

# 11.2 Resistance & Resistivity

## Question Paper

Course	CIE A Level Physics (9702) 2019-2021
Section	11. Current of Electricity
Topic	11.2 Resistance & Resistivity
Difficulty	Medium

**Time allowed:** 20

**Score:** /20

**Percentage:** /100

**Question 1**

Two wires have the same length and the same resistance. Wire X is made of a metal of resistivity  $1.7 \times 10^{-8} \Omega\text{m}$ , and wire Y is made of a metal of resistivity  $5.6 \times 10^{-8} \Omega\text{m}$ .

The diameter of wire X is 0.315 mm.

What is the diameter of wire Y?

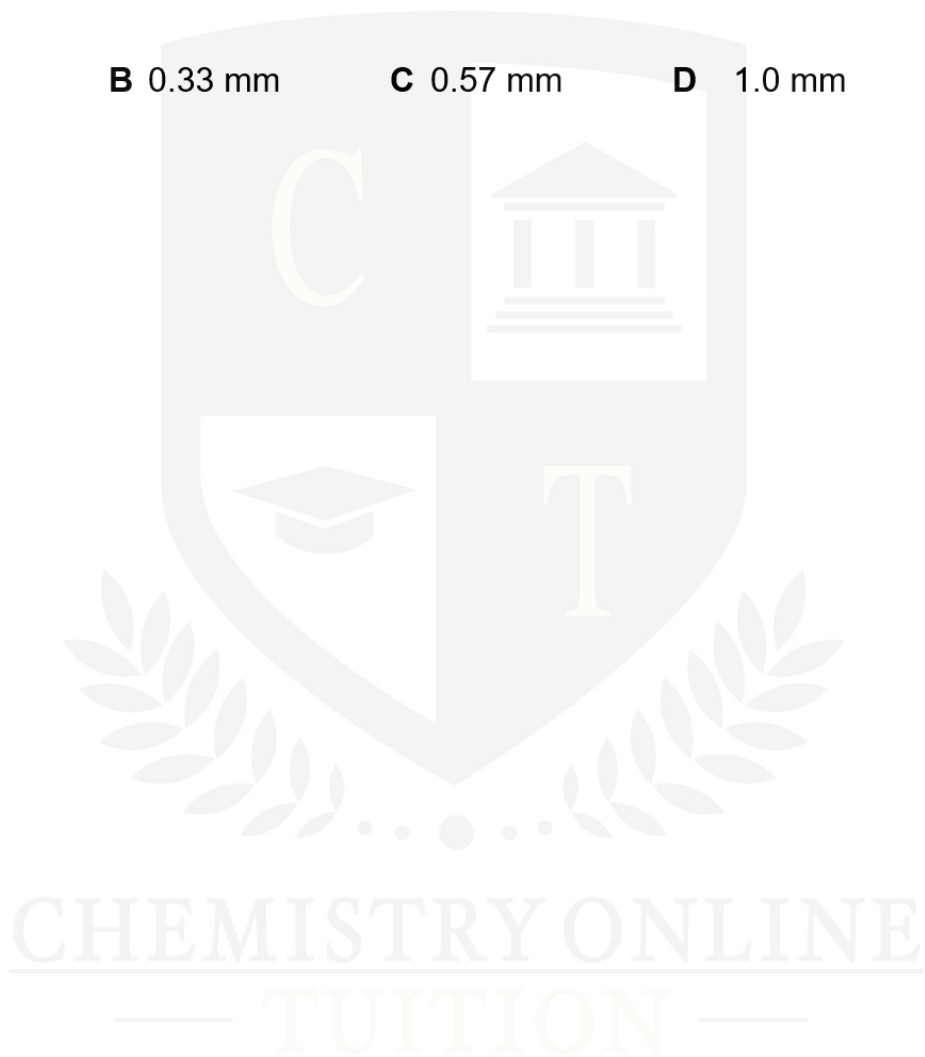
**A** 0.17 mm

**B** 0.33 mm

**C** 0.57 mm

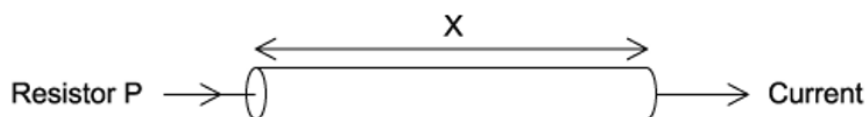
**D** 1.0 mm

**[1 mark]**

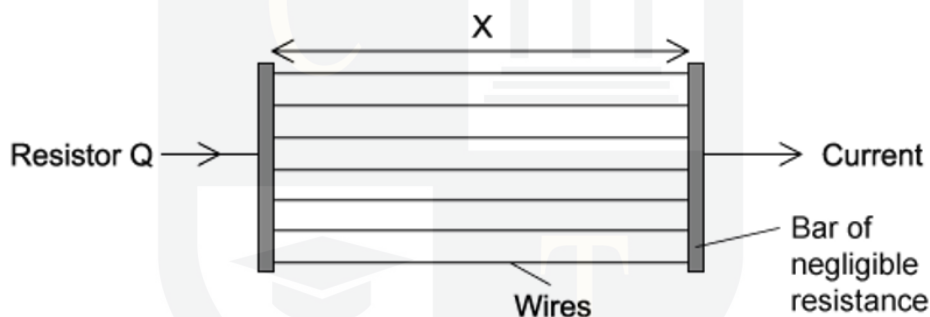


## Question 2

A researcher has two pieces of copper of the same volume. All of the first piece is made into a cylindrical resistor P of length  $x$ .



All of the second piece is made into uniform wires each of the same length  $x$  which he connects between two bars of negligible resistance to form a resistor Q.



How do the electrical resistances of P and Q compare?

- A** P has a larger resistance than Q
- B** Q has a larger resistance than P
- C** P and Q have equal resistance
- D** Q may have a larger or smaller resistance than P, depending on the number of wires made

[1 mark]

