IGCSE Physics Pastpapers

Year 2020

Summer22,42,62,41,43,61,63
winter22,42,62,41,43,61,63
march22,42,62

Class:_____
Name:_____

Cambridge Assessment International Education

Cambridge IGCSE™

PHYSICS **0625/22**

Paper 2 Multiple Choice (Extended) **May/June 2020**

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- 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 multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m / s^2).

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.

This document has **16** pages. Blank pages are indicated.

[Turn over

Name

Class

ZipGrade.com

40 Questions (0866)

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

1 Five athletes P, Q, R, S and T compete in a race. The table shows the finishing times for the athletes.

athlete	P	Q	R	S	T
finishing time / s	22.50	24.40	25.20	26.50	23.20

Which statement is correct?

A Athlete P won the race and was 0.70 s ahead of the athlete in second place.

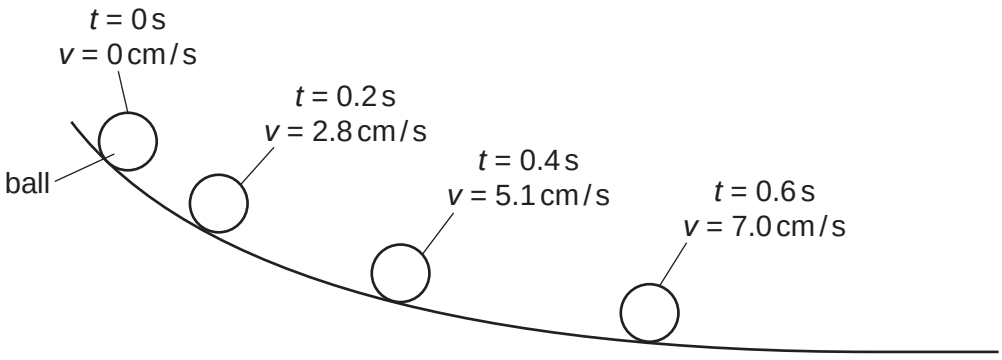
B Athlete P won the race and was 1.90 s ahead of the athlete in second place.

C Athlete S won the race and was 1.30 s ahead of the athlete in second place.

D Athlete S won the race and was 2.10 s ahead of the athlete in second place.

2 A student investigates the motion of a ball rolling down a slope.

The diagram shows the speed v of the ball at different times t.



Which statement describes the motion of the ball?

A The acceleration is not constant.

B The acceleration is negative.

C The speed is decreasing.

D The velocity is constant.

3 Which statement about acceleration is correct?

A It is related to the changing speed of an object.

B It is the distance an object travels in one second.

C It is the force acting on an object divided by the distance it travels in one second.

D It is the force acting on an object when it is near to the Earth.

4 Which statement correctly describes the effects of placing a heavy load in a car?

A It is easier to accelerate the car and easier to bring the car to rest.

B It is easier to accelerate the car but more difficult to bring the car to rest.

C It is more difficult to accelerate the car and more difficult to bring the car to rest.

D It is more difficult to accelerate the car but easier to bring the car to rest.

5 A space probe is taken from the Earth to Mars.

The force of gravity on the surface of Mars is less than the force of gravity on the surface of the Earth.

How do the weight and the mass of a space probe on the surface of Mars compare to their values when the probe is on the surface of the Earth?

	weight on Mars	mass on Mars
A	decreased	decreased
B	decreased	unchanged
C	unchanged	decreased
D	unchanged	unchanged

6 Water has a density of 1000 kg / m^3.

A rectangular swimming pool has an average depth of 1.6 m.

The length of the pool is 25 m.

The width of the pool is 10 m.

What is the mass of the water in the swimming pool?

A 2.5 kg **B** 400 kg **C** 400 000 kg **D** 800 000 kg

7 A satellite orbits the Earth at constant speed in a circular orbit.

Which statement is correct?

A The resultant force on the satellite is zero.

B The resultant force on the satellite is towards the Earth.

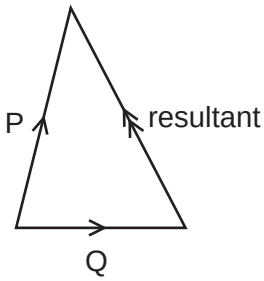
C The resultant force on the satellite is away from the Earth.

D The resultant force on the satellite is in the direction of motion.

8 Two forces P and Q act on an object.

Which diagram shows the resultant of these two forces?

A



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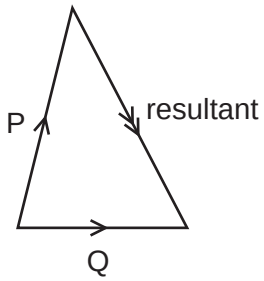
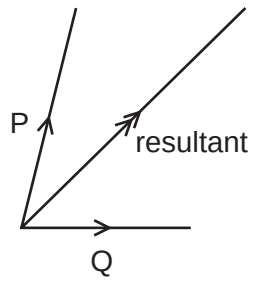
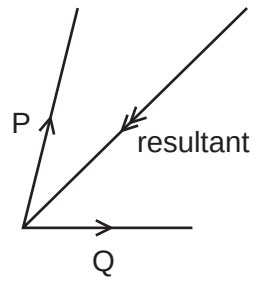


C



D



9 An object is moving at +3.0 m / s.

A force acts on the object.

After a time, the object is moving at –4.0 m / s.

The mass of the object is 5.0 kg.

What is the change in momentum of the body?

A –35 kg m / s **B** –5.0 kg m / s **C** +5.0 kg m / s **D** +35 kg m / s

10 Which energy resource is **not** renewable?

A geothermal

B nuclear fission

C solar

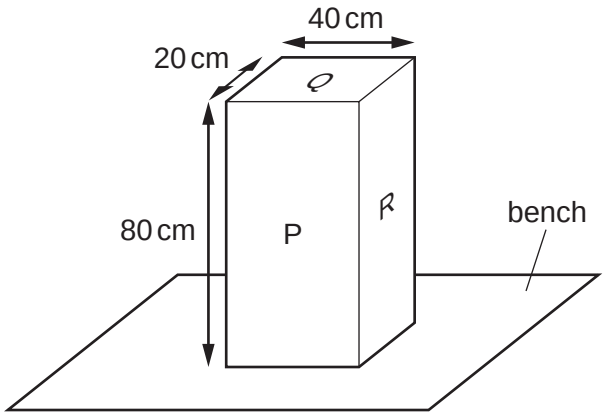
D wind

11 A car of mass 500 kg is moving at 10 m / s. The engine does work on the car and the speed increases to 16 m / s.

How much work is done by the engine to increase the speed of the car?

A 3000 J **B** 9000 J **C** 39 000 J **D** 78 000 J

12 The diagram shows a solid block resting on a bench. The dimensions of the block are shown.



On which labelled surface should the block rest to produce the smallest pressure on the bench?

A P

B Q

C R

D P, Q and R produce the same pressure

13 An object is 60 cm below the surface of a liquid. The pressure due to the liquid at this depth is 9000 Pa.

What is the density of the liquid?

A 15 kg / m^3 **B** 540 kg / m^3 **C** 1500 kg / m^3 **D** 54 000 kg / m^3

14 Which row describes the forces between the molecules and the motion of the molecules in a solid?

	forces between molecules	motion of molecules
A	strong	move freely
B	strong	vibrate only
C	weak	move freely
D	weak	vibrate only

15 Wet clothes are hanging outside to dry.

Which condition decreases the rate of evaporation of the water from the clothes?

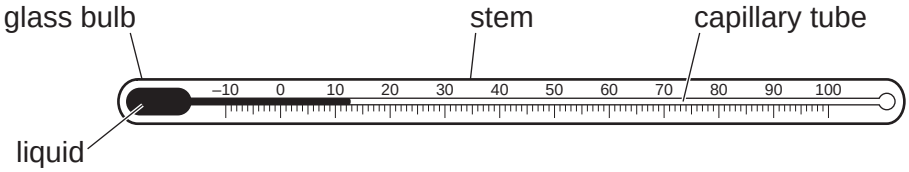
A folded clothes

B higher temperature

C wetter clothes

D windy day

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



The design of this thermometer includes the following features.

1 a liquid which expands linearly when it is heated

2 a glass bulb which has a thick glass wall

3 a capillary tube with a very small diameter

Which features increase the sensitivity of the thermometer?

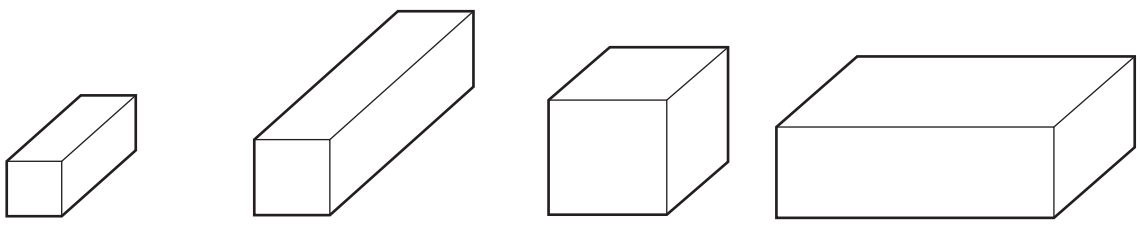
A 1 only **B** 1 and 2 **C** 2 and 3 **D** 3 only

17 The diagrams show four blocks of steel. The blocks are all drawn to the same scale.

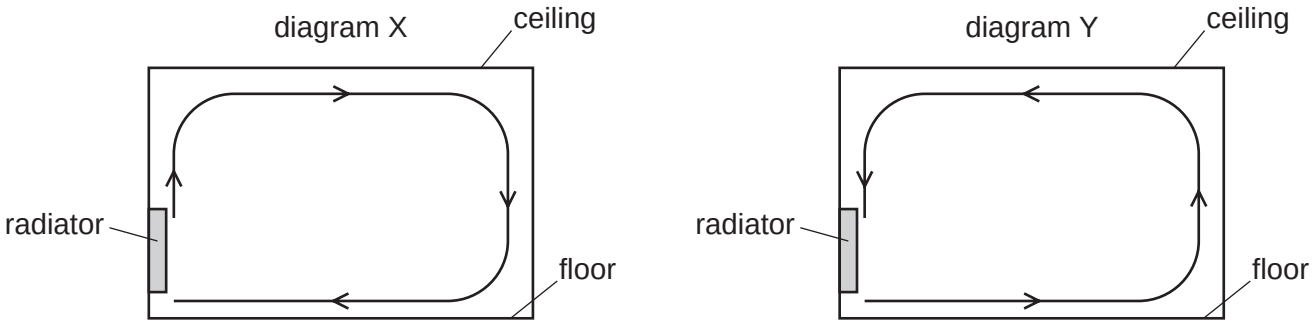
The same quantity of thermal energy is given to each block.

Which block shows the greatest rise in temperature?

A **B** **C** **D**



18 A room is heated by a radiator. The diagrams X and Y show two possible circulations of hot air, which heat the room.

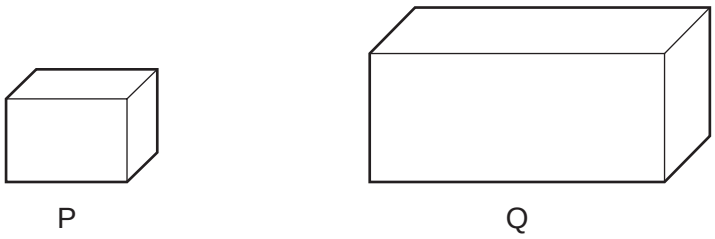


Which diagram and reason explain the heating of the room by convection?

	diagram	reason
A	X	air density decreases when air is heated
B	X	air density increases when air is heated
C	Y	air density decreases when air is heated
D	Y	air density increases when air is heated

19 Two copper containers P and Q are filled with hot water.

The diagrams are both drawn to the same scale.



Container P emits more infrared radiation from its surfaces than container Q.

What is a possible reason for this?

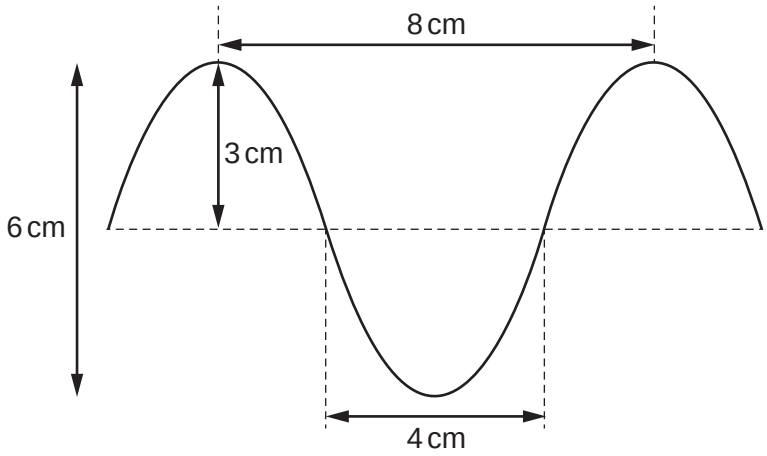
A The surfaces of P are painted white and the surfaces of Q are painted black.

B The surfaces of P are shiny and the surfaces of Q are dull.

C The surfaces of P have a smaller area than the surfaces of Q.

D The water in P is hotter than the water in Q.

20 The diagram shows a wave.



What are the amplitude and the wavelength of this wave?

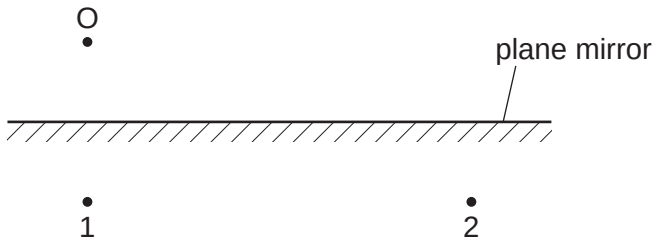
	amplitude / cm	wavelength / cm
A	3	4
B	3	8
C	6	4
D	6	8

21 The frequency of the microwaves used in a microwave oven is 2400 MHz.

What is the wavelength of these microwaves?

A 0.125 m **B** 8.00 m **C** 125 m **D** 7200 m

22 An object O is placed in front of a plane mirror as shown.



Which row is correct?

	position of the image	nature of the image
A	1	real
B	1	virtual
C	2	real
D	2	virtual

23 Which statement is correct?

A The speed of light in glass is equal to the speed of light in a vacuum multiplied by the refractive index of glass.

B The incident angle of a light ray at an air-glass surface is the angle between the ray and the glass surface.

C The sine of the critical angle at an air-glass surface is equal to $\frac{1}{\text{refractive index of glass}}$.

D The angle of refraction for light passing through an air-glass surface is proportional to the angle of incidence at that surface.

24 An intruder alarm sensor detects that a person is warmer than his surroundings.

Which type of electromagnetic wave does the sensor detect?

A infrared

B radio

C ultraviolet

D visible light

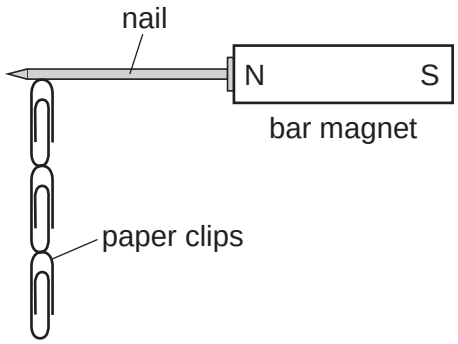
25 A dolphin sends out a sound wave. An echo returns 0.010 s later from a fish which is 7.5 m from the dolphin.

What is the speed of the sound wave in water?

A 0.075 m / s **B** 0.15 m / s **C** 750 m / s **D** 1500 m / s

26 Four nails **A**, **B**, **C** and **D** are tested to find which makes the strongest permanent magnet.

One of the nails is placed against a bar magnet and the number of paper clips which the nail can support is recorded.

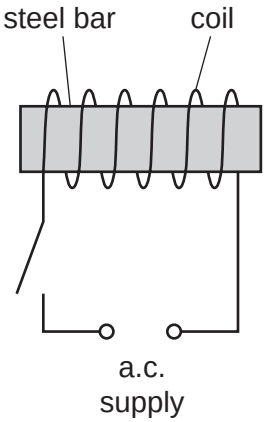


The bar magnet is then removed and the number of paper clips remaining attached to the nail is recorded. Each nail is tested individually.

Which nail becomes the strongest permanent magnet?

	number of paper clips attached to the nail	
	bar magnet present	bar magnet removed
A	2	0
B	2	1
C	4	3
D	5	2

27 A student wants to demagnetise a steel bar. He uses the apparatus shown. He switches on the circuit for a few seconds and then switches off. He finds that the steel bar is still magnetised.



What should he do to improve his method?

A change the supply from an alternating to a direct voltage

B use a lower alternating voltage

C remove the steel bar from the coil whilst the circuit is switched on

D use a coil that has fewer turns on it

28 A cloth is used to rub an uncharged plastic rod.

Both the rod and the cloth become charged.

Why does the plastic rod become negatively charged and the cloth become positively charged?

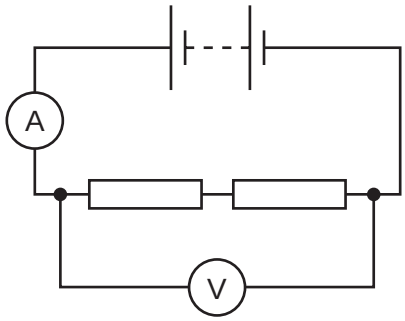
A The rod gains electrons and the cloth gains positive charges.

B The rod gains electrons and the cloth loses electrons.

C The rod loses electrons and the cloth gains electrons.

D The rod loses electrons and the cloth loses positive charges.

29 A student uses the circuit shown to determine the resistance of two identical resistors.



The voltmeter reading is 2.2 V and the ammeter reading is 0.25 A.

What is the resistance of each resistor?

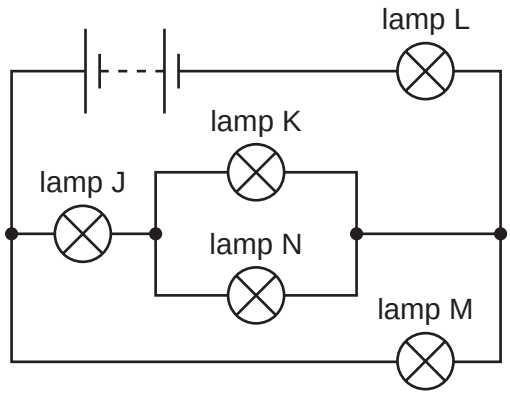
A 0.275 Ω **B** 0.55 Ω **C** 4.4 Ω **D** 8.8 Ω

30 A cell passes a current of 2.0 A in a circuit for 30 s. In this time the cell transfers 120 J of energy.

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

A 0.50 V **B** 1.5 V **C** 2.0 V **D** 8.0 V

31 The circuit shown contains five lamps J, K, L, M and N. All the lamps are glowing.



One lamp is removed and two other lamps go out.

Which lamp is removed?

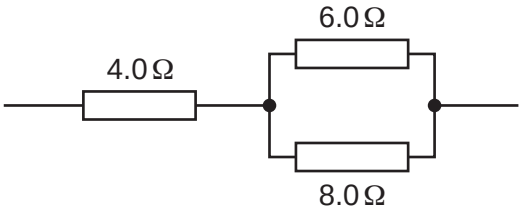
A lamp J

B lamp K

C lamp L

D lamp M

32 What is the effective resistance of the following combination of resistors?

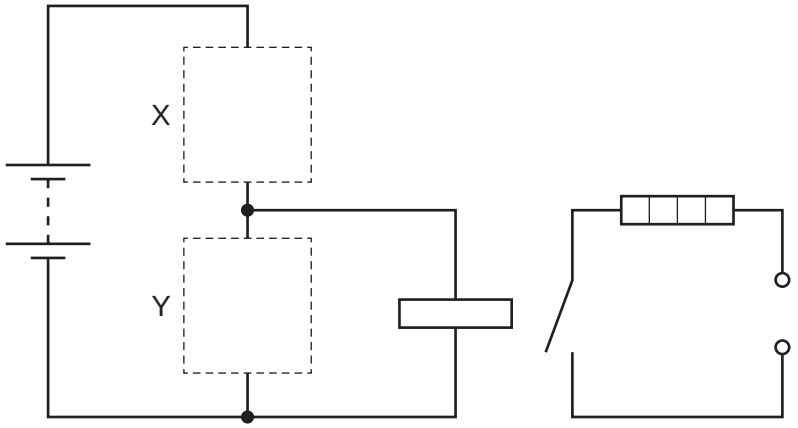


A 1.8Ω **B** 7.4Ω **C** 11Ω **D** 18Ω

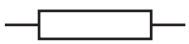
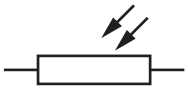
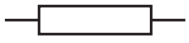
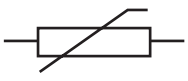
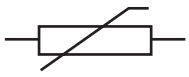
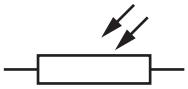
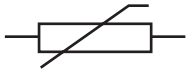
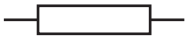
33 Which symbol represents a NAND gate?

A **B** **C** **D**

34 The diagram shows a circuit used to switch on a heater when the temperature drops below a certain value.

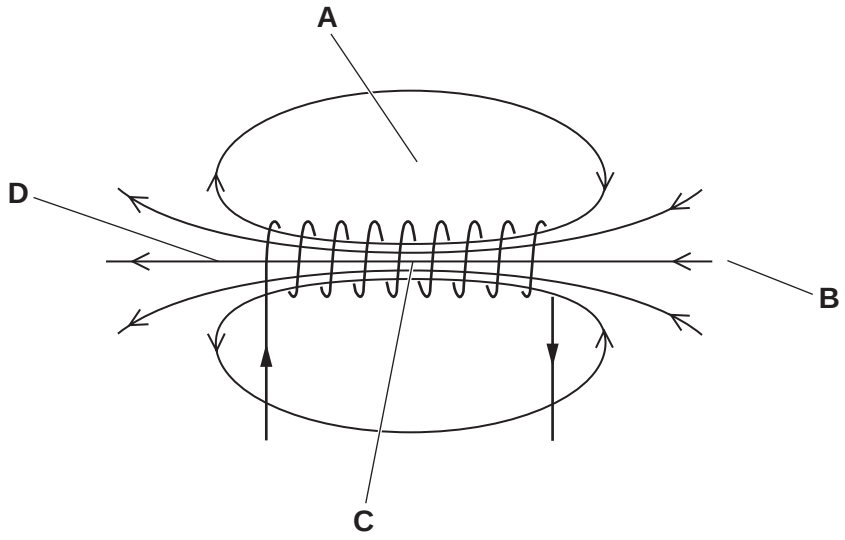


Which row shows the components that should be connected at X and at Y?

	X	Y
A		
B		
C		
D		

35 The diagram shows the magnetic field due to a current in a solenoid.

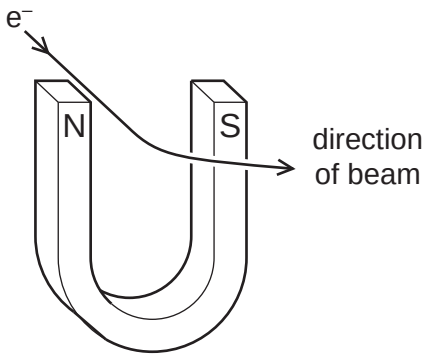
Where is the magnetic field the strongest?



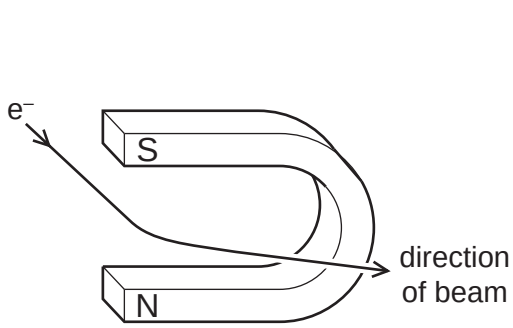
36 A beam of electrons is passed through the magnetic field of a magnet.

How must the magnet be positioned to deflect the beam in the direction shown?

A



B



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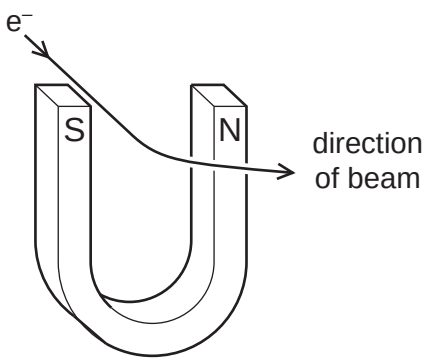
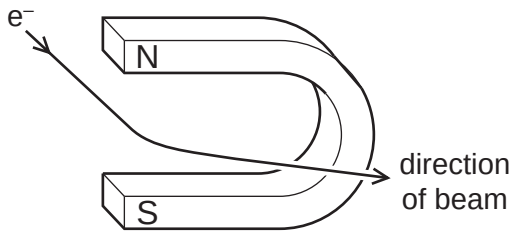


D



37 Uranium-235 can undergo nuclear fission in many ways.

Which equation correctly shows a possible fission reaction for uranium-235?

A $^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{141}_{56}Ba + {}^{92}_{36}Kr + 3{}^{1}_{0}n$

B $^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{91}_{38}Sr + {}^{144}_{54}Xe + 2{}^{1}_{0}n$

C $^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{95}_{37}Rb + {}^{136}_{55}Cs + 3{}^{1}_{0}n$

D $^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{87}_{35}Br + {}^{146}_{57}La + 4{}^{1}_{0}n$

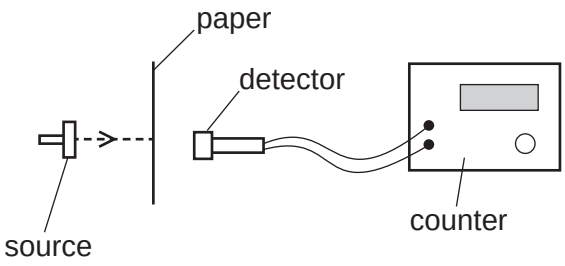
38 A radioactive material has a half-life of 20 days.

A sample of the material contains 8.0×10^{10} atoms.

How many atomic nuclei have decayed after 60 days?

A 1.0×10^{10} **B** 4.0×10^{10} **C** 6.0×10^{10} **D** 7.0×10^{10}

39 A thin sheet of paper is placed between a radioactive source and a radiation detector. The count rate falls to a very low reading.



From this result, which type of radiation is the source emitting?

A α-particles

B β-particles

C γ-rays

D X-rays

40 α-particles, β-particles and γ-rays are emitted by radioactive nuclei when they decay.

Which emissions can be deflected by an electric field?

A α-particles and β-particles only

B β-particles and γ-rays only

C γ-rays and α-particles only

D α-particles, β-particles and γ-rays

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CANDIDATE NAME									
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5120470809

PHYSICS **0625/42**

Paper 4 Theory (Extended) **May/June 2020**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.
- Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s^2).

INFORMATION

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

This document has **12** pages. Blank pages are indicated.

[Turn over

1 Fig. 1.1 shows the speed–time graph of a person on a journey.

On the journey, he walks and then waits for a bus. He then travels by bus. He gets off the bus and waits for two minutes. He then walks again. His journey takes 74 minutes.

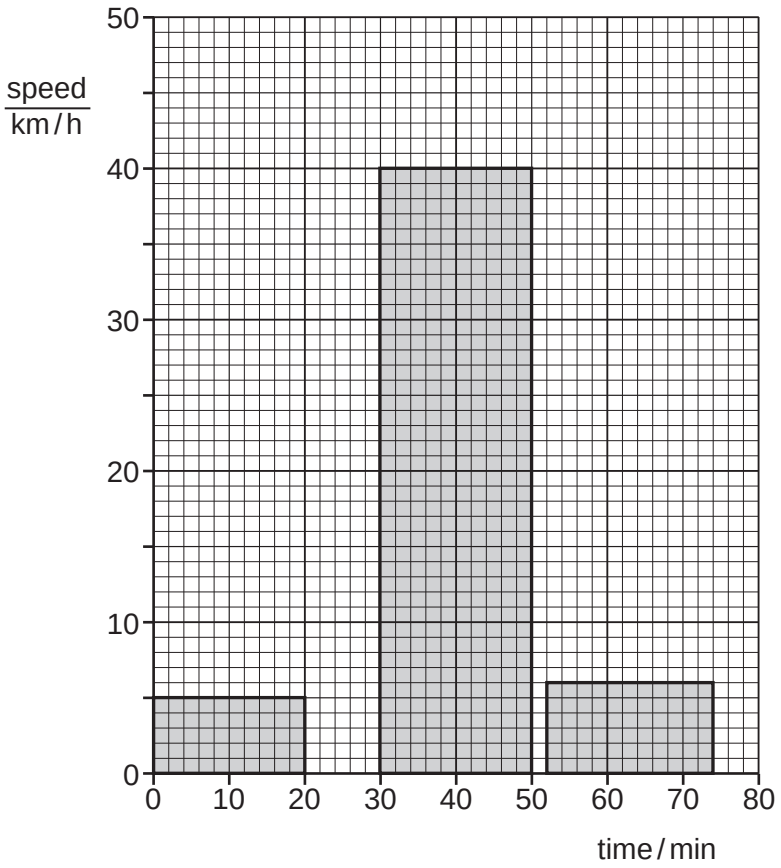

Fig. 1.1

(a) For the whole journey calculate:

(i) the distance travelled

distance = ... [3]

(ii) the average speed.

average speed = ... [2]

(b) State and explain which feature of a speed–time graph shows acceleration.

.....

..... [2]

(c) State and explain the acceleration of the person at time = 40 minutes.

.....

..... [2]

[Total: 9]

2 Fig. 2.1 shows a train.

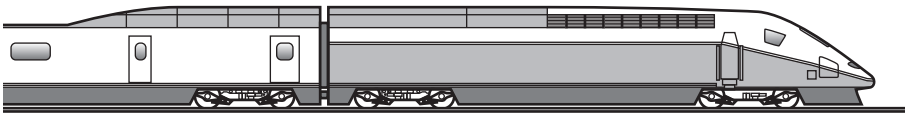

Fig. 2.1

The total mass of the train and its passengers is 750 000 kg. The train is travelling at a speed of 84 m/s. The driver applies the brakes and the train takes 80 s to slow down to a speed of 42 m/s.

(a) Calculate the impulse applied to the train as it slows down.

impulse = ... [3]

(b) Calculate the average resultant force applied to the train as it slows down.

force = ... [2]

(c) Suggest how the shape of the train helps it to travel at high speeds.

.....

..... [1]

(d) The train took 80 s to reduce its speed from 84 m/s to 42 m/s. Explain why, with the same braking force, the train takes more than 80 s to reduce its speed from 42 m/s to zero.

.....

..... [1]

(e) On a wet day, the train travels a greater distance before it stops along the same track. The train has the same speed of 84 m/s before the brakes are applied.

Suggest a reason for this.

.....

..... [1]

[Total: 8]

3 **(a)** A solar panel receives energy from the Sun at a rate of 5.0 kW.

Thermal energy is transferred from the solar panel to water with an efficiency of 20%.

Cold water of mass 15 kg enters the solar panel every hour.

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

Calculate the temperature increase of the water.

temperature increase = ... °C [4]

(b) State and explain **one** advantage and **one** disadvantage of heating the water in a solar panel compared with heating the water in a coal-burning boiler.

advantage .....

explanation .....

.....

disadvantage .....

explanation .....

..... [4]

[Total: 8]

4 Fig. 4.1 shows a liquid-in-glass thermometer without a temperature scale.
The liquid inside the thermometer has a melting point of –39 °C.

Fig. 4.1

(a) Describe simple experiments to mark the positions of the fixed points on this liquid-in-glass thermometer.

.....

.....

.....

.....

.....

..... [4]

(b) A scientist is measuring temperatures at the South Pole. These temperatures have a minimum value of –90 °C.

State why the liquid used in the thermometer in Fig. 4.1 would **not** be suitable for this scientist.

..... [1]

(c) State a design change that:

(i) increases the sensitivity of a liquid-in-glass thermometer

..... [1]

(ii) increases the range of a liquid-in-glass thermometer.

..... [1]

(d) State the property of the liquid which ensures that the scale on a liquid-in-glass thermometer is linear.

..... [1]

[Total: 8]

5 Fig. 5.1 shows crests of a wave approaching a barrier where the wave is reflected.

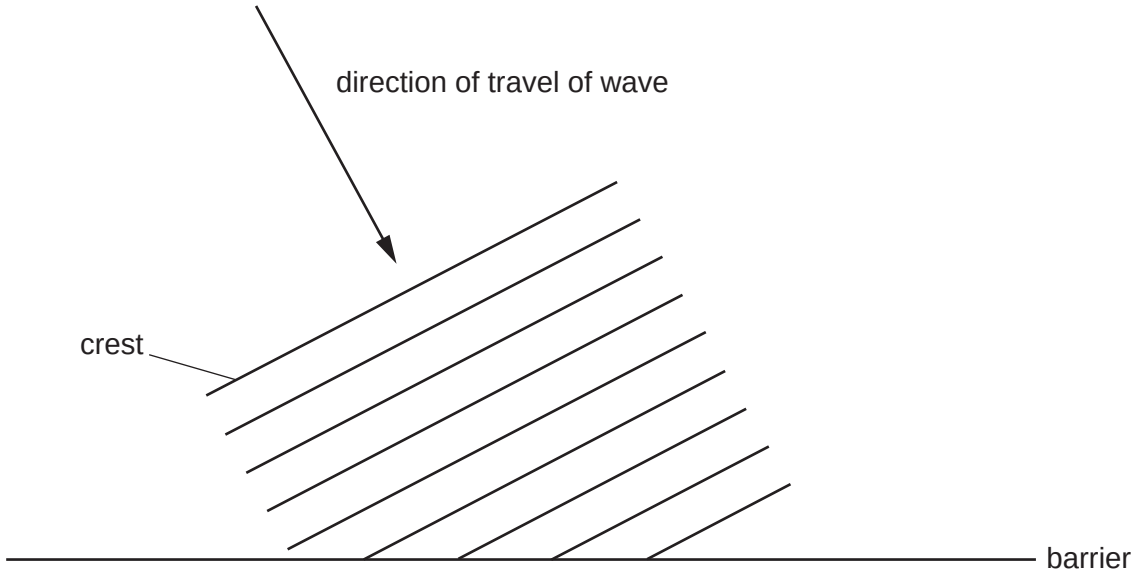

Fig. 5.1

(a) On Fig. 5.1, draw **three** crests of the reflected wave. [3]

(b) The wave has a wavelength of 36 cm and a speed of 1.2 m / s.

Calculate the frequency of the wave.

frequency = ... [3]

(c) Complete the following sentences.

An echo is the name for a reflected ..... wave.

The waves that form an echo are a type of longitudinal wave. Longitudinal waves are made up of ..... and rarefactions.

[2]

[Total: 8]

6 **(a)** Fig. 6.1 shows an arrangement of glass prisms inside a box. The angles of the prisms are 45°, 45° and 90°.

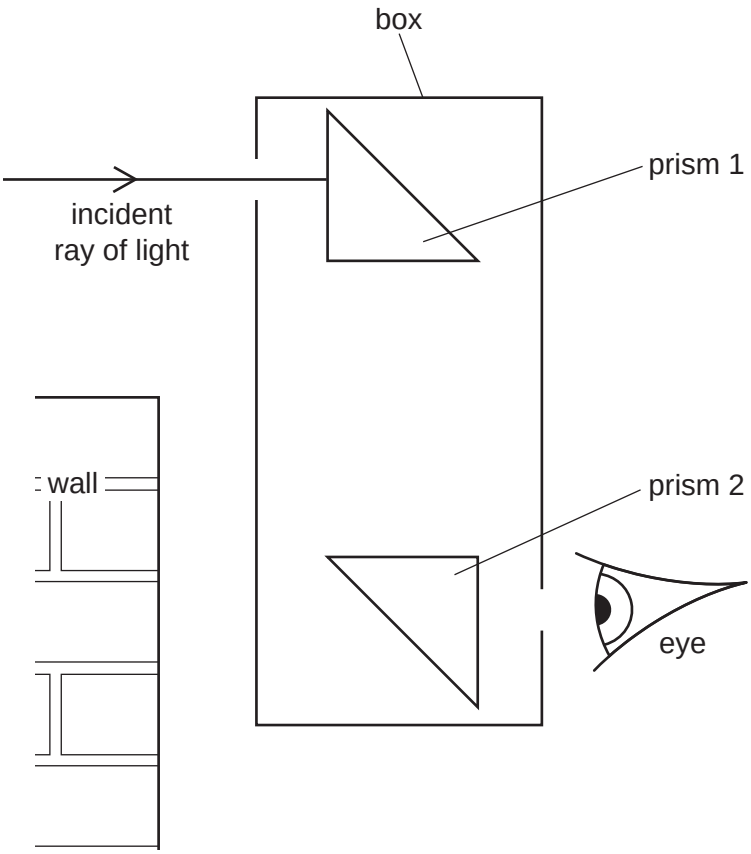

Fig. 6.1 (not to scale)

This is a device used to view objects that are behind a wall.
The incident ray of light undergoes total internal reflection in the prisms.

On Fig. 6.1, complete the path of the ray through the device and show the ray as it emerges from the box. [3]

(b) Show that the refractive index of glass with a critical angle of 45° is 1.41.

[2]

[Total: 5]

7 **(a)** A student makes a transformer that uses an alternating current (a.c.) supply with an electromotive force (e.m.f.) of 12.0 V to induce an output potential difference (p.d.) of 2.0 V.

The student is provided with two lengths of insulated wire and the U-shaped piece of iron shown in Fig. 7.1.

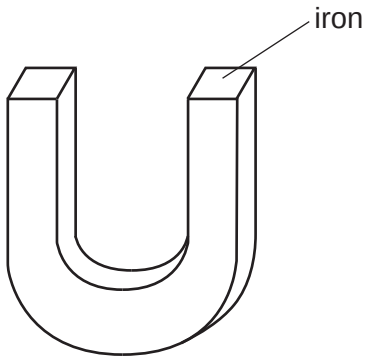

Fig. 7.1

(i) Complete and label Fig. 7.1 to show the transformer connected to the supply and the output from the transformer. [3]

(ii) Explain the function of the piece of iron in the transformer.

.....

.....

..... [2]

(iii) The output of the transformer is connected to a lamp. The current in the lamp is 100 mA. The transformer is 100% efficient.

Calculate the input current to the transformer.

current = ... [2]

(b) Another transformer is used in a school laboratory to step down a mains supply with a p.d. of 110 V to 12 V. This transformer is mounted in a metal case.

State and explain an essential safety feature required for this arrangement.

.....

..... [2]

[Total: 9]

8 **(a)** A light-emitting diode (LED) is a diode that emits light when there is a current in it. Draw a circuit diagram showing an LED, connected so that it is lit, in series with a battery and a fixed resistor. Use standard electrical symbols.

[4]

(b) The p.d. across the LED when lit is 3.1 V and the current in the LED is 0.030 A.

Calculate the value of the resistance of the LED when lit.

resistance = ... [2]

(c) Fig. 8.1 shows a power supply of e.m.f. 10.5 V connected in series with a lamp and a heater. The p.d. across the lamp is 2.1 V and the current in the lamp is 1.5 A.

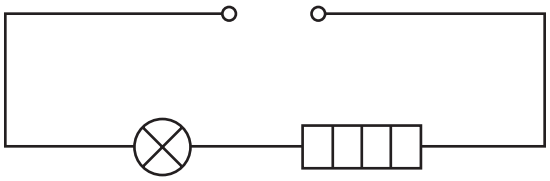

Fig. 8.1

Calculate:

(i) the resistance of the heater

resistance = ... [2]

(ii) the power of the heater.

power = ... [2]

[Total: 10]

9 **(a)** Complete the truth table shown in Table 9.1 for a NAND gate.

Table 9.1

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

[1]

(b) The circuit shown in Fig. 9.1 contains two different types of gate, labelled X and Y.

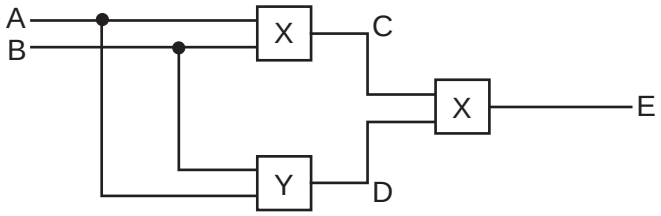

Fig. 9.1

Table 9.2 shows a partially completed truth table for this circuit.

Table 9.2

input		intermediate point		output
A	B	C	D	E
0	0	0	0	
0	1	1	0	
1	0	1	0	
1	1	1	1	

(i) From Table 9.2, deduce the name of logic gate Y.

Ring your answer from the list.

AND NAND NOR NOT OR [1]

(ii) Complete the truth table in Table 9.2. [2]

(c) There is a current of 3.0 A in a copper wire. Calculate how many electrons pass through the copper wire every 60 s. The charge on an electron is 1.6×10^{-19} C.

number of electrons = ... [3]

[Total: 7]

10 Fig. 10.1 shows a vacuum tube with a radioactive source. The radioactive source emits α-particles, β-particles and γ-rays. There is a very strong magnetic field between the N pole and the S pole of the magnet.

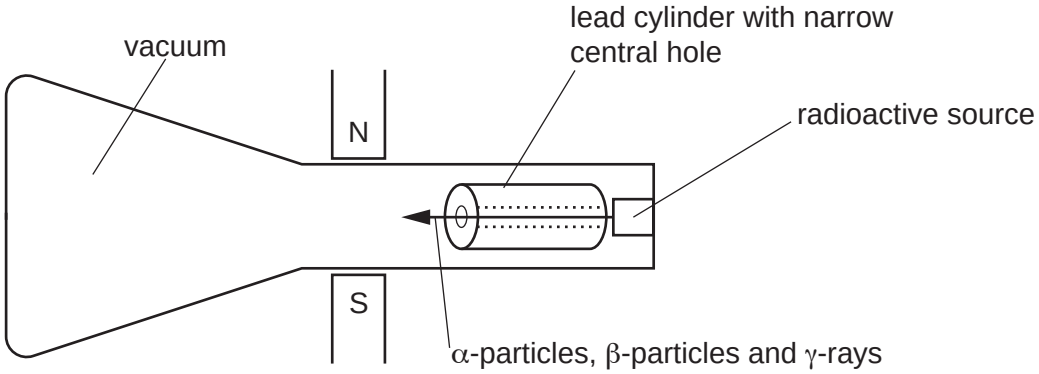

Fig. 10.1

(a) The lead cylinder has a narrow central hole. State and explain the effect of the lead cylinder.

.....

..... [2]

(b) Describe the paths of the α-particles, β-particles and γ-rays as they pass through the magnetic field. Explain your answers.

(i) α-particles

.....

.....

..... [2]

(ii) β-particles

.....

.....

.....

..... [2]

(iii) γ-rays

.....

.....

..... [2]

[Total: 8]

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PHYSICS **0625/62**

Paper 6 Alternative to Practical **May/June 2020**

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Blank pages are indicated.

DC (LK/SW) 195016/2

[Turn over

1 A student investigates the period of a pendulum. Fig. 1.1 and Fig. 1.2 show the apparatus she uses.

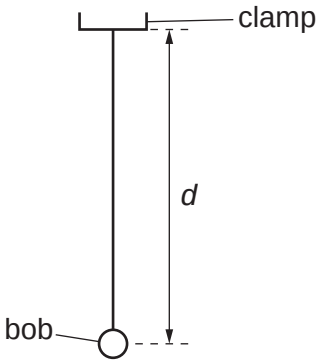


Fig. 1.1

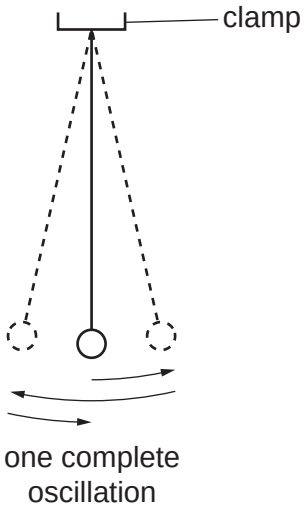


Fig. 1.2

(a) Explain briefly, with the help of a diagram, how you would use a metre rule and set square to measure the length *d* of a pendulum as accurately as possible.

Diagram:

.....

.....

