

Centre Number	Candidate Number	Name
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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

PHYSICAL SCIENCE

0652/03

Paper 3 Extended

October/November 2006

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 a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
A copy of the Periodic Table is printed on page 20.
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.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
Total	

This document consists of **17** printed pages and **3** blank pages.



- 1 (a) A spring is loaded with a mass of 250 g and comes to rest as shown in Fig. 1.1. Mark on Fig. 1.1 the size and direction of the forces acting on the **mass** in this position.

$$g = 10 \text{ N/kg}$$

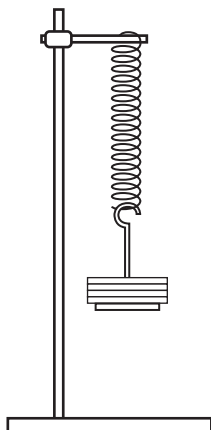


Fig. 1.1

[4]

- (b) Masses are added to the spring and it stretches beyond its limit of proportionality.

- (i) Sketch, on Fig. 1.2, the shape of the graph you would expect.

[2]

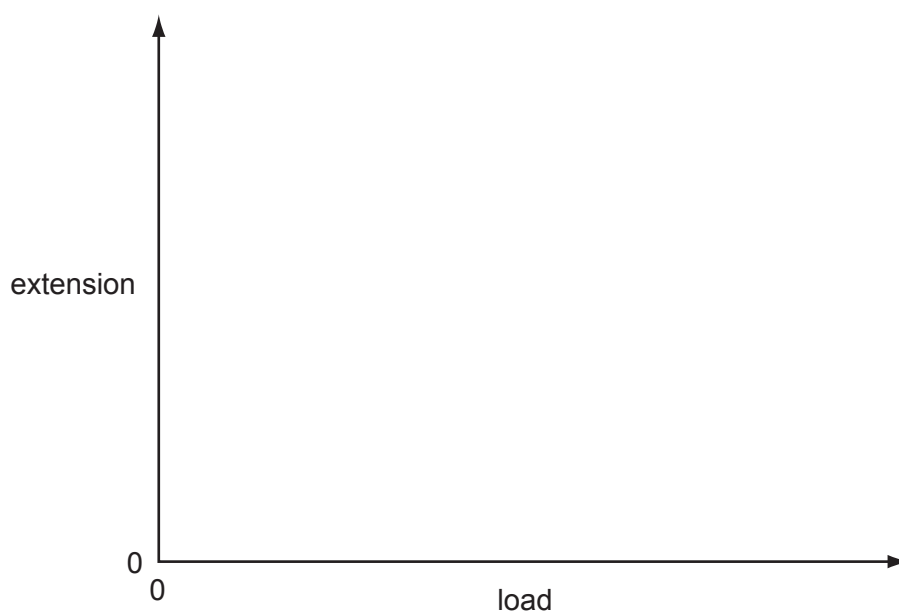


Fig. 1.2

- (ii) On your graph, clearly label the limit of proportionality.

[1]

(c) The spring is loaded with a 250 g mass. The mass is raised 8.0 cm above its normal rest position and released.

- (i) Calculate the additional gravitational potential energy given to the mass in raising it 8.0 cm.

additional gravitational potential energy = [2]

- (ii) Calculate the maximum speed that the mass gains after it has been released.

maximum speed = [3]

- 2 Fig. 2.1 shows the production of iron in a blast furnace.

