Kursverlauf
Kursmaterial
TARGET GROUP

Students enrolled in the following degree programs: Mechanical Engineering, Mechatronics and Advanced Energies. A good knowledge of the English language is a prerequisite.

Structure and Goals of the Course

This course helps students learn the proper ways of communicating and acting in technical and business situations while using a foreign language. The course covers relevant topics from the areas of business, mechanical engineering, mechatronics and advanced energies. Students will practice using English successfully in specific professional situations, e.g. participating in technical discussions and negotiations, preparing technical descriptions, giving lectures and making presentations, incl. descriptions of graphs, tables, etc. Reading comprehension will be improved by using authentic texts, while listening comprehension will benefit from training in situations taken from professional life (summarizing lectures, taking notes, etc.). Students will learn better business- and technology-related writing skills by composing business letters and technical reports. This language course will use the most up-to-date written and audio-visual materials, as well as computer applications.

STUDY MATERIAL

Teaching material will be provided.

This course is a subject-related language course, not a technical seminar or lecture in English. Knowledge of mechanical engineering/mechatronics/advanced energies is a prerequisite.
Tuning-in

Task 1
List the main branches of engineering. Combine your list with others in your group. Then read this text to find out how many of the branches listed are mentioned.

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

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

Task 2
Complete the blanks in this diagram using information from the text.
Reading Introduction

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

Task 3

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

Task 4

Now read the following texts to check your answers to Task 3. Match each text to one of the illustrations above.
Transport: Cars, trains, ships, and planes are all products of mechanical engineering. Mechanical engineers are also involved in support services such as roads, rail track, harbours, and bridges.

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

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

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

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

Source: Adapted from Turning Ideas into Action, Institution of Mechanical Engineers, and Engineering a Career, Institution of Electronics and Electrical Incorporated Engineers.

Language study deals with is concerned with

What is the link between column A and column B?

A

B

mechanical machines

electricity

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

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

Task 5

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

A

B

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

Words are divided into syllables. For example:

- engine  
  *engine*
- engineer  
  *engineer*
- engineering  
  *engineering*

Each syllable is pronounced separately, but normally only one syllable is stressed. That means it is said more slowly and clearly than the other syllables. We say *engine* but *engineer*. A good dictionary will show the stressed syllables.

**Task 6**  
Listen to these words. Try to mark the stressed syllables.

1. machinery
2. mechanical
3. machine
4. install
5. installation
6. electricity
7. electrical
8. electronics
9. aeronautical
10. ventilation

**Writing**  

**Task 7**  
Fill in the gaps in the following description of the different branches of engineering using information from this diagram and language you have studied in this unit.

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![Diagram of engineering branches]

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The main branches of engineering are civil, electronic, and mechanical. Mechanical engineering includes machinery of all kinds. This branch of engineering includes automobile, heating and ventilating. The first three are concerned with transport: cars and planes. The last with air-conditioning, refrigeration, etc.

Electrical engineering deals with electricity from generation to use. Electricity generating is concerned with stations. Electrical installation deals cables, switchgear, and connecting up electrical equipment.

Two branches of engineering include both and engineers. These are mining and engineering. The former deals with mines and mining equipment. The latter with hospital of all kinds.

**Listening**

**Task 2**
Listen to these short extracts. To which branch of engineering do these engineers belong?

**Task 3**
Listen again. This time note the words which helped you decide on your answers.
1 Reading and Comprehension

1. Engineers have to know the best and most economical materials to use. 2. Engineers must also understand the properties of these materials and how they can be worked. 3. There are two kinds of materials used in engineering — metals and non-metals. 4. We can divide metals into ferrous and non-ferrous metals. 5. The former contain iron and the latter do not contain iron. 6. Cast iron and steel, which are both alloys, or mixtures of iron and carbon, are the two most important ferrous metals. 7. Steel contains a smaller proportion of carbon than cast iron contains. 8. Certain elements can improve the properties of steel and are therefore added to it. 9. For example, chromium may be included to resist corrosion and tungsten to increase hardness. 10. Aluminium, copper, and the alloys, bronze and brass, are common non-ferrous metals.

Study the following statements carefully and write down whether they are true or not true according to the information expressed above. Then check your answers by referring to solutions at the end of the passage.

(a) Non-metals are used by engineers.
(b) Cast iron contains more carbon than steel.
(c) Chromium improves the properties of steel.
(d) Copper contains iron.
(e) Bronze is an alloy.

1. Plastics and ceramics are non-metals; however, plastics may be machined like metals. 2. Plastics are classified into two types — thermoplastics and thermosets. 3. Thermoplastics can be shaped and reshaped by heat and cold.

*The following symbols are used in the solutions:

= equals, means the same as
≠ does not equal, mean the same as
i.e. that is to say
therefore
pressure but thermosets cannot be reshaped because they undergo chemical changes as they harden. *Ceramics are often employed by engineers when materials which can withstand high temperatures are needed.

(f) Thermosets can be machined.
(g) Thermoplastics are metals.
(h) Ceramics can withstand high temperatures.

Solutions:

(a) There are two kinds of materials used in engineering – metals and non-metals. (3)
(b) metals and non-metals are used in engineering
(c) metals and non-metals are used by engineers
(d) Non-metals are used by engineers.

(b) Steel contains a smaller proportion of carbon than cast iron contains. (7)
(c) Cast iron contains a larger proportion of carbon than steel.

(c) Certain elements can improve the properties of steel and are therefore added to it. (8) For example, chromium may be included. . . . (9)
(d) Chromium is an example of the elements which are added to steel and can improve the properties of steel.
(e) Chromium improves the properties of steel.

(d) Aluminium, copper and the alloys, bronze and brass, are common non-ferrous metals. (10)
(e) Copper is a non-ferrous metal.
(f) but non-ferrous = does not contain iron
(g) It is NOT TRUE that copper contains iron.

(c) Aluminium, copper and the alloys, bronze and brass, are common non-ferrous metals. (10)
(d) Bronze and brass are alloys.
(e) Bronze is an alloy.

(f) Plastics and ceramics are non-metals; however, plastics may be machined like metals. (11)
(g) may be = can be
(h) Plastics can be machined.

Plastics are classified into two types – thermoplastics and thermosets. (12)

(i.e. Thermoplastics are a kind of plastic.

(i.e. It is NOT TRUE that thermoplastics are metals.

(h) Ceramics are often employed by engineers when materials which can withstand high temperatures are needed. (14)

(i.e. Engineers use ceramics when they need materials which can withstand high temperatures.

(i) Ceramics can withstand high temperatures.

EXERCISE A Rephrasing

Rewrite the following sentences, replacing the words printed in italics with expressions from the passage which have a similar meaning.

EXAMPLE

There are two kinds of materials used in engineering.

1. Nickel steel is a mixture of iron, carbon and nickel.
2. Chromium can be included in steel to provide a good cutting edge.
3. There are many kinds of steel used in industry.
4. Ceramics are used by engineers where heat-resistant materials are needed.
5. Chromium steels resist corrosion.

EXERCISE B Contextual reference

1. In sentence 2, 'they' refers to (a) the engineers

2. In sentence 5, 'the former' refers to (b) the materials

3. In sentence 5, 'the latter' refers to (a) ferrous metals

4. In sentence 8, 'it' refers to (b) non-ferrous metals

5. In sentence 13, 'they' refers to (a) plastics

(b) thermosets

(c) thermoplastics
II USE OF LANGUAGE

EXERCISE A Classification of engineering materials
Draw in your notebook the diagram below and complete it, using the information from the reading passage.

Note that this diagram classifies engineering materials at four levels of generality. Look at the following sentences:
1. Steel is a ferrous metal.
2. Iron and steel are ferrous metals.
3. Steel is an engineering material.
4. Steel is a metal.
5. Ferrous metals are engineering materials.
6. Metals are engineering materials.

Now write as many sentences as you can like those above based on the completed diagram.

EXERCISE B Classification (continued)
Draw diagrams to classify the items in the following lists. Each diagram should have three levels.
1. alloys, copper, brass, pure metals, aluminium, metals.
2. brazing, electric-arc welding, soldering, metal-joining methods, welding, oxy-acetylene welding.
3. measuring instruments, non-precision instruments, micrometer, vernier calipers, material-testing machines, block, gear pair.

EXERCISE C However, therefore, because
In this book you will meet many words which can be used to connect statements. Three of the most common are:

(1) however  (2) therefore  (3) because

Look at these examples:

(1) (a) Copper does not rust.
     (b) Copper corrodes.
     (a + b) Copper does not rust; however it corrodes.

(2) (a) Cast iron is a brittle metal.
     (b) Cast iron is not used to withstand impact loads.
     (a + b) Cast iron is a brittle metal, therefore it is not used to withstand impact loads.

(3) (a) Titanium is used for aircraft frames.
     (b) Titanium is light and strong.
     (a + b) Titanium is used for aircraft frames because it is light and strong.

In (1), statement (b) qualifies statement (a).
In (2), statement (b) is a result of statement (a).
In (3), statement (b) gives the reason why statement (a) is true.

Now join each of the following pairs of statements. Write down your answers in your notebook, using 'however', 'therefore' or 'because' as in the examples.
1. Chromium resists corrosion.
   Chromium is added to steels to make them rust proof.
2. Cutting tools are made from high-speed steels.
   High-speed steels retain their cutting edge at high temperatures.
   (... these steels ...)
3. Under normal conditions aluminium resists corrosion.
   Serious corrosion occurs in salt water.
   (... serious corrosion ...)
4. Manganese steel is very hard.
   Manganese steel is used for armour plate.
5. Bronze has a low coefficient of friction.
   Bronze is used to make bearings.
6. Nylon is used to make fibres and gears.
   Nylon is tough and has a low coefficient of friction.
7. Tin is used to coat other metals to protect them.
   Tin resists corrosion.
8. Tin is expensive.
   The coats of tin applied to other metals are very thin.
   (... the coats of tin ...)
9. Stainless steels require little maintenance and have a high strength.
   Stainless steels are expensive and difficult to machine at high speeds.
10. Nickel, cobalt and chromium improve the properties of metals.
    Nickel, cobalt and chromium are added to steels.

**EXERCISE D Language of measurement (i): Basic metric units**

Study the diagrams and memorize the examples.

**linear dimensions** A linear dimension is one which we can measure in a straight line.

(a) length

We can describe the length of this bar in four ways:
   - The bar is three metres long.
   - The bar is three metres in length.
   - The bar has a length of three metres.
   - The length of the bar is three metres.

(b) width or breadth

We can describe the width or breadth of this driving belt in four ways:
   - The belt is sixty millimetres wide/broad.
   - The belt is sixty millimetres in width/breadth.
   - The belt has a width/breadth of sixty millimetres.

(c) height

We can describe the height of this support tower in four ways:
   - The tower is a hundred metres high.
   - The tower is a hundred metres in height.
   - The tower has a height of one hundred metres.
   - The height of the tower is a hundred metres.

(d) thickness

We can describe the thickness of this steel sheet in three ways:
   - The sheet is three millimetres thick.
   - The sheet has a thickness of three millimetres.
   - The thickness of the sheet is three millimetres.

(e) depth

Depth is usually measured vertically downwards from a surface.
This surface is often ground level or the surface of a liquid.

We can describe the depth of this trench in four ways:
   - The trench is two metres deep.
   - The trench is two metres in depth.
   - The trench has a depth of two metres.
   - The depth of the trench is two metres.

Other examples of depth:

(i) The depth of the beam is three hundred millimetres.
(ii) The depth of the screw thread is one point seven five millimetres.

**mass**

We can describe the mass of this block in three ways:
   - The block has a mass of fifty kilogrammes.
   - The block is of mass fifty kilogrammes.
   - The mass of the block is fifty kilogrammes.
EXERCISE E Language of measurement (ii): Derived metric units

Study the diagrams and memorize the examples.

Derived metric units are products of the basic units.

**area** Area is measured in squared linear units, for example, square metres \(- m^2\).

We can describe the area of this steel plate in three ways:
The plate has an area of six square metres.
The plate is six square metres in area.
The area of the plate is six square metres.

**volume** Volume is measured in cubed linear units, for example, cubic metres \(- m^3\). The volume of a liquid may be measured in litres and subdivisions of a litre.

We can describe the volume of this brick in three ways:
The brick has a volume of 1600 cubic centimetres.
The brick is 1600 cubic centimetres in volume.
The volume of the brick is 1600 cubic centimetres.

**capacity** Capacity is the ability of a container to hold something. Like volume it is measured in cubed linear units. For liquids, litres and subdivisions of a litre may be used.

We can describe the capacity of this tank in three ways:
The tank has a capacity of twenty-four cubic metres.
The tank is twenty-four cubic metres in capacity.
The capacity of the tank is twenty-four cubic metres.

EXERCISE F Language of measurement (iii): Compound metric units

Look again at the diagrams on pages 6-8 and the language used to describe the diagrams. Copy the following table into your notebook and complete it by filling in the spaces.

<table>
<thead>
<tr>
<th>Physical quantity</th>
<th>Typical unit</th>
<th>Short form</th>
</tr>
</thead>
<tbody>
<tr>
<td>force</td>
<td>newton</td>
<td>N</td>
</tr>
<tr>
<td>time</td>
<td>second</td>
<td>s</td>
</tr>
<tr>
<td>length and distance</td>
<td>kilometre</td>
<td>m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>m(^2)</td>
</tr>
</tbody>
</table>

Compound units are made up of basic and derived units of measurement.
(a) The stroke / means 'per', and indicates that the unit in front of the stroke is divided by the unit after the stroke.
(b) Where there is no stroke between two units, the units are multiplied together.

