Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

5954441144

PHYSICAL SCIENCE **0652/31**

Paper 3 (Extended) **October/November 2016**

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 24.
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 **22** printed pages and **2** blank pages.

CAMBRIDGE International Examinations

1 Ticker tape is attached to a model car which moves across a bench from left to right.

This is shown in Fig. 1.1.

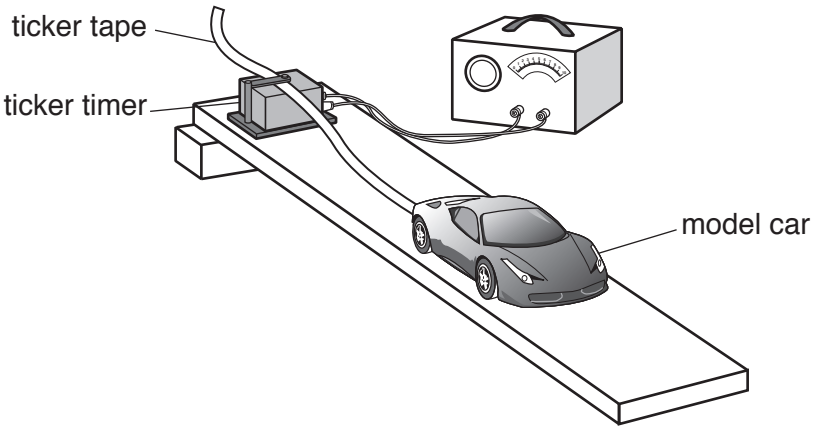


Fig. 1.1

The ticker tape passes through a ticker timer, which prints a dot on the tape every 0.01 s.

Fig. 1.2 shows part of the ticker tape next to a metre ruler.

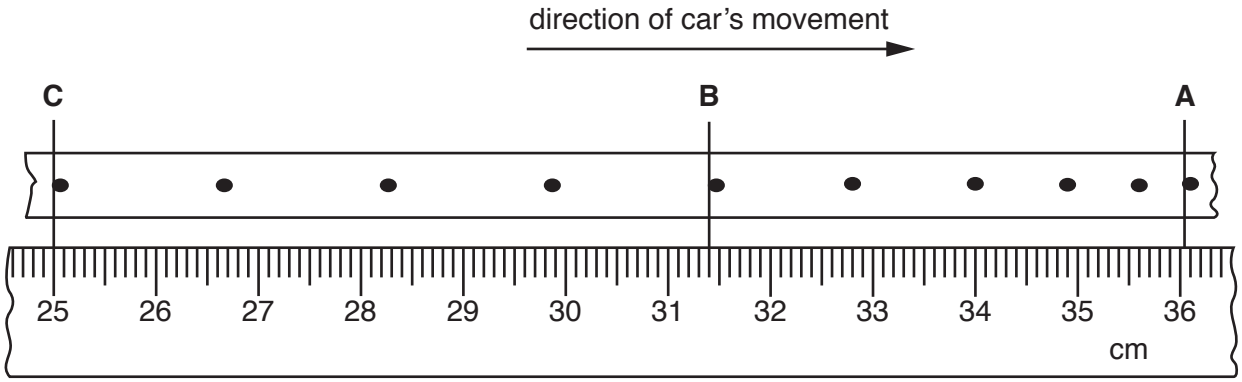


Fig. 1.2

(a) (i) The speed of the car can be calculated from the spacing of the dots.

Calculate the speed of the car during the time that the section **BC** of the tape was made.

speed = ... cm / s [3]

(ii) Describe the motion of the car during the time that section **AB** was made.

.....[1]

(b) On Fig. 1.3, sketch a speed/time graph for the motion of the car from time **A** to time **C**.

Fig. 1.3

[2]

(c) Describe how the acceleration of an object can be found from a speed/time graph.

.....

