



CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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0653/31

May/June 2022

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [].
- The Periodic Table is printed in the question paper.

This document has **20** pages. Any blank pages are indicated.

- 1 Fig. 1.1 is a diagram of the female reproductive system in humans.

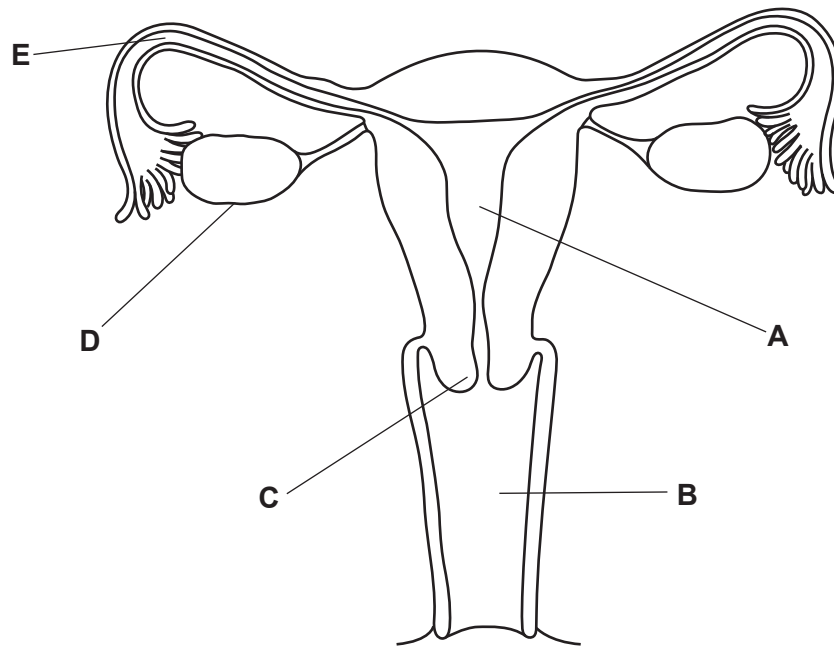


Fig. 1.1

- (a) State the letter in Fig. 1.1 that shows:

the position of the cervix

where fertilisation takes place

where the fetus develops.

[3]

- (b) Describe what happens to the lining of the uterus during the first few days of the menstrual cycle.

.....
 [1]

- (c) Complete these sentences about fertilisation in humans.

The fusion of the nuclei of the egg and sperm produces a fertilised cell called a

.....

This cell divides to form a ball of cells called an

[2]

[Total: 6]

2 (a) An aqueous solution of salt **MX** is made by dissolving solid **MX** in water.

(i) Identify the solvent and the solute in aqueous **MX**.

solute

solvent

[2]

(ii) A student tests separate samples of aqueous **MX**.

The results are shown in Table 2.1.

Complete Table 2.1 by naming the ions that these tests show are in aqueous **MX**.

Table 2.1

test	result	name of ion
add aqueous sodium hydroxide	green precipitate, insoluble in excess	
add aqueous barium ions under acidic conditions	white precipitate	

[2]

(b) A student makes an aqueous solution of **MX** by reacting excess metal **M** with dilute acid **HX**.

The student then separates the excess, unreacted solid metal **M** from the reaction mixture.

(i) Suggest how the student separates solid metal **M** from the reaction mixture.

..... [1]

(ii) State whether this separation process is a chemical change or a physical change.

Explain your answer.

change

explanation

.....

[1]

- (iii) State the effect of increasing the temperature on the rate of this reaction.

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

- (iv) During the reaction between metal **M** and dilute acid **HX**, atoms of **M** become cations.

Explain how atoms become cations.

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

- (v) Suggest what happens to the value of the pH of the reaction mixture during the reaction between excess metal **M** and dilute acid **HX**.

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

[Total: 9]

- 3 Fig. 3.1 shows a man pushing a shopping trolley forwards.



Fig. 3.1

- (a) Fig. 3.2 shows four forces, **P**, **Q**, **R** and **S**, acting on the shopping trolley as the man pushes it.

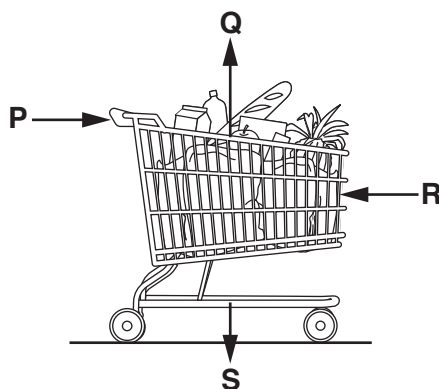


Fig. 3.2

State the name of force **S**.

.....

[1]

- (b) The man pushes the trolley with force **P** = 15 N. The trolley moves at a constant speed.

- (i) State the magnitude of force **R**.

force **R** = ... N [1]

- (ii) The man increases force **P** to 20 N.

Forces **Q**, **R** and **S** do not change.

Calculate the resultant force on the trolley.

resultant force = ... N [1]

- (iii) Describe how the change in force **P** affects the motion of the trolley.

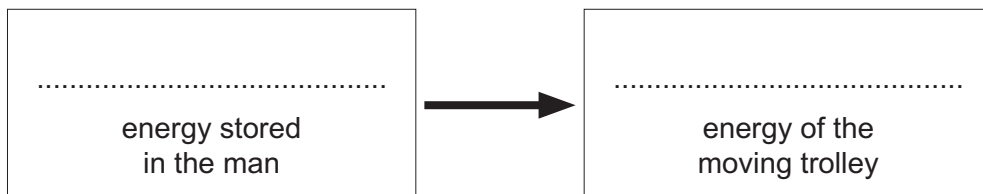
.....
 [1]

- (c) As the man pushes the trolley, he transfers 150 J of energy to the trolley.

- (i) State the work done on the trolley by the man. Give the unit of your answer.

work done = ... unit [1]

- (ii) Complete the boxes to show the useful energy transfer as the man pushes the trolley.



[2]

- (iii) The man lets go of the moving trolley. The trolley slows down and stops.

Explain why the trolley slows down.

.....

 [2]

[Total: 9]

- 4 (a) Fig. 4.1 is an image of a white blood cell.

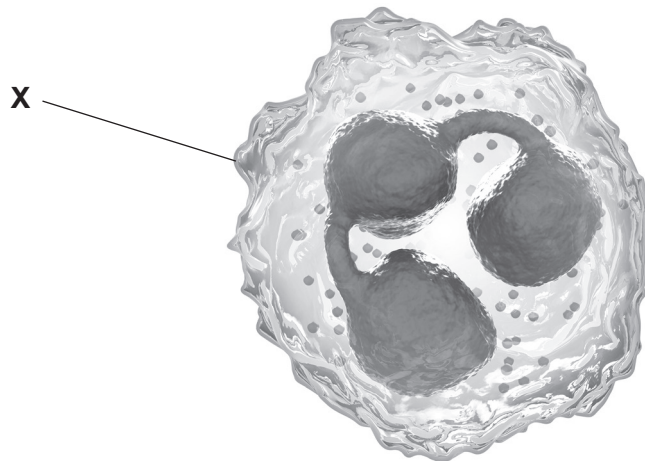


Fig. 4.1

- (i) Identify the part labelled **X** in Fig. 4.1.

..... [1]

- (ii) Use Fig. 4.1 to state **two** reasons why this cell is **not** identified as a plant cell.

1

2 [2]

- (iii) State **one** function of white blood cells.

..... [1]

- (b) A blood sample can be separated into its main components.

Fig. 4.2 is a diagram showing a separated blood sample.

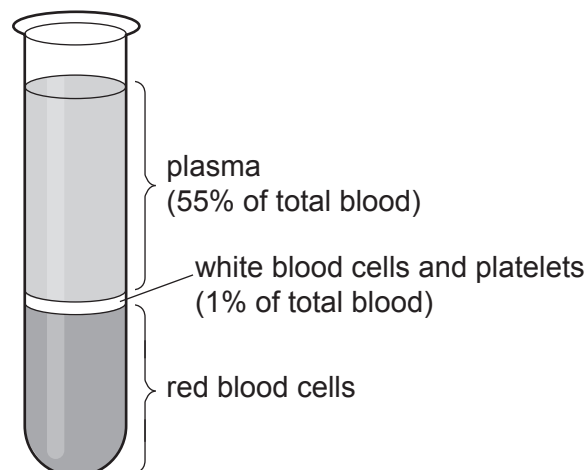


Fig. 4.2

- (i) Calculate the percentage of blood that is red blood cells in Fig. 4.2.

..... % [1]

- (ii) Red blood cells transport oxygen.

Explain why oxygen moves from the lungs into red blood cells.

Use ideas about diffusion in your answer.

.....

 [2]

- (c) Blood plasma transports soluble molecules.

Large insoluble food molecules in our diet are digested into small soluble molecules.

- (i) Circle the name of the soluble molecules proteins are made from.

amino acids **fatty acids** **glycerol** **glucose** **starch**

[1]

- (ii) Complete these sentences about digestion.

Choose words from the list.

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

active **absorption** **anus** **egestion** **excretion**
ingestion **pancreas** **oesophagus** **mechanical**

Food is taken into the mouth by the process of

The food then passes down the to the stomach.

In the stomach there are two types of digestion, chemical and

.....

Food that has been digested passes into the blood by the process of

.....

[4]

[Total: 12]

5 (a) Fossil fuels release heat energy during combustion.

(i) State the name given to any chemical reaction that releases heat energy.

..... [1]

(ii) State the name of the fossil fuel in which methane is the main constituent.

..... [1]

(iii) Complete the dot-and-cross diagram in Fig. 5.1 to show all the outer shell electrons in a molecule of methane.

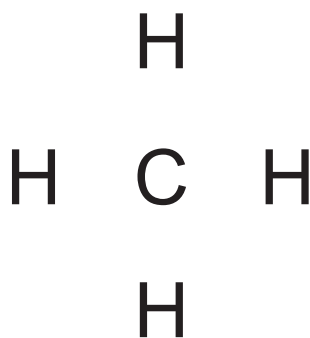


Fig. 5.1

[2]

(b) Magnesium burns in pure oxygen to form compound **Y** only.

Compound **Y** is a white solid base that reacts with dilute sulfuric acid to form compound **Z** and water only.

(i) State whether magnesium is oxidised or reduced when it burns.

Explain your answer.

.....

..... [1]

(ii) Identify compound **Y** and compound **Z**.

compound **Y**

compound **Z**

[2]

(iii) Describe **two** physical properties of magnesium.