Now rewrite the following sentences completing them by filling in the spaces.

**Example**

**moments** The moment of a force is measured in newton metres.

Short form = Nm

The moment of a force is found by multiplying a force by a distance.

1. **velocity** Velocity is measured in metres per second.

Short form = \( \ldots \) m/s

Velocity is found by \( \ldots \) a \( \ldots \) by \( \ldots \)

2. **pressure** Pressure is measured in \( \ldots \) per \( \ldots \)

Short form = \( \ldots \) N/m\(^2\)

Pressure is found by \( \ldots \) a \( \ldots \) by \( \ldots \)

3. **density** Density is measured in kilograms \( \ldots \) cubic metre.

Short form = \( \ldots \)

Density is found by dividing a \( \ldots \) by \( \ldots \)

4. **stress** Stress is measured in newtons per \( \ldots \)

Short form = \( \ldots \) N/mm\(^2\)

Stress is found by \( \ldots \) a \( \ldots \) by an area

5. **acceleration** Acceleration is measured in metres per second squared.

Short form = \( \ldots \)

Acceleration is found by \( \ldots \) a \( \ldots \) by a time.
III INFORMATION TRANSFER

EXERCISE A Describing dimensions

Describe the following objects in as many ways as you can.

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IV GUIDED WRITING

STAGE 1 Sentence building

Join the following groups of sentences to make eleven longer sentences, using the connecting words printed at the beginning of each group (except group 6). You may omit words and make whatever changes you think are necessary in the word order and punctuation of the sentences.

EXAMPLE

BECAUSE/AND/HOWEVER
Plastics are used widely in engineering.
They are cheap.
They have a resistance to atmospheric corrosion.
Plastics are not particularly strong.
Plastics are used widely in engineering because they are cheap and have a resistance to atmospheric corrosion; however they are not particularly strong.

1. AND
There are two types of plastics.
Thermoplastics are plastics.
Thermosets are plastics.

2. AND/WHEREAS/AND
Thermoplastics will soften when heated.
Thermoplastics will harden when cooled.
Thermosets set on heating.
Thermosets will not remelt.

3. FROM/TO
Plastics are used to make a great variety of products.
Plastics are used to make textiles.
Plastics are used to make engineering components.

4. SUCH AS
Plastics are available in many forms.
Plastics are available in the form of sheets, tubes, rods, moulding powders and resins.

5. TO
Various methods are used.
These methods convert raw plastic into finished products.

6. Compression moulding is a common method.
Compression moulding is used for shaping thermosets.

7. WITH/WHICH
The press has two heated platens.
The two heated platens carry an upper and a lower mould.

8. THEN
Powder is placed in the lower mould.
This is moulding powder.
The upper mould is pressed down on the lower mould.

9. TO/WHICH
The pressure and the heat change the powder.
The powder becomes liquid plastic.
The liquid plastic fills the space between the moulds.

10. WHEN/AND
The chemical changes have taken place.
The mould is opened.
The moulding is extracted.

11. BY
Plastic bowls are made.
The compression moulding method is used.

STAGE 2 Paragraph building
Now group the completed sentences into two paragraphs and give a title to the passage. Include the example as the first sentence of your passage.

V FREE READING

Read the following passage in your own time. If there are any words you do not know, look them up in your dictionary. Try to find additional examples of the points you have studied in this unit.

CORROSION

Corrosion attacks all engineering materials, especially metals. Corrosion is any chemical action which harms the properties of a material. It reduces the life of a material and increases the cost of a structure. For example, a steel bridge must be repainted regularly to protect it from rust. Various metals have therefore been developed to resist corrosion. Among them are the stainless steels. These metals contain from 12 to 35% chromium which forms a very thin layer or film of chromium oxide on the surface of the metal. This film protects the metal from corrosion. Alloys made from copper and nickel are also corrosion-resistant. For example Monel metal, which contains roughly 60% nickel and 30% copper, is resistant to both and for other surfaces like ships' propellers which are in contact with sea water. Cupronickels, which contain a smaller proportion of nickel, have a similar resistance to fresh and sea water. They are mainly used to make tubes.

When two different metals touch each other in the presence of moisture, corrosion occurs. This type of corrosion is known as galvanic or electrolytic corrosion because it has an electrical cause. The metals and the moisture act like a weak battery and the chemical action which results corrodes one of the metals. If, for example, aluminium sheets are riveted with copper rivets, the aluminium near the rivets will corrode in damp conditions.

No material can be completely corrosion-resistant. Even stainless steels will corrode. Engineers can, however, fight corrosion. For example, they can use high-purity metals because these metals are more resistant than alloys. They can also make sure that two dissimilar metals are not allowed to touch each other. Finally engineers can protect the surfaces of the metals in many different ways. One of the most common methods is to paint them.
Exercise

Student A reads the text (lecture). Student B collects information using strategies for interrupting student A.

I. definition of corrosion
   a) type and result of action:

   b) consequences of lifespan of materials:

   c) effect on construction plans:

   d) example of method to prevent corrosion:

II. development of corrosion-resistant metals
   a) example of corrosion-resistant material:

   b) percentage of chromium in stainless steels:

   c) effect of inclusion of chromium in stainless steel:

III. alloys
   a) 2 examples of corrosion-resistant alloys:

   b) positive aspects of Monel metal:

   c) usage of Monel metal:

   d) characteristics of cupronickels:
e) main use of cupronickels: ____________________________

IV. galvanic or electrolytic corrosion

a) occurrence of corrosion: ____________________________

b) cause of galvanic or electrolytic corrosion: ______________

c) description of reaction between metals and moisture: ____________

d) reaction of aluminium sheets riveted with copper rivets: ____________

V. fight against corrosion

a) solution (a): ____________________________

b) solution (b): ____________________________


c) solution (c): ____________________________
KORROSION


Manufacturing

A company visit

Wells Industries is a major supplier of semi-finished products to the automobile industry. The company wants to modernise its production plant and replace certain types of production machines. Production costs must also be reduced, by approximately 20%. A project group has decided to invite people from four machine tool companies to the plant in Stockton. Mrs Sue Wilkinson, an engineer in the project group, has written this letter to Hans Lindner, the German representative of ABA, an international manufacturer of machine tools and industrial robots.

Wells Industries

— and I was therefore pleased to hear that you will be able to come to Stockton on January 21st. As I mentioned on the phone, we are particularly interested in the X-2140 and in your 100 range of industrial robots. We will be expecting you at 10 a.m.

I understand you will be arriving by car from Birmingham. Enclosed are directions on how to find us — I am sure you will have no problems.

We are looking forward to seeing you.

Yours sincerely,

S. Wilkinson

S. Wilkinson
Focus Greetings and introductions

1 Hans Lindner meets the project group at Wells

Sue Wilkinson meets Mr. Lindner at the main gate and takes him to her office where some of her colleagues are waiting.

Sue Wilkinson: Good morning Alan, morning Carol, good morning Ralph. Thanks for coming. I'd like you to meet Hans Lindner from ABA Germany. I think some of you have already spoken to him.

Carol: Hello, how are you, Mr. Lindner? Yes, we've already spoken on the phone, I believe.

Mr. Lindner: Yes, that's right. How are you?

Carol: Fine, thanks. And how are you?

Mr. Lindner: Very well, thanks.

Carol: I hope you found us alright. I hear you came here by car.

Mr. Lindner: Yes, no problem. Mrs. Wilkinson sent me a map, so it was really no problem.

Ralph: Hello, Mr. Lindner, very glad to see you. Did you have a safe trip?

Mr. Lindner: Yes, thanks.

Sue Wilkinson: And this is Alan Waine. He's just been made our boss.

Mr. Waine: Oh, come off it, Sue. Hello, Mr. Lindner, very glad to see you. No, there is no boss. It's just me who reports to management.

Mr. Lindner: How do you do? Pleased to meet you.

Sue Wilkinson: Now, how about some coffee?

Greetings and introductions

Hello, (It's good/nice to see you again.)

(formal:) Good morning/afternoon/evening.

(formal:) How do you do? – How do you do?

How are you? – Fine/Very well, thanks. And how are you?

This is .../Have you met ...?

(formal:) May I/Can I/Let me introduce you to ...

(formal:) I'd like to introduce you to .../I'd like you to meet ...

Nice/Pleased/Glad to meet you (, too).

Haven't we met before?

Did you have a good flight/trip/journey?

(informal:) How are things?

Do take a seat. Would you like/care for a cup of ...?
Here are three jumbled-up conversations. There are three people in each. Work in groups of three and restore the conversations, then listen and check. After that, read or act them out.

Melba: Thank you. I've been looking forward to meeting you, too. How are things?

Ashmore: Hello, Mr Bauer. Sorry to keep you waiting. Did you have a good journey?

Ashmore: Oh yes. Thank you for sending it so promptly. Now, if you would like to follow me, please, I'd like you to meet Helen Krien first.

Schulz: Glad to meet you, Mr Larson.

Larson: How do you do? But haven't we met before?

Larson: Yes, that's right.

Fred: Oh, it's been a busy week, but things are easier now.

Schulz: Have we? ... Hmmm ... Yes, I think you're right. That was probably last year in Lisbon. You were still working for Pirelli, weren't you?

Bauer: Yes, no problem. I hope you got my fax.

Fred: Well, I think it's fine at the moment, but you'll have to see for yourself. Now, would you care for a cup of tea first?

Bauer: Yes, thanks. We left late, but the flight was O.K. And how are you?

Schulz: Well, good to see you again.

Bauer: Good afternoon, my name is Bauer. I've come to see Mr Ashmore.

Schulz: Good afternoon. We've been expecting you. Do take a seat. Mr Ashmore will be with you in a minute. (Pause)

Faulkner: Hello, Fred, have you met Melba Maciá?

Melba: Yes, Paul was telling me about your new project. How's it going?

Paul: Hello, Fred, have you met Melba Maciá?

Warner: Good morning, Mr Larson, nice to see you again. Did you have a good flight?

Warner: Fine, thank you. I'd like to introduce you to my colleague, Mr Schulz.

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Simple past – present perfect – present perfect continuous

1 a Mrs Wilkinson contacted Mr Lindner three days ago.

b Mrs Wilkinson has already contacted Mr Lindner.

2 a Some time ago I talked to Anne about her new project.

b I believe we have already talked about the new project.

The simple past (sentences 1a and 2a) is used to describe activities that were completed at a particular point of time or period in the past. The point or period of time is usually stated (yesterday, a few minutes ago, in 1966 etc.), or is understood from the context.
Unit 1

- The present perfect (1b, 2b) is used to talk about activities that have happened, but we don't know or don't want to say when exactly, because it is not important. The fact that something has happened, not the time when it happened, is what matters.

3  a. Mr. Lindner has arrived.
   b. The project group has been waiting since 10 o'clock.

4  a. I believe we have already discussed the new project.
   b. We have been discussing this project for long enough.

- The present perfect continuous (3b, 4b) is used to talk about activities which continued up to the present (and may still be going on).
- With the present perfect simple (3a, 4a) the result is important; with the present perfect continuous the emphasis is on the activity.
- Sometimes either form can be used, depending on whether the emphasis is more on the result or the activity.

3  **PRACTICE**

Complete the following sentences with the correct form of the simple past or present perfect.

1. We (modernise) ... our production facilities in 1996 and since then we (be able to) ... increase our efficiency by approximately 15%.
2. I (spend) ... three months in Spain when I was a student, but I (not be back) ... since then.
3. I (live) ... in Paris for the last three years. It (be) ... a great experience.
4. I (send) ... Briggs ... the brochures yet? - I (not see) ... them yet but let me ask Margret. Here they are. Margret says they (arrive) ... yesterday evening but she (forget) ... to tell you.
5. I (try to) ... get through to John's office, but the line (be) ... busy all the time.
6. I'm glad to see you, Mr. Calatrava. I (look forward to) ... meeting you.

4  **TASK**

Interview a partner, then briefly introduce your partner to the rest of the group. Find out:

- what kind of job your partner has or what she/he is studying, and how long she/he has been doing this
- what she/he did before
- where she/he lives and how long she/he has been living there
- whether she/he has any hobbies
- ...
Focus Describing a company

5 A profile of ABA

Mr Lindner sent you some promotional material about ABA. Decide whether the verbs should be in the present, simple past or present perfect.

ABA first [began] to develop its world-famous name for machine tools in the North American car industry in the late 1970s. We [then] became involved in overseas markets, and this [led] to our expansion into Europe. Here, we [identify] new user needs and opened our plant in the Netherlands in 1952, and a plant in Scotland in 1957. In the mid-1960s ABA concentrated on research and development, in response to demands for greater speed and reliability. We [approved] and expanded not only the product range, but also our service network – offering complete customer support wherever needed.

By the late 1970s, the climate of the machine tool industry was experiencing rapid change. Eastern competition fundamentally influenced the market, making purchase price a key issue. ABA [responded] by delivering a completely new product range, competitively priced with even further improved quality. The result was the revolutionary XL concept launched in 1994 which [influenced] our ABA product issue that time. It brings together every aspect of machine tool experience and design expertise, with the latest in development and production technology – in order to satisfy market demand for still higher quality, still lower costs.

