Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

7534265019

CO-ORDINATED SCIENCES **0654/32**

Paper 3 (Core) **October/November 2019**

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
A copy of the Periodic Table is printed on page 32.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **30** printed pages and **2** blank pages.

Cambridge Assessment International Education

[Turn over

1 **(a)** Fig. 1.1 is a photograph of blood as seen under a microscope.

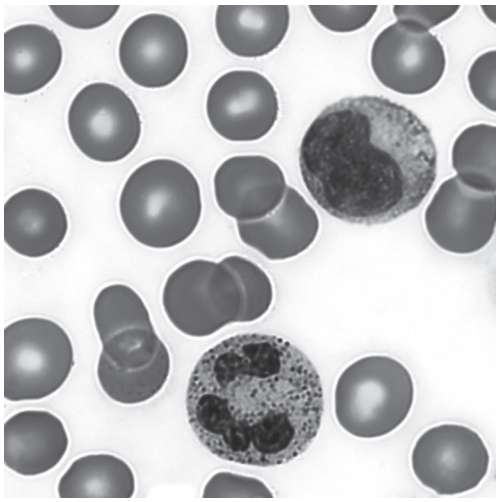


Fig. 1.1

(i) Use a label and a label line on Fig. 1.1 to identify a white blood cell. [1]

(ii) Name **one** other type of cell visible in Fig. 1.1.

..... [1]

(b) White blood cells produce antibodies that fight infection in the body.

The graph in Fig. 1.2 shows how the number of antibodies in the blood changes for 15 days after a person is infected by a pathogen.

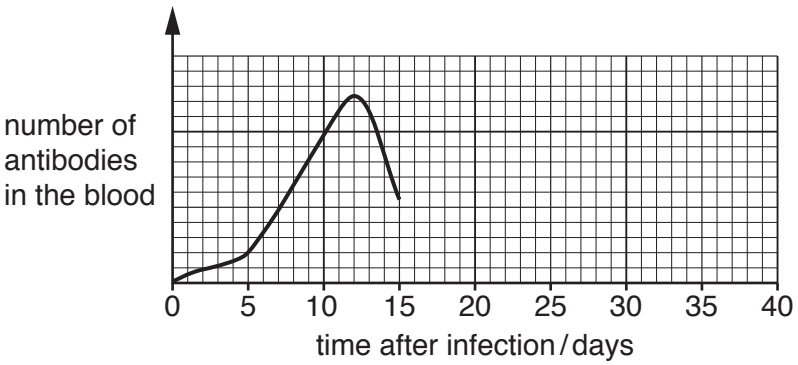


Fig. 1.2

(i) Use Fig. 1.2 to identify on which day there are the **most** antibodies in the blood.

..... [1]

(ii) Suggest **one** reason why there is a decrease in the number of antibodies in the blood as shown in Fig. 1.2.

.....

..... [1]

(c) **Twenty days** after the first infection, the same person is infected with a different pathogen.

Draw a line on Fig. 1.2 to suggest how the number of antibodies in the blood changes from day 15. [2]

(d) Platelets are also found in the blood.

State the function of platelets.

..... [1]

[Total: 7]

2 Fig. 2.1 is a diagram of an atom of element **Q**.

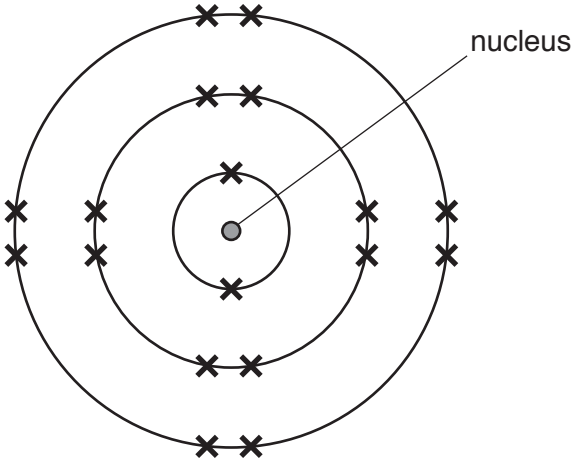


Fig. 2.1

(a) (i) Explain why the mass of an atom is almost the same as the mass of its nucleus.

.....

.....

..... [1]

(ii) Use Fig. 2.1 to identify element **Q**.

A copy of the Periodic Table is shown on page 32.

Explain your answer.

element .....

explanation .....

.....

.....

[2]

(iii) State why element **Q** does not easily combine with other elements.

.....

..... [1]

(b) A teacher investigates the change in mass when calcium burns in air to form calcium oxide.