### Question 3

The resistance of a thermistor depends on its temperature, and the resistance of a light-dependent resistor (LDR) depends on the illumination.

Under which conditions will the resistance of both a thermistor and an LDR be highest?

	thermistor	LDR
<b>A</b>	highest temperature	highest illumination
<b>B</b>	highest temperature	lowest illumination
<b>C</b>	lowest temperature	highest illumination
<b>D</b>	lowest temperature	lowest illumination

[1 mark]

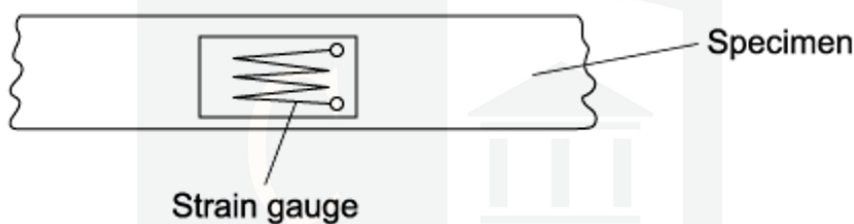


#### Question 4

Tensile strain may be measured by the change in electrical resistance of a strain gauge.

A strain gauge consists of folded fine metal wire mounted on a flexible insulating backing sheet.

The strain gauge is firmly attached to the specimen, so that the strain in the metal wire is always identical to that in the specimen.



When the strain in the specimen is increased, what happens to the resistance of the wire?

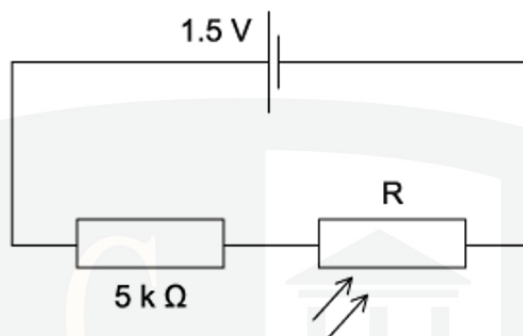
- A** it decreases, because the length decreases and the cross-sectional area increases
- B** it decreases, because the length increases and the cross-sectional area decreases
- C** it increases, because the length decreases and the cross-sectional area increases
- D** it increases, because the length increases and the cross-sectional area decreases

