



Rewarding Learning

General Certificate of Secondary Education
2021–2022

Centre Number

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Candidate Number

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Double Award Science: Physics

Unit P1

Higher Tier



[GDW32]

GDW32

FRIDAY 25 FEBRUARY 2022, MORNING

TIME

1 hour.

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 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 1.



- 1 This question is about the properties of radiation which comes from radioactive sources.

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

Which type of radiation has the greatest penetrating power and what material is best at blocking it?

Which type of radiation is least penetrating and what is its range in air?

What do we call the activity which is detected when no radioactive source is present?

How is this activity accounted for when measuring the activity of a radioactive source which **is** present?

[6]



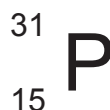
2 Atoms are made up of protons, neutrons and electrons.

(a) Complete the table below to show the relative mass and charge of each particle.

Particle	Relative mass	Relative charge
Proton		
Neutron		
Electron		

[6]

(b) The nucleus of a phosphorus atom is described below.



Complete the table below to show the number of each particle in the **nucleus** of the phosphorus atom.

Particle	Number
Proton	
Neutron	
Electron	

What is the value of the mass number of this phosphorus atom?

_____ [4]

[Turn over



3 (a) This question is about nuclear energy.

For nuclear fission of a uranium nucleus to occur, it must first absorb a particle.
Name this particle.

Which nuclear process is the source of a star's energy?

Name an isotope of hydrogen that can be used as a fuel for nuclear fusion.

What is the major by-product of nuclear fusion?

State an environmental advantage of producing energy by nuclear fusion.

_____ [5]

(b) How much more energy per kg does nuclear fusion release when compared to the energy released by nuclear fission?

Circle your answer.

4

4000

4 000 000 times

State two difficulties that must be overcome before nuclear fusion can be used to produce energy on a commercial scale on Earth.

1. _____

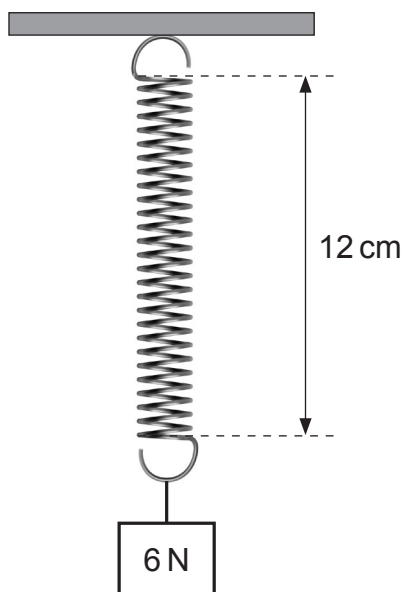
2. _____ [3]



4 (a) State Hooke's Law **in words**. Do not use symbols in your answer.

[2]

(b) When a force of 6 N is applied to a spring it has a total length of 12 cm.



© Getty Images

The spring has an unstretched length of 8 cm.

Calculate the spring constant and give its unit.

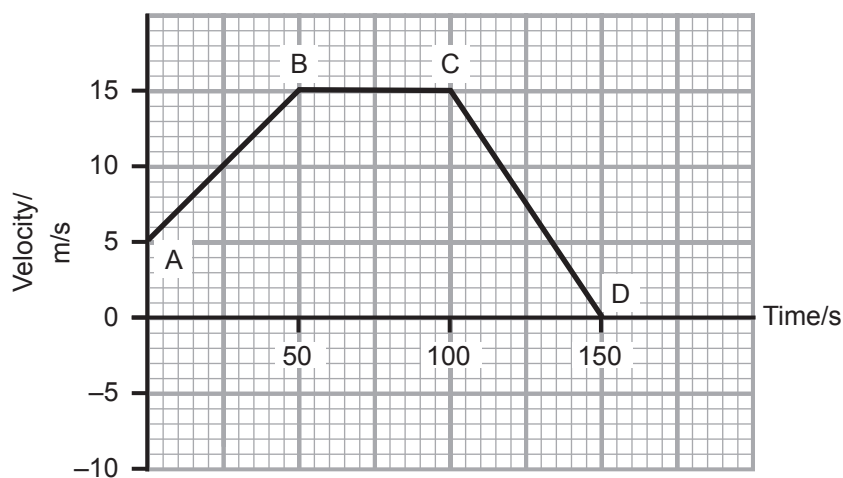
You are advised to show your working out.

