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**PHYSICS** **0625/03**

Paper 3 Theory (Core) **For examination from 2023**

SPECIMEN PAPER **1 hour 15 minutes**

You must answer on the question paper.

No additional materials are needed.

**INSTRUCTIONS**

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.
- Take the weight of 1.0 kg to be 9.8 N (acceleration of free fall = 9.8 m / $s^2$).

**INFORMATION**

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Any blank pages are indicated.

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**[Turn over**

**1** Model trains move along a track passing through two model stations, A and B.
Students analyse the motion of a model train.
They start a digital timer as the train starts to move.
They record the time it enters Station A and the time it enters Station B.

Fig. 1.1 shows the time on entering Station A.
Fig. 1.2 shows the time on entering Station B.




time entering Station A

**Fig. 1.1**




time entering Station B

**Fig. 1.2**

**(a)** Calculate the time taken from the train entering Station A to the train entering Station B.
State your answer in seconds.

time taken = ..... s [1]

**(b)** A faster train takes 54 s to travel from Station A to Station B.
The distance between the stations is 120 m.

Calculate the average speed of this train.

average speed = ..... m / s [3]

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**(c)** Fig. 1.3 shows the speed-time graph for another model train travelling on a different part of the track.

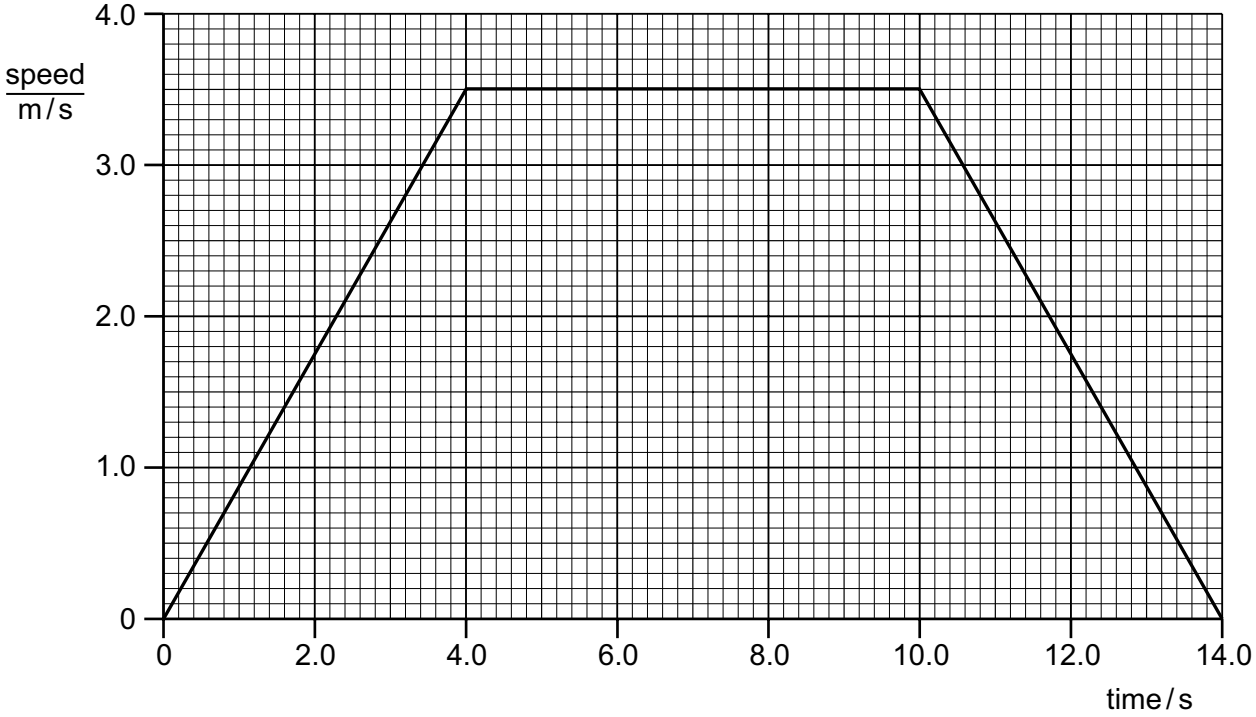



**Fig. 1.3**

Using the graph, determine the total distance travelled by this train on this part of the track.

