Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/11**

Paper 1 Multiple Choice (Core) **October/November 2016**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m / s^2).

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 **17** printed pages and **3** blank pages.

1 A student has a can of oil.

Which quantity can be measured using only a measuring cylinder?

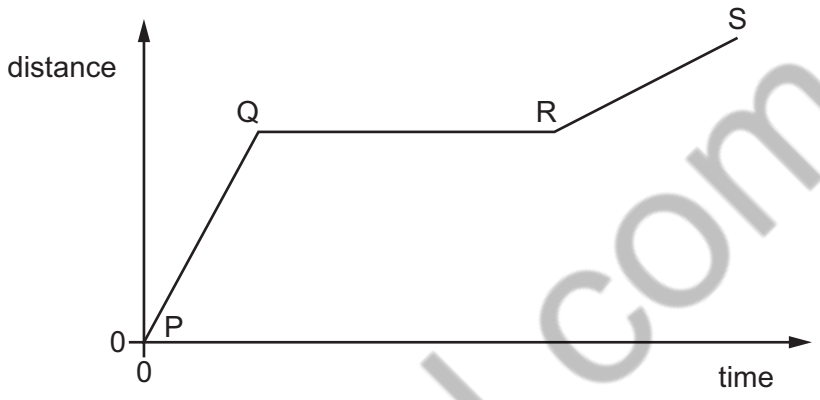
A density of the oil

B mass of the oil

C volume of the oil

D weight of the oil

2 The graph shows how the distance travelled by a vehicle changes with time.

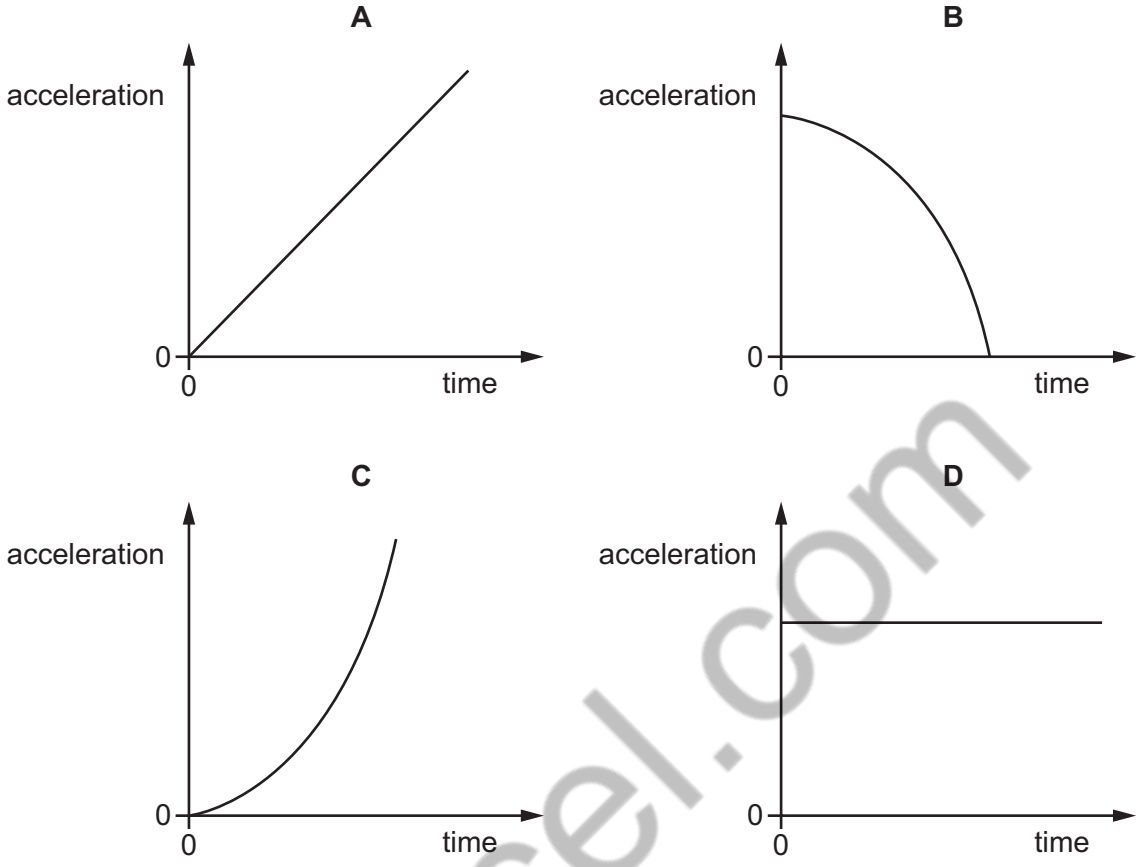


Which row describes the speed of the vehicle in each section of the graph?

	P to Q	Q to R	R to S
A	constant	zero	constant
B	constant	zero	decreasing
C	increasing	constant	decreasing
D	increasing	zero	constant

3 A stone falls freely from the top of a cliff. Air resistance may be ignored.

Which graph shows how the acceleration of the stone varies with time as it falls?



4 What name is given to the gravitational force of the Earth on an object?

A density

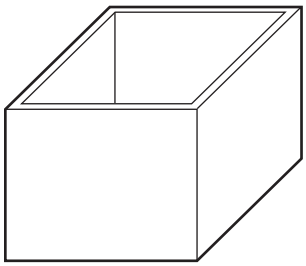
B mass

C volume

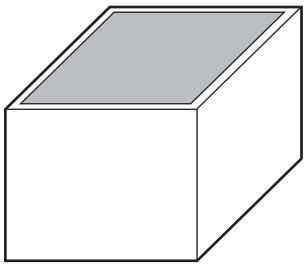
D weight

5 The diagrams show an empty rectangular box, and the same box filled with liquid.

The box has a mass of 60 g when empty. When filled with liquid, the total mass of the box and the liquid is 300 g.



empty box
60 g



box filled with liquid
300 g

The density of the liquid is 1.2 g / cm^3.

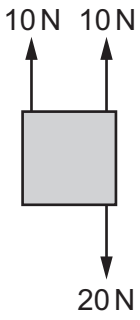
What is the volume of the liquid in the box?

A 50 cm^3 **B** 200 cm^3 **C** 250 cm^3 **D** 300 cm^3

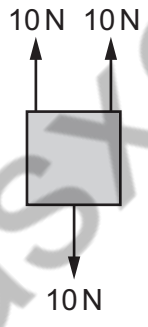
6 The diagrams show four identical objects. Each object is acted on by only the forces shown.

Which diagram shows an object in equilibrium?

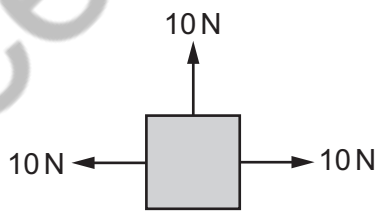
A



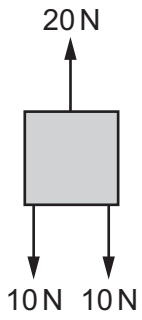
B



C



D



7 A student investigates a steel spring. He measures the length of the spring, then he hangs different weights from the spring. He measures the length of the spring for each different weight.

The table shows his results.

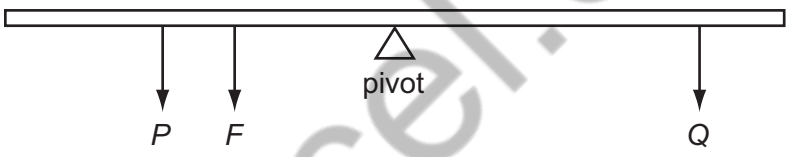
weight / N	length of spring / mm
0.0	108
2.0	116
4.0	124
6.0	132

A weight of 3.0 N is hung from the spring.

What is the extension of the spring?

A 4 mm **B** 12 mm **C** 40 mm **D** 120 mm

8 The diagram shows a plank balanced on a pivot. Three forces *F*, *P* and *Q* act on the plank, as shown.



The force *F* is increased, but continues to act at the same distance from the pivot. The plank is no longer balanced.

Which change could make the plank balance again?

A decrease *Q*

B increase *P*

C move *P* further from the pivot

D move *Q* further from the pivot

9 Which energy transfer takes place when petrol is burned?

A chemical to internal energy of surroundings (heat)

B chemical to nuclear

C gravitational potential to internal energy of surroundings (heat)

D kinetic to chemical

10 The box contains the names of eight different energy resources.

natural gas	geothermal	solar	waves
hydroelectric	oil	wind	coal

How many of these energy resources are renewable?

A 3 **B** 4 **C** 5 **D** 6

11 A child runs up a set of stairs four times. The time taken for each run is recorded.

Which time is measured when the child's useful power is greatest?

A 10 s **B** 20 s **C** 30 s **D** 40 s

12 The diagrams show the actual sizes of the heels of four different shoes, as seen from underneath the shoe.

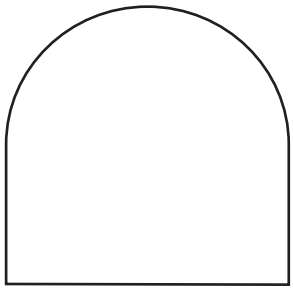
Which heel is **most** likely to cause damage to wooden floors?

A

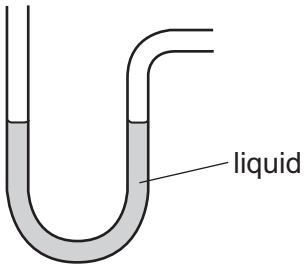
B

C

D



13 The diagram shows an instrument used to measure gas pressure.



What is the instrument called?

A ammeter

B barometer

C manometer

D thermometer

14 Smoke particles in air are illuminated by a beam of light. The particles are viewed through a microscope. They are seen to move in a random zig-zag way.

What causes this movement?

A convection currents in the air

B impacts of fast-moving air molecules

C the energy of the beam of light

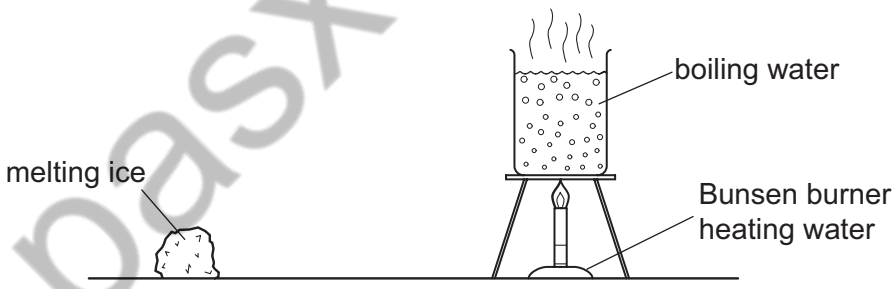
D vibrations of the atoms in the smoke particles

15 When a liquid evaporates, some of its molecules escape from the surface and the temperature of the liquid changes.

Which row describes the escaping molecules and the change in temperature of the liquid?

	escaping molecules	temperature of the liquid
A	less energetic	goes down
B	less energetic	goes up
C	more energetic	goes down
D	more energetic	goes up

16 A piece of melting ice at 0 °C and a beaker of boiling water are both in a laboratory. The laboratory is at 20 °C.



What is happening to the temperature of the melting ice and what is happening to the temperature of the boiling water?

	temperature of melting ice	temperature of boiling water
A	constant	constant
B	constant	increasing
C	increasing	constant
D	increasing	increasing

17 Changes in which physical property **cannot** be used for temperature measurement?

A decay rate of a radioactive source

B electrical resistance of a solid

C pressure of a gas

D volume of a liquid

18 Which statement about infra-red radiation is correct?

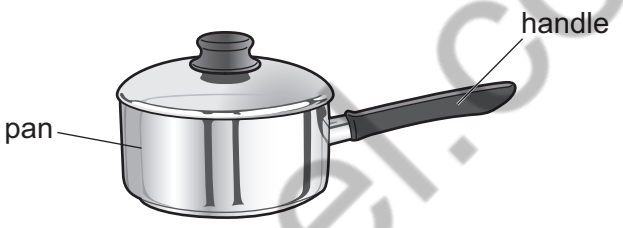
A A black surface is a poor absorber of infra-red radiation.

B A dull surface is a better emitter of infra-red radiation than a shiny surface.

C A shiny surface is a better absorber of infra-red radiation than a dull surface.

D A white surface is a poor reflector of infra-red radiation.

19 A pan is made for heating water on a stove.



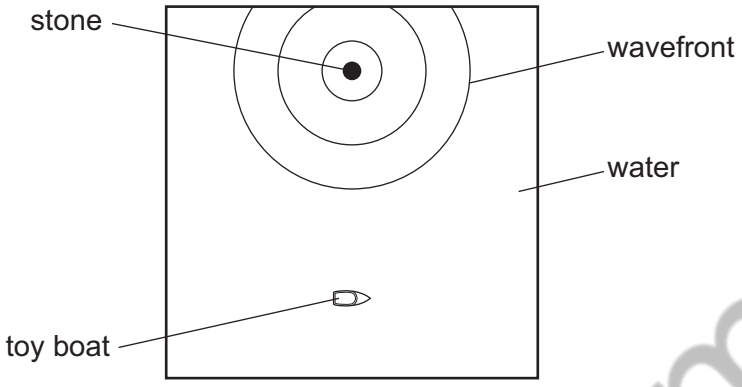
From which type of materials should the pan and its handle be made?

	material for pan	material for handle
A	good thermal conductor	good thermal conductor
B	good thermal conductor	poor thermal conductor
C	poor thermal conductor	good thermal conductor
D	poor thermal conductor	poor thermal conductor

20 A toy boat floats on water in a tank. The boat is initially stationary.

A stone is thrown into the tank, which causes a transverse water wave to move across the surface.

The diagram shows the view from above the tank.



How does the boat behave as the wave passes it?

A It moves steadily away from where the stone hit the water.

B It moves steadily towards where the stone hit the water.

C It stays the same distance from where the stone hit the water, and vibrates from side to side.

D It stays the same distance from where the stone hit the water, and vibrates up and down.

21 Below are four statements about the diffraction of a wave on the surface of water.

Which statement is correct?

A Diffraction involves a change in the speed of the wave.

B Diffraction involves a change in the wavelength of the wave.

C When a wave passes through a gap, its direction changes.

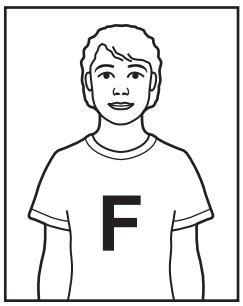
D When a wave passes through a gap, its frequency changes.

22 A child wears a T-shirt with the letter ‘F’ written on it.

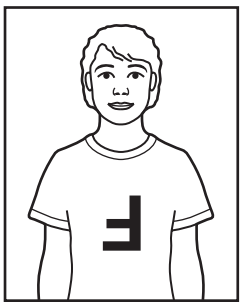
The child stands in front of a vertical plane mirror.

What does the child see?

A



B



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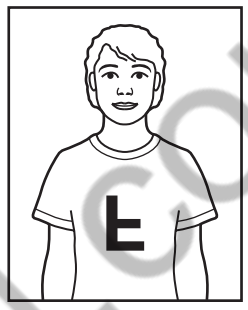

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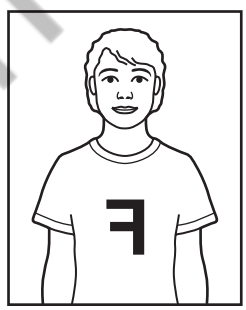
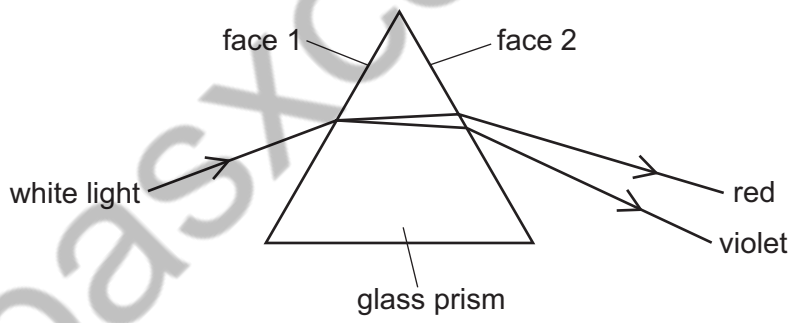


23 When white light passes through a glass prism, it disperses as shown in the diagram.



Which row compares the refraction of violet light with the refraction of red light at the faces 1 and 2 of the prism?

	face 1	face 2
A	violet refracts less	violet refracts less
B	violet refracts less	violet refracts more
C	violet refracts more	violet refracts less
D	violet refracts more	violet refracts more

24 Radiation from which part of the electromagnetic spectrum is used in the remote controller for a television?

A infra-red waves

B microwaves

C radio waves

D ultraviolet waves

25 A girl notices that, when she shouts into a cave, she hears an echo.

Which wave property causes the echo?

A diffraction

B dispersion

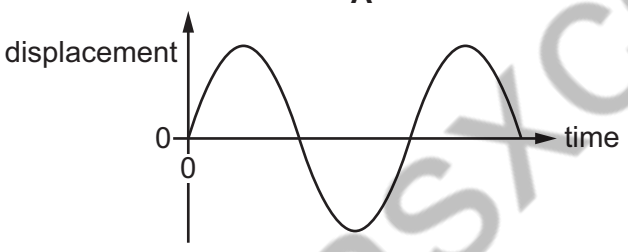
C reflection

D refraction

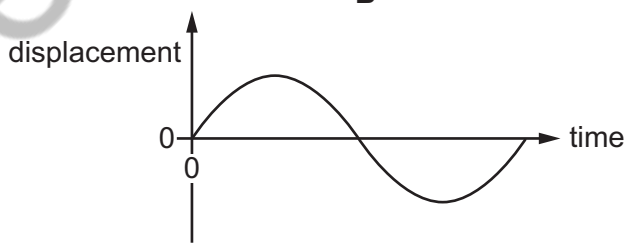
26 The diagrams represent the displacement in four different sound waves. All the diagrams are drawn to the same scale.

Which diagram represents the sound with the highest pitch?

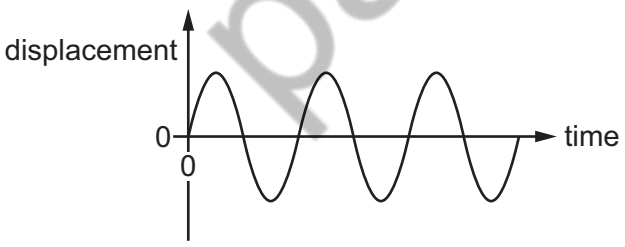
A



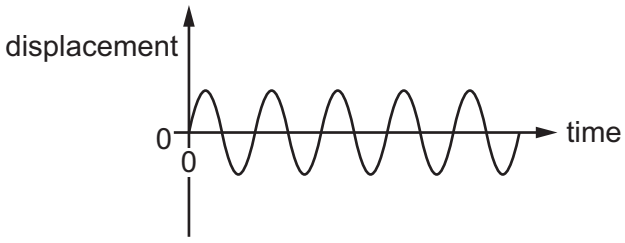
B



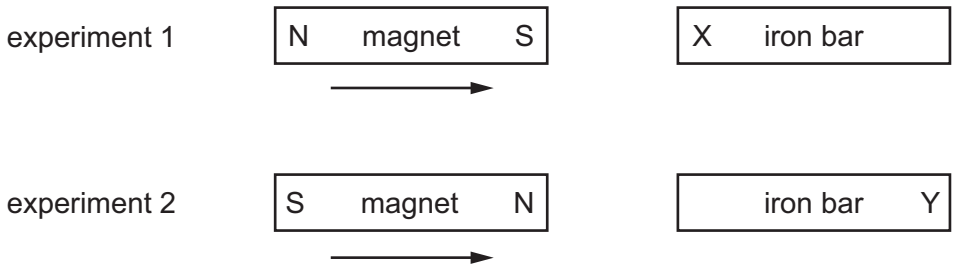
C



D



27 In two separate experiments, a magnet is brought near to an unmagnetised iron bar. This causes the bar to become magnetised.



Which magnetic pole is induced at X and at Y?

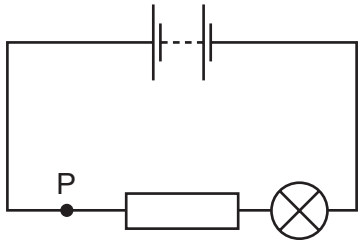
	pole induced at X	pole induced at Y
A	N	N
B	N	S
C	S	N
D	S	S

28 A polythene rod is rubbed with a cloth. The rod becomes positively charged because of the movement of charged particles.

