cea
Rewarding Learning

General Certificate of Secondary Education
2017–2018

Double Award Science: Physics

ML

Unit P1

Higher Tier

[GSD32]

FRIDAY 10 NOVEMBER 2017, MORNING

TIME

1 hour, plus your additional time allowance.

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
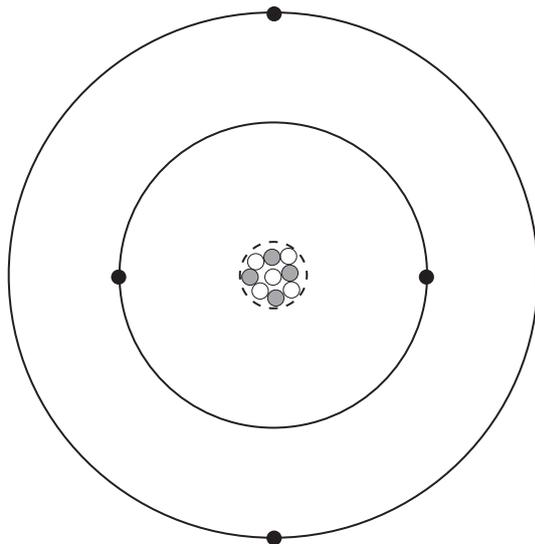
The total mark for this paper is 70.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Questions **2** and **7**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

1 A neutral atom is represented by the diagram below.

Some information about the atom is given in the table below.

(a) Complete the table.

Particle	Name	Relative mass	Relative charge
●		$\dfrac{1}{1840}$	
◉			+1
○	neutron		

[6]

When a substance is radioactive it will emit ionising radiation.

(b) What is 'ionisation'?

_____

_____ [2]

(c) A radioactive substance has a half-life of 4 minutes. There are 8000 undecayed nuclei present now.
How many undecayed nuclei will remain after 12 minutes?

Show your working out.

Number of undecayed nuclei = _____ [3]

2 Describe nuclear fission.

Your description should include:

- the name of a fuel;
- the particle which starts the fission;
- what occurs during fission;
- the result of the fission.

You will be assessed on your written communication skills including the use of specialist scientific terms.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [6]

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(Questions continue overleaf)

3 An object accelerates from rest for a time, t. During the acceleration it travels a distance, d.

The distance, d and the time, t are related by the equation:
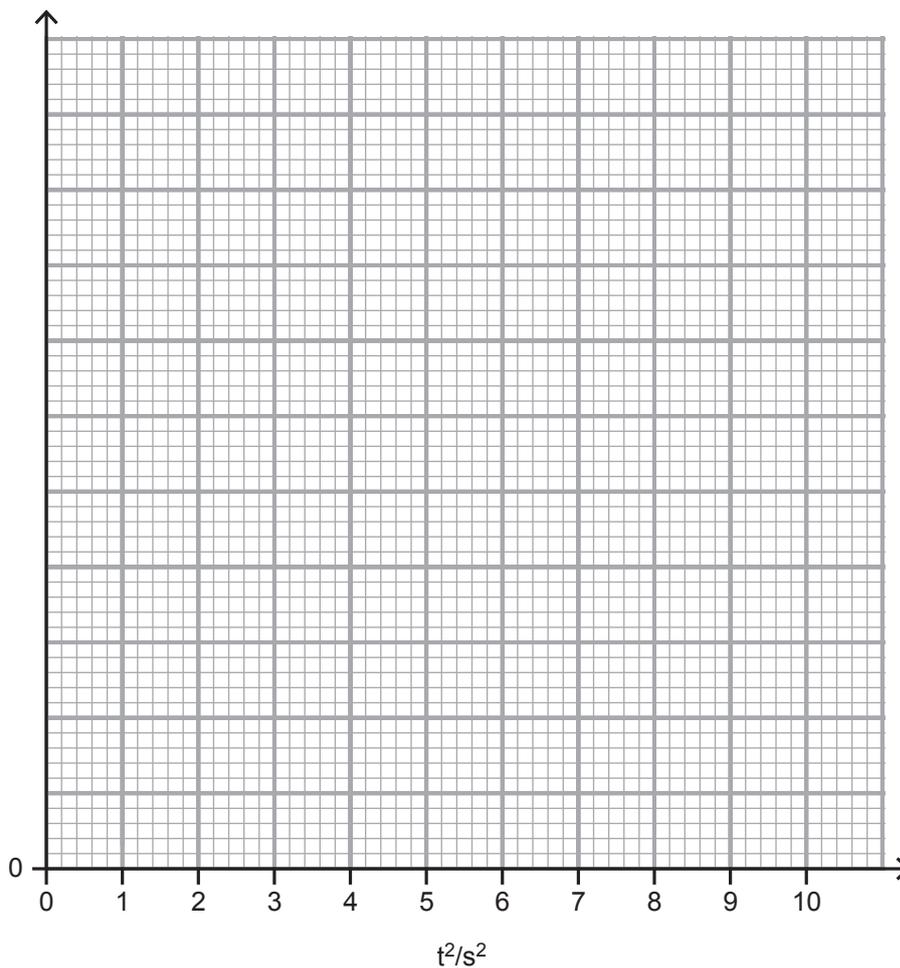
$$d = kt^2 \qquad \text{Equation 3.1}$$

