UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMBINED SCIENCE **5129/22**

Paper 2 **May/June 2013**

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 a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, 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 20.

Electronic calculators may be used.
You may lose marks if you do not use appropriate units.

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 **20** printed pages.

For Examiner's Use

1 Use words from the list to complete the sentences below.

carbon **carbon dioxide** **chemical** **chlorophyll**
haemoglobin **heat** **hormones** **light**
nitrogen **oxygen** **phloem**

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

(a) Energy from the Sun is converted into ..... energy during photosynthesis. This energy is trapped by ..... and used to combine water and ..... to form glucose. [3]

(b) Ions containing ..... are needed for a plant to form proteins. [1]

2 **(a)** Magnesium reacts with nitrogen to produce magnesium nitride.
The equation for the reaction is

$$3Mg + N_2 \longrightarrow Mg_3N_2$$

The relative molecular mass, M_r, of magnesium nitride is 100.
[A_r: Mg, 24; N, 14]

Complete the following sentences.

144 g of magnesium reacts with .....g of nitrogen and produces .....g of magnesium nitride.

14.4 g of magnesium reacts with .....g of nitrogen and produces .....g of magnesium nitride.

2.4 g of magnesium produces .....g of magnesium nitride. [4]

(b) Explain why the bonding in magnesium nitride is ionic.

.....

..... [1]

(c) Nitrogen and oxygen are the major constituents of air.

State the percentages of nitrogen and of oxygen in the air.

nitrogen .....

oxygen ..... [1]

For Examiner's Use

3 Fig. 3.1 shows a measuring cylinder containing a liquid.

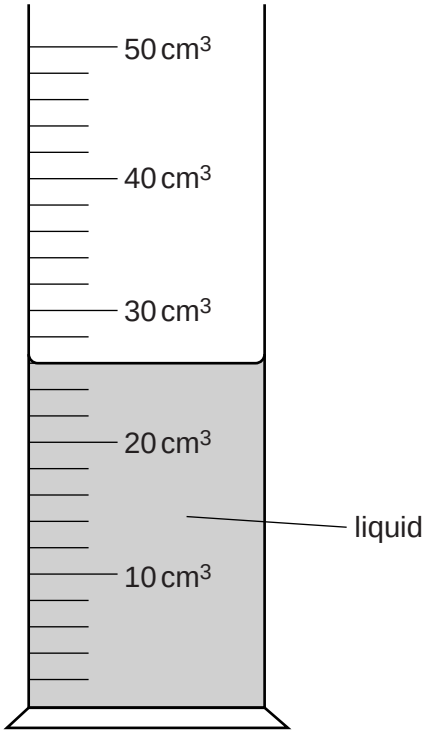


Fig. 3.1

(a) State the volume of the liquid in the cylinder.

volume = ... cm^3 [1]

(b) The mass of the measuring cylinder and the liquid is 30.2g.

The mass of the empty measuring cylinder is 9.4g.

Calculate the density of the liquid.

density = ... units ..... [3]

