Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2016–2017

Double Award Science: Physics

MV18

Unit P1
Higher Tier

[GSD32]

FRIDAY 11 NOVEMBER 2016, AFTERNOON

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 at the end of each question indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Questions **1** and **6**.

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1 Describe an experiment you would carry out to measure the power output of an electric motor. [6 marks]

In your description you should include:

- the apparatus used;
- the measurements you take.

Do not include any formulas.

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

2 **(a)** Explain why atoms are electrically neutral. [1 mark]

(b) Complete the table below to show the relative masses and charges of the particles that make up an atom. [4 marks]

Particle	Relative mass	Relative charge
	1	+1
Neutron		
Electron	$\frac{1}{1840}$	

(c) Explain in terms of nuclear particles the meaning of the term **isotope**. [2 marks]

(d) The lithium nucleus contains three protons and four neutrons.
Complete the symbol below for the lithium nucleus.
[2 marks]

(e) Another atom has the same number of neutrons but a different number of protons.
Tick (✓) the box to show what this other atom is.
[1 mark]

- ☐ An isotope of lithium
- ☐ An ion
- ☐ Another element

Nuclear reactors are used in power stations to release energy through nuclear fission.

(f) (i) What is meant by **nuclear fission**? [2 marks]

_____

_____

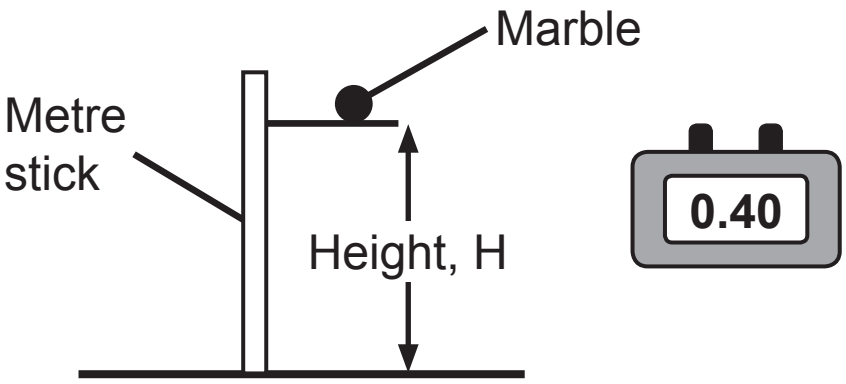
(ii) Name one fission fuel commonly used in nuclear reactors. [1 mark]

_____

(iii) State one disadvantage, not related to cost, of producing electricity using nuclear power. [1 mark]

_____

3 The acceleration due to gravity can be measured by finding the times, T, for a marble to fall through various heights, H, above the Earth's surface.



According to theory, the relationship between the height, H and the time T, is given by:

$H = k T^2$ Equation 3.1

The following data was obtained.

