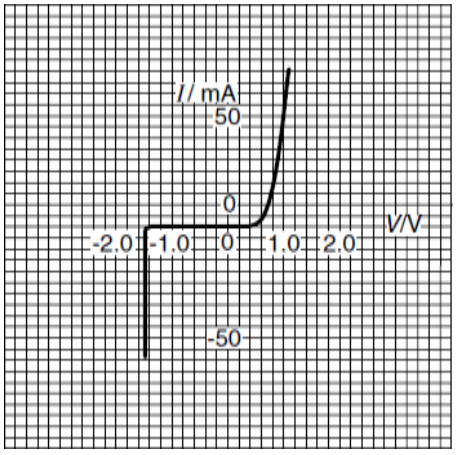
Current of Electricity

TOPIC QUESTIONS (1)

Level	AS Level
Subject	Physics
Exam Board	CIE
Paper Type	Multiple Choice

Time Allowed : 1hour 20min

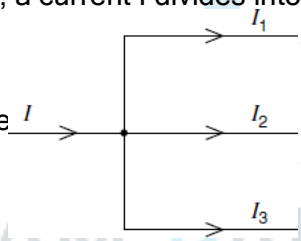
1. The variation with potential difference V of the current I in a semiconductor diode is shown below.



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
A	20 Ω	infinite
B	20 Ω	zero
C	0.05 Ω	infinite
D	0.05 Ω	zero

2. At a circuit junction, a current I divides into currents I1, I2 & I3.



These currents are re
I = I1 + I2 + I3.

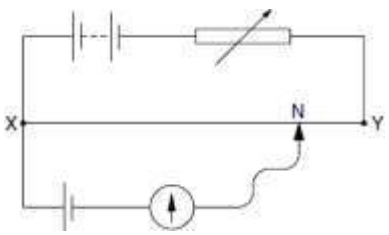
Which law does this statement illustrate and on what principle is the law based?

A Kirchhoff's first law based on conservation of charge
B Kirchhoff's first law based on conservation of energy
C Kirchhoff's second law based on conservation of charge
D Kirchhoff's second law based on conservation of energy

3. Which equation is used to define resistance?

A power = $(\text{current})^2$ x resistance
B resistivity = resistance x area ÷ length
C potential difference = current x resistance
D energy = $(\text{current})^2$ x resistance x time

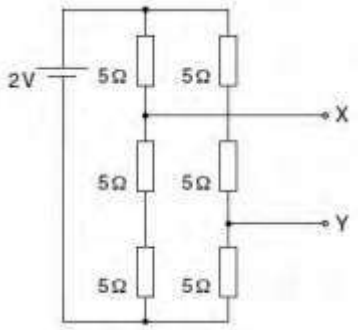
4. In the potentiometer circuit below, the moveable contact is placed at N on the bare wire XY, such that the galvanometer shows zero deflection.



The resistance of the variable resistor is now increased.
What is the effect of this increase on the potential difference across the wire XY and on the position of the moveable contactfor zero deflection?

	potential difference across XY	position of moveable contact
A	increases	nearer to X
B	increases	nearer to Y
C	decreases	nearer to X
D	decreases	nearer to Y

5. Six resistors, each of resistance 5 Ω, are connected to a 2 V cellof negligible internal resistance.



What is the potential difference between terminals X and Y?

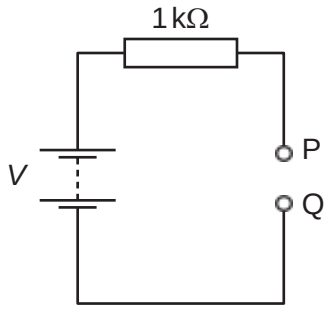
A $\frac{2}{3}$ V B $\frac{8}{9}$ V C $\frac{4}{3}$ V D 2 V

6. The potential difference across a component in a circuit is 2.0 V.

How many electrons must flow through this component in order for it to be supplied with 4.8 J of energy?

A 2.6×10^{18} B 1.5×10^{19} C 3.0×10^{19} D 6.0×10^{19}

7. A battery of electromotive force (e.m.f.) V and negligible internal resistance is connected to a 1 kΩ resistor, as shown.

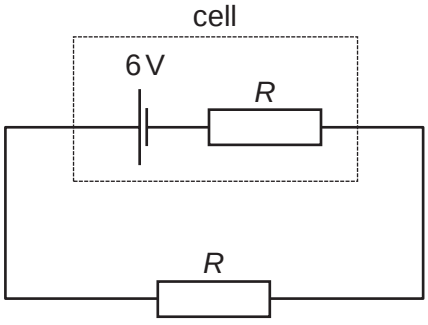


A student attempts to measure the potential difference (p.d.) between points P and Q using two voltmeters, one at a time. The first voltmeter has a resistance of 1 kΩ and the second voltmeter has a resistance of 1 MΩ.

What are the readings of the voltmeters?

	reading on voltmeter with 1 kΩ resistance	reading on voltmeter with 1 MΩ resistance
A	$\frac{V}{2}$	$\frac{V}{2}$
B	$\frac{V}{2}$	V
C	V	$\frac{V}{2}$
D	V	V

8. A cell has an electromotive force (e.m.f.) of 6 V and internal resistance *R*. An external resistor, also of resistance *R*, is connected across this cell, as shown.



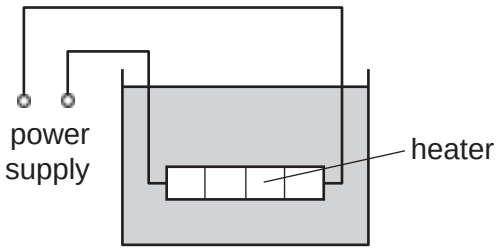
Power *P* is dissipated by the external resistor.

The cell is replaced by a different cell that has an e.m.f. of 6 V and negligible internal resistance.

What is the new power that is dissipated in the external resistor?

A 0.5*P* B *P* C 2*P* D 4*P*

9. The diagram shows a low-voltage circuit for heating the water in a fish tank.



The heater has a resistance of 3.0 Ω. The power supply has an e.m.f. of 12 V and an internal resistance of 1.0 Ω.

At which rate is energy supplied to the heater?

A 27 W B 36 W C 48 W D 64 W

10. Two lamps are connected in series to a 250 V power supply. One lamp is rated 240 V, 60 W and the other is rated 10 V, 2.5 W.