Spring constant = _____ [5]

[Turn over]



5 The velocity-time graph for part of a car journey is shown below.



- (a) Describe the motion of the car in the time intervals AB, BC and CD.
Calculations are not required.

AB _____

BC _____

CD _____

_____ [3]



(b) Calculate the total displacement of the car during the last 100 seconds.

You are advised to show your working out.

Displacement = _____ m [4]



- 6 (a) A parachutist jumps out of a plane and falls vertically towards the ground.



© Getty Images

As she falls, 330 000 J of work are done against a constant frictional force of 750 N until she opens her parachute.

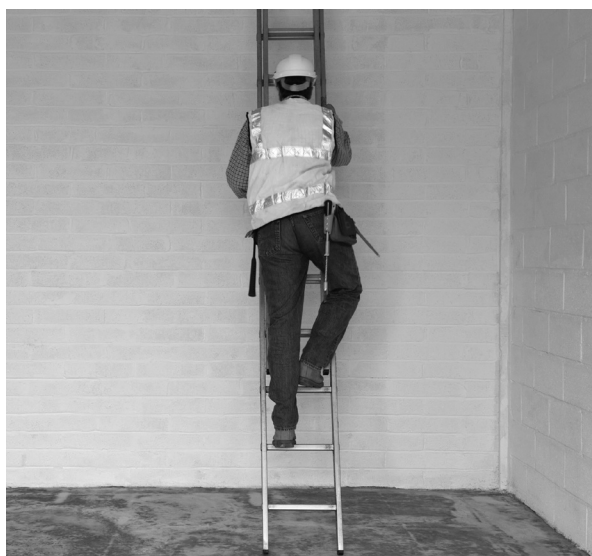
Calculate the distance fallen by the parachutist before she opens her parachute.

You are advised to show your working out.

Distance = _____ m [3]



- (b) (i) A builder does 6 kJ of work climbing up a ladder in 20 seconds.



© Getty Images

Calculate the power, in watts, developed by the builder during this time.

You are advised to show your working out.

Power = _____ W [4]

- (ii) How many joules of energy does the builder transfer per second during this time?

Energy transferred per second = _____ J [1]

[Turn over



- 7 (i) A travel carrier weighs 9 N when empty and has a base area of 1800 cm^2 .

A small dog is placed in the travel carrier.

The pressure exerted on the ground is 0.03 N/cm^2 .



© Getty Images

By first finding the force on the ground, calculate the mass of the dog.

You are advised to show your working out.

Mass of dog = _____ kg [5]



- (ii) The small dog is replaced with a dog of greater mass in the same travel carrier.

Complete the following sentence by circling the correct option.

The pressure will **increase** / **decrease** / **stay the same**

Explain fully the reason for your answer.

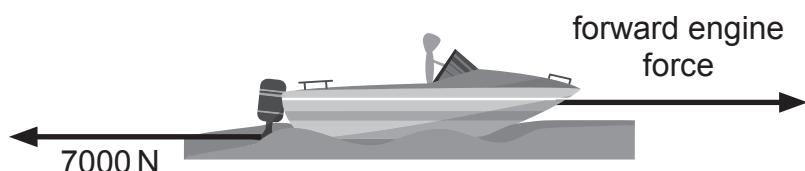
[3]



8 (a) What does a resultant force always cause?

[1]

- (b) (i) A speedboat of mass 230 kg accelerates forwards at 3.1 m/s^2 . The driver of the speedboat has a mass of 70 kg. The total frictional forces acting on the speedboat and the driver are 7000 N.



© Getty Images

Calculate forward force of the speedboat's engine.

You are advised to show your working out.

Forward engine force = _____ N [5]

- (ii) The resultant force acting on the speedboat is doubled.

How will this affect the acceleration of the speedboat?

Tick (✓) the correct box.

acceleration doubles

☐

acceleration halves

☐

acceleration stays the same

☐

[1]



- 9 An object of mass 4 kg is projected vertically upwards with an initial kinetic energy of 648 J.

(i) Calculate the speed at which the object is projected.

You are advised to show your working out.

Speed = _____ m/s [4]

(ii) What is the kinetic energy of the object when it is at its maximum height?

Kinetic energy = _____ J [1]

(iii) The object loses 24 J of energy during its upwards journey.
Calculate the maximum height reached by the object.

You are advised to show your working out.

Maximum height = _____ m [4]

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For Examiner's
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Question Number	Marks
1	
2	
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4	
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7	
8	
9	

Total Marks	
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Examiner Number

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