BOTSWANA EXAMINATIONS COUNCIL
in collaboration with
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE
Botswana General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

PHYSICS **0571/03**

Paper 3 **October/November 2011**

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 in the spaces provided at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided on the question paper.
You may lose marks if you do not show your working or if you do not use appropriate units.
Do not use staples, paper clips, highlighters, glue or correction fluid.
The number of marks is given in brackets [ ] at the end of each question or part question.
Take the weight of 1 kg to be 10 N (i.e. acceleration of free fall = 10 m/s^2).

For Examiner's Use

This document consists of **16** printed pages.

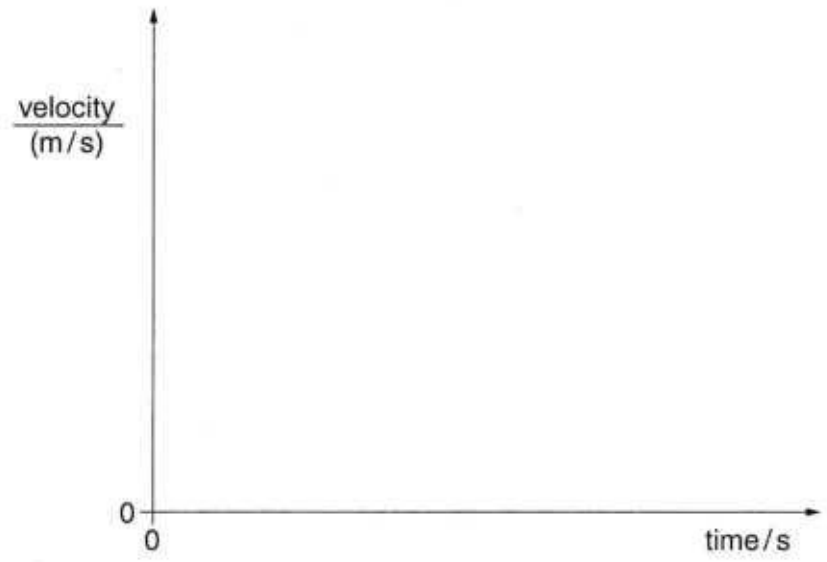
1 A truck slows down uniformly from a velocity of 30 m/s to a velocity of 5 m/s in 10 seconds.

For Examiner's Use

(a) Calculate the acceleration of the truck.

acceleration = ...[2]

(b) On the axes below, sketch a velocity-time graph to represent the motion of the truck during the 10 seconds.



[3]

2 Fig. 2.1 shows a spring of original length 5.0 cm, stretched by a load of 4.0 N. The spring is now 7.0 cm in length.

For Examiner's Use

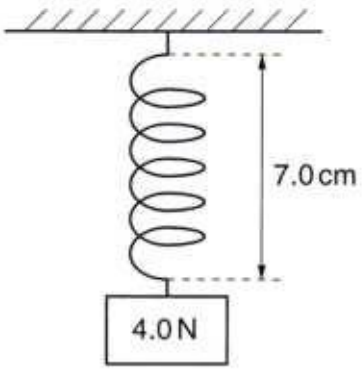


Fig. 2.1

(a) Find the extension caused by a 1.0 N load.

extension = ...[1]

(b) Two springs identical to the spring in Fig. 2.1 are arranged such that they are parallel to each other, as shown in Fig. 2.2.

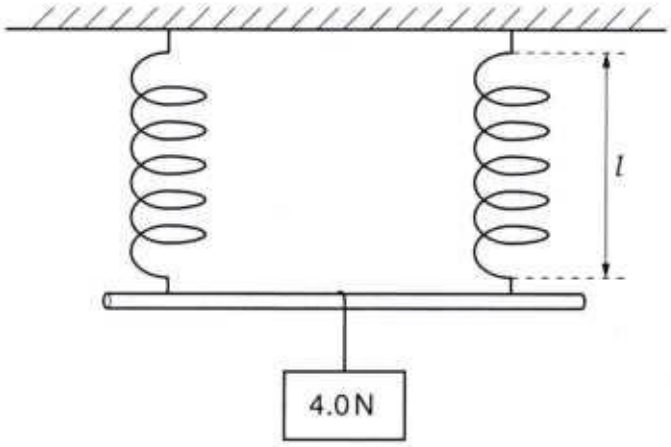


Fig. 2.2 (not to scale)

Calculate the value of the length l.

l = ...[2]

3 Fig. 3.1 shows a uniform fluorescent lamp of length 1.0 m and weight 8.0 N. The lamp is suspended from a ceiling using two strings, S_1 and S_2.