..... [3]

(b) The student adjusts the pendulum so that d = 50.0 cm. She displaces the bob slightly and releases it so that it swings. Fig. 1.2 shows one complete oscillation of the pendulum.
She measures the time t_1 for 20 complete oscillations.

(i) Record the time t_1 shown in Fig. 1.3.

Fig. 1.3

t_1 = ... [1]

(ii) Calculate the period T_1 of the pendulum. The period is the time for one complete oscillation.

T_1 = ... [1]

(c) The student adjusts the pendulum until the distance d is 100.0 cm.

She repeats the procedure and records the time t_2 for 20 oscillations and the period T_2.

t_2 = 39.80 s

T_2 = 1.99 s

She measures the mass m_A of the pendulum bob. The reading on the balance is shown in Fig. 1.4.

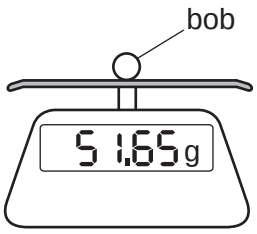


Fig. 1.4

Record mass m_A of the pendulum bob to the nearest gram.

m_A = ... g [1]

The student repeats the procedure using a pendulum bob of mass m_B.

m_B = 109 g

She obtains these results:

distance d = 50.0 cm

period T_3 = 1.39 s

distance d = 100.0 cm

period T_4 = 2.02 s

(d) **(i)** Using the results T_1, T_2, T_3 and T_4, for the period of each of the pendulums, tick (✓) the response that matches your results within the limits of experimental accuracy.

☐ the period T is affected by d only

☐ the period T is affected by both d and m

☐ the period T is affected by m only

☐ the period T is not affected by d or m

[1]

(ii) Justify your answer to **(d)(i)** by reference to the results.

.....

..... [1]

(e) The student now investigates the effect of the size of the oscillations on the period of the pendulum.

(i) Suggest briefly how you would measure the size of an oscillation. You may draw a diagram.

.....

..... [2]

(ii) State **one** variable that you would keep constant during this part of the investigation.

..... [1]

[Total: 11]

2 A student determines the resistance of a resistance wire.

Fig. 2.1 shows the circuit he uses.

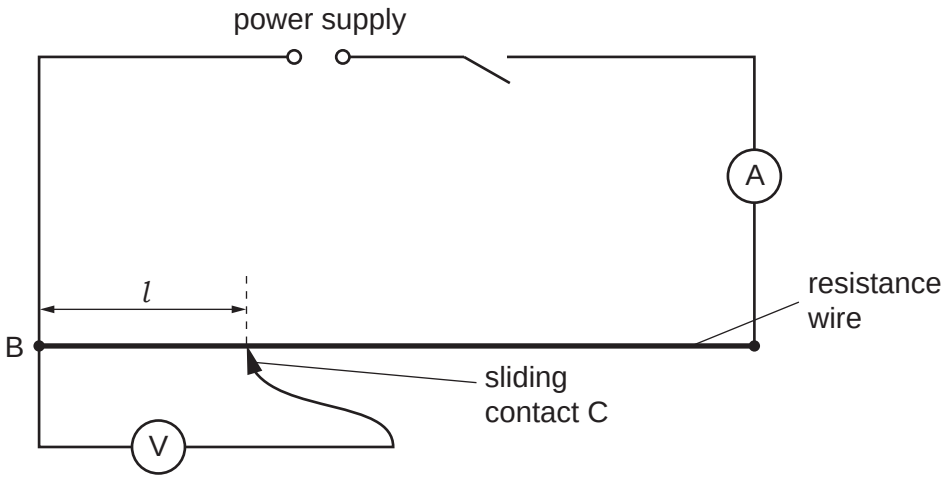


Fig. 2.1

(a)

- The student places the sliding contact C on the resistance wire at a distance l = 10.0 cm from B.
- Record, in the first row of Table 2.1, the potential difference V across the length l = 10.0 cm of resistance wire, as shown on the voltmeter in Fig. 2.2.

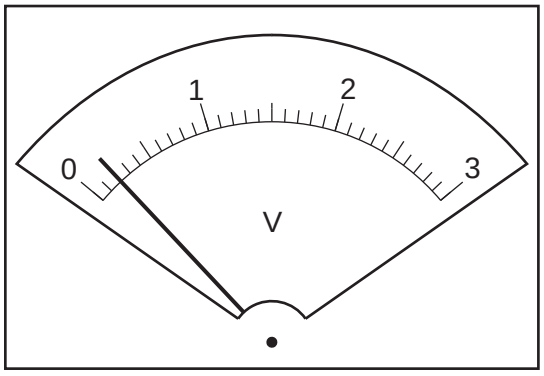


Fig. 2.2

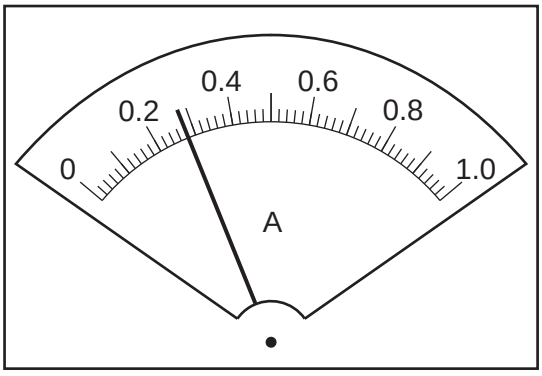


Fig. 2.3

- Record, in the first row of Table 2.1, the current I in the circuit as shown in Fig. 2.3.
- Complete the column headings in Table 2.1.

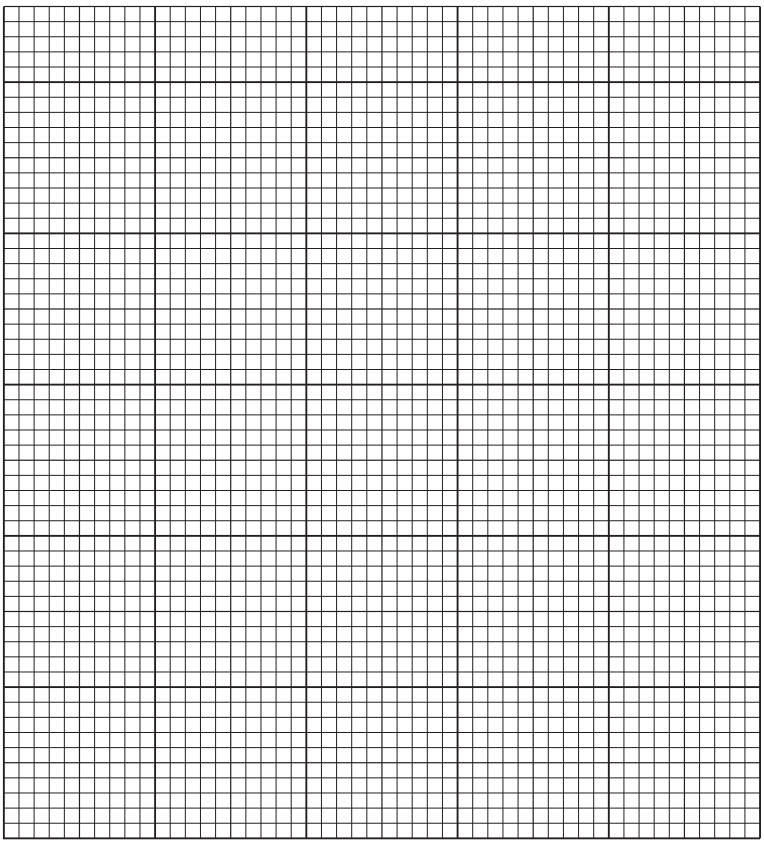
Table 2.1

l/	V/	I/
10.0		
30.0	0.7	0.30
50.0	1.1	0.27
70.0	1.5	0.28
90.0	2.1	0.29

[3]

(b) The student repeats the procedure using l = 30.0 cm, 50.0 cm, 70.0 cm and 90.0 cm. The readings are shown in Table 2.1.

Plot a graph of V/V (y-axis) against l/cm (x-axis). Start both axes at the origin (0,0).



[4]

(c) **(i)** Write a conclusion about the value of the current I in the circuit as the position of the sliding contact C is changed.

.....

..... [1]

(ii) Justify your conclusion by reference to your results.

.....

..... [1]

(d) Using the graph, determine the potential difference V_L when the length $l = 60.0\,\text{cm}$.

Show clearly on the graph how you obtained your result.

V_L = ... [2]

[Total: 11]

3 A student investigates some thermal properties of sand and water.

Fig. 3.1 shows the apparatus.

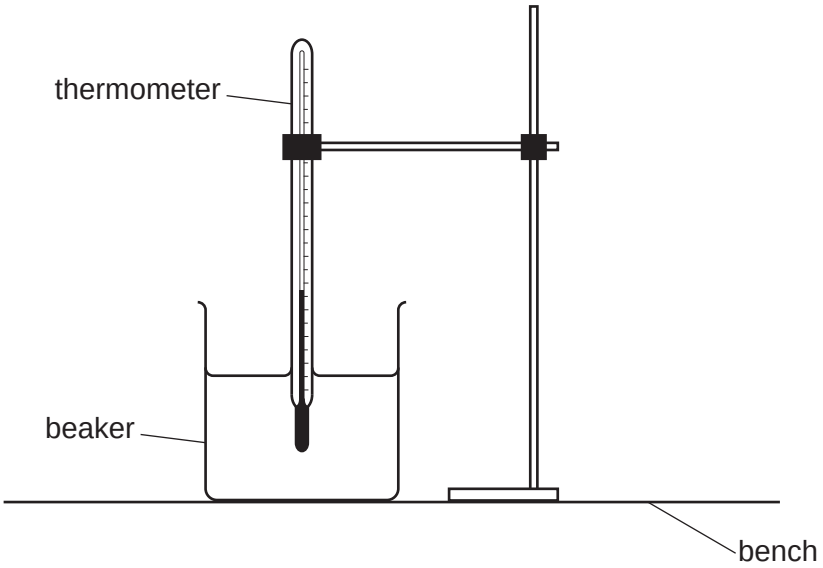


Fig. 3.1

(a) The thermometer in Fig. 3.2 shows the room temperature θ_S at the beginning of the experiment. Record θ_S.

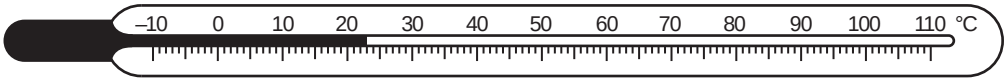


Fig. 3.2

θ_S = ... °C [1]

(b) The student is supplied with hot water at a temperature θ_H. She records the temperature of the hot water.

θ_H = 84 °C

She pours 100 cm^3 of hot water into a beaker that contains sand. Initially, the sand is at room temperature.

She measures the highest temperature θ_M of the mixture.

θ_M = 70 °C

(i) Calculate the rise in temperature θ_R of the sand using the equation $\theta_R = (\theta_M - \theta_S)$.

θ_R = ... °C [1]

(ii) Explain briefly what the student does after pouring the hot water into the sand and before taking the temperature, in order to obtain a reliable value for θ_M.

.....

..... [1]

(iii) Calculate the fall in temperature θ_F of the hot water using the equation $\theta_F = (\theta_H - \theta_M)$.

θ_F = ... °C

Calculate the ratio S using the equation $S = \frac{\theta_R}{\theta_F}$. Give your answer to a suitable number of significant figures for this experiment.

S = ... [1]

(c) The student pours 100 cm^3 of the hot water into a clean beaker that contains 100 cm^3 of water at room temperature. She records the highest temperature θ_M of the mixture.

θ_M = 49° C

Calculate the rise in temperature θ_R of the cold water using the equation $\theta_R = (\theta_M - \theta_S)$. Use the value of room temperature θ_S recorded in **(a)**.

θ_R = ...

Calculate the fall in temperature θ_F of the hot water using the equation $\theta_F = (\theta_H - \theta_M)$.

θ_F = ...

Calculate the ratio W using the equation $W = \frac{\theta_R}{\theta_F}$.

W = ... [2]

(d) The student studies the thermal properties of sand and water. She predicts that S should be equal to 6 × W.

State whether the results support the prediction. Justify your answer by reference to the readings.

statement .....

justification .....

.....

.....

[2]

(e) Suggest **two** temperatures that it would be sensible to keep constant when carrying out the experiments.

1. .....

2. .....

[2]

(f) The student measures the volume of the dry sand using a measuring cylinder before carrying out the experiment. Tick (✓) the boxes that show the precautions that she should take in order to obtain an accurate reading.

☐ Take the reading at the bottom of the meniscus.

☐ Tap the measuring cylinder to make sure the top of the sand is horizontal.

☐ View the scale of the measuring cylinder at right angles.

[1]

[Total: 11]

4 A student investigates the bending of 1 m length strips of different materials. She compares how far they bend when loaded at one end.

Plan an experiment to investigate how the material from which the strips are made affects the bending of the strips when loaded at one end.

The following apparatus is available to the student:

strips of wood, plastic, steel and aluminium, each of length 1 m
a set of slotted masses
a metre rule
a G-clamp (used to hold the strips to the laboratory bench).

Other apparatus normally available in a school laboratory can also be used.

In your plan, you should:

- draw a diagram to show the arrangement of the apparatus
- explain briefly how you would carry out the investigation, including the measurements you would take
- state the key variables to be kept constant
- draw a suitable table, with column headings, to show how you would display your readings (you are **not** required to enter any readings in the table)
- explain how you would use the results to reach a conclusion.

.....

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..... [7]

[Total: 7]

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CENTRE NUMBER						CANDIDATE NUMBER				

PHYSICS **0625/41**

Paper 4 Theory (Extended) **May/June 2020**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.
- Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s^2).

INFORMATION

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

This document has **16** pages. Blank pages are indicated.

DC (ST/CT) 194261/3

1 An aeroplane of mass 2.5×10^5 kg lands with a speed of 62 m/s, on a horizontal runway at time $t = 0$. The aeroplane decelerates uniformly as it travels along the runway in a straight line until it reaches a speed of 6.0 m/s at $t = 35$ s.

(a) Calculate:

(i) the deceleration of the aeroplane in the 35 s after it lands

deceleration = ... [2]

(ii) the resultant force acting on the aeroplane as it decelerates

force = ... [2]

(iii) the momentum of the aeroplane when its speed is 6.0 m/s.

momentum = ... [2]

(b) At $t = 35$ s, the aeroplane stops decelerating and moves along the runway at a constant speed of 6.0 m/s for a further 15 s.

On Fig. 1.1, sketch the shape of the graph for the distance travelled by the aeroplane along the runway between $t = 0$ and $t = 50$ s. You are **not** required to calculate distance values.

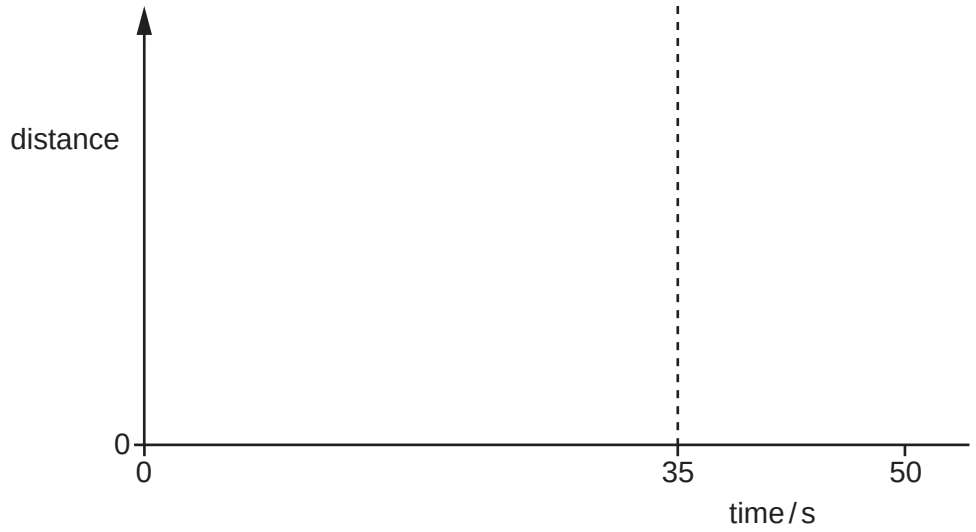

Fig. 1.1

[3]

(c) As the aeroplane decelerates, its kinetic energy decreases.

Suggest what happens to this energy.

.....

..... [1]

[Total: 10]

2 Fig. 2.1 is the extension–load graph for a light spring S.

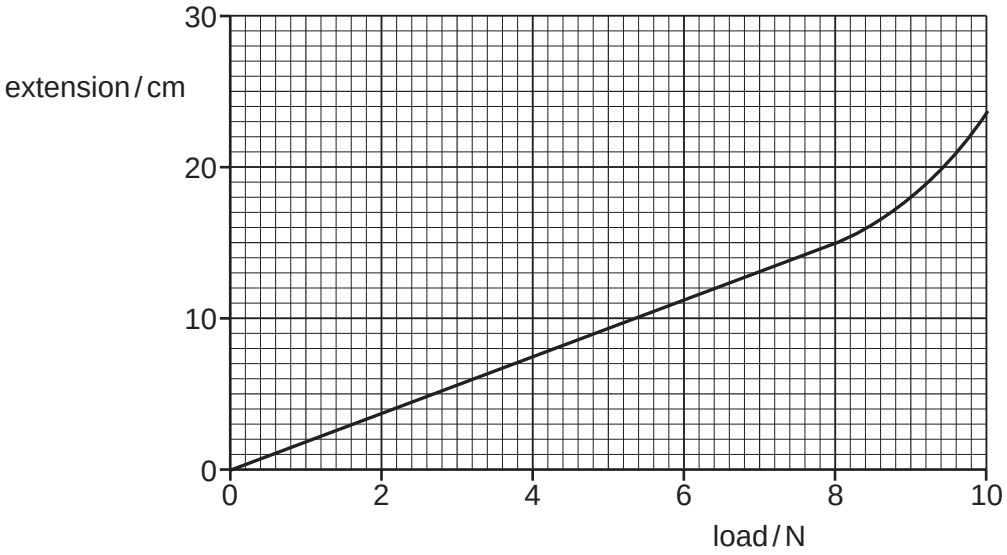

Fig. 2.1

(a) State the range of loads for which S obeys Hooke's law.

from ..... to ..... [1]

(b) Using information from Fig. 2.1, determine the spring constant *k* of spring S.

k = ... [2]

(c) A second spring, identical to spring S, is attached to spring S. The two springs are attached to a rod, as shown in Fig. 2.2. A load of 4.0 N is suspended from the bottom of spring S. The arrangement is in equilibrium.

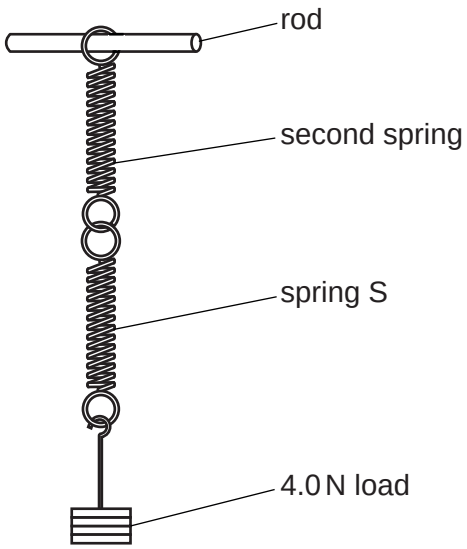

Fig. 2.2

(i) State the name of the form of energy stored in the two springs when they are stretched.

..... [1]

(ii) Determine the extension of the arrangement in Fig. 2.2.

extension = ... cm [1]

(iii) The load is carefully increased to 6.0 N in total.

Calculate the distance moved by the load to the new equilibrium position as the load increases from 4.0 N to 6.0 N.

distance moved = ... [1]

[Total: 6]

3 Fig. 3.1 shows gas trapped in the sealed end of a tube by a dense liquid.

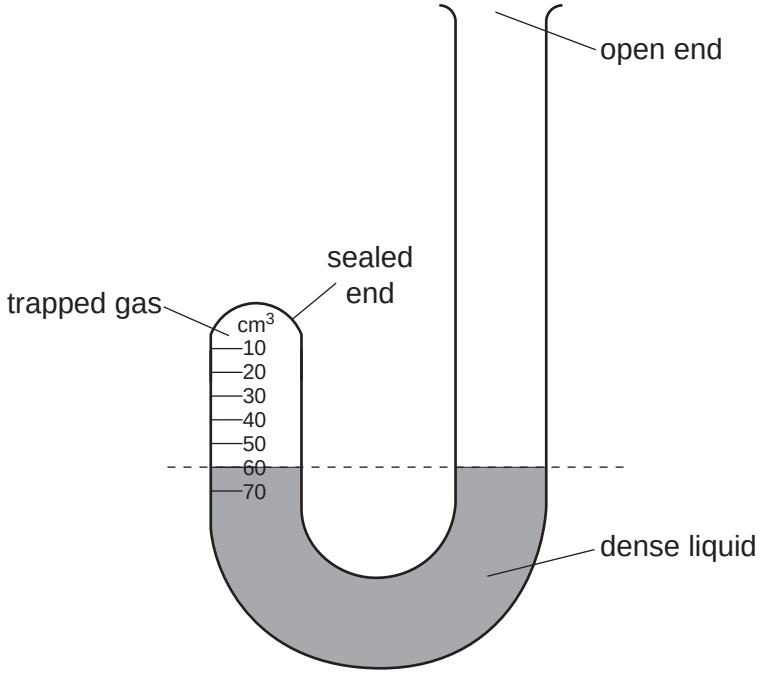

Fig. 3.1

The scale marked on the sealed end of the tube is calibrated to read the volume of gas trapped above the liquid surface. Fig. 3.1 shows that initially the volume V_1 of the gas is 60 cm^3.

The pressure of the atmosphere is 1.0×10^5 Pa.

(a) State how Fig. 3.1 shows that the pressure of the trapped gas is equal to the pressure of the atmosphere.

.....

..... [1]

(b) Explain, in terms of the momentum of its molecules, why the trapped gas exerts a pressure on the walls of the tube.

.....

.....

.....

..... [3]

(c) More of the dense liquid is poured into the open end of the tube. The level of the liquid surface in both the sealed and the open ends of the tube rises as shown in Fig. 3.2. The temperature of the trapped gas and atmospheric pressure both remain constant.

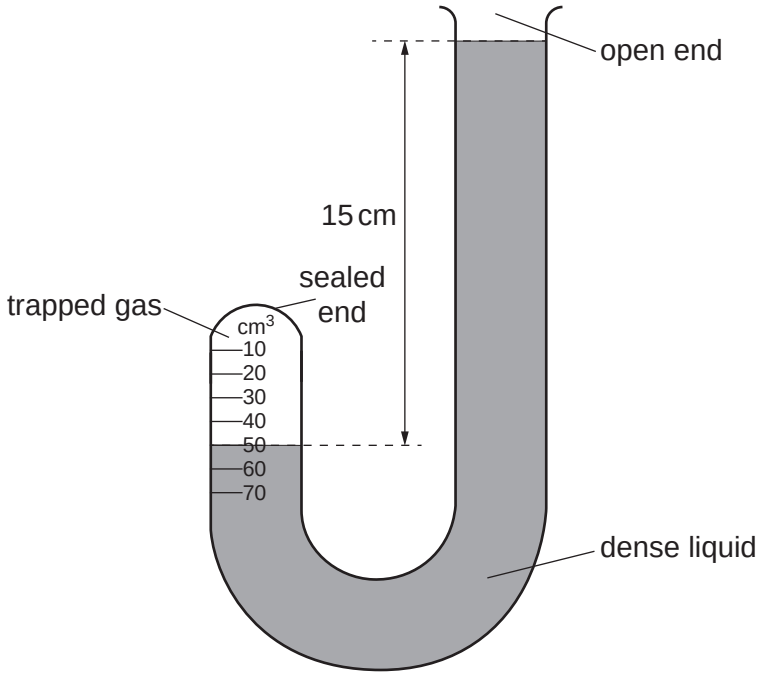

Fig. 3.2

(i) In the sealed end of the tube, the volume V_2 of the trapped gas is 50 cm^3. In the open end of the tube, the liquid surface is 15 cm above the new level in the sealed tube.

Calculate the pressure p_2 of the trapped gas.

pressure p_2 = ... [2]

(ii) Calculate the density of the liquid in the tube.

density = ... [2]

[Total: 8]

4 Water has a specific heat capacity of 4200 J / (kg °C) and a boiling point of 100 °C.

(a) State what is meant by *boiling point*.

.....

..... [1]

(b) A mass of 0.30 kg of water at its boiling point is poured into a copper container which is initially at 11 °C. After a few seconds, the temperature of the container and the water are both 95 °C.

(i) Calculate the energy transferred from the water.

energy transferred = ... [2]

(ii) Calculate the thermal capacity of the copper container.

thermal capacity of the copper container = ... [2]

(iii) Water from the container evaporates and the temperature of the remaining water decreases slowly.

Explain, in terms of molecules, why evaporation causes the temperature of the remaining water to decrease.

.....

.....

.....

..... [3]

[Total: 8]

5 The distance between the centre of a thin converging lens and each principal focus is 5.0 cm.

(a) Describe what is meant by the term *principal focus* for a thin converging lens.

.....

.....

..... [2]

(b) The lens is used as a magnifying glass to produce an image I of an object O.

(i) Underline the terms that describe the nature of the image produced by a magnifying glass. [2]

diminished enlarged inverted real same size upright virtual

(ii) Fig. 5.1 is a full-scale diagram of the lens and the image I.

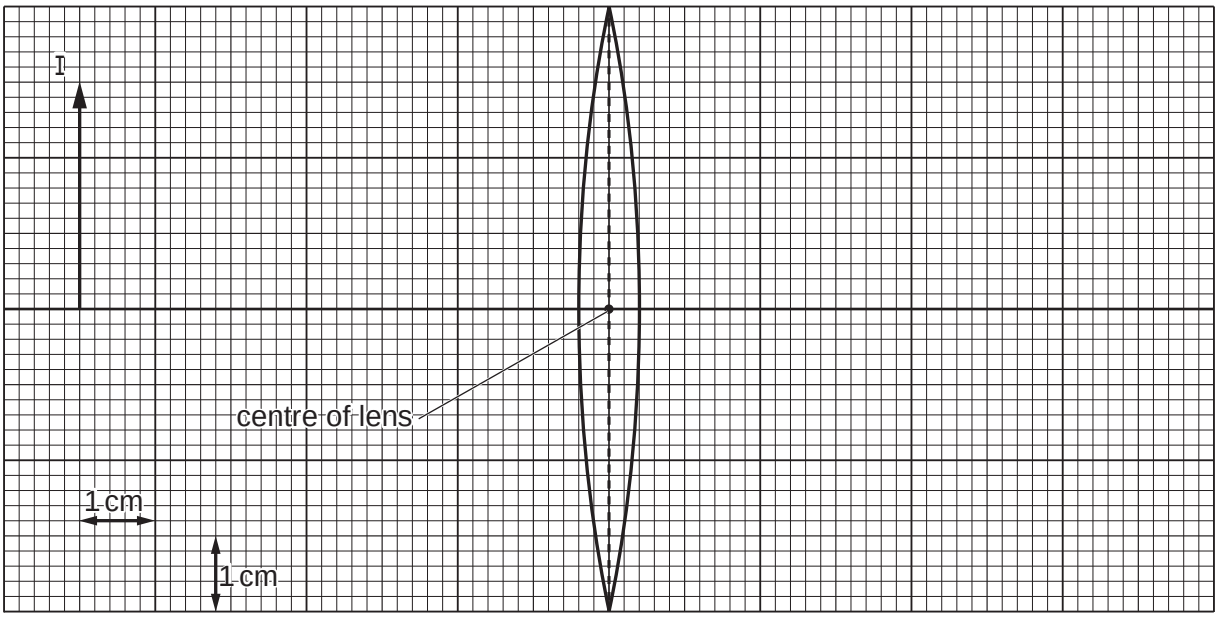

Fig. 5.1 (full-scale)

1. On Fig. 5.1, mark both principal focuses and label each of them F. [1]

2. By drawing on Fig. 5.1, find the position of object O and add object O to the diagram. [3]

(iii) Using Fig. 5.1, determine the distance of object O from the centre of the lens.

distance = ... [1]

[Total: 9]

6 The speed of sound in air is 340 m / s.

(a) Calculate the range of wavelengths for sounds that are audible by a healthy human ear.

wavelengths range from ..... to ..... [2]

(b) Sound waves are longitudinal waves.

Describe how a longitudinal wave differs from a transverse wave.

.....

.....

.....

..... [3]

(c) Fig. 6.1 shows a band in front of a building.

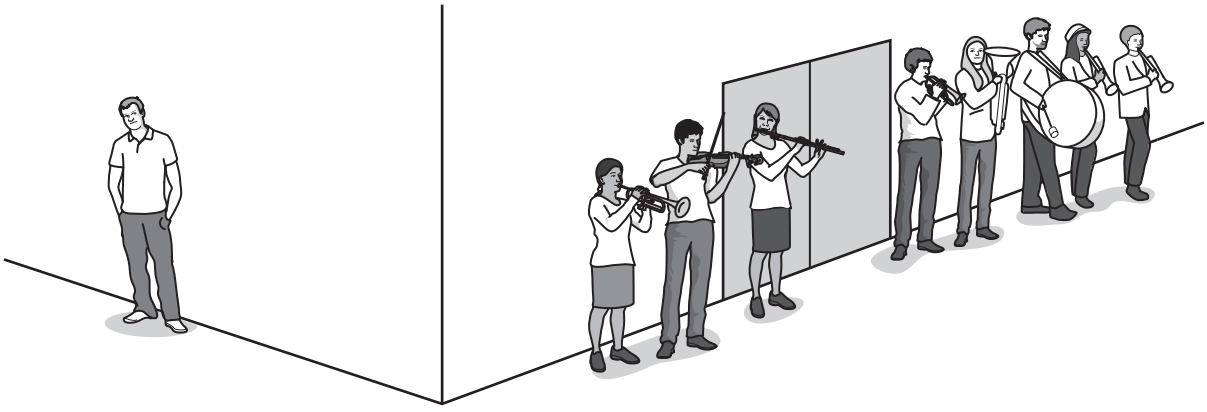

Fig. 6.1

The drum produces a low frequency sound. Other musical instruments produce a high frequency sound. These sounds are equally loud.

A young man at the side of the building hears the drum but not the high frequency sounds from the other musical instruments.

Explain why this happens.

.....

.....

..... [3]

[Total: 8]

7 An electromagnet consists of a solenoid X that is made of copper wire. The solenoid contains an iron core.

(a) Explain why:

(i) the structure of copper makes it a suitable material for the wire

.....

.....

..... [2]

(ii) iron is a suitable material for the core of an electromagnet.

.....

.....

..... [2]

(b) Fig. 7.1 shows the electromagnet inside a second solenoid Y.

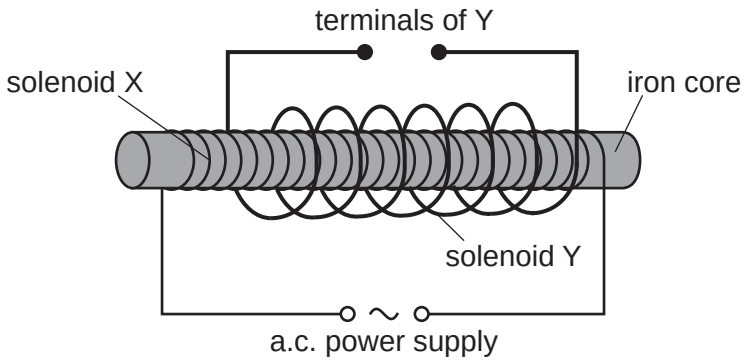

Fig. 7.1

(i) Describe and explain what happens in solenoid Y when solenoid X is connected to an alternating current (a.c.) power supply.

.....

.....

.....

..... [3]

(ii) A switch and a lamp are connected in series with the terminals of solenoid Y. When the switch is closed, the lamp lights up at normal brightness.

Describe and explain what happens to the current in solenoid X when the switch is closed.

.....

.....

..... [2]

[Total: 9]

8 The power supply used in an electric vehicle contains 990 rechargeable cells each of electromotive force (e.m.f.) 1.2 V.

The cells are contained in packs in which all the cells are in series with each other. The e.m.f. of each pack is 54 V.

(a) Calculate the number of packs in the power supply.

number of packs = ... [2]

(b) When in use, each pack supplies a current of 3.5 A.

(i) Calculate the rate at which each cell is transferring chemical energy to electrical energy.

rate of energy transfer = ... [2]

(ii) The packs are connected in parallel to supply a large current to drive the electric vehicle.

Explain why it is necessary to use thick wires to carry this current.

.....

.....

.....

..... [3]

[Total: 7]

9 **(a)** Describe how a digital signal differs from an analogue signal. You may draw a diagram.

.....

.....

..... [2]

(b) **(i)** In the appropriate box, draw the symbol for an AND gate and the symbol for an OR gate.

AND gate	OR gate

[1]

(ii) State how the behaviour of an AND gate differs from that of an OR gate.

.....

..... [1]

(c) An arrangement of logic gates A, B and C is shown in Fig. 9.1. The arrangement has two inputs, X and Y and two outputs P and Q.

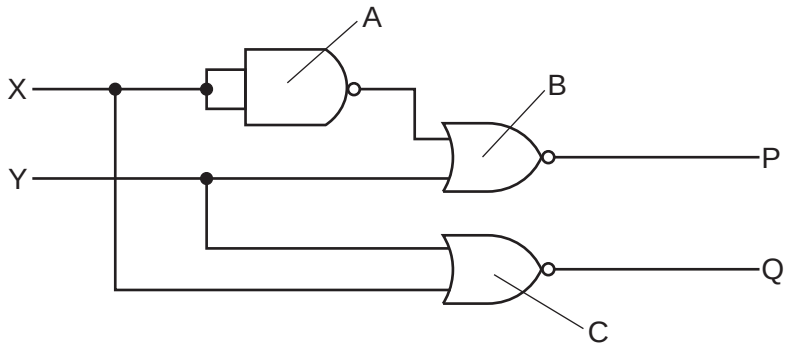

Fig. 9.1

Output P of logic gate B has logic state 1 (high).

(i) Determine the logic states of the two inputs of logic gate B.

upper input = ...

lower input = ...
[1]

(ii) Determine and explain the logic state of output Q.

.....

.....

.....

.....

logic state of Q = ... [3]

[Total: 8]

10 Fig. 10.1 represents a neutral atom of an isotope of element X.

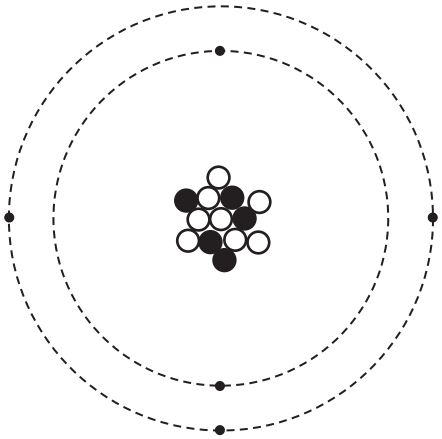

Fig. 10.1

(a) State **one** similarity between this atom and a neutral atom of a different isotope of element X.

.....

..... [1]

(b) The isotope of element X is radioactive. It decays to form an isotope of element Y by emitting a β-particle.

(i) Using Fig. 10.1 deduce the nuclide notation for the isotope of Y produced by this decay.

nuclide notation: $^{\ldots\ldots}_{\ldots\ldots}\mathrm{Y}$ [3]

(ii) β-particles ionise the air they pass through less strongly than the same number of α-particles.

Suggest why this is so.

.....

.....

..... [3]

[Total: 7]

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CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

PHYSICS **0625/43**

Paper 4 Theory (Extended) **May/June 2020**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.
- Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s^2).

INFORMATION

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

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DC (ST/CT) 194262/3

1 **(a)** Define *acceleration*.

.....

..... [1]

(b) Fig. 1.1 shows two speed–time graphs, A and B, and two distance–time graphs, C and D.

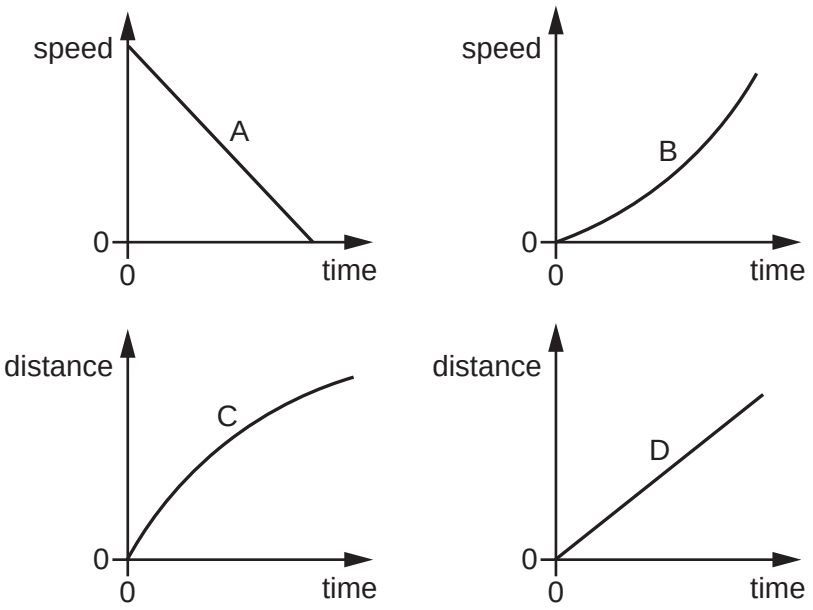

Fig. 1.1

Describe the motion shown by:

(i) graph A .....

..... [2]

(ii) graph B .....

..... [2]

(iii) graph C .....

..... [1]

(iv) graph D. .....

..... [1]

[Total: 7]

2 A scientist fills a container with sea water. The container has dimensions 30 cm × 30 cm × 40 cm. The density of sea water is 1020 kg / m^3.

(a) Calculate the mass of the sea water in the container.

mass = ... [3]

(b) Fig. 2.1 shows a submarine. The submarine is fully submerged in the sea.

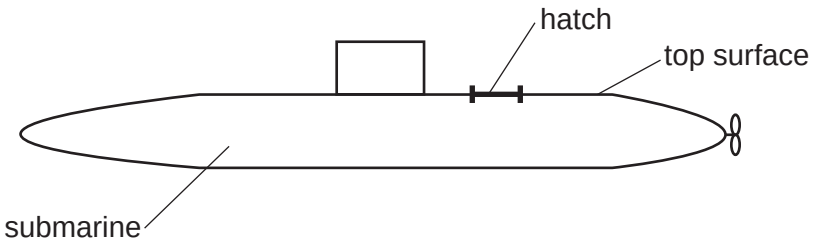

Fig. 2.1

(i) The atmospheric pressure is 100 kPa and the total pressure on the top surface of the submarine is 500 kPa.

Calculate the depth of the top surface of the submarine below the surface of the sea.

depth = ... [3]

(ii) A hatch (an opening door) on the top surface of the submarine has an area of 0.62 m^2.

Calculate the downward force on the hatch due to the total pressure on the top surface of the submarine.

force = ... [2]

[Total: 8]

3 In a double-decker bus there are two passenger compartments, one above the other.

(a) Fig. 3.1 shows a double-decker bus on a tilted platform.

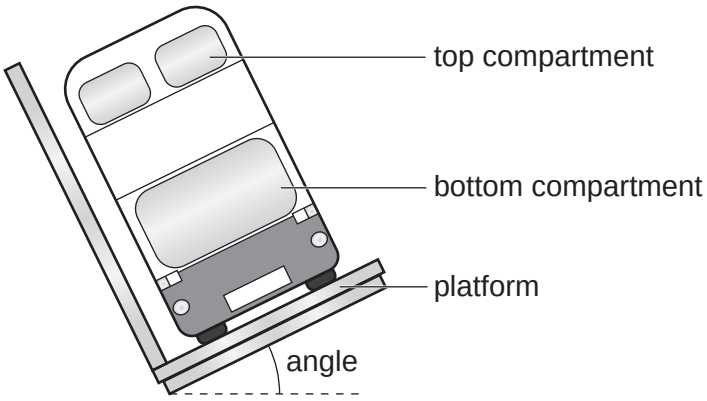

Fig. 3.1

The platform is used to test the stability of the bus.

The angle the bus makes with the horizontal is gradually increased until the bus begins to topple to the left.

Explain why the bus begins to topple.

.....

.....

..... [1]

(b) There are 30 passengers in the upper compartment of the bus and 2 passengers in the bottom compartment of the bus.

State how this affects the stability of the bus and the reason for this.

.....

.....

..... [2]

(c) A bus is travelling along a straight road. The bus and the driver have a combined mass of 16 000 kg when there are no passengers in it. The bus has 73 passengers. The average mass of each of the passengers is 65 kg.

(i) Calculate the total mass of the bus, the driver and the 73 passengers.

mass = ... [2]

(ii) The fully loaded bus accelerates uniformly from rest to a speed of 14 m/s. The time taken to reach a speed of 14 m/s is 20 s.

Calculate the resultant force on the bus during the acceleration.

force = ... [2]

[Total: 7]

4 **(a)** Describe, in terms of molecules, what happens when a liquid evaporates.

.....

.....

.....

.....

.....

..... [4]

(b) Fig. 4.1 shows wet clothes drying on a washing line in an outside area.

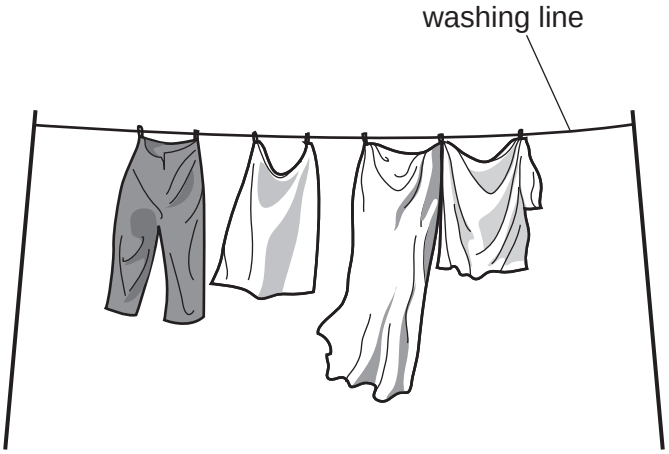

Fig. 4.1

State **two** changes in the weather that help the wet clothes to dry more quickly.

1. .....

2. .....

[2]

[Total: 6]

5 **(a)** Fig. 5.1 shows a plastic cup. The cup contains sand, an electric heater and a thermometer.

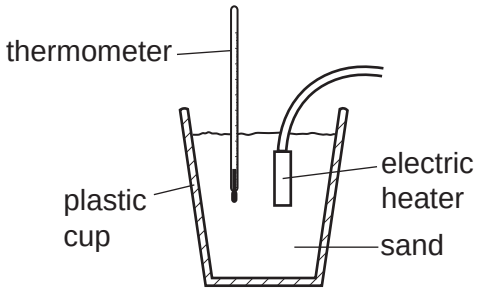

Fig. 5.1

The power of the heater is 50 W. The mass of the sand in the cup is 550 g. The initial temperature of the sand is 20 °C. The heater is switched on for 2.0 minutes. The temperature is recorded until the temperature stops increasing. The highest temperature recorded by the thermometer is 33 °C.

(i) Calculate the energy supplied by the heater.

energy = ... [2]

(ii) Calculate a value for the specific heat capacity of the sand, using your answer to **(a)(i)** and the data in the question.

specific heat capacity = ... [3]

(iii) Explain why the specific heat capacity of sand may be different from the value calculated in **(a)(ii)**.

.....

..... [2]

(b) On a sunny day, the temperature of the sand on a beach is much higher than the temperature of the sea.

Explain why.

.....

.....

..... [2]

(c) Draw a labelled diagram to show the structure of a thermocouple thermometer.

[3]

[Total: 12]

6 **(a)** Fig. 6.1 shows crests of a sound wave after reflection from a solid surface.

