1 The units of physical quantities can be expressed in terms of the fundamental (base) units of the SI system. In which line in the table are the fundamental units correctly matched to the physical quantity?

	Physical quantity	Fundamental units	
A	charge	$A\ s^{-1}$	⬭
B	power	$kg\ m^2\ s^{-3}$	⬭
C	potential difference	$kg\ m^2\ s\ A^{-1}$	⬭
D	energy	$kg\ m^2\ s^{-1}$	⬭

(Total 1 mark)

2 When the temperature of a copper wire increases, its ability to conduct electricity

A remains the same. ⬭

B increases. ⬭

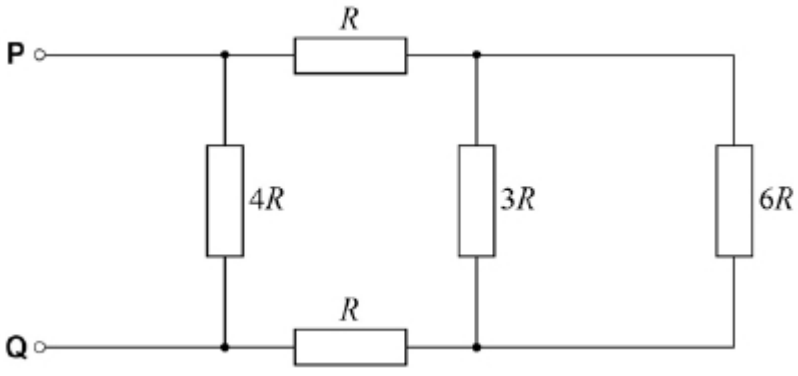
C decreases. ⬭

D remains the same at first and then increases. ⬭

(Total 1 mark)

3 The diagram shows a network of resistors connected between the terminals **P** and **Q**.

The resistance of each resistor is shown.



What is the effective resistance between **P** and **Q**?

A R ⬭

B $2R$ ⬭

C $3R$ ⬭

D $4R$ ⬭

(Total 1 mark)

4 A metal wire has a length l and a cross-sectional area A. When a potential difference V is applied to the wire, there is a current I in the wire.

What is the resistivity of the wire?

A $\frac{IA}{Vl}$ ⬭

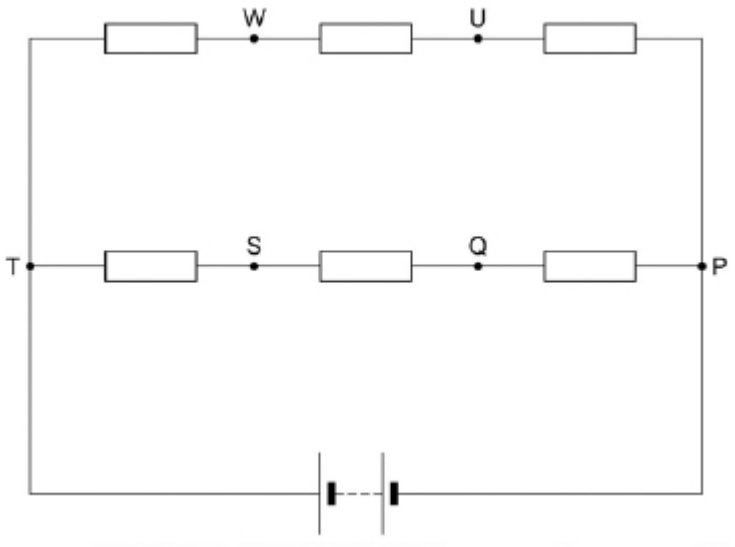
B $\frac{VA}{Il}$ ⬭

C $\frac{Il}{VA}$ ⬭

D $\frac{Vl}{IA}$ ⬭

(Total 1 mark)

5 In the circuit shown below, each of the resistors has the same resistance.



A voltmeter with very high resistance is connected between two points in the circuit.

Between which two points of connection would the voltmeter read zero?