Which row gives the name of these charged particles, and the direction in which they move?

	charged particles	direction of movement
A	electrons	from cloth to rod
B	electrons	from rod to cloth
C	protons	from cloth to rod
D	protons	from rod to cloth

29 The diagram shows a lamp in a circuit.



Which change to the circuit would increase the current in the lamp?

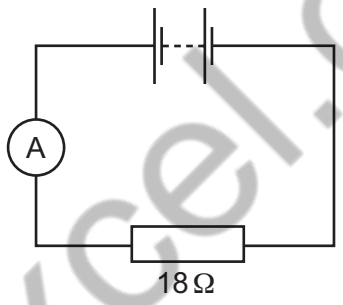
A adding another resistor in parallel with the one in the circuit

B adding another resistor in series with the one in the circuit

C decreasing the electromotive force (e.m.f.) of the battery in the circuit

D moving the lamp to point P in the circuit

30 An ammeter and an 18 Ω resistor are connected in series with a battery. The reading on the ammeter is 0.50 A.

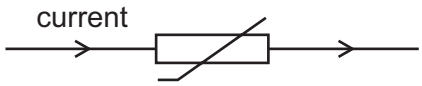


What is the electromotive force (e.m.f.) of the battery?

A 9.0 N **B** 9.0 V **C** 36 N **D** 36 V

31 A source of constant electromotive force (e.m.f.) is connected across a thermistor.

There is an electric current in the thermistor.

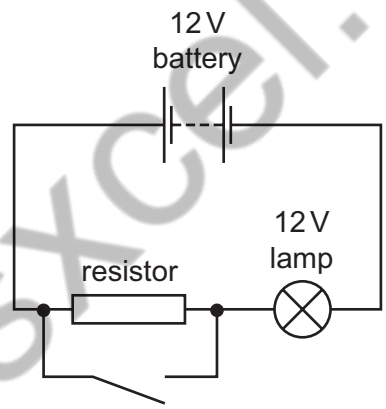


The temperature of the thermistor is reduced.

Which row shows what happens to the resistance of the thermistor and what happens to the current?

	resistance	current
A	increases	decreases
B	increases	increases
C	stays the same	decreases
D	stays the same	increases

32 The diagram shows a circuit containing a battery, a resistor with high resistance, a switch and a lamp.



Initially the switch is open.

What happens to the lamp when the switch is closed?

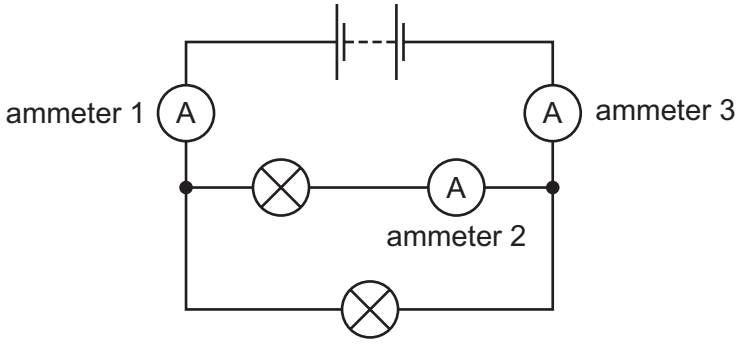
A It glows more brightly.

B It glows less brightly.

C It goes out.

D Its brightness does not change.

33 The diagram shows a circuit containing two identical lamps and three ammeters.



The current in ammeter 1 is 0.30 A.

Which row gives possible values for the currents in ammeters 2 and 3?

	ammeter 2 / A	ammeter 3 / A
A	0.15	0.00
B	0.15	0.30
C	0.30	0.00
D	0.30	0.30

34 Two electrical appliances are connected to the mains supply.

The cable connected to one appliance includes an earth wire.

The cable connected to the second appliance does **not** need an earth wire.

What is a reason for this difference?

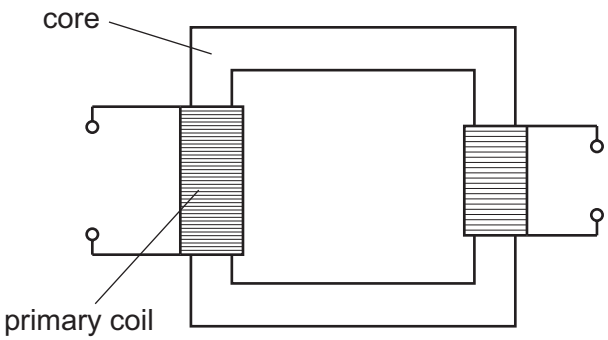
A One appliance has a metal case, but the other appliance does not.

B One appliance is fitted with a fuse, but the other appliance is not.

C One appliance is fitted with a switch, but the other appliance is not.

D One appliance needs more current than the other appliance.

35 The diagram represents a transformer.



Which row shows materials suitable for making the core and the primary coil?

	core	primary coil
A	iron	copper
B	iron	plastic
C	steel	copper
D	steel	plastic

36 An electric current can produce a heating effect and a magnetic effect.

Which row shows the effect that a relay uses and one application of a relay?

	effect used by a relay	one application of a relay
A	heating effect	allowing a small current to switch on a large current
B	heating effect	changing the voltage of an a.c. supply
C	magnetic effect	allowing a small current to switch on a large current
D	magnetic effect	changing the voltage of an a.c. supply

37 A nuclide of sodium can be represented by $^{23}_{11}Na$.

Which row gives the numbers of particles in a neutral sodium atom?

	number of electrons	number of protons	number of neutrons
A	11	11	12
B	12	11	23
C	12	12	11
D	23	23	11

38 Radioactive materials may emit α-particles or β-particles.

Which statement about the effect of these emissions is correct?

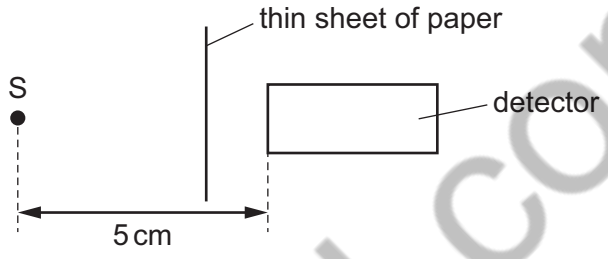
A Both α-particles and β-particles cause the nucleus to change into that of a different chemical element.

B Neither α-particles nor β-particles cause the nucleus to change into that of a different chemical element.

C Only α-particles cause the nucleus to change into that of a different chemical element.

D Only β-particles cause the nucleus to change into that of a different chemical element.

39 Radioactive source S emits α-particles, β-particles and γ-rays. A detector is placed 5 cm away from S. A thin sheet of paper is placed as shown in the diagram.



Which emissions from the source can be detected?

A α-particles and β-particles only

B α-particles and γ-rays only

C β-particles and γ-rays only

D α-particles, β-particles and γ-rays

40 The half-life of a radioactive nuclide is 2.0 hours.

The decay rate of a sample of this nuclide is measured at 1.0 hour intervals. The table shows the measurements, with one value shown as X.

time / hours	decay rate / decays / s
0	240
1.0	170
2.0	120
3.0	85
4.0	X

What is the most likely value of X?

A 15 **B** 42 **C** 50 **D** 60

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Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/21**

Paper 2 Multiple Choice (Extended) **October/November 2016**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
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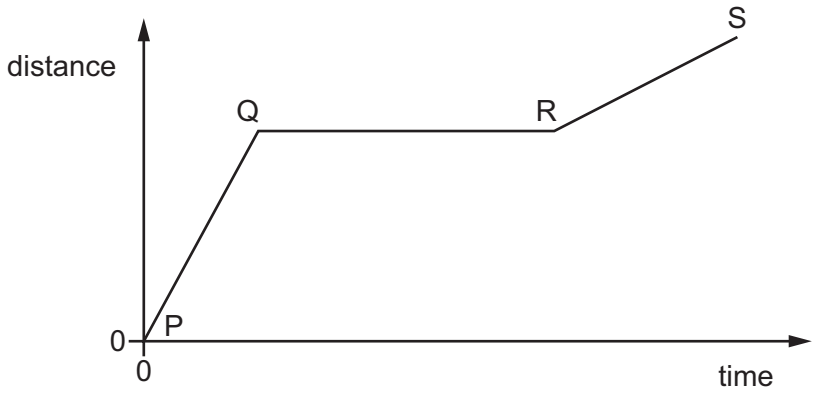
1 The graph shows how the distance travelled by a vehicle changes with time.



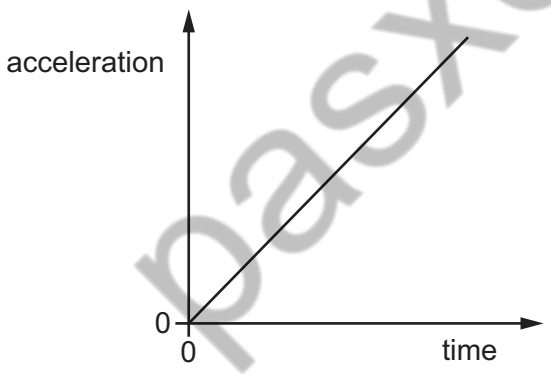
Which row describes the speed of the vehicle in each section of the graph?

	P to Q	Q to R	R to S
A	constant	zero	constant
B	constant	zero	decreasing
C	increasing	constant	decreasing
D	increasing	zero	constant

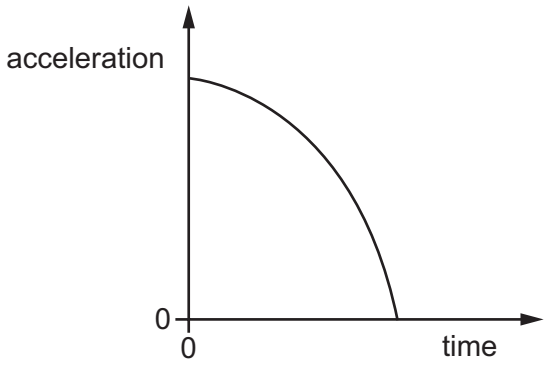
2 A stone falls freely from the top of a cliff. Air resistance may be ignored.

Which graph shows how the acceleration of the stone varies with time as it falls?

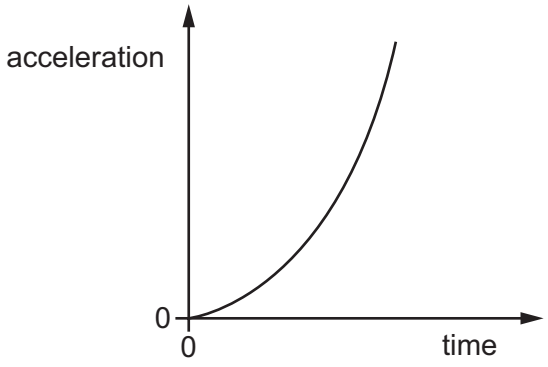
A



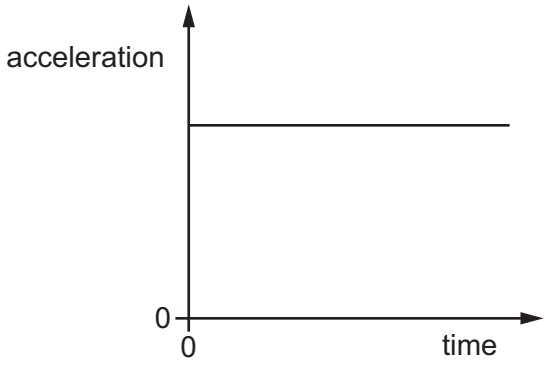
B



C

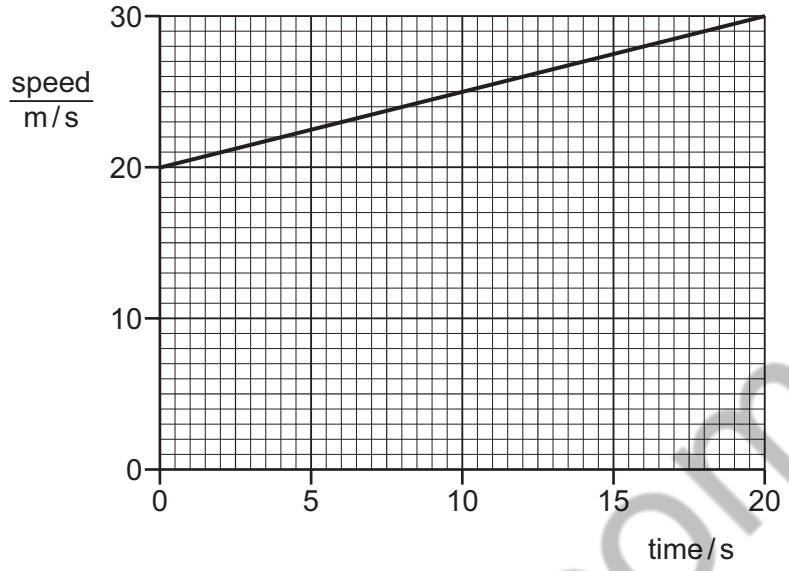


D



3 A car travels along a horizontal road in a straight line. The driver presses the accelerator to increase the speed of the car.

The speed-time graph for the car is shown.



What is the acceleration of the car?

A $0.50\,m/s^2$ **B** $1.00\,m/s^2$ **C** $1.50\,m/s^2$ **D** $2.00\,m/s^2$

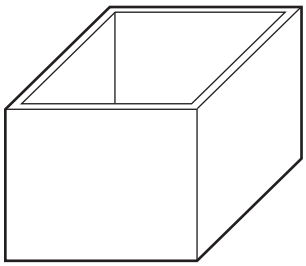
4 A spaceship approaches the Earth from deep space. Near the Earth, a force on the spaceship causes it to have weight. This causes it to change its speed and direction.

Which type of force causes the spaceship's weight, and which property of the spaceship resists its change in speed and direction?

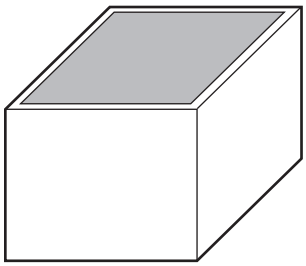
	force that causes weight	property that resists change in speed and direction
A	gravitational	mass
B	gravitational	volume
C	magnetic	mass
D	magnetic	volume

5 The diagrams show an empty rectangular box, and the same box filled with liquid.

The box has a mass of 60 g when empty. When filled with liquid, the total mass of the box and the liquid is 300 g.



empty box
60 g



box filled with liquid
300 g

The density of the liquid is 1.2 g / cm^3.

What is the volume of the liquid in the box?

A 50 cm^3 **B** 200 cm^3 **C** 250 cm^3 **D** 300 cm^3

6 An object travels in a circular path at constant speed.

Which statement about the object is correct?

A It has changing kinetic energy.

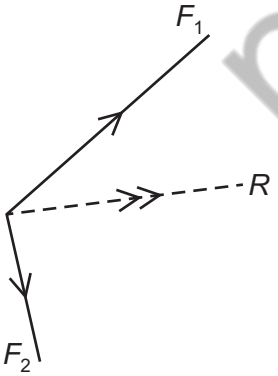
B It has changing momentum.

C It has constant velocity.

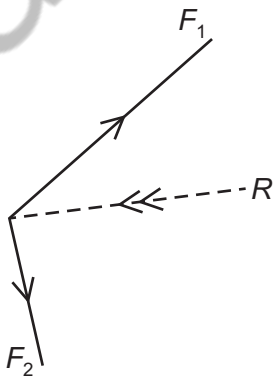
D It is not accelerating.

7 Which diagram shows the magnitude and direction of the resultant R of the two forces F_1 and F_2?

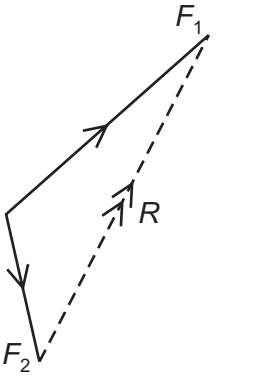
A



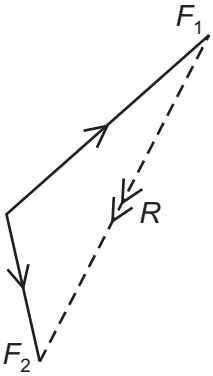
B



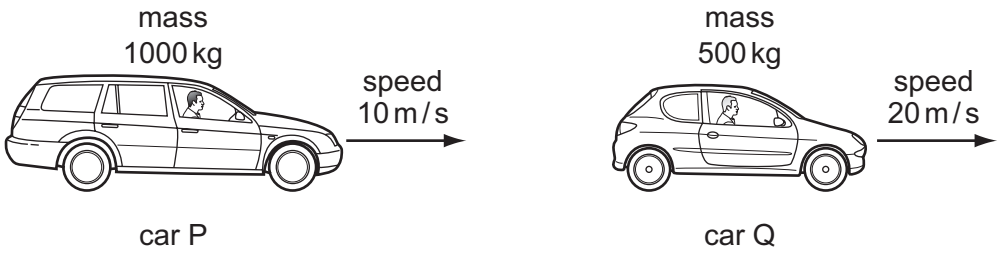
C



D



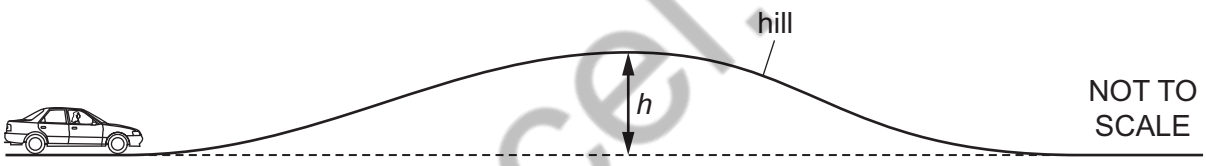
8 Two cars, P and Q, have different masses and different speeds as shown.



Which row correctly compares the momentum and the kinetic energy of P with the momentum and the kinetic energy of Q?

	momentum	kinetic energy
A	P greater than Q	P equal to Q
B	P equal to Q	P equal to Q
C	P equal to Q	P less than Q
D	P less than Q	P greater than Q

9 A car of mass 800 kg travels over a hill of height *h*.



By travelling to the top of the hill, the car gains 40 000 J of gravitational potential energy.

The gravitational field strength *g* is 10 N / kg.

What is the height *h* of the hill?

A 5.0 m **B** 20 m **C** 50 m **D** 500 m

10 A lamp has a power input of 5.0 W. It wastes 1.0 W of power heating the surroundings.

What is the efficiency of the lamp?

A 20% **B** 50% **C** 80% **D** 120%

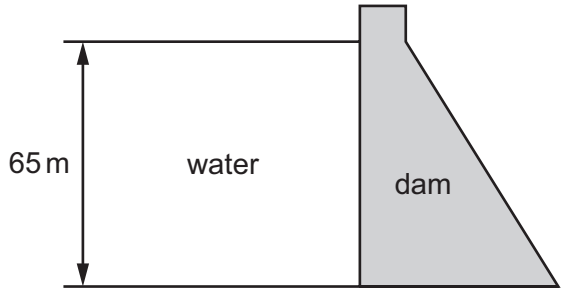
11 The box contains the names of eight different energy resources.

natural gas	geothermal	solar	waves
hydroelectric	oil	wind	coal

How many of these energy resources are renewable?

A 3 **B** 4 **C** 5 **D** 6

12 The diagram shows a dam holding back water.



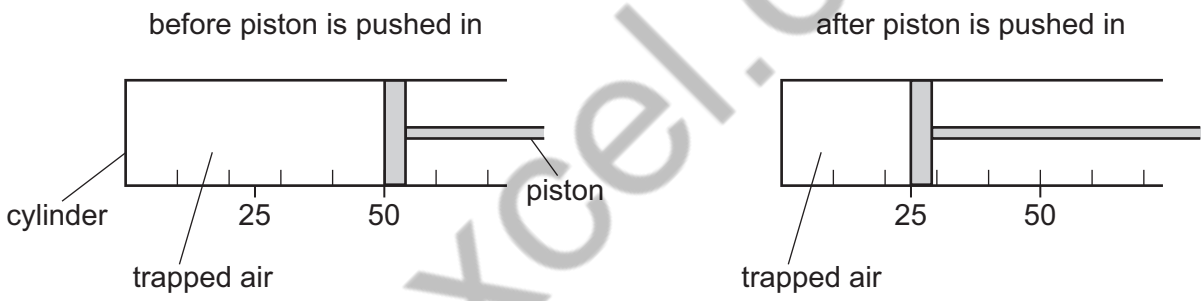
The depth of the water is 65 m.