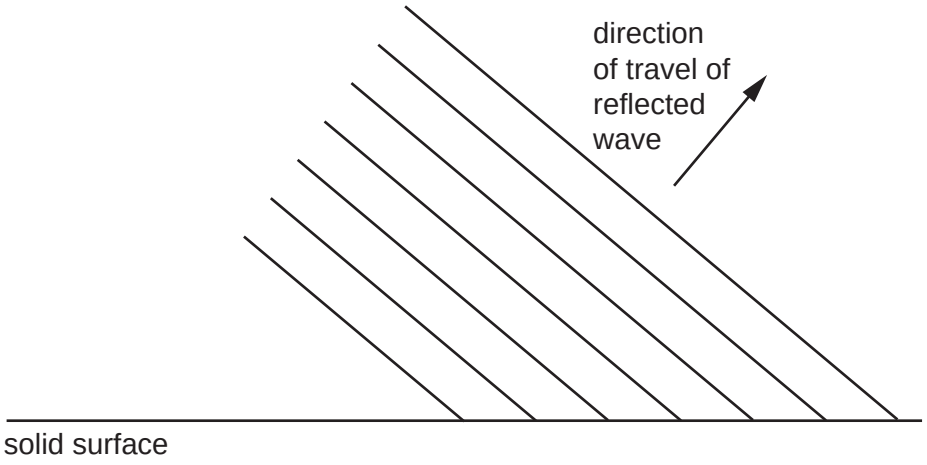

Fig. 6.1

On Fig. 6.1, draw **three** crests of the incident wave. [3]

(b) Tick **four** statements in the list below that are **false** for a sound wave that is audible to a healthy human ear.

The wave is longitudinal.	☐
The wave is transverse.	☐
The frequency of the wave is 1 Hz.	☐
The frequency of the wave is 1 kHz.	☐
The frequency of the wave is 1 MHz.	☐
The wave travels in a vacuum.	☐
The wave could travel in aluminium.	☐

[3]

(c) State a typical value for the speed of a sound wave in water.

..... [1]

[Total: 7]

7 Fig. 7.1 shows red light travelling from air into a prism made of diamond. The path of the red light is incomplete.

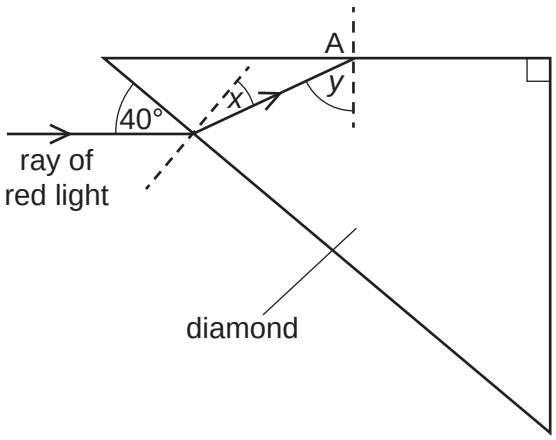

Fig. 7.1 (not to scale)

(a) The refractive index of diamond is 2.42.

Calculate angle *x*.

angle *x* = ... [2]

(b) Explain the term *total internal reflection*.

.....

.....

.....

.....

..... [3]

(c) The angle *y* is greater than the critical angle of diamond.

On Fig. 7.1, draw the path of the red light through and out of the prism after point A. [2]

[Total: 7]

8 **(a)** **(i)** Describe what is meant by an *electric field*.

.....

..... [1]

(ii) State what is meant by the *direction* of an electric field.

.....

..... [1]

(b) Fig. 8.1 shows a polystyrene ball covered with aluminium paint. The polystyrene ball is suspended between two charged metal plates by an insulated thread.

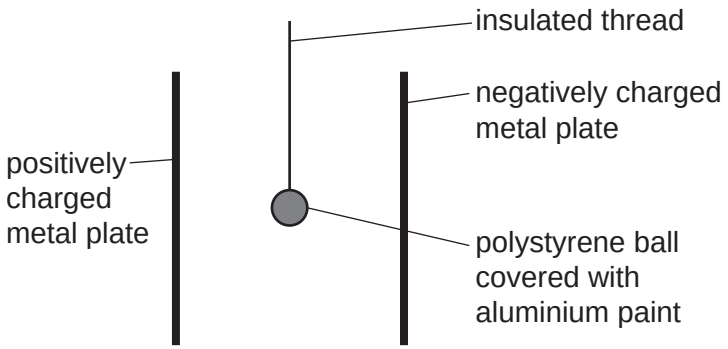

Fig. 8.1

The ball oscillates between the two charged plates.

Explain why the ball oscillates.

.....

.....

.....

.....

.....

..... [4]

(c) There is a current of 0.29 A in an electrical circuit.

Calculate the time taken for a charge of 15 C to flow through the electrical circuit.

time = ... [3]

[Total: 9]

9 Fig. 9.1 shows a simple direct current (d.c.) electric motor. The coil rotates about the axis when there is a current in the coil. The coil is connected to the rest of the circuit by the brushes.

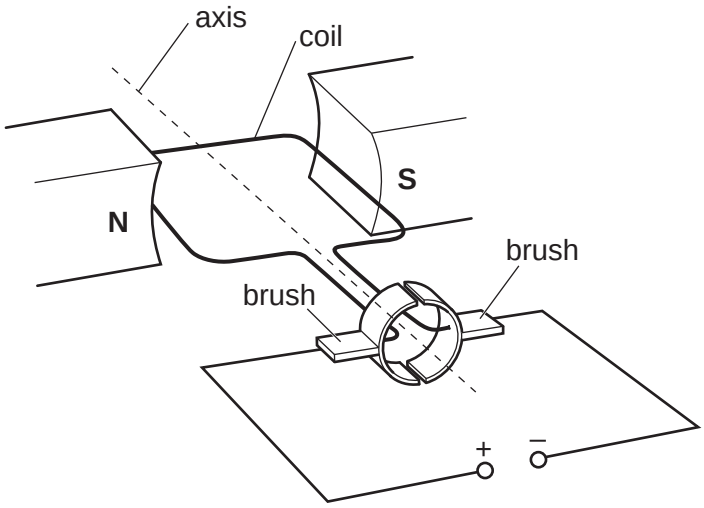

Fig. 9.1

(a) (i) On Fig. 9.1, draw a pair of arrows to show which way the coil rotates. Explain the direction you have chosen.

.....

.....

..... [3]

(ii) On Fig. 9.1, draw an arrow to show the direction in which electrons flow through the coil. [1]

(iii) Explain why the electrons flow in the direction you have shown in **(a)(ii)**.

.....

..... [1]

(b) State any difference each of the following changes makes to the rotation of the coil in Fig. 9.1:

(i) changing the polarity of the power supply to that shown in Fig. 9.2

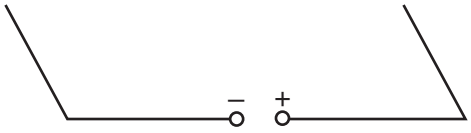

Fig. 9.2

..... [1]

(ii) changing the coil to the new coil shown in Fig. 9.3

original coil new coil

Fig. 9.3

..... [1]

(iii) using a stronger magnetic field.

..... [1]

[Total: 8]

10 **(a)** A radioactive nucleus of carbon decays to a nucleus of nitrogen by emitting a particle.

Complete the nuclide equation and state the name of the particle.

$$^{14}_{6}C \longrightarrow {}^{14}_{7}N + {}^{\cdots\cdots}_{\cdots\cdots}X$$

name of particle X …….. [3]

(b) A radiation detector in a laboratory records a reading of 10 counts / min. There are no radioactive samples in the laboratory.

(i) Explain why the radiation detector records a reading and suggest a possible source.

explanation .....

source .....

..... [2]

(ii) Carbon-14 has a half-life of 5700 years. There are atoms of carbon-14 in all living organisms.

An archaeologist digs up some ancient wood. In the same laboratory as in **(b)(i)**, a sample of this ancient wood gives a reading of 20 counts / min. An equivalent sample of living wood gives a reading of 80 counts / min. It is suggested that the age of the ancient sample is 11 400 years.

Do a calculation to check whether this suggestion is correct.

[4]

[Total: 9]

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CENTRE NUMBER						CANDIDATE NUMBER			

PHYSICS **0625/61**

Paper 6 Alternative to Practical **May/June 2020**

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

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DC (LK/SW) 195015/4

1 A student investigates the balancing of a metre rule.

Fig. 1.1 shows the arrangement.

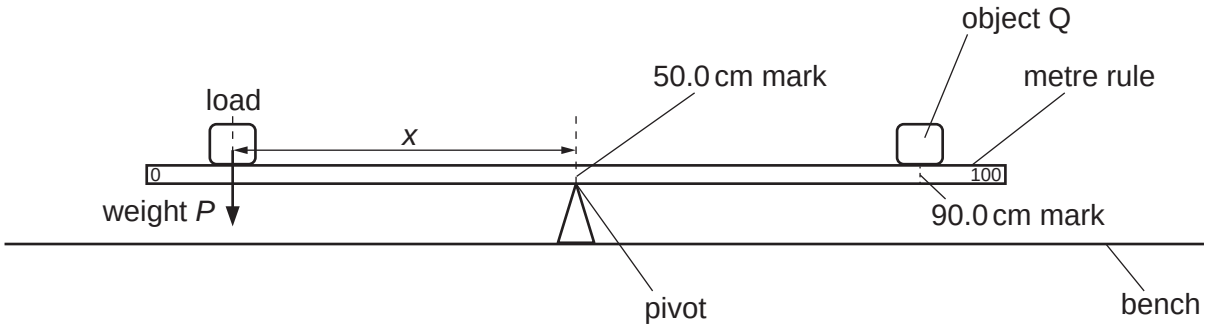


Fig. 1.1

(a) The student places the metre rule on the pivot at the 50.0 cm mark. He places an object Q on the metre rule with its centre at the 90.0 cm mark. He places a load of weight P = 2.0 N on the metre rule and adjusts the position of the load so that the metre rule is as near as possible to being balanced.

He measures the distance x from the centre of the load to the pivot.

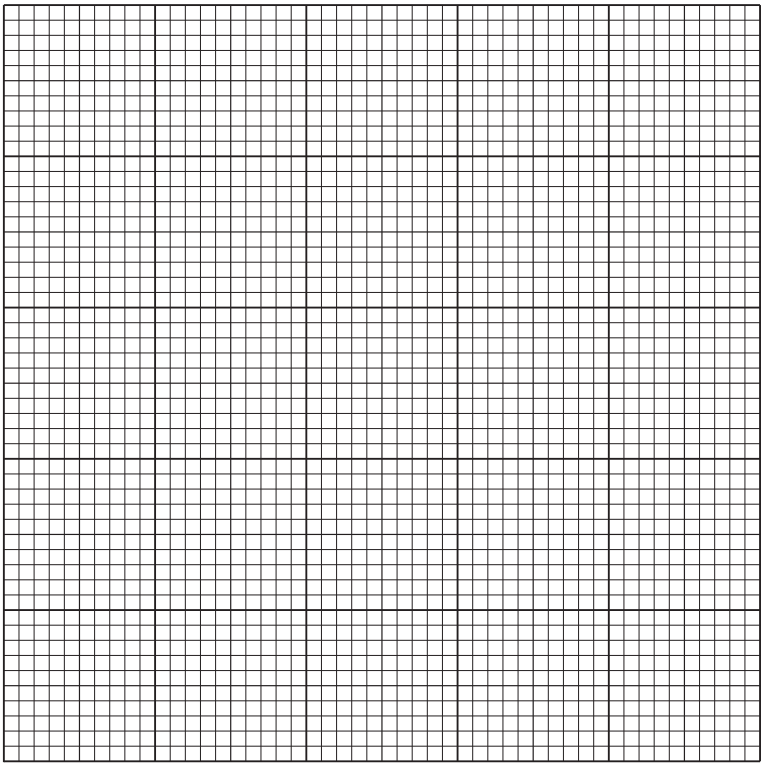
He repeats the procedure using loads of weight P = 3.0 N, 4.0 N, 5.0 N and 6.0 N. All the values of P and x are recorded in Table 1.1.

Table 1.1

P / N	x / cm	$\frac{1}{x} \Big/ \frac{1}{\text{cm}}$
2.0	40.0	
3.0	27.0	
4.0	20.0	
5.0	15.9	
6.0	13.3	

Calculate, and record in Table 1.1, the values of $\frac{1}{x}$. [2]

(b) Plot a graph of P/N (y-axis) against $\frac{1}{x} \Big/ \frac{1}{\text{cm}}$ (x-axis). Start both axes at the origin (0,0).



[4]

(c) In this experiment, x_{max}, the maximum possible value for x is 50.0 cm. Calculate $\frac{1}{x_{max}}$.

$$\frac{1}{x_{max}} = \text{.....} \ \frac{1}{\text{cm}}$$

Use the graph to determine the minimum value of P required to balance the metre rule in this experiment. Show clearly on the graph how you determined this value.

minimum value of P = ... [2]

(d) In this experiment, the width of object Q is slightly greater than the width of the metre rule. Explain briefly how you would place the object Q as accurately as possible on the 90.0 cm mark of the metre rule. You may draw a diagram.

.....

.....

.....

..... [1]

(e) In this experiment, it is difficult to determine the exact position of the load that will make the metre rule balance.

(i) Explain briefly why this is difficult.

.....

.....

..... [1]

(ii) Explain briefly how you would find the best position of the load that will make the metre rule balance.

.....

.....

..... [1]

[Total: 11]

2 A student determines the resistances of some filament lamps.

Fig. 2.1 shows the first circuit she uses.

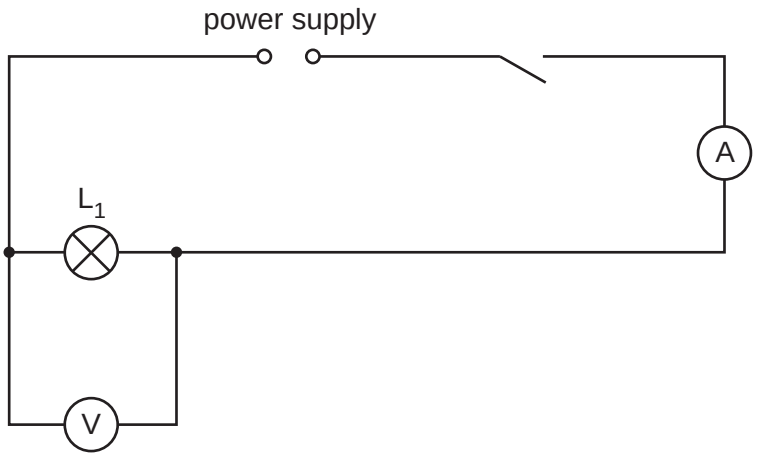


Fig. 2.1

(a) (i) Record the potential difference V_1 across the lamp L_1, as shown on the voltmeter in Fig. 2.2.

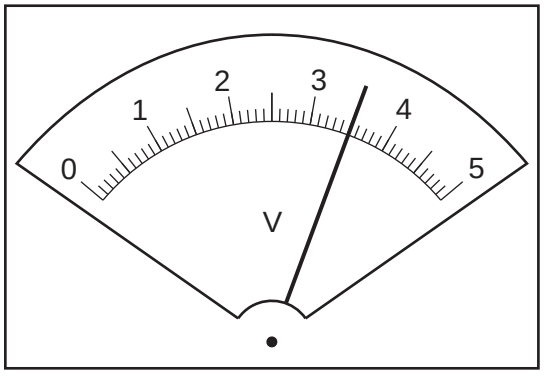


Fig. 2.2

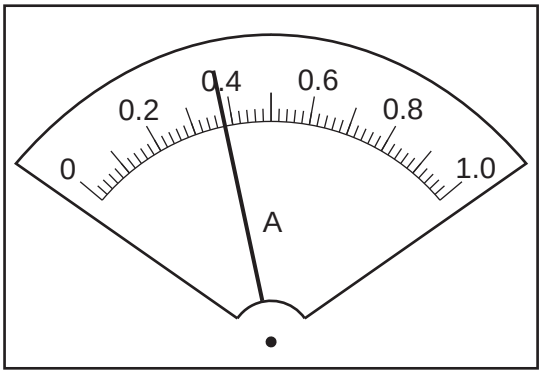


Fig. 2.3

V_1 = ... V [1]

(ii) Record the current I_1 in the circuit, as shown in Fig. 2.3.

I_1 = ... A [1]

(iii) Calculate the resistance R_1 of the filament of lamp L_1. Use the equation $R_1 = \frac{V_1}{I_1}$. Include the unit.

R_1 = ... [2]

(b) The student disconnects the voltmeter. She connects lamp L_2 in series with lamp L_1. She connects the voltmeter across lamp L_2.

She measures the current I_2 in the circuit and the potential difference V_2 across lamp L_2.

I_2 = 0.30 A

V_2 = 1.7 V

Calculate the resistance R_2 of the filament of lamp L_2. Use the equation $R_2 = \frac{V_2}{I_2}$.

R_2 = ...

The student disconnects the voltmeter. She connects lamp L_3 in series with lamps L_1 and L_2. She connects the voltmeter across lamp L_3.

She measures the current I_3 in the circuit and the potential difference V_3 across lamp L_3.

I_3 = 0.26 A

V_3 = 1.2 V

Calculate the resistance R_3 of the filament of lamp L_3. Use the equation $R_3 = \frac{V_3}{I_3}$.

R_3 = ...
[1]

(c) Calculate $R_1 + R_2 + R_3$. Give your answer to a suitable number of significant figures for this experiment.

$R_1 + R_2 + R_3$ = ... [1]

(d) Some students make suggestions about the results of the experiment.

Suggestion **A**: $R_1 + R_2 + R_3$ should be equal to $3 \times R_1$.

Suggestion **B**: $R_1 + R_2 + R_3$ should be less than $3 \times R_1$.

Suggestion **C**: $R_1 + R_2 + R_3$ should be greater than $3 \times R_1$.

State which suggestion **A**, **B** or **C** agrees with your results. Justify your answer by reference to your results.

statement .....

justification .....

.....
[2]

(e) Draw a circuit diagram to show the circuit used in part **(b)** with all three lamps connected in series.

[3]

[Total: 11]

3 A student investigates the position of the image in a plane mirror.

Fig. 3.1 shows the ray-trace sheet he uses.

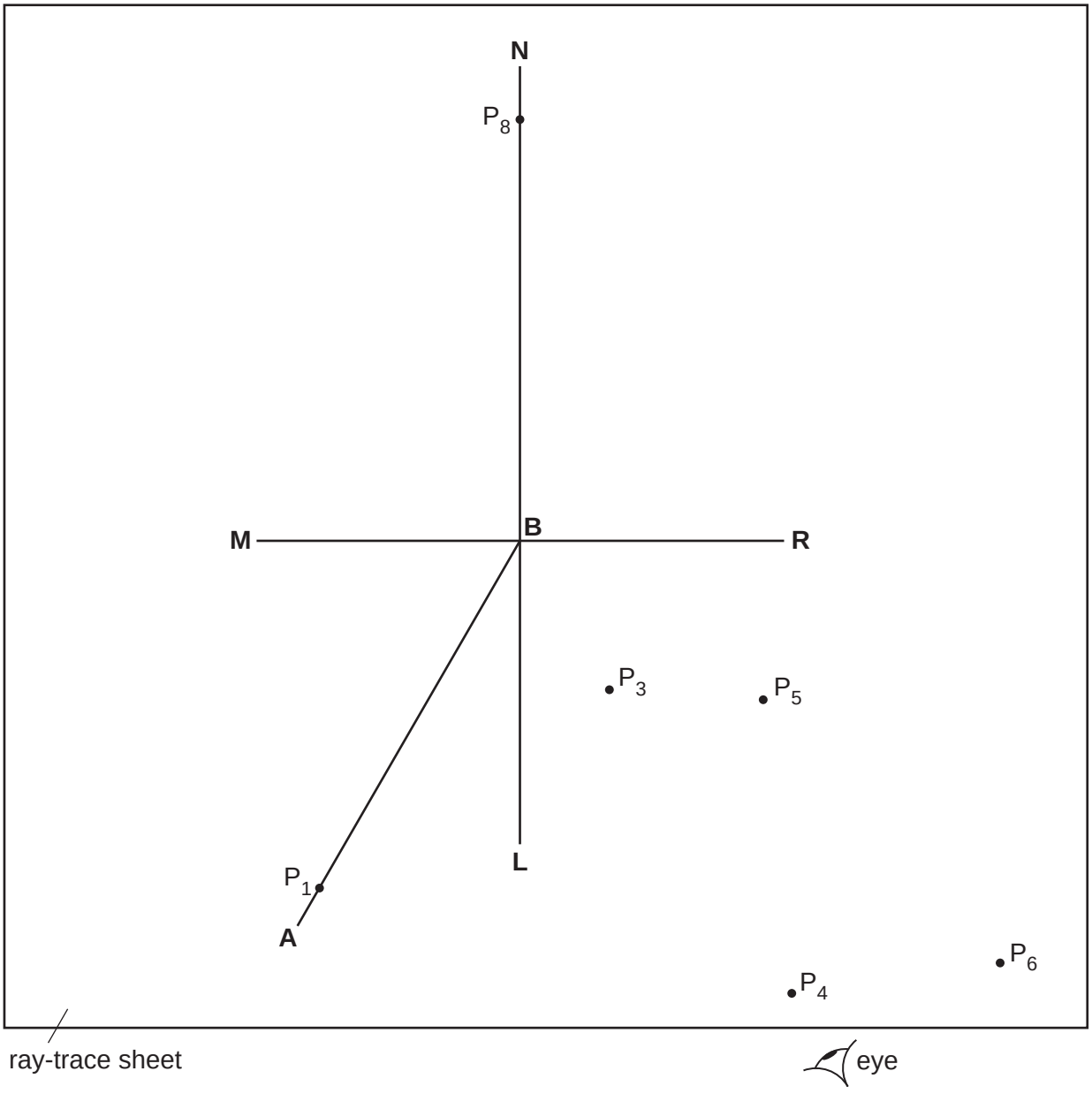


Fig. 3.1

(a)

- The student draws the line **MR**.
- He draws a normal **NL** to this line that passes through the centre of **MR**.
- He labels the point at which **NL** crosses **MR** with the letter **B**.
- He draws a line from **B** at an angle of incidence $i = 30°$ to the normal below **MR** and to the left of the normal. He labels the end of this line **A**.
- He places a pin P_1 on line **AB**, as shown in Fig. 3.1. He places another pin P_2 on the line **AB**.
- He places the reflecting face of the mirror vertically on the line **MR**.
- He views the images of pins P_1 and P_2 from the direction indicated by the eye in Fig. 3.1.

(i) On Fig. 3.1, mark with a cross a suitable position for pin P_2 in this experiment. [1]

- He places two pins P_3 and P_4 some distance apart so that pin P_3 and the images of P_2 and P_1 all appear exactly behind pin P_4. The positions of P_3 and P_4 are shown on Fig. 3.1.

(ii) Draw the line joining the positions of P_3 and P_4. Continue the line until it extends at least 7.0 cm beyond **MR**. [2]

(b)

- The student keeps pin P_1 in the same position but moves pin P_2 so that the angle of incidence $i = 40°$.
- The pin positions P_5 and P_6 for the reflected ray are marked on Fig. 3.1.

(i) Draw the line joining the positions of P_5 and P_6. Continue the line until it extends at least 7.0 cm beyond **MR**.

Label with the letter **Y** the point where the two lines cross beyond **MR**. [1]

(ii) Draw a line from P_1 to **MR** that meets **MR** at a right angle. Measure and record the length *a* of this line.

a = ... [1]

(iii) Draw a line from the point labelled **Y** to **MR** that meets **MR** at a right angle. Measure and record the length *b* of this line.

b = ... [1]

(c)

- The student removes all the pins. He places pin P_7 on the normal at a distance 6.0 cm from the front of the mirror.
- He views the image of P_7 in the mirror.
- He places pin P_8 on the normal behind the mirror.
- He adjusts the position of P_8 so that the image of the bottom of the pin P_7 and the top of pin P_8 seen over the mirror appear as one pin when viewed from all angles in front of the mirror.

(i) On Fig. 3.1, measure the distance *x* along the normal between P_8 and the mirror.

x = ... [1]

(ii) Complete the diagram in Fig. 3.2 to show the appearance of the image of pin P_7 and pin P_8 as described in **(c)**.

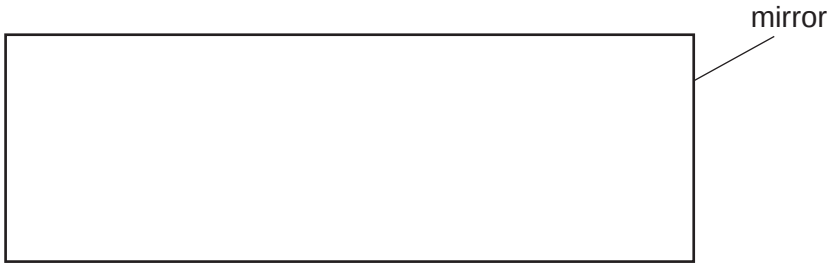


Fig. 3.2

[1]

(d) The student expects the readings to show that the image formed in a plane mirror is the same distance behind the mirror as the object is in front of the mirror. Readings of *a* = *b* and *x* = 6.0 cm will show this.

State whether your readings show that the image formed in a plane mirror is the same distance behind the mirror as the object is in front of the mirror. Justify your statement by reference to the readings.

statement .....

justification .....

.....

[2]

(e) The student carries out this experiment with care. Suggest a practical reason why the results may not be accurate.

.....

..... [1]

[Total: 11]

4 A student investigates the effect of the colour of the surface of a metal container on the rate of loss of heat from the container. She knows that black surfaces are better radiators of thermal energy than white surfaces and wants to investigate the effect of other colours.

The following apparatus is available:

metal containers each with the outer surface painted a different colour
a thermometer
a stop-watch
a supply of hot water.

She can also use other apparatus and materials that are usually available in a school laboratory.

Plan an experiment to investigate the effect of the colour of the surface of a metal container on the rate of loss of heat from the container.

You should:

- draw a diagram of the apparatus used
- explain briefly how you would carry out the investigation
- state the key variables to be kept constant
- draw a table, or tables, with column headings, to show how you would display your readings (you are **not** required to enter any readings in the table)
- explain how you would use your readings to reach a conclusion.

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[Total: 7]

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

7061103471

PHYSICS **0625/63**

Paper 6 Alternative to Practical **May/June 2020**

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Blank pages are indicated.

DC (CJ/CGW) 195057/3

1 A student determines the weight of a metre rule.
She uses the apparatus shown in Fig. 1.1.
The metre rule is supported by a pivot **at the 10.0 cm mark** and is suspended from a forcemeter by a loop of thread at the 90.0 cm mark.

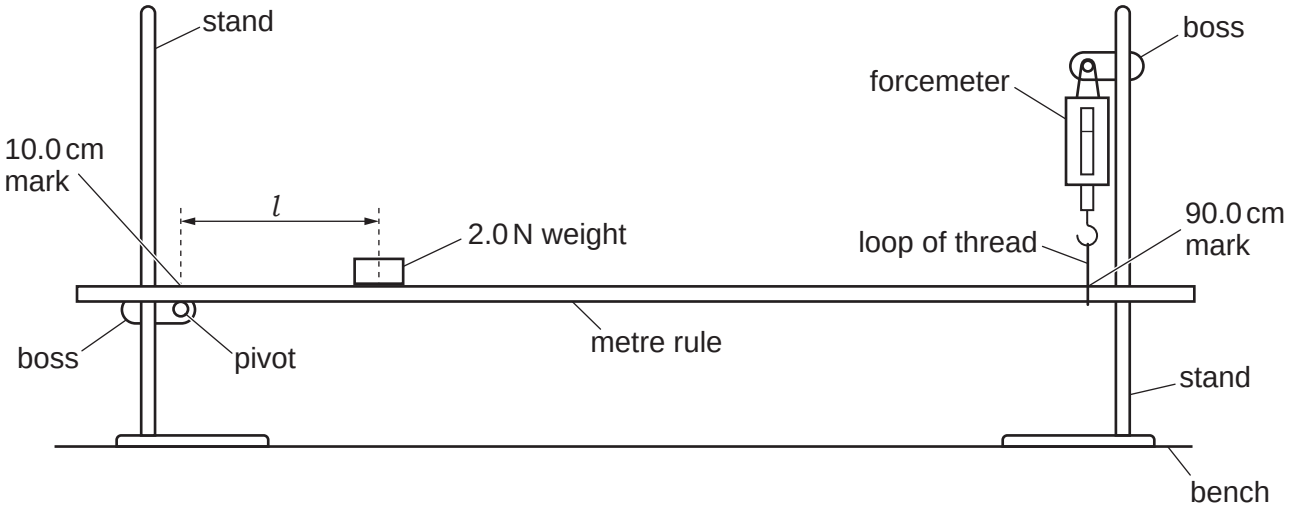


Fig. 1.1

(a) The student places a 2.0 N weight at a distance l from the pivot.
She then adjusts the height of the clamp holding the pivot so that the metre rule is horizontal.
She reads the force F on the forcemeter.
Fig. 1.2 shows the weight and the metre rule from above.
Fig. 1.3 shows the reading on the forcemeter.

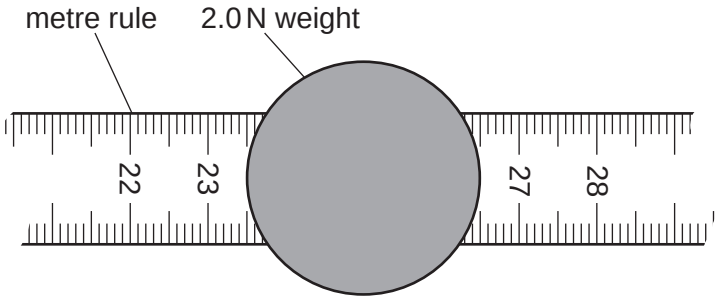


Fig. 1.2 (not to scale)

(i) Calculate the value of l from readings taken from Fig. 1.2.
Show your working clearly.

l = ... cm [2]

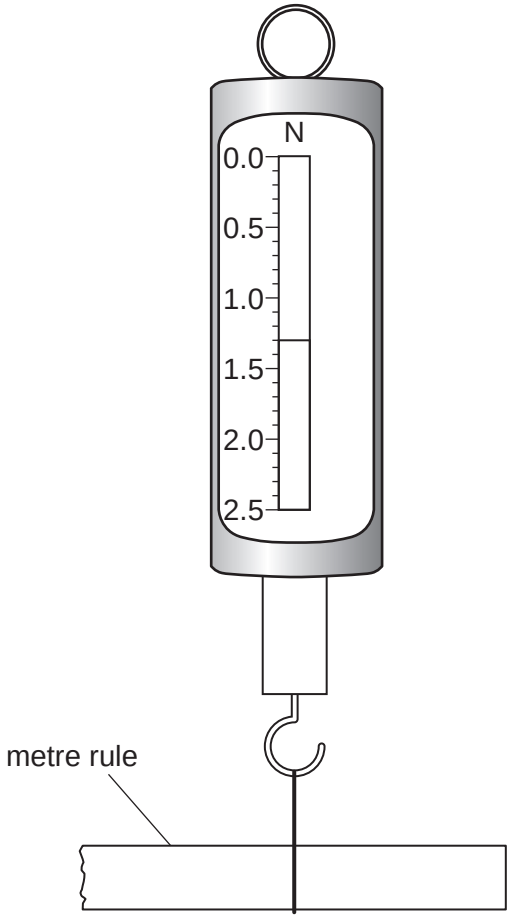


Fig. 1.3

(ii) Read the value *F* shown on the forcemeter in Fig. 1.3.

F = ... N [1]

(iii) Explain how the student makes sure that the rule is horizontal before taking the reading. You may draw a diagram.

.....

.....

..... [1]

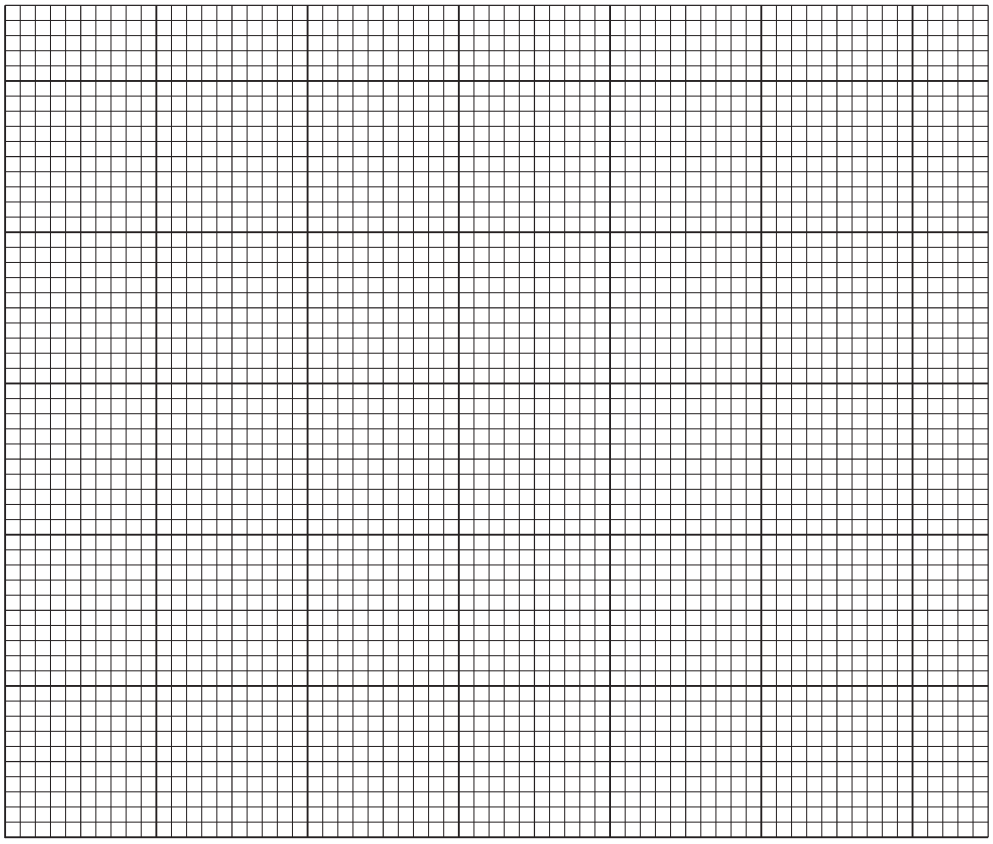
[Turn over

(b) The student carries out the procedure for values of l = 20.0 cm, 30.0 cm, 40.0 cm, 50.0 cm and 60.0 cm. Her readings are shown in Table 1.1.

Table 1.1

l / cm	F / N
20.0	1.35
30.0	1.60
40.0	1.90
50.0	2.15
60.0	2.45

Plot a graph of F / N (y-axis) against l / cm (x-axis).
Start your axes from the origin (0,0).



[4]

(c) **(i)** From your graph determine F_0, the value of F when l = 0.

F_0 = ... N [1]

(ii) Calculate the weight W_R of the metre rule, using the equation $W_R = 2 \times F_0$.

W_R = ... N [1]

(d) Another student carrying out this experiment finds it difficult to be sure that he has placed the centre of the 2.0 N weight on the metre rule at the correct value of l.

Suggest a more precise method of applying a 2.0 N load to the metre rule in this experiment. Explain why this method is an improvement.

.....

.....

..... [1]

[Total: 11]

2 Some students investigate a circuit containing different combinations of resistors.
Part of the circuit they are using is shown in Fig. 2.1.

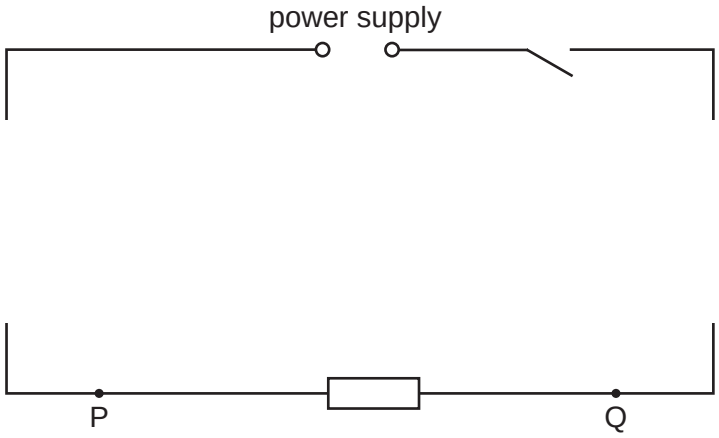


Fig. 2.1

(a) (i) On Fig. 2.1, complete the circuit to show:

- an ammeter connected to measure the current in the circuit
- a voltmeter connected to measure the potential difference (p.d.) across terminals P and Q.

[2]

(ii) A student measures the potential difference V_1 across terminals P and Q and the current I_1 in the circuit.

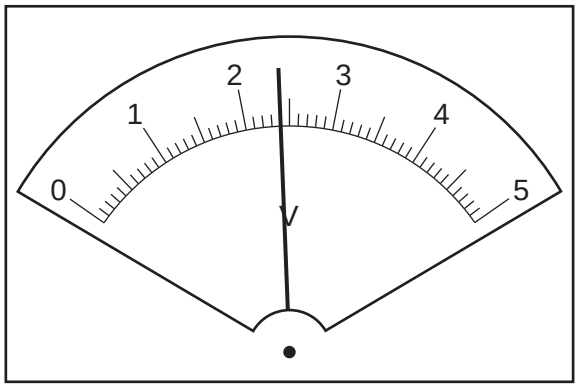


Fig. 2.2

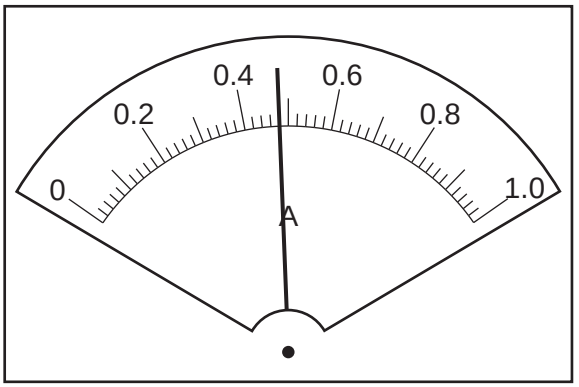


Fig. 2.3

Read the values of V_1 and I_1 shown on the meters in Fig. 2.2 and Fig. 2.3.

V_1 = ... V

I_1 = ... A
[2]

(iii) Calculate a resistance R_1 using your values from **(a)(ii)** and the equation $R_1 = \frac{V_1}{I_1}$.

R_1 = ... [1]

(b) The student connects two resistors in series between terminals P and Q, as shown in Fig. 2.4.

Fig. 2.4

He measures the potential difference V_2 across terminals P and Q and the current I_2 in the circuit.

V_2 = 2.7 V

I_2 = 0.26 A

Calculate a resistance R_2 using these values and the equation $R_2 = \frac{V_2}{(I_2 \times 2)}$.

R_2 = ... [1]

(c) The student connects the two resistors in parallel between terminals P and Q, as shown in Fig. 2.5.

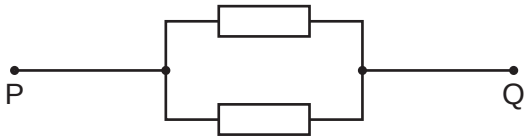


Fig. 2.5

He measures the potential difference V_3 across terminals P and Q and the current I_3 in the circuit.

V_3 = 2.3 V

I_3 = 0.94 A

Calculate a resistance R_3 using these values and the equation $R_3 = \frac{(V_3 \times 2)}{I_3}$.

R_3 = ... [1]

(d) Another student suggests that R_1, R_2 and R_3 should be equal.
State whether your results support this suggestion. Justify your statement with reference to your results.

statement .....

justification .....

.....
[2]

(e) **(i)** A student wants to determine R_1 by using a potential divider to vary the potential difference in the circuit. Draw the symbol for a potential divider.

[1]

(ii) Briefly explain how the use of a potential divider may give a more reliable value for R_1 than using the procedure carried out in **(a)**.

.....

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..... [1]

[Total: 11]

3 A student determines the focal length of a converging lens.
She uses the apparatus shown in Fig. 3.1.

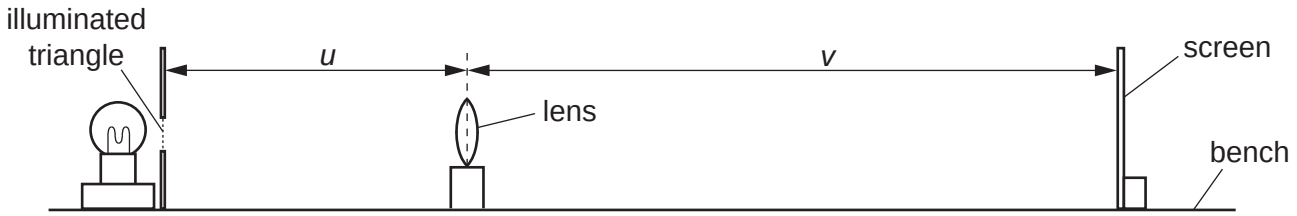

Fig. 3.1

Method 1

(a) The student sets the distance *U* between the illuminated triangle and the lens.
She moves the screen until a sharp image of the triangle is seen on the screen.

(i) On Fig. 3.1, measure the distance *u* between the illuminated triangle and the lens.

u = ...

On Fig. 3.1, measure the distance *v* between the lens and the screen.

v = ...
[1]

(ii) Fig. 3.1 is drawn to 1/5th scale.

Calculate the actual distance *U* between the illuminated triangle and the lens in the experiment.

U = ...

Calculate the actual distance *V* between the lens and the screen in the experiment.

V = ...
[1]

(iii) Calculate a value f_1 for the focal length of the lens. Use the equation

$$f_1 = \frac{UV}{(U + V)} .$$

f_1 = ... [1]

(iv) Briefly describe a technique to obtain an image on the screen that is as sharp as possible in this experiment.

.....

.....

..... [1]

Fig. 3.2

Method 2

(b) The student keeps the screen in the same position.

She moves the lens closer to the screen, as shown in Fig. 3.2, until another sharp image of the triangle is seen on the screen.

(i) Measure the distance v between the lens and the screen as indicated in Fig. 3.2.

v = ...

Fig. 3.2 is drawn to 1/5th scale.

Calculate the actual distance V between the lens and the screen in the experiment.

V = ...
[1]

(ii) The illuminated triangle and its image are shown full size in Fig. 3.3 and Fig. 3.4.

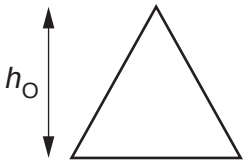

Fig. 3.3

Fig. 3.4

Measure h_O, the height of the illuminated triangle, as shown in Fig. 3.3.

h_O = ...

Measure h_I, the height of the image on the screen, as shown in Fig. 3.4.

h_I = ...
[1]

(iii) Calculate a value for the magnification M using the equation $M = \frac{h_I}{h_O}$.

M = ... [1]

(iv) Calculate a second value f_2 for the focal length of the lens using the equation $f_2 = \frac{V}{(M + 1)}$ and the value of V from **(b)(i)**.

f_2 = ... [1]

(c) State **one** precaution the student must take to ensure that the **measurements** of U and V in this experiment are as reliable as possible.

.....

..... [1]

(d) (i) Explain why **Method 2** is likely to produce a less accurate value for the focal length than **Method 1**.

.....

.....

..... [1]

(ii) Suggest **one** improvement to make **Method 2** more accurate.

.....

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..... [1]

[Total: 11]

4 A student investigates the factors affecting the electrical output of a solar cell. A solar cell is a device which transforms light energy into electrical energy.

Plan an experiment which will enable him to investigate how the potential difference across the terminals of the solar cell varies with the angle of the incident light.

The apparatus available includes:

a solar cell as shown in Fig. 4.1
a laboratory lamp.

In your plan, you should:

- list any additional apparatus needed
- state the key variables to be kept constant
- explain briefly how to carry out the experiment, including any precautions that must be taken to ensure reliable results
- draw a table, with column headings, to show how to display the readings (you are **not** required to enter any readings in the table)
- explain how to use the readings to reach a conclusion.

You may add to Fig. 4.1 or draw another diagram if it helps to explain your plan.

