ARMY BURN HALL COLLEGE FOR BOYS
Entry Test – Class AS Level
SUBJECT: PHYSICS

Time allowed: 1 hour **Maximum Marks: 50**

INSTRUCTIONS

- Write your Roll Number only on the top right corner.
- Do not write your name or any other information.
- Do not use lead pencil.
- Avoid erasing, cutting, overwriting, etc.
- Any sign, mark, name, etc written on Answer Script to disclose your identity will disqualify you for admission to the College.

ATTEMPT ALL QUESTIONS (Marks 20)

Note: Objective should be solved in first 20 minutes.

Circle the correct option i.e. A/B/C/D.

1 An electric shower takes in cold water at 17 °C. The shower gives 6000 J of energy every second to the cold water and heats it to 37 °C. The specific heat capacity of water is 4200 J / (kg °C).

What is the mass of hot water supplied by the shower in one second?

A 0.035 kg **B** 0.039 kg **C** 0.071 kg **D** 0.084 kg

2 The resistance R of a wire increases uniformly with temperature. The values of R at the fixed points are shown in the table.

	0 °C	100 °C
R/Ω	100	250

What is the temperature when $R = 160\,\Omega$?

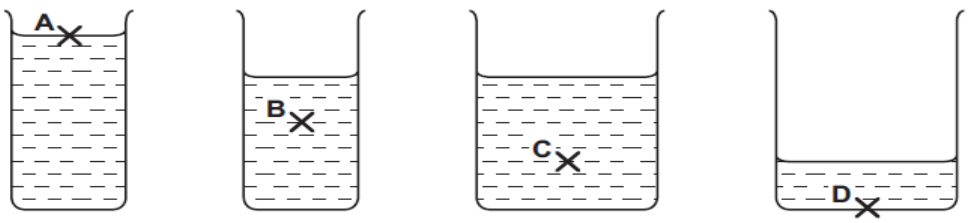
A 24 °C **B** 40 °C **C** 60 °C **D** 64 °C

3 What is one of the uses of ultrasound?

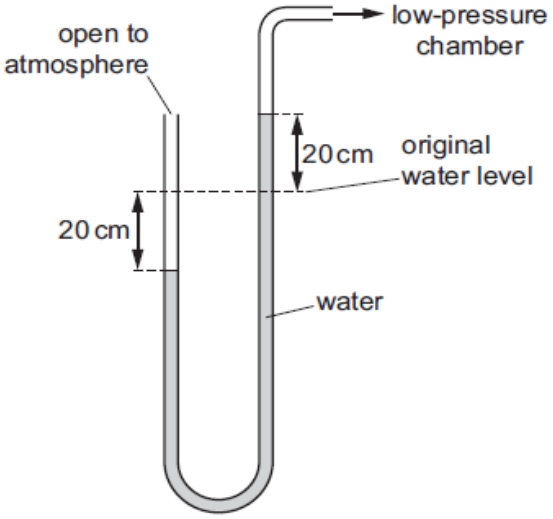
A cleaning jewellery **B** satellite communication
C fluorescent tubes **D** optical fibres

4 Four beakers contain the same liquid.

At which point is the pressure the greatest?



5 A U-tube containing water is used as a manometer.



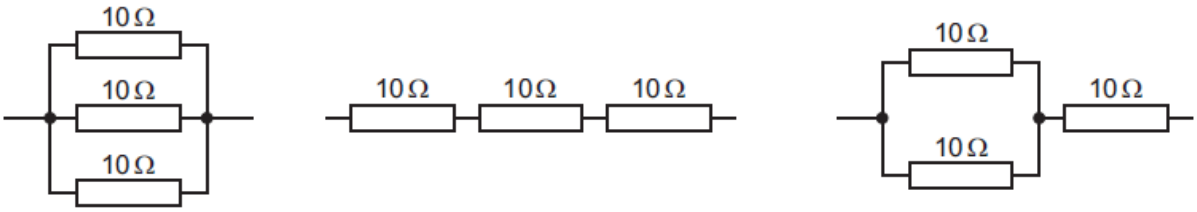
When one end of the manometer is connected to a low-pressure chamber, both water levels in the manometer change by 20 cm. The gravitational field strength g is 10 N / kg.