distance = ..... m [4]

[Total: 8]

**2** **(a)** A piece of metal has an irregular shape. The weight of the metal is 3.0 N.

Calculate the mass of the metal.

mass = ..... kg [2]

**(b)** Fig. 2.1 shows the piece of metal, a measuring cylinder and a beaker containing water.

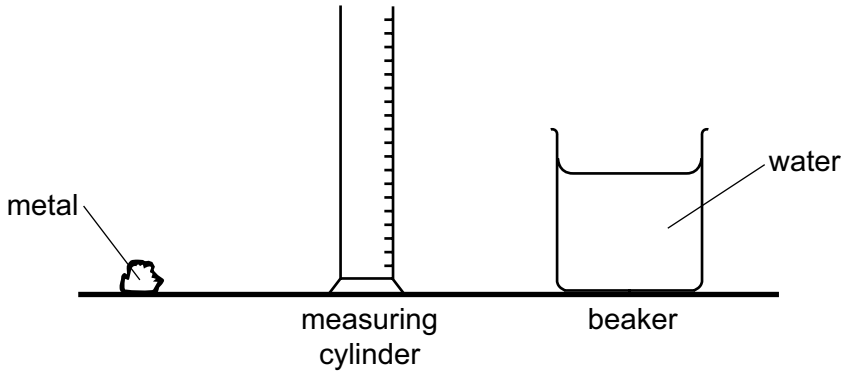



**Fig. 2.1**

**(i)** Describe how to determine the volume of the piece of metal, using the equipment in Fig. 2.1.

.....

.....

.....

.....

.....

..... [4]

**(ii)** Explain why the procedure in **(b)(i)** is not suitable for finding the volume of a piece of low-density wood that is a similar shape and size to the piece of metal.

.....

..... [1]

**(iii)** The mass of another piece of metal is 405 g and its volume is 150 $cm^3$.
Calculate the density of this piece of metal.

density = ..... $g / cm^3$ [3]

[Total: 10]

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**3** A man uses a metal bar to remove an iron nail from a piece of wood, as shown in Fig. 3.1.

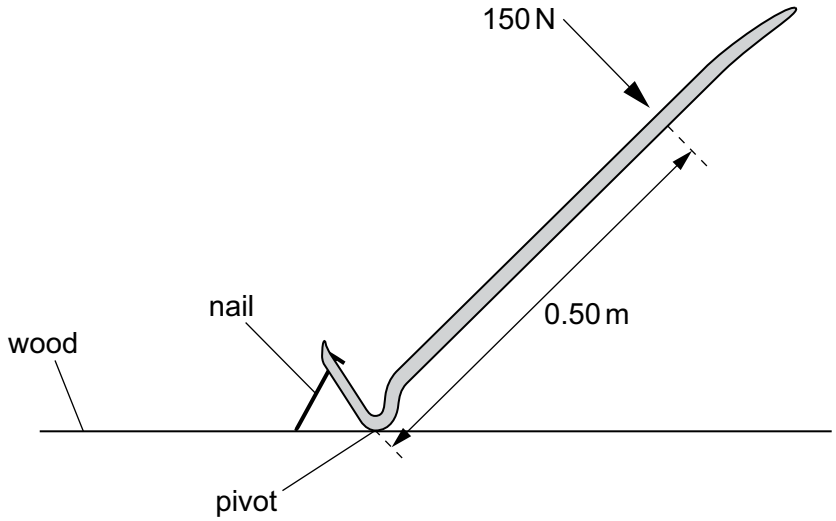



**Fig. 3.1**

**(a) (i)** The man applies a force of 150 N perpendicular to the bar and at a distance of 0.50 m from the pivot.

Calculate the moment of this force about the pivot. Give the unit.

moment = ..... [4]

**(ii)** The force applied by the man produces a turning effect (moment) about the pivot.

Describe another example of using the turning effect of a force.

