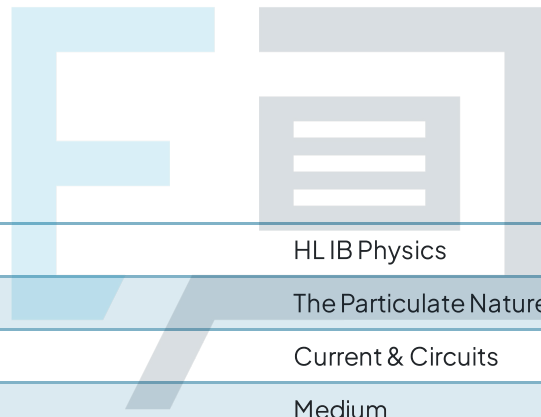




Current & Circuits

Question Paper



Course	HL IB Physics
Section	The Particulate Nature of Matter
Topic	Current & Circuits
Difficulty	Medium

Exam Papers Practice

To be used by all students preparing for HL IB Physics
Students of other boards may also find this useful

Question 1

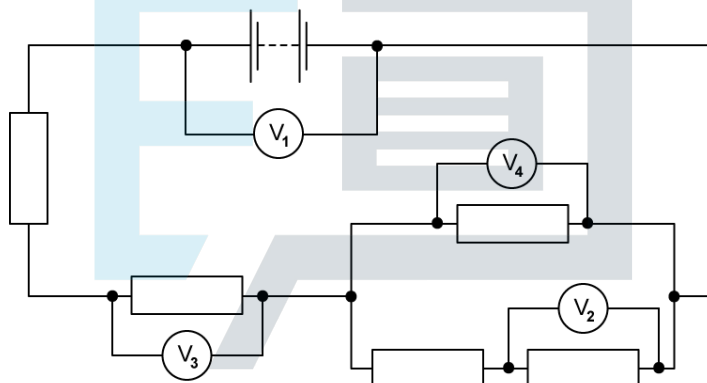
What is the definition of electric current?

- A. The ratio of potential difference across a component to the resistance of the component
- B. The rate of flow of electric charge
- C. The energy transferred per unit of charge flowing through a component
- D. The chemical energy transferred to electrical energy per unit of charge flowing in a cell

[1 mark]

Question 2

A circuit contains five identical resistors and four identical voltmeters. The reading on voltmeter V_1 is 8.0 V and the reading on voltmeter V_2 is 1.0 V. What are the readings on V_3 and V_4 ?



	reading on voltmeter V_3 / V	reading on voltmeter V_4 / V
A.	1.5	1.0
B.	3.0	2.0
C.	4.5	3.0
D.	6.0	4.0

[1 mark]

Question 3

A power cable **X** has resistance R and carries current I . A second cable **Y** has resistance $2R$ and carries current $\frac{1}{2}$.

What is the ratio $\frac{\text{power dissipated in Y}}{\text{power dissipated in X}}$?

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

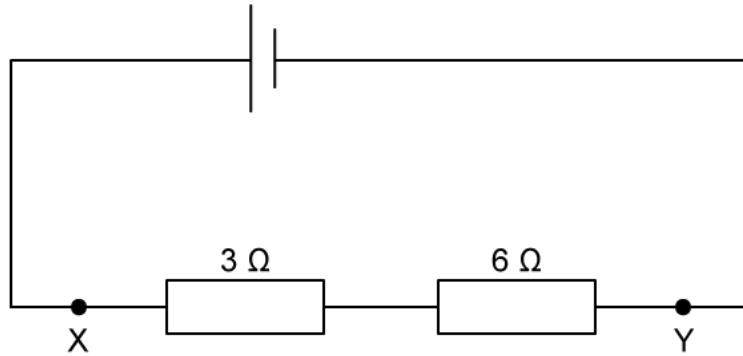
[1 mark]