Which statement most accurately describes what happens?

A Both lamps light at less than their normal brightness.

B Both lamps light normally.

C Only the 60 W lamp lights.

D The 10 V lamp blows.

11. The current in a resistor is 8.0 mA.

What charge flows through the resistor in 0.020 s?

A 0.16 mC B 1.6 mC C 4.0 mC D 0.40 C

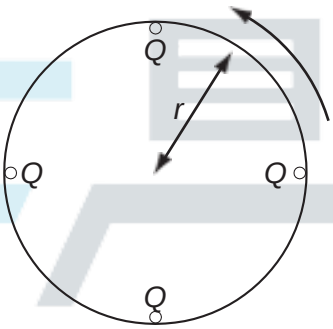
12. An electric railway locomotive has a maximum mechanical output power of 4.0 MW. Electrical power is delivered at 25 kV from overhead wires. The overall efficiency of the locomotive in converting electrical power to mechanical power is 80 %.

What is the current from the overhead wires when the locomotive is operating at its maximum power?

A 130 A B 160 A C 200 A D 250 A

13. Four point charges, each of charge Q, are placed on the edge of an insulating disc of radius r.

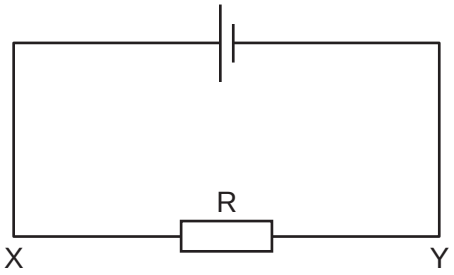
The frequency of rotation of the disc is f.



What is the equivalent electric current at the edge of the disc?

A $4Qf$ B $\frac{4Q}{f}$ C $8\pi rQf$ D $\frac{2Qf}{\pi r}$

14. The current in the circuit is 4.8 A.



What is the rate of flow and the direction of flow of electrons through the resistor R?

A $3.0 \times 10^{19}\,s^{-1}$ in direction X to Y

B $6.0 \times 10^{18}\,s^{-1}$ in direction X to Y

C $3.0 \times 10^{19}\,s^{-1}$ in direction Y to X

D $6.0 \times 10^{18}\,s^{-1}$ in direction Y to X

15. Which equation is used to define resistance?

A energy = $(\text{current})^2 \times$ resistance $\times$ time

B potential difference = current $\times$ resistance

C power = $(\text{current})^2 \times$ resistance

D resistivity = resistance $\times$ area $\div$ length

16. An experiment is carried out to measure the resistance of a wire.

The current in the wire is (1.0 ± 0.2) A and the potential difference across the wire is (8.0 ± 0.4) V.

What is the resistance of the wire and its uncertainty?

A $(8.0 \pm 0.2)\,\Omega$

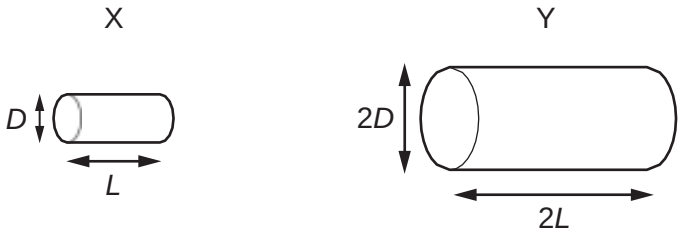
B $(8.0 \pm 0.6)\,\Omega$

C $(8 \pm 1)\,\Omega$

D $(8 \pm 2)\,\Omega$

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

B $\frac{1}{2}$

C $\frac{1}{4}$

D $\frac{1}{}$

18. Two wires P and Q made of the same material and of the same length are connected in parallelto the same voltage supply. Wire P has diameter 2 mm and wire Q has diameter 1 mm.

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

A $\frac{1}{4}$

B $\frac{1}{2}$

C $\frac{2}{1}$

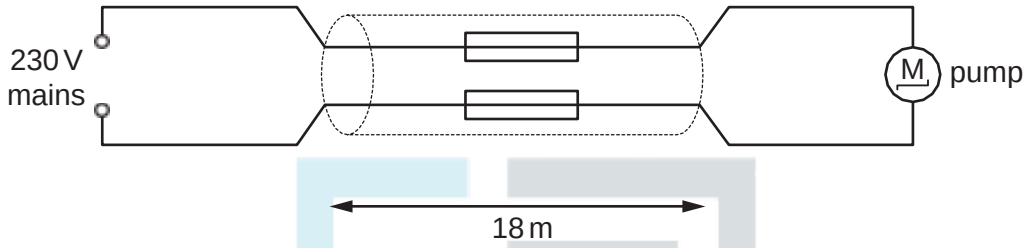
D $\frac{4}{1}$

19. A copper wire is to be replaced by an aluminium alloy wire of the same length and resistance. Copper has half the resistivity of the alloy.

What is the ratio $\frac{\text{diameter of alloy wire}}{\text{diameter of copper wire}}$?

A $\sqrt{2}$ B 2 C $\sqrt{2}$ 2 D 4

20. The diagram shows an electric pump for a garden fountain connected by an 18 m cable to a230 V mains electrical supply.

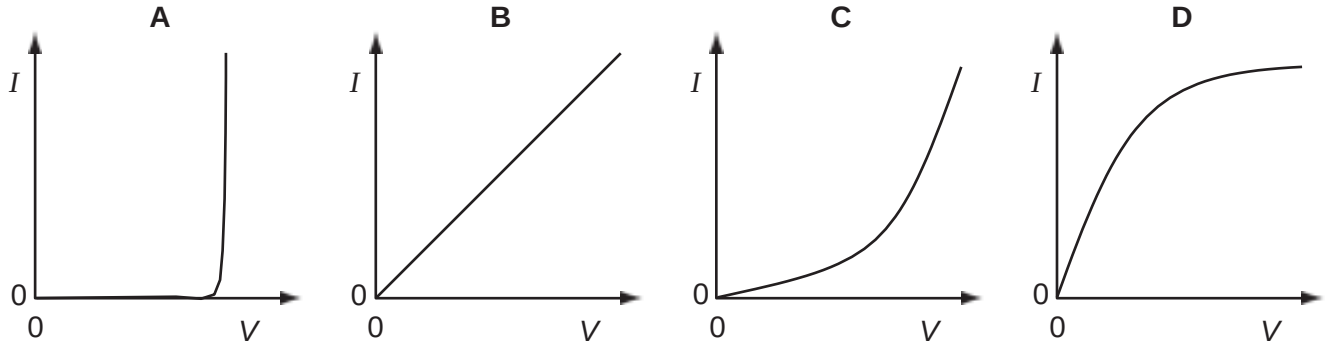


The performance of the pump is acceptable if the potential difference (p.d.) across it is at least218 V. The current through it is then 0.83 A.