The density of the water is 1000 kg / m^3. The gravitational field strength g is 10 N / kg.

What is the pressure exerted at the base of the dam due to the water?

A 15.4 Pa **B** 154 Pa **C** 65 000 Pa **D** 650 000 Pa

13 Air is trapped in a cylinder by a piston. The original volume of the trapped air is V and the original pressure of the trapped air is P. The piston is pushed to the left. The temperature of the gas does not change.



What is the new volume and what is the new pressure of the trapped air?

	new volume	new pressure
A	$2V$	$\frac{P}{2}$
B	$2V$	$2P$
C	$\frac{V}{2}$	$\frac{P}{2}$
D	$\frac{V}{2}$	$2P$

14 When a liquid evaporates, some of its molecules escape from the surface and the temperature of the liquid changes.

Which row describes the escaping molecules and the change in temperature of the liquid?

	escaping molecules	temperature of the liquid
A	less energetic	goes down
B	less energetic	goes up
C	more energetic	goes down
D	more energetic	goes up

15 A gas at a constant temperature is in a container of fixed volume. The gas exerts a pressure on the walls of the container. The pressure is caused by the gas molecules striking the walls.

Which statement about the gas molecules when they strike the walls is correct?

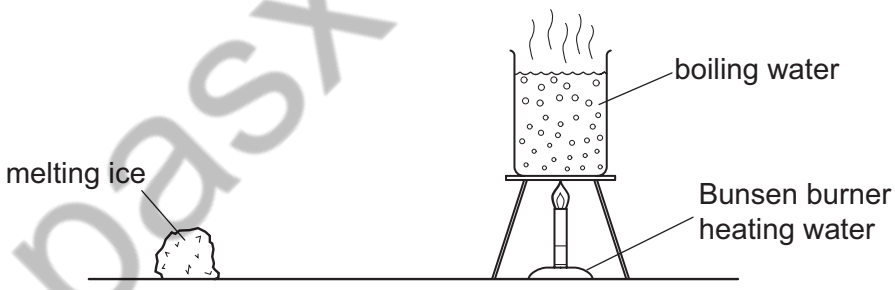
A The average kinetic energy of the gas molecules changes.

B The average momentum of the gas molecules changes.

C The average speed of the gas molecules changes.

D The chemical energy of the gas molecules changes.

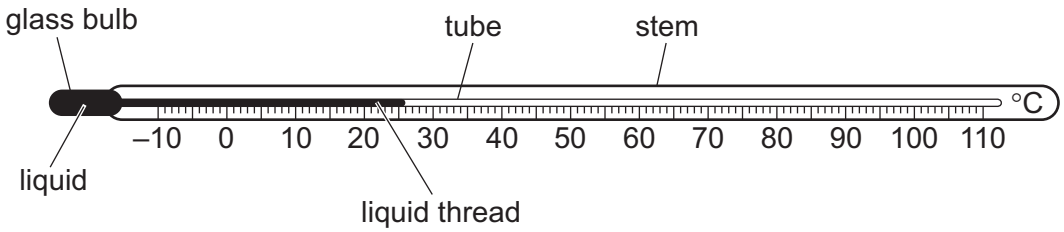
16 A piece of melting ice at 0 °C and a beaker of boiling water are both in a laboratory. The laboratory is at 20 °C.



What is happening to the temperature of the melting ice and what is happening to the temperature of the boiling water?

	temperature of melting ice	temperature of boiling water
A	constant	constant
B	constant	increasing
C	increasing	constant
D	increasing	increasing

17 The diagram shows a liquid-in-glass thermometer.



Which feature would give a thermometer with an increased range?

A a smaller internal diameter of the tube containing the liquid thread

B a thinner glass bulb

C a larger length of the tube and stem

D a larger volume of the liquid

18 A copper container of mass 0.20 kg contains 0.10 kg of water.

The specific heat capacity of copper is 385 J / (kg °C) and the specific heat capacity of water is 4200 J / (kg °C).

How much energy, in joules, is needed to raise the temperature of the copper container and the water by 10 °C?

A $(0.20 \times 385 \times 10) - (0.10 \times 4200 \times 10)$

B $(0.20 \times 385 \times 10) + (0.10 \times 4200 \times 10)$

C $(0.10 + 0.20) \times \left(\frac{4200 + 385}{2}\right) \times 10$

D $(0.10 + 0.20) \times (4200 + 385) \times 10$

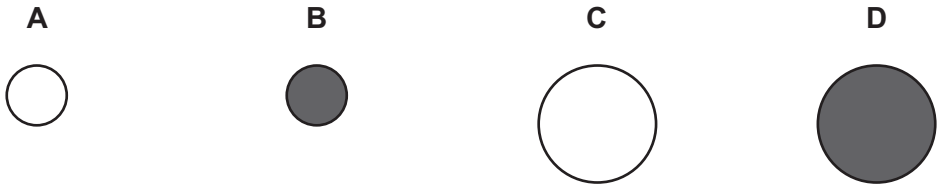
19 The thermal transfer of energy through a copper rod involves electrons.
A second process is also involved.

What is this method of thermal energy transfer, and what is the second process?

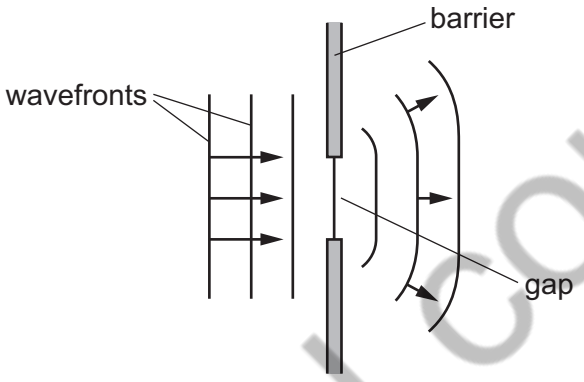
	method	second process
A	conduction	density change
B	conduction	lattice vibration
C	convection	density change
D	convection	lattice vibration

20 The diagrams show four spherical objects at the same temperature. Two of the objects are small and two are large. Two of the objects are white and two are black.

Which object emits infra-red radiation at the greatest rate?



21 The diagram represents plane wavefronts being diffracted by passing through a gap in a barrier.



Which pair of changes **must** increase the amount of diffraction that occurs?

A decrease the wavelength and decrease the size of the gap

B decrease the wavelength and increase the size of the gap

C increase the wavelength and decrease the size of the gap

D increase the wavelength and increase the size of the gap

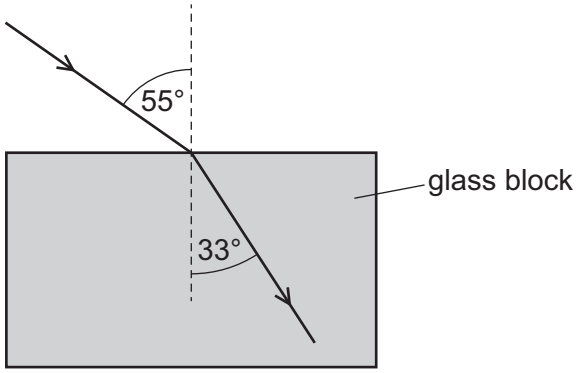
22 An image is formed by a plane mirror. A second image is formed by a lens used as a magnifying glass.

Which row states the nature of each of these images?

	plane mirror	magnifying glass
A	real	real
B	real	virtual
C	virtual	real
D	virtual	virtual

23 Light travelling at a speed of 3.0×10^8 m/s strikes the surface of a glass block and undergoes refraction as it enters the block.

The diagram shows a ray of this light before and after it enters the block.



What is the speed of light in the glass?

A 1.8×10^8 m/s

B 2.0×10^8 m/s

C 4.5×10^8 m/s

D 5.0×10^8 m/s

24 Radiation from which part of the electromagnetic spectrum is used in the remote controller for a television?

A infra-red waves

B microwaves

C radio waves

D ultraviolet waves

25 A girl notices that, when she shouts into a cave, she hears an echo.

Which wave property causes the echo?

A diffraction

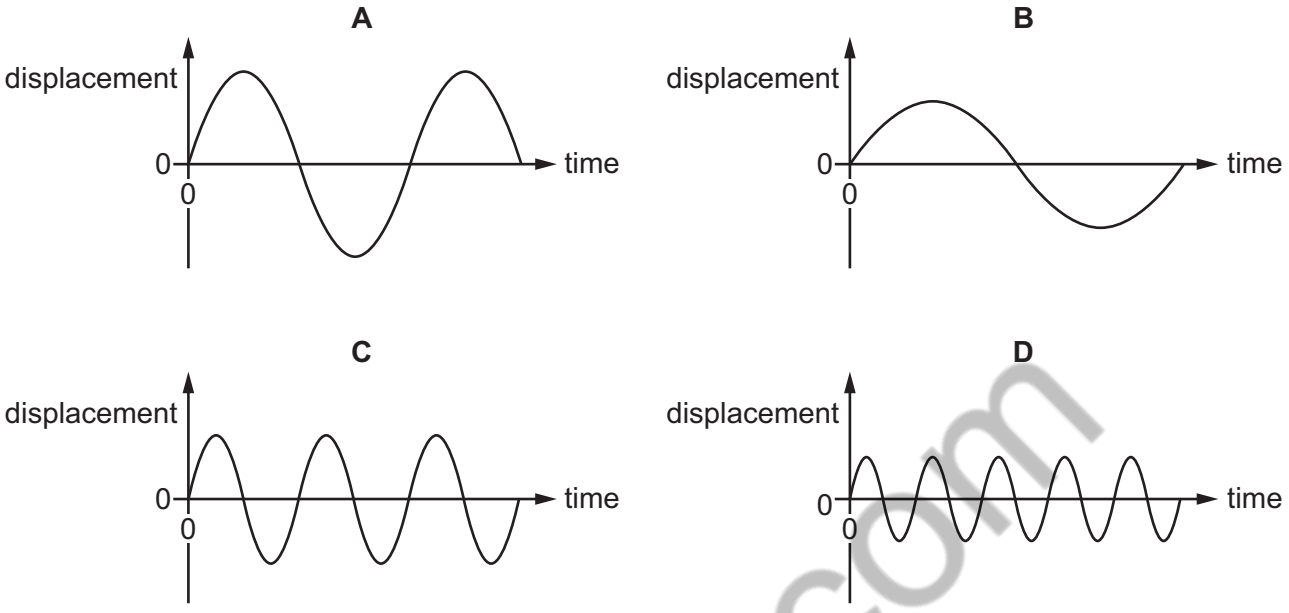
B dispersion

C reflection

D refraction

26 The diagrams represent the displacement in four different sound waves. All the diagrams are drawn to the same scale.

Which diagram represents the sound with the highest pitch?



27 A student suggests three methods for demagnetising a piece of steel.

1 placing it in an east-west direction and hammering it hard

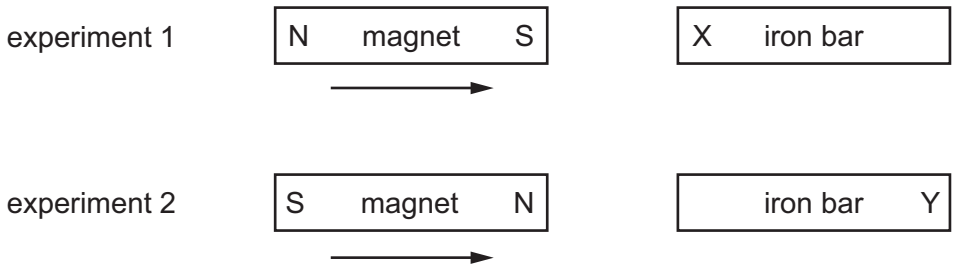
2 placing it in an east-west direction and heating it until red hot

3 removing it slowly from a coil carrying alternating current

Which of the methods will demagnetise the piece of steel?

A 1 only **B** 2 only **C** 3 only **D** 1, 2 and 3

28 In two separate experiments, a magnet is brought near to an unmagnetised iron bar. This causes the bar to become magnetised.



Which magnetic pole is induced at X and at Y?

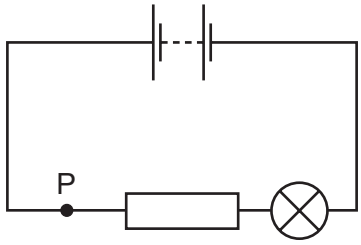
	pole induced at X	pole induced at Y
A	N	N
B	N	S
C	S	N
D	S	S

29 A polythene rod is rubbed with a cloth. The rod becomes positively charged because of the movement of charged particles.

Which row gives the name of these charged particles, and the direction in which they move?

	charged particles	direction of movement
A	electrons	from cloth to rod
B	electrons	from rod to cloth
C	protons	from cloth to rod
D	protons	from rod to cloth

30 The diagram shows a lamp in a circuit.



Which change to the circuit would increase the current in the lamp?

A adding another resistor in parallel with the one in the circuit

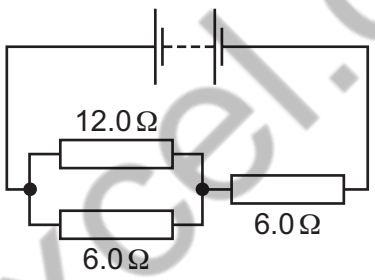
B adding another resistor in series with the one in the circuit

C decreasing the electromotive force (e.m.f.) of the battery in the circuit

D moving the lamp to point P in the circuit

31 A 12.0 Ω resistor and a 6.0 Ω resistor are connected in parallel.

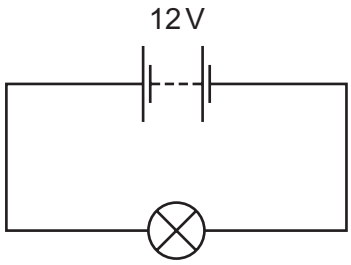
Another 6.0 Ω resistor is then connected in series with the parallel combination.



What is the combined resistance of all three resistors?

A 8.0 Ω **B** 10 Ω **C** 15 Ω **D** 24 Ω

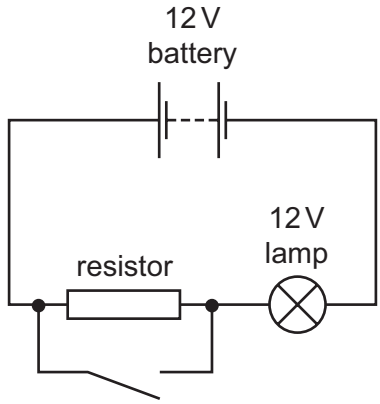
32 The circuit shows a 12 V battery connected to a lamp of resistance 3.0 Ω.



How much energy is transferred to the surroundings by the lamp in 2.0 minutes?

A 48 J **B** 96 J **C** 2880 J **D** 5760 J

33 The diagram shows a circuit containing a battery, a resistor with high resistance, a switch and a lamp.



Initially the switch is open.

What happens to the lamp when the switch is closed?

A It glows more brightly.

B It glows less brightly.

C It goes out.

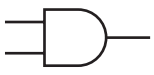
D Its brightness does not change.

34 This is the truth table for a logic gate.

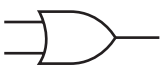
input 1	input 2	output
0	0	1
0	1	1
1	0	1
1	1	0

Which symbol represents the logic gate?

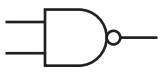
A



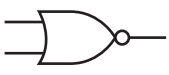
B



C



D



35 Why is a fuse used in an electrical circuit?

A so that the current can have only one value

B to prevent the current becoming too large

C to provide a path to earth if a fault occurs

D to save electrical energy

36 An electric current can produce a heating effect and a magnetic effect.

Which row shows the effect that a relay uses and one application of a relay?

	effect used by a relay	one application of a relay
A	heating effect	allowing a small current to switch on a large current
B	heating effect	changing the voltage of an a.c. supply
C	magnetic effect	allowing a small current to switch on a large current
D	magnetic effect	changing the voltage of an a.c. supply

37 A very important experiment improved scientists' understanding of the structure of matter.

The experiment involved α-particles being fired at a thin gold foil.

What happened?

A All the α-particles were absorbed by the nuclei of the gold atoms.

B All the α-particles were unaffected by the gold atoms.

C Some of the α-particles were attracted by the neutrons in the nuclei of the gold atoms.

D Some of the α-particles were repelled by the protons in the nuclei of the gold atoms.

38 What is meant by nuclear fusion?

A the emission of an electron from a nucleus

B the emission of two protons from a nucleus

C the joining together of two nuclei

D the splitting of a nucleus into two smaller nuclei

39 A nucleus undergoes radioactive decay. The proton number increases by one. The nucleon number does not change.

Which particle has been emitted in this decay?

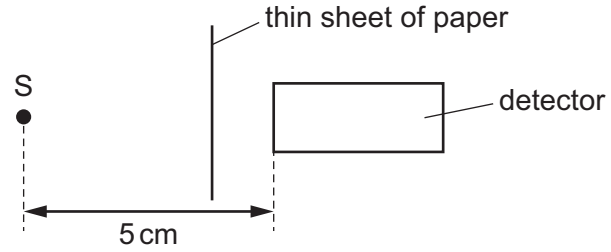
A a neutron

B a proton

C an α-particle

D a β-particle

40 Radioactive source S emits α-particles, β-particles and γ-rays. A detector is placed 5 cm away from S. A thin sheet of paper is placed as shown in the diagram.



Which emissions from the source can be detected?

A α-particles and β-particles only

B α-particles and γ-rays only

C β-particles and γ-rays only

D α-particles, β-particles and γ-rays

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PHYSICS **0625/31**

Paper 3 Theory (Core) **October/November 2016**

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 1.0 kg to be 10 N (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 **17** printed pages and **3** blank pages.

CAMBRIDGE International Examinations

[Turn over

1 Fig. 1.1 shows the speed-time graph for a cyclist travelling along a flat, straight road.

Fig. 1.1

(a) Complete the following sentence.

The cyclist has the greatest acceleration between ..... seconds

and ..... seconds. [1]

(b) Calculate the distance travelled by the cyclist between 10 s and 25 s.

distance = ... m [3]

(c) Fig. 1.2 shows the horizontal forces acting on the cyclist at three different times.

The length of each arrow represents the size of the force.

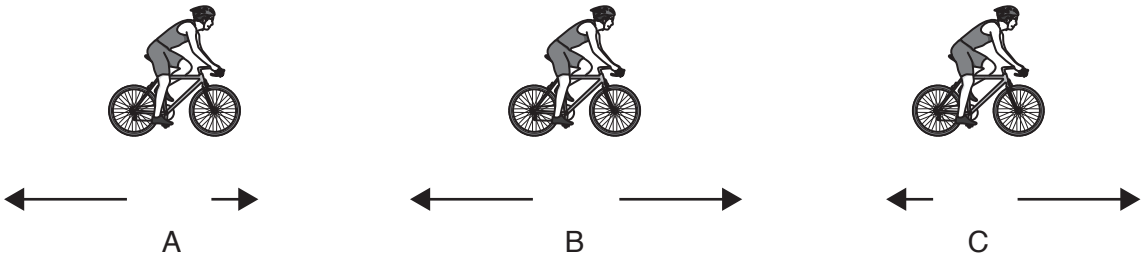

Fig. 1.2

(i) Which pair of forces, A, B or C, act on the cyclist when the time is 20 s? Tick **one** box.

A ☐

B ☐

C ☐ [1]

(ii) Explain your answer to **(c)(i)**.

.....

.....

.....

.....[2]

[Total: 7]

2 A student investigates the stretching of elastic bands.

Table 2.1 shows some of his results for elastic band A.

Table 2.1

load attached / N	elastic band A	
	length / cm	extension / cm
0	10.2	0.0
1	10.9	0.7
2	11.5	1.3
3	12.3	2.1
4	13.0	2.8
5	13.7	
6	14.5	

(a) Complete Table 2.1 by calculating the missing extensions. [2]

(b) The student repeats his experiment using elastic band B. Elastic band B is twice as long as elastic band A. It has the same thickness and is made of the same material.

Fig. 2.1 shows how he uses the apparatus.

