OCR
Oxford Cambridge and RSA

F

Friday 13 November 2020 – 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 Data Sheet for GCSE (9–1) Physics A (inside this document)

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

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 **28** pages.

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

SECTION A

Answer **all** the questions.

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

Write your answer to each question in the box provided.

1 What is the typical size for a small molecule?

A 0.1 cm

B 0.1 km

C 0.1 m

D 0.1 nm

Your answer ☐ **[1]**

2 A skydiver falls from a plane.

What is the name of the **downward** force in the diagram?

A Drag

B Electrostatic

C Mass

D Weight

Your answer ☐ **[1]**

3 A cyclist travels 750 m in 50 seconds.

Calculate the speed of the cyclist.

Use the equation: speed = distance / time

A 0.015 m / s

B 15 m / s

C 37.5 m / s

D 375 m / s

Your answer ☐ **[1]**

4 Which action **increases** the strength of an electromagnet?

A Decreasing the current

B Decreasing the number of turns of wire

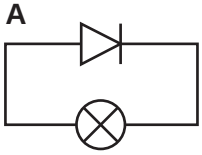
C Increasing the number of turns of wire

D Using a copper core

Your answer ☐ **[1]**

5 A student sets up four electrical circuits.

A



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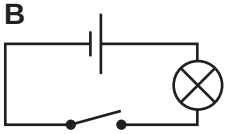

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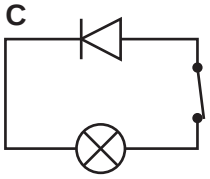

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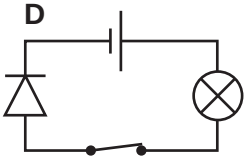


Identify in which circuit the lamp will light up.

Your answer ☐ **[1]**

6 On the Moon the gravitational field strength is 1.6 N / kg.

Calculate the gravity force for an 80 kg astronaut.

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

A 50 N

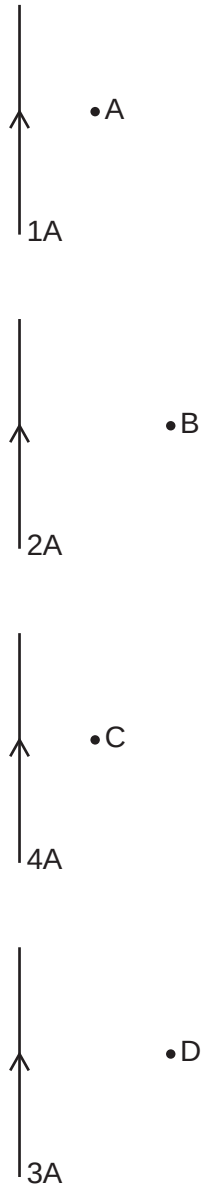
B 128 N

C 800 N

D 1280 N

Your answer ☐ **[1]**

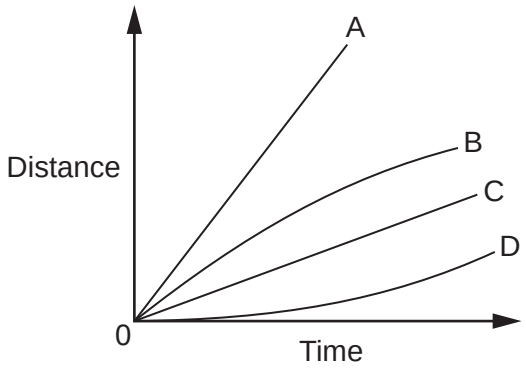
7 The different currents in four wires are shown below. The magnetic field is measured at positions **A**, **B**, **C** and **D**.



Which position will experience the strongest magnetic field?

Your answer ☐ **[1]**

8 Look at the distance-time graph.



Which line shows the largest average speed?

Your answer ☐ **[1]**

9 A girl runs twice around a 400 m circular track.

What is the final displacement of the girl from her starting point?