1

2

[2]

[Total: 9]

6 (a) Electromagnetic waves transfer energy through space from the Sun to the Earth.

- (i) State whether this transfer of energy through space is by conduction, convection or radiation.

Explain your answer.

.....

 [2]

- (ii) Fig. 6.1 shows an incomplete electromagnetic spectrum.

The Sun emits waves in all parts of the electromagnetic spectrum.

Complete Fig. 6.1 to show all parts of the electromagnetic spectrum.

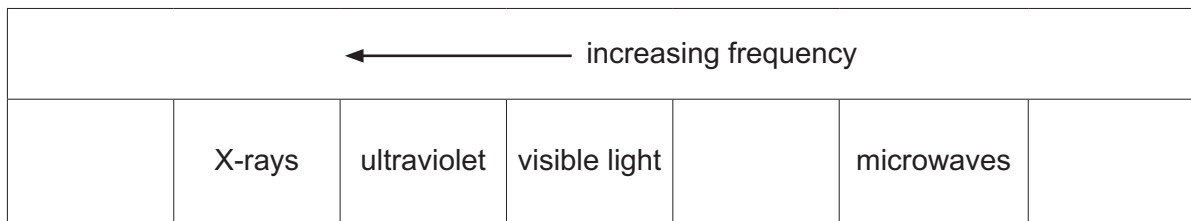


Fig. 6.1

[2]

- (iii) Visible light waves take 8 minutes to travel from the Sun to the Earth.

Suggest how long it takes for ultraviolet waves to travel from the Sun to the Earth.

Give a reason for your answer.

time taken

reason

[1]

- (b) Fig. 6.2 shows the Sun shining on a puddle of water. A student sees an image of the Sun in the puddle of water.

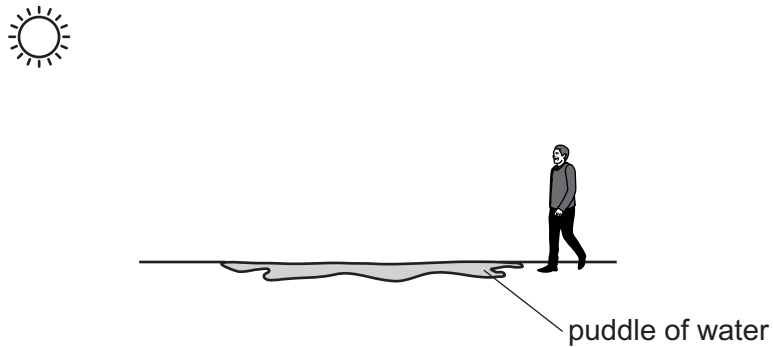


Fig. 6.2

- (i) The puddle acts as a plane mirror.

On Fig. 6.2, draw a ray diagram to show how the student can see an image of the Sun in the puddle.

Your diagram should include the position of the image of the Sun.

[3]

- (ii) Explain, in terms of water molecules, what happens as the Sun transfers energy to the puddle and the water in the puddle dries up.

.....

.....

..... [2]

[Total: 10]

- 7 (a) Fig. 7.1 shows part of a food web from the ocean.

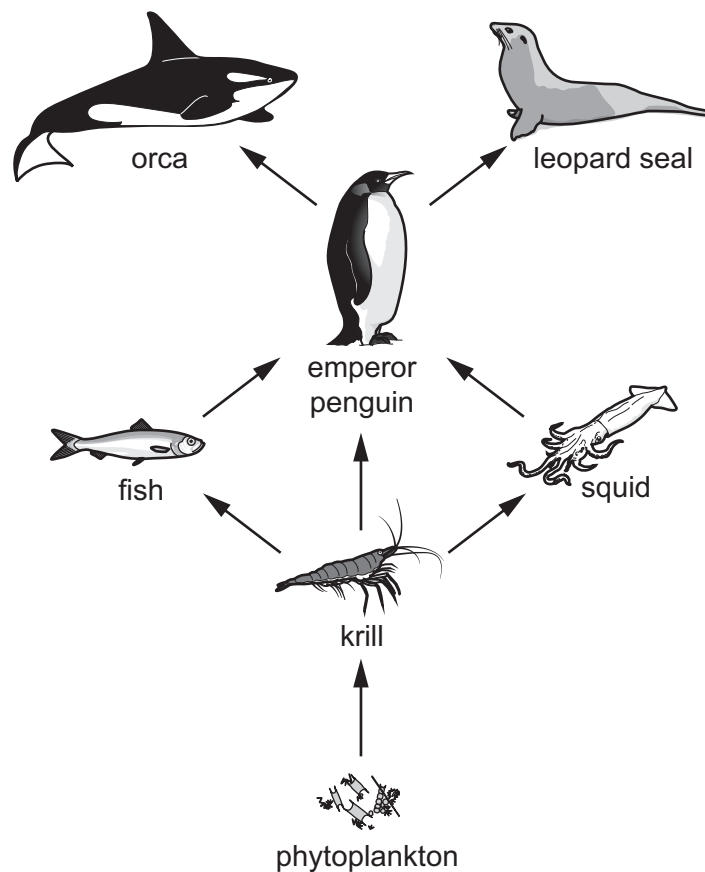


Fig. 7.1

- (i) Phytoplankton are producers.
Define the term producer.

.....
 [2]

- (ii) Identify a primary consumer in Fig. 7.1.

..... [1]

- (iii) Identify **two** organisms eaten by emperor penguins in Fig. 7.1.

1

2

[1]

- (iv) Orcas also eat fish.

Draw **one** arrow on Fig. 7.1 to show this feeding relationship. [1]

(b) Fig. 7.2 shows part of the carbon cycle.

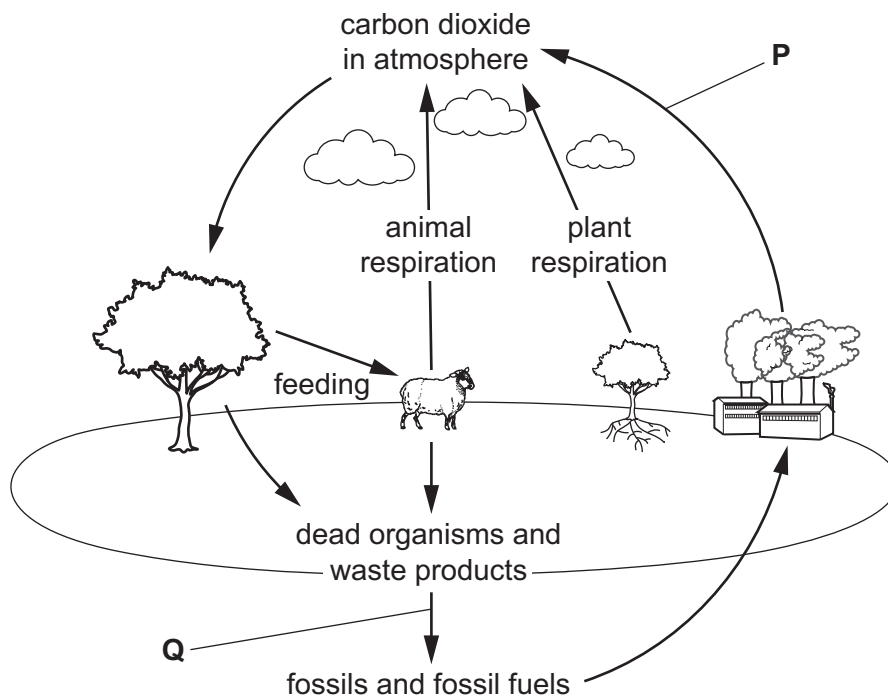


Fig. 7.2

(i) Identify processes **P** and **Q** in Fig. 7.2.

P

Q

[2]

(ii) Deforestation increases the concentration of carbon dioxide in the atmosphere.

List **two other** undesirable effects of deforestation.

1

2

[2]

[Total: 9]

- 8 (a) Lithium, sodium and potassium are metals in Group I of the Periodic Table.

Chlorine, bromine and iodine are halogens in Group VII of the Periodic Table.

Helium, neon and argon are elements in Group VIII of the Periodic Table.

- (i) State the trend in the density of the elements going down Group I.

..... [1]

- (ii) State the trend in the colour of the elements going down Group VII.

..... [1]

- (iii) Identify **one** similarity between the elements in Group VIII.

..... [1]

- (b) Aluminium, calcium, iron and sodium are in different groups of the Periodic Table.

Place these metals in order of reactivity, from most to least reactive.

.....	most reactive
.....	↓
.....	
.....	least reactive

[2]

- (c) An atom of sodium is represented as shown.



Deduce the number of protons and the number of neutrons in this atom.

protons

neutrons

[2]

- (d) State **one** use of helium.

..... [1]

[Total: 8]

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- 9 (a) Complete the following sentences using the terms shown.

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

current

positive charge

ohms

resistance

series

volts

A flow of electric charge is called a

An ammeter is used to measure

A potential difference is measured in

[3]

- (b) Fig. 9.1 shows an electric circuit.

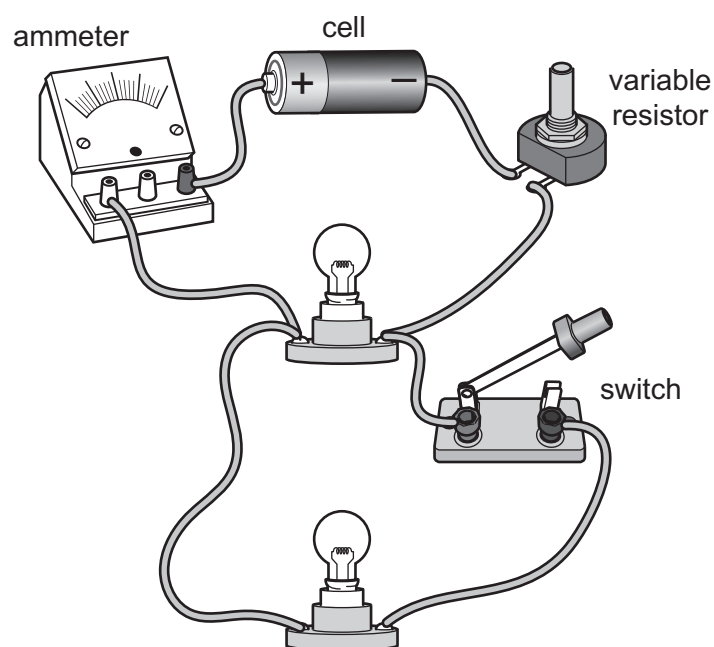


Fig. 9.1

- (i) Fig. 9.2 shows an incomplete circuit diagram for the circuit in Fig. 9.1.