.....[1]

2 Fig. 2.1 shows the apparatus used to measure the temperature change that occurs during an exothermic reaction.

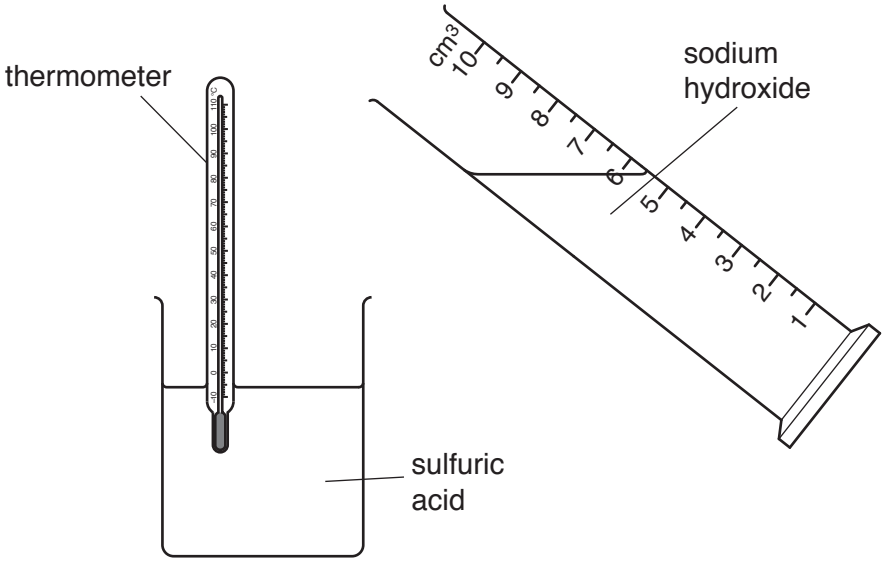


Fig. 2.1

(a) Predict what will happen to the temperature of the mixture during this reaction.

.....

.....[1]

(b) Explain why this reaction is exothermic.

You should refer to bond breaking and bond forming in your answer.

.....

.....

.....

.....[2]

(c) A student wants to increase the rate of reaction between sulfuric acid and sodium hydroxide.

Suggest **one** way the rate of this reaction could be increased.

.....

.....

.....

.....[1]

(d) Complete the symbol equation for the reaction between sulfuric acid and sodium hydroxide.

$$H_2SO_4 \quad + \quad NaOH \quad \rightarrow \quad Na_2SO_4 \quad + \quad H_2O$$

[1]

(e) Plants produce glucose and oxygen in an endothermic reaction called photosynthesis.

The equation for the reaction for photosynthesis is shown below.

$$6H_2O + 6CO_2 \rightarrow C_6H_{12}O_6 + 6O_2$$

(i) Calculate the mass of glucose, $C_6H_{12}O_6$, made when 1.0 g of water reacts with carbon dioxide.
[*A*r: C, 12; H, 1; O, 16]

Show your working in the box.

mass of glucose = ... g

[3]

(ii) Outline how green plants obtain the energy needed for photosynthesis to occur.

.....

.....

.....[2]

[Turn over

3 Fig. 3.1 shows a crane lifting a load of bricks of weight 5000 N from the ground to a height of 8.5 m.

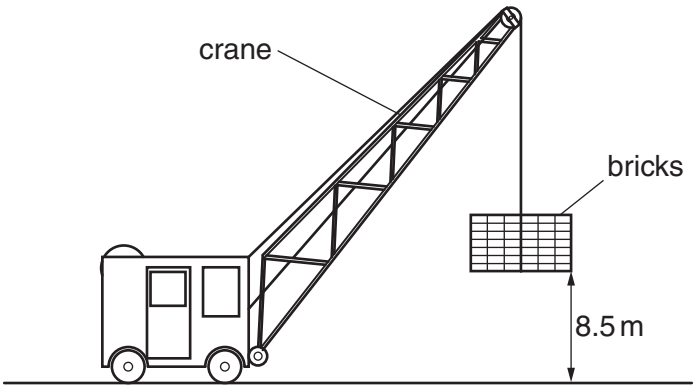


Fig. 3.1

(a) (i) Calculate the work done against gravity in lifting the bricks.

Show your working.

work done = ... J [2]

(ii) The energy transferred from the fuel to the crane's motor is considerably greater than the work done to lift the bricks in part **(i)**.

Use this information to explain what is meant by the term *efficiency*.

.....

.....[1]

(b) The crane takes 12 s to raise the bricks to the height of 8.5 m.

Calculate the power produced in raising the bricks.

Show your working and give the unit.

power = ... unit ..... [3]

4 **(a)** A student wants to determine the order of reactivity of four metals, **A** to **D**.