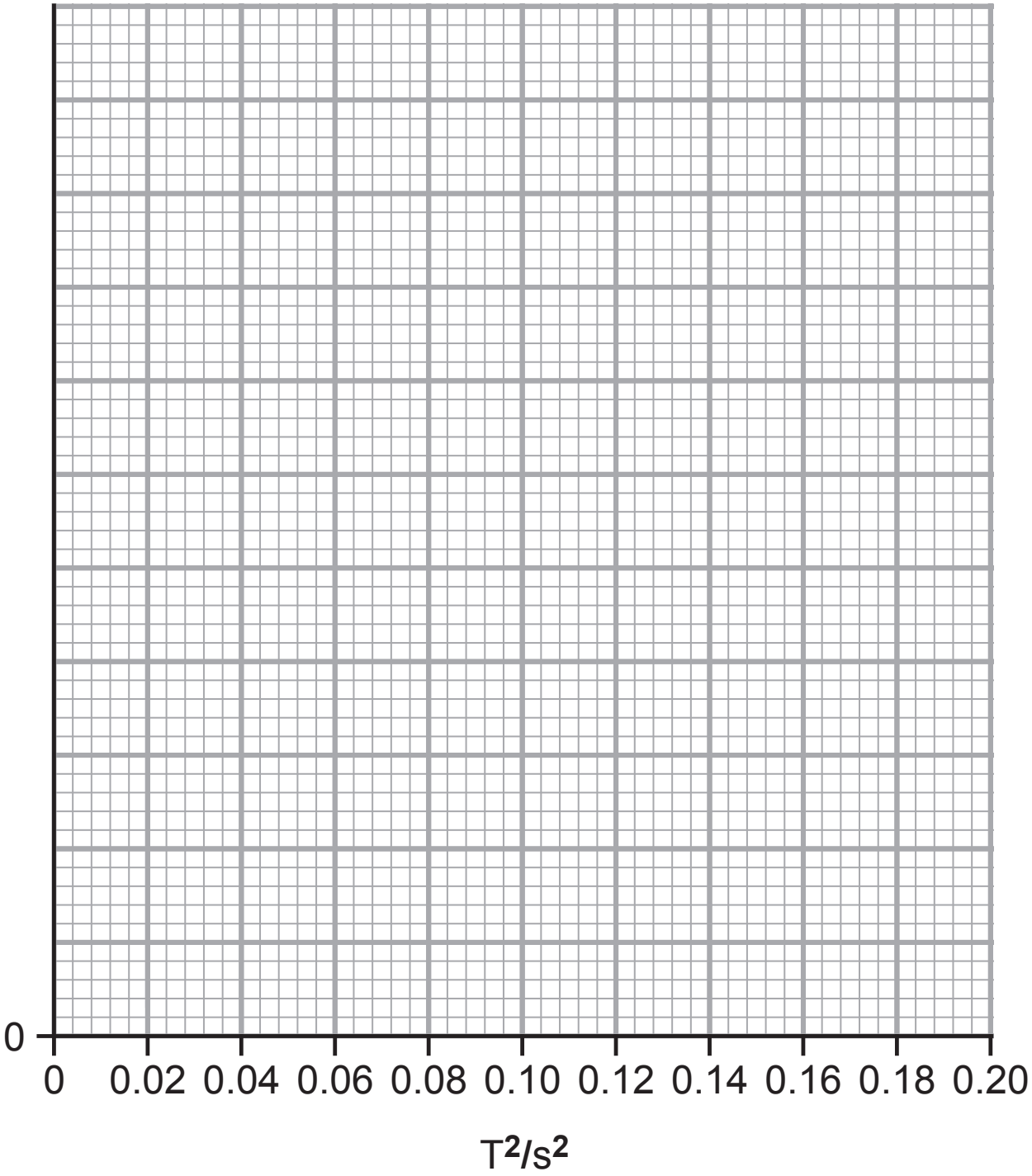
Height/m	0.2	0.4	0.6	0.8	1.0
T^2/s^2	0.04	0.08	0.12	0.16	0.20

(a) On the grid opposite, draw a graph of height H on the vertical axis versus T^2 on the horizontal axis.

(i) Label the vertical axis and insert the appropriate scale. [2 marks]

(ii) Plot the points. [2 marks]

(iii) Draw a line of best fit. [1 mark]



(b) (i) Use your graph to find the value of k. [2 marks]
Remember to include the unit for k. [1 mark]
You are advised to show your working out.

k = _____

Unit of k = _____

(ii) Does your graph support the relationship between H and T^2 in equation 3.1? [2 marks]

Yes **No** **Circle the correct answer.**

Explain your answer.

_____

_____

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(Questions continue overleaf)

4 The cheetah is the fastest land animal over a short distance.

A cheetah is **travelling** at a constant velocity when it spots its prey. It then accelerates at 8 m/s^2 for 3 seconds.

(a) Calculate the cheetah's **change in velocity**. [3 marks]

You are advised to show your working out.

Change in velocity = _____ m/s

(b) The mass of the cheetah is 80 kg.