For Examiner's Use

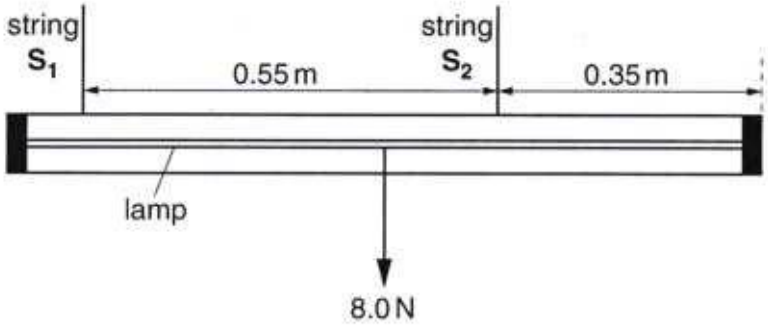


Fig. 3.1

(a) Taking moments about S_2, calculate the tension in string S_1.

tension = ...[3]

(b) Determine the tension in string S_2.

tension = ...[2]

4 Fig. 4.1 shows a mercury barometer.

For Examiner's Use

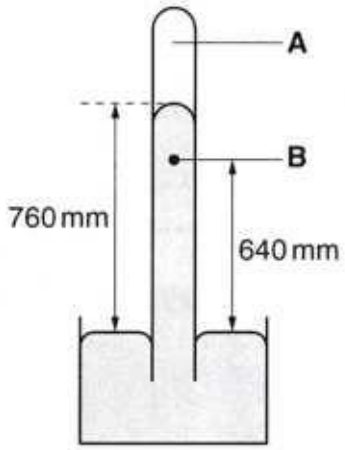


Fig. 4.1

(a) What does part **A** represent?

.....[1]

(b) Find the pressure at point **B**.
(density ρ of mercury = 13600 kg/m^3, g = 10 m/s^2)

pressure = ...[2]

(c) Fig. 4.2 shows isobars over two small islands.