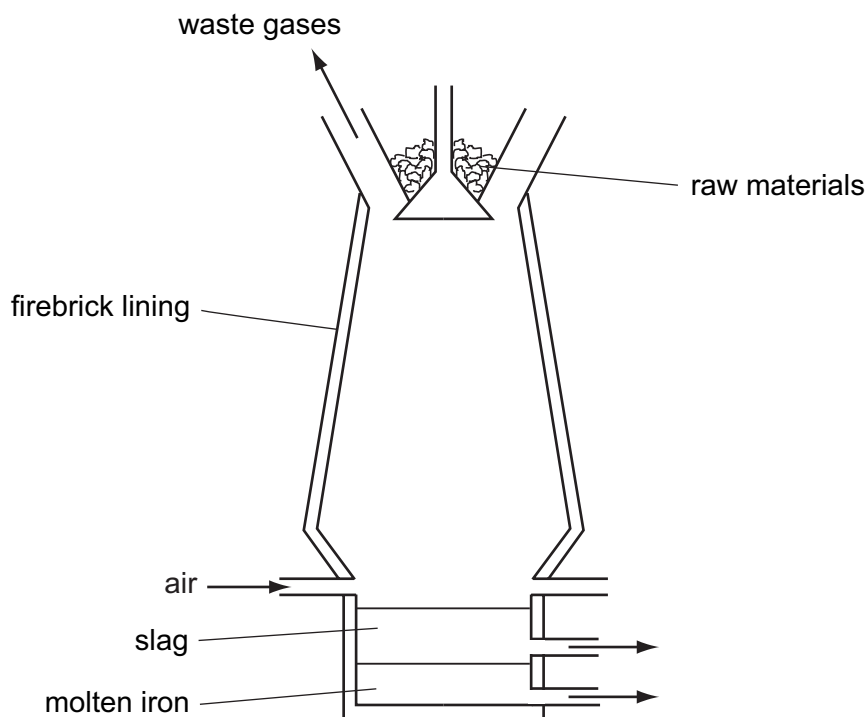


Fig. 2.1

- (a) Raw materials loaded into the top of the furnace are iron ore, coke and limestone. In the furnace iron(III) oxide, Fe_2O_3 , reacts with carbon monoxide to produce iron metal.

- (i) State the name of an ore containing iron(III) oxide.

..... [1]

- (ii) Explain how carbon monoxide is formed in the blast furnace.

.....

 [2]

- (iii) Write a balanced equation for the reaction between carbon monoxide and iron(III) oxide.

..... [2]

- (b) An ore used in a blast furnace contains 80% by mass of iron(III) oxide, Fe_2O_3 . The remaining 20% does **not** contain any iron or iron compounds. What mass of iron can be extracted from each tonne of this ore?
Show your working.

mass = tonne [4]

- 3 (a) Fig. 3.1 shows one wave property demonstrated by water waves in a ripple tank. The figure is drawn $\frac{1}{5}$ th full size and the frequency of the waves is 2 Hz.

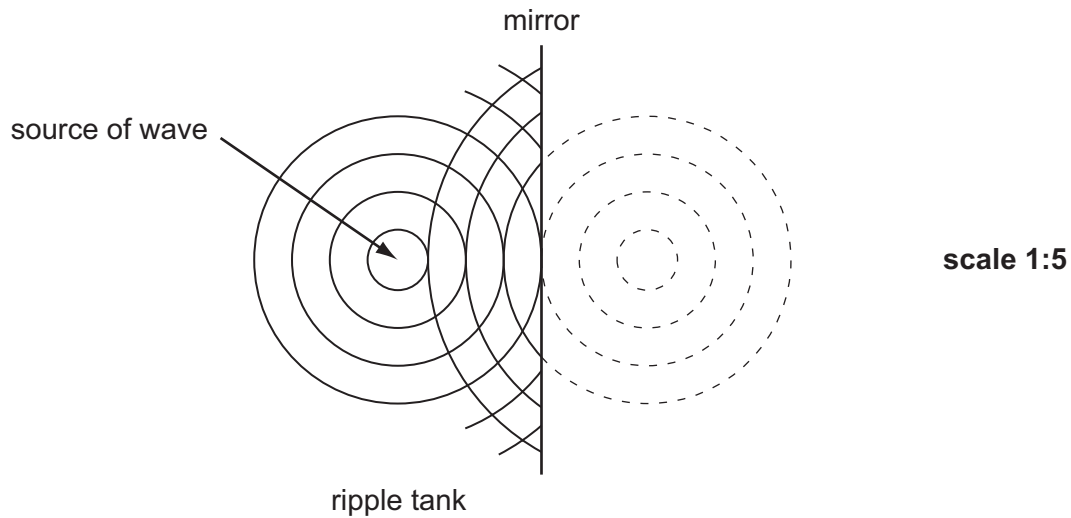


Fig. 3.1

- (i) Name the property illustrated by this experiment.

..... [1]

- (ii) Use Fig. 3.1 to calculate the wavelength of the wave **in the ripple tank**.

wavelength = [2]

- (iii) Calculate the speed of the water waves.

speed = [2]

- (b) Fig. 3.2 and Fig. 3.3 show a second property of waves demonstrated by another experiment in a ripple tank.

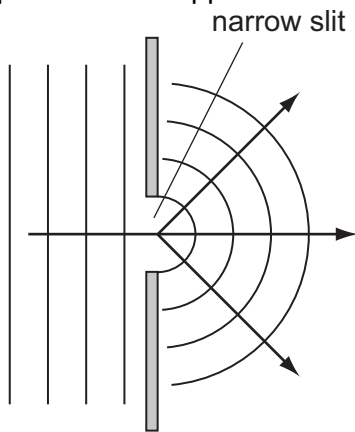


Fig. 3.2

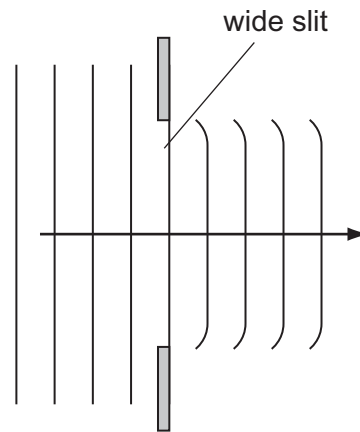


Fig. 3.3

- (i) Name the property illustrated by this experiment.