We [always play] a leading role in the development of machine tools design and manufacture, right from the start. We [always meet] the needs of our customers (and respond) with technical innovation and new product introductions to meet ever greater demands to the present day.

Today we [are] equipped to face the challenge of the 21st century through further investment in developing new products, through rapid answers to new customer priorities, and through greater efficiency in our plants and in our marketing services.
Now answer the following questions.

1. Which innovation did ABA introduce in the 1920s?
2. Which developments marked ABA's activities in the 60s?
3. Why was the XL concept so important?
4. Which names and developments do you associate with the American car industry?
5. What kind of new product range do you think was introduced in the late 70s?
6. What kind of drives do you think machine tools had before they were equipped with individual electric motors?

---

The following table indicates the main developments of Wells Industries. Use the information given to write a text on the history of Wells Industries.

<table>
<thead>
<tr>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965: founded in Sheffield</td>
</tr>
<tr>
<td>1975: new plant in Sheffield</td>
</tr>
<tr>
<td>1980: moved to Stockton</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MARKETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>First only domestic, now also western European countries (approximately 40%) and recently also eastern European countries (10% and increasing)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRODUCT RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965 - 1979: 100% supplier to automobile industry</td>
</tr>
<tr>
<td>1979 - now: 70% supplier to automobile industry, 20% supplier to kitchen appliances industry, 10% other markets</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EMPLOYEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970: 480</td>
</tr>
<tr>
<td>1988: 700</td>
</tr>
<tr>
<td>1998: 620</td>
</tr>
<tr>
<td>2010: expected to be 500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECONOMIC PERFORMANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>70s and 80s: very good</td>
</tr>
<tr>
<td>Last 5 years: difficult</td>
</tr>
<tr>
<td>Prospects: better in three years</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FUTURE OBJECTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased production safety</td>
</tr>
<tr>
<td>Better pollution control</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STRATEGIC PLANNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction of workforce continues; investment in new production technology continues; restructuring of decision-making procedures continues; steps towards lean production taken and to be increased.</td>
</tr>
</tbody>
</table>
Focus Describing production processes

Mr Lindner gives a presentation

After Mr Lindner has been shown the company, the project group meets again in the conference room for a presentation. Mr Lindner first explains different ways of organizing the production process in a company.

Make sure you understand the terms used in Figures 1 – 4, then listen for the main information: What sort of manufacturing systems do Figures 1 – 4 show?

1. How is the manufacturing process organized at Wells?
2. What is the main difference between a job-shop system and a flow-job system?
3. What are the advantages/disadvantages of a flow-job system?
4. What parts are manufactured in a flow-job system at Wells?
5. What is the main advantage of the cellular cell when compared with the flow-job system?
6. Which of Wells’ departments would be ideal for the use of a robotic cell?
The passive

The majority of parts are manufactured in what is commonly called a job shop.

From the drill presses, part C is brought to the grinding machines before it is heat treated, assembled and stored.

- In the passive, a form of be is used with the past participle of the full verb (e.g. heat, heated, heated/bring, brought, brought). The form of be indicates the tense (e.g. is, was, were, have, has been).
- The passive is used (especially in technical texts) when what is done is important, but not who does it. In the first sentence, for example, it is irrelevant (and possibly impossible to say) who manufactures the parts.

Complete the sentences with one of the following verbs in the correct form.

- repair
- improve
- launch
- equip
- can change
- need
- replace
- not give

1. Next year all the traditional lathes by new CNC models.
2. The new XL concept ... in 1984.
3. Different kinds of machines ... to complete the product range.
4. Over the last 15 years, the design of the machine ... that they now meet the new safety regulations.
5. Now all our machines ... with sensors that stop the machines automatically.
6. Production ... over from one product to another almost immediately.
7. I don't know what happened, we ... any explanation for the changes.
8. Whether or not this machine ... depends on several factors.

Welcoming a visitor to a company

<table>
<thead>
<tr>
<th>Country</th>
<th>Situations</th>
<th>Physical greeting</th>
<th>Introducing self (I'm ...)</th>
<th>Introducing others (This is ...)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>formal</td>
<td>handshake</td>
<td>normally only surname</td>
<td>normally title + surname</td>
</tr>
<tr>
<td></td>
<td>informal</td>
<td>handshake</td>
<td>first name + surname</td>
<td>Mr/Mrs/Ms + surname</td>
</tr>
<tr>
<td>Britain</td>
<td>formal</td>
<td>handshake if offered</td>
<td>first name + surname</td>
<td>first name + surname</td>
</tr>
<tr>
<td></td>
<td>informal</td>
<td>handshake at first meeting</td>
<td>first name (+ surname)</td>
<td>first name (+ surname)</td>
</tr>
<tr>
<td>USA</td>
<td>formal</td>
<td>handshake if offered</td>
<td>first name</td>
<td>title + first name + surname</td>
</tr>
<tr>
<td></td>
<td>informal</td>
<td>handshake</td>
<td>first name</td>
<td>first name + surname</td>
</tr>
<tr>
<td>Japan</td>
<td>formal</td>
<td>handshake</td>
<td>surname</td>
<td>Mr/Mrs/Ms + surname</td>
</tr>
<tr>
<td></td>
<td>informal</td>
<td>handshake</td>
<td>first name + surname</td>
<td>first name + surname</td>
</tr>
<tr>
<td>Scandinavia</td>
<td>formal</td>
<td>handshake</td>
<td>first name + surname</td>
<td>first name + surname</td>
</tr>
<tr>
<td></td>
<td>informal</td>
<td>handshake</td>
<td>first name + surname</td>
<td>first name + surname</td>
</tr>
</tbody>
</table>

1 The table shows basic trends; behaviour may vary. 2 At first meeting, but probably not at later meetings. 3 Occasionally the greeting is a kiss (man – woman, woman – woman). 4 A man should always offer a handshake. 5 There is no informal way to introduce a visitor in Japan. 6 A title is used if the person is a medical doctor, professor or teacher.
Before you listen again, try to complete the following extracts from the presentation. Use one word per space. Then listen again to check your answers.

1. Before I come to a more _______________ presentation of the products you expressed an _______________ in, I think it would help to _______________.

2. In job-shop systems we have groups of more or less _______________ machinery located in different areas of the _______________ so that the parts to be machined go from one station to the next.

3. The trend in _______________ production clearly goes away from mass-produced identical parts to mass-produced _______________ parts.

4. As you can see from the _______________ the machinery is grouped according to the _______________ of operations needed to complete a product.

5. The cell shown in Figure 3 is U-shaped so that the _______________ can easily control all the machinery.

6. In such a cell a robot takes the place of the operator which, of course, places very high _______________ on the capabilities of the robot.

7. Apart from the high degree of _______________, accuracy and manufacturing speed which they offer, they are also necessary elements of modern _______________ systems.
Unit 1 – 1/7

First of all let me thank you again for having invited me and, of course, for your interest in our products. Our company tour has been very interesting for me and has helped me understand where you are and what your plans are. Before I come to a more detailed presentation of the products you expressed an interest in, I think it would help to outline briefly some more general concepts of manufacturing systems.

Now, from what I have seen and from what you have explained to me, I understand that the majority of parts in this plant are manufactured in what is commonly called a job shop. In job-shop systems we have groups of more or less identical machinery located in different areas of the plant so that the parts to be machined go from one station to the next. You see a typical layout of a job-shop system in Figure 1. As you can see, different parts move through the plant in different paths. Part A, for example, first goes to the turning lathes, is then taken to the grinding machines before it reaches assembly and storage. Oh, I’m sorry, I’ve just realized that I’ve forgotten to mark the lathes. The lathes are the boxes between reception and the grinding department. Now let’s look at part C. Part C first goes to the saws and then to the drill presses. From the drill presses it is brought to the grinding machines, before it is heat treated, assembled and stored. The diagram shows clearly that there is a lot of transport time involved, of course you know.

Let’s now turn to Figure 2, the flow job system – or assembly line –, the kind of system you use for the manufacture of small parts. Such a system is ideal for the mass production of one and the same product. The diagram shows very clearly the production line. The parts “flow” from each station to the next, and this of course reduces transport time drastically. The disadvantage of such a system is, as you know, that it takes a lot of time to set up the production line for a new product. And this is where you are facing problems now. The trend in modern production clearly goes away from mass-produced identical parts to mass-produced dissimilar parts, even in the car industry.

This brings me to Figure 3, the diagram of a cellular manufacturing system. The cellular manufacturing system groups different kinds of machinery together which are needed to complete a product. As you can see from the diagram, the machinery is grouped according to the sequence of operations needed to complete a product. It is thus not unlike an assembly line, but much more flexible. The individual machines are typically NC or CNC machines, which means that production can be changed over from one product to another – almost immediately. The cell shown in Figure 3 is U-shaped so that the operator can easily control all the machinery.

Finally, I’d like to draw your attention to Figure 4, the example of a robotic cell which manufacture is completely automatic. In such a cell a robot takes the place of the operator, which, of course, puts very high demands on the capabilities of the robot. This is ideal for working environments that are not suitable for people to work in, or if the parts to be moved from one machine to the next are very heavy. In your company both conditions come together in the casting department.

I think it’s fair to say that cellular manufacturing systems are the systems of the future. Apart from the high degree of flexibility, accuracy and manufacturing speed which they offer, they are also necessary elements of modern management systems. We will be talking about this again a little later. Now, I think this brief overview of different types of manufacturing systems helps us to see where ABAS products nicely fit into your plans. But before I come to that, are there any questions or comments?
Automation

Focus Drawing and turning

1. Crankshafts and camshafts can be used to convert rotary motion into special types of linear motion. In small groups study the illustrations and answer the questions that follow. If necessary consult your dictionaries.

   - What is the meaning of "upper dead centre", "lower dead centre" and "stroke"?
   - What is the main difference in the kind of motion that a camshaft and a crankshaft produce?
   - Name three examples of the use of crankshafts or camshafts.
   - What other mechanisms can you think of that convert motion?

2. Early production machinery

   Figure 1 shows the process of "wire drawing". In wire drawing, a thin wire is produced by pulling a thick wire through a small hole (the die) to reduce its diameter. Figure 2 on the next page shows a lathe. Lathes are used, for example, to reduce the diameter of a round workpiece.

   Before you read the texts, look at the illustrations and try to identify some of the parts in the following list. Then read the texts and — if necessary — complete the task.

   Wire drawing: water wheel, wire-drawing bar, rope, operator, crankshaft, wire, pair of pliers; Lathe: flywheel, fixed centre, foot treadle, running centre, crankshaft
Mechanization of production processes began very early, much earlier in fact than the time we usually call the Industrial Revolution, when steam began to be used as a source of power. For centuries, water mills had provided the power for many industrial processes such as the process of wire drawing shown in Figure 1. The illustration shows a medieval water wheel with a crankshaft attached to its centre. Wheel and crankshaft rotate continuously. The two ends of the crankshaft are mounted in bearings, and the crankshaft is attached to a pulling device or rope. The other end of this rope is fastened to a pair of pliers in such a manner that, when the rope is pulled, the jaws of the pliers close firmly around the wire. The operator grips the wire when the position of the crank is at the dead centre closest to the wire-drawing bar. As the crank continues its rotation, the wire is pulled through the die in the wire-drawing bar. This lengthens the wire while reducing its diameter. At the opposite dead centre, the operator releases the pliers, and during the following forward stroke the pliers slide back until the crank is back at the starting point. He now grips the wire again with the pliers, and the cycle is repeated. In such a manner a great length of wire can be drawn; the operator needs to apply only little force, as all the pulling force is provided by the water wheel. If a further reduction of the wire diameter is necessary, a smaller diameter die is used, and the process is repeated. When the wire is first threaded through the die, the tip of the wire must be sharpened to allow it to be pushed through the die far enough for the operator to grip it with the pliers. Only soft materials such as copper could be drawn in such a manner. To reduce friction, the die also needed frequent lubrication.

Figure 2 shows a sketch made by Leonardo da Vinci: the design of a lathe for the turning of wood. An interesting feature of this design is the flywheel attached to one end of the crankshaft. The crankshaft is rotated by the up-and-down movement of the foot treadle. Due to the weight of the flywheel, the motion of the crankshaft is made more uniform. The running centre of the lathe is attached to the opposite end of the crankshaft, and the workpiece to be turned is mounted between the running centre and the fixed centre. To fit different lengths of workpieces, the distance between the two centres can be adjusted.
3 PRACTICE

In technical texts the passive is often preferred when processes are being described. Read the text again and write down all the passive constructions. Why is the passive used?

(For an explanation of the passive go to Unit 1, page 14)

Now make passive sentences as in the example. Remember to add the correct form of the auxiliary verb 'be'.

1. The ends of the crankshaft
2. The wire
3. The oscillating movement of the tool breech
4. The tip of the wire
5. The diameter of the wire
6. The crank
7. Uniform rotation of the workpiece

to a pulling device.
thread it through the die,
when the wire is drawn through the die
through the die by means of a pair of pliers
by means of a flywheel,
in bearings to reduce friction.
into rotary motion of the workpiece.

4 VOCABULARY

The verbs allow, cause, permit, enable are similar in meaning. They all express ability or a cause-and-effect relationship between two things. Enable is usually only used with a human object.

Reformulate the sentences below using the words in brackets.