where k is a constant.

An engineer obtains the following results in an investigation.

d/m	0	2	8	18	20
t^2/s^2	0	1	4	9	10

Plot a graph of d (vertical axis) against t^2 (horizontal axis).

(a) Choose a suitable vertical scale and label it. [2]

(b) Plot a graph of d against t^2. [2]

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

t^2/s^2

(d) (i) Using your graph, state the relationship, in words, between distance (d) and time^2 (t^2).

_____

_____ [1]

(ii) Explain how your graph shows this.

_____

_____ [2]

(iii) Calculate the gradient of your line and give its unit.

Show your working out.

Gradient = _____

Unit = _____ [3]

4 (a) The mass of a lorry and its fuel is 2200 kg. Their total momentum is 39 600 kg m/s.
Calculate the velocity of the lorry.

Show your working out.

Velocity = _____ m/s [3]

(b) The lorry is driven with an acceleration of 2 m/s^2.

(i) Calculate the resultant force on the lorry.
Remember the mass of the lorry and its fuel is 2200 kg.

Show your working out.

Resultant force = _____ N [3]

Much later in the journey the **same resultant force** causes the lorry to move with an acceleration of 2.2 m/s^2.

(ii) Calculate the mass of fuel consumed.

Show your working out.

Mass of fuel consumed = _____ kg [3]

8

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(Questions continue overleaf)

5 The velocity–time graph for a train journey is shown.
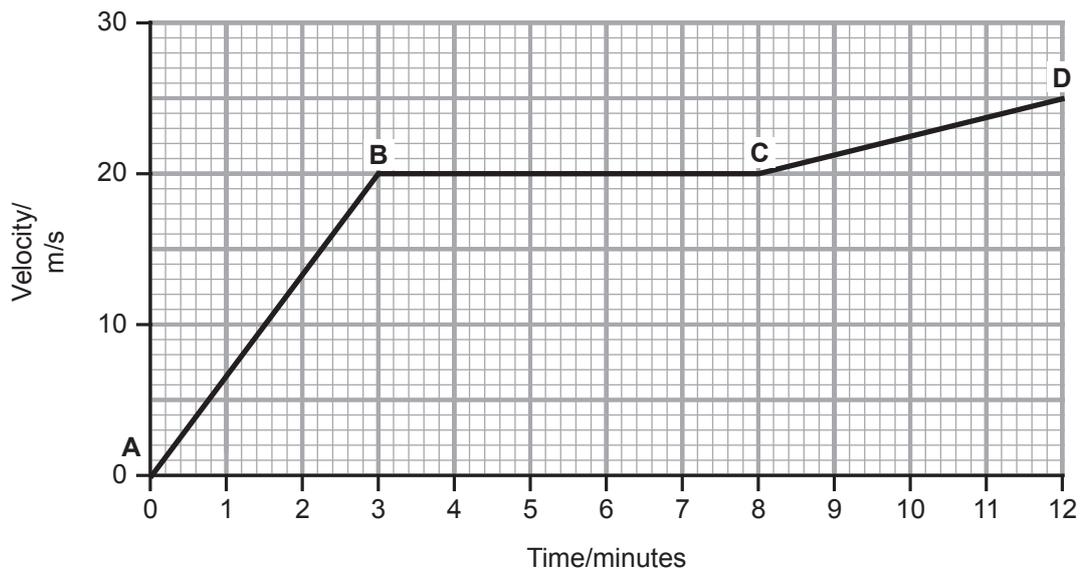
(a) The graph has three regions AB, BC and CD. For **each region** tick (✓) the box which describes the motion of the train.