4 Fig. 4.1 shows how the speed of a runner changes with time.

For Examiner's Use

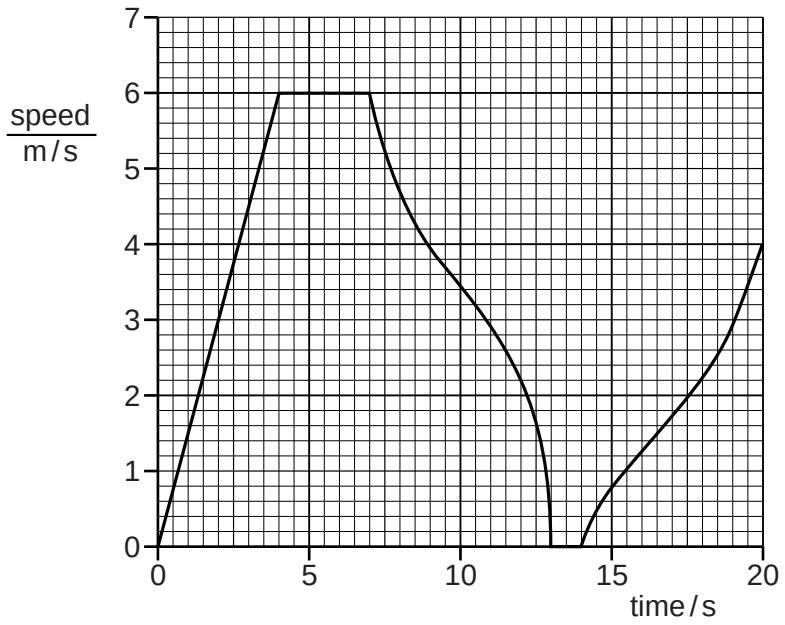


Fig. 4.1

(a) Use Fig. 4.1 to calculate the length of time that the runner is

(i) at rest, ...s

(ii) moving with constant non-zero acceleration. .....s

[2]

(b) Explain why it is possible for the runner to have a constant speed but not have a constant velocity.

.....

..... [1]

(c) The runner has a mass of 70.0 kg.

At one time, the accelerating force produced by the runner is 175 N.

Calculate the acceleration of the runner.

acceleration = ... m/s^2 [2]

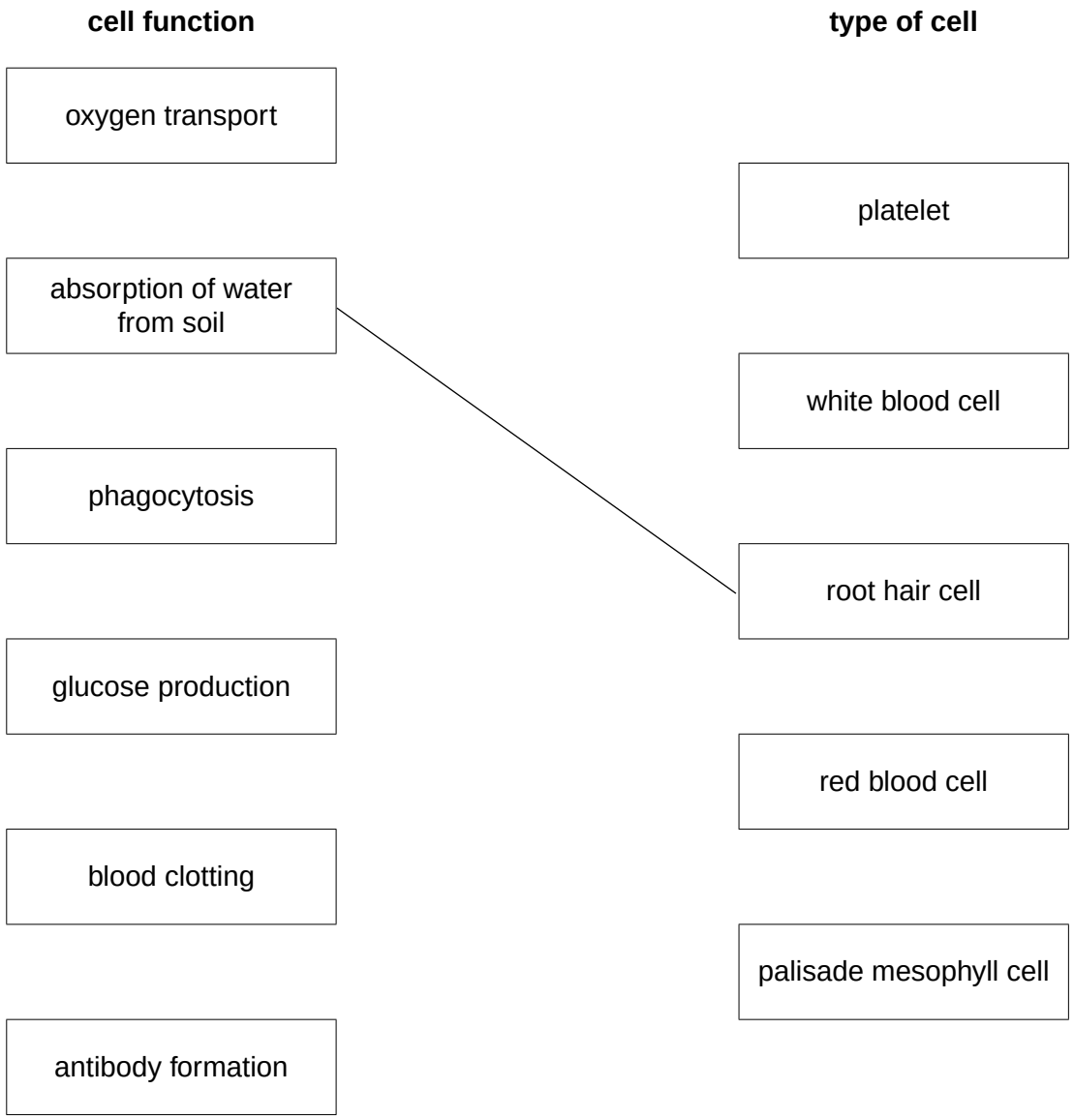
5 Fig. 5.1 shows cell functions and different types of cell.