(i) The mass of calcium oxide produced is greater than the mass of calcium the teacher used.

Explain this result.

.....

..... [1]

(ii) The teacher mixes calcium oxide with water to form a solution.

Predict the pH of the solution.

Explain your answer.

prediction .....

.....

explanation .....

.....

.....

[2]

[Total: 7]

3 **(a)** A girl runs around a 400 m athletics track.

State a device she could use to measure precisely the time this takes.

..... [1]

(b) Fig. 3.1 shows the speed-time graph for her run around the track.

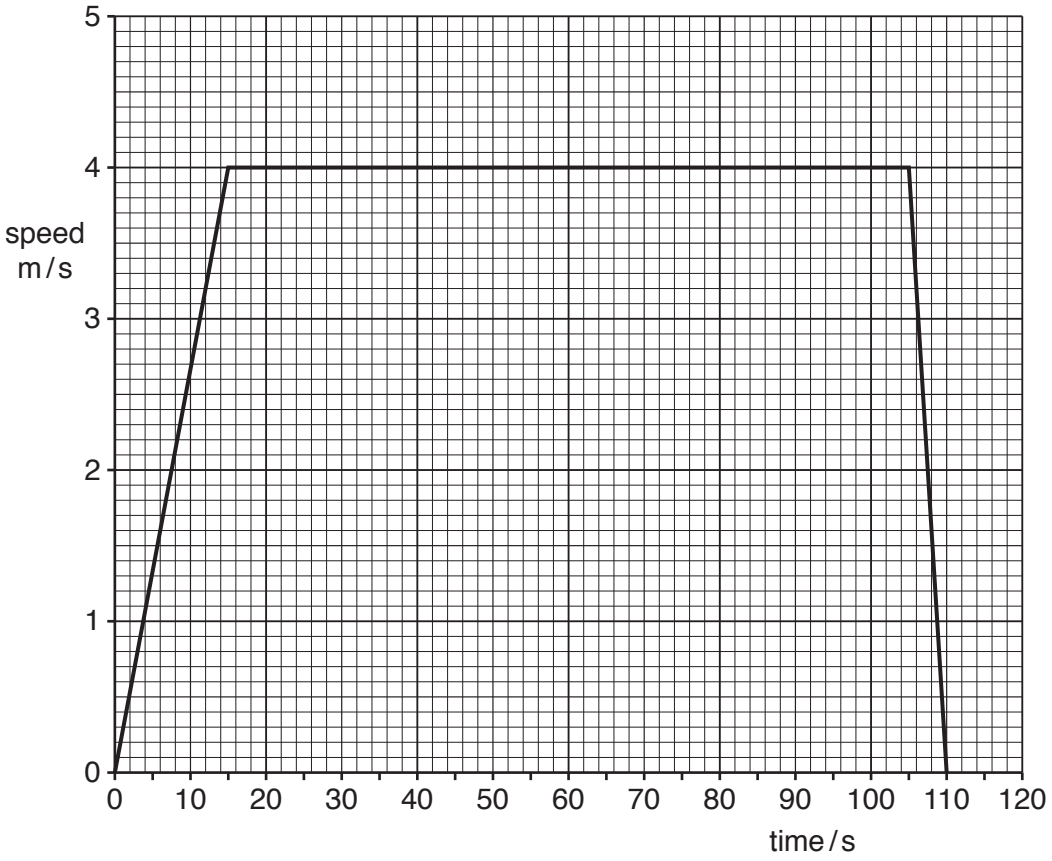


Fig. 3.1

(i) Label with the letter **X** a point on the graph when the girl is running at constant speed. [1]

(ii) Label with the letter **Y** a point on the graph when the girl is at rest. [1]

(iii) The girl's deceleration is greater than her acceleration.

Describe the evidence for this from the graph.

.....

..... [1]

(iv) Calculate the distance travelled by the girl in the first 15 seconds of her run.

distance = ... m [2]

(c) When she returns home, the girl rings the doorbell.

The electric circuit for the doorbell contains a cell, a switch and an electric bell all connected in series.

 is the symbol for an electric bell.

(i) Complete the circuit diagram for the doorbell.

[2]

(ii) The potential difference across the electric bell is 6 V.

The resistance of the electric bell is 2 Ω.

Calculate the current in the circuit.

current = ... A [2]

(iii) The girl hears the bell clearly.

State the approximate range of audible frequencies that the girl is able to hear with healthy hearing.

from ..... Hz to ..... Hz
[1]

[Total: 11]

[Turn over

4 **(a)** Respiration is a process that is part of the carbon cycle.

