UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

1967526888

PHYSICS **0625/22**

Paper 2 Core **May/June 2013**

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 pencil for any diagrams or graphs.
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.
Take the weight of 1 kg to be 10 N (i.e. acceleration of free fall = 10 m/s^2).

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.

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UNIVERSITY *of* CAMBRIDGE
International Examinations

[Turn over

1 The highlight of Super Academy's athletics calendar is the end-of-year cross-country race. This is a circular race over a distance of 6.0 km. By tradition, it starts and ends below the school clock tower.

Student Goodrunner is the school's fastest athlete. His dream is to beat the school record for the race, which is 26 minutes.

At the start of the race, the school clock looks as shown in Fig. 1.1.

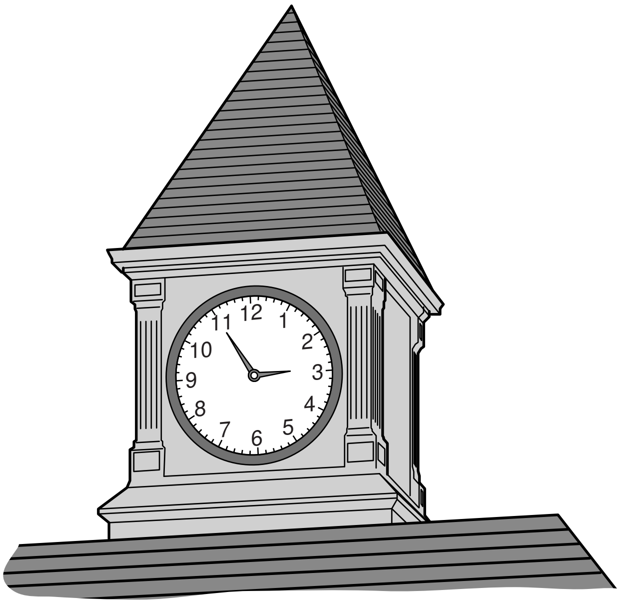

Fig. 1.1

As student Goodrunner crosses the finishing line, the school clock looks as shown in Fig. 1.2.

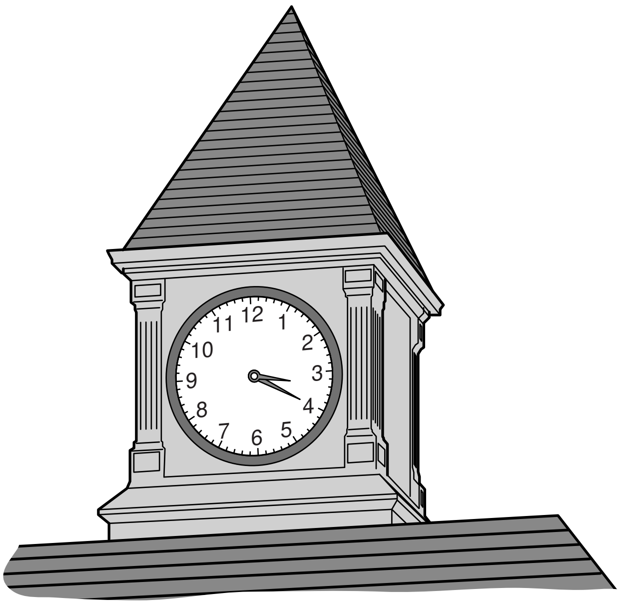

Fig. 1.2

(a) **(i)** Calculate Goodrunner's race time. Show your working.

For Examiner's Use

race time = ... minutes

(ii) Did Goodrunner beat the record?

yes ☐

no ☐

[3]

(b) Calculate Goodrunner's average speed during the race.

average speed = ... m/s [3]

[Total: 6]

