

# Circuits & The Potential Divider

## TOPIC QUESTIONS

<b>Level</b>	<b>A Level</b>
<b>Subject</b>	<b>Physics</b>
<b>Exam Board</b>	<b>AQA</b>
<b>Paper Type</b>	<b>Multiple Choice</b>

Time Allowed : 30min

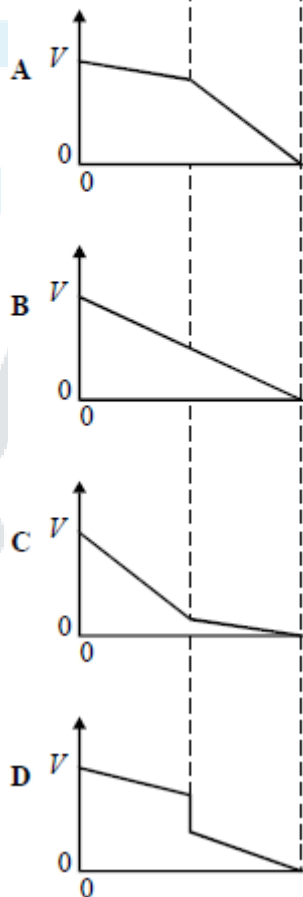
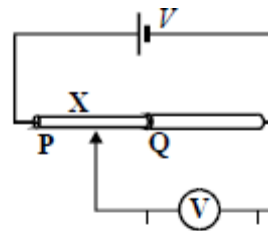
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1. Copper metal is a good conductor of electricity because copper atoms in copper metal
- A have gained an extra or “free” electron
  - B are ionised so that both ions and “free” electrons can move
  - C have a negative charge because of the “free” electrons
  - D have lost an electron to form positive ions and “free” electrons

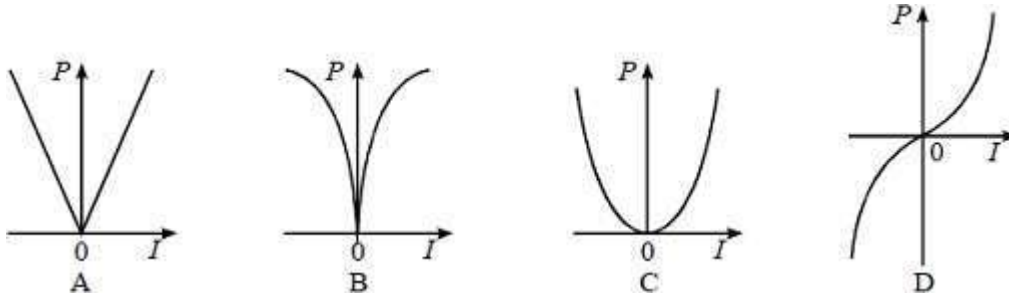


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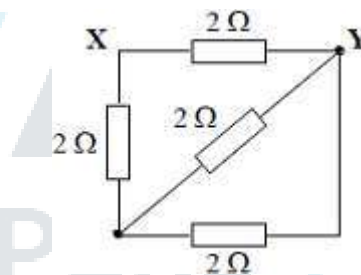
2. The diagram shows two wires, **P** and **Q**, of equal length, joined in series with a cell. A voltmeter is connected between the end of **Q** and a point **X** on the wires. The p.d. across the cell is  $V$ . Wire **Q** has twice the area of cross-section and twice the resistivity of wire **P**. The variation of the voltmeter reading as the point **X** is moved along the wires is best shown by



3. A metal wire is maintained at a constant temperature. Which one of the following graphs best represents the relationship between the dissipated power  $P$  and the current  $I$  in the wire?



4. The diagram shows a network of four  $2\ \Omega$  resistors.



The effective resistance, in  $\Omega$ , between X and Y is

- A 0.5
- B 1.2
- C 1.7
- D 2.0

5. Two resistors  $R_1$  and  $R_2$  are made of wires of the same material. The wire used for  $R_1$  has half the diameter and is twice as long as the wire used for  $R_2$ .