For Examiner's Use

On Fig. 5.1, draw a line to link each cell function with the type of cell that carries out that function.

One line has been drawn for you.

Each type of cell may be linked-to once, more than once, or not at all.



[5]

Fig. 5.1

6 Element **P** reacts with dilute hydrochloric acid but not with steam.

Element **Q** does **not** react with dilute hydrochloric acid.

Element **R** reacts with both dilute hydrochloric acid and cold water.

Element **S** reacts with both dilute hydrochloric acid and steam but not cold water.

For Examiner's Use

(a) Deduce the order of reactivity of the elements **P**, **Q**, **R** and **S**.

most reactive .....

.....

.....

least reactive ..... [2]

(b) When element **S** reacts with dilute hydrochloric acid, hydrogen is given off and a solution of the chloride of **S** is produced.

(i) State the test for hydrogen.

test .....

result .....

..... [2]

(ii) Element **S** forms an ion S^{2+}.

Deduce the formula of the chloride of **S**. ..... [1]

(c) One of the four elements **P**, **Q**, **R** and **S** is zinc.

Complete the equation for the reaction of zinc with steam.

$$Zn + H_2O \longrightarrow \text{.....} + \text{.....}$$ [1]

7 A weight-lifter lifts a weight of 1700N.

For Examiner's Use

(a) Calculate the work done on the weight in lifting it through a vertical distance of 2.0m.

work done = ... J [2]

(b) Complete the following sentence.

As the weight is being lifted, the useful energy changes are from

..... energy of the weight-lifter to .....

energy and ..... energy of the weight. [2]

8 Sound is an example of a longitudinal wave.

Air particles vibrate as the sound wave passes through the air.

(a) Fig. 8.1 shows the direction of vibration of an air particle as a sound wave moves through the air.

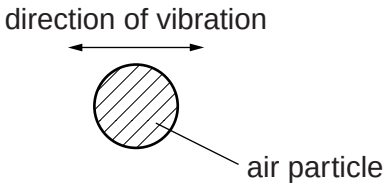


Fig. 8.1

On Fig. 8.1, draw an arrow to show a possible direction of the sound wave. [1]

(b) **(i)** Explain what is meant by *frequency*.

.....

..... [1]

(ii) A sound wave has a frequency of 200Hz and travels at a speed of 340m/s.

Calculate the wavelength of the sound wave.

wavelength = ... m [2]

9 Amylase is an enzyme that digests starch.

(a) State the chemical produced when amylase digests starch.

..... [1]

Iodine solution is a brown liquid. When starch and iodine solution are mixed together, the starch grains are stained black.

An experiment used to investigate amylase digesting starch is shown in Fig. 9.1.