A Q and U ⬭

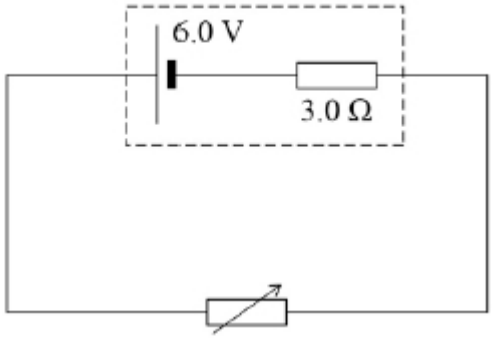
B P and T ⬭

C Q and W ⬭

D S and U ⬭

(Total 1 mark)

6 The cell in the following circuit has an emf (electromotive force) of 6.0 V and an internal resistance of 3.0 Ω. The resistance of the variable resistor is set to 12 Ω.



How much electrical energy is converted into thermal energy **within the cell** in 1 minute?

A 0.48 J ⬭

B 29 J ⬭

C 45 J ⬭

D 144 J ⬭

(Total 1 mark)

7 Three identical cells, each of internal resistance R, are connected in series with an external resistor of resistance R. The current in the external resistor is I. If one of the cells is reversed in the circuit, what is the new current in the external resistor?

A $\frac{I}{3}$ ⬭

B $\frac{4I}{9}$ ⬭

C $\frac{I}{2}$ ⬭

D $\frac{2I}{3}$ ⬭

(Total 1 mark)

8 In a cathode ray tube 7.5×10^{15} electrons strike the screen in 40 s. What current does this represent?

Charge of the electron is 1.6×10^{-19} C.

A 1.3×10^{-16} A ⬭

B 5.3×10^{-15} A ⬭

C 3.0×10^{-5} A ⬭

D 1.2×10^{-3} A ⬭

(Total 1 mark)

9 A cylindrical conductor of length l, diameter D, and resistivity ρ has a resistance R.

What is the resistance of another cylindrical conductor of length l, diameter $\frac{D}{2}$, and resistivity ρ?

A $8R$ ⬭

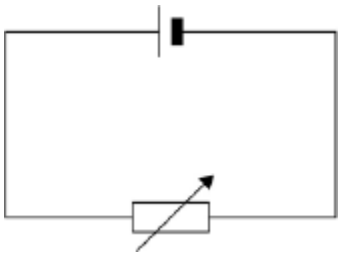
B $4R$ ⬭

C $2R$ ⬭

D R ⬭

(Total 1 mark)

10 The cell in the circuit has an emf of 2.0 V. When the variable resistor has a resistance of 4.0 Ω, the potential difference (pd) across the terminals of the cell is 1.0 V.



What is the pd across the terminals of the cell when the resistance of the variable resistor is 12 Ω?

A 0.25 V ⬭

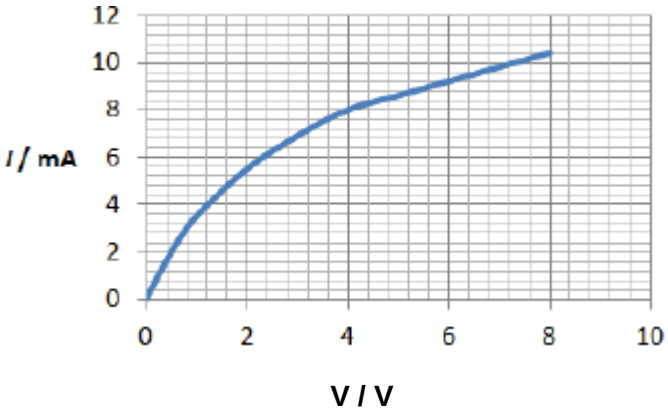
B 0.75 V ⬭

C 1.33 V ⬭

D 1.50 V ⬭

(Total 1 mark)

11 The graph shows the current–voltage (*I*–*V*) characteristics of a filament lamp.



What is the resistance of the filament when the potential difference (pd) across it is 4.0 V?