**[1 mark]**

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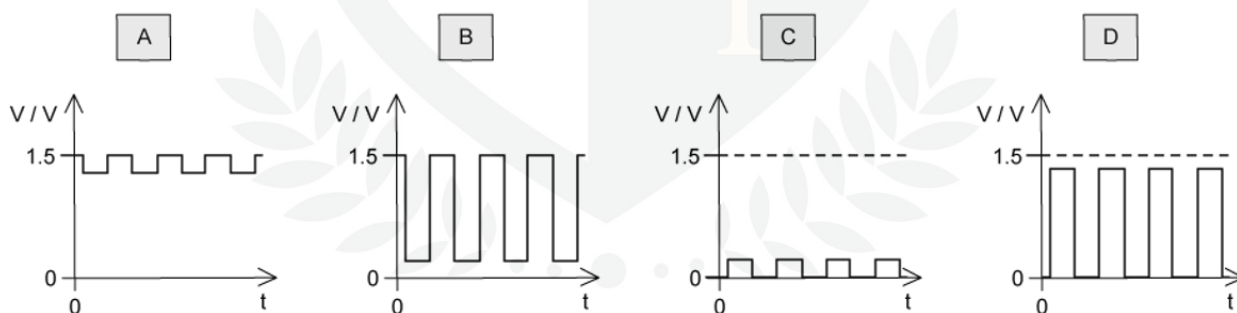
### Question 5

A light-dependent resistor  $R$  has a resistance of about  $1\text{ M}\Omega$  in the dark and about  $1\text{ k}\Omega$  when illuminated. It is connected in series with a  $5\text{ k}\Omega$  resistor to a  $1.5\text{ V}$  cell of negligible internal resistance.



The light-dependent resistor is illuminated (in an otherwise dark room) by a flashing light.

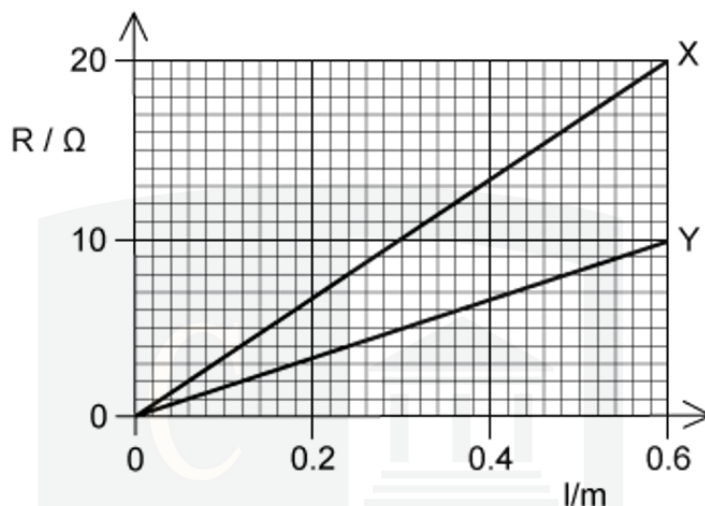
Which graph best shows the variation with time  $t$  of potential difference  $V$  across  $R$ ?



[1 mark]

### Question 6

The graph shows the variation with length  $l$  of resistance  $R$  for two wires X and Y made from the same material.



What does the graph show?

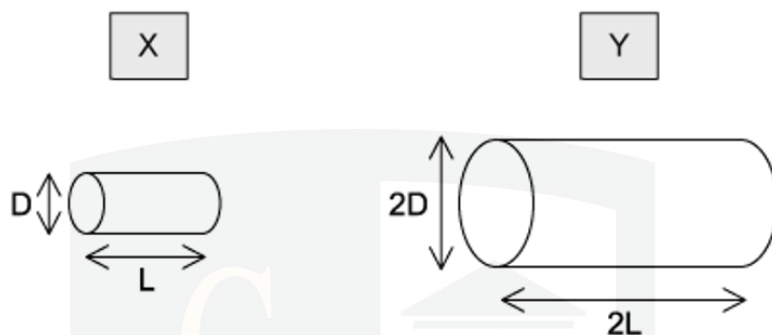
- A** cross-sectional area of X =  $2 \times$  cross-sectional area of Y
- B** resistivity of X =  $2 \times$  resistivity of Y
- C** when equal lengths of X and Y are connected in series to a battery, power in X =  $2 \times$  power in Y
- D** when equal lengths of X and Y are connected in parallel to a battery, current in X =  $2 \times$  current in Y

[1 mark]

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### Question 7

Two electrically-conducting cylinders X and Y are made from the same material. Their dimensions are as shown.



The resistance between the ends of each cylinder is measured.

What is the ratio  $\frac{\text{resistance of X}}{\text{resistance of Y}}$ ?