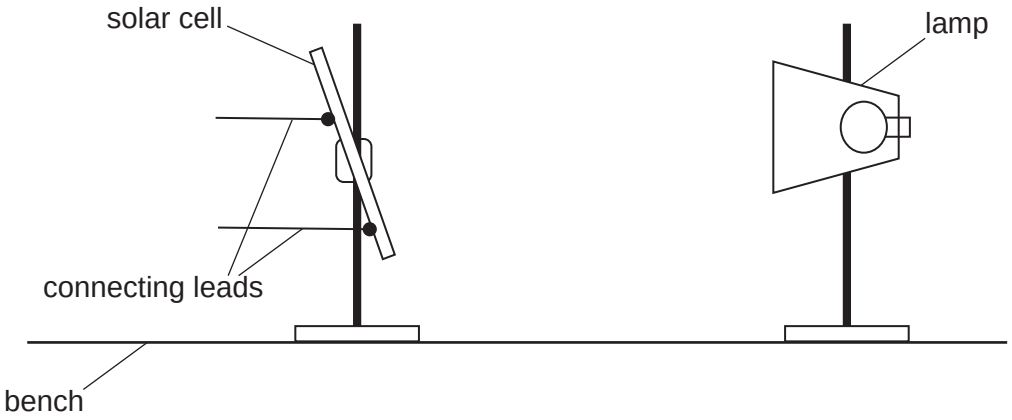

Fig. 4.1

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[Total: 7]

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PHYSICS **0625/22**

Paper 2 Multiple Choice (Extended) **October/November 2020**

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- 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 multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s^2).

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.

This document has **16** pages. Blank pages are indicated.

Name

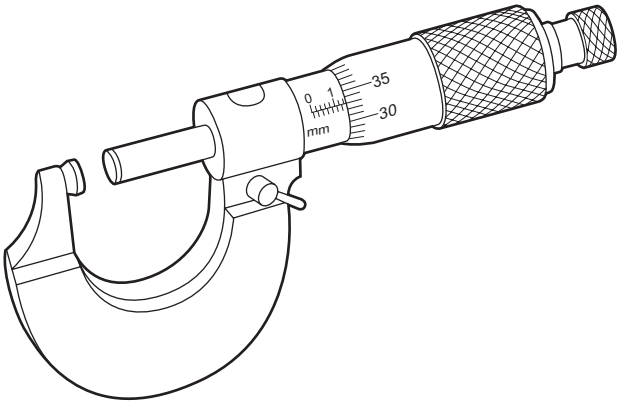
Class

ZipGrade.com

40 Questions (0866)

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

1 The diagram shows a measuring device.



For which measurement is this device suitable?

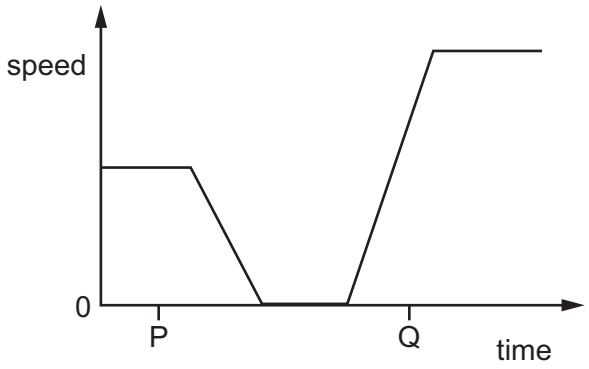
A diameter of a cylinder of aluminium of about 20 cm

B distance between two molecules of zinc

C length of a rod of iron of about 1 m

D thickness of a sheet of copper of about 1.5 mm

2 The graph shows how the speed of an object varies with time.



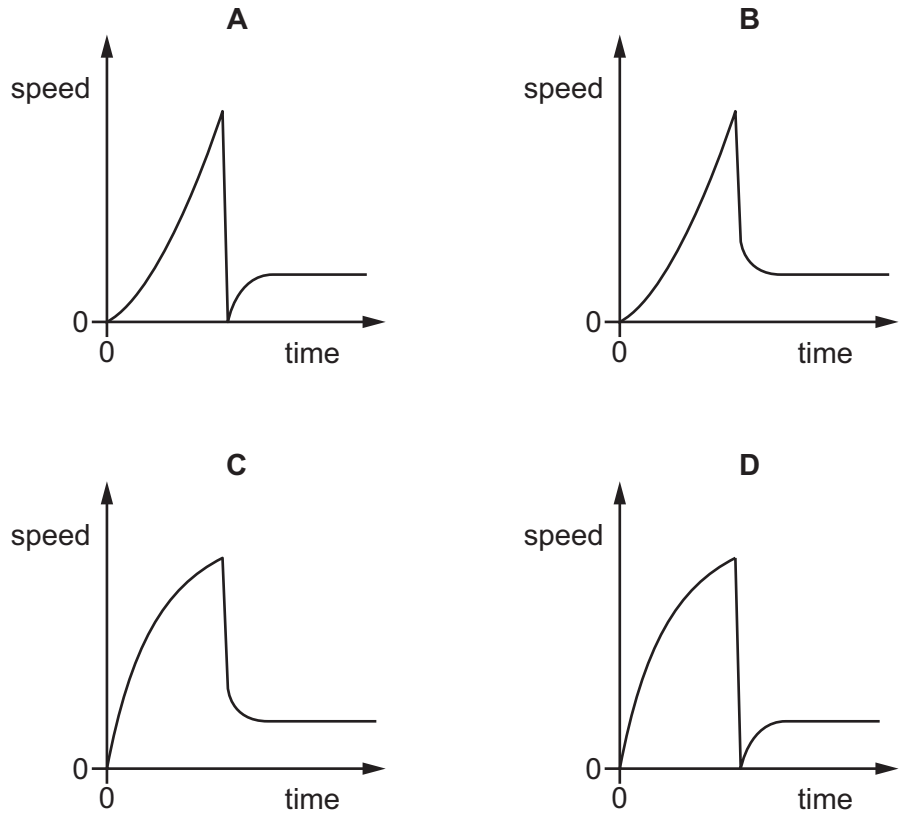
Which row describes the motion of the object at times P and Q?

	P	Q
A	at rest	accelerating
B	at rest	decelerating
C	moving with constant speed	accelerating
D	moving with constant speed	decelerating

3 A concrete block falls vertically from an aeroplane.

The concrete block falls into the sea and sinks.

Which graph shows the vertical motion of the concrete block?



4 Which quantity is weight an example of?

A acceleration

B force

C mass

D pressure

5 Which statement about the mass of an object is correct?

A It changes when the object is lifted further from the ground.

B It is the gravitational force on the object.

C It is zero if the object is in orbit around the Earth.

D It resists any change in motion of the object.

6 A rectangular metal block is 20 cm long.

The cross-sectional area of the block is 25 cm^2.

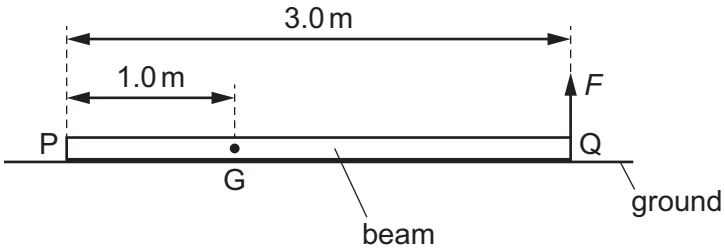
The mass of the block is 4000 g.

What is the density of the metal?

A 0.13 g / cm^3 **B** 0.32 g / cm^3 **C** 8.0 g / cm^3 **D** 2000 g / cm^3

7 The diagram shows a beam lying on the ground. End Q is lifted from the ground by the force *F*.

End P of the beam remains on the ground.



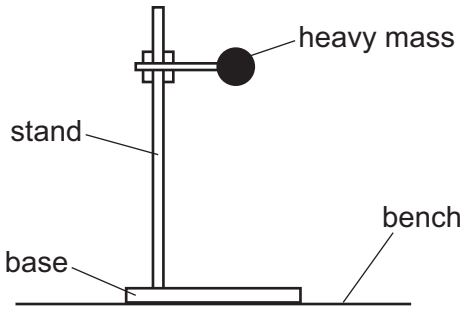
The length of the beam is 3.0 m and its weight is 600 N.

The centre of mass of the beam at G is 1.0 m from end P.

What is the size of the force *F* when it just raises end Q from the ground?

A 200 N **B** 300 N **C** 400 N **D** 600 N

8 The diagram shows a stand. The stand holds a heavy mass above the bench.



Which two changes would definitely make the stand more stable?

A Lower the mass and make the base narrower.

B Lower the mass and make the base wider.

C Raise the mass and make the base narrower.

D Raise the mass and make the base wider.

9 A footballer kicks a stationary football.

His foot is in contact with the ball for 0.050 s.

The mass of the ball is 0.40 kg.

The speed of projection of the ball is 25 m / s.

What is the average force exerted on the ball by his foot?

A 0.32 N **B** 0.50 N **C** 200 N **D** 1300 N

10 A woman of mass 50 kg has 81 J of kinetic energy.

What is her speed?

A 1.3 m / s **B** 1.6 m / s **C** 1.8 m / s **D** 3.2 m / s

11 What is the source of the Sun's energy?

A chemical reactions in the Sun's core

B γ-emissions in the Sun's core

C nuclear fission in the Sun's core

D nuclear fusion in the Sun's core

12 To calculate the power produced by a force, the size of the force must be known.

What else needs to be known to calculate the power?

	the distance that the force moves the object	the time for which the force acts on the object
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = needed

✗ = not needed

13 A research submarine is at a depth of 10 000 m below the surface of the sea.

The average density of the water above the submarine is 1030 kg / m^3.

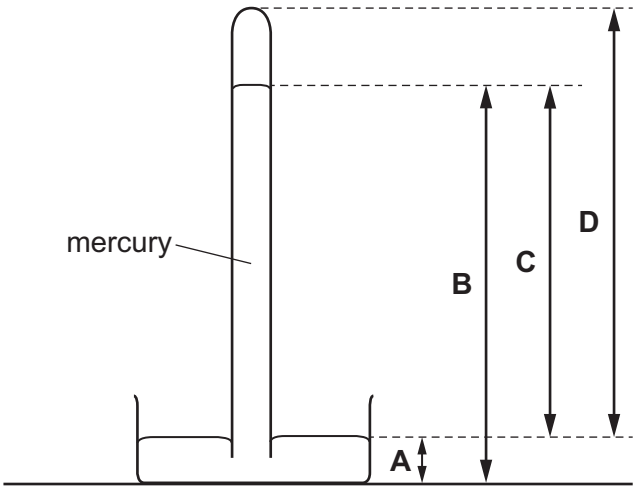
The atmospheric pressure at the surface of the sea is 103 000 Pa.

How many times greater is the pressure due to the sea water than the atmospheric pressure?

A 10 **B** 100 **C** 1000 **D** 100 000

14 The diagram shows a mercury barometer.

Which height is used as a measurement of atmospheric pressure?



15 A student splashes water on to her face. Here are three statements about the effects.

P The water uses energy to evaporate.

Q The water gains energy from the student.

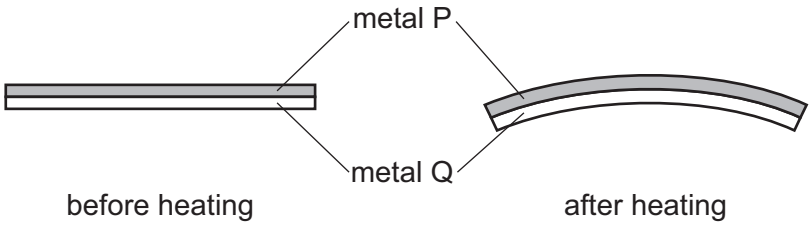
R The face of the student cools.

Which statements are correct?

A P and Q only **B** P and R only **C** Q and R only **D** P, Q and R

16 A bimetallic strip is used to control the temperature of electrical appliances. It is made of two different metals fixed together.

The diagram shows the shape of the bimetallic strip before and after heating.



Which statement is correct?

A Metal P contracts more than metal Q on heating.

B Metal Q contracts more than metal P on heating.

C Metal P expands more than metal Q on heating.

D Metal Q expands more than metal P on heating.

17 A student writes three statements about thermocouples.

1 They have a small thermal capacity.

2 They respond very slowly to temperature changes.

3 They can measure temperatures above 500 °C.

Which statements are correct?

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

18 Four blocks are made from different metals. Each block is heated for five minutes with an identical heater.

Assume there is no energy loss from the blocks.

The table gives the masses of the blocks and the temperature rises.

Which metal has the highest specific heat capacity?

	mass of block / kg	temperature rise / °C
A	2.0	5.0
B	2.0	9.0
C	4.0	5.0
D	4.0	9.0

19 A scientist measures the air temperature at different heights from the floor in a cave. The results are recorded in the table.

height / m	temperature / °C
0	10
10	11
20	13
30	14
40	16

Why does altering the height affect the temperature of the air?

A The molecules in warm air have less energy than the molecules in cool air.

B The molecules in cool air are further apart than the molecules in warm air.

C Warm air is less dense than cool air.

D Cool air rises above warm air.

20 Four solid spheres made of the same metal are heated to the same temperature.

Which sphere initially loses thermal energy by radiation at the greatest rate?

A diameter of 10 cm with a dull surface

B diameter of 10 cm with a shiny surface

C diameter of 5 cm with a dull surface

D diameter of 5 cm with a shiny surface

21 Which row correctly describes light waves?

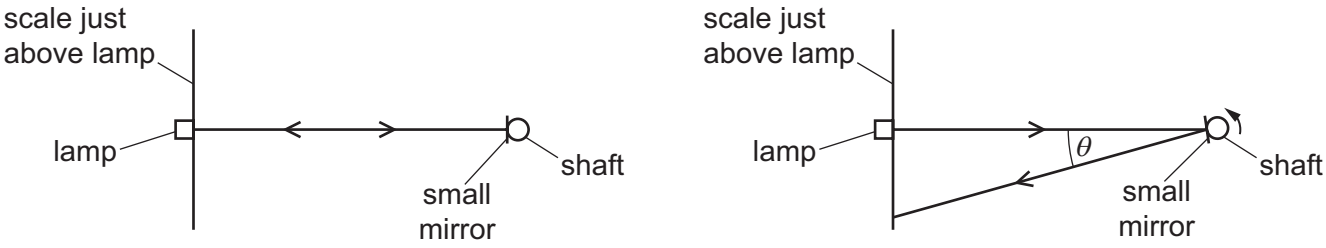
	wave type	direction of vibrations
A	longitudinal	parallel to direction of wave travel
B	longitudinal	perpendicular to direction of wave travel
C	transverse	parallel to direction of wave travel
D	transverse	perpendicular to direction of wave travel

22 A radio transmitter broadcasts at a frequency of 200 kHz.

What is the wavelength of these radio waves?

A 6.7×10^{-4} m **B** 1.5 m **C** 1.5×10^{3} m **D** 1.5×10^{6} m

23 An optical lever is a very sensitive device for detecting small rotations. A lamp sends a narrow beam of light on to a small plane mirror attached to a shaft whose rotation is to be measured. The operation of the device is shown in plan view.



The beam from the lamp reflects from the mirror to give a small spot of light on a scale placed just above the lamp. The shaft and mirror rotate through 1°. The spot of light moves along the scale.

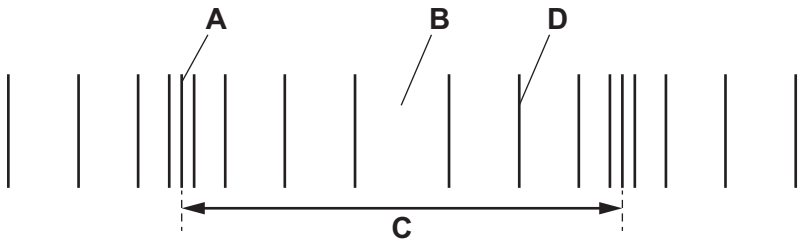
The table shows the angle θ through which the reflected beam rotates and the conditions required for high sensitivity.

Which row is correct?

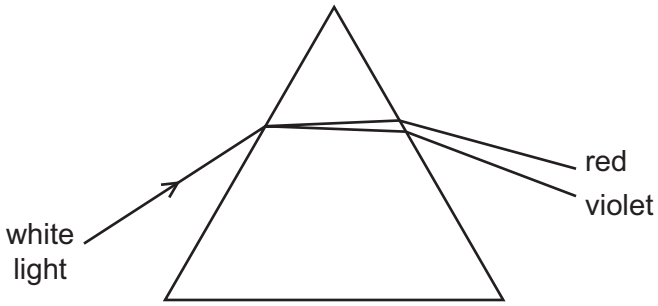
	angle θ	to achieve high sensitivity
A	1°	the lamp and scale need to be as close to the mirror as possible
B	1°	the lamp and scale need to be as far from the mirror as possible
C	2°	the lamp and scale need to be as close to the mirror as possible
D	2°	the lamp and scale need to be as far from the mirror as possible

24 A student draws a diagram to illustrate the different sections of a longitudinal wave.

Which labelled section is a rarefaction?



25 The diagram shows white light passing through a prism.



Which description of what happens as the light passes into the prism is correct?

A The speed of the red light is less than the speed of the violet light and the red light is the least refracted.

B The speed of the red light is greater than the speed of the violet light and the red light is the least refracted.

C The speed of the violet light is less than the speed of the red light and the violet light is the least refracted.

D The speed of the violet light is greater than the speed of the red light and the violet light is the least refracted.

26 A police car with its siren sounding is stationary in heavy traffic. A pedestrian notices that, although the loudness of the sound produced does not change, the pitch varies.

Which row describes the amplitude and the frequency of the sound?

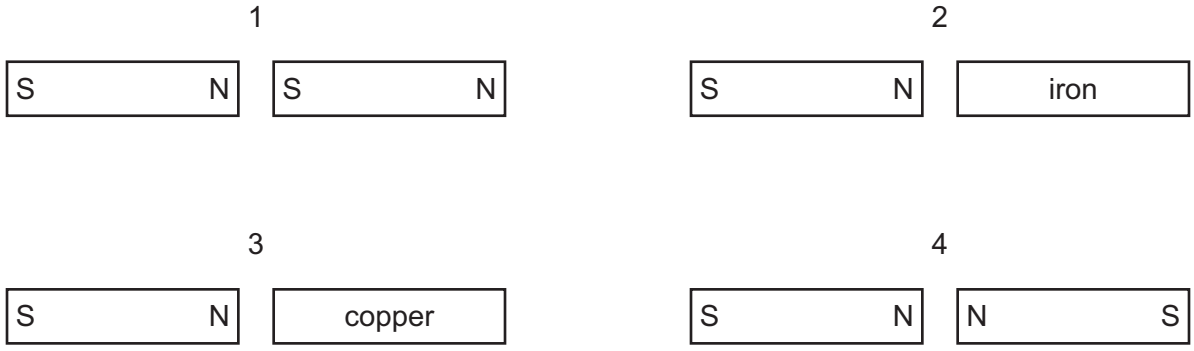
	amplitude	frequency
A	constant	constant
B	constant	varying
C	varying	constant
D	varying	varying

27 A piece of steel is slightly magnetised. It is hit several times with a hammer.

What effect will this have on the steel?

	the steel is parallel to a strong magnetic field	the steel is at right-angles to a weak magnetic field
A	it becomes magnetised more strongly	it becomes magnetised more strongly
B	it becomes magnetised more strongly	it loses its magnetism
C	it loses its magnetism	it becomes magnetised more strongly
D	it loses its magnetism	it loses its magnetism

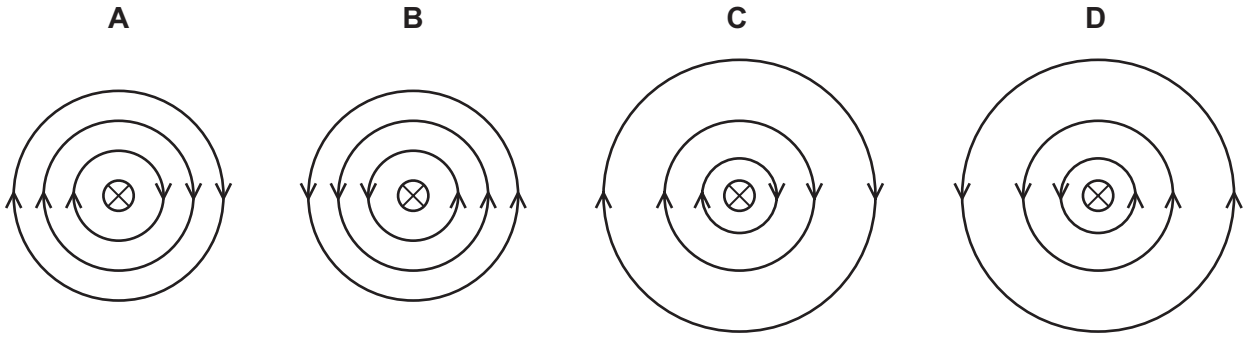
28 A student sets up four experiments using bar magnets and other metal objects. The N and S poles of the bar magnets are labelled N and S.



Which pairs attract each other?

A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

29 Which diagram represents the strength and direction of the magnetic field around a current-carrying conductor? (The direction of the current is into the page.)



30 Which quantity is defined as the energy transferred by a cell in driving unit charge around a complete circuit?

A current

B electromotive force (e.m.f.)

C power

D resistance

31 There is a current in a variable resistor when a potential difference (p.d.) is applied across it.

In which situation is the current increased?

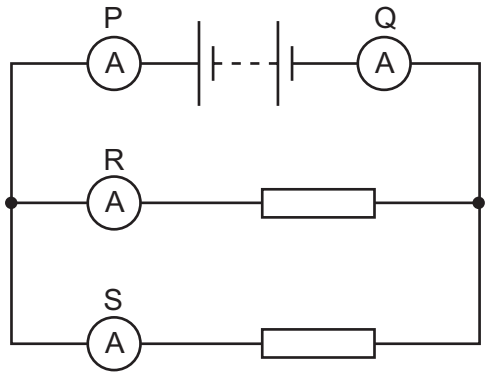
A Decrease the p.d. and keep the resistance the same.

B Decrease the p.d. and increase the resistance.

C Keep the p.d. the same and decrease the resistance.

D Keep the p.d. the same and increase the resistance.

32 A student uses four ammeters P, Q, R and S to measure the current in different parts of the circuit shown.



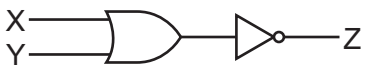
Which two ammeters read the largest current?

A P and Q **B** P and R **C** R and Q **D** R and S

33 Which combination of logic gates gives the truth table shown?

inputs		output
X	Y	Z
0	0	1
0	1	1
1	0	1
1	1	0

A

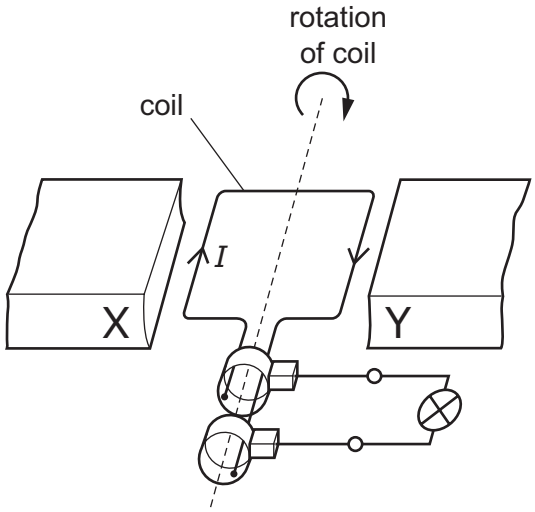


B

C

D

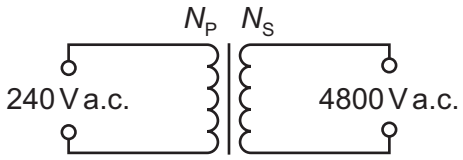
34 The diagram shows an a.c. generator used to power a lamp. The coil rotates in a clockwise direction.



Which magnetic poles are X and Y?

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

35 A transformer is needed to convert a supply of 240 V a.c. into 4800 V a.c..



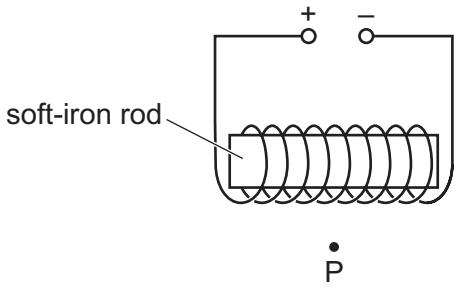
Which pair of coils would be suitable for this transformer?

	number of turns on primary coil N_P	number of turns on secondary coil N_S
A	50	1 000
B	240	48 000
C	480	24
D	2000	100

36 The diagram shows a coil of wire wrapped around a soft-iron rod.

The wire is connected to a d.c. power supply as indicated.

The apparatus is in a region which is totally shielded from the Earth's magnetic field.



A small compass needle is placed at point P.

In which direction does the N pole of the compass needle point?

A towards the bottom of the page

B towards the left of the page

C towards the right of the page

D towards the top of the page

37 Which statement is correct for the nucleus of **any** atom?

A The nucleus contains electrons, neutrons and protons.

B The nucleus contains the same number of protons as neutrons.

C The nucleus has a total charge of zero.

D The nucleus is very small compared with the size of the atom.

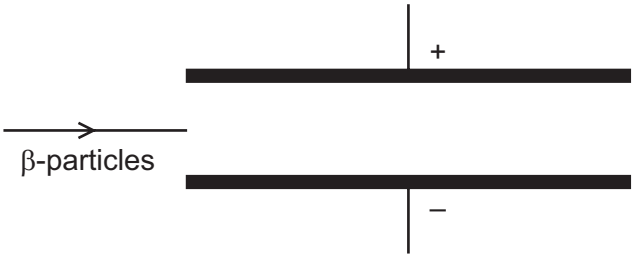
38 The symbol represents a nucleus of zinc.

$$^{68}_{30}\mathrm{Zn}$$

Which row gives the numbers of protons and neutrons in this nucleus?

	number of protons	number of neutrons
A	30	38
B	30	68
C	38	30
D	38	68

39 The diagram shows a beam of β-particles passing through a strong electric field.



In which direction will the β-particles be deflected?

A upwards towards the top of the page

B downwards towards the bottom of the page

C into the plane of the page

D out of the plane of the page

40 Which equation represents the β-decay of lead-209?

A $^{209}_{82}\mathrm{Pb} + {}^{0}_{-1}\mathrm{e} \rightarrow {}^{209}_{83}\mathrm{Bi}$

B $^{209}_{82}\mathrm{Pb} + {}^{0}_{-1}\mathrm{e} \rightarrow {}^{209}_{81}\mathrm{T}l$

C $^{209}_{82}\mathrm{Pb} \rightarrow {}^{209}_{83}\mathrm{Bi} + {}^{0}_{-1}\mathrm{e}$

D $^{209}_{82}\mathrm{Pb} \rightarrow {}^{209}_{81}\mathrm{T}l + {}^{0}_{-1}\mathrm{e}$

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PHYSICS **0625/42**

Paper 4 Theory (Extended) **October/November 2020**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.
- Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m / s^2).

INFORMATION

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

This document has **16** pages. Blank pages are indicated.

1 A sky-diver jumps out of a hot-air balloon, which is 4000 m above the ground. At time = 30 s, she opens her parachute.

Fig. 1.1 is the speed-time graph of her fall.

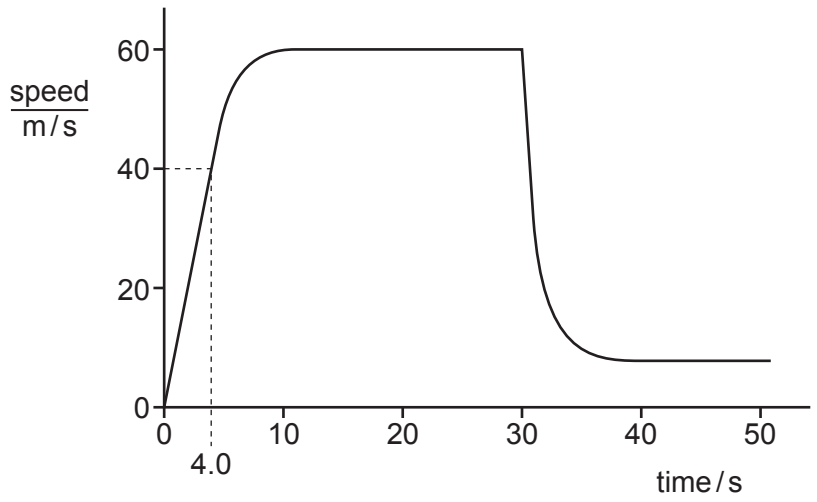

Fig. 1.1

(a) **(i)** Label with the letter X the point on the graph where the sky-diver opens her parachute. [1]

(ii) Label with the letters Y and Z the **two** parts of the graph where the sky-diver falls at terminal velocity. [1]

(b) Describe, in terms of the forces acting on the sky-diver, her motion between leaving the balloon and opening her parachute.

.....

.....

.....

.....

.....

..... [4]

(c) Calculate the average speed of the sky-diver in the first 4.0 s of her fall.

average speed = ... [2]

[Total: 8]

2 **(a)** Define the moment of a force about a point.

.....

..... [1]

(b) Fig. 2.1 shows a uniform rod of wood suspended from a pivot.

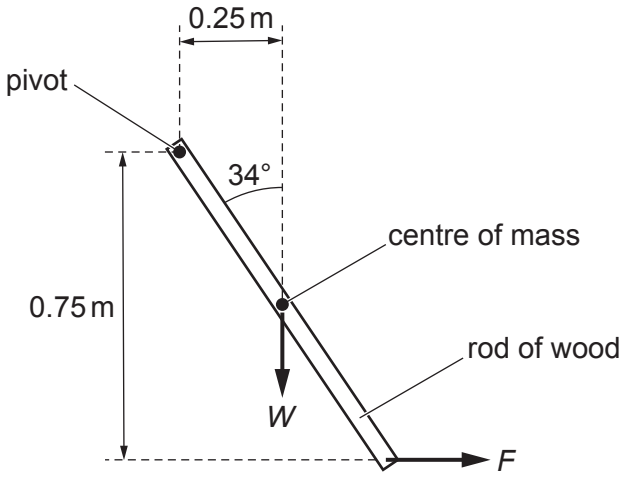

Fig. 2.1 (not to scale)

The rod is held stationary by a horizontal force *F* acting as shown.
The mass of the rod is 0.080 kg.

Calculate:

(i) the weight *W* of the rod

weight = ... [1]

(ii) the moment of *W* about the pivot

moment = ... [2]

(iii) the moment of *F* about the pivot

moment = ... [1]

(iv) the force *F*.

force = ... [2]

(c) The angle between the rod and the vertical is increased.

State whether the force *F* needed to hold the rod stationary must be increased, decreased or stay the same.
Explain your answer.

.....

.....

.....

..... [2]

[Total: 9]

3 The kinetic energy of air passing through a wind turbine every minute is 720 000 J. The electrical output of the turbine is 9.0 A at a potential difference (p.d.) of 240 V.

Calculate the efficiency (%) of the wind turbine.

efficiency = ... % [5]

4 Fig. 4.1 shows a thermometer.

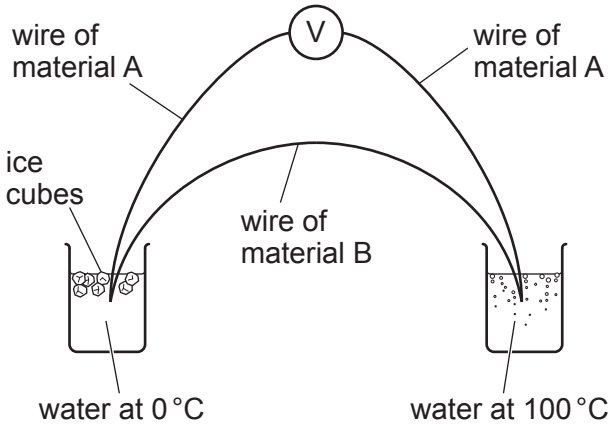

Fig. 4.1

The voltmeter reading is 5.4 mV.

(a) State the name of this type of thermometer.

..... [1]

(b) Fig. 4.2 shows the same thermometer used to measure the temperature of liquid X.

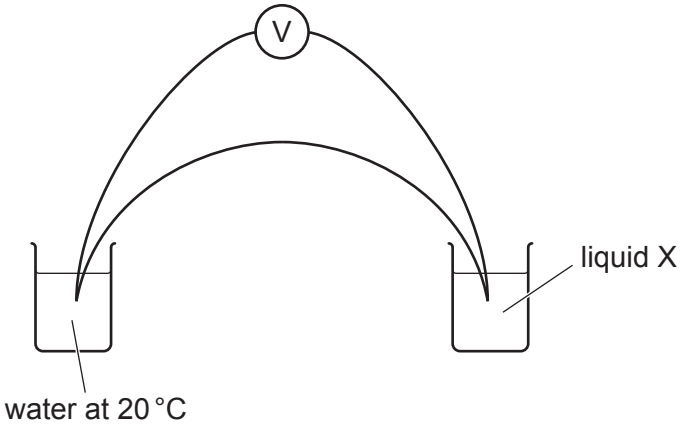

Fig. 4.2

With the setup in Fig. 4.2, the voltmeter reading is 1.7 mV.

Calculate the temperature of liquid X measured by the thermometer.

temperature = ... [2]

(c) Suggest an application for which this type of thermometer is more suitable than a liquid-in-glass thermometer.

..... [1]

[Total: 4]

5 **(a)** **(i)** Define specific latent heat.

.....

..... [2]

(ii) Explain the melting of a solid in terms of molecules and energy.

.....

.....

.....

..... [2]

(b) An electrical heater is used to heat a liquid to its boiling point. Fig. 5.1 shows the apparatus.

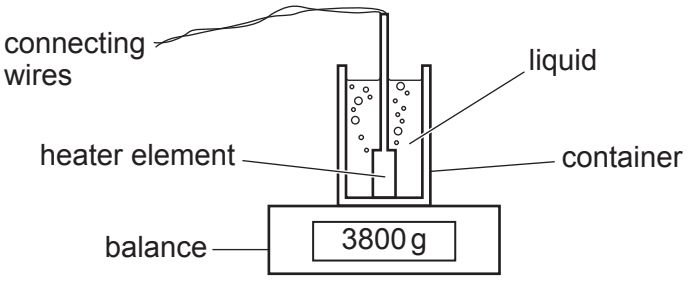

Fig. 5.1

When the liquid is boiling, the heater supplies 1.26 MJ of thermal energy. The mass reading shown on the balance decreases from 3800 g to 2300 g.

Calculate the specific latent heat of vaporisation of the liquid.

specific latent heat = ... [3]

(c) State and explain a precaution to improve the accuracy of the value of specific latent heat calculated in **(b)**.

.....

.....

.....

..... [2]

[Total: 9]

6 Fig. 6.1 shows a transverse wave produced in a string.

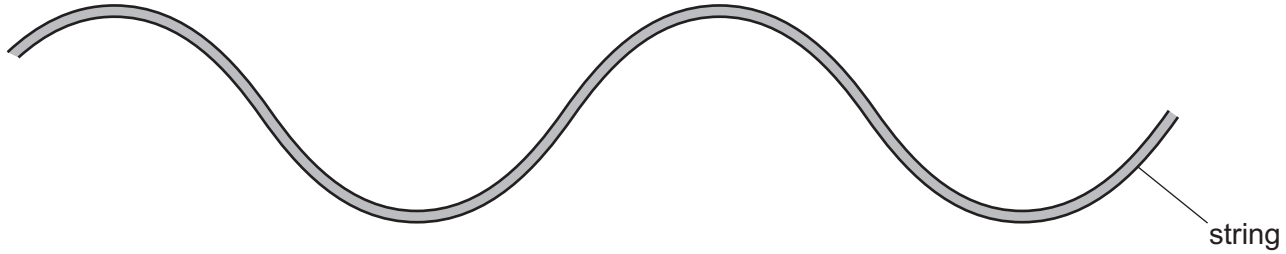

Fig. 6.1 (full size)

(a) On Fig. 6.1:

(i) draw labelled lines to show

1. the amplitude of the wave

2. the wavelength of the wave

[2]

(ii) label a trough with the letter T. [1]

(b) A person vibrates one end of the string vertically to produce the wave. He makes 15 complete oscillations in 60 s.

Show that the speed of the wave is 2.0 cm / s.

[3]

(c) State the difference between transverse waves and longitudinal waves. Use your ideas about the direction of oscillations.

transverse waves .....

.....

longitudinal waves .....

.....

[2]

[Total: 8]

7 Fig. 7.1 shows a ray of light passing through an optical fibre.

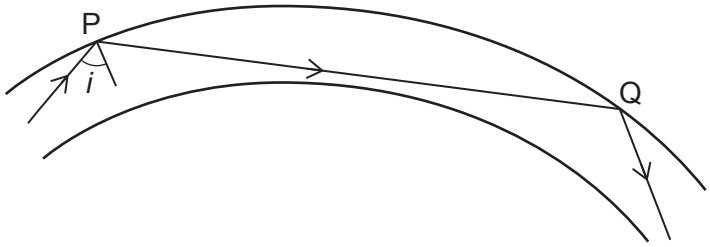

Fig. 7.1

The optical fibre is made of glass that has a refractive index of 1.4.

(a) (i) No light refracts from the fibre at points P and Q.

State the name of the process that occurs at P and Q.

..... [1]

(ii) Calculate the minimum value of angle *i* for there to be no refraction at point P.

angle = ... [2]

(b) State and explain the use of optical fibres in medicine.

.....

.....

.....

.....

.....

..... [3]

(c) The ray of light shown in Fig. 7.1 is monochromatic light from a laser.

State what is meant by monochromatic light. Use **one** of the following quantities in your answer.

amplitude **brightness** **frequency** **refractive index** **speed**

.....

..... [2]

[Total: 8]

8 **(a)** State and explain why electrical sockets and plugs used outside in a garden need to be different from those that can be used safely in a room inside a house.

.....

.....

.....

..... [2]

(b) State and explain why fuses and circuit breakers are installed in electrical circuits connected to the mains supply.

.....

.....

.....

..... [2]

[Total: 4]

9 **(a)** Fig. 9.1 shows a bar magnet and four plotting compasses A, B, C and D.

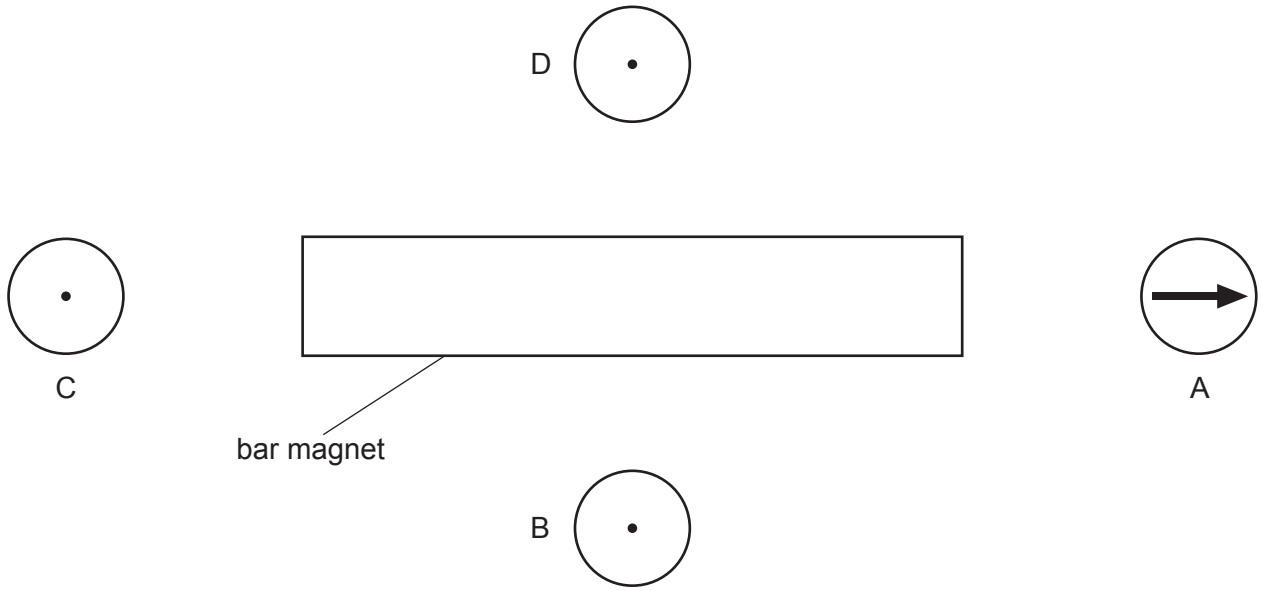

Fig. 9.1

On Fig. 9.1:

(i) draw an arrow on each of the three plotting compasses B, C and D to show the direction of the magnetic field [2]

(ii) label the magnetic poles of the bar magnet N and S. [1]

(b) Describe **one** method for demagnetising a bar magnet.

.....

.....

.....

..... [2]

(c) Fig. 9.2 represents a current in a wire. The current is into the plane of the paper.

(i) Draw the pattern of the magnetic field produced around the wire. Show clearly the direction of the magnetic field.

Fig. 9.2

[2]

(ii) The direction of the current in the wire is reversed. The magnitude of the current is unchanged.

State the effect that reversing the current has on the magnetic field produced.

.....

..... [1]

[Total: 8]

10 Fig. 10.1 shows an incomplete electrical circuit.

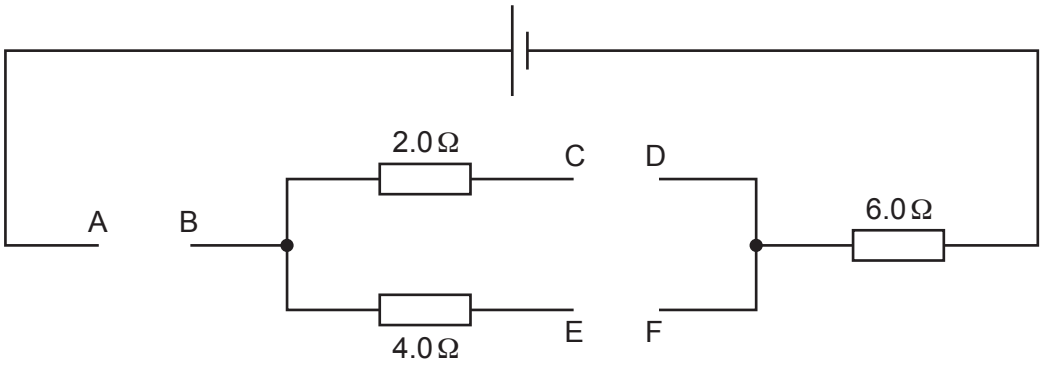

Fig. 10.1

(a) (i) A student completes the circuit and measures the current in the 6.0Ω resistor.

On Fig. 10.1, draw an ammeter symbol in one gap and straight lines to indicate wires in the other gaps to show how the student should do this. [1]

(ii) A voltmeter is connected to measure the potential difference (p.d.) across the 4.0Ω resistor.

On Fig. 10.1, draw a voltmeter symbol connected in the correct position. [2]

(iii) With the circuit completed, the current in the 2.0Ω resistor is 2.5A.

Calculate the current in the 6.0Ω resistor.

current = ... [4]

(b) Fig. 10.2 shows the same electrical circuit with an alternating current (a.c.) power supply and a wire in the gap AB.

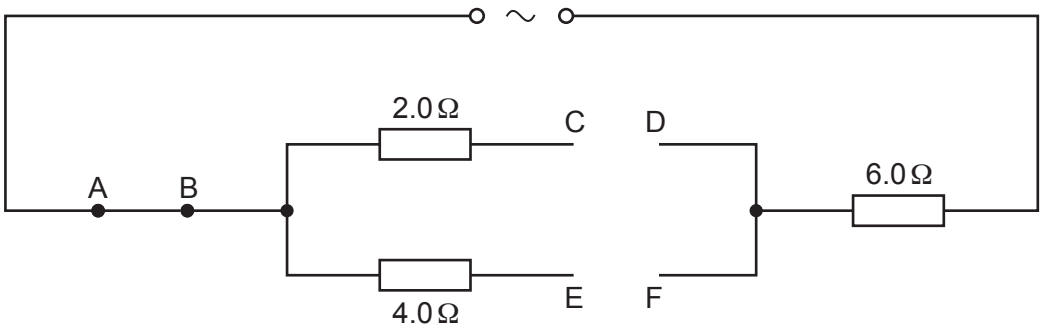

Fig. 10.2

On Fig. 10.2, draw a diode symbol in one gap and a straight line to indicate a wire in the other gap so that there is a current from right to left in the 4.0 Ω resistor and an alternating current in the 2.0 Ω resistor. [2]

[Total: 9]

11 (a) State **two** differences between nuclear fission and nuclear fusion.

1 .....

.....

2 .....

.....

[2]

(b) Radioactive tracers emitting γ-rays can be used in medicine. The half-life of the source of these γ-rays is 6 hours.