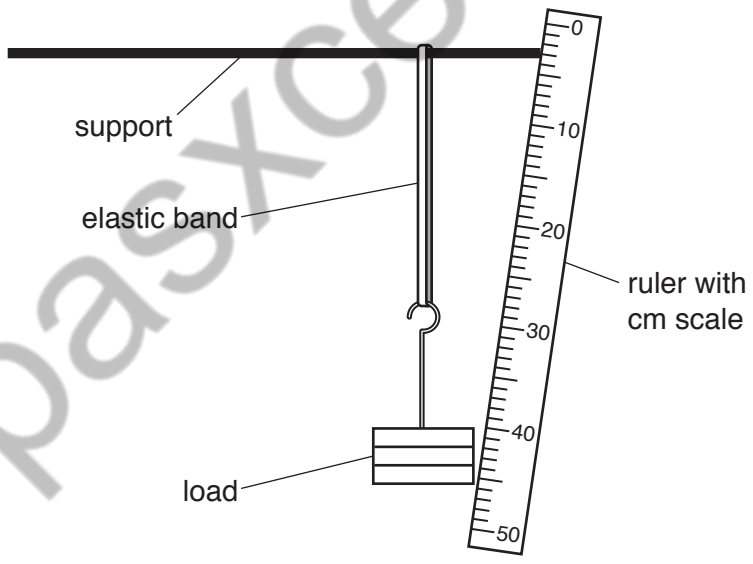

Fig. 2.1

Describe **two** changes the student could make to improve the accuracy of his measurements.

1. .....

.....

2. .....

.....

[2]

(c) The student draws a graph of extension against load for each elastic band.

The lines of best fit for elastic bands A and B are shown in Fig. 2.2.

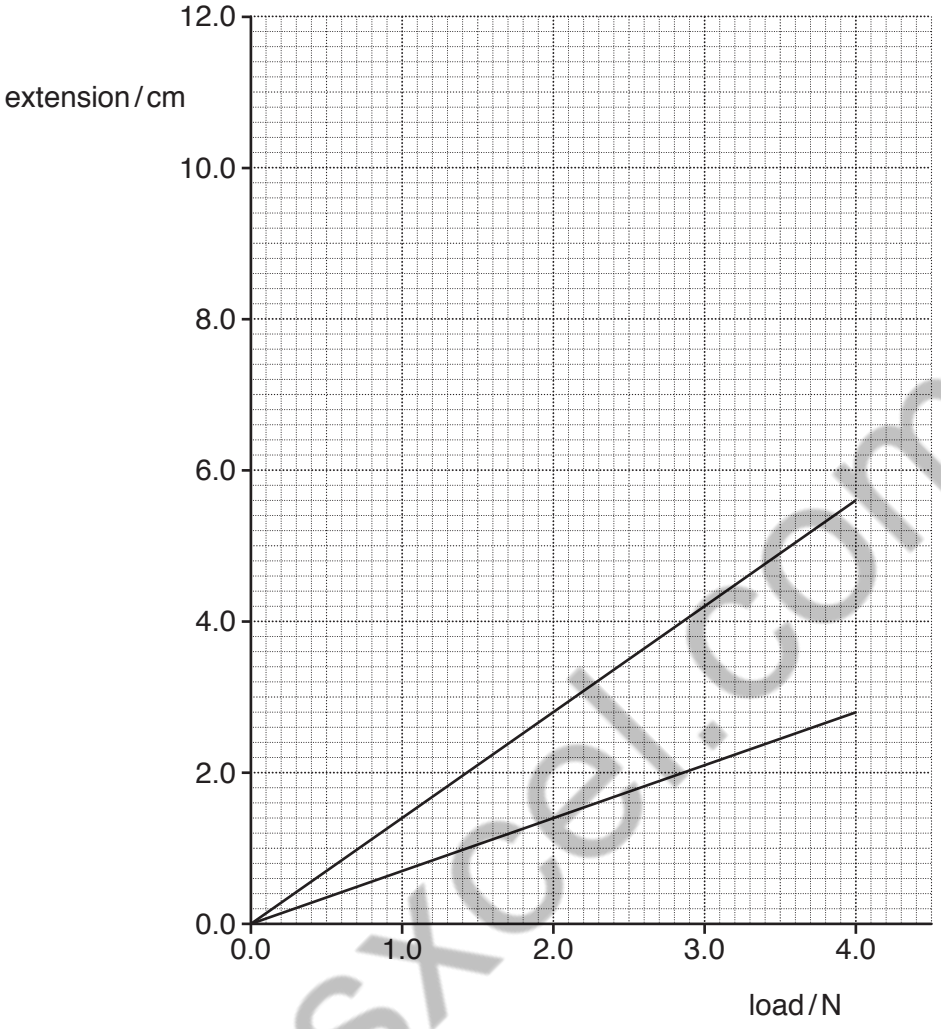

Fig. 2.2

(i) Use information from Table 2.1 to label each of the graph lines. Label the lines **band A** and **band B**. Explain how you decided on your answer.

.....

.....

.....[1]

(ii) The student repeats his experiment using elastic band C, which is three times as long as elastic band A. It has the same thickness and is made of the same material.

On Fig. 2.2, draw a line to suggest how extension would vary with load for elastic band C. Label the line **band C**. [1]

[Total: 6]

3 Fig. 3.1 shows a barrier pivoted near one end. The barrier is raised to allow cars to pass.

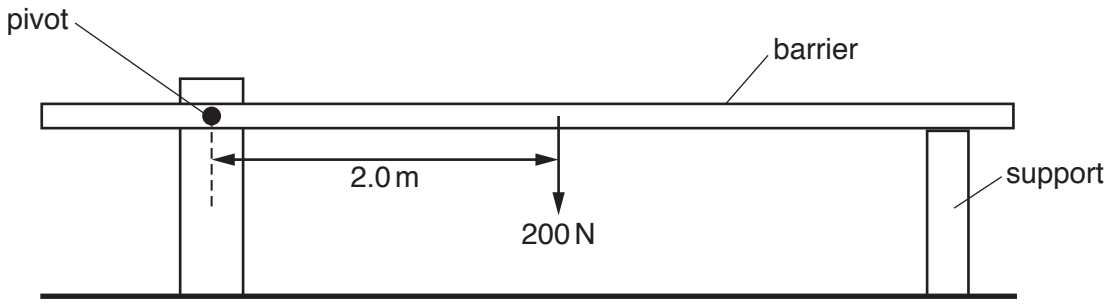

Fig. 3.1

(a) A force is used to raise the barrier off the support.

On Fig. 3.1, draw an arrow to show the position and direction of the smallest force that can be used to raise the barrier. [2]

(b) The barrier has a weight of 200 N. This acts at a distance of 2.0 m from the pivot, as shown in Fig. 3.1.

Calculate the moment of the weight of the barrier about the pivot.

moment = ... N m [2]

(c) To reduce the force needed to raise the barrier, a counterweight is added, as shown in Fig. 3.2.

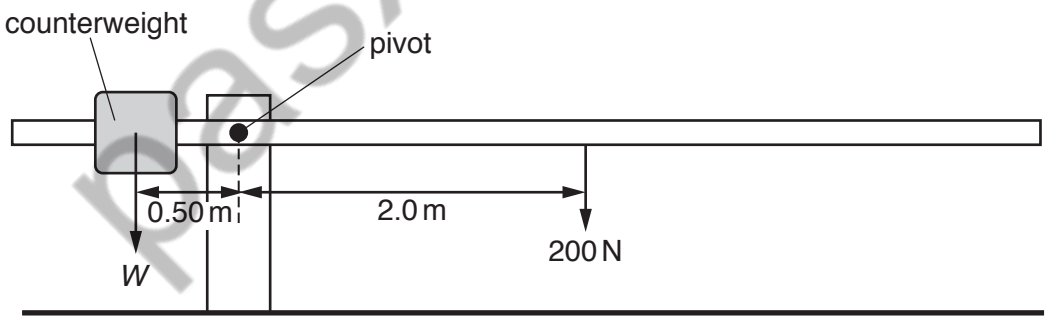

Fig. 3.2 (not to scale)

The weight *W* of the counterweight acts at a distance of 0.5 m from the pivot. The barrier is in equilibrium, without the support.

Calculate the weight *W* of the counterweight.

weight = ... N [2]

[Total: 6]

4 An electric motor is used to lift a load. The energy involved is shown in Fig. 4.1.

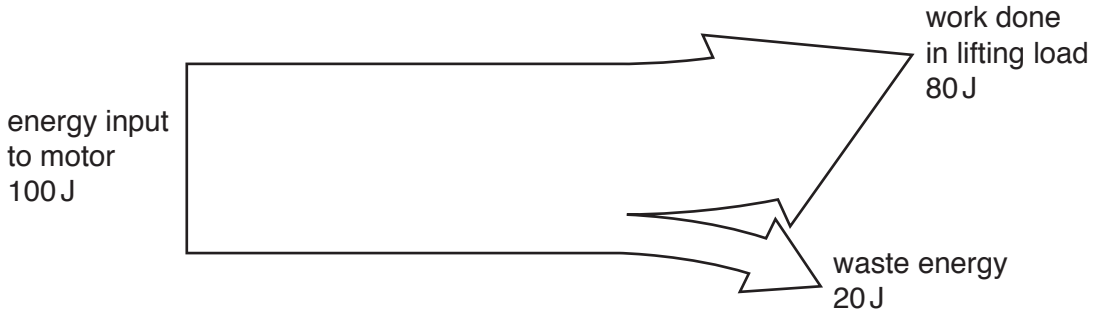

Fig. 4.1

(a) **(i)** State the term used to describe the energy gained by the load due to its increase in height.

.....[1]

(ii) What effect does the waste energy from the motor have on its surroundings?

.....[1]

(iii) State the principle of conservation of energy and explain how it applies to the working of the motor. Use information from Fig. 4.1 in your answer.

.....

.....

.....[2]

(b) The electrical power for the motor is generated in a coal-fired power station.

State **two** benefits of using coal-fired power stations and state **two** problems that arise from their use.

benefits

1. .....

.....

2. .....

.....

problems

1. .....

.....

2. .....

.....

[4]

[Total: 8]

5 **(a)** Fig. 5.1 shows a ray of red light passing through a semi-circular glass block.

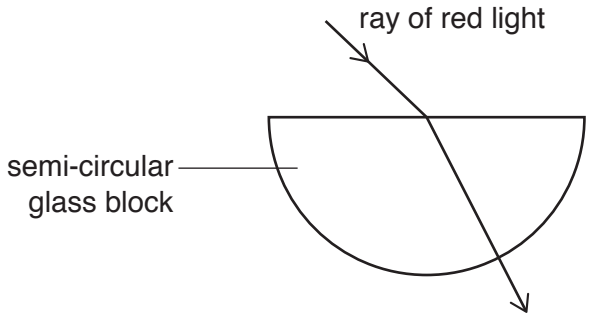

Fig. 5.1

(i) The ray of light changes direction as it travels into the block.

State the name that is given to this change of direction.

.....[1]

(ii) Fig. 5.2 shows another ray of red light travelling into the semi-circular glass block. It meets the curved surface at 90°.

Inside the block, the ray meets the flat surface of the block at an angle greater than the critical angle.

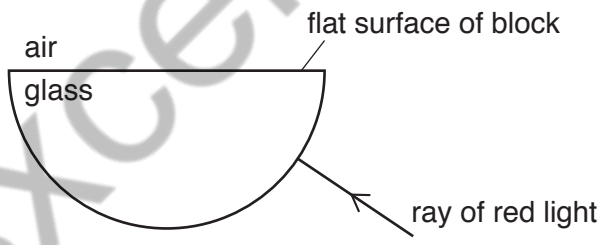

Fig. 5.2

On Fig. 5.2, complete the path of the ray of red light. [2]

(b) Fig. 5.3 shows the view from above of a car approaching an observer, marked with a cross (✕).

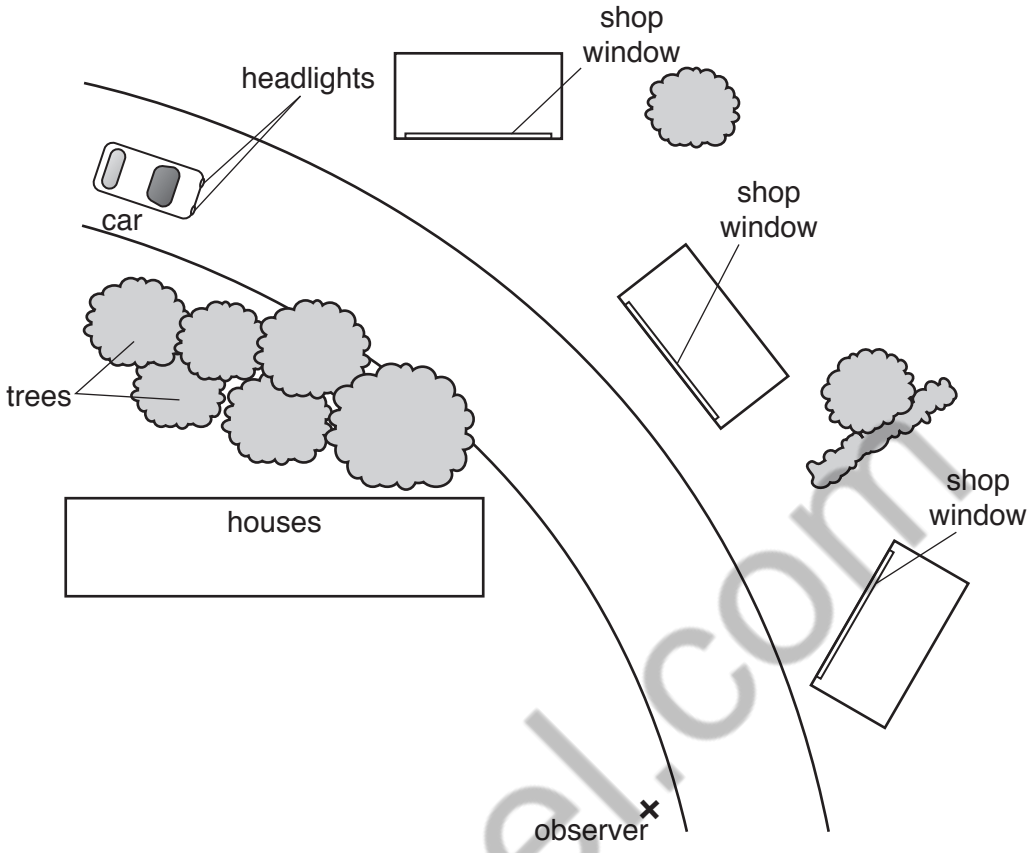

Fig. 5.3

(i) The observer sees the car's headlights reflected in one of the shop windows. The car's headlights are labelled.

In which shop window does the observer see the reflection? Show your answer by drawing, on Fig. 5.3, the path of a ray of light from a headlight to the observer. Use a ruler. [1]

(ii) State the law that you used to answer **(b)(i)**.

.....[1]

(iii) Add labels to Fig. 5.3 to show how the law stated in **(b)(ii)** applies. [2]

[Total: 7]

6 Fig. 6.1 shows a flask of hot water.

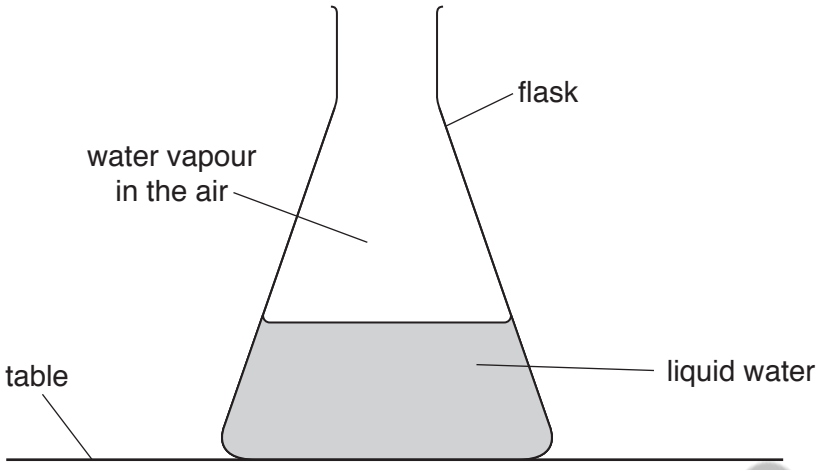

Fig. 6.1

(a) Describe the arrangement and movement of the molecules in the liquid water and in the water vapour.

.....

.....

.....

.....[3]

(b) Describe, in terms of molecules, how water in the flask becomes water vapour in the air. State the name of the process.

description .....

.....

.....

process .....

[3]

(c) The total weight of the flask and water is 5.6 N.

The area of the flask in contact with the table is 140 cm^2.

Calculate the pressure of the flask on the table.

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

[Total: 9]

7 Fig. 7.1 represents the electromagnetic spectrum.

radio waves	micro-waves	infra-red waves	visible light		X-rays	gamma rays

Fig. 7.1

(a) One type of wave is missing from Fig. 7.1.

State its name.

.....[1]

(b) One type of electromagnetic wave is used to send signals to satellites.

State its name.

.....[1]

(c) Gamma rays and light waves travel through the vacuum of space to the Earth.

Which statement is correct? Tick **one** box.

☐ Gamma rays travel at a slower speed than light waves.

☐ Gamma rays travel at the same speed as light waves.

☐ Gamma rays travel at a faster speed than light waves. [1]

(d) State **one** way in which sound waves are different from electromagnetic waves.

.....[1]

[Total: 4]

8 A student measures the resistance of a sample of wire.

She plans to use the circuit shown in Fig. 8.1.

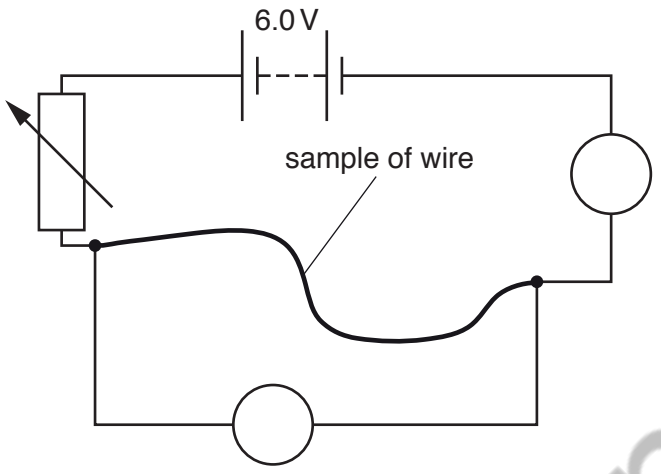

Fig. 8.1

Two circuit symbols are incomplete.

(a) Complete the symbols for the two meters on Fig. 8.1. [2]

(b) The current in the wire is 0.20 A. The potential difference across the wire is 6.0 V.

Calculate the resistance of the wire.

resistance = ... Ω [3]

(c) The student tests a thinner wire. It is the same length as the wire in **(b)** and is made of the same material. The potential difference across the wire is 6.0 V.

Explain how the current in this thinner wire compares with that in the first wire.

.....

.....

.....[2]

[Total: 7]

9 The charger for a mobile phone contains a transformer. Fig. 9.1 shows a simple transformer.

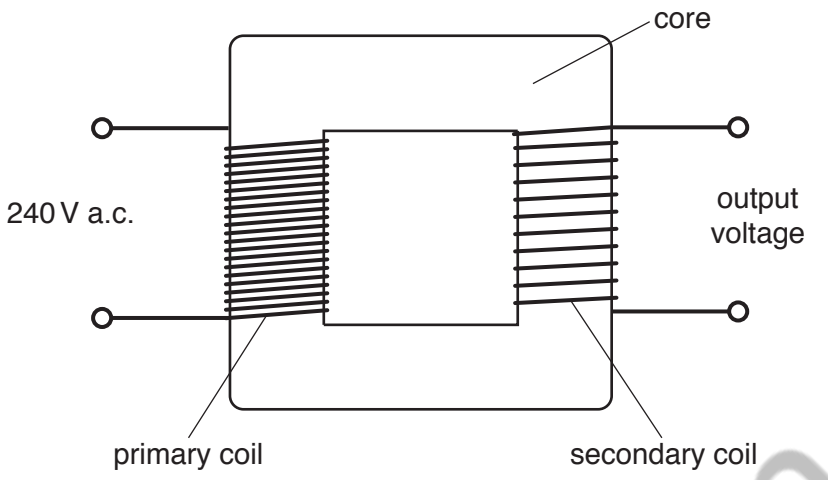

Fig. 9.1

(a) State the name of the material used in the core.

.....[1]

(b) **(i)** The transformer has 36 000 turns on the primary coil and 900 turns on the secondary coil. The input voltage is 240 V.

