Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6492117810

PHYSICAL SCIENCE **0652/31**

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

1 hour 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 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.
A copy of the Periodic Table is printed on page 16.
You may lose marks if you do not show your working or 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 **16** printed pages.

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1 Three cars travel along the same straight track in a race.

Fig. 1.1 shows the speed–time graph for each car.

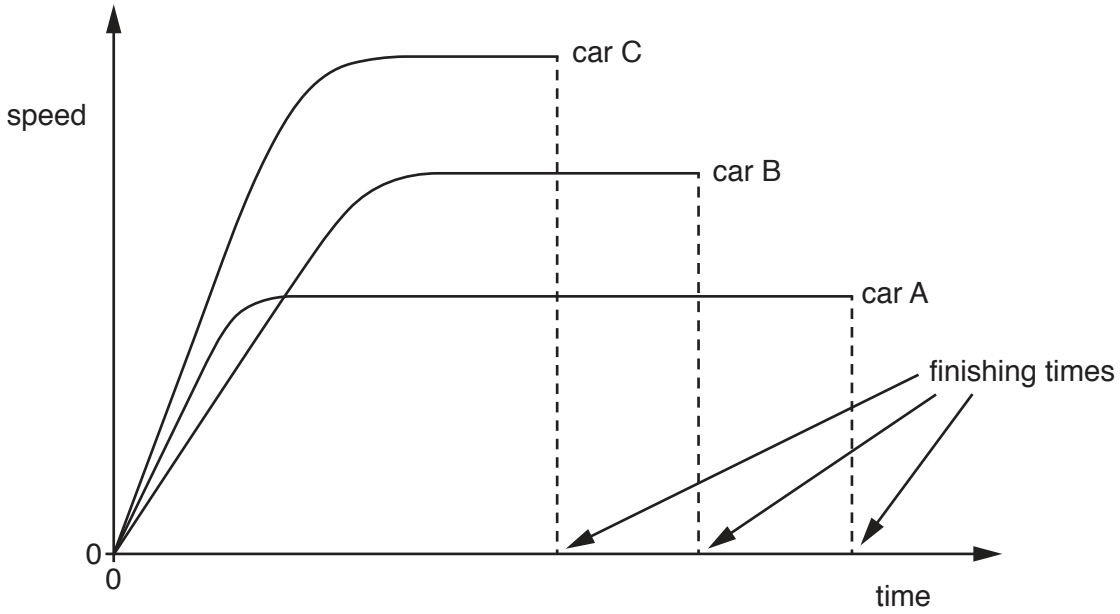


Fig. 1.1

(a) State which car:

(i) completes the course in the shortest time

..... [1]

(ii) has the greatest acceleration at the start

..... [1]

(iii) has the lowest final speed.

..... [1]

(b) Circle the word in the list that completes the sentence.

acceleration **average speed** **top speed**

The car which finishes any race in the shortest time is always the car that has the greatest ..... . [1]

(c) Each car in a race travels the same distance.

Describe how this is shown by the speed–time graph in Fig. 1.1.

.....

.....

..... [1]

[Total: 5]

2 Lithium is an element in the Periodic Table.

(a) Use words from the box to complete these sentences.

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

one	**two**	**three**	**four**	**five**
six	**seven**	**eight**	**nine**	**ten**

Lithium is an element in Group ..... of the Periodic Table.

A lithium ion has a positive charge of ..... .

An atom of lithium has a total of ..... electrons.

Lithium has a mass number (nucleon number) of ..... .

[4]

(b) Lithium reacts with chlorine to make lithium chloride.

Balance the equation for the reaction.