A 500 Ω ⬭

B 1700 Ω ⬭

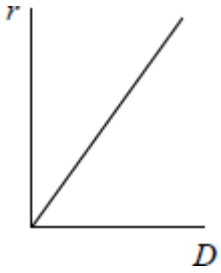
C 2000 Ω ⬭

D 6000 Ω ⬭

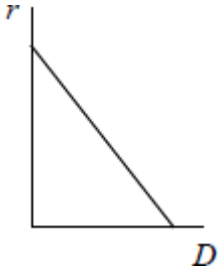
(Total 1 mark)

12 Which graph shows how the resistance per unit length *r* of a wire varies with diameter *D* of the wire?

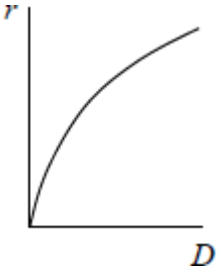
A



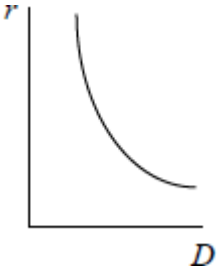
B



C



D



A ☐

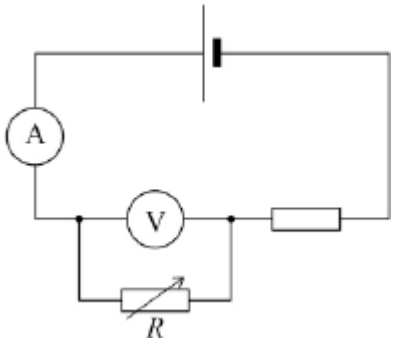
B ☐

C ☐

D ☐

(Total 1 mark)

13 In the circuit shown in the diagram the cell has negligible internal resistance.



What happens to the reading of both meters when the resistance of R is decreased?

	Reading of ammeter	Reading of voltmeter	
A	increases	increases	☐
B	increases	decreases	☐
C	decreases	increases	☐
D	unchanged	decreases	☐

(Total 1 mark)

14 The current in a wire is 20 mA.

How many electrons pass a point in the wire in 2 minutes?

A 2.5×10^{17} ⬭

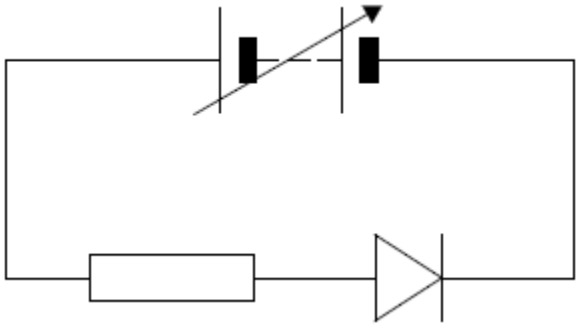
B 1.5×10^{19} ⬭

C 2.5×10^{20} ⬭

D 1.5×10^{22} ⬭

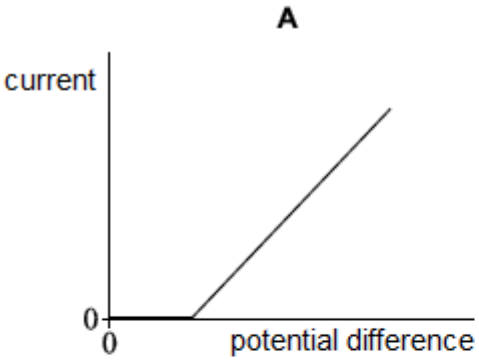
(Total 1 mark)

15 A resistor and diode are connected in series with a variable power supply as shown in the diagram.

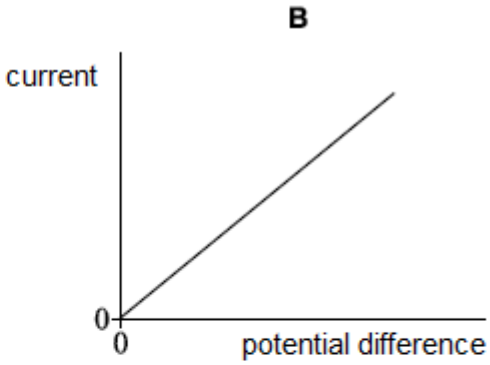


Which best shows the characteristic for the combination of the resistor and diode?