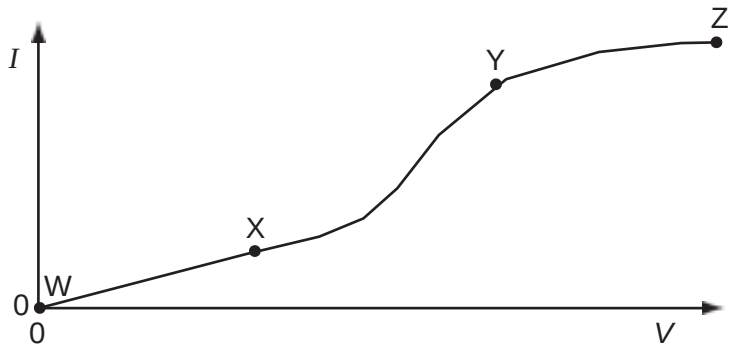
What is the maximum resistance per metre of each of the two wires in the cable if the pump is to perform acceptably?

A $0.40\,\Omega\,m^{-1}$ B $0.80\,\Omega\,m^{-1}$ C $1.3\,\Omega\,m^{-1}$ D $1.4\,\Omega\,m^{-1}$

21. Which graph shows the I – V characteristic of a filament lamp?



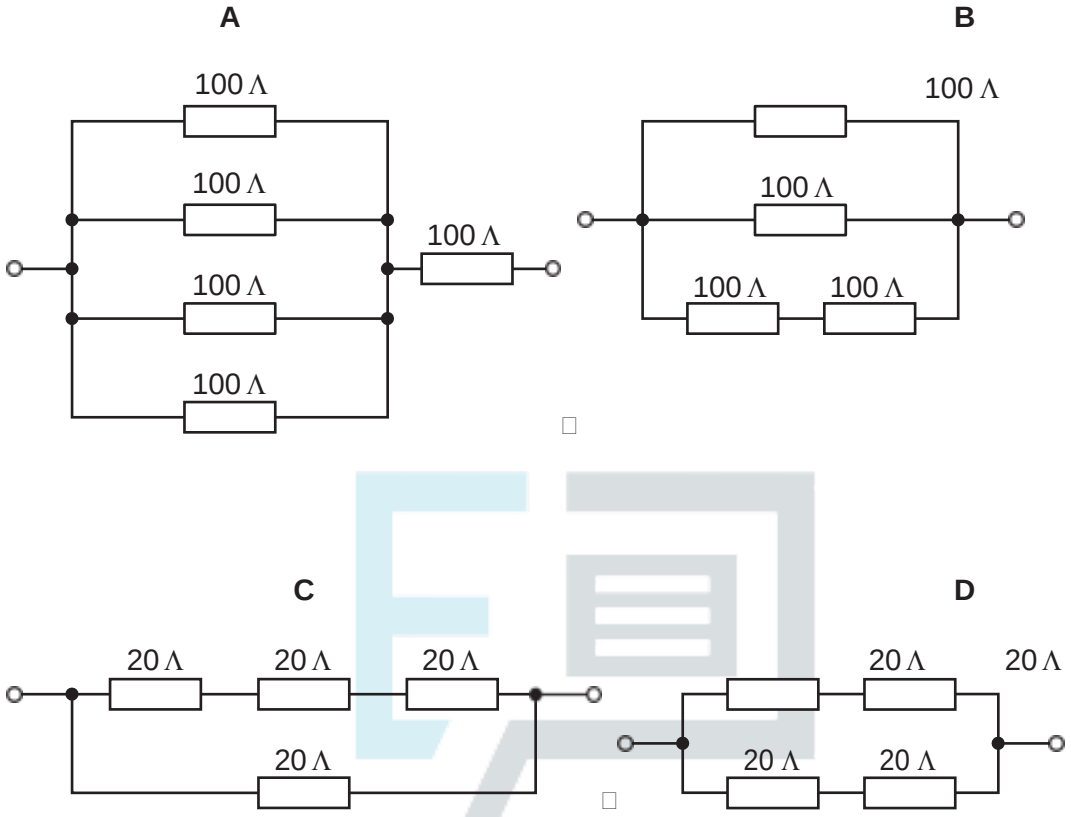
22. An electrical component has a potential difference V across it and a current I through it. A graph of I against V is drawn and is marked in three sections WX, XY and YZ.



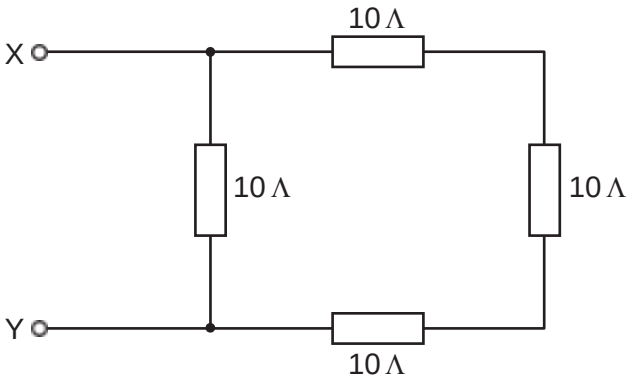
In which ways does the resistance of the component vary within each of the three sections?

	WX	XY	YZ
A	constant	decreases	increases
B	constant	increases	increases
C	increases	decreases	constant
D	increases	increases	decreases

23. Which circuit has a resistance of 40 Ω between the terminals?



24. The diagram shows an arrangement of resistors.



What is the total electrical resistance between X and Y?