Use words from the list to complete the definition of the term *respiration*.

Each word may be used once, more than once or not at all.

cells **DNA** **elements** **energy**

enzymes **molecules**

Respiration is the chemical reactions in ..... that break down nutrient ..... and release ..... .

[3]

(b) Fig. 4.1 is a simplified diagram of the carbon cycle.

Some of the processes that take place in the carbon cycle are represented with the letters **A**, **B**, **C** and **D**.

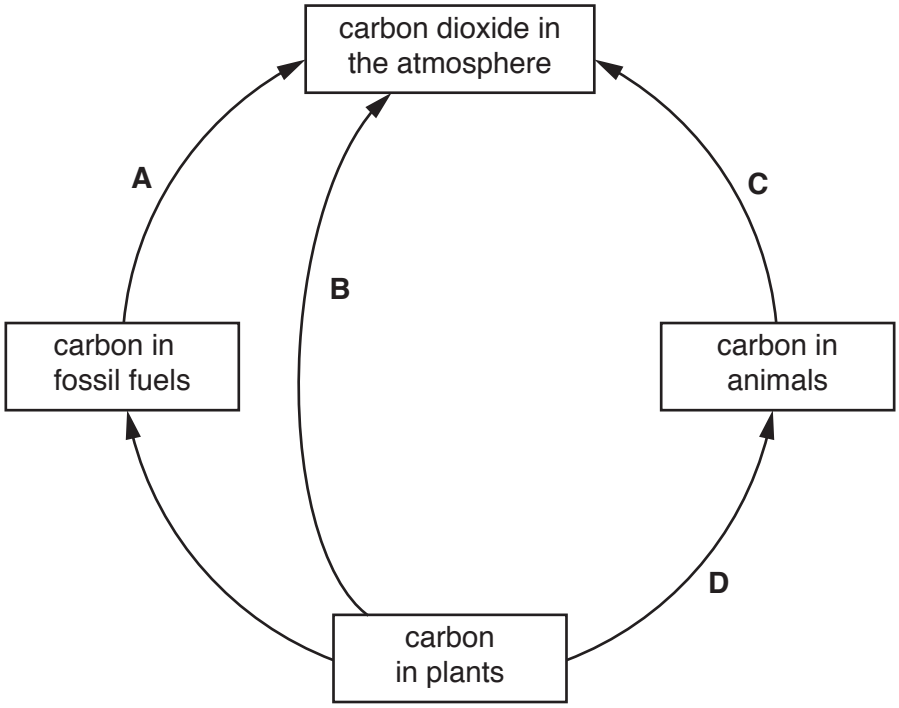


Fig. 4.1

(i) Identify **all** the letters that represent respiration in Fig. 4.1.

..... [1]

(ii) Add an arrow to Fig. 4.1 to represent photosynthesis. [2]

(c) Deforestation can cause an increase of carbon dioxide in the atmosphere.

Animal species living in areas where deforestation occurs are also affected.

Describe two effects of deforestation on animal species.

1 .....

.....

2 .....

.....

[2]

[Total: 8]

5 Impurities are unwanted substances in mixtures. Impurities can be removed using purification techniques.

(a) Some gaseous oxides are impurities which pollute air.

(i) Name the gaseous oxide that forms when sulfur burns.

..... [1]

(ii) Describe how this gaseous oxide can damage the environment.

.....

.....

..... [2]

(iii) Identify two gaseous oxides, other than water vapour or carbon dioxide, that can form during the combustion of hydrocarbons in air.

1 .....

2 .....
[2]

(b) A scientist uses the apparatus shown in Fig. 5.1 to test four food dyes, **P**, **Q**, **R** and **S**.

Fig. 5.2 shows her results for food dyes **Q**, **R** and **S**.

