so they play a vital role in industry. Mechanisms deliver power to do work; therefore they play a vital role in industry.</i>
5. Friction sometimes helps. 6. It is often a hindrance.	Sentence 6 contrasts with sentence 5. We can link them like this: <i>Friction is sometimes a help but it is often a hindrance.</i>

Practice makes perfect

Show the links between these sets of ideas using an appropriate linking word.

- 1 Copper is highly conductive. It is used for electric wiring.
*Copper is highly conductive **so** 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 Friction is essential in brakes. Friction is a nuisance in an engine.
- 6 Lever is an essential part of any mechanism. It can be used to change the direction of movement.

Insert linking words: like/unlike, whereas, although, however

___ *Although* ___ the SI unit for force is the newton (N), the US customary unit is the pound (lb).
One acre seems to be very different from 4,047 m² at first glance. ____, both figures denote the same area.

Daily temperature in Europe is expressed in Celsius, _____ in the USA where Fahrenheit is used.

A diesel engine requires no ignition system _____ a gasoline engine cannot operate without one.
_____ the gasoline engine, the diesel engine is of the internal combustion design since they both burn fuel within the cylinders.

Dealing with technical terms

One of the difficult things about the English of engineering is that there are many technical terms to learn.

Below try to find the appropriate definitions for the following technical terms and write down Slovenian equivalents.

FRICION BRAKE

CRANKSHAFT

BALL BEARING

LATHE

KINETICS

ENGINE

BAND SAW

HEAT PUMP

F

stružnica

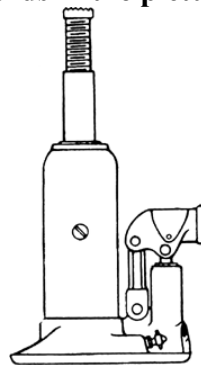
- A** a bearing permitting free motion between moving and fixed parts by means of balls
- B** a brake in which the resistance is provided by friction
- C** a shaft about which a crank rotates
- D** a science which deals with the nature of a body in relation to the force acting (the dynamics of materials bodies)
- E** a self-propelled wheeled machine that transports people or goods on and off roads
- F** a machine which holds and rotates a workpiece under power against a suitable cutting tool for turning
- G** a device which transfers heat from a cooler reservoir to a hotter one
- H** a power-operated woodworking saw consisting of a flexible band of steel having teeth on one edge running over two vertical pulleys
- I** a machine in which power is applied to do work by the conversion of various forms of energy into mechanical force of motion

5.3 EXPLAINING AND GIVING INSTRUCTIONS

Read the description and label the underlined words in the picture.

Explaining the principle works of a hydraulic jack.

A jack is a tool in which force is applied through the mechanism of a hydraulic press. It operates by means of a liquid, usually oil, which acts against a piston. A small force, applied by means of a lever attached to a small piston, produces a very large force on a large piston.



Here is a list of instructions for someone wanting to add hydraulic fluid to a hydraulic cylinder jack. Put the instructions in the correct order.

- Stop filling when oil comes at just 5 to 10mm below the plug height
- Wait for 2 minutes for air to purge out (if present)
- Always ensure jack piston is at the bottom for filling oil
- Remove filler plug at jack body (mostly situated at jack body side top)
- Start filling
- Release pressure of pump by loosening relief valve knob

Describing processes - 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

A hydraulic lift can raise very heavy objects high into the air.

Link the statements below to explain the operation of a hydraulic jack.

- 1 The jack is placed under the object.
 The lever is moved up and down.
- 2 The movement is converted into a reciprocating motion.
 The motion slides the piston back and forwards.
- 3 Each movement of the piston pumps a small amount of fluid.
 The fluid is pumped from the reservoir through the one-way valve into the main cylinder.
- 4 This action gradually raises the jack.
 The object is lifted from the ground.
- 5 The object is lowered by releasing the one-way valve.
 This allows the weight of the object to force fluid from the cylinder back into the reservoir.
 The object slowly descends.

Now consider the stages in the operation. Instead of numbers, we can show the correct order of using sequence words:

First the jack is placed under the object.

Then the lever is moved up and down.

Continue:

Next.....

After that, ...

Finally, ...

Tell your partner how to take a picture with a mobile phone. Advise them what to do and what not to do.

Use these verbs:

load, wind, forget, take off, set, turn, choose, focus, move, shake, press
--

Follow up set: Use new knowledge you have acquired so far and complete the following tasks:

Double helical gear pair: describe its function shortly.



Fig. 8: Double helical gear pair

Image sources: <http://fabathome.org/machinesandmechanisms/images/...>(online). 13. 9. 09

Try these exercises.

1) How much net force is required to accelerate a 1500 kg car at 6.00 m/s^2 ?

.....newtons

2) What is the mass of an object that has a weight of 115 N on the Moon? The gravity of the Moon is $1/6$ of g (which is 9.8 m/s^2).

.....kg.

3) An object in free fall will accelerate at a rate of :

.....m/sec/sec

1. Which of the following are contact forces?

- a) magnetic forces
- b) gravity
- c) air resistance
- d) electrostatic forces

2. Which of the following are action at a distance forces?

- a) air resistance
- b) normal forces

c) magnetic forces

d) frictional forces

3. What is the force that opposes the relative motion or tendency to such motion of two bodies in contact?

- a) magnetism
- b) the normal force
- c) gravity
- d) friction

4. 1 kg-m/sec/sec is equal to--

- a) 1 Newton
- b) 1 pound
- c) 1000 newtons
- d) none of the above

5. Which of the following statements is not correct?

- a) air resistance is a force
- b) mass is the result of the force of gravity
- c) to accelerate an object requires a force
- d) weight is the force of gravity

Build your own (technical) glossary

Use the dictionary and find Slovenian translations.

[illegible]

Summary

Mechanisms, one of the classes of mechanics, is a truly versatile topic with a place in every technological field of work. Movement mechanics deals with mechanics anatomy and physics, and in this chapter aims to cover some of the fundamentals in order to help students learn why language training with good techniques and form works.

6 MATERIALS ENGINEERING

This passage introduces you to the different types of engineering materials and the characteristics of each type. The tasks provide an overview of their properties and comparisons.

Materials engineering is a field which involves the properties of matter and its applications to various areas of science. This science investigates the relationship between the structure of materials and their properties. The material science deals with *fundamental properties* and *characteristics* of material.

Engineers use the **natural** chemicals and materials found in the world, as well as the **artificial** chemicals and materials created in the laboratory, to design and build the things we need every day.

For example, engineers use:

Brick, steel and glass to design and build buildings
Earth, rock, cement and asphalt to design and build roads and roadway systems
Wood, aluminium and new composite materials to design and build cars, airplanes and jets

Standard classification diagram

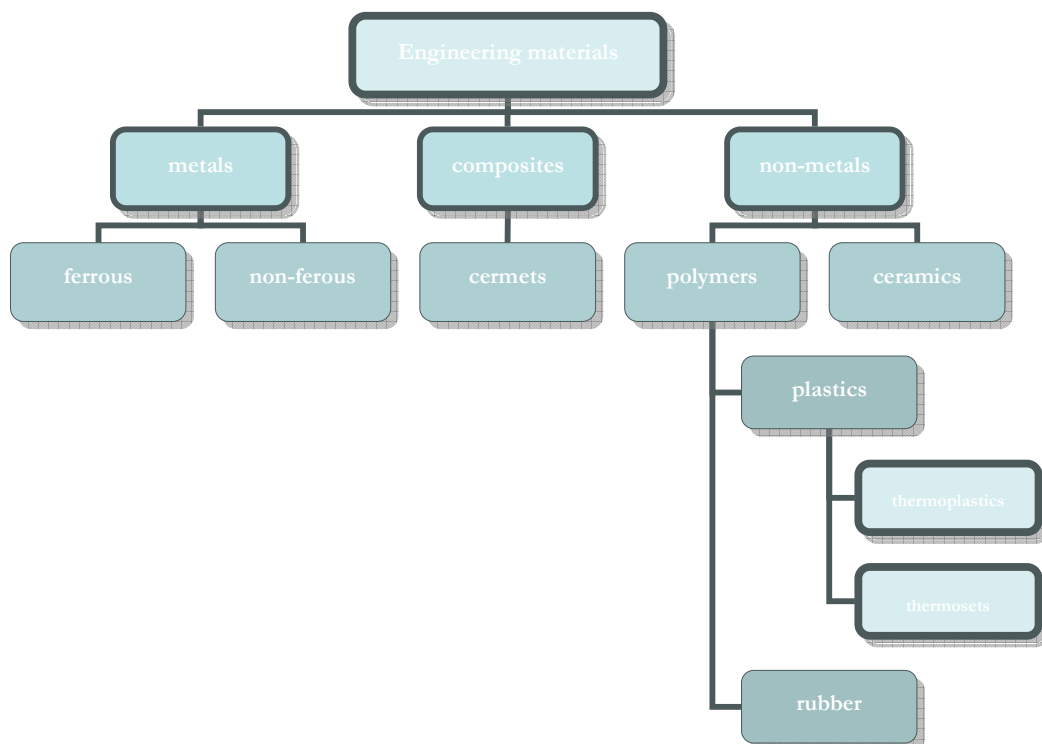


Fig. 9: Engineering Materials Diagram

6.1 DESCRIBING PROPERTIES OF MATERIALS

Composites are made up of several different substances. Cermets is a term coined by engineers and means ceramic+metal materials. Ceramic is a hard substance - a clay that has been heated to a very high temperature so that it becomes hard.

All materials have various properties:

e.g. Steel is strong and rigid.

Steel is *a* strong and rigid *material*.

We often want to modify statements about the properties of materials:

Glass is extremely brittle.

Glass is an extremely brittle material.

Wood is fairly strong.

Wood is a fairly strong material.

Rubber is quite a tough material.

Paper is not a very strong material.

Study the properties of metals and make full sentences.

For example

- Steel
- Iron –based alloy
- Max 2% carbon

Steel is an iron-based alloy which contains up to total 2% carbon.

Cast iron

- Any carbon-iron alloy containing 2 – 4% C
- High compressive strength
-

- Easy to shape – high fluidity and fusibility
- Low malleability and tensile strength

Grey iron

- = grey in appearance
- C is present in the form of graphitic carbon

- widely used due to low cost (cheaper than steel), ease of melting, good tensile and comprehensive strength
- used for gears, camshafts, crankshafts

Mild steel

- carbon steel containing 0.05 – 0.25% C
- easily worked when cold and hot
- production of: nuts, bolts, car bodies, rods, bars, beams and other structural sections

- good compressive and tensile strength
- elastic, ductile, malleable, fairly tough and soft

Aluminium

- light ductile metal
- good conductor of heat and electricity
- extremely soft

- strength may be increased by adding a small amount of copper, silicon, magnesium and iron.

Glossary

stiff – tog	flimsy – tenek, šibek	resilient – prožen
strong – trden	weak – lomljiv, krhek	tough – žilav
brittle – krhek	flexible – upogljiv	ductile – raztegljiv
rigid – tog, trd	pliable – gibek	hard – trden, trd
fragile – lomljiv	malleable – koven preoblikovalen	soft – mehak

One way of increasing new vocabulary is to learn the associated words from a key word. Look at the table below which shows words related to the key words presented above.

ADJECTIVE	NOUN	VERB
malleable	malleability	to make a certain material....
ductile	ductility	To make a certain material ...
heavy	weight	To weigh
soft	softness	To soften
brittle	brittleness	To make.....
plastic	plasticity	To make....
elastic	elasticity	To make....
strong	strength	To strengthen
tough	toughness	To toughen

6.2 PROPERTIES OF LIQUIDS AND FLUIDS

Oily	Sticky	Thin
Runny	Viscous	
Thick	Free-flowing	

Some substances are between solid and liquid forms:

Gel - jelly – gelatinous (=adj)
Cream – creamy (=adj)

Some solids may be found in the following forms:

Powder – powdery
Crystals – crystalline
Granules – granular
e.g. refined sugar consists of white granules.

Describing colour / appearance

We can modify descriptions of colours by saying:

light blue	dark blue	bright yellow
pale blue	deep blue	dull brown

When an object is not exactly one colour, we can add – *ish* to the colour: red/reddish, blue/bluish, yellow/yellowish. But: silver – silvery

Types of surfaces

Surfaces can be bright, shiny, dull, glossy, and matt.

Also: smooth, rough, un/even, grainy, pitted (small holes), abrasive (abrasive cleaner to polish hard surfaces).

6.3 COMPARING AND CONTRASTING

Cardboard is slightly stronger than paper.

Steel is much/a lot stronger than wood.

Wool is considerably softer than wood.

But: Polythene is far more resilient/far less fragile than glass.

Glass is considerably less resilient than wood.

Practice makes perfect

Adjective or adverb?

Alloys are *general* / ***generally*** prepared by mixing molten metals.

Pure iron is a *soft* / *softly* metal.

Platinum has *exceptionally* / *exceptional* resistance to corrosion.

Iron is *easy* / *easily* to extract from iron ores.

Rolled gold consists of a *thin* / *thinly* layer of gold alloy.

Radium is an *extreme* / *extremely* rare / *rarely* metal.

It is also *high* / *highly* radioactive.

Magnesium is known as a metal which burns *bright* / *brightly*.

Write the words from the list below in the correct column.

Colours	Materials	Shapes	Tools/machines
	steel		

steel, sphere, purple, scissors, pink, cube, plastic, wrench, yellow, copper, rectangle, calculator, titanium, saw, cotton, control unit, cone, rubber, green, aluminium, oval, pump, quartz, cylinder.

Complete the table.

Material	natural	Soft	ductile	tensile	brittle	Is/can be transparent	Is a good conductor of electricity	Is a good heat insulator
Gold	✓	✓	✓	✓			✓	
Glass								
Polythene								
Wood								
Steel								
Leather								
Rubber								
Paper								

Underline the properties or reasons that are correct. Two can be correct.

- We use gold connectors because gold
a) is strong b) is a good conductor c) doesn't react with most chemicals.
- Plastic bags are made of polythene because it's
a) cheap b) simple to produce c) brittle.
- Steel is used in the construction of a lot of buildings because it
a) has high tensile strength b) is ductile c) is soft.
- A lot of cans are made of aluminium because aluminium
a) corrodes quickly b) is easy to recycle c) isn't toxic.
- We used polystyrene in the housing of the refrigeration unit because:
a) it's lightweight b) it's absorbent c) it's good heat insulator.

Build your own (technical) glossary

Use the dictionary and find Slovenian translations.

English word

Slovenian translation

Follow up set:



Search the Internet and find an article about:

**A new generation of materials
Superconductors
Shape memory materials**

Then answer the questions:

- 1 Is the use of metals in decline? Could you give some reasons why?
- 2 What kind of ability do shape-memory materials display?
- 3 What is superconductivity?

Summary

As we claimed in the text, materials engineering terminology supports a vast array of industries. From the manufacturer that uses metals, ceramics, plastics, composites, or hybrid materials to manufacture parts, to the operator that must maintain structures – whether it is aircraft or pipeline. Each area of language discussed is an integral part of English language skills.

7 MATERIAL PROCESSING

This unit provides an overview of the area of machining dealing with technology news and resources for production engineers.

The newspaper articles give some information of improved machining practices and greater automation. They will also give you an opportunity to practice a lot of new words and expressions related to cutting geometry, laser welding and nanotechnology.

Below are some common words in material processing. Try to find their meaning. Consult a good technical dictionary!

- | | | | | | |
|----------|-----------|----------------|---------|----------|-------------|
| • anneal | • anodize | • electroplate | • forge | • found | • galvanize |
| • grind | • harden | • soften | • roll | • temper | • normalise |

Read the passage on metal forming and underline the common words for processes in treating metals.

Processes by metal forming can be classified into six major groups:

- casting;
- mechanical processing of materials such as forging, drawing, extrusion, rolling, stamping, and spinning;
- welding;
- machining, such as turning, drilling, boring, milling, grinding;
- powder and fibre metal forming;
- electroforming.

Metal cutting involves removing metal through machining operations. Machining traditionally takes place on lathes, drill presses, and milling machines with the use of various cutting tools. Successful machining also requires knowledge about the material you are cutting.

Common words in engineering describing change. Complete the list.

- | | | |
|--------|---|--------------------|
| harden | → | make sth. harder |
| _____ | → | make sth. weaker |
| _____ | → | make sth. stronger |

Nouns	adjectives	verbs
strength	_____	<u>strengthen</u>
resistance	_____	_____
_____	tough	_____
hardness	_____	_____
_____	soft	_____
_____	brittle	_____
design	_____	_____
product	_____	_____

7.1 MACHINING

Read the newspaper article on metal cutting.



Inserts feature positive rake cutting geometry.

November 15, 2006 - Suited for plunge milling and high feed milling applications, CoroMill 210 Inserts are optimized for cutting titanium, HRSA, tool steel, and stainless steel. Ten degree entering angle allows for extreme feed rates at small axial depths of cut when face milling, and high radial depths of cut when plunge cutting in rough operations. Design of cutter body allows for use of screws with coolant holes to provide through-the-tool coolant supply to each pocket. (Archive News Story)

New Sandvik Coromant Inserts Raise Efficiency in High Feed Face Milling and Plunge Milling

Innovative insert geometry boosts cutting performance

Fair Lawn, New Jersey, November 13, 2006 - Sandvik Coromant has recently added a new, positive rake cutting geometry insert to its CoroMill 210 line of milling tools. The new sharper and lighter cutting geometry possesses a cutting edge, which allows for superior performance and productivity in plunge milling and high feed milling applications.