She tests each metal with cold water, steam and dilute hydrochloric acid.

Her results are shown in Table 4.1.

Table 4.1

metal	reaction with cold water	reaction with steam	reaction with hydrochloric acid
A	no	yes	yes
B	slowly	yes	yes
C	yes	yes	yes
D	no	no	no

Deduce the order of reactivity for the metals **A** to **D**.

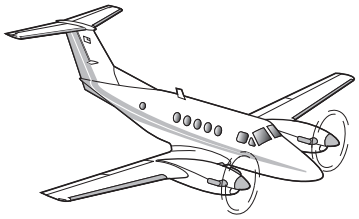
most reactive .....

.....

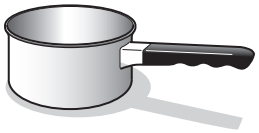
.....

least reactive ..... [2]

(b) The diagram in Fig. 4.1 shows three uses for metals.



aeroplane



saucepan

cutlery

Fig. 4.1

Suggest three different metals that could be used to make each of the items shown above. Use ideas about the properties of the different metals to explain your choice.

(i) aeroplane

metal .....

reason .....

.....[1]

(ii) saucepan

metal .....

reason .....

.....[1]

(iii) cutlery

metal .....

reason .....

.....[1]

(c) Metals are good conductors of electricity.

Use ideas about metallic structure and bonding to explain why metals conduct electricity.

You may draw and label a diagram to help your answer.

.....

.....

.....

.....[3]

5 Fig. 5.1 shows a harbour and some anchored boats, viewed from above.

One wavefront of the waves out at sea is labelled.

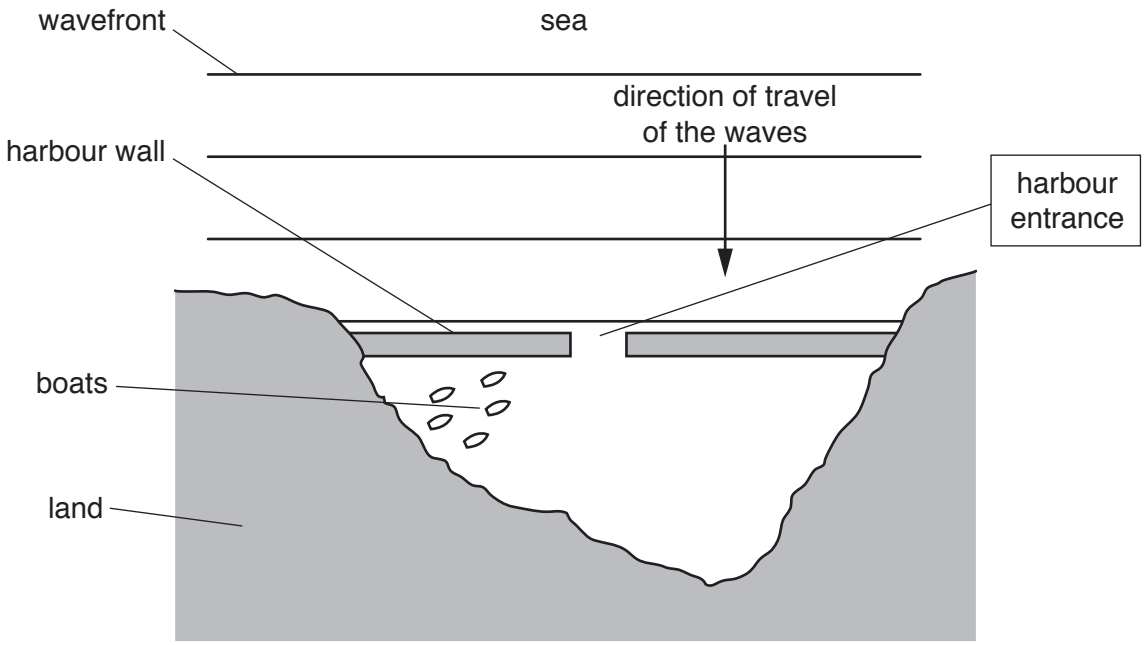


Fig. 5.1

(a) (i) Draw, on Fig. 5.1, **three** wavefronts after they pass through the harbour entrance. [3]

(ii) Name the property of waves which is demonstrated by the behaviour of the waves after they have passed through the harbour entrance.

