CHAPTER 3

Current Electricity

Current and Motion of Charges

1. Across a metallic conductor of non-uniform cross section a constant potential difference is applied. The quantity which remains constant along the conductor is: **[RC]** *(2015)*

a. Current
b. Drift velocity
c. Electric field
d. Current density

Ohm's Law Resistance and Resistivity

2. Two solid conductors are made up of same material have same length and same resistance. One of them has a circular cross section of area A_1 and the other one has a square cross section of area A_2. The ratio A_1/A_2 is *(2020-Covid)*

a. 1
b. 0.8
c. 2
d. 1.5

3. The resistance of a wire is 'R' ohm. If it is melted and stretched to 'n' times its original length, its new resistance will be: *(2017-Delhi)*

a. $\frac{R}{n}$
b. n^2R
c. $\frac{R}{n^2}$
d. nR

4. A wire of resistance 4 Ω is stretched to twice its original length. The resistance of stretched wire would be: *(2013)*

a. 16 Ω
b. 2 Ω
c. 4 Ω
d. 8 Ω

Resistance and Conductance

5. A copper wire of length 10 m and radius $(10^{-2}/\sqrt{\pi})$ m has electrical resistance of 10 Ω. The current density in the wire for an electric field strength of 10 V/m is : *(2022)*

a. 10^5 A/m^2
b. 10^4 A/m^2
c. 10^6 A/m^2
d. 10^{-5} A/m^2

6. Column-I gives certain physical terms associated with flow of current through a metallic conductor. Column-II gives some mathematical relations involving electrical quantities. Match Column-I and Column-II with appropriate relations. *(2021)*

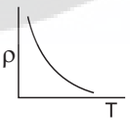
Column-I		Column-II	
(A)	Drift Velocity	(P)	$\frac{m}{ne^2\rho}$
(B)	Electrical Resistivity	(Q)	nev_d
(C)	Relaxation Period	(R)	$\frac{eE}{m}\tau$
(D)	Current Density	(S)	$\frac{E}{J}$

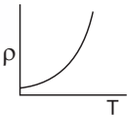
a. (A) - (R), (B) - (S), (C) - (Q), (D) - (P)
b. (A) - (R), (B) - (P), (C) - (S), (D) - (Q)
c. (A) - (R), (B) - (Q), (C) - (S), (D) - (P)
d. (A) - (R), (B) - (S), (C) - (P), (D) - (Q)

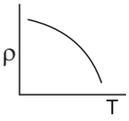
7. A charged particle having drift velocity of 7.5×10^{-4} m S^{-1} in an electric field of 3×10^{-10} Vm^{-1}, has a mobility in $m^2\ V^{-1}\ S^{-1}$ of : *(2020)*

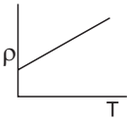
a. 2.5×10^6
b. 2.5×10^{-6}
c. 2.25×10^{-15}
d. 2.25×10^{15}

8. Which of the following graph represents the variation of resistivity (ρ) with temperature (T) for copper *(2020)*

a. 

b. 

c. 

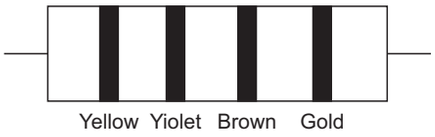
d. 

9. Two metal wires of identical dimensions are connected in series. If σ_1 and σ_2 are the conductivities of the metal wires respectively, the effective conductivity of the combination is: *(2015 Re)*

a. $\frac{\sigma_1\sigma_2}{\sigma_1+\sigma_2}$
b. $\frac{2\sigma_1\sigma_2}{\sigma_1+\sigma_2}$
c. $\frac{\sigma_1+\sigma_2}{2\sigma_1\sigma_2}$
d. $\frac{\sigma_1+\sigma_2}{\sigma_1\sigma_2}$

Colour Code of Carbon Resistance

10. The color code of a resistance is given below: **[RC]** *(2020)*



The values of resistance and tolerance, respectively, are:

a. 47 kΩ, 10%

b. 4.7 kΩ, 5%

c. 470 Ω, 5%

d. 470 kΩ, 5%

11. A carbon resistor of (47 ± 4.7) kΩ is to be marked with rings of different colours for its identification. The colour code sequence will be **[RC]** *(2018)*

a. Yellow – Green – Violet – Gold

b. Yellow – Violet – Orange – Silver

c. Violet – Yellow – Orange – Silver

d. Green – Orange – Violet – Gold

Combination of Resistance

12. The effective resistance of a parallel connection that consists of four wires of equal length, equal area of cross-section and same material is 0.25 Ω. What will be the effective resistance if they are connected in series? *(2021)*