2 A piece of stiff cardboard is attached to a plank of wood by two sticky-tape "hinges", as shown in Fig. 2.1.

For Examiner's Use

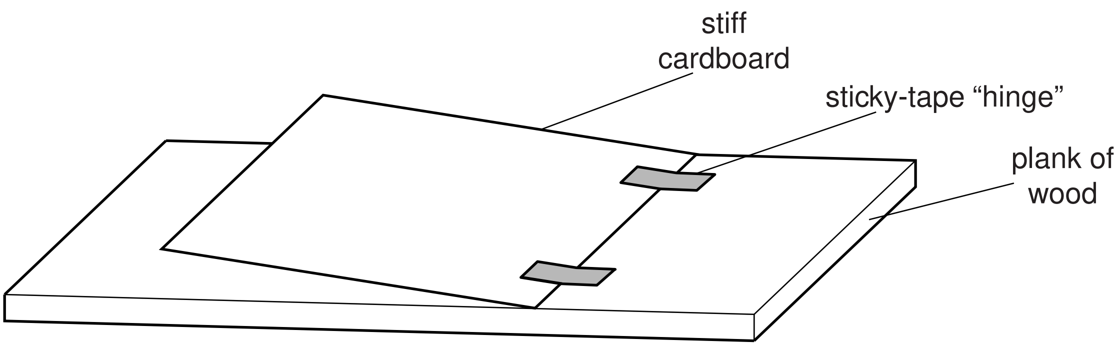

Fig. 2.1

(a) The cardboard in Fig. 2.1 is to be lifted by a vertical force *F*, so that it turns about the hinges.

(i) What name do we give to the turning effect of a force?

.... [1]

(ii) Force *F* is to be as small as possible.

On Fig. 2.1, show force *F*, positioned so that it fulfils this requirement. [1]

(b) A box of matches is balanced on the cardboard, as shown in Fig. 2.2.

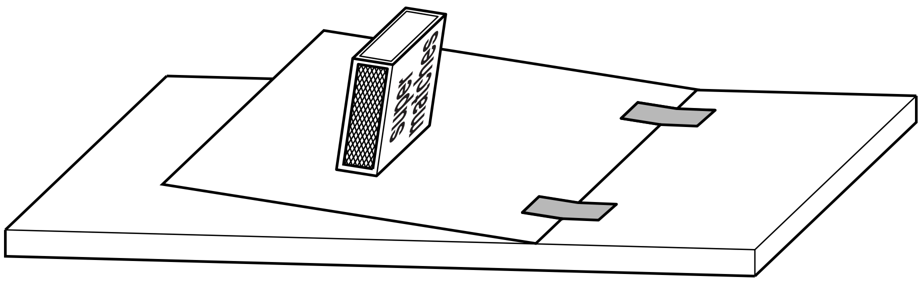

Fig. 2.2

(i) The left-hand edge of the cardboard is gradually raised. The box does not slide.

What will eventually happen to the box of matches as the edge is raised?

.... [1]

(ii) State where the centre of mass of the box is positioned when this happens.

....

.... [2]

(c) Filing cabinets often have a mechanism that prevents more than one drawer being opened at a time. Fig. 2.3 shows a filing cabinet standing on the floor with the middle drawer open.

For Examiner's Use

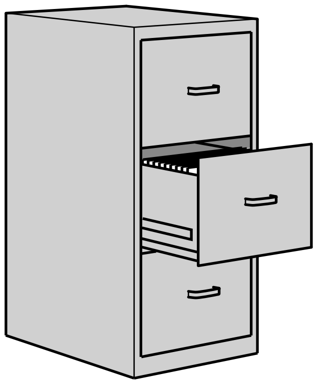

Fig. 2.3

State and explain why it might be dangerous to open the top drawer at the same time as the middle drawer.

....

....

....

....[2]

[Total: 7]

For Examiner's Use

3 **(a)** A spring is hung from a support. A load, hung on the spring, makes it extend.

Describe how you would use a ruler to measure the extension.

....

....

....

....

....

....[3]

(b) The lengths of the spring are found for loads of various weights. From these lengths, the extensions are calculated. Most of the results are shown in the table below.

load / N	length / mm	extension / mm
0	200	0
1.0	220	20
2.0	249	49
3.0	258	
4.0	279	79
5.0		97
6.0	318	118

(i) Calculate the two missing values and insert them in the table. [1]

(ii) On Fig. 3.1, plot the values of extension against load, but do not draw the line yet. [2]