The new insert improves cutting performance across a variety of materials, including titanium, HRSA, tool steel and stainless steel. In addition to productivity gains, the insert provides longer tool life and produces a smoother cutting action. Machining noise is reduced substantially, as is power consumption.

The CoroMill 210's unique design causes it to excel in productive plunge milling and high feed face milling. The tool's 10-degree entering angle allows for extreme feed rates at small axial depths of cut when face milling. The design also allows for high radial depths of cut when plunge cutting in rough operations.

In high feed face milling, the CoroMill 210 removes extremely high chip volumes at rates far above those with traditional face mills. The tool's plunge milling capabilities provide a highly efficient means of removing large amounts of metal in the axial direction, such as when milling deep cavities or externally along deep shoulders.

The design of the CoroMill 210 cutter body allows for the use of screws with coolant holes to provide through-the-tool coolant supply to each pocket. This ensures the best possible chip evacuation and cutting performance, even in difficult-to-machine materials.

Adapted from: <http://news.thomasnet.com/> (online). 13. 9. 2009



Class vocabulary

Work in groups. Then discuss your findings with the class.

Group 1

Look at the vocabulary list below and find the appropriate terms in the text you have just read. Are the methods mentioned in the text conventional or non-conventional? Sort them.

Group 2

Look at the vocabulary list below and complete it.

Group 3

List at the vocabulary list below and sort the words for methods according to:

- a) material removal methods
- b) material deposition methods

Group 4

Look at these figures and label the cutting zones and important cutting angles. You will find the expressions in the vocabulary list below.

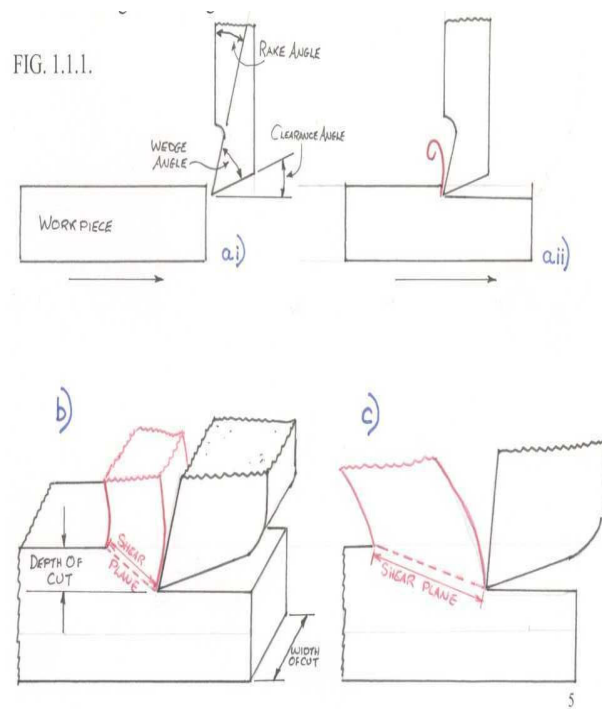


Fig 1.1.6.

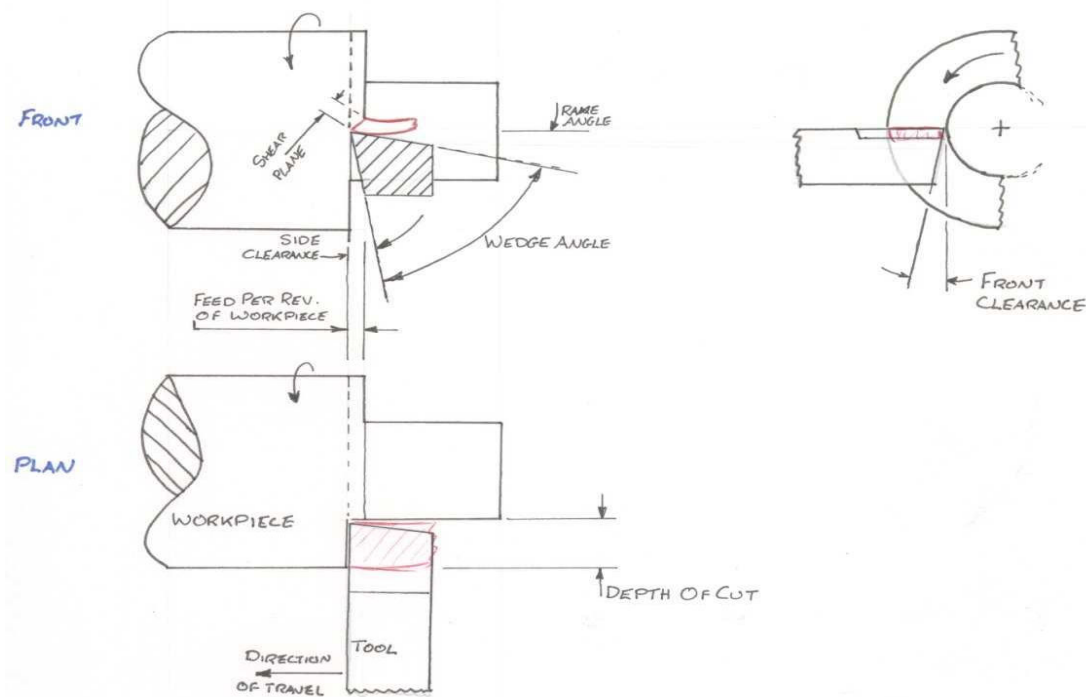


Fig. 10: Cutting zones

Vocabulary list

TERM	DEFINITION	Slovenian
boring	The process of using a single-point tool to enlarge a pre-existing hole. Boring is commonly performed on a lathe but is also possible on a mill.	
broach	A multi-point cutting tool with a series of progressively changing teeth that can both remove metal and finish the surface of a workpiece in one pass.	
casting	A manufacturing process that pours a liquid material into a hollow mold until the material cools into a solidified shape.	
cutting	A machining process that uses a tool to create chips and remove metal from a workpiece.	
drilling	The process of using a multi-point tool to penetrate the surface of a workpiece and make a round hole	
face milling	A cutting process that uses a mill to cut a flat surface by positioning the tool at a right angle to the workpiece.	
grinding	The use of an abrasive wheel to wear away at the surface of a workpiece.	
grooving	The process of cutting a narrow channel or passageway into the outside diameter of a cylindrical workpiece.	
inner diameter	The interior surface of a hole in a workpiece.	
machine tool	A power-driven machine that uses a cutting tool to create chips and remove metal from a workpiece.	
metalworking	A material manufacturing process that produces parts by mechanically deforming metal into parts. Stamping and forging are two major types of metalworking processes.	
mill	A multi-point tool that is used to remove metal from the surface of a workpiece.	
pocket	An interior recess that is cut into the surface of a workpiece.	
reaming	The use of a cutting tool with straight cutting edges to enlarge or smooth holes that have been previously drilled.	
single-point tool	A machining tool that has a single cutting edge.	
taper turning	An operation performed on a lathe that feeds a tool at an angle to the length of the workpiece in order to create a conical shape.	
chip	An unwanted piece of metal that is removed from a workpiece. Chips are formed when a tool cuts or grinds metal.	

chip breaker	A device located on the cutting tool or tool holder that is designed to prevent chips from forming into long pieces.	
depth of cut	The distance that the cutting tool is plunged into the workpiece. Depth of cut is typically measured in millimetres or inches.	
feed	The rate at which the cutting tool and the workpiece move in relation to one another.	
insert	A cutting bit that has multiple cutting edges. Once a cutting edge is excessively worn, it can be indexed to another edge, or the insert can be replaced.	
rake angle	The angle that the front of the cutting tool is tilted either forward or backward from its perpendicular position.	
relief angle	The angle that is formed by the surface of the workpiece and the bottom end of the cutting tool.	
shear force	A force that attempts to cause the internal structure of a material to slide against itself.	
shear strain	The deformation that occurs due to forces that attempt to cause the internal structure of a material to slide against it.	
back rake angle	If viewed from the side facing the end of the workpiece, it is the angle formed by the face of the tool and a line parallel to the floor. A positive back rake angle tilts the tool face back, and a negative angle tilts it forward and up.	
depth of cut	The thickness of the material that is removed by one pass of the cutting tool over the workpiece.	
end cutting edge angle	If viewed from above looking down on the cutting tool, it is the angle formed by the end flank of the tool and a line parallel to the workpiece centreline. Increasing the end cutting edge angle tilts the far end of the cutting edge away from the workpiece.	
carbide insert	A cutting bit made of hard carbide material that has multiple cutting edges. Once a cutting edge is excessively worn, it can be indexed to another edge, or the insert can be replaced.	
face	The flat surface of a single-point tool into which the workpiece rotates during a turning operation. On a typical turning setup, the face of the tool is positioned upwards.	
flank	A flat surface of a single-point tool that is adjacent to the face of the tool. During turning, the side flank faces the direction that the tool is fed into the workpiece, and the end flank passes over the newly machined surface.	
tool geometry	The collective angles formed by the dimensions of a cutting tool that make a tool unique.	

7.2 USE OF LASERS

What are lasers? What does the acronym LASER mean?

Put the verbs in brackets in the correct form.

The word Laser _____ (come) from the first letters of the phrase _____ and this also _____ (describe) how the laser _____ (work). The light from the laser _____ (differ) from normal light in that it _____ (consist) of only one wavelength _____ (emit) in only one direction in the form of a narrow beam. The concentrated energy from such a beam can be (can) made (make; passive) very great.

What applications do you know for lasers?

Complete this table by writing in other laser applications you know..

Military	Engineering	Communications	Medicine	Arts
_____	drilling diamonds	_____	treating damaged tissues	_____
_____	_____	information recording and reading	_____	_____
_____	_____	_____	_____	_____

Language study: used to/for

Study these examples of laser applications:

- 1 Laser beams can be **used to** cut complex shapes.
- 2 They can be **used for** drilling diamonds
- 3 They can be **used for** light displays.

We can describe applications with expressions

used to + *infinitive* or **used for** + *-ing or noun*

Now describe the use of the following appliances:

Word partnerships: noun + noun compounds

We can use adjectives to describe an object in greater detail. For example:

light	electric light
a motor	an electric motor
steel	stainless steel
gears	helical gears

We can also use nouns. For example:

light	laser light
a motor	an air motor
steel	carbon steel
gears	titanium gears
welding	laser welding

These word partners are also referred to as collocations. Collocations are words which commonly hang out with each other in phrases which form accepted meaning. Look at the words below and try to find out which words function together.

adjective + noun	noun + adjective	verb + adverb
<i>fantastic opportunity</i>	<i>proof positive</i>	<i>deny strongly</i>

colossal
explosion
substantial
reduction
pleasant
environment
fantastic
opportunity
high

quality
unmitigated
disaster
proof positive
deny strongly

7.3 LASER WELDING

Read the newspaper article and answer the questions below.

Laser deposition welding and milling in a single machine

Source: [alphagalileo](http://alphagalileo.com) (online). 13. 9. 2009.

Improving the productivity of machining processes is one of the basic requirements in every machine-tool engineering specification. The Fraunhofer Institute for Material and Beam Technology IWS in Dresden has integrated a laser module into the tool station of a milling spindle.

The IWS's manufacturing experts will be exhibiting their two-in-one machining solution on the joint Fraunhofer stand at the EUROMOLD trade show in Frankfurt from December 3 to 6, 2008 (Hall 8, Stand L113).

We linked all the processing steps on the basis of uniform CAD and NC data, and implemented them in a single machine with one tool fixture, relates Dr.-Ing. Steffen Nowotny of the IWS in Dresden. The 5-axis CNC milling centre is ideal for performing repairs on mold inserts used to manufacture plastic components, and for machining finely structured surfaces and functional coatings on metallic components.

Instead of having to discard damaged precision tools, they can now be returned to the workshop, reprocessed by the laser welding and milling machine, and reused – thus saving costs and reducing expenditure on new tools.

The combination of laser cladding and milling is also a cost-effective method of manufacturing complex molds and metallic components directly from the 3-D CAD model. The machining system's high degree of automation and its multitasking capability are extremely useful attributes in applications such as aircraft engine maintenance and automobile construction: The software links together all the individual processes. This simplifies and speeds up the task of programming the machine, says Nowotny.

The use of a complete machining solution significantly improves process efficiency, because the numerical control system regards the laser tool head and the milling spindle as interchangeable tools. The ability to switch rapidly and easily between milling and laser welding provides added flexibility, resulting in a machine that offers all the necessary features for time-saving manufacturing processes.

- 1. What is the main idea of the article?**
- 2. Which statement best expresses the main idea?**

Make questions and answer them. Ask:

- 1 what the increased use of machining tools has necessitated
- 2 for the names of some advanced laser-machining processes
- 3 what its main strengths are

What are Slovenian terms for the underlined words in the text below?

Welding is a process of permanent connecting by which pieces of the same kind of metal are strongly joined together. **Forge welding** is a very old process used to join together pieces of metal (usually **wrought iron**) by heat. Nowadays **machine welding** and laser welding are used in the manufacture. **Fusion welding** is successful with all kinds of steel, cast iron, copper and alloys of aluminium and magnesium. The two pieces of metal must be brought to a temperature above their **melting point**. This high temperature can be achieved by a powerful electric current – **arc welding**, or by burning acetylene gas in oxygen – **oxy-acetylene welding**.

Word partnerships in Technical English: verb + object combinations

Which of the verbs listed below might be combined with the nouns and phrases? Then insert the combinations in the blanks.

meet
apply
exert
raise
lay on
reach
tighten
make
incur
encounter
exceed
conserve

a load
a force
the limit
massive error rates
a problem.
an influence
emphasis on.
decision
a bolt
a specific requirement
an effort
any energy

1. Using an electric motor
2. What happens when I on an object in space?
3. Which Union Olimpija basketball player will*exceed*..... the technical foul*limit*.....in the regular season?
4. Thermodynamics introduces significant fluctuations which would massive rates if efficient proofreading mechanisms were not in place.
5. Windows Explorer has and needs to close.
6. Does the moon on cloud formation?
7. It is reasonable to on the research of the longitudinal 3d latticed beam.
8. decision by using an agreement method.
9. The best way to correctly is to use a torque wrench.
10. In many cases if your PC does not a specific then System Requirements Lab provides links to specific solutions so you can run the product.
11. Do you to adopt “green practices”, such as recycling, in your daily life?
12. Using natural energy resources doesn't necessarily mean you will any, yet we do advise every household to research the possibility of implementing natural energy resources to influence their home power supply. This will conserve the fossil fuels we are currently consuming at an alarming rate.

Word partnerships - collocations

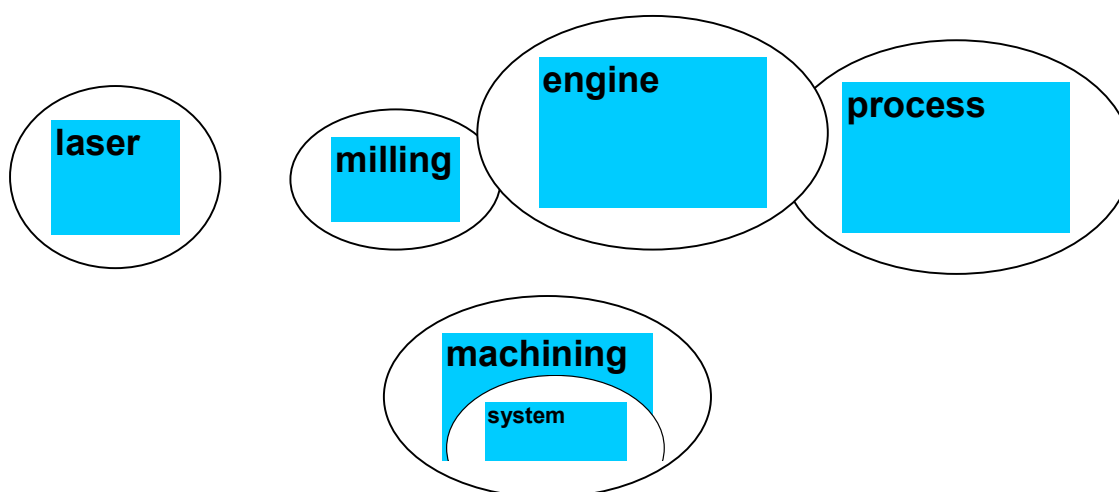
Refer back to the text on *Laser deposition welding and milling in a single machine* and find adjective + noun combinations. Translate them into Slovenian.

Besides adjective-noun combinations (*high rigidity*), noun-noun combinations (*light effects*) are extremely common in Technical English. Multiple noun structures can be understood by being read backwards (*carbon fibre composite casing*). Some combinations form lexical units and as such cannot be separated (*machine tool*, *power plant*, *gas turbine*).

Technical vocabulary concentrates on what the word means; you may already know what a single word means; but you have to concentrate also on how the words go together – **collocate**.

Collocations are frequent word combinations in technical domains. Using them makes your language sound more authentic to the professional community. Poor knowledge of collocations can result in making your English sound unnatural. We use wrong collocations under the influence of our mother tongue. Technical terms can involve unpredictable collocations so we should be made familiar with the field, to be able to recognize them.

Work in pairs. Look back at the text on *Laser deposition welding and milling in a single machine* and find words from the text that go together with the words below. Write the word combinations out next to each circle.



7.4 NANOTECHNOLOGY – A SMALL SCIENCE WITH A HUGE POTENTIAL



With significant media attention focused on nanoscience and nanotechnology in recent years, materials science has been propelled to the forefront in many companies.

