OCR
Oxford Cambridge and RSA

Thursday 25 May 2023 – Morning

GCSE (9–1) Physics A (Gateway Science)

J249/01 Paper 1 (Foundation Tier)

Time allowed: 1 hour 45 minutes

You must have:
- a ruler (cm/mm)
- the Equation Sheet for GCSE (9–1) Physics A (inside this document)

You can use:
- a scientific or graphical calculator
- an HB pencil

F

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for a correct method, even if the answer is wrong.

INFORMATION
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*****).
- This document has **24** pages.

ADVICE
- Read each question carefully before you start your answer.

Section A

You should spend a **maximum** of **30 minutes** on this section.

Write your answer to each question in the box provided.

1 Which statement is an example of a chemical change?

A Boiling milk

B Freezing water

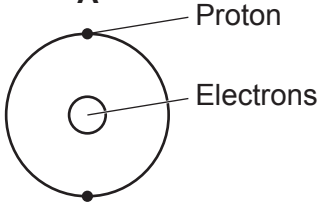
C Frying an egg

D Melting ice cream

Your answer ☐ **[1]**

2 Which diagram shows the correct model of an atom?

A



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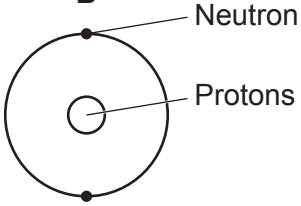

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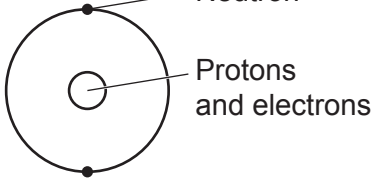

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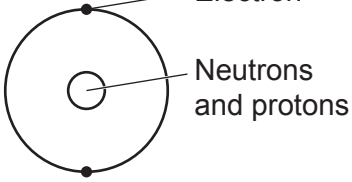


Your answer ☐ **[1]**

3 Which row describes the particles in a **gas**?

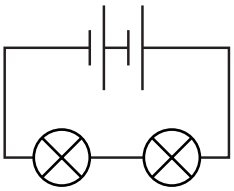
	Distance between particles	Arrangement of particles
A	close together	random
B	close together	regular
C	far apart	random
D	far apart	regular

Your answer ☐ **[1]**

4 A student connects four circuits using identical cells and identical lamps.

Which circuit has the **brightest** lamps?

A



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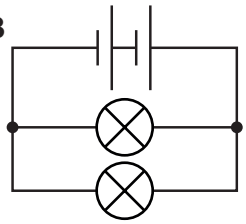

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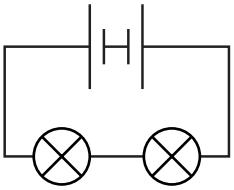

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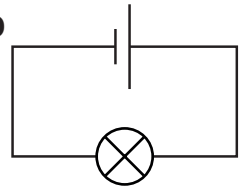
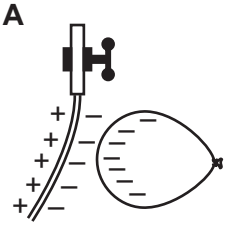


Your answer ☐ **[1]**

5 Which diagram correctly shows a charged balloon **attracting** a stream of water?

A



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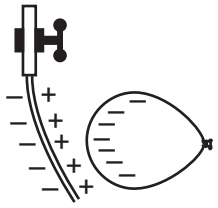

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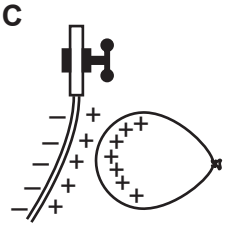

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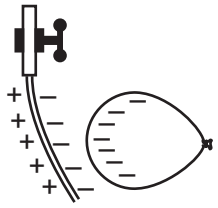


Your answer ☐ **[1]**

6 The time taken for four students to run a race is recorded.

Student	Time taken (s)
1	21.5
2	21.6
3	21.0
4	21.5

What is the mean time taken by the students?