(i) Explain why a source of γ-rays used in this way should not have a half-life shorter or longer than about 6 hours.

.....

.....

.....

..... [2]

(ii) Technetium-99 is a source of γ-rays often used as a radioactive tracer. It is produced from molybdenum-99 which emits β-particles. The symbol for technetium is Tc and the symbol for molybdenum is Mo.

Complete the nuclide equation for this decay.

$$^{99}_{42}\text{Mo} \rightarrow {}^{\cdots\cdots}_{\cdots\cdots}\text{Tc} + {}^{\cdots\cdots}_{\cdots\cdots}\beta$$

[3]

(iii) Technetium-99 is a radioactive nuclide.

State another use of radioactive nuclides in medicine.

.....

..... [1]

[Total: 8]

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PHYSICS **0625/62**

Paper 6 Alternative to Practical **October/November 2020**

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Blank pages are indicated.

DC (DH/CGW) 196157/3

1 A student investigates the stretching of a spring.

Fig. 1.1 shows the set up.

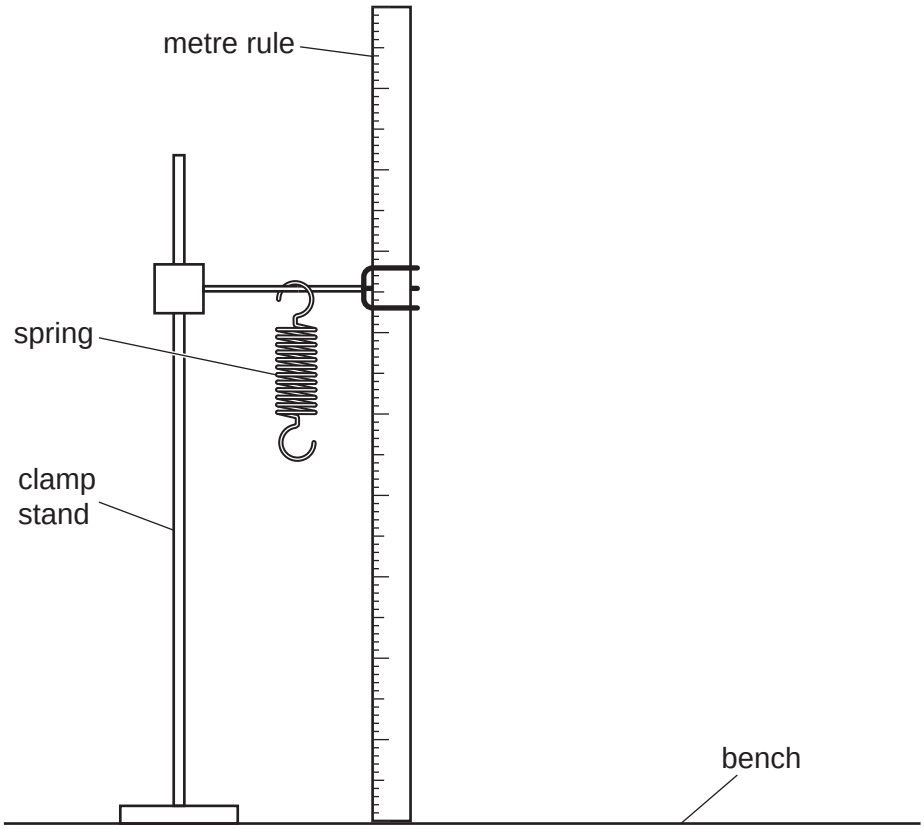


Fig. 1.1

(a) The metre rule is clamped in position near to the spring.

On Fig. 1.1, show clearly how you would use a set square to obtain an accurate reading of the position of the bottom of the coiled part of the spring from the metre rule. [2]

(b) Fig. 1.2 shows the spring drawn to actual size. On Fig. 1.2, measure the length *L* of the coiled part of the spring.

Fig. 1.2

L = ... mm [1]

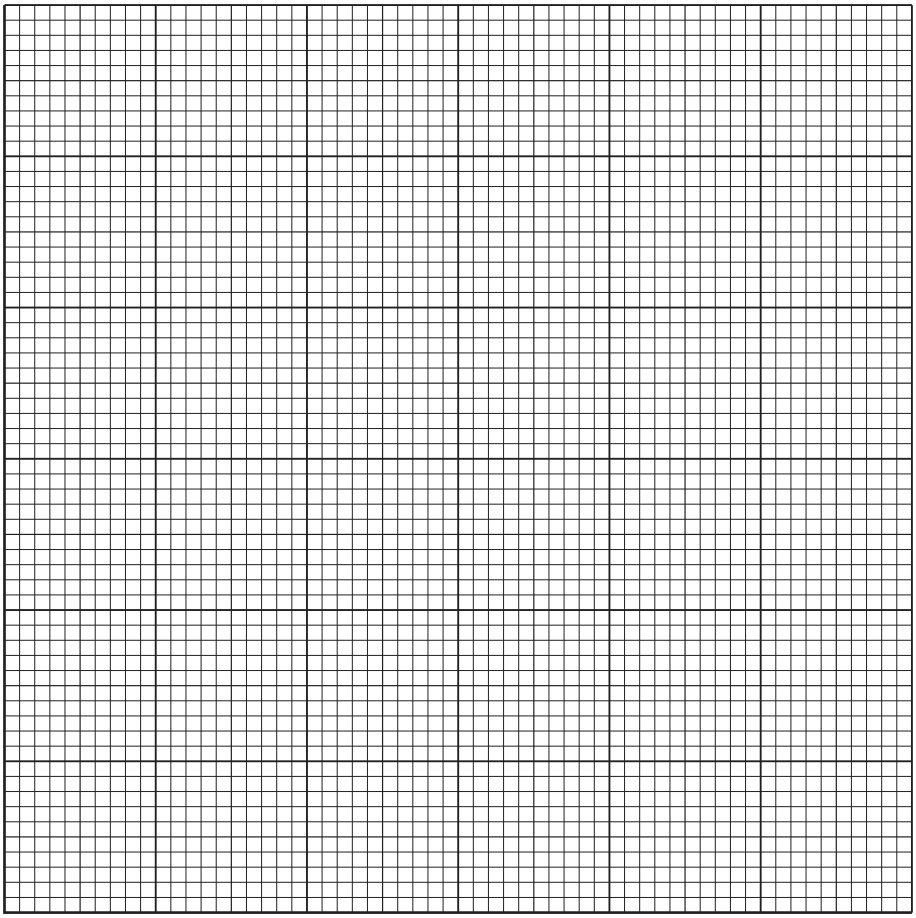
(c) The student adds a load *P* = 0.20 N to the spring. He records the new length *l* of the coiled part of the spring.

He repeats the procedure using loads *P* = 0.40 N, 0.60 N, 0.80 N and 1.00 N. All the readings are recorded in Table 1.1.

Table 1.1

P/N	l/mm
0.20	20
0.40	26
0.60	31
0.80	35
1.00	41

Plot a graph of l/mm (y-axis) against P/N (x-axis). Start both axes at the origin (0,0).



[4]

(d) The intercept on the y-axis of the graph is numerically equal to the length l_0 of the spring when P = 0. Determine the value of l_0. Show clearly on the graph how you obtained the necessary information.

l_0 = ... [2]

(e) Calculate $L - l_0$.

$L - l_0$ = ... [2]

[Total: 11]

[Turn over

2 A student investigates the refraction of light in a transparent block.

Fig. 2.1 shows her ray-trace sheet. She places a transparent block on the ray-trace sheet and draws the outline **ABCD** of the block. The student uses pins to mark the positions of objects and images.

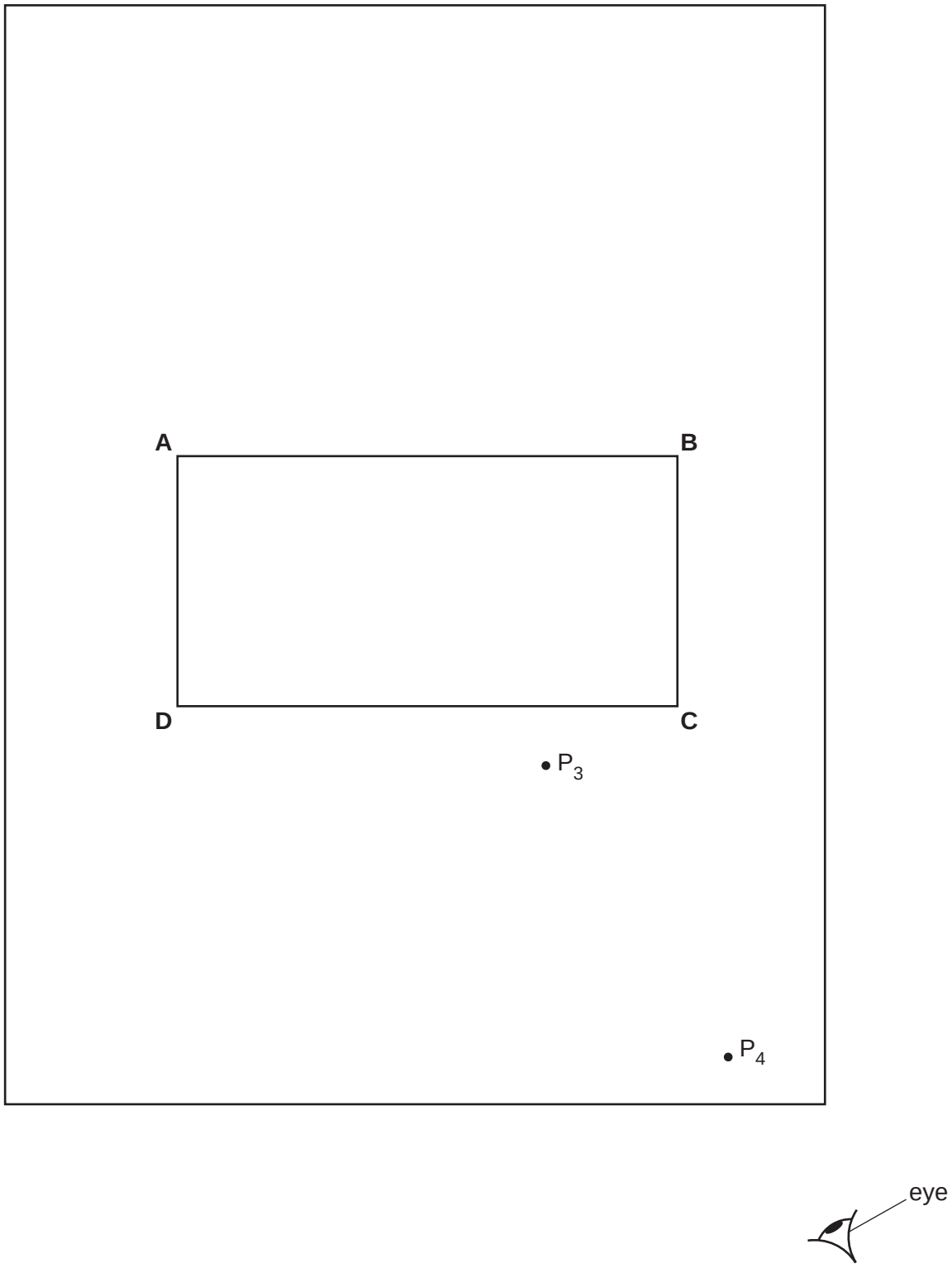


Fig. 2.1

(a) • On Fig. 2.1, draw the normal **NL** at the centre of side **AB**. Continue the normal **NL** so that it passes through side **CD** of the block.

• Label the point **F** where the normal **NL** crosses side **AB**.

• Label the point **G** where the normal **NL** crosses side **CD**.

[1]

(b) • On Fig. 2.1, draw a line **EF** at least 7 cm long above side **AB** and at an angle $i = 30°$ to the left of the normal. Label the end of the line **E**.

• Mark the positions of two pins P_1 and P_2, to act as objects, on line **EF** at a suitable distance apart for this type of ray-trace experiment.

[1]

(c) • The student looks from the position of the eye shown in Fig. 2.1, to observe the images of P_1 and P_2 through side **CD** of the block. She adjusts her line of sight until the images of P_1 and P_2 appear one behind the other.

• She places two pins P_3 and P_4 between her eye and the block so that P_3, P_4 and the images of P_1 and P_2, seen through the block, appear one behind the other.

• The positions of P_3 and P_4 are marked on the ray-trace sheet.

(i) Draw a line joining the positions of P_3 and P_4. Continue the line through the block until it extends to just outside the outline of the block. Label this end of the line **K**. [1]

(ii) • Label the point **H** where the line in **(c)(i)** meets side **CD**.

• Label the point **J** where the line meets the normal **NL**.

• Draw the line **FH**.

[1]

(iii) Measure and record the length *a* of the line **GH**.

a = ...

Measure and record the length *b* of the line **FH**.

b = ...
[1]

(d) Measure and record the acute angle θ between the line **JF** and the line **JK**. An acute angle is less than 90°.

θ = ... [2]

(e) State **one** precaution that you would take in order to produce an accurate ray-trace.

.....

..... [1]

(f) A student suggests that i should be equal to θ within the limits of experimental accuracy. In this experiment, $i = 30°$. Suggest a range of values for θ that match this suggestion for the experiment.

range ..... [1]

(g) A student plans to test the suggestion that, in this experiment, $i = \theta$ for all possible values of i.

Explain briefly how you would test the suggestion.

.....

.....

..... [2]

[Total: 11]

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3 A student is investigating the resistance of samples of wire.

Fig. 3.1 shows the circuit used.

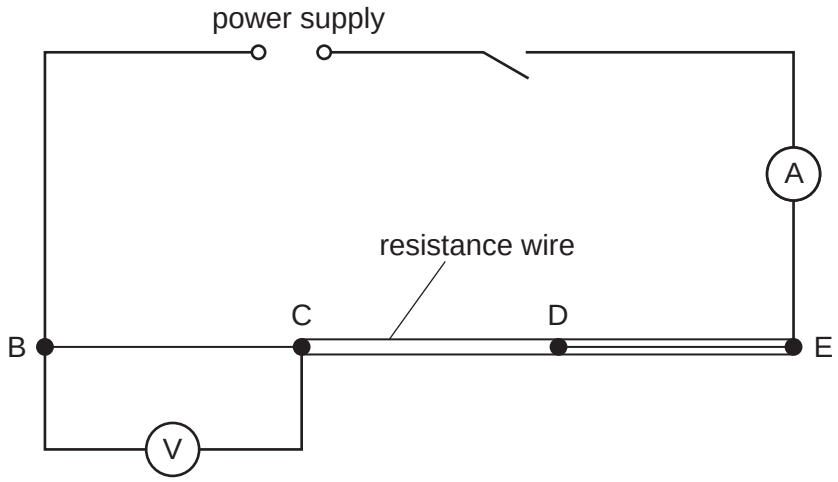

Fig. 3.1

Table 3.1 shows how the samples of wire are connected into the circuit.

Table 3.1

section	wire
BC	one 30 cm piece
CD	two 30 cm pieces
DE	three 30 cm pieces

(a) **(i)** Record the potential difference (p.d.) V_1 across section BC of the resistance wire, as shown on the voltmeter in Fig. 3.2.

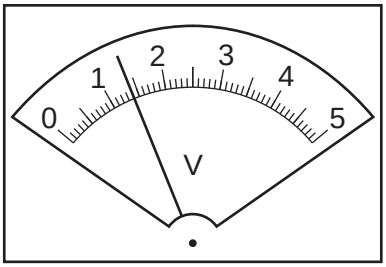

Fig. 3.2

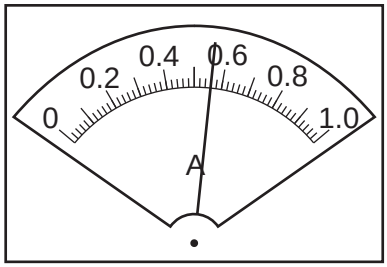

Fig. 3.3

V_1 = ... [1]

(ii) Record the current I in the circuit, as shown in Fig. 3.3.

I = ... [1]

(iii) Calculate the resistance R_1 of the section BC of the resistance wire. Use the equation $R_1 = \frac{V_1}{I}$. Give your answer to a suitable number of significant figures for this experiment.

R_1 = ... [1]

(b) The student connects the voltmeter across section CD.

He records the potential difference (p.d.) V_2 across section CD.

V_2 = ... 0.70 .....

He calculates the resistance R_2 of section CD.

R_2 = ... 1.25 .....

He connects the voltmeter across section DE.

He records the potential difference (p.d.) V_3 across section DE.

V_3 = ... 0.46 .....

Calculate the resistance R_3 of section DE using the equation $R_3 = \frac{V_3}{I}$. Use the value of I from **(a)(ii)**. Give your answer to a suitable number of significant figures for this experiment.

R_3 = ... [1]

(c) Complete the student's recorded readings by including the units in **(b)**. [1]

(d) The sections BC, CD and DE are all the same length and made of the same metal.

(i) Tick the box to show your conclusion from the results.

☐ The resistance of a section increases as the number of wires increases

☐ The resistance of a section decreases as the number of wires increases

☐ The resistance of a section is independent of the number of wires.

[1]

(ii) Justify your conclusion in **(d)(i)** by reference to the results.

.....

..... [1]

(e) Explain how you would change this experiment to investigate the relationship between the length of a sample of wire and its resistance.

.....

.....

.....

..... [2]

(f) A student repeats the investigation in **(a)** to **(d)**, but uses different values of current I. He has a power source with a single fixed output potential difference.

(i) Name the component he could connect into the circuit to vary the current.

..... [1]

(ii) Draw the circuit symbol for this component.

[1]

[Total: 11]

4 A student investigates the length of time taken for ice cubes to melt when they are placed in water. She uses beakers of water at different temperatures to investigate how the initial temperature of the water affects the time taken for the ice cubes to melt.

Plan an experiment to investigate how the initial temperature of the water affects the time taken for the ice cubes to melt.

The following apparatus is available:

thermometer
supply of ice cubes
250 cm^3 beakers
supply of cold water

In your plan, you should:

- write a list of additional apparatus to use
- explain how to carry out the investigation
- state the key variables to keep constant
- draw a table, or tables, with column headings, to show how to display the readings (you are **not** required to enter any readings in the table)
- explain how to use the readings to reach a conclusion.

.....

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.....

..... [7]

[Total: 7]

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PHYSICS **0625/41**

Paper 4 Theory (Extended) **October/November 2020**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.
- Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m / s^2).

INFORMATION

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

This document has **20** pages. Blank pages are indicated.

1 Fig. 1.1 shows an ice-hockey player moving on ice. He is preparing to hit the solid disc called a puck.

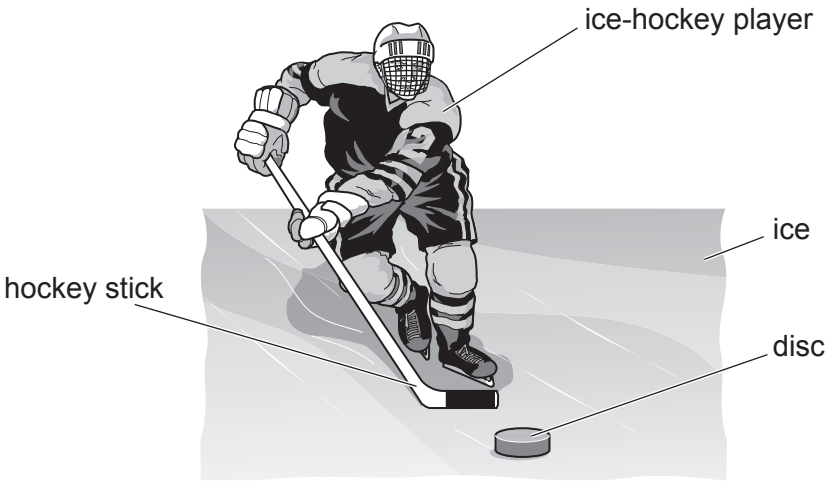

Fig. 1.1

The disc of mass 0.16 kg is moving horizontally across the surface of the ice at a speed of 15 m / s.

(a) Calculate the magnitude of the momentum of the disc.

magnitude of momentum = ... [2]

(b) The hockey player strikes the disc with his hockey stick and the momentum of the disc changes. The disc gains momentum of 3.0 kg m / s at 45° to the original direction of travel of the disc, as shown in Fig. 1.2.

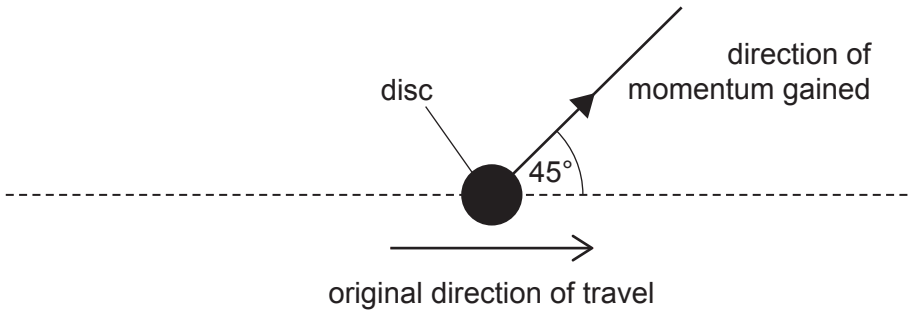

Fig. 1.2 (view from above)

(i) State the magnitude of the impulse exerted on the disc and the direction, in degrees, of the impulse relative to the original direction of travel.

magnitude of impulse = ...

direction of impulse: ..... ° to original direction
[1]

(ii) Determine the magnitude of the new momentum of the disc and its new direction relative to the original direction of travel by drawing a scale diagram.

magnitude of new momentum = ...

direction of new momentum: ..... ° to original direction
[4]

[Total: 7]

2 A vertical tube contains a liquid. A metal ball is held at rest by a thread just below the surface of the liquid, as shown in Fig. 2.1.

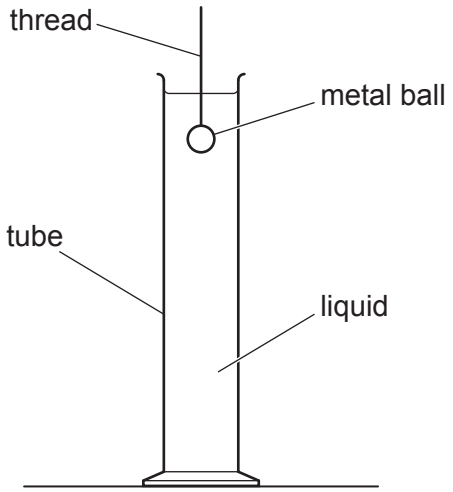

Fig. 2.1 (not to scale)

The diameter of the tube is much greater than the diameter of the ball. The ball is released and it accelerates downwards uniformly for a short period of time.

(a) Describe what happens to the velocity of the ball in the short period of time as it accelerates downwards uniformly.

.....

..... [2]

(b) The ball reaches terminal velocity.

Describe and explain the motion of the ball from when it is released until it reaches terminal velocity.

.....

.....

.....

..... [3]

(c) The metal ball has a mass of 2.1 g. It falls a distance of 0.80 m between being released and reaching the bottom of the tube.

(i) Calculate the gravitational potential energy transferred from the ball as it falls.

gravitational potential energy transferred = ... [2]

(ii) When the ball reaches the bottom of the tube, it has a speed of 1.2 m / s. Calculate the kinetic energy of the ball at the bottom of the tube.

kinetic energy = ... [3]

(iii) Explain why the value calculated in **(c)(i)** is different from that calculated in **(c)(ii)**.

.....

..... [1]

[Total: 11]

3 A U-shaped tube of constant cross-sectional area contains water of density 1000 kg / m^3. Both sides of the U-tube are open to the atmosphere.

Fig. 3.1 shows that the water levels in the two sides of the tube are equal.

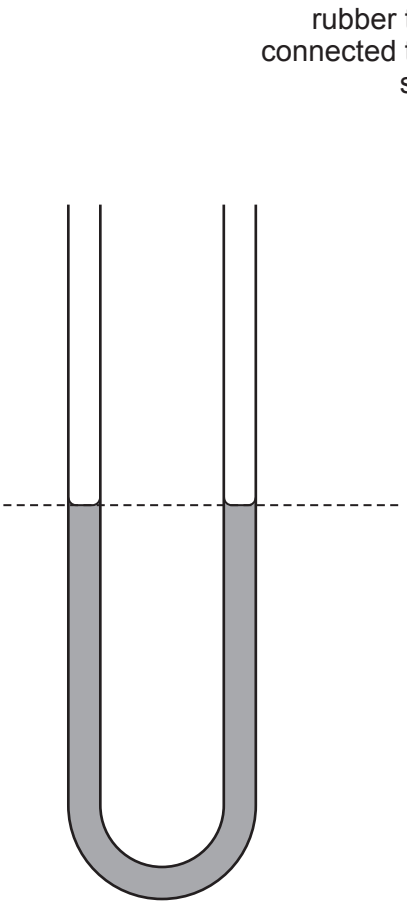

Fig. 3.1

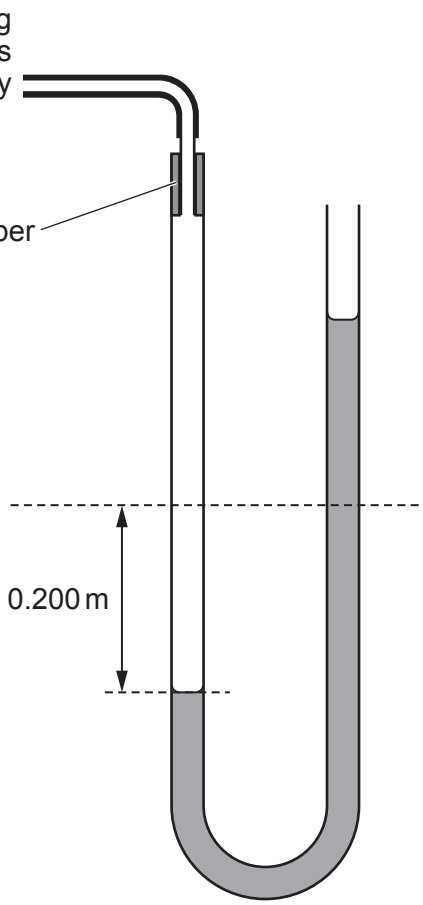

Fig. 3.2

The atmospheric pressure is 1.00×10^5 Pa.

The left-hand side of the tube is now connected to a gas supply using a length of rubber tubing. This causes the level of the water in the left-hand side of the tube to drop by 0.200 m, as shown in Fig. 3.2.

(a) Calculate the pressure of the gas supply. Give your answer to 3 significant figures.

pressure = ... [3]

(b) Fig. 3.3 shows that the gas supply is now connected to a cylinder that contains a piston.

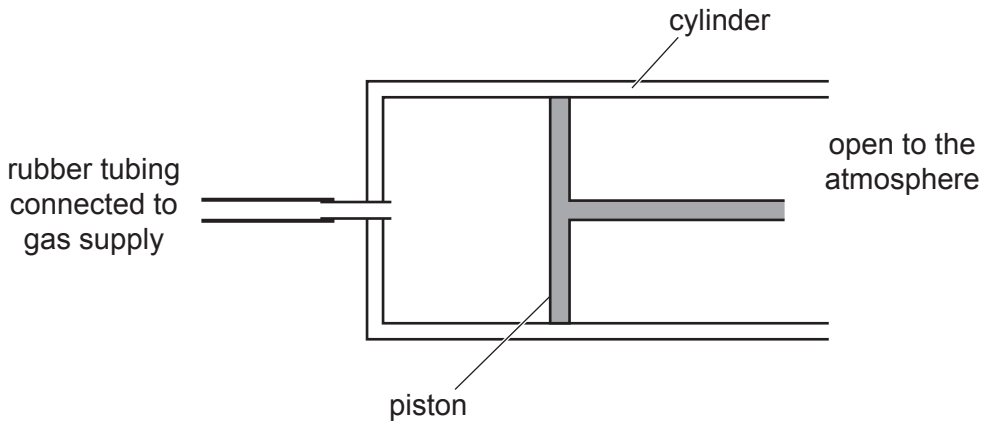

Fig. 3.3

The pressure of the gas moves the piston to the right.

(i) The area of the piston in contact with the gas is $0.025\,m^2$.

Calculate the resultant force on the piston.

resultant force = ... [2]

(ii) The pressure of the gas causes the piston to move a distance of 0.50 m to the right.

Calculate the work done by the gas from the supply on the piston.

work done = ... [2]

[Total: 7]

4 A large test-tube contains a liquid at room temperature. An electric heater is immersed in the liquid and is switched on. Thermal energy is supplied to the liquid by the heater. The temperature of the liquid increases until it reaches its boiling point. The liquid then starts to change into gas.

(a) Describe, in terms of molecules and their motion, how a liquid differs from a gas.

.....

.....

.....

.....

..... [3]

(b) Describe what happens to molecules of the liquid as its temperature begins to increase.

.....

.....

..... [2]

(c) **(i)** Explain, in terms of molecules, why a supply of thermal energy is needed to change the liquid into a gas.

.....

..... [1]

(ii) The density of the liquid in the test-tube is $0.86\,g/cm^3$. The volume of liquid in the test-tube is $50\,cm^3$.

The liquid reaches its boiling point. It now absorbs 18 000 J of thermal energy and all of the liquid changes into a gas.

Calculate the specific latent heat of vaporisation of this liquid.

specific latent heat = ... [3]

[Total: 9]

5 A metal container is used to cook food. The metal container has thick walls. Hot cooking oil at a temperature of 120 °C is poured into the container.

(a) The outside surface of the container gets hot. Some thermal energy passes through the metal because vibrating atoms in the metal collide with neighbouring atoms and transfer energy to them.

Explain how the rest of the thermal energy is conducted through the metal container to the outside surface by another process.

.....

.....

.....

..... [3]

(b) The outside surface of the container is brightly polished and shiny.

Explain how this reduces the power that needs to be supplied to keep the oil at the correct temperature.

.....

.....

.....

.....

..... [3]

(c) The metal container is spherical. The spherical container has a smaller surface area than a long, thin container of the same volume.

Explain the advantage of using a spherical container.

.....

.....

..... [1]

[Total: 7]

6 Fig. 6.1 shows a shallow tank viewed from above. The depth of the water is different in the two parts of the tank. Fig. 6.1 shows the crests and the troughs of a wave that pass from left to right.

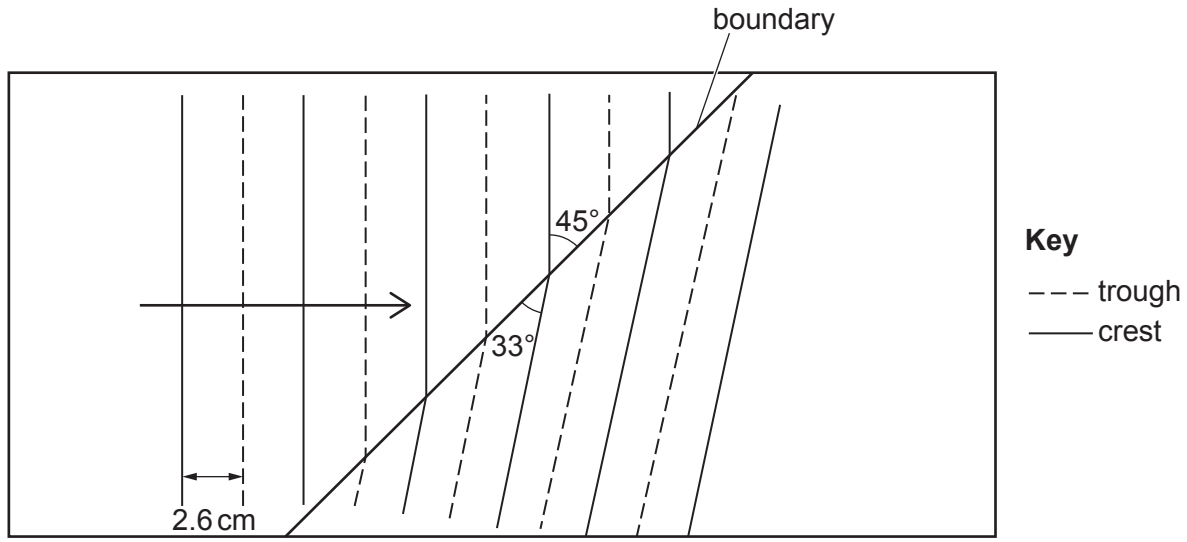

Fig. 6.1 (not to scale)

As the wave passes from one side to the other, the direction of the wavefronts changes.

(a) Explain why the direction of the wavefronts changes in the way shown in Fig. 6.1.

.....

.....

.....

.....

..... [3]

(b) The speed of the wave in the left-hand part of the tank is 0.39 m / s.

(i) Using information from Fig. 6.1, determine the frequency of the wave.

frequency = ... [3]

(ii) Determine the speed of the wave in the right-hand side of the tank.

speed = ... [3]

[Total: 9]

7 **(a)** A permanent magnet is made from only one material.

Underline the material from which it is possible to make a permanent magnet. [1]

aluminium **copper** **soft iron** **mercury** **plastic** **steel** **uranium**

(b) An electron source produces a narrow beam of electrons that all travel at the same speed.

The electron source is placed in a vacuum and the beam of electrons travels vertically downwards. Fig. 7.1 shows the beam of electrons before it passes between the N-pole and the S-pole of a magnet.

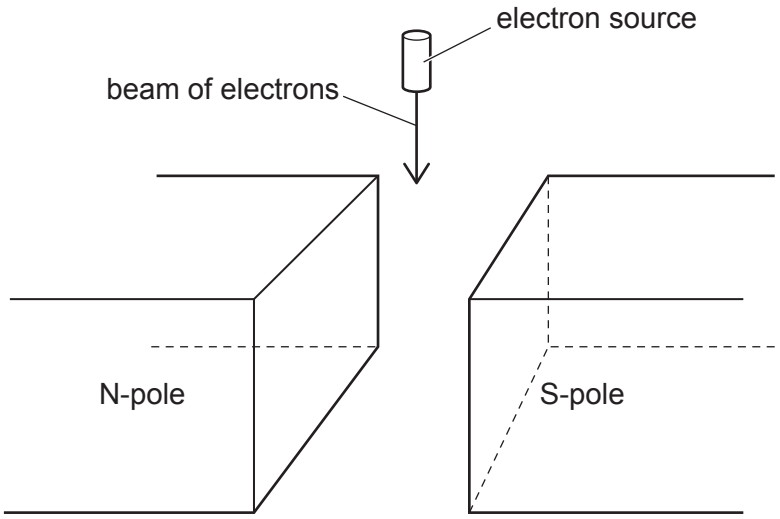

Fig. 7.1

(i) Describe what is meant by the direction of a magnetic field. State the direction of the magnetic field between the two poles in Fig. 7.1.

.....

.....

..... [1]

(ii) Describe and explain what happens to the beam of electrons in the magnetic field between the poles of the magnet in Fig. 7.1.

.....

.....

.....

..... [3]

(c) A beam consists of α-particles, β-particles and γ-rays.

Explain how a uniform magnetic field may be used to separate the α-particles, the β-particles and the γ-rays.

.....

.....

.....

..... [3]

[Total: 8]

8 **(a)** Explain what is meant by *electromotive force* (*e.m.f.*).

.....

.....

..... [2]

(b) An electric heater contains two heating elements R_1 and R_2. An electric motor operates a fan. The fan blows cool air over the heating elements.

Fig. 8.1 shows the circuit.

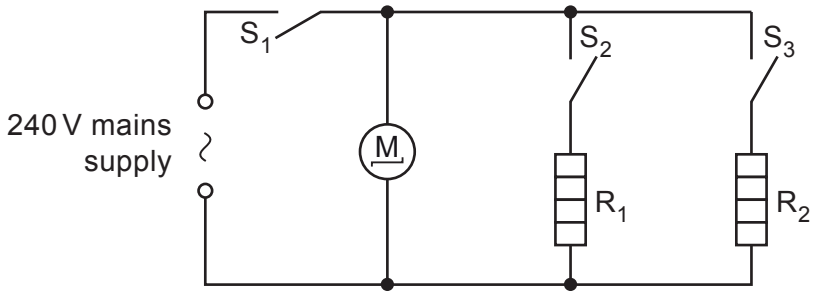

Fig. 8.1

The heater is powered by a mains supply of e.m.f. 240 V.

Switches S_1 and S_2 are closed. Heating element R_1 gets hot. The resistance of R_1 is 30 Ω.

(i) Calculate the current in heating element R_1.

current = ... [1]

(ii) Calculate the power produced in heating element R_1.

power = ... [2]

(iii) The resistance of heating element R_2 is 60 Ω.

Switches S_1, S_2 and S_3 are closed.

1. State and explain how the current in R_2 compares with the current in R_1.

.....

.....

..... [2]

2. The current in the motor is 0.10A. The cable from the electric heater to the plug for the mains socket is safe when the current in it is less than 20A.

Suggest and explain a suitable fuse rating for this circuit.

.....

.....

.....

..... [2]

[Total: 9]

9 **(a)** **(i)** Describe what is observed during *total internal reflection*.

.....

..... [1]

(ii) State **two** conditions required for light to be totally internally reflected.

1. .....

.....

2. .....

.....

[2]

(b) Describe and explain the action of optical fibres in communication technology. You may draw a diagram in your answer.

.....

.....

.....

..... [3]

[Total: 6]

10 A radiation detector is placed on the bench in a laboratory. It detects a background count rate of 40 counts / minute.

(a) State what is meant by background radiation. Suggest one source for it.

.....

.....

..... [2]

(b) A sample containing atoms of the radioactive isotope polonium-208 is removed from a lead container and brought close to the detector. The average count rate increases to 890 counts / minute.

When two sheets of paper are inserted between the sample and the detector, the average count rate returns to 40 counts / minute.

Polonium-208 is represented by the symbol $^{208}_{84}Po$. It decays to an isotope of lead (Pb).

(i) Deduce the type of radiation emitted by polonium-208. Explain your answer.

.....

.....

.....

..... [2]

(ii) Write down the nuclide equation for the decay of polonium-208.

[3]

[Total: 7]

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0172842249

PHYSICS **0625/43**

Paper 4 Theory (Extended) **October/November 2020**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.
- Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m / s^2).

INFORMATION

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

This document has **20** pages. Blank pages are indicated.

1 **(a)** Fig. 1.1 shows a trolley travelling down a ramp.

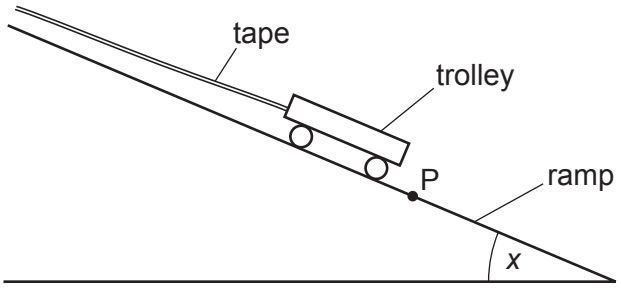

Fig. 1.1

The trolley has a piece of paper tape attached to it. The tape passes through a machine which makes a dot on the tape every 0.02 s.

Fig. 1.2 shows a section of the tape.

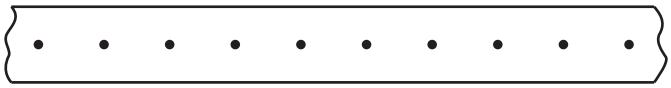

Fig. 1.2

(i) State how the dots on the tape show that the trolley was moving with constant speed.

..... [1]

(ii) When the trolley reaches the point P, the ramp is tilted so that the angle *x* is greater.

Describe and explain the change in motion of the trolley.

description .....

.....

explanation .....

.....
[2]

(b) Another trolley is released from the top of the ramp.

Fig. 1.3 shows the speed–time graph for this trolley.

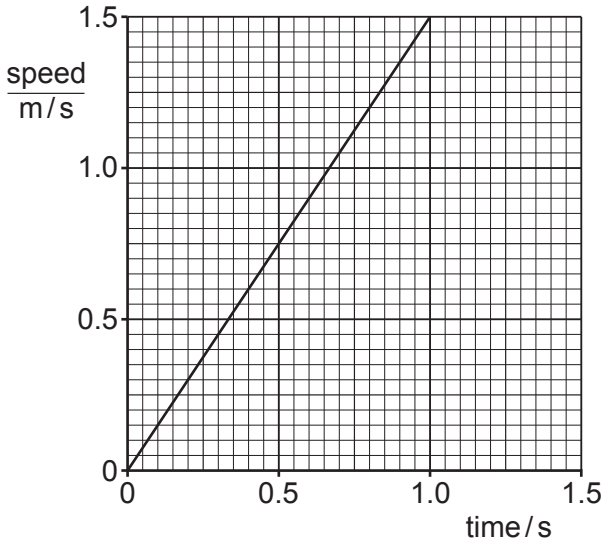

Fig. 1.3

Using Fig. 1.3, calculate the distance travelled by the trolley in the first 0.5 s.

distance = ... [2]

(c) Fig. 1.4 shows a metal ball at rest in a tube of liquid.

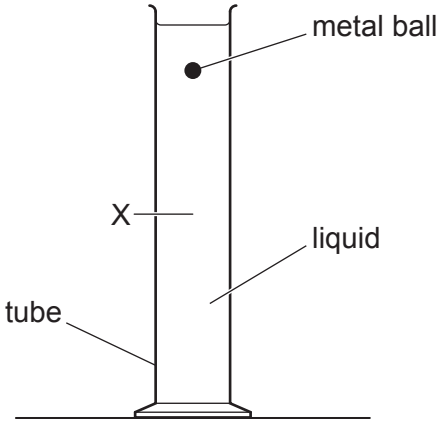

Fig. 1.4

The ball is released and reaches terminal velocity at point X.

Explain the motion of the ball as it falls from rest until it reaches point X.

Use ideas of force and acceleration in your answer.

.....

.....

.....

.....

..... [3]

[Total: 8]

2 Fig. 2.1 shows a cliff edge with water below it.

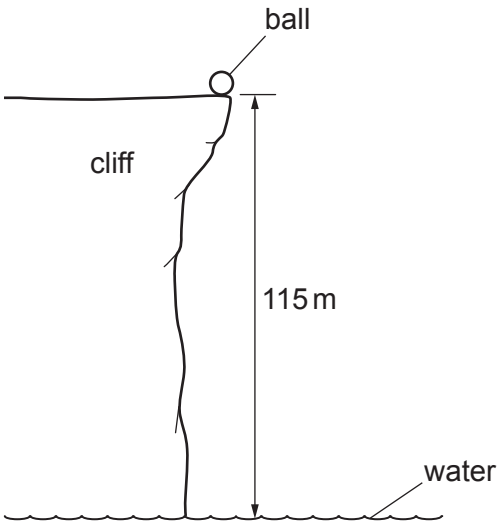

Fig. 2.1

A ball falls over the edge of the cliff. The mass of the ball is 160 g. The height of the cliff is 115 m.

(a) Calculate the vertical speed of the ball as it hits the water. Air resistance can be ignored.

speed = ... [3]

(b) Calculate the vertical momentum of the ball as it hits the water.

momentum = ... [2]

[Total: 5]

3 **(a)** **(i)** Speed is a scalar quantity.

State **one** other scalar quantity.

..... [1]

(ii) Velocity is a vector quantity.

State **one** other vector quantity.

..... [1]

(b) Fig. 3.1 shows a model car travelling at constant speed on a flat circular track.

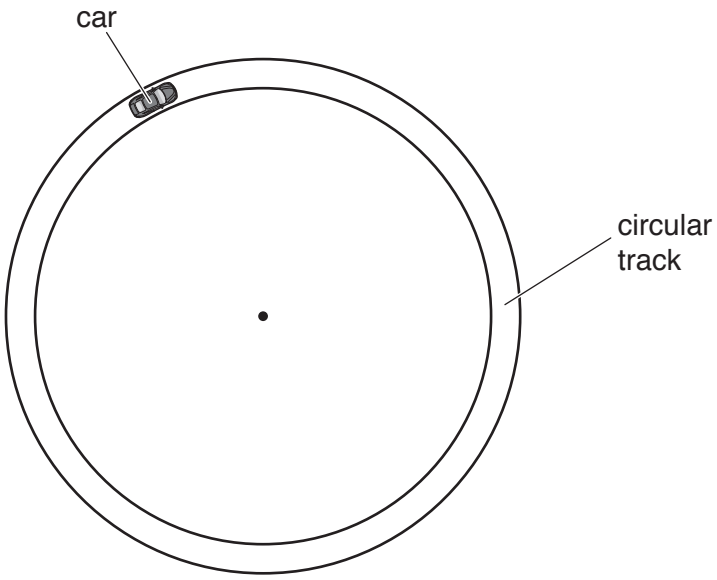

Fig. 3.1

The speed of the car is 0.30 m / s. In one complete revolution around the track, the car travels 3.9 m.

