



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

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**PHYSICAL SCIENCE**

**0652/42**

Paper 4 (Extended)

**October/November 2018**

**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, graphs, tables or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

A copy of the Periodic Table is printed on page 20.

Electronic calculators may be used.

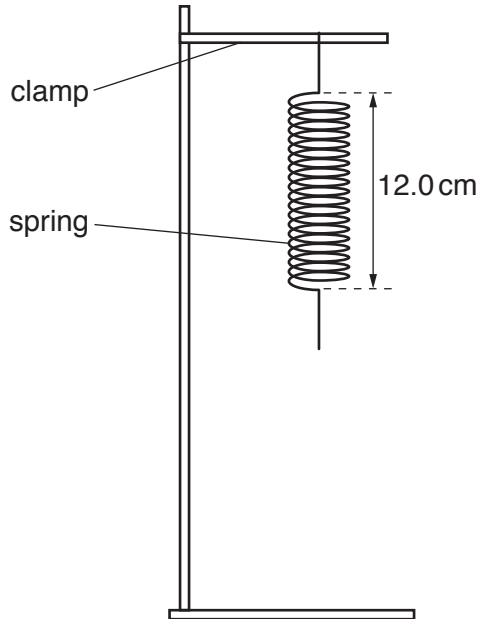
At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

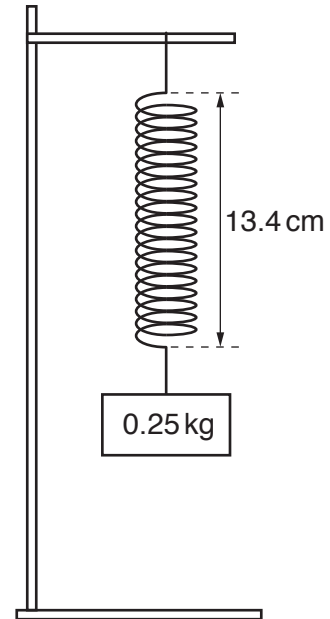
This document consists of **20** printed pages.

1 Fig. 1.1 shows a spring suspended from a clamp.

Fig. 1.2 shows the same spring with a mass of 0.25 kg attached.



**Fig. 1.1**



**Fig. 1.2**

The length of the spring in Fig. 1.1 is 12.0 cm.

The length in Fig. 1.2 is 13.4 cm.

(a) (i) Calculate the weight of the 0.25 kg mass. Use  $g = 10 \text{ N/kg}$ .

weight = ..... N [1]

(ii) Calculate the extension of the spring when the 0.25 kg mass is attached to it.

extension = ..... cm [1]

(b) The extension of the spring is proportional to the load attached.

Calculate the length of the spring when the 0.25 kg mass is replaced by a 0.10 kg mass.

Show your working

length = ..... cm [2]

(c) Fig. 1.3 shows a graph of load against extension for another spring.

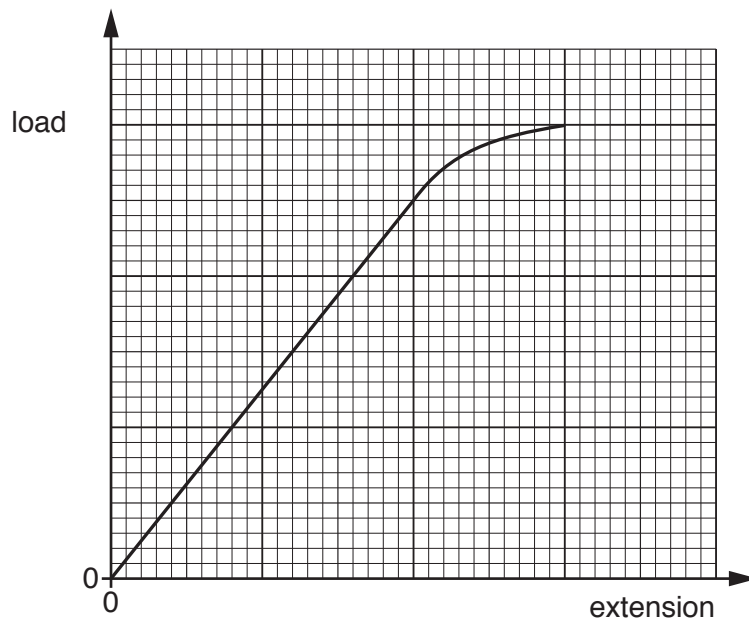


Fig. 1.3

On Fig. 1.3, mark, with an **X**, the limit of proportionality of the spring.