A 0 m

B 200 m

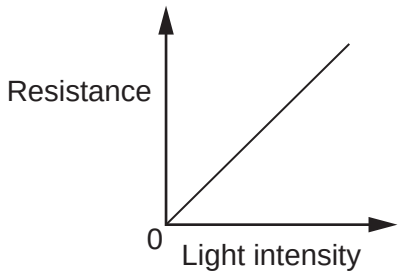
C 400 m

D 800 m

Your answer ☐ **[1]**

10 A student investigates how the resistance of a light dependent resistor (LDR) changes with light intensity.

A



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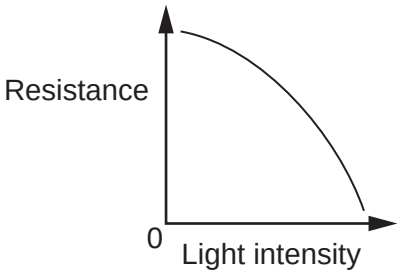

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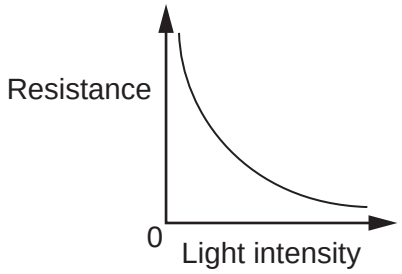

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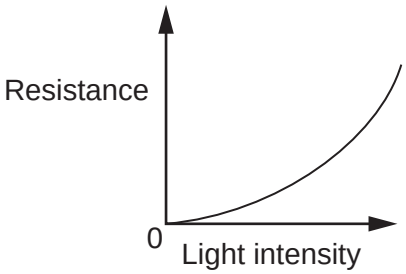


Which graph shows the correct relationship between the resistance of an LDR and light intensity?

Your answer ☐ **[1]**

11 Four cars of the same mass are shown here.

A

B

C

D

Which car will accelerate?

Your answer ☐ **[1]**

12 Calculate the charge flow when a current of 20 mA flows for 2000 s.

Use the equation: charge flow = current × time

A 40 C

B 100 C

C 40 000 C

D 100 000 C

Your answer ☐ **[1]**

13 A student measures the weight of four boxes and the area in contact with the ground.

Box	Weight (N)	Area (cm^2)
A	50	100
B	75	250
C	90	400
D	100	500

Which box exerts the greatest pressure on the ground?

Your answer ☐ **[1]**

14 Which item uses the most power?

Use the equation: power = potential difference × current

	Item	Current (A)	Potential difference (V)
A	Calculator	0.1	3
B	Mobile Phone	1.0	5
C	Radio	0.5	12
D	Torch	1.2	6

Your answer ☐ **[1]**

15 Energy is needed to change ice into water.

Calculate the energy needed to change 5 kg of ice into water.

Use an equation from the data sheet to help you.

Specific latent heat of melting = 3.34×10^5 J/kg.

A 16.7 J

B 1670 J

C 1 670 000 J

D 1 670 000 000 J

Your answer ☐ **[1]**

SECTION B

Answer **all** the questions.

16 (a) Complete the sentences about an atom.

Use words from the list.

You may use each word once, more than once, or not at all.

Atom	**Electrons**	**Negatively**	**Neutrons**
Nucleus	**Orbits**	**Positively**	**Protons**

An atom has a ..... charged nucleus surrounded by ..... charged electrons.

The nucleus contains protons and ..... .

Almost all of the mass of an atom is in the ..... .

[4]

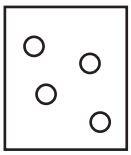
(b) (i) A swimming pool contains 9970 kg of water in 10 m^3.

Calculate the density of water.

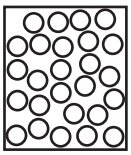
Use the equation: density = mass ÷ volume

Density = ... kg / m^3 **[2]**

(ii) The diagrams, **A**, **B** and **C**, show the particles in three states of matter.



A



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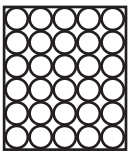

C

Write the letters in the boxes to give the correct order of density, from **most** to **least dense**.

Most dense ⟶ **Least dense**

☐ ☐ ☐

[1]

(iii) Explain why you chose the order in **(b)(ii)**.

.....

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

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17 A student sets up the circuit in **Fig. 17.1** to investigate the resistance of a lamp.

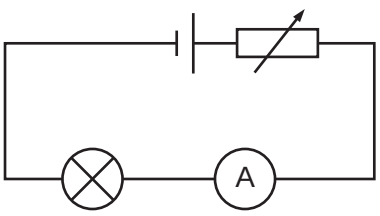

Fig. 17.1

(a) (i) The student also needs to add a voltmeter to the circuit.