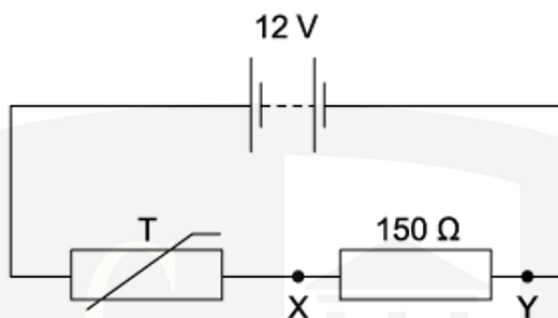
- A  $\frac{2}{1}$       B  $\frac{1}{1}$       C  $\frac{1}{2}$       D  $\frac{1}{4}$

[1 mark]

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### Question 8

In a fire alarm system, a thermistor T has a resistance of  $2000\ \Omega$  at room temperature. Its resistance decreases as the temperature increases. The alarm is triggered when the potential difference between X and Y reaches  $4.5\text{ V}$ .



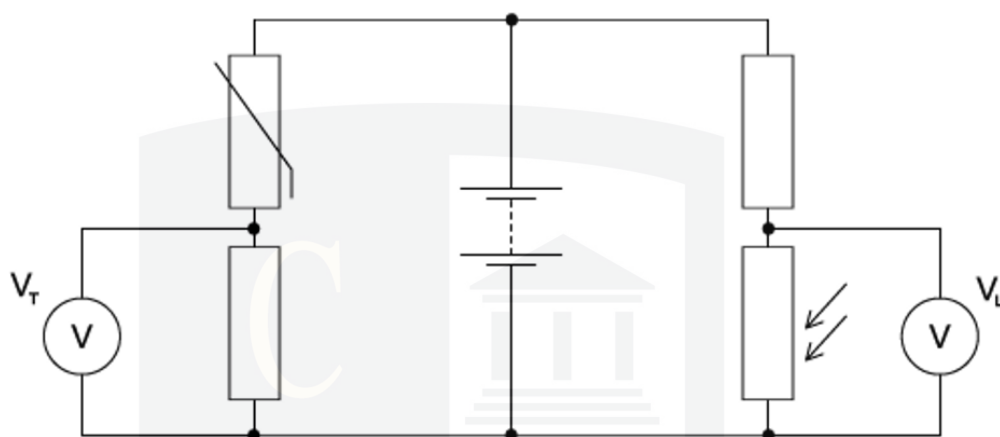
What is the resistance of the thermistor when the alarm is triggered?

- A**  $90\ \Omega$       **B**  $150\ \Omega$       **C**  $250\ \Omega$       **D**  $1300\ \Omega$

[1 mark]

### Question 9

In the circuit below, the reading  $V_T$  on the voltmeter changes from high to low as the temperature of the thermistor changes. The reading  $V_L$  on the voltmeter changes from high to low as the level of light on the light-dependent resistor (LDR) changes.



The readings  $V_T$  and  $V_L$  are both high.

What are the conditions of temperature and light level?

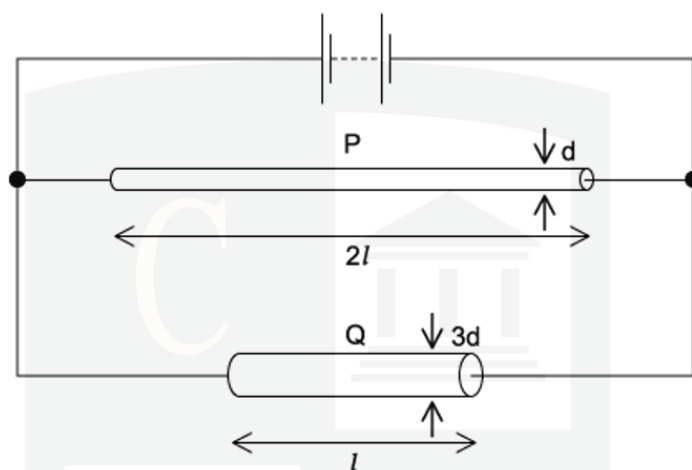
	temperature	light level
<b>A</b>	low	low
<b>B</b>	low	high
<b>C</b>	high	low
<b>D</b>	high	high

[1 mark]

### Question 10

Two wires P and Q made of the same material are connected to the same electrical supply.

P has twice the length of Q and one-third of the diameter of Q, as shown in the diagram.