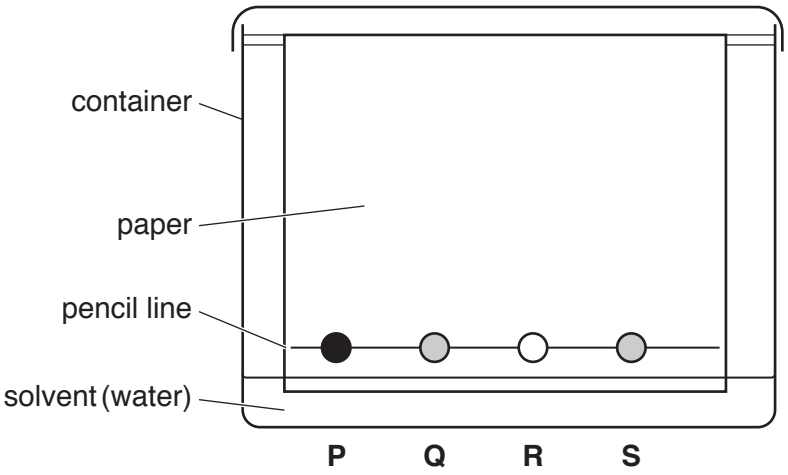


Fig. 5.1

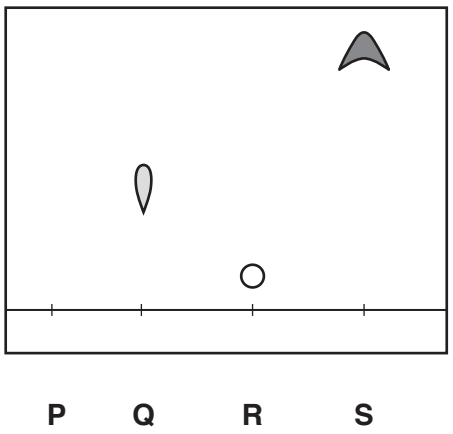


Fig. 5.2

(i) Name this method the scientist uses to test the food dyes.

..... [1]

(ii) Describe what happens inside the container that produces the results shown in Fig. 5.2.

.....

.....

.....

.....

..... [3]

(iii) Food dye **P** is made by mixing together food dyes **Q**, **R** and **S**.

Complete Fig. 5.2 by drawing the result for food dye **P**. [2]

(iv) Suggest why impurities in food dyes must be removed before the dyes are used to colour food.

.....

..... [1]

[Total: 12]

6 **(a)** A team of students enter a competition to see who can build the highest tower from identical wooden cubes.

One cube has a mass of 200 g.

One cube has a volume of 250 cm^3.

(i) Calculate the density of one wooden cube.

density = ... g / cm^3 [2]

(ii) Calculate the weight of each wooden cube.

gravitational field strength = 10 N / kg

weight = ... N [2]

(b) Fig. 6.1 shows the towers of cubes built by two teams.

Team A's tower is only 6 cubes tall before it falls over.

Team B's tower reaches 10 cubes tall and stays standing.

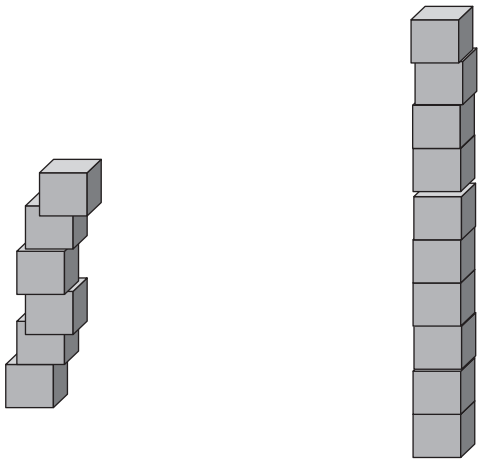


Fig. 6.1

(i) Use ideas about stability and centre of mass to suggest why team A's tower falls over.

.....

..... [2]

(ii) Explain why more work is done to lift a cube to the top of the tower as the tower gets taller.

..... [1]

(iii) State the type of energy that is greater for a cube at the top of the tower compared with a cube lower down the tower.

..... [1]

(c) One student hits two cubes together. He hears the sound echo from the back wall of the room.

The time interval from the student hitting the cubes to the student hearing the echo is 0.25 seconds.

The distance to the wall is 39 m.

Calculate the speed of sound through the air.

speed of sound = ... m/s [3]

[Total: 11]

7 **(a)** In plants, glucose produced by photosynthesis is stored in leaves as starch.

A student investigates one factor that affects photosynthesis by testing for the presence of starch in the leaves of two plants, **A** and **B**.

- Plant **A** is kept next to a window for two days.
- Plant **B** is kept in the dark for two days.

The student uses iodine solution to test leaves from plants **A** and **B** for the presence of starch.

(i) Predict the colour of the iodine solution after testing a leaf from each plant for starch.

colour of iodine solution after testing a leaf from plant **A**

.....

colour of iodine solution after testing a leaf from plant **B**

.....
[2]

(ii) State the factor needed for photosynthesis which the student is investigating.

..... [1]

(b) Soil provides mineral ions to plants for healthy growth.

Explain the importance of magnesium ions for healthy plant growth.

.....

.....