1. Rotary motion is transformed into reciprocating motion by means of the crank. 
   (permit/transformation of)
2. The operator is positioned flexibly in the basket and therefore can follow the lateral movement of the rope. (Flexible positioning/enable)
3. The operator has to apply only little force because the pliers are self-enforcing. (self-enforcing mechanism/allow)
4. The flywheel ensures that the lathe rotates smoothly. (cause)

5 DISCUSSION

In groups of three or four discuss the following questions. Compare your results with the other groups.

1. Was it necessary to have the operator sit on a swing suspended from above?
2. What was the shape of the dies in the wire-drawing bar? Make a sketch.
3. Did it matter whether the water wheel rotated clockwise or anticlockwise?
4. The pliers are of the self-enforcing type. This means that the more force is applied to pull the rope, the firmer the pliers close around the wire. What was the shape of the pliers to make them self-enforcing? Make a drawing of the pair of pliers.
5. The wire drawing illustrated in Illustration 1 shows an intermittent process, which means that the wire is not stretched continuously but bit by bit. How do you think a continuous drawing process could have been achieved?
Focus Sensors in manufacturing

6 Types of sensors

The following short text classifies sensors according to output and according to function. Decide what categories of sensors you expect it to name, then read and check.

Most modern manufacturing techniques would not be possible without the use of sensors. A sensor is a device that produces a signal to detect or measure a property such as, for example, the position, temperature of a workpiece, or the force being applied to it. Traditionally, sensors are used to set limits on the performance of machines. Examples are the stops on machine tools which restrict the movement of the worktable.

There are two different types of sensors. Analogue sensors produce a signal that is proportional to the measured quantity, whereas digital sensors have numeric or digital outputs that are transferred directly to computers.

Sensors are frequently found in assembly operations. They are classified as either tactile sensors or visual sensors. Systems using tactile sensors are used to handle fragile parts such as glass bottles or electronic devices. In visual sensing, cameras optically sense the presence and shape of an object.
Now read the rest of the text about sensors and decide whether the verbs in brackets should be in the passive or active. Sometimes you may want to add a modal verb (can, must, should, may etc).

Types of sensors

In applications where fragile parts are handled, the robot's gripper (equip) with a sensor such as a piezo electric device or a strain gauge that is capable of measuring the force being applied. The force sensed can be monitored and controlled to such an extent that even slipping (sense) and thus prevented, a capability of human fingers and hands that we (take) for granted but which is very difficult to achieve in robotics.

Advanced visual sensing systems can sense up to three dimensions and are, for example, capable of detecting properly inserted components in a printed circuit or a properly made solder joint. When they (use) in automated inspection systems, they also (detect) cracks and imperfections.

In visual sensing, the visual image of the object (measure) by a microprocessor, the measurements (digitize and compare) with an equally digitized image of the ideal shape or orientation of the object.

Machines equipped with visual sensors can identify and inspect parts and reject defective ones. Grippers are able to pick up parts and put them into the correct position. However, picking parts from a bin is a difficult task, because of the way they are randomly arranged very close to each other.

Reduced relative clauses I

1. Illustration 2 shows a sketch which was made by Leonardo da Vinci.
   Illustration 2 shows a sketch made by Leonardo da Vinci.

2. An interesting feature of the design is the flywheel which was attached to one end of the crankshaft.
   An interesting feature of the design is the flywheel attached to one end of the crankshaft.

Relative clauses with a passive are often reduced by leaving out the relative pronoun and the auxiliary be, leaving just the past participle.

Now read the texts in sections 6 and 7 again. How many reduced relative clauses can you find?
VOCABULARY

Some verbs can be changed into nouns by adding -ment or -ion, or -ity/-ivity, for example equip/equipment, automate/automation, produce/productivity. Other verbs do not change, e.g. to change/the change.

What are the nouns that belong to the following verbs? Use your dictionary to check spelling changes.

| 1 operate        | 12 require       |
| 2 repeat         | 13 measure       |
| 3 pull           | 14 be able       |
| 4 grip           | 15 produce       |
| 5 restrict       | 16 describe      |
| 6 lubricate      | 17 push          |
| 7 reject         | 18 transfer      |
| 8 adjust         | 19 prevent       |
| 9 attach         | 20 rotate        |
| 10 achieve       | 21 apply         |
| 11 illustrate    |                  |

PHRASES

Describing a function or purpose

- The lathe serves to reduce the diameter of a round workpiece.
- The function of the lathe is to reduce the diameter of a round workpiece.
- A lathe can be used to reduce the diameter of a round workpiece.
- The purpose of a lathe is to reduce the diameter of a round workpiece.
- The diameter of a round workpiece can be reduced by means of a lathe.
- A lathe is for reducing the diameter of a round workpiece.

Express the function or purpose of the following:

1 tactile sensors
2 visual sensors
3 the stops on machine tools
4 strain gauges
5 grippers
6 da Vinci's flywheel
Understanding servo-mechanisms

The illustrations below show different kinds of servo-mechanisms that are described in a lecture on the cassette. First study the diagrams. Several items are missing. As you listen, note down the missing items and where they should be, and the names of the parts indicated by arrows and numbers. Make sure you know the meaning of the words 'amplify' and 'amplification' before you start.

Illustration 2: The transistor

Illustration 3: A hydraulic clamping device

Write a description of the plastic extruding process shown in the illustrations below. The following information will help you.

Purpose Plastic Granules → pipes/rods/films etc.

Process Granules → Hopper → Feed zone (granules are mixed) → Melting zone (granules begin to melt) → Melt-pumping zone (melting and increasing of pressure) → Die (shape given) → Cooling of material

Details
- Diameter of the screw increases to increase the pressure
- Continuous process (great length can be produced)
- Great variety of shapes can be produced
An assembly plant

Focus Authentic reading

1 Toyota sacks some robots

First look at the heading and the subheading of the following article. What do you think the text is going to be about?

Now read the text and decide which two of these statements are correct:

1. Toyota is reducing automation in all of its plants.
2. Toyota has discovered that it is more economic to have fewer robots and more humans than a few years ago.
3. Toyota is replacing robots by humans because they are cheaper.
4. Toyota has redesigned its assembly lines and increased the number of subassembly lines.

Toyota Sacks Some Robots

Manufacturing:

Japan’s famously automated automakers emphasize the human touch at home

Toyota’s newest car factory is an industrial wonderland. Sparks fly as floors, side panels and roofs are welded. Robots install parts, while humans thread electrical wire and put in brake linings. Overhead, an electronic board tracks productivity; at midmorning, the plant has produced 145 cars—two behind its 480-cars-a-day schedule. "We’re probably behind because we just came back from a long holiday," says a guide. "We’re usually running at 105 percent." Toyota’s $1.4 billion Kyushu factory is arguably Japan’s most modern—but not in the ways one may expect. The country has long been at the forefront of factory automation and robotics, but in designing the Kyushu plant, Toyota chose to rely on less automation, not more. Jobs performed by robots at other Toyota car factories have been given back to humans. "More automation is not necessarily our aim," says Tadao Kajiwara, an adviser to the Kyushu plant. "We want manufacturing that is done with human skill and wisdom."

The main reason Japan’s leading carmaker has slowed its march toward automation at its Japanese plants is that it doesn’t think that course will yield any further significant cost savings. In the past, adding machines meant subtracting workers. But having ridden a wave of automation in the 1980s, Japanese carmakers have...
reduced labor to only 6 percent of total production costs. There is just not that much more left to save. But Toyota also learned an unexpected lesson after spending heavily in 1991 to set up a new assembly plant at its massive Thara complex. Some of the state-of-the-art machines it installed proved too complex and unreliable. Assembly workers were demoralized by sophisticated equipment they could neither operate nor maintain effectively. As a result, Jagnwa says, the plant struggled financially.

Tadayuki Kaneda, a general manager of Tokyo-based Toyota Engineering Corp., says that in the rush to automate, many Japanese manufacturers made a mistake. They took the most interesting assembly work away from humans and gave it to robots, which must be programmed every time there is a model change. With frequent model changes, retooling and engineering costs climb. “It’s not good to introduce technologies that threaten the workers at a plant. We’d like to manufacture cars in a way that maintains communication between autoworkers and customers.” As a practical matter, Kaneda says that a plant’s automation level is not a good measure of its efficiency. A factory with a 30 percent automation rate and 250 workers may be less cost-effective than one with 400 workers and a 10 percent automation rate.

Toyota Kyushu’s most innovative concept may be its redesigned assembly line. Most automobile plants have three to four subassembly lines, with roughly 70 workers on each. If something goes wrong, an entire line usually stops. Kyushu has broken the big lines into 11 mini-lines, each tended by a “kumi,” a group of 15 to 20 workers. Each kumi, in turn, is segmented into three teams, or beads, that handle specific tasks such as the installation of steering wheels. Kumi is responsible for the quality of work on its line. If there is a human skills problem, fewer workers are left standing around, and the other 10 lines can keep moving. “The mini-lines have improved morale significantly, and because of that, productivity has also improved.”

Though Toyota is re-emphasizing the human touch, the company realizing there is no getting away from advanced technology. Computer-controlled machines not only do the heavy work — lifting body panels and engines — but also perform such precision tasks as measuring engine blocks by microns and conducting all sorts of diagnostic tests. Humans could do that work, it is segmented into three teams, or beads, that handle specific tasks such as the installation of steering wheels. Kumi is responsible for the quality of work on its line. If there is a human skills problem, fewer workers are left standing around, and the other 10 lines can keep moving. “The mini-lines have improved morale significantly, and because of that, productivity has also improved.”

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1. What is the new concept that Toyota Kyushu is implementing to improve productivity and worker morale?
2. How does the new assembly line at Toyota Kyushu differ from traditional assembly lines?
3. What are the advantages of using mini-lines in the assembly process?
4. How do computer-controlled machines contribute to improved productivity and quality control?
5. What is the significance of the kumi in the Toyota Kyushu production process?
2. **VOCABULARY**

   Use words from the text to replace the underlined words in the following sentences. (The figures in brackets indicate the lines of the text in which the word is used.)

   1. Robots can **do** jobs that are difficult for humans to do. (1 – 34)
   2. Some **very modern** machines have proved to be unreliable. (35 – 57)
   3. The Japanese learned that the **new** machines were expensive to **service**. (57 – 63)
   4. The company’s most **creative** aspect may be its division of labour. (64 – 95)
   5. The workforce is **grouped into** several teams. (96 – 117)
   6. Toyota’s car factory continues to rely on **sophisticated** technology. (117 – 129)
   7. Many human **capabilities** are not matched by robots. (130 – 137)

3. **SUMMARY**

   Prepare a written or oral summary of the text concentrating on the most important aspects.

4. **DISCUSSION**

   In the past few years more and more people have been made redundant, partially due to new technologies in manufacturing. In many European countries 10% and more of the workforce are unemployed. Could a return to "old production techniques" help, or do we have to hope for "new markets" and "new" products or services in, for example, telecommunications?
Forces in engineering

Tuning-in

Task 1

1. Why doesn’t the ship sink?
2. What makes the spring stretch and what keeps the weight up?
3. Why doesn’t the box slide down the slope?

Reading 1 Predicting

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

Task 2

The text you are going to read is called Forces in engineering. Here are some of the words it contains. Can you explain the link between each word and the title of the text?

<table>
<thead>
<tr>
<th>weight</th>
<th>buoyancy</th>
<th>equilibrium</th>
</tr>
</thead>
<tbody>
<tr>
<td>elasticity</td>
<td>magnitude</td>
<td>resultant</td>
</tr>
<tr>
<td>newton</td>
<td>gravity</td>
<td></td>
</tr>
</tbody>
</table>
Now read the text. Use the information in the text to check the explanation you made in Task 1.

Forces in engineering

To solve the ship problem, we must look at the forces on the ship (Fig. 1). The weight, W, acts downwards. That is the gravity force. The buoyancy force, B, acts upwards. Since the ship is in equilibrium, the resultant force is zero, so the magnitudes of B and W must be the same.

![Diagram of a ship with forces B and W]

Fig. 1

Another very important force in engineering is the one caused by elasticity. A good example of this is a spring. Springs exert more force the more they are stretched. This property provides a way of measuring force. A spring balance can be calibrated in newtons, the unit of force. The block in Fig. 2 has a weight of 10 newtons. The weight on the balance pulls the spring down. To give equilibrium, the spring pulls up to oppose that weight. This upward force, F1, equals the weight of the block, W.

![Diagram of a spring balance with force F1 and weight W]

Fig. 2

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

We have looked at buoyancy, elasticity, and gravity. There is a fourth force important in engineering, and that is friction. Friction is a help in some circumstances but a hindrance in others. Let us examine the forces on the box (Fig. 3). Firstly, there is its weight, W, the gravity force, then there is the reaction, R, normal to the plane. R and W have a resultant force trying to pull the box down the slope. It is the friction force, F, acting up the slope, that stops it sliding down.
Reading 2 Grammar links in texts

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

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

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

Study these common grammar links:

1. A repeated noun becomes a pronoun.
   Springs becomes they.

2. A word replaces an earlier expression.
   Force in engineering becomes one.

3. A word replaces a whole sentence or clause.
   Springs exert more force the more they are stretched becomes This property.

Task 4

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

Source: S. Lurie and L. Barbaurn (eds.), The Penguin Book of the Physical World
Language study The present passive

Study these instructions for a simple experiment on friction.