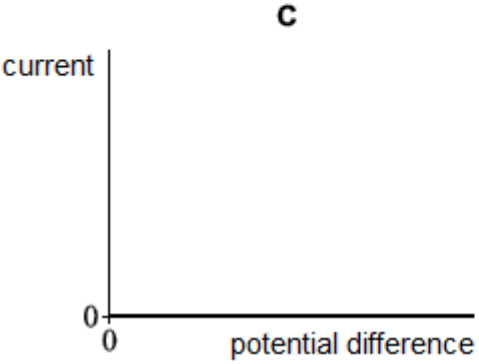
A



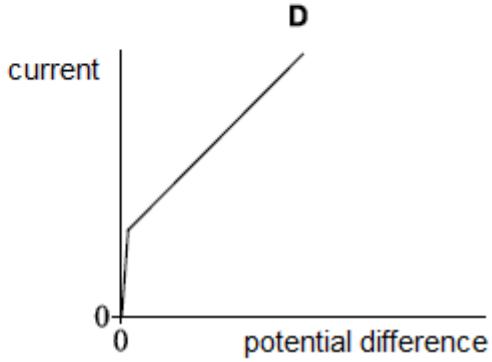
B



C



D



A ⬭

B ⬭

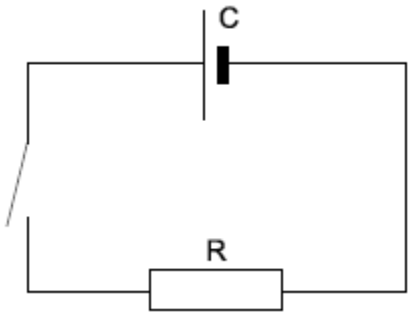
C ⬭

D ⬭

(Total 1 mark)

16 A cell C of negligible resistance and a switch are in series with a resistor R. The switch is moved to the on (closed) position for a time *t*.

Which change reduces the amount of charge flowing through R in time *t*?



A add an identical cell in parallel with C ⬭

B add an identical cell in series with C ⬭

C add a second resistor in series with R ⬭

D add a second resistor in parallel with R ⬭

(Total 1 mark)

17 The National Grid uses high-voltage transmission lines to carry electrical power around the UK. A particular transmission line delivers 800 MW of power at 132 kV to the user. It loses 1% of the transmitted power as heat.

What is the resistance of the transmission line?

A 0.2 Ω ⬭

B 6 Ω ⬭

C 20 Ω ⬭

D 2000 Ω ⬭

(Total 1 mark)

18 A potential divider circuit consists of a battery connected across a thermistor and variable resistor in series.

Which of the following causes the potential difference (pd) across the thermistor to increase?

A increasing the temperature of the thermistor ⬭

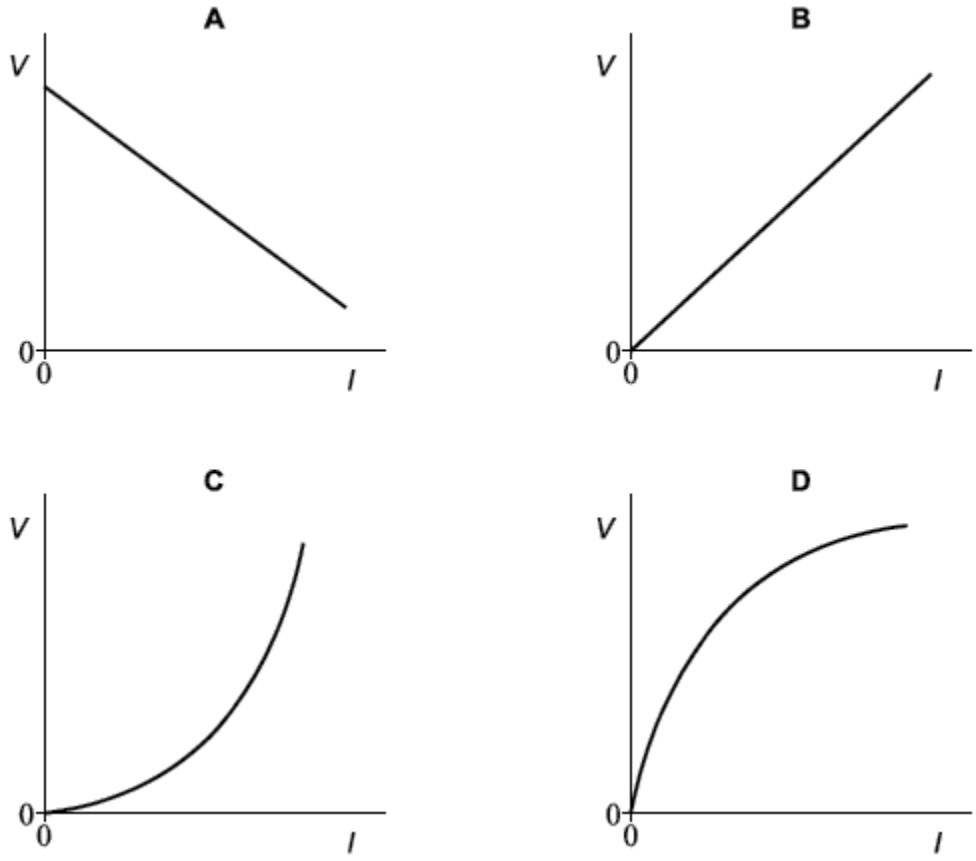
B increasing the resistance of the variable resistor ⬭