A 16.0 s

B 21.4 s

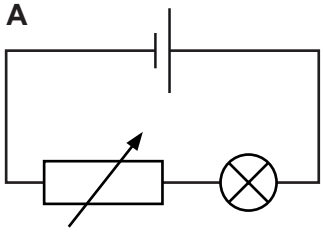
C 21.5 s

D 85.6 s

Your answer ☐ **[1]**

7 Which circuit diagram shows how the brightness of a lamp is changed using a variable resistor?

A



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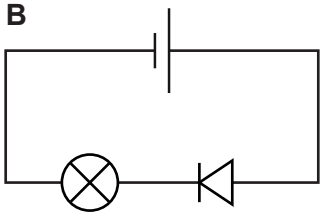

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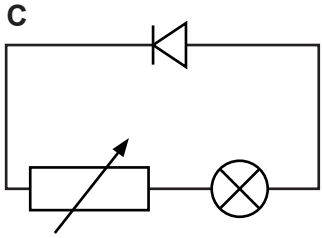

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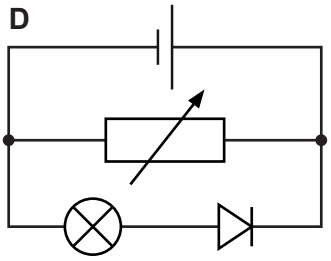
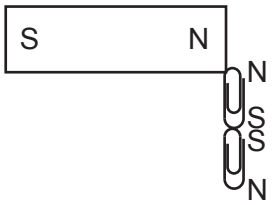


Your answer ☐ **[1]**

8 A magnet attracts two paperclips. S represents a South pole and N represents a North pole.

Which diagram shows the correct magnetic poles of each paperclip?

A



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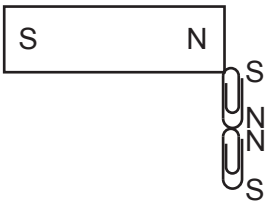

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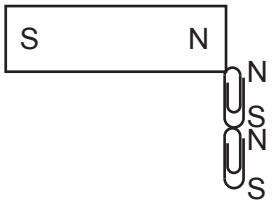

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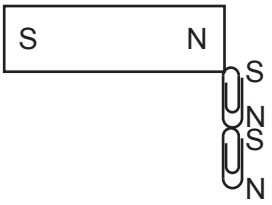


Your answer ☐ **[1]**

9 Which row states the correct term used for the rate of flow of charge and a condition for charge to flow in a circuit?

	Rate of flow of charge	Condition for charge flow
A	current	closed circuit
B	current	open circuit
C	potential difference	open circuit
D	potential difference	closed circuit

Your answer ☐ **[1]**

10 In which of these situations is the **most** work done?

A 5 kg cat climbing 5 m vertically upwards

B 10 kg dog climbing 10 m vertically upwards

C 50 kg boy climbing 10 m vertically upwards

D 75 kg man climbing 5 m vertically upwards

Your answer ☐ **[1]**

11 Specific latent heat is the energy transferred when 1 kg of a substance changes state.

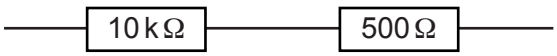
Which row lists the correct change of state for specific latent heat of fusion and specific latent heat of vaporisation?

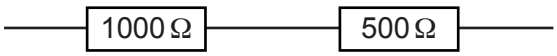
	Specific latent heat of fusion	Specific latent heat of vaporisation
A	boiling	melting
B	condensing	boiling
C	freezing	condensing
D	melting	freezing

Your answer ☐ **[1]**

12 Which pair of resistors has the greatest total resistance?

A 

B 

C 

D 

Your answer ☐ **[1]**

13 A student investigates the gears on their bicycle.

The larger cog has 60 teeth and the smaller cog has 20 teeth.

If the larger cog rotates once, how many times does the smaller cog rotate?

A 1

B 3

C 40

D 80

Your answer ☐ **[1]**

14 The current in a wire is 5.0 A.

What is the charge flow in the wire in 2 minutes?

