



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

Foundation Tier



[GDW31]

\*GDW31\*

**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 60.

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 8.



1 Energy can be changed from one form to another.

Complete the boxes below to show the **main energy change** that is happening in each case.

An example has been completed for you.

Example: A microphone



*sound*  
energy



*electrical*  
energy

A working electric motor



\_\_\_\_\_  
energy



\_\_\_\_\_  
energy

A lit candle

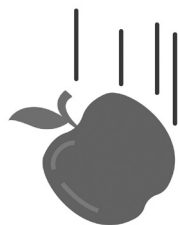


\_\_\_\_\_  
energy



\_\_\_\_\_  
energy

A falling apple



\_\_\_\_\_  
energy



\_\_\_\_\_  
energy

[6]





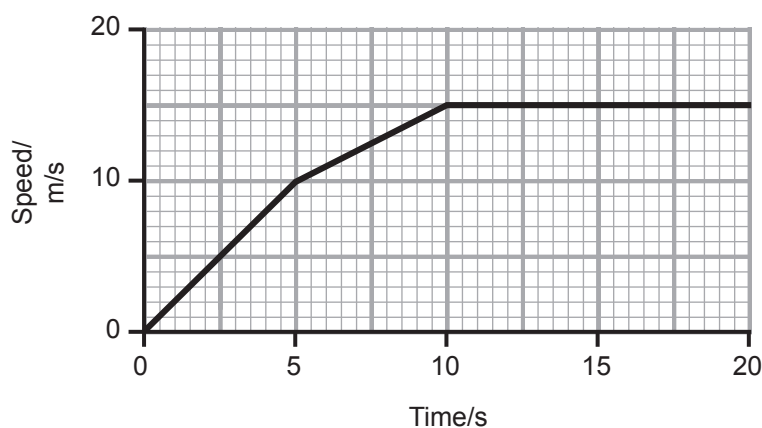
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**(Questions continue overleaf)**



- 2 The speed–time graph for part of a car journey is shown below.



- (i) During which time period is the car travelling at a constant speed?

\_\_\_\_\_ to \_\_\_\_\_ seconds [1]

- (ii) Use values from the graph to calculate the rate of change of speed of the car during the time period 0 to 5 seconds.

Include the unit in your answer.

**You are advised to show your working out.**

Rate of change of speed = \_\_\_\_\_ [4]



- (iii) Use values from the graph to calculate the distance moved by the car during the time period 0 to 5 seconds.

**You are advised to show your working out.**

Distance moved = \_\_\_\_\_ m [3]



3 This question is about radioactivity.

(i) Explain why some nuclei are radioactive.

[1]

(ii) Radioactive nuclei can emit alpha, beta or gamma radiation.

Place a tick (✓) in the correct box to match each property to the type of radiation.

| Property                              | Type of radiation |      |       |
|---------------------------------------|-------------------|------|-------|
|                                       | Alpha             | Beta | Gamma |
| Electromagnetic wave of high energy   |                   |      |       |
| Fast moving electron                  |                   |      |       |
| Contains two protons and two neutrons |                   |      |       |
| A helium nucleus                      |                   |      |       |

[4]

(iii) Which type of radiation, alpha, beta or gamma, is used:

in smoke alarms?

to sterilise medical equipment?

to detect leaks from pipes deep underground?

[3]



4 This question is about nuclear energy.

(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]

(iv) State a major environmental **disadvantage** of generating electricity by nuclear fission.

\_\_\_\_\_ [1]

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

\_\_\_\_\_

How much more energy is released, per kg of fuel, in nuclear fusion compared to nuclear fission?

\_\_\_\_\_ [2]

[Turn over]



5 A girl climbs a cliff.



- (i) The girl has a mass of 70 kg.

Calculate the gravitational potential energy of the girl when she is 14 m above the ground.

**You are advised to show your working out.**

Gravitational potential energy = \_\_\_\_\_ J [3]



- (ii) On her way back down, the girl drops her rucksack of mass 8 kg.  
The rucksack falls vertically and hits the ground with a speed of 15 m/s.

Calculate the kinetic energy of the rucksack when it hits the ground.

**You are advised to show your working out.**

Kinetic energy of rucksack = \_\_\_\_\_ J [3]



- 6 (i) A container is used to store 0.27 kg of hydrogen gas. The density of hydrogen gas is  $0.09 \text{ kg/m}^3$ .

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]





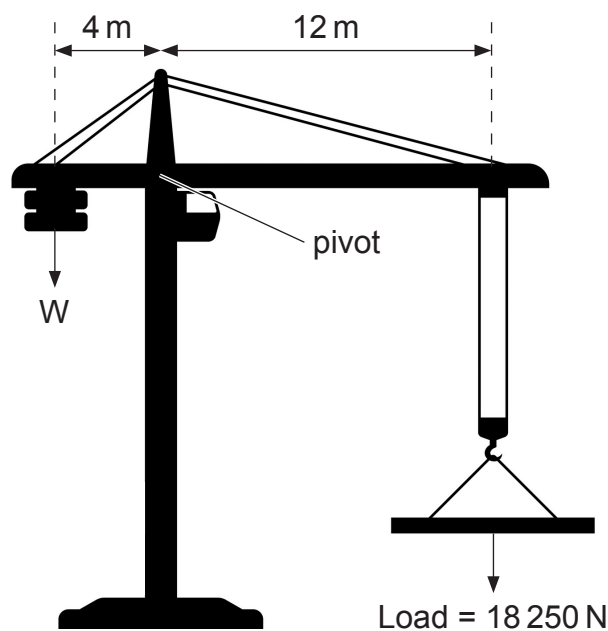
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**(Questions continue overleaf)**



- 7 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]



8 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]



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

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

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[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]

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**THIS IS THE END OF THE QUESTION PAPER**

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|-------------------------|-------|
| Question Number         | Marks |
| 1                       |       |
| 2                       |       |
| 3                       |       |
| 4                       |       |
| 5                       |       |
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| 8                       |       |
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Examiner Number

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