Cambridge
O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4777721169 3

COMBINED SCIENCE **5129/22**

Paper 2 **May/June 2019**

2 hours 15 minutes

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, graphs or rough working.
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 Assessment International Education

1 Fig. 1.1 shows a cylinder at the top of a curved slope.

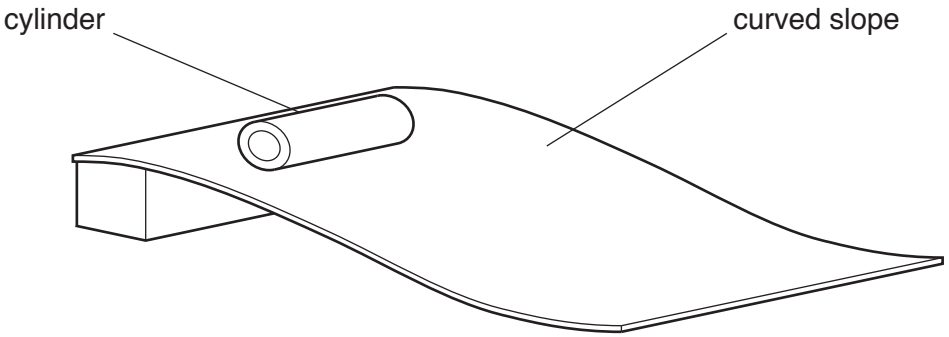


Fig. 1.1

(a) The cylinder rolls down the curved slope.

The speed of the cylinder is determined at regular intervals, as shown in Table 1.1.

Table 1.1

time / s	0	0.25	0.50	0.75	1.0	1.25
$\frac{\text{speed}}{\text{cm/s}}$	0	1.0	2.2	3.9	5.9	8.5

(i) On Fig. 1.2, complete the speed–time graph by plotting the points at 1.0 s and 1.25 s. [1]