..... [2]

(c) Water is another substance needed by plants.

(i) Describe how water enters a plant.

.....

.....

..... [2]

(ii) Describe how water is lost from a plant.

.....

.....

.....

..... [3]

[Total: 10]

8 Sodium is a very reactive metallic element.

(a) Sodium chloride is a raw material that occurs in nature.

Fig. 8.1 shows a process that is used to extract useful products from concentrated aqueous sodium chloride.

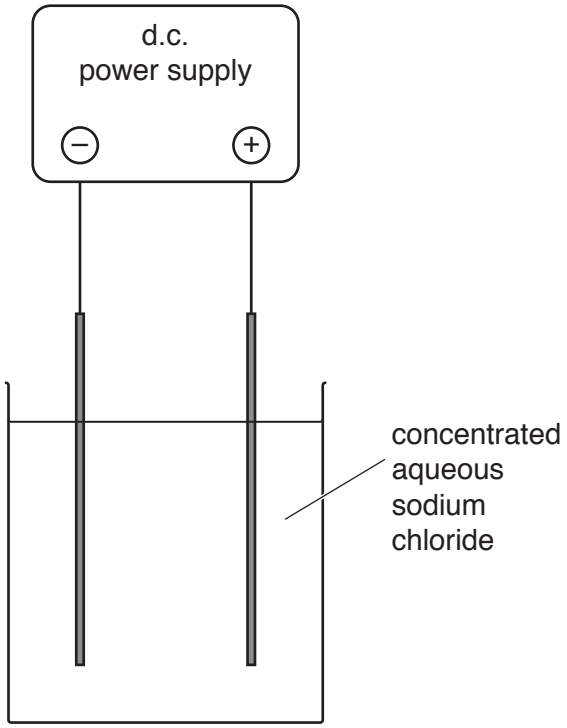


Fig. 8.1

(i) Name this process.

..... [1]

(ii) On Fig. 8.1, use the letter **E** to label the electrolyte and the letter **C** to label the cathode. [2]

(iii) State **one** useful gaseous element produced by this process.

..... [1]

(b) Fig. 8.2 shows how sodium is stored so that it does not react with air.

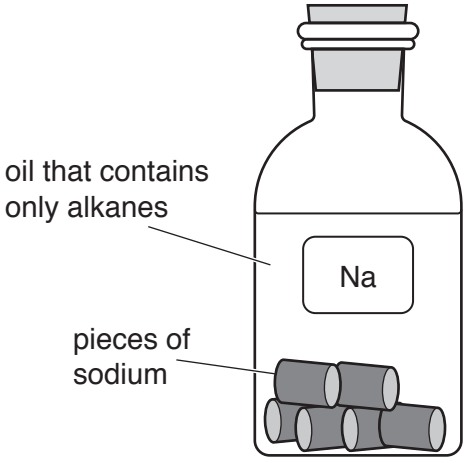


Fig. 8.2

(i) Suggest **one** compound that forms when sodium reacts in air.

..... [1]

(ii) Suggest **one** reason why oil containing alkanes is a suitable liquid to use to protect sodium from contact with air.

.....

..... [1]

[Turn over

(c) Fig. 8.3 shows apparatus a teacher uses to show the reaction between sodium and cold water.

The water contains a solution of full-range universal indicator.

The gas that is given off collects in the test-tube.

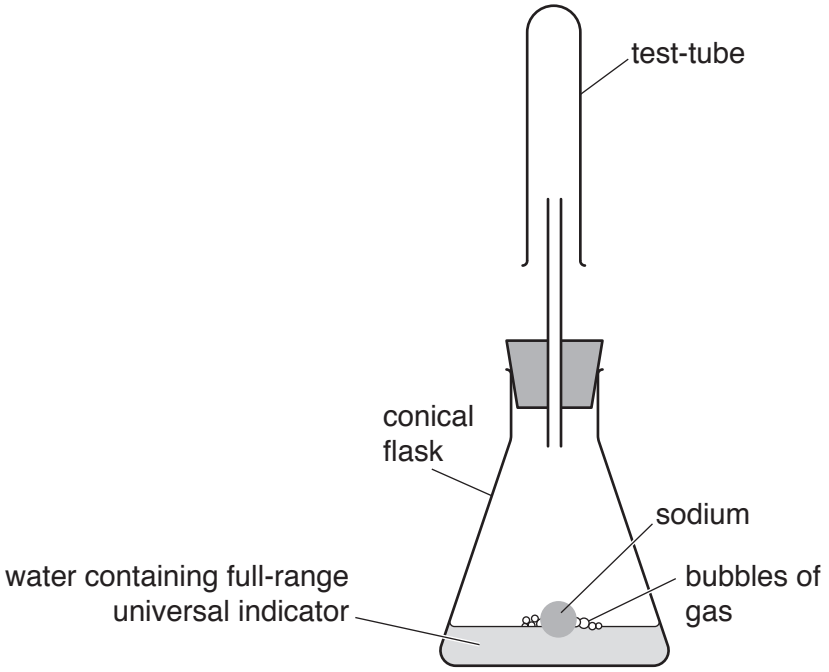


Fig. 8.3

(i) Before the sodium is added the water is neutral.