The density of water is 1000 kg / m^3.

How far below atmospheric pressure is the pressure in this chamber?

A 2000 Pa **B** 4000 Pa **C** 200 000 Pa **D** 400 000 Pa

6 Three 10 Ω resistors are connected together to form networks X, Y and Z.



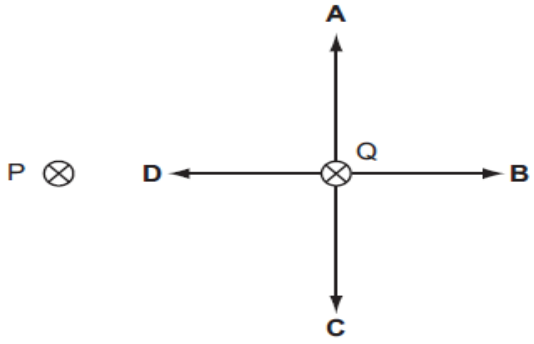
network X network Y network Z

What is the order of resistance of the networks going from the smallest total resistance to the largest total resistance?

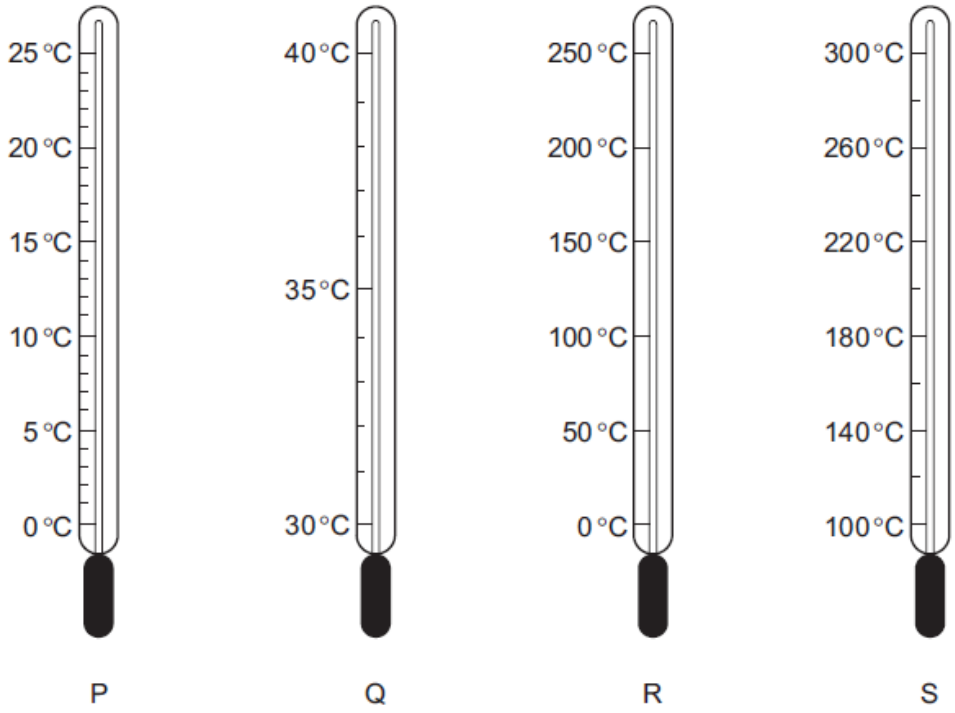
A X → Y → Z **B** X → Z → Y **C** Z → X → Y **D** Z → Y → X

7 P and Q represent two, parallel, straight wires carrying currents into the plane of the paper. P and Q exert a force on each other.

Which arrow shows the force on Q?