On **Fig. 17.1 draw** where the voltmeter should be connected. **[2]**

(ii) The student takes readings of potential difference and current and records them in **Table 17.1**.

Potential difference (V)	Current
1.0	1.000
2.0	1.9
3.0	2.7
4.0	3.2
5.0	3.5

Table 17.1

There are **two** mistakes in the results table.

Write down the **two** mistakes and suggest how they could be corrected.

Mistake 1: .....

Correction 1: .....

Mistake 2: .....

Correction 2: .....

[4]

(iii) Calculate the resistance of the lamp when the potential difference is 4.0 V in **Table 17.1**.

Use the equation: potential difference = current × resistance

Resistance = ... Ω **[3]**

(b) The student plots the results from **Table 17.1** on the graph in **Fig. 17.2**.

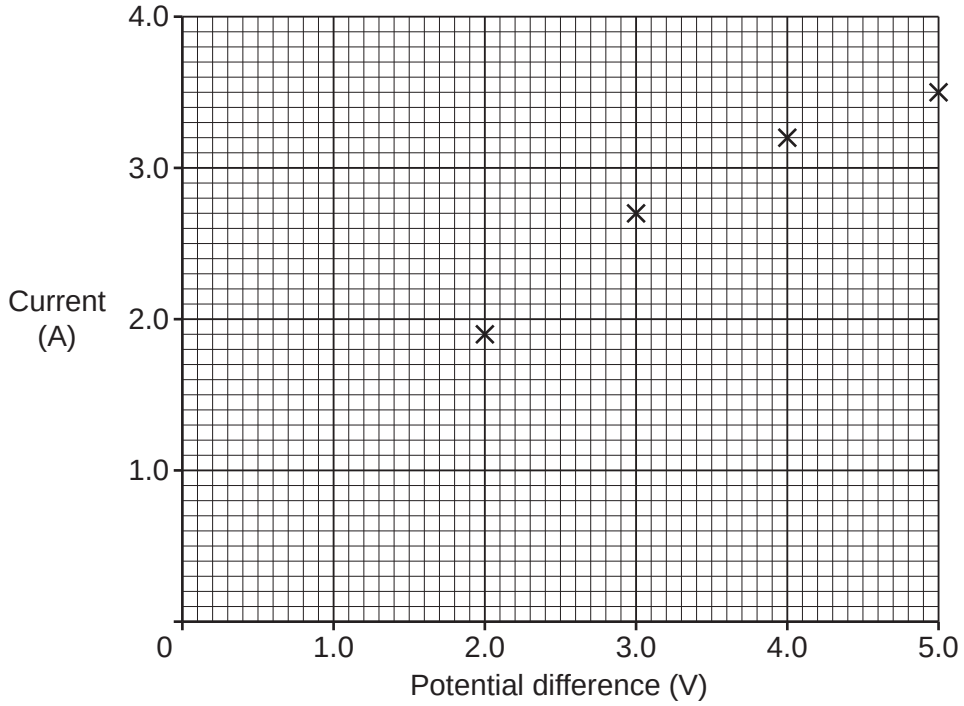

Fig. 17.2

(i) Plot the missing point at 1.0 V on the graph **and** draw a line of best fit. **[2]**

(ii) Describe the relationship between potential difference and current.

Use data from the graph to support your answer.

.....

.....

.....

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

(iii) Explain how you could use the circuit in **Fig. 17.1** to investigate the resistance of a fixed resistor instead of a lamp.

.....

.....

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

(iv) Explain how and why the graph in **Fig. 17.2** would look different for a fixed resistor at a constant temperature.

.....

.....

