**General Certificate of Secondary Education
2012–2013**

Double Award Science: Physics

Unit P1

Foundation Tier

[GSD31]

THURSDAY 23 MAY 2013, MORNING

GSD31

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in question **7(a)**.

8725

1 An electric heater changes energy from one form to another. This is shown below.
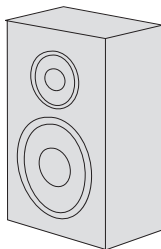
Electrical energy to ____heat____ energy.

(a) Complete the following to describe the energy change each device is **designed** to bring about.
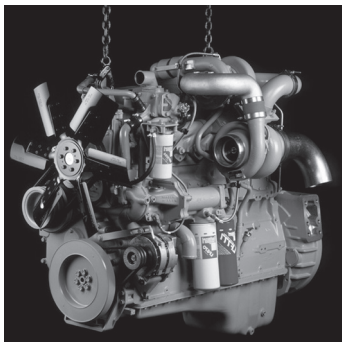Part of one has been done for you.
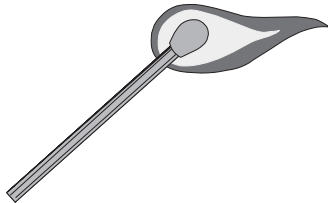
Match

_____ energy to ___heat___ energy.

Loudspeaker

_____ energy to _____ energy.

Diesel engine

_____ energy to _____ energy.

[5]

2

A ball travels through the air.

ground

(b) What two types of energy does the ball have?
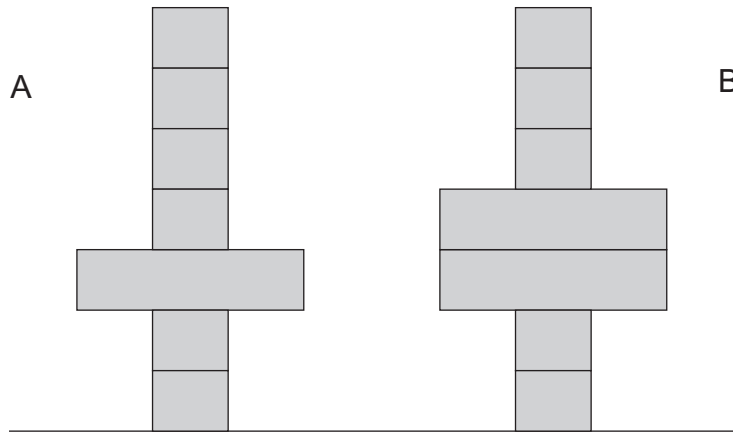
_____ energy and _____ energy. [2]

3

2 **(a)** What do you understand by the centre of gravity of an object?

_____

_____ [2]

Benjamin builds two towers with toy building blocks. These are shown below.

A   B

(b) **(i)** Which tower, if any, is more stable?

Give your answer by placing a tick (✓) in the correct box below.

