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Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTER NUMBER | CANDIDATE NUMBER

7483172970

PHYSICS (US) **0443/33**

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 Center 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.

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

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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 fi
of the race, the car's speed increases from 0 m / s to 25 m / s at a uniform rate.

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.

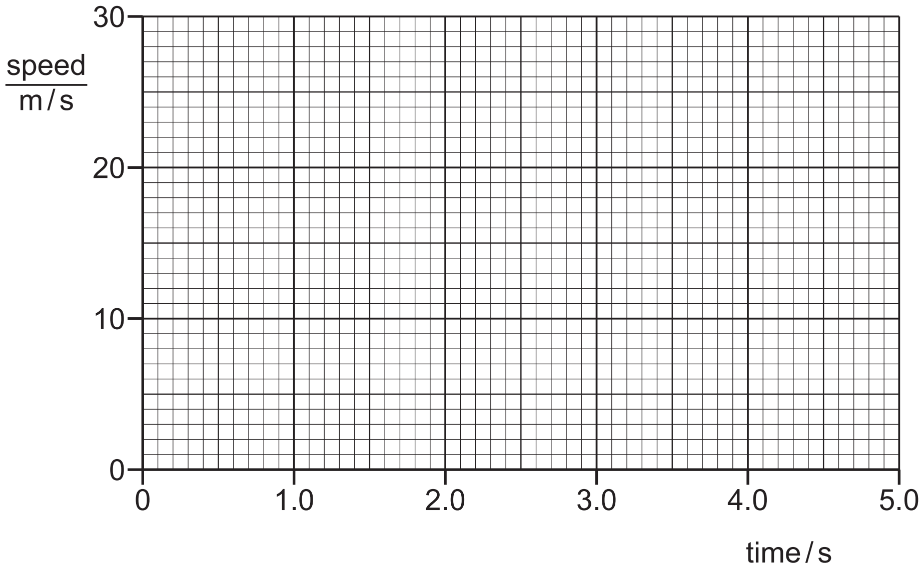

Fig. 1.1

[1]

(b) Use your graphs to determine

(i) the distance traveled by the runner in the 5.0 s,

distance = ...[1]

(ii) the distance traveled by the car in the 5.0 s,

distance = ...[2]

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

time = ...[2]

[Total: 7]

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2 An electric train is initially at rest at a railway station. The motor causes a cons[illegible]f 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.

....[1]

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

(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.

maximum possible speed = ...[3]

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

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

....

....[1]

(c) After traveling 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]

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3 **(a)** The boxes on the left contain the names of some sources of energy. The boxes ... t 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 des... that source of energy.

	renewable
solar energy	not renewable
natural gas	polluting
	not polluting

[2]

(b) Coal-fired power stations are polluting.

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, 2.05×10^8 kg of water is pumped up through a vertical height of 500 m.

(i) Calculate the weight of the water.

weight = ...[1]

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

energy gained = ...[2]

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

Calculate the efficiency of this energy storage scheme.

efficiency = ...[2]

[Total: 8]

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

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

....

....[1]

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

State the lowest temperature that it can measure.

lowest temperature = ...[1]

(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]

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(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 in air.

