Cambridge IGCSE

**Cambridge International Examinations**
Cambridge International General Certificate of Secondary Education

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**PHYSICS** **0625/33**

Paper 3 Extended **May/June 2015**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1 kg to be 10 N (i.e. acceleration of free fall = 10 m/s$^2$).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **19** printed pages and **1** blank page.

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CAMBRIDGE International Examinations

**1** At a sports event, a champion runner and a car take part in a race.

**(a)** The runner runs at a constant speed of 10 m/s from the start of the race. During the first 5.0 s of the race, the car's speed increases from 0 m/s to 25 m/s at a uniform rate.

View solution

On Fig. 1.1, draw

**(i)** a graph to show the motion of the runner, [1]

**(ii)** a graph to show the motion of the car.

View solution

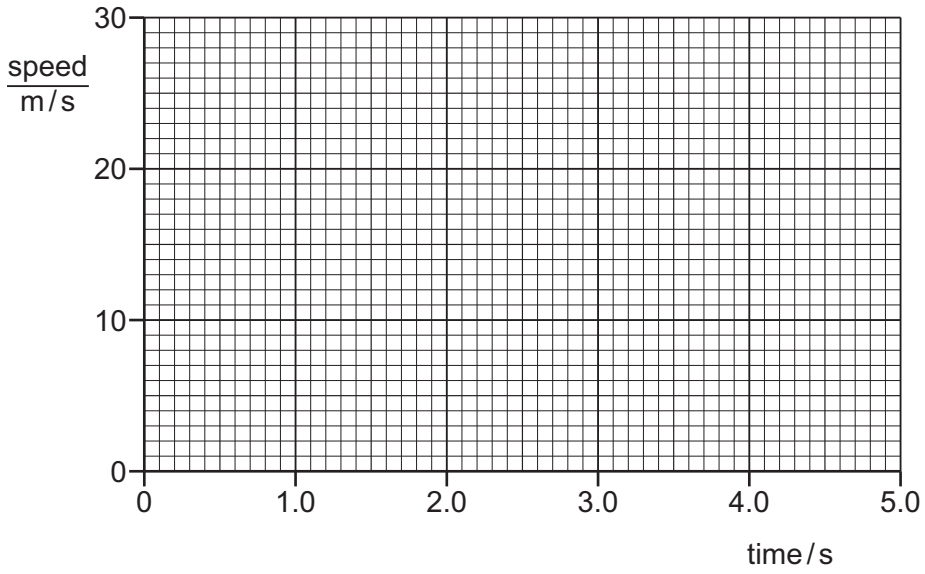


**Fig. 1.1**

[1]

**(b)** Use your graphs to determine

View solution

**(i)** the distance travelled by the runner in the 5.0 s,

distance = .....[1]

**(ii)** the distance travelled by the car in the 5.0 s,

View solution

distance = .....[2]

**(iii)** the time at which the car overtakes the runner.

View solution

time = .....[2]

[Total: 7]

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**2** An electric train is initially at rest at a railway station. The motor causes a constant force of 360 000 N to act on the train and the train begins to move.

**(a)** State the form of energy gained by the train as it begins to move.

View solution

.....[1]

**(b)** The train travels a distance of 4.0 km along a straight, horizontal track.

View solution

**(i)** Calculate the work done on the train during this part of the journey.

work done = .....[2]

**(ii)** The mass of the train is 450 000 kg.

Calculate the maximum possible speed of the train at the end of the first 4.0 km of the journey.

View solution

maximum possible speed = .....[3]

**(iii)** In practice, the speed of the train is much less than the value calculated in **(ii)**.

View solution

Suggest **one** reason why this is the case.

.....

.....[1]

**(c)** After travelling 4.0 km, the train reaches its maximum speed. It continues at this constant speed on the next section of the track where the track follows a curve which is part of a circle.

State the direction of the resultant force on the train as it follows the curved path.

.....[1]

[Total: 8]

View solution

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**3** **(a)** The boxes on the left contain the names of some sources of energy. The boxes on the right contain properties of some sources of energy.

Draw **two** straight lines **from each box** on the left to the two boxes on the right which describe that source of energy.

View solution

| | |
|---|---|
| solar energy | renewable |
| | not renewable |
| natural gas | polluting |
| | not polluting |

[2]

**(b)** Coal-fired power stations are polluting.

View solution

State an advantage of using coal as a source of energy.

.....

.....[1]

**(c)** A coal-fired power station generates electricity at night when it is not needed.

Some of this energy is stored by pumping water up to a mountain lake. When there is high demand for electricity, the water is allowed to flow back through turbines to generate electricity.