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

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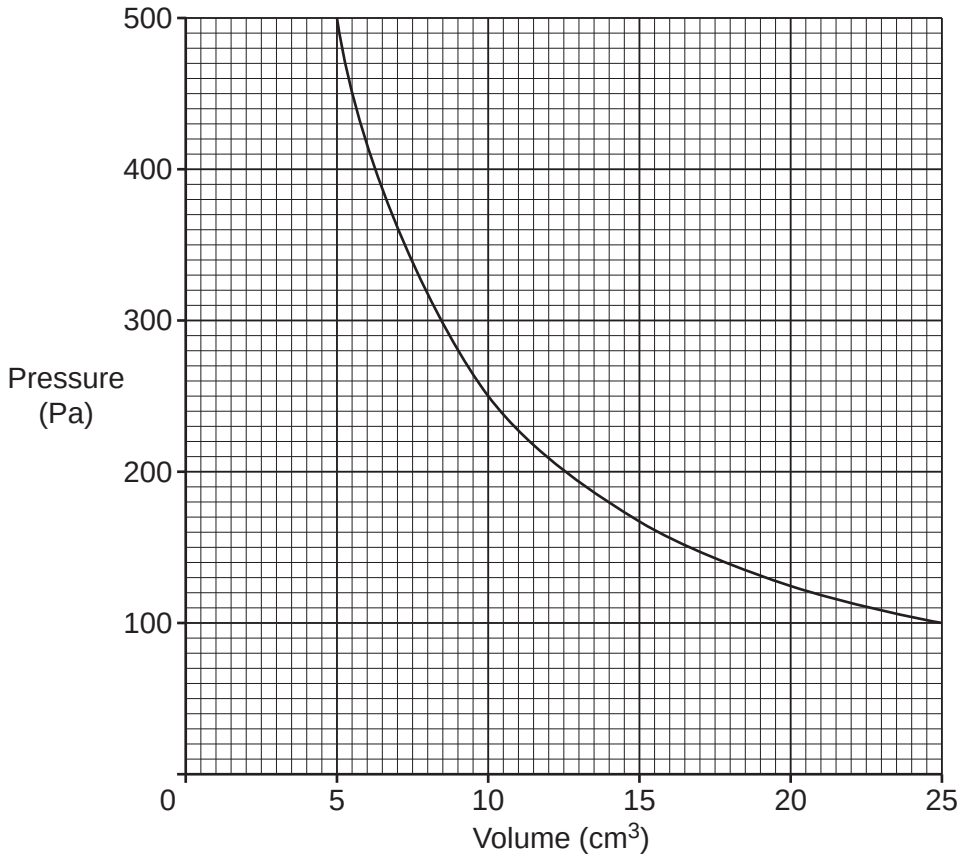
18 A student investigates the link between the volume and pressure of a gas. The student uses a fixed mass of gas in a closed container. The student plots a graph of the results.



(a) The student thinks that pressure multiplied by volume is always equal to the same number.

Explain why the student is correct.

Use data from the graph to support your answer.

.....

.....

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

(b) Complete the sentences to explain how volume and pressure are related.

Use words from the list.

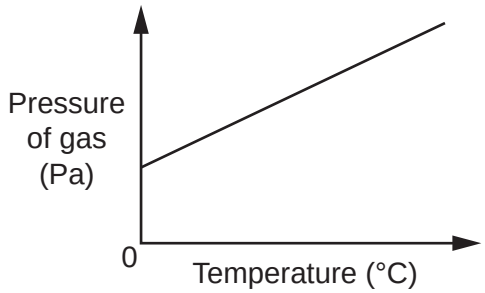
You can use each word once, more than once, or not at all.

doubled **halved** **the same**

If the volume of a gas is halved, the number of collisions per second between the gas particles and the container is ..... .

The pressure is ..... . **[2]**

(c) The student then investigates how temperature and pressure of a gas are linked. The student measures the pressure of a gas as its temperature increases. The results are plotted on a graph.



Explain how temperature and pressure are linked.

Use the graph to support your answer.

.....

.....

.....

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

19 A toy car travels around a race track. After one lap it is back at the start position.

(a) Explain why the velocity of the toy car is different from its speed as it travels around the track.

.....

.....

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

(b) The mass of the toy car is 5 kg and it has an acceleration of 4 m/s^2.

(i) Calculate the force needed to accelerate the toy car.

Use the equation: force = mass × acceleration

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

(ii) Suggest why the **actual** force needed would be more than in part **(b)(i)**.

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

(c) **(i)** Another toy car requires a constant force of 30 N to move it along a surface.

Calculate the work done on the car when it moves a distance of 50 m.

Use the equation: work done = force × distance

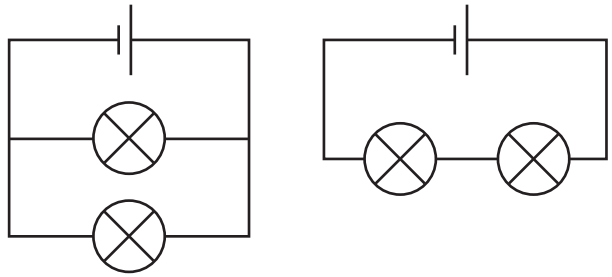
Work done = ... J **[2]**

(ii) Calculate the power output of this toy car if the work is done over 75 seconds.