Use the equation: charge flow = current × time

A 0.40 C

B 2.5 C

C 10 C

D 600 C

Your answer ☐ **[1]**

15 What is 15 J converted into newton-metres?

A 0.15 N m

B 1.5 N m

C 15 N m

D 150 N m

Your answer ☐ **[1]**

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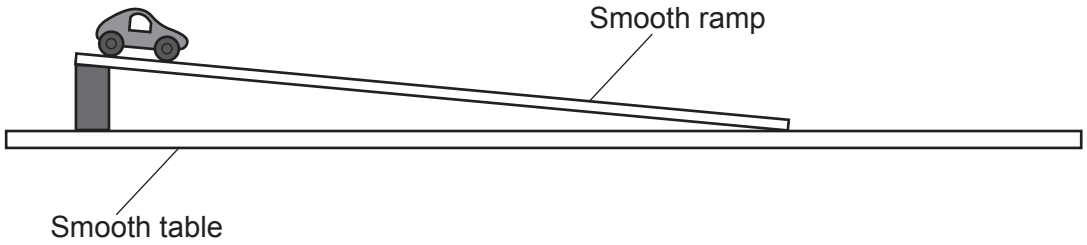
Section B

16 The diagram shows a toy car rolling down a smooth ramp onto a smooth table where it travels at a constant velocity.



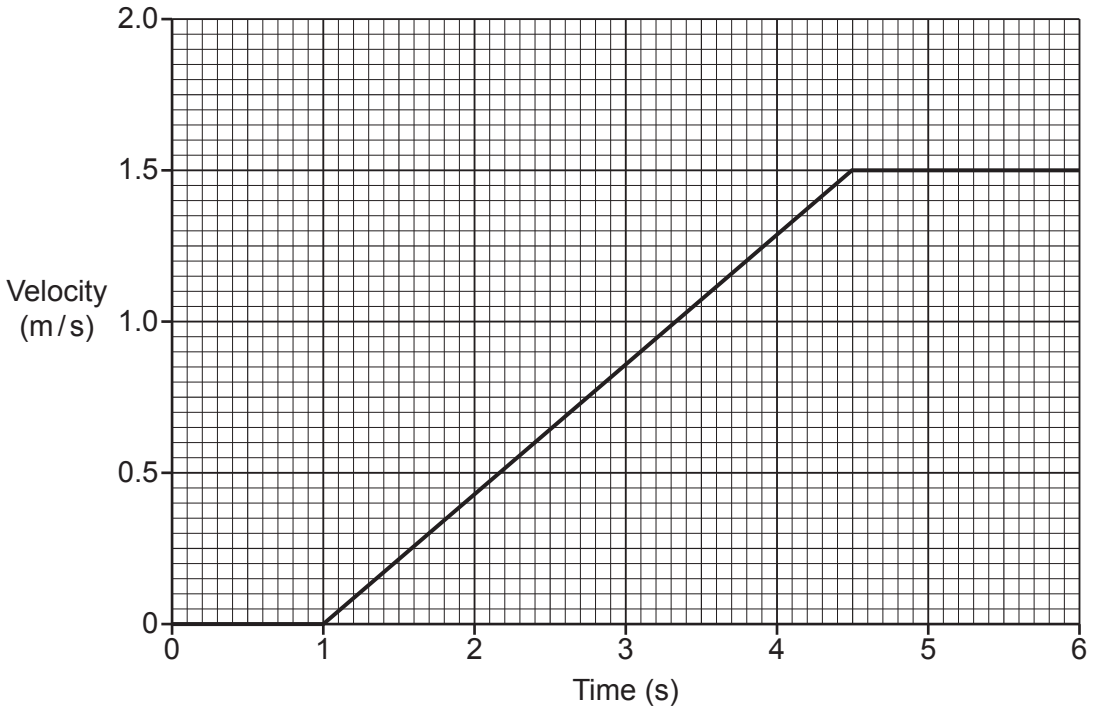
(a) (i) Suggest the equipment the student uses to measure the **distance travelled** by the car on the ramp.