A is more stable than B.   ☐

B is more stable than A.   ☐

A and B are equally stable.   ☐   [1]
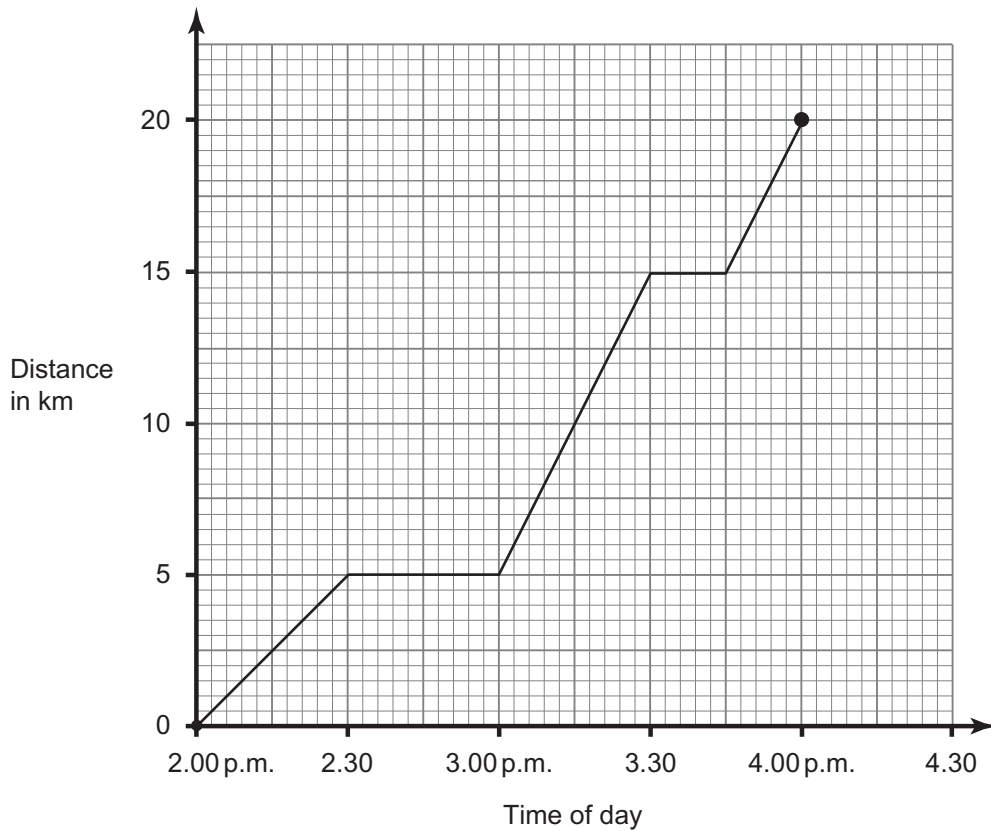
(ii) Give a reason for your choice.

_____

_____ [1]

3 An athlete runs a 20 km race from 2 p.m. until 4 p.m. The distance–time graph of the run is shown below.

Use the graph to find:

(a) **(i)** how many times the athlete stopped **during** the race,

_____ times [1]

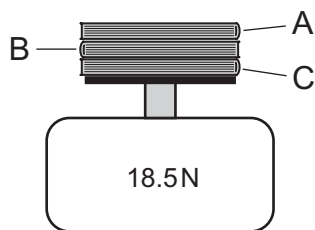**(ii)** how long the athlete was actually running.

_____ hours [1]

(b) Find the athlete's average speed in **km/h**.

You are advised to show your working out.

Average speed = _____ km/h [3]

8725

5

4 Tabitha finds the weight of three books, A, B and C, by placing them on a top pan balance. The reading on the balance is 18.5 N.

B — [A]

C

18.5 N

Book A has a mass of 0.75 kg, book B a mass of 0.5 kg.

(a) What is the mass of book C?

You are advised to show your working out.

Mass of book C = _____ kg [3]

(b) (i) What force do the books exert downwards on the balance?

Downward force = _____ N [1]
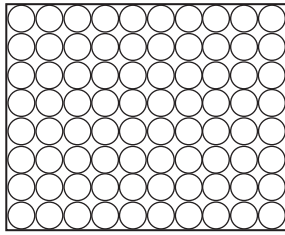
(ii) What force does the balance exert on the books?

Force = _____ N [1]

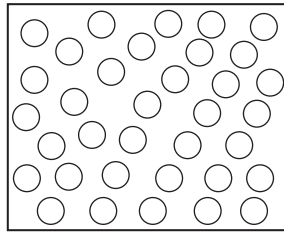**(iii)** Give the direction of the force exerted by the top pan balance.

_____ [1]

5 The diagrams below illustrate the three states of matter.
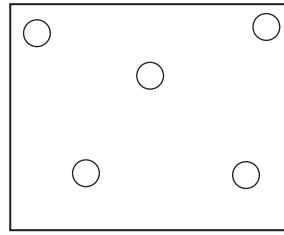
A	B	C

(a) (i) Which diagram, A, B or C, represents the liquid state?