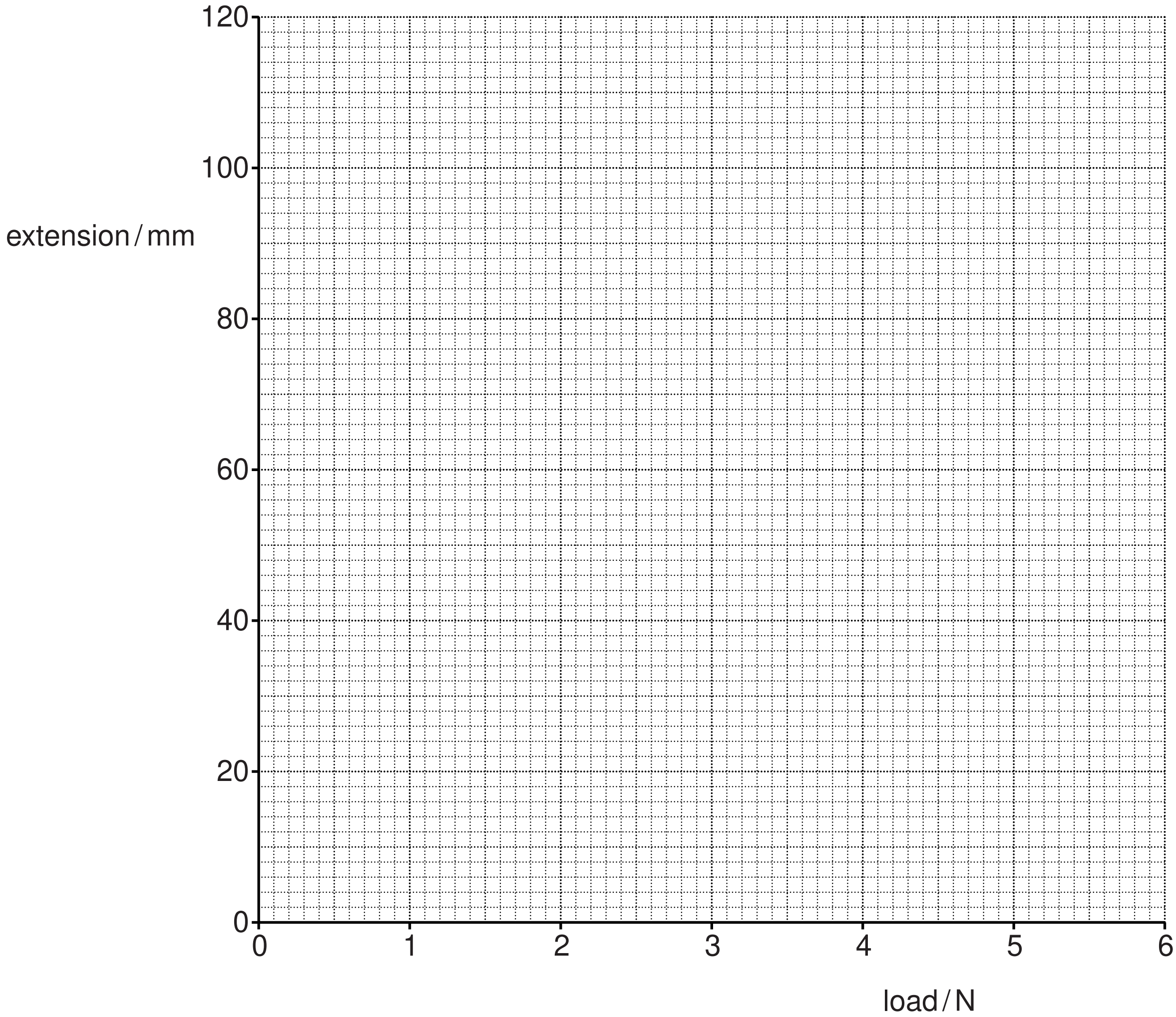

Fig. 3.1

(iii) A mistake was made with one of the length values.

State the value of the **length** that is incorrect. .... [1]

(iv) Ignoring the value in **(iii)**, draw the best-fit straight line through your points and the origin. [1]

(v) Complete the following sentences.

Within the limits of the experiment, when the load doubles, the extension of the spring

....

The straight-line graph through the origin shows that the extension and the load are

....

[2]

[Total: 10]

4 Fig. 4.1 shows a typical laboratory liquid-in-glass thermometer.

For Examiner's Use

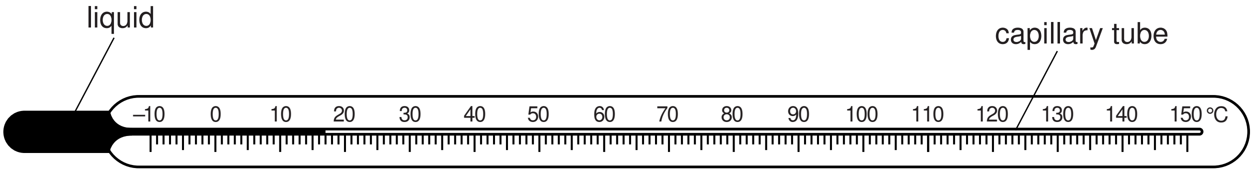

Fig. 4.1

(a) What is seen happening when the thermometer is put into a hot liquid?