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

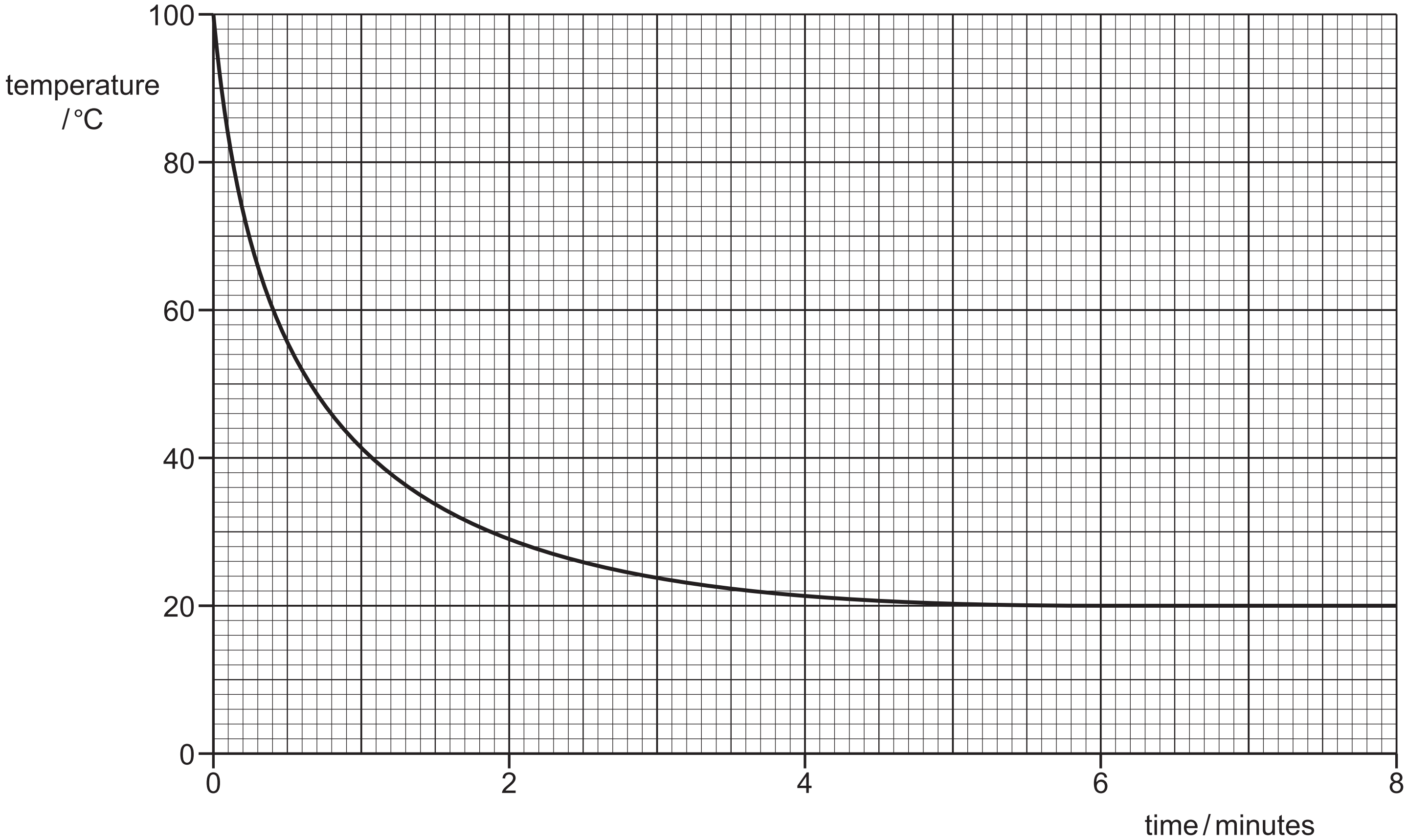

Fig. 4.1

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 lin[illegible]e scale, the range and the sensitivity of the thermometer.

- ☐ 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.

....

....[

(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.

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.

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.

....

....

....[2]

[Total: 8]

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

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

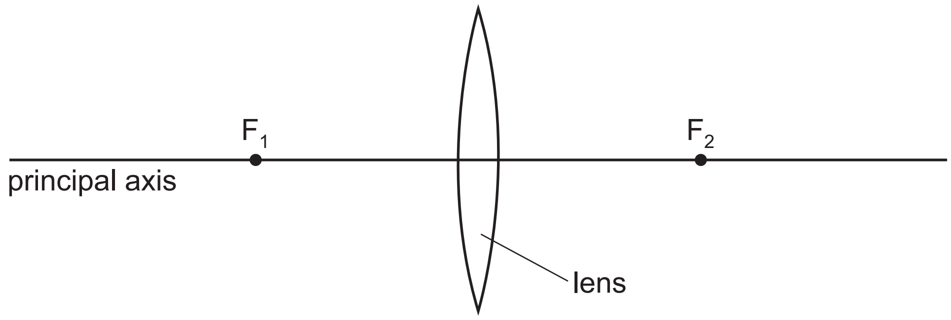

Fig. 6.1

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

2. On Fig. 6.1, mark a point on the principal axis, labeled 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.

☐ 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]

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

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]

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

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

....

....[1]

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

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.

(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.

....

....[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.

Calculate the distance traveled 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 aluminum wire.