**Fig. 4**

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

When we describe this experiment, we write:

A block of wood is placed on a flat surface. A spring balance is attached to one end of the block.

This description uses the present passive. We form the present passive using is/are + past participle.

**Task 5**

Complete this description of the experiment using the present passive.

A block of wood \( \text{1. } \) on a flat surface. A spring balance \( \text{2. } \) to one end of the block. A gradually increasing force \( \text{3. } \) to the balance. The force at which the block just begins to move \( \text{4. } \).

The block \( \text{5. } \) along at a steady speed. The force required to maintain movement \( \text{6. } \). The two forces \( \text{7. } \). It is found that the first force is greater than the second.

What does this experiment show?

Listening Listening to lectures

The listening passage you are going to hear is an extract from a typical engineering lecture. Here are some of the features of lectures.

1. Incomplete sentences: Spoken language is not divided neatly into sentences and paragraphs. For example:
   *Now what I thought I might do today ... What we are going to talk of ...*

2. Repetition and rephrasing: Lecturers often say the same thing more than once and in more than one way. For example:
   *It will turn, revolve.*

3. Signpost expressions: Lecturers often use expressions to help the students know what they are going to do next, what is important, etc. For example:
   *What we are going to talk of is the extension of a force.*
In the same way as when reading, it is helpful to think about the topic of a lecture before you listen. The topic here is *The Moment of a Force*. Can you explain the links between these words from the lecture and the topic? Use a dictionary to help you if necessary.

- turning
- distance
- product
- pivot
- perpendicular
- fulcrum
- hinge
- leverage

Now listen to the lecture to check your explanations.

During the lecture, the lecturer drew this diagram on the board. Which of the words in Task 6 can be used to talk about the diagram?

Here are some signpost expressions from the lecture. What do you think the lecturer is indicating each time? Select from the labels below, a to c.

1. We're going to talk about the moment of a force.
2. You can think of a spanner ...
3. But what you have to remember is ...
4. Something simple to illustrate.
5. I'm thinking of a practical job.
6. Why do we put a handle there on the door?
7. Is that understood? All right?
8. Well that's the end of the explanation of how you calculate moments.

- a. Emphasizing an important point
- b. Showing that the lecture is over
- c. Checking that the students can follow him
- d. Introducing the topic of the lecture
- e. Giving examples to illustrate the points

Listen to the tape again and answer these questions according to the information given by the lecturer.

1. What advantage does a longer spanner offer in loosening a tight nut?
2. What is the formula for calculating the moment of a force?
3. Why is it sometimes difficult to apply a force at right angles in a motor car engine?
4. Why is the handle of a door at the edge?
5. Write down the formulae for calculating force and distance.
Something simple to illustrate. If we take the drawing of a spanner ... The drawing of a spanner there, We apply a force at the end there, your pivot or the turning point, or as we call it the fulcrum, is in the centre there. Now the moment of that force is that force (D1) multiplied by the perpendicular distance (D2).

So that if you were doing ... I'm thinking of a practical job, where you couldn't get the perpendicular distance in. If you were applying a force there because of some other component that was in the way ... You know that in a motor car engine sometimes it's very difficult to get your hand in and get a right-angled pull. You might have to hold it right up at the head. Now that, as you can see, that, we'll call it D2, is a smaller distance, so you would have to use a much greater force there.

Why do we put a handle there on the door? Why do we put a handle there on the edge? Because it's much easier to open the door with the handle at the edge. Because it's further away from the fulcrum. Even a simple thing like that has got a scientific reason. Is that understood? All right. We have the handle there because it's much easier. The fulcrum is the hinge of the door. It would be much more difficult to close the door right up at the hinge. Does that help you?

Now to calculate our moment, then, one would simply multiply the force by the distance that you were away from it. So moment is force times distance. If I want, if someone says, ah yes, we want the force ... If I want to calculate the force, then it's moment divided by distance. And if I want distance, moment divided by force.

Well that's it then — a little explanation of how you calculate moments.
Introductions

How you begin your presentation depends on how formal the situation is. Most audiences prefer a relatively informal approach.

TASK 1
Below you will find two alternative ways of introducing yourself and the subject of your presentation - one fairly formal, the other more friendly. At each stage choose the expression you would feel more comfortable using and highlight it.

FAIRLY FORMAL

Err, perhaps we should begin.
Good morning, ladies and gentlemen.
On behalf of..., may I welcome you to ...
My name's ...
For those of you who don't know me already,
I'm responsible for ...
This morning I'd like to ...
discuss ...
report on ...
and present ...
If you have any questions you'd like to ask, I'll be happy to answer them.
or Perhaps we can leave any questions you may have until the end of the presentation.

MORE FRIENDLY

OK, let's get started.
Morning, everyone.
Thanks for coming.
I'm ...
As you know, ...
I'm in charge of ...
What I want to do this morning is ...
talk to you about ...
tell you about ...
and show you ...
Feel free to ask any questions you like as we go along.
And don't worry, there'll be plenty of time left over for questions at the end.

How happy would you be taking questions a) during your presentation b) at the end?

TASK 2
Now put together an introduction of your own using some of the expressions you chose above. Remember how important it is to be totally confident about this part of your presentation.

Don't waste a lot of time at the beginning of your presentation introducing yourself, your company and the subject of your talk. Get on with it!
TASK

Below you will find a number of ways of stating the purpose of your presentation. Complete them using the words given. Combining the sentences with the number 1 will give you a complete introduction. Then do the same with those numbered 2 etc. The cassette provides a good model for you. Use it to check your answers after you have done the exercise.

OK, let's get started. Good morning, everyone. Thanks for coming. I'm (your name). This morning I'm going to be:

showing talking taking reporting telling
1. .............. to you about the videophone project.
2. .............. you about the collapse of the housing market in the early 90s.
3. .............. you how to deal with late payers.
4. .............. a look at the recent boom in virtual reality software companies.
5. .............. on the results of the market study we carried out in Austria.

... so, I'll begin by:

making outlining bringing giving filling
1. .............. you in on the background to the project.
2. .............. a few observations about the events leading up to that collapse.
3. .............. company policy on bad debt.
4. .............. you an overview of the history of VR.
5. .............. you up-to-date on the latest findings of the study.

... and then I'll go on to:

put discuss make highlight talk
1. .............. what I see as the main advantages of the new system.
2. .............. the situation into some kind of perspective.
3. .............. you through our basic debt management procedure.
4. .............. detailed recommendations regarding our own R&D.
5. .............. in more depth the implications of the data in the files in front of you.

Highlight all the verb phrases above, e.g. talking to you about, making a few observations about. Notice it is not the verb alone, but the whole phrase you need to learn.
PRESENTATION

Prepare to introduce and state the purpose of a presentation of your own by completing the notes below. Then present your introduction.

Perhaps we should begin. or OK, let's get started.
Good morning / afternoon / evening, everyone.

Thanks for coming. I'm And, as you know, I

This morning I'm going to be - talking to you about
- telling you
- showing you
- reporting on
- taking a look at

So, I'll start off by - filling you in on the background to
- bringing you up-to-date on
- giving you an overview of
- making a few observations about
- outlining

And then I'll go on to - highlight what I see as the main
- put the situation into some kind of perspective
- discuss in more depth the implications of
- talk you through
- make detailed recommendations regarding
Stating Your Purpose 2

When you give a presentation in English, clarity is very important, particularly if there are non-native speakers in your audience. It often helps if you state your purpose at each stage of your talk as well as at the beginning.

TASK
Cross out the verbs which do not fit in the following presentation extracts. The first one has been done for you as an example.

1. First of all, I'd like to preview / overview / outline the main points of my talk.
2. Perhaps I should start off by pointing / stressing / reminding that this is just a preliminary report. Nothing has been finalized as yet.
3. But later on I will, in fact, be putting forward / putting out / putting over several detailed proposals.
4. One thing I'll be dealing with / referring / regarding is the issue of a minimum wage.
5. And I'll also be asking / raising / putting the question of privatization.
6. So, what we're really driving at / aiming at / looking at are likely developments in the structure of the company over the next five to ten years.
7. If we could just draw / focus / attract our attention on the short-term objectives to begin with.
8. The eighteen-month plan, which by now you should've all had time to look at, outlines / reviews / sets out in detail our main recommendations.
9. Basically, what we're suggesting / asking / reviewing is a complete reorganization of staff and plant.
10. I'd now like to turn / draw / focus my attention to some of the difficulties we're likely to face.
11. I'm sure there's no need to draw out / spell out / think out what the main problem is going to be.
12. But we do need to seriously ask / answer / address the question of how we are going to overcome it.
13. The basic message I'm trying to get through / get across / get to here is simple. We can't rely on government support for much longer.
14. Disappointing end-of-year figures underline / undermine / underestimate the seriousness of the situation.
15. And the main conclusion we've thought / got to / come to is that massive corporate restructuring will be necessary before any privatization can go through.
Effective Openings

Communications experts are all agreed that the first three minutes of a presentation are the most important. They talk about 'hooks' - simple techniques for getting the immediate attention of the audience.
A good start makes you feel more confident. Here's how the experts suggest you 'hook' your audience:

1. Give them a problem to think about.
2. Give them some amazing facts.
3. Give them a story or personal anecdote.

**TASK**

Look at the presentation openings below and divide them under three headings:

<table>
<thead>
<tr>
<th>PROBLEMS</th>
<th>AMAZING FACTS</th>
<th>STORIES</th>
</tr>
</thead>
</table>

What do you think each presentation was about?

1. Did you know that Japanese companies spend four times more on entertaining clients in a year than the entire GDP of Bulgaria? 40 billion dollars, to be precise. You know, that's twice Colombia's total foreign debt. You could buy General Motors for the same money.

2. Suppose your advertising budget was cut by 99% tomorrow. How would you go about promoting your product?

3. According to the latest study, by 2050 only one in every four people in Western Europe will be going to work. And two will be old age pensioners.

4. You know, R&D is 90% luck. When I think about creativity, I'm reminded of the man who invented the microwave oven. He spent years messing around with radar transmitters, then noticed the chocolate in his pocket was starting to melt!

5. Statistics show that in the last ten years more people have legally emigrated to the United States than to the rest of the world put together - about half a million of them a year, in fact. Now, over ten years, that's roughly equivalent to the population of Greece.

6. Have you ever wondered why it is that Americans are easier to sell to than Europeans? And why nine out of ten sales gurus are American? You have! Well, if I could show you what stops Europeans buying, would you be interested?
7. I read somewhere the other day that the world's highest paid executive works for Disney and gets $2300 million a year. Now that's about $2000 a minute! That means he's currently making more money than Volkswagen.

8. How many people here this morning hate going to meetings? Just about everybody, right? Well, imagine a company where there were never any meetings and everything ran smoothly. Do you think that's possible?

9. Have you ever been in the situation where you've had to negotiate with the Japanese? I remember when I was working in Nagoya and everybody had told me the Japanese don't like saying no. So in meetings I just kept saying yeah to everything. And they hated it. It turned out yeah sounds like no in Japanese!

PRESENTATION
Use the frames below to help you prepare effective openings, using the problem, amazing facts, or story technique. Whatever technique you choose, prepare your opening carefully. You should always know exactly how you are going to start.

PROBLEM TECHNIQUE
1. Suppose ..........................................................?
   How would you .......................................................?
2. Have you ever wondered why it is that ............................? You have?
   Well, if I could show you ...................................... would you be interested?
3. How many people here this morning / afternoon / evening .......................?
   Well, imagine ......................................................... Do you think that's possible?

AMAZING FACTS TECHNIQUE
1. Did you know that .....................................................?
2. According to the latest study, ...................................
3. Statistics show that ...............................................?
4. I read somewhere the other day that .................................

STORY / ANECDOTE TECHNIQUE
1. You know, ..........................................................
   When I think about .................................................
   I'm reminded of ...............................................?
2. Have you ever been in the situation where ............................?
   I remember when ................................................
   It turned out .....................................................
Signposting

In a good presentation, what you say – the content – is much more important than anything else. But a clear structure helps. When you move on to your next point or change direction, tell the audience.

You can do this easily and effectively, using simple phrases as ‘signposts’ to guide the audience through your presentation:

<table>
<thead>
<tr>
<th>To move on</th>
<th>To go back</th>
<th>To summarize</th>
</tr>
</thead>
<tbody>
<tr>
<td>To expand on</td>
<td>To recap</td>
<td>To turn to</td>
</tr>
<tr>
<td>To digress</td>
<td>To conclude</td>
<td>To elaborate on</td>
</tr>
</tbody>
</table>

**TASK 1**

Choose one of the ‘signpost’ expressions from the box above for the following situations:

1. When you want to make your next point.
2. When you want to change direction.
3. When you want to refer to an earlier point.
4. When you want to repeat the main points.
5. When you want to give a wider perspective.
6. When you want to do a deeper analysis.
7. When you just want to give the basics.
8. When you want to depart from your plan.
9. When you want to finish your talk.

**TASK 2**

These nine basic signposts are all you need, but you have to remember them automatically. Listen to your cassette or your teacher. When you hear an instruction, for example, make your next point, write the correct phrase:

1. ................................
2. ................................
3. ................................
4. ................................
5. ................................
6. ................................
7. ................................
8. ................................
9. ................................
**TASK 3**

Once you know the nine basic signposts, you can build them into the points you make to give direction and coherence to your presentation.