(i) Calculate the time taken for the car to complete one revolution around the track.

time = ... [2]

(ii) On Fig. 3.1, draw and label with the letter F an arrow to show the resultant force acting on the car. [1]

(iii) The speed of the car increases and at point P on Fig. 3.2 the car does not stay on the track.

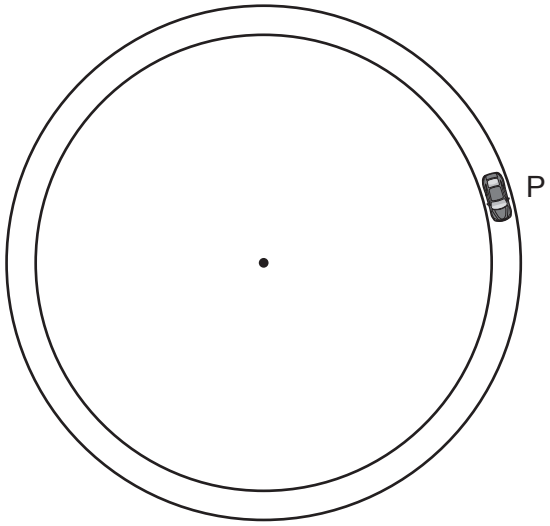

Fig. 3.2

1. Suggest, in terms of the force acting on the car, why the car does not stay on the track at point P.

.....

..... [1]

2. On Fig. 3.2, draw and label an arrow with the letter S to show the direction of motion of the car as it leaves the track at point P. [1]

[Total: 7]

4 In Fig. 4.1, the circles represent molecules in different states of matter.

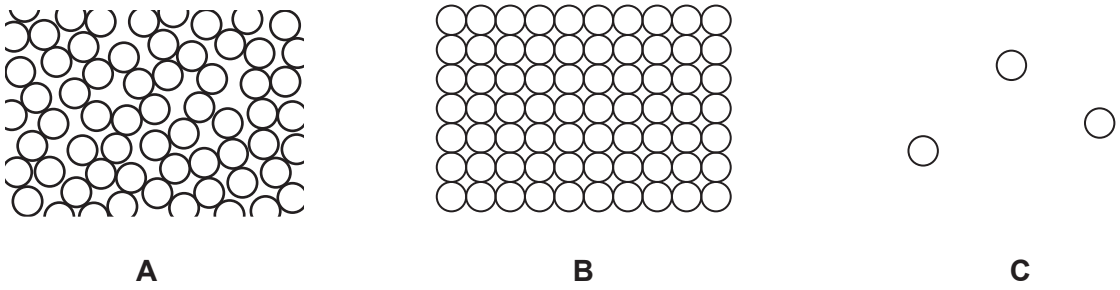

Fig. 4.1

(a) Identify the states **A**, **B** and **C**.

A ……..

B ……..

C ……..

[2]

(b) Explain, in terms of forces between molecules, why gases expand more than liquids when they have the same rise in temperature. Assume that the pressure remains constant.

.....

.....

..... [2]

(c) Fig. 4.2 shows a cylinder and piston.

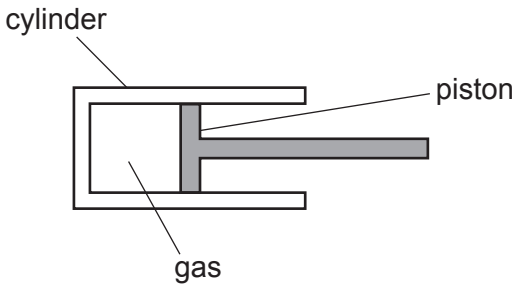

Fig. 4.2

The volume of gas in the cylinder is 3400 cm^3. The pressure of the gas in the cylinder is 0.90×10^5 Pa.

(i) The piston is moved to the left and fixed in a new position. The pressure of the gas in the cylinder increases to 2.5×10^5 Pa. Assume that the temperature of the gas does not change.

Calculate the new volume of the gas.

volume = ... [3]

(ii) The gas in the cylinder is now heated. The piston remains fixed in the same position as in **(c)(i)**.

State and explain, in terms of molecules, any change in the pressure of the gas.

statement .....

explanation .....

.....
[3]

[Total: 10]

5 Fig. 5.1 shows two metal plates A and B with a radiant heater placed midway between them.

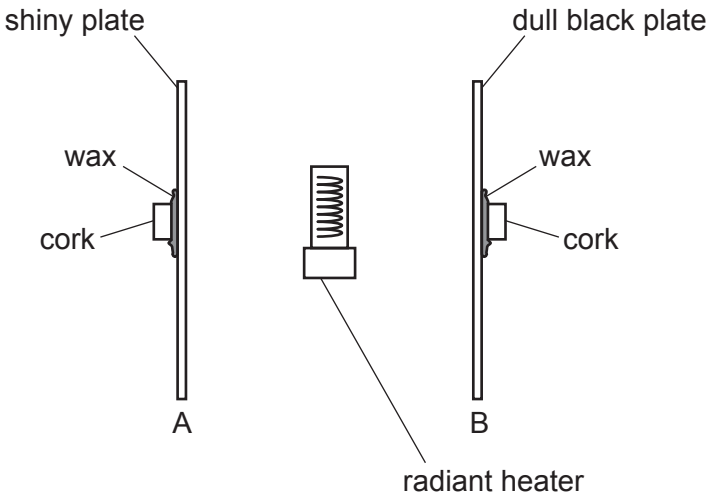

Fig. 5.1

Metal plate A is shiny. Metal plate B is dull black. A piece of cork is attached to each plate using wax. The wax is a solid at room temperature and has a melting point of 37 °C.

(a) State and explain what happens to the pieces of cork a few minutes after the heater is switched on.

.....

.....

.....

.....

..... [4]

(b) Give the name of the method of transfer of thermal energy in solid metals.

..... [1]

[Total: 5]

6 **(a)** Sound waves consist of compressions and rarefactions.

Explain the terms *compression* and *rarefaction*. Give your explanation in terms of the spacing of molecules and the pressure for sound waves in air.

compression .....

.....

rarefaction .....

.....
[3]

(b) A musical instrument emits a sound with a frequency of 4.4 kHz. The speed of sound in air is 340 m / s.

(i) Calculate the wavelength of the sound.

wavelength = ... [3]

(ii) The frequency of the sound emitted by the instrument is changed to 5.1 kHz and the amplitude of the sound is increased.

Without calculation, state what happens to

1. the speed of the sound .....

2. the wavelength of the sound .....
[2]

[Total: 8]

7 **(a)** State **two** uses for infrared radiation.

1. .....

.....

2. .....

.....

[2]

(b) X-rays are used in hospitals to help treat patients.

Suggest and explain **three** precautions for the safe use of X-rays.

1. .....

.....

2. .....

.....

3. .....

.....

[3]

(c) **(i)** State the speed in a vacuum of

1. microwaves ..... [1]

2. X-rays ..... [1]

(ii) State a possible frequency for an ultrasound wave.

..... [1]

[Total: 8]

8 (a) (i) Fig. 8.1 shows an electrical circuit. The resistor has a resistance of 4.0 Ω. The reading on the voltmeter is 3.0 V.

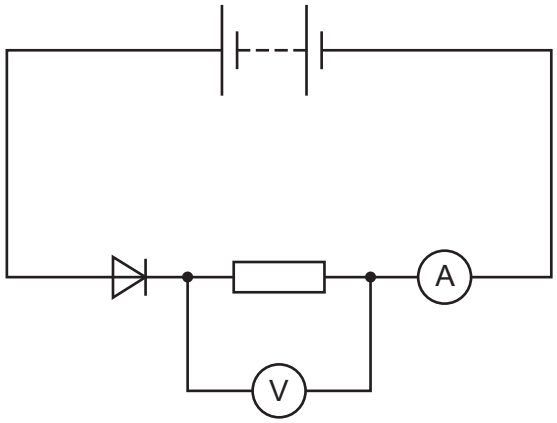

Fig. 8.1

Calculate the current in the resistor.

current = ... [2]

(ii) Fig. 8.2 shows the same circuit with one component reversed.

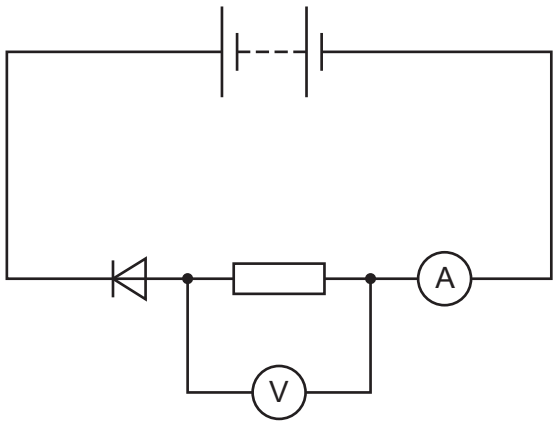

Fig. 8.2

State the reading on the voltmeter and explain your answer.

reading = ...

explanation .....

.....
[2]

(b) Fig. 8.3 shows the symbol for a logic gate.

Fig. 8.3

The truth table for this logic gate is shown in Table 8.1.

Table 8.1

input X	input Y	output Z
0	0	0
0	1	0
1	0	0
1	1	1

State the name of this logic gate. ……... [1]

(c) (i) A student designs the circuit shown in Fig. 8.4.

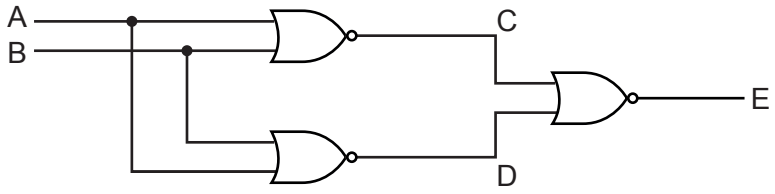

Fig. 8.4

Complete the truth table for this circuit in Table 8.2.

Table 8.2

A	B	C	D	E
0	0			
0	1			
1	0			
1	1			

[3]

(ii) A single logic gate can be used to produce output E in Fig. 8.4 with the inputs A and B shown in Table 8.2.

State the name of this logic gate. ……. [1]

[Total: 9]

9 **(a)** Electrical power is produced in a power station by an alternating current (a.c.) generator. The output of the generator has a voltage of 22 000 V. The electrical power is transmitted at a voltage of 400 000 V.

Explain why electrical power is transmitted at a voltage of 400 000 V and not 22 000 V.

.....

.....

.....

.....

.....

..... [3]

(b) A computer contains a transformer.

The input voltage to the transformer is 240 V. The output voltage from the transformer is 20 V and the output current is 2.3 A.

The efficiency of the transformer is 90%.

Calculate the input current to the transformer.

current = ... [5]

[Total: 8]

10 Fig. 10.1 shows a relay.

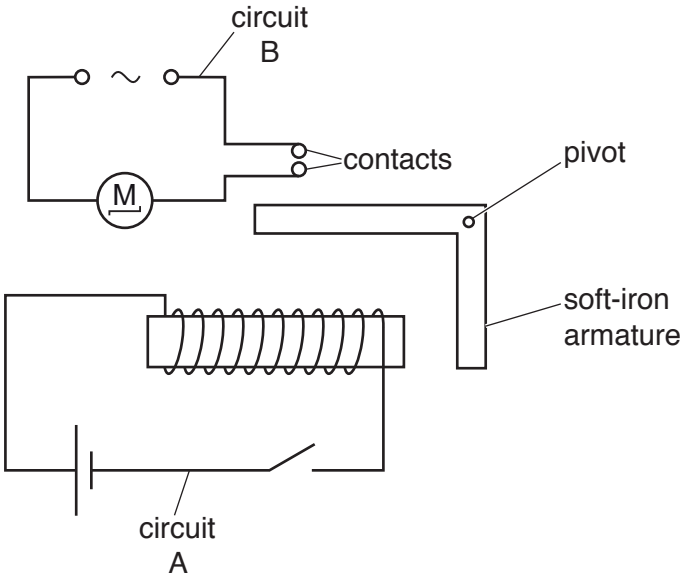

Fig. 10.1

(a) The switch in circuit A is closed. Describe how this operates the motor in circuit B.

.....

.....

.....

..... [3]

(b) The switch in circuit A is opened. The soft-iron armature is replaced with a steel armature. The switch in circuit A is closed.

Explain what happens when the switch in circuit A is then opened.

.....

.....

..... [2]

[Total: 5]

11 **(a)** Fig. 11.1 shows a beam of α-particles, β-particles and γ-rays directed between two metal plates P and Q.

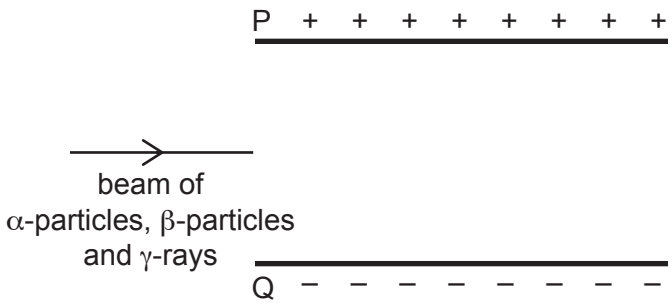

Fig. 11.1

The metal plates are parallel and there is a large potential difference (p.d.) between them. Plate P is positive and plate Q is negative.

On Fig. 11.1, draw the paths of each of the radiations between the plates and after leaving the plates.

Label the paths α, β and γ. [5]

(b) State and explain **one** practical application of γ-rays.

application .....

explanation .....

.....

[2]

[Total: 7]

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0983362815

PHYSICS **0625/61**

Paper 6 Alternative to Practical **October/November 2020**

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Blank pages are indicated.

DC (DH/CGW) 196156/4

1 A student determines the density of modelling clay by two methods.

Method 1

(a) Fig. 1.1 shows one face of a piece of modelling clay that the student uses. This is sample A.

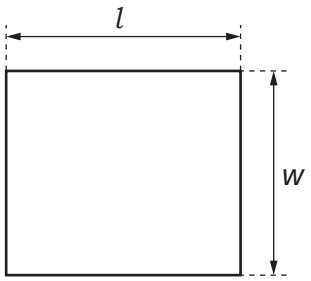


Fig. 1.1

The student measures the depth d of sample A.

d = 3.2 cm

(i) Measure and record the length l and the width w of the sample A of modelling clay. Fig. 1.1 is drawn actual size.

l = ... cm

w = ... cm
[1]

(ii) Calculate the volume V_A of sample A using the equation $V_A = l \times w \times d$.

V_A = ... cm^3 [1]

(iii) Fig. 1.2 shows sample A on a balance. Record the mass m_A of sample A to the nearest g.

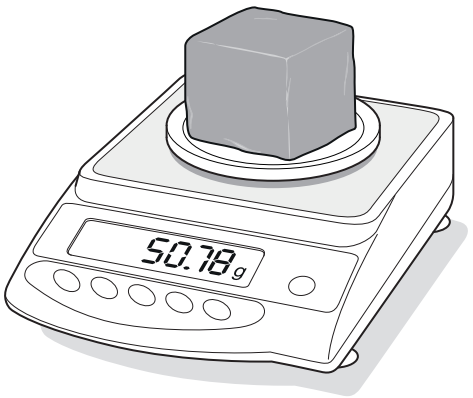


Fig. 1.2

m_A = ... g [1]

(iv) Calculate the density ρ_A of sample A of modelling clay using the equation $\rho_A = \frac{m_A}{V_A}$.

Give your answer to a suitable number of significant figures for this method and include the unit.

ρ_A = ... [2]

Method 2

(b) The student records the volume V_1 of water in a measuring cylinder.

V_1 = 150 cm^3

He carefully lowers sample B of the same modelling clay into the measuring cylinder until it is completely covered with water.

He records the new reading V_2 of the water level in the measuring cylinder.

V_2 = 182 cm^3

(i) Calculate the volume V_B of sample B using the equation $V_B = V_2 - V_1$.

V_B = ... cm^3 [1]

(ii) The student measures the mass m_B of sample B.

m_B = 60 g

Calculate the density ρ_B of sample B using the equation $\rho_B = \frac{m_B}{V_B}$. Give your answer to a suitable number of significant figures for this method and include the unit.

ρ_B = ... [1]

(c) A student suggests that the density of modelling clay is **not** affected by the mass or the volume of the sample used.

State whether your results agree with the suggestion. Justify your answer by reference to your results.

statement .....

justification .....

.....

[2]

(d) Tick the boxes that describe the correct line of sight for taking a reading of the volume of water in a measuring cylinder. Fig. 1.3 shows the curved surface of water, which is called the meniscus.

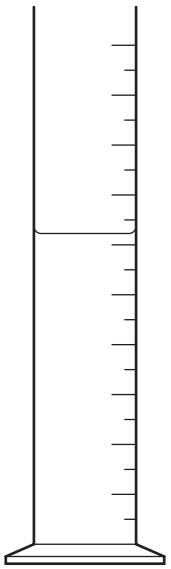


Fig. 1.3

- ☐ along the scale
- ☐ parallel to the scale
- ☐ perpendicular to the scale
- ☐ vertical to the scale
- ☐ in line with the bottom of the meniscus
- ☐ in line with the top of the meniscus
- ☐ in line with midway between the top and bottom of the meniscus.

[2]

[Total: 11]

2 A student investigates the cooling of water under different conditions.

Fig. 2.1 shows the apparatus she uses.

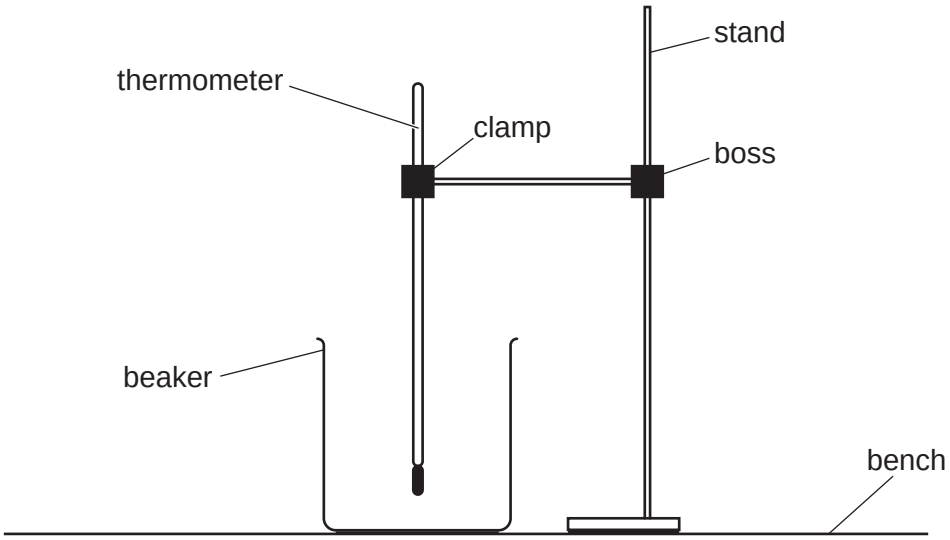


Fig. 2.1

(a) The thermometer in Fig. 2.2 shows the room temperature θ_R at the beginning of the experiment. Record θ_R.

Fig. 2.2

θ_R = ... [1]

(b) The student pours 200 cm^3 of hot water into the beaker.

She records the temperature θ of the hot water at time t = 0. She immediately starts a stopclock.

After 180 s, she measures the temperature θ shown on the thermometer. Her temperature readings are shown in Table 2.1.

Table 2.1

t/	θ_1/
	85
	69

(i) Complete the time column and the column headings in Table 2.1. [1]

(ii) Calculate the drop in temperature $\Delta\theta_1$ between times t = 0 and t = 180 s.

$\Delta\theta_1$ = ... [1]

(iii) Calculate the average rate of cooling R_1 of the water using the equation $R_1 = \frac{\Delta\theta_1}{\Delta t}$,

where Δt = 180 s. Include the unit.

R_1 = ... [1]

(c) The student empties the beaker. She pours 150 cm^3 of hot water into the beaker. She adds 50 cm^3 of cold water to the beaker. She repeats the timing and temperature recording procedure described in **(b)**. The temperature readings are shown in Table 2.2.

Table 2.2

t/	θ_2/
	69
	57

(i) Complete the time column and the column headings in Table 2.2. [1]

(ii) Calculate the drop in temperature $\Delta\theta_2$ between times t = 0 and t = 180 s.

$\Delta\theta_2$ = ...

Calculate the average rate of cooling R_2 of the water using the equation $R_2 = \frac{\Delta\theta_2}{\Delta t}$,

where $\Delta t = 180\,\text{s}$. Include the unit.

R_2 = ... [1]

(d) A student suggests that the average rate of cooling R of the water depends on the difference D between the temperature of the water at time $t = 0$ and room temperature.

(i) Calculate the difference D_1 using the readings in Table 2.1 and your answer to **(a)**.

D_1 = ...

Calculate the difference D_2 using the readings in Table 2.2 and your answer to **(a)**.

D_2 = ...
[1]

(ii) Write a conclusion about the relationship between R and D. Justify your answer by reference to your results.

conclusion .....

.....

justification .....

.....

.....
[2]

(e) **(i)** Explain why the thermometer scale should be read at right-angles.

.....

..... [1]

(ii) Explain why the mixture of hot and cold water should be stirred before taking the temperature reading at the start of the experiment in **(c)**.

.....

..... [1]

[Total: 11]

[Turn over

3 A student investigates the magnification of the image produced by a lens.

Fig. 3.1 shows the apparatus used.

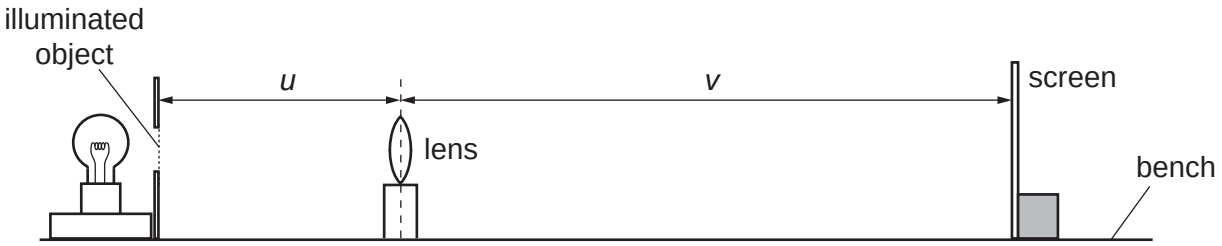


Fig. 3.1

Fig. 3.2 shows a triangular hole in a card that forms the illuminated object. Fig. 3.2 is drawn actual size.

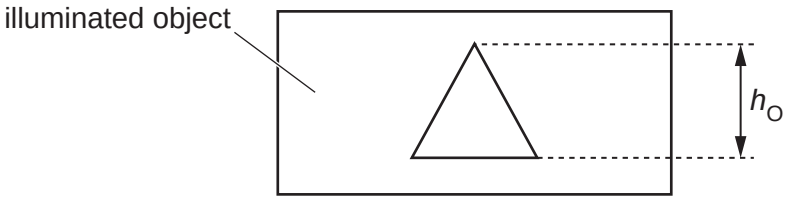


Fig. 3.2

(a) On Fig. 3.2, measure and record the height h_O of the object.

h_O = ... [1]

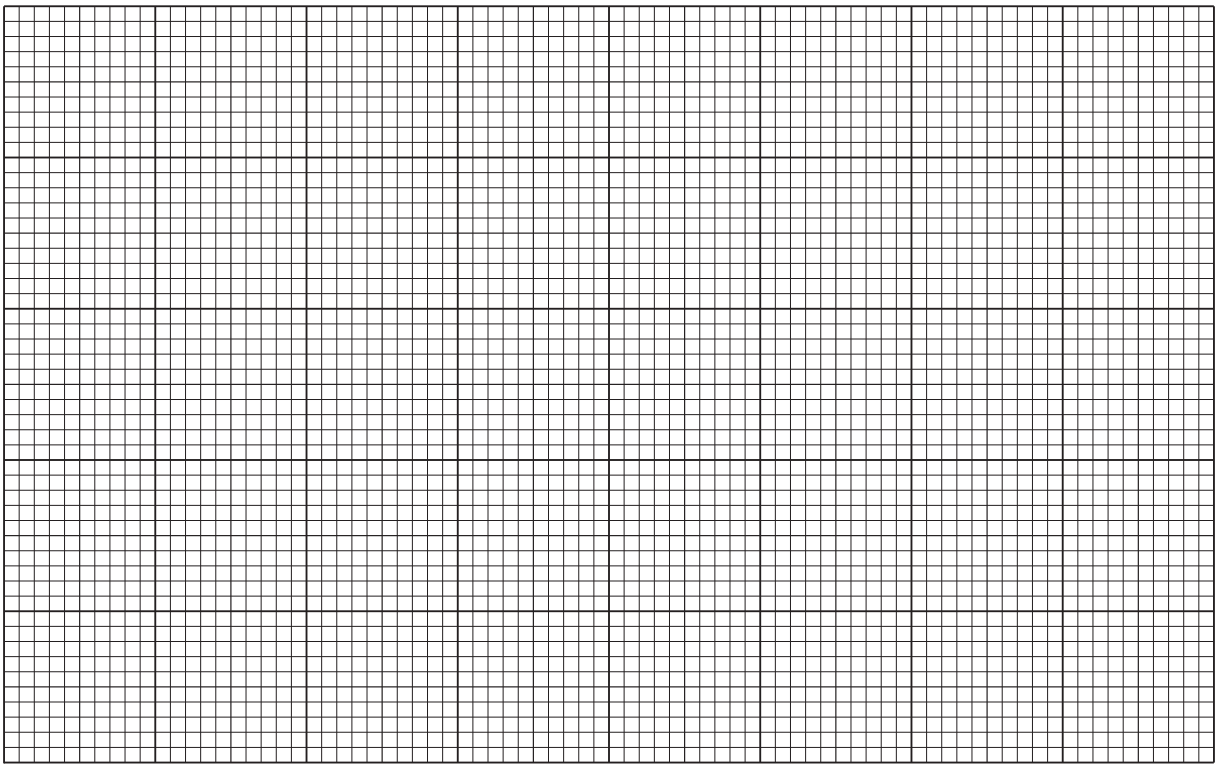
(b)
- The student places the lens a distance u = 20.0 cm from the illuminated object.
- He moves the screen slowly until a clearly focused image is formed on the screen.
- He measures the distance v between the centre of the lens and the screen.
- He repeats the procedure using values of u equal to 25.0 cm, 30.0 cm, 35.0 cm and 40.0 cm.
- The readings are shown in Table 3.1.

Table 3.1

u / cm	v / cm	m
20.0	70.9	
25.0	41.5	
30.0	32.5	
35.0	28.1	
40.0	25.6	

Calculate, and record in Table 3.1, the magnification m for each value of u. Use the equation $m = \frac{v}{u}$. [1]

(c) Plot a graph of u / cm (y-axis) against m (x-axis). Start the y-axis at u = 20.0 cm.



[4]

(d) Use your graph to determine the value of the object distance u_1 when the magnification m = 1.0.

Show clearly on the graph how you obtained the necessary information.

u_1 = ... cm [2]

(e) Calculate the focal length f of the lens using the equation $f = \frac{u_1}{2}$.

f = ... cm [1]

(f) State **two** precautions that you would take with this experiment in order to obtain accurate readings.

1. .....

.....

2. .....

.....

[2]

[Total: 11]

4 A student investigates the resistances of different wires.

Plan an experiment to investigate the resistances of wires made from different metals.

Resistance is calculated using the equation $R = \frac{V}{I}$.

The following apparatus is available:

ammeter
voltmeter
power supply
metre rule
a selection of wires made from different metals.

You can also use other apparatus and materials that are usually available in a school laboratory.

In your plan, you should:

- write a list of suitable metals for the wires you will investigate
- draw a diagram of a suitable electrical circuit using standard electrical symbols
- explain briefly how to carry out the investigation
- state the key variables to keep constant
- draw a table, or tables, with column headings, to show how to display your readings (you are **not** required to enter any readings in the table).

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Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

PHYSICS **0625/63**

Paper 6 Alternative to Practical **October/November 2020**

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Blank pages are indicated.

DC (DH/CGW) 196161/3

1 Some students investigate the transfer of thermal energy from a beaker of hot water. They use the apparatus shown in Fig. 1.1.

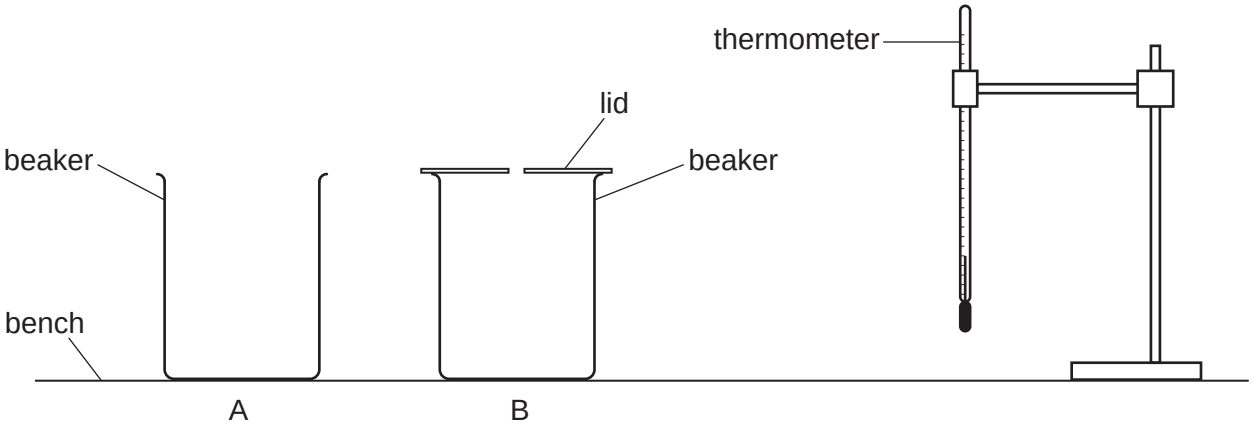

Fig. 1.1

(a) Fig. 1.2 shows the reading on the thermometer at the start of the investigation.

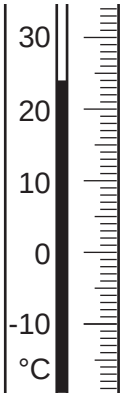

Fig. 1.2

Record the room temperature θ_R shown on the thermometer in Fig. 1.2.

θ_R = ... [1]

(b) A student pours 100 cm^3 of hot water into beaker A.
He records the temperature of the water in beaker A and immediately starts a stopclock.
The student records the temperature θ of the water every 30 s. His readings are shown in Table 1.1.

The student repeats the procedure for beaker B. Beaker B is fitted with a lid.

Complete the headings and the time column in Table 1.1.

Table 1.1

	beaker A without a lid	beaker B with a lid
t/	θ_A/	θ_B/
0	85.0	86.0
	79.0	83.0
	73.5	80.5
	68.5	78.5
	64.0	77.0
	60.0	76.5
	56.5	76.0

[2]

(c) Describe a precaution that should be taken to ensure that the temperature readings are as accurate as possible in this experiment.

.....

..... [1]

(d) **(i)** Write a conclusion stating how using the lid affects the cooling of the water.

.....

.....

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..... [1]

(ii) The temperature of the water in each beaker decreases during this investigation.

Describe **one** other similarity in the pattern of the cooling of water in beakers A and B.

.....

..... [1]

(e) **(i)** Calculate the average rate of cooling x_A of the water in beaker A. Use the values of θ_A from Table 1.1 and the equation $x_A = \frac{(\theta_0 - \theta_{180})}{T}$

where θ_0 is the temperature of the water in beaker A at $t = 0$, θ_{180} is the temperature of the water at $t = 180$ s, and $T = 180$ s.

Include a unit.

x_A = ... [1]

(ii) Calculate the average rate of cooling x_B of the water in beaker B. Use the values of θ_B from Table 1.1 and the equation $x_B = \frac{(\theta_0 - \theta_{180})}{T}$

where θ_0 is the temperature of the water in beaker B at $t = 0$, θ_{180} is the temperature of the water at $t = 180$ s, and $T = 180$ s.

x_B = ... [1]

(iii) Thermal energy is transferred from the surface of the water and from the sides of the beaker during the investigation.

A student suggests that more thermal energy is transferred from the surface of the water than from the sides of the beaker.

State whether your results support this suggestion. Justify your statement by reference to your values of x_A, the average rate of cooling without a lid, and x_B, the average rate of cooling with a lid.

statement .....

justification .....

.....

.....
[2]

(f) Suggest a change to the apparatus or the procedure to produce a greater difference between x_A and x_B.

.....

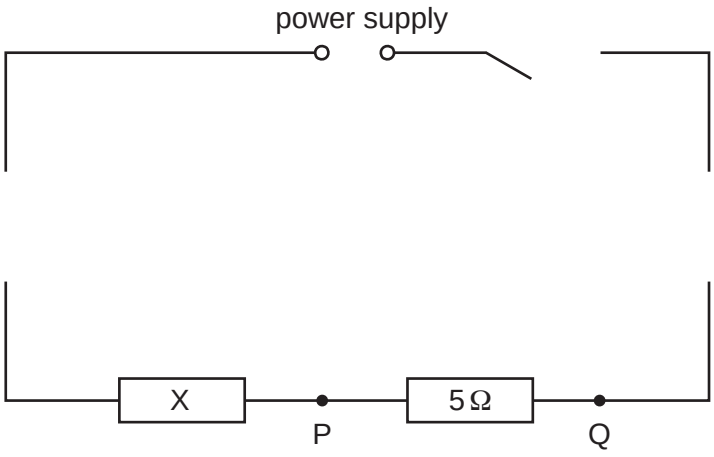
.....

..... [1]

[Total: 11]

2 Some students investigate an electrical circuit containing different combinations of resistors.

They use circuit A shown in Fig. 2.1.
Circuit A is not shown complete.



circuit A

Fig. 2.1

(a) On Fig. 2.1, complete circuit A to show a voltmeter connected to measure the potential difference (p.d.) across resistor X and an ammeter connected to measure the current in the circuit. [2]

(b) A student measures the potential difference *V* across resistor X and the current *I* in the circuit. The voltmeter reading is shown in Fig. 2.2. The ammeter reading is shown in Fig. 2.3.

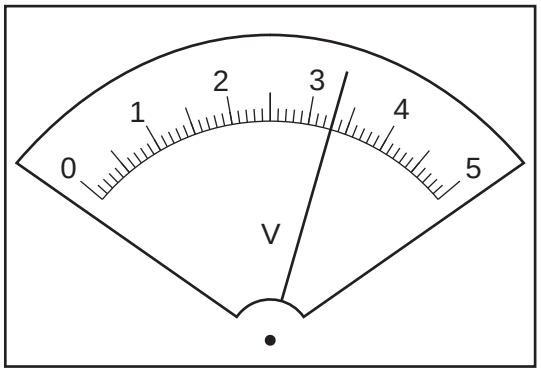


Fig. 2.2

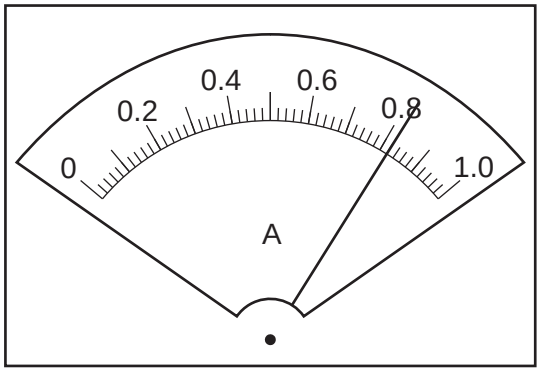


Fig. 2.3

Record, in the first line of Table 2.1, the values of *V* and *I* shown on the meters in Fig. 2.2 and Fig. 2.3. [1]

Table 2.1

circuit	V/	I/	R/Ω
A			
B	2.1	0.54	
C	1.6	0.39	

(c) The student now connects two 5Ω resistors in series between P and Q, as shown in Fig. 2.4, to form circuit B. The rest of the circuit remains as in Fig. 2.1.

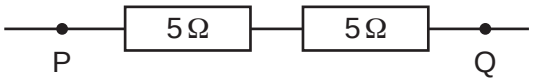


Fig. 2.4

She measures the potential difference (p.d.) V across resistor X and the current I in the circuit.

The student then connects three 5Ω resistors in series between P and Q, as shown in Fig. 2.5, to form circuit C. The rest of the circuit remains as in Fig. 2.1.

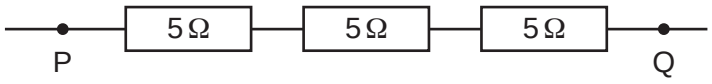


Fig. 2.5

She measures the potential difference (p.d.) V across resistor X and the current I in the circuit.

All her readings are shown in Table 2.1.

(i) Complete the headings in Table 2.1. [1]

(ii) Calculate, and record in Table 2.1, a value for the resistance R of resistor X for each combination of resistors the student has used.

Use the readings from Table 2.1 and the equation $R = \frac{V}{I}$.

[2]

(d) A student suggests that the values of *R* should be the same.
State whether your results support this suggestion. Justify your statement by reference to values from your results.

statement .....

justification .....

.....

.....
[2]

(e) The results can be checked by using a different circuit.

Draw, on Fig. 2.6, **one** other arrangement of **three** 5 Ω resistors between terminals P and Q.

Fig. 2.6

[1]

(f) **(i)** A student wants to determine *R* by using a variable resistor to vary the current in the circuit. Draw the circuit symbol for a variable resistor.

[1]

(ii) Explain **one** advantage of using a variable resistor to vary the current compared to the procedure carried out in **(b)** and **(c)**.

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..... [1]

[Total: 11]

3 A student investigates the image produced by a converging lens.

She uses the apparatus shown in Fig. 3.1.

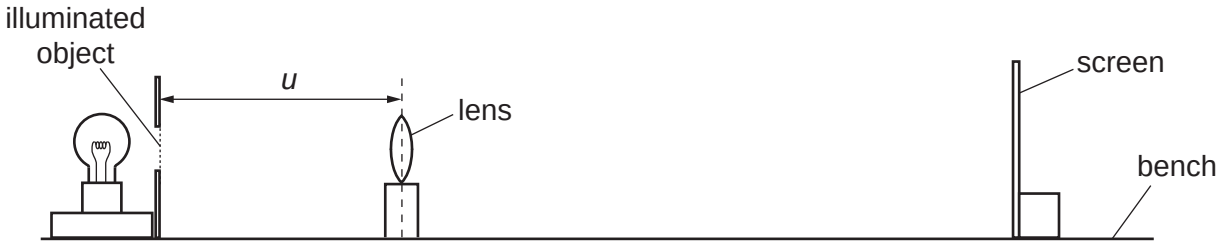


Fig. 3.1

(a) Fig. 3.2 shows the illuminated object, drawn to full size.

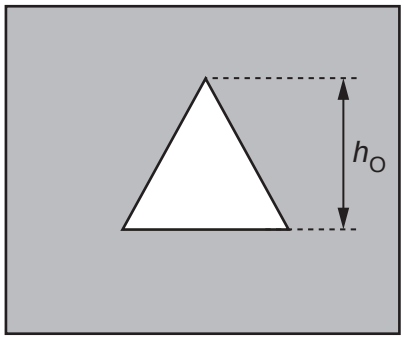


Fig. 3.2

Measure and record the height h_O of the illuminated object, as shown on Fig. 3.2.

h_O = ... cm [1]

(b) The distance *u* between the illuminated object and the lens is set to 20.0 cm.

The screen is moved until a sharp image of the illuminated object is seen, as shown full size in Fig. 3.3.

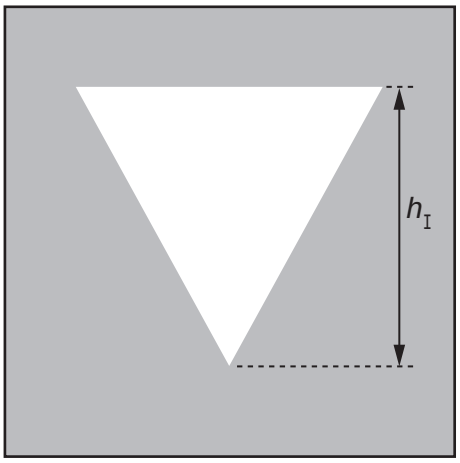


Fig. 3.3

(i) Measure and record in the first line of Table 3.1 the height h_I of the image, as shown on Fig. 3.3. [1]

(ii) Calculate and record in Table 3.1 a value W using your measurements for h_O and h_I and the equation $W = \frac{h_O}{h_I}$.

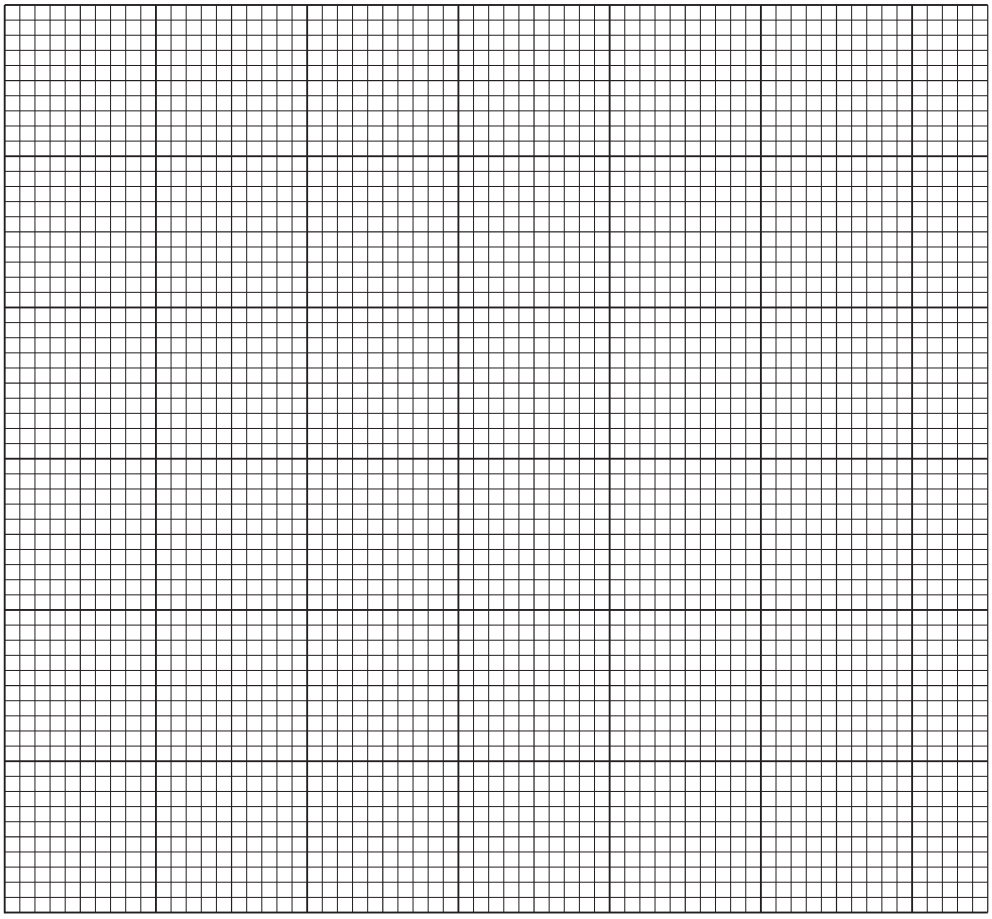
Table 3.1

u / cm	h_I / cm	W
20.0		
30.0	1.5	1.3
40.0	1.0	2.0
50.0	0.7	2.9
60.0	0.6	3.3

[1]

(c) The student repeats the process for u = 30.0 cm, 40.0 cm, 50.0 cm and 60.0 cm. Her results are shown in Table 3.1.

Plot a graph of u / cm (y-axis) against W (x-axis).



[4]

(d) The gradient of the line on the graph is numerically equal to the focal length f of the lens.

Record a value of f for this experiment. Show clearly on the graph how you obtained the necessary information to determine the gradient.

f = ... [2]

(e) A student decides to extend the experiment using larger values of u.

Use Table 3.1 to explain why this could produce **less reliable** values for W.
Suggest an improvement to overcome this difficulty.

explanation .....

.....

improvement .....

.....