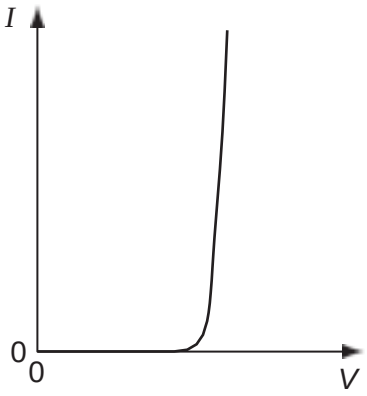
A less than 1 Ω

B between 1 Ω and 10 Ω

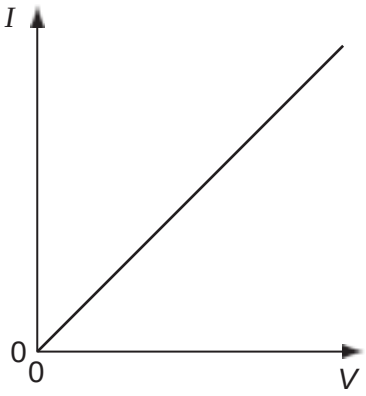
C between 10 Ω and 30 Ω

D 40 Ω

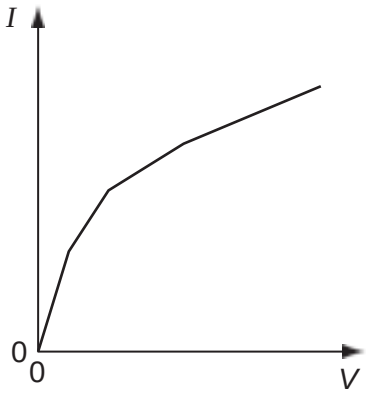
25. The graphs show the variation with potential difference V of the current I for three circuit components.



graph X



graph Y



graph Z

The components are a metal wire at constant temperature, a semiconductor diode and a filament lamp.

Which row of the table correctly identifies these graphs?

	metal wire at constant temperature	semiconductor diode	filament lamp
A	X	Z	Y
B	Y	X	Z
C	Y	Z	X
D	Z	X	Y

26. Which electrical component is represented by the following symbol?

a. a diode

b. a potentiometer

c. a resistor

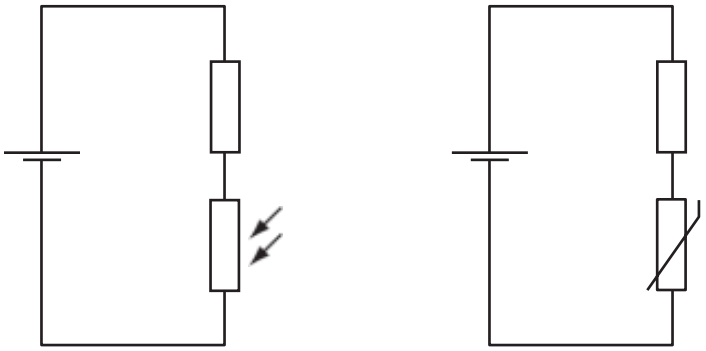
d. a thermistor

27. 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
A	highest temperature	highest illumination
B	highest temperature	lowest illumination
C	lowest temperature	highest illumination
D	lowest temperature	lowest illumination

28. The diagrams show a light-dependent resistor in circuit P, and a thermistor in circuit Q.



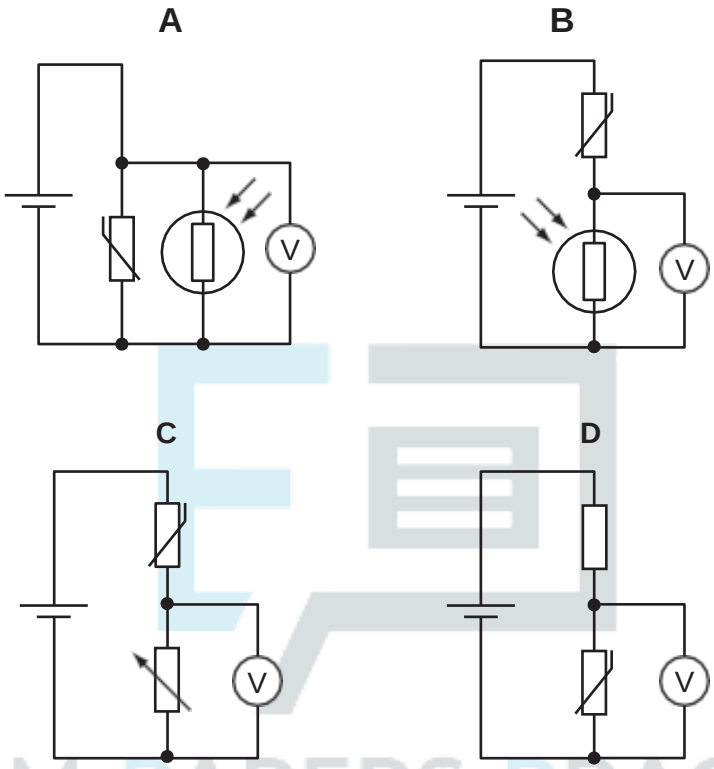
circuit P circuit Q

How does the potential difference across the fixed resistor in each circuit change when both the brightness of the light on the light-dependent resistor and the temperature of the thermistor are increased?

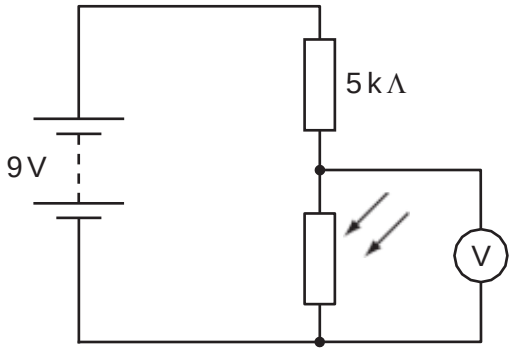
	circuit P	circuit Q
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

29. A thermistor and another component are connected to a constant voltage supply. A voltmeter is connected across one of the components. The temperature of the thermistor is then reduced but no other changes are made.

In which circuit will the voltmeter reading increase?



30. A circuit is set up with an LDR and a fixed resistor as shown.



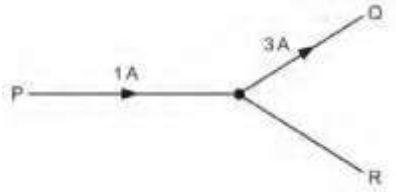
The voltmeter reads 4 V.

The light intensity is increased.

What is a possible voltmeter reading?

A 3 V B 4 V C 6 V D 8 V

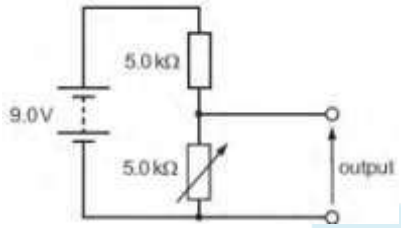
31. The diagram shows a junction in a circuit where three wires P, Q and R meet. The currents in P and Q are 1 A and 3 A respectively, in the directions shown.



