Unit 1, pp. 4-7

1

1 wood
2 steel
3 ceramic
4 gold
5 glass
6 plastic

2

1 b 2 c 3 a 4 f 5 d 6 e 7 h 8 g

3

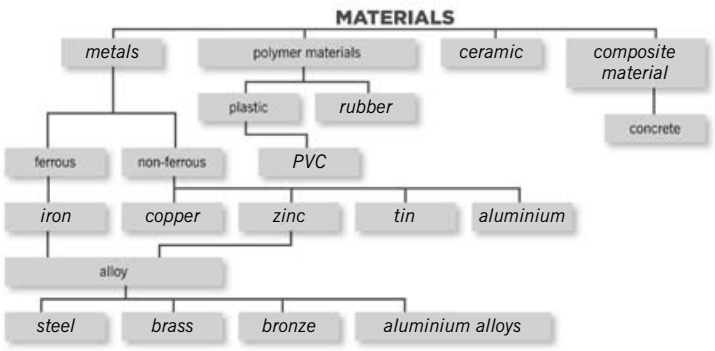
1 ferrous and non-ferrous metals
2 Iron is soft and pasty and for this reason it is not suitable to be used as a structural material.
3 They are used to improve some properties of the metals.
4 plastic and ceramic
5 Yes, it is an alloy made of iron and carbon.

4 1

Iron: Its Latin name is *ferrum*. It is magnetic and has a silvery colour. In prehistoric times it was used to make ornaments and weapons. If exposed to the air, it oxidises.
Copper: It is one of the most widely used metals by humans. In prehistoric times it was used to make cooking utensils, coins and ornamental objects. It is used in wires and cables.
Gold: It is the most expensive metal and is used to create precious jewellery. It is the most ductile metal.
Steel: It is an alloy formed from iron and carbon. It can contain between 2.1% and 4% carbon. It is also used for cooking utensils and pans.

1 ferrum
2 air
3 copper
4 coins
5 wires
6 gold
7 expensive
8 ductile
9 steel
10 alloy
11 carbon
12 cooking

5



6

Personal answers

7 2

Casting is a 6,000-year-old process. It is the oldest and most well-known technique based on three fundamental steps: moulding, melting and casting. First the pattern is made to form the mould. Then an empty mould is created, and finally the empty cavity is filled with molten metal which is then left to solidify into the shape. Casting materials are usually metals but can also be plastic, resin or various cold materials, for example concrete. Casting is usually used for making complex shapes.
Drawing is a manufacturing process for producing wires, bars and tubes by pulling on material through a series of dies until it increases in length. It is divided into two types: sheet metal drawing, and wire, bar, and tube drawing. Drawing is usually done at room temperature but it can be performed at elevated temperatures to hot work large wires, rods or hollow sections in order to reduce forces.
Forging is the process by which metal is heated and shaped by a compressive force using a hammer or a press. It is used to produce large quantities of identical parts, such as machine parts in the automobile industry. Cold forging is done at a low temperature using soft metals and plastic. Hot forging is done at a high temperature and makes metal easier to shape without breaking. In the past, forging was done by a blacksmith using a hammer. Nowadays industrial forging is done with presses powered by a machine.
Rolling is a metal forming process in which a material (metal, plastic, paper or glass) is passed through a pair of rollers. According to the type of material rolled, there is hot rolling or cold rolling.
Extrusion is a process used to produce objects with a fixed cross-sectional profile. A material is pushed or drawn through a die of the desired cross-section. The two main advantages of this process are its ability to create very complex cross-sections and work materials that are brittle. The extrusion process can be done with hot or cold materials. Commonly extruded materials include metals, polymers, ceramics, concrete and foodstuffs.
Ceramic can also be formed into shapes via extrusion. Terracotta extrusion is used to produce pipes. Many modern bricks are also manufactured using a brick extrusion process. Extrusion is also used in food processing. Products such as certain pastas, many breakfast cereals, French fries, dry pet food and ready-to-eat snacks are mostly manufactured by extrusion.
Sheet metal forming is simply metal formed into thin and flat pieces. The basic forms can be cut and bent into a variety of different shapes. Everyday objects are constructed with this process. There are many different metals that can be made into sheet metal, such as aluminium, brass, copper, steel, tin, nickel and titanium. For decorative uses, important sheet metals include silver, gold, and platinum. Sheet metal forming is used in car bodies, airplane wings and roofs for buildings.