..... **[1]**

(ii) Suggest the equipment the student uses to measure the **time** it takes the car to roll down the ramp.

..... **[1]**

(b) This is the velocity–time graph for the car.



(i) State the time the car starts to move.

..... **[1]**

(ii) State the time the car reaches the bottom of the ramp.

..... **[1]**

(iii) Describe how the acceleration of the car will change if the ramp is made steeper.

..... **[1]**

(iv) Draw a line on the graph to show the acceleration of the car if the ramp is made steeper.

[1]

(c) Velocity and speed are different quantities.

Complete the sentence about velocity. Use words from the list.

acceleration	**direction**	**energy**	**force**	**magnitude**

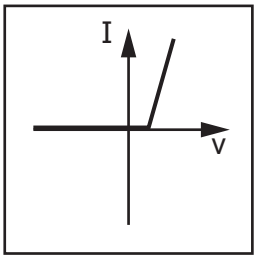
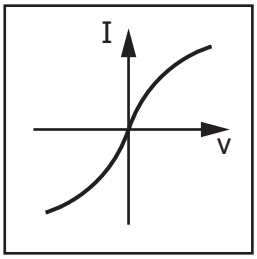
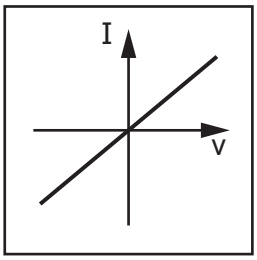
Velocity is a vector quantity because it has ..... and ..... .

[2]

17 (a) A student draws current–potential difference (I-V) graphs for three different components. These are shown in **Fig. 17.1**.

Draw one line from each **component** to its correct **current–potential difference graph**.

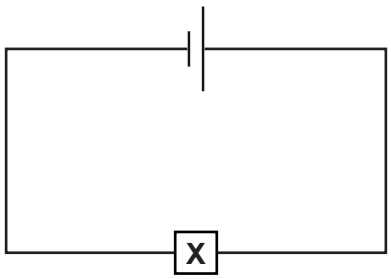
Fig. 17.1

Component	Current–potential difference graph
Filament lamp	
Diode	
Fixed resistor	

[2]

(b) The student uses the circuit in **Fig. 17.2** to investigate the current in component **X** and the potential difference across it.

Fig. 17.2



(i) State the name of the measuring instrument the student uses to measure the current in the circuit.

..... **[1]**

(ii) Draw the circuit symbol for the measuring instrument in **(b)(i)** in a correct position in **Fig. 17.2**.

[2]

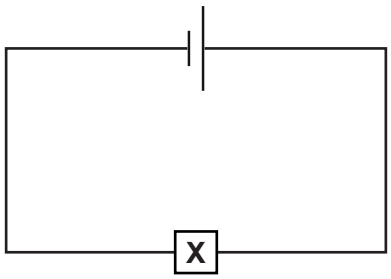
(iii) State the name of the measuring instrument the student uses to measure the potential difference across component **X**.

..... **[1]**

(iv) Draw the circuit symbol for the measuring instrument in **(b)(iii)** in a correct position in **Fig. 17.3**.

[2]

Fig. 17.3



(c) Component **X** has a resistance of 6.0 Ω.

A current of 4.0 A flows through component **X**.

Calculate the potential difference across component **X**.

Use the Equation Sheet.

Potential difference = ... V **[3]**

18 A student investigates how the number of turns of wire on an electromagnet affects the strength of the magnetic field produced.

The student passes a current through a wire wrapped around an iron nail and uses this to pick up paperclips.

(a) (i) Name **two** variables the student controls in the experiment.

1 .....

2 .....

[2]

(ii) The table shows the student's results.

Number of turns	Number of paperclips picked up
4	5
8	10
12	15
16	20
20	25

Describe the pattern shown by the student's results.