[1]

[Total: 5]

2 Fig. 2.1 shows a mixture of two different metal atoms in a solid.

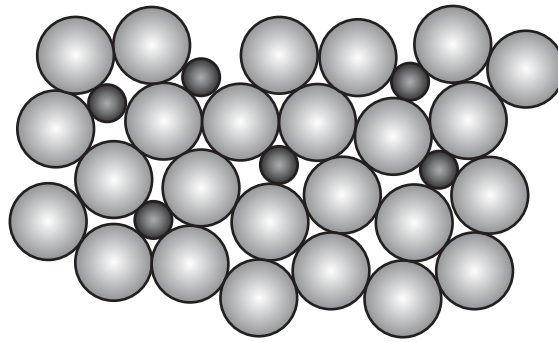


Fig. 2.1

(a) (i) State the name of this type of mixture of metals.

..... [1]

(ii) The arrangement of atoms shown in Fig. 2.1 makes the solid less malleable than a solid metal consisting of only one type of atom.

Explain why.

.....  
 .....  
 .....  
 ..... [3]

(b) Copper is a metal.

State **one** use for copper and state which of its properties are related to this use.

use .....

property .....

..... [2]

(c) Chalcopyrite is the main ore of copper.

It contains copper, Cu, iron, Fe, and sulfur, S.

Table 2.1 shows the charges on the ions in chalcopyrite.

**Table 2.1**

element	charge on the ion
Cu	1+
Fe	3+
S	2-

Suggest a possible formula of chalcopyrite.

..... [2]

[Total: 8]

3 Fig. 3.1 shows a crane lifting a tree trunk onto a lorry.

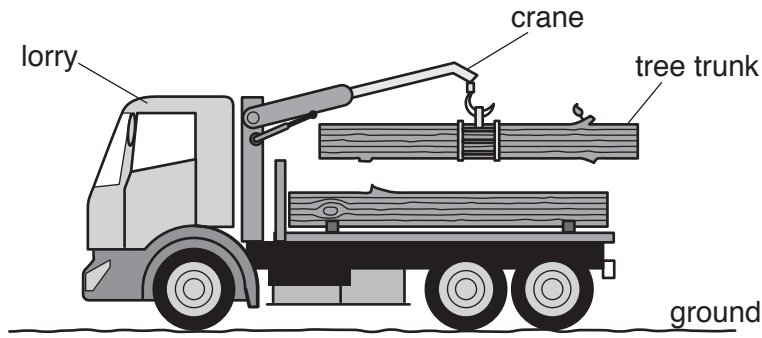


Fig. 3.1

(a) State the form of energy the tree trunk has gained when held stationary above the ground, as in Fig. 3.1.

..... [1]

(b) The tree trunk has a weight of 96 000 N.

The crane lifts the tree trunk to a maximum height of 3.2 m in 25 s.

(i) Calculate the work done by the crane against gravity in lifting the tree trunk.

Show your working and give the unit.

work done = ..... unit ..... [3]

(ii) Calculate the power output of the crane when lifting the tree trunk.

power = ..... W [2]

(iii) The power input to the crane when lifting the tree trunk is greater than the power output calculated in (ii).

Suggest a reason for this.

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

[Total: 7]

- 4 A student tests four unidentified metals, labelled **W**, **X**, **Y** and **Z**, using water and dilute acid.

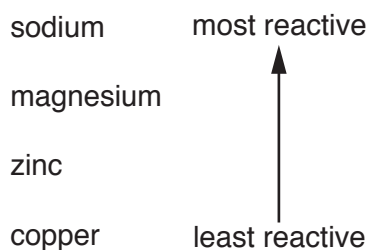
Table 4.1 shows the student's observations.

**Table 4.1**

metal label	reaction with water or steam	reaction with dilute acid
<b>W</b>	reacts with steam, bubbles of gas produced	reacts quickly, bubbles of gas produced
<b>X</b>	no reaction	no reaction
<b>Y</b>	no reaction	slow reaction, bubbles of gas produced
<b>Z</b>	reacts vigorously with cold water, bubbles of gas produced	violent reaction, bubbles of gas produced

- (a) (i) Suggest how the observations show that **none** of the metals are caesium.  
 ..... [1]
- (ii) Suggest the pH of the solutions formed by the reaction of the metals **W** and **Z** with water or steam.  
 ..... [1]
- (b) The metals are identified as sodium, magnesium, zinc and copper.