Diagram _____ [1]

(ii) To change from one state to another, heat energy has to be added or removed. Tick (✓) the box to show if heat is added or removed in the following changes of state.
Tick one box only, in each line.

A to C   Heat added   ☐   Heat removed   ☐

C to B   Heat added   ☐   Heat removed   ☐   [2]

(b) The densities of the three states of water are (in kg/m³) 0.6, 1000 and 931.
Ice is **less** dense than water.

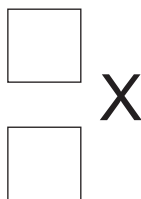Write the densities in the correct places in the table below.

State	Density in kg/m³
Liquid water	
Steam	
Ice	

[3]

6 An atom, X, is electrically neutral. It contains 17 electrons and 18 neutrons.

(a) (i) Insert the mass number and the atomic number for the nucleus of atom X.

$$\boxed{}_{\boxed{}} X$$

[2]

A number of unknown nuclei, P, Q, R and S are listed below.

30	30	32	33
P	Q	R	S
16	15	17	16

(ii) Which, if any, of P, Q, R and S are isotopes?

_____ [1]

(iii) Explain your answer.

_____

_____ [2]

The nuclei of some atoms are radioactive and emit radiation.

(b) (i) Why do these nuclei emit radiation?

_____ [1]

(ii) Complete the table below, giving the names of the three types of radiation emitted by radioactive substances and state whether it is an electromagnetic wave or a particle.

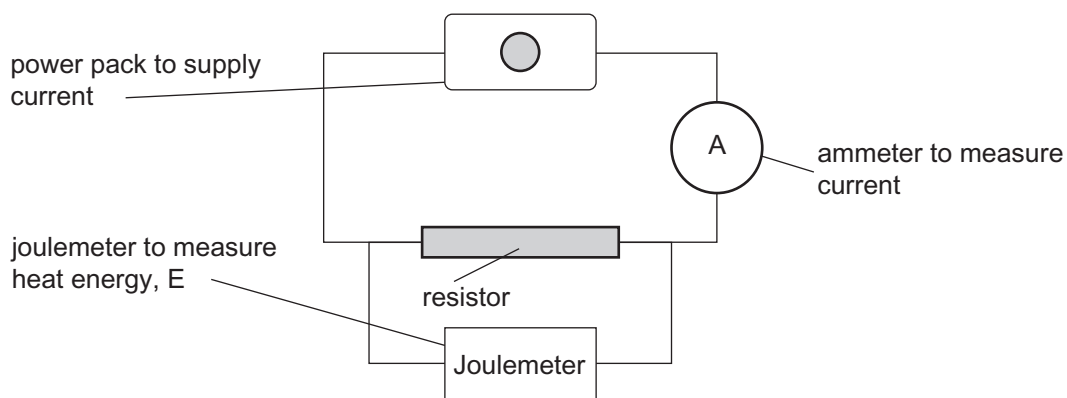| Name of radiation	Nature (electromagnetic wave or particle)

[6]

8

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(Questions continue overleaf)

7 **(a)** Describe an experiment you would carry out to measure the power output of an electric motor.

In your description you should include:

- the apparatus used,
- the measurements you take,
- the formula you would use to find the power.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [6]

(b) A guillotine is used to cut sheets of paper. A constant downward force of 20 N is exerted on the handle.

Calculate the moment of the 20 N force about the pivot.

Remember to include the unit in your answer.

You are advised to show your working out.

Moment = _____ [4]

11

8 When a battery passes a current through a resistor then heat energy is produced in the resistor.

power pack to supply current

A — ammeter to measure current

joulemeter to measure heat energy, E

resistor

Joulemeter

David suspects that the heat energy, E, produced depends on the square of the current, I. This relationship could be written as:

$$E = k\,I^2$$

He obtains a series of readings of current and energy and these are shown in the table.