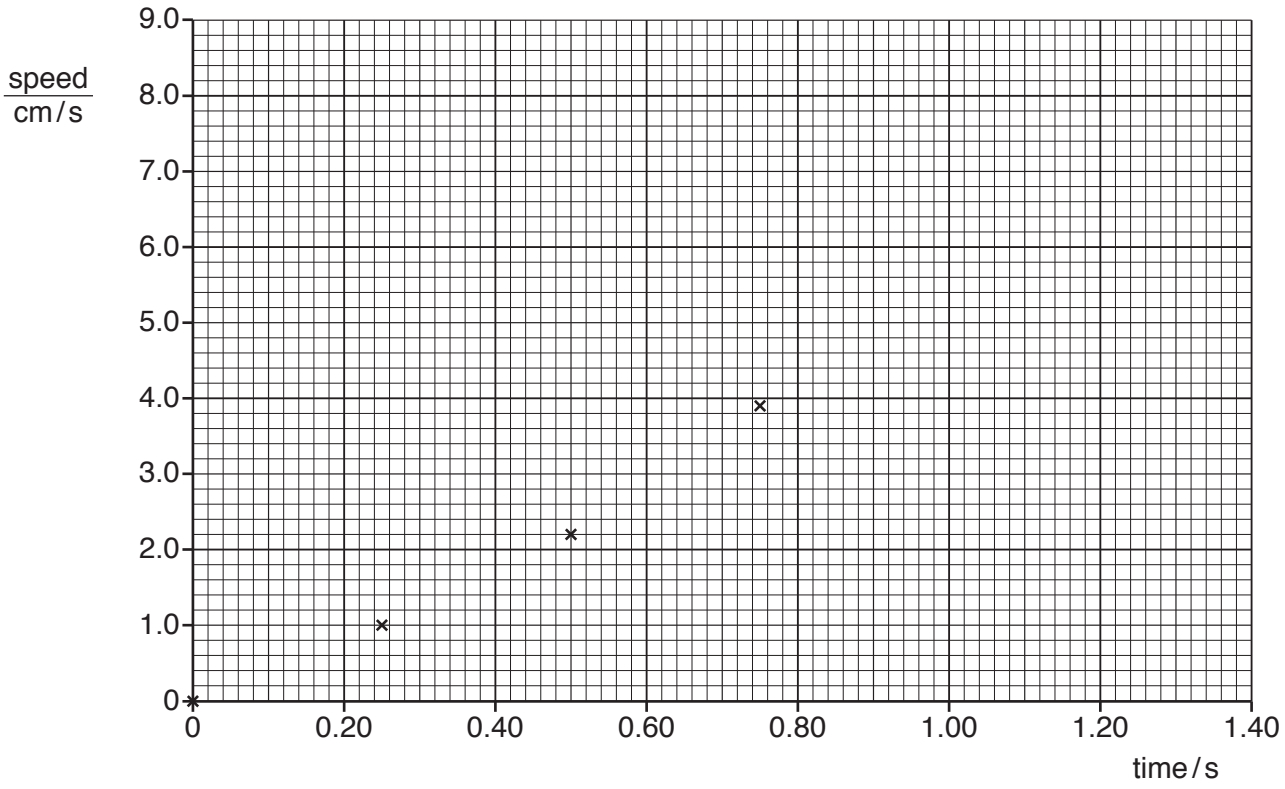


Fig. 1.2

(ii) Draw a curved line of best fit through all the points. [1]

(iii) Describe the acceleration of the cylinder between 0 s and 1.25 s.

.....

..... [1]

(b) State what is meant by *velocity*.

.....

.....

..... [2]

[Total: 5]

[Turn over

2 The electronic structure of an atom of chlorine is 2,8,7.

The electronic structure of an atom of sodium is 2,8,1.

(a) (i) State the formula of a sodium ion and of a chloride ion.

sodium ion .....

chloride ion ..... [1]

(ii) Explain why sodium ions and chloride ions are stable.

.....

..... [1]

(b) Sodium chloride is an ionic compound.

State **two** properties of sodium chloride that show it is an ionic compound.

1 .....

.....

2 .....

.....

[2]

(c) Explain why chlorine is placed in Group VII of the Periodic Table.

.....

..... [1]

[Total: 5]

3 The boxes on the left in Fig. 3.1 contain some functions of blood.

The boxes on the right contain blood components that carry out these functions.

Draw **one** straight line from each function to the blood component responsible for it.

function	**blood component**
glucose transport	platelet
blood clotting	plasma
urea transport	red blood cell
phagocytosis	white blood cell
oxygen transport	
antibody production	

Fig. 3.1

[6]

4 A travel case has small wheels at the bottom and a handle at the top.

When it is tilted, one of the small wheels acts as a pivot. The handle of the case is also extended, as shown in Fig. 4.1.

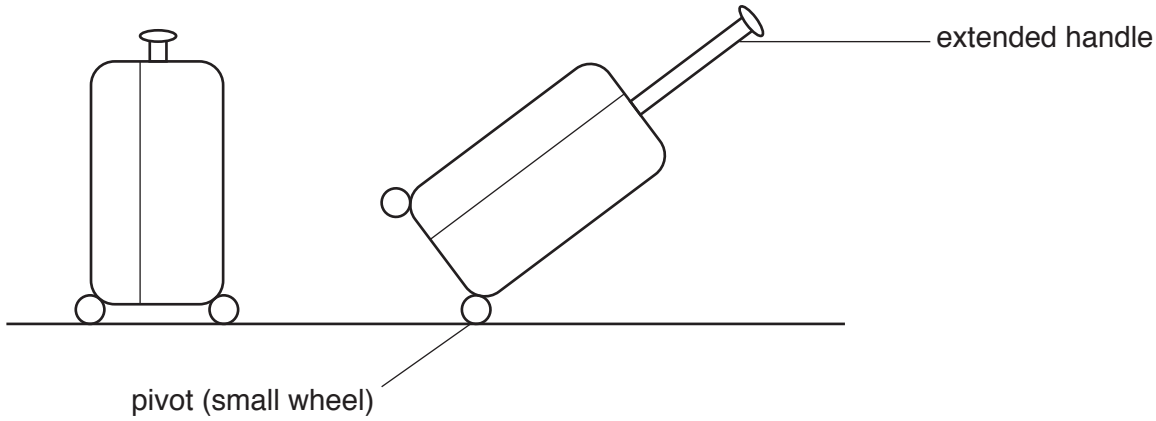


Fig. 4.1

(a) The weight *W* of the case and its contents is 180 N.

When the case is horizontal, the weight *W* acts through a point 0.3 m from the pivot, as shown in Fig. 4.2.