..... [1]

- (ii) Different widths of slits are used in the two parts of the experiment. Describe the effect this has on the waves.

.....

 [2]

- 4 A little metal powder is added to an aqueous solution of a metal salt. Any change to the appearance of the solid is noted. The experiment is repeated with different metals and metal salt solutions.

Results for these experiments are shown in Fig. 4.1.

	aqueous solution of metal salt			
metal powder	copper(II) sulphate	iron(II) sulphate	magnesium sulphate	aluminium sulphate
aluminium	forms a red-brown solid	forms a dark grey solid	no change	no change
copper	no change	no change	no change	no change
iron	forms a red-brown solid	no change	no change	no change
magnesium	forms a red-brown solid	forms a dark grey solid	no change	forms a dark grey solid

Fig. 4.1

- (a) (i) A red-brown solid is formed when magnesium is added to aqueous copper(II) sulphate.

Name this solid.

..... [1]

- (ii) Write a balanced equation for the reaction that takes place between magnesium and copper(II) sulphate.

..... [2]

- (b) Use the information in Fig. 4.1 to place the four metals in order of reactivity.

most reactive

.....

.....

least reactive

[3]

- (c) (i) When left in damp conditions iron rusts but aluminium does not show any change. Explain this difference.

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

- (ii) Suggest how another metal can be used to prevent iron from rusting.

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

- 5 (a) Fig. 5.1 illustrates a simple alternating current generator.

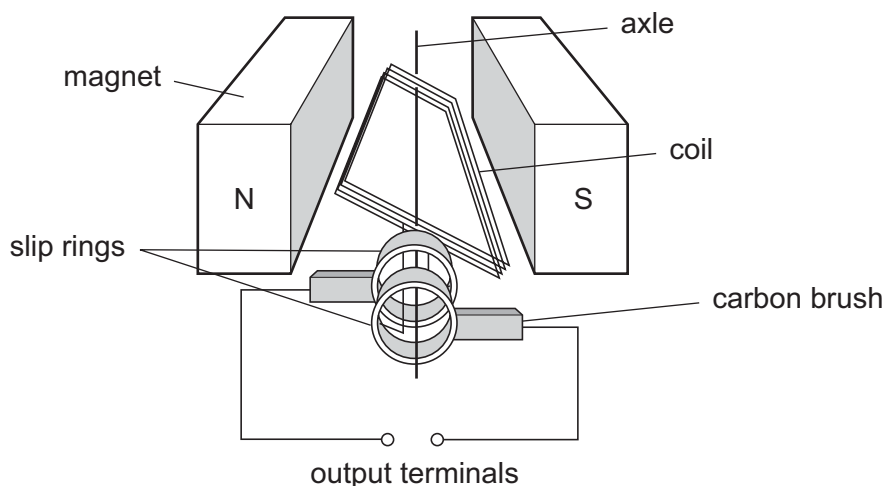


Fig. 5.1

- (i) Name the principle used to explain how a generator works.

..... [1]

- (ii) State three ways of increasing the voltage generated.

1.
2.
3. [3]

- (iii) Explain why the direction of the voltage reverses each half revolution of the coil.

.....

.....

.....

.....

.....

..... [2]

- (b) (i) Draw a circuit that could be connected to the output terminals to produce a direct current.
Label your components.

output terminals



[2]

- (ii) State the difference between the direction of conventional current and the direction of electron flow.

..... [1]

- 6 (a) Fig. 6.1 shows the arrangement of atoms in diamond and graphite.

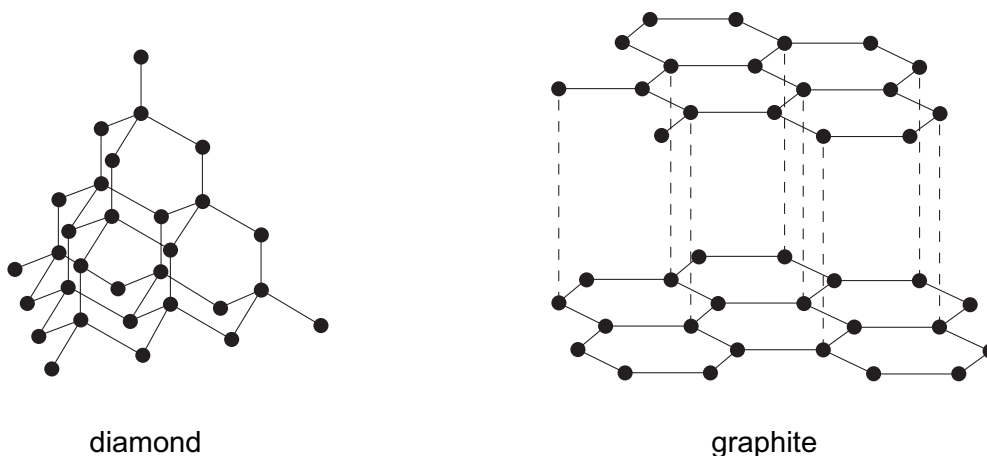


Fig. 6.1

- (i) Describe two differences in the properties of diamond and graphite.