Calculate the output voltage.

output voltage = ... V [3]

(ii) State whether this transformer is *step-up* or *step-down*. Give a reason for your answer.

.....

.....[1]

(c) Transformers can produce high voltages for transmitting electricity from power stations to towns.

Describe the advantages of transmitting electricity at a high voltage.

.....

.....

.....[2]

[Total: 7]

10 (a) Fig. 10.1 shows two bar magnets.

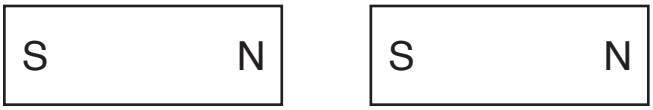

Fig. 10.1

Draw a ring around the correct description of the force between the magnets.

attractive force **repulsive force** **no force**

[1]

(b) Fig. 10.2 shows a current-carrying solenoid, wound on a piece of card.

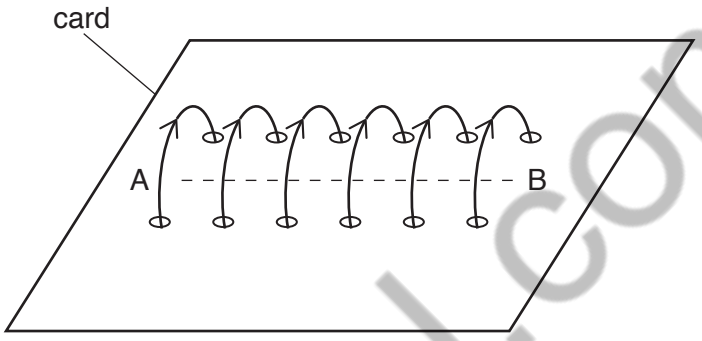

Fig. 10.2

The ends of the solenoid are labelled A and B. The arrows show the direction of the current in the solenoid.

(i) When there is a current in the solenoid, the ends of the solenoid act like the poles of a bar magnet.

Complete Table 10.1 by naming the pole produced at end A and at end B.

Table 10.1

position	pole
end A	
end B	

[1]

(ii) Fig. 10.3 shows the current-carrying solenoid viewed from above. The arrows show the direction of the current in the solenoid.

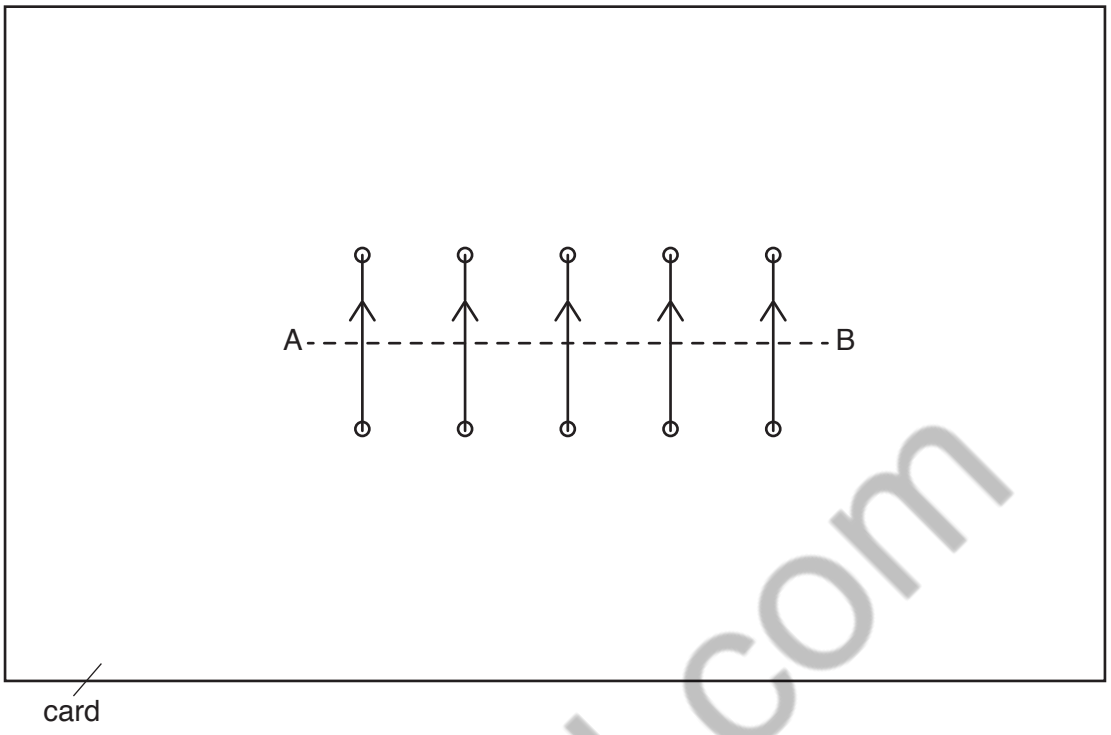

Fig. 10.3

On Fig. 10.3, draw the pattern of the magnetic field produced by the solenoid.
Draw at least **two** magnetic field lines above line AB and **two** below the line AB. [2]

(iii) Draw arrows on the field lines to show the direction of the magnetic field produced by the solenoid. [1]

(c) A current-carrying solenoid is wrapped around an iron rod to create an electromagnet.

State **two** reasons why an electromagnet can be more useful than a permanent magnet.

1. .....

2. .....
[2]

[Total: 7]

11 A student is given a length of wire, a sensitive voltmeter and two bar magnets.

(a) Describe how he could use the equipment to demonstrate the induction of an e.m.f. in the wire. You may include a diagram in your answer.

.....

.....

.....

.....[3]

(b) State how the student will know when an e.m.f. has been induced.

.....[1]

(c) Describe **two** ways the student could increase the size of the induced e.m.f.

1. .....

2. .....

[2]

[Total: 6]

12 Caesium-137 is formed in nuclear reactors.

The nucleus of caesium-137 can be represented as

$$^{137}_{55}Cs$$

(a) Complete Table 12.1 by stating the two types of particle in a nucleus of caesium-137, and the number of each particle present.

Table 12.1

type of particle	number of particles

[4]

(b) Caesium has more than one isotope.

Explain what is meant by the term *isotope*.

.....

.....

.....[2]

[Total: 6]

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Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
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5254520812

PHYSICS **0625/41**

Paper 4 Theory (Extended) **October/November 2016**

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 1.0 kg to be 10 N (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 **16** printed pages.

CAMBRIDGE International Examinations

[Turn over

1 An astronaut on the Moon drops a feather from rest, off the top of a small cliff. The acceleration due to gravity on the Moon is $1.6\,m/s^2$. There is no air on the Moon.

(a) The feather falls for 4.5 s before it hits the ground.

(i) On Fig. 1.1, draw the speed-time graph for the falling feather. [2]

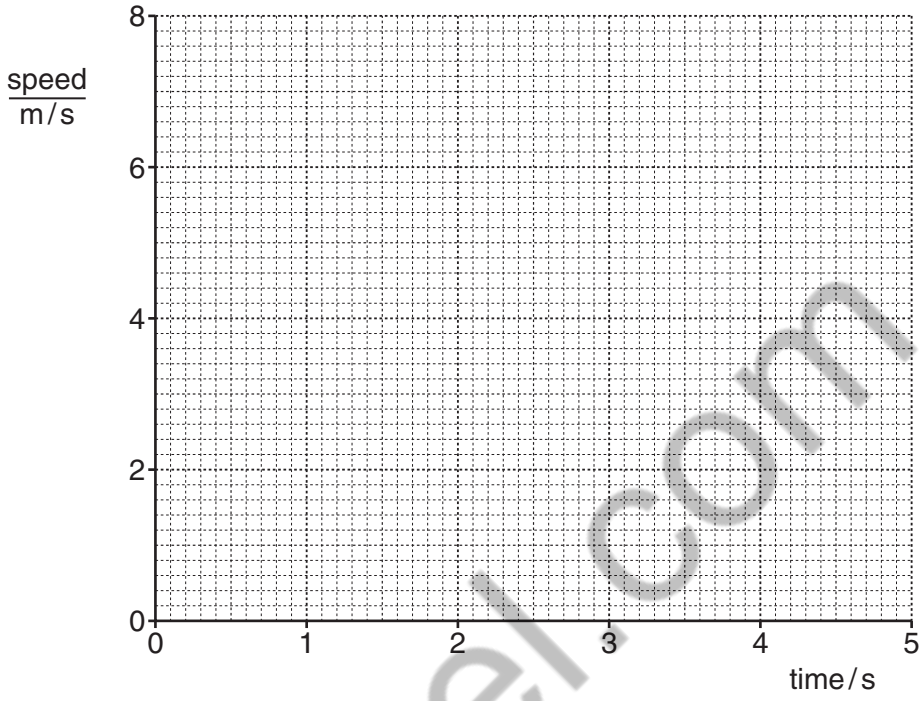

Fig. 1.1

(ii) Determine the distance fallen by the feather.

distance = ... [2]

(b) On Fig. 1.2, sketch the shape of a speed-time graph for the same feather falling on Earth.

Fig. 1.2

[2]

(c) Explain the difference between speed and velocity. Include the words *vector* and *scalar* in your answer.

.....

.....

.....

.....[2]

[Total: 8]

2 Fig. 2.1 represents the cross-section of an oil tanker in a river.

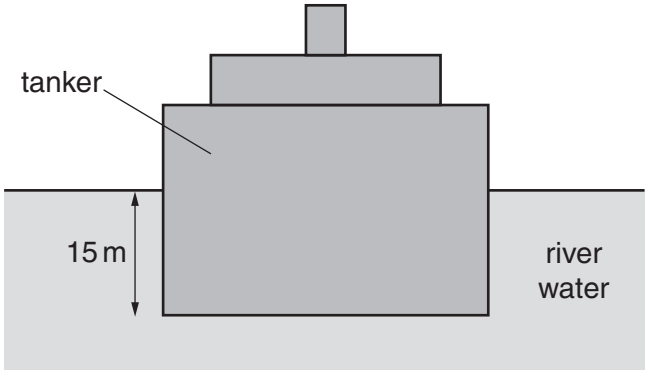

Fig. 2.1

(a) The bottom of the tanker is 15 m below the surface of the water. The area of the bottom of the tanker is 6000 m^2. The density of the water is 1000 kg/m^3.

(i) Calculate the pressure due to the water at the depth of 15 m.

pressure = ...[2]

(ii) Calculate the force due to the water pressure on the bottom of the tanker.

force = ...[2]

(iii) Deduce the weight of the tanker.

weight = ...[1]

(b) The tanker sails out onto a calm sea. The density of sea-water is greater than the density of river water.

State and explain any change in the depth of the bottom of the tanker below the surface.

.....

.....

.....

.....[3]

[Total: 8]

3 **(a)** A closed container holds a quantity of gas.

Explain, in terms of momentum, how molecules of the gas exert a force on a wall of the container.

.....

.....

.....[2]

(b) Fig. 3.1 shows a glass tube containing mercury.

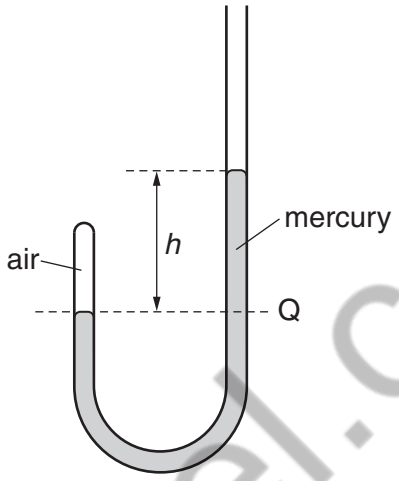

Fig. 3.1

The mercury traps a fixed mass of air in the left-hand arm of the tube. The right-hand arm of the tube is open to the atmosphere. The difference in mercury levels in the two arms is *h*.

(i) The pressure of the atmosphere on the surface of the mercury in the right-hand arm of the tube is 760 mm Hg. The distance *h* is 120 mm.

Calculate the total pressure at level Q, in mm of mercury (mm Hg), due to the atmosphere and the mercury above Q.

pressure = ... mm Hg [1]

(ii) State the pressure exerted by the air in the left-hand arm of the tube.

pressure = ... mm Hg [1]

(iii) Initially, the volume of air trapped in the left-hand arm of the tube is 12 cm^3.

More mercury is poured into the right-hand arm of the tube. The volume of the trapped air decreases. The temperature does not change. The difference in levels, *h*, becomes 240 mm.

Calculate the new volume of the trapped air.

volume = ...[3]

[Total: 7]

4 **(a)** In an experiment, cold water is poured into a bowl made of an insulating material. The container is placed in a draught-free room. After several hours, the volume and the temperature of the water are found to have decreased.

Name and describe the process that causes the decrease in the volume of the water, and explain why the temperature of the water decreases.

.....

.....

.....

.....

.....

.....

.....

.....[4]

(b) In a second experiment, using the same apparatus and the same initial amount of cold water as in **(a)**, an electric fan blows air over the top of the bowl.

Predict and explain how the results of this experiment compare with the results of the experiment in **(a)**.

.....

.....

.....[2]

(c) In a third experiment, the same initial amount of cold water as in **(a)** is poured into a **metal** bowl. The metal bowl is the same shape and size as the bowl used in **(a)**.

Compared with the experiment in **(a)**, the decrease in temperature is less in the same time.

Explain why.

.....

.....

.....[2]

[Total: 8]

5 **(a)** Compare the arrangement and motion of the molecules in ice and in liquid water.

ice .....

.....

water .....

.....

[2]

(b) An ice-hockey rink has an area of 1800 m^2. The ice has a thickness of 0.025 m. The density of ice is 920 kg/m^3.

(i) Calculate the mass of ice on the rink.

mass = ...[2]

(ii) The ice is at 0 °C. To form the ice, water at 0 °C was poured onto the floor of the rink and then frozen. The specific latent heat of fusion of ice is 3.3×10^5 J/kg.

Calculate the energy removed from the water to form the ice at 0 °C.

energy = ...[2]

[Total: 6]

6 **(a)** **(i)** State a typical value for the speed of sound in air.

speed = ...[1]

(ii) State the range of frequencies that can be heard by a healthy human ear.

.....[1]

(b) A sound wave in air has a wavelength of 22 mm.

Fig. 6.1 represents wavefronts of this sound. These wavefronts are successive compressions.

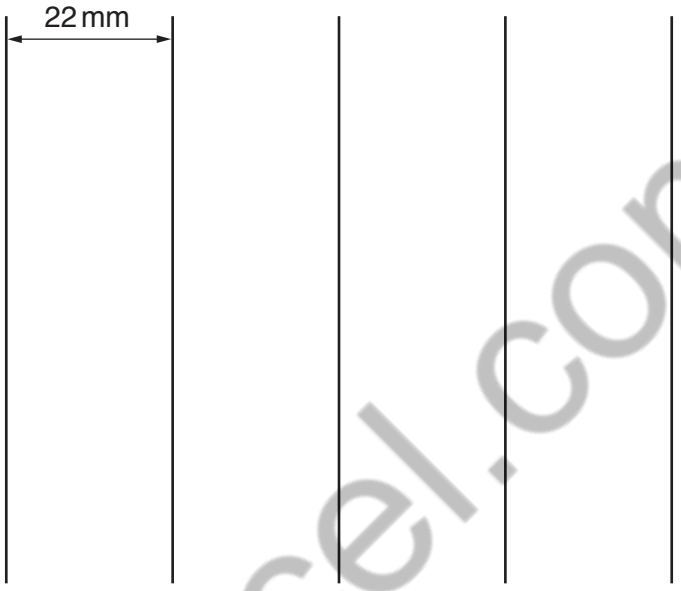

Fig. 6.1

(i) Using your value for the speed of sound in **(a)(i)**, calculate the frequency of the sound wave.

frequency = ...[2]

(ii) On Fig. 6.1, draw dotted lines to represent **three** different rarefactions. [1]

(iii) State, in terms of both molecules and pressure, what is meant by a *rarefaction*.

.....

.....

.....

.....[2]

[Total: 7]

7 Fig. 7.1 shows a box ABCD.

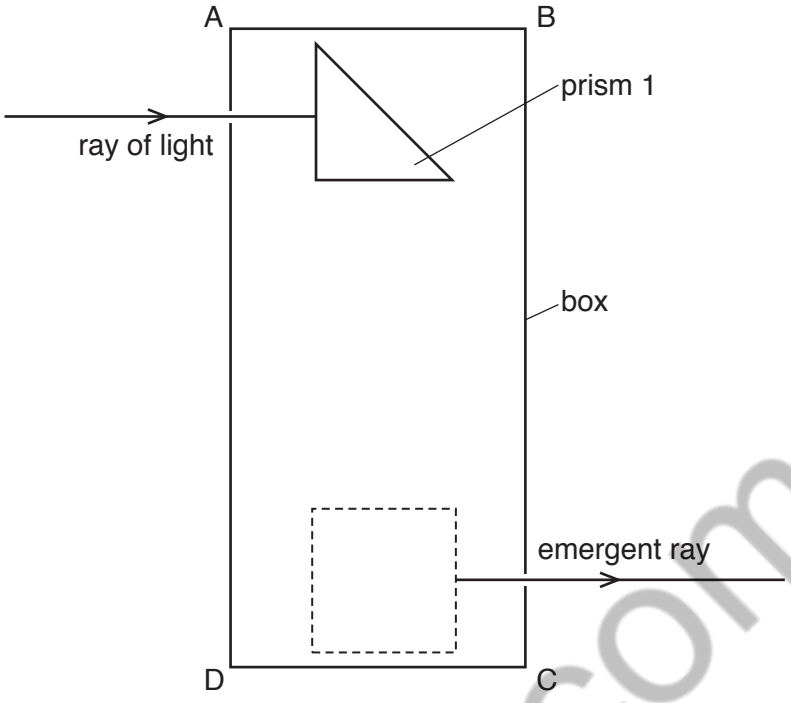

Fig. 7.1

The box contains two identical glass prisms, one of which is shown. Light incident on prism 1 undergoes total internal reflection within the glass.

(a) (i) On Fig. 7.1, complete the path of the ray of light through prism 1. [2]

(ii) On Fig. 7.1, draw a second prism inside the dashed square, positioned so that the light reflects inside the glass and emerges from the box as shown. Complete the path of the ray. [2]

(b) Select the statements that correctly describe the necessary conditions for the light to undergo total internal reflection. Tick **two** boxes.

- ☐ The angle of incidence in the glass is less than the critical angle of light in the glass.
- ☐ The angle of incidence in the glass is greater than the critical angle of light in the glass.
- ☐ The angle of reflection in the glass is equal to the angle of refraction.
- ☐ The speed of light in the glass is greater than the speed of light in air.
- ☐ The speed of light in the glass is equal to the speed of light in air.
- ☐ The speed of light in the glass is less than the speed of light in air.

[2]

[Total: 6]

[Turn over

8 A battery is made up of 8 cells in series. Each cell has an e.m.f. of 1.5 V.

The battery is connected to one 8.0 Ω resistor for 40 minutes.

(a) Calculate the e.m.f. of the battery.

e.m.f. = ...[1]

(b) Calculate the energy transferred from the battery in 40 minutes.

energy = ...[4]

(c) Describe the energy changes that take place during the 40 minutes.

.....

