Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

8700818334

CO-ORDINATED SCIENCES **0654/32**

Paper 3 (Core) **May/June 2017**

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 soft 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 28.

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 **28** printed pages.

CAMBRIDGE International Examinations

1 **(a)** Fig. 1.1 is a drawing of the alimentary canal and associated organs.

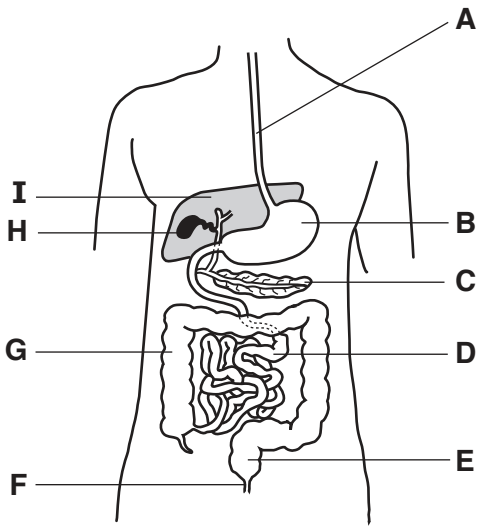


Fig. 1.1

(i) Name the parts labelled **B** and **G**.

B .....

G .....
[2]

(ii) Using Fig. 1.1, identify the letter where

food is absorbed, ...

egestion occurs. .....
[2]

(b) Define the term *ingestion*.

.....

.....

.....[2]

(c) Draw lines between the boxes to match the **digestive enzyme** with its **substrate** and **product**.

digestive enzyme	substrate	products
protease	fats	fatty acids and glycerol
lipase	proteins	glucose
amylase	starch	amino acids

[3]

2 Fig. 2.1 shows diagrams of atoms of two elements, **J** and **Q**.

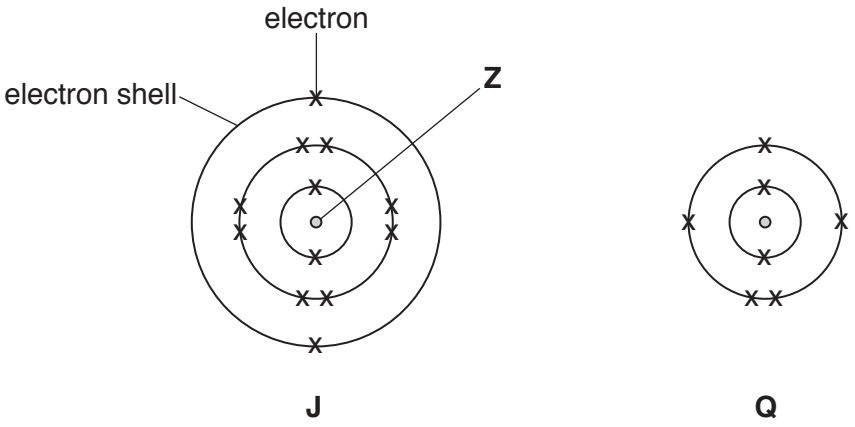


Fig. 2.1

(a) (i) Name the central part of atom **J** labelled **Z**.

.....[1]

(ii) Name the **two** sub-atomic particles in **Z**.

1 .....

2 .....
[2]

(iii) State which number places elements in order in the Periodic Table.

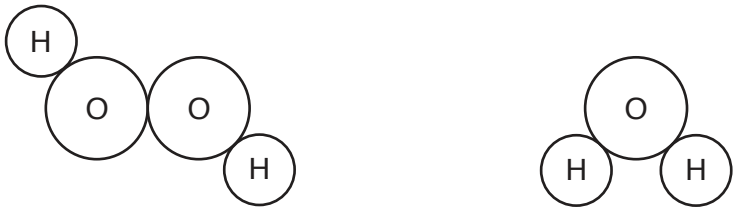
.....[1]

(iv) Use the Periodic Table on page 28 to determine the identity of element **Q**.

element **Q** is .....[1]

(b) The elements hydrogen and oxygen are combined in the compounds hydrogen peroxide and water.

