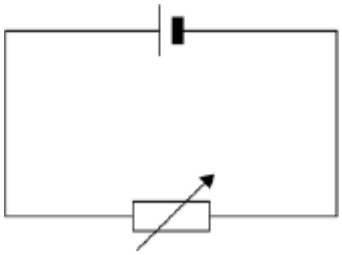
Resistance and Resistivity

TOPIC QUESTIONS

Level	A Level
Subject	Physics
Exam Board	AQA
Paper Type	Multiple Choice

Time Allowed : 30min

1. The cell in the circuit has an emf of 2.0 V. When the variable resistor has a resistance of 4.0 Ω, thepotential 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?

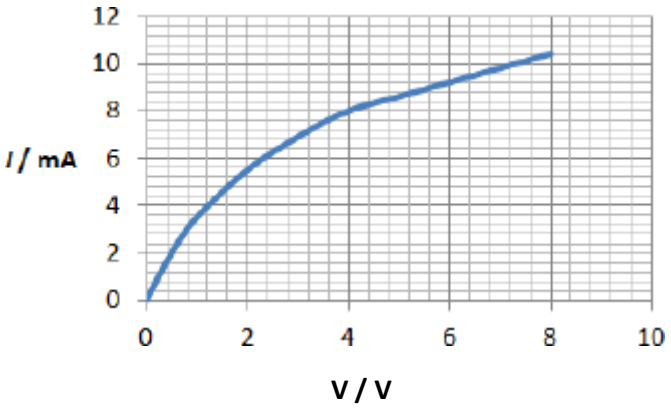
A 0.25 V

B 0.75 V

C 1.33 V

D 1.50 V

2. 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?

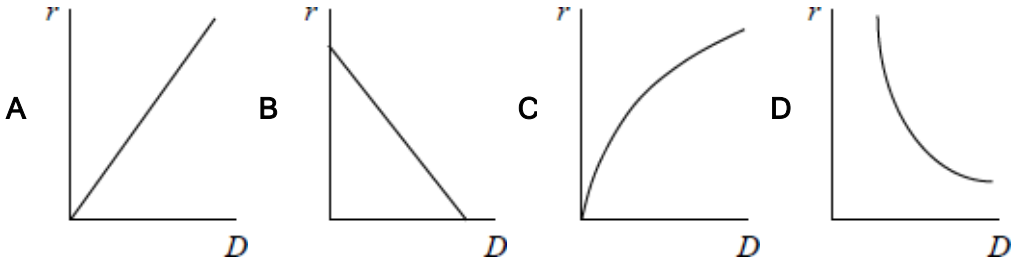
A 500 Ω

B 1700 Ω

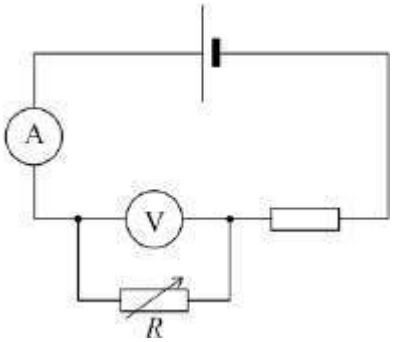
C 2000 Ω

D 6000 Ω

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



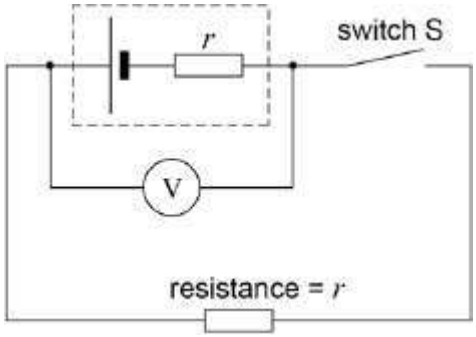
4. In the circuit shown in the diagram the cell has negligible internal resistance.