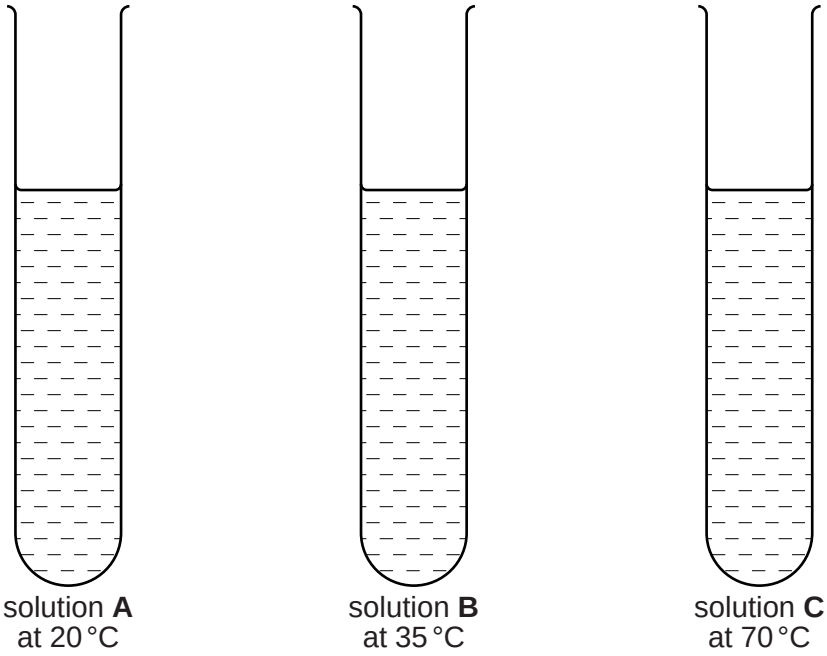


Fig. 9.1

Each tube contains the same concentrations of starch, amylase and iodine solution.

Each tube is kept at a different temperature, as shown in Fig. 9.1.

Table 9.1 shows the results of this experiment.

Table 9.1

time / min	colour of solution		
	solution **A**	solution **B**	solution **C**
1	black	black	black
15	black	brown	black
25	brown	brown	black

(b) Explain why solutions **A** and **B** change from black to brown.

For Examiner's Use

.....

.....

.....

..... [2]

(c) **(i)** State which solution turns brown most quickly.

..... [1]

(ii) Explain the difference in the timing of the colour change in solutions **A** and **B**.

.....

.....

.....

..... [2]

(iii) Explain why solution **C** remains black.

.....

.....

.....

..... [2]

10 Fig. 10.1 shows some reactions of ethene.

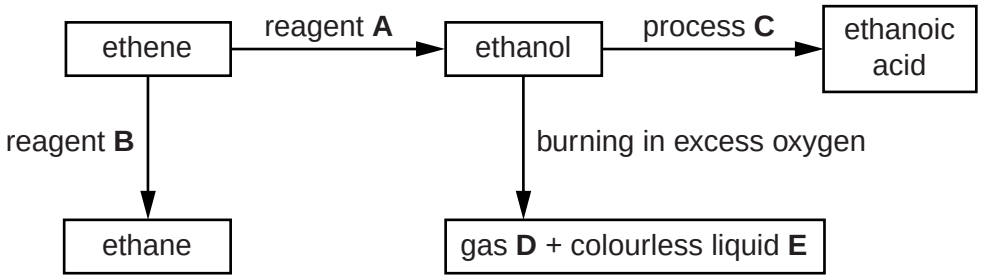


Fig. 10.1

(a) (i) Identify the reagents **A** and **B** and process **C**.

reagent **A** .....

reagent **B** .....

process **C** ..... [3]

(ii) Identify gas **D** and liquid **E**.

gas **D** .....

liquid **E** ..... [2]

(b) The molecular formula of ethanol is C_2H_5OH.

(i) Draw the structure of ethanol.

[1]

(ii) State one use of ethanol.