State the pH of the water and the colour of the full-range universal indicator **before** any sodium is added.

pH .....

colour .....

[2]

(ii) The teacher tests the gas in the test-tube using a lighted splint. She obtains a positive result.

Describe the positive result and identify the gas.

positive result .....

.....

gas .....

[2]

(d) Sodium combines with bromine to form sodium bromide.

(i) State the type of chemical bonding in sodium bromide.

..... [1]

(ii) Balance the symbol equation for this reaction.

$$\text{..... Na} \quad + \quad \text{Br}_2 \quad \rightarrow \quad \text{..... NaBr}$$ [1]

[Total: 12]

9 **(a)** A battery from a mobile phone (cell phone) is analysed to see what it contains.

One of the materials is the metal lithium. The sample taken from the battery consists of two types of lithium atom, lithium-6 and lithium-7.

(i) Name the two types of particle in the nucleus of an atom.

..... and .....
[1]

(ii) The nuclide notation for lithium-6 is written as $^{6}_{3}\text{Li}$.

State what each of the numbers in the nuclide notation represents.

6 represents .....

3 represents .....
[2]

(iii) The nuclide notation for lithium-7 is written as $^{7}_{3}\text{Li}$.

Explain why this is an isotope of lithium.

.....

..... [1]

(b) The lithium battery is connected to a lamp to produce visible light.

(i) Write **visible light** in the correct position in the incomplete electromagnetic spectrum in Fig. 9.1.

gamma rays						radio waves

Fig. 9.1

[1]

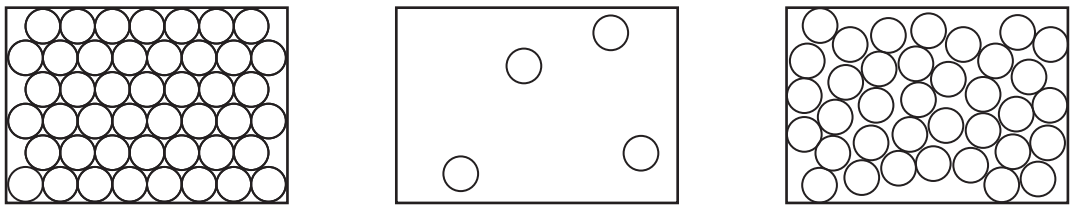
(ii) The lithium battery produces an electromotive force (e.m.f.).

State the unit of e.m.f.

..... [1]

(c) Fig. 9.2 shows the arrangement of lithium atoms in three different states of matter.

Label Fig. 9.2 to identify the state represented in each diagram.



....

Fig. 9.2

[2]

[Total: 8]

10 **(a)** Fig. 10.1 is a diagram showing a simple reflex arc.

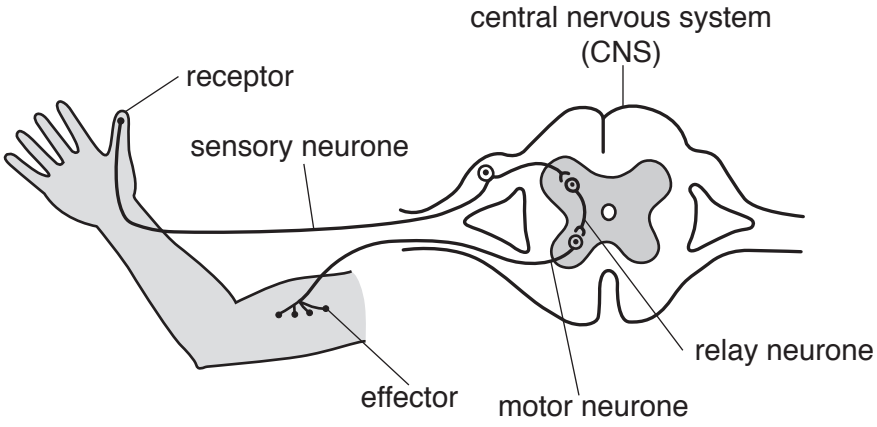


Fig. 10.1

(i) If a neurone is cut, impulses **cannot** pass along the neurone.