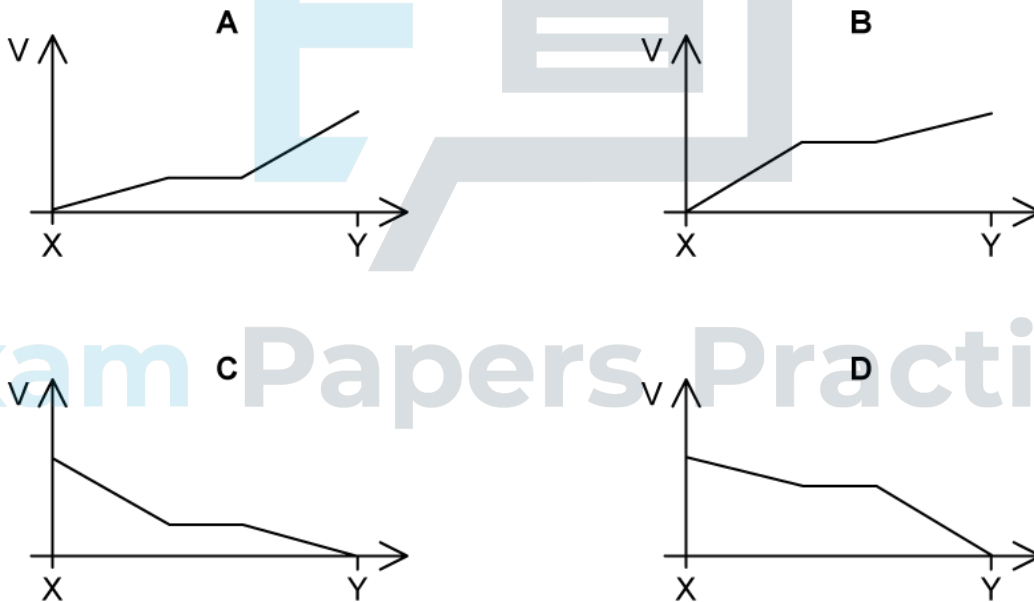
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Question 4

Two resistors are connected to a cell.



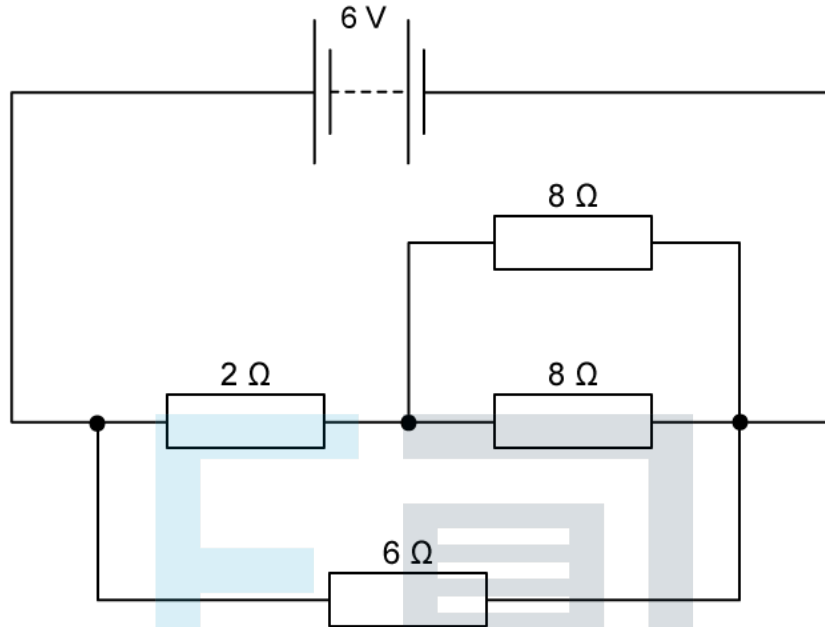
Assuming both resistors are made from wires of the same length, which graph shows how the potential V varies along the line XY ?



[1 mark]

Question 5

Four resistors are connected to a battery of e.m.f. 6 V as shown.



If the battery has negligible internal resistance, what is the current in the battery?

- A. 2 A
- B. 3 A
- C. 4 A
- D. 5 A

[1 mark]

Question 6

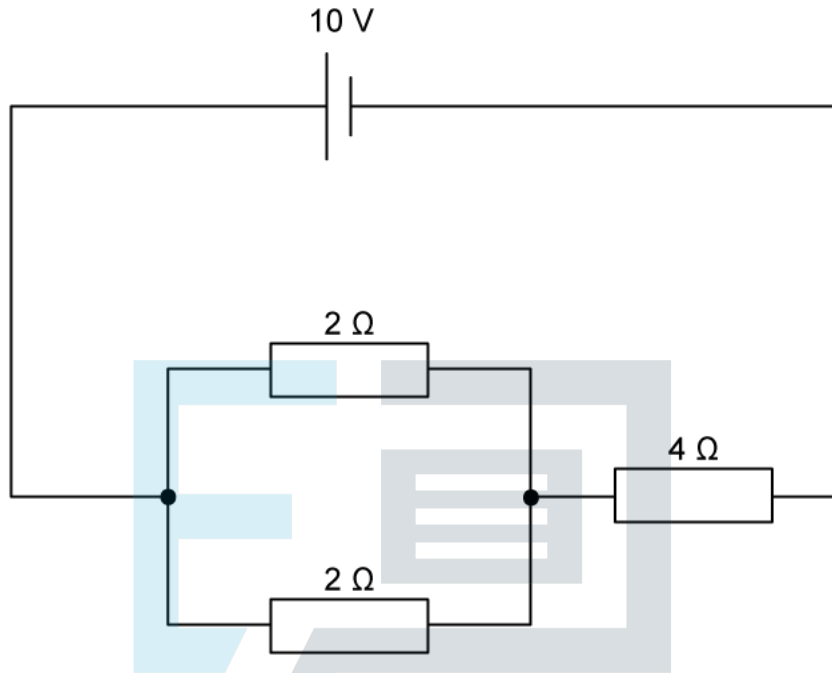
Which of the following cannot be the units for resistivity?