.....[2]

[Total: 7]

9 Fig. 9.1 shows a gardener cutting damp grass with a high-powered electric mower.

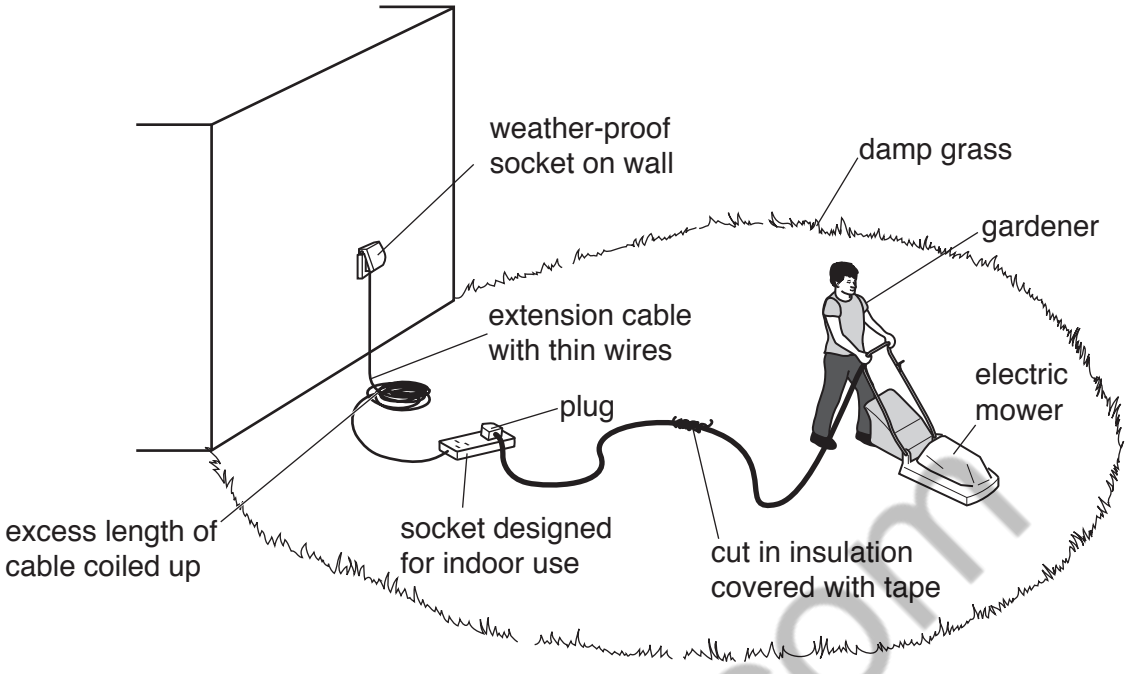

Fig. 9.1

The mower cable has thick wires appropriate for the current of the mower and the correct fuse. This cable is too short, and so the gardener uses an extension cable with thin wires, intended for use with a reading lamp. This cable has no fuse.

Discuss any dangers of the electrical arrangement shown in Fig. 9.1.

.....

.....

.....

.....

.....

.....

.....

.....[4]

[Total: 4]

10 Fig. 10.1 shows a wire AB suspended on two supports so that it is between the poles of a strong magnet.

The wire AB is loosely held so that it is free to move.

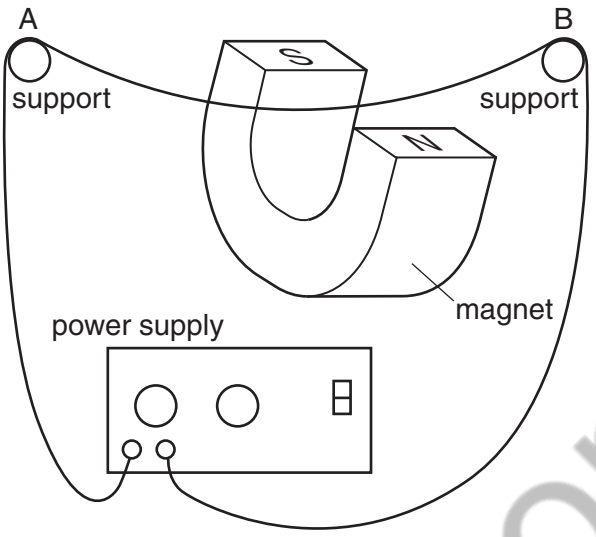

Fig. 10.1

Describe and explain any movement of the wire AB when there is

(a) a large direct current (d.c.) in the wire in the direction from A to B,

.....

.....

.....

.....[3]

(b) a large alternating current (a.c.) in the wire.

.....

.....

.....

.....[2]

[Total: 5]

11 **(a)** State what is meant by

(i) an *electric field*,

.....

.....[1]

(ii) the direction of an electric field at a point.

.....

.....[1]

(b) Fig. 11.1 shows a positively charged sphere.

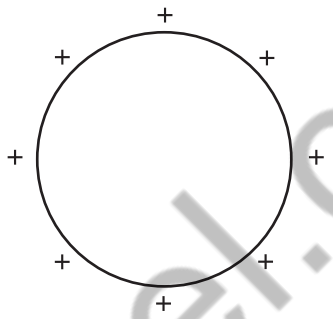

Fig. 11.1

On Fig. 11.1, draw the pattern of the electric field in the region around the positively charged sphere. Show the direction of the field with arrows. [2]

(c) The charge on the sphere in **(b)** is + 2.0 × 10^{-5} C. A high resistance wire is now connected between the sphere and earth. It takes 20 minutes for the sphere to become completely discharged through the wire.

(i) Suggest why there is a current in the wire between the sphere and earth.

.....[1]

(ii) Calculate the average current in the wire between the sphere and earth.

average current = ...[2]

[Total: 7]

[Turn over

12 The nuclear equation below shows the decay of a plutonium (Pu) nucleus to an americium (Am) nucleus and a β-particle.

$$^{241}_{Z}\text{Pu} \longrightarrow {}^{241}_{95}\text{Am} + \beta$$

(a) (i) State the quantity that is represented by the letter Z in this equation.

.....[1]

(ii) State the numerical value of Z.

Z = ...[1]

(b) The americium nucleus decays by the emission of an α-particle into a neptunium (Np) nucleus.

Complete the nuclear equation for this decay.

$$^{241}_{95}\text{Am} \longrightarrow$$

[2]

(c) The half-life of this americium nuclide is 470 years. A sample of this nuclide contains 8.0×10^{14} atoms.

After some time, 6.0×10^{14} americium atoms have decayed.

Calculate the time required for this decay.

time = ...[3]

[Total: 7]

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

8880412447

PHYSICS **0625/51**

Paper 5 Practical Test **October/November 2016**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of the page.
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.
You are advised to spend about 20 minutes on each of questions 1 to 3, and 15 minutes on question 4.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

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.

For Examiner's Use	
1	
2	
3	
4	
Total	

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This document consists of **10** printed pages and **2** blank pages.

CAMBRIDGE International Examinations

1 In this experiment, you will use a pendulum to determine a value for the acceleration of free fall *g*.

Carry out the following instructions, referring to Figs. 1.1 and 1.2.

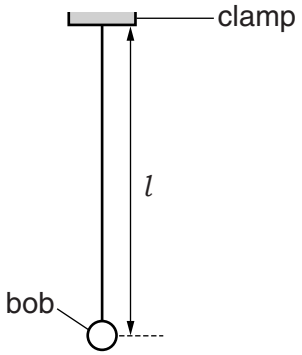

Fig. 1.1

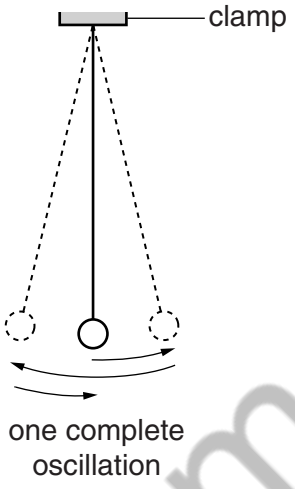

Fig. 1.2

A pendulum has been set up for you as shown in Fig. 1.1.

(a) Adjust the pendulum until its length l = 50.0 cm. The length l is measured to the centre of the bob.

Explain briefly how you avoided a parallax (line of sight) error when measuring the length l.

.....

.....

.....[1]

(b) Displace the pendulum bob slightly and release it so that it swings. Fig. 1.2 shows one complete oscillation of the pendulum.

(i) Measure the time t for 20 complete oscillations.

t = ...[1]

(ii) Calculate the period T of the pendulum. The period is the time for one complete oscillation.

T = ...[2]

(iii) Measuring the time for a large number of oscillations, rather than for 1 oscillation, gives a more accurate value for T.

Suggest one practical reason why measuring the time for 200 oscillations, rather than 20 oscillations, may not be suitable.

.....

.....[1]

(c) (i) Calculate T^2.

T^2 = ...[1]

(ii) Calculate the acceleration of free fall g using the equation $g = \frac{4\pi^2 l}{T^2}$. Give your answer to a suitable number of significant figures for this experiment.

g = ... m/s^2 [2]

(d) A student checks the value of the acceleration of free fall g in a text book. The value in the book is 9.8 m/s^2.

(i) Suggest a practical reason why the result obtained from the experiment may be different.

.....

.....

.....[1]

(ii) Suggest two improvements to the experiment.

1. .....

.....

2. .....

.....
[2]

[Total: 11]

2 In this experiment, you will investigate the cooling of water.

(a)
- Pour 100 cm^3 of the hot water provided into beaker **A**.
- Measure the temperature θ_H of the water in beaker **A**.

θ_H = ...

- Pour 100 cm^3 of the cold water provided into beaker **B**.
- Measure the temperature θ_C of the water in beaker **B**.

θ_C = ...

- Calculate the average temperature θ_{AV} using the equation $\theta_{AV} = \frac{\theta_H + \theta_C}{2}$.

θ_{AV} = ...
[3]

(b) Add the water from beaker **B** to the hot water in beaker **A**. Stir briefly.

Measure the temperature θ_M of the mixture.

θ_M = ...[1]

(c) State one precaution that you took to ensure that the temperature readings are as reliable as possible.

.....

.....[1]

(d) Empty both beakers.

You are provided with

- a lid, with a hole for the thermometer,
- some insulating material,
- two elastic bands.

(i) In the space below, draw a labelled diagram to show how you will use these items to reduce the loss of thermal energy when the procedure is repeated.

[2]

(ii) Using the improvements shown in your diagram, repeat the procedure in parts **(a)** and **(b)**.

θ_H = ...

θ_C = ...

θ_{AV} = ...

θ_M = ...

[1]

(iii) Comment on whether the improvements made to the apparatus have significantly changed the value of the temperature θ_M. Use your results to justify your answer.

.....

.....

.....[1]

(iv) Suggest two conditions that should be kept constant for all parts of this experiment.

1. .....

2. .....

[2]

[Total: 11]

3 In this experiment, you will investigate refraction using a transparent block.

Carry out the following instructions, using the separate ray-trace sheet provided. You may refer to Fig. 3.1 for guidance.

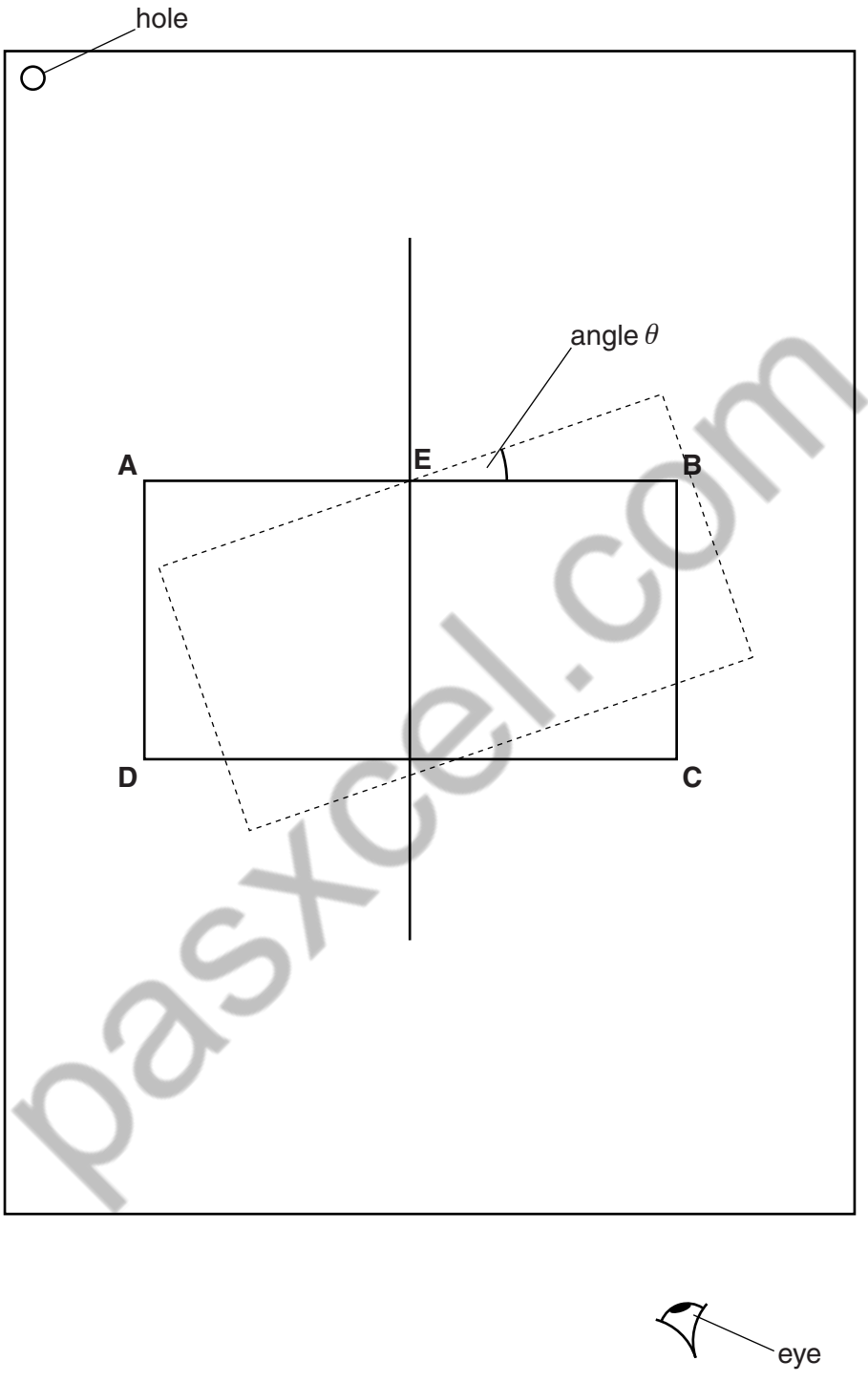

Fig. 3.1

(a)

- Place the transparent block, largest face down, on the ray-trace sheet supplied. The block should be approximately in the middle of the paper. Draw the outline of the block **ABCD**.
- Remove the block and draw a normal at the centre of side **AB**. Label the point **E** where the normal crosses **AB**.
- Draw a line **FE** to the left of the normal and at an angle $i = 20°$ to the normal.
- Place a pin P on the line **FE**, at a suitable distance from the block for producing an accurate ray trace.
- There are vertical lines $\mathbf{L_1}$ and $\mathbf{L_2}$ drawn on the block. Replace the block so that line $\mathbf{L_1}$ is at point **E**.
- Observe the images of $\mathbf{L_1}$ and P through side **CD** of the block. Carefully move the block, keeping line $\mathbf{L_1}$ at point **E**, until the vertical line $\mathbf{L_2}$ and the images of $\mathbf{L_1}$ and P appear one behind the other. This is indicated by the dashed position of the block shown in Fig. 3.1.
- Draw a line along side **AB** of the block to mark its new position.
- Remove the block.
- Measure the angle θ between the original position of **AB** and the new position of **AB**, as indicated in Fig. 3.1.
- Record $i = 20°$ and θ in Table 3.1.
- Repeat the procedure using values of $i = 30°$, 40°, 50° and 60°.

Table 3.1

i/°	θ/°

[4]

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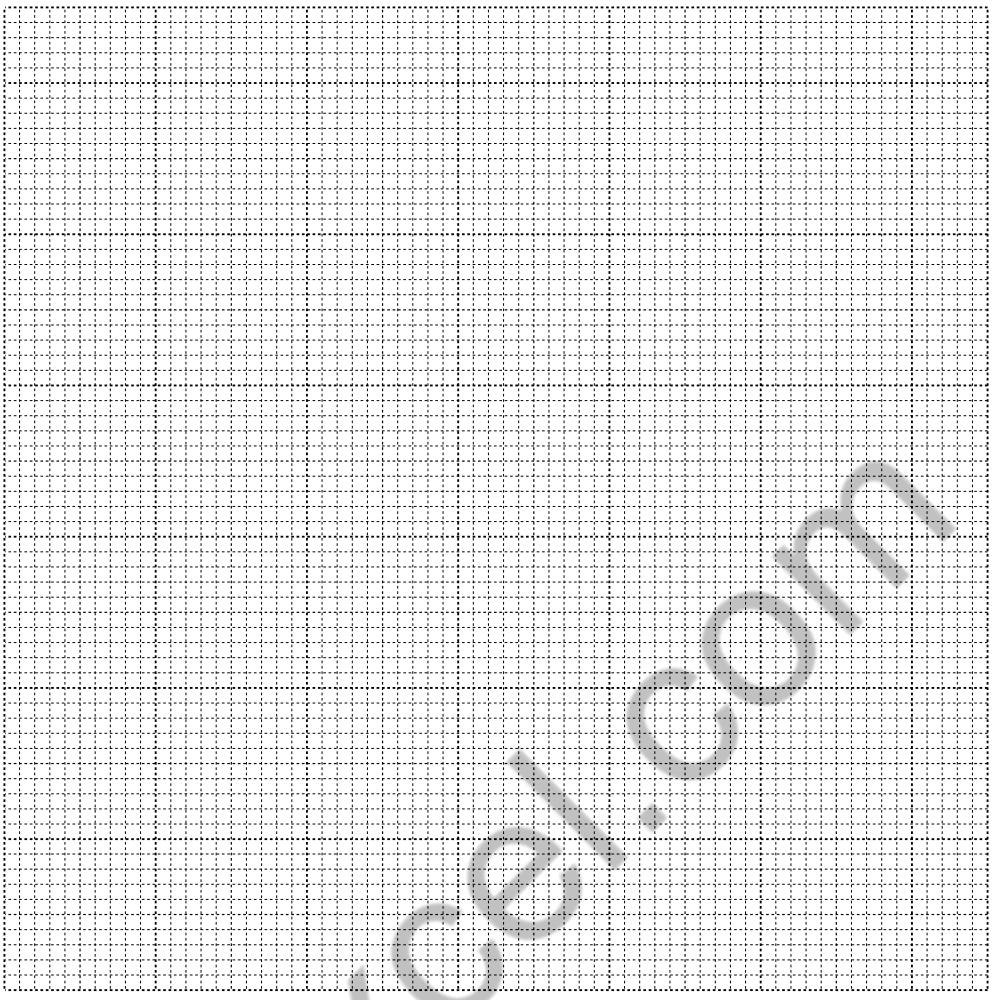
(b) Plot a graph of θ/° (y-axis) against i/° (x-axis).



[4]

(c) Determine the gradient G of the graph. Show clearly on the graph how you obtained the necessary information.

G = ...[2]

(d) Referring to your graph, comment on the quality of your measurements.

.....

.....[1]

Tie your ray-trace sheet into this Booklet between pages 8 and 9.

[Total: 11]

4 A student is investigating resistors connected in parallel.

The following apparatus is available to the student:

ammeter
voltmeter
power supply
variable resistor
switch
connecting leads
a box of identical resistors.

Plan an experiment to investigate how the combined resistance of the resistors, connected in parallel, depends on the number of resistors. You are **not** required to carry out this investigation.

You should:

- draw a diagram of the circuit you could use to determine the resistance of resistors connected in parallel (show only two resistors in your diagram)
- explain briefly how you would carry out the investigation
- draw a table or tables, with column headings, to show how you would display your readings. You are **not** required to enter any readings into the table.

.....

.....

.....

.....

[7]

[Total: 7]

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Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

3067840024

PHYSICS **0625/61**

Paper 6 Alternative to Practical **October/November 2016**

1 hour

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.

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 **15** printed pages and **1** blank page.

1 A student uses a pendulum to determine a value for the acceleration of free fall *g*.

Figs. 1.1 and 1.2 show the apparatus.

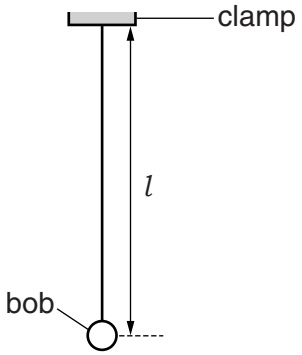


Fig. 1.1

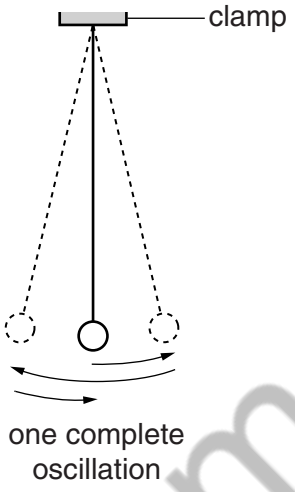


Fig. 1.2

(a) On Fig. 1.1, measure the length *l* of the pendulum.

l = ... cm [1]

(b) The student adjusts the pendulum until its length *l* = 50.0 cm. The length *l* is measured to the centre of the bob.

Explain briefly how the student avoids a parallax (line of sight) error when measuring length *l*.

.....

.....

.....[1]

(c) The student displaces the pendulum bob slightly and releases it so that it swings.

He measures the time t for 20 complete oscillations of the pendulum.

