New Specification

Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2017–2018

Double Award Science
Physics

Unit P1

Higher Tier

ML

[GDW32]

WEDNESDAY 23 MAY 2018, 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.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all ten** 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 **2**.

1 **(a)** The nucleus of an element, X, may be written as shown below.

$$ {}^{A}_{Z}X $$

A and Z are numbers. What are the numbers called?

A is the _____ number.

Z is the _____ number. [2]

The following incomplete sentence describes radioactive decay. Complete the sentence by filling in the blank spaces.

(b) A nucleus decays because it is _____ and so emits

_____ or _____ particles

or _____ radiation. [4]

A radioactive substance has 8400 **undecayed** particles and 90 minutes later 7350 particles have decayed.

(c) By first finding the number of **undecayed** particles after 90 minutes, calculate the half-life of the substance.

You should show your working out.

Half-life = _____ minutes [3]

2 Describe the structure of the atom.

In your answer write about:

- the names of the particles which make up the atom;
- where these particles are located.

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

[6]

[Turn over

3 A gardener pushes a lawnmower with an average force of 9 N.

© KatarzynBialasiewicz / iStock / Thinkstock

By the time the lawn is mowed the gardener has walked a total distance of 600 m.

(a) Calculate the work done.

You should show your working out.

Work done = _____ J [3]

On another occasion he did 72 000 J of work and took 15 **minutes** to complete the job.

(b) Calculate the power developed.

You should show your working out.

Power = _____ W [4]

[Turn over

4 A mountaineer wears snow shoes.

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The snow shoes prevent her from sinking into the snow.

(i) Explain fully, in terms of pressure, why this is so.

_____

_____

_____ [2]

The mountaineer wears snow shoes of total area 0.5 m^2 and exerts a pressure on the snow of 1800 Pa.

(ii) Calculate the weight of the mountaineer.

You should show your working out.

Weight = _____ N [3]

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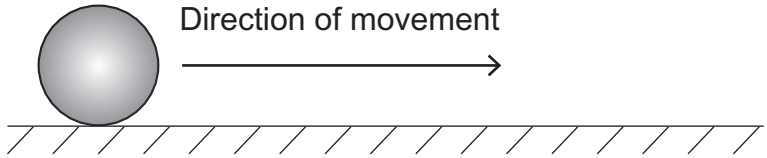
(Questions continue overleaf)

[Turn over

5 A ball is rolled along a surface.



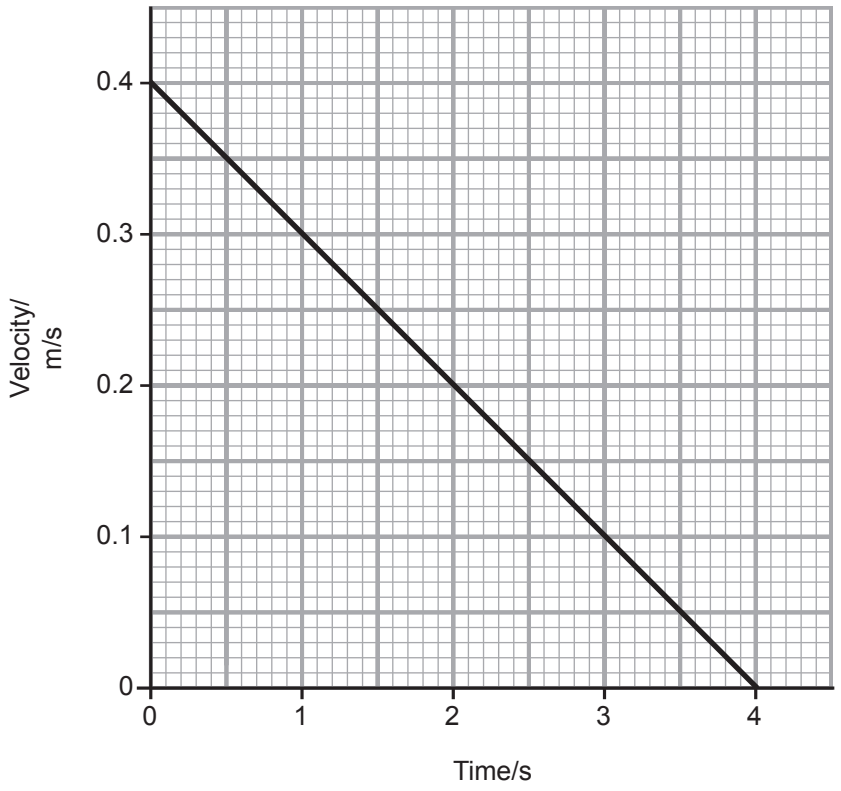
(a) The ball travels along this surface before coming to **rest**. During this time the ball slows down at a constant rate and has an average velocity of 0.14 m/s.