How many coulombs of charge pass a given point in wire R in 5s?

A 0.4 B 0.8 C 2 D 10

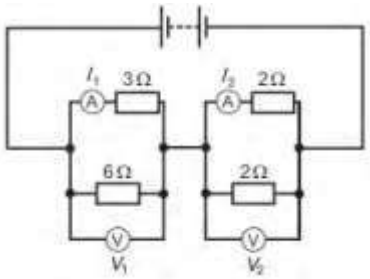
32. The diagram shows a potential divider circuit designed to provide a variable output p.d.



Which gives the available range of output p.d?

	maximum output	minimum output
A	3.0V	0
B	4.5V	0
C	9.0V	0
D	9.0V	4.5V

33. In the circuit shown, the ammeters have negligible resistance and the voltmeters have infinite resistance.

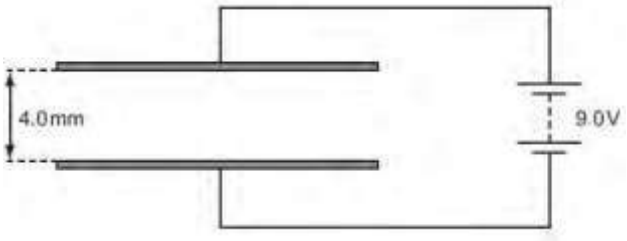


The readings on the meters are I1, I2, V1 and V2, as labelled on the diagram.
Which is correct?

A $I_1 > I_2$ and $V_1 > V_2$ **C** $I_1 < I_2$ and $V_1 > V_2$

B $I_1 > I_2$ and $V_1 < V_2$ **D** $I_1 < I_2$ and $V_1 < V_2$

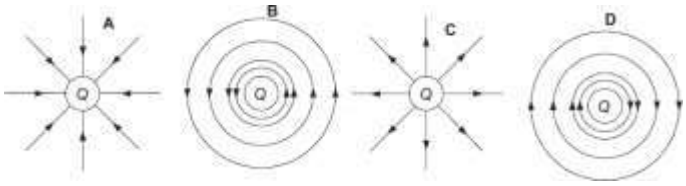
34. The diagram shows a pair of metal plates 4.0 mm apart connected to a 9.0 V battery.



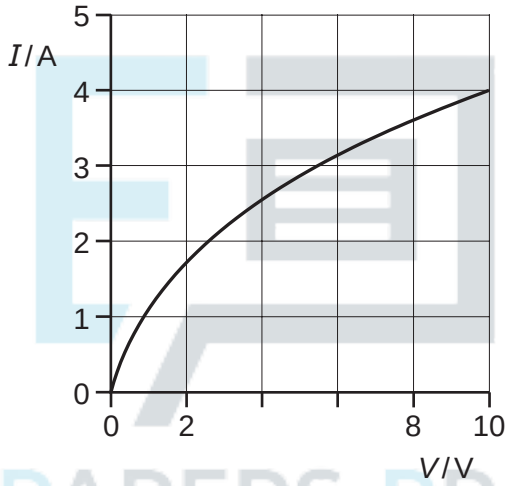
What is the electric field between the plates?

A 4.4×10^{-4} N C^{-1} B 3.6×10^{-2} N C^{-1}
C 36 N C^{-1} D 2.3×10^{3} N C^{-1}

35. Which diagram represents the electric field in the vicinity of a positive electric charge of magnitude Q?



36. 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?

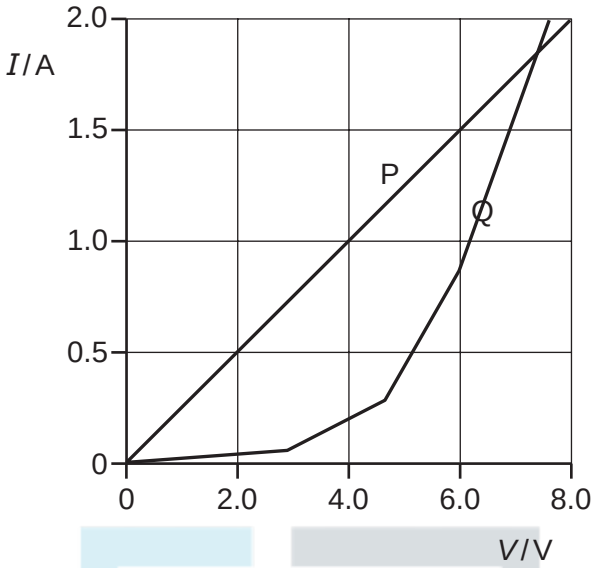
	V / V	R / Ω
A	2.0	1.5
B	4.0	3.2
C	6.0	1.9
D	8.0	0.9

37. The potential difference between point X and point Y in a circuit is 20V. The time taken for charge carriers to move from X to Y is 15 s. In this time, the energy of the charge carriers changes by 12 J.

What is the current between X and Y?

A 0.040 A B 0.11 A C 9.0 A D 25 A

38. 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.

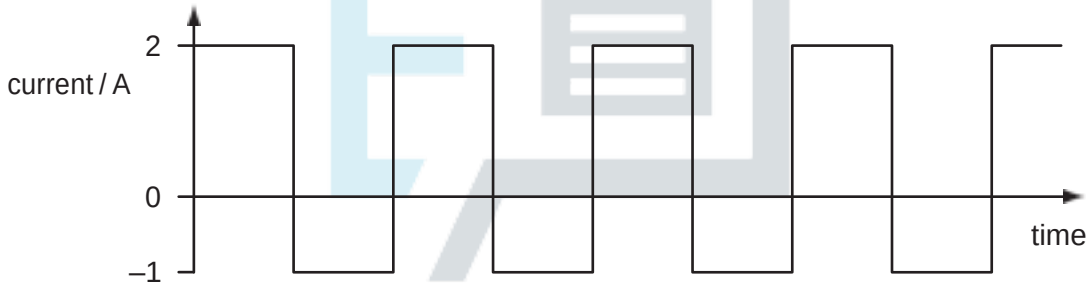
D For a current of 0.5 A, the power dissipated in Q is double that in P.