On Fig. 9.2, complete the circuit diagram.

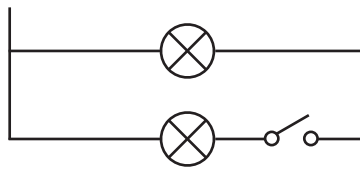


Fig. 9.2

[3]

- (ii) When the switch is off, the reading on the ammeter is 0.5A.

When the switch is on, the reading on the ammeter increases.

Explain why the reading on the ammeter increases.

.....

.....

..... [2]

[Total: 8]

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0653/32

May/June 2022

1 hour 15 minutes

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This document has **24** pages. Any blank pages are indicated.

- 1 (a) Fig. 1.1 is a diagram of the human gas exchange system.

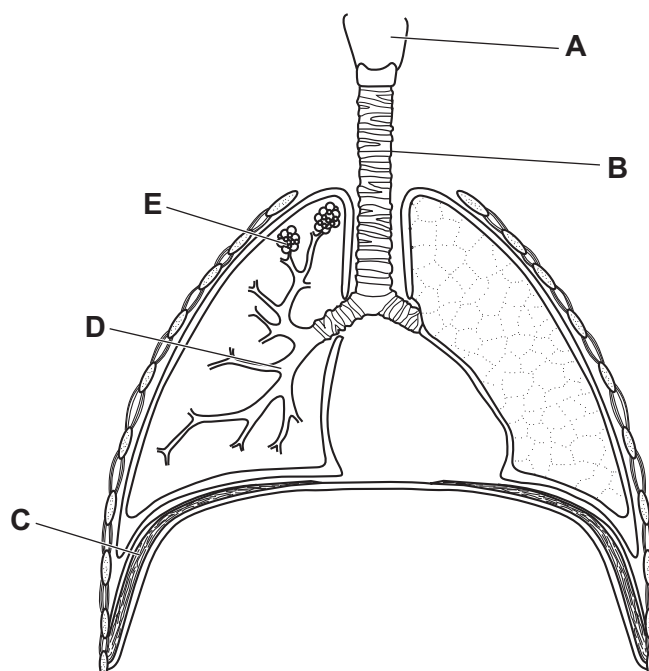


Fig. 1.1

Identify the letter in Fig. 1.1 that shows:

the position of the larynx

the position of the alveoli.

[2]

- (b) The composition of inspired air is different from expired air.

Complete these sentences.

Expired air contains carbon dioxide than inspired air.

Expired air also contains vapour.

Both of these substances are products of, the process used to release energy from nutrients.

[3]

- (c) A student investigates the relationship between height and lung volume in five different people.

Fig. 1.2 shows the apparatus the student uses.

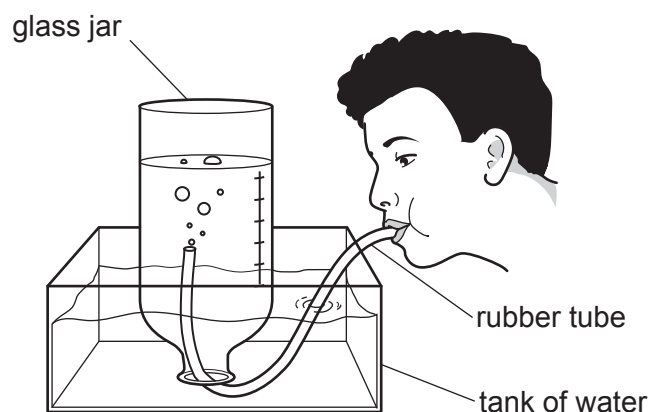


Fig. 1.2

Each person blows into the rubber tube.

The student records the volume of expired air that is blown into the glass jar by each person.

This volume of expired air is used as an estimate of their lung volume.

The student also records the height of each person.

Table 1.1 shows the results.

Table 1.1

person	height /cm	estimated lung volume /dm ³
A	155	3.2
B	122	1.8
C	145	2.9
D	136	2.3
E	140	2.5

- (i) Identify the person with the largest estimated lung volume in Table 1.1. [1]

- (ii) Describe the relationship between height and estimated lung volume in Table 1.1.

.....
 [1]

(d) Fig. 1.3 is a diagram of the human circulatory system.

The arrows show the direction of blood flow.

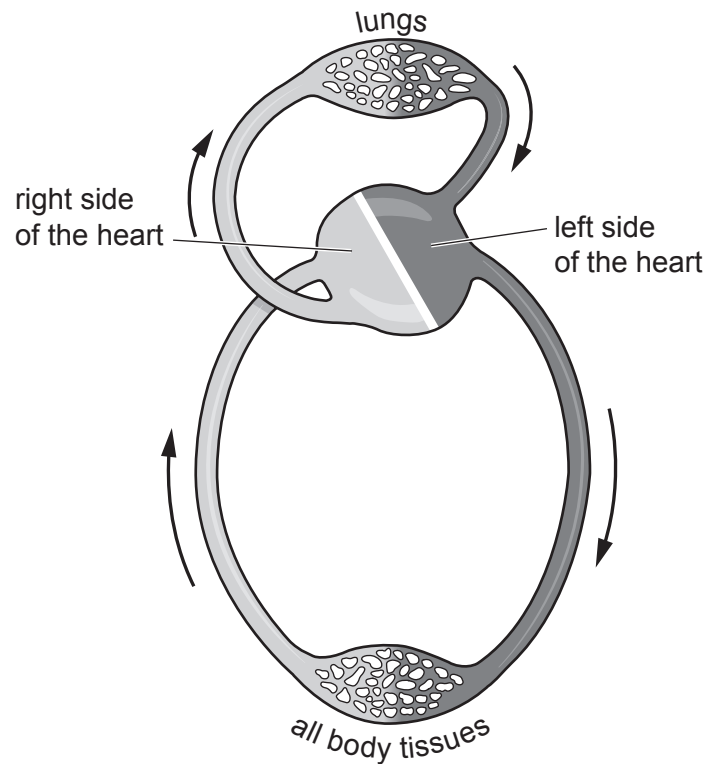


Fig. 1.3

(i) Draw a label line and the letter **P** to show the position of the pulmonary vein on Fig. 1.3. [1]

(ii) State the name of the structures inside the circulatory system that ensure one-way flow of blood.

..... [1]

(e) Blood contains red blood cells.

Describe the function of red blood cells.

.....

 [2]

[Total: 11]

- 2 (a) Zinc is extracted from zinc oxide by heating with carbon.

The equation for this reaction is shown.



- (i) State the type of chemical change that occurs when compounds lose oxygen.

..... [1]

- (ii) State the name given to any chemical reaction that absorbs (takes in) heat energy.

..... [1]

- (iii) Explain why zinc **can** be extracted from zinc oxide by heating with carbon but magnesium **cannot** be extracted from magnesium oxide by heating with carbon.

.....

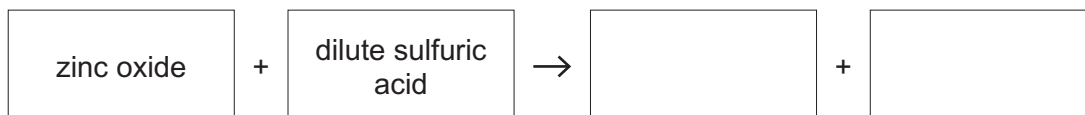
.....

..... [2]

- (b) Excess zinc oxide is added to dilute sulfuric acid.

A zinc salt and one other compound are formed.

- (i) Complete the word equation for this reaction.



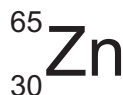
[2]

- (ii) Describe what happens to the pH value of the reaction mixture during this reaction.

.....

..... [1]

- (c) An atom of zinc is represented as shown.



Deduce the number of electrons and the number of neutrons in this atom of zinc.

electrons

neutrons

[2]

[Total: 9]

- 3 Fig. 3.1 shows the forces acting as a student rides on a moving scooter.

The scooter has an electric motor.

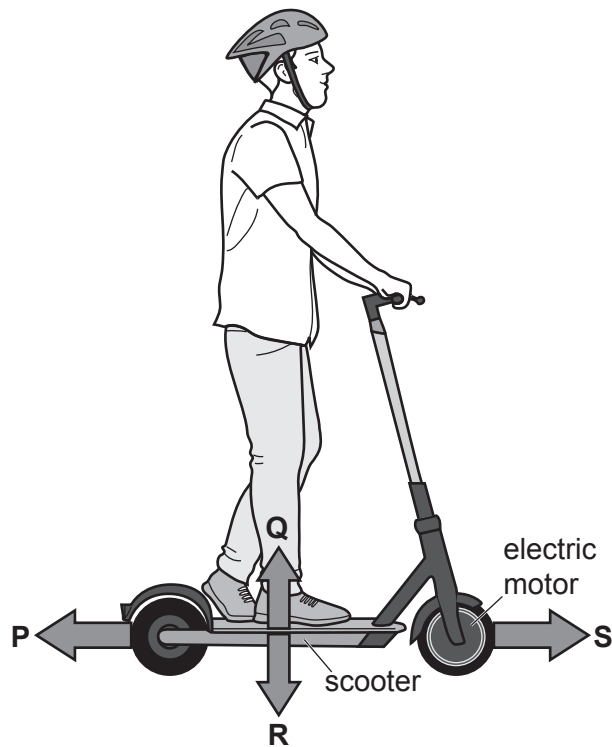


Fig. 3.1

- (a) (i) Force **R** is the result of the Earth's gravitational field acting on the total mass of the student and the scooter.

Name force **R**.

.....

[1]

- (ii) The total mass of the student and the scooter is 35 kg.

Calculate the magnitude of force **R**.

The gravitational force on unit mass is 10 N/kg.

force **R** = ... N [2]

(b) Fig. 3.2 shows a speed-time graph for the motion of the scooter.