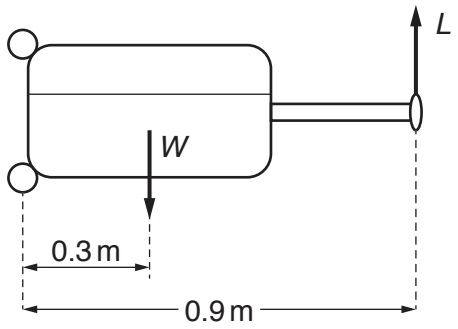


Fig. 4.2

A lifting force *L* is applied to the handle at a distance of 0.9 m from the pivot. This keeps the case horizontal.

Calculate the lifting force *L* needed to balance the case.

lifting force *L* = ... N [2]

(b) The handle is now extended further.

State and explain the effect of using a longer handle on the lifting force *L* in Fig. 4.2.

.....

.....

.....

..... [3]

[Total: 5]

5 When ammonium nitrate is heated with a catalyst, nitrous oxide N_2O is produced.

The equation for the reaction is

$$NH_4NO_3 \longrightarrow N_2O + 2H_2O$$

[A_r: O, 16; N, 14; H, 1]

The relative molecular mass of ammonium nitrate is 80.

(a) (i) Calculate the relative molecular mass of nitrous oxide.

..... [1]

(ii) Complete the following sentences.

160 g of ammonium nitrate produces .....g of nitrous oxide and .....g of water.

4 g of ammonium nitrate produces .....g of nitrous oxide.

[3]

(b) The reaction is *exothermic*.

State the meaning of *exothermic*.

.....

..... [1]

(c) A different oxide of nitrogen is produced in car engines during the combustion of petrol.

State **one** environmental effect caused by oxides of nitrogen in the atmosphere.

.....

..... [1]

[Total: 6]

Question 6 starts over the page.

6 Fig. 6.1 shows the front part of an eye in normal daylight.

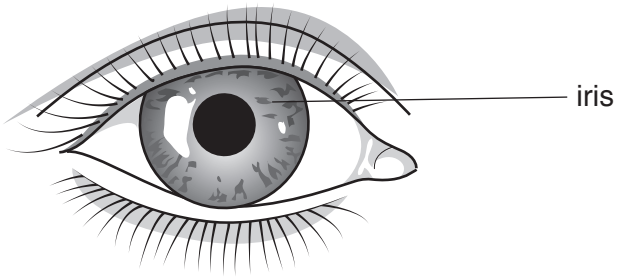


Fig. 6.1

(a) On Fig. 6.2, complete the diagram to show the eye in a dark room.

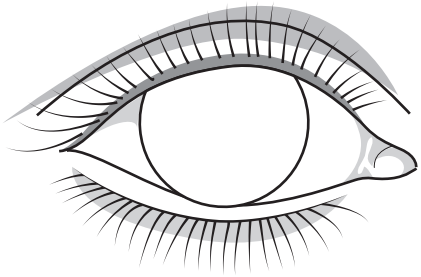


Fig. 6.2

[1]

(b) Fig. 6.3 shows a section through an eye.