....

.... [1]

(b) Why does this happen?

....

.... [1]

(c) On Fig. 4.1, clearly mark with an arrow the point that the liquid will reach when the thermometer is put in pure boiling water at standard atmospheric pressure. [1]

(d) State why it is necessary for the capillary tube to be very narrow.

....

....

.... [1]

[Total: 4]

For Examiner's Use

5 **(a)** The descriptions in the table below each give information about the molecules of a substance.

In the space alongside each description, write the state of the substance being described.

description	state of the substance
The molecules are close together but not tightly-packed. They move around amongst each other.	
The molecules of the substance exert virtually no force on each other. They move around freely and fill their container.	
The molecules are tightly-packed. They have "fixed" positions, about which they can only vibrate. During these vibrations, they exert strong forces on each other.	

[2]

(b) Which word is used to describe what is happening

(i) when a solid turns to a liquid, without change of temperature,

....

(ii) when a gas turns to a liquid, without change of temperature,

....

(iii) when more molecules of a liquid are escaping from the surface than are returning to it?

....

[3]

[Total: 5]

6 Fig. 6.1 shows a converging lens with an object placed to one side of it.

For Examiner's Use

Points F_1 and F_2 are the principal foci of the lens.

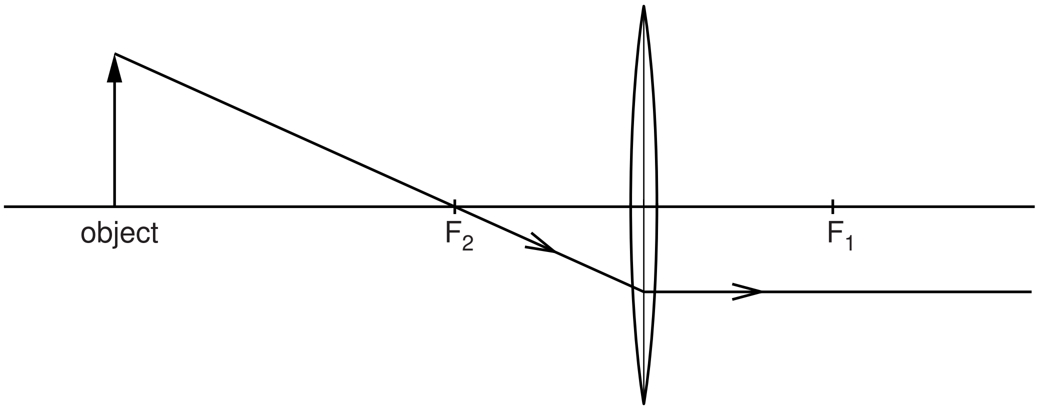

Fig. 6.1

(a) On Fig. 6.1, mark the focal length of the lens, showing clearly where it starts and finishes. [2]

(b) One ray has been drawn through the lens from the top of the object.

(i) On Fig. 6.1, draw another ray to locate the image of the top of the object. Draw and label the image of the whole object. [2]

(ii) State two ways in which this image differs from the object.

1. ....

2. ....

[2]

[Total: 6]

7 A student has devised the circuit in Fig. 7.1 to control the lighting of three lamps, A, B and C.

For Examiner's Use

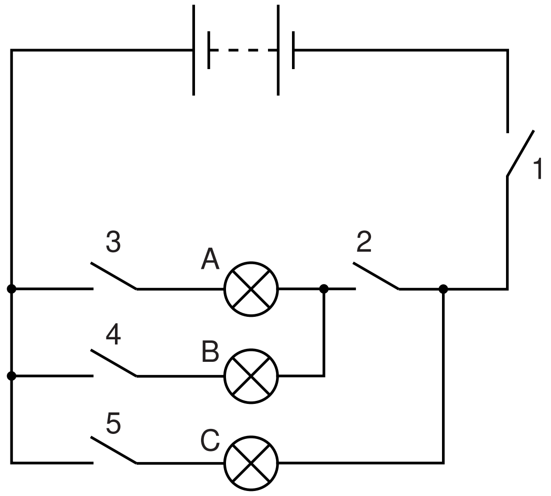

Fig. 7.1

More than one switch must be closed in order to light any lamp.

(a) In the table below, put ticks to indicate which switches **must** be closed in order to light the lamps. The first row has been completed for you.

lamp that is lit	switches closed				
	1	2	3	4	5
lamp A only	✓	✓	✓		
lamp B only					
lamp C only					

[3]

(b) **All** the switches are now closed.