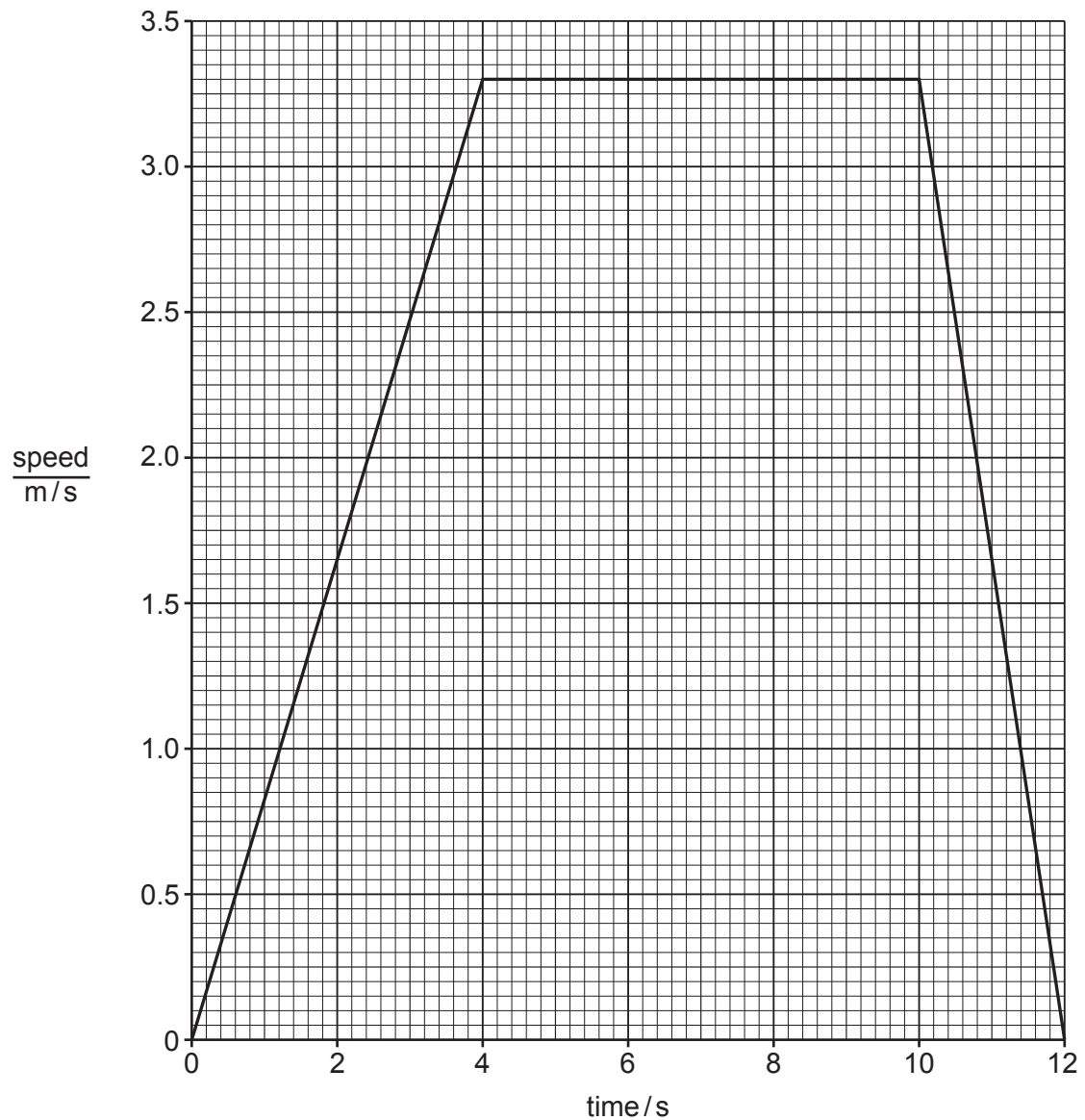


Fig. 3.2

(i) State the maximum speed of the scooter in Fig. 3.2.

maximum speed = ... m/s [1]

(ii) Calculate the distance travelled by the scooter while at maximum speed.

distance = ... m [2]

- (iii) The scooter has a speedometer that shows the speed in km/h.

At one point the speedometer reads 3.6 km/h.

Show that 3.6 km/h is the same as 1.0 m/s.

[2]

[Total: 8]

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- 4 (a) Fig. 4.1 is a diagram of the male reproductive system in humans.

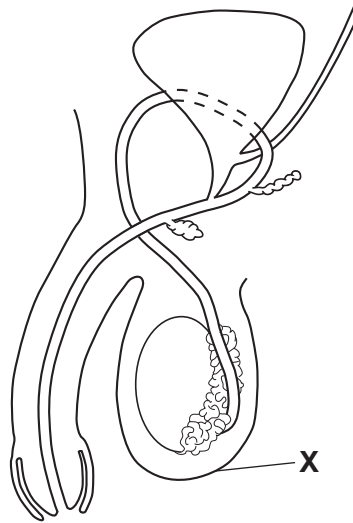


Fig. 4.1

- (i) State the name of the part labelled **X** in Fig. 4.1.

..... [1]

- (ii) Name the gland that secretes fluids for sperm to swim in.

..... [1]

- (b) Complete these sentences about reproduction.

Choose words from the list.

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

embryo

gamete

ovary

oviduct

uterus

vagina

zygote

The male releases sperm from the penis into the of the female.

The sperm swim to the where fertilisation takes place.

The fertilised egg is called a

[3]

- (c) The menstrual cycle in females is controlled by hormones.

Fig. 4.2 shows the relationship between the lining of the uterus and one of these hormones.

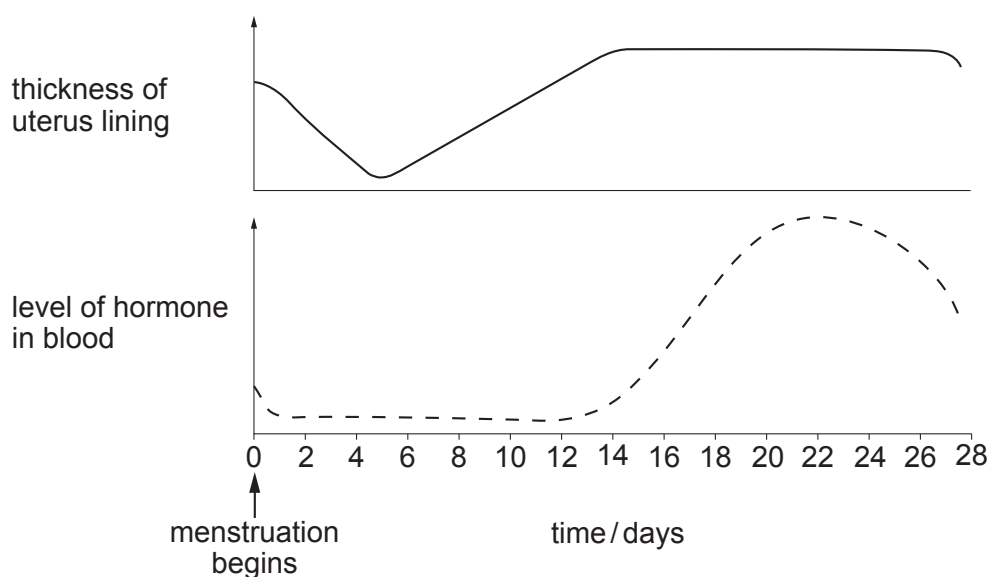


Fig. 4.2

- (i) Use Fig. 4.2 to identify the day when the blood contains the highest level of the hormone.

..... [1]

- (ii) Describe how the thickness of the uterus lining changes during the menstrual cycle.

Include data from Fig. 4.2 in your answer.

.....

 [2]

- (d) During pregnancy a female is advised to increase the amount of protein in her diet.

State the importance of protein in the diet.

.....
 [1]

[Total: 9]

- 5 (a) An electric current is passed through an aqueous solution of compound **X** using inert electrodes. Compound **X** is broken down by this process.

The apparatus used is shown in Fig. 5.1.

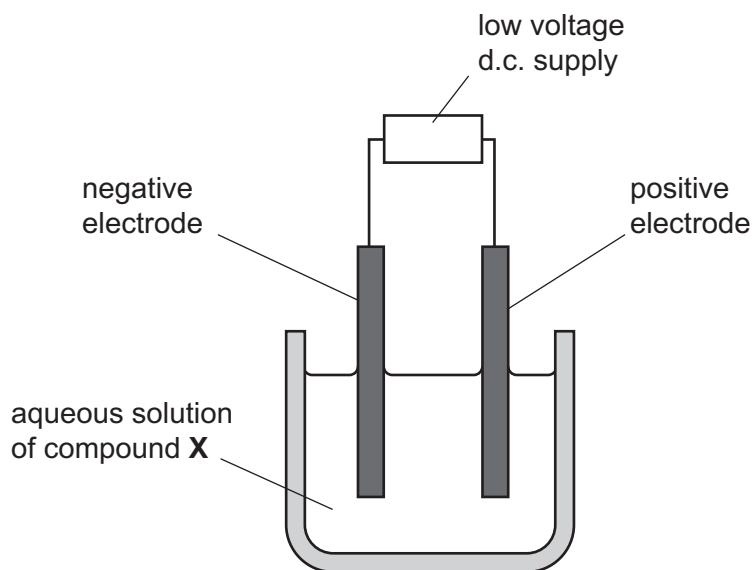


Fig. 5.1

- (i) Name this process.

..... [1]

- (ii) State the name of the negative electrode.

..... [1]

- (iii) Suggest the name of the element from which the electrodes are made.

..... [1]

- (iv) Deduce the type of bonding present in compound **X**.

..... [1]

- (v) During this process a gas is formed at the positive electrode.

This gas bleaches damp litmus paper.

Identify this gas.

..... [1]

- (vi) State whether the type of change occurring when an electric current is passed through the aqueous solution of compound **X** is a chemical change or a physical change.

Explain your answer.

type of change

explanation

[1]

- (b) An aqueous solution of compound **X** is a mixture.

- (i) Describe the difference between a compound and an element.

.....

..... [1]

- (ii) Describe the difference between a compound and a mixture.

.....

..... [1]

- (c) An aqueous solution of compound **X** contains compound **X** dissolved in water.

- (i) Describe **one** chemical test that shows the presence of water.

State the observation for a positive result.

test

observation

[2]

- (ii) State **one** method of separation that can be used to collect pure water from an aqueous solution of compound **X**.

..... [1]

[Total: 11]

- 6 (a) Fig. 6.1 shows a heat lamp used to keep newborn chicks warm.