Complete the following signpost phrases and sentences using the notes to help you. Say them first. Then write them down. The first one has been done for you as an example.

1. Moving on / question / the US market,
   Moving on to the question of the US market,

2. Expand / the figures / last year,

3. I'd like / recap / the main points.

4. Let's go back / question / clinical research methods.

5. Digress / a moment, let's consider / alternatives.

6. Going back / a moment / the situation last year,

7. Let's turn now / our targets / the next five years.


9. Go back / the main reason / our collaboration / the Germans,

10. I'd like / expand / that / little, before we move on.

11. Let's go back / a moment / what we were discussing earlier.

12. Let me expand / some / the main points / our proposal.

13. Elaborate / that / little / those of you / aren't familiar / Russian business practices,

14. If I could just move on / some / the problems we face / Central / Latin America,

15. I'd like / conclude / I may / repeating what I said / the beginning / this presentation.

Present the signpost sentences above until you feel comfortable saying them.

Neat, short signposts are more effective than long explanations of the structure of your presentation. Remember, the simplest way to signpost the end of one stage of your presentation and the beginning of the next is to say:

**OK. So, ...**
Survival Tactics

Giving a presentation in a foreign language is a challenge. Concentrate too hard on the facts and you make language mistakes. Concentrate too hard on your English and you get your facts wrong.

**TASK 1**

If you have problems during your presentation, don't panic. Pause. Sort out the problem and continue. Here are the eight most common problems people face. Match what you think with what you say:

**WHAT YOU THINK**
1. I've got my facts wrong!
2. Too fast! Go back.
3. I've forgotten to say something!
4. Too complicated! Make it simple.
5. I'm talking nonsense.
6. How do you say this in English?
7. Wrong! Try again.
8. I'm running out of time!

**WHAT YOU SAY**

a. So, let's just recap on that.

b. So, basically, what I'm saying is this...

c. Sorry, what I meant is this...

d. Sorry, I should just mention one thing.

e. So, just to give you the main points here...

f. Sorry, let me rephrase that.

g. Sorry, what's the word / expression?

h. Sorry, perhaps I didn't make that quite clear.

Notice how some of the words are stressed in each phrase. Repeat the phrases until you feel comfortable saying them.

**TASK 2**

Knowing how to get out of difficulty in a presentation is essential. If you learn these expressions by heart, you will be able to do it automatically and, therefore, confidently. Listen to the following problems and use the correct survival phrase.

1. Facts wrong!
2. Too fast!
3. Forgotten something!
4. Too complicated!
5. Talking nonsense!
6. Don't know the English!
7. Sounds wrong!
8. No time!

Repeat this activity several times until you can do it automatically.
Exploiting Visuals

How to use visual aids to maximum effect

"I hope you can read this from the back."
Introducing Visuals

Visuals are important in any professional presentation. But when you give a presentation in a foreign language, they are even more important. Visual information is highly memorable and reduces the amount of talking you have to do. Good visuals speak for you.

TASK 1
Divide the visuals below into three groups:

1. GRAPHS
2. CHARTS
3. DIAGRAMS

What sort of visuals do you regularly use in your job?

You don't need to know all the names of the different types of visual in order to present them. Simply say:

Have a look at this. or Take a look at this.
As you can see, here... and here...

American English prefers take (take a look, take a shower, take a break).
British English prefers have (have a look, have a shower, have a break).
**TASK 2**

Effective presenters introduce and highlight visual information briefly and clearly. Remember to keep everything simple. Write out the following sentence fragments in the correct order to make complete presentation extracts. The cassette provides a good model for you. Use it to check your answers after you have done the exercise.

**EXTRACT 1**

see, it's a fairly typical growth
Have a look at
stages of its development. The vertical axis
and the horizontal
this graph. As you can
shows turnover in millions of dollars
curve for a young company in the early
axis represents the years 1990 to 1996

**EXTRACT 2**

productivity of our European
levels in the Netherland, shown
looking at very clearly
plants, and gives you some
The graph we're
here, exceed the rest
idea of how far production
demonstrates the comparative

**EXTRACT 3**

products. Let's take a closer
which shows the current
growth sector
I'd like you
position of six of our leading
movement in the high
to look at this chart,
look for a moment at product

Now underline the most useful expressions used to introduce visuals and highlight key points.
Commenting on Visuals

Visuals help you to give a lot of information in a short space of time. They are really 'quick snapshots' of situations, developments, events and processes which would take a long time to explain fully in words.

Good visuals speak for themselves and require little or no description, but you often need to draw your audience's attention to one or more key points before you discuss them in more detail:

1. **Highlights** Which parts of the visual are most significant?
2. **Comments** Why?
3. **Interpretations** What conclusions can you draw?

**TASK 1**

These expressions highlight important information in a visual. Complete them using the following words:

- **on**
- **to**
- **at**
- **out**
- **about**

1. **us to look** 1. **......** this part of the graph in more detail.
2. **us to focus our attention** 2. **......** one particularly important feature.
3. **I'd like you to think** 3. **......** the significance of this figure here.
4. **to point** 4. **......** one or two interesting details.
5. **to draw your attention** 5. **......** the upper half of the chart.

**TASK 2**

These expressions comment on important information in a visual. Complete them using the following words:

- **If**
- **As**
- **Whatever**
- **Whichever**
- **However**

1. **......** you can see, there are several surprising developments.
2. **......** you look at it more closely, you'll notice a couple of apparent anomalies.
3. **......** you try to explain it, this is very bad news.
4. **......** the reasons for this, the underlying trend is obvious.
5. **......** way you look at it, these are some of our best results ever.
TASK 3
These expressions interpret important information in a visual. Complete them using the following words:

lesson  message  significance  conclusions  implications

1. ................ to be drawn from this are
2. ................ to be learned from this is
I'm sure the
3. ................ of this are clear to all of us.
4. ................ of this is
5. ................ here is

Now highlight all the useful expressions, eg. I'd like us to look at, I'd like us to focus our attention on etc.

TASK 4
In the box below prepare a visual which is relevant to your work, company or interests. Present it several times, using the suggested expressions to help you.

Introduction and Explanation
Take a look at this / Let's have a look at this / I'd like you to look at this.
Here we can see ........
The ........ represents ........ And the ........ represents ........

Highlights and Comments
I'd like us to look at ........ in more detail. As you can see, ........
I'd also like to draw your attention to ........
If you look at it more closely, you'll notice ........

Interpretations
I'm sure the implications of this / the conclusions to be drawn from this are clear to all of us.
Change and Development 1

In many professional presentations you need to talk about changes and developments. Usually a visual will explain these for you. But if you do not have a visual to illustrate a particular point, you need the specialized language of change and development.

TASK 1

Here are the most important verbs used to talk about change and development. Complete them by adding the vowels a, e, i, o and u.

1. ncr_s
2. r_s_
3. dcr_s
4. f_l
5. sh_t_p
6. t_k_ff
7. pl_ng_
8. sl_mp
9. f1_cr_t
10. r_c_v_r
11. p_ck_p
12. s_t_b_l_z
13. l_v_l_ff
14. r_m_n s_t_d_y
15. _k
16. h_t_l_w
17. b_tr_m_r
18. gr_w
19. x_p_n_d
20. sh_r_n_k
21. d_cl_n_

TASK 2

Now answer the following questions:

1. Which of these verbs are irregular (e.g. rise – rose – risen)?
2. Which can be both a verb and a noun (e.g. to rise – a rise)?
3. Which can be changed into a noun (e.g. fluctuate – fluctuation)?
Change and Development 2

Sometimes it is not enough to talk about increases and decreases. You may also want to draw your audience's attention to the scale and speed of the change and comment on its significance.

**TASK 1**

Write the following adjectives in the correct space on the diagram below according to what kind of change they describe:

<table>
<thead>
<tr>
<th>a(n)</th>
<th>substantial</th>
<th>rapid</th>
<th>encouraging</th>
<th>slight</th>
<th>spectacular</th>
<th>enormous</th>
<th>increase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>disastrous</td>
<td>moderate</td>
<td>disappointing</td>
<td>steady</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Which of the words above mean more or less the same as the following:

a. massive
b. gradual
c. significant
d. tremendous

**TASK 2**

Cross out the word which does not fit in the following sentences:

1. Demand increased slightly / steadily / tremendously / disappointingly.
2. Interest rates rose sharply / considerably / keenly / marginally.
3. Profitability slumped moderately / disastrously / suddenly / rapidly.
4. The price of oil fluctuated enormously / wildly / gradually / dramatically.

Now re-write the sentences above using a noun instead of a verb:

1. There was a(n)...
2. There was a(n)...
3. There was a(n)...
4. There was a(n)...

59
TASK 1

Below you will find an extract from a presentation comparing stock market performance in four European countries. Complete it using the words given in the lists.

PART 1

around at downs so upward of

First, let's have a look at this graph, which shows us the ups and downs of the 'footsie' over the last three months. As you can see, the overall trend is upward, with the index finishing up around 3,200 in mid-May. This trend, however, can't hide the fact that there was a fall between the middle of February and the beginning of March. We'll be looking at the reasons for this unexpected dip in a moment.

PART 2

at about of over to from

In Paris it's been the same story, with the CAC falling just in mid-February, putting on roughly 120 points over the three-month period, peaking just short of 2020, give or take a point.
PART 3

don down between over of by downward

As you can see, the picture in Milan is rather different. The early trend was decidedly (1) . . . . . . . . In fact, the MIBTol had already fallen (2) . . . . . . . . in excess (3) . . . . . . . . 1400 points by mid-March.

It then fluctuated (4) . . . . . . . . 9700 and 9300 for the best part of a month, before partially recovering to end up well (5) . . . . . . . . a hundred points (6) . . . . . . . . on the figure for mid-February.

PART 4

for in below near down up

If anything, the DAX has fared rather worse. In mid-February it was well (1) . . . . . . . . at getting on (2) . . . . . . . . 2200 and looking strong. But by the end of March it was way (3) . . . . . . . . the 1950 threshold and nowhere (4) . . . . . . . . where our forecasts had put it. And it's still well (5) . . . . . . . . at somewhere (6) . . . . . . . . the region of 2080.

TASK 2

Now try to remember some of the phrases from the presentation which could be of use to you:

1. . . . . . . . . . . and downs
2. a rise of . . . . . . . . ten points
3. give or . . . . . . . . a point
4. just . . . . . . . of 2000
5. the . . . . . . . . part of a week
6. the overall . . . . .
7. an unexpected . . .
8. in the . . . . . . . . of 1080
9. a couple of weeks . . .
10. getting . . . . . . . for 1800

Source of graphs: The European
PRESENTATION
Complete the visuals below with information relevant to your work, company or interests. Make a few notes on each before you present them. You don't need to describe the visuals in detail. Give approximate figures and point out the overall trends and developments.

USEFUL WORDS AND EXPRESSIONS
just over just under well over well under
about / around approximately roughly more or less
in the region of getting on for just short of nowhere near
Cause, Effect and Purpose

As a presenter, your job is not just to present facts, but also to explain the reasons behind the facts and their likely causes and effects. English has a lot of expressions which are used to link cause, effect and purpose, but these are mostly used in written reports. The language used in presentations is often much simpler. Compare the following:

<table>
<thead>
<tr>
<th>REPORT</th>
<th>PRESENTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>TQM was introduced</td>
<td>We introduced TQM</td>
</tr>
<tr>
<td><em>in order to increase efficiency.</em></td>
<td><em>to increase efficiency.</em></td>
</tr>
<tr>
<td>The introduction of TQM</td>
<td>We introduced TQM</td>
</tr>
<tr>
<td><em>led to a 20% increase in efficiency.</em></td>
<td>and efficiency increased by 20%</td>
</tr>
<tr>
<td>The 20% increase in efficiency was</td>
<td>Efficiency increased by 20%</td>
</tr>
<tr>
<td><em>a result of the introduction of TQM.</em></td>
<td><em>because we introduced TQM.</em></td>
</tr>
</tbody>
</table>

Notice also how noun phrases (the introduction of TQM, a 20% increase in efficiency) are more common in reports, and verb phrases (we introduced TQM, efficiency increased by 20%) are more common in speech.

**TASK 1**

Look at the following extracts from a report. Change them into what you might say in a presentation, using *and, because and to.* Remember to change noun phrases into verb phrases where possible. The first words are given:

1. TV coverage of the launch led to a significant increase in customer response rate.
   The launch ..............................................................

2. There has been a dramatic fall in operating costs as a result of last year’s efforts.
   Operating costs ...........................................................

3. Product modifications may be needed in order to remain internationally competitive.
   We .................................................................

4. Market entry was successful due to our competitive pricing strategy.
   We .................................................................

5. Investment was increased so as to take advantage of the upturn in the economy.
   We .................................................................

6. The slowdown in growth was caused by a loss of corporate confidence.
   Growth .................................................................
TASK 2
Sort the following expressions:

- thanks to
- accounts for
- brought about
- owing to
- gave rise to
- resulted in
- can be traced back to
- is attributable to

CAUSE (because . . . )

EFFECT (and . . . )

PRESENTATION
Present the graph below. Don’t worry about quoting precise dates and figures, but pay particular attention to the language of cause, effect and purpose. Remember, and, because and to are usually the only words you will need. The graph has labels to help you.
Give a formal presentation!