8 The diagrams represent four thermometers.

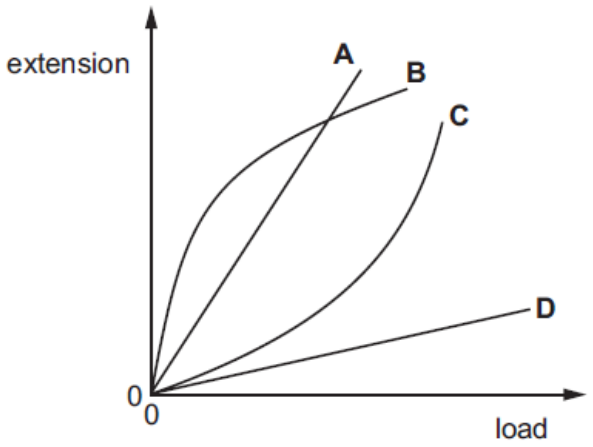


Which thermometer has the greatest sensitivity and which thermometer has the greatest range?

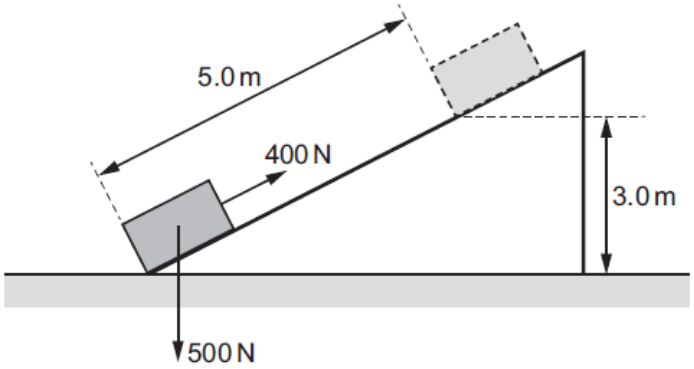
	greatest sensitivity	greatest range
A	P	R
B	P	S
C	Q	R
D	Q	S

9 The graph shows extension-load curves for four fibres.

Which fibre is the most difficult to stretch over the range of loads shown?



10 Work is done when a force of 400 N pulls a crate of weight 500 N at a constant speed along a ramp, as shown.

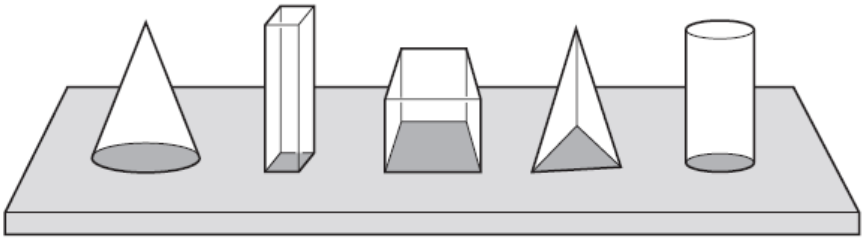


Part of the work done increases the gravitational potential energy E of the crate and the rest is work done W against friction.

What are the values of E and W?

	E / J	W / J
A	1500	500
B	1500	2000
C	2000	2500
D	3500	500

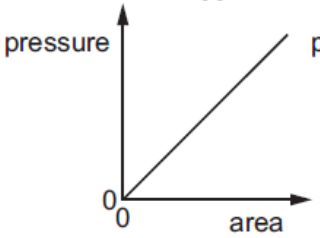
11 Five blocks have the same mass but different base areas. They all rest on a horizontal table.



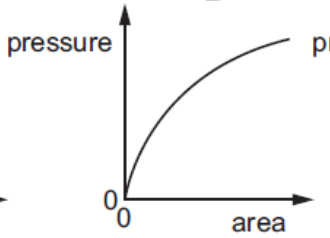
A graph is plotted to show the relationship between the pressure exerted on the table and the base area of the block.

Which graph shows this relationship?

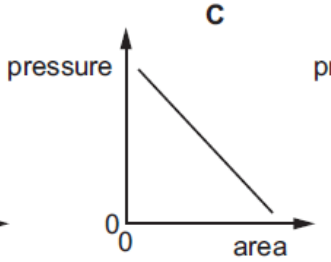
A



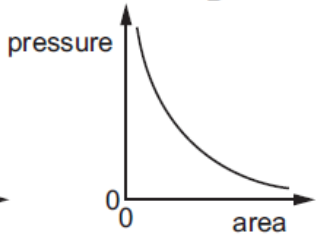
B



C



D



12 Equal masses of copper and water are heated to the same temperature. As they cool down, the copper and the water lose thermal energy at the same rate.