.....

.....

..... [1]

**(b)** The man tries to use the metal bar to remove another nail from the piece of wood.
He applies the same force of 150 N at a distance of 0.50 m from the pivot.
The turning effect produced is not enough to remove this nail from the piece of wood.

Describe how the man can increase the turning effect without increasing the force.

.....

..... [1]

[Total: 6]

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**4** Fig. 4.1 and Fig. 4.2 show two methods of using renewable sources to generate electrical power.

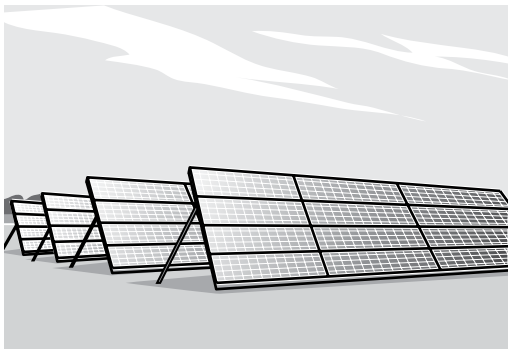


**Fig. 4.1**

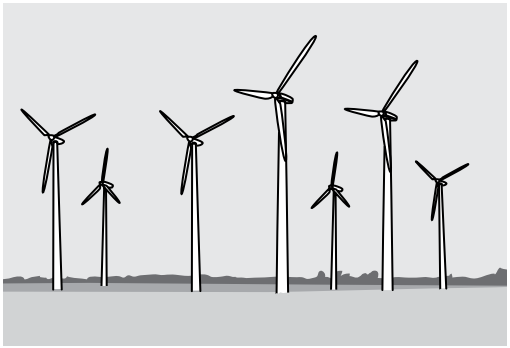


**Fig. 4.2**

**(a)** Name the energy source used by each method.

In Fig. 4.1 the energy source is .....

In Fig. 4.2 the energy source is .....
[2]

**(b)** **(i)** State **two** advantages of using the renewable sources in either Fig. 4.1 or Fig. 4.2 for generating electrical power compared to using a coal-fired power station.

1 .....

.....

2 .....

.....
[2]

**(ii)** State **one** disadvantage of using the renewable sources in either Fig. 4.1 or Fig. 4.2 for generating electrical power compared to using a coal-fired power station.

.....

..... [1]

[Total: 5]

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**5** Fig. 5.1 shows a glass bottle containing air. The bottle is sealed with a cap. The mass of the air in the bottle is constant.

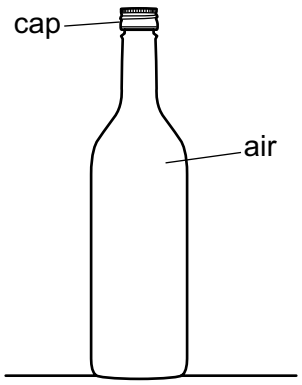



**Fig. 5.1**

**(a)** The temperature of the air in the bottle increases.

**(i)** State what happens to the pressure of the air in the bottle.

..... [1]

**(ii)** Explain why the pressure of the air in the bottle changes.
Use ideas about gas particles in your answer.

.....

.....

.....

.....

.....

..... [4]

**(b)** The bottle has a weight of 5.4 N and an area of 9.2 $cm^2$ in contact with the table.

Calculate the pressure produced by the bottle on the table.

pressure = ..... N / $cm^2$ [3]

[Total: 8]

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**6** A student constructs a device for absorbing thermal energy from the Sun.
Fig. 6.1 shows the device.