What is the ratio  $\frac{\text{current in P}}{\text{current in Q}}$ ?

**A**

$$\frac{2}{3}$$

**B**

$$\frac{2}{9}$$

**C**

$$\frac{1}{6}$$

**D**

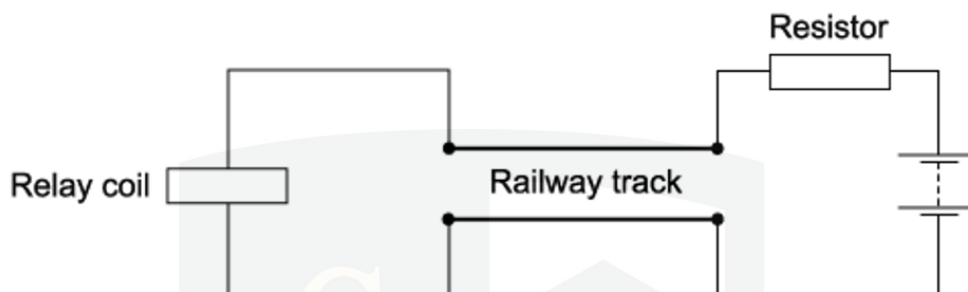
$$\frac{1}{18}$$

[1 mark]

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### Question 11

The diagram shows a length of track from a model railway connected to a battery, a resistor and a relay coil.



With no train present, there is a current in the relay coil which operates a switch to turn on a light.

When a train occupies the section of track, most of the current flows through the wheels and axles of the train in preference to the relay coil. The switch in the relay turns off the light.

Why is a resistor placed between the battery and the track?

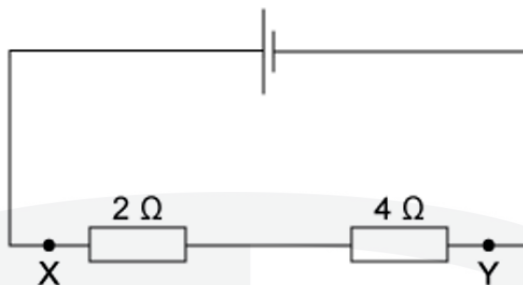
- A** to limit the heating of the wheels of the train
- B** to limit the energy lost in the relay coil when a train is present
- C** to prevent a short circuit of the battery when a train is present
- D** to protect the relay when a train is present

**[1 mark]**

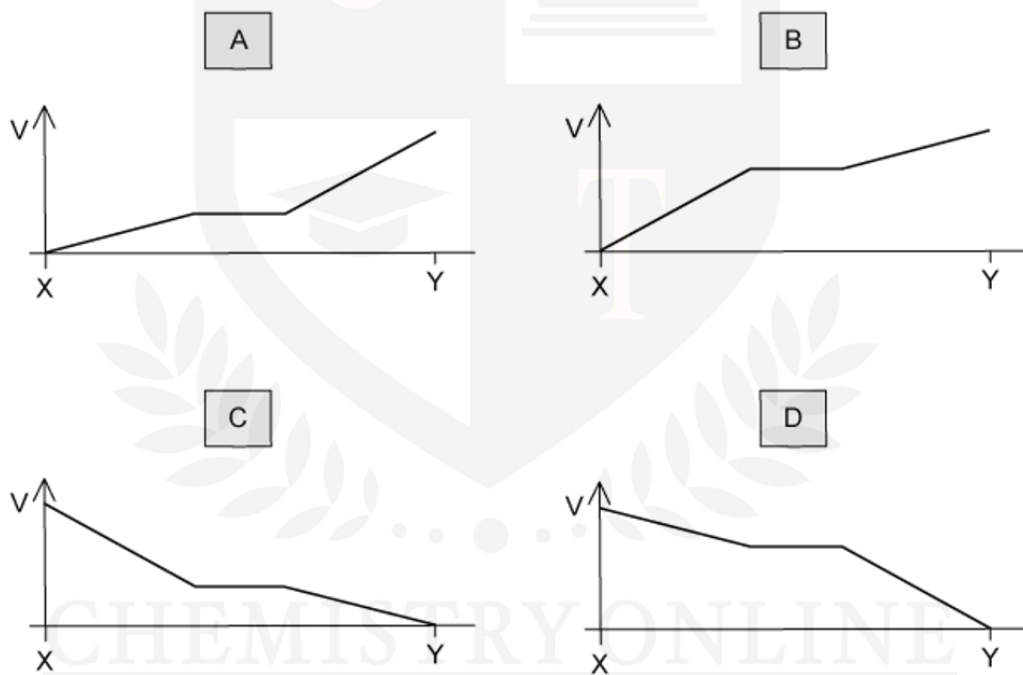


### Question 12

A  $2\ \Omega$  resistor and a  $4\ \Omega$  resistor are connected to a cell.