..... [1]

(iii) The boats in the harbour are sheltered by the harbour wall but still move up and down.

Refer to your diagram to explain why the boats move up and down.

.....

.....[1]

(b) A girl stands on the harbour wall and counts the waves hitting the harbour wall.

In 2 minutes she counts 6 waves hitting the wall.

(i) Calculate the frequency of the waves.

frequency = ... Hz [2]

(ii) She estimates the distance between successive crests of the waves as 25 m.

State the wavelength of the waves.

wavelength = ... m [1]

(iii) Calculate the speed at which the waves travel towards the harbour wall.

speed = ... m/s [2]

[Turn over

6 **(a)** Bauxite, haematite and malachite are three metal ores.

State the metal found in malachite.

.....[1]

(b) Fig. 6.1 shows a blast furnace used to extract iron from its ore.

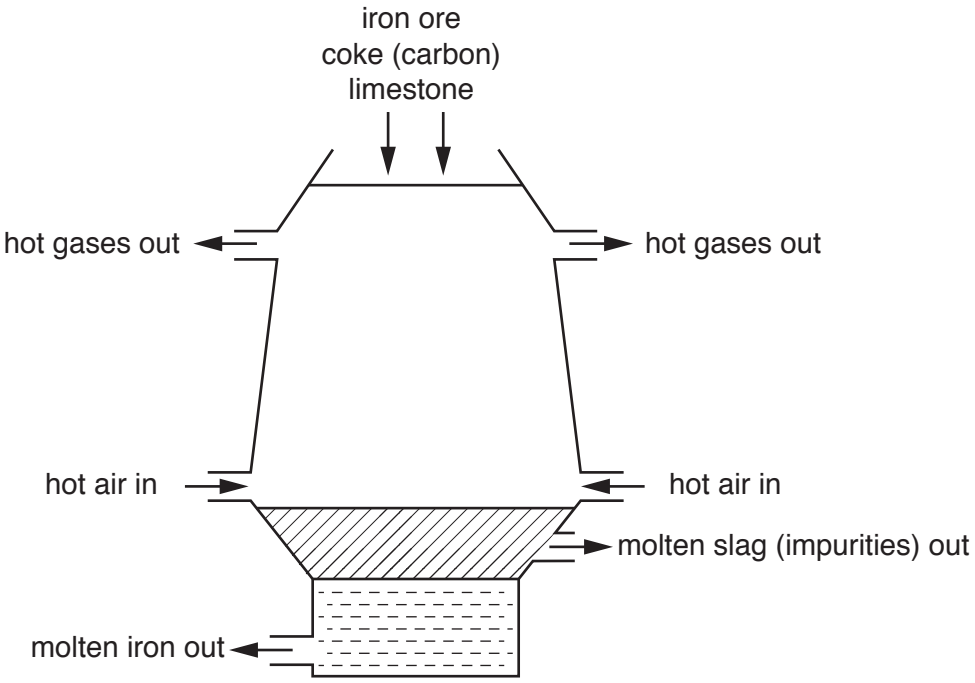


Fig. 6.1

(i) Explain why it is possible to extract the iron metal from its ore by reacting the ore with carbon.

.....

.....[1]

(ii) Suggest why heated air is forced into the blast furnace.

You may use an equation to help your answer.

.....

.....

.....

.....[2]

(iii) Complete the symbol equation to show the products of the reaction between iron oxide and carbon monoxide in the blast furnace.

$$Fe_2O_3 + 3CO \rightarrow \text{.....} + \text{.....}$$

[2]

(c) State the role of the calcium carbonate (limestone) in the extraction of iron from haematite.

.....

.....[1]

(d) Calcium carbonate (limestone) is also used in the manufacture of calcium oxide (lime).

(i) Write a word equation for the reaction of calcium carbonate to form calcium oxide.

.....[1]

(ii) State the name given to this type of reaction.

.....[1]

[Turn over

7 Fig. 7.1 is a diagram of a circuit in which there is a battery of e.m.f. 9.0 V, three resistors and three voltmeters **A**, **B** and **C**.