39. A cell of internal resistance 2.0 Ω and electromotive force (e.m.f.) 1.5V is connected to a resistor of resistance 3.0 Ω.

What is the potential difference across the 3.0 Ω resistor?

A 1.5 V B 1.2 V C 0.9 V D 0.6 V

40. A 100 Ω resistor conducts a current with changing direction and magnitude, as shown.



What is the mean power dissipated in the resistor?

A 100 W B 150 W C 250 W D 400 W

41. The potential difference between point X and point Y is 20V. The time taken for charge carriers to move from X to Y is 15 s, and, in this time, the energy of the charge carriers changes by 12 J.

What is the current between X and Y?

A 0.040 A B 0.11 A C 9.0 A D 25 A

42. Which electrical quantity would be the result of a calculation in which energy is divided by charge?

A current

B potential difference

C power

D resistance

43. A wire carries a current of 2.0 amperes for 1.0 hour.

How many electrons pass a point in the wire in this time?

A 1.2×10^{-15}

B 7.2×10^{3}

C 1.3×10^{19}

D 4.5×10^{22}

44. What physical quantity would result from a calculation in which a potential difference is multiplied by an electric charge?

A electric current

B electric energy

C electric field strength

D electric power

45. The current in a component is reduced uniformly from 100 mA to 20 mA over a period of 8.0 s.

What is the charge that flows during this time?

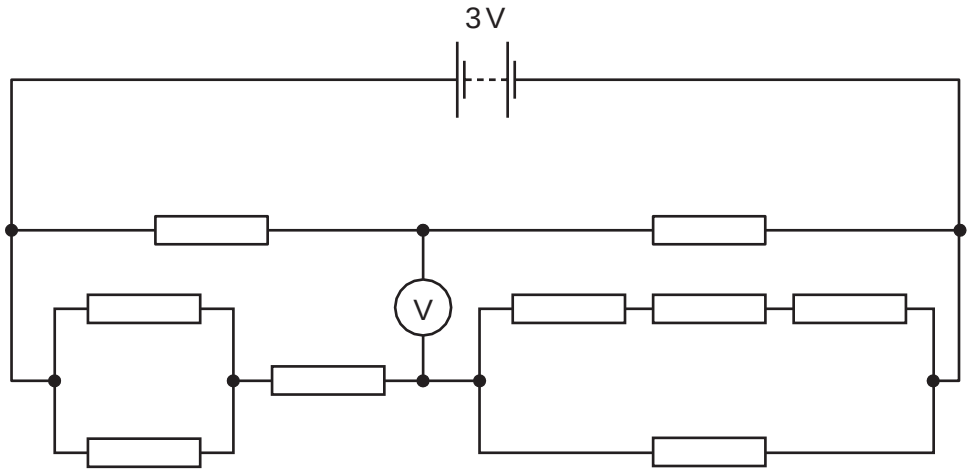
A 160 mC **B** 320 mC **C** 480 mC **D** 640 mC

46. A copper wire is cylindrical and has resistance R.

What will be the resistance of a copper wire of twice the length and twice the radius?

A $\frac{R}{4}$ B $\frac{R}{2}$ C R D $2R$

47. A circuit is set up as shown, supplied by a 3 V battery. All resistances are 1 kΩ.



What will be the reading on the voltmeter?

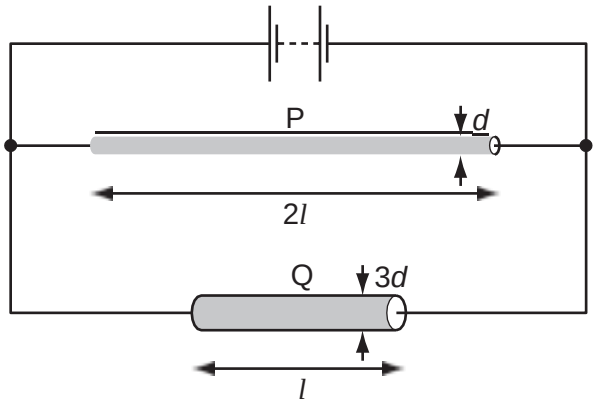
A 0 B 0.5 V C 1.0 V D 1.5 V

48. A power cable has length 2000 m. The cable is made of twelve parallel strands of copper wire, each with diameter 0.51 mm.

What is the resistance of the cable? (resistivity of copper = $1.7 \times 10^{-8}\,\Omega\,m$)

A 0.014 Ω B 3.5 Ω C 14 Ω D 166 Ω

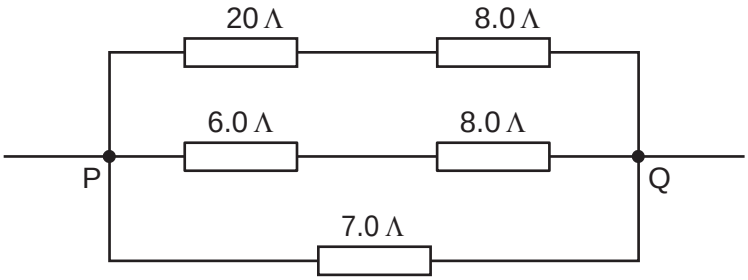
49. Two wires P and Q made of the same material are connected to the same electrical supply. P has twice the length of Q and one-third of the diameter of Q, as shown in the diagram.



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 $\frac{1}{18}$

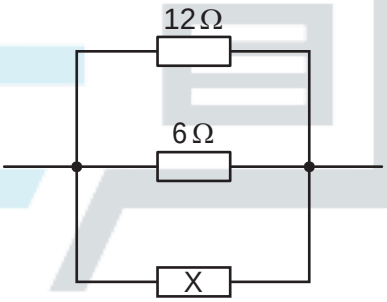
50. Five resistors are connected as shown.



What is the total resistance between P and Q?

A 0.25 Ω B 0.61 Ω C 4.0 Ω D 16 Ω

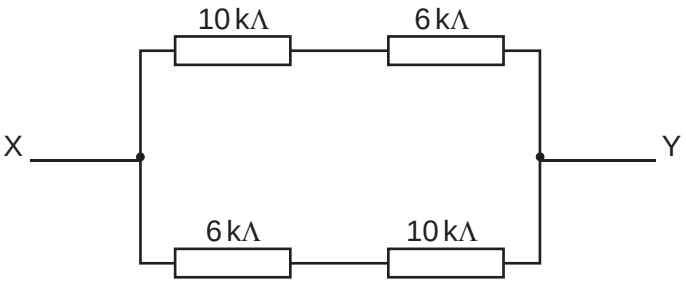
51. The diagram shows a parallel combination of three resistors. The total resistance of the combination is 3 Ω.



