17 Current Electricity

Conceptual MCQs

1. A steady current flows in a metallic conductor of non-uniform cross-section. The quantity/ quantities remain constant along the length of the conductor is/are

(a) current, electric field and drift speed

(b) drift speed only

(c) current and drift speed

(d) current only

2. At room temperature, copper has free electron density of 8.4×10^{28} per m^3. The copper conductor has a cross-section of 10^{-6} m^2 and carries a current of 5.4 A. The electron drift velocity in copper is

(a) 400 m/s (b) 0.4 m/s (c) 0.4 mm/s (d) 72 m/s

3. A wire of length l and resistance R is stretched to get the radius of cross-section $\frac{r}{2}$. Then the new value of R is

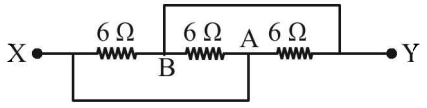
(a) 16R (b) 4R (c) 8R (d) 5R

4. A current of 1 mA flows through a copper wire. How many electrons will pass through a given point of wire in each second?

(a) 6.25×10^8 (b) 6.25×10^{31}

(c) 6.25×10^{15} (d) 6.25×10^{19}

5. In a given network, each resistance has value of 6Ω. The point X is connected to point A by a copper wire of negligible resistance and point Y is connected to point B by the same wire. The effective resistance between X and Y will be



(a) 18Ω (b) 6Ω (c) 3Ω (d) 2Ω

6. Two resistors of resistance R_1 and R_2 having $R_1 > R_2$ are connected in parallel. For equivalent resistance R, the correct statement is

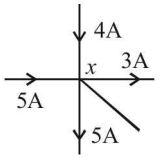
(a) $R > R_1 + R_2$ (b) $R_1 < R < R_2$

(c) $R_2 < R < (R_1 + R_2)$ (d) $R < R_1$

7. A primary cell has an e.m.f. of 1.5 volt, when short-circuited it gives a current of 3 ampere. The internal resistance of the cell is

(a) 4.5 ohm (b) 2 ohm (c) 0.5 ohm (d) 1/4.5 ohm

8. Five conductors are meeting at a point x as shown in the figure. What is the value of current in fifth conductor.



(a) 3 A away from x

(b) 1 A away from x

(c) 4 A away from x

(d) 1 A towards x

9. The resistance of a wire at 20°C is 20Ω and at 500°C is 60 ohm. At which temperature its resistance will be 25 ohm?

(a) 80°C (b) 70°C (c) 60°C (d) 50°C

10. A cell of emf E is connected across a resistance R. The potential difference between the terminals of the cell is found to be V volt. Then the internal resistance of the cell must be

(a) $(E-V)R$ (b) $\frac{(E-V)}{V}R$

(c) $\frac{2(E-V)R}{E}$ (d) $\frac{2(E-V)V}{R}$

11. The sensitivity of a potentiometer can be increased

(a) by increasing the length of potentiometer wire

(b) by decreasing the current of potentiometer wire circuit.

(c) by joining high resistance to potentiometer wire circuit.

(d) All of the above.

12. A piece of copper and another of germanium are cooled from room temperature to 50 K. The resistance of

(a) each of them decreases

(b) copper decreases and germanium increases

(c) each of them increases

(d) copper increases and germanium decreases

13. The powers of two electric bulbs are 100 watt and 200 watt. Both of them are joined with 220 volt. The ratio of resistance of their filament will be

(a) 4 : 1 (b) 1 : 4 (c) 1 : 2 (d) 2 : 1

14. A 220 V, 100 watt bulb is joined with a 110 V supply. The power consumed by the bulb is

(a) 50 watt (b) 25 watt (c) 80 watt (d) 100 watt

15. In a metre-bridge, the balancing length from the left end when standard resistance of 1 Ω is in right gap is found to be 20 cm. The value of unknown resistance is