The temperature of the copper falls faster.

Why is this?

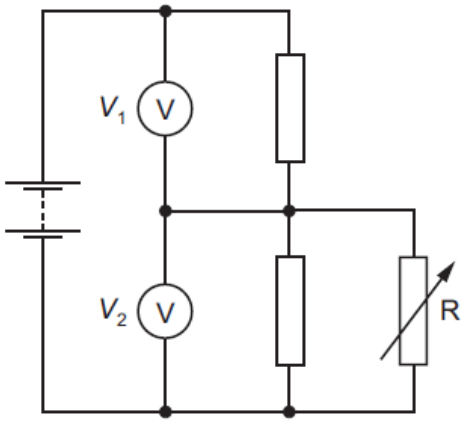
A Copper has a larger specific heat capacity.

B Copper has a larger specific latent heat.

C Copper has a smaller specific heat capacity.

D Copper has a smaller specific latent heat.

13 The circuit diagram shows a variable resistor R connected in parallel to the lower half of a potential divider.

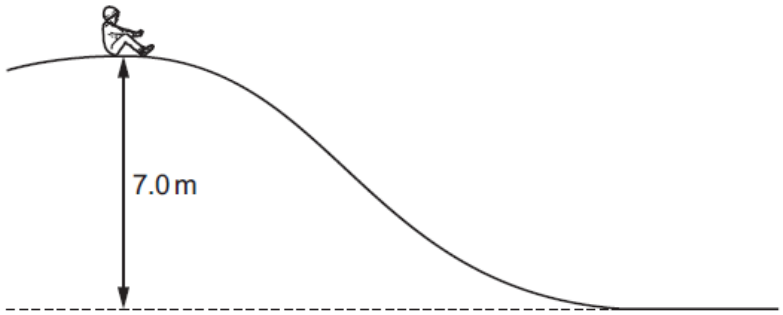


The resistance of R increases.

What happens to the two voltmeter readings?

	V_1	V_2
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

14 A child slides down a slide.

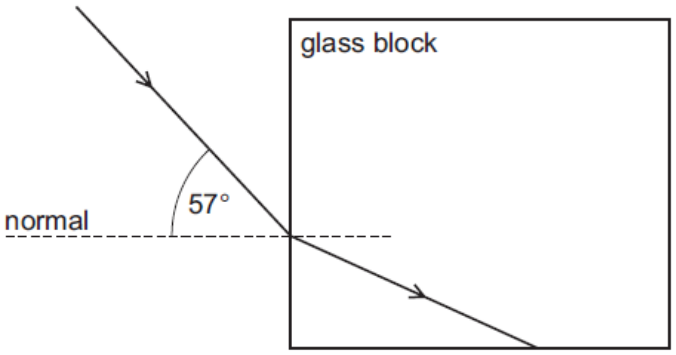


The weight of the child is 250 N. The height of the slide is 7.0 m. The work done against friction as the child travels down the slide is 1300 J.

What is the change in gravitational potential energy and what is the final kinetic energy of the child?

	change in gravitational potential energy	final kinetic energy
A	1750	450
B	1750	1750
C	17500	16200
D	17500	17500

15 Light passes from air into a glass block of refractive index 1.5, as shown.

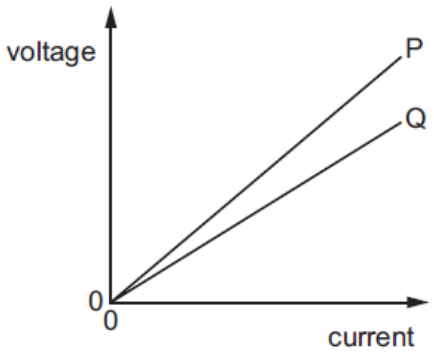


NOT TO SCALE

What is the angle of refraction in the glass and what is the critical angle?

	angle of refraction	critical angle
A	34°	42°
B	34°	60°
C	38°	42°
D	38°	60°

16 The graph is the voltage-current graph for two resistance wires P and Q.



The wires are made from the same material and have equal lengths.