Which graph shows how the potential  $V$  varies with distance between X and Y?

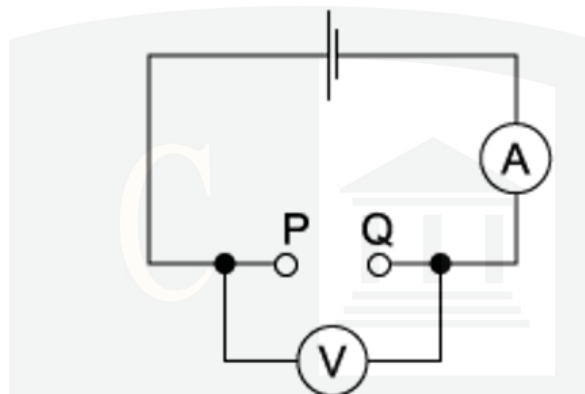


[1 mark]

### Question 13

A student found two unmarked resistors. To determine the resistance of the resistors, the circuit below was set up. The resistors were connected in turn between P and Q, noting the current readings.

The voltage readings were noted without the resistors and with each resistor in turn.



The results were entered into a spreadsheet, as shown.

1.5	1.3	28	46
1.5	1.4	14	100

The student forgot to enter the column headings.

Which order of the headings would be correct?

<b>A</b>	e.m.f / V	V / V	R / $\Omega$	I / mA
<b>B</b>	V / V	e.m.f / V	R / $\Omega$	I / mA
<b>C</b>	V / V	e.m.f / V	I / mA	R / $\Omega$
<b>D</b>	e.m.f / V	V / V	I / mA	R / $\Omega$

[1 mark]

### Question 14

Two heating coils X and Y, of resistance  $R_X$  and  $R_Y$  respectively, deliver the same power when 12 V is applied across X and 6 V is applied across Y.

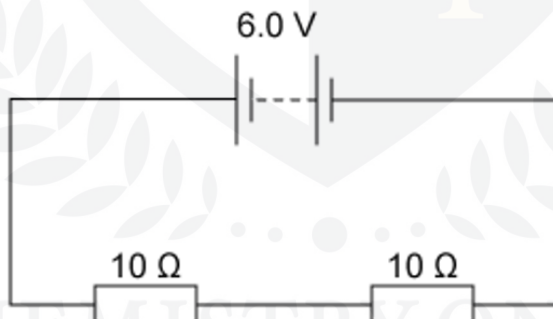
What is the ratio  $\frac{R_X}{R_Y}$  ?

- A**  $\frac{1}{4}$       **B**  $\frac{1}{2}$       **C** 2      **D** 4

[1 mark]

### Question 15

A battery of negligible internal resistance is connected to two  $10\ \Omega$  resistors in series.



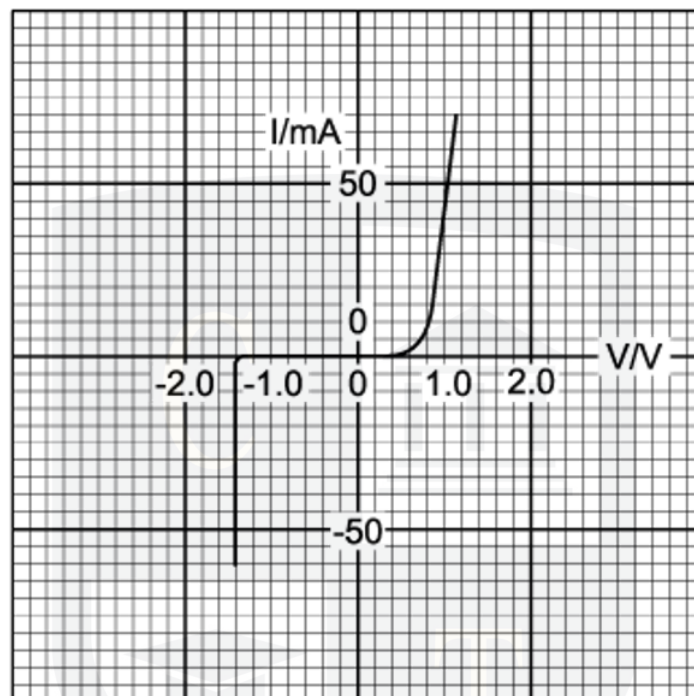
What charge flows through each of the  $10\ \Omega$  resistors in 1 minute?