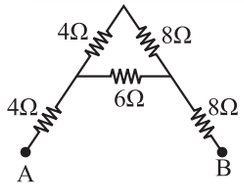
a. 0.5 Ω

b. 1 Ω

c. 4 Ω

d. 0.25 Ω

13. The equivalent resistance between A and B for the mesh shown in the figure is *(2020-Covid)*



a. 16 Ω b. 30 Ω

c. 4.8 Ω d. 7.2 Ω

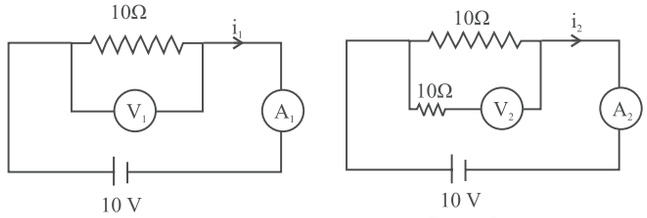
14. A circuit contains an ammeter, a battery of 30 V and a resistance 40.8 ohm all connected in series. If the ammeter has a coil of resistance 480 ohm and a shunt of 20 ohm, the reading in the ammeter will be: *(2015 Re)*

a. 1 A b. 0.5 A

c. 0.25 A d. 2 A

Internal Resistance of a Cell and Grouping

15. In the circuits shown below, the readings of the voltmeters and the ammeters will be *(2019)*



a. $V_2 > V_1$ and $i_1 = i_2$ b. $V_1 = V_2$ and $i_1 > i_2$

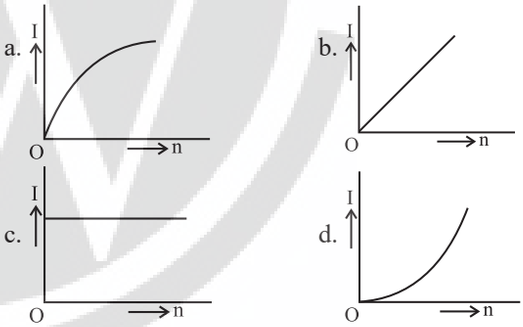
c. $V_1 = V_2$ and $i_1 = i_2$ d. $V_2 > V_1$ and $i_1 > i_2$

16. A set of 'n' equal reistors, of value 'R' each, are connected in series to a battery of emf 'E' and internal resistance 'R'. The current drawn is I. Now, the 'n' resistors are connected in parallel to the same battery. Then the current drawn from battery becomes 10 I. The value of 'n' is *(2018)*

a. 20 b. 11

c. 10 d. 9

17. A battery consists of a variable number 'n' of identical cells (having internal resistance 'r' each) which are connected in series. The terminals of the battery are short-circuited and the current I is measured. Which of the graphs shows the correct relationship between I and n? *(2018)*



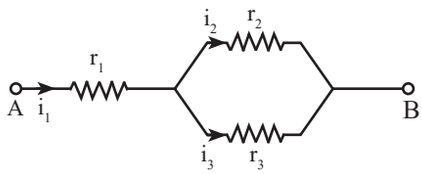
18. The internal resistance of a 2.1 V cell which gives a current of 0.2 A through a resistance of 10 Ω is: *(2013)*

a. 1.0 Ω b. 0.2 Ω

c. 0.5 Ω d. 0.8 Ω

Kirchhoff's Law

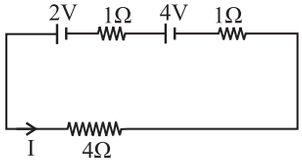
19. Three resistors having resistances r_1, r_2 and r_3 are connected as shown in the given circuit. The ratio $\frac{i_3}{i_1}$ of currents in terms of resistances used in the circuit is: *(2021)*