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

5. 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 resistanceWhich

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

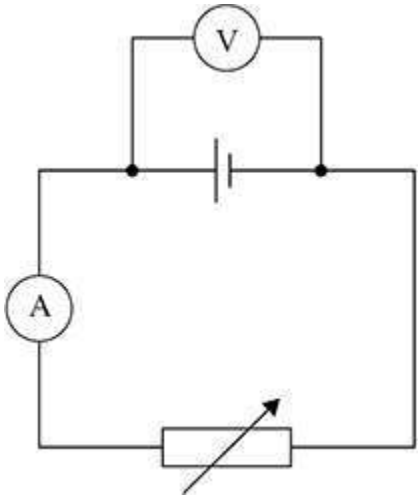
A the reading of the voltmeter when the Switch S is open

B the chemical energy changed to electrical energy when unitcharge passes through the cell

C twice the reading of the voltmeter when the switch S isclosed

D the electrical energy produced when unit current passesthrough the cell

6. In the circuit shown, the cell has an emf of 12 V and an internal resistance which is not negligible.



When the resistance of the variable resistor is 10 Ω the voltmeter reads 10 V and the ammeter reads 1.0 A.

The resistance of the variable resistor is changed to 5 Ω.

What is the new reading on the ammeter?

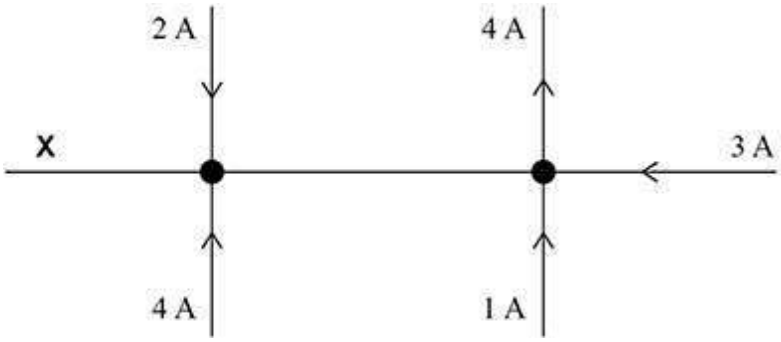
A 1.4 A

B 1.7 A

C 2.0 A

D 2.4 A

7. The diagram shows the currents in a set of wires.



What is the magnitude of the current at **X**?

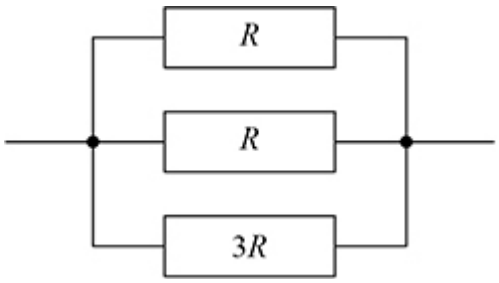
A zero

B 2 A

C 3 A

D 6 A

8. Resistors of resistance R, R and $3R$ are connected as shown.



What is the resistance of the arrangement?