The resistances of the wires and their cross-sectional areas are different.

Which wire has the greater resistance and which wire has the larger cross-sectional area?

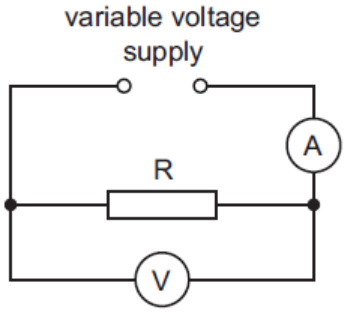
	greater resistance	larger cross-sectional area
A	P	P
B	P	Q
C	Q	P
D	Q	Q

17 An intruder alarm is adjusted to give a quieter sound without affecting the pitch of the note.

How are the amplitude and the frequency of the sound affected?

	amplitude	frequency
A	lower	lower
B	lower	same
C	same	lower
D	same	same

18 A student is investigating resistance using the circuit shown.

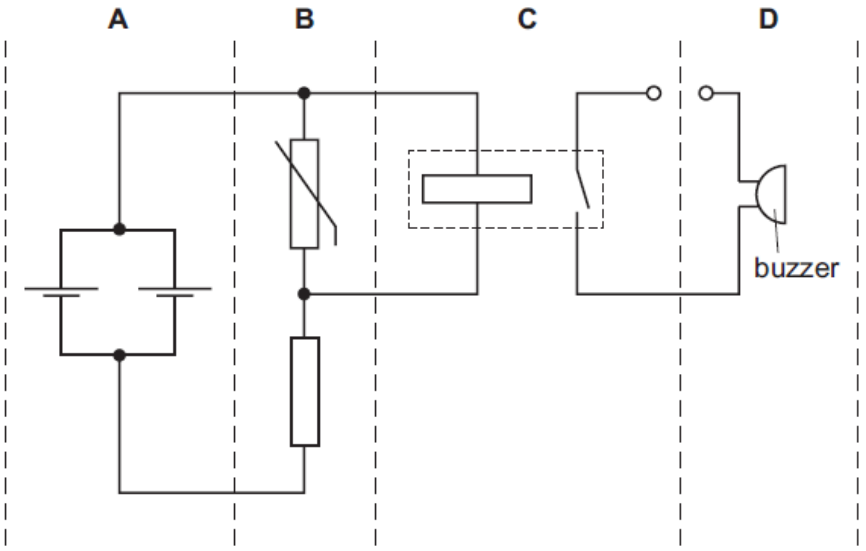


The resistance of R is approximately 5 Ω.

What are the most suitable ranges for the voltmeter and for the ammeter?

	voltmeter range	ammeter range
A	0–2 V	0–0.5 A
B	0–2 V	0–2 A
C	0–5 V	0–5 A
D	0–10 V	0–5 A

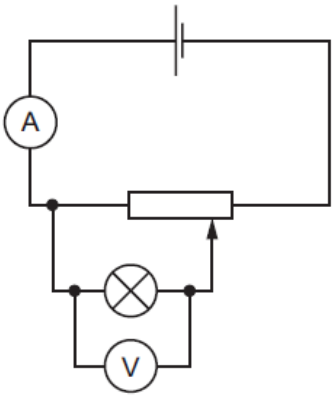
19 Which section of the circuit contains a potential divider?



20 An experiment is set up to investigate how the current in a filament lamp changes with the potential difference across it.

Which circuit is correct?