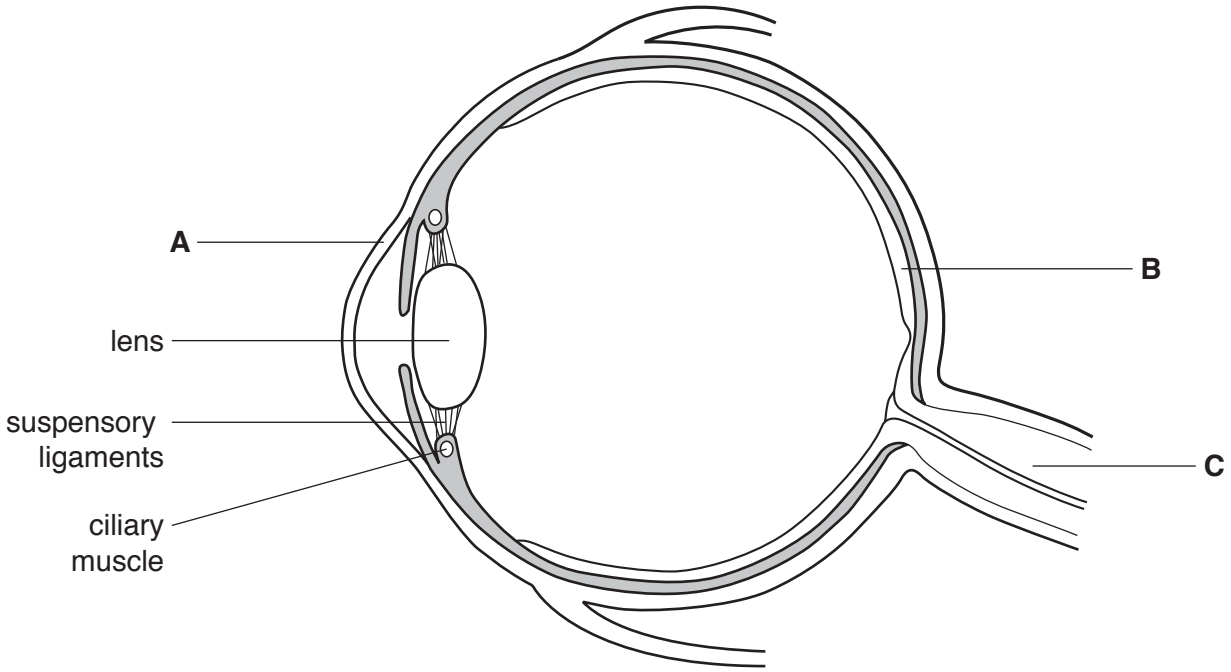


Fig. 6.3

(i) State the name of the structures **A**, **B** and **C** on Fig. 6.3.

A .....

B .....

C .....

[3]

(ii) The eye in Fig. 6.3 is focused on a near object.

The eye then focuses on a distant object.

Describe the changes in the eye to focus on the distant object.

.....

.....

.....

.....

.....

..... [3]

[Total: 7]

7 Four different materials **A**, **B**, **C** and **D** are at room temperature.

They are heated at one end by the same heat source, as shown in Fig. 7.1.

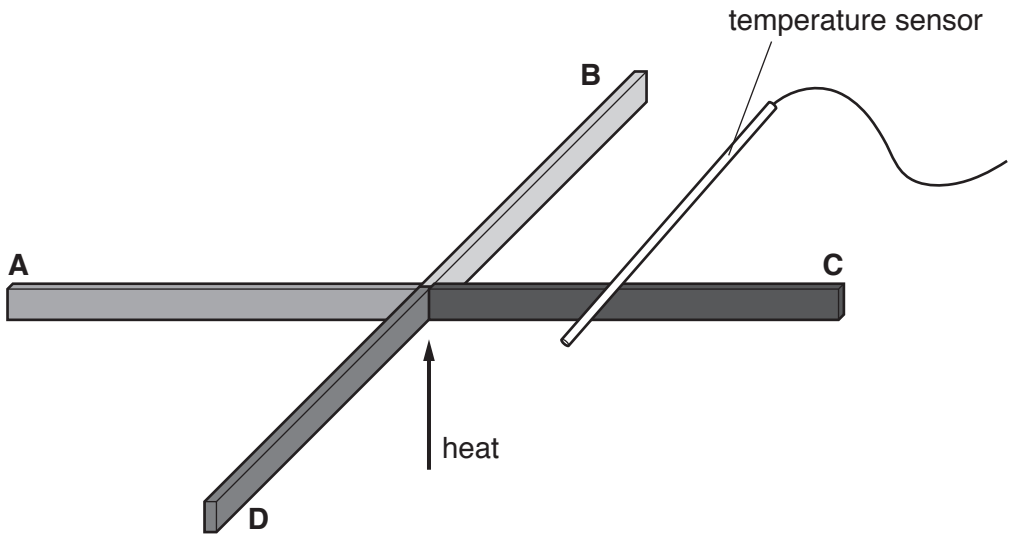


Fig. 7.1

After 2 minutes of heating, temperature sensors are used to measure the temperature at different points along each material.

The results are shown in Table 7.1.

Table 7.1

distance from heat source / cm	0.0	5.0	10.0	15.0	20.0
temperature of material **A** / °C	150	126	101	77	52
temperature of material **B** / °C	150	104	58	22	22
temperature of material **C** / °C	150	137	125	112	100
temperature of material **D** / °C	150	87	25	24	23

(a) (i) State which material, **A**, **B**, **C** or **D**, is the best thermal conductor.

Explain your answer.

material .....

explanation .....

.....

.....