1 casting
2 metals
3 concrete
4 tubes
5 bar
6 machine
7 soft
8 presses
9 process
10 type
11 advantages
12 ceramics
13 food
14 brass
15 buildings

8
1 Fluid substances solidify into moulds taking their forms.
2 Drawing is done at room temperature.
3 Heat is not essential in the drawing process.
4 In the past forging was done using a hammer.
5 Extrusion can be done with brittle materials.
6 Sheet forming is used to make many everyday objects.

9
1 wires: drawing
2 pasta: extrusion
3 sheet: sheet metal forming
4 bricks: extrusion
5 tubes: drawing
6 rods and bars: drawing
7 golden leaves: sheet metal forming
8 machine parts: forging
9 concrete: extrusion

10
1 moulding, melting and casting
2 The mould is filled with liquid metal which is left to solidify into complex shapes.
3 a series of dies
4 sheet metal drawing, and wire, bar, and tube drawing
5 Metal is heated and shaped by a compressive force.
6 It was done by a blacksmith using a hammer.
7 The material is passed through a pair of rollers.
8 metal, plastic, paper or glass
9 The two main advantages of this process are its ability to create very complex cross-sections and work materials that are brittle.
10 metals, polymers, ceramics, concrete and foodstuffs
11 Metal is formed into thin and flat pieces.
12 shape and thickness

Unit 2, pp. 8-9

1
1 compass
2 protractor
3 T-square
4 rubber
5 pencils
6 ruler

2
1 C 2 B 3 A 4 A 5 B 6 B

3 3

Drawing boards and manual drawing are not always precise and rapid: traditional design is usually slow, especially in its revision and modification. For this reason manufacturing firms have replaced manual drawing with computer-aided design (CAD) to carry out functions related to design and production. This computer technology assists the designer in the creation, modification and analysis of a physical object. Nowadays computer software can easily provide a three-dimensional drawing, which allows engineering designers to see how mechanical components may fit together without making models thus saving a lot of time. CAD is much faster and more accurate than manual drawing; designs can be quickly modified, reproduced and transmitted electronically. Computer simulated analysis of the model helps experts find problems and defects without building prototypes, in this way saving a lot of money and time. When the design is ready, the CAD system can generate the detailed drawings needed to start product manufacturing.

When CAD systems are linked to manufacturing equipment controlled by computers, they form an integrated CAD/CAM system. Computer-aided manufacturing (CAM) offers significant advantages over traditional approaches by controlling manufacturing equipment with computers instead of human labour. CAM converts the design of a component into computer language and it gives instructions to the computer regarding machine operations.
Thanks to CAD/CAM systems it is possible to eliminate operator errors and reduce manufacturing costs.

1 boards
2 traditional
3 modification
4 creation
5 software
6 faster
7 electronically
8 defects
9 drawings
10 advantages
11 instructions
12 reduce

4
1 b 2 d 3 e 4 f 5 a 6 h 7 c 8 g

Unit 3, pp. 10-11

1

Machine tool	Final result	Description
Turning machine	external and internal flat surface	It removes excess metal from the external diameter. It enlarges and finishes a hole.
Milling machine	specific shape	It cuts flat metal surfaces.
Drilling machine	holes	It uses a twist drill to make holes.
Shaper	flat surface	It cuts the piece.
Press	specific shape	It changes the shape of a workpiece.
Band saw	cut pieces	It cuts various parts using a continuous band of metal with teeth.
Grinding machine	finishing	It removes excessive material from parts.

2
1 T 2 F 3 T 4 F 5 T 6 T 7 F

3 4

1 f Programmers view the part in its three-dimensional computer aided design.
2 d It is calculated where to cut and tools and materials are selected.
3 a The planned machine operations are translated into a set of instructions.
4 b These instructions are translated into a CAM program.
5 c The program contains a set of commands for the machine.
6 e The computer checks all the operations made by the machine tools.

1 f 2 d 3 a 4 b 5 c 6 e

Unit 4, pp. 12-13

1
1 electron
2 proton
3 neutron

2
1 Elements make up all substances.
2 Identical atoms compose each element.
3 Atoms consist of neutrons, protons and electrons.
4 Inside there are neutrons and protons, while outside there are electrons.
5 Shells of electrons orbit around the nucleus.
6 Valence electrons are the electrons in the outermost shell.
7 Neutrons do not have any electric charge.
8 Electricity is generated when valence electrons are free to move from one atom to another.