$t =$ 27.8 s

(i) Calculate the period T of the pendulum. The period is the time for one complete oscillation.

$T =$ .....[1]

(ii) Measuring the time for a large number of oscillations, rather than for one oscillation, gives a more accurate value for T.

Suggest one practical reason why measuring the time for 200 oscillations, rather than 20 oscillations, may **not** be suitable.

.....

.....[1]

(iii) Calculate T^2.

$T^2 =$ .....[1]

(iv) Calculate the acceleration of free fall g using the equation $g = \frac{4\pi^2 l}{T^2}$. Give your answer to a suitable number of significant figures for this experiment.

$g =$ ..... m/s^2 [2]

(d) The student checks the value of the acceleration of free fall g in a text book. The value in the book is $9.8\,m/s^2$.

(i) Suggest a practical reason why the result obtained from the experiment may be different.

.....

.....

.....[1]

(ii) Suggest **two** improvements to the experiment.

1. .....

.....

2. .....

.....

[2]

[Total: 10]

2 A student is investigating the cooling of water.

(a) She pours 100 cm^3 of hot water into a beaker.

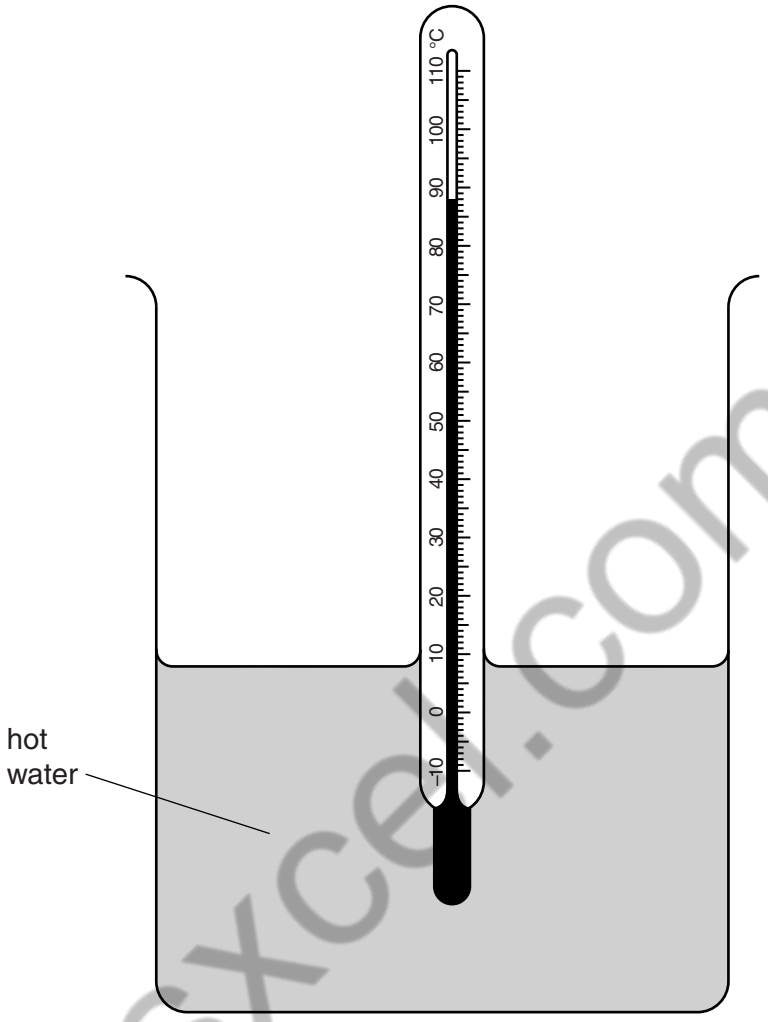


Fig. 2.1

(i) Record the temperature θ_H of the hot water, as shown in Fig. 2.1.

θ_H = ...[1]

(ii) The student measures the temperature θ_C of an equal volume of cold water.

θ_C = 19 °C

Calculate the average temperature θ_{AV} using the equation $\theta_{AV} = \frac{\theta_H + \theta_C}{2}$.

θ_{AV} = ...[1]

(b) The student adds the cold water to the hot water. She records the temperature θ_M of the mixture.

θ_M = 46 °C

State **one** precaution that you would take to ensure that the temperature readings are as reliable as possible.

.....

.....[1]

(c) The student is provided with:

- a lid, with a hole for the thermometer
- some insulating material
- two elastic bands.

In the space below, draw a labelled diagram to show how you would use these items to reduce the loss of thermal energy when the procedure is repeated.

[2]

(d) Using the improvements shown in your diagram, the student repeats the procedure and obtains these readings.

θ_H = 86 °C

θ_C = 20 °C

θ_{AV} = 53 °C

θ_M = 49 °C

Comment on whether the improvements made to the apparatus have significantly changed the value of the temperature θ_M. Use the results to justify your answer.

.....

.....

.....[1]

(e) Suggest **two** conditions that should be kept constant for all parts, **(a)** to **(d)**, of this experiment.

1. .....

2. .....
[2]

[Total: 8]

3 A student is investigating refraction using a transparent block.

Fig. 3.1 shows the first stage of the student's ray trace. **ABCD** is the outline of the transparent block. **E** is at the centre of **AB** and **G** is at the centre of **CD**.

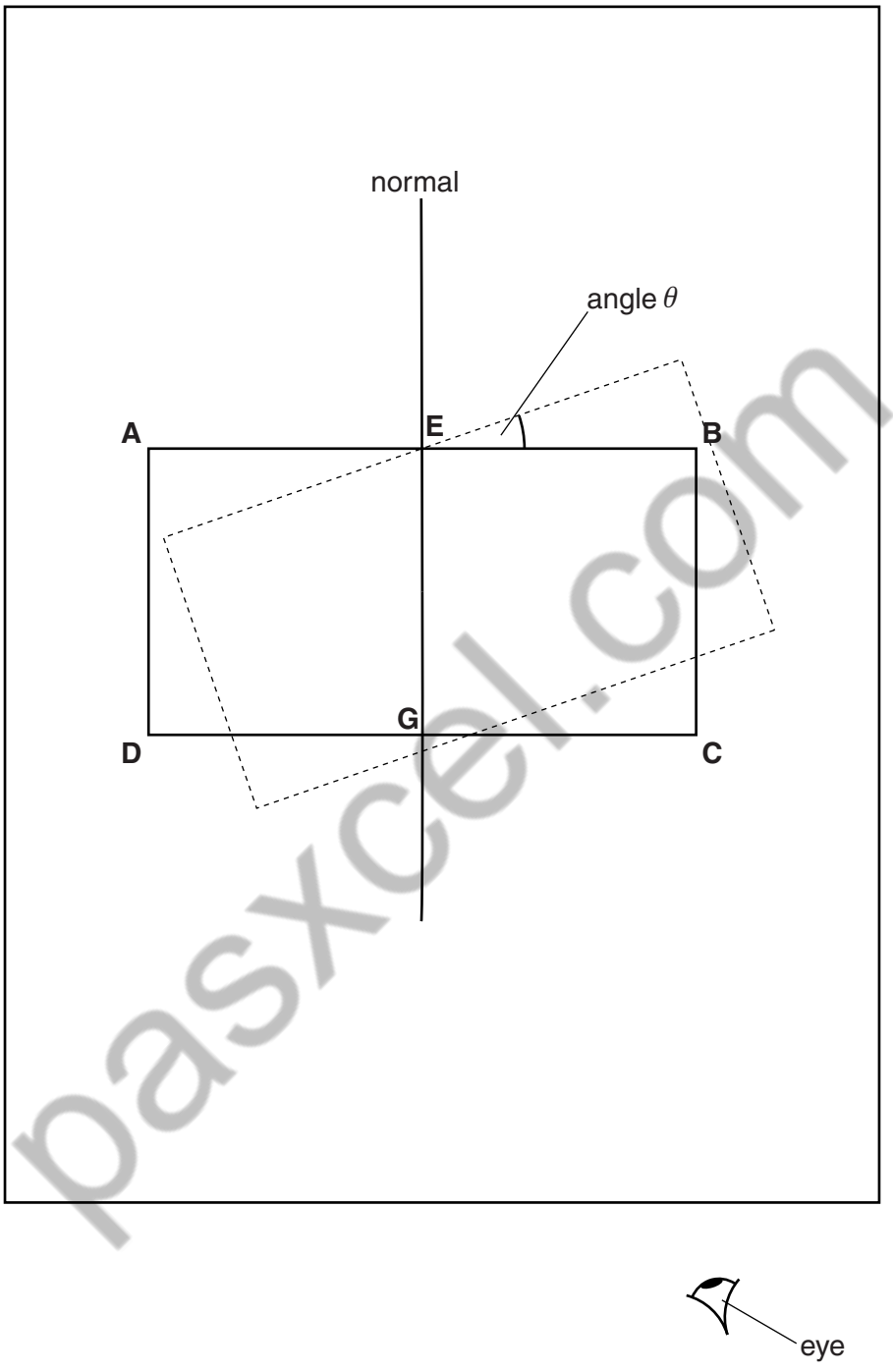


Fig. 3.1

(a) On Fig. 3.1, draw a line **FE** to the left of the normal, above the outline of the block, and at an angle $i = 20°$ to the normal. [1]

(b)
- The student places a pin P on the line **FE**, at a suitable distance from the block.
- There is a vertical line L_1 drawn on side **AB** of the block at point **E**. There is a second vertical line L_2 drawn on side **CD** at point **G**.
- The student observes the images of L_1 and P through side **CD** of the block. He carefully turns the block to the dashed position in Fig. 3.1. In this position the vertical line L_2 and the images of L_1 and P appear one behind the other.

(i) On Fig. 3.1, mark with a cross (×) a suitable position for pin P. [1]

(ii) Explain briefly the experimental reason for your choice of position for pin P.

.....

.....

.....[1]

(iii) On Fig. 3.1, measure the angle θ and enter it in the first row of Table 3.1, on page 10. [1]

(c) • The student measures the angle θ between the original position of **AB** and the new position of **AB**, as indicated in Fig. 3.1.

• He repeats the procedure, using values of $i = 30°$, 40°, 50° and 60°.

• The readings are shown in Table 3.1.

Table 3.1

i/°	θ/°
20	
30	29
40	41
50	51
60	59

Plot a graph of θ/° (y-axis) against i/° (x-axis).

[4]

(d) Determine the gradient *G* of the graph. Show clearly on the graph how you obtained the necessary information.

G = ...[2]

[Total: 10]

4 A student is investigating resistors connected in parallel.

The following apparatus is available to the student:

ammeter
voltmeter
power supply
variable resistor
switch
connecting leads
a box of identical resistors.

Plan an experiment to investigate how the combined resistance of the resistors, connected in parallel, depends on the number of resistors.

You should:

- draw a diagram of the circuit you could use to determine the resistance of resistors connected in parallel (show only two resistors in your diagram),
- explain briefly how you would carry out the investigation,
- draw a table or tables, with column headings, to show how you would display your readings. You are **not** required to enter any readings into the table.

.....

.....

[7]

[Total: 7]

5 A student is investigating the extension of a spring.

(a) Fig. 5.1 shows the spring with, and without, a load attached.

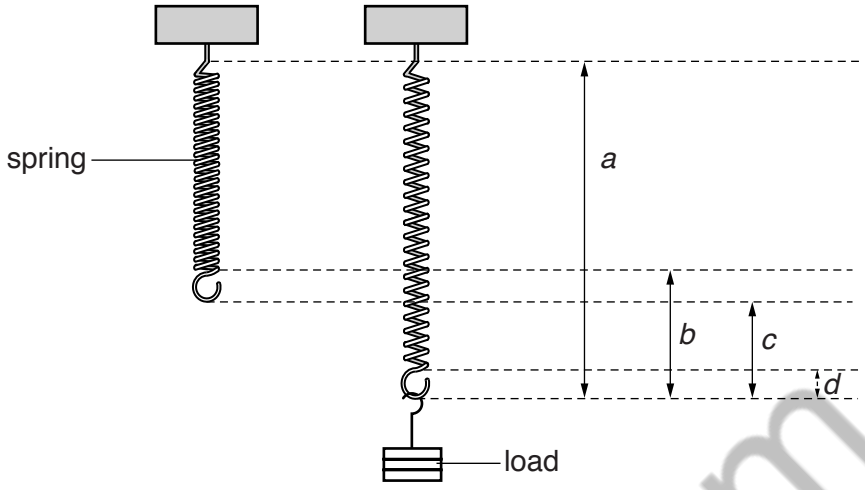
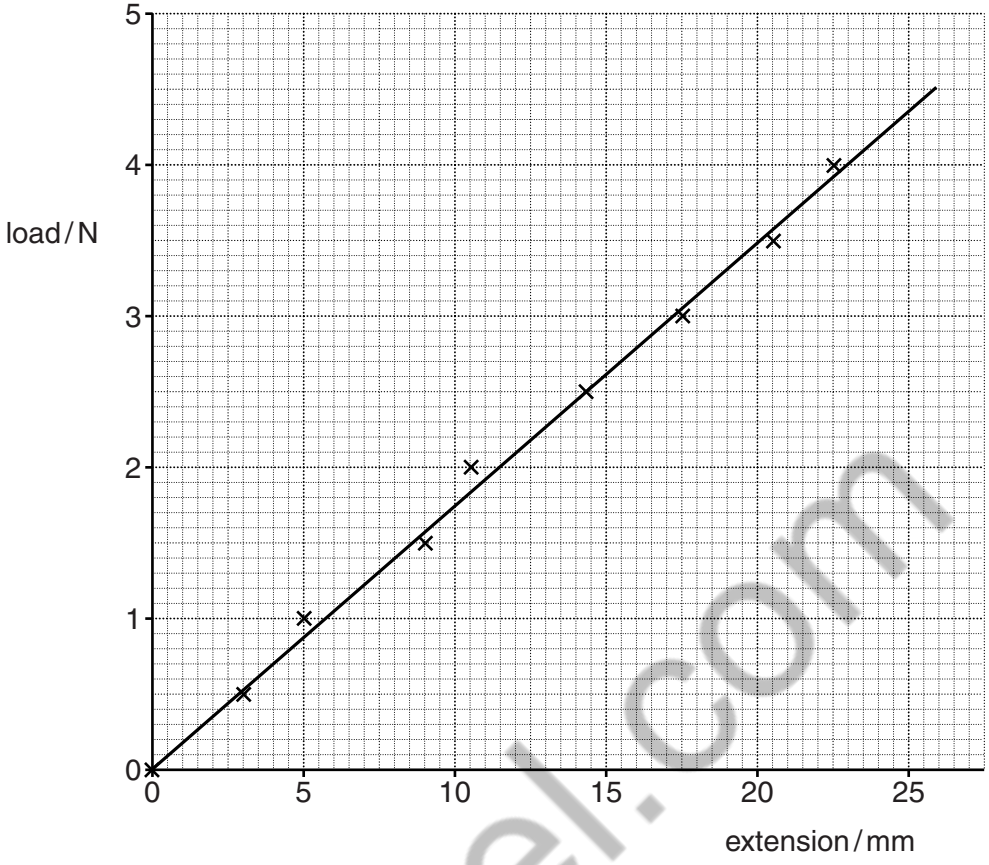


Fig. 5.1

Tick the distance that shows the extension of the spring when the load is added.

☐ *a* ☐ *b* ☐ *c* ☐ *d* [1]

(b) The graph shows the student's results.



(i) State whether the graph shows that the load and the extension are directly proportional. Justify your answer by reference to the graph.

statement .....

justification .....

.....

[2]

(ii) The student determines the gradient *G* of the graph line.

G = 0.1744729

G is numerically equal to a constant *k* for the spring.

Write down the value of the constant *k*. Give your answer to a suitable number of significant figures and include the unit.

k = ...[2]

[Total: 5]

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Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/11**

Paper 1 Multiple Choice **October/November 2016**

MARK SCHEME

Maximum Mark: 40

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

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

Question Number	*Key*	*Question Number*	*Key*
1	**C**	21	**C**
2	**A**	22	**D**
3	**D**	23	**D**
4	**D**	24	**A**
5	**B**	25	**C**
6	**D**	26	**D**
7	**B**	27	**A**
8	**D**	28	**B**
9	**A**	29	**A**
10	**C**	30	**B**
11	**A**	31	**A**
12	**A**	32	**A**
13	**C**	33	**B**
14	**B**	34	**A**
15	**C**	35	**A**
16	**A**	36	**C**
17	**A**	37	**A**
18	**B**	38	**A**
19	**B**	39	**C**
20	**D**	40	**D**

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/21**

Paper 2 Multiple Choice **October/November 2016**

MARK SCHEME

Maximum Mark: 40

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

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

Question Number	*Key*	*Question Number*	*Key*
1	**A**	21	**C**
2	**D**	22	**D**
3	**A**	23	**B**
4	**A**	24	**A**
5	**B**	25	**C**
6	**B**	26	**D**
7	**A**	27	**D**
8	**C**	28	**A**
9	**A**	29	**B**
10	**C**	30	**A**
11	**C**	31	**B**
12	**D**	32	**D**
13	**D**	33	**A**
14	**C**	34	**C**
15	**B**	35	**B**
16	**A**	36	**C**
17	**C**	37	**D**
18	**B**	38	**C**
19	**B**	39	**D**
20	**D**	40	**C**

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/31**

Paper 3 Core Theory **October/November 2016**

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

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

NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

M marks — are method marks upon which further marks depend. For an M mark to be scored, the point to which it refers **must** be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent marks can be scored.

B marks — are independent marks, which do not depend on other marks. For a B mark to scored, the point to which it refers must be seen specifically in the candidate's answers.

A marks — In general A marks are awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are normally awarded. It is very occasionally possible to arrive at a correct answer by an entirely wrong approach. In these rare circumstances, do not award the A marks, but award C marks on their merits. However, correct numerical answers with no working shown gain all the marks available.

C marks — are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, **provided subsequent working gives evidence that they must have known it.** For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows that they knew the equation, then the C mark is scored. A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.

Brackets ( ) — around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.

Underlining — indicates that this must be seen in the answer offered, or something very similar.

OR / or — indicates alternative answers, any one of which is satisfactory for scoring the marks.

e.e.o.o. — means "each error or omission".

o.w.t.t.e. — means "or words to that effect".

Ignore — indicates that something which is not correct or irrelevant is to be disregarded and does not cause a right plus wrong penalty.

Spelling — Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. However, beware of and do not allow ambiguities: e.g. spelling which suggests confusion between reflection / refraction / diffraction or thermistor / transistor / transformer.

Not/NOT — indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate i.e. right plus wrong penalty applies.

e.c.f.	meaning “error carried forward” and is mainly applicable to numerical questions, but may occasionally be applied in non-numerical questions. This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by e.c.f. may be awarded, provided the subsequent working is correct, bearing in mind the earlier error.
Significant figures	Answers are normally acceptable to any number of significant figures $\geqslant 2$. Any exceptions to this general rule will be specified in the mark scheme.
Units	Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: maximum 1 per question.
Arithmetic errors	Deduct only one mark if the **only** error in arriving at a final answer is clearly an arithmetic one. Regard a power-of-ten error as an arithmetic one.
Fractions	Only accept these where specified in the mark scheme.