1

2

[2]

- (ii) Use the structures in Fig. 6.1 to explain **one** of the differences you described in (a).

.....

.....

.....

[2]

- (b) Fig. 6.2 shows the arrangement of particles in a metal.

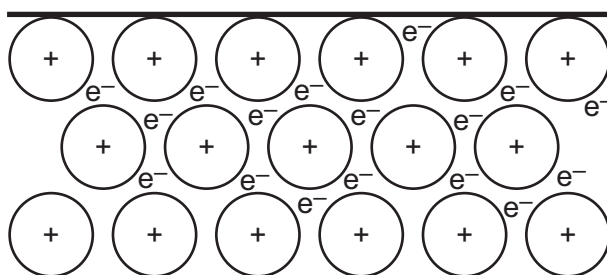


Fig. 6.2

Use information from Fig. 6.2 to help explain the following facts about this metal.

- (i) The metal conducts electricity.

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

- (ii) The metal is malleable.

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

- (c) The metal is mixed with another metal to make an alloy.

- (i) Suggest how the malleability of the alloy will compare with that of the metal in Fig. 6.2.

..... [1]

- (ii) Explain your suggestion.

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

- 7 Fig. 7.1 shows a refrigerator in which a liquid absorbs thermal energy from the cold compartment and evaporates. As the vapour is compressed by the pump, work is done on it. The vapour condenses, giving out thermal energy to the surroundings through the cooling fins on the back of the refrigerator.

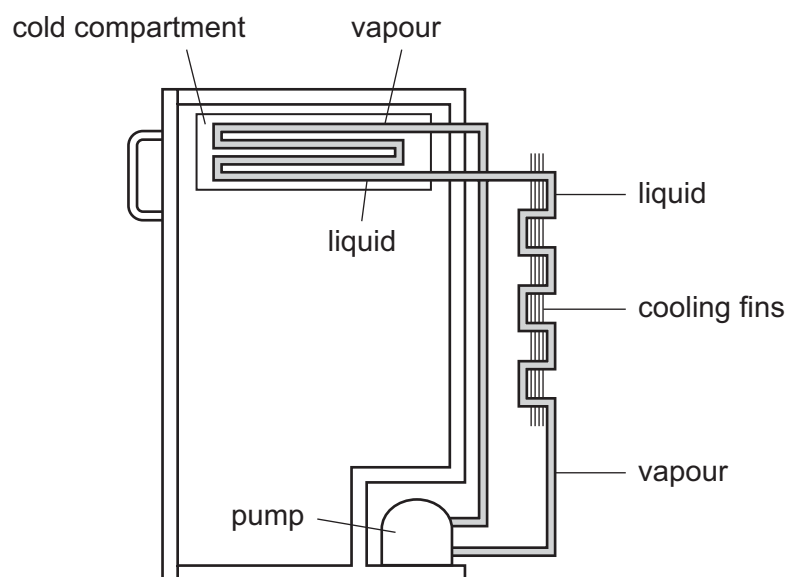


Fig. 7.1

- (a)** Explain the difference between boiling and evaporation.

.....

.....

.....

.....

.....

..... [3]

- (b)** Explain why the pump compresses the vapour much more than it could compress a liquid.

.....

.....

.....

..... [2]

- (c) Explain the effect that a refrigerator has on the temperature of the air surrounding it.

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

- (d) The pump is rated at 220 V, 110W.

- (i) Calculate the working current of the pump.
Show your working.

current = [3]

- (ii) Calculate the working resistance of the pump.

resistance = [2]

- 8 Methanol, CH_3OH , and ethanol, $\text{C}_2\text{H}_5\text{OH}$, belong to the homologous series of alcohols.

(a) What is meant by the term *homologous series*?

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

(b) Ethanol is manufactured from ethene.

(i) How is this process carried out?

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

(ii) Write an equation for the process.

..... [1]

(iii) Name another way that ethanol is made.

..... [1]

(iv) State **one** industrial use of ethanol.

..... [1]

(c) The atoms in methanol, CH_3OH , are joined by covalent bonds.
Draw a diagram to show the electron arrangement in methanol.
Show only outer shell electrons in your diagram.

[3]

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DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
		<div>1 H Hydrogen</div>															