C reducing the emf of the battery ⬭

D adding a resistor across the variable resistor ⬭

(Total 1 mark)

19 A student investigates how the potential difference *V* across the terminals of a cell varies with the current *I* in the cell.



Which graph correctly shows how *V* varies with *I*?

A ⬭

B ⬭

C ⬭

D ⬭

(Total 1 mark)

20 A battery is connected to a 10 Ω resistor and a switch in series. A voltmeter is connected across the battery. When the switch is open (off) the voltmeter reads 1.45 V. When the switch is closed the reading is 1.26 V.

What is the internal resistance of the battery?

A 0.66 Ω ⬭

B 0.76 Ω ⬭

C 1.3 Ω ⬭

D 1.5 Ω ⬭

(Total 1 mark)

21 The resistance of a metallic conductor increases with temperature because, at higher temperatures,

A more electrons become available for conduction

B the conductor becomes a superconductor

C the amplitude of vibration of lattice ions increases

D the length and cross-sectional area of the conductor both increase

(Total 1 mark)

22 A 1.5 m length of wire has a cross-sectional area 5.0×10^{-8} m ^{2}. When the potential difference across its ends is 0.20 V, it carries a current of 0.40 A. The resistivity of the material from which the wire is made is

A 6.0×10^{7} Ω m

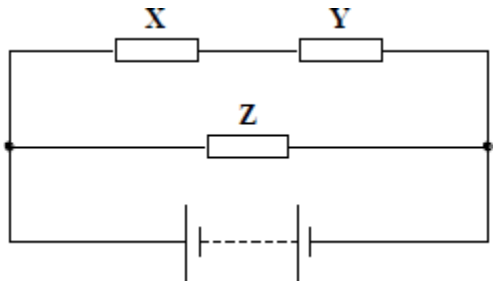
B 1.7×10^{-8} Ω m

C 1.1×10^{6} Ω m

D 9.4×10^{-7} Ω m

(Total 1 mark)

23 Three identical resistors **X**, **Y** and **Z** are connected across a battery as shown.



The ratio $\frac{\text{power developed in } \mathbf{X}}{\text{power developed in } \mathbf{Z}}$ is

A $\frac{1}{4}$

B $\frac{1}{2}$

C 1

D 2

(Total 1 mark)