For Examiner's Use

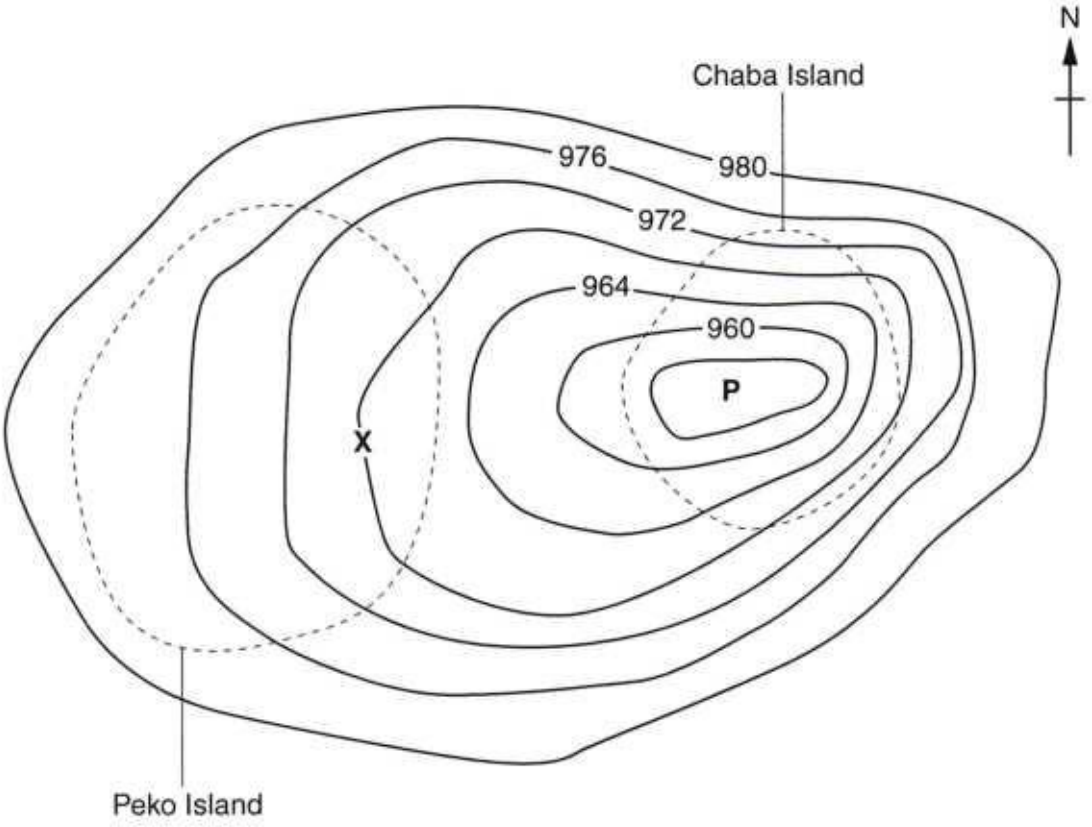


Fig. 4.2

(i) What are isobars?

.....[1]

(ii) What is the name of region **P**?

.....[1]

(iii) What is likely to be the weather pattern on the east of Chaba Island?

.....[1]

(iv) A mercury barometer is placed at point **X**.

What is the reading on the barometer?
(1000 mb = 760 mm Hg)

reading = ...[2]

5 (a) (i) Define absolute zero.

For Examiner's Use

.....

.....[1]

(ii) State the value of absolute zero in degrees Celsius.

.....[1]

(b) Fig. 5.1 shows a 0.40 kg iron bolt being cooled by immersing it in 8.0 kg of water at 25 °C. The specific heat capacity of iron is 450 J/(kg °C) and that of water is 4200 J/(kg °C). The initial temperature of the iron bolt is 800 °C.

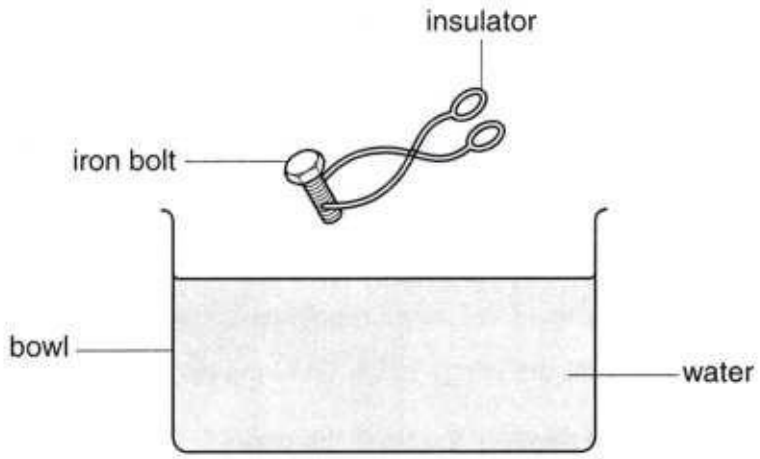


Fig. 5.1

Find the final temperature of the water.

final temperature = ...[3]

6 Fig. 6.1 shows a pencil partly submerged in water. The tip of the pencil rests at the bottom of the bowl. An observer sees the tip of the pencil at point **X**. The diagram is not drawn to scale.

For Examiner's Use

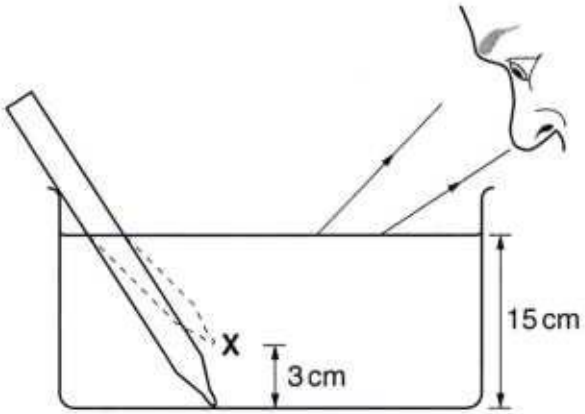


Fig. 6.1 (not to scale)

Two rays are shown emerging from the surface of the water after refraction.