Fig. 2.2 shows diagrams of molecules of these compounds.



hydrogen peroxide water

Fig. 2.2

(i) State the chemical formula of hydrogen peroxide.

.....[1]

(ii) Describe a chemical test for water and the positive result of this test.

description of test .....

.....

result .....

[2]

(c) Water supplied to homes is treated with chlorine.

Explain why this is done.

.....

.....

.....[2]

3 **(a)** A list of metals is shown below.

aluminium copper iron lead uranium

From the list of metals, choose one to match each description.

Each metal can be used once, more than once or not at all.

(i) It may be easily magnetised. .....[1]

(ii) It is used as the conductor in electric cables. .....[1]

(iii) It is used as a fuel in nuclear power stations. .....[1]

(iv) It is a good absorber of γ-radiation. .....[1]

(b) Copper has a boiling point of 2562 °C.

State the meaning of the term *boiling point*.

.....

.....[1]

(c) Fig. 3.1 shows two sealed containers. One contains some hydrogen gas and the other contains a copper block.

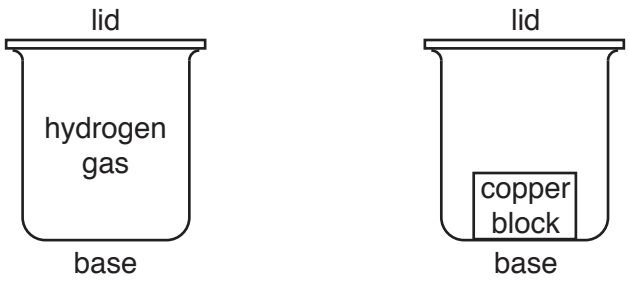


Fig. 3.1

The hydrogen gas exerts pressure on the lid of its container.

The copper block does not exert pressure on the lid of its container.

(i) Explain, using the idea of particles, why the hydrogen gas exerts pressure on the lid but the copper block does not.

.....

.....

.....

.....[2]

(ii) The copper block does exert pressure on the base of the container.

Name the **two** quantities that need to be known to find the pressure exerted by the block on the base of the container.

..... and ..... [2]

4 The diagram in Fig. 4.1 shows a cross-section of human skin.

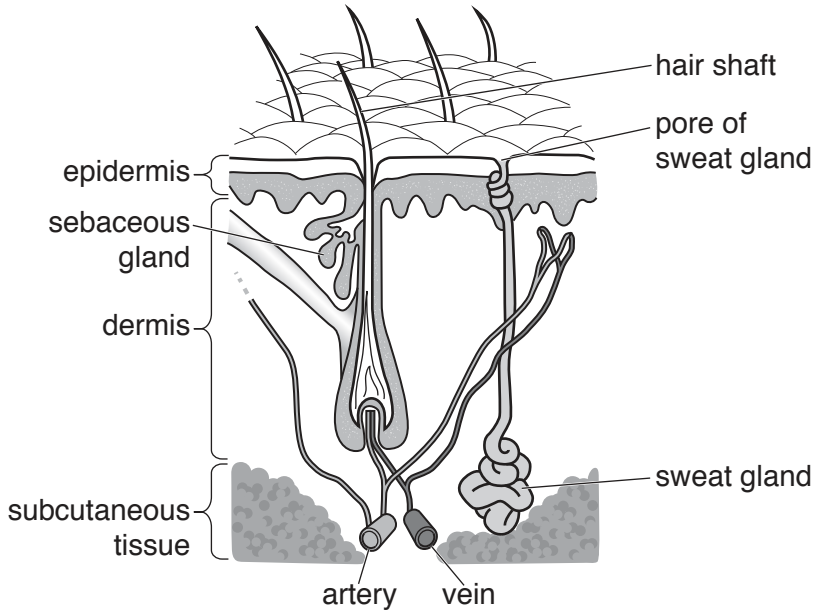


Fig. 4.1

(a) The skin has an important role in regulating the temperature of the body.