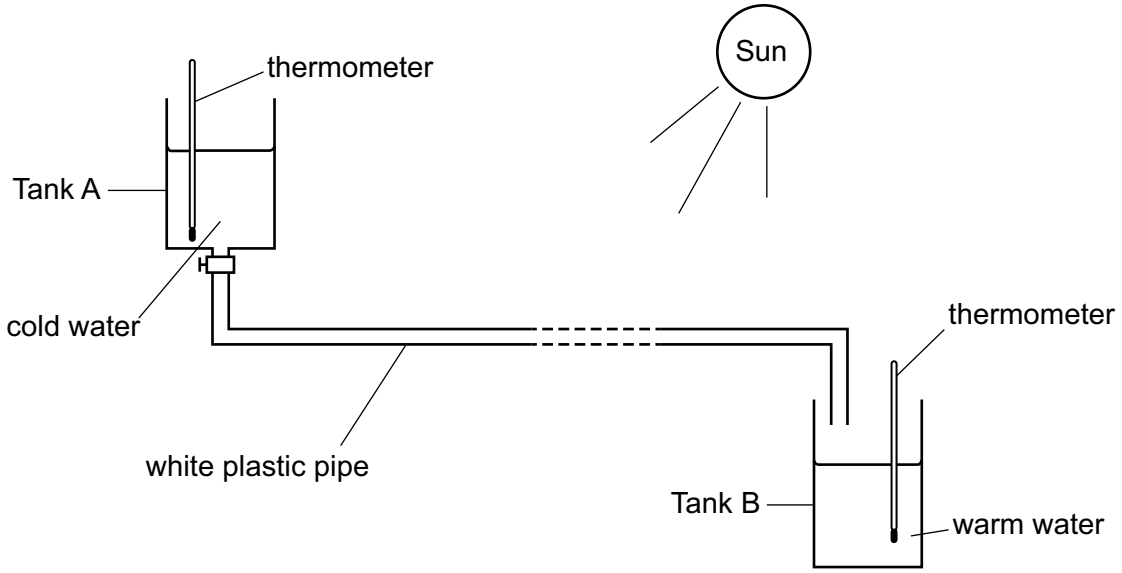
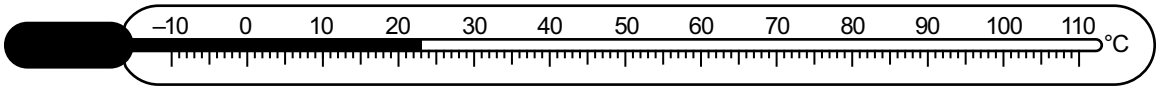


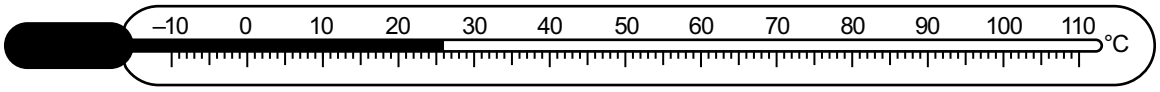

**Fig. 6.1**

The student places the white plastic pipe in sunlight. The cold water flows slowly from Tank A to Tank B. Energy from the Sun heats the water in the pipe.

Fig. 6.2 shows the temperatures in Tank A and in Tank B.




thermometer showing temperature in Tank A




thermometer showing temperature in Tank B

**Fig. 6.2**

**(a)** Determine the rise in temperature of the water as it passes between Tank A and Tank B.

temperature rise = ..... °C [1]

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**(b)** The student wants to increase the thermal energy absorbed by the water in the pipe.
State **three** improvements she can make to increase the thermal energy absorbed.

1 .....

.....

2 .....

.....

3 .....

.....
[3]

**(c)** Describe the processes that transfer the thermal energy from the Sun to the water inside the pipe.

.....

..... [2]

[Total: 6]

**7** Fig. 7.1 shows a floating plastic ball attached by a long rope to a weight on the bottom of a lake. A water wave on the surface of the lake causes the ball to move vertically up and down.