..... Li + Cl_2 → ..... LiCl [1]

[Total: 5]

3 Fig. 3.1 shows methods of generating electricity.

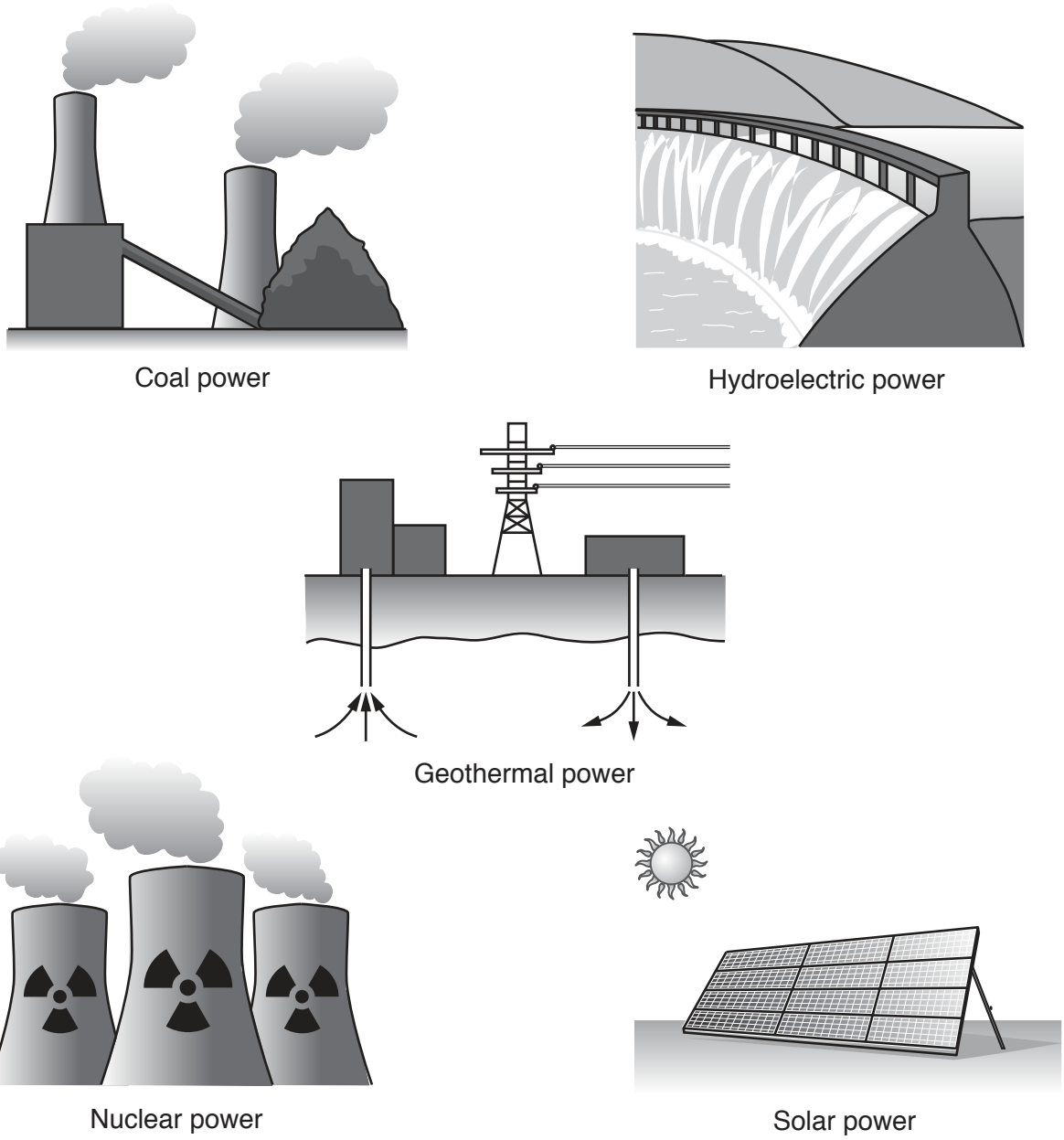


Fig. 3.1

(a) Name a method of generating electricity which is:

(i) renewable ..... [1]

(ii) non-renewable. ..... [1]

(b) Name the method of generating electricity that is best suited to a location with:

(i) many hours of sunshine ..... [1]

(ii) mountains and high rainfall ..... [1]

(iii) hot water bubbling from beneath the ground. ..... [1]

(c) **(i)** Suggest **two** reasons why it is expensive to generate electricity in nuclear power stations.

reason 1 .....