Fig. 4.1 shows the order of reactivity for these metals.



**Fig. 4.1**

Use Table 4.1 and Fig. 4.1 to deduce the identities of the metals, **W**, **X**, **Y** and **Z**.

- W** .....
- X** .....
- Y** .....
- Z** .....

[2]

- (c) The student investigates the reaction of aluminium and zinc with acid.

She puts same-sized pieces of zinc and aluminium into separate test-tubes of acid of the same concentration, as shown in Fig. 4.2.

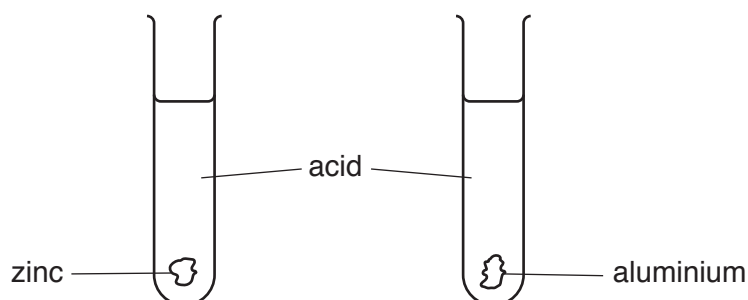


Fig. 4.2

She observes that aluminium takes more time to react than zinc.

- (i) Aluminium is higher in the reactivity series than zinc.

State why aluminium takes **more** time to react than zinc. Give a reason for your answer.

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

- (ii) Write the balanced symbol equation for the reaction of aluminium with hydrochloric acid,  $\text{HCl}$ , to form aluminium chloride,  $\text{AlCl}_3$ , and hydrogen gas,  $\text{H}_2$ .

..... [2]

[Total: 8]



5 Fig. 5.1 shows the construction of a simple solar panel used to produce hot water.

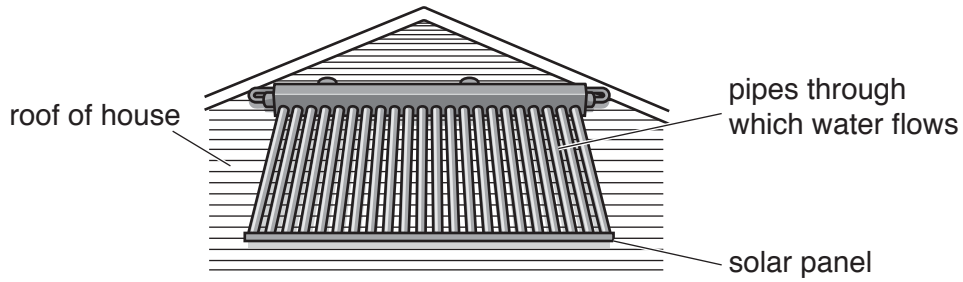


Fig. 5.1

(a) Name the process by which energy is transferred from the Sun to the Earth.

..... [1]

(b) The pipes in this type of solar panel are painted black.

Explain why.

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

(c) (i) Name the process by which energy is transferred from the outside of the pipes to the inside of the pipes.

..... [1]

(ii) Use ideas about particles to describe how the energy is transferred through solids.

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

[Total: 5]



- (c) Sodium bromide reacts with chlorine in a displacement reaction. The equation for the reaction is shown.



Predict what will happen when iodine is added to sodium bromide.

Give a reason for your answer.

prediction .....

reason .....

..... [1]

- (d) Table 6.1 shows some physical properties of elements in Group VII.

**Table 6.1**

	state at room temperature	melting point /°C	boiling point /°C
fluorine	gas	-219	-188
chlorine	gas	-101	-34
bromine	liquid	-7	.....
iodine	solid	114	184
astatine	.....	302	337