- A** 0.30 C      **B** 0.60 C      **C** 3.0 C      **D** 18 C

[1 mark]

**Question 16**

The variation with potential difference  $V$  of the current  $I$  in a semiconductor diode is shown below.



What is the resistance of the diode for applied potential differences of +1.0 V and -1.0 V?

	resistance	
	at +1.0 V	at -1.0 V
<b>A</b>	20 $\Omega$	infinite
<b>B</b>	20 $\Omega$	zero
<b>C</b>	0.05 $\Omega$	infinite
<b>D</b>	0.05 $\Omega$	zero

[1 mark]

### Question 17

The resistance  $R$  of a resistor is to be determined. The current  $I$  in the resistor and the potential difference  $V$  across it are measured.

The results, with their uncertainties, are

$$I = (2.0 \pm 0.2) \text{ A}$$

$$V = (15.0 \pm 0.5) \text{ V}$$

What is the uncertainty in this value for  $R$ ?

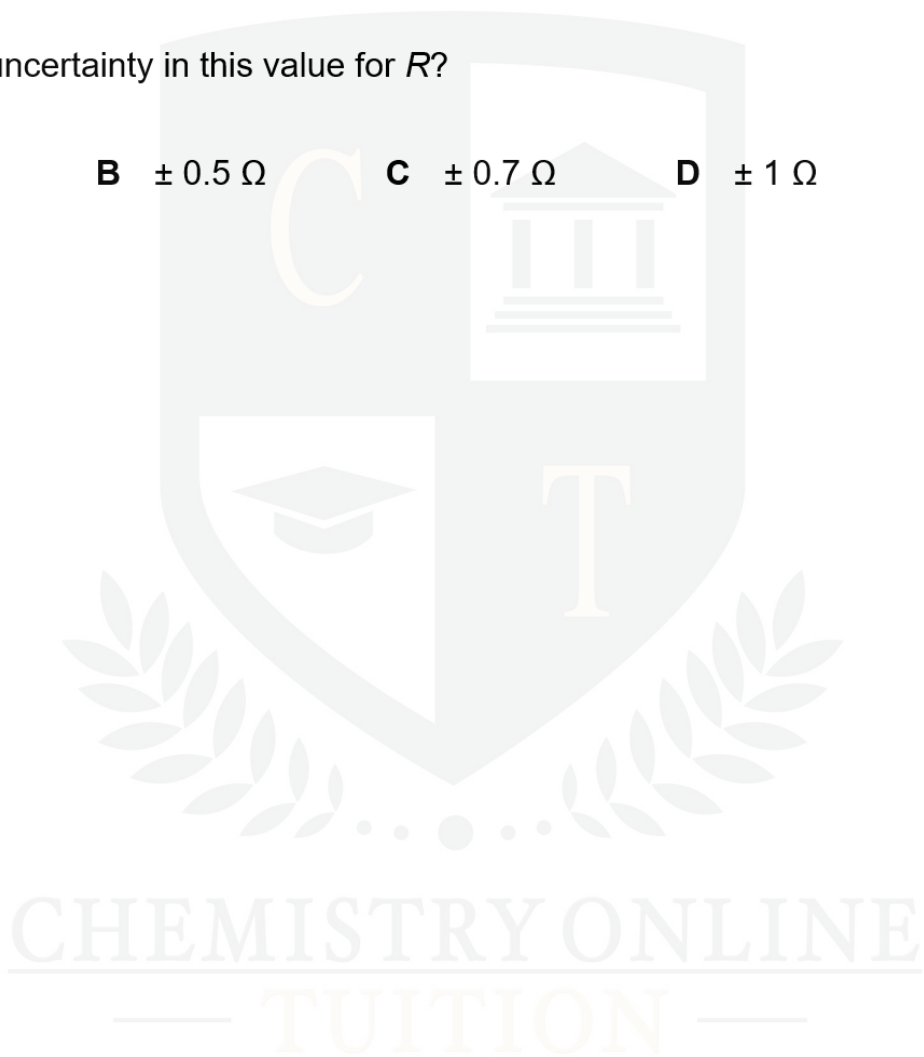
**A**  $\pm 0.3 \, \Omega$

**B**  $\pm 0.5 \, \Omega$

**C**  $\pm 0.7 \, \Omega$

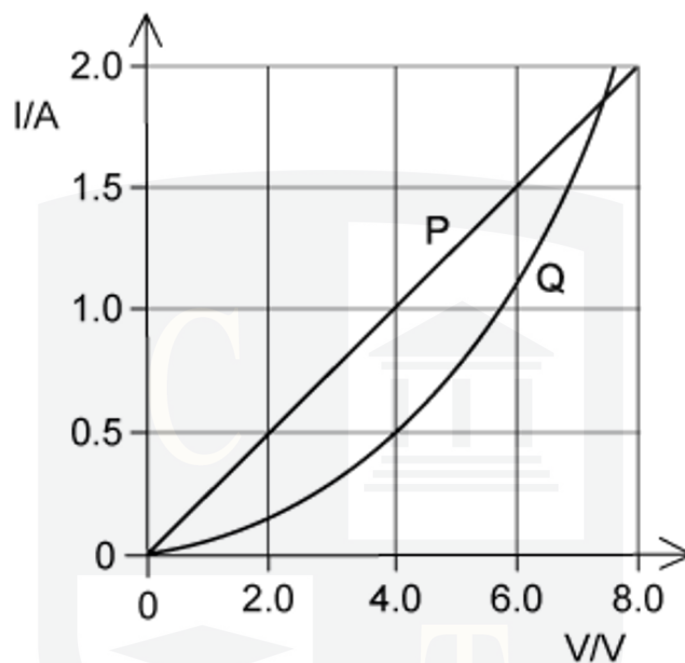
**D**  $\pm 1 \, \Omega$

[1 mark]