.....

reason 2 .....

.....

[2]

(ii) Complete the flow diagram in Fig. 3.2 to show the energy transfers when electricity is generated in a nuclear power station.

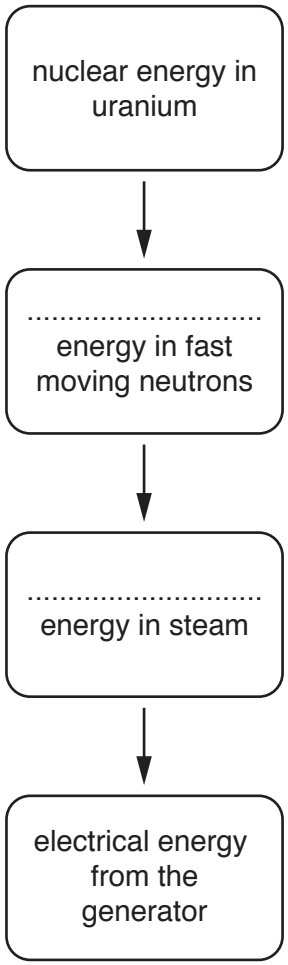


Fig. 3.2

[2]

(d) Solar panels are attached to the roofs of houses of different sizes.

Explain why more electricity can be generated by a house with a larger roof.

.....

..... [1]

[Total: 10]

4 Fig. 4.1 shows apparatus used to react hydrogen with copper(II) oxide.

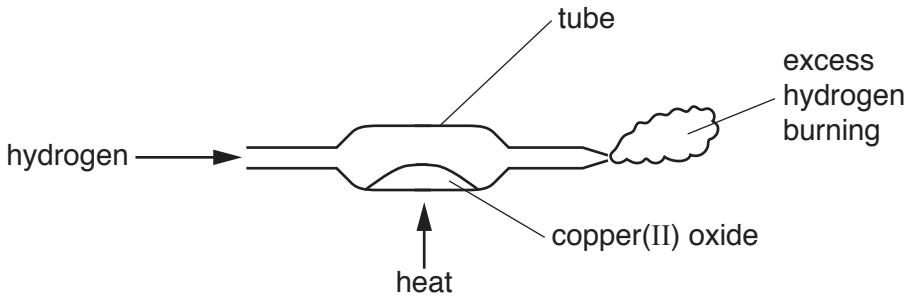


Fig. 4.1

The equation for the reaction is shown.

$$H_2 + CuO \rightarrow H_2O + Cu$$

(a) Copper(II) oxide is black.

Suggest the colour of the product formed in the tube.

..... [1]

(b) State which substance is reduced in this reaction.

Give a reason for your answer.

substance reduced .....

reason.....

.....

[2]

(c) Water vapour is formed when the excess hydrogen burns.

(i) Name the process that turns water vapour into liquid water.

..... [1]

(ii) A chemical test shows that the liquid is water.

Name the chemical used in the test and state the result of a positive test.

name .....

result .....

.....

[2]

[Total: 6]

5 A student builds a circuit to measure resistance.

Part of the circuit is shown in Fig. 5.1.

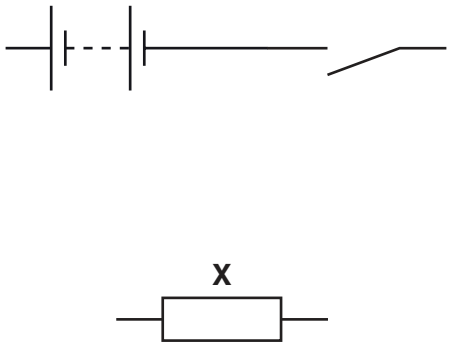


Fig. 5.1

(a) (i) Complete the series circuit diagram in Fig. 5.1 by adding an ammeter and suitable connecting wires to measure the current in component **X**. [2]

(ii) Add a voltmeter to the circuit diagram in Fig. 5.1 to measure the potential difference across component **X**. [1]

(b) (i) Name component **X**.