What is the resistance of resistor X?

A 2 Ω B 3 Ω C 6 Ω D 12 Ω

52. The diagram shows an arrangement of four resistors.



What is the resistance between X and Y?

A 4 kΛ **B** 8 kΛ **C** 16 kΛ **D** 32 kΛ

53. Which equation is used to define resistance?

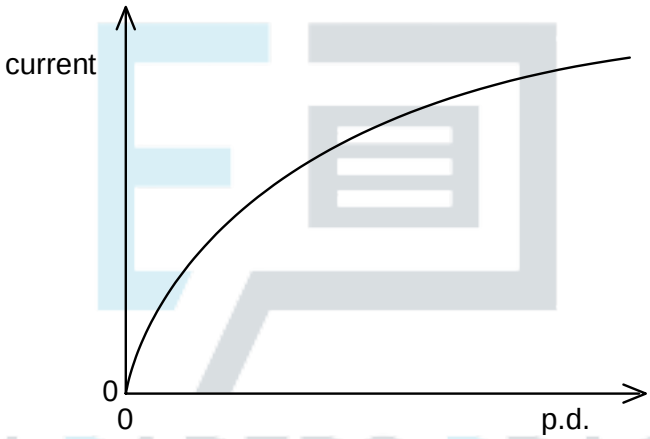
A power = (current)^2 × resistance

B resistivity = resistance × area ÷ length

C potential difference = current × resistance

D energy = (current)^2 × resistance × time

54. The graph shows how the current through a lamp filament varies with the potential difference across it.



Which statement explains the shape of this graph?

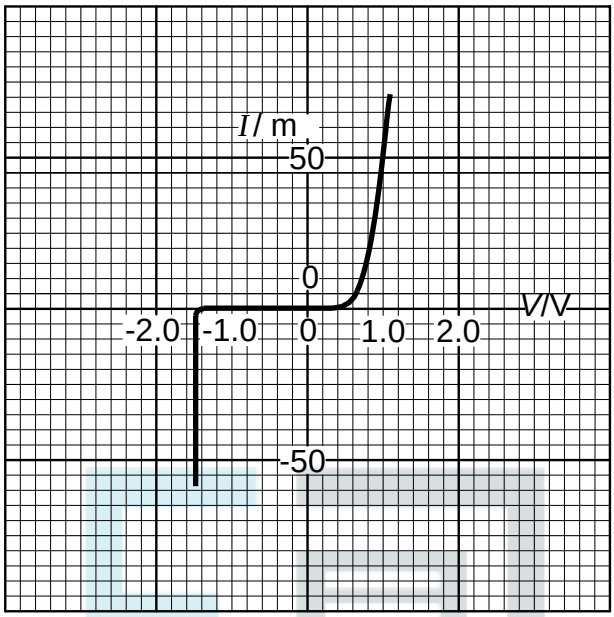
A As the filament temperature rises, electrons can pass more easily through the filament.

B It takes time for the filament to reach its working temperature.

C The power output of the filament is proportional to the square of the current through it.

D The resistance of the filament increases with a rise in temperature.

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

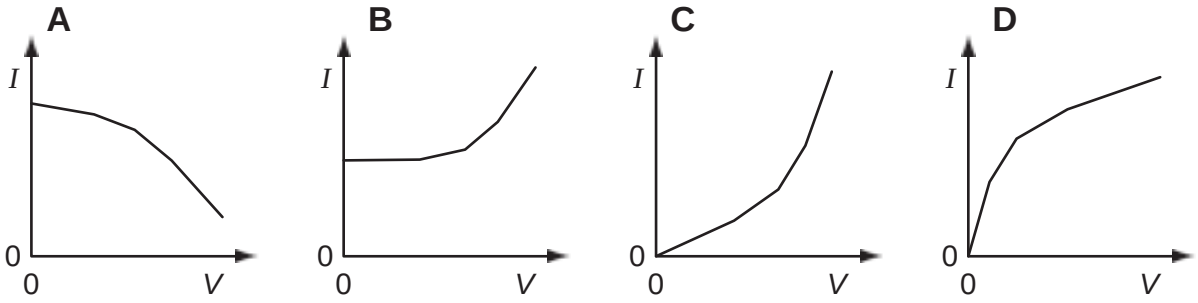


What is the resistance of the diode for applied potential differences of +1.0 V and –1.0 V?

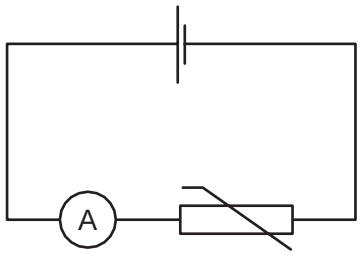
	resistance	
	at +1.0 V	at -1.0 V
A	20 Ω	infinite
B	20 Ω	zero
C	0.05 Ω	infinite
D	0.05 Ω	zero

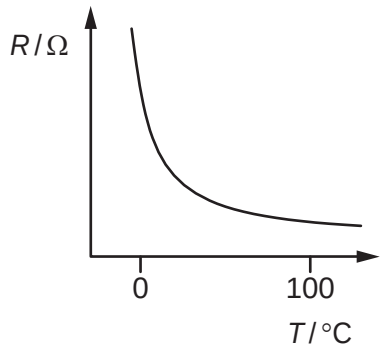
56. The resistance of a thermistor decreases significantly as its temperature increases.

The thermistor is kept in air. The air is at room temperature.
Which graph best represents the way in which the current I in the thermistor depends upon thepotential difference V across it?



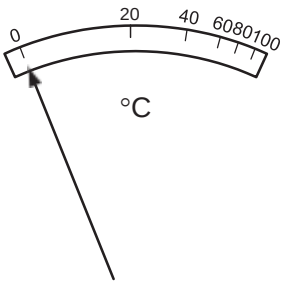
57. In the circuit shown, an analogue ammeter is to be recalibrated as a thermometer. The graph shows how the resistance R of the thermistor changes with temperature T.



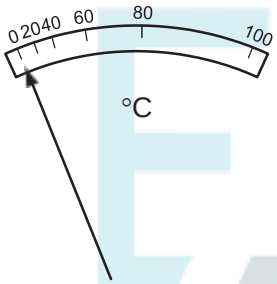


Which diagram could represent the temperature scale on the ammeter?