(a) 0.25Ω (b) 0.4Ω (c) 0.5Ω (d) 4Ω

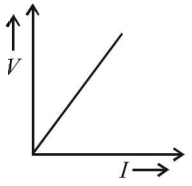
Application Based MCQs

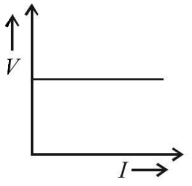
16. An electric current passes through a circuit containing two wires of the same material connected in parallel. If the lengths of the wires are in the ratio of 4/3 and radius of the wires are in the ratio of 2/3, then the ratio of the currents passing through the wires will be

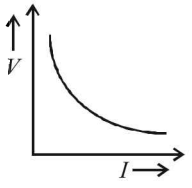
(a) 3 (b) 1/3

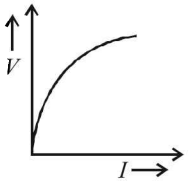
(c) 3/9 (d) None of these

17. Which of the adjoining graphs represents ohmic resistance

(a) 

(b) 

(c) 

(d) 

18. If a negligibly small current is passed through a wire of length 15 m and of resistance 5Ω having uniform cross-section of 6×10^{-7} m^2 , then coefficient of resistivity of material, is

(a) 1×10^{-7} Ω-m (b) 2×10^{-7} Ω-m

(c) 3×10^{-7} Ω-m (d) 4×10^{-7} Ω-m

19. A small power station supplies electricity to 5000 lamps connected in parallel. Each lamp has a resistance of 220 ohm and is operated at 220V. The total current supplied by the station is

(a) 2.500A (b) 3,500A (c) 5,000A (d) 10,000A

20. 125 cm of potentiometer wire balances the emf. of a cell and 100 cm of the wire is required for balance, if the terminals of the cell are joined by a 2Ω resistor. Then the internal resistance of the cell is

(a) 0.25 Ω (b) 0.5 Ω (c) 0.75 Ω (d) 1.25 Ω

21. How much heat is developed in 210 watt electric bulb in 5 minutes? (Chemical equivalent of heat = 4.2 J/C)

(a) 30000 cal (b) 22500 cal (c) 15000 cal (d) 7500 cal

22. Three bulbs of 40 W, 60 W and 100 W are connected in series to a current source of 200 V. Which of the following statements is true?

(a) 40 W bulb glows brightest

(b) 60 W bulb glows brightest

(c) 100 W bulb glows brightest

(d) all bulbs glow with same brightness

23. The resistance of a bulb filmanet is 100Ω at a temperature of 100°C. If its temperature coefficient be 0.005 per °C, its resistance will become 200 Ω at a temperature of

(a) 300°C (b) 400°C (c) 500°C (d) 200°C

24. A wire of resistance 5Ω is drawn out to its new length, three times its original length. The resistance of the new wire is

(a) 45Ω (b) 15Ω (c) 5Ω (d) $\frac{5}{3}\Omega$

25. A heater boils a certain quantity of water in time t_1 Another heater boils the same quantity of water in time t_2. If both heaters are connected in parallel, the combination will boil the same quantity of water in time

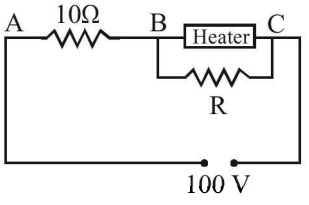
(a) $\frac{1}{2}(t_1 + t_2)$ (b) $(t_1 + t_2)$

(c) $\frac{t_1 t_2}{t_1 + t_2}$ (d) $\sqrt{t_1 t_2}$

26. 50 V battery is supplying current of 10 amp when connected to a resistor. If the efficiency of battery at this current is 25%, then internal resistance of battery is

(a) 2.5Ω (b) 3.75Ω (c) 1.25Ω (d) 5Ω

27. A heater is operated with a power of 1000 W in a 100 V line. It is connected in combination with a resistance of 10Ω and a resistance R to a 100 V line as shown in figure. What should be the value of R so that the heater operates with a power of 62.5 W ?