(a) Complete the diagram to show how,

(i) the two rays from the tip of the pencil reach the surface of the water, [1]

(ii) the refracted rays form the image of the tip of the pencil at point **X**. [1]

(b) (i) What is the apparent depth of the tip of the pencil?

apparent depth = ...[1]

(ii) Calculate the refractive index of the water.

refractive index = ...[2]

7 **(a)** Define magnetic field.

For Examiner's Use

.....

.....[1]

(b) Fig. 7.1 shows a bar magnet of unknown poles tested with a bar magnet of known poles.

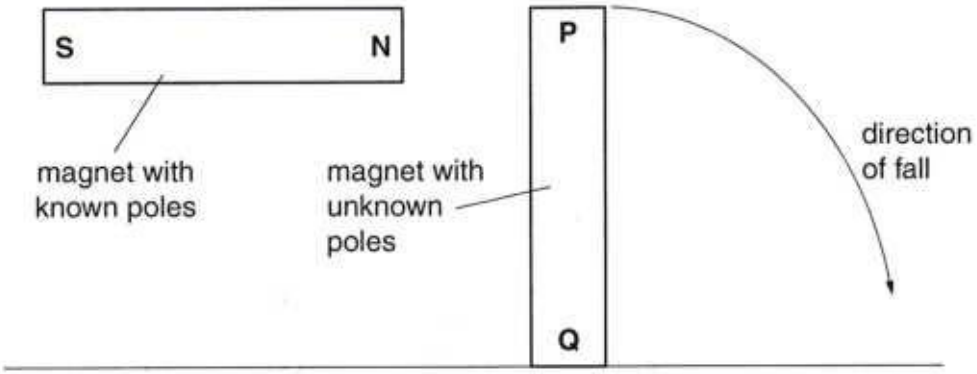


Fig. 7.1

When the **N** pole is moved towards end **P**, the magnet falls in the direction shown in Fig. 7.1 and lies as shown in Fig. 7.2 below.

Fig. 7.2

Draw the magnetic field lines around the bar magnet in Fig. 7.2. [3]

8 Fig. 8.1 shows two metal spheres, **A** and **B**, touching each other with a positively charged rod placed next to sphere **A**. Each sphere is placed on an insulating stand.

For Examiner's Use

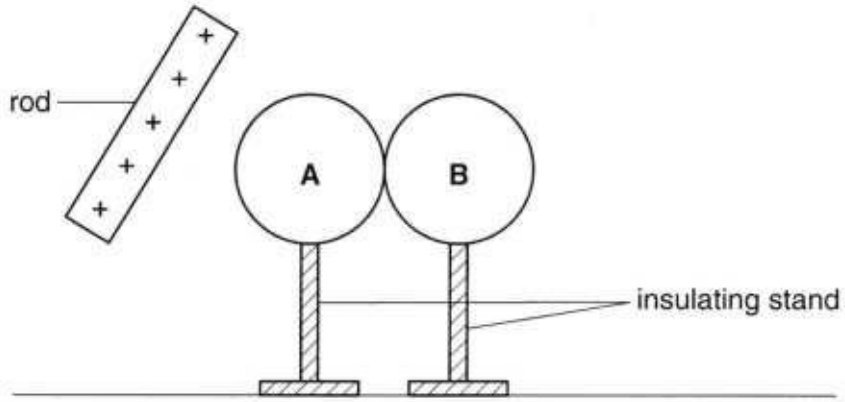


Fig. 8.1

(a) Show the charge distribution on each sphere in Fig. 8.1. [2]

(b) The spheres in Fig. 8.1 are separated as shown in Fig. 8.2.