(i) Describe **two** responses by the body when it gets too hot.

1 .....

2 .....[2]

(ii) Describe **two** responses by the body when it gets too cold.

1 .....

2 .....[2]

(b) The body is kept at a constant temperature of around 37 °C. This is the best temperature for enzyme activity.

(i) State the function of enzymes.

.....[1]

(ii) State **one** other factor that affects enzyme activity.

.....[1]

(c) Enzymes are made of protein.

List the chemical elements in a protein molecule.

.....[1]

5 Fig. 5.1 is a drawing of an insect-pollinated flower.

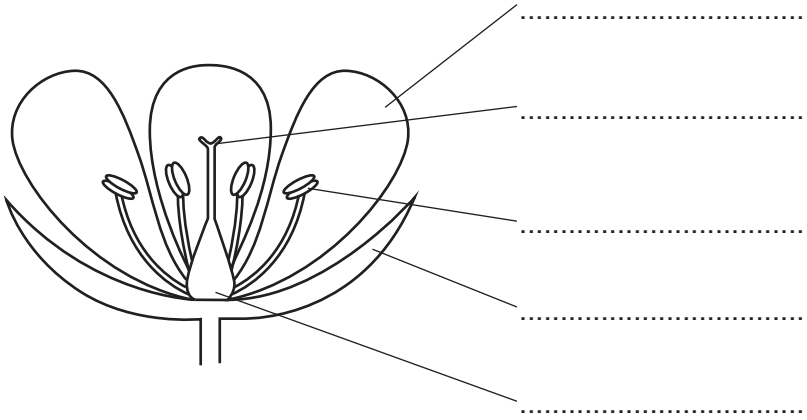


Fig. 5.1

(a) (i) Use the following words to label the parts of the flower in Fig. 5.1.

anther **ovary** **petal** **sepal** **stigma**

[3]

(ii) Complete Table 5.1 to state the functions of the flower parts in the insect-pollinated flower.

Table 5.1

part of flower	function
ovary	
petal	
sepal	

[3]

(b) Complete the following sentence.

Pollination is the transfer of pollen from the …… to the ……
[2]

(c) Name **one** example of a pollinator.

.....[1]

6 **(a)** Most of the compounds in petroleum contain only the elements carbon and hydrogen.

State which **two** of the terms listed below refer to compounds or types of compounds that contain **only** carbon and hydrogen.

calcium carbonate

ethanol

hydrocarbon

methane

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

(b) Gasoline contains mainly alkanes and is used as a fuel for cars.

Explain, in terms of combustion products, why running a car engine in an enclosed space is a health hazard.

.....

.....

.....[2]

(c) **(i)** Name the industrial process used to produce alkenes from alkanes.

.....[1]

(ii) Describe how poly(ethene) is formed from ethene molecules.

.....

.....[1]

(iii) An aqueous bromine test is used to identify whether a hydrocarbon is saturated or unsaturated.

Describe the result of this test with **ethane**.

.....

.....[1]

(d) Polymers are used to make paint.

The steel parts of car bodies are painted to prevent rusting.

Fig. 6.1 shows a small area of rust on a car.

Fig. 6.1

(i) Name the metallic element present in steel that reacts to form rust.

.....[1]

(ii) Name **two** substances in the environment that react with the element in **(d)(i)** to form rust.

1 .....

2 .....
[2]

(iii) Suggest how the area of rust forms on the car in Fig. 6.1.

.....

.....[1]

[Turn over

7 A school orchestra is practising.

(a) Table 7.1 shows the highest and lowest sound frequencies of some of the musical instruments in the orchestra.

Table 7.1

instrument	highest frequency / Hz	lowest frequency / Hz
cymbals	900	300
flute	2600	260
piano	4200	30
trumpet	1050	170
violin	3500	200

(i) State the meaning of the term *frequency*.