..... [1]

11 Fig. 11.1 shows a lighting circuit.

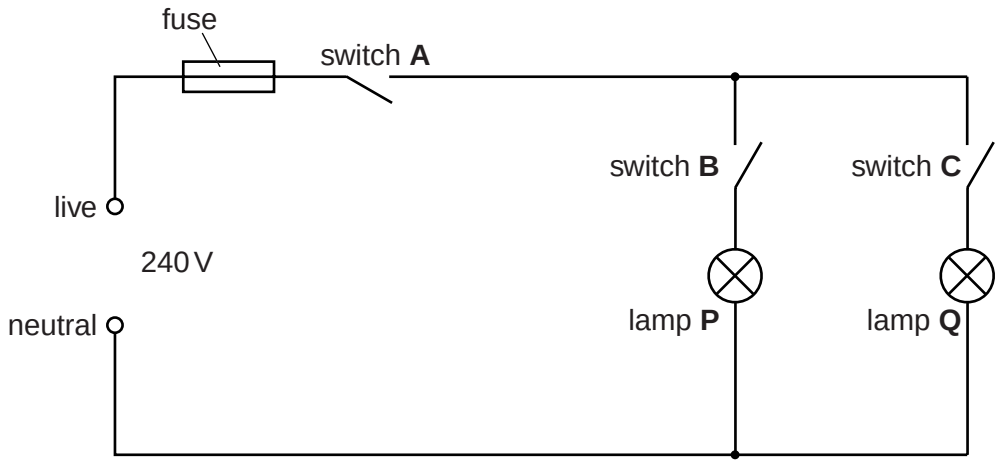


Fig. 11.1

(a) Switch **A** is left open and switches **B** and **C** are closed.

State which lamp or lamps, if any, will light. ..... [1]

(b) The circuit contains a fuse.

The fuse has a rating of 3A.

Explain what is meant by the *fuse rating*.

.....

..... [2]

(c) When all the switches are closed to light both lamps, the current in lamp **P** is 0.25A and the current in lamp **Q** is 0.35A.

(i) Calculate the current in the fuse.

current = ... A [1]

(ii) The p.d. across lamp **P** when lit is 240V and the current in it is 0.25A.

Calculate the power of lamp **P**.

power = ... W [2]

12 Fig. 12.1 shows an electromagnet, an iron rod and a permanent magnet.
The poles of the permanent magnet are marked.

For Examiner's Use

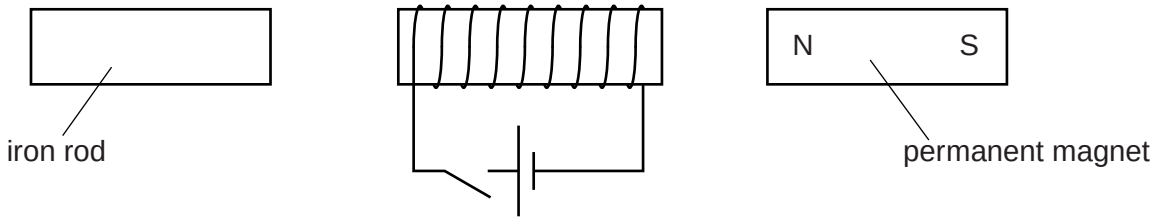


Fig. 12.1

(a) The current in the electromagnet is switched on and the iron rod becomes magnetised.

Both the iron rod and the permanent magnet are attracted to the electromagnet.

On Fig. 12.1, mark the poles of the iron rod. [1]

(b) The current in the electromagnet is now reversed.

(i) State whether the iron rod is attracted, repelled or neither attracted nor repelled.

The iron rod is ..... .

(ii) State whether the permanent magnet is attracted, repelled or neither attracted nor repelled.

The permanent magnet is ..... .

[2]

13 **(a)** Complete Table 13.1.

