



General Certificate of Secondary Education
2023–2024

Centre Number

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Candidate Number

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Double Award Science: Physics

Unit P1

Higher Tier



[GDW32]

GDW32

FRIDAY 23 FEBRUARY 2024, 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 3.



- 1 (i) A container is used to store 0.27 kg of hydrogen gas. The density of hydrogen gas is 0.09 kg/m^3 .

Calculate the volume of hydrogen in the container.

Include the unit in your answer.

Do not change any units.

You are advised to show your working out.

Volume of hydrogen = _____ [4]

- (ii) The hydrogen gas is cooled so that it turns into liquid hydrogen.

In what way, if at all, will the distances between the particles change?

_____ [1]





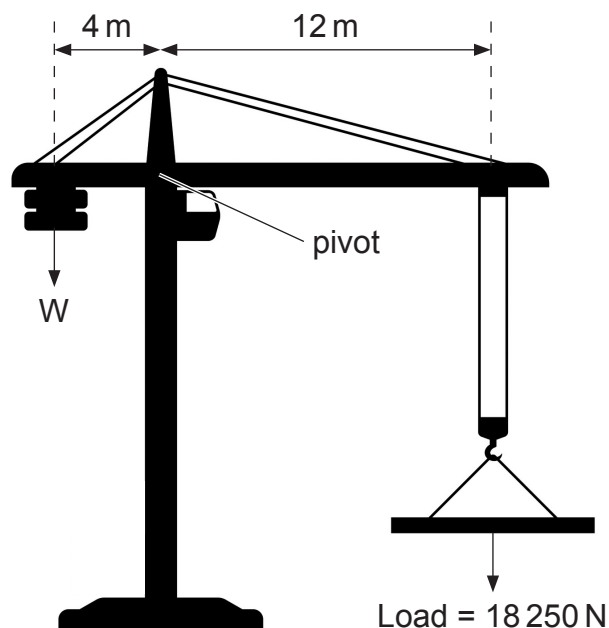
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- 2 When a crane is used to lift a load of 18 250 N, a weight, W , must be used to ensure that the crane does not topple over.



- (i) What is the name of the Physics principle being applied in this situation?

[1]

- (ii) The crane in the diagram above is used to lift a load of 18 250 N. Use the information on the diagram to calculate the weight, W .

You are advised to show your working out.

Weight, W = _____ N [4]



(iii) What is the direction of the moment created by the weight, W ?

_____ [1]

(iv) The weight, W , must be kept at 4 m from the pivot.
The crane has to lift a load greater than 18 250 N.

In which direction must the load be moved if the crane is not to topple?

_____ [1]

[Turn over]



3 A student wishes to measure their personal power.

The student has access to a staircase.

State the three measuring instruments required, and the three measurements taken, in the experiment to find the personal power of the student.

Do not include any calculations or equations.

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

Measuring instruments: _____

Measurements: _____

_____ [6]



4 Half-life is a term used in Physics when studying radioactive decay.

(a) Explain the meaning of the term half-life.

[2]

(b) A sample of rainwater was collected. Some days later, the sample was found to be contaminated with iodine-131 with a count rate of 900 counts per second.

The half-life of iodine-131 is 8 days.

What was the count rate of the sample 8 days **before** its count rate was measured?

Count rate = _____ counts per second [1]

(c) Another sample of rainwater contaminated with iodine-131 is found to have a count rate of 600 counts per second.

Calculate how many days it will take the sample to fall to 150 counts per second.

Remember, the half-life of iodine-131 is 8 days.

You are advised to show your working out.

Time taken = _____ days [3]

[Turn over



5 This question is about nuclear energy and ionisation.

(a) (i) Name a suitable fuel for nuclear fission.

_____ [1]

(ii) Explain why the fuel used in nuclear fission is considered as a **non-renewable** energy resource.

_____ [1]

(iii) The stages of the nuclear fission process are listed below.

The first and last stages are indicated by the numbers 1 and 5.
Place the numbers 2, 3 and 4 in the remaining boxes to indicate the correct order in which the stages happen during the nuclear fission process.