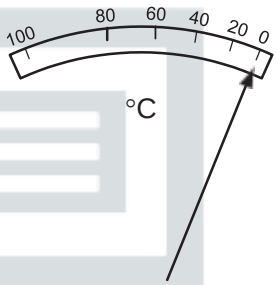
A



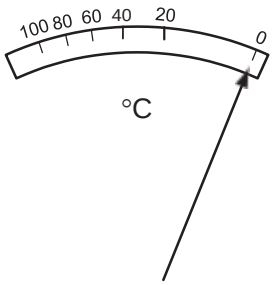
B



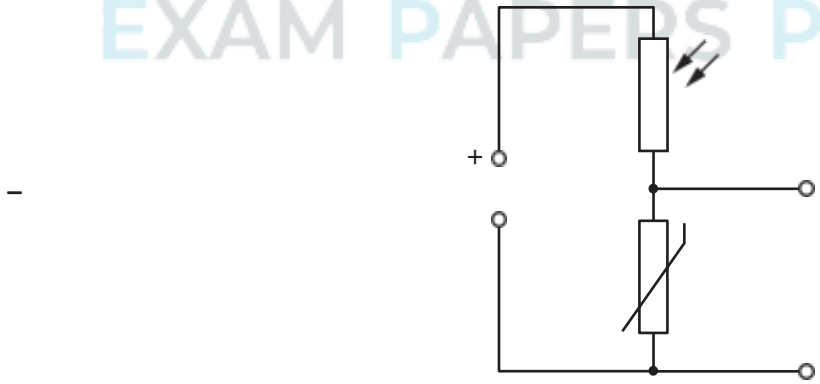
C



D



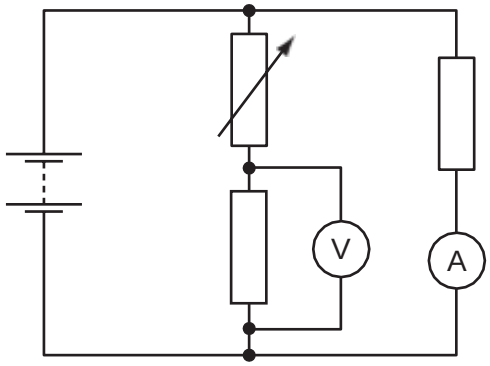
58. The diagram shows a light-dependent resistor (LDR) and a thermistor forming a potential divider.



Under which set of conditions will the potential difference across the thermistor have the greatest value?

	illumination	temperature
A	low	low
B	high	low
C	low	high
D	high	high

59. A network of electrical components is connected across a battery of negligible internal resistance, as shown.

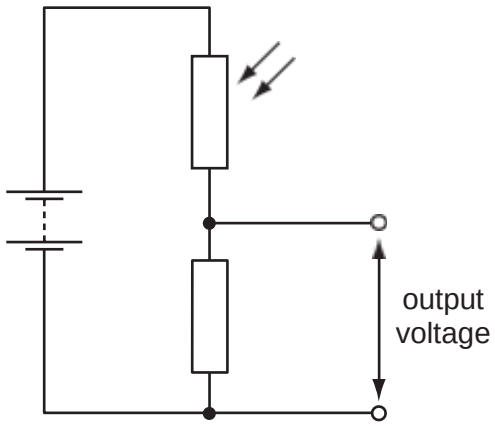


The resistance of the variable resistor is increased.

What is the effect on the readings of the ammeter and voltmeter?

	ammeter	voltmeter
A	decreases	increases
B	increases	decreases
C	unchanged	decreases
D	unchanged	increases

60. The diagram shows a potential divider circuit.



The light level increases.

What is the effect on the resistance of the light-dependent resistor (LDR) and on the output voltage?

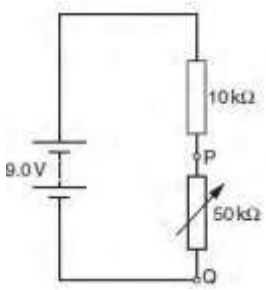
	resistance of the LDR	output voltage
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

61. The diagram shows an arrangement of four resistors.

What is the resistance between X and Y?

A 4kΩ **B** 8kΩ **C** 16 kΩ **D** 32 kΩ

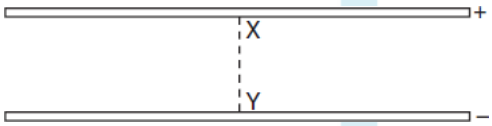
62. The diagram shows a potential divider connected to a 9.0 Vsupply of negligible internal resistance.



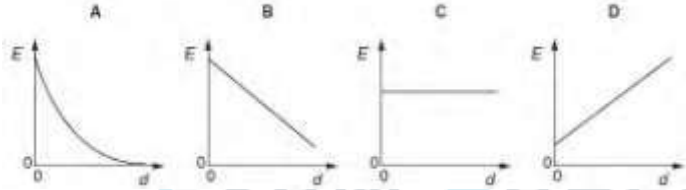
What range of voltages can be obtained between P and Q?

A zero to 1.5V
B zero to 7.5V
C 1.5 V to 7.5V
D 1.5 V to 9.0V

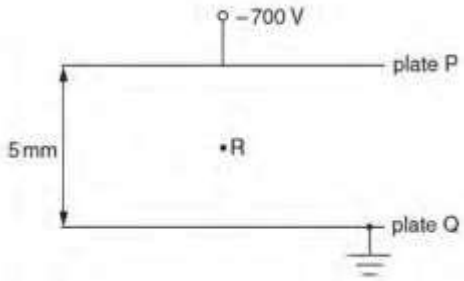
63. An electric field exists in the space between two charged metal plates.



Which of the following graphs shows the variation of electric field strength E with distance d from X along the line XY?



64. The diagram shows two metal plates P and Q between which there is a potential difference of 700V. Plate Q is earthed.



What is the magnitude and direction of the electric field at point R?

A 1.4×10^2 NC^{-1} from P towards Q
B 1.4×10^2 NC^{-1} from Q towards P
C 1.4×10^5 NC^{-1} from P towards Q
D 1.4×10^5 NC^{-1} from Q towards P

65. Which electrical quantity would be the result of a calculation in which energy is divided by charge?

A current
B potential difference
C power
D resistance