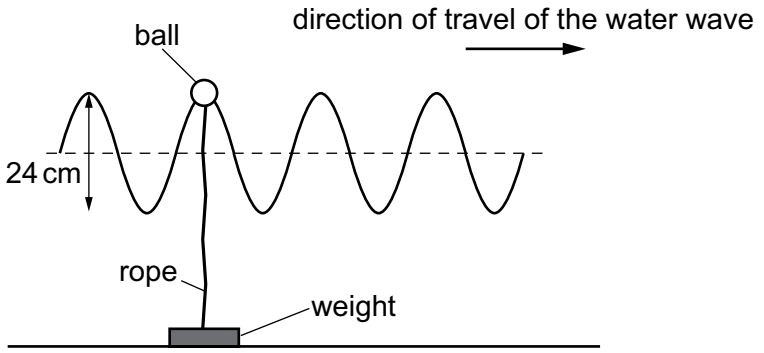



**Fig. 7.1**

**(a)** On Fig. 7.1, show the wavelength of the wave. Label the distance W. [1]

**(b)** Determine the amplitude of the wave.

amplitude = ..... cm [1]

**(c)** The ball reaches its maximum height 40 times in 60 seconds. Calculate the frequency of the wave.

frequency = ..... Hz [2]

**(d)** Explain how the motion of the ball shows that the water wave is transverse.

.....

..... [1]

**(e)** State another example of a transverse wave.

..... [1]

[Total: 6]

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**8** **(a)** A ray of light refracts as it travels from air into glass, as shown in Fig. 8.1.

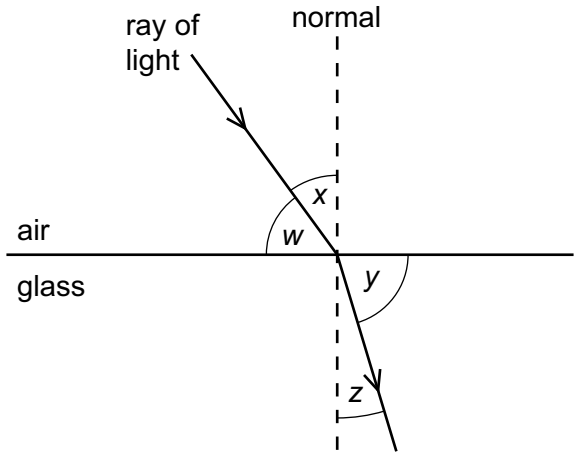



**Fig. 8.1**

State which angle *w*, *x*, *y* or *z*, is the angle of refraction.

..... [1]

**(b)** Fig. 8.2 represents some wavefronts approaching a barrier with a narrow gap.

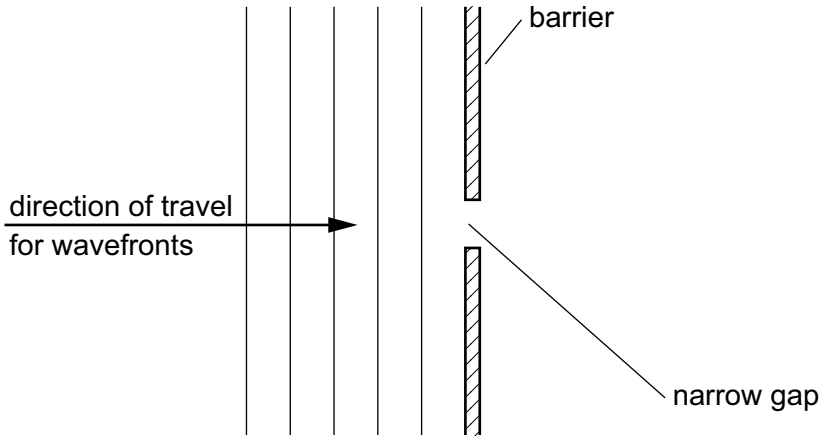



**Fig. 8.2**

On Fig. 8.2, draw **three** wavefronts that have passed through the gap. [3]

[Total: 4]

**9** Fig. 9.1 shows some parts of the electromagnetic spectrum.

| | | | | | | |
|---|---|---|---|---|---|---|
| radio waves | | infrared waves | visible light | ultraviolet waves | X-rays | $\gamma$-rays |

**Fig. 9.1**

**(a) (i)** In Fig. 9.1, one part of the electromagnetic spectrum is **not** labelled.

State the name of this part.