Question	Expected answer	Mark
1(a)	0 and 5	**B1**
1(b)	distance = area under (speed-time)graph **or** distance = speed × time 8 × 15 120 (m)	**C1** **C1** **A1**
1(c)(i)	middle box ticked B	**B1**
1(c)(ii)	cyclist is moving with zero acceleration (so) forward force must be same as backward force	**B1** **B1**
	Total:	**7**

Question	Expected answer	Mark
2(a)	3.5 4.3	**B1** **B1**
2(b)	any 2 from: ruler with mm scale ruler vertical o.w.t.t.e. ruler next OR behind to elastic use of fiducial marker o.w.t.t.e. have eye level (with reading)	**B2**
2(c)(i)	top line labelled B – bottom line labelled A AND statement linked to readings for A OR idea that B will stretch more than A	**B1**
2(c)(ii)	straight line (by eye) steeper than line for B, through origin	**B1**
	Total:	**6**

Question	Expected answer	Mark
3(a)	arrow drawn vertically upwards (by eye)	**B1**
	arrow positioned beyond RH support	**B1**
3(b)	moment = force × (perp.) distance from pivot or 200 × 2.0	**C1**
	400 (Nm)	**A1**
3(c)	sum of Clockwise moments = sum of Anticlockwise moments **OR** 400 = W × 0.50 **OR** 400 / 0.50	**C1**
	800 (N)	**A1**
	Total:	**6**

Question	Expected answer	Mark
4(a)(i)	(gravitational) potential (energy)	**B1**
4(a)(ii)	increases the temperature	**B1**
4(a)(iii)	The total energy (of a system) remains constant **OR** energy cannot be created or destroyed o.w.t.t.e. 100 J = 80 J + 20 J **OR** all of the input energy is stored as PE or in the surroundings (as thermal energy)	**B1** **B1**
4(b)	any 2 benefits from: reliable supply of electricity large amount of (electrical) energy produced / power output plentiful supply of fuel one of cheapest methods of generating electricity any 2 problems from: non-renewable (energy source) **OR** use up earth's resources greenhouse gases / carbon dioxide produced / increases global warming contributes to atmospheric pollution / acid rain	**B2** **B2**
	Total:	**8**

Question	Expected answer	Mark
5(a)(i)	refraction	B1
5(a)(ii)	ray travels un-deviated through curved surface ray reflected with i = r by eye	B1 B1
5(b)(i)	ray drawn from headlight to hit middle shop and reflected towards X	B1
5(b)(ii)	angle of reflection = angle of incidence	B1
5(b)(iii)	normal drawn at point of incidence on window angles of incidence and reflection correctly labelled	B1 B1
	Total:	**7**

Question	Expected answer	Mark
6(a)	molecules are closer in water **OR** molecules are further apart in water vapour randomly arranged moving randomly	**B3**
6(b)	more energetic particles **OR** particles near the surface are moving in correct direction overcome force of attraction (in surface) (process) Evaporation	**B1** **B1** **B1**
6(c)	P = F / A 5.6 / 140 0.040 (N / cm^2)	**C1** **C1** **A1**
	Total:	**9**

Question	Expected answer	Mark
7(a)	ultraviolet	**B1**
7(b)	microwaves	**B1**
7(c)	middle box ticked	**B1**
7(d)	ANY ONE from (sound waves are) longitudinal OR compression waves cannot travel through a vacuum move at much slower speed	**B1**
	Total:	**4**

Question	Expected answer	Mark
8(a)	A in circle in series with wire V in circle in parallel with wire	**B1** **B1**
8(b)	V = I R **OR** (R =) V / I 6.0 / 0.2 30 (Ω)	**C1** **C1** **A1**
8(c)	current is smaller (in 2nd wire) (as) resistance is greater (in 2nd wire)	**B1** **B1**
	Total:	**7**

Question	Expected answer	Mark
9(a)	(laminated) iron	**B1**
9(b)(i)	(V_p / V_s) = (N_p / N_s) in any form $240 / V_s$ = 36 000 / 900 or V_s = 240 / 40 6.0 (V)	**C1** **C1** **A1**
9(b)(ii)	step-down (transformer because) there are fewer turns on secondary (compared to primary coil) OR the output voltage is smaller than the input voltage	**B1**
9(c)	Any 2 from: less energy or power wasted or less heating or more efficient accept lower current can use thinner (transmission) wires or cables fewer power stations needed (so) lower cost for cable and supporting pylons transmit (electricity over) longer distances (without drop in power)	**B2**
	Total:	**7**

Question	Expected answer	Mark
10(a)(i)	attractive force ringed	**B1**
10(b)(i)	(end A) N / north(seeking) **AND** (end B) S / south(seeking)	**B1**
10(b)(ii)	at least two field lines drawn above AB at least two field lines below AB	**B1** **B1**
10(b)(iii)	at least one arrow towards B ecf from bi	**B1**
10(c)	(it / electromagnet) can be switched off / on strength of electromagnet can be changed (by varying current in coil)	**B1** **B1**
	Total:	**7**

Question	Expected answer	Mark
11(a)(i)	(arrange) magnets with opposite poles facing connect (ends of) wire across / to millivoltmeter move wire between poles	**B3**
11(a)(ii)	deflection on meter (as wire moves between poles)	**B1**
11(a)(iii)	any **two** from: wrap wire into (more) coils move wire / magnet faster use stronger magnets move (poles of) magnets closer together	**B2**
	Total:	**6**

Question	Expected answer	Mark
12(a)	**(type of particle)** / **(number of particles)** PROTON / 55 NEUTRON / 82	**B2** **B2**
12(b)	(nucleus has) same number protons different number of neutrons	**B1** **B1**
	Total:	**6**

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/41**

Paper 4 Extended Theory **October/November 2016**

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

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

NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

M marks — are method marks upon which further marks depend. For an M mark to be scored, the point to which it refers **must** be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent marks can be scored.

B marks: — are independent marks, which do not depend on other marks. For a B mark to scored, the point to which it refers must be seen specifically in the candidate's answers.

A marks — In general A marks are awarded for final answers to numerical questions.
If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are normally awarded.

It is very occasionally possible to arrive at a correct answer by an entirely wrong approach. In these rare circumstances, do not award the A marks, but award C marks on their merits. However, correct numerical answers with no working shown gain all the marks available.

C marks — are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, **provided subsequent working gives evidence that they must have known it.** For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored

A C marks is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.

brackets ( ) — around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.

underlining — indicates that this must be seen in the answer offered, or something very similar.

OR / or — indicates alternative answers, any one of which is satisfactory for scoring the marks.

e.e.o.o. — means "each error or omission".

o.w.t.t.e. — means "or words to that effect".

Spelling — Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. However, beware of and do not allow ambiguities, accidental or deliberate: e.g. spelling which suggests confusion between reflection / refraction / diffraction thermistor / transistor / transformer.

Not/NOT — Indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate, i.e. right plus wrong penalty applies.

Ignore — Indicates that something which is not correct or irrelevant is to be disregarded and does not cause a right plus wrong penalty.

ecf — meaning "error carried forward" is mainly applicable to numerical questions, but may in particular circumstances be applied in non-numerical questions.

This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate being penalised more than once for a particular mistake, but **only** applies to marks annotated ecf.

Significant Figures	Answers are normally acceptable to any number of significant figures ⩾ 2. Any exceptions to this general rule will be specified in the mark scheme.
Units	Deduct one mark for each incorrect or missing unit from **an answer that would otherwise gain all the marks available for that answer: maximum 1 per question.** No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working.
Arithmetic errors	Deduct one mark if the **only** error in arriving at a final answer is clearly an arithmetic one.
Transcription errors	Deduct one mark if the only error in arriving at a final answer is because given or previously calculated data has clearly been misread but used correctly..
Fractions	(e.g. ½) Allow these only where specified in the mark scheme.
Crossed out work	Work which has been crossed out **and not replaced but can easily be read,** should be marked as if it had not been crossed out.
Use of **NR**	(# key on the keyboard) Use this if the answer space for a question is completely blank or contains no readable words, figures or symbols.

Question	Answer	Marks
1(a)(i)	Straight line from origin to (4.5 s, 7.2 m/s) Tolerance in plotting: ½ a square	**B2**
1(a)(ii)	Use of area stated or implied by numbers used OR average speed × time OR s = (u+v)/t/2 OR vt/2 OR 0.5 × 4.5 × 7.2 16(.2) m	**C1** **A1**
1(b)	Rises from origin and curves with decreasing gradient Finishes horizontal	**B1** **B1**
1(c)	Speed is scalar Velocity is vector Speed has magnitude/size/value (only) Velocity has magnitude/size/value and direction OR velocity has direction; speed does not	**B1** **B1**
	Total:	**8**

Question	Answer	Marks
2(a)(i)	(P =) hdg OR $15 \times 1000 \times 10$ 1.5×10^5 or 150 000 Pa or N / m^2 or 150 kPa or kN / m^2	**C1** **A1**
2(a)(ii)	(F =) PA OR $150\,000 \times 6000$ 9.0×10^8 N / 9.0×10^5 kN	**C1** **A1**
2(a)(iii)	Same value as (a)(ii) or 9.0×10^8 N	**B1**
2(b)	Weight of tanker has to be equal to upward force of water Depth (below surface) is / becomes less OR Tanker rises (Tanker rises) because pressure / force on bottom of tanker is greater OR because upthrust greater OR At same depth as in river, pressure / force on bottom of tanker is higher so tanker rises	**B1** **M1** **A1**
	Total:	**8**

Question	Answer	Marks
3(a)	(Molecules / they) collide with / hit walls of container OR rebound from walls of container Change of momentum OR Rate of change of momentum occurs OR F = (mv – mu) / t	**B1** **B1**
3(b)(i)	(760 + 120 =) 880 mmHg	**B1**
3(b)(ii)	Same value as (b)(i) or 880 mmHg	**B1**
3(b)(iii)	New pressure = (760 + 240 =) 1000 (mmHg) PV = constant OR $P_1V_1 = P_2V_2$ OR $12 \times 880 = V \times 1000$ 11 cm^3	**C1** **C1** **A1**
	Total:	**7**

Question	Answer	Marks
4(a)	Evaporation Molecules with higher / highest (kinetic) energy OR that gain enough energy escape (from the liquid surface) Molecules remaining in liquid have low / lower (kinetic) energy OR Energy for evaporation came from remaining liquid	**B1** **B1** **B1** **B1**
4(b)	Greater decrease in temperature and / or volume than in (a). Fan removes vapour / blows vapour away / reduces humidity / reduces return of vapour to liquid, allowing more molecules to escape OR faster / more evaporation	**B1** **B1**
4(c)	Metal is a <u>good</u> (thermal) conductor so passes heat <u>to</u> the liquid or <u>from</u> the surroundings (raising its temperature)	**B1** **B1**
	Total:	**8**

Question	Answer	Marks
5(a)	Molecular arrangement: Ice: in lattice / regular / arranged / orderly / fixed in place Water: random / irregular / not arranged / not orderly Molecular movement: Ice: vibrate Water: move (around) or slide over each other	**B2**
5(b)(i)	d = m / V in any form OR (m =) Vd OR $1800 \times 0.025 \times 920$ = 41 000 kg	**C1** **A1**
5(b)(ii)	(H =) mL OR $41\,400 \times 3.3 \times 10^5$ 1.4×10^{10} J OR 1.4×10^7 kJ OR $1{,}4 \times 10^4$ MJ	**C1** **A1**
Total		**6**

Question	Answer	Mark
6(a)(i)	300 – 360 m / s	**B1**
6(a)(ii)	20 Hz – 20 kHz	**B1**
6(b)(i)	$v = f\lambda$ OR (f =) v / λ OR (a)(i) / 0.022 Correct answer: e.g. 330 m / s gives 15 000 Hz	**C1** **A1**
6(b)(ii)	Vertical dotted lines midway (by eye) between each pair of compressions OR to right or left of compressions shown with correct spacing (by eye)	**B1**
6(b)(iii)	(At rarefactions) molecules have above normal separation / far apart / spread out Pressure (of air) is below normal / low OR Molecules exert below normal / low pressure	**B1** **B1**
	Total:	**7**

Question	Answer	Marks
7(a)(i)	Ray continues through first face, without bending, to sloping face Ray reflected vertically down at sloping face	**M1** **A1**
7(a)(ii)	Prism drawn with correct orientation in square Correct reflection to produce emergent ray	**M1** **A1**
7(b)	Tick in box 2 Tick in box 6	**B1** **B1**
	Total:	**6**

Question	Answer	Marks
8(a)	12 V	**B1**
8(b)	(I =) V/R 12 / 8 OR 1.5 (A) (W =) IVt OR 1.5 × 12 × 40 (× 60) OR (W =) I^2Rt OR $1.5^2 \times 8 \times 40$ (× 60) OR W = V^2t / R OR $12^2 \times 40$ (× 60) / 8 43 000 J	**C1** **C1** **C1** **A1**
8(c)	Chemical (energy) to electrical (energy) (in battery) Electrical (energy) to thermal / heat (energy) (in resistor)	**B1** **B1**
	Total:	**7**

Question	Answer	Marks
9	Mention of overheating or fire seen anywhere Mention of electric shock or electrocution seen anywhere Any two of: Fire / overheating: if thin / extension cable carries too large a current OR because thin / extension cable has no fuse. Fire / overheating due to extension cable being coiled (so that escape of heat is prevented) Electric shock / electrocution (of gardener) if unsuitable socket lets in moisture / gets wet Electric shock / electrocution (of gardener) if tape repair lets in moisture / gets wet Electric shock / electrocution if cable is cut by mower and no circuit-breaker	**B1** **B1** **B2**
	Total:	**4**

Question	Answer	Marks
10(a)	(Wire) moves vertically or down (page) Moves up (page) OR Magnetic field is into the page OR (Fleming's) left hand-rule applies	**C1** **A1** **B1**
10(b)	Moves up and down (page) / vibrates up and down (page) (Vertical) force on wire alternates OR due to interaction of field of magnet and alternating field (of current)	**B1** **B1**
	Total:	**5**

Question	Answer	Marks
11(a)(i)	(Region) where a force acts on a charge	**B1**
11(a)(ii)	Direction of the force acting on a positive charge	**B1**
11(b)	At least 4 radial equally spaced straight lines drawn from surface of sphere Arrows on lines pointing away from sphere	**B1** **B1**
11(c)(i)	Charges on sphere attract electrons (from earth) OR There is a p.d. between the sphere and earth	 **B1**
11(c)(ii)	$I = Q/t$ in any form OR Q/t OR $20 \times 10^{-6}/(20 \times 60)$ 1.7×10^{-8} A OR $I = Q/t$ in any form OR Q/t OR $20/(20 \times 60)$ 0.017 μA	**C1** **A1** **(C1)** **(A1)**
	Total:	**7**

Question	Answer	Marks
12(a)(i)	Atomic number OR number of protons OR proton number	**B1**
12(a)(ii)	94	**B1**
12(b)	$^{237}_{93}Np$ $+ \, ^{4}_{2}\alpha$	**B1** **B1**
12(c)	(No of Am atoms remaining = $8 \times 10^{14} - 6 \times 10^{14}$) = 2×10^{14} 4×10^{14} (Am atoms remain after) 470 yrs or 1 half-life (2×10^{14} Am atoms remain after) 940 yrs or 2 half-lives	**C1** **C1** **A1**
	Total:	**7**

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/51**

Paper 5 Practical **October/November 2016**

MARK SCHEME

Maximum Mark: 40

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Question	Answer	Mark
1(a)	Either suitable use of a horizontal straight edge Or holding rule close to pendulum Or line of sight perpendicular to rule	**1**
1(b)(i)	t = 27.8 – 29.0 (s)	**1**
1(b)(ii)	T correct Unit s	**1** **1**
1(b)(iii)	More likely to miscount/pendulum may stop swinging	**1**
1(c)(i)	Correct calculation and unit s^2	**1**
1(c)(ii)	g between 9 and 11 from correct T and working 2 or 3 significant figures	**1** **1**
1(d)(i)	Explanation of cause of inaccuracy in measurement of t or l. e.g. student did not react quickly enough when starting/stopping stopwatch OR difficulty in measuring accurately to centre of bob	**1**
1(d)(ii)	Any two from: Use different length(s) Repeat timing Use of a fiducial mark Increased number of oscillations Plot a graph using length and time or $time^2$	**2**
	Total:	**11**

Question	Answer	Mark
2(a)	θ_H 60 – 100 θ_C 10 – 40 and θ_{AV} correct Unit °C	**1** **1** **1**
2(b)	θ_M *between* θ_H *and* θ_C	**1**
2(c)	Perpendicular viewing of scale OR wait until temperature stops rising OR carry out without undue delay between parts	**1**
2(d)(i)	Correct diagram with lid Insulation placed round beaker	**1** **1**
2(d)(ii)	Sensible series of values with θ_M between θ_H and θ_C	**1**
2(d)(iii)	Statement and justification to match results	**1**
2(d)(iv)	Two from: Room temperature (or other environmental condition) Temperature of cold water Temperature of hot water Volumes of water Size/shape/material/surface area of beaker	**2**
	Total	**11**

Question	Answer	Mark
3(a)	Ray trace: Correct normal and all lines in approximately the right places P at least 5 cm from **AB** Table: θ values within ±2° of ray trace values θ values within ± 1° of 20, 30, 40, 50, 60	 **1** **1** **1** **1**
3(b)	Graph: Axes correctly labelled and right way round Suitable scales All plots correct to ½ small square Good line judgement, thin, continuous line	 **1** **1** **1** **1**
3(c)	Triangle method shown on graph and triangle using at least half of candidate's line *G* 0.9 – 1.1	**1** **1**
3(d)	Points close to/scattered from line (to match graph)/all on line.	**1**
	Total:	**11**

Question	Answer	Mark
4	**MP1** On circuit diagram: one voltmeter in parallel with any component	1
	MP2 Circuit diagram correctly shows power supply, ammeter, unless in a branch, two or more resistors in parallel	1
	MP3 Circuit diagram: Correct symbols for ammeter, voltmeter and fixed resistor	1
	MP4 Repeat with a different number of resistors (in parallel)	1
	MP5 Table that includes columns for number of resistors, voltage/V and current/A	1
	MP6 & MP7 Then any two from: Resistance calculated (may be shown in table) Use low current (to stop resistors getting too hot)/switch off between readings Use at least 5 different combinations Repeat with different current or voltage or variable resistor setting Drawing a graph of number of resistors against combined resistance	2
	Total:	7

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/61**

Paper 6 Alternative to Practical **October/November 2016**

MARK SCHEME

Maximum Mark: 40

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Question	Answer	Mark
1(a)	l = 4.1 – 4.2 (cm)	**1**
1(b)	Either suitable use of a horizontal straight edge, explained briefly Or holding rule close to pendulum Or line of sight perpendicular (to rule)	**1**
1(c)(i)	T = 1.39 (s) OR 1.4	**1**
1(c)(ii)	Pendulum may stop OR student may lose count	**1**
1(c)(iii)	1.93 s^2 (ecf allowed)	**1**
1(c)(iv)	10.2(2) 2 or 3 significant figures	**1** **1**
1(d)(i)	Explanation of cause of inaccuracy in measurement of t or l. e.g. student did not react quickly enough when starting/stopping stopwatch OR difficulty in measuring accurately to centre of bob	**1**
1(d)(ii)	Any two from: Use different length(s) Repeat timing Use of a fiducial mark Increased number of oscillations Plot a graph using length and time or time^2	**2**
	Total:	**10**

Question	Answer	Mark
2(a)(i)	88 (°C)	1
2(a)(ii)	θ_{AV} = 53.5 (°C)	1
2(b)	Perpendicular viewing of scale OR stirring OR wait until temperature stops rising, OR avoid delay (between adding water and taking temperature) Allow thermometer not touching beaker, owtte	1
2(c)	Correct diagram with lid drawn Insulation placed round beaker	1 1
2(d)	Statement and justification to match results. A number or numbers must be seen. Comment must include yes or no or 'too close to call'; owtte	1
2(e)	Two from: Room temperature (or other environmental condition) Temperature of cold water Temperature of hot water Volumes of water Size/shape/material/surface area of beaker	2
	Total:	8

Question	Answer	Mark
3(a)	Ray trace: i = 20	**1**
3(b)(i)	P at least 5 cm from the block	**1**
3(b)(ii)	Greater accuracy with greater distance owtte OR easier to line up accurately	**1**
3(b)(iii)	19°	**1**
3(c)	Graph: θ 19 (or ecf), 29,41,51,59 i 20, 30, 40, 50, 60 Axes correctly labelled and right way round Suitable scales All plots correct to ½ small square Good line judgement, thin, continuous line	 **1** **1** **1** **1**
3(d)	Triangle method shown on graph and triangle using at least half of candidate's line G 0.9 – 1.1	**1** **1**
	Total:	**10**

Question	Answer	Mark
4	**MP1** On circuit diagram: one voltmeter in parallel with any component	1
	MP2 Circuit diagram correctly shows power supply, ammeter, unless in a branch, two or more resistors in parallel	1
	MP3 Circuit diagram: Correct symbols for ammeter, voltmeter and fixed resistor	1
	MP4 Repeat with a different number of resistors (in parallel)	1
	MP5 Table that includes columns for number of resistors, voltage/V and current/A	1
	MP6 & MP7 Then any two from: Resistance calculated (may be shown in table) Use low current (to stop resistors getting too hot)/switch off between readings Use at least 5 different combinations Repeat with different current or voltage or variable resistor setting Drawing a graph of number of resistors against combined resistance	2
	Total:	7

Question	Answer	Mark
5(a)	c	**1**
5(b)(i)	(yes) straight line through the origin	**1** **1**
5(b)(ii)	0.174 or 0.17 N/mm	**1** **1**
	Total:	**5**