(i) State the resultant force on the cheetah, when it is travelling at a constant velocity. [1 mark]

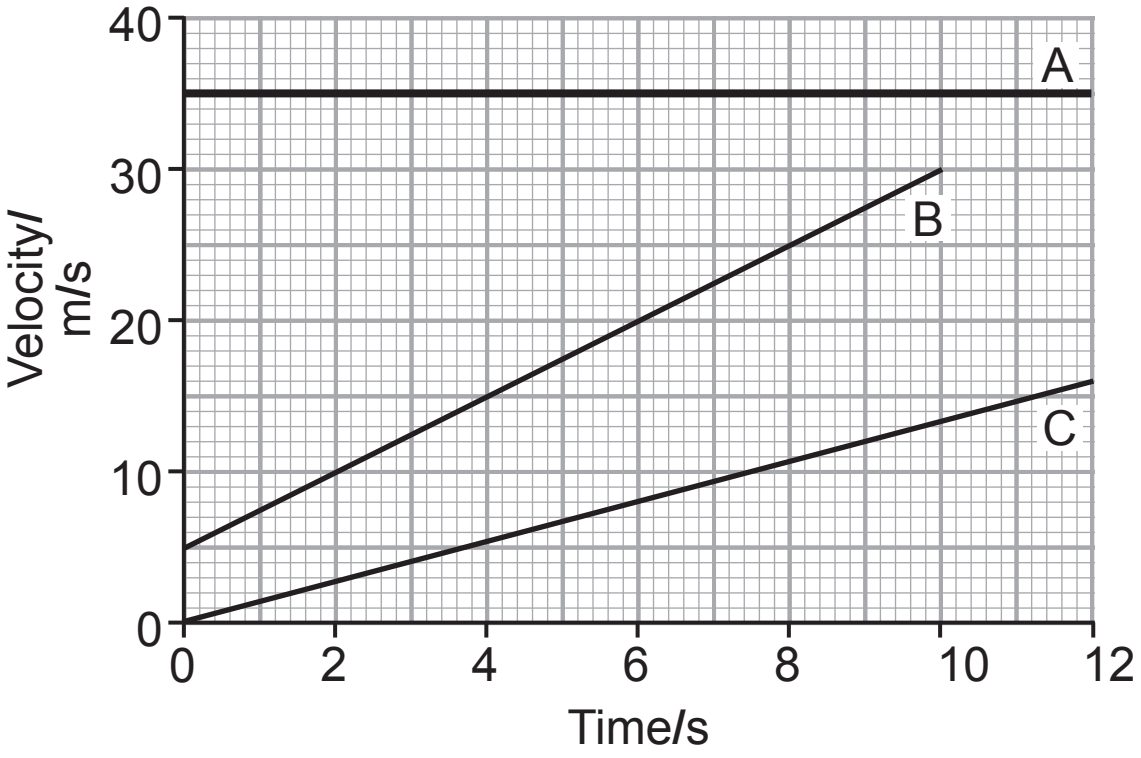
Resultant force = _____ N

(ii) Calculate the resultant force on the cheetah while it is accelerating at 8 m/s^2. [3 marks]

You are advised to show your working out.

Resultant force = _____ N

5 The graphs below represent the motions of three different vehicles, A, B and C.



(a) (i) Which vehicle is not accelerating? [1 mark]

Vehicle/s = _____

(ii) Which vehicle is travelling with the greatest acceleration? [1 mark]

Vehicle = _____

(iii) Give a reason for your answer to **(ii)**. [1 mark]

_____

(b) (i) Calculate the acceleration of vehicle B. [3 marks]

You are advised to show your working out.

Acceleration = _____ m/s^2

(ii) What does the area between line B and the horizontal axis represent? [1 mark]

_____

(iii) Find the displacement of vehicle B in the 10 seconds of its motion. [3 marks]

You are advised to show your working out.

Displacement = _____

6 Write an account of the process of nuclear fusion.
[6 marks]

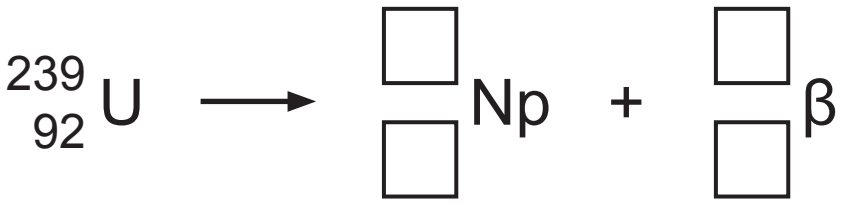
Your account should include the following:

- the particles involved;
- the process itself;
- where fusion occurs naturally.