### Question 18

The  $I$ - $V$  characteristics of two electrical components P and Q are shown below.



Which statement is correct?

- A** P is a resistor and Q is a filament lamp
- B** the resistance of Q increases as the current in it increases
- C** for a current of 1.9 A, the resistance of Q is approximately half that of P
- D** for a current of 0.5 A, the power dissipated in Q is double that in P

[1 mark]

**Question 19**

A charge of 8.0 C passes through a resistor of resistance 30  $\Omega$  at a constant rate in a time of 20 s.

What is the potential difference across the resistor?

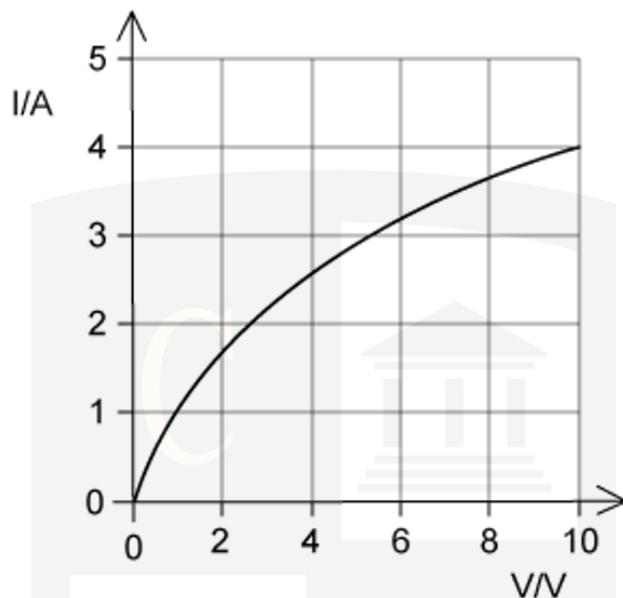
- A** 0.40 V      **B** 5.3 V      **C** 12 V      **D** 75 V

**[1 mark]**



### Question 20

The graph shows how current  $I$  varies with voltage  $V$  for a filament lamp.



Since the graph is not a straight line, the resistance of the lamp varies with  $V$ .

Which row gives the correct resistance at the stated value of  $V$ ?

	$V / V$	$R / \Omega$
<b>A</b>	2.0	1.5
<b>B</b>	4.0	3.2
<b>C</b>	6.0	1.9
<b>D</b>	8.0	0.9

[1 mark]