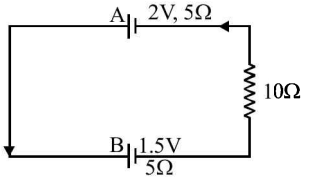


(a) 10Ω (b) 62.5Ω (c) $\frac{1}{5}\Omega$ (d) 5Ω

28. Two wires have lengths, diameters and specific resistances all in the ratio of 1 : 2. The resistance of the first wire is 10 ohm. Resistance of the second wire in ohm will be

(a) 5 (b) 10 (c) 20 (d) infinite

29. Two cells A and B of e.m.f. 2V and 1.5V respectively, are connected as shown in figure through an external resistance 10Ω. The internal resistance of each cell is 5Ω. The potential difference E_A and E_B across the terminals of the cells A and B respectively are



(a) $E_A = 2.0V, E_B = 1.5V$

(b) $E_A = 2.12V, E_B = 1.375V$

(c) $E_A = 1.875V, E_B = 1.625V$

(d) $E_A = 1.875V, E_B = 1.375V$

30. The number of free electrons per 100 mm of ordinary copper wire is 2×10^{21}. Average drift speed of electrons is 0.25 mm/s. The current flowing is

(a) 5 A (b) 80 A (c) 8 A (d) 0.8 A

31. A Daniel cell is balanced on 125 cm length of a potentiometer wire. Now the cell is short circuited by a resistance 2Ω and the balance is obtained at 100cm. The internal resistance of the Daniel cell is

(a) 0.5 Ω (b) 1.5 Ω (c) 1.25 Ω (d) 4/5 Ω

32. A battery of emf E produces currents I_1 and I_2 when connected to external resistances R_1 and R_2 respectively. The internal resistance of the battery is

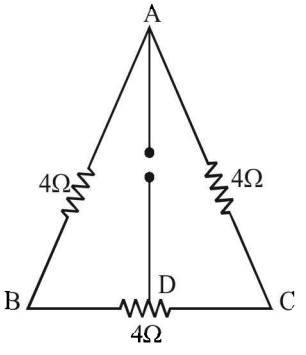
(a) $\frac{I_1R_2 - I_2R_1}{I_2 - I_1}$ (b) $\frac{I_1R_2 + I_2R_1}{I_1 - I_2}$

(c) $\frac{I_1R_1 + I_2R_2}{I_1 - I_2}$ (d) $\frac{I_1R_1 - I_2R_2}{I_2 - I_1}$

33. When two identical batteries of internal resistance 1Ω each are connected in series across a resistor R, the rate of heat produced in R is J_1. When the same batteries are connected in parallel across R, the rate is J_2. If $J_1 = 2.25\ J_2$ then the value of R in Ω is

(a) 4 Ω (b) 6 Ω (c) 0.5 Ω (d) 8 Ω

34. Three resistances of 4Ω each are connected as shown in figure. If the point D divides the resistance into two equal halves, the resistance between point A and D will be



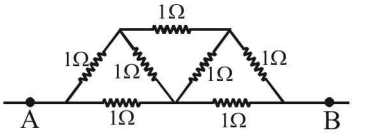
(a) 12Ω (b) 6Ω (c) 3Ω (d) 1/3Ω

35. A wire of diameter 0.01 metre contains 10^{28} free electrons per cubic metre. For an electrical current of 100 A, the drift velocity of the free electrons in the wire is nearly

(a) 1×10^{-19} m/s (b) 5×10^{-10} m/s

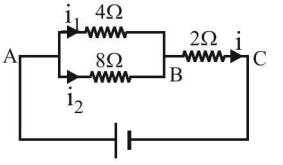
(c) 2×10^{-4} m/s (d) 8×10^{3} m/s

36. In the network shown in the Fig, each resistance is 1Ω. The effective resistance between A and B is



(a) $\frac{4}{3}\Omega$ (b) $\frac{3}{2}\Omega$ (c) 7 Ω (d) $\frac{8}{7}\Omega$

37. In the circuit shown in Fig, the current in 4 Ω resistance is 1.2 A. What is the potential difference between B and C?