- A. V m A^{-1}
- B. $\text{J m s}^{-1} \text{A}^{-1}$
- C. $\text{J m s}^{-1} \text{A}^{-2}$
- D. $\Omega \text{ m}$

[1 mark]

Question 7

Three resistors are connected to a cell of e.m.f. 10 V and negligible internal resistance as shown.



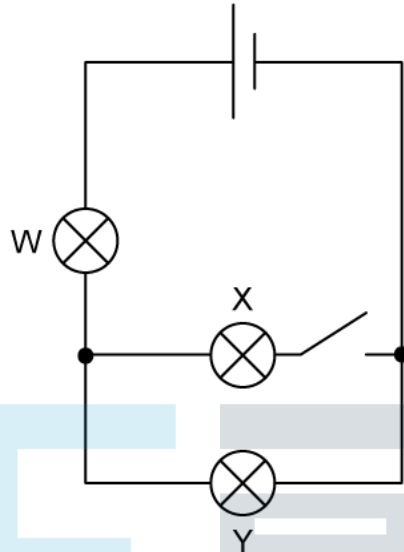
What is the power dissipated in one of the $2\ \Omega$ resistors and in the whole circuit?

	power dissipated in the $2\ \Omega$ resistor / W	power dissipated in the whole circuit / W
A	1	18
B	1	20
C	2	18
D	2	20

[1 mark]

Question 8

Three identical lamps, W, X and Y are connected to a cell of negligible internal resistance as shown.



When the switch is closed, each lamp is lit. Which of the following correctly describes the brightness of lamps W, X and Y when the switch is opened?

	lamp W	lamp X	lamp Y
A	increases	increases	decreases
B	decreases	off	decreases
C	decreases	off	increases
D	increases	decreases	decreases

[1 mark]

Question 9

A science student who lives in the UK, where the mains voltage is 240 V, buys a light bulb marked 60 W which she uses in her bedroom. The student takes the lightbulb with her on a trip to Canada where the mains voltage is 100 V and also uses it there.

Which line correctly identifies the approximate power dissipated in the bulb in the UK and Canada?

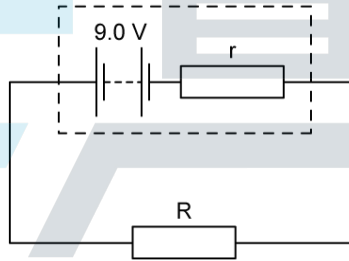
	UK / W	Canada / W
A.	30	10
B.	60	30
C.	60	10
D.	120	60

A.

[1 mark]

Question 10

A resistor R is connected to the terminals of a battery of emf 9.0 V and internal resistance r .



A charge of 240 C through the resistor in two minutes. The power dissipated in the resistor as a result is 1440 J. What is the internal resistance r of the battery?

- A. 3.0 Ω
- B. 2.0 Ω
- C. 1.5 Ω
- D. 4.5 Ω

[1 mark]

Question 11

A battery of electromotive force ϵ delivers charge Q to the load resistance. Which of the following statements is correct?

- A. The chemical work done around the circuit is ϵQ
- B. The electrical work done between the terminals of the battery is ϵQ
- C. The load resistance is ϵQ
- D. The electrical work done in the battery and the across the load resistance is ϵQ

[1 mark]

Question 12

The potential difference across the terminals of a battery is 5.0 V when the current is 1.0 A and 4.0 V when the current is 1.5 A. What is the emf of the battery and its internal resistance?

	emf (V)	internal resistance (Ω)
A.	7.0	2.0
B.	7.0	0.5
C.	3.0	2.0
D.	3.0	0.5

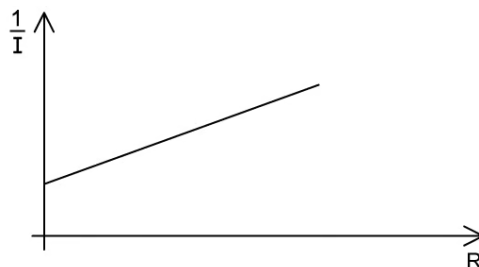
[1 mark]

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Question 13

An electrical circuit is designed to measure the current I through a variable resistor R . The cell used in the circuit has an emf ϵ and an internal resistance r .