Nano-Tex

If spilling soda, spaghetti sauce, or orange juice on ourselves strikes us with the fear of wearing dirty clothes. Nano-Tex, LLC, would encourage us to shop for pants and shirts made with NANO-CARE® fabric - pants and shirts that almost magically resist stains and repel water, giving us the ability to walk away from messy situations with clean clothes. Nano-Tex supplies material to many well-known brands (Nano-Tex).

What looks like magic in the Nano-Tex fabrics is actually the product of a science called nanotechnology, a cutting-edge field that deals with machines, materials, structures, and how they behave at the scale of atoms and molecules, or the nanoscale. By working on this small scale, scientists are able to create enhanced materials with desirable properties, such as stain-resistance.

Nano-Tex has a family of textile enhancements that become inherent to the fabric to improve the comfort, appearance and durability of everyday apparel, residential and commercial interiors.

Products include:

Resists Spills: spill resistant fabric enhancement for many types of fibres (cotton, synthetics, wool, silk, and rayon, polypropylene) that repels a range of liquids.

Cooler Comfort: quick-absorbing fabric enhancement providing superior wicking properties, which pulls perspiration away from the body and dries it quickly to keep the body cool and comfortable.

Resists Static: the only permanent anti-static treatment for synthetic fabrics.

Resists Spills & Releases Stains: the market's highest level of stain release combined with stain repellence.

Answer these questions:

What is nano tex?

What products does nano-tex make?

What makes nano-tex different from other fabrics?

How »big« is a nanometre?

A nanometre (nm) is 1,000 times smaller than a micrometer. It is equal to 1/1,000,000,000th or one-billionth of a meter. When things are this small, you can't see them with your eyes, or a light microscope. Objects this small require special tools called a scanning probe microscope (SPM) and a scanning electron microscope (SEM).

All these things are on the nanometre scale:

Virus (30-50 nm), DNA (2.5 nm), CNT (~1 nm in diameter). Atoms are smaller than a nanometre. One atom measures ~0.1-0.3 nm, depending on the element.

Tools that have created new technologies

Try to find the missing expressions below:

A Scanning _____ Microscope (SEM) is a microscope that uses electrons to form an image.

A Scanning _____ Microscope (SPM) allows scientists to image, characterize material structures at exceedingly small scales including features of atomic proportions.

A Scanning _____ Microscope (STM) is a powerful instrument for imaging surfaces at the atomic level.

An Atomic _____ Microscope (AFM) or scanning _____ Microscope (SFM) is a very high-resolution type of microscope.

Which capabilities do these microscopes have? Complete the table below.

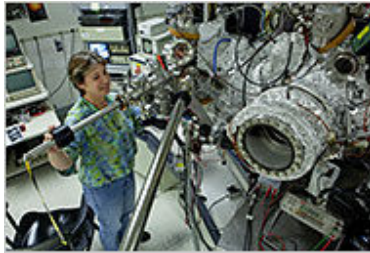
tool	capabilities
<i>AFM</i>	<i>very high resolution</i>

Follow up set: **Read this article about nanotechnology and circle T (true) or F (false).**

The New York Times

Chip Technology Nearing a Limit

YORKTOWN HEIGHTS, N.Y. — Gaze into the electron microscope display in Frances Ross's laboratory here and it is possible to persuade yourself that Dr. Ross, a 21st-century materials scientist, is actually a farmer in some Lilliputian silicon world.



CAPTAIN MINIATURE

Frances Ross, a scientist at I.B.M. Research in Yorktown Heights, N.Y., operating an electron microscope, which allows her to study nanowires, about one one-thousandth the width of a human hair, as they grow.

Dr. Ross, an I.B.M researcher, is growing a crop of mushroom-shaped silicon nanowires that may one day become a basic building block for a new kind of electronics. Nanowires are just one example, although one of the most promising, of a transformation now taking place in the material sciences as researchers push to create the next generation of switching devices smaller, faster and more powerful than today's transistors.

The reason that many computer scientists are pursuing this goal is that the shrinking of the transistor has approached fundamental physical limits. Increasingly, transistor manufacturers grapple with subatomic effects, like the tendency for electrons to "leak" across material boundaries. The leaking electrons make it more difficult to know when a transistor is in an on or off state, the information that makes electronic computing possible. They have also led to excess heat, the bane of the fastest computer chips.

The transistor is not just another element of the electronic world. It is the invention that made the computer revolution possible. In essence it is an on-off switch controlled by the flow of electricity. For the purposes of computing, when the switch is on it represents a one. When it is off it represents a zero. These zeros and ones are the most basic language of computers.

For more than half a century, transistors have gotten smaller and cheaper, following something called Moore's Law, which states that circuit density doubles roughly every two years. This was predicted by the computer scientist Douglas Engelbart in 1959, and then described by Gordon Moore, the co-founder of Intel, in a now-legendary 1965 article in *Electronics*, the source of Moore's Law.

Today's transistors are used by the billions to form microprocessors and memory chips. Often called planar transistors, they are built on the surface (or plane) of a silicon wafer by using a manufacturing process that precisely deposits and then etches away different insulating, conducting and semi conducting materials with such precision that the industry is now approaching the ability to place individual molecules.

A typical high-end Intel microprocessor is today based on roughly one billion transistors or more, each capable of switching on and off about 300 billion times a second and packed densely enough that two million transistors would fit comfortably in the period at the end of this sentence. In fact, this year, the chip industry is preparing to begin the transition from a generation of microprocessor chips based on a minimum feature size of 45 nanometres (a human hair is roughly 80,000 nanometres in width) to one of 32 nanometres — the next step down into the microcosm. But the end of this particular staircase may be near.

“Fundamentally the planar transistor is running out of steam,” said John E. Kelly III, I.B.M.’s senior vice president and director of research. »We’re at an inflection point, you better believe it, and most of the world is in denial about it,” said Mark Horowitz, a Stanford University electrical engineer who spoke last week at a chip design conference in Palo Alto, Calif. “The physics constraints are getting more and more serious.”

Many computer scientists have been warning for years that this time would come, that Moore’s Law would cease to be valid because of increasing technical difficulties and the expense of overcoming them. Last week at Stanford University, during a panel on the future of scaling (of which the shrinking of transistors is one example), several panellists said the end was near.

“We’re done scaling. We’ve been playing tricks since 90 nanometres,” said Brad McCredie, an I.B.M. fellow and one of the company’s leading chip designers, in a reference to the increasingly arcane techniques the industry has been using to make circuits smaller.

For example, for the past three technology generations Intel has used a material known as “strained silicon” in which a layer of silicon atoms are stretched beyond their normal atomic distance by depositing them on top of another material like silicon germanium. This results in lower energy consumption and faster switching speeds.

Source: <http://www.nytimes.com/2009/09/01/science/...> online) 13. 9. 2009

The writer of this article thinks that:

- | | |
|---|------------|
| 1 it will be possible to manufacture atoms in future | T/F |
| 2 we will be able to move atoms around in the way we want. | T/F |
| 3 today’s manufacturing methods are primitive. | T/F |

Summary

The chapter gives a broad overview of the field of material processing vocabulary and emphasises the fundamentals of laser material processing. It also presents the concept of meeting present manufacturing needs with the ability of future generations of technology. In other words, sustainable advanced manufacturing is being able to coexist with other systems without either system being damaged. Balance is what we should all aim at all levels ... because it is good for life, and even pays off.

8 ENQUIRING ABOUT A PRODUCT

This unit deals with basic telephoning skills and situations connected with improving your trading communication skills. The functions of asking for and giving information is also covered and practised.

8.1 TELEPHONE ENQUIRIES: I'D LIKE TO SPEAK TO ...

In a real-life phone call you have to depend on your voice, not gestures and eye contact. You can't see the other person's reactions and the other person can't see how friendly you are – you have to show everything in your voice.

Introductory vocabulary – check the meaning of the words below in the dictionary!

mobile phone	extension	application	confirm
phone booth	connect	equipment	arrangements
telephonist	switchboard	put through	ring up
put through	dis/connect	hang up	take down
lift	wait	cut off	replace
get through	find out	put down	pick up
ring back	phone book	phone boot	dial

calls:	international, local, trunk, collect, personal
code:	country, area, extension
line:	busy, engaged, free, party, occupied

Vocabulary

Fill the gaps with suitable words from the list above.

- 1 To make a call: first listen for the tone and dial the number. With any luck, you'll hear a tone telling you that the number is If the other phone is being used you'll hear the tone.
- 2 To make an international call: first dial the international code, then the country code, then the and finally the number you require.
- 3 If you want the other person to pay for the call, you can make a ...*collect call*.
- 4 If you want to talk to a particular person you can make a
- 5 If you don't want to be interrupted, you can leave the phone.....

Useful phrases

RING...RING...RING...

Hello, I'd like to speak to Mr.

Hello, this is Ms ... calling from.

Is Mr available, please? My name's

STARTING

Speaking.

I'll put you through to ...

PLEASE WAIT

Hold on a moment, please.

Could you hold the line a moment, please?

Sorry to keep you waiting.

I'll just find out if he's back yet /in the other office/available

NOT AVAILABLE

I'm afraid he's in/at a meeting/not in the office/still at lunch/not available just now. Is there anything I can do for you?

I'm afraid he's not available at the moment.

He's not at his desk at the moment.

I'll ask him to call you back as soon as he's free. What's the extension? Number / fax number?

I'm afraid she's not here just now. She won't be back till 2:30.

Can I ask her to call you when she's free?

TAKING MESSAGE

Could you ask him to call me back, please?

My number is...

Could you give him a message, please?

GOODBYE

I'll call again later today.

Thanks very much for your help.

Thank you for calling. Goodbye.

I'll speak to you tomorrow.

Nice talking to you.

PROBLEMS

Do you mind if I call you back in a minute?

My computer has crashed again.

I tried calling several times but I couldn't get through.

I tried calling you this morning but the line was busy all the time.

IS EVERYTHING CLEAR?

Could you say that again more slowly, please?

I'm sorry, could you spell that for me, please?

I'm sorry, did you say 14 or 40?

Could I just check that I've noted the details down correctly?

Do you want me to repeat anything?

Complete the telephone conversation with the phrases in the list

OK, go ahead	No, at A-T-S dot F-R.	Can I speak to Sandra Bulc?
You're welcome.	Can I help you?	Is there anything else?
Can I give her a message?	Can you speak up?	Sorry, how do you spell Peyrac?

JAN Jan Novak, HTP Electronika.

JOFFREY Yes, this is Joffrey Peyrac from ATS.

JAN I'm afraid she's in a meeting.

JOFFREY Yes, please. Could you ask her to email me the specifications of the JN-007 processors?

JAN Sorry, I didn't catch that.

JOFFREY Yes, I need the specifications of the JN-007 processors.

JAN The JN-007 processors. OK. Does she have your email address, Mr Peyrac?

JOFFREY I think so, but I'll give it to you just in case she hasn't.

JAN

JOFFREY It's J underscore Peyrac at A-T-S dot F-R.

JAN

JOFFREY P-E-Y-R-A-C.

JAN OK, so that's J underscore Peyrac, P-E-Y-R-A-C at A-T-C dot F-R.

JOFFREY

JAN A-T-S dot F-R.

JOFFREY Yes, that's right.

JAN, Mr Peyrac?

JOFFREY No, that's all, thanks.

JAN I'll give Ms Bulc your message.

JOFFREY Thanks, bye.

JAN Bye.

Albert Burns calls to the paint plant of Fenton Engineering to make an appointment with Mr Duval. Read the conversation and fill the gaps.

Reception: Fenton Engineering. *Good morning. Can I help you*.....?

Caller: 300, please.

Reception: I'm the line is busy. Will you?

Caller: Yes.

Reception: The line is free now. I will

Caller: Thank you.

Paint Plant: Paint Shop.

Caller: I'd like to to Mr Duval.

Paint Plant: Who is calling, ...?

Caller: Albert Burns

Paint Plant:, Mr Burns, I will get him.

Paint Plant: I'm he is Do you want?

Caller: No. Could I a message?

Paint Plant: Yes, certainly.



Image:

<http://www.youtube.com/...>
(online). 19. 9. 2009

Fully Automated Laser Welding Machine

This is a fully automated **laser welding machine** that can **weld** over 4 parts per minute (2 seams per part). The **machine** can hold numerous **welding** programs for different part sizes.



If Internet access is available view a You Tube video tutorial which shows an operation of a laser welding machine. Try to catch and write down 5 useful words/phrases about the machine.



Role-play

Practice making a phone call to the company making laser welding machines (role play)

You decided to buy a new laser welding machine. Before you write them an e-mail you decide to telephone for basic technical information. First check the time difference (it is 10 a.m. in Philadelphia right now). Your partner will role-play the sales officer. Call, explain which machine you are interested in, the partner should ask you some questions about technical details you require. Don't forget to finish the conversation appropriately. Practice without writing out the whole conversation.

Image: <http://www.cartoonstock.com/newscartoons/cartoonists/mba/lowres/mban1242l.jpg> (13. 11. 2009)

8.2 WRITING 2: E-mails

Nowadays the most common form of communication is almost certainly an e-mail. Because e-mails are designed for speed, they often avoid the formal expressions used in letters, relying more heavily on the use of incomplete sentences and abbreviations:

AFAIK	as far as I know	GL	good luck	SYS	see you soon
ASAP	as soon as possible	HTH	hope this helps	TU	thank you.
BTW	by the way	NP	no problem	I'll cc U	details ASAP.

CHECKLIST

- | | |
|---|--|
| ✓ Keep you message short | ✓ Keep spelling and grammar reasonably correct |
| ✓ Don't overuse abbreviations | |
| ✓ CAPITALS look as if you're SHOUTING | ✓ Check e-mail before sending |
| ✓ No underlining – hyperlinks for a website | ✓ Check for attachments |
| ✓ Clarity – line spaces | ✓ Check the e-mail address |

Useful phrases

OPENING

Thank you for your e-mail.
 Thank you for ordering from us.
 In reply to your request we can confirm that...
 Thank you for sending us your catalogue.

REASON FOR WRITING

I'm sorry I wasn't available to take your call yesterday.
 I'm sorry for the delay in ... I can now confirm that your order...

Sorting out problems

INTRODUCTION

I'm afraid I have some bad news...
 Due to circumstances beyond our control...

PROBLEMS

There's one point that I don't quite understand. Can you please confirm that....
 I'm sorry to inform you that we have to cancel the order/your reservation/...
 We're sorry that your order has been delayed.

REQUESTS

Could you please call me later today?
 Please confirm that these arrangements are OK.

ENDING

Sincerely, Best (wishes-GB), Regards

APOLOGY

I am sorry for any inconvenience this has caused you.
 Please let me know if there's anything I can do to help.
 I apologise for the delay ...
 I can assure you that this will not happen again.
 There's been a problem with...

8.3 LETTERS OF ENQUIRY

Opening

Give information about your company:

We are a co-operative wholesale company based in Ljubljana, Slovenia.

Our company is a subsidiary of Universal Business Machines and we specialise in...

We are one of the main producers of industrial chemicals in the south east of Europe, and we are interested in ...

Point out that they were recommended to you by a business partner ...

We were given your name by the ...

We were impressed by the selection of machine tools that were displayed on your stand at this year's Kunststoff Exhibition held in Duesseldorf, Germany.

We saw a demonstration of your product at the Paris Automobile Fair.

Body

Asking for catalogues, price lists

Could you please send your current catalogue and price list? We are particularly interested in ...

I would appreciate your sending me an up-to-date price list for your building materials.

Asking for details – be specific and state exactly what you want ➡ if replying to an advertisement mention it and quote the date

We have heard about your latest equipment in laser surgery and would like more details. Please send us any information you can supply, marking the letter "For the attention of Purchasing manager".

I am replying to your advertisement in the Journal "Tailor&Cutter". I would like to know more about the "steam pressers" which you offered at cost price.

Asking for samples, patterns

When replying, could you please enclose a pattern card?

Before selling laser cutters we prefer to test them for safety. Could you therefore send us at least two examples of these cutters in the mid range?

I would like to discuss the problem of maintenance before deciding which model to install in my factory. I would be grateful if you could arrange for one of your representatives to call me on within the next two weeks.

Suggesting terms of payment, discounts

We usually deal on a 30% trade discount basis with an additional quantity discount for orders over 1,000 units.

Could you let us know if you allow cash or trade discounts?

We intend to place a substantial order, and would therefore like to know what quantity discounts you allow.

Closing

Simple “Thank you” is sufficient to close an inquiry. However, you could mention that:

A prompt reply is appreciated.

Prompt delivery would be necessary as we have a fast turnover.

We would need your assurance that you could meet all delivery dates.

Indicate further business

If the product is satisfactory, we will place further orders with you in the future.

If the prices quoted are competitive, and the quality up to standards, we will order on a regular basis.