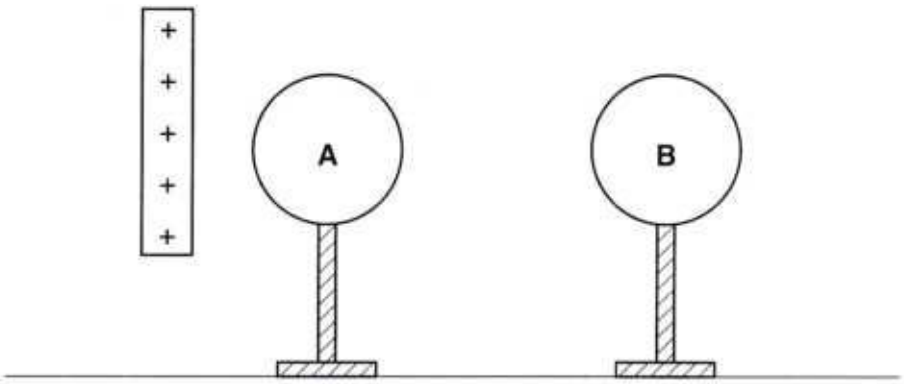


Fig. 8.2

Sphere **B** is touched with a finger.

State and explain what happens to the charge on sphere **B**.

.....

.....

.....[2]

9 Fig. 9.1 shows an electric circuit.

For Examiner's Use

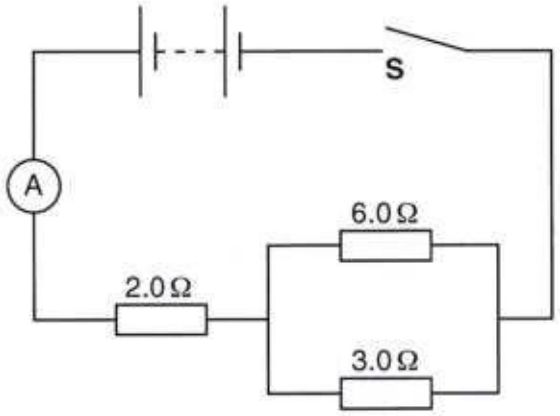


Fig. 9.1

When switch **S** is closed, the ammeter reading is 3.0 A.

Find

(a) the total resistance of the circuit,

resistance = ...[3]

(b) the current that flows through the 3.0 Ω resistor,

current = ...[1]

(c) the electromotive force (e.m.f.) of the battery.

electromotive force = ...[2]

10 (a) State Lenz's law.

For Examiner's Use

.....

.....[1]

(b) Fig. 10.1 shows a magnet being pulled out of a coil which is connected to a galvanometer.

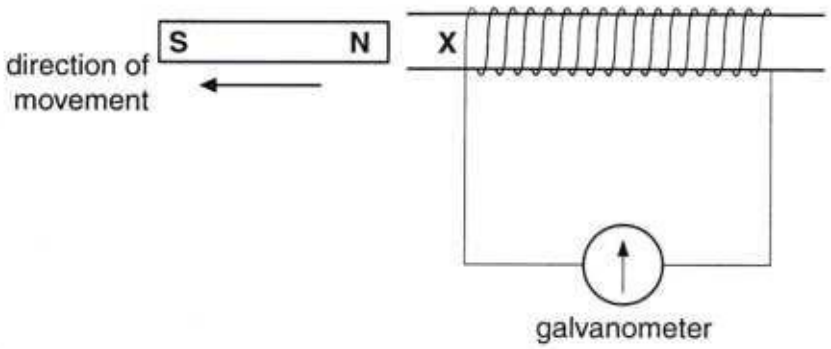


Fig. 10.1

(i) Which pole is induced at end **X** of the coil?

.....[1]

(ii) On Fig. 10.1, show the direction of the induced current in the coil. [1]

(iii) The magnet is pushed back into the coil with the **S** pole facing point **X**.

What effect, if any, does this have on the direction of the induced current?

.....