1. **Greeting and welcoming your audience**
   - Good morning / afternoon / evening, ladies and gentlemen / everyone ...
   - I'd like to welcome you all to (company's name) ...

2. **Introducing yourself by giving your name and your position**
   - My name is (name) and I am (title) responsible for marketing at (company's name) ...
   - Let me introduce myself ...

3. **Introducing the subject of your talk**
   - I'd like to give you an overview of ...
   - I'd like to say a few words about ...
   - I'd like to explain to you ...

4. **Outlining your talk**
   - I have divided my talk into three main parts ...
   - During my presentation I'll be looking at three key areas (First ..., second ..., and finally ...) ...
   - The subject can be looked at under three main heads ...

5. **Explaining that you will be using some charts to highlight the key information**
   - To illustrate my talk I intend to use some charts.
   - I'll be using some charts to highlight the key information.

6. **Telling the audience that you aim to speak for about 15 minutes**
   - I aim to speak for about 15 minutes.
   - This will take about 15 minutes.

7. **Explaining how you want to handle questions**
   - If you have any questions, please feel free to interrupt.
   - If you have any questions, I'll be happy to answer them at the end of my talk.

8. **Introducing your first point**
   - To start with, then, I'd like to consider ...
   - First of all, I'd like to look at / draw your attention to ...
   - Firstly, let's take a look at ...
Dr. Andrea Koßlowski-Klee

Practical Application

**Presenting yourself**
*(Fill in the blanks)*

You are attending the **Deutscher Absolventen-Kongress** in Cologne in November and are at the stand of a British company. You are making a contact with a company representative because you are interested in a permanent position and plan to mail in your application at some point in the future. The British representative does not understand any German and is not familiar with the German educational system.

I am currently a **Student** at a Fachhochschule where I am **eingeschrieben** in an Honors Course in **Wirtschaftsingenieurwesen Bau**. This study program is leading to a Bachelor’s **Grad/Abschluß** in **wirtschaftsingenieurwesen Bau**. Fachhochschule is probably **anwendungsorientiert** here, the education is more **anspruchsvoll** compared to programs at German universities where it is theory-oriented. But the coursework at a Fachhochschule is just as **akademisch** as it is at a university. My **Abschluß** will be **verliehen** upon me at the end of four years of study at this institution. The degree “Diplom-Ingenieur (FH)” is **berufszweifizierend** to enter the **zugelassen werden** immediately. My friend, however, who is an architect, has to be **zugelassen werden** with the Chamber of Architects, before he will be allowed to practice his profession. (...)

66
<table>
<thead>
<tr>
<th>Deutsch</th>
<th>Englisch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akademisches Auslandsamt</td>
<td>office of international relations</td>
</tr>
<tr>
<td>akademischer Abschluß</td>
<td>(academic) degree</td>
</tr>
<tr>
<td>allgemeine Grundlagen</td>
<td>basic studies</td>
</tr>
<tr>
<td>Architektur</td>
<td>architecture</td>
</tr>
<tr>
<td>ASIA</td>
<td>students’ union executive committee</td>
</tr>
<tr>
<td>Auslandsstudium</td>
<td>study abroad</td>
</tr>
<tr>
<td>ausländischer Studienbewerber</td>
<td>international student applicant</td>
</tr>
<tr>
<td>ausländischer Studierender</td>
<td>international student</td>
</tr>
<tr>
<td>Austauschstuderender</td>
<td>(non-degree-seeking) exchange student</td>
</tr>
<tr>
<td>BAFÖG</td>
<td>law on support for education and training</td>
</tr>
<tr>
<td>Bauingenieurwesen</td>
<td>civil engineering</td>
</tr>
<tr>
<td>Dekan</td>
<td>dean, department head</td>
</tr>
<tr>
<td>Dekanat</td>
<td>dean’s office</td>
</tr>
<tr>
<td>Diplom</td>
<td>Diplom</td>
</tr>
<tr>
<td>Diplomarbeit</td>
<td>Diplom thesis</td>
</tr>
<tr>
<td>Diplomprüfungsordnung</td>
<td>Diplom examination regulations</td>
</tr>
<tr>
<td>Eignungstest</td>
<td>aptitude test</td>
</tr>
<tr>
<td>Einschreibung</td>
<td>registration</td>
</tr>
<tr>
<td>Einstufung in ein höheres Fachsemester</td>
<td>advanced placement</td>
</tr>
<tr>
<td>Elektrotechnik</td>
<td>electrical and electronic engineering</td>
</tr>
<tr>
<td>Erstsemester</td>
<td>first semester student</td>
</tr>
<tr>
<td>Fachbereich</td>
<td>department</td>
</tr>
<tr>
<td>Fachbereichsrat</td>
<td>departmental council</td>
</tr>
<tr>
<td>Fachhochschule</td>
<td>university of applied sciences</td>
</tr>
<tr>
<td>Fachpraktikum</td>
<td>subject related practical training</td>
</tr>
<tr>
<td>Fachprüfung</td>
<td>(oral / written) subject examination</td>
</tr>
<tr>
<td>fortgeschrittene Studierende</td>
<td>advanced students</td>
</tr>
<tr>
<td>Frauenbeauftragte</td>
<td>women’s representative</td>
</tr>
<tr>
<td>Frauenrat</td>
<td>women’s council</td>
</tr>
<tr>
<td>Grundpraktikum</td>
<td>basic practical training</td>
</tr>
<tr>
<td>Grundstudium</td>
<td>basic study stage</td>
</tr>
<tr>
<td>Hauptstudium</td>
<td>main study stage</td>
</tr>
<tr>
<td>Hochschule</td>
<td>university; institution of higher education</td>
</tr>
<tr>
<td>Hochschulzugangsberechtigung</td>
<td>qualification for admission to higher education</td>
</tr>
<tr>
<td>Immatrikulationsamt</td>
<td>office of the registrar</td>
</tr>
<tr>
<td>Immatrikulationsbescheinigung</td>
<td>certificate of registration</td>
</tr>
<tr>
<td>Innenarchitekt</td>
<td>interior design</td>
</tr>
<tr>
<td>Kanzler</td>
<td>head of budget and administration</td>
</tr>
<tr>
<td>Kolloquium</td>
<td>(final) oral examination</td>
</tr>
<tr>
<td>Konvent</td>
<td>administrative council</td>
</tr>
<tr>
<td>Kreis Lippe</td>
<td>Lippe district</td>
</tr>
<tr>
<td>Kursverlaufsplan: Lehrplan</td>
<td>syllabus</td>
</tr>
<tr>
<td>German Term</td>
<td>English Equivalent</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Lebensmitteltechnologie</td>
<td>food science and technology</td>
</tr>
<tr>
<td>Lehrbeauftragter</td>
<td>(part-time) lecturer</td>
</tr>
<tr>
<td>Leistungsnachweis</td>
<td>course certificate; course credit</td>
</tr>
<tr>
<td>Logistik</td>
<td>logistics</td>
</tr>
<tr>
<td>Maschinenbau</td>
<td>mechanical engineering</td>
</tr>
<tr>
<td>Mitarbeiter in Lehre und Forschung</td>
<td>research assistant</td>
</tr>
<tr>
<td>Mitarbeiter in der Verwaltung</td>
<td>(administrative) staff member</td>
</tr>
<tr>
<td>Note</td>
<td>grade</td>
</tr>
<tr>
<td>Notendurchschnitt</td>
<td>grade point average (GPA)</td>
</tr>
<tr>
<td>Pflichtfach</td>
<td>compulsory subject</td>
</tr>
<tr>
<td>Praktikum</td>
<td>practical training / internship</td>
</tr>
<tr>
<td>praktische Übung</td>
<td>practical course</td>
</tr>
<tr>
<td>Praxissemester</td>
<td>practical semester</td>
</tr>
<tr>
<td>Produktionstechnik</td>
<td>production engineering</td>
</tr>
<tr>
<td>Professor</td>
<td>professor, faculty member</td>
</tr>
<tr>
<td>Prorektor</td>
<td>vice-president</td>
</tr>
<tr>
<td>Prüfungsausschuß</td>
<td>examination committee</td>
</tr>
<tr>
<td>Prüfungsausschußvorsitzender</td>
<td>head of the examination committee</td>
</tr>
<tr>
<td>Prüfungsnachweis</td>
<td>transcript of records</td>
</tr>
<tr>
<td>Rektor</td>
<td>president</td>
</tr>
<tr>
<td>Schulabgangszeugnis</td>
<td>school leaving certificate</td>
</tr>
<tr>
<td>Semesterwochenstunde</td>
<td>weekly hour per semester</td>
</tr>
<tr>
<td>Senat</td>
<td>senate</td>
</tr>
<tr>
<td>Senatsausschuss</td>
<td>senate committee on international affairs</td>
</tr>
<tr>
<td>Sommersemester</td>
<td>spring semester</td>
</tr>
<tr>
<td>Studienangebot</td>
<td>courses offered, range of courses</td>
</tr>
<tr>
<td>Studienbedingungen</td>
<td>study requirements</td>
</tr>
<tr>
<td>Studienberater</td>
<td>academic advisor</td>
</tr>
<tr>
<td>Studienfach</td>
<td>subject</td>
</tr>
<tr>
<td>Studiengang</td>
<td>degree program</td>
</tr>
<tr>
<td>Studienplan</td>
<td>curriculum</td>
</tr>
<tr>
<td>Studienrichtung</td>
<td>focus of study; study focus</td>
</tr>
<tr>
<td>Studienschwerpunkt</td>
<td>area of specialization</td>
</tr>
<tr>
<td>Studienverlauf</td>
<td>course of studies</td>
</tr>
<tr>
<td>Studienziele</td>
<td>study objectives</td>
</tr>
<tr>
<td>Stundenplan</td>
<td>schedule</td>
</tr>
<tr>
<td>Vorlesung</td>
<td>lecture</td>
</tr>
<tr>
<td>Vor-Diplom</td>
<td>pre-Diplom examination</td>
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<tr>
<td>Wahlfach</td>
<td>elective</td>
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<tr>
<td>Wahlpflichtfach</td>
<td>compulsory elective</td>
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<tr>
<td>Wintersemester</td>
<td>winter semester</td>
</tr>
<tr>
<td>Zulassung</td>
<td>admission</td>
</tr>
<tr>
<td>Zulassungsantrag</td>
<td>admissions form</td>
</tr>
<tr>
<td>Zulassungsbescheid</td>
<td>letter of acceptance; letter of admission</td>
</tr>
<tr>
<td>Zulassungsvoraussetzungen</td>
<td>admissions requirements</td>
</tr>
<tr>
<td>Zusatzstudiengang</td>
<td>supplementary study program</td>
</tr>
</tbody>
</table>
3. **Wie drückt man mathematische Gleichungen und Formeln aus? – Focus on mathematics**


Im Zeitalter moderner Kommunikationsmittel wird man sich bei schwierigen mathematischen Gleichungen auf deren schriftliche Übermittlung konzentrieren, um eventuelle Fehler bei der mündlichen Aussage zu vermeiden.

Dennoch sollten Sie wissen, wie einige mathematische Begriffe ausgesprochen werden. Beginnen wir also mit den Grundrechenarten.

<table>
<thead>
<tr>
<th>Addition</th>
<th>Substraktion</th>
<th>Die Ergebnisse</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>+</strong></td>
<td><strong>−</strong></td>
<td><strong>=</strong></td>
</tr>
<tr>
<td><em>plus</em></td>
<td><em>minus</em></td>
<td><em>equals / is equal to / is</em></td>
</tr>
<tr>
<td><em>plus</em></td>
<td><em>minus</em></td>
<td><em>equals / is equal to / is</em></td>
</tr>
</tbody>
</table>

- **Vermehrung**: multipliziert mit / mal
- **Division**: dividiert durch

**Beispiele**:

- 3 + 5 = 8
- 10 - 3 = 7
- 2 × 3 = 6
- 10 ÷ 2 = 5
\[ x_1 + x_2 = u \quad \text{x one plus x two equals u} \]

\[ L - l = d \quad \text{capital L minus small l is equal to d} \]

\[ a \times b = c \quad \text{a multiplied by b is equal to c} \]

\[ \text{oder: } a \text{ times } b \text{ equals } c \]

\[ a + b = c \quad \text{a divided by b is equal to c} \]

\[ \text{oder: } a \text{ over } b \text{ is equal to c} \]

\[ \frac{an}{bn} = \frac{a}{b} \quad \text{an over bn equals a over b} \]

\[ \frac{a \times c}{b \times d} = \frac{ac}{bd} \quad \text{a over b, this fraction multiplied by c over d equals ac over bd} \]

\[ \frac{7}{6} + \frac{1}{2} = \frac{7}{3} = 2 \frac{1}{3} \quad \text{seven sixths divided by one half equals seven thirds} \]

\[ \text{equals two and a third} \]

\[ 2 \div 3 = 0.666 \quad \text{two thirds equal (zero) point six six six recurring} \]

Die nachfolgenden Übungen 27–33 haben das Ziel, Sie mit dem Aussprechen von Gleichungen und Formeln vertraut zu machen. Viel Spaß dabei!
Wurzeln, Potenzen und Logarithmen

Wurzeln – Roots

\[ \sqrt[n]{a} = b \]  the n-th root of a is b

\[ \sqrt{4} = 2 \]  the square root of four is two

\[ \sqrt[3]{27} = 3 \]  the cubic [kjuːbɪk] root of twenty-seven is three

\[ \sqrt[4]{x} = k \]  the fourth root of x is k

Your Turn 28 Wurzeln – Roots

Nun drücken Sie es in (englischen) Worten aus.