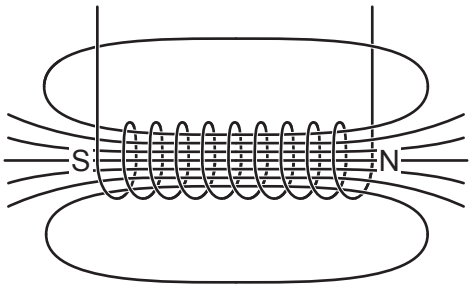
.....

..... **[2]**

(iii) Predict how many paperclips the electromagnet will pick up if it has 28 turns.

..... **[1]**

(b) The diagram shows a sketch of the magnetic field around the electromagnet.



(i) Add arrows to the magnetic field lines to show the direction of the magnetic field. **[1]**

(ii) Write the letter **X** to show a position where the magnetic field is stronger. **[1]**

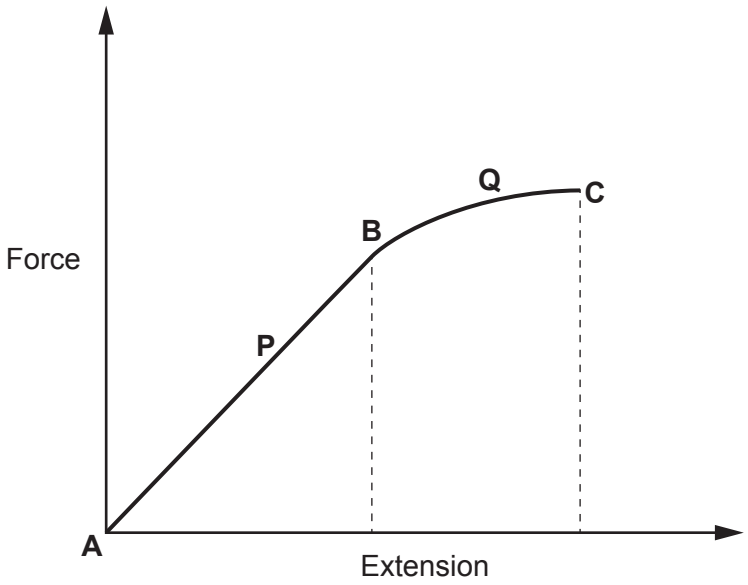
(iii) Write the letter **W** to show a position where the magnetic field is weaker. **[1]**

19 A student applies different forces to a spring and measures the extension of the spring each time. The force–extension graph shows their results.

A, **B** and **C** are points on the graph.

P is the region on the graph between points **A** and **B**.

Q is the region on the graph between points **B** and **C** where the spring is permanently deformed.



(a) Use the letters **A, B, C, P** and **Q** to answer the following questions about the graph.

(i) Which letter represents where the spring has elastic deformation?

..... **[1]**

(ii) Which letter represents where the spring obeys Hooke's Law?

..... **[1]**

(iii) Which letter represents the elastic limit of the spring?

..... **[1]**

(iv) Which letter represents where the graph is non-linear?

..... **[1]**

(b) State the **minimum** number of forces that need to be applied to the spring in order to stretch it.

..... **[1]**

(c) The spring constant of the spring is 28 N / m.

(i) Calculate the force exerted by the spring when it is extended by 0.15 m.

Use the equation: force exerted by a spring = spring constant × extension

Force = ... N **[2]**

(ii) Calculate the energy transferred when the spring is extended by 0.15 m.

Use the Equation Sheet.

Energy transferred when stretching = ... J **[2]**

20 (a)* A student investigates the resistance of a thermistor at different temperatures.

The student uses a Bunsen burner to heat the water in a beaker to three different temperatures. The student uses an ohmmeter to measure the resistance of the thermistor at each temperature.

Fig. 20.1 shows how the student sets up their experiment and **Fig. 20.2** shows a graph of their results.