Calculate the initial velocity of the ball.

You should show your working out.

Initial velocity = _____ m/s [3]

(b) (i) The velocity-time graph for another ball is shown below.



Calculate the acceleration of the ball.

You should show your working out.

Acceleration = _____ m/s^2 [4]

(ii) How would you use this graph to find the displacement of the ball after four seconds?

_____ [1]

[Turn over

6 A student is attempting to find the density of a gas in a balloon. Some of the student's data is shown in the table below.

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Mass of empty balloon	12.0 g
Mass of balloon filled with gas	12.8 g
Volume of gas inside balloon	400 cm^3

(i) Use the data in the table to calculate the density of the gas inside the balloon. Include the unit with your answer.

You should show your working out.

Density of gas = _____ [5]

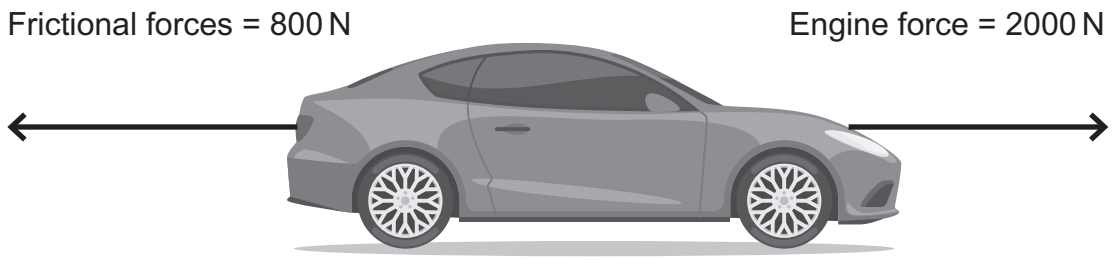
(ii) The student places the gas-filled balloon in a fridge to cool it down. As a result of the cooling the density of the gas increases.

What effect does this have on the distances between the gas particles?

_____ [1]

[Turn over

7 Forces act on a car as shown below.



(i) The car accelerates uniformly at 1.2 m/s^2.
Calculate the mass of the car.

You should show your working out.

Mass = _____ kg [4]

(ii) Describe and explain what would happen to the size of the acceleration, if the frictional forces acting on the car decrease.

Effect on acceleration: _____

Explanation: _____

_____ [2]

(iii) The brakes are applied and the car begins to slow down. In which direction will the resultant force now act?

_____ [1]

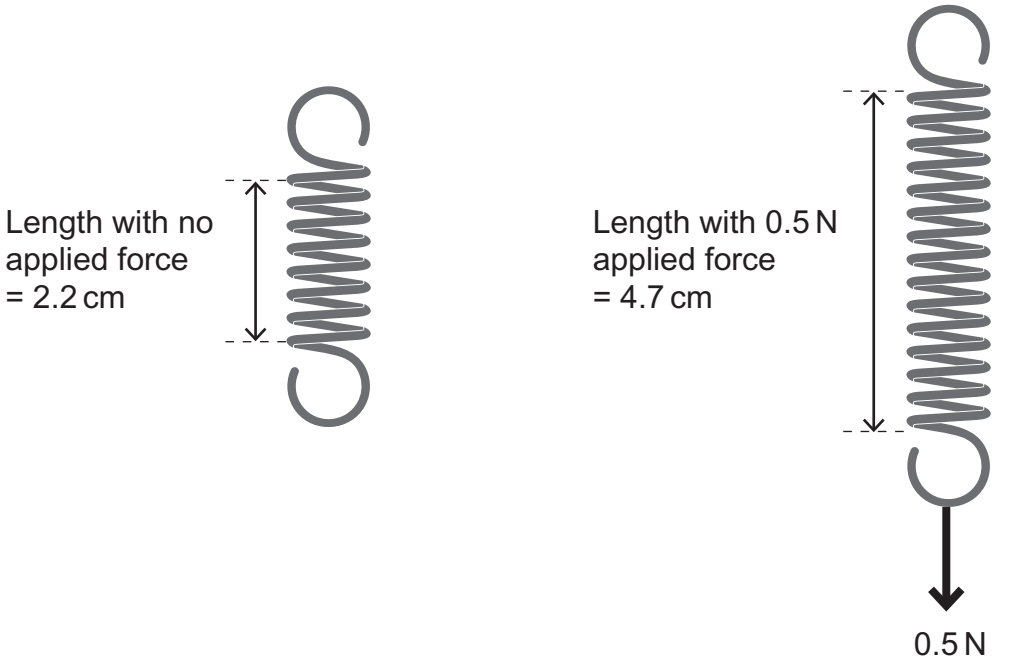
8 **(a)** State Hooke's Law.

_____

_____

_____ [2]

A force is applied to a spring, as shown below.