3 5

Electricity consists of a flow of free electrons along a conductor. To produce this current flow, a generator is placed at the end of the conductor in order to move the charge.
Conductors
Electricity needs a material which allows a current to pass through easily, which offers little resistance to the flow and is full of free electrons. This material is called a conductor and can be in the form of a bar, tube or sheet. The most commonly used conductors are wires, available in many sizes and thicknesses. They are coated with insulating materials such as plastic.
Semiconductors
Semiconductors such as silicon and germanium are used in transistors and their conductivity is halfway in between a conductor and an insulator. Small quantities of other substances, called impurities, are introduced in the material to reduce the conductivity.
Insulators
A material which contains very few electrons is called an insulator. Glass, rubber, dry wood and plastic resist the flow of electric charge, and as such they are good insulating materials.

1 flow
2 charge
3 resistance
4 conductors
5 insulator
6 reduce
7 few
8 plastic

4
1 T
2 T
3 F Electrons can easily pass through materials which are full of free electrons.
4 F Not any material is a good conductor.
5 T
6 T
7 F Impurities are introduced to reduce conductivity.
8 T

5
1 Ampere (A)
2 Coulomb (C)
3 Kilowatt (kW)
4 Volt (V)
5 Watt (W)

Unit 5, pp. 14-15

1
1 load
2 switch
3 fuse
4 wire
5 power source

2
1 e 2 a 3 c 4 f 5 d 6 b

3
1 It consists of a power source, two conducting wires and a load.
2 It lights up.
3 light bulbs, electric motors and speakers
4 It is an example of loads.
5 It controls the electrical device.
6 It occurs when there is a drop in the resistance or a broken insulation.
7 We can use fuses.
8 It melts when too much current flows though it.

4 6

The components of a circuit can be wired in two different ways: series or parallel.
If components are arranged one after another to form a single path between the terminals and the components, the circuit is known as a series circuit. In this type of circuit, the current flows from the negative terminal to the positive terminal, passing through all the other components of the circuit. This means that the amount of energy passing through all the components in the series is the same. The main disadvantage of a series circuit is that when a single component in the path burns out, the entire circuit stops operating (e.g. Christmas tree lights).
A parallel circuit consists of several paths connecting the different components. Each separate path is called a branch of the circuit. Current from the source divides and flows through the different branches. Unlike series circuits, if one of the components in the parallel circuit burns out, the other paths continue to operate. Parallel circuits are commonly used to connect appliances at home, so that each socket can function independently. For example, you don't have to turn on the light in your room for the TV socket to work.

1 components
2 path
3 current
4 positive
5 amount
6 burns out
7 branch
8 continue
9 appliances
10 turn on

5
1 undue
2 heat-sensitive
3 to liquefy
4 overloading
5 reset
6 customers

Unit 6, pp. 16-19

1
1 B 2 A 3 C

2
1 F They produce less air pollution than other power plants.
2 T
3 F They produce waste material which stays radioactive for centuries.
4 F It is generated by the combustion of fossil fuels, which are non-renewable resources.
5 F They cause environmental pollution.
6 T
7 F It flows through giant turbines.
8 F The main disadvantage is its impact on the environment.

3

Type of energy	How it works	Advantages	Disadvantages
Solar energy	Solar cells made of silicon absorb sunlight, which knocks electrons loose, allowing them to flow freely and produce electricity.	The PV system provides an independent, reliable electrical power source and its routine maintenance is simple and cheap.	high initial costs
Wind energy	The wind turns the blades of giant turbines, producing kinetic energy which is then converted into mechanical power and electricity by a generator.	It is one of the cheapest renewable technologies available today.	There are few suitable wind sites.
Tidal energy	Underwater turbines capture the kinetic energy of rising and falling tides and turn it into electricity.	It is a natural process because it exploits the potential energy of tides.	Only massive increases in tides can produce energy and there are very few places where this occurs. Moreover the changes in the tidal flow can damage the aquatic ecosystem and the shoreline.
Geothermal energy	The hot water stored in the Earth is brought to the surface and used to drive turbines to produce electricity or it can be piped through houses as heat.	It is cheap and has a low impact on the environment.	There are few sites where it can be extracted at low cost.
Biomass energy	Plant material and animal waste are burnt in order to release chemical energy as heat.	It is a natural process, is carbon neutral and has low initial costs.	It has a smaller potential than other energy sources and requires excellent maintenance skills.