I in A	0.0	0.5	1.0	1.5	2.0	2.5
I^2 in A²					4.0	
E in J	0.0	0.5	2.0	4.5	8.0	12.5

(a) Complete the table by entering the values of I^2, correct to 1 decimal place. One entry has been recorded for you. [2]

(b) Choose a suitable scale and label the *x*-axis. Plot a graph of energy, E, on the vertical axis versus I^2 on the horizontal axis. [4]

E in J

13 –

12 –

11 –

10 –

9 –

8 –

7 –

6 –

5 –

4 –

3 –

2 –

1 –

0

0
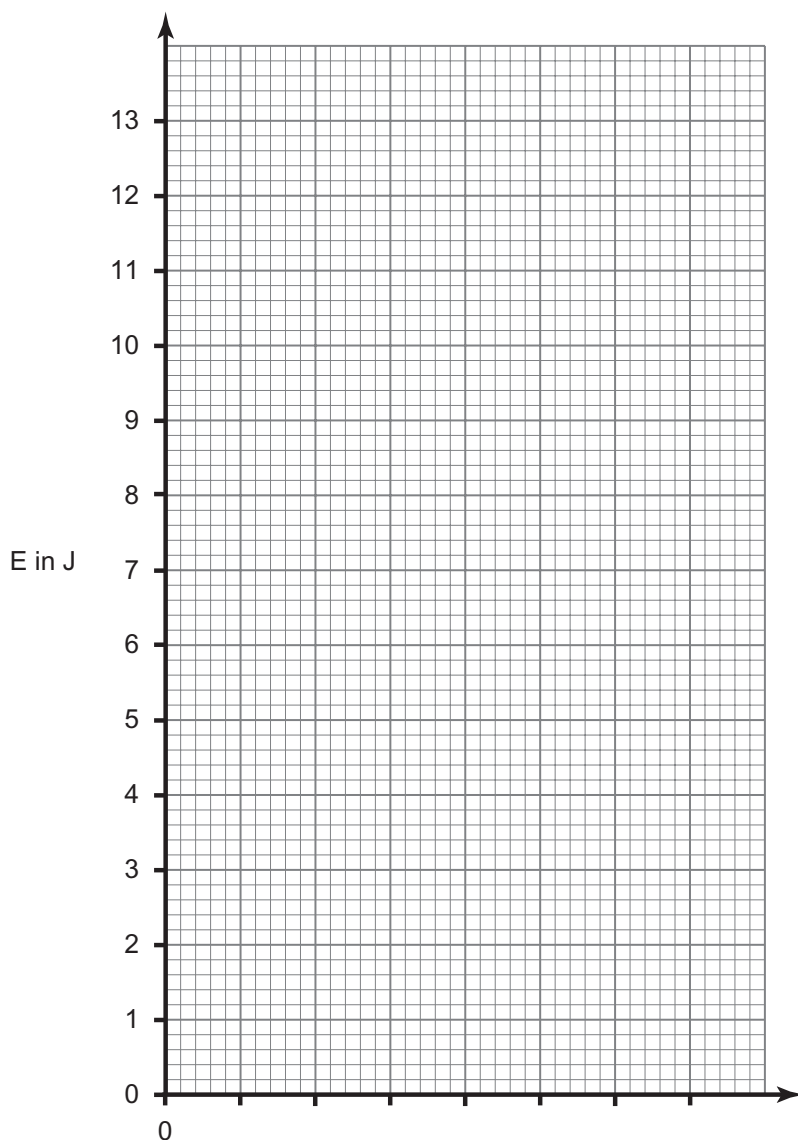
(c) Draw the line of best fit. [1]

(d) Use your graph to find the constant k.