Which of the lamps light up? .... [1]

(c) Which one switch **must** be open to ensure that none of the lamps light up? .... [1]

[Total: 5]

For Examiner's Use

8 (a) There is a current in a wire.

(i) What is moving in the wire, to create this current?

....

(ii) What must be done to the wire in order to cause a current?

....

(iii) In which unit do we measure the current?

....
[3]

(b) Fig. 8.1 shows a circuit connected to a 6.0 V power supply. Ignore the resistance of the power supply and the ammeter.

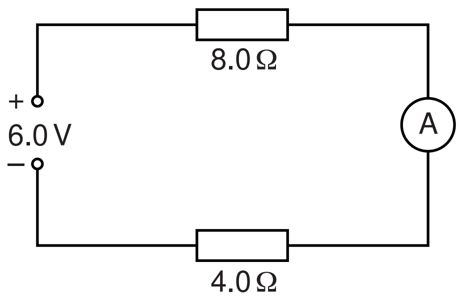

Fig. 8.1

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

resistance = ... Ω [2]

(ii) Calculate the current indicated by the ammeter. Your answer must include the unit.

reading = ... [3]

For Examiner's Use

(iii) The 8.0 Ω resistor is replaced by another resistor with a larger resistance.

Without further calculation, state the effect this has on

1. the ammeter reading,

....

2. the potential difference across the 4.0 Ω resistor.

....
[2]

[Total: 10]

For Examiner's Use

9 **(a)** A transformer consists of two coils of insulated wire, wound on a core.

State a suitable material from which to make

(i) the coils,

....

(ii) the core.

....
[2]

(b) A lamp has a normal working voltage of 6.0 V.

The transformer in Fig. 9.1 is used to enable the 6.0 V lamp to be lit at normal brightness using a 240 V mains supply.

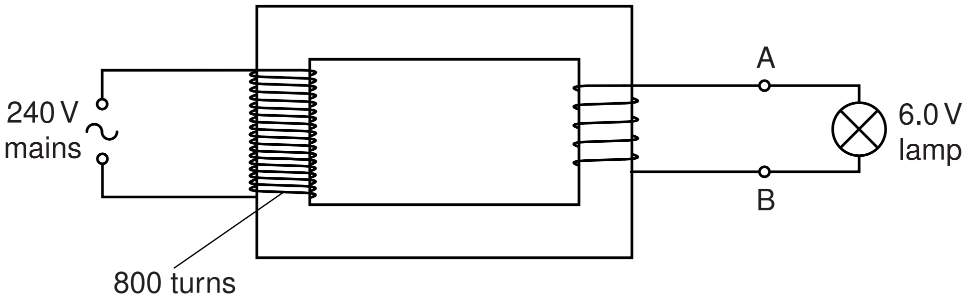

Fig. 9.1

The primary coil has 800 turns. The secondary coil is connected to terminals A and B.

Calculate the number of turns in the secondary coil.

number of turns = ...[3]

(c) A technician wishes to use the transformer in Fig. 9.1 to light three 6.0 V lamps.

(i) What would happen to the lamps if the technician connected them directly across the mains supply?

....

....[1]

(ii) On Fig. 9.2 below, show how the three lamps should be connected to terminals A and B, so that they all light with normal brightness

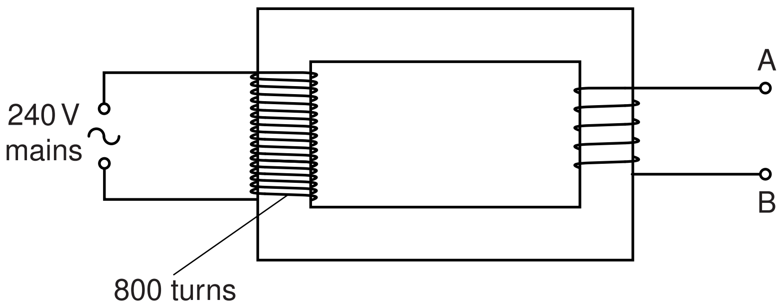

Fig. 9.2

[1]

[Total: 7]

For Examiner's Use

10 **(a)** Fig. 10.1 shows a bar magnet.

Fig. 10.1

(i) On Fig. 10.1, carefully draw the magnetic field pattern around the magnet, ignoring the Earth's magnetic field.

(ii) On **one** of your lines, draw an arrowhead to show the direction of the field.