.....

.....[1]

(ii) State which instrument can produce the sound with the highest pitch.

Explain your answer.

instrument .....

explanation .....

.....

[2]

(iii) State the highest and lowest frequencies that can normally be heard by a human.

highest ..... Hz lowest ..... Hz

[1]

(b) A cymbal is made from brass. The volume of brass used to make the cymbal is 160 cm^3. The mass of the cymbal is 1200 g.

Calculate the density of brass.

State the formula you use, show your working and state the unit of your answer.

formula

working

density = ... unit .....[3]

(c) Sound waves are longitudinal waves.

(i) Give an example of a transverse wave.

.....[1]

(ii) Describe the difference between a longitudinal wave and a transverse wave.

.....

.....

.....[1]

(d) A teacher and a student are measuring the speed of sound. The teacher makes a loud sound by hitting two cymbals together.

(i) The student stands 150 m from the teacher. She records the time between when she sees the teacher hit the cymbals and when she hears the sound.

The sound takes 0.5 s to reach the student.

Calculate the speed of sound in air.

State the formula you use and show your working.

formula

working

speed of sound = ... m/s [2]

(ii) Explain why a sound wave is produced when the cymbals hit each other.

.....

.....[1]

(e) Fig. 7.1 shows a student working on her laptop computer at school.

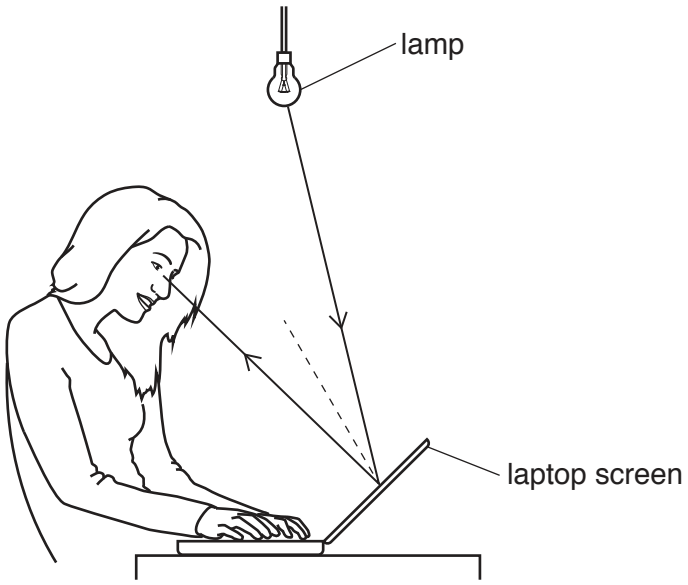


Fig. 7.1 *not to scale*

Light from a lamp is reflected by the laptop screen into the student's eyes.

(i) On Fig. 7.1, label the angle of incidence with the letter *i* . [1]

(ii) When the angle of reflection is 40°, state the angle of incidence.

Explain your answer.

angle of incidence ..... °.

explanation .....

.....

[2]

Question 8 starts on page 16.

8 The reactivity of an element describes how easily the element forms compounds.

A reactivity series is shown below.

Mg (most reactive)
C
H
Cu (least reactive)

(a) Fig. 8.1 shows two sets of apparatus, **X** and **Y**, that a teacher uses to compare the reactivities of copper and magnesium.