[2]

(ii) Describe **one** physical change to the materials as they are heated.

.....

..... [1]

(b) Use the results in Table 7.1 to determine the room temperature.

..... °C [1]

(c) The temperature sensor shown in Fig. 7.1 is connected to a meter by an electric wire.

Suggest **one** physical property of the sensor which varies with temperature.

..... [1]

[Total: 5]

8 The apparatus used for the fermentation of glucose is shown in Fig. 8.1.

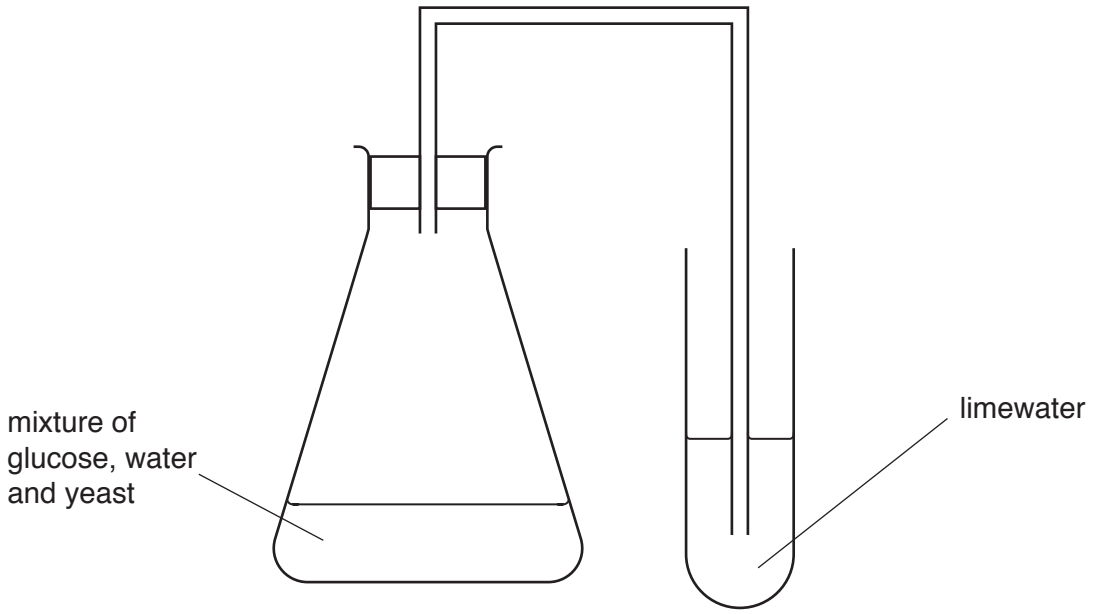


Fig. 8.1

The experiment is left for a few days.

(a) Balance the equation for the fermentation of glucose.

$C_6H_{12}O_6 \longrightarrow$ ..... C_2H_5OH + ... CO_2 [1]

(b) Describe how the limewater changes as the fermentation occurs.

.....

..... [1]

(c) Describe how ethanol is obtained from the mixture after the reaction has finished.

.....

.....

..... [2]

(d) Ethanol is a constituent of wine.

When wine is left open to the air for a few days, a solution that turns universal indicator orange is produced.

State the type of reaction that occurs and suggest the pH of the solution.

type of reaction .....

pH of the solution ..... [2]

[Total: 6]

9 **(a)** Describe **three** ways in which expired air is different to inspired air.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(b) There are two types of respiration: aerobic and anaerobic.

State how anaerobic respiration differs from aerobic respiration in:

production of lactic acid .....

.....

release of energy .....

.....

conditions under which it takes place .....

.....

tissues in which it occurs. .....

.....

[4]

[Total: 7]

10 A scientist studies the waves produced by earthquakes.

When earthquakes move through the Earth, they are detected by sensors on the Earth's surface.

Fig. 10.1 shows an earthquake just underneath the surface of the Earth and two sensors **A** and **B** in a straight line with it.