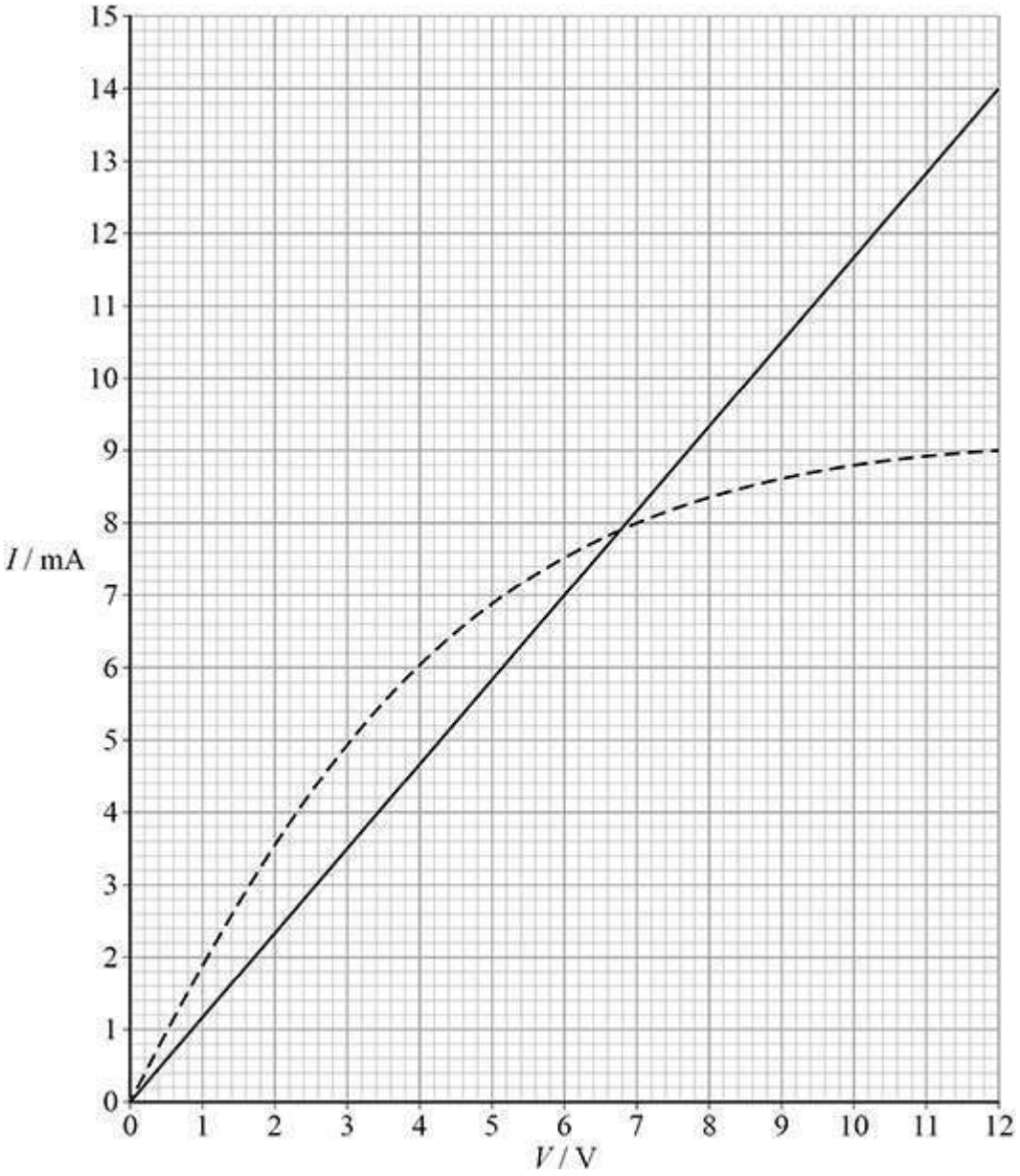
A $\frac{3R}{7}$

B $\frac{7R}{3}$

C $\frac{5R}{6}$

D $\frac{6R}{5}$

9. The graph shows the current-voltage (I-V) characteristics for two components.



The two components are connected in parallel with a 12 V battery that has negligible internal resistance.

What is the current in the battery?

A 7.9 mA

B 14.5 mA

C 15.8 mA

D 23.0 mA

10. Measurements are taken to determine the resistivity of a uniform metal wire. The table shows thequantities measured and their percentage uncertainties.

Quantity	Percentage uncertainty
potential difference across wire	0.3%
current in wire	5.0%
diameter of wire	4.0%
length of wire	0.2%

What is the percentage uncertainty in the calculated value for the resistivity of the metal of the wire?