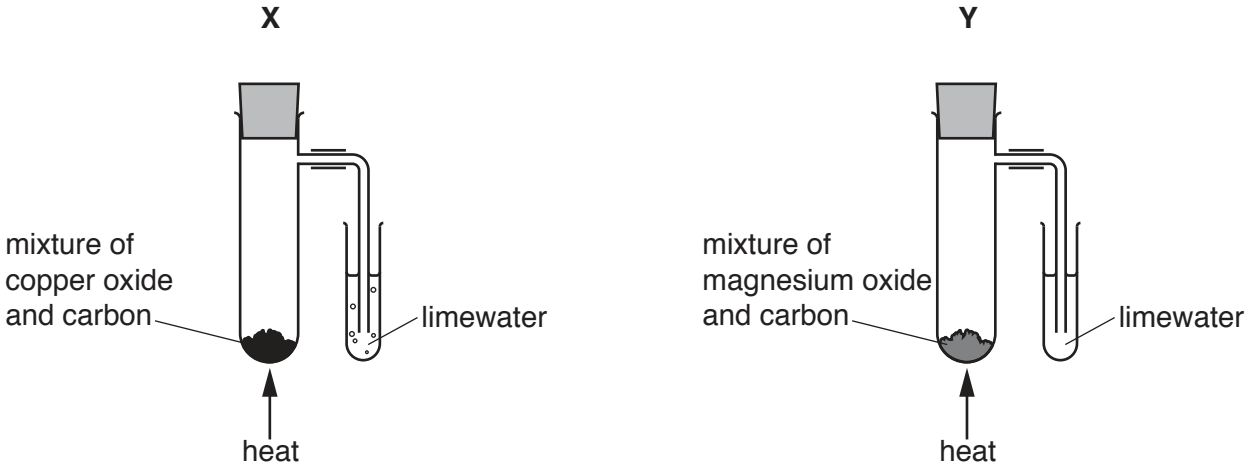


Fig. 8.1

Use the reactivity series to explain why the limewater in apparatus **X** becomes milky, but that in apparatus **Y** does not.

.....

.....

.....

.....[3]

(b) A student investigates what happens when the four solids, listed in Table 8.1, are added separately to dilute hydrochloric acid.

(i) The student records some of her observations in Table 8.1.

Complete Table 8.1 by writing

- a tick (✓) if you predict that the observation does occur,
- a cross (✗) if you predict the observation does **not** occur.

The correct observations for magnesium are shown.

Table 8.1

solid	observations	
	solid reacts and dissolves	gas given off
copper		
copper oxide		
magnesium	✓	✓
magnesium oxide		

[3]

(ii) Complete the **word** equation for the reaction between dilute hydrochloric acid and magnesium.

dilute hydrochloric acid + magnesium → ☐ + ☐

[2]

(iii) Predict and explain whether the pH of the reacting mixture in **(b)(ii)** decreases, increases or stays the same during the reaction.

prediction .....

explanation .....

.....

[2]