24 Copper metal is a good conductor of electricity because copper atoms in copper metal

A have gained an extra or “free” electron

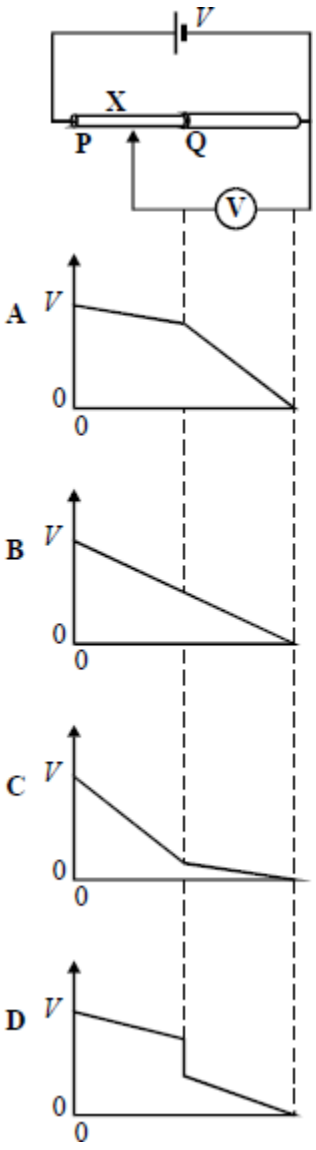
B are ionised so that both ions and “free” electrons can move

C have a negative charge because of the “free” electrons

D have lost an electron to form positive ions and “free” electrons

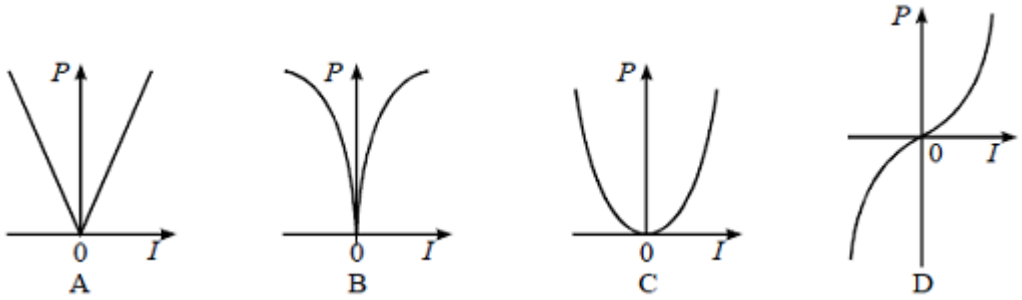
(Total 1 mark)

25 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



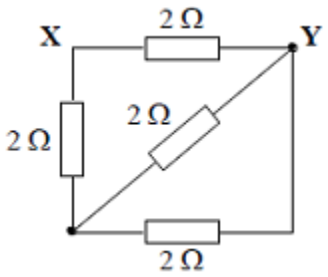
(Total 1 mark)

26 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?



(Total 1 mark)

27 The diagram shows a network of four 2 Ω resistors.



The effective resistance, in Ω, between **X** and **Y** is

A 0.5

B 1.2

C 1.7

D 2.0

(Total 1 mark)

28 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.

What is the value of the ratio $\frac{\text{resistance of } R_1}{\text{resistance of } R_2}$?

A 8

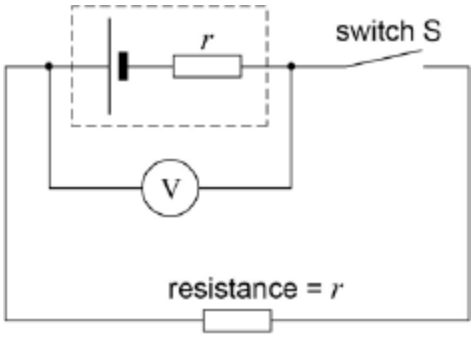
B 4

C 1

D 0.5

(Total 1 mark)

29 In the circuit shown, V is a voltmeter with a very high resistance. The internal resistance of the cell, r, is equal to the external resistance in the circuit.



external resistance

Which of the following is not equal to the emf of the cell?

A the reading of the voltmeter when the Switch S is open ⬭

B the chemical energy changed to electrical energy when unit charge passes through the cell ⬭

C twice the reading of the voltmeter when the switch S is closed ⬭

D the electrical energy produced when unit current passes through the cell ⬭

(Total 1 mark)

30 An electric motor of input power 100 W raises a mass of 10 kg vertically at a steady speed of 0.5 m s^{-1}. What is the efficiency of the system?

A 5% ⬭

B 12% ⬭

C 50% ⬭

D 100% ⬭

(Total 1 mark)