Fig. 20.1

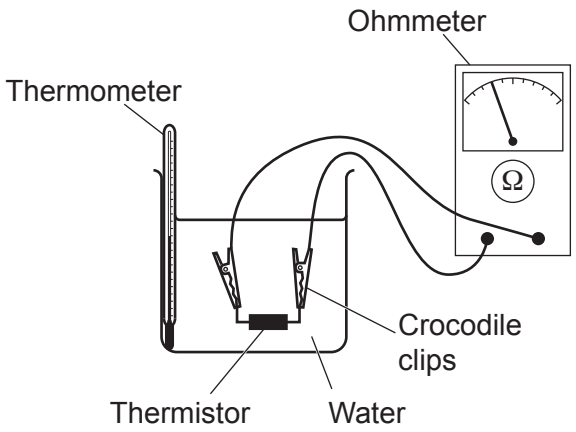
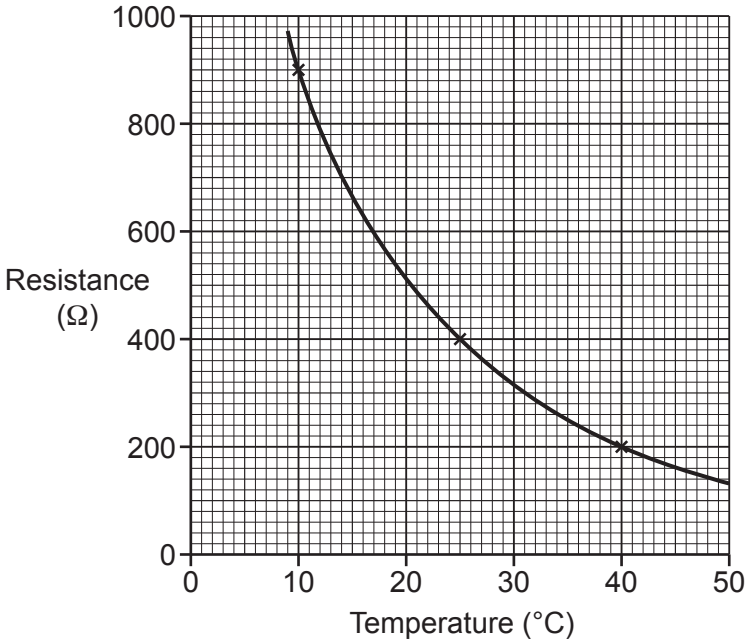


Fig. 20.2



Describe the trend shown by the graph.

Suggest how the student's method could be improved. Include ideas about accuracy and precision.

.....

.....

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.....

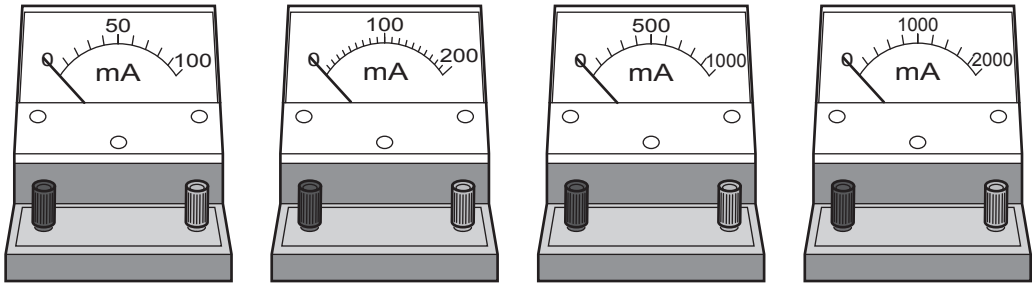
.....

..... **[6]**

(b) At one of the temperatures, the current in the thermistor is 300 mA.

Fig. 20.3 shows a choice of ammeters that the student can use to measure this current accurately.

Fig. 20.3



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

Which ammeter should the student use to measure a current of 300 mA?

Ammeter .....

Explain your answer.