1. \[ \sqrt[4]{81} = 3 \]   the fourth root of eighty-one is three

2. \[ \sqrt[5]{a} = b \]   the fifth root of a is b

3. \[ \sqrt[4]{\frac{36}{4}} = \sqrt[4]{\frac{36}{4}} = \sqrt[4]{9} = 3 \]
Potenzen – Powers

\[ x \cdot x \cdot x = x^3 \]

\( x^2 \quad \) x squared
\( x^3 \quad \) x cubed
\( x^n \quad \) x to the n-th (power)
oder: the n-th (power) of x
oder: x to the power of n
\( x^{n-1} \quad \) x to the (power of) minus one

\( a^{-n} = \frac{1}{a^n} \quad \) a to the (power of) minus n equals one over a to the n-th

\( (x+k)^3 \quad \) x plus four (in brackets) all to the minus three

\( a^{-3} = b^{\frac{3}{9}} \quad \) a to the minus three equals b cubed times b to the power two ninths x

Sprechen Sie nun bitte diese komplexe Gleichung:

\[ (x + k)^n - \sqrt[3]{x}^3 - s = 0 \quad x plus k in (round) brackets to the (power of) p, minus the third root of x all [in square brackets] to the (power of) minus a, minus s equals zero / nothing

Anmerkung: Das Wurzezeichchen kann man auch manchmal so vorfinden: \( \sqrt{ } \)
Your Turn 29 Potenzen – Powers

Geben Sie die folgenden Rechnungen auf Englisch wieder.

1. \( 100^{\frac{1}{2}} = \sqrt{100} = 10 \)  
   *one hundred to the (power of) one half equals (the square) root of one hundred equals ten*

2. \( k \times m : k \times m = k \times m \)

3. \( a^4 \cdot b^{-1} \)

4. \( \frac{1^3}{m^{-1}} \)

5. \( [2 (m+k)^{-1}] = P \)

**Logarithmen – Logarithms**

\[ \log_{10} x = \lg x \]

\[ \log_b c = n \]

*the logarithm of \( c \) to the base \( b \) is equal to \( n \)*

\[ \ln c \]

*‘l’, ‘n’, ‘c’ [el, en, si]*

oder ausführlich: *natural logarithm of \( c \)*

\[ \log 2 = 0.301 \]

*the logarithm of two equals (nought / zero) point three zero one*
Your Turn 30 Logarithmen – Logarithms

Wie heißt das auf Englisch? Ein Beispiel ist für Sie bereits vorgegeben.

1. \( n = \log_{a} b \)  
   \( n \) equals the \text{logarithm} [\text{logarithm}] of \( b \) to the base \( a \)

2. \( a = \sqrt{b} \Rightarrow n = \log_{a} b \)

3. \( \log (x \cdot y) = \log_{a} x - \log_{a} y \)

4. \( \log_{10} x = \lg x \)

5. \( \lg 0.21544 = \lg \frac{2.1544}{10} = \lg 0.21544 - \lg 10 = 0.33333 - 1 \) (the mantissa [mænˈtɪsæ])

Trigonometrische Funktionen – Trigonometric Functions

\[
\tan \alpha = \frac{b}{a}
\]

\( \sinus \) sine [sain] \( \arcsinus \) the arc sine / the inverse sine

\( \cosinus \) cosine \( \arccosinus \) the arc cosine / the inverse cosine
Tangens  tangent  [ˈtændʒənt]  Arctangens the arc tangent / the inverse tangent
Cotangens  cotangent  (ctn)  Arccotangens the arc cotangent / the inverse cotangent

Die Bogenfunktionen werden im Englischen wie folgt geschrieben:

\[ y = \sin^{-1} x \]
\[ y = \arcsin x \]

Dies entspricht der deutschen Schreibweise:

\[ y = \sin^{-1} x \]
\[ y = \arcsin x \]

\[ \text{Your Turn 31 Trigonometrie – Trigonometry} \]

Das Englische heißt ... Zwei Beispiele sind vorgegeben.

1. \[ y = \sin x \]  \( y \) equals the sine of \( x \)

2. \[ y = \sin^{-1} x = y = \arcsin x \]  \( y \) equals the arc sine of \( x \)
   \[ \text{oder: } y \text{ equals the inverse sine of } x \]
   \[ \text{oder: } y \text{ equals the angle [ˈæŋgl] whose sine is } x \]

3. \[ y = \text{ctn } x \]

4. \[ \cos 45^\circ = \frac{1}{2} \sqrt{2} \]

5. \[ \tan 60^\circ = \sqrt{3} \]

6. \[ A = \frac{1}{2} ab \sin \gamma \]
Grundlegende Beziehungszeichen  

|\equiv| identical [ədˈtɪkəl] with / always equal with |
|\lt| less than |
|\gt| greater than |
|\ll| much less than |
|\gg| much greater than |
|\not\gt\not\lt| not greater than / less than or equal to |
|\not\lt\not\gt| not less than / greater than or equal to |
|\ne| not equal to |
|\approx| approximately [əˈprɔksmətli] |
|\propto| (directly) proportional to (brit. Schreibweise) |
|\varpropto| (directly) proportional to (deutsche Schreibweise) |
|\parallel| be parallel to |
|\lvert 3 \rvert| the absolute value of 3 is -3 (minus three) and +3 (plus three) |
|\{ \}| parentheses [pərˈeɪnθəz] round brackets |
|\} \}| (square) brackets |
|\} \}| braces |

Your Turn 32  Grundlegende Beziehungszeichen – Basic Symbols

Nun mal wieder eine Möglichkeit, dieses auf Englisch zu üben.

1. \pi \approx 3.14  \qquad \pi \text{ [pai] is approximately equal to three point one. }
   \quad \text{four} 

2. a \neq b
3. \( p = q \)
4. \( EF \parallel DG \)
5. \( \sqrt{81} = 13 \)

### Weitere Zeichen – More Symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Sigma a_k )</td>
<td>the sum of a (sub) k</td>
</tr>
<tr>
<td>( K = (-\infty, +\infty) )</td>
<td>capital K equals the open interval minus infinity, plus infinity</td>
</tr>
<tr>
<td>( x \to x_0 )</td>
<td>x tends to x zero / nought</td>
</tr>
<tr>
<td>( \lim_{n \to \infty} a_n = 0 )</td>
<td>the limit of a sub n is zero as n tends to infinity</td>
</tr>
<tr>
<td>( (\sin x)' = \cos x )</td>
<td>the (first) derivative [di: rivetv] of the sine [tæm] of x equals the cosine of x</td>
</tr>
<tr>
<td>( \Delta s )</td>
<td>delta s</td>
</tr>
<tr>
<td>( \dot{s} = \frac{ds}{dt} )</td>
<td>s dot equals ds [di: es] by dt [di:ti:]</td>
</tr>
<tr>
<td>( y^{(n)} = f^{(n)}(x) )</td>
<td>y n prime [praɪm] equals f n prime</td>
</tr>
<tr>
<td>( \frac{dn_x}{dx^n} )</td>
<td>dn [di: en] sub v by dx [di: eks] to the n-th power</td>
</tr>
</tbody>
</table>

\[ \int \cot x \, dx = \ln |\sin x| + C \] the integral ['integral] of the cotangent of x dx [eks di: eks] equals the natural ['nætʃrəl] logarithm of the absolute value of the sine of x plus capital C
Maßtabelle – Table of measures

Allgemeine Umrechnungsfaktoren – Common conversion factors

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 centimeter</td>
<td>= 0.39 inches</td>
</tr>
<tr>
<td>1 meter</td>
<td>= 39.4 inches</td>
</tr>
<tr>
<td>1 kilometer</td>
<td>= 0.62 miles</td>
</tr>
<tr>
<td>1 square centimeter</td>
<td>= 0.16 square inches (sq in)</td>
</tr>
<tr>
<td>1 square meter</td>
<td>= 1.20 square yards (sq yd)</td>
</tr>
<tr>
<td>1 liter</td>
<td>= 0.88 quarts (qt)</td>
</tr>
<tr>
<td>1 cubic centimeter</td>
<td>= 0.06 cubic inches (cu in)</td>
</tr>
<tr>
<td>1 cubic meter</td>
<td>= 1.31 cubic yards (cu yd)</td>
</tr>
<tr>
<td>1 gram</td>
<td>= 0.04 ounces (oz)</td>
</tr>
<tr>
<td>1 kilogram</td>
<td>= 2.20 pounds (lb)</td>
</tr>
<tr>
<td>1 ton</td>
<td>= 1.10 short tons</td>
</tr>
</tbody>
</table>

Länge und Fläche – Length and Area

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch</td>
<td>= 2.54 cm</td>
</tr>
<tr>
<td>1 square inch</td>
<td>= 6.452 cm²</td>
</tr>
<tr>
<td>1 foot</td>
<td>= 12 in</td>
</tr>
<tr>
<td>1 square foot</td>
<td>= 144 sq in</td>
</tr>
<tr>
<td>1 yard</td>
<td>= 3 ft</td>
</tr>
<tr>
<td>1 square yard</td>
<td>= 9 sq ft</td>
</tr>
<tr>
<td>1 rod</td>
<td>= 5 1/2 yd</td>
</tr>
<tr>
<td>1 square rod</td>
<td>= 30.25 sq yd</td>
</tr>
<tr>
<td>1 furlong</td>
<td>= 220 yd</td>
</tr>
<tr>
<td>1 acre</td>
<td>= 4.84 sq yd</td>
</tr>
<tr>
<td>1 statute mile</td>
<td>= 1,760 yd</td>
</tr>
<tr>
<td>1 square mile</td>
<td>= 640 acres</td>
</tr>
</tbody>
</table>

= 2.590 km²
**Volumen – Capacity**

<table>
<thead>
<tr>
<th>Unit</th>
<th>USA</th>
<th>GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 gallon (gal)</td>
<td>= 3.7854 liters</td>
<td>= 4.546 liters</td>
</tr>
<tr>
<td>1 barrel</td>
<td>= 159.106 liters</td>
<td>= 192.459 liters</td>
</tr>
<tr>
<td>1 quart (qt)</td>
<td>= 0.9464 liters</td>
<td>= 1.136 liters</td>
</tr>
<tr>
<td>1 pint (pt)</td>
<td>= 0.4732 liters</td>
<td>= 0.568 liters</td>
</tr>
<tr>
<td>1 gill (gi)</td>
<td>= 0.1183 liters</td>
<td>= 0.142 liters</td>
</tr>
</tbody>
</table>

**Raummaße – Cubic Measures**

<table>
<thead>
<tr>
<th>Unit</th>
<th>USA</th>
<th>GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cubic yard</td>
<td>= 27 cu feet</td>
<td>= 0.765 m³</td>
</tr>
<tr>
<td>1 cubic foot</td>
<td>= 100 cu feet</td>
<td>= 2.832 m³</td>
</tr>
<tr>
<td>1 cubic inch</td>
<td>= 16.387 cm³</td>
<td>= 0.0283 m³</td>
</tr>
</tbody>
</table>

**Gewicht – Weight**

<table>
<thead>
<tr>
<th>Unit</th>
<th>USA</th>
<th>GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 dram</td>
<td>= 27.34 grains</td>
<td>= 1.772 g</td>
</tr>
<tr>
<td>1 ounce (oz)</td>
<td>= 16 ounces</td>
<td>= 453.59 g</td>
</tr>
<tr>
<td>1 pound (lb)</td>
<td>= 16 ounces</td>
<td>= 453.59 g</td>
</tr>
<tr>
<td>1 hundredweight (cwt)</td>
<td>= 100 pounds (USA)</td>
<td>= 45.36 kg short cwt</td>
</tr>
<tr>
<td></td>
<td>= 112 pounds (GB)</td>
<td>= 50.8 kg long cwt</td>
</tr>
<tr>
<td>1 ton</td>
<td>= 20 cwt (GB)</td>
<td>= 1016 kg long ton</td>
</tr>
<tr>
<td>1 ton</td>
<td>= 2000 pounds (USA)</td>
<td>= 907,185 kg short ton</td>
</tr>
</tbody>
</table>

**Temperaturumrechnung – Temperature Conversion**

**Grad Fahrenheit**

\[ \text{Grad Celsius} = \frac{9}{5} \times \text{Grad Fahrenheit} + 32 \]

**Grad Celsius**

\[ \text{Grad Celsius} = \left( \text{Grad Fahrenheit} - 32 \right) \times \frac{5}{9} \]

**Faustregel**

\[ ^\circ \text{C} = \frac{5}{2} \times ^\circ \text{F} - 18 \]

109
### Volumen – Capacity

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<td>1 gill</td>
<td>= 4 fluid ounces (fl oz)</td>
<td>= 0.1183 liters</td>
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<td>= 35 gallons (O)</td>
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### Raummaße – Cubic Measures

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</tbody>
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### Temperature Umrechnung – Temperature Conversion

| Grad Fahrenheit  | = \frac{9}{5} \text{ Grad Celsius} + 32 |
| Grad Celsius     | = (\text{Grad Fahrenheit} - 32) \cdot \frac{5}{9} |
| Faustregel       | °C = \frac{1}{2} °F - 18 |