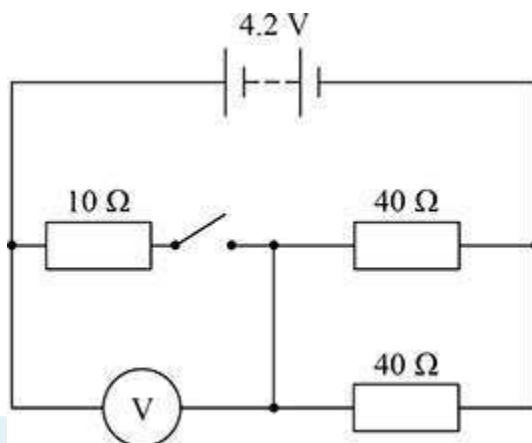
$$\frac{\text{resistance of } R_1}{\text{resistance of } R_2} ?$$

What is the value of the ratio

- A 8
  - B 4
  - C 1
  - D 0.5
6. Superconductors are used to
- A increase the strength of electricity cables.
  - B make light dependent resistors.
  - C produce strong magnetic fields.
  - D increase the rate of heat energy transfer.

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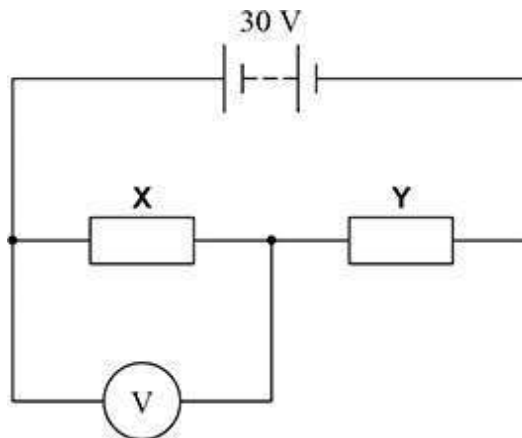
7. The battery in this circuit has an emf of 4.2 V and negligible internal resistance.



What are the readings on the voltmeter when the switch is open (off) and when the switch is closed (on)?

	Open	Closed	
<b>A</b>	0 V	2.1 V	<input type="radio"/>
<b>B</b>	4.2 V	2.1 V	<input type="radio"/>
<b>C</b>	0 V	1.4 V	
<b>D</b>	4.2 V	1.4 V	

8. Two resistors **X** and **Y** are connected in series with a power supply of emf 30 V and negligible internal resistance.



The resistors are made from wire of the same material. The wires have the same length. **X** uses wire of diameter  $d$  and **Y** uses wire of diameter  $2d$ .

What is the reading on the voltmeter?

A 10 V

B 15 V

C 20 V

D 24 V

9. The table shows corresponding values of potential difference  $V$  and current  $I$  for four electrical components **A**, **B**, **C** and **D**.

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
$V/V$	$I/A$	$I/A$	$I/A$	$I/A$
0	0.0	0.0	0.0	0.0
2	0.0	0.3	0.4	0.3
4	0.1	0.6	0.8	0.6
6	0.7	0.9	1.2	0.9
8	1.4	1.2	1.6	1.1
10	2.1	1.5	2.0	1.3
12	2.8	1.8	2.4	1.4

Which component is an ohmic conductor with the greatest resistance?