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

7 An isotope of uranium (U) decays by emitting a beta (β) particle.

(a) Write the numbers in the boxes below to complete the equation. [4 marks]



(b) A sample of neptunium-240 contains 1000 undecayed nuclei. After 21.9 minutes 875 neptunium-240 nuclei have decayed.

By first working out how many undecayed neptunium-240 nuclei remain, [1 mark]
calculate the half-life of neptunium-240. [3 marks]

You are advised to show your working out.

Number of undecayed neptunium-240 nuclei = _____

Half-life = _____ minutes

8 An archer shoots an arrow vertically into the air.

The arrow has a mass of 200 g and its initial kinetic energy on release is 50 J. Later in its flight the arrow's kinetic energy has decreased to 20 J.

Use the Principle of Conservation of Energy to calculate the height of the arrow at this point. Assume no energy losses have occurred. [4 marks]

You are advised to show your working out.

Height = _____ m

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(Questions continue overleaf)

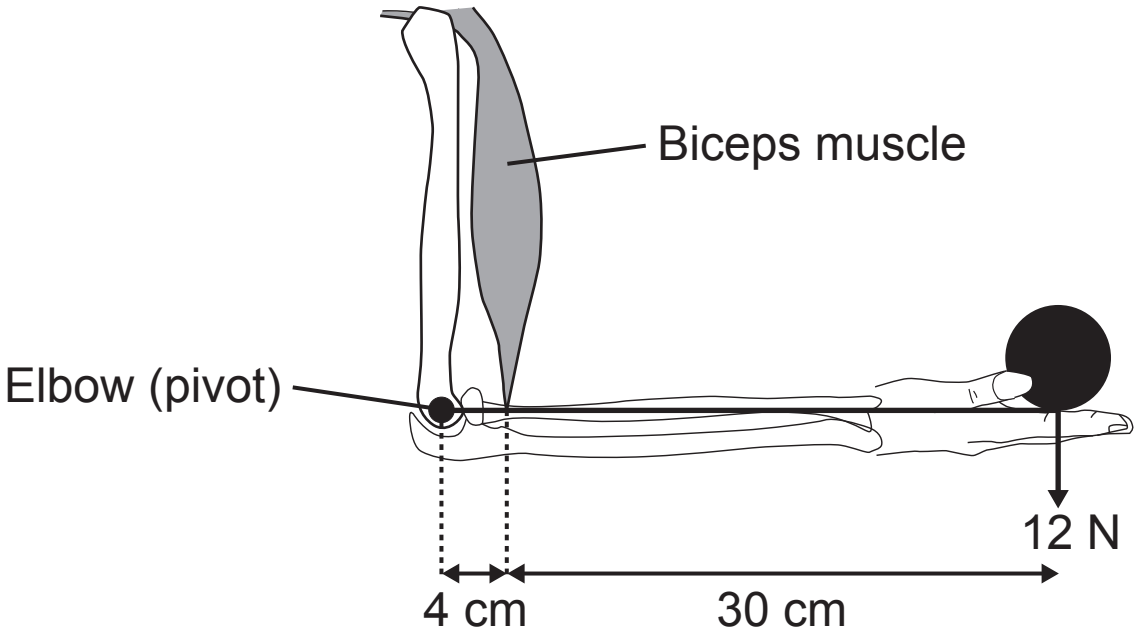
9 **(a)** State the Principle of Moments. [2 marks]

_____

_____

_____

(b) The diagram represents the forearm bone and the biceps muscle of the arm of an athlete holding a weight of 12 N.



Calculate the upwards force exerted by the athlete's biceps muscle. [3 marks]

You are advised to show your working out.

Force = _____ N

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Question Number	**Marks**
1	
2	
3	
4	
5	
6	
7	
8	
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Total Marks	