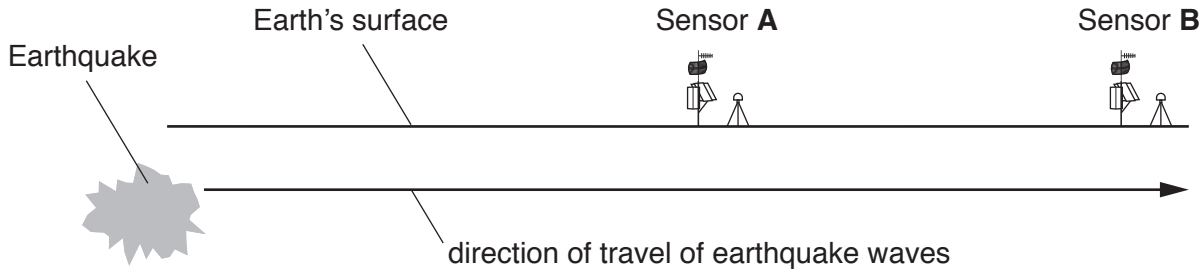


Fig. 10.1

(a) The scientist observes that the sensors show the particles of the ground moving **in the same direction** as the earthquake wave is travelling.

State the name of the type of wave that produces this movement.

..... [1]

(b) (i) Sensor **A** detects the wave at 3 minutes and 48 seconds after the earthquake happens.

Sensor **B** detects the wave at 4 minutes and 17 seconds after the earthquake happens.

Determine the time taken for this wave to travel from sensor **A** to sensor **B**.

time = ... s [1]

(ii) The distance between sensor **A** and sensor **B** is 200 km.

Calculate the speed of this wave.

Use your answer to (**b)(i)** and the equation

$$\text{speed} = \frac{\text{distance}}{\text{time}}.$$

speed = ... km/s [1]

(c) Fig. 10.2 shows the display of this wave on computer screens at sensor **A** and at sensor **B**.

sensor **A** sensor **B**

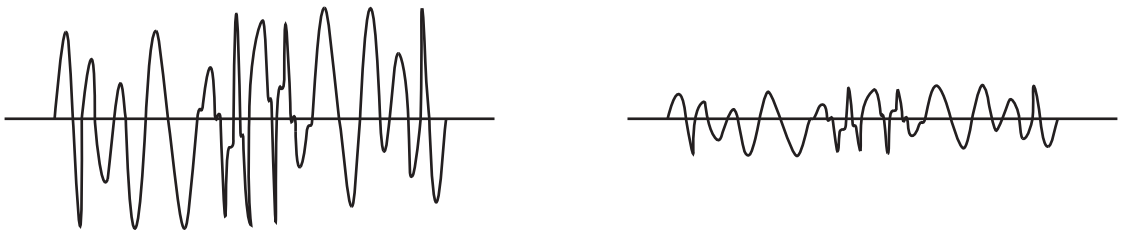


Fig. 10.2

State the difference between this wave when it is at sensor **A** and when it is at sensor **B**.

Explain this difference.

difference .....

explanation .....

.....

.....

[2]

[Total: 5]

11 The following is a list of substances.

ammonium chloride **bromine** **chlorine** **copper carbonate**

copper oxide **ethane** **hydrogen** **methane**

Descriptions of some substances are shown in Table 11.1.

Complete Table 11.1 by selecting the substance from the list that matches the description.

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

Table 11.1

description	substance
the element that is used in the purification of water	
the hydrocarbon that is the main constituent of natural gas	
the substance that reacts with aqueous sodium hydroxide to produce a colourless gas	
the substance that is used to distinguish an unsaturated hydrocarbon from a saturated hydrocarbon	
the substance that reacts with dilute hydrochloric acid to produce a colourless gas	

[5]

12 Choose words or phrases from the list to complete the sentences about excretion.

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

carbon dioxide **gall bladder** **harmless**

hormones **liver** **nitrogen**

plasma **toxic** **water**

Excretion is defined as the removal of ..... materials and the waste products of metabolism from the body.

The gas excreted from the lungs is ..... .

Urea is produced by the ..... and excreted from the kidneys along with excess ..... . [4]