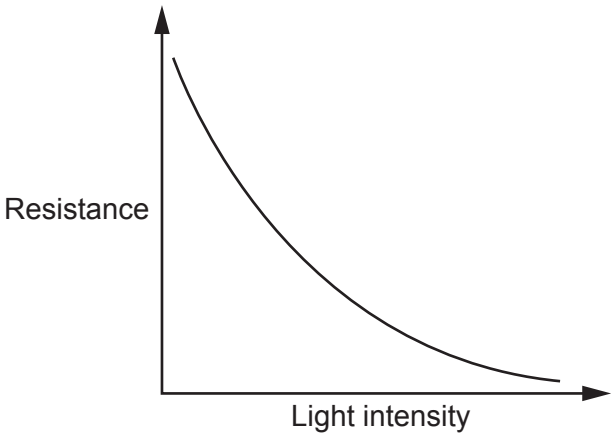
.....

.....

.....

[2]

(c) The graph shows how the resistance changes for a light dependent resistor (LDR).



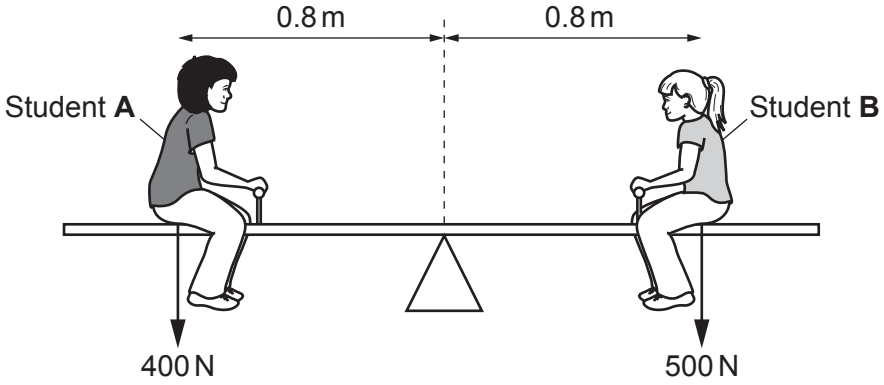
State **one** use for a light dependent resistor and describe how it is used.

.....

.....

..... **[2]**

21 The diagram shows two students sitting on a seesaw.



(a) **(i)** Explain what happens to the seesaw when both students lift their feet off the ground.

.....

.....

..... **[2]**

(ii) Calculate the distance from the pivot that student **B** sits to balance the seesaw when student **A** sits 0.6 m from the pivot.

Use the equation: moment of a force = force × distance

Distance = ... m **[3]**

(b) Student **A** has a weight of 400 N.

(i) Calculate the mass of student **A**.

Use the equation: gravitational force = mass × gravitational field strength

Mass = ... kg **[3]**

(ii) Student **A** stands on one foot when they leave the seesaw.

The area of their foot in contact with the ground is $2.5 \times 10^{-2}\,m^2$.

Calculate the pressure student **A** exerts on the ground.

Use the Equation Sheet.

Pressure = ... Pa **[3]**

22 **(a)** A teacher drops a ball from a height of 2.1 m. The ball hits the floor after 0.6 s.

Calculate the average speed of the ball as it falls.

Use the equation: distance travelled = average speed × time

Average speed = ... m/s **[3]**

(b) The teacher draws a free body force diagram for the ball as it falls.

(i) Label the two forces acting on the ball as it falls. **[2]**

(ii) Explain the motion of the ball as it falls.

.....

.....

..... **[2]**

(c) A lorry has a mass of 30 000 kg.

Calculate the force needed to accelerate the lorry at 3.0 m/s^2.

Use the Equation Sheet.

Force = ... N **[3]**

23 A scientist investigates how the pressure and volume of a gas are related.

The results from their experiment are shown in the table.

Pressure (kPa)	Volume (cm^3)
300	250
500	150
625	120
1000	75
1250	60

(a) Explain how these results show that pressure × volume = constant.

Use calculations in your answer.