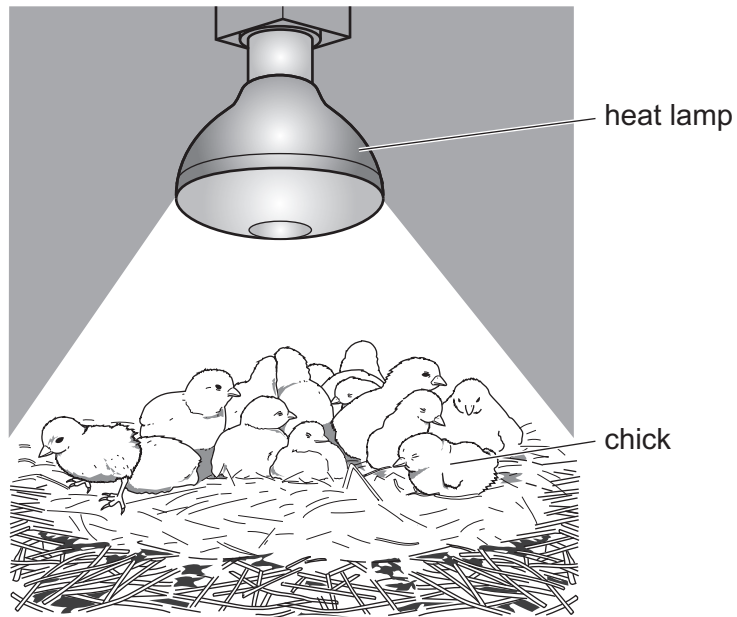


Fig. 6.1

The heat lamp emits radiation in the visible light and infrared regions of the electromagnetic spectrum.

Fig. 6.2 shows an incomplete electromagnetic spectrum.

On Fig. 6.2, write visible light and infrared radiation in the correct places.

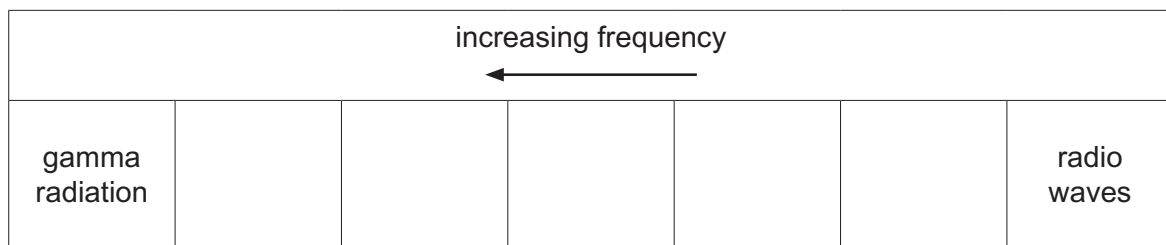


Fig. 6.2

[2]

- (b) The heat lamp is connected to a 230 V electricity supply.

The current in the lamp when it is switched on is 1.1 A.

- (i) Calculate the resistance of the lamp.

Give the unit of your answer.

resistance = ... unit [3]

- (ii) A farmer connects two identical heat lamps in parallel.

State **two** advantages of connecting the heat lamps in parallel.

- 1
- 2 [2]

- (c) A newborn chick emits a sound with a frequency of 3.5 kHz.

As the chick grows, the frequency of the sound changes.

After 36 weeks, the sound emitted is 1.5 kHz.

- (i) Describe how the pitch of the sound emitted by the chick changes over 36 weeks.

..... [1]

- (ii) State whether all the sounds made by the chick as it grows over 36 weeks can be heard by a healthy human ear.

Give a reason for your answer.

..... [1]

[Total: 9]

- 7 (a) Fig. 7.1 shows information about four organisms living in an ocean habitat.

- Krill eat microscopic producers called phytoplankton.
- Fish eat krill.
- Penguins eat fish.

Fig. 7.1

- (i) Construct a food chain using the information in Fig. 7.1.

..... [2]

- (ii) Identify the herbivore in Fig. 7.1.

..... [1]

- (b) Fig. 7.2 shows a photomicrograph of phytoplankton.

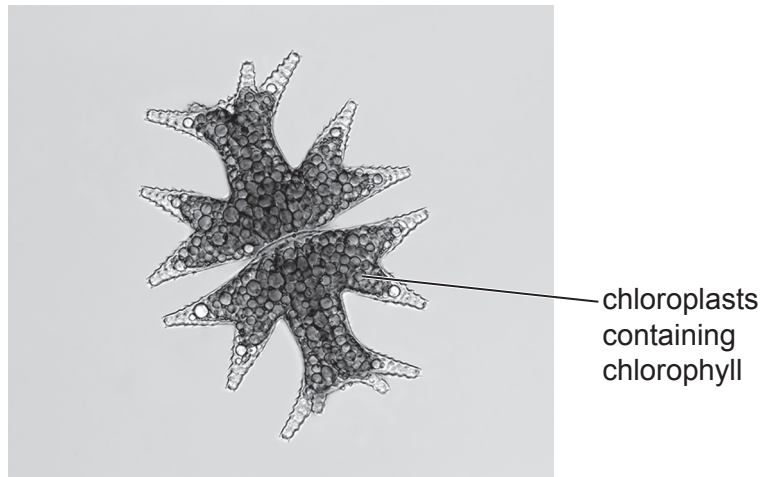


Fig. 7.2

Explain why phytoplankton need chlorophyll.

.....

.....

..... [2]

(c) Food is digested in the alimentary canal.

Fig. 7.3 shows some of the pathway taken by food in the human alimentary canal.

Complete Fig. 7.3.

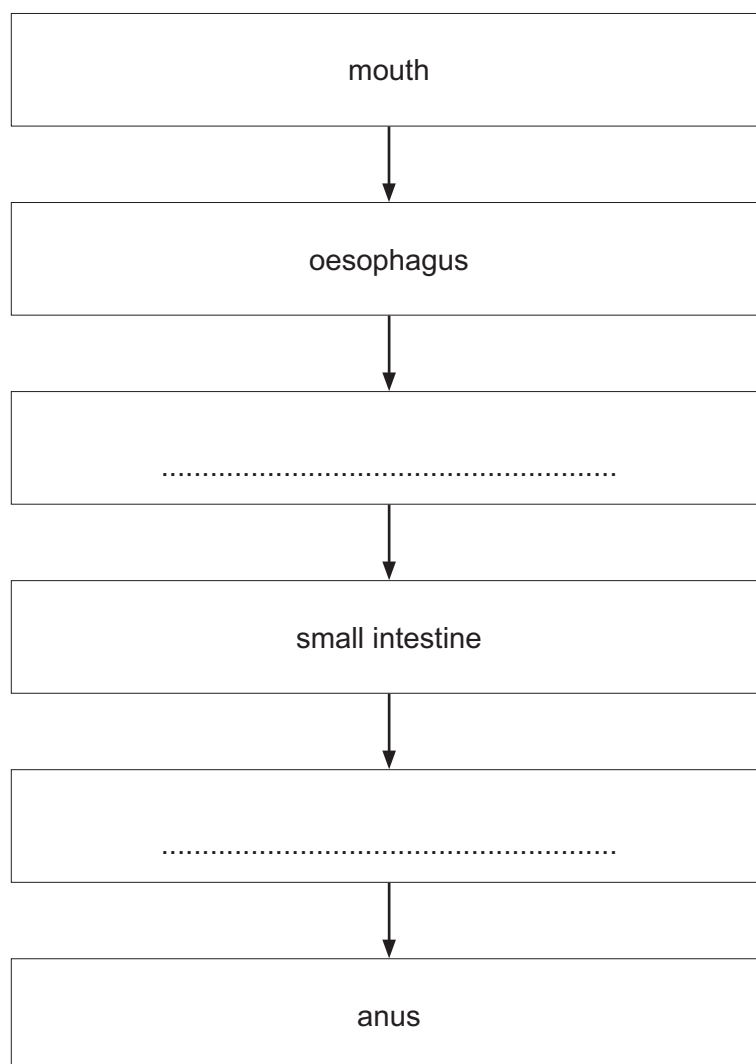
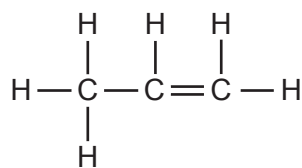


Fig. 7.3

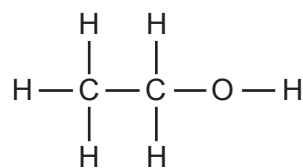
[2]

[Total: 7]

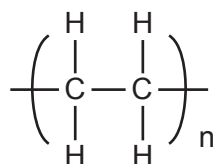
- 8 The molecular structures and names of three compounds are shown in Fig. 8.1.



propene



ethanol



poly(ethene)

Fig. 8.1

- (a) Complete Table 8.1 using the information in Fig. 8.1.

Explain how the molecular structures in Fig. 8.1 help you to identify each type of compound.

Table 8.1

type of compound	name of compound	explanation
alkane		
alkene		
not a hydrocarbon		

[3]

- (b) The complete combustion of each of the three compounds shown in Fig. 8.1 produces the greenhouse gas carbon dioxide.

Identify the gas in the air that reacts with these compounds during combustion.

..... [1]

- (c) Propene and poly(ethene) are made from compounds obtained from petroleum.

State the processes in which propene and poly(ethene) are made.

propene

poly(ethene) [2]

[Total: 6]

- 9 (a) Some water is heated in a beaker using an electric heater.

Fig. 9.1 shows the circuit for the electric heater.