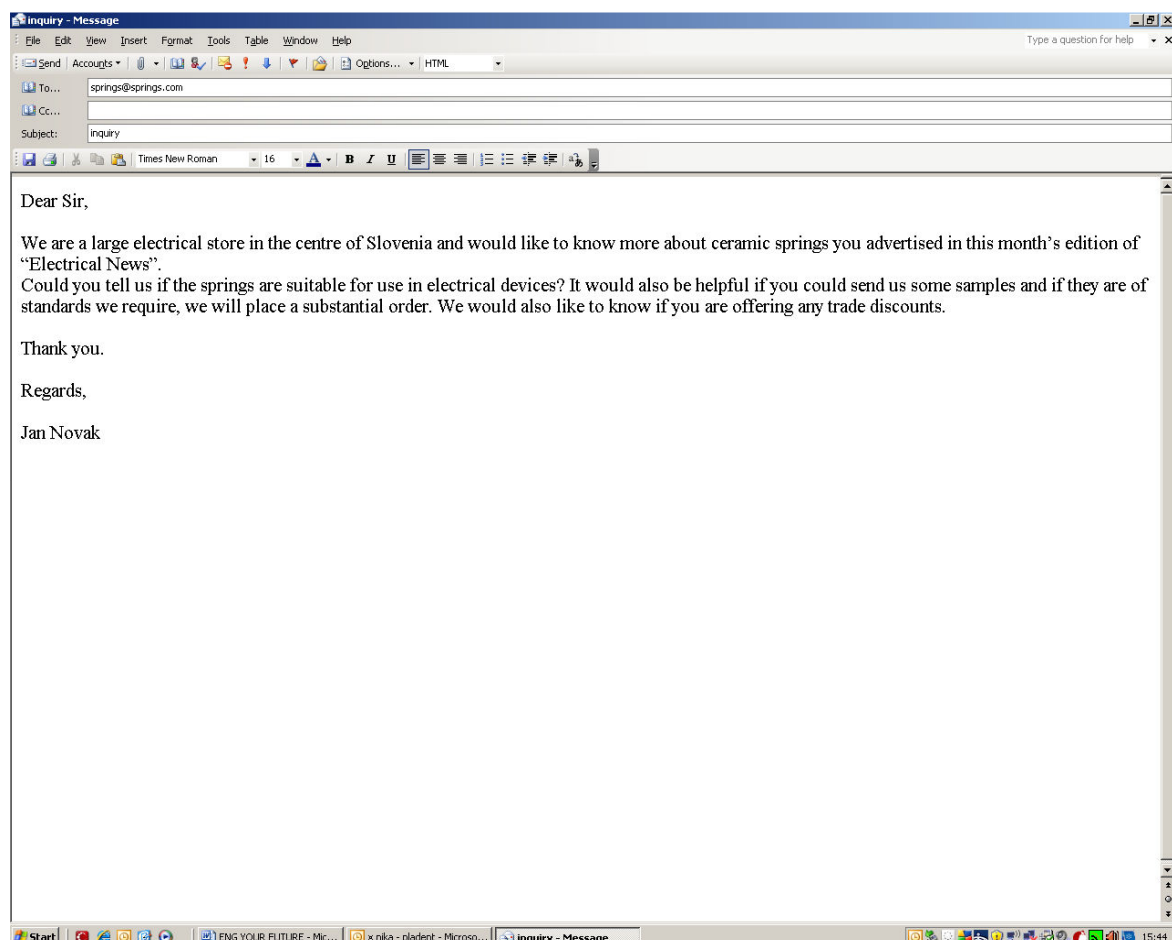
Greeting

We look forward to your reply.

We look forward to receiving your offer.

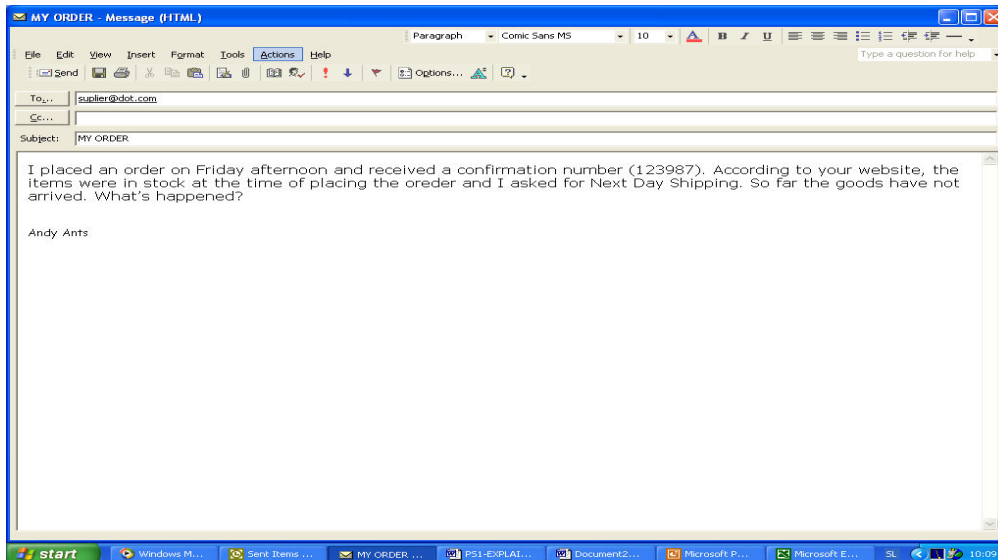
Regards, (option for e-mails)

Model letter: Enquiry

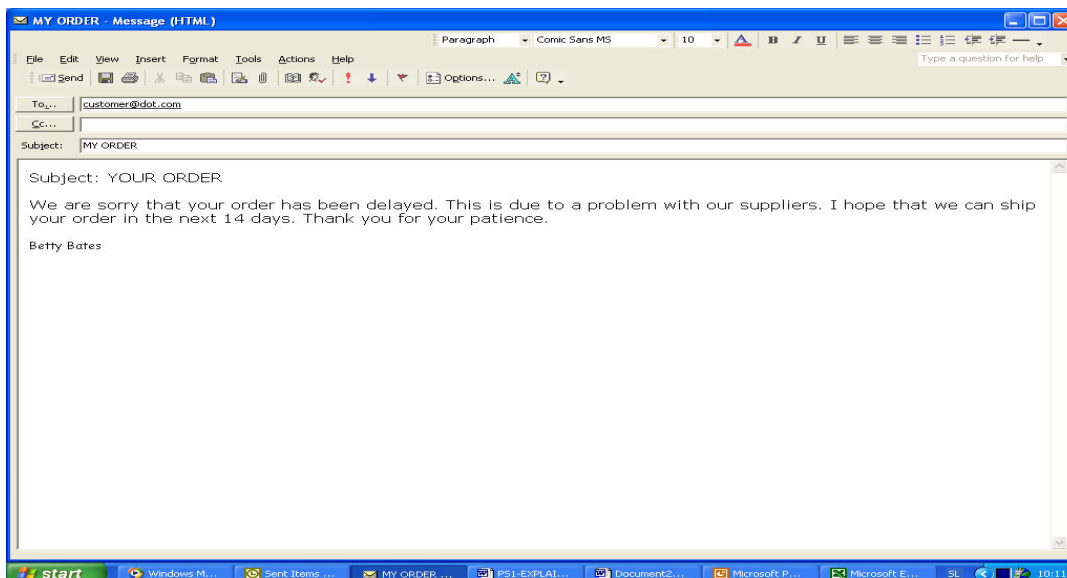


Practice makes perfect

Write a reply to the following e-mails, using the information on the right.

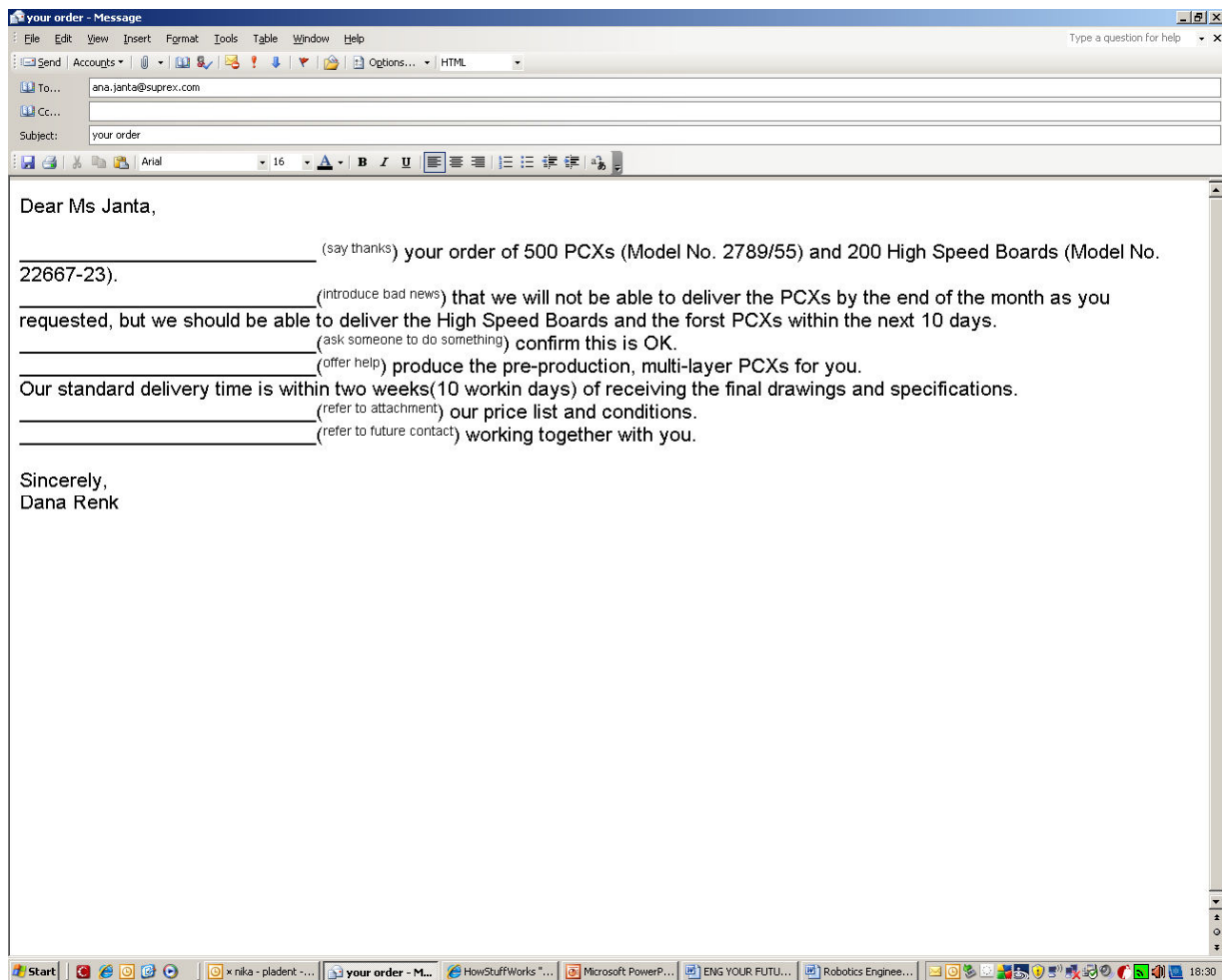


**Next day shipping only for orders placed before noon.
Goods will arrive before 5 pm on Tues –
let me know if they don't.**



**Cancel order.
Customer wanted goods this week –
can't wait longer.**

Insert the missing expressions.



Write an enquiry about a portable air compressor asking for technical details (cylinder size and stroke, maximum working pressure, air receiver in litres, etc), delivery and payment terms, brochures, etc.

We are widely known for supplying portable air compressors and industrial air compressors for iron & steel industry, engineering, and automobiles.

Starair Reciprocating Compressors are highly efficient machines. The compressors are manufactured at our works in New Town with high quality checks to give maximum performance with minimum consumption. The high cooling efficiency is due to specially designed cylinders, pulley and finned intercooler tubes. The connecting rod and crank shaft are made of high quality forged steel, hardened and ground to give best performance. Valves, the heart of compressor, are made of best steel to give best performance.

Follow up set: So far you have probably mastered a lot of new phrases which are used in writing business letters. To boost your language proficiency, read this news press release and write an e-mail enquiry about their cutting machine.

NEWS RELEASE

June 7, 2004

FOR:

Ingenium Cutter, Inc.

118 Liberty Drive

Libertyville, IL 60048

847-362-1560

Contact: Janice Brown@118

For Immediate Release

The landscape of CNC routing applications continues to change drastically. Those involved in providing CNC machining services for traditionally wood related products are now being asked to rout a variety of materials. Plastic, aluminium, and honeycomb are just a few of the materials which have surfaced in the past few years. All these materials pose different challenges in the area of router tooling because of their uniqueness.

With this thought in mind, Ingenium Cutter for the first time in history will have a CNC router in the booth at IWF 2004. The theme of “Unique Tools – Unique Solutions” will be practically illustrated by demonstrating how these materials are effectively machined through proper tool selection and methods.

Application specialists will be manning the booth to explain the tooling, the process, and most importantly the way these services can be brought to your facility through the OC On-Call Program. This no-cost service provides on-site training, technical support, troubleshooting, and custom tool designs which are unsurpassed in the industry.

If you want the correct tool and methodology to solve the challenges of ever-changing materials, visit Ingenium Cutter in Building A, Booth 2134.

For more information, contact Ingenium Cutter, 118 Liberty Drive, Libertyville, IL 61008 (188-234-1560) or visit us at www.ingenuim.com.

Summary

Beside the telephoning etiquette, this chapter describes the language of enquiries, with example letters and exercise. Letters (and mails) of enquiry describe what we want and why. The more unusual the request, the more convincing the reason needs be.

9 AUTOMOTIVE INDUSTRY

The texts in this unit give an overview of some concepts and terminology related to (future) car technology. There is no doubt that some alternative fuels, because they have less by-products, should be the ultimate in green alternatives to fossil fuels. But they have not delivered on their promise yet. You will continue to build your vocabulary skills and focus on talking about similarities and differences.

9.1 A LOOK AT THE FUNCTIONING OF YOUR CAR

Label the car parts.

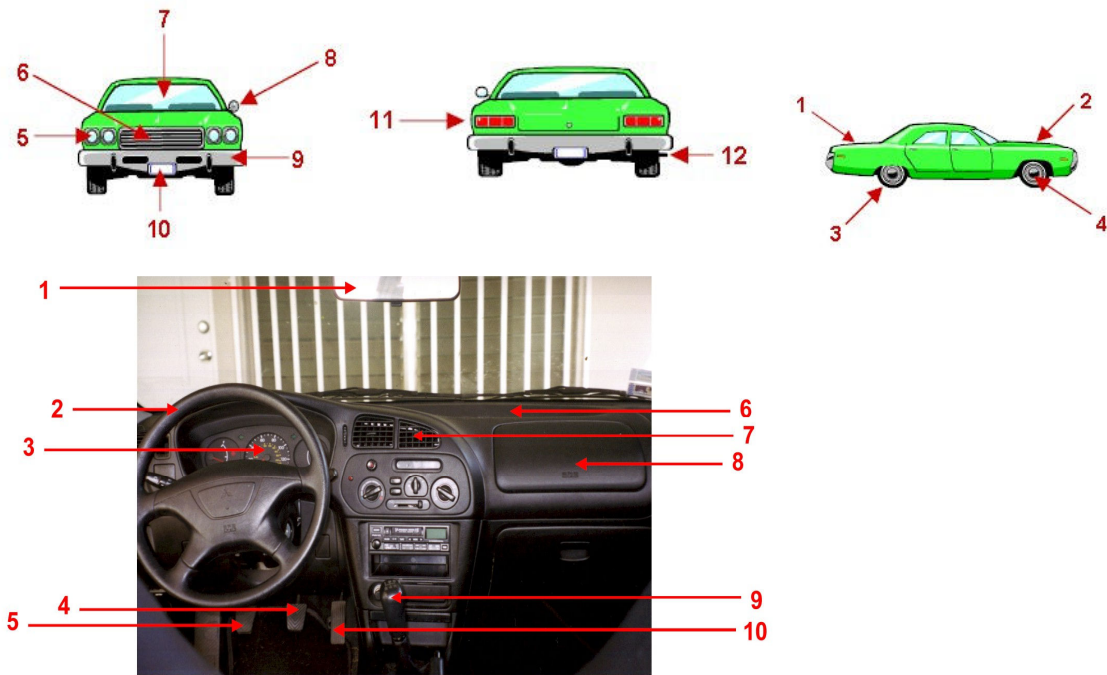
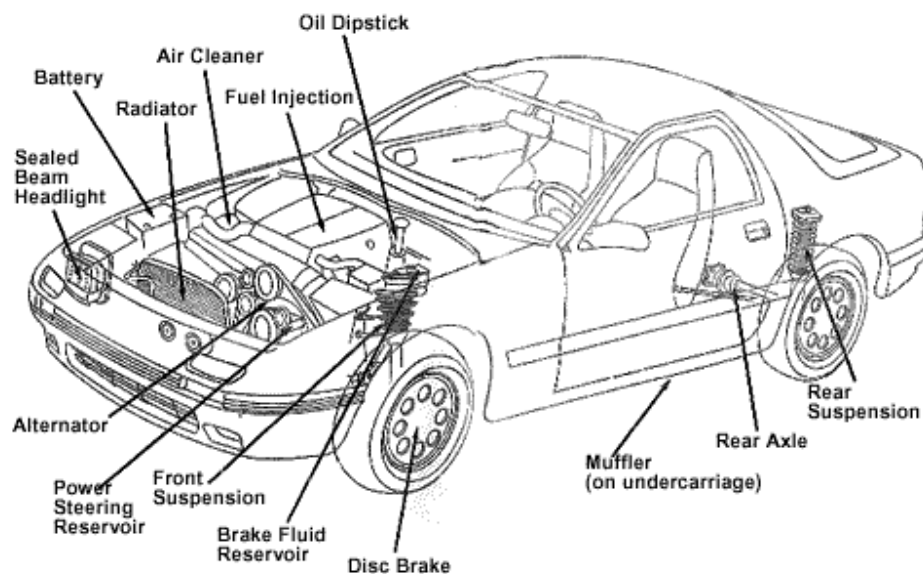


Fig. 11. Car parts

Car parts word formation. Complete the table.