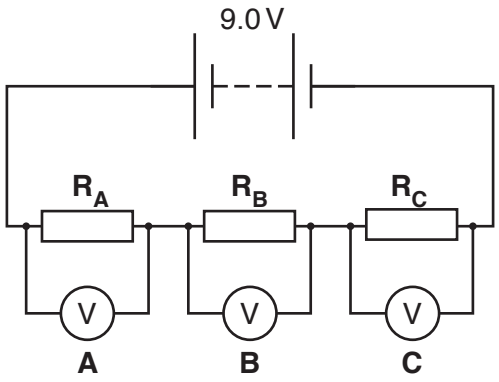


Fig. 7.1

(a) Table 7.1 shows the readings on voltmeters **A** and **B**.

Table 7.1

reading on voltmeter **A** / V	reading on voltmeter **B** / V	reading on voltmeter **C** / V
4.2	3.6	

Complete Table 7.1 to show the reading on voltmeter **C**. [1]

(b) **(i)** The current through $\mathbf{R_A}$ is 0.40 A.

Calculate the energy dissipated in $\mathbf{R_A}$ in 5.0 minutes.
Show your working and state the unit.

energy = ... unit ..... [3]

(ii) Determine the current through $\mathbf{R_B}$ and $\mathbf{R_C}$.

current through $\mathbf{R_B}$ = ... A

current through $\mathbf{R_C}$ = ... A [1]

(c) Fig. 7.2 shows the same 9.0 V battery connected across two resistors in parallel.

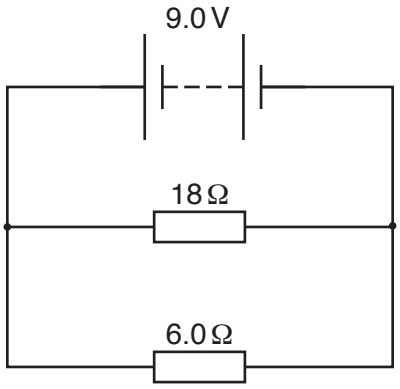


Fig. 7.2

(i) Calculate the combined resistance of the two resistors.

resistance = ... Ω [2]

(ii) Calculate the current in the battery.

current = ... A [1]

(iii) Calculate the charge passing through the battery in 30 seconds.

charge = ... C [2]

[Turn over

8 Table 8.1 shows data for the atomic radii of elements in Group II of the Periodic Table.

Table 8.1

Group II element	atomic radius / nm
beryllium	0.125
magnesium	0.160
calcium	0.174
strontium	------
barium	0.198

(a) Suggest a value for the atomic radius of strontium.

..... nm [1]

(b) State the number of electrons barium has in its outer electron shell.

.....[1]

(c) Magnesium can be reacted with the Group VII element chlorine to form the ionic compound magnesium chloride.

Describe the formation of ionic bonds between magnesium and chlorine.
You should draw and label a diagram to help your answer.

.....

.....

.....

.....

.....[4]

Question 9 begins over the page.

9 Fig. 9.1 shows a simple alternating current (a.c.) generator.

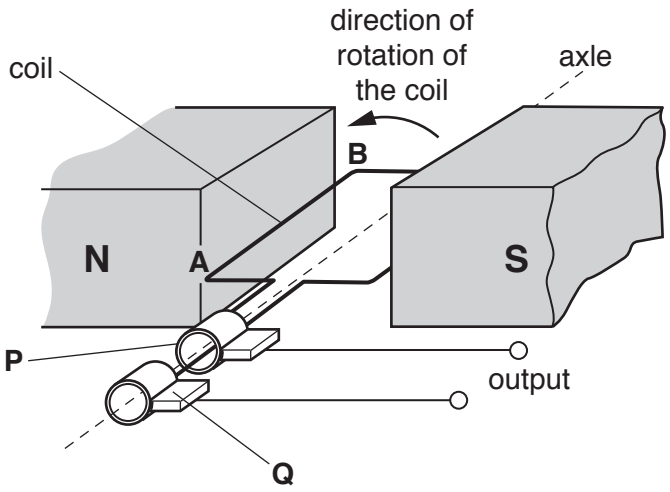


Fig. 9.1

(a) Name the parts labelled **P** and **Q** in Fig 9.1.

P .....

Q .....
[2]

(b) Explain why an e.m.f. is induced across the section **AB** of the coil when the coil rotates.