A 1.6%

B 9.5%

C 13.5%

D 21.5%

11. Which statement about superconductors is **correct**?

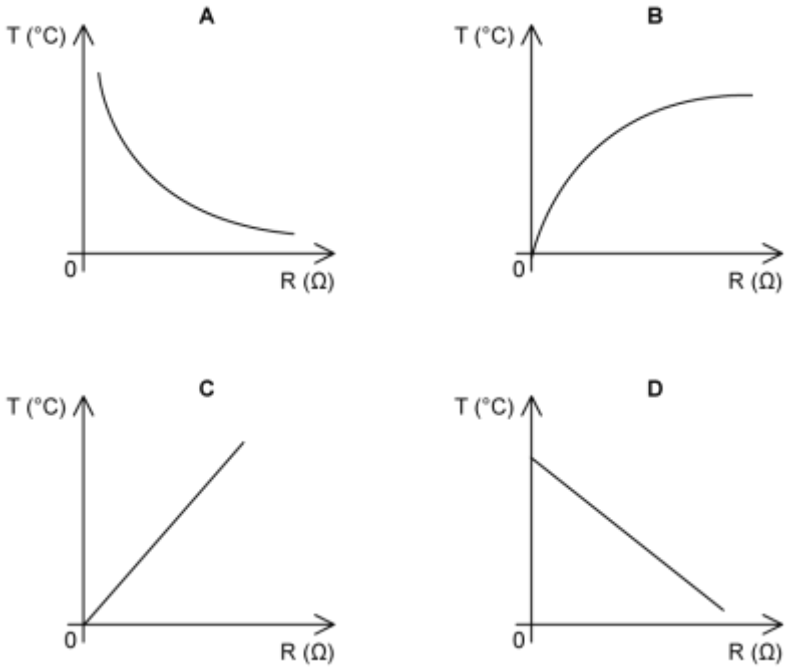
A. The temperature at which a material becomes a superconductor is called the critical temperature

B. When a material becomes a superconductor, its resistivity is almost zero

C. Copper is a superconductor at room temperature

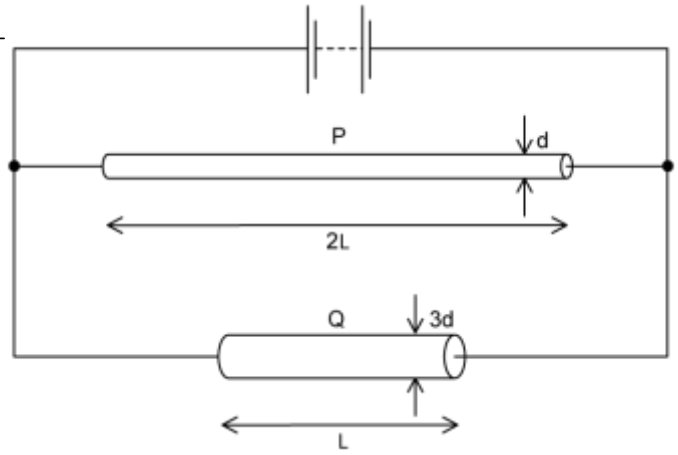
D. When current passes through a superconductor, the potential difference across it becomes a maximum

12. Which graph shows the variation of the resistance with temperature for an NTC thermistor?


A
T (°C)
0
R (Ω)
B
T (°C)
0
R (Ω)
C
T (°C)
0
R (Ω)
D
T (°C)
0
R (Ω)

13. 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

$$\frac{\textbf{current in P}}{\textbf{current in Q}}$$?

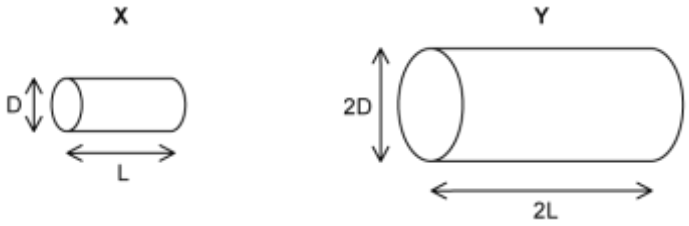
A. $\frac{2}{3}$

B. $\frac{2}{9}$

C. $\frac{1}{6}$

D. $\frac{1}{18}$

14. 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 $\frac{\textbf{resistance of X}}{\text{resistance of Y}}$?

A. $\frac{2}{1}$

B. $\frac{1}{1}$

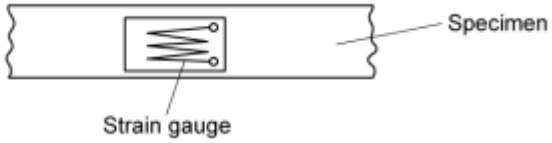
C. $\frac{1}{2}$

D. $\frac{1}{4}$

15. 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 thatin the specimen.