A

B

C

D



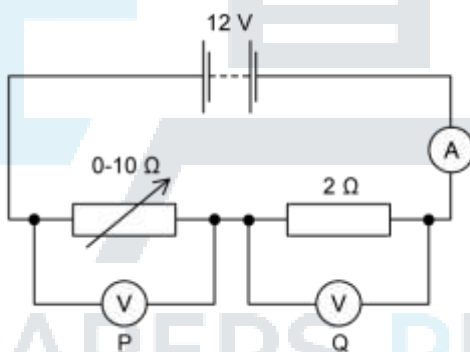
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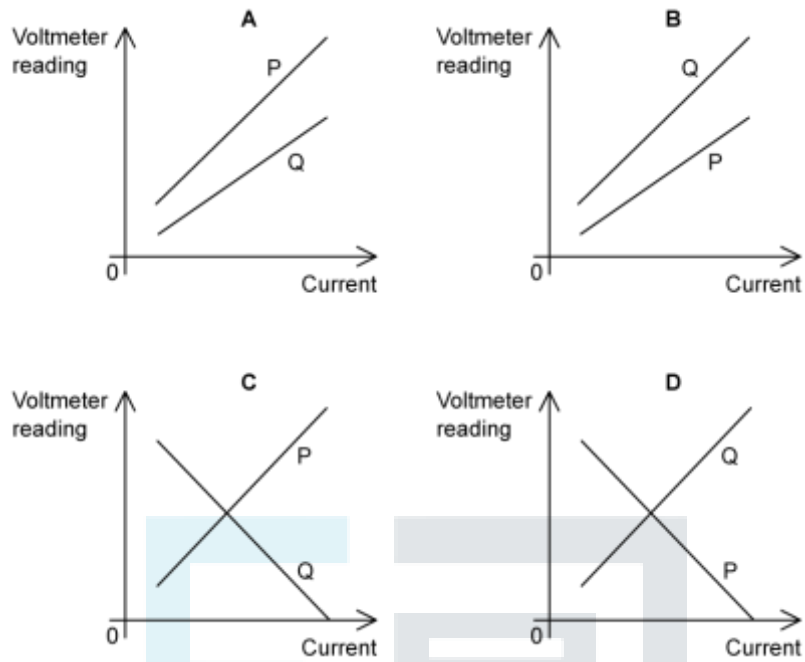
10. Which row shows the resistances of an ideal ammeter and an ideal voltmeter?

	Ideal ammeter	Ideal voltmeter
<b>A</b>	infinite	infinite
<b>B</b>	infinite	zero
<b>C</b>	zero	infinite
<b>D</b>	zero	zero

11. A 12 V battery is in series with an ammeter, a  $2\ \Omega$  fixed resistor and a  $0 - 10\ \Omega$  variable resistor. High-resistance voltmeters P and Q are connected across the variable resistor and the fixed resistor, respectively, as shown.

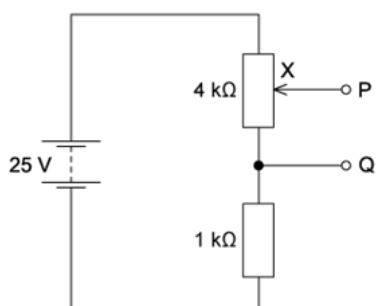


The resistance of the variable resistor is changed from its maximum value to zero. Which graph shows the variation with current of the voltmeter readings?



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12. The diagram shows a potential divider circuit which, by adjustment of the contact X, can be used to provide a variable potential difference between the terminals P and Q.



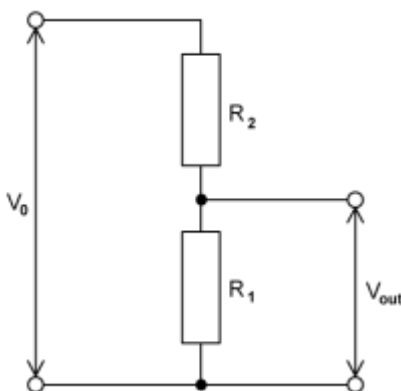
What range of potential difference is provided between P and Q?

- A. 5 V
- B. 10 V
- C. 20 V
- D. 25 V



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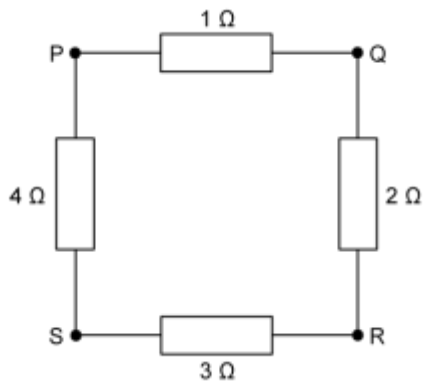
13. A potential divider consists of resistors of resistance  $R_1$  and  $R_2$  connected in series across a source of potential difference  $V_0$ . The potential difference across  $R_1$  is  $V_{out}$ .