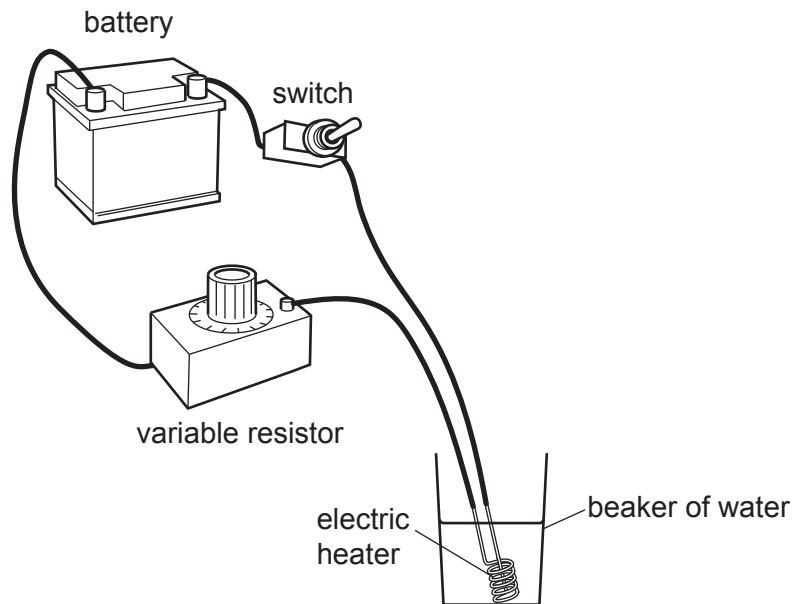
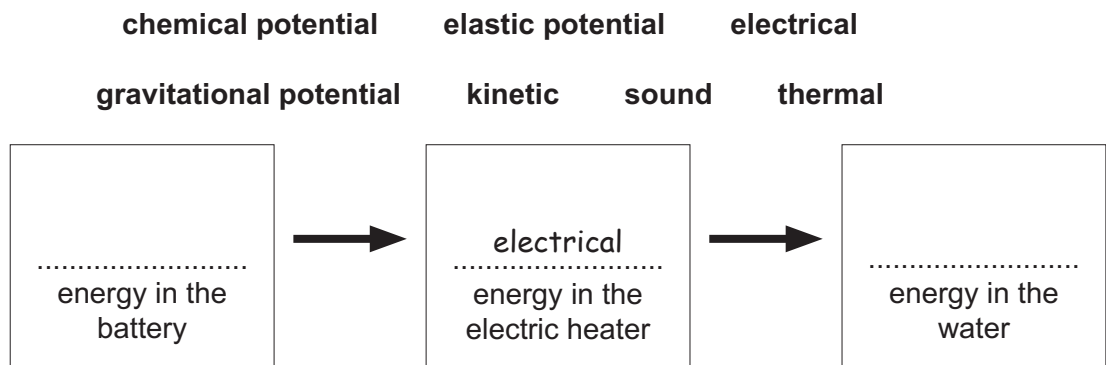


Fig. 9.1

- (i) Use words from the list to complete the boxes to show the sequence of useful energy transfers taking place in Fig. 9.1.

Each word may be used once or not at all.

One has been completed for you.



[2]

- (ii) On Fig. 9.2, complete the circuit diagram for the circuit shown in Fig. 9.1.

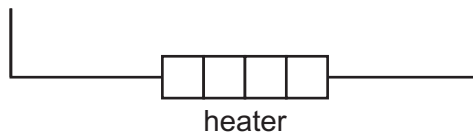


Fig. 9.2

[3]

- (b) Fig. 9.3 shows a liquid-in-glass thermometer without a scale.



Fig. 9.3

- (i) The thermometer is placed in a beaker of water. The beaker of water is heated.

State what happens to the level of liquid inside the thermometer while the water is being heated.

Give a reason for your answer.

level

reason

[2]

- (ii) The thermometer in Fig. 9.3 measures temperatures between -10°C and $+110^{\circ}\text{C}$.

Table 9.1 gives some information about four liquids, **A**, **B**, **C** and **D**.

Table 9.1

liquid	melting point/ $^{\circ}\text{C}$	boiling point/ $^{\circ}\text{C}$
A	-86	$+80$
B	-117	$+79$
C	-39	$+367$
D	$+17$	$+118$

Identify the liquid used in this thermometer.

liquid [1]

- (iii) Explain why the liquid you identified in (ii) is suitable for use in this thermometer.

.....

 [2]

[Total: 10]

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The Periodic Table of Elements

Group																	
I	II	1 H hydrogen 1										III	IV	V	VI	VII	VIII
3 Li lithium 7	4 Be beryllium 9	Key atomic number atomic symbol name relative atomic mass										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 dm³ at room temperature and pressure (r.t.p.).



CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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0653/33

May/June 2022

1 hour 15 minutes

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [].
- The Periodic Table is printed in the question paper.

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[Turn over

- 1 (a) The boxes on the left show different parts of the male and female reproductive system in humans.

The boxes on the right show functions of the different parts.

Draw one straight line from each part to its function.

part	function
cervix	holds testes outside the body
scrotum	receives penis during sexual intercourse
vagina	ring of muscle at the opening of the uterus

[2]

- (b) Fig. 1.1 is a diagram of an insect-pollinated flower.

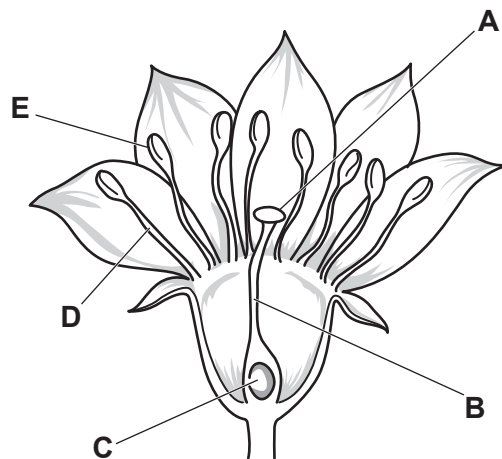


Fig. 1.1

State the letter on Fig. 1.1 that shows:

the part that makes pollen

where pollination takes place.

[2]

- (c) Describe the process of fertilisation in **flowering** plants.

.....

.....

..... [2]

- (d) Fig. 1.2 shows a potato plant reproducing **without** fertilisation.

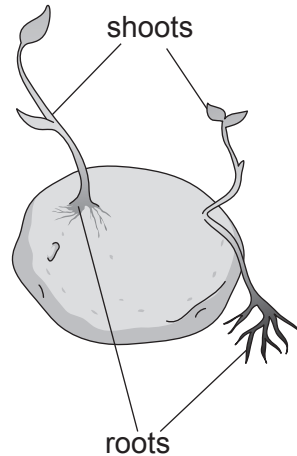


Fig. 1.2

- (i) Identify the type of reproduction shown in Fig. 1.2.

..... [1]

- (ii) A gardener decides to grow potato plants.

She chooses the best potatoes from a plant she has already grown.

She then uses the method shown in Fig. 1.2 to grow new plants from her best potatoes, rather than using seeds.

Place a tick (✓) in **one** box to show the advantage of using this method.

all the offspring will be genetically identical	
the plants will grow slower	
the plants will not need water to grow	
the potatoes will taste different	

[1]

[Total: 8]

2 A student investigates the gases in air.

- (a)** The student leaves blue cobalt(II) chloride paper in air for a few hours.

The cobalt(II) chloride paper turns pink.

- (i)** Identify the substance in air that makes the cobalt(II) chloride paper turn pink.

..... [1]

- (ii)** The student also leaves a small sample of anhydrous copper(II) sulfate in air for a few hours.

State the colour change that is observed when anhydrous copper(II) sulfate is left in air for a few hours.

from to [1]

- (b)** The student passes clean air through one sample of limewater.

Then he blows air from his lungs through another sample of limewater, as shown in Fig. 2.1.

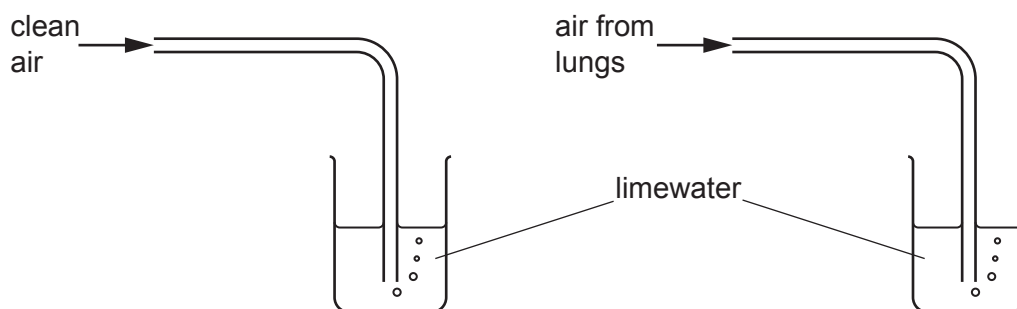


Fig. 2.1

Carbon dioxide from the student's lungs turns the limewater milky within a few seconds.

The clean air takes a long time to turn the limewater milky.

Suggest why the air from the student's lungs turns the limewater milky faster than the clean air does.

.....

..... [1]

- (c) The student leaves damp blue litmus paper in polluted air for a few hours.

The litmus paper turns red.

Suggest **one** common pollutant in the air, other than carbon dioxide, that makes the litmus paper turn red.

State **one** adverse effect of this pollutant on people's health.

common pollutant

adverse effect

[2]

- (d) The student increases the temperature of water in a beaker, as shown in Fig. 2.2.

The Bunsen burner uses natural gas.

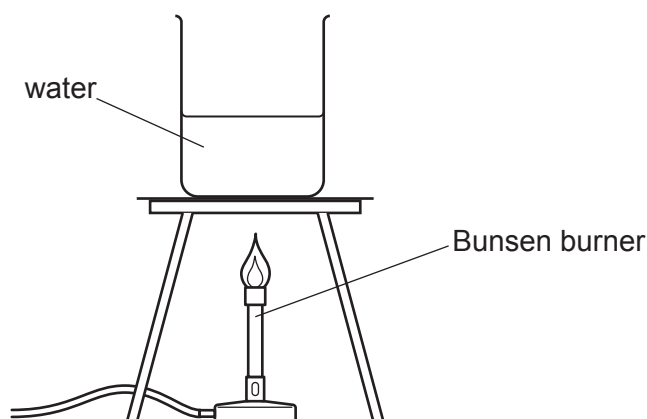


Fig. 2.2

- (i) State the name of the main constituent of natural gas.

..... [1]

- (ii) Name **one** piece of apparatus that can be used to measure the temperature of the water.

..... [1]

- (iii) State the name given to any chemical reaction that causes a temperature increase.

..... [1]

[Total: 8]

- 3 Fig. 3.1 shows a solid block at rest on a table.

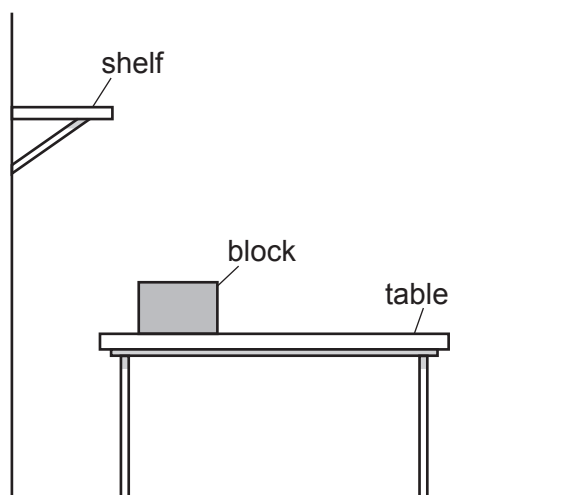


Fig. 3.1

- (a) (i) On Fig. 3.1, draw a force arrow to show the gravitational force acting on the block. Label this force **A**. [1]
- (ii) On Fig. 3.1, draw a force arrow to show the force exerted by the table on the block. Label this force **B**. [1]
- (iii) The gravitational force on the block is 30 N.