On one occasion, $2.05 \times 10^8$ kg of water is pumped up through a vertical height of 500 m.

View solution

**(i)** Calculate the weight of the water.

weight = .....[1]

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**(ii)** Calculate the gravitational potential energy gained by the water.

View solution

energy gained = .....[2]

**(iii)** The electrical energy used to pump the water up to the mountain lake is $1.2 \times 10^{12}$ J. Only $6.2 \times 10^{11}$ J of electrical energy is generated when the water is released.

Calculate the efficiency of this energy storage scheme.

View solution

efficiency = .....[2]

[Total: 8]

**4** A liquid-in-glass thermometer has a linear scale and a range of 120 °C.

View solution

**(a)** State what is meant by a *linear scale*.

.....

.....[1]

View solution

**(b)** The highest temperature that this thermometer can measure is 110 °C.

State the lowest temperature that it can measure.

lowest temperature = .....[1]

View solution

**(c)** A second liquid-in-glass thermometer has the same range but it has a greater sensitivity.

Suggest **two** ways in which the second thermometer might differ from the first.

1. .....

2. .....

[2]

**(d)** A thermometer has a bulb that is painted white and is shiny.

It is placed in boiling water for several minutes. It is then removed from the water and is held in air.

View solution

Fig. 4.1 shows how the thermometer reading changes during the next 8 minutes.