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

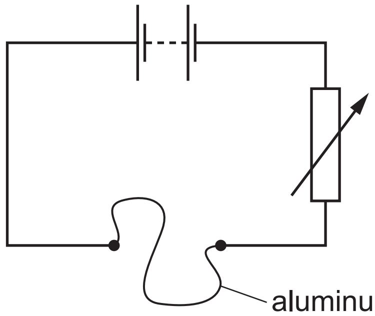

Fig. 8.1

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.

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 aluminum cable of resistance 1.2 Ω. Power loss occurs because of the resistance of the cable.

The current in the cable is 250 A.

(i) Calculate the power loss in the cable.

power loss = ...[3]

(ii) The aluminum cable is replaced with a new aluminum 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.

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 center of the Sun. It is this t enables the Sun to emit both a very large quantity of energy and an extremely large charged particles.

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

....[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.

....

....[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

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 traveling in a magnetic field. This is represented in Fig. 9.1. The direction of the magnetic field is into the page.

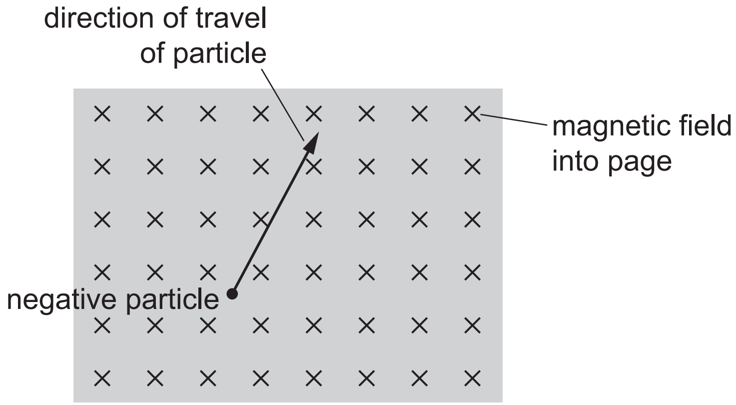

Fig. 9.1

On Fig. 9.1, draw an arrow, labeled 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, [illegible] ammeter.

A vertical bar magnet is held stationary at position X just above the upper end of the solenoi[illegible] shown in Fig. 10.1.

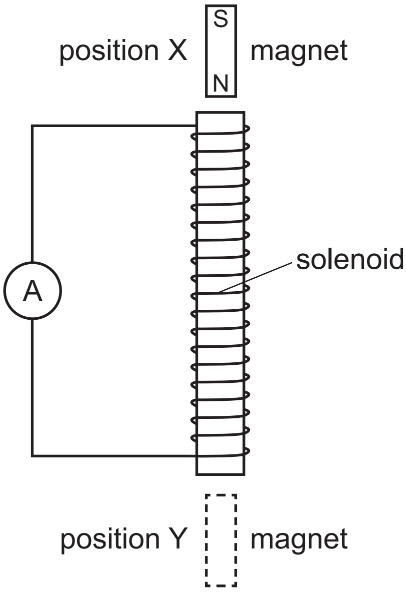

Fig. 10.1

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.

....

....[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]

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(c) Suggest **two** changes to the apparatus that would increase the initial defle[illegible]e ammeter.

1. ....

....

2. ....

.... [2]

[Total: 7]

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

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

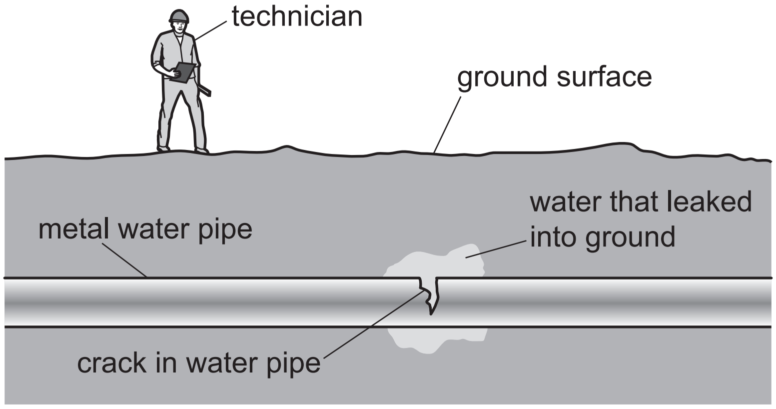

Fig. 11.1

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.

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

....

....

....

....[2]

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(b) Cesium-133 is a stable isotope of the element cesium, but cesium-135 is radioa...

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

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

The first row has been completed already.

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

[2]

[Total: 6]

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