a. $\frac{r_2}{r_2 + r_3}$ b. $\frac{r_1}{r_1 + r_2}$

c. $\frac{r_2}{r_1 + r_3}$ d. $\frac{r_1}{r_2 + r_3}$

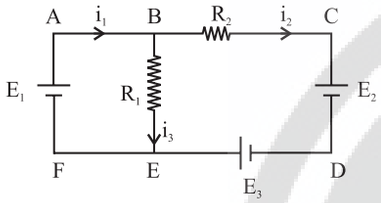
20. For the circuit shown in the figure, the current I will be *(2020-Covid)*



a. 1 A b. 1.5 A

c. 0.5 A d. 0.75 A

21. For the circuit given below, the Kirchoff's loop rule for the loop BCDEB is given by the equation *(2020-Covid)*



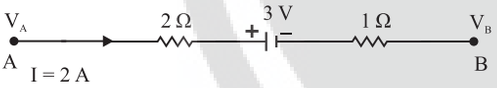
a. $i_2R_2 + E_2 - E_3 - i_3R_1 = 0$

b. $i_2R_2 + E_2 + E_3 - i_3R_1 = 0$

c. $-i_2R_2 + E_2 + E_3 - i_3R_1 = 0$

d. $-i_2R_2 + E_2 - E_3 - i_3R_1 = 0$

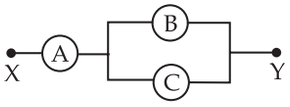
22. The potential difference $(V_A - V_B)$ between the points A and B in the given figure is: *(2016 - II)*



a. + 6 V b. +9 V

c. –3 V d. +3 V

23. A, B and C are voltmeters of resistance R, 1.5R and 3R respectively as shown in the figure. When some potential difference is applied between X and Y, the voltmeter readings are V_A, V_B and V_C respectively, then: *(2015)*

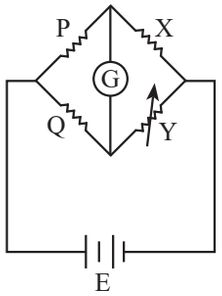


a. $V_A \neq V_B \neq V_C$ b. $V_A = V_B \neq V_C$

c. $V_A \neq V_B \neq V_C$ d. $V_A = V_B = V_C$

Wheatstone and Meter Bridge

24. A wheatstone bridge is used to determine the value of unknown resistance X by adjusting the variable resistance Y as shown in the figure. For the most precise measurement of X, the resistances P and Q: *(2022)*



a. do not play any significant role

b. should be approximately equal to 2X

c. should be approximately equal and are small

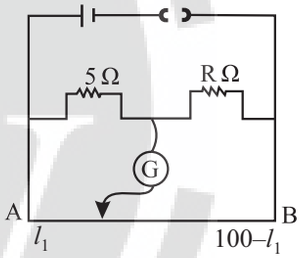
d. should be very large and unequal

25. A resistance wire connected in the left gap of a metre bridge balances a 10Ω resistance in the right gap at a point which divides the bridge wire in the ratio 3 : 2. If the length of the resistance wire is 1.5 m, then the length of 1Ω of the resistance wire is: *(2020)*

a. 1.0×10^{-1} m b. 1.5×10^{-1} m

c. 1.5×10^{-2} m d. 1.0×10^{-2} m

26. The resistances in the two arms of the meter bridge are 5 Ω and R Ω , respectively. When the resistance R is shunted with an equal resistance, the new balance point is at 1.6 l_1. The resistance R is: *(2014)*



a. 10 Ω b. 15 Ω

c. 20 Ω d. 25 Ω

27. The resistances of the four arms P, Q, R and S in a Wheatstone's bridge are 10 ohm, 30 ohm, 30 ohm and 90 ohm, respectively. The e.m.f. and internal resistance of the cell are 7 volt and 5 ohm respectively. If the galvanometer resistance is 50 ohm, the current drawn from the cell will be: *(2013)*

a. 2.0 A b. 1.0 A

c. 0.2 A d. 0.1 A

Potentiometer (i) Comparison of E.M.F. of Two Cells (ii) Internal Resistance of a Cell