.....

.....

.....[2]

(c) (i) A resistor is connected across the generator. There is an alternating current in the resistor.

Explain what is meant by the term *alternating current*.

.....

.....[1]

(ii) Fig. 9.2 shows the screen of a cathode ray oscilloscope (c.r.o.).

The output from the a.c. generator is connected to the c.r.o.

Draw, on Fig. 9.2, two complete cycles of the trace seen on the screen of the oscilloscope.

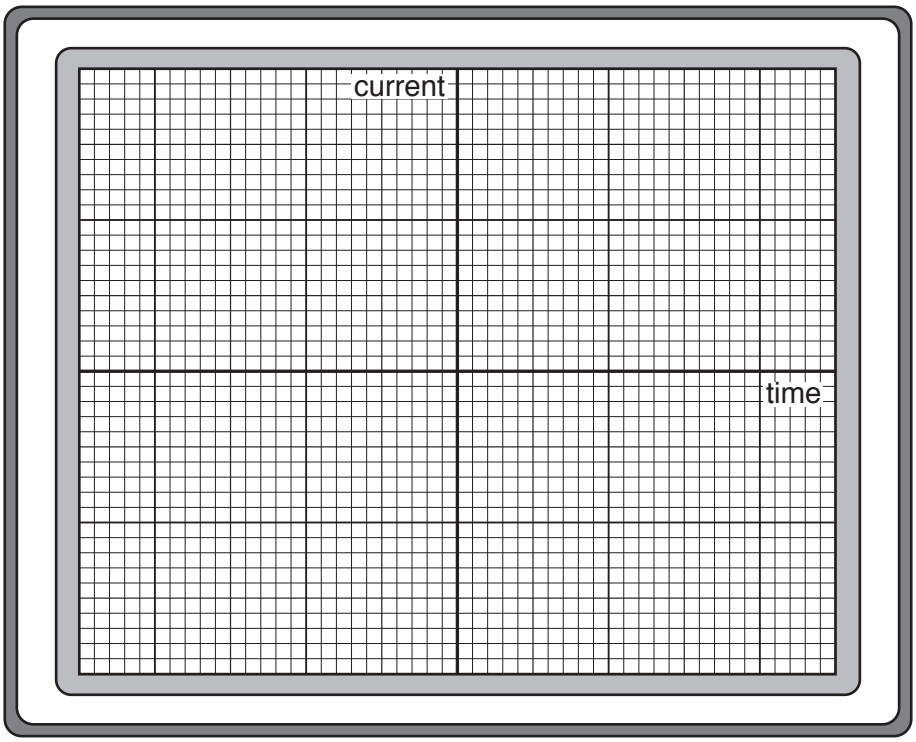


Fig. 9.2

[2]

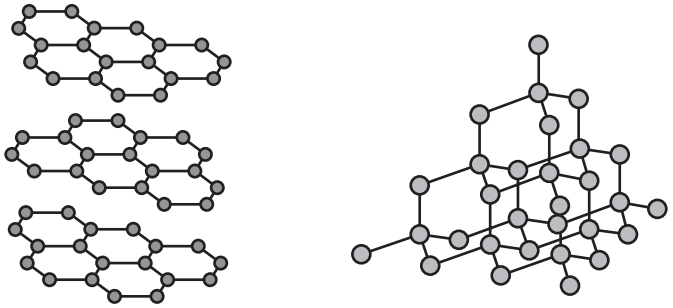
10 Graphite and diamond are both forms of carbon.

Table 10.1 shows some physical properties of graphite and diamond.

Table 10.1

	melting point / °C	hardness
graphite	3600	soft
diamond	4000	hard

Fig. 10.1 shows the structure of graphite and diamond.



graphite diamond

Fig. 10.1

(a) Use Table 10.1 and Fig. 10.1 to explain the following properties of graphite and diamond.

(i) hardness .....

.....

.....

.....[3]

(ii) melting point .....

.....[1]

(b) Carbon is one of the elements found in ethanol and ethene.

Name the process used to produce ethanol from ethene.

.....[1]

(c) Draw a diagram to show the electron arrangement in ethene, C_2H_4.

[2]

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The Periodic Table of Elements

Key

atomic number
atomic symbol
name
relative atomic mass

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 –		

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.)