A



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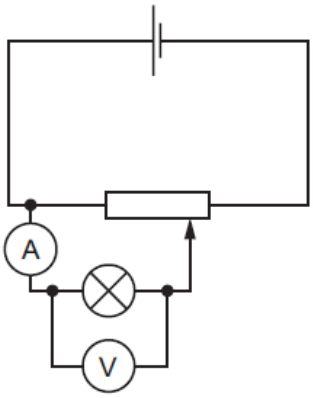

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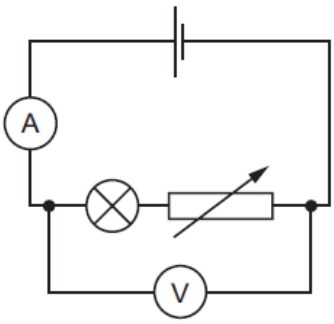

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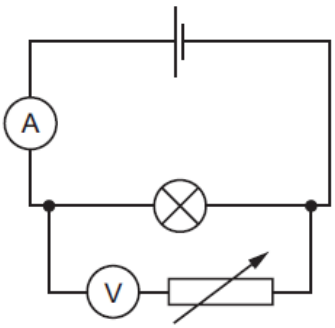

ATTEMPT ALL QUESTIONS (Marks 30)

Q. 2 A teacher demonstrates magnetic screening. When a magnet is placed near a small cardboard box, paper clips on the other side of the box are picked up, as shown in Fig. 4.1.

When a small piece of soft iron is placed inside the box as shown in Fig. 4.2, the paper clips fall off.

Magnetic field lines in each diagram are shown as thin lines.

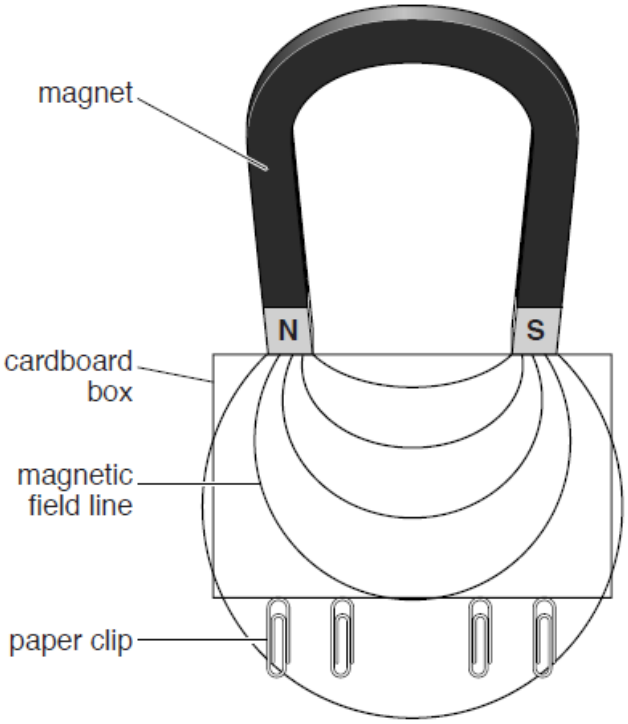

Fig. 4.1

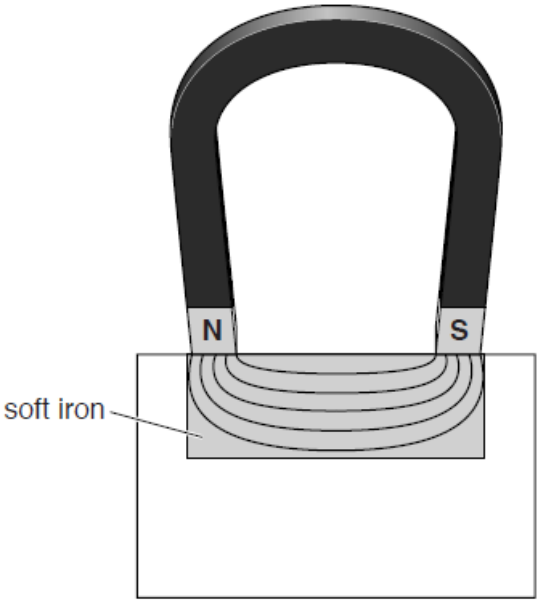

Fig. 4.2

(a) On Fig. 4.1, mark an arrow on each of the magnetic field lines to show its direction. [1]

(b) Explain why placing the soft iron inside the box causes the paper clips to fall off.