VERB	NOUN	Slovenian
❖ accelerate ❖ back up ❖ change gears ❖ crash ❖ de-accelerate ❖ fasten seat-belt ❖ fill up with gas ❖ idle the engine ❖ park, pass ❖ push the accelerator, push the clutch ❖ race ❖ run out of gas ❖ shift into drive, shift into reverse ❖ slow down ❖ speed up ❖ stop	<i>acceleration</i>	<i>pospešek</i>

Basic Car Engine Parts



Below are the descriptions of the technical terms in the list. Put the appropriate term from the list next to each description. There is one description missing. Try to make it in your own words. The figure above might help you in your decisions.

List of terms:

**Air cleaner/filter
Air intake manifold
Alternator
Battery
Carburettor
Coolant reservoir (tank)**

**Distributor
Exhaust manifold
Fuel injection system
Muffler
Suspension system
Power steering reservoir
Brake fluid reservoir**

**Disc brakes
Oil dip stick
Rear Axle
Radiator
Timing Belt**

- Sprays controlled amount of fuel directly into either the intake manifold or combustion chambers, resulting in a very precise air to fuel ratio that improves fuel economy.
- The interior "baffles" and tubes quieten the explosive release of exhaust.
- Takes over from the battery when the engine is running. Recharges the battery and supplies power to all electrical components.
- Supplies the initial electrical power that starts the engine.
- Most new cars now have fuel injected engines. Older vehicles have carburettors. This gadget mixes air and fuel in the proper ratio for burning in the engine's combustion chambers.
- Air is drawn through it. Contains a filter that blocks dirt before it can enter the engine.
- Timing belts are commonly used on Japanese cars. The timing belt is a rubber belt that drives the engine's internal components. The water pump on some vehicles is driven by the timing belt, and should be replaced with the timing belt replacement. Air is distributed into the combustion chamber.
- Holds hot coolant (antifreeze) that overflows from the radiator and also draws back into the radiator as it is needed.
- Distributes high voltage electricity to the spark plugs, one at a time.
- Set of pipes, one for each cylinder that conducts exhaust away from cylinders.
- This system receives a great deal of punishment from the roads. This system consists of shock absorbers, Struts, springs, and motor mounts, tires, tie rods, ball joints, control arms, torsion bar, strut rods, spindle, axles.
- A metal disk that spins with the wheel that the brake pad uses to pressure against to stop.
- The stick that's used to check the level of the motor oil.
- A shaft that connects the power from the transmission to the wheels.
- The device that helps to remove heat from the cooling system as coolant passes through it.
- This reservoir contains fluid for your power steering system. Once the reservoir cap is unscrewed the cap will consist of a dip stick. This will identify the fluid levels.
- The brake fluid level can be inspected by the plastic box or bottle by the fire wall on the driver side.



If Internet access is available view a You Tube video tutorial which shows an operation of a car engine. Try to catch and write down 5 useful words/phrases. Then describe how a car engine works.

Source: <http://www.youtube.com/watch?v=Miw5vehtTck> (13. 9. 2009)

Most of us women don't think we are smart enough to understand how a car's engine works, but they're dead wrong. If a man can understand, so can we. We don't have to know how to fix them, but it helps if we understand them.

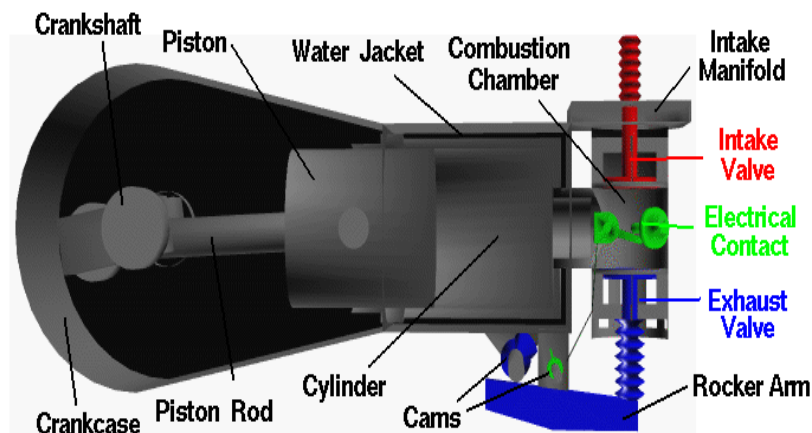


Fig 12: Operation of a car engine

9.2 THE CHANGING FACE OF OUR MOTORISED WORLD

Read the article about our changing world.

Find words and phrases that match the definitions: a.) the time when roads are full of traffic because of people travelling to or from work b) together, closely connected c) places used for a particular purpose or activity	Cars have given us freedom. We can go everywhere we want to go, whenever we want to go. They have also given us independence. Cars provide us with door-to-door transport solution that's always available. But they also change the world we live in. If you had to consider the impact of cars on your own town, first of all you would probably think of traffic jams and the difficulty of getting about in a car in the rush hour. Or maybe you would think of pollution and the toxic fumes. But there is a much bigger change we almost never think about. Cars change the face of the towns themselves. As people buy more and more cars, roads are getting widened to accommodate the increasing volume of traffic. They expand until the pavements become a thin strip along the foot of the buildings, further narrowed by the parked cars. We all enjoy the facilities that shopping malls and multiplex cinemas bring – because we can use our cars to get to them. Preferring our freedom to sharing transport with others, we get into our cars to get to our workplaces, to do our shopping, to go to the theatre, and many would even drive to go for a walk in the fields. And, wherever we drive to, we have to park, too. Parking spaces are huge areas of land, before grassy meadows, now used up by empty cars. We must realise that these changes come hand in hand, and we are to blame. And what cars have changed, will never be like it used to be, ever again.
--	--

Use of tenses.

1 Underline the verbs in the text above. Answer the following questions for each verb:

- A Which tense is it?
- B When does the action take place?
- C Why is this tense used?

9.3 THE FUTURE OF A CAR

Read the newspaper article about new trends in car battery technology.

The New York Times

WORLD TRENDS: Friday, September 18, 2009

New Battery Allows Electric Cars to Travel Extra Distance

By JOHN MARKOFF

SAN JOSE, California

A future generation lithium-air battery might be the much sought after power source for electric vehicles with the range that many gasoline powered cars have today.

The interest in the as-yet-unproven technology was underscored this summer when I.B.M. said it had begun to pursue a tenfold improvement in battery storage, with hopes of reaching the goal before the end of the next decade.

I.B.M. executives said the company was unlikely to enter the battery business directly but was aiming toward a partnership that would marry its hardware systems design expertise with ultra light battery technology.

Such a strategy would follow the lead of Tesla Motors, a new California company that produced a high-end electric roadster based on a computerized and sensor-based battery system. Tesla put 6,800 standard lithium-ion battery cells designed for consumer electronic products into a 450 kilogram package.

"I strongly believe that climbing this Mount Everest of 10 times better, given resources, time and patience, will happen, said Winfried Wickie, a physicist and I.B.M.'s senior manager for nano-scale science and technology here at the Almaden Research Center. "This is simply so overwhelming in its simplicity and its clarity and the socioeconomic consequences it

would have, that it deserves a Manhattan-like effort."

Battery experts met at the centre for two days last month. Burton Richter, who won a Nobel Prize in Physics, expressed optimism about the progress in battery technology. "We have a wonderful confluence of people who are concerned about society, and people who are concerned about the environment, which makes batteries and electrical transportation a big deal," Dr. Richter said.

Lithium-ion batteries, the technology of choice for hybrid and electric car makers, have limited energy capacity. Researchers working on lithium-air and lithium-sulphur alternatives said that they would broaden the market for solar cars if safety issues could be overcome.

Lithium-ion batteries have the potential to deliver about 585 watt-hours of electricity per kilogram, while lithium-sulphur has a theoretical potential of about 2,600 watt-hours, and lithium-air batteries might reach targets well above 5,000 watt-hours.

If they can be perfected, lithium-air batteries would be ideal for transportation applications, given their potential for high energy capacity and low weight. And, alike zinc-air batteries, it should be possible to make them rechargeable.

Scientists at the I.B.M. conference spelled out a range of challenges, like safety concerns and lowering the costs of the batteries, which now add thousands of dollars to the price of electric vehicles.

Nadav Enbar, an energy analyst at IDC Corp., said that despite I.B.M.'s optimism, the advent of lithium-air batteries was unlikely in the near term. Mr. Enbar cited the long testing cycles that new battery technologies must go through as the most significant challenge the company would face.

Main idea

Which statement best expresses the main idea of the article? Why did you eliminate the other choices?

- 4 Electrical technology could help determine winners and losers in the auto industry of the future.
- 5 To commercialize pure electric vehicles we need a battery that far exceeds the current technology
- 6 Battery production technology is no more complicated than that of semiconductors, which are already mass produced.

Locating information

Find the passages in the text where the following ideas are expressed. Give the paragraph reference.

- 1. Some energy specialists are highly sceptical of electric vehicles.
- 2. Advances in batteries, as well as in strong magnets, have made electric vehicles viable.
- 3. Consumers appear more interested in buying eco-friendly cars.
- 4. In a world, to make the vehicles run on electrons, the automakers will have to reinvent their businesses.
- 5. There's a potential for electric cars to be easier and cheaper to make than conventional cars.



Finance 180/2009, 17.9.09 (online <http://www.finance.si/257952>; 18. 9. 2009)

Hidria razvila generator za električne avtomobile

Miloš Milač

HIDRIJIN GENERATOR BO PODALJŠAL DOSEG ELEKTRIČNIH AVTOMOBILOV S 50 NA 150 DO 200 KILOMETROV

Idrijska Hidria je za avstrijski inštitut AVL List razvila generator za električne motorje, ki bo podaljšal doseg električnih avtomobilov za dva- do trikrat. V katerih avtomobilih bo naprava na voljo, za zdaj še ni jasno.

Po pojasnilu iz Hidrie je električni stroj neposredno povezan z glavno gredjo običajnega motorja z notranjim izgorevanjem z majhno delovno prostornino in se uporablja za njegov zagon. V generatorskem režimu pa električni stroj proizvaja 15 KW električne moči. Končni rezultat je precejšnje podaljšanje neprekinjenega delovanja električnega avtomobila in povečanje uporabnega dosega z izhodiščnih 50 na kar 150 do 200 kilometrov med polnjenji. Hidrii je pri razvoju generatorja pomagala tudi Fakulteta za elektrotehniko Univerze v Ljubljani.

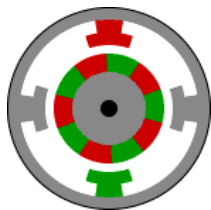
HIDRIJIN GENERATOR V DOSTOPNIH ELEKTRIČNIH AVTOMOBILIH

Avstrijski inštitut AVL pa bo ob pomoči Hidrijinega generatorja skupaj s partnerji Magna Europe, Siemens in KTM do leta 2015 razvil dostopnejšo tehnologijo, predvsem baterije za električne avtomobile. Njihov cilje je do leta 2015 predvsem poceniti tehnologijo in izdelati električni avto, ki bo deloval z nižjimi stroški kot avto z motorjem z notranjim izgorevanjem. Po besedah Karla Nigla, vodje razvoja v Magni Europe, bodo električni avtomobili leta 2020 že za 20 odstotkov cenejši od navadnih.

Read the text and write down English expressions for:

Generator	.....
Uporabni doseg delovanja	.....
Gred motorja z notranjim izgorevanjem	.....
Električna moč	.....
Električni motor	.....
Delovna prostornina motorja	.....
Baterija za električni avtomobil	.....

Read the text and underline the verbs. How many of them are in the active and how many passive?



Stepper Motors

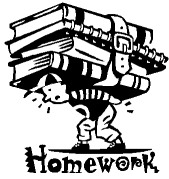
This stepper motor is very simplified. The rotor of a real stepper motor usually has many poles. The animation has only ten poles, however a real stepper motor might have a hundred. These are formed using a single magnet mounted inline with the rotor axis and two pole pieces with many teeth. The teeth are staggered to produce many poles. The stator poles of a real stepper motor also have many teeth. The teeth are arranged so that the two phases are still 90° out of phase. This stepper motor uses permanent magnets. Some stepper motors do not have magnets and instead use the basic principles of a switched reluctance motor. The stator is similar but the rotor is composed of iron laminates.

These sentences below are in the active voice. Study them and define the tense.

1. For the purposes of this report I surveyed six companies.
2. We tested the samples under various conditions.
3. The department will announce the results next Tuesday.
4. A company in Korea manufactures this equipment.
5. You did not inform us about the results of the survey.

Now fill in the blanks to change the verbs in the sentences above from active voice to passive voice. Remember to keep the verb in the same tense.

1. Six companies _____ (survey) for the purpose of this report.
2. The samples _____ (test) under various conditions.
3. The results _____ (announce) next Tuesday.
4. This equipment _____ (manufacture) by a company in Korea.
5. We _____ (not inform) about the results of the survey.



Follow up set:
HOME ASSIGNMENT: Compare and Contrast Paragraph

In a compare and contrast paragraph, you write about the similarities and differences between two or more - people, places, things, or ideas.

Write a short paragraph comparing battery-driven cars to engine-driven cars.

The following words can help you write a good compare and contrast paragraph – consult your (note)book or dictionary, too!

Linking words:

But
Compared with/to
In comparison with
On the other hand
Although
However
While
Whereas
In contrast (to)
For this reason
Contrast(s) with

Comparison expressions:

- More / much
- Fewer / less / little
- Not as/so much as
- Not as/so many as
- Lower than
- as early as
- Less/much = are used for uncountable nouns!

Summary

Due to the global crisis, the automotive industry has declined heavily, from a decline in global assembly production to the decrease in sales. As it is commonly assumed that mechanical engineers are automotive engineers, the new language knowledge and implicit vocabulary will help students cope with the demands of car technology areas.

10 ENERGY

The following passage will give you some information about alternative types and sources of energy. It will also explain how energy may be converted and stored. The concept of ecology is central to the topic of energy supply in future.

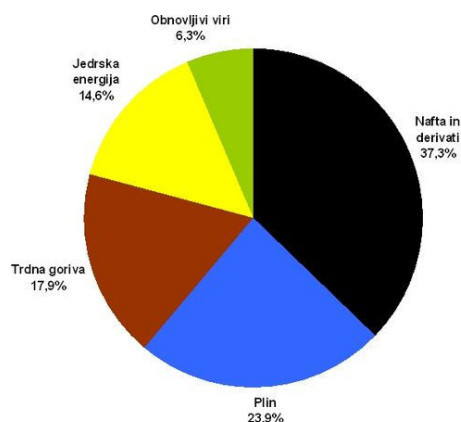
The following text will give you an opportunity to refer to energy issues in Europe and boost your vocabulary.

Read the text and translate the expressions in bold type into English.

Energetika



Dostop do energije je temeljnega pomena v vsakodnevnem življenju vsakega Evropejca. Višje cene, grožnje varnosti oskrbe z energijo in sprememb evropskega podnebja vplivajo na vsakega od nas. Energijo v vsakdanjem življenju jemljemo kot samoumevno.



Pomanjkanje goriva in motnje pri preskrbi z energijo so redek pojav, a kljub temu občasno opozarjajo, da smo odvisni od energije za prevoz, ogrevanje domov pozimi in ohlajevanje poleti ter delovanje tovarn, kmetijskih gospodarstev in pisarn. Vendar so mnogi **energetski viri** omejeni, **njihova izraba** pa je pogosto vir onesnaževanja. Varovanje okolja in potreba po tem, da bi dosegli čim večjo varnost oskrbe ter z rastjo cen ostali konkurenčni na mednarodni ravni, pomeni, da mora EU postati gospodarstvo z nizko proizvodnjo CO₂, ki uporablja **manj fosilnih goriv** v industriji, prometu in gospodinjstvih ter izkorišča **obnovljive energetske vire** za **proizvajanje električne energije, ogrevanje ali ohlajevanje zgradb** in v prometu. To predpostavlja ambiciozen prehod na **energijo vetra, biomase, vode in sonca ter biogoriva iz organskih snovi**.

V grafikonu so prikazani deleži posameznih **primarnih virov energije** v Evropski uniji leta 2004. Za primerjavo, v strukturi oskrbe z energijo v Sloveniji podobno kot v EU prevladuje **nafta** (36 %), sledijo **trdna goriva** (21 %) in **jedrska energija** (19 %), medtem ko ima **plin** v primerjavi s povprečjem EU le 12-odstotni delež, obnovljivi viri pa 11 %, kar je občutno več kot na ravni Unije.

Source: <http://www.evropa.gov.si/si/energetika/> (online). 18. 9. 2009

10.1 COGENERATION

Read the text and translate the expressions in bold type into Slovenian.

Can we conserve energy?

Cogeneration means simultaneous **production of electricity and thermal energy**, both of which is used. The phrase “cogeneration” was coined in the 1970s by the USA President Carter. It is also called **Combined Heat and Power (CHP)**. **Thermal demand** can include **hot water, steam, space heating, cooling, and refrigeration**.

The central and most fundamental principle of cogeneration is that systems should be based according to the **heat demand** of the application. This can be an individual building, an industrial factory or a town/city served by **district heat/cooling**.

- The efficiency of a cogeneration plant can reach 90% or more. Cogeneration therefore offers **energy savings** ranging between 15-40% when compared against the **supply of electricity and heat** from conventional power stations and boilers.