Which changes to  $R_1$  and  $R_2$  will increase the value of  $V_{out}$ ?

	$R_1$	$R_2$
<b>A</b>	doubled	doubled
<b>B</b>	doubled	halved
<b>C</b>	halved	doubled
<b>D</b>	halved	halved

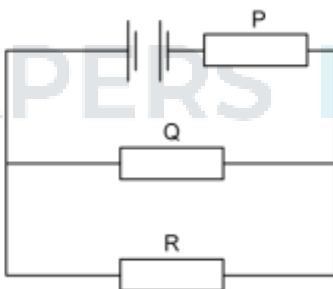
14. A network of resistors is set up as shown:



Between which two points does the **minimum** of resistance of the combination occur?

- A. P and Q
- B. R and S
- C. Q and S
- D. S and P

15. Three identical resistors P, Q and R are connected in a circuit as shown:

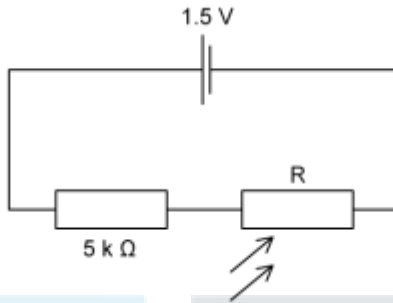


The battery, of negligible internal resistance, supplies a total power of 15

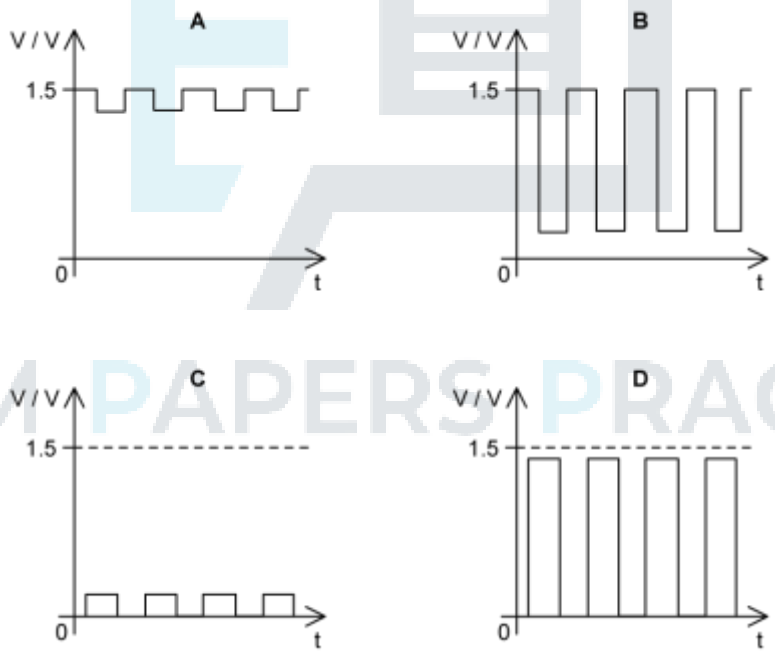
W. What is the power dissipated in resistor R?

- A. 2.5 W
- B. 5.0 W
- C. 7.5 W
- D. 8.0 W

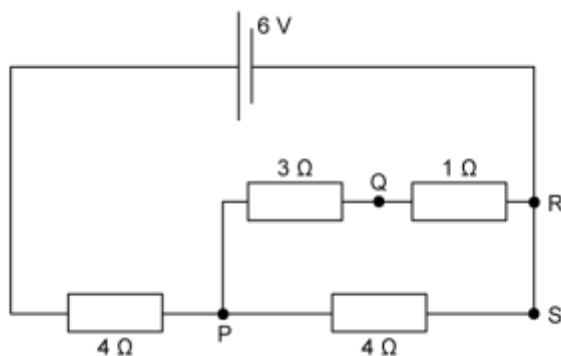
16. A light-dependent resistor  $R$  has a resistance of about  $1\text{ M}\Omega$  in the dark and about  $1\text{ k}\Omega$  when illuminated. It is connected in series with a  $5\text{ k}\Omega$  resistor to a  $1.5\text{ V}$  cell of negligible internal resistance.