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..... [2]

(c) Explain why it is sensible to have magnetic screening around the tube of a cathode-ray oscilloscope.

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..... [1]

Q. 3 A student connects a battery to two resistors. The circuit diagram is shown in Fig. 10.1.

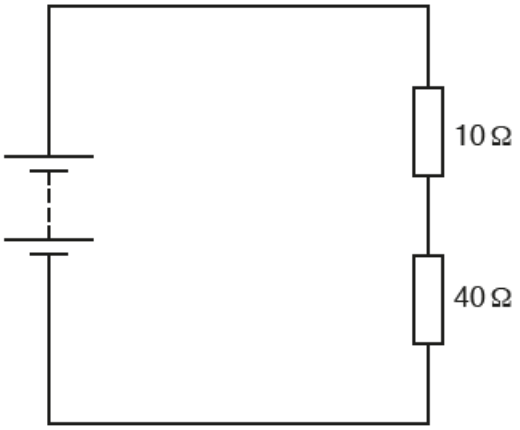

Fig. 10.1

The potential difference (p.d.) across the 40 Ω resistor is 9.6 V.

(a) State what is meant by the *potential difference* across a resistor.

.....

.....[2]

(b) **(i)** Calculate the current in the 40 Ω resistor.

current = ...[2]

(ii) Calculate the electromotive force (e.m.f.) of the battery.

e.m.f. = ...[2]

(c) The student has three different voltmeters to measure the p.d. across the 40 Ω resistor. These are labelled 0–2 V, 0–20 V and 0–200 V. Each has a pointer that shows the p.d. on a scale.

State and explain which of the three voltmeters is best to measure this p.d.

.....

.....

.....

.....[2]

(d) **(i)** Calculate the power P produced in the 10 Ω resistor.

P = ...[2]

(ii) The student has available two 10 Ω resistors, with power ratings of $\frac{1}{2}P$ and $2P$.

Suggest why a resistor with a power rating of $\frac{1}{2}P$ is not suitable for the circuit in Fig. 10.1.

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.....[1]

(e) The student adds a resistor R to the circuit, to make the circuit shown in Fig. 10.2.

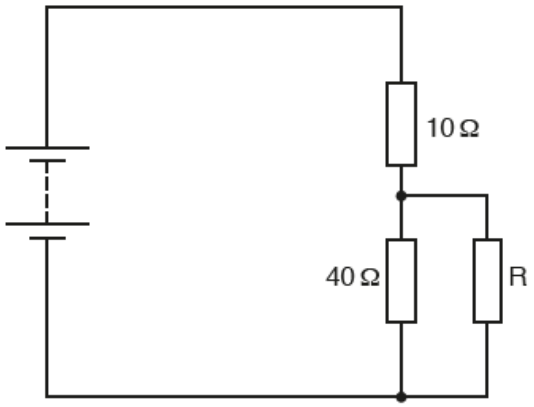

Fig. 10.2

Complete the table in Fig. 10.3 to show what happens as resistor R is connected.

You should state whether each quantity increases, decreases or stays the same and give a brief explanation of why any change occurs. Calculations are not required.

quantity	increases, decreases or stays the same as resistor R is added	brief explanation of why the change occurs
current in 10 Ω resistor	increases	
p.d. across 10 Ω resistor		
p.d. across 40 Ω resistor		

[4]

Fig. 10.3

Q. 4 Fig. 2.1 shows a student doing a press-up. A total force *F* acts upwards on his hands. There is also a force upwards on his toes.