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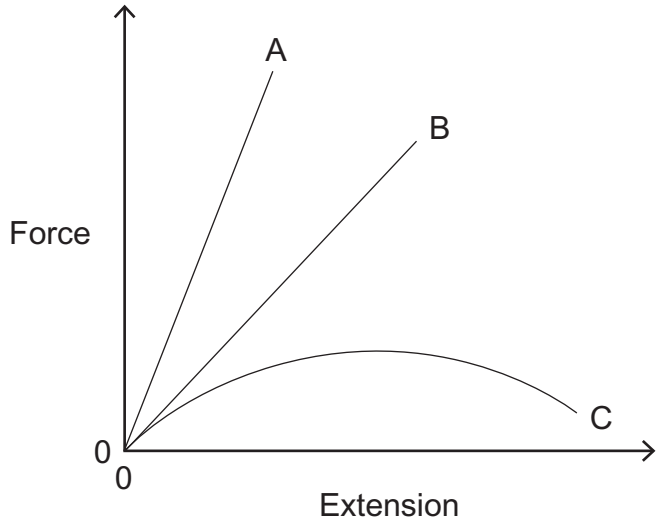
(b) Use the information given to calculate the spring constant k.
Remember to include the unit.

You should show your working out.

Spring constant, k = _____ [5]

[Turn over

(c) Graphs of force against extension for three different springs are shown below.



Insert the letter of the line for the spring that is best described by each of the following statements.

(i) Has the greatest spring constant _____ [1]

(ii) Does not obey Hooke's Law _____ [1]

(iii) Has the smallest extension for the same applied force _____ [1]

9 Nuclear fusion has the potential to solve the world's energy needs.

(i) Write an account of nuclear fusion making reference to the following:

- an isotope of hydrogen which could be used;
- where we would find this isotope;
- the main by-product of the fusion reaction;
- the main environmental advantage of producing energy in this way.

[4]

(ii) How much more energy per kg does nuclear fusion release when compared to the energy released by burning coal, oil or gas?

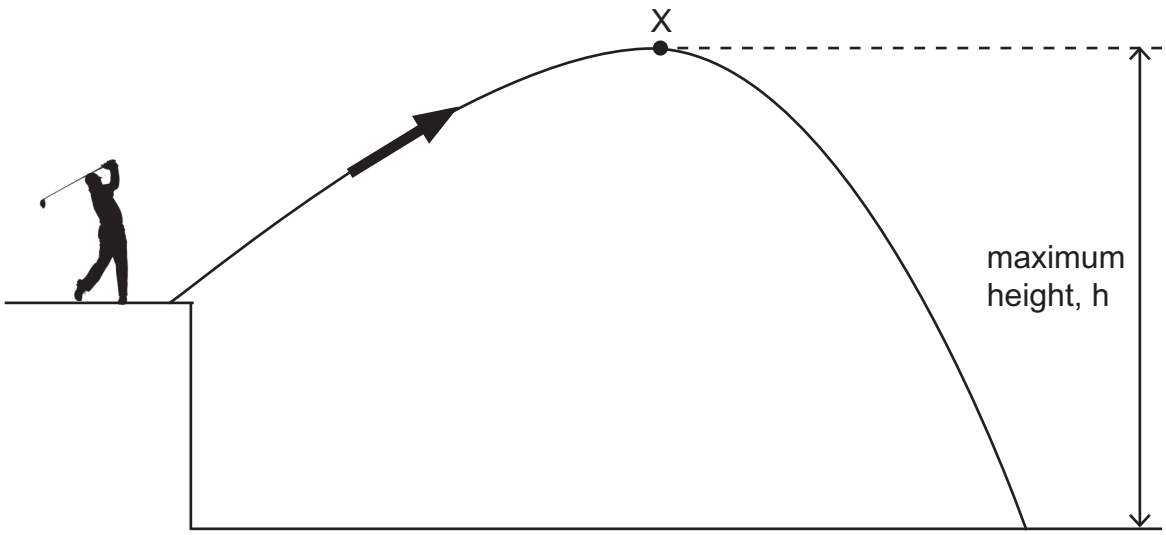
[1]

(iii) State one technical difficulty that must be overcome before nuclear fusion can be used to produce energy on a commercial scale on Earth.

[1]

[Turn over

10 A golfer strikes a golf ball as shown in the diagram below.



The golf ball has a mass of 0.045 kg and hits the ground with a velocity of 20 m/s.
At point X, the highest point in its motion, the kinetic energy of the golf ball is 5.5 J.

By first finding the kinetic energy of the ball when it hits the ground, use the Principle of Conservation of Energy to calculate the maximum height, h, the ball reaches.
Give your answer correct to **one decimal place**.
Assume there are no energy losses.

You should show your working out.

Maximum height = _____ m [6]

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Question Number	**Marks**
1	
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Total Marks	

Examiner Number