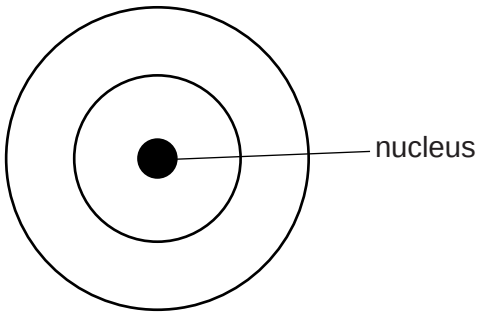
For Examiner's Use

particle	number of protons	number of neutrons	number of electrons
^{16}O	8		8
^{27}Al		14	13
$^{35}Cl^-$		18	18
$^{40}Ca^{2+}$	20	20	

[4]

Table 13.1

(b) Complete Fig. 13.1 to show the electronic structure of ^{16}O.



[1]

Fig. 13.1

14 Fig. 14.1 shows a flower.

For Examiner's Use

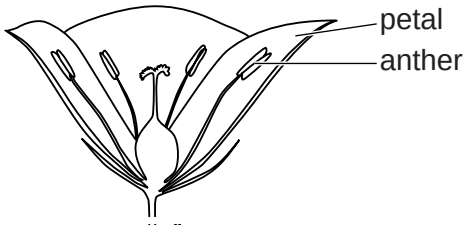


Fig. 14.1

(a) **(i)** State the function of petals.

.....

..... [1]

(ii) State the function of anthers.

.....

..... [1]

(b) Fig. 14.2 shows a section through a seed.

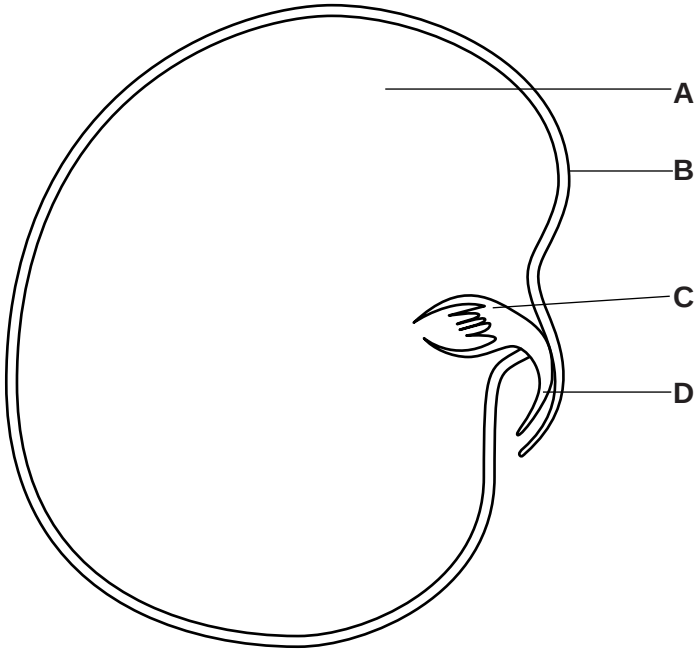


Fig. 14.2

(i) Use letters from the diagram to identify

1. the testa, ...

2. the radicle. .....

[2]

(ii) State a function of the cotyledon.

.....

..... [1]

(c) **(i)** State two ways in which seeds are dispersed.

1. .....

.....

2. .....

.....

[2]

(ii) Explain why it is important for seeds to be dispersed.

.....

..... [1]

(d) Complete Table 14.1 to show differences between asexual reproduction and sexual reproduction for the given features.

Table 14.1

feature	asexual reproduction	sexual reproduction
number of parents		
appearance of offspring		

[2]