..... [1]

**(ii)** The speed of visible light waves in a vacuum is $3.0 \times 10^8$ m / s.

State the value for the speed of infrared waves in a vacuum.

speed = ..... m / s [1]

**(iii)** Some parts of the electromagnetic spectrum have a wavelength shorter than that of visible light.

State **one** example.

..... [1]

**(b) (i)** X-rays and $\gamma$-rays are used in hospitals.

Describe **one** medical use for X-rays and **one** medical use for $\gamma$-rays.

X-rays .....

.....

$\gamma$-rays .....

.....

[2]

**(ii)** State **two** reasons why $\gamma$-rays are dangerous to living things.

1 .....

.....

2 .....

.....

[2]

[Total: 7]

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**10** Fig. 10.1 shows a simplified circuit diagram for an electric oven. The oven contains a fan driven by a motor.

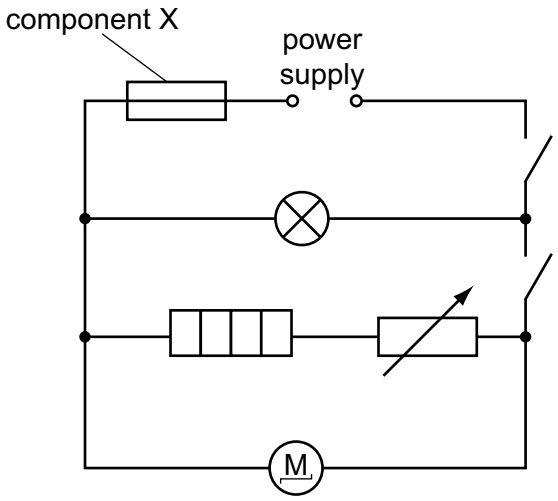



**Fig. 10.1**

**(a)** On Fig. 10.1, circle the symbol representing the heater. [1]

**(b)** Fig. 10.1 includes a variable resistor.

Explain the function of the variable resistor in this circuit.

.....

..... [2]

**(c)** The potential difference across the motor is 250 V. The current in the motor is 2.0 A.

Calculate the resistance of the motor.

resistance = ..... Ω [3]

**(d)** State the name of component X and explain how it contributes to the safety of the user.

name of component X .....

explanation .....

.....
[2]

[Total: 8]

**11** **(a)** The nuclide notation ${}^{A}_{Z}\mathrm{X}$ describes the nucleus of one type of atom.
On Fig. 11.1 draw a line from each symbol to the correct description for that symbol.

| symbol | description |
|---|---|
| | number of neutrons |
| *A* | |
| | element symbol |
| *Z* | proton number |
| | nucleon number |
| X | |
| | number of atoms |

**Fig. 11.1** [3]

**(b)** A radioactive isotope has a half-life of 6.0 years.
A sample of this isotope has a mass of 12 mg.

Calculate the mass of this isotope that remains in the sample after 18 years.

mass remaining = ..... mg [3]

[Total: 6]

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**12** **(a)** The Sun is our nearest star.

**(i)** State the **three** main forms of electromagnetic radiation emitted by the Sun.

1 .....

2 .....

3 .....

[2]

**(ii)** State the **two** main elements that are found in the Sun.

1 .....

2 .....

[1]

**(b)** State and explain what can be deduced from the 'redshift' observed by astronomers in the light from all distant galaxies.

.....

.....

.....

.....

..... [3]

[Total: 6]

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