.....[1]

11 Fig. 11.1 shows a transformer connected to a 250V a.c. supply. The transformer has 1000 turns in the primary coil.

For Examiner's Use

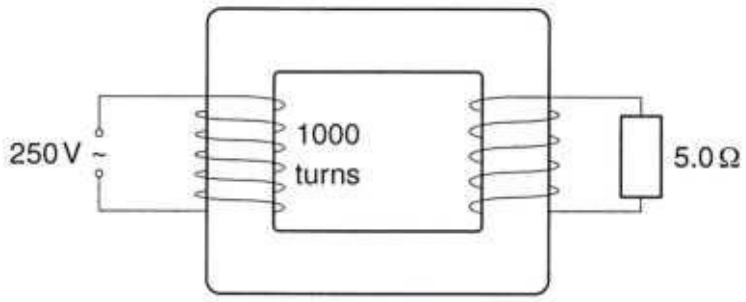


Fig. 11.1

A 5.0Ω resistor is connected to the secondary coil and a current of 0.50 A flows through the resistor.

(a) Calculate

(i) the potential difference across the resistor,

potential difference = ...[1]

(ii) the number of turns in the secondary coil.

number of turns = ...[2]

(b) Explain the principle of operation of the transformer.

.....

.....

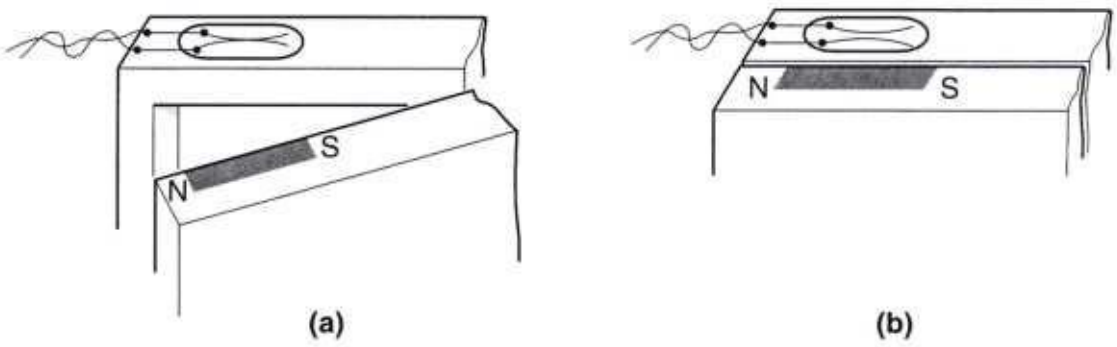
.....

.....

.....[4]

12 Fig. 12.1 shows a normally closed reed switch operated by a permanent magnet. The switch is used to turn a buzzer on and off.

For Examiner's Use



(a) (b)

Fig. 12.1

Explain why

(a) the reed switch opens when the door closes,

.....

.....

.....

.....[3]

(b) the buzzer rings when the door is opened.

.....

.....

.....[2]

13 **(a)** Define radioactive decay.

For Examiner's Use

.....

.....[1]

(b) The radioactive nucleus of element **X** decays to form the nucleus of element **Y** by releasing a beta particle. Complete the equation to show the mass number and the atomic number of element **Y**.

$$^{A}_{Z}\mathbf{X} \longrightarrow \text{.....}\,\mathbf{Y} + {}^{0}_{-1}\beta$$

[1]

(c) Fig. 13.1 shows a radioactive source that emits alpha, beta and gamma radiations. The radiations enter a magnetic field which is directed into the plane of the paper.

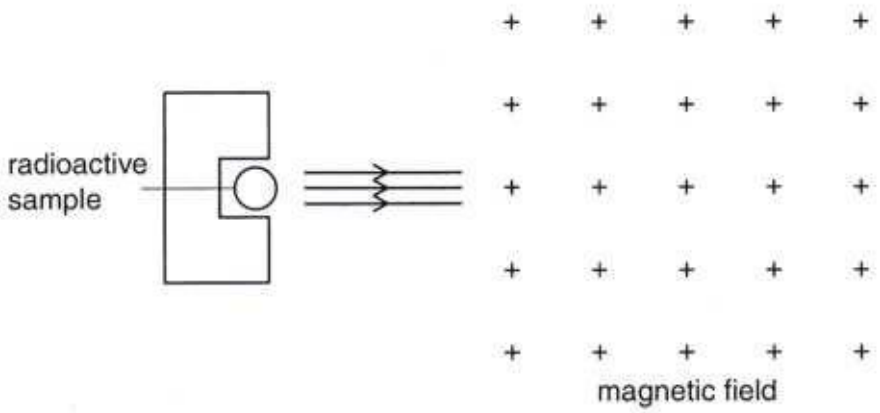


Fig. 13.1

On Fig. 13.1, draw and label the path followed by each radiation. [3]