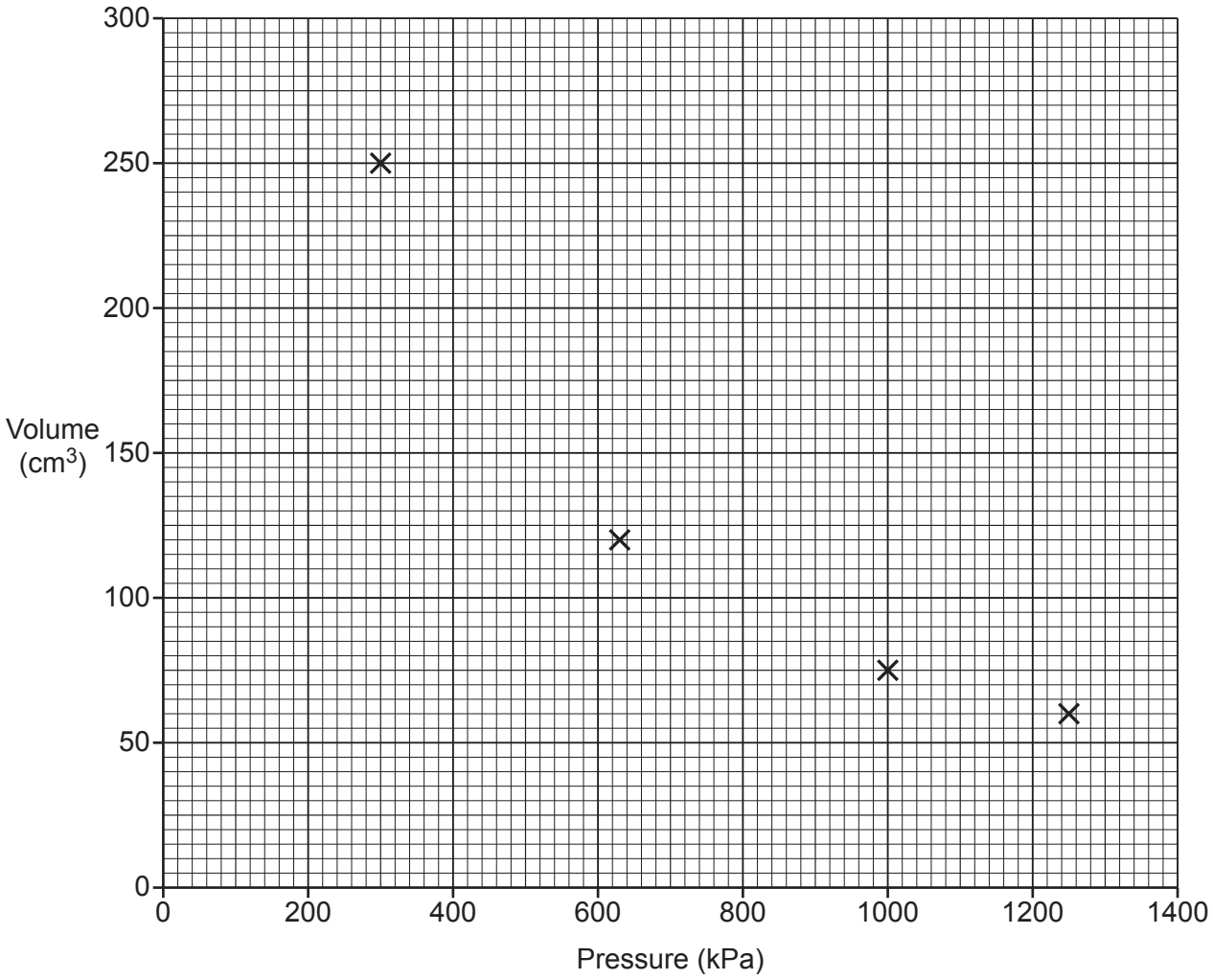
.....

.....

.....

..... **[3]**

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



(i) Plot the missing point on the graph. **[1]**

(ii) Draw a line of best fit on the graph. **[1]**

(iii) Use the graph to find the volume of gas at 900 kPa.

Volume of gas = ... cm^3 **[1]**

(c) Explain how and why atmospheric pressure changes with height above the surface of the Earth.

.....

.....

.....

..... **[2]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).