Remember to include the unit for k.
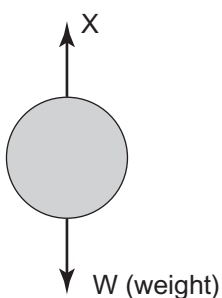
You are advised to show your working out.

k = _____

Unit = _____ [4]

9 Kyle is interested in how quickly a glass bead falls through water.
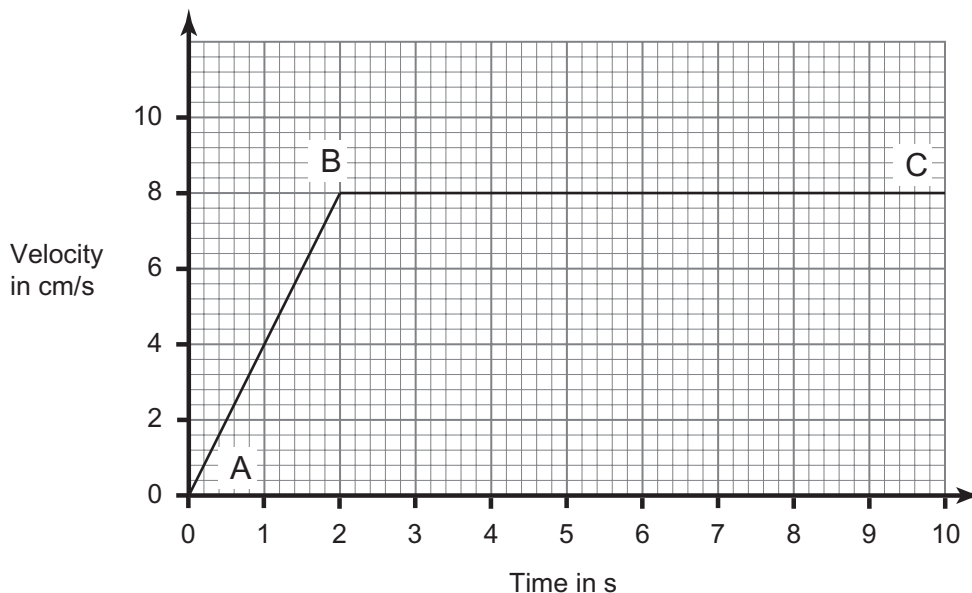
glass bead
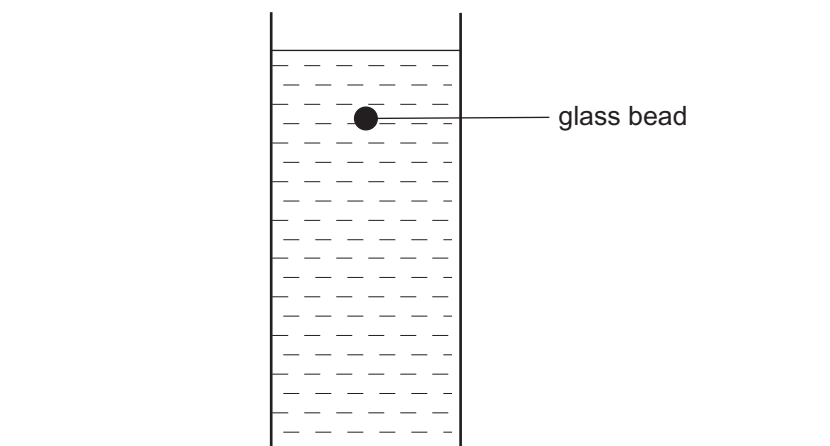
(a) Two forces, W and X, act on the bead as it falls. W is the weight.

X

W (weight)

(i) What is the name of the other force X?

Force X is called _____ [1]

Kyle plots a velocity–time graph of the bead's motion.

14

(ii) How do the sizes of these forces compare during the regions AB and BC? Give your answer by ticking (✓) the correct box in each case.

During AB,

W is less than X.   ☐

The two forces are equal.   ☐

X is less than W.   ☐

During BC,

W is less than X.   ☐

The two forces are equal.   ☐

X is less than W.   ☐   [2]

The bead hits the bottom of the cylinder after 10 s.

(b) (i) Use the graph on page 14 to calculate the depth of water in the container.

You are advised to show your working out.

Depth of water = _____ cm [3]

(ii) The bead has a mass of 0.2 g. Calculate its maximum momentum in g cm/s.

You are advised to show your working out.

Maximum momentum = _____ g cm/s [3]