State the magnitude of the force exerted by the table on the solid block.

Give a reason for your answer.

force = ... N

reason

..... [1]

- (iv) Calculate the mass of the block.

The gravitational force on unit mass is 10 N/kg.

mass = ... kg [2]

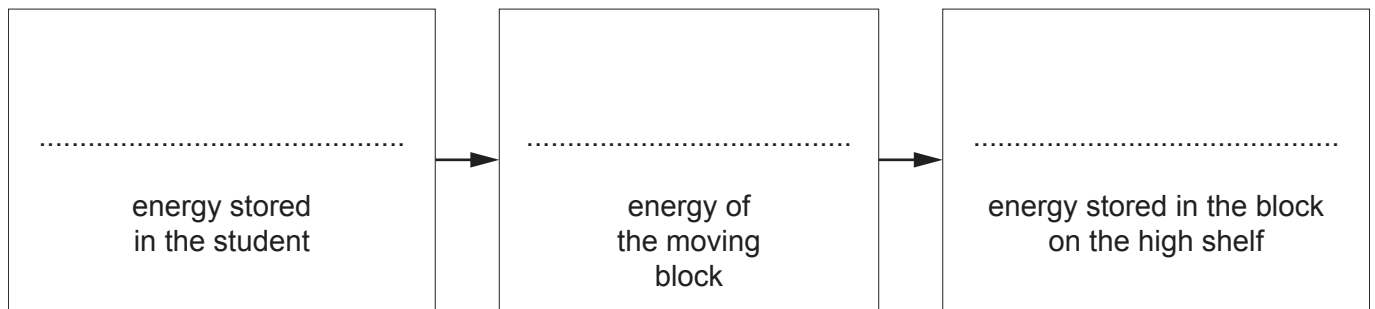
- (v) The block has a volume of 0.0040 m^3 .

Use your answer from (a)(iv) to calculate the density of the block.

density = ... kg/m^3 [2]

(b) A student lifts the block up onto a high shelf.

Complete the boxes to show the sequence of useful energy transfers that occur.



[3]

[Total: 10]

4 (a) Fig. 4.1 is a diagram of the human heart.

(i) Complete the labels on Fig. 4.1.

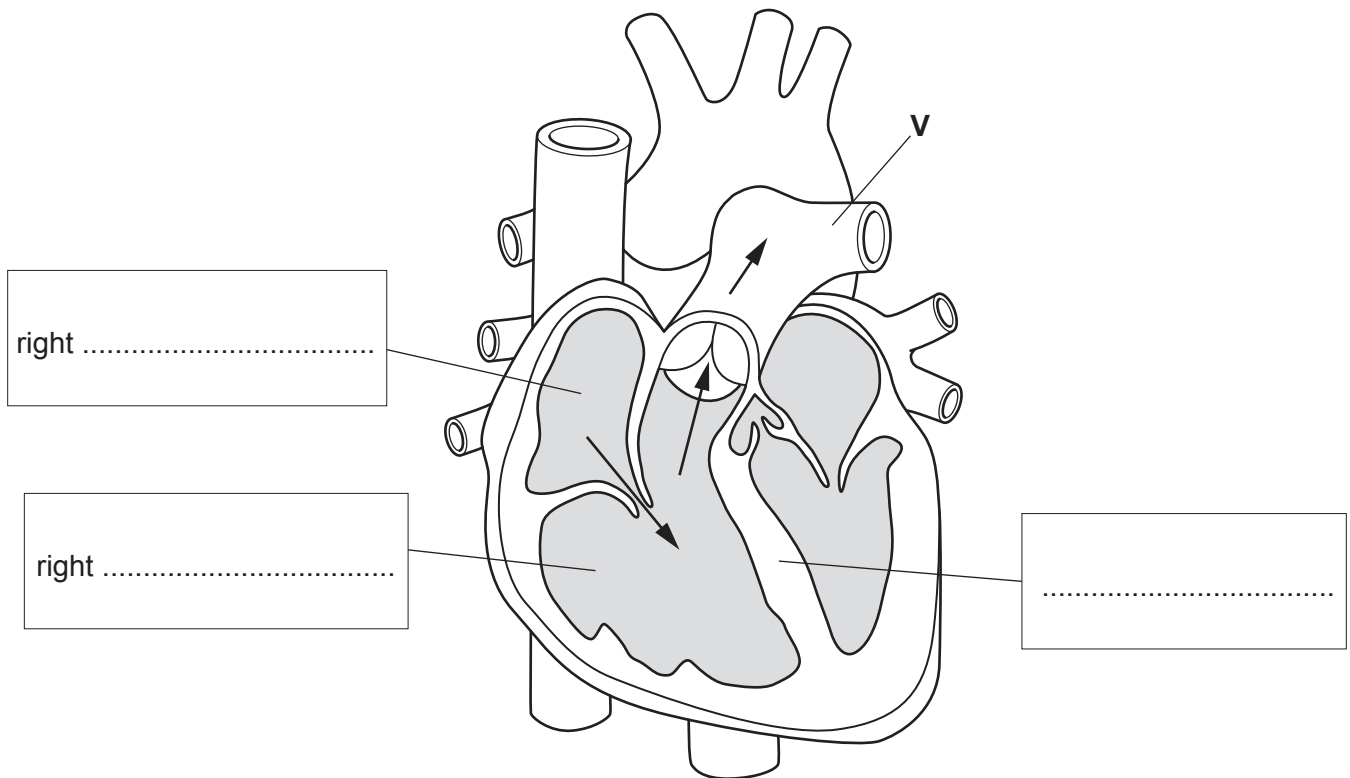


Fig. 4.1

[3]

(ii) The arrows on Fig. 4.1 show the direction of blood flow.

Use this information to state why vessel **V** is an artery.

..... [1]

(iii) The heart is part of the transport system in humans.

State the name of this transport system.

..... [1]

(b) Arteries and veins transport substances in the human body.

State the name of the **two** transport vessels in plants.

1

2

[2]

- (c) A student investigates water transport in plants using two leaves from the same plant.

Fig. 4.2 shows the apparatus the student uses.

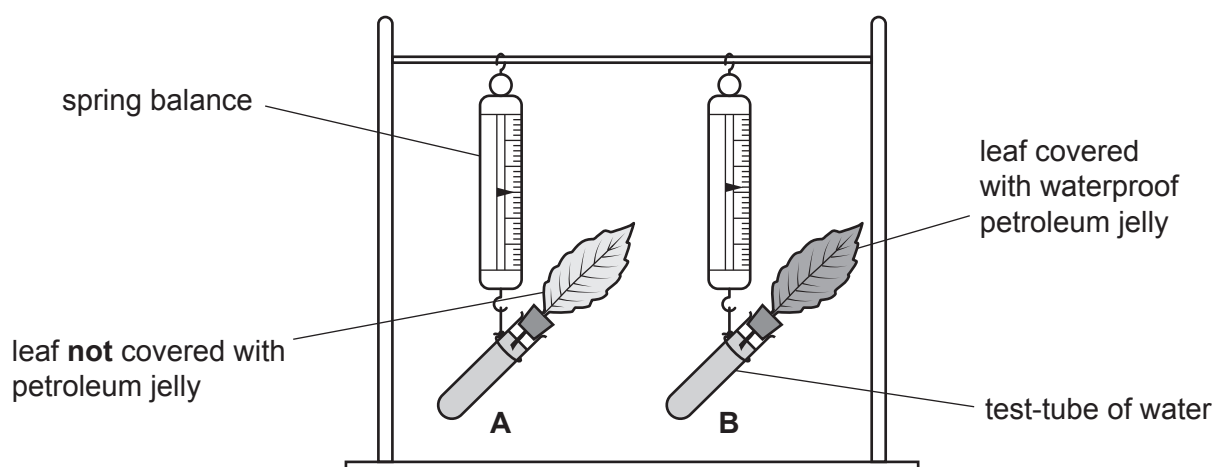


Fig. 4.2

The student uses the spring balance to measure the mass of each leaf at the start. Both leaves are placed in the same conditions. The mass of each leaf is then measured again 24 hours later.

Table 4.1 shows the results.

Table 4.1

leaf	mass at start /g	mass at end /g	change in mass /g
A	31	25	
B	32	31	–1

- (i) Calculate the change in mass for leaf **A**.

change in mass = ...g [1]

- (ii) Explain the results in Table 4.1.
Use ideas about stomata in your answer.

.....

.....

.....

.....

..... [3]

[Total: 11]

- 5 (a) Lithium, sodium and potassium are three elements in Group I of the Periodic Table, as shown in Fig. 5.1.

3 Li lithium 7
11 Na sodium 23
19 K potassium 39

Fig. 5.1

Identify which of these three elements has:

the lowest density

the highest reactivity

the highest melting point.

[2]

- (b) Chlorine, bromine and iodine are three elements in Group VII of the Periodic Table.

They exist as diatomic molecules.

- (i) Describe what is meant by diatomic.

.....

..... [1]

- (ii) Complete the dot-and-cross diagram in Fig. 5.2 to show all the outer shell electrons in a molecule of chlorine, Cl_2 .



Fig. 5.2

[2]

- (iii) State the type of chemical bonding in a molecule of chlorine.

..... [1]

- (c) When sodium and chlorine react together, they form sodium chloride, NaCl.

- (i) Describe what happens to sodium atoms and to chlorine atoms when they react together.

Use ideas about electrons in your answer.

sodium atoms

.....

chlorine atoms

.....

[2]

- (ii) Complete Table 5.1 by stating whether each substance conducts or does **not** conduct electricity when solid, molten (liquid) or gas.

Use a tick (✓) for conducts or a cross (X) for does **not** conduct in each empty box.

Table 5.1

	solid	molten (liquid)	gas
sodium			
sodium chloride			
chlorine			

[3]

[Total: 11]

- 6 Fig. 6.1 shows an ice cube floating in a glass of water.