4
1 c 2 f 3 h 4 a 5 g 6 d 7 b 8 e

5 7

Electricity distribution is the final stage in the delivery of electricity to end users. In order to be able to use electric power for our daily activities, electricity must be transmitted from the power plants to other areas where it can be distributed to different consumers.
The electricity generated by power plants is increased or stepped up at substations and distributed though high-voltage transmission lines, in order to minimize energy losses and to economise on the material needed for conductors. Transmission lines use voltages as high as 765,000 volts and they are usually connected in a network. This means that if a station receives an unexpected demand for electric power, it can call on the other stations to help to meet the demand. Then electrical power is converted from high voltage to lower voltages thanks to step-down transformers which turn electricity into different power levels. Once it is sent to your neighbourhood, another small transformer mounted on a pole converts the power to even lower levels to be used at home. The final voltage is between 110 volts – for lights, TVs, and other smaller appliances – and 240 volts for larger appliances.

1 delivery
2 power plants
3 consumers
4 high-voltage
5 network
6 demand
7 lower voltages
8 transformer
9 pole
10 appliances

6
1 b 2 e 3 a 4 c 5 f 6 d

7
1 d 2 f 3 c 4a 5b 6 e

8
Personal answers

Unit 7, pp. 20-22

1

Invention	Year	Function
Radio	1920	Read and understand electronic signals; make electromagnetic waves travel long distances.
Radar	during the Second World War	Determine the altitude, direction and speed of moving and fixed objects.
Television	1920s	Transmit images and sound over wire circuits.
Computer	1946	Do a range of computing problems.
Transistor	1957	Replace the use of valves.
Silicon chip	1960s	Improve the way information is stored, processed and distributed; pave the way to microelectronics.

2
Personal answers

3
1 It is made of separate components attached to a base (PCB).
2 It stands for printed circuit board.
3 It is a perforated block of plastic with several spring clips connected by copper wires.
4 It consists of millions of transistors and other electronic components combined to form a complex set.
5 It is made out of a semiconductor material, such as silicon.
6 They work faster, consume less power and generate less heat. They are also more reliable.
7 It is a logic integrated circuit chip which can carry out a sequence of operations when it receives instructions from different input devices.
8 Up to a billion every second.

4
1 c 2 e 3 b 4 d 5 f 6 a

5 8

A cellular phone (or mobile phone) is designed to give the user freedom of movement while using a telephone. It uses radio signals to communicate between the phone and the antenna. The server area is divided into smaller areas called cells and an antenna is placed within each cell and connected by telephone lines. These lines connect cellular phones to one another: a computer selects the antenna closest to the telephone when a call is made. If the phone moves to one serving cell to another, the radio signal is transferred to the actual cell without interrupting the conversation.
The circuit board is the heart of the system. A chip translates the outgoing and incoming signals from analogue to digital and back from digital to analogue. The microprocessor handles all the functions for the keyboard, the display and the loudspeakers, and it controls the signal to the base station. Other flash memory chips provide storage for the operating system.
A cellular phone is not only a phone but it provides an incredible amount of functions:
- store information;
- use a calculator;
- send and receive emails;
- surf the Internet;
- play simple games;
- play music, take photos and videos.

Can you imagine your life without your mobile phone?

1 movement
2 radio
3 antenna
4 lines
5 cell
6 signals
7 microprocessor
8 flash
9 emails
10 photos

6
1 T 2 F 3 F 4 F 5 F 6 F 7 T 8 F 9 T 10 T

Unit 8, pp. 23-27

1
Personal answers

2
1 transmission
2 cables
3 waves
4 wires
5 coaxial
6 fibres
7 antennas
8 satellites

3

Means of transmission	Material	Function	Type of signal (ground or air)	Advantages
wires	copper insulated with plastic	They are used mainly in telephone and computer networks.	ground signal	cheap and effective
coaxial cables	inner conductor insulated with plastic and surrounded by a copper shield	They are used in television and radio.	ground signal	They can support about 60 channels; the inner cable is insulated to protect the wires from bending and to reduce the noises.
optical fibres	strands of pure glass	They are used in commu-nication systems, in some medical instruments and in a wide variety of sensing devices.	ground signal	They can transmit signals over longer distances and at higher speed.
antennas	metal	They capture radio signals and convert them into electrical signals through the receiver. They can also convert electrical signals into radio signals.	air signal	They provide information at a cheap rate.
satellites	metal	They receive signals in a given frequency and then retransmit them at a different frequency to avoid interference problems.	air signal	They provide accurate information about agriculture, pollution and weather forecasting. They are also used in telecommu-nications.