[2]

[Total: 11]

4 A student investigates the factors that affect the average speed of a ball falling in water.

Plan an experiment which will enable him to investigate the effect of **one** factor on the speed at which a ball of modelling clay falls in water.

The apparatus available includes:

modelling clay that can be made into different sized balls
metal ball bearings that can be embedded in the modelling clay
a long transparent tube, closed at one end
a supply of water

In your plan, you should:

- state clearly the factor to be investigated
- list any additional apparatus needed
- state any key variables to be kept the same
- explain how to carry out the investigation, including the measurements to be made and any precautions that must be taken to ensure reliable results
- explain how to use the readings to reach a conclusion.

You may draw a diagram if it helps to explain your plan.

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[Total: 7]

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PHYSICS **0625/22**

Paper 2 Multiple Choice (Extended) **February/March 2020**

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- 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 multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m / s^2).

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.

This document has **20** pages. Blank pages are indicated.

Name

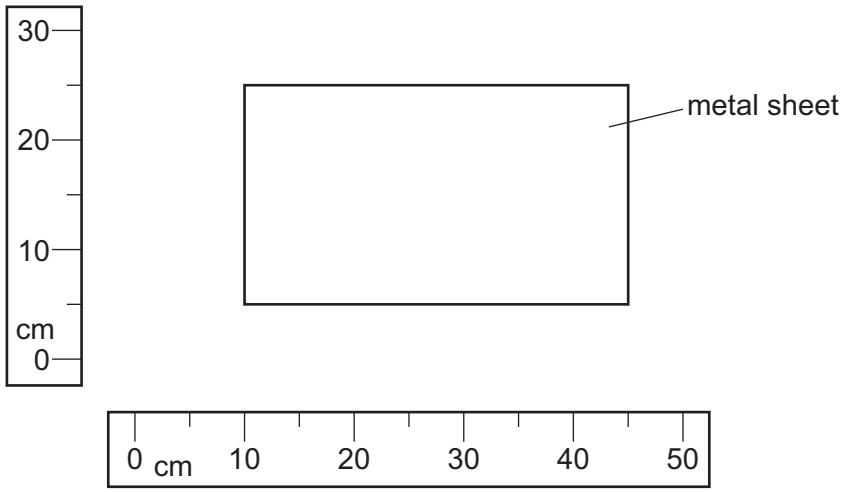
Class

ZipGrade.com

40 Questions (0866)

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

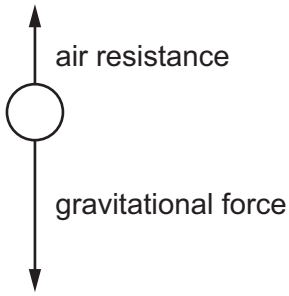
1 The diagram shows a rectangular metal sheet close to two rulers.



What is the area of the metal sheet?

A 700 cm^2 **B** 875 cm^2 **C** 900 cm^2 **D** 1125 cm^2

2 A ball falls from rest through the air towards the ground. The diagram shows two forces acting on the ball.



As the ball falls, the air resistance increases.

Which statement is correct?

A The acceleration of the ball decreases.

B The acceleration of the ball increases.

C The speed of the ball decreases.

D The gravitational force on the ball decreases.

3 A compressed spring projects a ball horizontally in a vacuum chamber.

On the Earth, the ball reaches the chamber floor 4.0 m in front of the spring.

An identical experiment is done on the Moon. The gravitational field strength is lower on the Moon than on the Earth.

The experimental results on the Moon are compared with those on the Earth.

Which statement is correct?

A The horizontal speed is greater on the Moon and the ball hits the floor 4.0 m in front of the spring.

B The horizontal speed is greater on the Moon and the ball hits the floor more than 4.0 m in front of the spring.

C The horizontal speed is the same on the Moon and the ball hits the floor 4.0 m in front of the spring.

D The horizontal speed is the same on the Moon and the ball hits the floor more than 4.0 m in front of the spring.

4 Diagram 1 shows a piece of flexible material that contains many pockets of air. Diagram 2 shows the same piece of flexible material after it has been compressed so that its volume decreases.

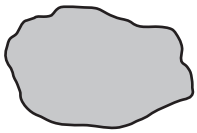


diagram 1
(before compression)

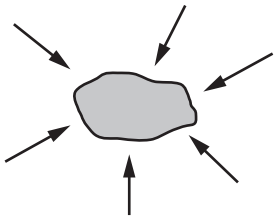
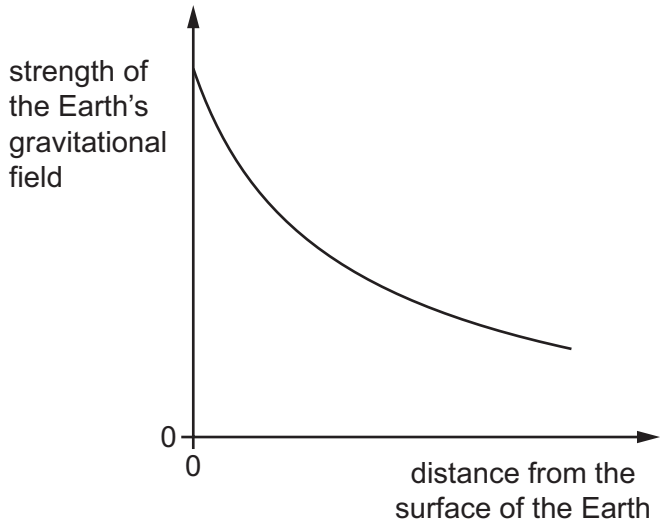


diagram 2
(after compression)

What happens to the mass and to the weight of the flexible material when it is compressed?

	mass	weight
A	increases	increases
B	increases	no change
C	no change	increases
D	no change	no change

5 The graph shows how the strength of the Earth's gravitational field varies as the distance from the Earth's surface increases.



Which row describes the effect that this has on the mass and on the weight of an object as it moves further away from the Earth's surface?

	mass of object	weight of object
A	decreases	decreases
B	decreases	unchanged
C	unchanged	decreases
D	unchanged	unchanged

6 A measuring cylinder contains 40 cm^3 of water.

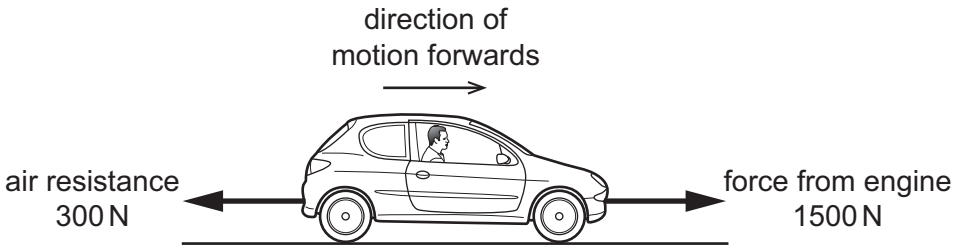
A solid metal ball is dropped into the water and the water level rises to 56 cm^3.

The mass of the ball is 80 g.

What is the density of the metal from which the ball is made?

A 0.20 g/cm^3 **B** 1.4 g/cm^3 **C** 2.0 g/cm^3 **D** 5.0 g/cm^3

7 A car travels along a horizontal road at constant speed. Three horizontal forces act on the car. The diagram shows two of these forces.



What is the size and the direction of the third horizontal force acting on the car?

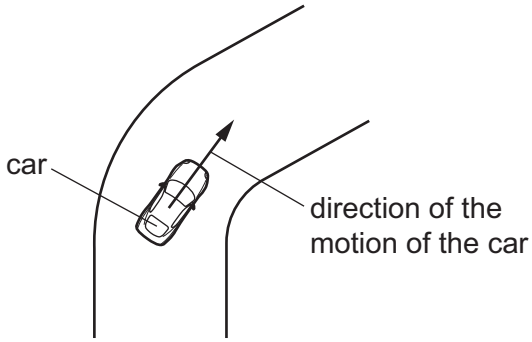
A 1200 N backwards

B 1200 N forwards

C 1800 N backwards

D 1800 N forwards

8 A car is driven round a bend in the road at a constant speed.



What is the direction of the resultant force on the car when it is going round the bend?

A parallel to the motion and in the same direction as the motion

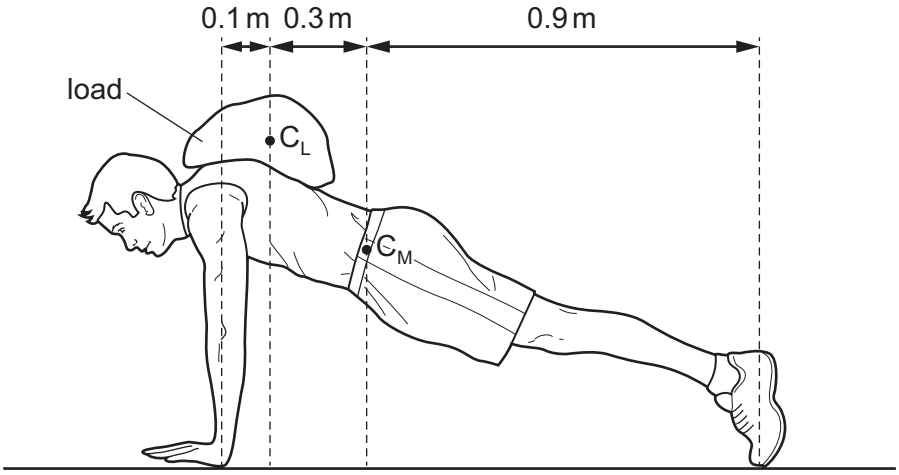
B parallel to the motion and in the opposite direction to the motion

C perpendicular to the motion and towards the inside of the bend

D perpendicular to the motion and towards the outside of the bend

9 An athlete with mass 70 kg trains by performing press-ups with a load on his back. The diagram shows the perpendicular distances involved.

The centre of mass of the athlete is C_M and the centre of mass of the load he is carrying is C_L.



The mass of the load is 6.0 kg.

What is the upward force exerted by his two arms?

A 54 N **B** 76 N **C** 540 N **D** 760 N

10 An air pistol fires a pellet forwards.

What is the motion of the air pistol?

A The air pistol moves backwards with speed greater than the pellet.

B The air pistol moves backwards with speed less than the pellet.

C The air pistol moves forward with speed greater than the pellet.

D The air pistol moves forward with speed less than the pellet.

11 Which row describes an advantage and a disadvantage of wind turbines?

	advantage	disadvantage
A	no fuel needed	harmful gases released
B	variable supply	fuel needed
C	no harmful gases released	variable supply
D	constant supply	noisy

12 An electric motor provides 900 J of useful output energy. The efficiency of the motor is 60 %.

How much electrical energy is supplied to the motor?

A 15 J **B** 540 J **C** 1500 J **D** 5400 J

13 A crane takes 2.0 minutes to lift a 500 kg load to the top of a building that is 12 m high.

What is the useful power developed against gravity by the crane?

A 21 W **B** 50 W **C** 500 W **D** 30 000 W

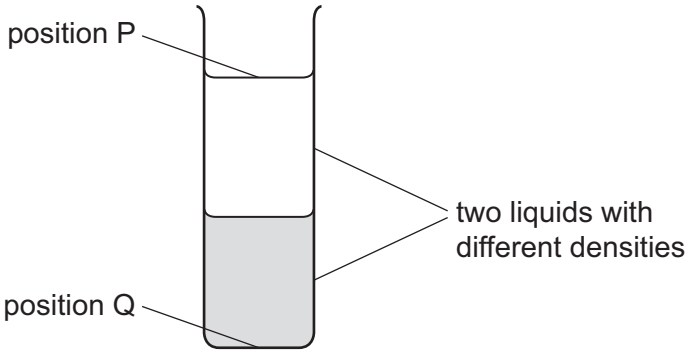
14 A skier is standing still on a flat area of snow.

The weight of the skier is 550 N. The total area of his skis in contact with the ground is 0.015 m^2.

What is the pressure exerted on the ground by the skier?

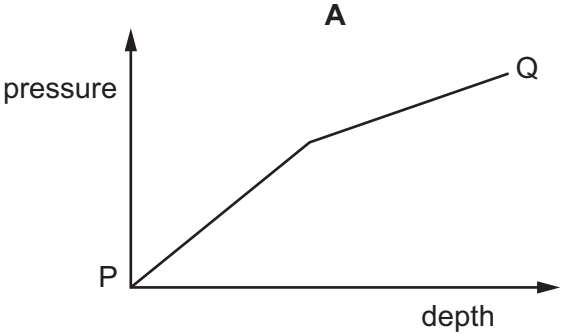
A 0.83 N/m^2 **B** 8.3 N/m^2 **C** 3700 N/m^2 **D** 37 000 N/m^2

15 A tall cylinder is partly filled with two liquids which do not mix. The two liquids have different densities. A student measures the pressure due to the liquids at different depths.

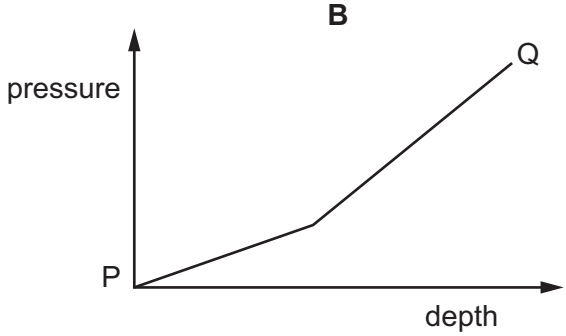


Which graph shows how the liquid pressure varies between positions P and Q?

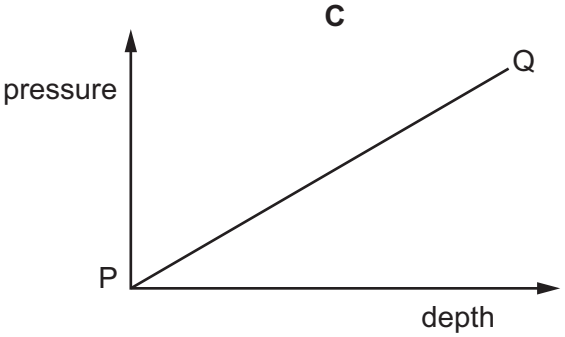
A



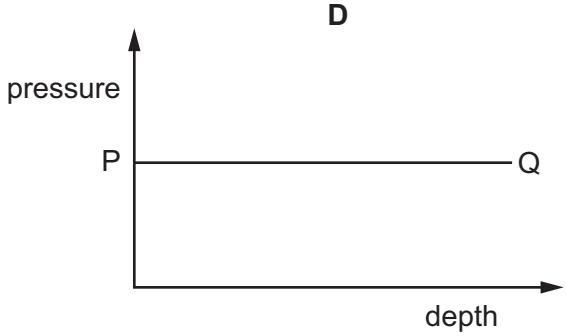
B



C



D



16 When pollen grains in water are viewed through a microscope, they are seen to be in continuous, rapid random motion.

What causes a pollen grain to move in this way?

A convection currents in the water

B bombardment by a single molecule of water

C uneven bombardment on different sides by water molecules

D collision with another pollen grain due to their kinetic energies

17 A student measures the mass of warm water in an open container over two minutes. The container is kept at a constant temperature. The results are in the table.

time / minutes	mass / g
0.0	33.9
0.5	30.6
1.0	27.6
1.5	24.9
2.0	22.5

Why does the mass of the water change?

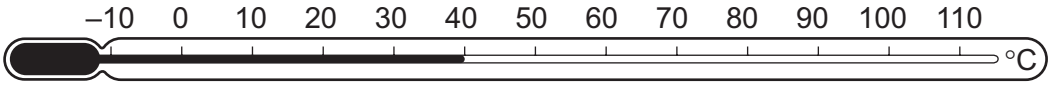
A The water evaporates.

B The water freezes.

C The water condenses.

D The water boils.

18 Which points are the fixed points of the liquid-in-glass thermometer shown?



A the beginning and end points of the column of liquid

B the points marked –10 °C and 110 °C

C the points marked 0 °C and 100 °C

D the top and bottom points of the thermometer bulb

19 The specific heat capacities of aluminium, iron, ethanol and water are given.

substance	specific heat capacity / J / kg °C
aluminium	900
iron	450
ethanol	2400
water	4200

1 kg of each metal is put into 5 kg of each liquid.

The starting temperature of each metal is 60 °C. The starting temperature of each liquid is 10 °C.

Which example has the highest final temperature?

	metal	liquid
A	aluminium	ethanol
B	iron	ethanol
C	aluminium	water
D	iron	water

20 Metals are good thermal conductors.

Insulators are poor thermal conductors.

Which description of the mechanism of thermal conductivity is correct?

A In insulators, conduction takes place by electron transfer and molecular vibrations.

B In insulators, conduction takes place by electron transfer only.

C In metals, conduction takes place by electron transfer and molecular vibrations.

D In metals, conduction takes place by electron transfer only.

21 A teacher shows his class a polystyrene cup. The cup is made from thick plastic with lots of tiny air bubbles in it.

He asks the class why the cup is so good at keeping a hot drink warm. Three suggestions are made.

1 It contains air which is a poor thermal conductor.

2 The air is trapped in tiny bubbles so very little convection is possible.

3 The plastic is a poor thermal conductor.

Which suggestions are correct?

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

22 A boy jumps into an indoor swimming pool. He notices that the water appears to get colder as he goes deeper underwater. This is due to convection.

Which statement is correct?

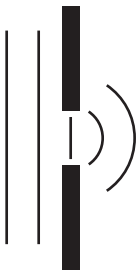
A Cold water is more dense than warm water so it sinks to the bottom of the pool.

B Warm water is more dense than cold water so it rises to the surface of the pool.

C The molecules in cold water have more kinetic energy than the molecules in warm water so they move to the bottom of the pool faster.

D The molecules in warm water are closer together than the molecules in cold water so they rise to the surface of the pool.

23 Four students **A**, **B**, **C** and **D**, investigate the diffraction of water waves through a gap.



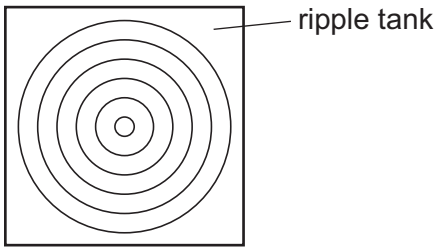
Each student uses a different gap size and a different wavelength for the water waves.

Which student produces the waves which have the most diffraction?

	gap size / cm	wavelength / cm
A	2.0	1.8
B	3.0	2.1
C	4.0	2.0
D	5.0	0.9

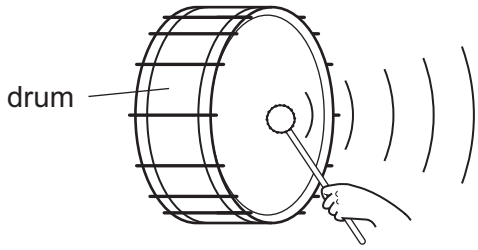
24 The diagrams show examples of wave motion.

1



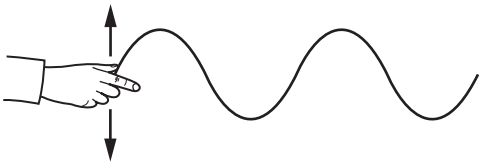
waves on water

2



waves in air

3



waves on a rope

4

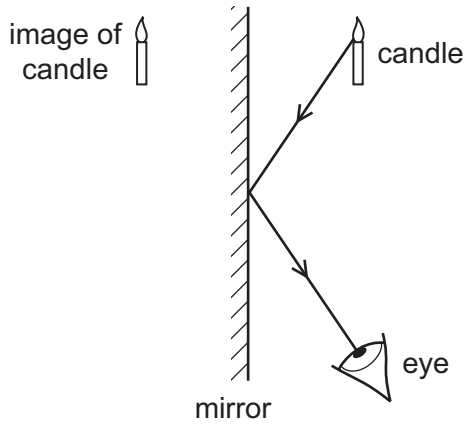
waves in a spring

Which waves are longitudinal?

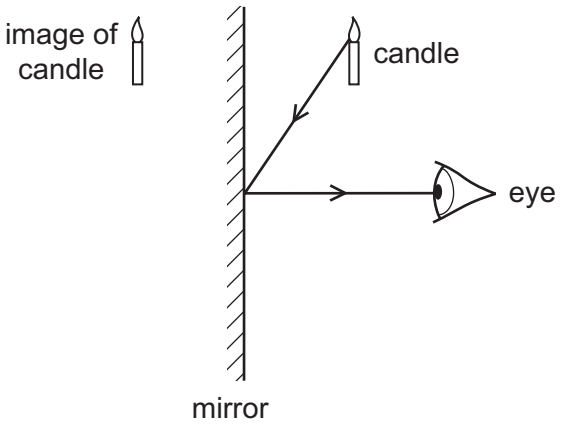
A 1 only **B** 2 and 3 only **C** 2, 3 and 4 **D** 2 and 4 only

25 Which diagram shows how the light from a candle is reflected by a mirror, and shows the position of the image formed?

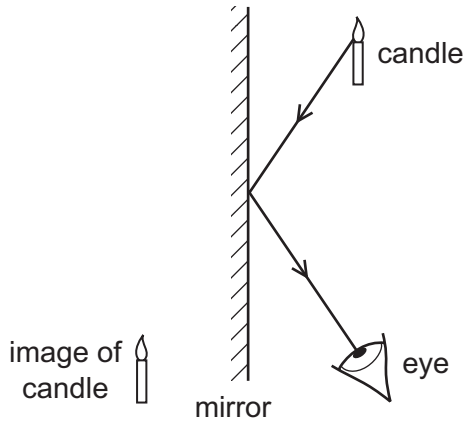
A



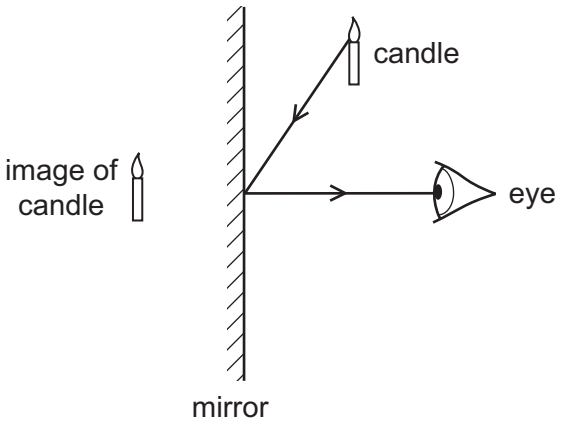
B



C



D



26 A converging lens can be used as a magnifying glass.

What will be the nature of the image?

A real, inverted, diminished

B real, upright, enlarged

C virtual, inverted, enlarged

D virtual, upright, enlarged

27 The wavelength of blue light changes from 4.7×10^{-7} m to 3.5×10^{-7} m as it passes from air to water.

What is the speed of this light in water?

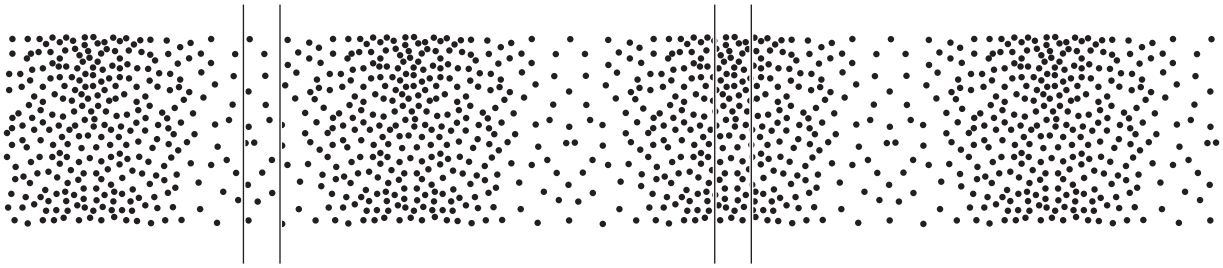
A 7.4×10^{7} m/s

B 1.3×10^{8} m/s

C 2.2×10^{8} m/s

D 3.0×10^{8} m/s

28 The diagram shows compressions and rarefactions in air as a sound wave moves from left to right.



A quieter sound of the same frequency is made.

What will happen to the number of particles in a region of rarefaction and in a region of compression?

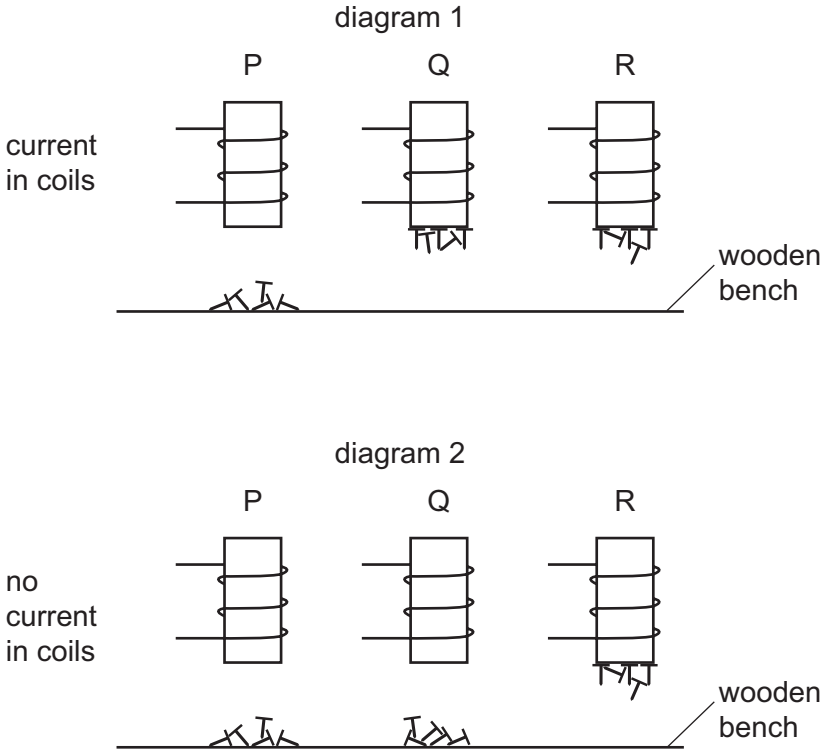
	number of particles in region of rarefaction	number of particles in region of compression
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

29 The diagrams show three different metal rods P, Q and R, inside coils of wire.

Small iron nails are placed on a wooden bench under the rods.

Diagram 1 shows the situation when there are electric currents in the wires.

Diagram 2 shows the situation when the currents are switched off.



Which row correctly identifies the metal rods?

	P	Q	R
A	copper	soft iron	steel
B	soft iron	copper	steel
C	steel	soft iron	copper
D	copper	steel	soft iron

30 Which row describes conventional current and electron flow in a circuit containing a cell?

	conventional current	electron flow
A	from the negative terminal of the cell to the positive terminal of the cell	from the negative terminal of the cell to the positive terminal of the cell
B	from the negative terminal of the cell to the positive terminal of the cell	from the positive terminal of the cell to the negative terminal of the cell
C	from the positive terminal of the cell to the negative terminal of the cell	from the negative terminal of the cell to the positive terminal of the cell
D	from the positive terminal of the cell to the negative terminal of the cell	from the positive terminal of the cell to the negative terminal of the cell

31 A student makes four resistors using different pieces of wire. The wires have different diameters and lengths. All the pieces of wire are made of the same material.

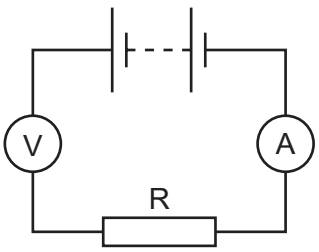
Which piece of wire will make the resistor with the largest resistance?

	diameter / mm	length / cm
A	0.8	10
B	0.8	17
C	2.0	10
D	2.0	17

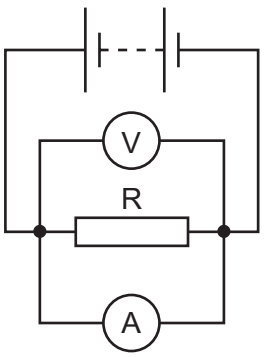
32 A student is to determine the resistance of resistor R. She uses a circuit including a voltmeter and an ammeter.

Which circuit should be used?

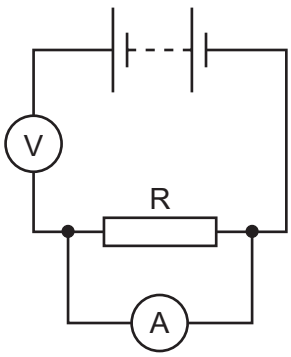
A



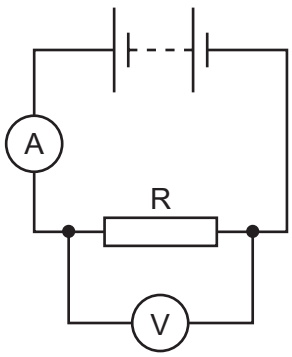
B



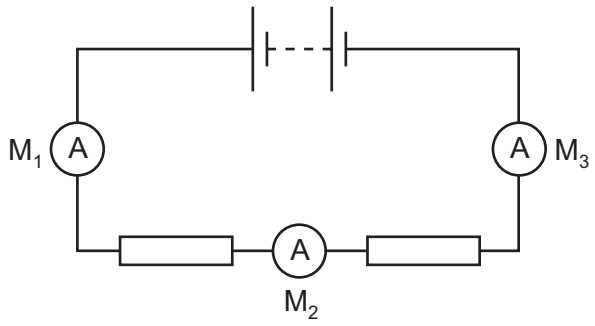
C



D



33 The diagram shows a battery connected to two resistors. Three ammeters M_1, M_2 and M_3 are connected in the circuit.

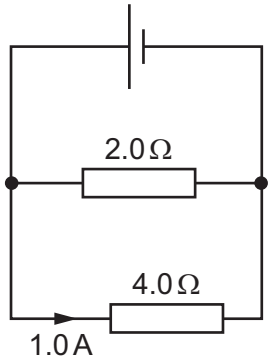


Ammeter M_1 reads 1.0 A.

What are the readings on M_2 and on M_3?

	reading on M_2 / A	reading on M_3 / A
A	0.0	0.0
B	0.5	0.5
C	0.5	1.0
D	1.0	1.0

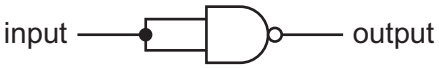
34 A cell is connected to a parallel combination of a 2.0 Ω resistor and a 4.0 Ω resistor. The current in the 4.0 Ω resistor is 1.0 A.



What is the current in the cell?

A 1.0 A **B** 1.5 A **C** 2.0 A **D** 3.0 A

35 The two inputs of a NAND gate are joined together.



Which truth table represents the action of this gate?

A

input	output
0	0
1	0

B

input	output
0	1
1	0

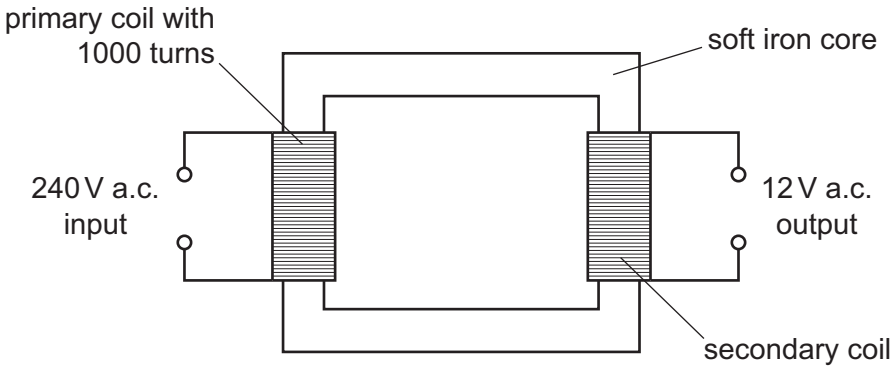
C

input	output
0	0
1	1

D

input	output
0	1
1	1

36 The diagram shows a transformer that has an output voltage of 12 V.



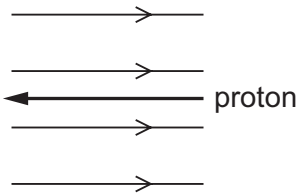
How many turns of wire are in the secondary coil?

A 12 **B** 20 **C** 50 **D** 20 000

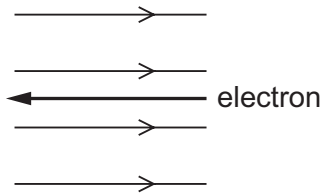
37 The diagrams show different particles moving through a magnetic field.

Which particle experiences a magnetic force acting up out of the plane of the paper?

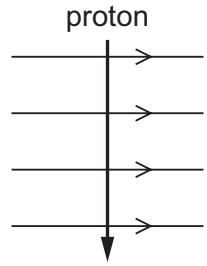
A



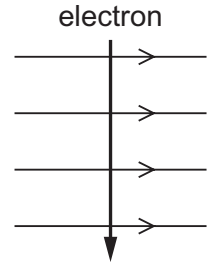
B



C



D



38 When Rutherford bombarded thin gold foil with α-particles, he found that some α-particles were deflected through large angles.

Which statement explains this deflection?

A Most of the atom consists of empty space.

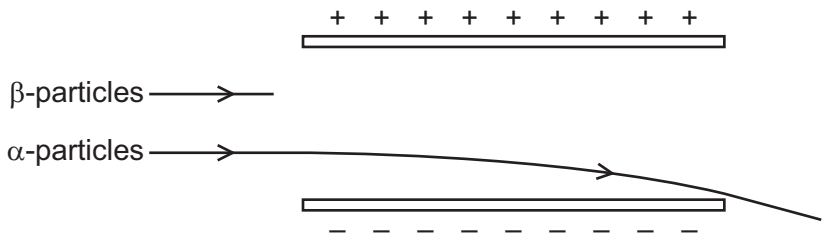
B All of the positive charge and most of the mass of the gold atom are concentrated in a small volume.

C Positive charge in the gold atom is spread evenly throughout the atom.

D All of the negative charge is concentrated at its centre.

[Turn over

39 The diagram shows the path followed by α-particles as they pass between two charged plates. They are deflected downwards.



What happens to β-particles passing through the same electric field?

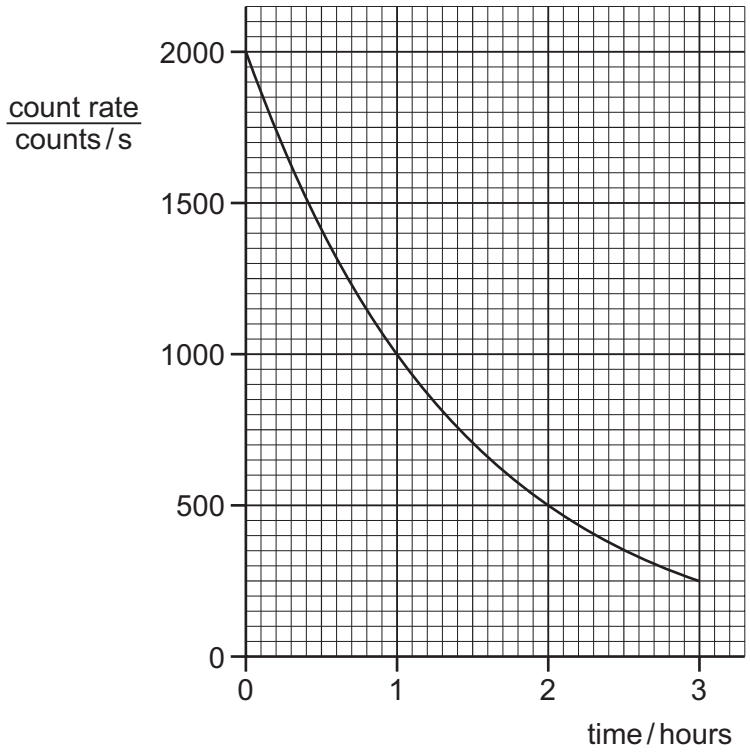
A They are deflected downwards more than the α-particles.

B They are deflected upwards.

C They are not deflected at all.

D They are deflected downwards by the same amount as the α-particles.

40 The graph shows the count rate from a radioactive source over a period of time.



What is the half-life of the source?

A 0.5 hour **B** 1.0 hour **C** 1.5 hours **D** 3.0 hours

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PHYSICS **0625/42**

Paper 4 Theory (Extended) **February/March 2020**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.
- Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m / s^2).

INFORMATION

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

This document has **16** pages. Blank pages are indicated.

1 A rocket is launched vertically upwards from the ground. The rocket travels with uniform acceleration from rest. After 8.0 s, the speed of the rocket is 120 m / s.

(a) Calculate the acceleration of the rocket.

acceleration = ... [2]

(b) **(i)** On Fig. 1.1, draw the graph for the motion of the rocket in the first 8.0 s.

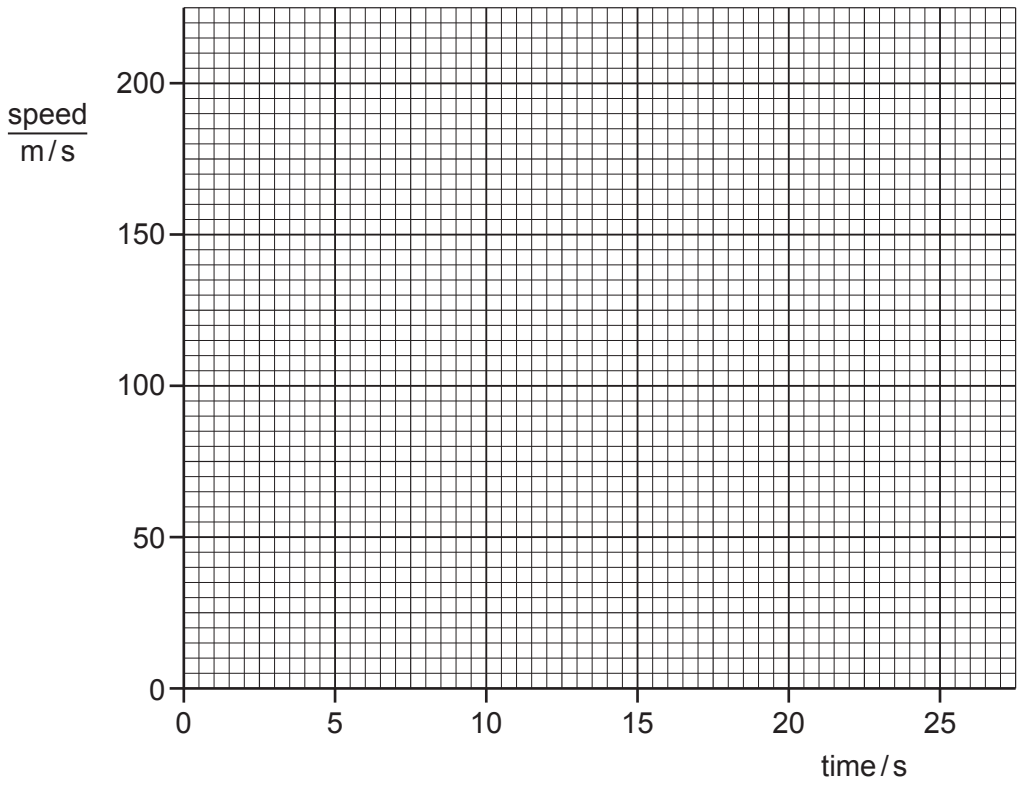

Fig. 1.1

[1]

(ii) Use the graph to determine the height of the rocket at 8.0 s.

height = ... [2]

(iii) From time = 8.0 s to time = 20.0 s, the rocket rises with increasing speed but with decreasing acceleration.

From time = 20.0 s to time = 25.0 s, the rocket has a constant speed of less than 200 m / s.

On Fig. 1.1, draw the graph for this motion. [3]

[Total: 8]

2 Fig. 2.1 shows an athlete crossing the finishing line in a race. As she crosses the finishing line, her speed is 10.0 m / s. She slows down to a speed of 4.0 m / s.

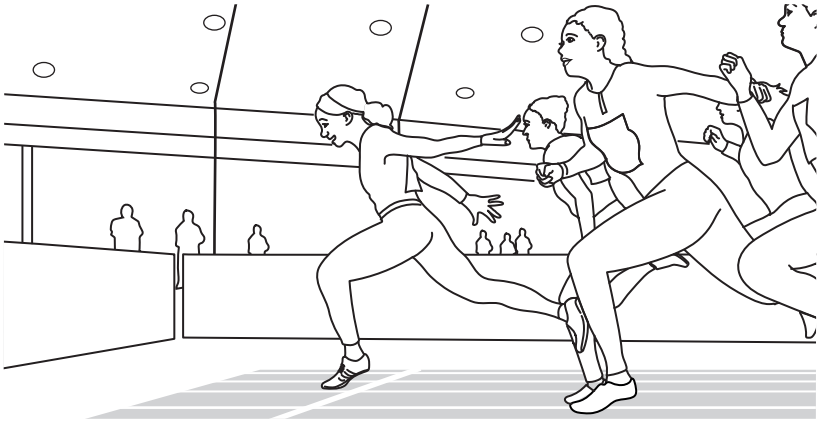

Fig. 2.1

(a) The mass of the athlete is 71 kg. Calculate the impulse applied to her as she slows down.

impulse = ... [3]

(b) (i) Define *impulse* in terms of *force* and *time*.

.....

..... [1]

(ii) The athlete takes 1.2 s to slow down from a speed of 10.0 m / s to a speed of 4.0 m / s.

Calculate the average resultant force applied to the athlete as she slows down.

force = ... [2]

(c) Calculate the force required to give a mass of 71 kg an acceleration of 6.4 m / s^2.

force = ... [2]

[Total: 8]

3 Fig. 3.1 shows a model of a wind turbine used to demonstrate the use of wind energy to generate electricity. The wind is blowing towards the model, as shown.

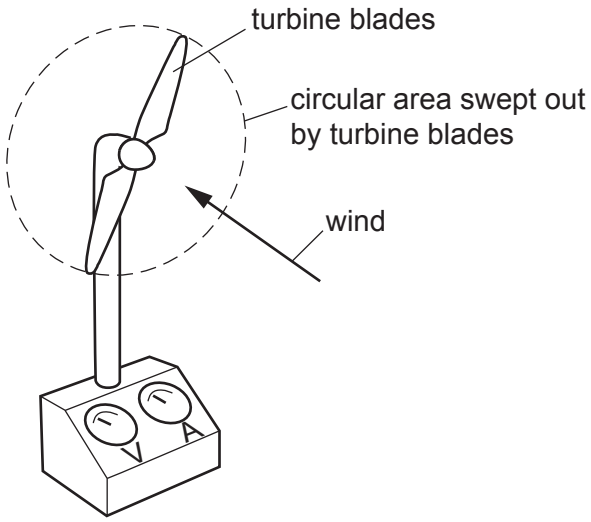

Fig. 3.1

(a) The mass of air passing through the circular area swept out by the turbine blades each second is 7.5 kg. The kinetic energy of the air that passes through this circular area each second is 240 J.

(i) Calculate the speed of the air.

speed = ... [3]

(ii) The kinetic energy of the air drives a generator. State the input power of the air passing through the turbine blades.

input power = ... [1]

(b) The output current of the generator is 2.0A. The output potential difference (p.d.) of the generator is 11V.

(i) Calculate the output power of the generator.

output power = ... [2]

(ii) Calculate the efficiency of the wind turbine.

efficiency = ... % [2]

(c) The density of air is 1.3kg/m^3.
Calculate the volume of air passing through the circular area swept out by the turbine blades each second.

volume = ... [2]

[Total: 10]

4 **(a)** Define the *specific latent heat of fusion* of a substance.

.....

.....

..... [2]

(b) Small pieces of ice at 0 °C are added to 0.35 kg of water. The initial temperature of the water is 24.5 °C. The temperature of the water decreases to 0 °C. The water loses 35 000 J of thermal energy as it cools. All of the ice added to the water melts.

The specific latent heat of fusion of ice is 3.3×10^5 J / kg.

Calculate:

(i) the specific heat capacity of water

specific heat capacity = ... [2]

(ii) the mass of ice added to the water.

mass = ... [3]

[Total: 7]

5 **(a)** Complete the sentences with words that describe the main process of thermal energy transfer in each case.

A man goes for a walk on a cold day. He touches a metal gate, which removes thermal energy from his hands by ..... . He holds the sides of a cup containing a hot drink. His hands gain thermal energy by ..... . Some farm workers have lit a fire. The man warms his hands by the side of the fire. His hands gain thermal energy by ..... . [3]

(b) Describe in terms of particles the transfer of thermal energy through the metal of the gate after transfer from the man's hands.