(a) 3.6 volt (b) 6.3 volt (c) 1.8 volt (d) 2.4 volt

38. The current through a bulb is increased by 1%. Assuming that the resistance of the filament remains unchanged the power of the bulb will

(a) increase by 1% (b) decrease by 1%

(c) increase by 2% (d) decrease by 2%

39. A 100 watt bulb working on 200 volt has resistance R and a 200 watt bulb working on 100 volt has resistance S then R/S is

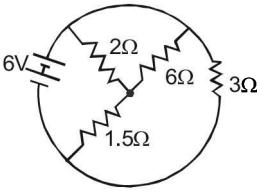
(a) $\frac{1}{8}$ (b) $\frac{1}{4}$ (c) 8 (d) 4

40. It takes 12 minutes to boil 1 litre of water in an electric kettle. Due to some defect it becomes necessary to remove 20% turns of heating coil of the kettle. After repair, how much time will it take to boil 1 litre of water ?

(a) 9.6 minute (b) 14.4 minute

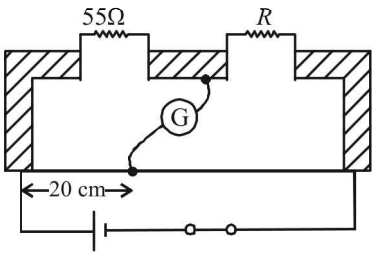
(c) 16.8 minute (d) 18.2 minute

41. The total current supplied to the circuit by the battery is



(a) 4 A (b) 2 A (c) 1 A (d) 6 A

42. Shown in the figure below is a meter-bridge set up with null deflection in the galvanometer.



The value of the unknown resistor R is

(a) 13.75Ω (b) 220Ω (c) 110Ω (d) 55Ω

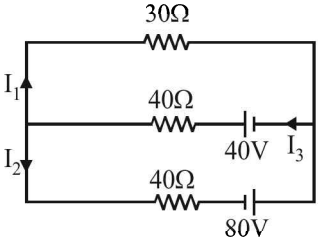
43. A cell in secondary circuit gives null deflection for 2.5 m length of potentiometer having 10 m length of wire. If the length of the potentiometer wire is increased by 1 m without changing the cell in the primary, the position of the null point now is

(a) 3.5m (b) 3m (c) 2.75m (d) 2.0m

44. Two resistors of 6Ω and 9Ω are connected in series to a 120V source. The power consumed by 6Ω resistor is

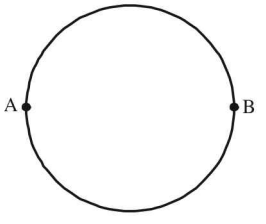
(a) 384 W (b) 616 W (c) 1500 W (d) 1800 W

45. In the given circuit the current I_1 is



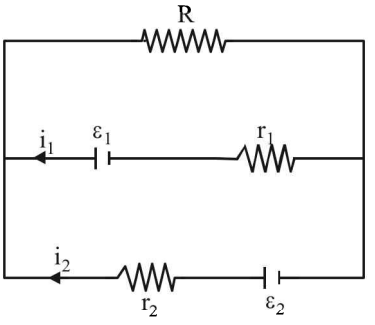
(a) 0.4A (b) –0.4A (c) 0.8A (d) –0.8A

46. A wire of resistance 12 ohms per meter is bent to form a complete circle of radius 10 cm. The resistance between its two diametrically opposite points, A and B as shown in the figure, is



(a) 3Ω (b) 6πΩ (c) 6Ω (d) 0.6πΩ

47. See the electric circuit shown in the figure.



Which of the following equations is a correct equation for it?