15 Fig. 15.1 shows a heater emitting infra-red radiation.

For Examiner's Use

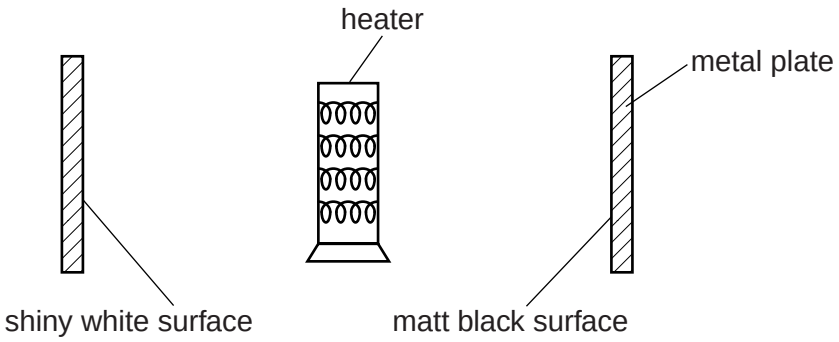


Fig. 15.1

Two metal plates are placed equal distances from the heater.

One plate has a shiny white surface and the other plate has a matt black surface.

(a) There is a large air-gap between each plate and the heater.

Suggest why there is very little heating of the plates by

(i) conduction, ...

..... [1]

(ii) convection. .....

..... [1]

(b) Explain why the plate with the matt black surface heats up more quickly than the plate with the shiny white surface.

.....

..... [1]

(c) Infra-red radiation is part of the electromagnetic spectrum.

Name two components of the electromagnetic spectrum with longer wavelengths than infra-red radiation.

1. .....

2. .....
[2]

16 The following is a list of metals.

For Examiner's Use

copper **iron** **lead**

sodium **zinc**

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

From the list, select the metal that

(a) **(i)** is extracted from haematite,

.....

(ii) is used for electrical wiring,

.....

(iii) forms compounds which pollute the air,

.....

(iv) is used in galvanising.

..... [4]

(b) Brass is an alloy.

(i) State what is meant by the term *alloy*.

..... [1]

(ii) Explain why metals are made into alloys.

.....

..... [1]

17 Fig. 17.1 shows a magnet being pushed towards a coil to induce an e.m.f.

For Examiner's Use

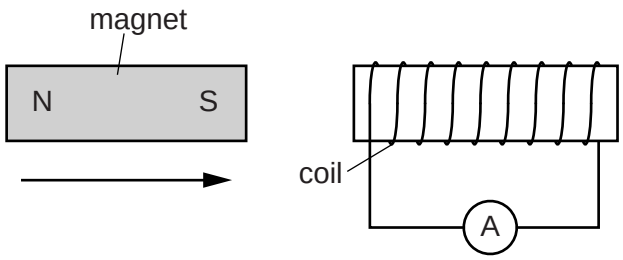


Fig. 17.1

A current is induced in the coil.

Explain how the induced current produces effects that oppose the motion of the magnet.

.....

.....

..... [2]

18 **(a)** Define a *drug*.

.....

.....

.....

..... [2]

(b) **(i)** Alcohol is a drug.

State **three** effects that the excessive consumption of alcohol may have on a person.

1. .....

.....

2. .....

.....

3. .....

.....

[3]

(ii) Name a drug of abuse other than alcohol.

..... [1]

19 A student breaks a bottle containing potassium nitrate crystals.

For Examiner's Use

In order to separate the potassium nitrate from the broken glass, the student adds the mixture to water.

Use words from the list below to complete the following sentences.

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

distillation **filtration** **insoluble** **soluble**

solute **solution** **solvent**

The potassium nitrate dissolves in the water to form a colourless ..... .

The glass is ..... in water and is removed from the solution by

..... . In this experiment the potassium nitrate acts as the

..... .

[4]

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II										III	IV	V	VI	VII	0
							1 H Hydrogen 1									4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4										11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12										27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	209 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	147 Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	231 Pa Protactinium 91	238 U Uranium 92	237 Np Neptunium 93	244 Pu Plutonium 94	243 Am Americium 95	247 Cm Curium 96	247 Bk Berkelium 97	251 Cf Californium 98	252 Es Einsteinium 99	257 Fm Fermium 100	258 Md Mendelevium 101	259 No Nobelium 102	260 Lr Lawrencium 103

* 58–71 Lanthanoid series
† 90–103 Actinoid series

Key

a X b	a = relative atomic mass X = atomic symbol b = atomic (proton) number

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