.....

..... [2]

(c) Fig. 5.1 shows a car on a sunny day in a hot country.

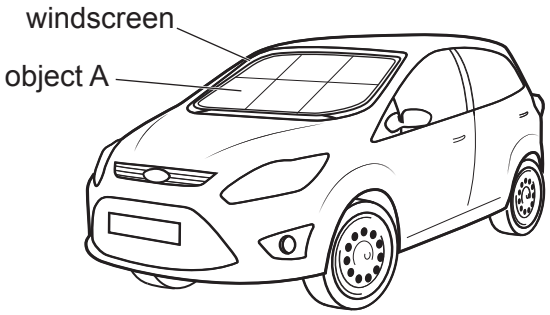

Fig. 5.1

The object labelled A is placed inside the windscreen. It is used by the owner of the car to reduce the temperature rise of the air in the car.

Ring the most suitable material for the outer surface of object A. Explain your choice.

dull black **dull white** **shiny black** **shiny white**

explanation .....

..... [2]

[Total: 7]

6 **(a)** Fig. 6.1 shows crests of a water wave moving from left to right in a harbour.

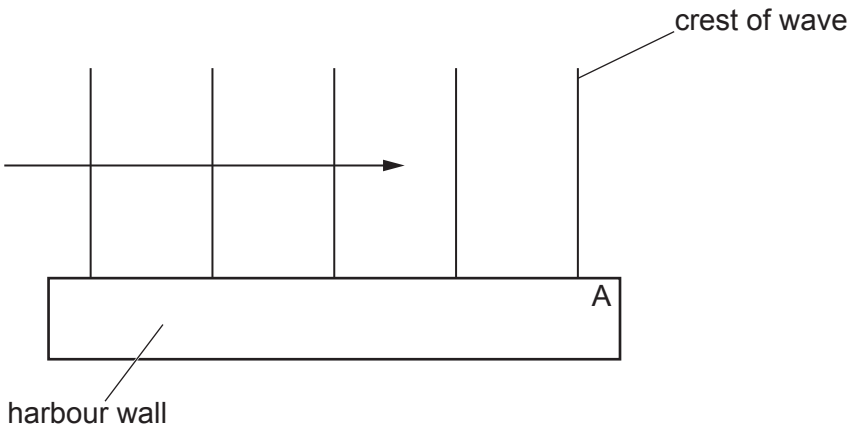

Fig. 6.1

(i) On Fig. 6.1, draw three more crests to the right of point A. [2]

(ii) State the name of the wave process that occurs as the wave passes point A.

..... [1]

(b) Fig. 6.2 shows the crests of another wave moving from left to right in a different part of the harbour. This wave moves from deep water to shallow water.

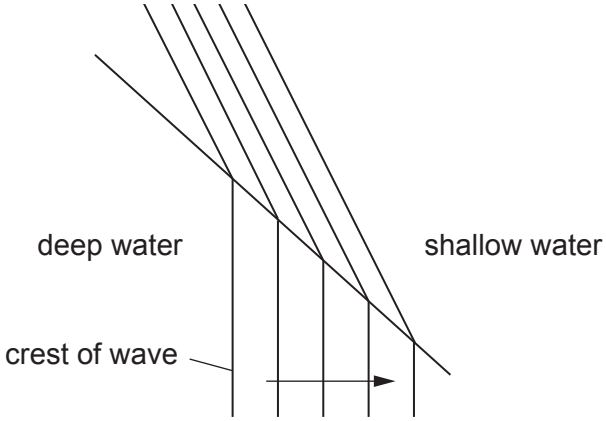

Fig. 6.2

(i) On Fig. 6.2, draw an arrow to show the direction of movement of the wave after it has passed into the shallow water. [1]

(ii) State the name of the process that occurs as the wave passes into the shallow water.

..... [1]

(iii) Complete Table 6.1 to state whether each of the properties of the wave **increases**, **decreases** or **stays the same** as the wave passes into the shallow water.

Table 6.1

property	effect
wavelength	
frequency	
speed	

[3]

[Total: 8]

7 **(a)** Fig. 7.1 shows a converging lens and the image I formed when an object is placed to the left of the lens. The principal focuses are labelled A and B and the centre of the lens is labelled C.

(i) On Fig. 7.1, draw two rays to locate the position of the object.
Draw the object and label it O.

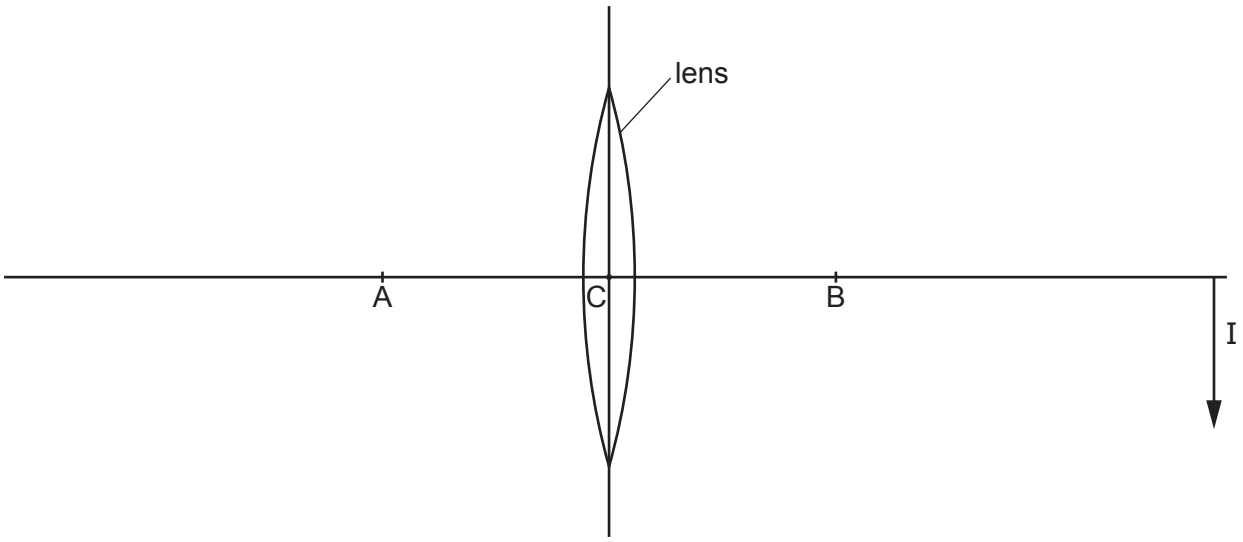

Fig. 7.1

[3]

(ii) Ring all of the following distances that are equal to the focal length of the lens.

AB AC CB 2AB

[2]

(b) Fig. 7.2 shows green light passing through a triangular glass block.

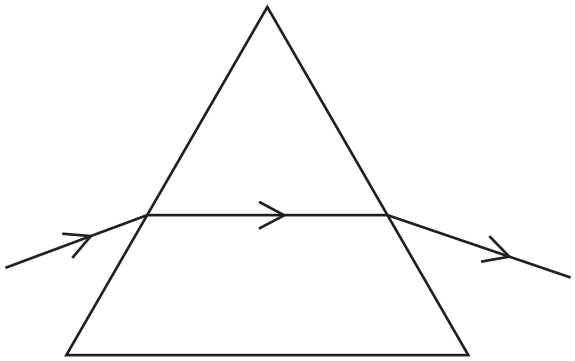

Fig. 7.2

Red light enters the triangular glass block shown in Fig. 7.2 along the same path as the green light.

(i) On Fig. 7.2, draw the path of the red light within the triangular glass block. [1]

Fig. 7.3 shows green light passing through a rectangular glass block.

Red light enters the rectangular glass block shown in Fig. 7.3 along the same path as the green light.

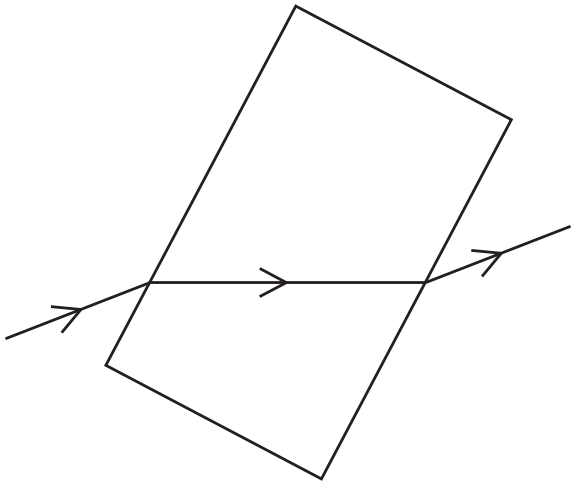

Fig. 7.3

On Fig. 7.3:

(ii) draw the path of the red light within the rectangular glass block [1]

(iii) draw the path of the red light after leaving the rectangular glass block. [1]

[Total: 8]

8 Fig. 8.1 shows a circuit.

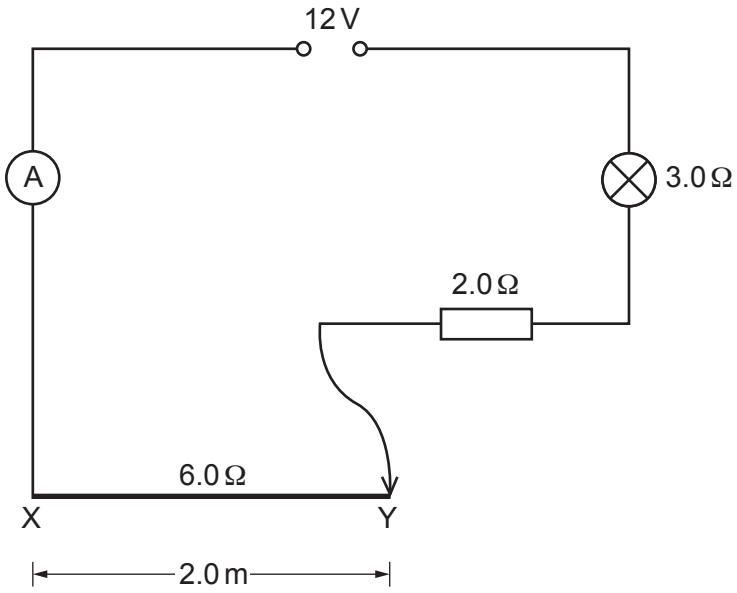

Fig. 8.1

The lamp has a resistance of 3.0 Ω. Line XY represents a uniform resistance wire of resistance 6.0 Ω.

(a) Calculate the reading on the ammeter.

ammeter reading = ... [2]

(b) Fig. 8.2 shows the circuit with a different connection to the resistance wire and an added resistor. The length XY of the whole resistance wire is 2.0 m. The contact is made at Q where the distance XQ is 0.60 m.

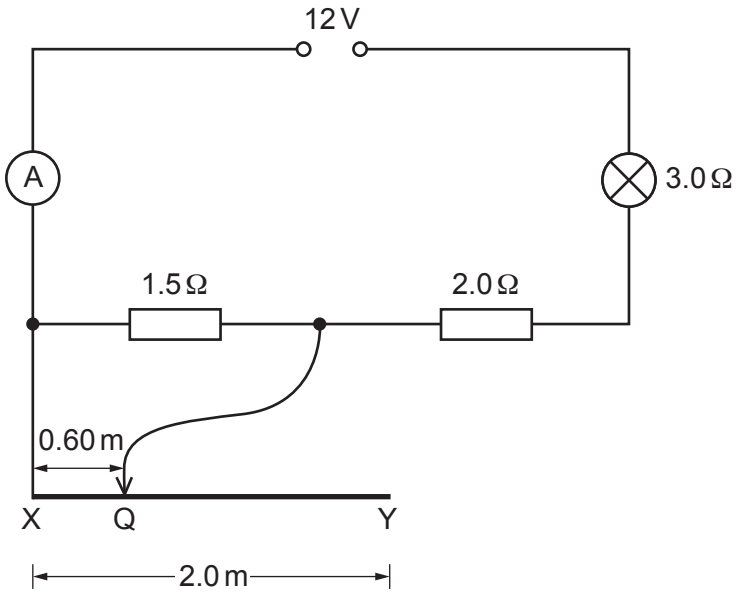

Fig. 8.2

Calculate the resistance of the circuit.

resistance = ... [4]

[Total: 6]

9 **(a)** State the name of the logic gate with the symbol shown in Fig. 9.1.

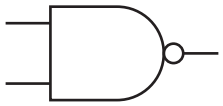

Fig. 9.1

..... [1]

(b) State the name of the logic gate with the truth table shown in Table 9.1.

Table 9.1

input	output
0	1
1	0

..... [1]

(c) Fig. 9.2 shows a digital circuit.

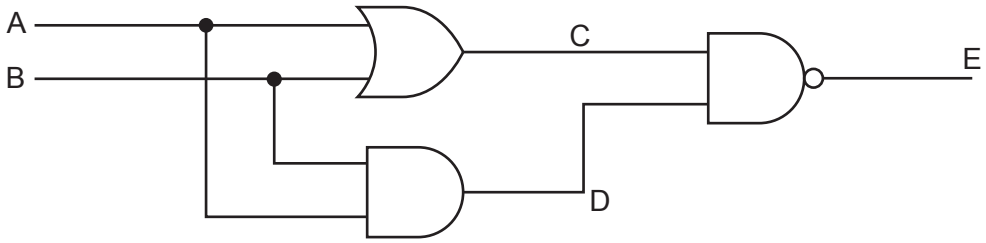

Fig. 9.2

Complete the truth table in Table 9.2 for this circuit for all possible combinations of input.

Table 9.2

A	B	C	D	E
		1	1	
		1	0	
		1	0	
		0	0	

[4]

[Total: 6]

10 **(a)** Fig. 10.1 is a simplified top view of a flat coil. There is an alternating current (a.c.) in the coil.

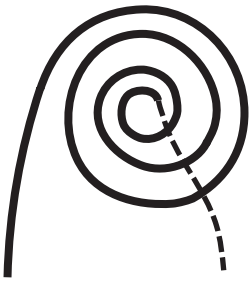

Fig. 10.1

Describe the magnetic effect of this alternating current.

.....

.....

..... [2]

(b) Fig. 10.2 shows a pan placed above the coil. The base of the pan is made of steel.

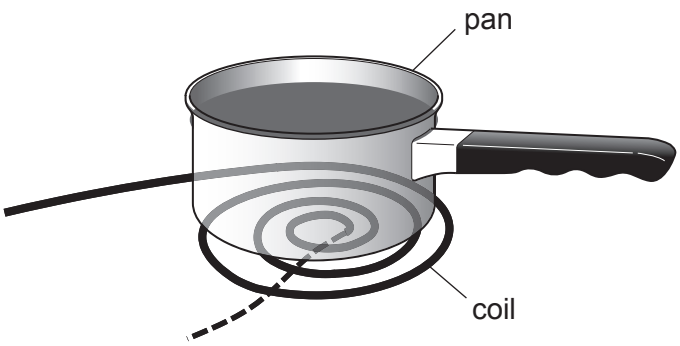

Fig. 10.2

State what quantity is induced in the base of the pan.

..... [1]

(c) The pan contains water.

State and explain the effect of the quantity induced in part **(b)** on the temperature of the water in the pan.

.....

.....

..... [3]

[Total: 6]

11 (a) The isotope hydrogen-1 has a proton number of 1 and a nucleon number of 1.

Two isotopes of helium are helium-3 and helium-4.

Helium-3 has a proton number of 2 and a nucleon number of 3.

Helium-4 has a nucleon number of 4.

Complete Table 11.1 for neutral atoms of these isotopes of helium.

Table 11.1

	helium-3	helium-4
number of neutrons		
number of electrons		
mass compared to a neutral atom of hydrogen-1		

[3]

(b) An experiment takes place in a laboratory shielded from all background radiation. A sample of radioactive material is wrapped in aluminium foil of thickness 0.1 mm. A detector of ionising radiation placed 1 cm from the foil records a reading.

A piece of aluminium of thickness 5 mm is placed between the detector and the foil. The detector reading drops to zero.

State and explain any type of radiation passing through the aluminium foil.

.....

.....

.....

..... [3]

[Total: 6]

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PHYSICS **0625/62**

Paper 6 Alternative to Practical **February/March 2020**

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Blank pages are indicated.

DC (RW/FC) 189188/4

[Turn over

1 A student is determining the density of wood by two methods.

He is using the wooden rod shown in Fig. 1.1.

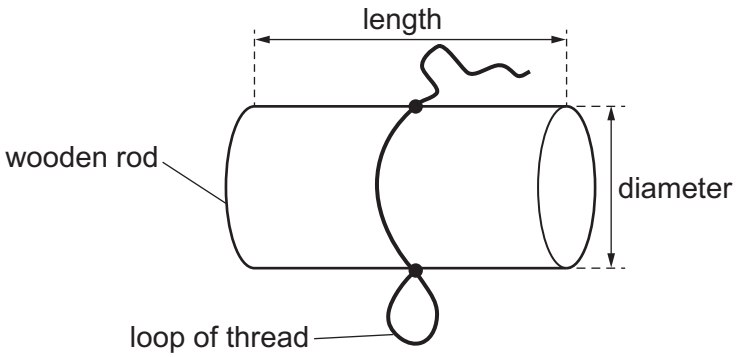


Fig. 1.1

Method 1

The dimensions of the wooden rod are shown full size in Fig. 1.2.

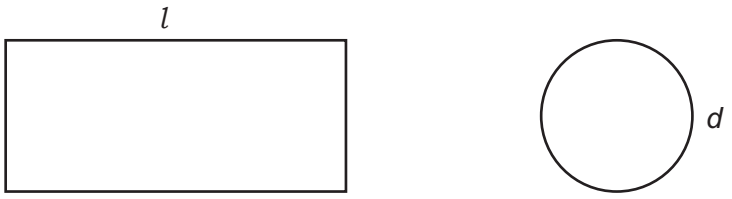


Fig. 1.2

(a) (i) Measure the length l and the diameter d of the wooden rod in Fig. 1.2.

l = ... cm

d = ... cm
[2]

(ii) Suggest an accurate method for measuring the diameter of the wooden rod in this experiment.
List any additional apparatus that might be required and briefly describe how you would determine the diameter.
You may draw a diagram if it helps to explain your answer.

.....

.....

..... [2]

(b) The student uses a balance to measure the mass *m* of the wooden rod as shown in Fig. 1.3.

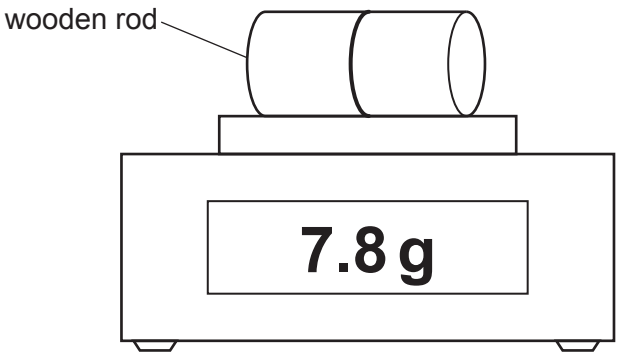


Fig. 1.3

Record the mass *m* of the rod.

m = ...g

Calculate a value ρ_1 for the density of the wooden rod. Use your values from **(a)(i)** and **(b)** and the equation $\rho_1 = \frac{4m}{\pi d^2 l}$. Include a suitable unit.

ρ_1 = ... [2]

Method 2

(c) The student pours water into a measuring cylinder as shown in Fig. 1.4.
He then floats the wooden rod in the water as shown in Fig. 1.5.

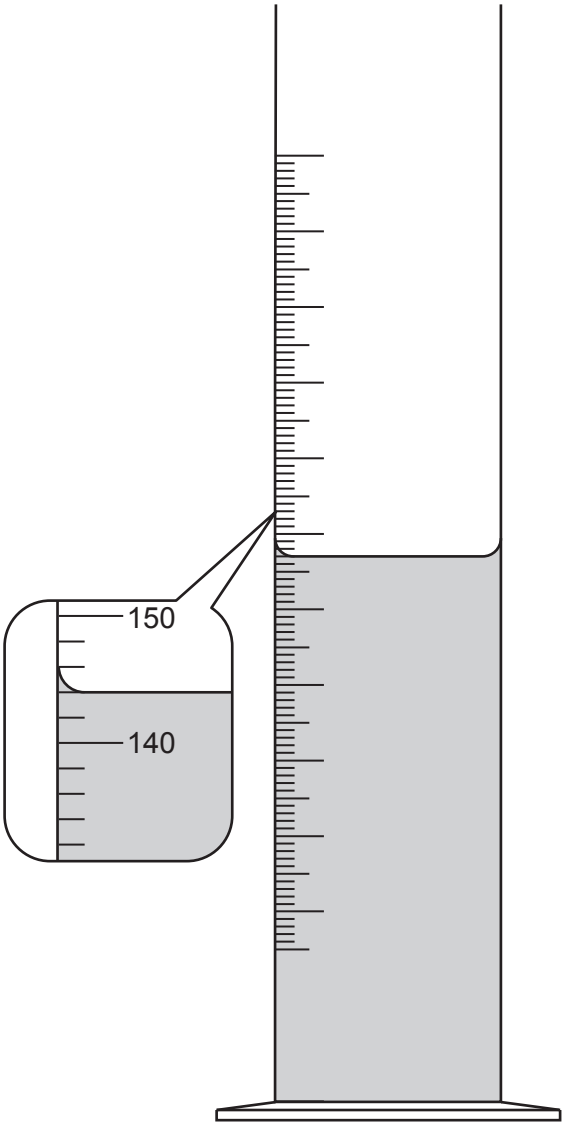


Fig. 1.4

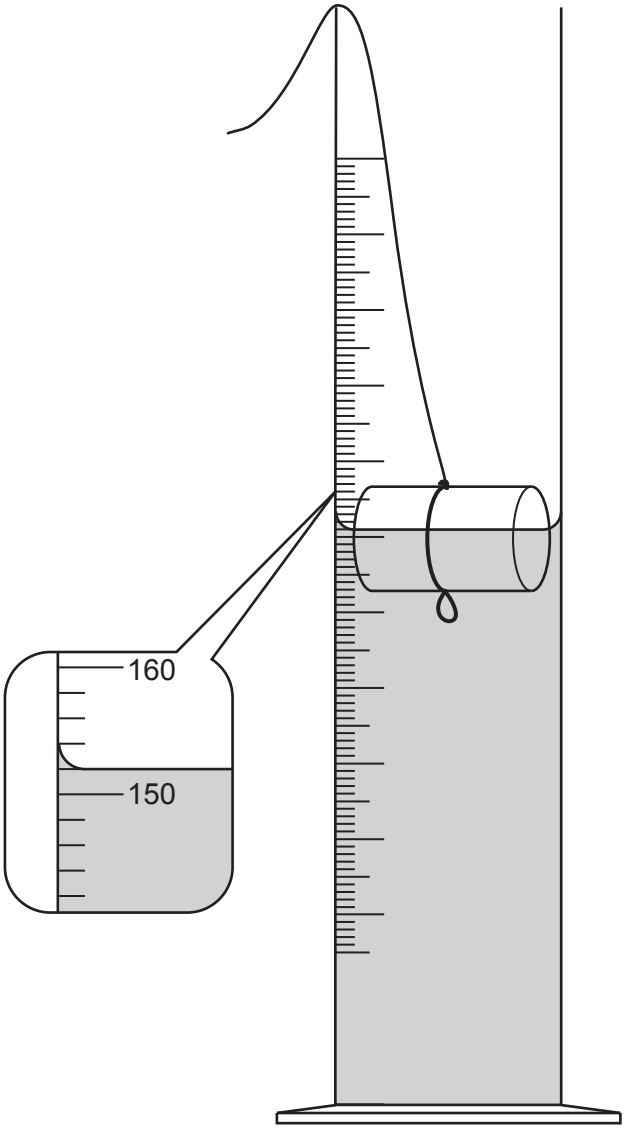


Fig. 1.5

Record the reading V_1 of the water level in the measuring cylinder as shown in Fig. 1.4.

V_1 = ...cm^3

Record the new reading V_2 of the water level in the measuring cylinder with the rod floating in the water as shown in Fig. 1.5.

V_2 = ...cm^3
[1]

(d) The student removes the rod and lowers a piece of modelling clay into the water as shown in Fig. 1.6.
He then hooks the rod to the modelling clay and lowers them into the water as shown in Fig. 1.7.

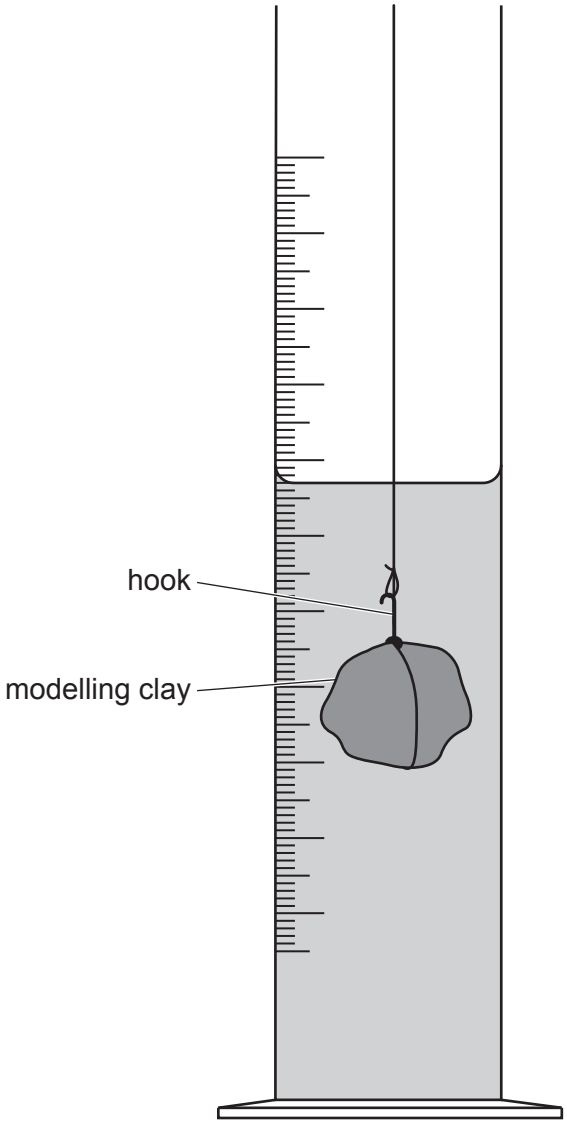


Fig. 1.6

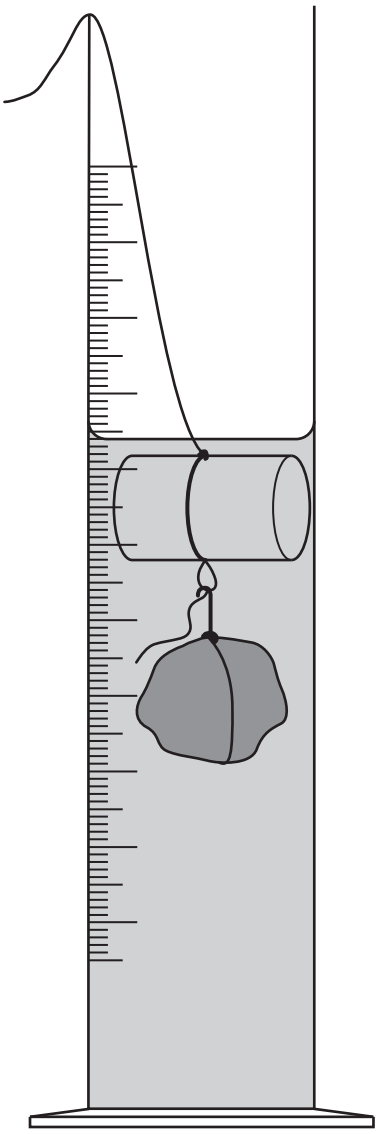


Fig. 1.7

He records the new reading V_3 of the water level in the measuring cylinder with the modelling clay.

He records the reading V_4 of the water level in the measuring cylinder with the modelling clay and rod.

V_3 = 164 cm^3

V_4 = 178 cm^3

Calculate another value ρ_2 for the density of the wooden rod. Use the values from **(c)** and **(d)** and the equation $\rho_2 = \dfrac{(V_2 - V_1)}{(V_4 - V_3)} \times k$ where $k = 1.0\,\text{g/cm}^3$.

ρ_2 = ... [2]

(e)

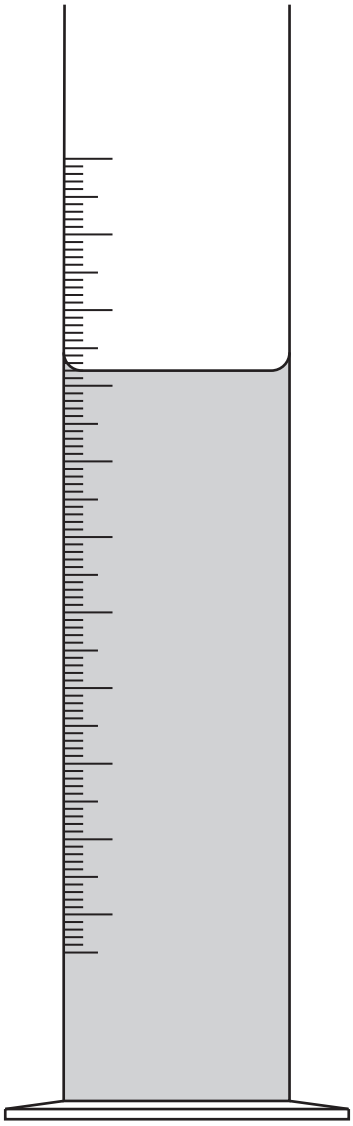


Fig. 1.8

On Fig. 1.8, **draw** an arrow showing the correct line of sight for reading the volume of water in the measuring cylinder. [1]

(f) Suggest a possible source of inaccuracy in **Method 2**, even if it was carried out carefully.

.....

..... [1]

[Total: 11]

2 Students are investigating the cooling of hot water in a beaker.

They are using the apparatus shown in Fig. 2.1.

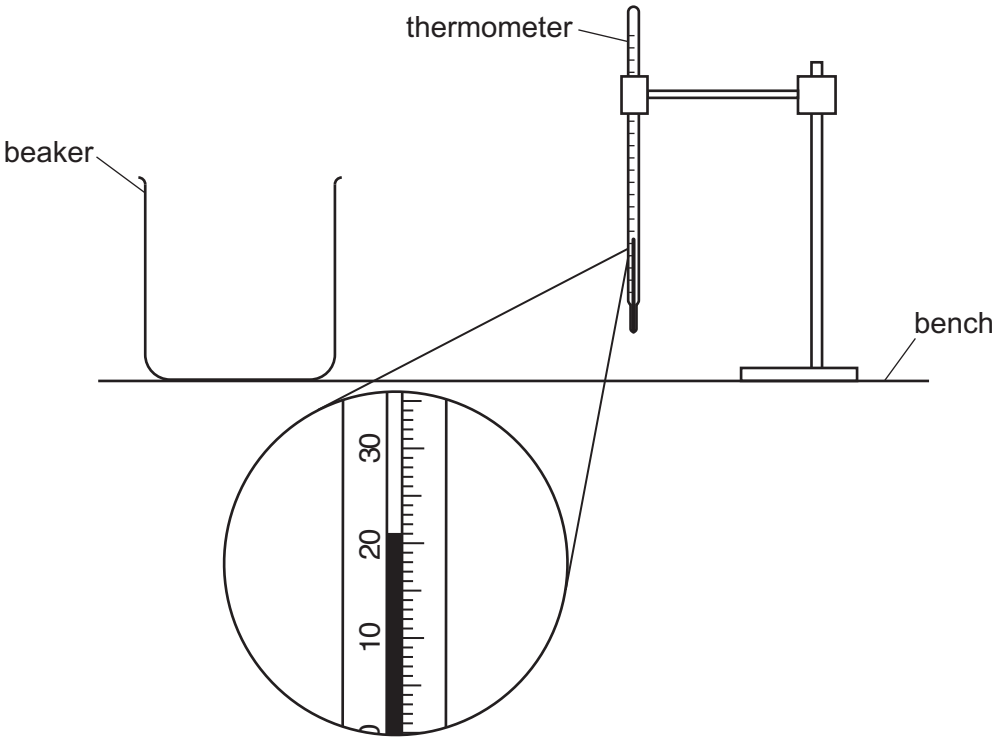


Fig. 2.1

(a) Record room temperature θ_R shown on the thermometer in Fig. 2.1.

θ_R = ... [1]

(b) A volume of 150 cm^3 of hot water is poured into the beaker and the initial temperature θ is recorded in Table 2.1.
The temperature of the water is recorded every 30 s. The values are shown in Table 2.1.

(i) Complete the headings in Table 2.1. [1]

Table 2.1

t/	θ/
0	95.0
30	89.0
60	83.5
90	79.0
120	75.0
150	71.5
180	68.5
210	66.0
240	64.0
270	62.5

(ii) Describe **one** precaution that you would take to ensure that the temperature readings in the experiment are as accurate as possible.

.....

..... [1]

(c) (i) Calculate the average cooling rate x_1 during the first 90 s of the experiment. Use the readings from Table 2.1 and the equation

$$x_1 = \frac{\theta_0 - \theta_{90}}{T}$$

where T = 90 s and θ_0 and θ_{90} are the temperatures at t = 0 and t = 90 s.
Include the unit for the cooling rate.

x_1 = ... [1]

(ii) Calculate the average cooling rate x_2 during the middle 90 s of the experiment. Use the readings from Table 2.1 and the equation

$$x_2 = \frac{\theta_{90} - \theta_{180}}{T}$$

where T = 90 s and θ_{90} and θ_{180} are the temperatures at t = 90 s and t = 180 s.

x_2 = ... [1]

(iii) Calculate the average cooling rate x_3 during the last 90 s of the experiment. Use the readings from Table 2.1 and the equation

$$x_3 = \frac{\theta_{180} - \theta_{270}}{T}$$

where T = 90 s and θ_{180} and θ_{270} are the temperatures at t = 180 s and t = 270 s.

x_3 = ... [1]

(d) (i) The temperature of the water falls as time passes. Use the results from **(c)** to describe the pattern of the rate of cooling of the water during the experiment.
Justify your answer by reference to the results.

.....

.....

.....

..... [1]

(ii) Give an estimate of the probable final temperature θ_F of the water if left to cool for many hours.

θ_F = ... [1]

(e) (i) A student in another school carries out a similar experiment.
She starts with the hot water at a lower initial temperature.
Suggest how her cooling rates are likely to compare with those calculated in **(c)**.
Use the results to explain your answer.

suggestion .....

.....

explanation .....

.....

.....
[2]

(ii) State **one** variable, other than the initial temperature, which the student should control.

.....

..... [1]

[Total: 11]

3 A student is investigating a power supply.
She is using the circuit shown in Fig. 3.1.

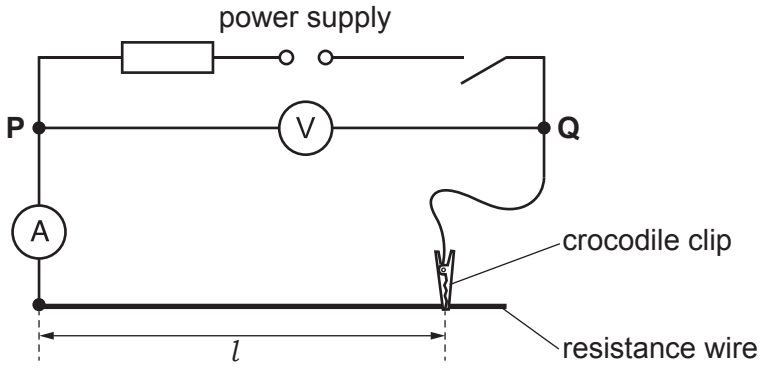


Fig. 3.1

(a) The student connects the crocodile clip to a length l = 100.0 cm of the resistance wire and measures the potential difference V_0 across terminals **P** and **Q** and the current I_0 in the circuit.

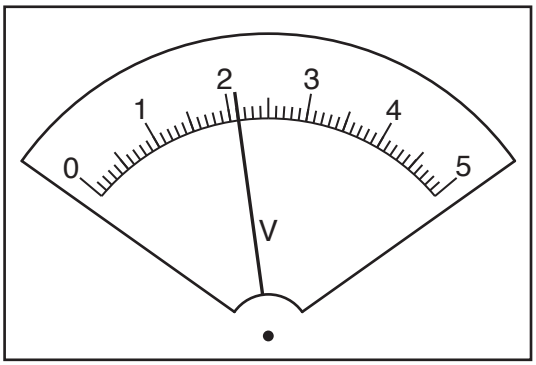


Fig. 3.2

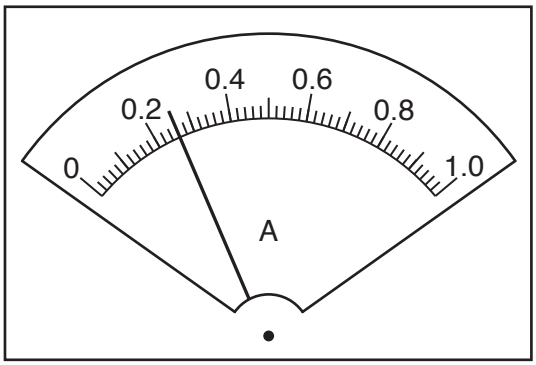


Fig. 3.3

(i) Record the values of V_0 and I_0 shown on the meters in Fig. 3.2 and Fig. 3.3.

V_0 = ... V

I_0 = ... A
[1]

(ii) Calculate the resistance R_0 of 100.0 cm of the wire. Use your values of V_0 and I_0 and the equation $R_0 = \frac{V_0}{I_0}$.

R_0 = ... Ω
[1]

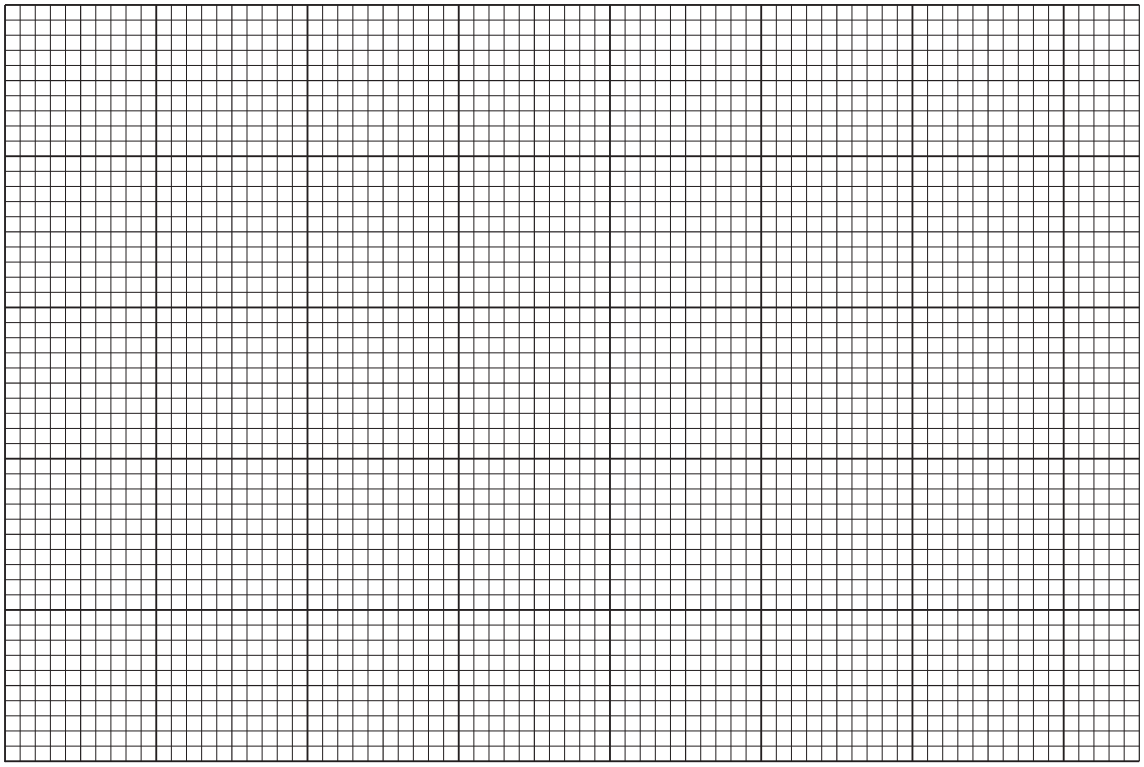
(b) The student then connects the crocodile clip to lengths l = 70.0 cm, 60.0 cm, 50.0 cm, 40.0 cm and 30.0 cm of the resistance wire. She measures the current I in the circuit for each length. Her readings are shown in Table 3.1.

Table 3.1

l/cm	I/A	$\frac{1}{I}\Big/\frac{1}{\text{A}}$
70.0	0.35	
60.0	0.40	2.50
50.0	0.44	2.27
40.0	0.53	1.89
30.0	0.65	1.54

Calculate, and record in Table 3.1, the value of $\frac{1}{I}$ for length l = 70.0 cm of the wire. [1]

(c) Plot a graph of l/cm (y-axis) against $\frac{1}{I}\Big/\frac{1}{\text{A}}$ (x-axis). You do **not** need to start your axes at the origin (0,0).



[4]

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

G = ... [1]

(ii) Calculate the electromotive force (e.m.f.) E of the power supply. Use your value of R_0 from **(a)(ii)** and the equation $E = \frac{G \times R_0}{k}$, where k = 100 cm.

E = ...V [1]

(e) The ammeter in this circuit has a small resistance which affects the current. The effect of this resistance on the measured current I will be different for each measured length l of the resistance wire.
State and explain which length l will be most affected by the resistance of the ammeter.

statement .....

explanation .....

.....
[2]

[Total: 11]

4 A student investigates a wind turbine, which is an electrical generator driven by a propeller blade.

Plan an experiment which will enable him to investigate how the current in a resistor connected across the terminals of the turbine varies with the speed of the air flow through the turbine.

The apparatus available includes:

a model wind turbine as shown in Fig. 4.1
an electric fan to provide the moving air to turn the turbine
a device for measuring air speed.

In your plan, you should:

- list any additional apparatus needed
- complete the wind turbine circuit diagram on Fig. 4.1
- state the key variables to be kept constant
- explain briefly how to carry out the experiment, including how the speed of the air flow is to be changed
- explain how to use the readings to reach a conclusion.

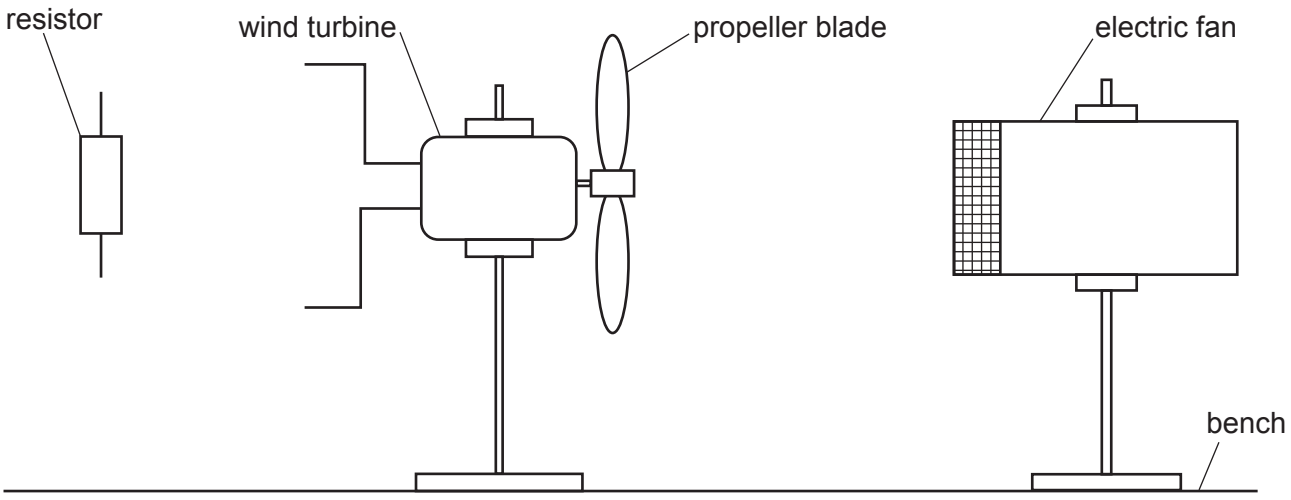


Fig. 4.1

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[Total: 7]

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