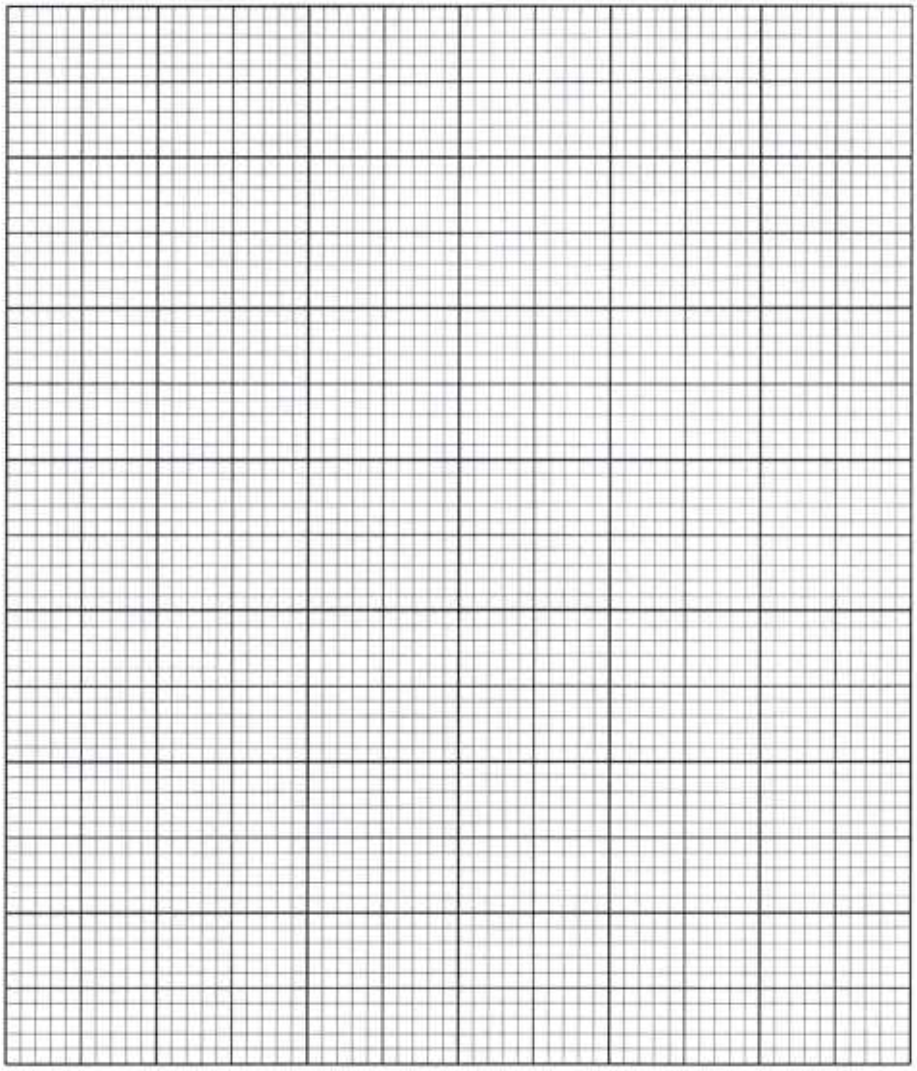
14 Table 14.1 shows the count rate of a radioactive substance for a time of 200 seconds.

For Examiner's Use

Table 14.1

time/s	0	40	80	120	160	200
count rate/per second	30	16	10	6	3	1.5

(a) On the grid below, plot a graph of count rate against time.



[2]

(b) Use your graph to determine the half-life of the substance.
Show your working.

half-life = ...[2]