(a) $\varepsilon_2 - i_2\, r_2 - \varepsilon_1 - i_1\, r_1 = 0$

(b) $-\varepsilon_2 - (i_1 + i_2) R + i_2\, r_2 = 0$

(c) $\varepsilon_1 - (i_1 + i_2) R + i_1\, r_1 = 0$

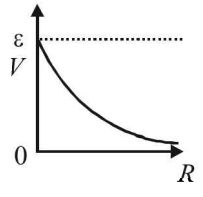
(d) $\varepsilon_1 - (i_1 + i_2) R - i_1\, r_1 = 0$

48. In a large building, there are 15 bulbs of 40 W, 5 bulbs of 100 W, 5 fans of 80 W and 1 heater of 1 kW. The voltage of electric mains is 220 V. The minimum capacity of the main fuse of the building will be:

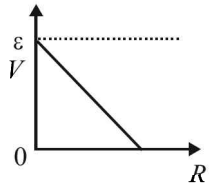
(a) 8A (b) 10A (c) 12A (d) 14A

49. Cell having an emf ε and internal resistance r is connected across a variable external resistance R. As the resistance R is increased, the plot of potential difference V across R is given by

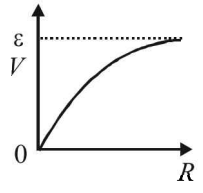
(a)



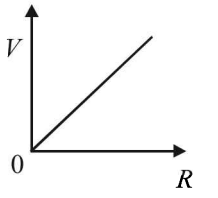
(b)



(c)



(d)



50. Two electric bulbs marked (i) 25W – 220 V and (ii) 100W – 220V are connected in series to a 440 V supply. Which of the bulbs will fuse?

(a) Both (i) and (ii) (b) 100 W –220V

(c) 25 W–220V (d) Neither (i) nor (ii)

Skill Based MCQs

51. Two sources of equal emf are connected to an external resistance R. The internal resistances of the two sources are R_1 and R_2 ($R_2 > R_1$). If the potential difference across the source having internal resistance R_2 is zero then

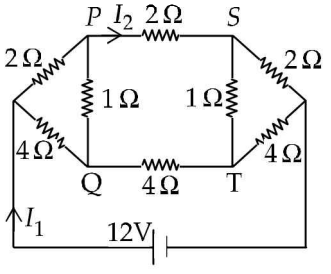
(a) $R = R_1R_2/(R_1 + R_2)$

(b) $R = R_1R_2/(R_2 - R_1)$

(c) $R = R_2 \times (R_1 + R_2)/(R_2 - R_1)$

(d) $R = R_2 - R_1$

52. For the resistance network shown in the figure, choose the incorrect option(s).



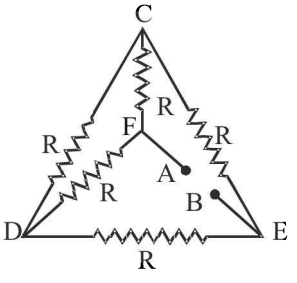
(a) The current through PQ is zero.

(b) $I_1 = 3A$

(c) The potential at S is less than that at Q.

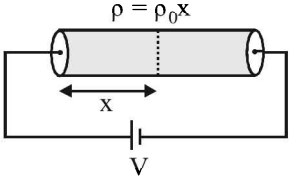
(d) $I_2 = 5A$

53. Five equal resistances each of resistance R are connected as shown in the figure. A battery of V volts is connected between A and B. The current flowing in AFCEB will be



(a) $\frac{2V}{R}$ (b) $\frac{3V}{R}$ (c) $\frac{V}{R}$ (d) $\frac{V}{2R}$

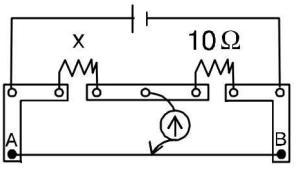
54. A cylindrical solid of length L and radius a is having varying resistivity given by $\rho = \rho_0 x$, where ρ_0 is a positive constant and x is measured from left end of solid. The cell shown in the figure is having emf V and negligible internal resistance. The electric field as a function of x is best described by