[4]

(b) Fig. 10.2 shows a coil wound on a hollow cardboard tube. There is a current in the coil.

For Examiner's Use

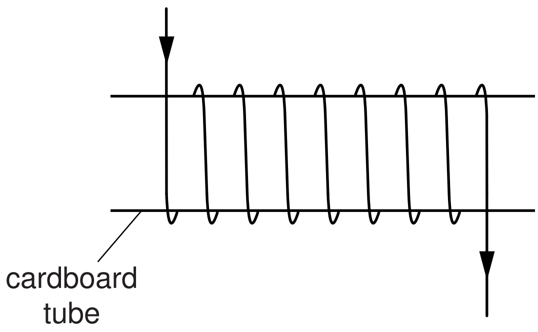

Fig. 10.2

(i) On Fig. 10.2, carefully draw the magnetic field pattern around and through the coil. You do not need to use arrows to show any directions. [2]

(ii) Suggest one material that could be inserted into the tube to increase the strength of the magnetic field.

.... [1]

(iii) What name is given to a current-carrying coil used to provide a magnetic field? Tick one box.

capacitor ☐

potentiometer ☐

relay ☐

solenoid ☐ [1]

[Total: 8]

11 **(a)** The emissions from some radioactive sources are tested.

Use the information in the table below to deduce the types of the emissions being described.

passes through a sheet of paper	passes through 8 mm of aluminium	type of emission
yes	yes	
yes	no	
no	no	

[2]

(b) A radioactive sample has a half-life of *x* seconds.

Which one of the following statements is correct? Tick one box.

☐ At a time of *x* seconds after starting measurements, there will be only half as many atoms in the sample.

☐ At a time of *x* seconds after starting measurements, there will be only half as many atoms of the original sort in the sample.

☐ It will take *x*/2 seconds for all of the atoms in the sample to decay.

☐ It will take 2*x* seconds for all of the atoms in the sample to decay.

[1]

(c) The number of atoms of a radioactive nuclide in a sample decreases with time, as shown in Fig. 11.1.

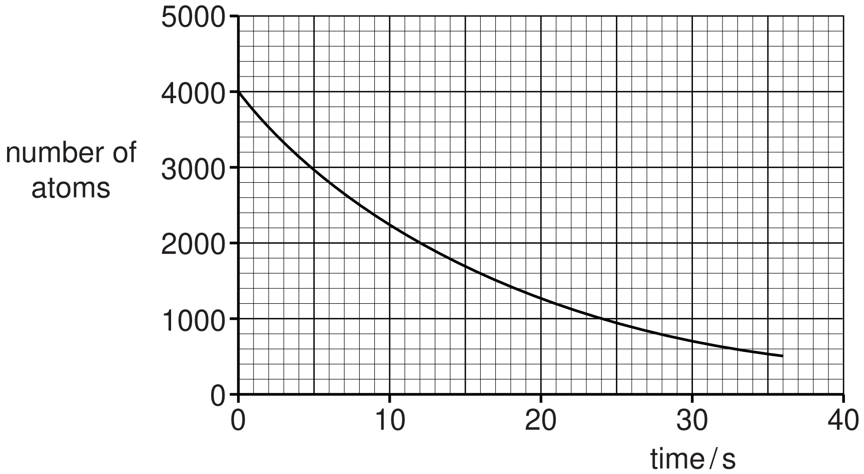

Fig. 11.1

For Examiner's Use

(i) Use Fig. 11.1 to find the time taken for the number of atoms to decrease from 4000 to 1000.

time = ... s

(ii) How many half-lives elapse as the number of atoms decreases from 4000 to 1000?

....

(iii) Calculate the half-life of this nuclide.

half-life = ... s
[3]

[Total: 6]

Question 12 is on the next page.

For Examiner's Use

12 (a) Atoms are composed of protons, neutrons and electrons.

(i) Which of these particles has the smallest mass?

....

(ii) Which two of these types of particle are found in the nucleus?

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

(b) Naturally-occurring chlorine gas contains two types of atom.

These are $^{35}_{17}Cl$ and $^{37}_{17}Cl$.

(i) What does the number 17 tell us about the nuclei of chlorine atoms?

.... [1]

(ii) Which particle does an atom of $^{37}_{17}Cl$ contain more of than an atom of $^{35}_{17}Cl$?

.... [1]

(iii) State the number of electrons in a neutral atom of

1. $^{35}_{17}Cl$, ...

2. $^{37}_{17}Cl$. ....
[2]

[Total: 6]