9 Fig. 9.1 shows an aircraft landing with constant deceleration along an airport runway.

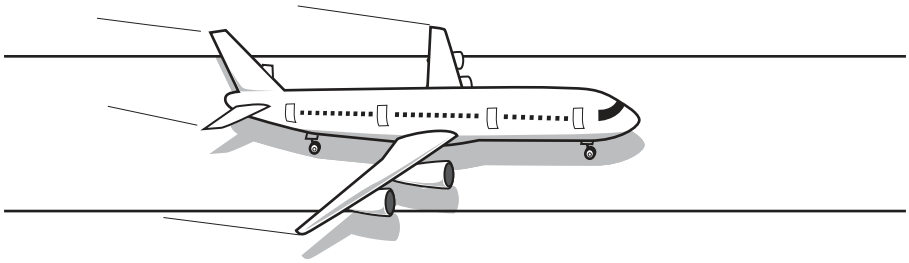


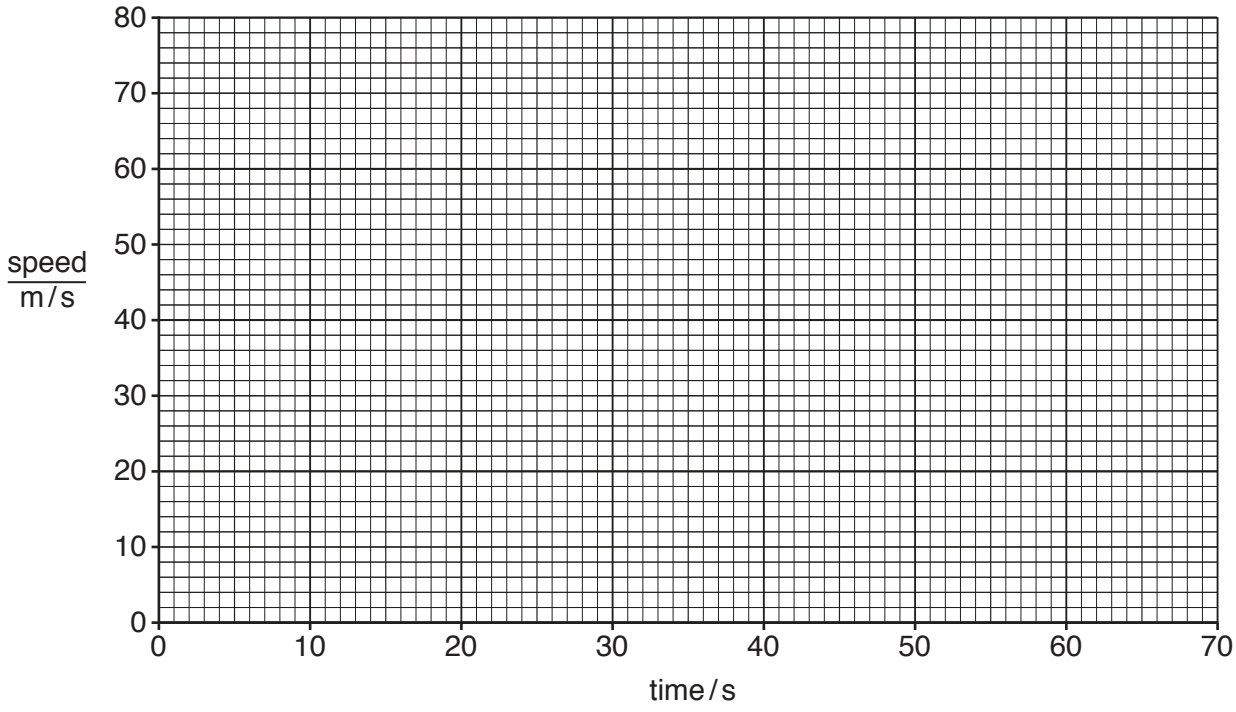
Fig. 9.1

The plane lands at 70 m / s and comes to a stop after 60 seconds.

(a) Calculate the landing speed in kilometres / hour.

landing speed = ... kilometres / hour [1]

(b) **(i)** On the grid provided, draw a speed-time graph to show the motion of the plane during this 60 second period.



[2]

(ii) State the form of energy that decreases as the aircraft loses height on its descent to the runway.

.....[1]

(iii) State the form of energy that the aircraft loses as it slows down on the runway.

.....[1]

(iv) State the form of energy carried by the aircraft in its fuel tanks.

.....[1]

[Turn over

10 **(a)** Fig. 10.1 shows information on the label attached to a television.

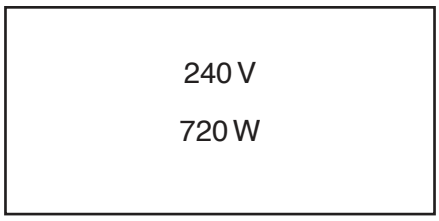


Fig. 10.1

State the name of the unit whose symbol is W.

.....[1]

(b) **(i)** There is a fuse in the electrical supply to the television.

Describe how a fuse works.

.....

.....

.....[2]

(ii) The fuse in the electrical supply to the television has to be replaced.

The current through the television when in use is 3 A.

Three fuses with different current ratings are available.

3 A **5 A** **13 A**

Explain why only the 5 A fuse should be used.

.....

.....

.....[2]

(c) **(i)** Radio waves are used in television communication.