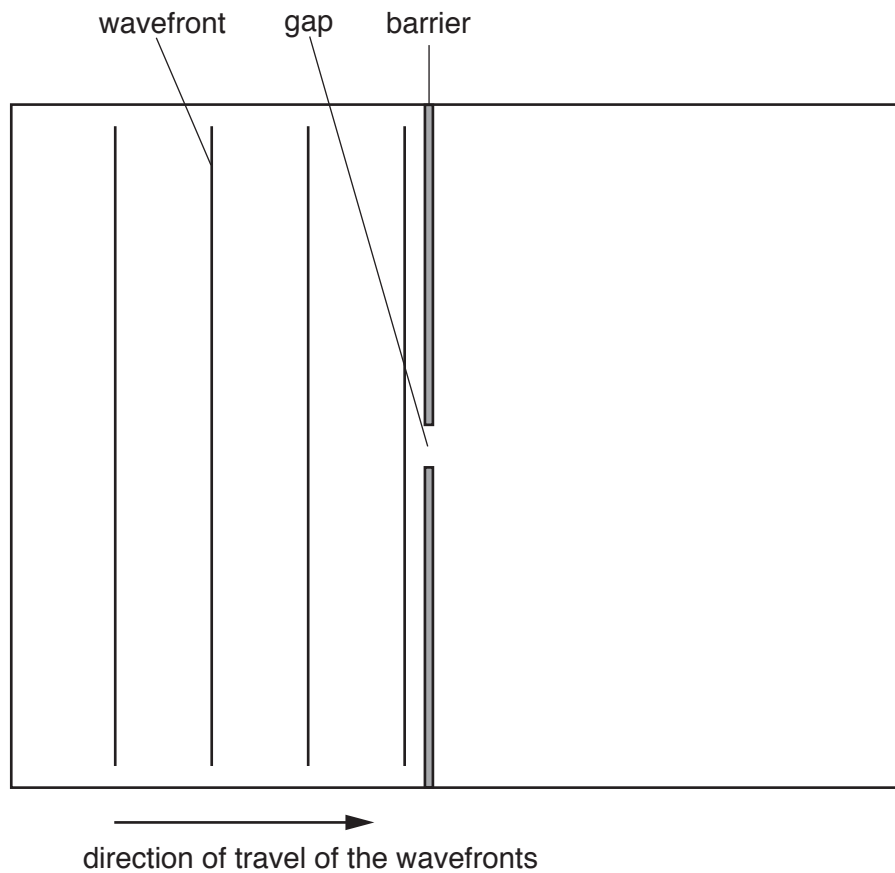
Complete Table. 6.1 to suggest the state of astatine and the approximate boiling point of bromine. [2]

[Total: 10]

7 Fig 7.1 shows a shallow tank of water.

Wavefronts on the surface of the water move towards a barrier.

There is a gap in the barrier.



**Fig. 7.1**

- (a) (i) On Fig. 7.1, draw three wavefronts after they pass through the gap. [3]  
 (ii) State the property of waves that this demonstrates.

..... [1]

(b) The graph in Fig. 7.2 shows a side view of the waves at an instant in time.

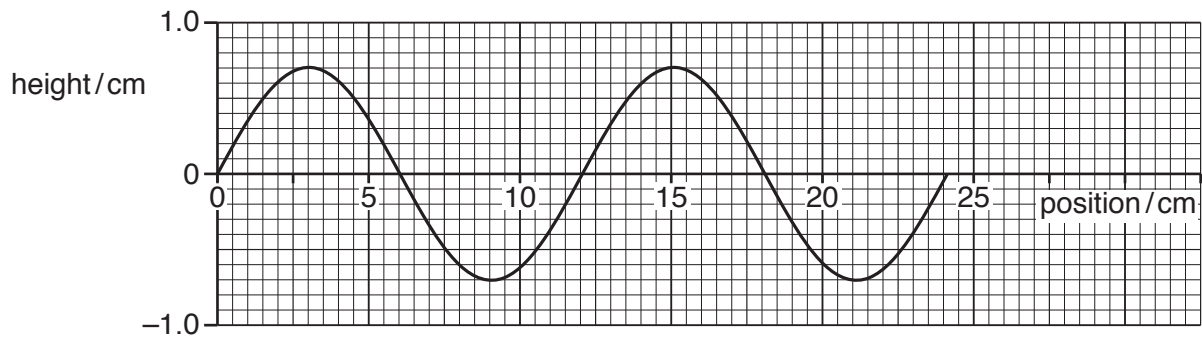


Fig. 7.2

- (i) On Fig. 7.2, draw an arrow to show the amplitude of the wave. [1]
- (ii) Determine the wavelength of the wave.

wavelength = ..... cm [1]

- (iii) The wave travels at a speed of 64 cm/s.

Calculate the frequency of the wave.