13 A student builds a circuit containing two identical lamps and three ammeters, as shown in Fig. 13.1.

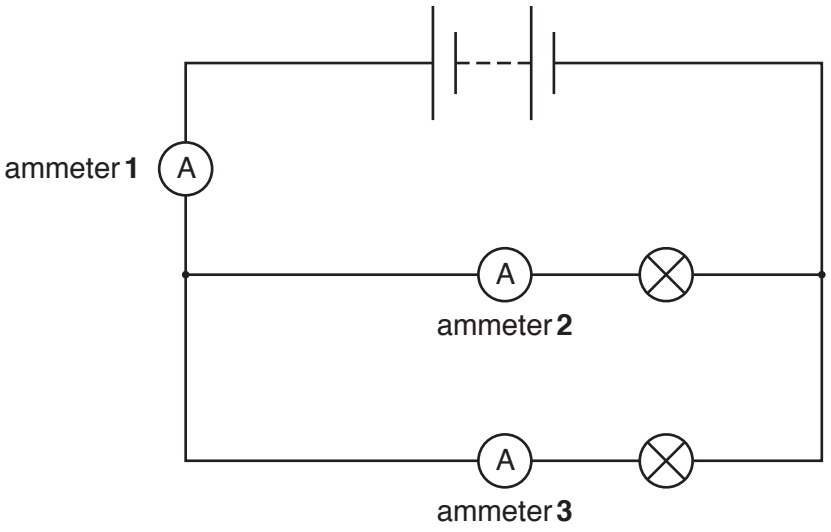


Fig. 13.1

(a) Table 13.1 shows four different sets of ammeter readings.

Put **one** tick in the last column to indicate which set of readings is correct for the circuit in Fig. 13.1.

Table 13.1

ammeter **1** / A	ammeter **2** / A	ammeter **3** / A	correct readings
0.4	0.8	0.8	
0.8	0.4	0.4	
0.8	0.6	0.6	
0.8	0.8	0.8	

[1]

(b) The student measures the *e.m.f. of the battery*.

(i) Name the instrument used to measure e.m.f.

..... [1]

(ii) Explain what is meant by *e.m.f. of a battery*.

.....

.....

..... [2]

(c) The student builds another circuit using a different battery, with a lamp and an ammeter in series.

The reading on the ammeter is 0.86 A.

The resistance of the lamp is 3.5 Ω.

Calculate the e.m.f. of the battery.

State the unit.

e.m.f. = ... unit ..... [3]

[Total: 7]

14 The main gases in clean air are nitrogen and oxygen.

(a) **(i)** Name a different gas that has a **variable** percentage composition in clean air.

..... [1]

(ii) Name a different gas that has a **constant** percentage composition in clean air.

..... [1]

(b) State the property of the gases in liquid air that allows them to be separated by fractional distillation.

..... [1]

(c) State an industrial use of nitrogen.

..... [1]

(d) Oxygen is used during the combustion of fossil fuels and during aerobic respiration.

State **two** other ways in which the combustion of fossil fuels and aerobic respiration are similar.

1 .....

.....

2 .....

.....

[2]

[Total: 6]

15 A student compares the growth of tomato plants in a glasshouse and in the open air.

He starts with twenty young tomato plants of the same age, species and variety.

He grows ten plants inside a glasshouse and ten plants in the open air.

When the plants are mature he obtains the results shown in Table 15.1.

Table 15.1

measurement	situation of tomato plants	
	glasshouse	open air
average height of plant / cm	85	62
average total mass of tomato fruits per plant / g	2500	1200
average mass of one tomato fruit / g	90	60

(a) State **three** ways in which these results show that tomato plants grow better in a glasshouse.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(b) Suggest **three** ways in which the environment inside a glasshouse can be changed to increase the rate of photosynthesis.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

[Total: 6]

[Turn over

16 A student investigates the strength of a magnet.

He uses a steel screw with a sharp tip and a wide head as shown in Fig. 16.1.

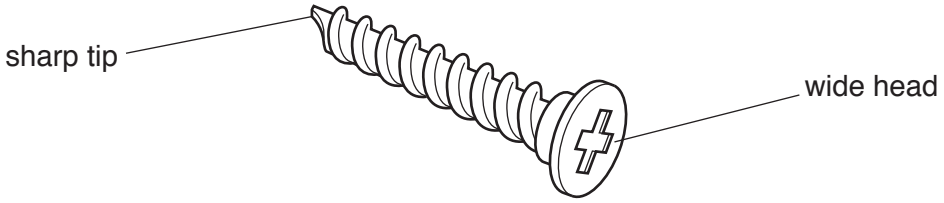


Fig. 16.1

He attaches the head of the steel screw to a spring and places the tip in contact with the magnet as shown in Fig. 16.2.