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

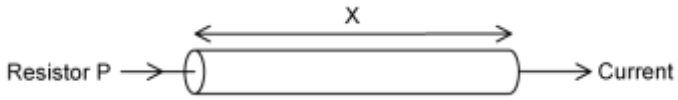
A. it decreases, because the length decreases and the cross-sectional area increases

B. it decreases, because the length decreases and the cross-sectional area increases

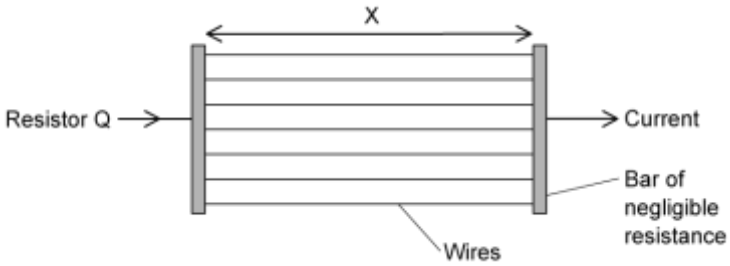
C. it increases, because the length decreases and the cross-sectional area increases

D. it increases, because the length increases and the cross-sectional area decreases

16. A researcher has two pieces of copper of the same volume. All of the first piece is made into a cylindrical resistorP of length *x*.



All of the second piece is made into uniform wires each of the same length *x* which he connects between twobars 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

17. Two wires have the same length and the same resistance. Wire X is made of a metal of resistivity 1.7 × 10^{-8} Ω m,and wire Y is made of a metal of resistivity 5.6 × 10^{-8} Ω 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

18. A metal wire has a length and a cross-sectional area A.

The wire is connected to a cell of emf ϵ, with no internal resistance, such that a current I flows in the wire. Which expression gives the resistivity of the wire?

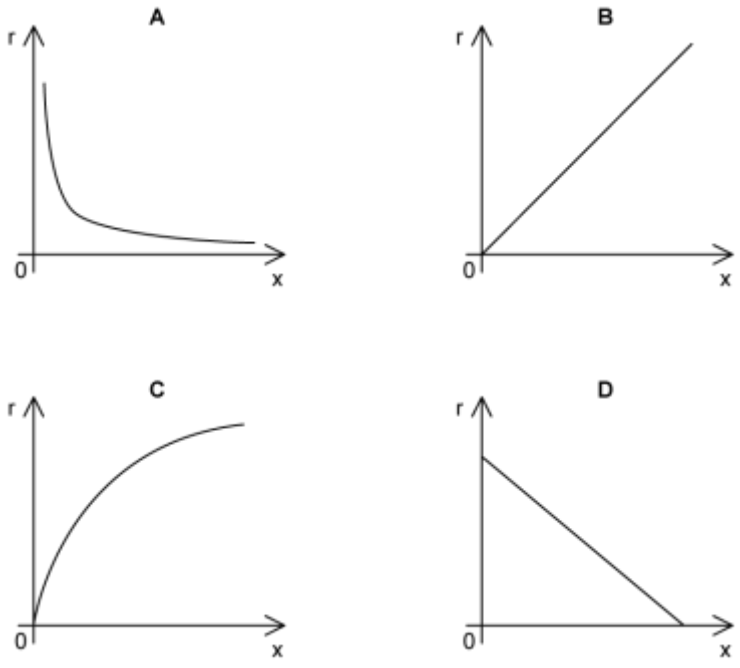
A. $\frac{IA}{\varepsilon L}$

B. $\frac{\varepsilon A}{IL}$

C. $\frac{IL}{\varepsilon A}$

D. $\frac{\varepsilon I}{LA}$

19. Which graph shows how the resistance per unit length r of a wire varies with radius of the wire?



20. A student carries out an experiment to determine the resistivity of a metal wire.

She determines resistance from measurements of potential difference and the corresponding current andmeasures the length of a wire with a metre rule and the diameter of the wire with a micrometer.

Each measurement is made with an uncertainty of 2 %.

Which quantity contributes the largest uncertainty in the calculated value of resistivity?

A. Cross-sectional area, *A*

B. Length, l

C. Potential difference, *V*

D. Current, *I*