Show your working.

frequency = ..... Hz [2]

[Total: 8]

8 Fig. 8.1 shows a circuit which contains a heater.

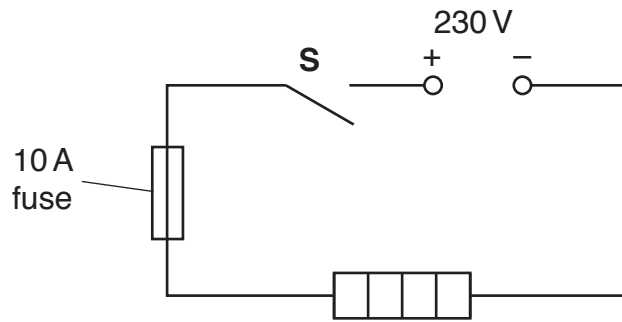


Fig. 8.1

The power supply has an e.m.f. of 230 V.

The heater is rated at 230 V, 1.5 kW.

The circuit contains a 10 A fuse.

(a) (i) Calculate the current in the circuit when switch **S** is closed.

current = ..... A [2]

(ii) Calculate the charge passing through the heater in 5 minutes.

charge = ..... C [2]

(b) An electrician connects a second identical heater into the circuit in Fig. 8.1.

(i) The two heaters are connected in series.

In series, the two heaters produce less power than one heater alone.

Explain why.

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

(ii) The electrician then connects the two heaters in parallel.

He closes switch **S** and finds that the heaters do not work.

Explain why the heaters stop working.

.....

.....

..... [2]

[Total: 8]

9 Use words from the box to complete the sentences about making an insoluble salt.

<b>cold</b>	<b>boiling</b>	<b>filtration</b>	<b>heat</b>	<b>hot</b>
<b>insoluble</b>	<b>liquid</b>	<b>precipitate</b>	<b>soluble</b>	

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

Two ..... salts in solution are added to each other.

This forms a .....

The insoluble salt is separated by .....

The salt is washed with ..... water and dried.

[4]

[Total: 4]

10 Butane combusts in oxygen, as shown by the equation.



(a) Calculate the mass of water produced by the complete combustion of 3.5 kg of butane.

Show your working in the box.

[ $A_r$ : C, 12; H, 1; O, 16]

mass of water = ..... kg [3]

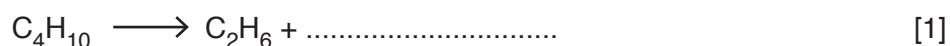
(b) Butane is a member of a homologous series.

(i) Describe what is meant by the term *homologous series*.

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

(ii) Ethane is one product of the cracking of butane.

Complete the equation to show the other product formed during this reaction.



(iii) State why a catalyst is used during the cracking.

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

[Total: 7]



- 11 A student has a long thin wire, a horseshoe magnet and a sensitive, zero-centred voltmeter, as shown in Fig. 11.1.

The wire is placed between the poles of the magnet.

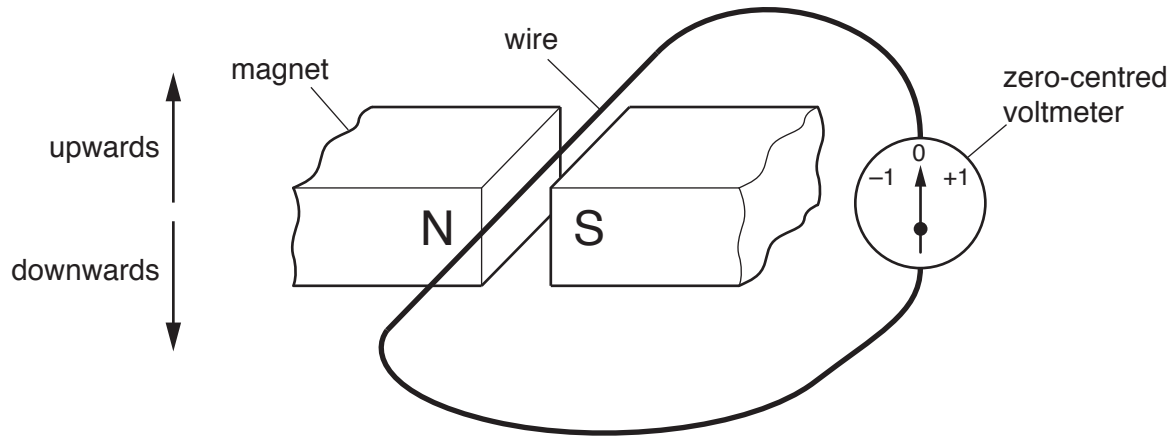


Fig. 11.1

- (a) State what is observed on the voltmeter when the student moves the wire

from N to S, .....