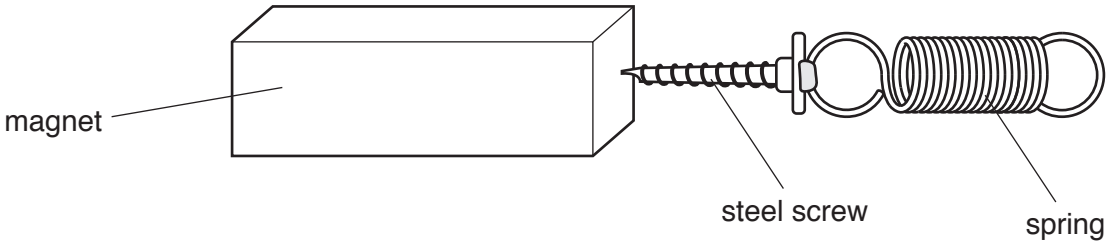
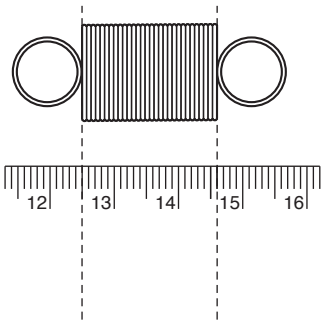


Fig. 16.2

(a) The student pulls on the spring until the screw loses contact with the magnet.

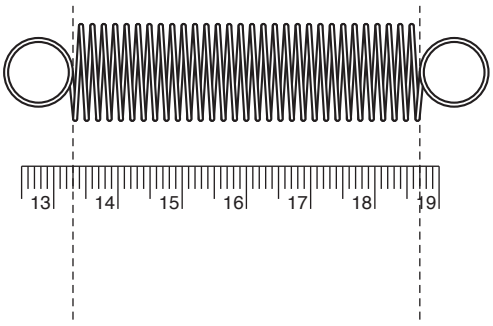
Fig. 16.3 shows the unstretched length of the spring.

Fig. 16.4 shows the stretched length of the spring just before the screw loses contact with the magnet.



unstretched spring

Fig. 16.3



stretched spring

Fig. 16.4

(i) Use Fig. 16.3 and Fig. 16.4 to determine:

the unstretched length of the spring ..... cm

the stretched length of the spring. ..... cm

[1]

(ii) Calculate the extension of the spring.

extension = ... cm [1]

(b) The student repeats the experiment with the wide head of the screw in contact with the magnet and the tip attached to the spring.

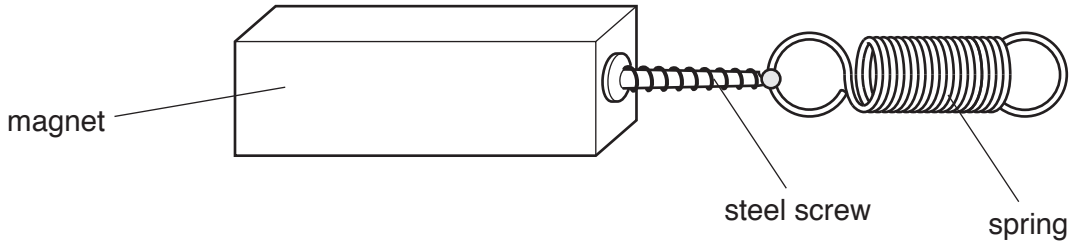


Fig. 16.5

The extension of the spring is greater than the value calculated in **(a)(ii)**.

State the reason for this difference and suggest an explanation.

.....

.....

..... [2]

(c) Steel is a magnetic material.

(i) Name **one** other magnetic material.

..... [1]

(ii) Explain how the magnet produces a force of attraction between itself and the steel.

.....

.....

..... [2]

[Total: 7]

17 Copper and iodine are both elements.

Water is a compound.

(a) Describe the differences between an element and a compound.

.....

.....

.....

.....

..... [3]

(b) Below 0 °C water is ice, a solid.

Above 100 °C water is steam, a gas.

State, in terms of movement and energy, how water particles in ice differ from water particles in steam.

.....

.....

..... [2]

[Total: 5]

18 Amylase is an enzyme produced in the alimentary canal.

(a) State the name of the chemical that amylase digests and the name of the chemical that is produced.

chemical digested .....

chemical produced .....
[2]

(b) State **one** condition that affects the rate at which amylase works.

..... [1]

[Total: 3]

The Periodic Table of Elements

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 –		

Key

atomic number
atomic symbol
name
relative atomic mass

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.).