..... [1]

(ii) The circuit is complete and the switch is closed.

The potential difference across **X** is 3.0 V. The current in **X** is 0.02 A.

Calculate the resistance of component **X**.

Show your working.

resistance = ... ohms [2]

[Total: 6]

6 Fig. 6.1 shows the apparatus used for the electrolysis of molten lead(II) bromide.

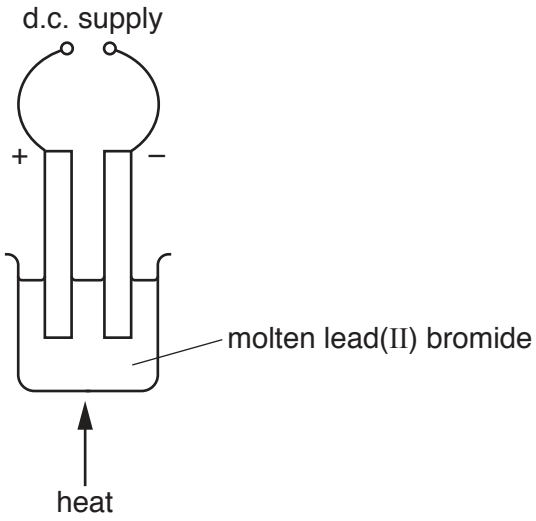


Fig. 6.1

(a) **(i)** Label the anode **and** cathode on the diagram. [1]

(ii) State **two** reasons why the anode and cathode are made from carbon.

1. .....

2. .....

[2]

(b) Name the products formed at each electrode.

anode .....

cathode .....

[2]

(c) The lead(II) bromide is allowed to solidify.

State the effect this has on the electrolysis.

.....

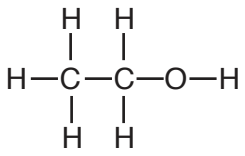
..... [1]

[Total: 6]

7 **(a)** Information about different organic compounds is shown in Table 7.1.

Complete Table 7.1 to show the missing information.

Table 7.1

name	formula	structure
methane		
	C_2H_6	
	C_2H_4	
		

[8]

(b) **(i)** State **one** use of methane.

..... [1]

(ii) Name **one** source of methane.

..... [1]

[Total: 10]

8 **(a)** A student investigates magnetic and non-magnetic materials.

He tests four metal bars labelled **A**, **B**, **C** and **D**. His observations are shown in Fig. 8.1.

One end of bar ***A*** attracts one end of bar **D** but repels the other end of bar **D**.

Both ends of bar ***A*** attract both ends of bar **B**.

There are no forces between any of the ends of bars ***C*** and **D**.

Fig. 8.1

Identify each bar using words or phrases from the list.

You may use each word or phrase once, more than once or not at all.

aluminium **soft iron** **a permanent magnet**

A .....

B .....

C .....

D .....

[3]

(b) On Fig. 8.2, draw the pattern and direction of the magnetic field around the magnet.

You should draw at least six field lines.

Fig. 8.2

[3]

(c) A magnet is placed on a pivot so that it is free to rotate.

A current carrying wire is moved close to the magnet, as shown in Fig. 8.3.

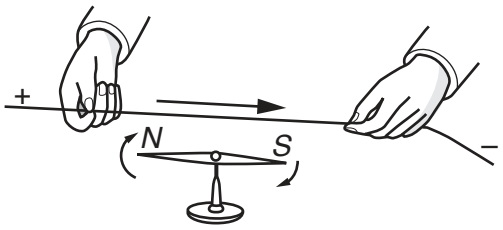


Fig. 8.3

The magnet rotates when the current carrying wire is placed near it.

State what causes this movement.

.....

..... [1]

(d) A simple electromagnet is made by winding 20 turns of wire around a pencil, as shown in Fig. 8.4.