Fission neutrons go on to cause further fissions.

The nucleus absorbs a neutron.

Energy and several neutrons are released.

A chain reaction is created.

The nucleus splits into two smaller nuclei.

[3]

(b) Name a suitable fuel for nuclear **fusion**.

_____ [1]



(c) Radioactive waste can emit ionising radiation.

Explain what is meant by ionisation.

How could ionisation of molecules in living cells be dangerous?

[3]



6 (a) State the Principle of Conservation of Energy.

[2]

(b) (i) An elastic band is used to propel a stone vertically upwards.

The stone has a mass of 40 g.

Before release, the elastic band has 5 J of strain energy.

Calculate the maximum height reached by the stone.

Assume no energy losses.

You are advised to show your working out.

Maximum height of stone = _____ m [4]

(ii) In reality, some energy will be lost as the stone travels through the air.

In what form will the energy be lost?

_____ [1]



- (c) On another occasion, the elastic band transfers 5.52 J of useful energy to the stone.

If the elastic band has an efficiency of 92%, calculate the total input energy.

You are advised to show your working out.

Total input energy = _____ J [4]



- 7 (a) A car of mass 1600 kg has a kinetic energy of 320 kJ.

Calculate the velocity of the car.

You are advised to show your working out.

Velocity of car = _____ m/s [4]

- (b) (i) A different car has a weight of 18 000 N.
The pressure exerted by the car on the ground is 200 000 Pa.

Calculate the area of the tyres in contact with the ground.

Include the unit in your answer.

Do not change any units.

You are advised to show your working out.

Area of tyres = _____ [4]

- (ii) Some air is let out of the tyres. This causes the area of the tyres in contact with the ground to increase.

In what way, if at all, will this affect the pressure exerted by the car on the ground?

_____ [1]





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8 Physical quantities can be described as scalars or vectors.

(a) Explain the meaning of each of these terms and give an example of each.

Scalar quantity: _____

Example of a scalar quantity: _____

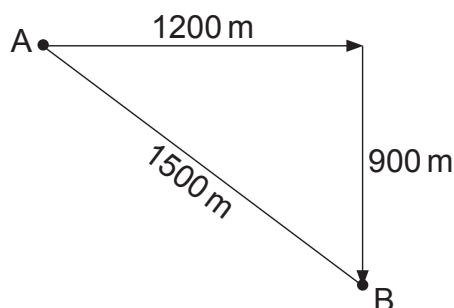
Vector quantity: _____

Example of a vector quantity: _____

_____ [4]



- (b) A person travels 1200 m east from point A.
The person then travels 900 m south to point B.
This is shown in the diagram below.



- (i) The person takes 10 minutes to complete the journey from A to B.

Calculate the size of the average velocity of the person.

You are advised to show your working out.

Average velocity = _____ m/s [4]

- (ii) The person then returns to their starting point at A.

What is their total displacement?

Total displacement = _____ m

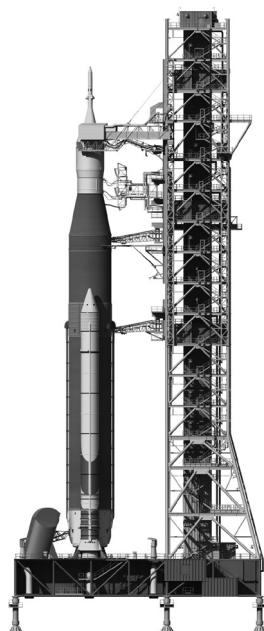
What is the average velocity of the person for the entire journey?

Average velocity = _____ m/s [2]

[Turn over



- 9 A rocket of mass 12 000 kg is about to be launched into space.



For a successful launch the rocket requires an acceleration of 20 m/s^2 .

By first finding the resultant force, calculate the upward thrust force produced by the rocket.

You are advised to show your working out.

Upward thrust force = _____ N [7]



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Question Number	Marks
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Examiner Number

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