4
1 It consists of at least two computers joined by cables.
2 It is a special computer that can send messages.
3 It is a Local Area Network.
4 It is a Wide Area Network.
5 They define the formats and rules that computers must follow when exchanging information.
6 It is used in LANs.
7 It facilitates communication and allows people to share files and other types of information.
8 It can be difficult to set up and may be insecure. Sometimes it can interfere with other technologies.

5
Personal answers

6 9

Bus network
In a bus network all nodes are connected to a common medium, called backbone, as it happens with Christmas lights. Information sent along the backbone travels until the destination is reached. This kind of topology is generally used only for small networks, as it isn't able to connect a large number of computers. The main advantage offered by this topology is that if a computer or device doesn't work, it doesn't affect the others.
Star network
In a star network all nodes are connected to a special central node called the hub. Once it has received a signal, the hub passes it to all the other nodes until it reaches the destination computer. This means that all the computers and devices are joined together. This topology is commonly used in businesses because it can grant rapidity and safety in exchanging data. Thanks to this topology, data is always up-to-date and if a computer doesn't work, it doesn't affect the others. The only disadvantage to it is that if the hub goes down, the whole network doesn't work.
Ring network
In a ring network each node is connected to its left in a circle. There is no central hub that holds all the data, and communication is sent in one direction around the ring through the use of a token. As it requires fewer cables, this topology is less expensive. Nonetheless, because it provides only one pathway among the nodes, a single node failure may isolate all the devices attached to the ring.
Star bus topology
Star bus topology is the most common network topology used today. It combines elements of star and bus topologies to create a more effective network. Computers in a specific area are connected to hubs creating a star, then each hub is connected together along the network backbone.
The main advantage of this type of topology is that it can be more easily expanded over time than a bus or a star. On the other hand, this topology is more difficult to configure than the others and if the backbone line breaks, the whole network goes down.

1 nodes
2 backbone
3 small
4 affect
5 destination
6 exchanging
7 network
8 circle
9 pathway
10 failure
11 star
12 configure

7
1 F It depends also on the type of hardware and the stability needed.
2 F The ring topology is the cheapest and requires few cables.
3 T
4 F There is no server.
5 T
6 F It connects all the devices.
7 F There is no hub.
8 F There is no hub.
9 F It combines elements of star and bus topologies.
10 T

8

Topology	Connection	Use	Advantages	Disadvantages
bus	All nodes are connected to a backbone.	small networks	If a computer doesn't work, it doesn't affect the others.	It can't connect a large number of computers.
star	All nodes are connected to the central hub.	businesses	It can grant rapidity and safety in exchanging data. Data is always up to date and if a computer doesn't work, it doesn't affect the others.	If the hub goes down, the whole network doesn't work.
ring	Each node is connected in a circle.	small networks	It requires fewer cables and is less expensive than other topologies.	If one computer goes down, the whole network doesn't work.
star bus	Computers in a specific area are connected to hubs creating a star. Each hub is connected together along the network backbone.	unlimited use	It can be easily expanded over time.	It is more difficult to configure and if the backbone line breaks, the whole network goes down.

Unit 9, pp. 28-33

1
Personal answers

2

Component (acronym)	Full name/Description	Functions and properties
hardware	components you can physically see	component
software	computer programs and related data	provide the instructions for the computer to work properly
CPU	Central Processing Unit	internal memory system
ALU	Arithmetic Logic Unit	carry out the instructions of a program to perform arithmetical and logical operations
CU	Control Unit	control the system and coordinate all the operations
RAM	Random Access Memory	store data as long as the machine is on
ROM	Read Only Memory	contain essential and permanent information and software