28. In a potentiometer circuit a cell of EMF 1.5 V gives balance point at 36 cm length of wire. If another cell of EMF 2.5 V replaces the first cell, then at what length of the wire, the balance point occurs? **[RC]** *(2021)*

a. 21.6 cm b. 64 cm

c. 62 cm d. 60 cm

29. A potentiometer is an accurate and versatile device to make electrical measurements of E.M.F. because the method involves: **[RC]** *(2017-Delhi)*

a. Potential gradients

b. A condition of no current flow through the galvanometer

c. A combination of cells, galvanometer and resistances

d. Cells

30. A potentiometer wire is 100 cm long and a constant potential difference is maintained across it. Two cells are connected in series first to support one another and then in opposite direction. The balance points are obtained at 50 cm and 10 cm from the positive end of the wire in the two cases. The ratio of emf's is: **[RC]** *(2016 - I)*

a. 5 : 1 b. 5 : 4

c. 3 : 4 d. 3 : 2

31. A potentiometer wire has length 4 m and resistance 8 Ω. The resistance that must be connected in series with the wire and an accumulator of e.m.f. 2 V, so as to get a potential gradient 1 mV per cm on the wire is: **[RC]** *(2015)*

a. 40 Ω b. 44 Ω

c. 48 Ω d. 32 Ω

32. A potentiometer wire of length L and a resistance r are connected in series with a battery of e.m.f. E_0 and a resistance r_1. An unknown e.m.f. E is balanced at a length l of the potentiometer wire. The e.m.f. E will be given by:

[RC] *(2015 Re)*

a. $\frac{LE_0r}{(r+r_1)\ell}$ b. $\frac{LE_0r}{\ell r_2}$

c. $\frac{E_0r}{(r+r_1)}.\frac{\ell}{L}$ d. $\frac{E_0\ell}{L}$

33. A potentiometer circuit has been set up for finding the internal resistance of a given cell. The main battery, used across the potentiometer wire, has an emf of 2.0 V and a negligible internal resistance. The potentiometer wire itself is 4 m long. When the resistance, R, connected across the given cell, has values of (i) Infinity (ii) 9.5 Ω

The 'balancing lengths', on the potentiometer wire are found to be 3 m and 2.85 m, respectively. The value of internal resistance of the cell is: **[RC]** *(2014)*

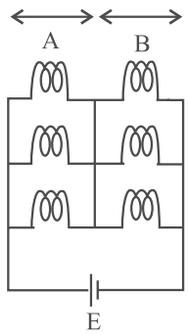
a. 0.25 Ω b. 0.95 Ω

c. 0.5 Ω d. 0.75 Ω

Electrical Power

34. Six similar bulbs are connected as shown in the figure with a DC source of emf E and zero internal resistance.

The ratio of power consumption by the bulbs when (i) all are glowing and (ii) in the situation when two from section A and one from section B are glowing, will be: *(2019)*



a. 4 : 9 b. 9 : 4

c. 1 : 2 d. 2 : 1

35. A filament bulb (500 W, 100 V) is to be used in a 230 V main supply. When a resistance R is connected in series, it works perfectly and the bulb consumes 500 W. The value of R is: *(2016 - II)*

a. 26 Ω b. 13 Ω

c. 230 Ω d. 46 Ω

36. Two cities are 150 km apart. Electric power is sent from one city to another city through copper wires. The fall of potential per km is 8 volt and the average resistance per km is 0.5 Ω. The power loss in the wire is: *(2014)*

a. 19.2 W b. 19.2 kW

c. 19.2 J d. 12.2 kW

Electric Energy and Heating of Current

37. As the temperature increases, the electrical resistance: *(2022)*

a. decrease for conductors but increases for semiconductors

b. increases for both conductors and semiconductors

c. decreases for both conductors and semiconductors

d. increases for conductors but decreases for semiconductors

38. Two resistors of resistance, 100 Ω and 200 Ω are connected in parallel in an electrical circuit. The ratio of the thermal energy developed in 100 Ω to that in 200 Ω in a given time is: *(2022)*

a. 4 : 1 b. 1 : 2

c. 2 : 1 d. 1 : 4

39. Which of the following acts as a circuit protection device? *(2019)*

a. Conductor b. Inductor

c. Switch d. Fuse

40. The charge flowing through a resistance R varies with time t as $Q = at - bt^2$, where a and b are positive constants. The total heat produced in R is: *(2016 - I)*

a. $\frac{a^3R}{6b}$ b. $\frac{a^3R}{3b}$

c. $\frac{a^3R}{2b}$ d. $\frac{a^3R}{b}$

Answer Key

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
a	a	b	a	a	d	a	b	b	c	b	c	a	b	c	c	c
18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
c	a	a	a	b	d	c	a	b	c	d	b	d	d	c	c	b
35	36	37	38	39	40											
a	b	d	c	d	a											