Draw lines to link other waves in the electromagnetic spectrum to their uses.

electromagnetic wave	**use**
γ-radiation	airport security scanners
microwaves	mobile phone (cell phone) communication
X-rays	radioactive medical tracers

[2]

(ii) Name the electromagnetic wave used in a television remote control.

.....[1]

(d) Two speakers in the television, each with a resistance of 8 Ω, are connected in series.

Calculate their combined resistance.

Show your working.

resistance = ... Ω [2]

11 A student investigates the changes to her heart rate when she exercises.

The student's heart rate at rest is 68 beats per minute.

The graph in Fig. 11.1 shows the results.

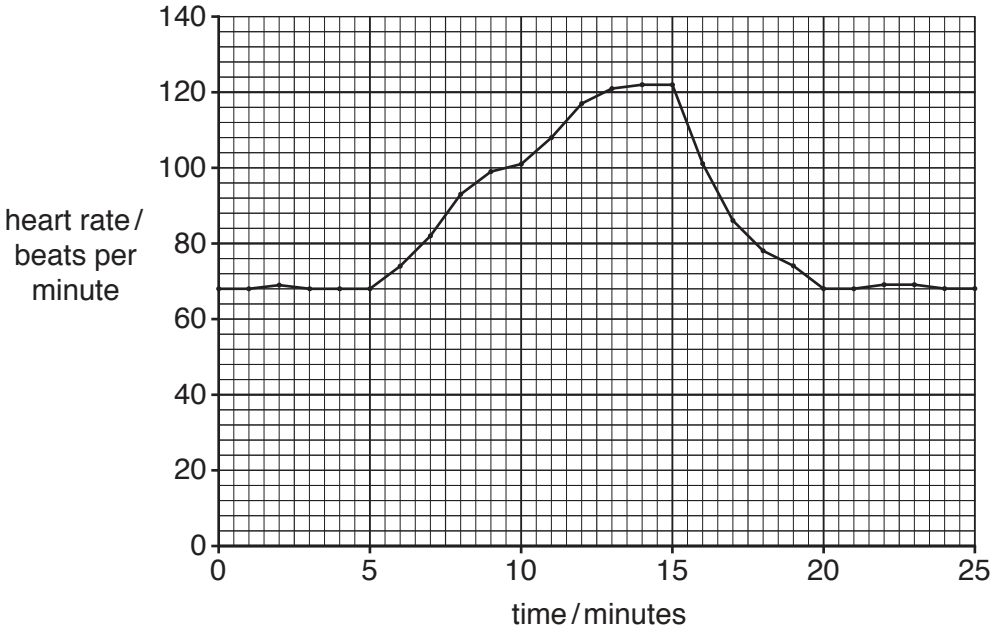


Fig. 11.1

(a) (i) Describe the changes to the student's heart rate between 0 minutes and 25 minutes.

.....

.....

.....

.....[2]

(ii) Suggest the time that the student starts to exercise.

..... minutes [1]

(iii) The student stops exercising at 15 minutes.

State the length of time it takes for her heart rate to return to her resting value.

..... minutes [1]

(b) Blood delivers oxygen to the muscle cells for respiration.

(i) State **one** other reactant required for respiration.

.....[1]

(ii) Name the component of the blood that transports oxygen.

.....[1]

(iii) State **two** other components of blood.

1 .....

2 .....
[2]

12 Electrolysis occurs when an electric current passes through a solution that contains ions.

(a) (i) State the general name given to solutions that contain ions.

.....[1]

(ii) State the name of the negative electrode.

.....[1]

(b) Fig. 12.1 shows the electrolysis of copper chloride solution.