3 10

A USB flash drive is a flash memory data storage device integrated with a USB (Universal Serial Bus) interface. USB flash drives are removable and rewritable, and they're small enough to be carried in a pocket. These portable drives are faster, have thousands of times more capacity, and are more durable and reliable than CD-ROMs because of their lack of moving parts.
Unlike most removable drives, a USB drive does not require rebooting after it's attached, they are very robust and use very little power. They just need to be plugged into a USB port to work and they're compatible with any modern operating system, such as Linux, Mac OS X and Windows.
A flash drive consists of a small printed circuit board carrying the circuit elements and a USB connector, insulated electrically and protected inside a plastic case.
The drive is often used as a backup medium to save data, because it is very user-friendly and it can be carried off-site for safety despite being large enough for several backups. Moreover, flash drives are cheaper and less fragile than many other backup systems. Its only disadvantage is that it can be easily lost because of its size and it's easy for people without a right to data to take illicit backups.
Some specially manufactured flash drives are provided with a metal or rubber case designed to be waterproof and almost unbreakable. It's been tested that these flash drives can retain their memory even after being submerged in water, put in a washing machine and run over with a car.

1 pocket
2 moving
3 plugged
4 operating system
5 board
6 case
7 backup
8 off-site
9 disadvantage
10 water

4
1 durable
2 robust
3 plugged
4 user-friendly
5 manufactured
6 retain

5
1 F They have a huge storage capacity (up to 256 GB).
2 T
3 F They don't require batteries.
4 F They are compatible with any modern operating system.
5 T
6 T
7 F They are cheaper.
8 T

6
1 monitor
2 keyboard
3 mouse
4 scanner
5 printer
6 speaker
7 modem
8 disk drives

7
1 modem: I-O
2 monitor: I
3 speakers: O
4 keyboard: I
5 scanner: I
6 mouse: I
7 printer: O
8 disk drive: I-O

8
1 D 2 E 3 A 4 C 5 B

9
1 It consists of a monitor and a tower with extra drivers inside.
2 No, they are designed to sit on a desk.
3 people who do not have a fixed place to work at
4 Netbooks have limited capabilities as compared to laptops.
5 by using special pens or touch screens
6 They are used for jobs requiring enormous amounts of calculations.

10
1 The Internet allows people to share information and data and to communicate in a fast and cheap way.
2 In the 1960s, the Internet was used by the US Department of Defence to link computers.
3 Thanks to Sir Timothy Berners-Lee, hypertext was used to share and update information among researchers.
4 He created the World Wide Web by linking hypertext to the Internet.
5 All you need to access the Internet is a computer, a telephone line, a modem and an account with an Internet Service Provider.
6 The ISP is a company that provides access to the Internet.

11
Personal answers

12
1 dial-up
2 DSL
3 cable
4 wireless
5 satellite

Unit 10, pp. 34-37

1

1 e 2 f 3 h 4 i 5 g 6 b 7 j 8 a 9 d 10 c

2

Personal answers

3

1 It means the use of computer systems to aid in the design, analysis, and manufacture of products.
2 It includes computer-aided design (CAD) and computer-aided manufacturing (CAM).
3 Some abilities are well beyond the capabilities of computer systems; these technologies require high-skilled engineers and the synthesis of complex sensory data; initial costs can be very high.
4 Domotics and robotics.
5 In a domotic house lights, heating and conditioning systems, windows shutters, kitchen equipment and surveillance systems can be controlled by a remote control or even by a cell phone at a distance.
6 They are used to move, manipulate objects and interact with the environment.

4 11

Nowadays robots can perform some tasks more efficiently than people. For a start, robots never get sick or need to rest, so they can work twenty-four hours a day, seven days a week. They are commonly used in factories to assemble parts. They can also be involved in certain environmental activities, such as checking underwater mineral deposits, cleaning nuclear waste or exploring active volcanoes.
The most recent applications have seen robots exploring distant planets. Nevertheless, robots also have some limits, especially with movement. For example, they have difficulty walking on two legs, but implementations with four or six legs allow them to walk quite well. They use infrared or ultrasound sensors to see obstacles and microphones to make simple sounds. Although they have smell sensors to analyse the world around them, they can't taste food. Some robots resemble human beings, with arms and hands to pick up, hold and move things. In the future, robots will be found in schools, hospitals and homes, and technical development could even allow them to have feelings.