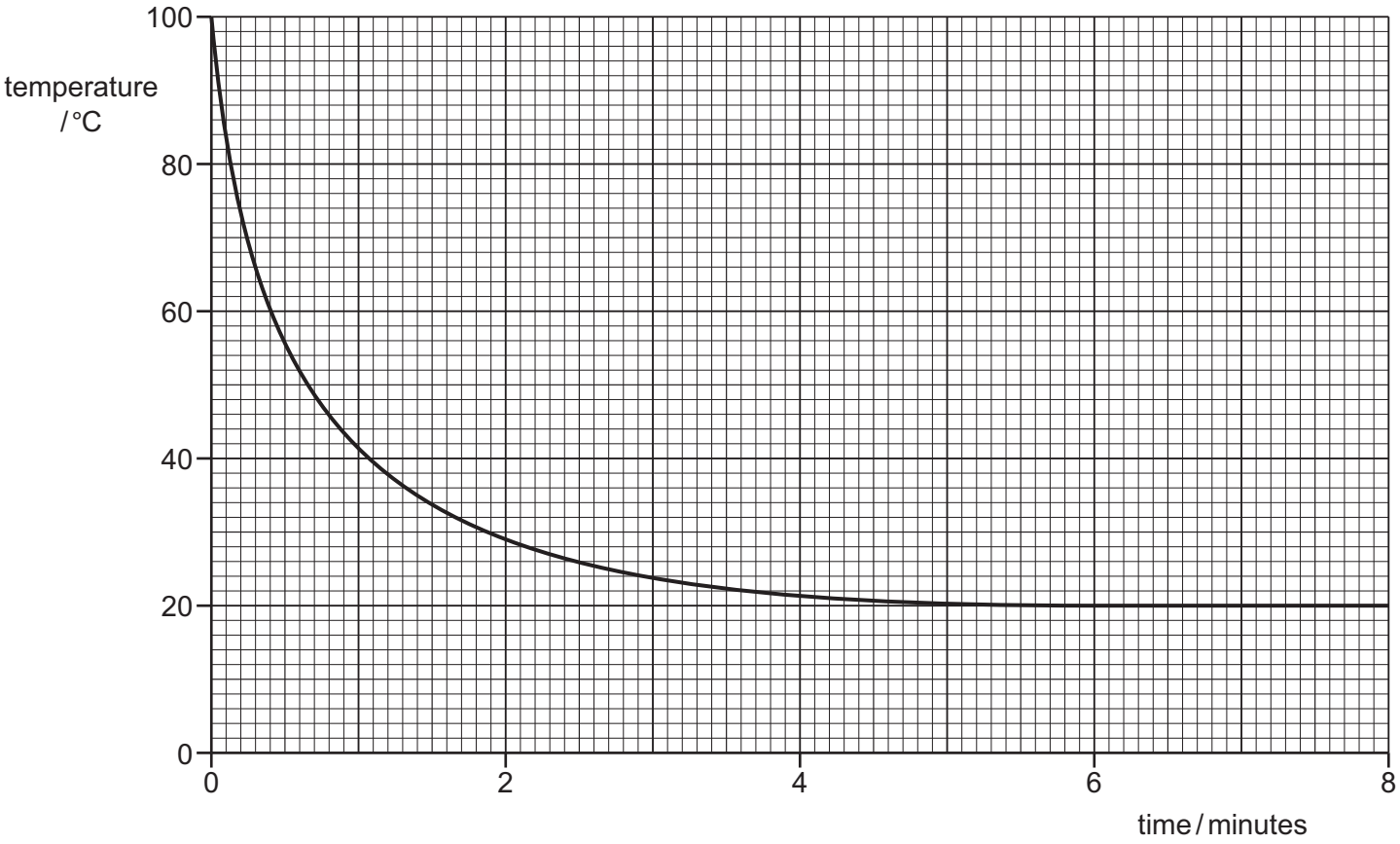


**Fig. 4.1**

The bulb of this thermometer is now re-painted so that it has a matt, black surface.

The procedure is repeated.

**(i)** On Fig. 4.1, sketch a second line to suggest how the reading of the re-painted thermometer changes during the 8 minutes. [2]

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**(ii)** Tick **one** of the boxes to show how painting the bulb black affects the linearity of the scale, the range and the sensitivity of the thermometer.

View solution

- ☐ The linearity, the range and the sensitivity all change.
- ☐ Only the linearity and the range change.
- ☐ Only the linearity and the sensitivity change.
- ☐ Only the range and the sensitivity change.
- ☐ Only the linearity changes.
- ☐ Only the range changes.
- ☐ Only the sensitivity changes.
- ☐ None of these properties changes.

[1]

[Total: 7]

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**5** **(a)** State what is meant by the *specific latent heat of fusion* (*melting*) of a substance.

View solution

.....

.....[2]

**(b)** Ice cubes of total mass 70 g, and at 0 °C, are put into a drink of lemonade of mass 300 g.

All the ice melts as 23 500 J of thermal energy transfers from the lemonade to the ice. The final temperature of the drink is 0 °C.

**(i)** Calculate the specific latent heat of fusion for ice.

View solution

specific latent heat of fusion = .....[2]

**(ii)** The thermal energy that causes the ice to melt is transferred from the lemonade as it cools. The loss of this thermal energy causes the temperature of the 300 g of the lemonade to fall by 19 °C.

Calculate the specific heat capacity of the lemonade.

View solution

specific heat capacity = .....[2]

**(iii)** The melting ice floats on top of the lemonade.

Explain the process by which the lemonade at the bottom of the drink becomes cold.

View solution

.....

.....

.....[2]

[Total: 8]

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**6** A glass, converging lens is used as a magnifying glass to observe a red ant.

View solution

**(a)** Fig. 6.1 shows the lens, the principal axis, and the two principal focuses $F_1$ and $F_2$.

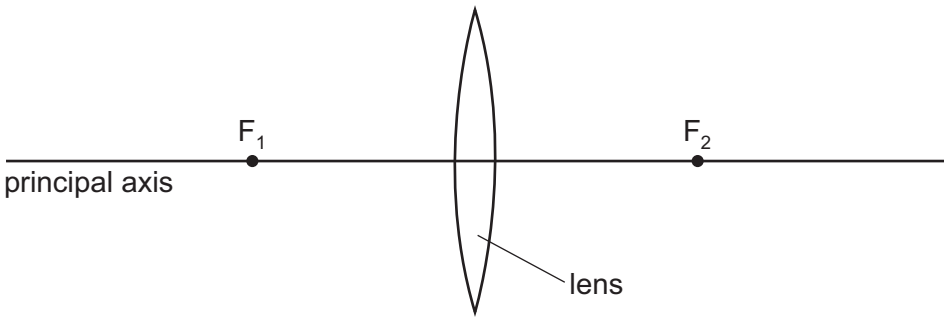


**Fig. 6.1**

**(i)** **1.** On Fig. 6.1, mark a point on the principal axis, labelled A, to indicate a suitable position for the ant.

**2.** On Fig. 6.1, mark a point on the principal axis, labelled E, to indicate a suitable position for the observer's eye.

[1]

**(ii)** Tick **one** of the boxes to indicate where, on the principal axis, the image of the ant is located.

View solution

- ☐ to the left of $F_1$
- ☐ between $F_1$ and the lens
- ☐ within the lens
- ☐ between the lens and $F_2$
- ☐ to the right of $F_2$

[1]

**(iii)** Underline **two** words in the list that describe the image produced by the magnifying glass.

**diminished** **inverted** **real** **upright** **virtual**

[2]

View solution

**(b) (i)** The red light from the ant passes into the lens.

View solution

As the light enters the lens, state what happens to

**1.** its wavelength,

.....[1]

**2.** its frequency.

.....[1]

**(ii)** State how the wavelength of violet light in air differs from the wavelength of red light in air.

.....[1]

[Total: 7]

View solution

**7** **(a)** A sound wave in air consists of alternate compressions and rarefactions along its path.

View solution

**(i)** Explain how a compression differs from a rarefaction.

.....