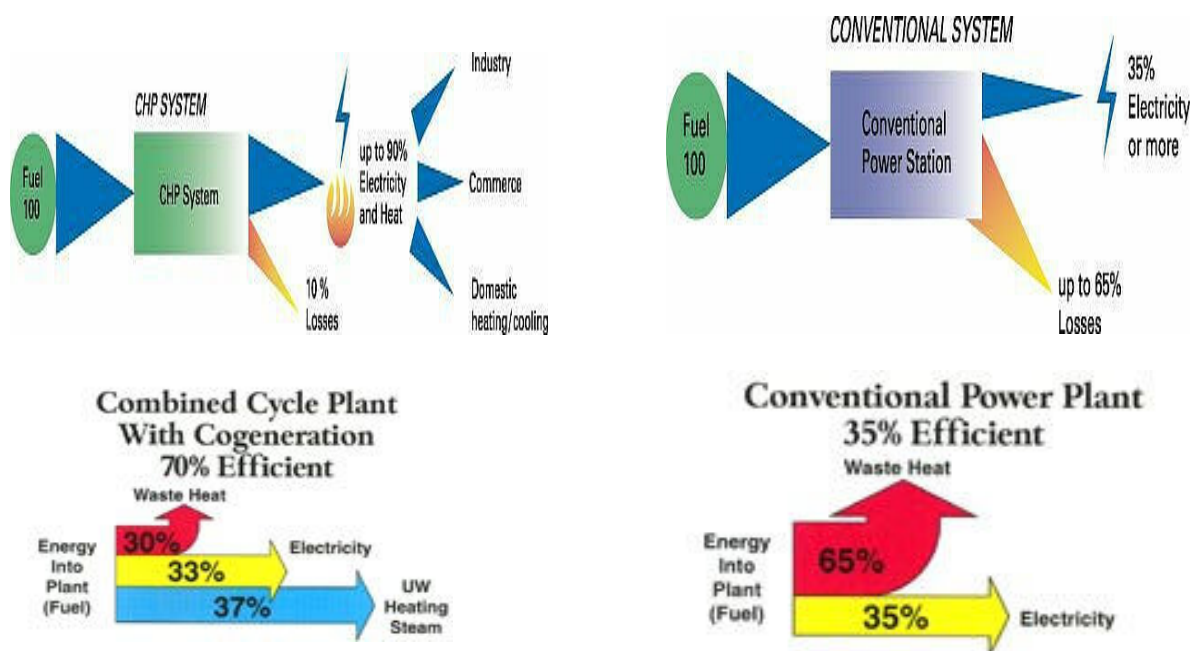


Fig. 13: Efficiency of a cogeneration plant
 Source: <http://images.google.com/images...> online). 13. 11. 2009

10.2 FUELS OF THE NANO AGE?

Name some energy resources.

What are the examples of fossil fuels?

Can you name any other renewable fuels?

Do you agree with the following statements? Then sort them either under advantages or disadvantages.

- 1 A fossil-fuelled power station can be built almost anywhere, so long as you can get large quantities of fuel to it.
- 2 Mining coal can be difficult and dangerous. Strip mining destroys large areas of the landscape.
- 3 Coal-fired power stations need huge amounts of fuel, which means train-loads of coal almost constantly. In order to cope with changing demands for power, the station needs reserves. This means covering a large area of countryside next to the power station with piles of coal.
- 4 Very large amounts of electricity can be generated in one place using coal, fairly cheaply.
- 5 Burning coal produces more carbon dioxide than burning oil or gas.
- 6 It also produces sulphur dioxide, a gas that contributes to acid rain. We can reduce this before releasing the waste gases into the atmosphere.
- 7 Transporting oil and gas to the power stations is easy.
- 8 Gas-fired power stations are very efficient.
- 9 Basically, the main drawback of fossil fuels is pollution.
- 10 Burning any fossil fuel produces carbon dioxide, which contributes to the "greenhouse effect", warming the Earth.

ADVANTAGES	DISADVANTAGES

Look at the pie chart presenting the use of fuels in CHP systems. Describe it.

Natural gas

Coal

Biomass

Bagasse (waste product from sugar cane processing)

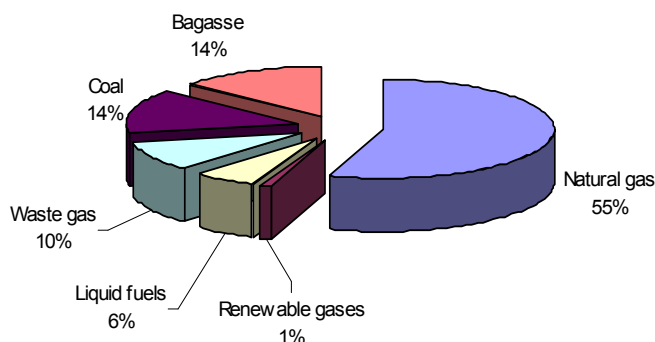
Waste gas

Sludge gas from sewage treatment plant

Methane from landfills and coal bed methane

Liquid fuels (oil)

Renewable gases



10.3 SHOULD I BE WORRIED ABOUT NUCLEAR POWER?

Nuclear power stations are not atomic bombs waiting to go off, and are not prone to "meltdowns". If the reactor gets too hot, the control rods are lowered in and it cools down. If that doesn't work, there are sets of emergency control rods that automatically drop in and shut the reactor down completely.

The computers will shut the reactor down automatically if things get out of hand (unless engineers intervene within a set time). At Chernobyl, in Ukraine, they did not have such a sophisticated system, indeed they over-rode the automatic systems they did have. When they got it wrong, the reactor overheated, melted and the excessive pressure blew out the containment system before they could stop it. Then, with the coolant gone, there was a serious fire. Many people lost their lives trying to sort out the mess.

If something does go wrong in a really big way, much of the world could be affected.

With AGR reactors (the most common type in Britain) there are additional safety systems, such as flooding the reactor with nitrogen and/or water to absorb all the neutrons - although the water option means that reactor can never be restarted.

So should we worry? I think the answer is "so long as things are being done properly, I don't need to worry too much." The bit that does worry me is the small amount of high-level nuclear waste from power stations. Although there's not much of it, it's very, very dangerous and we have no way to deal with it apart from burying it and waiting for a few thousand years.

There are many different opinions about nuclear power.

Please make up your mind, find out as much as you can, and make your own:

1 Predictions about the future energy sources in Slovenia when we run out of oil.

Notice that to make a prediction for the future the first Conditional is used. See Grammar Point.

2 What would happen in case of a nuclear power plant meltdown?

Notice that to express hypothetical situations the Second Conditional is used. See Grammar Point.

Read the text first, then do the exercises below.

ENVIRONMENT: The waste-to-fuel experiment

When you read the following text, remember to try and understand the meaning of new words and expressions from the context. Don't check new words in the dictionary until you have read the whole text.

Casella Waste Systems wants to build a waste-to-fuel plant at the Ontario County Landfill.

When we fill our cars with gasoline, we're using the processed product of petroleum - a material with the application of a tremendous amount of heat and pressure over millions of years. There's only so much of it and burning lots and lots of petroleum, as humanity has learned, has dire consequences - environmental, political, and economical.

Experimental technology may have an answer. Researchers have found several ways to convert any number of materials to hydrocarbon fuels. Often the methods involve the forces used in nature - heat and pressure, for example - but with much quicker results.

There's a catch: the technology's **long-term viability** is uncertain. But **waste-to-fuel plants**, as they're known, are being built all over the country. In the Finger Lakes region, Casella Waste Systems wants to build a waste-to-fuel plant at the Ontario County Landfill in the town of Seneca. The waste-to-fuel processing equipment, however, is scheduled to arrive in the next few weeks. If the project proves technically and financially viable, it has the potential to **alter** waste-disposal practices as well as reduce dependence on imported oil, says Jerry Leone, **director of sustainable development** for Casella. Casella wants to use a method called thermal-chemical **dissolution**, a process that uses heat to break down source material into its basic elements. The process creates a gas, which can be condensed into a liquid fuel.

The technology could also be used to produce polyethylene, which is used to make plastics. Unrecyclable plastics and paper will be used as the source material - feedstock, in technical terms, pop bottle tops, or plastic six-pack rings as examples. The company hopes to be able to process one ton of waste into 100 gallons of liquid fuel each hour. The plant would cost about \$3.5 million to \$4 million to build.

"I think it's a very interesting project," says David Baker, a city of Canandaigua representative on the county's Board of Supervisors and the chair of its solid waste management committee. "I like the idea, but there's a lot we need to do before we proceed." Among the benefits, Baker says, is the possibility of prolonging the life of the landfill.

But there are broader questions that need to be addressed. This is where a life-cycle analysis comes in handy, says Eli Hopson, the Washington representative for the Union of Concerned Scientists' clean vehicle program. That means looking at emissions and energy factors for the entire project, not just the impact of burning the fuel. With typical fossil fuels, the colloquial term is "well to wheel."



Ethanol taught politicians, environmentalists, and average folks some important lessons about alternative fuels, such as looking beyond the tailpipe when evaluating impacts. The fuel may burn cleaner than standard gasoline, but the location of the source crop and farming methods can mean a much greater **greenhouse gas** contribution.

But the Union of Concerned Scientists, a non-profit organisation that's influential on environmental **issues**, does see potential in waste-to fuel technology. "Using wastes as a feedstock to create fuels is the right approach," Hopson says.

Carbon dioxide is less of an issue as well. Drawing petroleum out of the ground and then processing and burning it puts emissions into the air that wouldn't have been there otherwise. As **landfill waste** decays, carbon dioxide is released anyway. Burning waste derivatives as fuel releases no more carbon dioxide than if the waste decayed.

The results and impacts can still vary from project to project and place to place, much as they can with other alternative fuels. Using ethanol as an example, the fuel sometimes **yields** less energy than was consumed producing it. "The interesting question becomes, how much energy is going into the process?" Hopson says.

Adapted from: Jeremy Moule on February 4, 2009 <http://www.rochestercitynewspaper.com/news/...> (online).
18. 9. 2009

Understanding the text

What is the main idea of the text?

What are some environmental consequences of the project?

What are some advantages of the project in terms of economic efficiency?

Understanding words

Refer back to text and find synonyms for the following words (bold printed):

alter

dissolution

issues

yields

Refer back to text and re-phrase the following words (bold printed):

director of sustainable development

landfill waste

greenhouse gas

long-term viability

waste-to-fuel plants

Language focus: TIME RELATIONS

Study the use of tenses. Note that when talking about the **future**, you should use one of the **present tenses** in the time clause.

Expressing simultaneity	Expressing sequence
When we fill our cars with gasoline, we're using the processed product of petroleum. PRESENT When they start producing polyethylene, the new technology will use unrecyclable plastics and paper as the source material. FUTURE While landfill waste decays, carbon dioxide was released anyway. PAST	After the project proves technically and financially viable, it will alter waste-disposal practices. FUTURE As soon as the project had proved environment friendly, they started to build a new plant. PAST

Combine the two sentences to express simultaneity or sequence. Use linking words for simultaneity or sequence: **when, while, after, as soon as, as, until, by the time**.

- 1 Toyota waits for electric cars.
Its rivals race to an electric future.
- 2 In spring 2008, the final design of the new product was determined.
The mechanical engineers now have the task of switching from the prototype to mass production.
- 3 The ground collector is used as an air-to-ground heat exchanger.
The air is sucked in via ground.

10.4 WIND TURBINES

Word formation. Fill in the word in the right form.

Wind power is a clean energy source. Its fuel is the wind. It produces (produce) no pollution (pollute). Wind power is a renewable energy source. New wind is created every day by the heating (heat) and cooling (cool) of the earth. The price of wind power is not affected by fuel price increases (increase) or supply disruptions (disrupt). Wind power creates jobs. The American Wind Energy Association estimates that 10,500 direct jobs and more than 11,000 indirect jobs have been created in the United States by wind energy production (produce). Due to technological (technology) advances, wind power costs as little as three to five cents per kilowatt hour. Wind plants can be built quickly (quick) to respond to electricity shortages. Most electricity is created from fossil fuels like coal, oil and natural gas. Wind power provides less than half of one percent of the electricity, but could provide much more. There is enough wind and windy (wind) areas to produce three times as much electricity as we use today. Winds could generate more electricity in 15 years than all of Saudi Arabia's oil, without being depleted.

How far do you agree with the statements in the text?

Wind turbine facts

- 1 One 1.5 MW wind turbine can produce enough clean electricity for about 400 homes each year.
- 2 A 1.5 MW wind turbine is more than 328 feet tall at its tallest point (that's taller than a 32 story building).
- 3 A 1.5 MW wind turbine weighs about 92 tons.
- 4 Just one blade from the 1.5 MW wind turbine is 112 feet long (that's more than 37 yards on a football field).

According to your knowledge in the field, are the following statements true or false? Why?

1. _____ Wind power is safe, clean, and we'll never run out of it.
2. _____ One 1.5 megawatt wind turbine can produce enough electricity to meet the annual electricity needs of about 400 homes.
3. _____ Wind is created by the phases of the moon.
4. _____ The Beaufort wind scale uses observations of everyday things to determine wind speed.
5. _____ Windmills have been used for many things, including grinding flour and pumping water.
6. _____ A wind turbine uses the power of the wind to produce nuclear energy.
7. _____ Carbon dioxide is the primary "greenhouse gas" that contributes to global warming.
8. _____ Wind is actually a form of solar energy.
9. _____ For thousands of years, people have harnessed the power of the wind.

10.5 SOLAR POWER



Read the text first, then do the exercises below.

September 18, 2009 – Vol.14 No.26

COMMUNITY BUILT SOLAR FOR THE COMMUNITY. *by Bruce Mulliken, Green Energy News*

It seems as though everyone wants to save the world or at least have a plan for doing so. (Not a bad aspiration as aspirations go.) We're talking about energy here, so saving the world means stopping global warming by cutting greenhouse gas emissions related to energy consumption. (Global warming isn't the only crisis the world needs saving from. A lack of fresh water is another one.)

Here's one company's plan: Applied Materials calls it "fab2farm". Fab2farm is described as a "business model for solar deployment designed to bring cost-effective, utility-scale solar photovoltaic (PV) power generation to local areas and stimulate economic development."

The new solar power capacity would be competitive with other forms of peak power such as natural gas. The SunFab production line is fully-integrated to produce solar energy.

The cost of the new solar energy should also be lower since grid connections would be easy at load centres operated by utility-companies. And, the cost of solar would also be cut down since middlemen, outside suppliers of solar panels, would not be needed: all the new solar power would be home grown, owned by the utility.

The wrinkle is that it would eliminate only peak power, not baseload power. Baseload power, the electricity that flows at a steady state around the clock, can be the biggest emission problem on the grid, since it is coal that provides most of that power.

Adapted from: <http://www.green-energy-news.com...> (online). 19. 9. 2009

What does the "fab2farm" offer? What would you suggest as a solution for the world's energy crisis? What are the main problems of harnessing alternative energy sources?

Use the context to help you select which of the simpler words or phrases has the same meaning as the difficult one used in the text.

Not a bad aspiration as aspirations go.

- a) ambition b) desire c) inspiration

Business model for solar deployment designed to bring cost-effective, utility-scale solar photovoltaic (PV) power generation to local areas and stimulate economic development."

- a) distribution b) preparation c) arrangement

The wrinkle is that it would eliminate only peak power, not baseload power.

- a) factor b) method c) difficulty

Now find some (simpler) synonyms for the underlined words in the text above. Do not change the meaning!

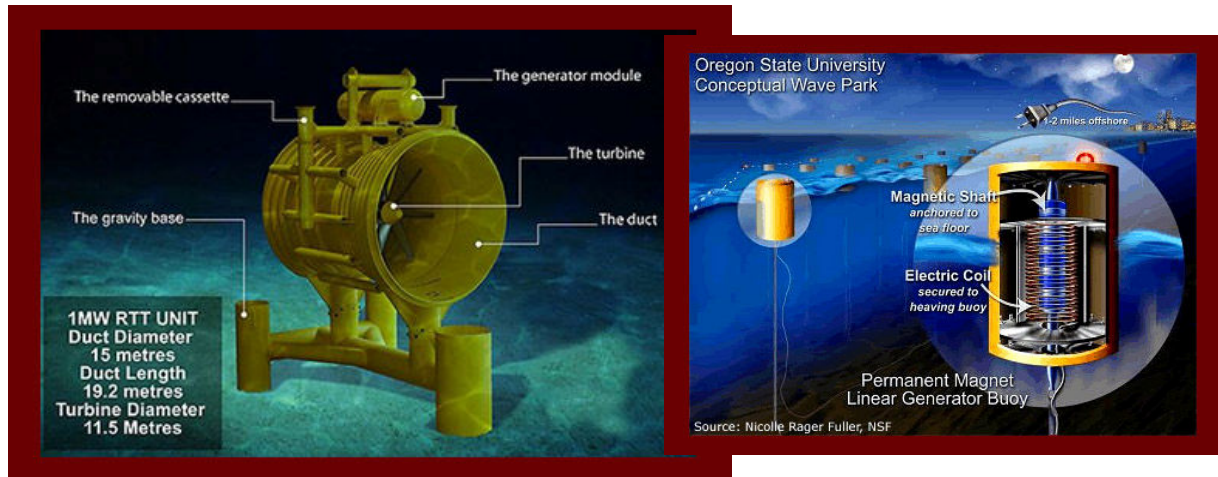
10.6 TIDAL AND WAVE POWER

As an alternative to fossil fuels, water power is becoming more and more important as a power source. Water power is arguably the most valuable renewable energy resource – and also could be considered the most ignored, until recently. Tidal power farms sustainably harness renewable

energy generated by lunar cycles, wave power parks take advantage of the natural repetitive motion of the surface of water and hydroelectric power plants harvest the kinetic energy produced by gravitation from changes in water levels.