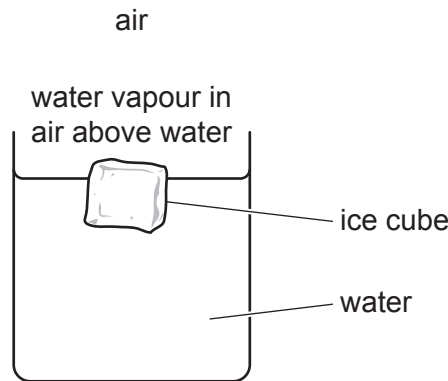


Fig. 6.1

- (a) (i) Fig. 6.1 shows four substances: air, ice, water and water vapour.

Identify which substance in Fig. 6.1 fits this description:

'It is made of molecules which are closely packed, arranged in a regular pattern, and cannot move around.'

substance [1]

- (ii) The ice slowly disappears.

Name the process by which molecules in the ice cube become molecules in water and state the temperature at which this happens.

process

temperature °C [2]

- (b) Fig. 6.2 shows a ray of light passing through the ice cube.

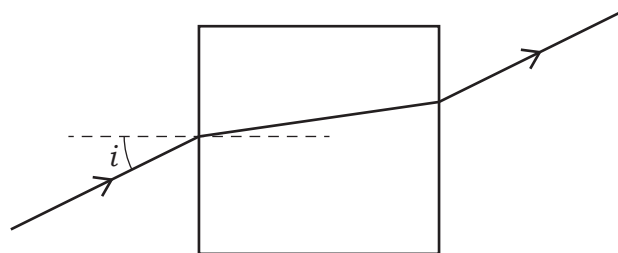


Fig. 6.2

- (i) State the property of light shown in Fig. 6.2.

..... [1]

- (ii) State the name of the angle marked i on Fig. 6.2.

..... [1]

- (c) A glacier is a very large area of ice that moves slowly down a slope or valley.

One glacier in Antarctica is 95 km wide.

An explosion causes a loud sound on one side of the glacier.

- (i) Calculate the time taken for the sound to travel through the ice of the glacier to the other side.

The speed of sound in ice is 3800 m/s.

time = ... s [3]

- (ii) A human explorer is studying some penguins on the glacier.

Penguins have a range of hearing from 100 Hz to 15 kHz.

The sound wave from the explosion has a frequency of 30 Hz.

Explain why the human explorer can hear the explosion but the penguins **cannot** hear the explosion.

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

[Total: 10]

- 7 (a) The nuts in Fig. 7.1 are a good source of fats.



Fig. 7.1

- (i) List the **three** chemical elements that make up fats.

..... [1]

- (ii) Fats are large molecules made from smaller molecules.

Circle the **two** smaller molecules that make up fat molecules.

amino acids

fatty acids

glucose

glycerol

glycogen

starch

[2]

- (b) Fats are digested in the alimentary canal.

Complete these sentences about digestion.

Choose words from the list.

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

absorption

anus

egestion

excretion

mouth

pancreas

stomach

Food is taken into the by the process of ingestion.

The food then passes down the oesophagus to the

The food then passes into the small intestine to complete the digestion process.

The digested food is then moved into the blood by the process of [3]

(c) Enzymes are used in the process of digestion.

Fig. 7.2 shows the effect of pH on the activity of one enzyme.

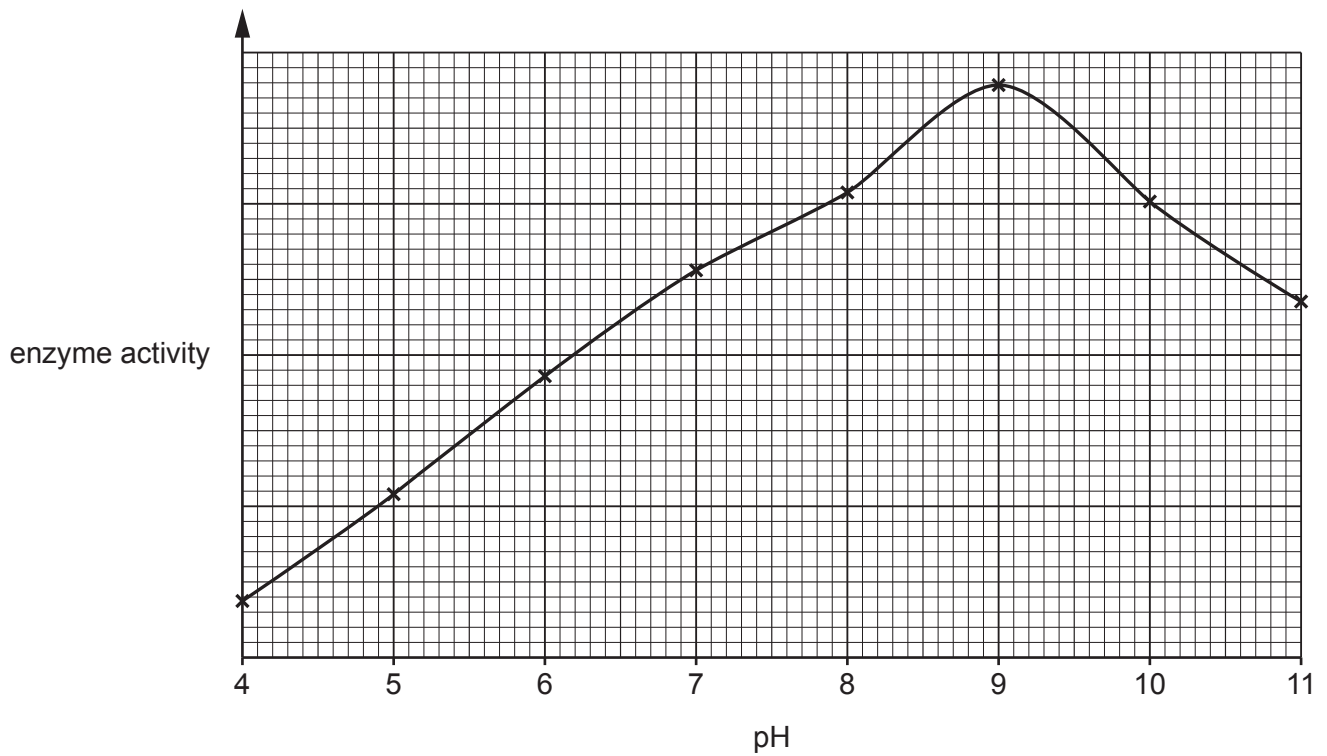


Fig. 7.2

Describe the effect of pH on enzyme activity in Fig. 7.2.

Use data to support your answer.

.....

.....

..... [2]

[Total: 8]

- 8 Petroleum is separated into useful fractions by the process shown in Fig. 8.1.

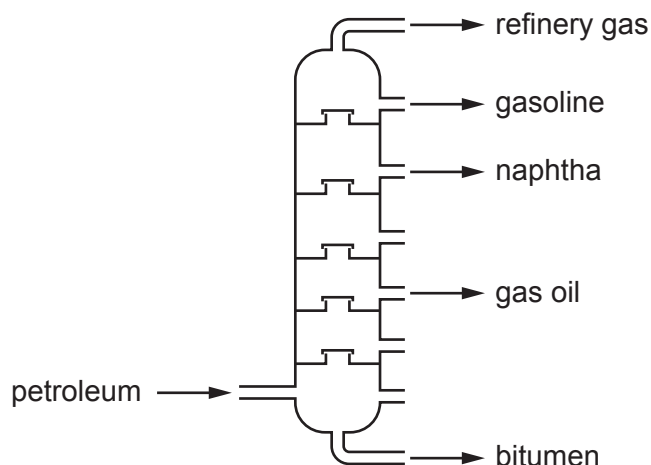


Fig. 8.1

Each fraction is a mixture of different hydrocarbons.

- (a) These hydrocarbons are generally unreactive. They burn in air, but they do not react with aqueous bromine.

- (i) Name the type of hydrocarbons that do **not** react with aqueous bromine.

..... [1]

- (ii) State **one** use for gas oil.

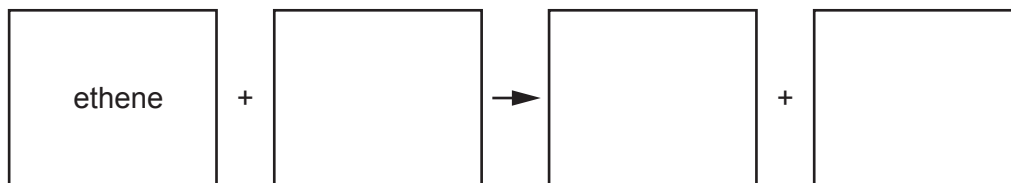
..... [1]

- (b) Naphtha is used to make ethene.

- (i) Name the process used to make ethene from naphtha.

..... [1]

- (ii) Complete the word equation for the complete combustion of ethene, C_2H_4 .



[2]

(c) Ethene is used to make a polymer.

(i) State the name of the polymer that is made from ethene.

..... [1]

(ii) State the type of polymerisation reaction that makes this polymer from ethene.

..... [1]

[Total: 7]

- 9 Two 1.5V cells are connected to two lamps and a switch.

Fig. 9.1 shows the circuit.

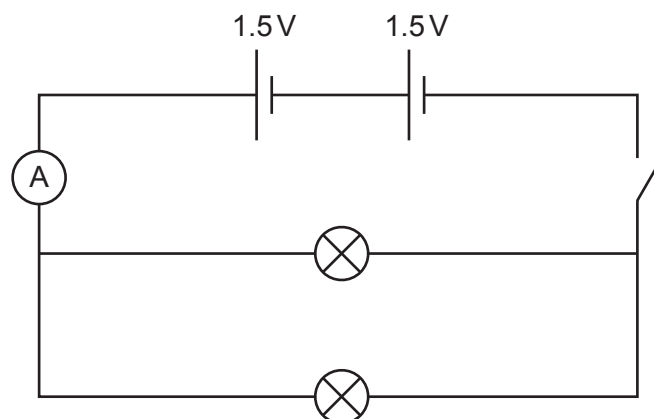


Fig. 9.1

- (a) On Fig. 9.1, draw a voltmeter to measure the potential difference across one cell. [2]

- (b) (i) The current in each lamp is 1.2A.

The potential difference across each lamp is 3.0V.

Calculate the resistance of each lamp.

resistance = ... Ω [2]

- (ii) The lamps operate at 3.0V.

Suggest why two cells are needed to light the lamps.

.....

 [2]

(iii) State which of these values could be the reading on the ammeter.

0.3A 0.6A 1.2A 2.4A

current = ... A

Give a reason for your answer.

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

[Total: 7]

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The Periodic Table of Elements

Group																	
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	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
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 dm³ at room temperature and pressure (r.t.p.).