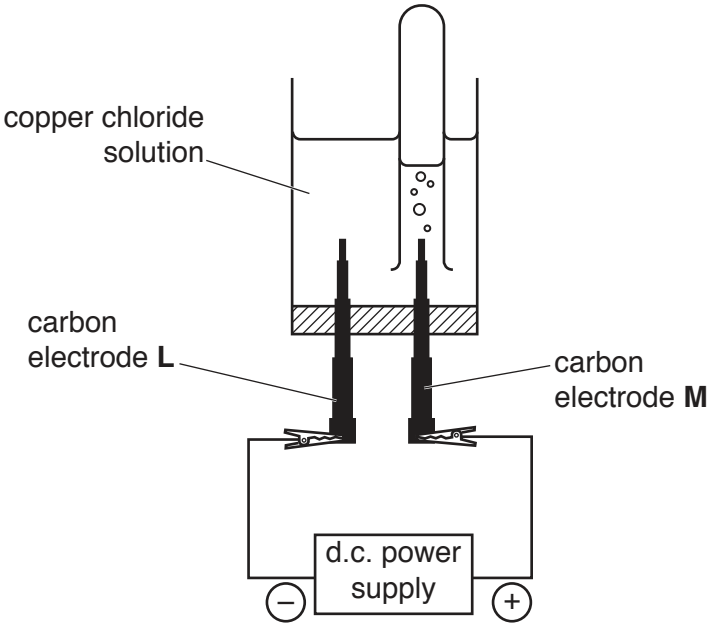


Fig. 12.1

(i) Electrode **L** changes colour.

Explain this observation.

.....

.....[1]

(ii) A gas is given off at electrode **M**.

Name the gas and describe a safe chemical test for it.

name of gas .....

test .....

positive result of test .....
[3]

(c) Bromine is a non-metal in Group VII of the Periodic Table.

(i) State and explain the type of electrical charge on a bromide ion.

type of charge .....

explanation .....

.....

[2]

(ii) Suggest why a bromine atom and a bromide ion have almost the same mass.

Use ideas about the masses of protons, neutrons and electrons in your answer.

.....

.....

.....[2]

13 Fig. 13.1 shows a family tree and the genotypes of the family members.

Sarah was investigating the inheritance of eye colour in her family.

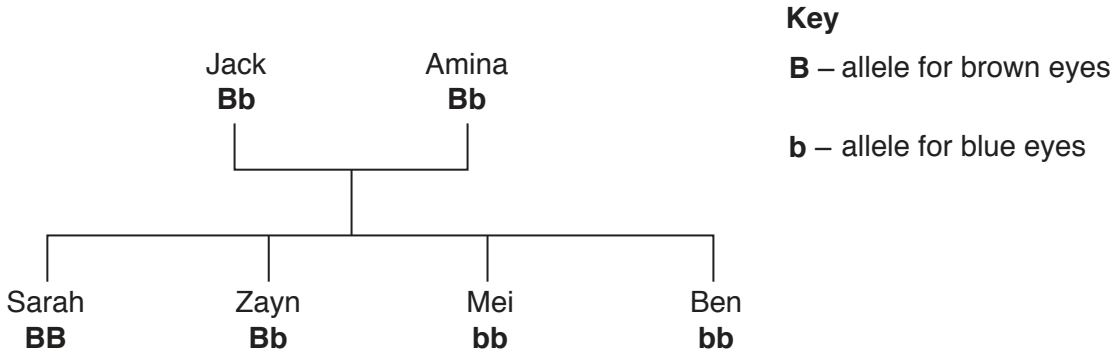


Fig. 13.1

(a) Use the family tree in Fig. 13.1 to answer the following questions.

(i) Name a person with two dominant alleles.

.....[1]

(ii) Name a person with a heterozygous genotype.

.....[1]

(iii) Name a person with blue eyes.

.....[1]

(b) Define the term *allele.*

.....[1]

(c) Zayn has children with someone who has the genotype **bb**.

Complete the diagram below to calculate the expected ratio of eye colour in these children.

parental genotypes	**Bb**	×	**bb**	
parental gametes	....	+	....	
offspring genotypes	....		....	
expected ratio	.....**brown**	**:**	.....**blue**	

[3]

The Periodic Table of Elements

Key

atomic number
atomic symbol
name
relative atomic mass

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.)