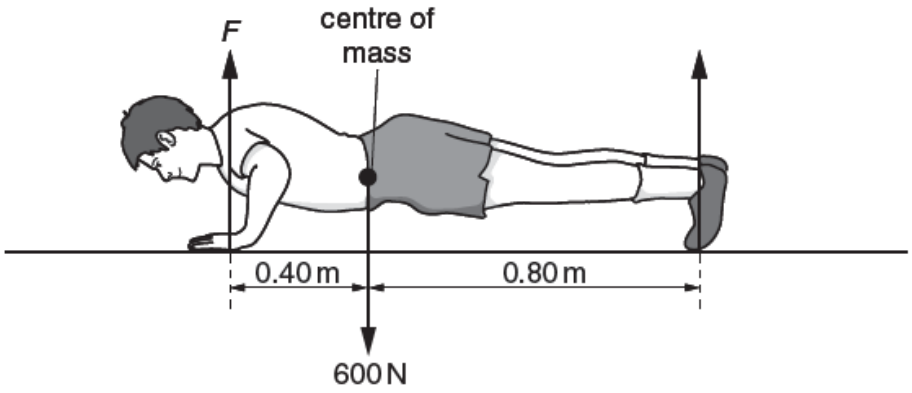

Fig. 2.1 (not to scale)

The weight of the student is 600 N and this force acts downwards from his centre of mass.

(a) (i) Explain why the student does work as his body rises from the ground.

.....

.....[1]

(ii) State the form of energy that the student uses to do this work.

.....[1]

(b) At the position shown in Fig. 2.1, the student is stationary.
The weight of the student causes a moment about his toes.

(i) Calculate the moment of the weight of the student about his toes.

moment = ...[1]

(ii) Calculate the value of the force *F*.

F = ...[2]

Q. 5 An experiment is carried out to find how the pressure of a fixed mass of air at room temperature varies with volume. Fig. 3.1 shows the apparatus used. The syringe is sealed at one end and the piston is free to move up and down as different metal weights are used.

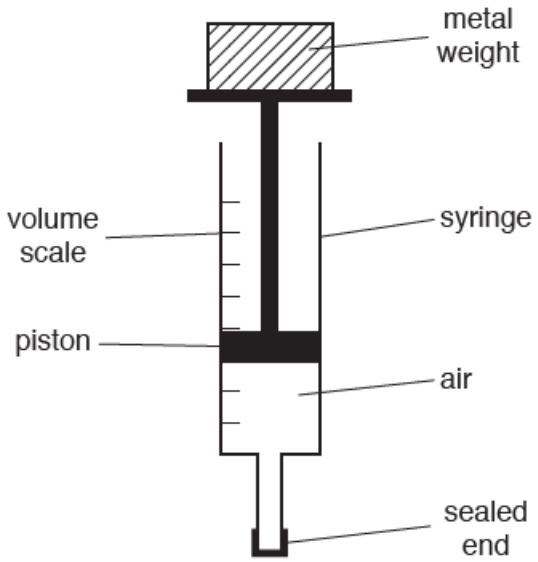

Fig. 3.1

(a) State the unit in which pressure is measured.

.....[1]

(b) Fig. 3.2 shows the axes for a graph of pressure against volume for the air in the syringe.

One point is plotted on the graph at pressure of P_0 and volume V_0.

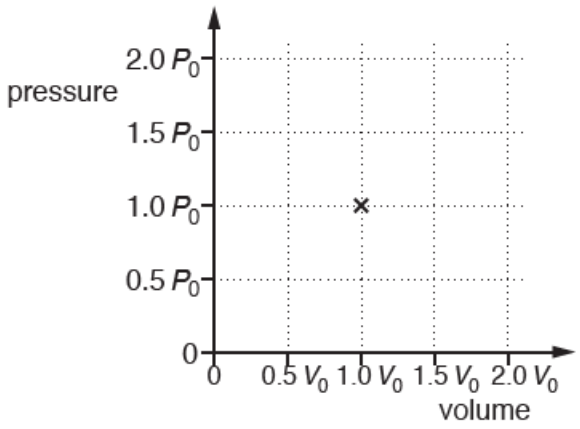

Fig. 3.2

The temperature of the air is kept constant.

On Fig. 3.2,

(i) plot points at volumes of 0.5 V_0 and 2.0 V_0, [1]

(ii) complete the graph. [1]

(c) More metal weights are placed on top of the syringe.

Explain how the molecules of air inside the syringe are able to support more metal weights.

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.....[3]