A graph shows the variation of $\frac{1}{I}$ with R .



What is the magnitude of the gradient?

- A. $\frac{1}{\epsilon}$
- B. $\frac{1}{R}$
- C. $\frac{1}{r}$
- D. r



[1 mark]

Question 14

Which statement about terminal potential difference V and e.m.f. ϵ is incorrect?

- A. For non-ideal batteries, terminal potential difference is always measured to be less than the e.m.f.
- B. $V = \epsilon$ only when current in the cell is zero
- C. For ideal batteries, the terminal potential difference is always measured to be less than the e.m.f.
- D. The terminal potential difference of non-ideal batteries decreases over time

[1 mark]

Question 15

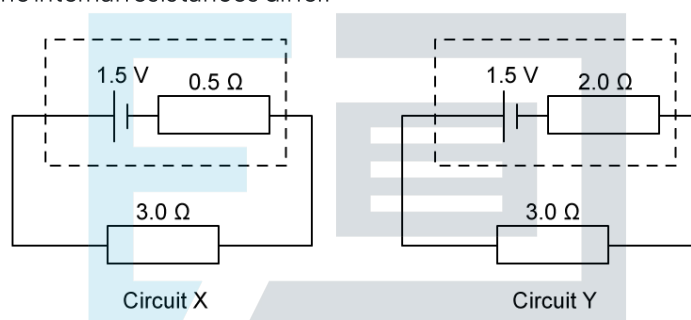
Which of the following units for internal resistance is incorrect?

- A. VA^{-1}
- B. $\text{Js}^{-1}\text{A}^{-2}$
- C. $\text{kgm}^2\text{A}^{-2}\text{s}^{-2}$
- D. $\text{kgm}^2\text{A}^{-2}\text{s}^{-3}$

[1 mark]

Question 16

In the two circuits shown, only the internal resistances differ.



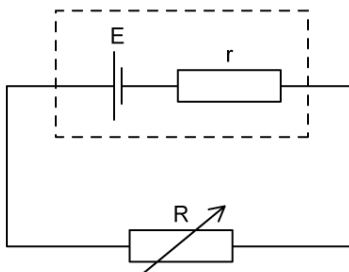
Which row in the table below correctly describes the potential difference across and power dissipated by the 3Ω resistor?

	potential difference across the 3Ω resistor (V)	power dissipated in the 3Ω resistor (W)
A.	Greater in X than in Y	Lesser in X than in Y
B.	Greater in X than in Y	Greater in X than in Y
C.	Lesser in X than in Y	Lesser in X than in Y
D.	Lesser in X than in Y	Greater in X than in Y

[1 mark]

Question 17

A cell of internal resistance r is connected to a variable resistor R .



Which of the following statements about the circuit is/are correct?

- (1) If the resistance of R decreases, the terminal potential difference of the cell also decreases, but the power dissipated in the cell is large
- (2) If the resistance of R is made very large, the current in the circuit is very small but most of the power supplied by the cell is dissipated by R
- (3) If the resistance of R is made very small, then the lifetime of the cell reduces

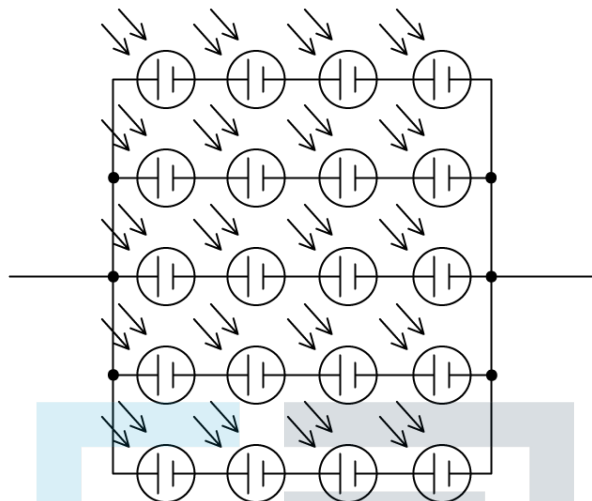
- A. Statement (1) only
- B. Statement (2) only
- C. Statements (1) and (3) only
- D. Statements (1), (2) and (3)

[1 mark]

Exam Papers Practice

Question 18

An array of photovoltaic cells is set up so that 20 solar cells are connected together as shown. Each cell has an output of 12 V and 2.5 A.



What is the potential difference and the current output of the array?

	Potential difference / V	Current / A
A.	48	10.0
B.	48	12.5
C.	60	10.0
D.	60	12.5

[1 mark]