- ✗ get sick
- ✓ go underwater
- ✓ handle dangerous materials
- ✓ clean nuclear waste
- ✓ explore volcanoes
- ✓ go to space
- ✗ easily walk with two legs
- ✓ see obstacles
- ✗ speak fluently
- ✓ smell things
- ✗ taste food
- ✓ move objects
- ✗ have feelings

5

1 What is a sensor?
2 Sensor applications
3 Types of sensors

6

1 B 2 A 3 C 4 B 5 A 6 B

7 12

A common example of the application of sensors to everyday objects is the computer mouse.
The mechanical mouse has a ball which rotates and translates the motion of our hand into signals that the computer can use.
Developed in late 1999, the optical mouse is an advanced computer pointing device that uses a light-emitting diode (LED), an optical sensor and a digital signal processor (DSP) in place of the traditional mouse ball and electromechanical transducer. The optical mouse actually uses a tiny camera to take thousands of pictures at a rate of more than 1,000 images per second.
Optical mice can work on many surfaces without a mouse pad, thanks to an LED that bounces light off the surface it is on onto an optical sensor. The sensor sends each image to a digital signal processor which examines how the patterns have moved since the previous image, determining how far the mouse has moved. The computer then moves the cursor on the screen based on the coordinates received from the mouse. This happens hundreds of times each second, making the cursor appear to move very smoothly.
The best surfaces reflect but some others, for example a blank sheet of white paper, do not allow the sensor and DSP to work properly because the details are too small to be detected.
In addition to LEDs, a recent innovation are laser-based optical mice that detect more surface details compared to LED technology. This results in the ability to use a mouse on almost any surface and to increase the resolution of the image.

1 motion
2 optical
3 camera
4 second
5 processor
6 smoothly
7 paper
8 increase

8

1 e 2 d 3 a 4 f 5 g 6 c 7 b

Unit 11, pp. 38-41

1

1 In order to avoid the risk of damage or breakdown.
2 Preventive and corrective maintenance.
3 It aims at preserving and restoring equipment before it actually fails.
4 It includes partial or complete overhauls at specified periods, oil changes and lubrication.
5 Corrective maintenance or simply 'repair'.
6 Because sometimes equipment needs to be replaced with substantial costs for the company.

2

1 e 2 g 3 f 4 h 5 a 6 d 7 b 8 c

3

1 oil filter
2 radiator
3 battery
4 trunk
5 spare wheel
6 disk brake
7 steering wheel
8 windshield wiper
9 seat
10 tyre

4
1 F 2 F 3 T 4 F 5 T 6 F 7 F 8 F

5
1 inspect tyre pressure
2 car wash
3 replace air filter
4 inspect/replace windshield wipers
5 check/replace engine oil
6 check lights
7 check wheel alignment
8 lubricate hinges

6 13

Mechanic Good afternoon, Mrs Farrell.
Mrs Farrell Good afternoon, John. How are you?
Mechanic I'm fine, thank you. How can I help you?
Mrs Farrell Well, I need a complete tune up for my car. Next week my husband and I are going on holiday by car. It's going to be a long journey all the way to Spain and I want my car to be in good condition.
Mechanic Sure. No problem. Have you checked your car recently?
Mrs Farrell Let me think… It must have been last year, in June, when the car wouldn't start. Anyway, it should all be written in the service book. It's in the glove compartment.
Mechanic OK, I'll take it. Let's see… Oh, yes, it was the battery and I changed it. Are there any problems at the moment?
Mrs Farrell Not really, but I think the engine oil needs to be replaced.
Mechanic Sure. I'll check the filters too.
Mrs Farrell Yes, I think it's a good idea. Could you inspect the tyres as well? And maybe wash it; it's so dirty. Well, John, when do you think the car will be ready?
Mechanic Actually, I'm quite busy at the moment, Mrs Farrell, so I could give it back to you next Friday. Would that be convenient for you?
Mrs Farrell Yes, it'd be perfect, because we're leaving on Sunday. I'll call you on Tuesday for a confirmation then.
Mechanic All right. Goodbye, Mrs Farrell.
On Friday…
Mechanic Good morning, Mrs Farrell. Here are your keys. I replaced the engine oil and the filters. Then I checked the tyres and the brakes too. I had to replace the spark plugs because they were fouled. I also tested the electronics and then I washed the car. Now everything is OK, you can set off with no worries.
Mrs Farrell That's great! Thank you very much, John.

1 help
2 tune-up
3 good condition
4 start
5 service book
6 engine oil
7 inspect
8 filters
9 replace
10 tested

7
1 She needs a complete tune-up for her car.
2 Because she is going to Spain by car.
3 when she last checked her car
4 The engine oil must be replaced; filters and tyres need to be inspected and the car needs to be washed.
5 It will be ready on Friday.
6 He replaced the engine oil, the filters and the spark plugs.