Place **only two** ticks (✓) in Table 10.1 to show the correct effect of cutting each neurone in the reflex arc shown in Fig. 10.1.

Table 10.1

	sensory neurone cut	motor neurone cut
CNS does **not** receive impulses from the receptor and effector does **not** receive impulses from CNS.		
CNS receives impulses from the receptor and effector receives impulses from CNS.		
CNS receives impulses from the receptor but effector does **not** receive impulses from CNS.		

[2]

(ii) Circle **all** the words that can be used to describe a reflex action.

automatic **chemical** **conscious** **rapid** **slow**

[2]

(b) State how impulses are passed along a neurone.

.....

..... [1]

(c) Name the two parts of the central nervous system.

1 .....

2 .....
[2]

(d) Muscles are one example of an effector.

Name another example of an effector.

..... [1]

[Total: 8]

11 Useful hydrocarbons are obtained from petroleum.

(a) Fig. 11.1 shows the industrial process used to separate useful hydrocarbons from petroleum.

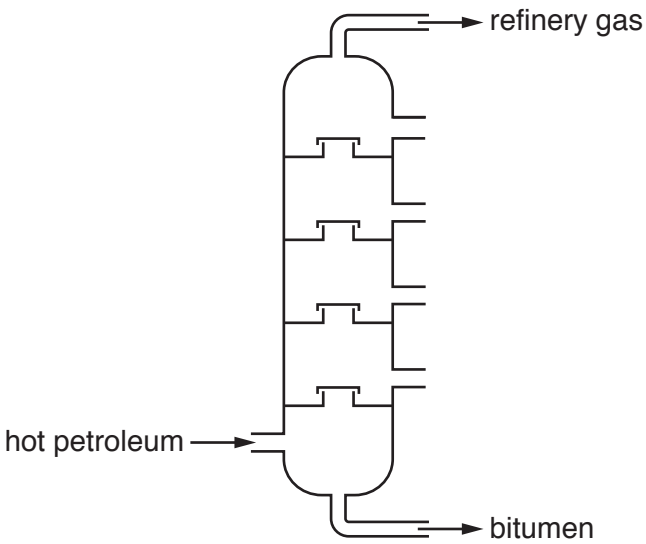


Fig. 11.1

(i) Name this process shown in Fig. 11.1.

..... [1]

(ii) State if chemical changes or physical changes are involved when useful hydrocarbons are obtained from petroleum in this process.

Explain your answer.

changes .....

explanation .....

.....
[1]

(iii) Refinery gas and bitumen are obtained from petroleum.

State **one** use of refinery gas and **one** use of bitumen.

refinery gas .....

bitumen .....
[2]

(b) Explain why the measurement of boiling temperature can be used to find out whether a liquid is a pure alkane or a mixture of alkanes.

.....

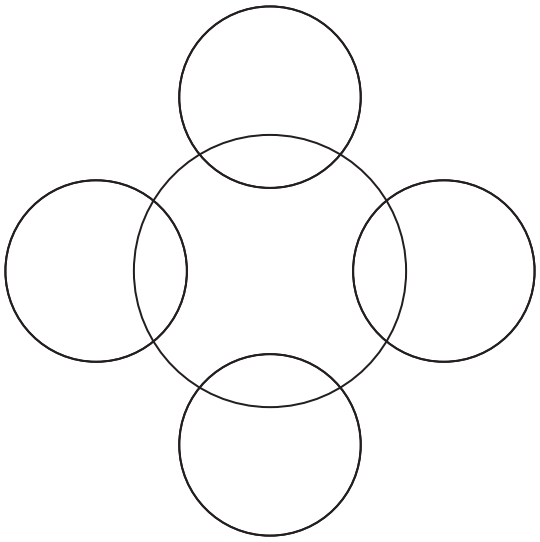
..... [1]

(c) Methane and ethane are gaseous alkanes.

(i) Complete the dot-and-cross diagram of a molecule of methane.

In your diagram, show:

- the chemical symbols of the elements
- the arrangement of the outer shell electrons.



[2]

(ii) State why ethane is a **saturated** hydrocarbon.

.....

..... [1]

(iii) State the name of the **unsaturated** hydrocarbon that has only two carbon atoms in each of its molecules.

..... [1]

[Total: 9]

12 A boy swims in a heated swimming pool.

(a) Water molecules with enough energy escape from the surface of the swimming pool.