Ocean Tidal Power

Surface Wave Power Works



Tidal power is in many cases the lowest-impact but also the most reliable form of taking energy from water. Because it relies on repetitive lunar cycles, unlike wind or solar power, a tidal power station can be relied upon to produce a predictable amount of energy. Also, since most tidal power generators sit below the surface of the water they are not obstacles or eyesores to humans but can impact ecosystems.

Like tidal power, wave power generates energy primarily from large open bodies of water (seas and oceans) using an array of machines that individually harness the kinetic energy around them. Water power stations (or parks) take advantage of the elliptical motion of surface waves to drive pistons and convert the power around them into electric energy. They are also relatively inexpensive to build and deploy.

Fig. 14: Ocean Tidal Power & Surface Wave Power

Source: <http://webecoist.com/2008/11/09/hydroelectric-wave-tidal-power/> (online). 8. 10. 2009

What are the advantages of using water power?

Follow up set: How much energy does Slovenia consume in one year? Can Slovenia meet all its future energy needs? Can you name any renewable energy sources?

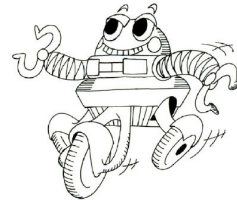
Summary

Today we consume energy from many sources and energy is known as the »lifeblood of society« because of its essential role in life on Earth. Energy choices have shifted from wood, biomass and coal to other forms of energy that create a diverse energy portfolio.

11 THE ROBOTICS REVOLUTION

The purpose of this unit, although short, is to introduce you to basics of robot systems. It explains robotic terminology, the classification of robots, and their principles of operation. It concludes with a look at robotics engineering.

What do today's industrial robots look like?
Which language does the word "robot" come from?
What are some advantages of using robots in industry?



11.1 INDUSTRIAL ROBOTICS – THE HEART OF MODERN MANUFACTURING

Today's robots

- used in modern industrial automation
- intelligent machines used to build things
- an important part of many assembly lines.

The evolution of robots

George Moore built a walking robot in 1893. It had a .5 Horsepower Steam Engine using a Gas Fired Boiler. It was a mechanical device without any intelligence. It could walk at 9 Miles Per Hour.

First Commercial Robot

After the 1950's the first commercial Robot nicknamed the 'Unimate', was created. The first Unimate was installed at a General Motors plant to work with heated die-casting machines.

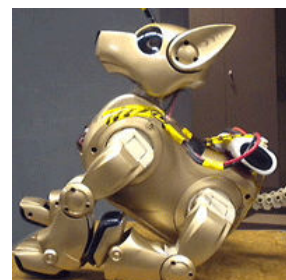
Robots in Fiction/Hollywood

Robby the Robot (1956)– the first robot seen at the movies, Forbidden Planet, Lost In Space (1965), Star Wars

Asimov's Laws of Robotics (1942)

- 1 A robot may not injure a human being, or, through inaction, allow a human being to come to harm.
- 2 A robot must obey orders given to it by human beings, except where such orders would conflict with the First Law.
- 3 A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

Study the classification of types of robots and describe it.



Industrial Robots ⇒

- materials handling
- welding
- inspection
- improving productivity
- laboratory applications

Mobile Robots ⇒

- Robots that move around on legs, tracks or wheels.
- In 1979 a nuclear accident in the USA caused a leak of radioactive material →led to production of special robot – **teleoperator** to handle the radioactive material

Domestic Robots – 2 types ⇒

- designed to perform household tasks and modern toys which are programmed to do things like talking, walking and dancing.

Image: <http://www.howstuffworks.com/enlarge-image.htm?terms=robots&page=10>

Another classification

stationary → remain in 1 place but have arms that move.	mobile → free to move around
--	-------------------------------------

Use of Robots

From Hard automation ...

Hard Automation devices are drive mechanisms controlled by timers, cams, switches, and electrical stops.

These are machines with one purpose and little flexibility.

A change in the manufacturing process meant building a new machine every time.

To Servo Controls ⇒ an improvement

These are ‘feed back’ devices that used small motors and sensors.

The sensors told the motor when to stop moving the machine or platform.

These were ‘electronically’ controlled. No computer.

Today’s Industrial Robot is flexible:

A computer is used to control the device.

A ‘program’ can be changed to meet new situations.



As the manufacturing process changes, the modern robotic system can simply be reprogrammed.

It does not have to be totally rebuilt.

The most flexible industrial robots fall into this category:

6-axis articulated
 5-axis and 4-axis articulated
 SCARA
 Gantry-style

The most common flexible robots are designed with six degrees of freedom. The combined strength and reach of these segments determine the payload and reach of the robot.

11.2 ROBOT TERMINOLOGY

A robot has a **‘manipulator’** – to move, arrange, operate, or control by mechanical means, especially in a skilful manner

There are **‘actuators’** - mechanisms that put something into automatic action - to position the ‘arm’

There may be a **‘gripper’** - a mechanical device that grasps and holds - or hand-like device

The **‘controller’** is the microcomputer

The ‘power supply’ may be pneumatic, hydraulic, or electrical.

Answer these questions.

In what ways have robots improved the safety and health for workers in manufacturing industries?

What comes to mind when you think of a robot?

What are the two categories of robots?

What functions are performed by robots in manufacturing?

Why are robots used for certain tasks in the manufacturing industry?

Name and label parts of a robot arm.

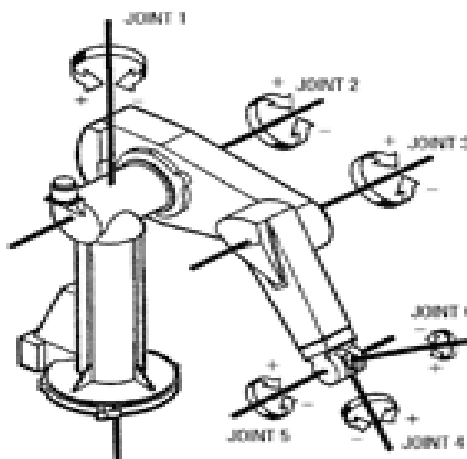
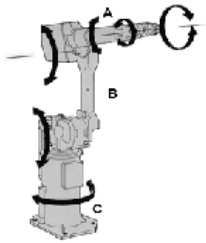


Fig. 15: Robot arm



Every manipulator is divided into three parts. Match the picture with the right answers.

- A= base; B= upper arm; C= lower arm
- A= upper arm; B= base; C= lower arm
- A= lower arm; B= base; C= upper arm
- A=upper arm; B= lower

- Upper Arm: this robotic forearm tapers to the end of arm.
- Base: the robot base is the foundation of the robot. The base determines the entire scope of the robot. Depending on the robot model, the base can be installed to walls, ceilings, tables and floors.
- Lower Arm: The lower arm is designed to extend and support the upper arm.

Which is one of Asimov's Laws of Robots?

Robots are smart.

Robots are never late for work.

A robot can never harm a human.

Robots can do anything.

11.3 ROBOTICS ENGINEERING



The field of robotics engineering is a sub field of mechanical engineering. Robotics engineers design robots and develop new applications for them for use in a wide range of industries. With new possibilities for robotics due to advances in the computer sciences, robotics engineering is growing rapidly. From production line robots to experimental robotics for the medical, military, and automotive industries, the future of robotics engineering will certainly offer a range of opportunities for professionals entering the field .

Cutting edge research is currently being conducted in robotics engineering for application in a number of industries: military, medical, manufacturing, automotive, and space exploration to name a few.

Answer these questions.

What are the challenges of a career in Robotics Engineering?

What do you find most interesting or surprising about the field of robotics engineering?

Which two disciplines work closely together in robotics engineering?

How is robotics used in manufacturing?

What types of technologies do robotics engineers work on?

Follow up set: You have learnt pretty much about industrial robots so far. To finish this lesson off, read the text below and provide the robot configuration that might be used.

When you read the following text, you will probably meet words that are new to you. First try to understand their meaning from the context – read the same passage a few times. When you have read the whole text, check new words in a dictionary. Words in bold print are explained below the text.

Industrial Robots

Modern industrial robots are true marvels of engineering. A robot the size of a person can easily carry a load over one hundred pounds and move it very quickly. Furthermore these robots can do that 24 hours a day for years on end with no failures whatsoever. Though they are reprogrammable, in many applications (particularly those in the auto industry) they are programmed once and then repeat that exact same task for years.



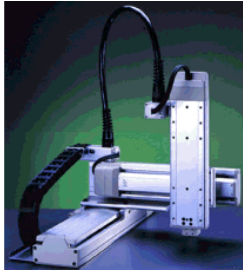
This is the typical machine people think of when they think of industrial robots. This robot has six independent joints, also called six degrees of freedom. The reason for this is that placing a solid body in space requires six parameters; three to specify the location (x, y, z for example) and three to specify the orientation (roll, **yaw**, **pitch** for example).

If you look closely you will see two cylindrical pistons on the side of the robot. These cylinders contain "anti-gravity" springs that are a big part of the reason robots like these can carry such heavy loads. These springs counter-balance against gravity similar to the way the springs on the garage door make it much easier for a person to lift. You will see robots like these welding, painting and handling materials

The robot shown at right is a SCARA robot. This is actually the most common industrial robot. SCARA stands for Selective Compliance **Articulated** (though some folks use **Assembly** here) Robot Arm. The robot has three joints in the horizontal plane that give it x-y positioning and orientation parallel to the plane. There is one linear joint that supplies the z positioning. This is the typical "pick and place" robot. When combined with a **vision system** it can move product from conveyor belt to package at a very high rate of speed.

The robot's joint structure allows it to be **compliant** (or soft) to forces in the horizontal plane. This is important for "peg in hole" type applications where the robot will actually **flex** to make up for inaccuracies and allow very tight part fits.





The machine at left can be called a Cartesian robot, though calling this machine a robot is really stretching the definition of a robot. It is Cartesian because it allows x-y-z positioning. Three linear joints provide the three axes of motion and define the x, y and z planes. This robot is suited for pick and place applications where either there are no orientation requirements or the parts can be pre-oriented before the robot picks them up (such as surface **mounted** circuit board assembly).

Adapted from: <http://www.learnaboutrobots.com/industrial.htm> (online). 13. 11. 2009

In the table below provide the robot configuration that might be used for the following purposes:

Robot configuration	Purpose
	reach
	repeatability
	load-carrying capacity
	machine-loading

Glossary

yaw = naklon

pitch = stopnja

articulated = členkast (robot s členkasto roko)

assembly = sestav

vision system = vidno območje

compliant = skladen

flex = upogniti

mounted = montiran, nameščen

Summary

Robots are used in almost any industry. This chapter has specified a range of newer technologies which are concerned with robot interactions. New technologies will permit more robot applications in the areas where repetitive, difficult and dangerous tasks are performed, such as in welding, assembly, and underwater and space exploration. Vocabulary assignment required students to check in their dictionaries the meanings of the unknown terms and enrich the vocabulary.

12 DESIGN ENGINEERING

This text gives a brief description of the engineering design. As you read, look for the answers to the questions below. Remember, you do not need to understand all the words to answer the questions.

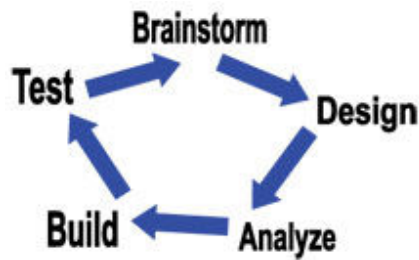
Mechanical design engineering technology is the design of machinery and industrial consumer products. Related areas include technical sales, automotive component design, manufacturing, and performance testing of machines and products. Graduates in ME Design are able to complete mechanical analysis and create working industrial drawings. This is accomplished using the latest two-dimensional CAD and three-dimensional solid modelling software packages.

The mechanical design engineers are professionals who:

- ❖ have knowledge and skills to succeed in continued technical and formal education;
- ❖ can function effectively as technicians in the mechanical or related field of engineering technology;
- ❖ can function professionally and with ethical responsibility as an individual and on multidisciplinary teams;
- ❖ can adapt to rapidly changing technologies;
- ❖ can effectively design products and machines using sound engineering principles and practice;
- ❖ produce proper documentation for design using appropriate methods such as CAD drawings, calculations, and codes.

Career Opportunities:

-
- Mechanical Designer
- Mechanical CAD Designer
- Mechanical Technician
- Fluid Power System Designer
- Machinery Field Technician
- Product Designer
- CAD Drafter
- Heavy Equipment Designer
- Hydraulic Designer
- Installation Supervisor



Engineers use their science and math knowledge to explore all possible options and compare many design ideas. This is called **open-ended** design because when you start to solve a problem, you don't know what the best solution will be to meet the requirements. The process is **cyclical** and may begin at, and return to, any step.

The Computerized Design & Manufacturing has three exciting and very rewarding areas: CAD, the machine tool technology, and welding.

With the rising demand for skilled machine operators and machinists, the machine tool technology professionals possess skills needed to perform well in an industrial setting. Manual machine tools are used extensively, as well as computer numerical control machine tools and cutting-edge software and advanced machine techniques.

MIG, TIG, stick arc, plasma, Flux Core, Shielded Metal Arc, and Oxy-Fuel are welding processes. Welding professionals are versed in welding metallurgy, testing and inspection, blueprint reading, fabrication, and industry related special welding processes.

What is the role of engineering design?

How is engineering design influenced by creativity and the ability to visualize and think abstractly?



If Internet access is available share the videos below on Engineering Design Today. (online). 13. 11. 2009

Video: Don Norman on Engineering Design Education

<http://www.youtube.com/watch?v=uOYZ-9ZWVms>

Video: Don Norman: Thoughtful Design

http://www.youtube.com/watch?v=E_rwwEo5YhY (online). 13. 11. 2009

Try to catch up the most striking thoughts by Mr Norman and write them down.

Share them with your classmates.

Do you find any of them provocative?

12.1 MAJOR: MACHINE TOOL TECHNOLOGY

Take apart a car engine or a washing machine, and what do you find? Parts, all kinds of parts. With a major in machine tool technology, the parts you make will be at the heart of machines of all kinds, from guitars to jets.

Working with everything from hand tools to CNC (computer-numerically-controlled) machines, you'll learn to make precision parts from blueprints and other specifications. You'll learn how to inspect, test, and **repair** parts and machines. And you'll learn how to play it safe on the job -- right down to the goggles.

Machine tool technology majors learn to make, test, and repair precision machine parts.

Did You Know?

- Some companies offer on-the-job training, but tech school or community college will give you a leg up on the competition.

Are You Ready To ... ?

- **Sharpen** your math skills
- Read blueprints
- Spend **lots of time** in the lab
- Use hand tools to cut and mold metal
- Learn to program CNC machines

It Helps to Be ...

A math whiz who **likes** to know what makes things tick and is **ultra-precise**: accuracy is critical in this line of work.

Understanding words

Refer back to the text and find antonyms (i.e. words with an opposite meaning) for the following words and expressions (bold printed):

take apart
repair
sharpen
lots of time vs little time
likes
ultra-precise

12.2 COMPUTER AIDED DESIGN

Computer Aided Design CAD

A CAD system is a combination of hardware and software that enables engineers and architects to design everything from furniture to airplanes. In addition to the software, CAD systems require a high-quality graphics monitor; a mouse, light pen, or digitizing for drawing; and a special printer or plotter for printing design specifications.

CAD systems allow an engineer to view a design from any angle with the push of a button and to zoom in or out for close-ups and long-distance views. In addition, the computer keeps track of design dependencies so that when the engineer changes one value, all other values that depend on it are automatically changed accordingly.

Until the mid 1980s, all CAD systems were specially constructed computers. Now, you can buy CAD software that runs on general-purpose workstation and personal computers.

Fill in the blanks in these sentences with appropriate forms of the words in brackets.

- 1 Designers who work with CAD don't have to produce drawings (draw) on paper.
- 2 The _____ (produce) planner can use the computer model to _____ (calculate) what machining needs be done.
- 3 One problem in working with wood or clay models is that they have to _____ (convert) into drawings for manufacture.
- 4 With _____ (tradition) design, you have to imagine a three-dimensional shape from a two-dimensional drawing.
- 5 With CAD, _____ (design) can put their ideas into solid shapes without having to use paper.
- 6 Making cars lighter doesn't mean making them _____ (flimsy) or less _____ (safe).

Word formation. Fill in the word in brackets in the right form.**CAD**

Computer Aided Design is used in industry for a number of purposes and may be performed (perform) in the tradition two-dimensional world or in the more revealing three-dimensional world. For example, the floor layout of a manufacture plant might be made from a bird's eye view perspective, which might be best served with a 2-D plan view. Or, the swing path of a curved door might be best model (model) in 3-D so the opening and closing path can be viewed from many perspectives - to more clearly see potential interferences.

The technical core classes at EvCC have been structured to offer instruct (instruct) in both perspectives. The classes in AutoCAD are currently offered for lessons in two dimensional representations (represent), and include instruct (instruct) in the way in which engineering draw (draw) are laid out, the basic and some of the more advanced design tools contained in the software, as well as detailed instruction (instruct) exploring precision fits, tolerances, and geometric dimensioning and tolerancing. Also, the classes are offered in Solid Works, examining the basics involved in three dimensional representation, and exploring the use (use) of these 3D models to build something on a 3-axis bench mill.