.....[1]

**(ii)** Explain, in terms of compressions, what is meant by

View solution

**1.** the wavelength of the sound,

.....

.....[1]

**2.** the frequency of the sound.

.....

.....[1]

**(b)** At night, bats emit pulses of sound to detect obstacles and prey. The speed of sound in air is 340 m / s.

View solution

**(i)** A bat emits a pulse of sound of wavelength 0.0085 m.

Calculate the frequency of the sound.

frequency = .....[2]

**(ii)** State why this sound cannot be heard by human beings.

View solution

.....

.....[1]

**(iii)** The pulse of sound hits a stationary object and is reflected back to the bat. The pulse is received by the bat 0.12 s after it was emitted.

View solution

Calculate the distance travelled by the pulse of sound during this time.

distance = .....[2]

[Total: 8]

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**8** **(a)** A student determines the resistance of a length of aluminium wire.

She connects the wire in series with a battery and a variable resistor. The circuit is shown in Fig. 8.1.

View solution

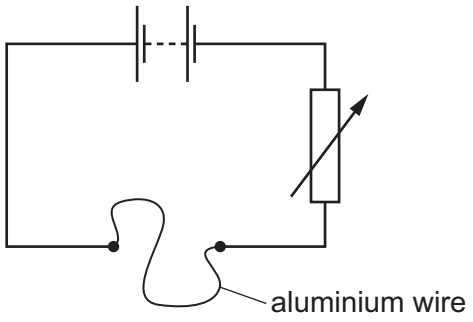


**Fig. 8.1**

She knows that an ammeter and a voltmeter are needed in the circuit.

**(i)** On Fig. 8.1, draw the circuit symbol for an ammeter connected in a suitable position. [1]

**(ii)** A variable resistor is included so that the current in the circuit may be changed.

View solution

Suggest an advantage of being able to change the current.

.....

.....[1]

**(b)** Electricity is transmitted from a power station to a distant city using an aluminium cable of resistance 1.2 Ω. Power loss occurs because of the resistance of the cable.

View solution

The current in the cable is 250 A.

**(i)** Calculate the power loss in the cable.

power loss = .....[3]

**(ii)** The aluminium cable is replaced with a new aluminium cable of the same length. The current remains at 250 A. The diameter of the new cable is double the diameter of the original cable.

View solution

State and explain how the power loss is affected by this change.

.....

.....

.....[3]

[Total: 8]

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**9** An extremely violent nuclear reaction is taking place at the centre of the Sun. It is this reaction that enables the Sun to emit both a very large quantity of energy and an extremely large number of charged particles.

**(a)** Name the type of nuclear reaction taking place in the Sun.

View solution

.....[1]

**(b)** Many of the charged particles produced by the Sun are emitted from its surface at high speeds and travel out into space.

**(i)** Explain why these particles constitute an electric current.

View solution

.....

.....[1]

**(ii)** State the equation that relates the electric current $I$ to the charge $Q$ that is flowing. Define any other terms in the equation.

.....

.....[1]

**(c)** Some of the particles emitted by the Sun travel straight towards the Earth until they enter the Earth's magnetic field. Because they constitute a current, they experience a force and are deflected.

**(i)** Describe the relationship between the direction of the force and

View solution

**1.** the direction of the current,

.....[1]

**2.** the direction of the magnetic field.

.....[1]

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**(ii)** A negatively charged particle is travelling in a magnetic field. This is represented in Fig. 9.1. The direction of the magnetic field is into the page.

View solution

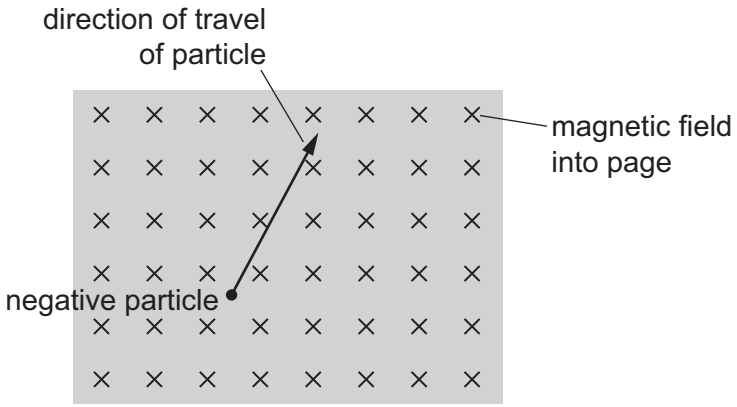


**Fig. 9.1**

On Fig. 9.1, draw an arrow, labelled F, to show the direction of the force that acts on the particle. [1]

[Total: 6]

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**10** A solenoid is held in a vertical position. The solenoid is connected to a sensitive, centre-zero ammeter.