AB   Increasing acceleration   ☐

        Zero acceleration   ☐

        Constant acceleration   ☐

BC   Increasing acceleration   ☐

        Zero acceleration   ☐

        Constant acceleration   ☐

CD   Increasing acceleration   ☐

        Zero acceleration   ☐

        Constant acceleration   ☐
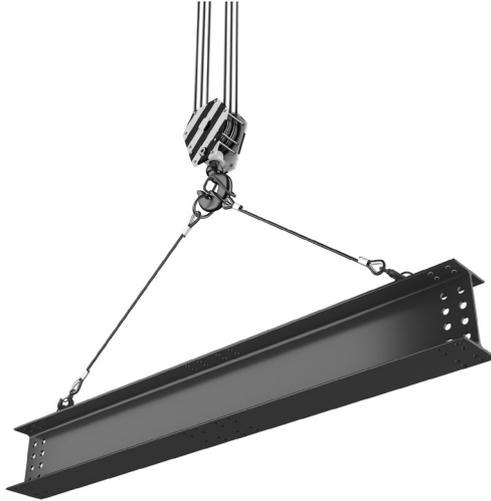
[3]

(b) Find the distance travelled by the train in the first 3 **minutes** of its journey.

Show your working out.

Distance travelled = _____ m [4]

6 A crane lifts a steel beam.

© Grassetto / iStock / Thinkstock

The crane's power output is 0.5 kW. The crane lifts the beam in a time of 150 seconds.

(i) Calculate the work done on the beam.

Show your working out.

Work done = _____ J [4]

(ii) What is the increase in potential energy of the beam?

Increase in potential energy = _____ J [1]

(iii) A different beam is lifted and the crane's output energy is 50 000 J. If the crane's efficiency is 0.4 calculate its input energy.

Show your working out.

Input energy = _____ J [3]

[Turn over

7   Solids, liquids and gases are the three states of matter.

Describe the **arrangement** and **motion** of the particles in each of these three states.
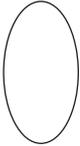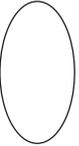
You will be assessed on your written communication skills including the use of specialist scientific terms.

Solid _____

_____

_____

Liquid _____

_____

_____

Gas _____

_____

_____ [6]

8 Cobalt-60 emits a beta particle to become nickel.

(i) Complete the boxes in the equation below.

$$^{60}_{27}\text{Co} \longrightarrow \, ^{60}_{28}\text{Ni} \, + \, ^{\boxed{}}_{\boxed{}}\beta$$

[2]

The nickel nucleus is still unstable and emits gamma radiation.
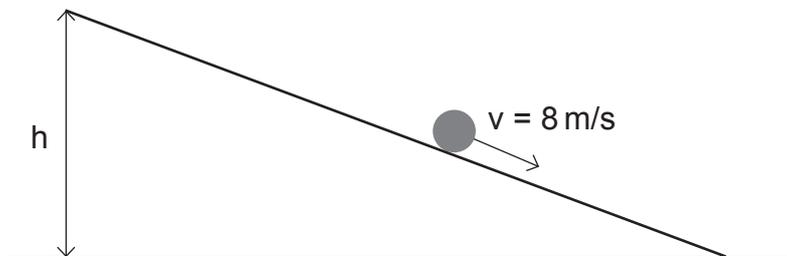
(ii) Complete the boxes in the equation below.

$$^{60}_{28}\text{Ni} \longrightarrow \, ^{\boxed{}}_{\boxed{}}\text{Ni} \, + \, \gamma$$

[2]
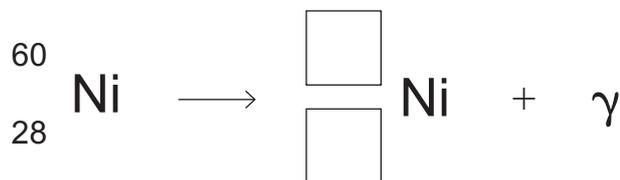
9 **(a)** State the Law of Conservation of Energy.

_____

_____ [1]

(b) A boulder of mass 120 kg rolls down a slope from rest.

At the point shown the velocity of the boulder is 8 m/s and its potential energy is 4560 J.

(i) Calculate the kinetic energy of the boulder at this point and use your answer to find the boulder's total energy.

Show your working out.

Total energy = _____ J [4]

(ii) Use the law of Conservation of Energy to calculate the initial height, h of the boulder. Assume no energy losses.

Show your working out.

Height, h = _____ m [3]

THIS IS THE END OF THE QUESTION PAPER

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