Use your answer from **(c)(i)**.

Power = ... W **[3]**

20* A student investigates if lamps are brighter in a series circuit or a parallel circuit. He sets up two different circuits, **A** and **B**.



A **B**

State which circuit will have the brightest lamps and explain why.

In your answer, include the variables that the student will need to control in this experiment.

.....

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

21 A student investigates how a spring stretches.

She measures the original length of the spring, adds a 2.0 N weight, and then measures the extended length of the spring.

Look at her data in the table.

Force used	2.0 N
Original length	3.0 cm
Extended length	7.0 cm
Extension	4.0 cm

(a) (i) Calculate the spring constant for the spring.

Use the equation: force = spring constant × extension

Spring constant = ... N / cm **[3]**

(ii) Suggest **two** ways that the student could improve and develop their method to find the spring constant.

.....

.....

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

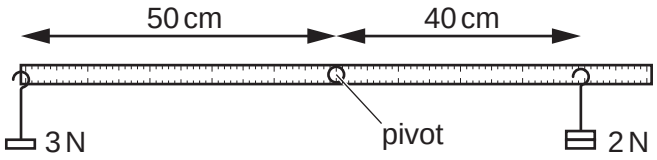
(b) The spring constant of a different spring is 40 N / m.

Calculate the energy stored in the spring when it is stretched 0.20 m.

Use an equation from the data sheet to help you.

Energy stored = ... J **[2]**

(c) The diagram shows an experiment a student set up to study moments.



The student:
- holds the metre rule so that it is horizontal
- adds weights to the metre rule at different distances from the pivot.

(i) Calculate the moments of the 2 N weight and the 3 N weight about the pivot.

Use the equation: moment = force × distance from pivot

Moment of 2 N weight = ... N cm

Moment of 3 N weight = ... N cm
[2]

(ii) Which way will the metre rule rotate when it is released by the student?

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

22 A student investigates static electricity using a plastic ruler.

(a) (i) Explain in terms of electrons why the plastic ruler is not normally charged.

.....

.....

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

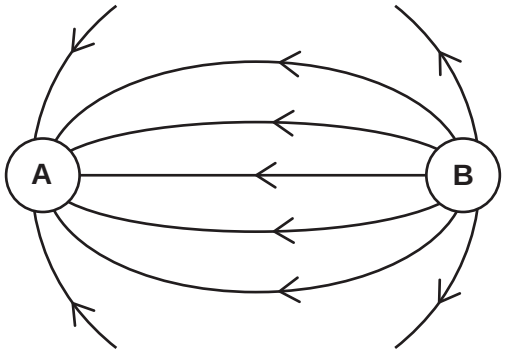
(ii) Explain in terms of electrons why the ruler becomes charged when the student rubs it with a cloth.

.....

.....

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

(b) The diagram shows the electric field between two charges, **A** and **B**.



(i) State the charges of **A** and **B**.

Use the diagram to explain your answer.

.....

.....

.....

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

(ii) Describe **one** similarity between the electric field line diagram and a magnetic field line diagram.

.....

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

(c) Calculate the charge when 200 J of energy is transferred with a potential difference of 40 V.

Use the equation: energy transferred = charge × potential difference

Charge = ... C **[3]**

23 A student drops a paper ball from a balcony 4.00 m high. Her friend measures the time taken for the paper ball to reach the ground.

(a) Suggest the equipment used to measure the height of the balcony and the time taken for the paper ball to reach the ground.

Height .....

Time taken .....

[1]

(b) They record their results in a table.

Attempt	**1**	**2**	**3**	**4**	**5**
Time taken (s)	1.84	2.08	2.02	2.08	1.98

(i) Use the data in the table to calculate the mean, median and mode of their results.

Mean = ...

Median = ...

Mode = ...

[3]

(ii) The results are not very precise. Explain how you can tell from the data in the table.

.....

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

(iii) Suggest a possible source of error in the experimental method **and** how it could be improved.

Source of error .....

Improvement .....

.....

[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).