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  $R$ ?



17. A circuit is connected as shown in the diagram below:



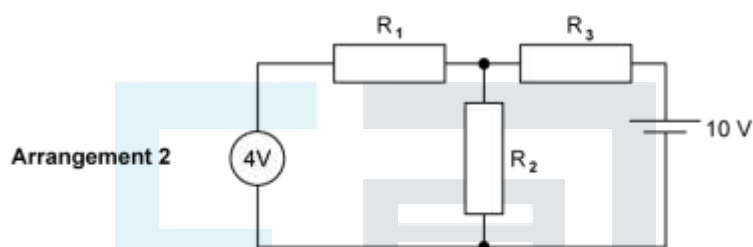
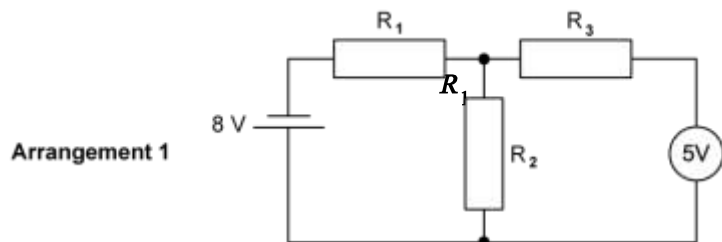
What reading would a voltmeter measure if it was connected between P and Q? A. 0.50 V

- B. 0.75 V
- C. 1.0 V
- D. 1.5 V



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18. Three resistors are arranged in a circuit such that two measurements of input and output voltage are recorded, by swapping the arrangement of the cell and the voltmeter (which is assumed ideal), as shown:



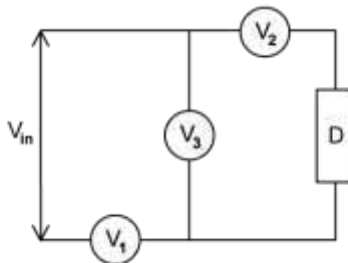
The current supplied by the cell in arrangement 1 is 0.50

A. Which row, A to D, gives the correct values of the resistances  $R_1$ ,  $R_2$  and  $R_3$ ?

	$R_1$	$R_2$	$R_3$
A	10 $\Omega$	10 $\Omega$	15 $\Omega$
B	6 $\Omega$	15 $\Omega$	10 $\Omega$
C	6 $\Omega$	10 $\Omega$	15 $\Omega$
D	15 $\Omega$	6 $\Omega$	10 $\Omega$



19. Three identical, non-ideal voltmeters are connected as shown.



Each voltmeter has a finite resistance  $R$  which allows a small current to flow through them when connected to a source of emf,  $V_{in}$ .

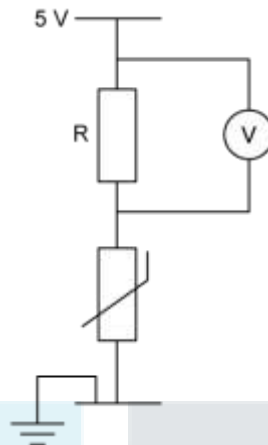
The  $I$ - $V$  characteristic of the device  $D$  is unknown.

If  $V_2 = 2\text{ V}$  and  $V_3 = 3\text{ V}$ , what is the reading of  $V_1$ ?

- A. 1 V
- B. 2 V
- C. 4.5 V
- D. 5 V



20. A student wishes to design a circuit which is sensitive to temperature changes in a room. They intend to connect a thermistor to a fixed resistor and a voltmeter, all across an input of 5 V, as shown:



Data about the resistance-temperature characteristics of the thermistor is shown below:

Temperature / °C	Resistance $\Omega$
5.0	420
10	290
15	200
20	150
25	120

Which resistor, A to D, results in a circuit that is **most sensitive** to changes in room temperature?

- A. 50 k $\Omega$
- B. 5 k $\Omega$
- C. 500  $\Omega$
- D. 50  $\Omega$