(a) $\frac{2V}{L^2}x$ (b) $\frac{2V}{\rho_0 L^2}x$

(c) $\frac{V}{L^2}x$ (d) None of these

55. A meter bridge is set up as shown, to determine an unknown resistance 'X' using a standard 10 ohm resistor. The galvanometer shows null point when tapping-key is at 52 cm mark. The end-corrections are 1 cm and 2 cm respectively for the ends A and B. The determined value of 'X' is

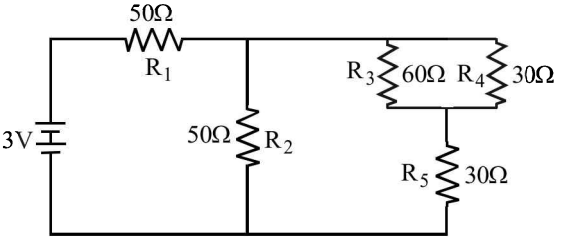


(a) 10.2 ohm (b) 10.6 ohm (c) 10.8 ohm (d) 11.1 ohm

56. A conducting disc of radius R rotates about its axis with an angular velocity ω. Then the potential difference between the centre of the disc and its edge is $\frac{m_e\omega^2R^2}{Ae}$ (no magnetic field is present). Find the value of A.

(a) 2 (b) 3 (c) 4 (d) 5

57. In circuit shown below, the resistances are given in ohms and the battery is assumed ideal with emf equal to 3 volt. The voltage across the resistance R_4 is



(a) 0.4V (b) 0.6V (c) 1.2V (d) 1.5V

58. Two conductors have the same resistance at 0°C but their temperature coefficients of resistance are α_1 and α_2. The respective temperature coefficients of their series and parallel combinations are nearly

(a) $\frac{\alpha_1 + \alpha_2}{2}, \alpha_1 + \alpha_2$ (b) $\alpha_1 + \alpha_2, \frac{\alpha_1 + \alpha_2}{2}$

(c) $\alpha_1 + \alpha_2, \frac{\alpha_1\alpha_2}{\alpha_1 + \alpha_2}$ (d) $\frac{\alpha_1 + \alpha_2}{2}, \frac{\alpha_1 + \alpha_2}{2}$

59. The supply voltage to room is 120V. The resistance of the lead wires is 6Ω. A 60 W bulb is already switched on. What is the decrease of voltage across the bulb, when a 240 W heater is switched on in parallel to the bulb?

(a) zero (b) 2.9 Volt (c) 13.3 Volt (d) 10.04 Volt

60. On interchanging the resistances, the balance point of a meter bridge shifts to the left by 10 cm. The resistance of their series combination is 1kΩ. How much was the resistance on the left slot before interchanging the resistances?

(a) 990 Ω (b) 505 Ω (c) 550 Ω (d) 910 Ω

ANSWER KEY																			
Conceptual MCQs																			
1	(d)	**3**	(a)	**5**	(d)	**7**	(c)	**9**	(a)	**11**	(d)	**13**	(d)	**15**	(a)				
2	(c)	**4**	(c)	**6**	(d)	**8**	(b)	**10**	(b)	**12**	(b)	**14**	(b)						
Application Based MCQs																			
16	(b)	**20**	(b)	**24**	(a)	**28**	(b)	**32**	(d)	**36**	(d)	**40**	(a)	**44**	(a)	**48**	(c)		
17	(a)	**21**	(c)	**25**	(c)	**29**	(c)	**33**	(a)	**37**	(a)	**41**	(a)	**45**	(b)	**49**	(c)		
18	(b)	**22**	(a)	**26**	(b)	**30**	(d)	**34**	(c)	**38**	(c)	**42**	(b)	**46**	(a)	**50**	(c)		
19	(c)	**23**	(b)	**27**	(d)	**31**	(a)	**35**	(c)	**39**	(c)	**43**	(c)	**47**	(d)				
Skill Based MCQs																			
51	(d)	**52**	(d)	**53**	(d)	**54**	(a)	**55**	(b)	**56**	(a)	**57**	(a)	**58**	(d)	**59**	(d)	**60**	(c)