A vertical bar magnet is held stationary at position X just above the upper end of the solenoid as shown in Fig. 10.1.

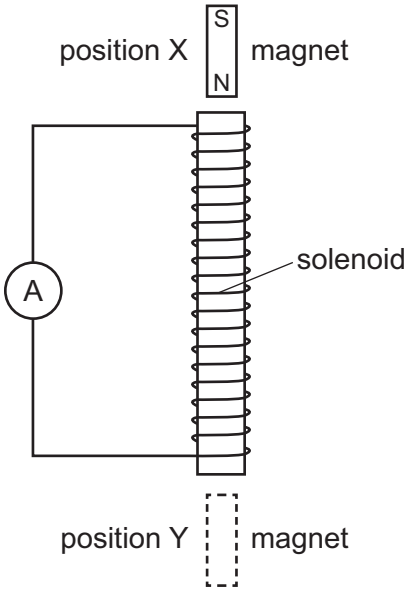


**Fig. 10.1**

The magnet is released and it falls through the solenoid. During the initial stage of the fall, the sensitive ammeter shows a small deflection to the left.

**(a)** Explain why the ammeter shows a deflection.

View solution

.....

.....[1]

**(b)** The magnet passes the middle point of the solenoid and continues to fall. It reaches position Y.

Describe and explain what is observed on the ammeter as the magnet falls from the middle point of the solenoid to position Y.

.....

.....

.....

.....

.....

.....[4]

View solution

**(c)** Suggest **two** changes to the apparatus that would increase the initial deflection of the ammeter.

1. .....

.....

2. .....

.....

[2]

[Total: 7]

View solution

**11 (a)** An underground water pipe has cracked and water is leaking into the surrounding ground.

View solution

Fig. 11.1 shows a technician locating the position of the leak.

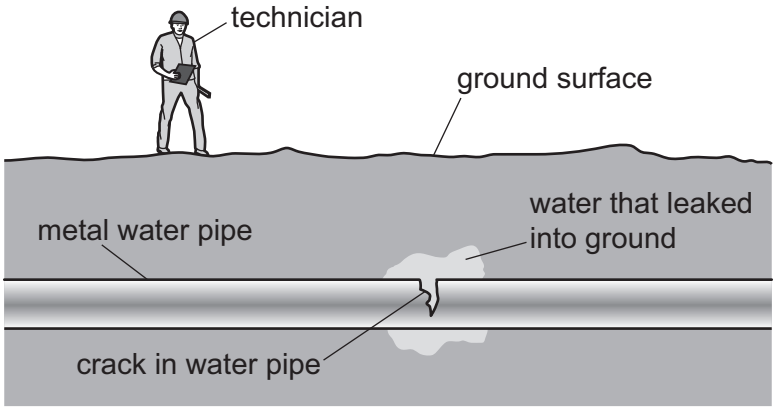


**Fig. 11.1**

A radioactive isotope is introduced into the water supply and the water that leaks from the crack is radioactive.

The technician tries to locate an area above the pipe where the radioactive count rate is higher than in the surrounding area.

**(i)** State and explain the type of radiation that must be emitted by the isotope for the leak to be detected.

.....

.....

.....[2]

**(ii)** The half-life of the isotope used is 6.0 hours.

View solution

Explain why an isotope with this half-life is suitable.

.....

.....

.....

.....[2]

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**(b)** Caesium-133 is a stable isotope of the element caesium, but caesium-135 is radioactive.

A nucleus of caesium-133 contains 78 neutrons and a nucleus of caesium-135 contains 80 neutrons.

Put **one** tick in each row of the table to indicate how the number of particles in a neutral atom of caesium-133 compares with the number of particles in a neutral atom of caesium-135.




The first row has been completed already.

| | particles in caesium-133 | | | | |
|---|---|---|---|---|---|
| | 2 more than caesium-135 | 1 more than caesium-135 | equal to caesium-135 | 1 fewer than caesium-135 | 2 fewer than caesium-135 |
| number of neutrons | | | | | ✓ |
| number of protons | | | | | |
| number of nucleons | | | | | |
| number of electrons | | | | | |

[2]

[Total: 6]

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