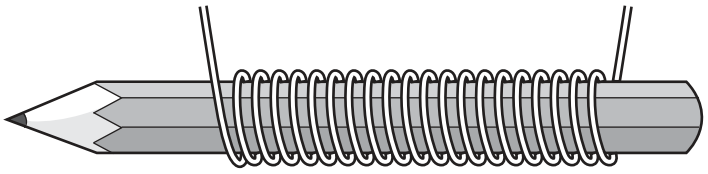


Fig. 8.4

The wire is connected to a power supply.

There is not enough wire to increase the number of turns.

Suggest **two other** ways of increasing the strength of the electromagnet.

1. .....

.....

2. .....

.....

[2]

[Total: 9]

9 Background radiation is present all the time.

Some of the background radiation comes from outer space.

(a) Name **one** other source of background radiation.

..... [1]

(b) A radioactive source has a half-life of 10 years.

Describe how the rate of emissions from this radioactive source will change over a 20-year period.

.....

.....

.....

..... [2]

(c) Paper is made to a constant thickness by passing between rollers.

The thickness of the moving paper is measured using a source of beta-radiation.

Fig. 9.1 shows this.

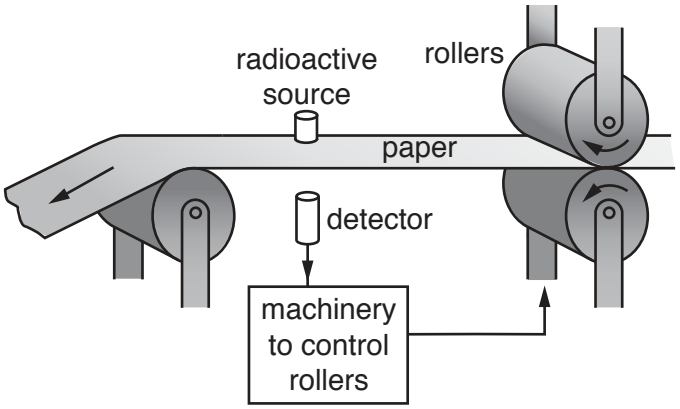


Fig. 9.1

As the rollers are squeezed together the paper gets thinner.

State the effect this has on:

(i) the amount of beta-radiation absorbed by the paper

..... [1]

(ii) the amount of beta-radiation detected by the detector.

..... [1]

(d) Beta-radiation consists of beta-particles.

Describe the nature of beta-particles.

.....

.....

..... [2]

(e) **(i)** Explain why it is necessary to take safety precautions when working with radioactive sources.

.....

.....

.....

..... [2]

(ii) Give **one** safety precaution that is taken when working with radioactive sources.

.....

..... [1]

[Total: 10]

[Turn over

10 **(a)** Ammonia, NH_3, is made by reacting nitrogen with hydrogen.

The reaction is very slow.

Describe **two** ways of increasing the rate of this reaction.

1. .....

2. .....

[2]

(b) Name a common mixture which contains a large proportion of nitrogen gas.

State the percentage of nitrogen in this mixture.

common mixture .....

percentage of nitrogen .....

[2]

(c) The bonding in ammonia, NH_3, is covalent.

(i) Draw a dot-and-cross diagram to show the arrangement of the outer electrons in a molecule of ammonia.

[2]

(ii) Name a covalent compound containing hydrogen and oxygen.

..... [1]

(iii) Name the type of bonding which involves electron transfer.

..... [1]

[Total: 8]

11 Information about some acids and bases is shown in Table 11.1.

Table 11.1

substance	acidity	colour of litmus when added	pH
hydrochloric acid	strong acid	.....	2
sulfuric acid	.....	red	2
sodium hydroxide	strong base	.....	14
ammonia	weak base	blue	.....

(a) Complete Table 11.1 to show the missing information. [4]

(b) Sodium hydroxide reacts with sulfuric acid.

Name the **two** products.

1. .....

2. .....
[1]

[Total: 5]

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.).