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1
1 In order to avoid or reduce accidents.
2 The Health and Safety at Work Act 1974
3 It defines general duties of employers, employees, suppliers and people who manage and maintain work premises.
4 They have to ensure the health and safety at work of all the employees, visitors, the general public and clients. They have to ensure the absence of risk when handling or storing items and substances, as well as provide adequate facilities. They also have to provide employees with proper instructions and training in case of accidents.
5 So that they will be able to cope with any problem that may occur at work.
6 They should always behave responsibly at work and take care of themselves and other people who may be affected by their actions.

2
1 e 2 d 3 f 4 a 5 c 6 b

3 14

Safety Rules
Machinery
- Be sure to understand how to operate every machine you are going to use.
- Never use machinery when you are in a room alone.
- Use all the protection required in the place of work.
- Check that the safety devices are working. If they are not working, ask for them to be repaired immediately.
- Do not talk to anybody who is operating a machine. Concentration is important at all times.
- Turn off the electricity before cleaning a machine.

Tools
- Report any damage to the tools used at work.
- See that tools are correctly set.

Dress
- Before starting work, wear protective clothing.
- Always wear safety glasses, gloves and boots when using a machine.

Workshop
- Keep the workshop tidy, do not leave rubbish around and do not throw cigarette ends or ashes into the rubbish bin.
- The area around machines must be kept clear to avoid falling.
- Tools and protective clothing should be put away when not in use.
- Clean machines after use with a brush not with your hands.

Accident procedures
- Make sure you know where to assemble in the event of fire and where the emergency stop buttons are located.
- Check where the fire extinguishers are in your workplace and how they work, in order to be able to use them in case of fire.
- Do not shout or run as this can lead to panic, and inform the supervisor immediately if any accident occurs.

Never administer first aid unless you have been trained to do so.

1 operate
2 protection
3 concentration
4 gloves
5 tidy
6 brush
7 fire
8 first aid

4
1 T
2 F People mustn't talk while using a machine.

3 F Turn off electricity before cleaning a machine.
4 F Wear safety boots before starting work.
5 F Always wear safety glasses when using a machine.
6 T
7 T
8 F You should already know where the emergency stop buttons are located.
9 F You shouldn't shout because this can lead to panic.
10 F Only people who have been trained can administer first aid.

5
1 regulatory
2 warning
4 information

6
1 d mandatory
2 b danger
3 f prohibition
4 c emergency
5 a caution
6 e general information

7
1 safety glasses
2 hearing protection
3 hard hats
4 respirator
5 face shield
6 overall

8 15

Dialogue 1
George Hey, Frank, watch out. Stop handling those chemicals. You should put them down.
Frank Why?
George Don't you know you must put on your safety glasses? Those chemicals are strong. They can splash into your eyes.
Frank Thanks, George. I'll go and get them.
Dialogue 2
Mr Bates Good morning, Mrs Ellis. Nice to see you here on the site.
Mrs Ellis Good morning, Mr Bates. I'm very interested in your building site. If you don't mind, I'd like to have a look around.
Mr Bates Sure, no problem, but we require all our visitors to wear a hard hat on the site… you know, it will protect you from falling objects.
Mrs Ellis That's right. Can I have one then?
Dialogue 3
Robert Hi, Mark. Can I have a word with you?
Mark Sure, Robert. What's the matter?
Robert Well, I noticed you weren't using your face shield yesterday… You know, you shouldn't forget to wear it; it'll protect you from the sparks.
Mark You're right, Rob… It was very irresponsible of me. It won't happen again. Thanks.
Dialogue 4
Alison Hey Tom, why aren't you wearing your respirator?
Tom Well, actually I don't think I need one.
Alison Are you kidding? You must always wear a respirator in the workshop. It's the rule. Don't you know these chemicals release toxic fumes?
Tom Well, I suppose you're right, Alison… OK, I'll go and get it.

Dialogue	Equipment	Hazard
1	safety glasses	chemicals could splash into eyes
2	hard hat	falling objects
3	face shield	sparks
4	respirator	toxic fumes released by chemicals

9
1 g 2 j 3 d 4 i 5 a 6 k
7 f 8 e 9 c 10 b 11 h