Mechanical Design Engineer - AutoCAD - SolidWorks

There is an exciting opportunity for an expert in AutoCAD and SolidWorks mechanical design to join a scientific (science) organisation (organise) that is looking to progress its working practices into the modern era. You will be working as a Mechanical Design Engineer and will be responsible, along with a team of manufacturing specialists, for the modernise (modernise) of the company's produce (produce) and services.

Due to the succeed (succeed) of this company's products over the last 30 years this company is very stable in the market place but now there is a real need to galvanise (galvanise) the products and services to help with the improve (improve) of service and the advance (advance) of its position in the market place.

It will be ideal for you to have a degree in Mechanical Engineering or Physics and you must have a lot of experience in specific product design. AutoCAD and SolidWorks knowledge are essential and it would be advantage (advantage) to have experience of risk management tools. Any experience with Moulded Plastics products would be an added bonus but not essential. This is the opportunity to join a company who is build (build) an exciting future that will aid you career in years to come. As the company is growing this is an exciting time to join and really start a productive career.

Adapted from: <http://www.everettcc.edu/programs/...> (online). 18. 9. 2009

12.3 IMPROVING THE DESIGN PROCESS

When you read the following text, you will probably meet words that are new to you. First try to understand their meaning from the context – read the same passage a few times. When you have read the whole text, check new words in a dictionary.

Design Optimisation by Evolution

- 1 By adopting the principles of natural selection, engineers are using survival of the fittest to breed better design solutions.
- 2 An important legacy of Charles Darwin's theories, unimaginable 150 years ago, has been the development of a thriving field of computational science based around the ideas of evolution by natural selection. Evolutionary computation, as it is known, encompasses a variety of methods, the most well known being evolution strategies, genetic algorithms and genetic programming. All seek to solve challenging optimisation problems (the problem of finding the best solution from all feasible solutions) in a vast range of application areas.
- 3 Although the methods differ in the detail of their implementation, they all follow the same basic blueprint: 'parents' are selected from a current population of available solutions, with better (fitter) solutions being selected more often; 'offspring' are bred by combining portions of the parents' 'chromosomes' (the set of parameters that define the solution); and finally, small random 'mutations' are made to the offspring's chromosomes, analogous to the copying errors that occur in real-world biological reproduction. The end result – the algorithm – can often succeed in solving problems where other methods fail.
- 4 The Computational Design Group, led by Dr Geoff Parks within the Cambridge Engineering Design Centre, aims to improve the design process and designed products by developing methods that effectively exploit the potential of computational optimisation to enhance the creativity and decision-making of engineering designers.
- 5 The optimisation of an engineering design is usually a multi-objective task: the designer wants to improve several objectives, or attributes, of the design simultaneously. Inevitably these objectives are often in conflict as it's frequently not possible to improve one objective for an optimised design without making another worse. Evolutionary computation methods can readily be adapted to tackle multi-objective problems. In so doing, they identify the trade-off surface – the set of solutions for which it is impossible to improve one objective without another deteriorating – allowing the designer to make a fully informed choice of final design.
- 6 There is widespread interest in applying these types of optimisation technique to real-world engineering design problems. Researchers in the Computational Design Group are using evolutionary computation to tackle a diverse range of design optimisation problems: from improving hybrid electric vehicle drive systems; to trading off reduction in pollutants and noise in aero engines; to designing cheaper, more compact space satellites.

Selective breeding

- 7 Developing evolutionary algorithms that perform well on particular applications can pose challenges. It is not always straightforward to find a suitable way to encode designs ‘genetically’ such that when two good solutions are combined there is a reasonable chance that the characteristics that made them good are preserved in their offspring. Interesting research questions under investigation by the group also surround the issues of how parents are selected.
- 8 In a virtual world, one can try schemes that would be physically or ethically impossible in the real one. The rules of the game can change too: for instance, the group has found that, in multi-objective optimisation problems, genetic diversity is often naturally maintained in the population as it spreads out across the trade-off surface and therefore highly selective breeding schemes in which only the best solutions are allowed to reproduce can be very effective.
- 9 By adapting the principles of Darwinian evolution, we can develop methods that enable engineers to design better submarine propulsion systems or nuclear reactor reload cores or... in fact, the potential applications are about as diverse as the natural world itself.

Adapted from: <http://www.research-horizons.cam.ac.uk/...> 13. 11. 2009.

Locating information

Find the passages in the text where the following ideas are expressed.

- | | | |
|-------|----|---|
| ..... | 1. | When Charles Darwin proposed the theory of evolution, he envisioned that the process was continuous. He believed that the complexity and diversity of life could be explained by numerous slight modifications to existing species. His whole theory hinges on the idea that nature will preserve beneficial variations (natural selection) and thereby guide evolution creating new and more complex animals and plants. |
| ..... | 2. | The engineering design process is a series of steps that engineering teams use to guide them as they solve problems. Anyone can do it! |
| ..... | 3. | The design engineers select the most promising idea and embark upon a design that includes drawings, and analytical decisions on the materials and construction, manufacturing and fabrication technologies to use. They create and test many prototypes, making improvements until the product design is good enough to meet their needs. |

12.4 FALSE FRIENDS

False friends” are pairs of words in two languages that appear to be similar, but differ in meaning. For example, in Slovenian “eventuelno” means “morebiti” – quite different from the English sense of “eventually” (končno, nazadnje). False friends are tricky because they are so tempting to use, but can sometimes lead to problematic misunderstanding.

Translate into English paying attention to false friends.

Preko poletja niso počivali konstrukterji turnih smučī.

Za takšne vrste načrtov imenujemo odgovornega projektanta.

Energetske razmere na trgu s sončno energijo se hitro spreminjajo.

Za klimatizacijo laboratorijev uporabljamo klima omare ali klimate.

Poleg novih energetskih objektov potrebuje Slovenija tudi učinkovitejšo izrabo električne energije.

Stene hotela so nadstandardno izolirane in tako karseda omejujejo uhajanje toplote. Poleg sodobnih izolacijskih materialov ...

Pretekli teden so v Škodini tovarni v češkem Kvasinyju pričeli s serijsko proizvodnjo modela Roomster.

Naloga tehnologa je ustvariti idelane pogoje, da se kvasovke lahko namnožijo in pripeljejo alkoholno fermentacijo do konca po najboljši poti, z vnosom različnih ...

Za dosego visoke hitrosti morajo imeti konstrukcijski materiali vrtljivih sestavnih delov visoko razmerje med trdnostjo in gostoto.

Raziskava uporabe piezo efekta za krmiljenje fluidtehničnih ventilov in odziva strojnih in konstrukcijskih elementov

Follow up set: Summarise the text on »Design optimisation by evolution” by completing the following table. The first one is done for you.

topic	No. of paragraphs	Key points
<i>Legacy of Charles Darwin</i>	<i>1,2,9</i>	<i>principles of natural selection, ideas of Darwinian evolution by natural selection, the potential technical applications are as diverse as the natural world</i>

Summary

This chapter has dealt with one of the many engineering disciplines. In fact, design engineers are employed in an enormous range of technical areas. It is a challenging, rewarding, and highly respected profession.

The ways language and grammar packages are covered in this chapter provide students with rules valuable for their grasp of English structures. The second language learners may experience difficulties with some constructions covered in this chapter because of the contrastiveness of the English and Slovenian languages. On the other hand, it may be practical and very helpful for students to try to determine what principles underlie their language error patterns.

Conclusion

You have reached to the end. No profound knowledge of technical English is assumed, but if you work through the booklet carefully you will certainly learn a great deal about it. I feel strongly that the material in this booklet embraced most of the basic concepts of the language typical of the subject.

To conclude, the ability to listen combined with persistence to boost language skills are essential traits in a successful engineer.

13 GRAMMAR POINT

Tenses

Present Simple

- ❖ actions done regularly or frequently, often with adverbs like **never, seldom, occasionally, sometimes, often, usually** and **always**
- ❖ facts that are always true
- ❖ feelings, opinions, states of mind
- ❖ timetables and schedules

Use

- permanent or long term situations
 - *I work for Iskra. We sell electrical gadgets.*
- regular activities
 - *I usually travel to work by car.*
- Timetable and schedule
 - *The board meeting starts at 3.30 p.m.*
- facts
 - *The company employs more than 1,000 people.*

Formation

Add an –s to the 3rd person singular.

- *I work in the office.*

Use *do* or *does* for the 3rd person singular as a help word to make question forms.

- *Do I work ...? Do you work ...? Does he work ...?*

Use *don't* or *do not* and *doesn't* or *does not* for the 3rd person singular to make negative forms.

- *I don't work. You don't work ... They don't work ... He doesn't work ...*

Present Continuous

- ❖ actions happening **now, at the moment, at present, today, this week**
- ❖ future plans and arrangements
- ❖ Verbs not used in the continuous form
- ❖ *belong, contain, know, mean, resemble, seem, suppose, surprise, understand, want*
- ❖ **Stative verbs, used in the Continuous form with different meanings:** feel, see, smell, taste, think ...

Use

- to describe actions happening at the time of speaking:
 - *We're building a new factory in Croatia at the moment.*
- to describe temporary situations:
 - *I'm dealing with the new accounts for a few weeks.*
- to refer to future arrangements:
 - *We're going to install a new energy recovery application.*

Formation: to be (am, are, is) + infinitive + -ing

Signal words: now, at the moment, Look! Listen! ...

- AFFIRMATIVE-NEGATIVE-INTERROGATIVE FORM

■ *I'm working on an on-site implementation project. Am I working ...? I'm not working ...*

Note: We use the **Present Simple tense** to talk about *regular* activities.

*Hilti diamond drilling systems **offer** support to concrete cutting. The company **specializes** in steel and metal.*

But we use the **Present Continuous tense** to talk about *temporary* activities.

*The Stanford engineers **are creating** a structural design that lets buildings rock during earthquakes.*

Past Simple

● Is used to:

● describe finished events:

- We launched the product in 2000.

● refer to finished time periods:

- He set up the company in 1991.

Formation

● regular verbs → -ed

● Irregular verbs → special forms for past tense, list of irregular verbs

Adverbs of time: yesterday, last Monday/week /month /year/century, two days/a week/five months/a year/ a century AGO

NEGATIVE-INTERROGATIVE FORM

Use *did* + *not* for all forms as a help word to make negatives and *did* for questions:

- The project didn't (or did not) start on time.
- When did the meeting start?

Past Continuous

■ is used to talk about continuous actions which are interrupted by a Past Simple action:

We were developing new techniques for reducing air pollution when the use of tide power was under way. While one surface was sliding over another strong friction occurred.

formation

to be in past tense (was, were) + infinitive + -ing

Present Perfect Simple

Use

- past actions continuing now, with results in present, life experiences
- past actions still going on (in the present)
 - *The company has been doing business with them since 1994.*
- unfinished or indefinite time
 - *They've improved their customer services a lot.*

Formation

have/has + past participle

The company has opened a subsidiary in South America.

Remember

The Present Perfect is not used:

- to refer to a definite time in the past
- in questions that begin with When...?
yesterday, in July, last month,... → PAST SIMPLE

Adverbs of time

Just, already, never, yet, so far, ever, all my life, recently, for a long time, this week

SINCE: with a point of time

- ✓ since 2001, since April, since yesterday,...

FOR: with a period of time

- ✓ for 2 years, for the last three days,...

Expressing Future

1. TIMETABLES AND SCHEDULES

Tense: Present Simple Tense

*The Board meeting **starts** at 3:30 p.m.*

*When **does** the Paris plane **arrive**?*

2. PLANS AND ARRANGEMENTS

Tense: Present Continuous Tense

*When **is** he **arriving**?*

*She's **meeting** the CEO at 2 p.m.*

3. INTENTIONS

Tense: Going to future

*We **are going to** open a new sales office in Spain.*

4. INSTANT DECISIONS

Tense: Will future

Hold on. I'll get a pencil.

"She's busy." "Then I'll come back later."

5. FUTURE FACTS AND PREDICTIONS

Tense: Will future

We'll need a big hotel.

*How many people **will** work here?*

Modal verbs

- ✚ CAN: permission, requests, possibility/ability, inability
 - *You can borrow my technical dictionary. Can you press the button?*
 - *Modern power plants can generate thousands of watts of electric energy.*
 - *A windmill can't produce solar power.*
- ✚ COULD: permission, requests, suggestions
 - *Could we start with the project? Could you check the position of the flywheel?*
 - *We could inspect the combustion chamber.*
- ✚ MAY: permission
 - *We may approach the problem in any way you wish.*
- ✚ MIGHT: future possibility
 - *We might remove the cylinder head to make sure the coolant flows freely.*
- ✚ WILL: promises, future facts, predictions
- ✚ WOULD: requests, offers, invitations, suggestions
- ✚ SHALL: suggestions, offers, asking what to do
 - *Shall I examine the bearings for wear?*
- ✚ SHOULD: recommending action, saying what is right or correct
 - *Care should be taken when overcharging the batteries.*
- ✚ MUST: obligation, prohibition
 - *You must change oil filters regularly. You must not use cold water to flush the system when the engine is hot.*

Comparison of adjectives

Comparative degree:

- Short: -er
- Long: more/less + adjective

Superlative degree:

- Short: the -est
- Long: the most/the least + adjective

Conjunction: **than**

Irregular comparison

- good-better-the best; bad/ill-worse-the worst
- much/many-more-the most; little-less-the least

Equality:

- as-as; so-as

Alloyed steel is as (so) hard as cermets.

Inequality

- not as-as; so-as

Mild steel is not as (so) light as aluminium.

Conditionals

I. Real possibility: Zero conditional

If clause: if + present simple tense

Main clause: present tense or modal verb+infinitive

If we increase the thickness, the steel plate gets stronger.

Use – real possibility

- ✓ to show cause and effect:

If the oil filter is not changed regularly, it might become blocked.

- ✓ to request action if sth. happens

Call me if the components don't arrive today.

II. Future predictions: First conditional

If clause: if + present simple tense

Main clause: will + infinitive

If the bearings are not lubricated, they will become damaged.

III. Hypothetical situations: Second conditional

If clause: if + past simple tense

Main clause: would + infinitive

If we selected a stronger material, our losses would be minimised.

Complete each sentence below using all there types of Conditional Clauses. Then explain the difference in meaning.

If we (heat) ice, it (change) into water. If we want to (turn) a gas into a liquid we (need to) change its temperature. If we (lower) the temperature, the liquid (turn) into a solid.

If there (be) gas below then there (be) probably oil as well. The team (cannot, tell) for sure if there (be) oil. If the oil-company (be) interested in the project they (start) drilling for oil.

If the diameter (be) longer, the wheel (rotate) faster.

The Passive Voice

Passive voice is used frequently in technical writing, where the focus is usually on what was done rather than who did it. In order to use passive voice correctly, it is necessary to fully understand, and be able to recognise, the difference between passive and active voice.

Active and passive voice

The active voice names an 'actor' which/who is the subject of the verb; the actor does the verb.

- Who/What does the verb? If the answer is clear, the sentence is active. Note that often there is a direct object (DO) 'receiving' the action.

Part of speech	Subject	Verb	Direct object
Sentence	The students	tested	the samples.
	The samples	failed.	

- Where possible, use the active voice. It is direct, brief, and easy to understand.

The passive voice places the emphasis on the action rather than the actor. The direct object is placed before the verb, which is given in the passive form. The subject, or actor, is usually not mentioned.

Formation of the passive		
The passive can use any tense of the verb <i>to be</i>		+ a Past participle
The load/s	is/are was/were	calculated
The report/s	has been / have been	presented
The sample/s	will be / can be	tested
The result/s	is/are (should) have (could) have been	being been compared

Reasons for using the passive

1. The 'actor' is not known.	Oil was discovered off the coast of Australia.
2. The 'actor' is not important.	The results will be presented at the conference.
3. It is considered desirable to conceal the identity of the 'actor'.	The results are invalid as the correct testing procedure was not followed.

4. An impersonal tone is needed for academic writing.	In this report, the stress fields in a C-shape plate will be analysed.
An impersonal tone is also used for process descriptions. First, the raw materials are loaded into a container ...	
A tactful tone is needed to smooth over an error or difficulty. Compare these two examples:	
Example of passive voice The samples were not checked at the second stage.	Example of active voice We did not check the samples. Maybe we forgot.

Changing active to passive

Example of active voice				
Part of speech	Subject	Verb	Direct object	
Sentence	The group	will present	the report	next week.

STEP 1: move the direct object to the subject position

The report ...

STEP 2: change the verb to the passive, making sure that BE takes the same tense as the verb in the active sentence

The report will be presented ...

STEP 3: drop the subject

The report will be presented by the group next week.

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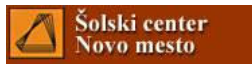
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Projekt **Impletum**

Uvajanje novih izobraževalnih programov na področju višjega strokovnega izobraževanja v obdobju 2008–11

Konzorcijski partnerji:



Operacijo delno financira Evropska unija iz Evropskega socialnega sklada ter Ministrstvo RS za šolstvo in šport. Operacija se izvaja v okviru Operativnega programa razvoja človeških virov za obdobje 2007–2013, razvojne prioritete Razvoj človeških virov in vseživljenjskega učenja ter prednostne usmeritve Izboljšanje kakovosti in učinkovitosti sistemov izobraževanja in usposabljanja.