Name the process in which more-energetic molecules escape from the surface of a liquid.

..... [1]

(b) Fig. 12.1 shows a boy looking at an object at the bottom of the pool.

A ray of light is shown from the object to the boy's eye.

The ray of light is refracted as it leaves the water.

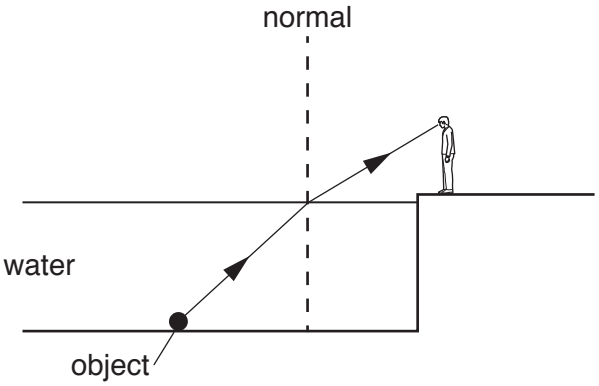


Fig. 12.1

(i) Describe why the light is refracted.

.....

..... [1]

(ii) On Fig. 12.1, mark the angle of incidence **and** label with the letter ***i***. [1]

(c) The boy stands in the swimming pool and repeatedly splashes his hand on the surface of the water to create a regular set of waves.

Place the terms relating to wave properties into the correct sentence. Each word may be used once, more than once, or not at all.

amplitude **frequency** **speed** **wavefront** **wavelength**

By splashing his hand more times per second, he will increase the ..... of the waves.

By splashing his hand harder, the height of the waves increases, which means the

..... has increased.

By splashing his hand more slowly, he notices that the distance between each crest of the

wave has increased, which means the ..... has increased.

[3]

(d) Fig. 12.2 shows the boy swimming.

Fig. 12.2

(i) State what happens to the swimming speed of the boy if his driving force becomes less than the frictional force.

..... [1]

(ii) State what happens to the swimming speed of the boy if his driving force is equal to the frictional force.

..... [1]

(e) The temperature of the water in the swimming pool is measured using a liquid-in-glass thermometer.

Before the water temperature is measured, the thermometer has a reading of 20 °C.

When used to measure the temperature of the water, the thermometer reading rises to 28 °C.

Explain why the liquid inside the thermometer rises when the thermometer is put into the water.

.....

.....

..... [2]

[Total: 10]

13 (a) Fig. 13.1 is a diagram of a flower.

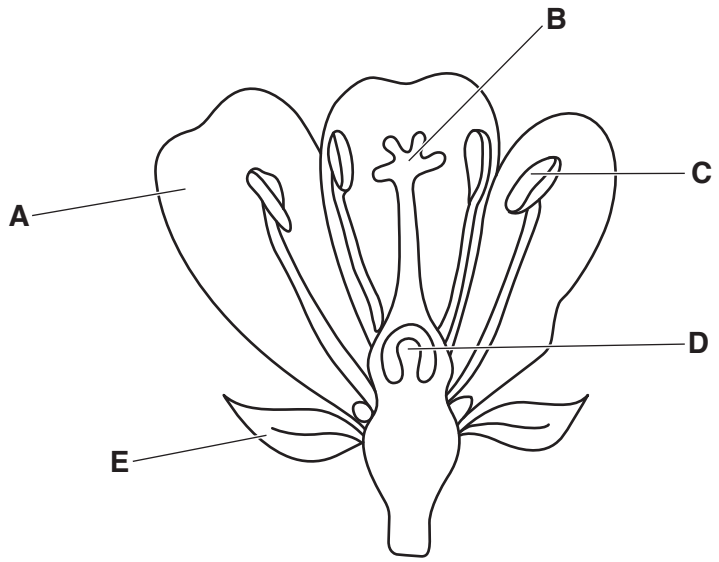


Fig. 13.1

Table 13.1 shows some of the parts labelled in Fig. 13.1.

Table 13.1

part	letter in Fig. 13.1	function
		protects flower when in bud
anther	**C**	produces pollen
petal		
		produces ovules

Use Fig. 13.1 to complete Table 13.1. [3]

(b) Describe fertilisation in plants.

.....

.....

..... [2]

(c) Name the cell formed by the fusion of the nuclei of gametes.

..... [1]

(d) State the number of parents needed for:

asexual reproduction .....

sexual reproduction. .....
[1]

[Total: 7]

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The Periodic Table of Elements

Key

atomic number
atomic symbol
name
relative atomic mass

Group I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).