.....

upwards, .....

.....

downwards. ....

.....

[4]

(b) Fig. 11.2 shows a simple a.c. generator.

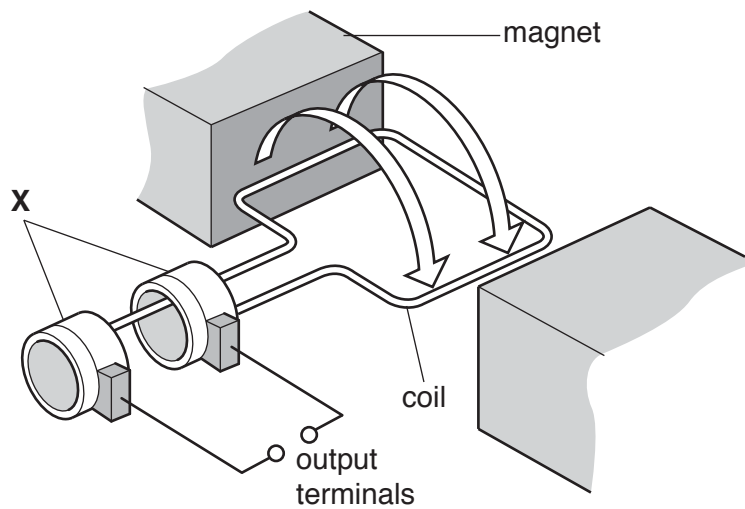


Fig. 11.2

(i) Name the parts labelled X.

..... [1]

(ii) Fig. 11.3 shows how the output voltage of the generator varies as the coil rotates through two turns.

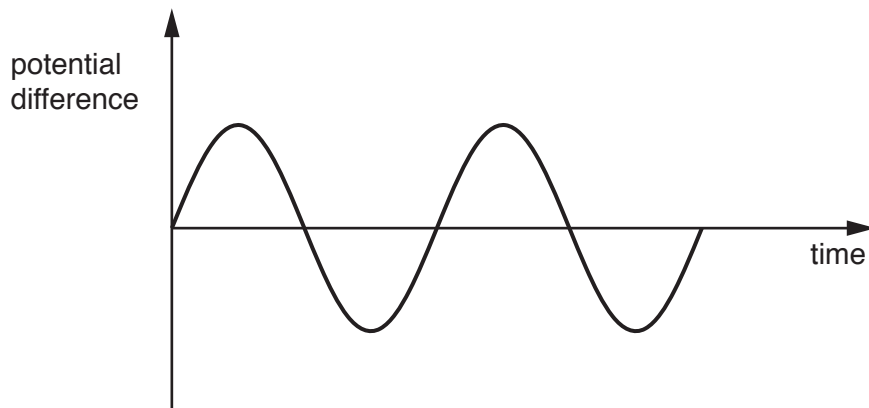


Fig 11.3

On the same axes in Fig. 11.3, draw the output voltage of the generator when the coil rotates at a greater speed through two turns. [2]

[Total: 7]

12 Hydrogen gas is used as fuel.

Hydrogen reacts with oxygen as shown by the equation.



(a) The volume of one mole of any gas is  $24\text{dm}^3$  at room temperature and pressure.

Determine the volume of oxygen, measured at room temperature and pressure, needed for the complete combustion of  $250\text{cm}^3$  of hydrogen.

volume of oxygen = .....  $\text{cm}^3$  [1]

(b) Suggest why using hydrogen as a fuel causes less harm to the environment than burning fossil fuels.

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

[Total: 3]

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## The Periodic Table of Elements

Group																																																																																																						
I	II	III										IV	V	VI	VII	VIII																																																																																						
3 Li lithium 7	4 Be beryllium 9	<div style="display: flex; justify-content: space-between;"> <div style="border: 1px solid black; padding: 5px;">           1 H hydrogen 1         </div> <div style="border: 1px solid black; padding: 5px;"> <b>Key</b>            atomic number            atomic symbol            name            relative atomic mass         </div> </div>																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
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 —

actinoids

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