V PLUS U
IIT/PMT INSTITUTE

CHAPTER TEST

Subject : Physics **Topic : Current Electricity** **M.M. : 180**

Have patience all things are difficult before they become easy.

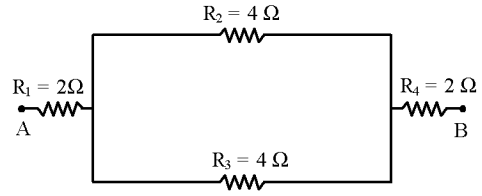
Marking Scheme:
(i) Each question is allotted 4 (four) marks for each correct response.
(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

Q.1 The relaxation time in conductors
(A) Increases with the increase of temperature
(B) Decreases with the increase of temperature
(C) It does not depend on temperature
(D) All of sudden changes at 400 K

Q.2 A wire of diameter 0.02 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

Q.3 Three resistances, each of 1 ohm, are joined in parallel. Three such combinations are put in series, then the resultant resistance will be
(A) 9 ohm (B) 3 ohm
(C) 1 ohm (D) (1/3) ohm

Q.4 In the given figure, the equivalent resistance between the points A and B is



(A) 8 Ω (B) 6 Ω
(C) 4 Ω (D) 2 Ω

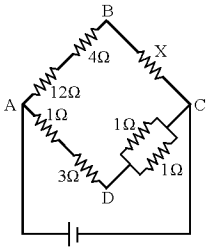
Q.5 A uniform wire of resistance 9 Ω is cut into 3 equal parts. They are connected in the form of equilateral triangle ABC. A cell of e.m.f. 2V and negligible internal resistance is connected across B and C. Potential difference across AB is
(A) 1 V (B) 2 V
(C) 3 V (D) 0.5 V

Q.6 Two wires of the same dimensions but resistivities ρ_1 and ρ_2 are connected in series. The equivalent resistivity of the combination is

(A) $\rho_1 + \rho_2$ (B) $\dfrac{\rho_1 + \rho_2}{2}$

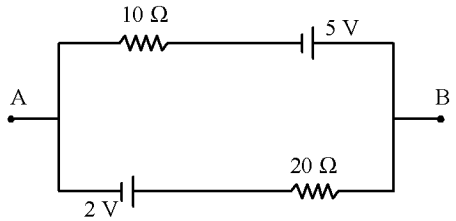
(C) $\sqrt{\rho_1 \rho_2}$ (D) $2(\rho_1 + \rho_2)$

Q.7 In the circuit shown in the adjoining figure, the current between B and D is zero, the unknown resistance is of
(A) 4Ω
(B) 2Ω
(C) 3Ω
(D) em.f. of a cell is required to find the value of X



Q.8 A wire has a resistance of 6 Ω. It is cut into two parts and both half values are connected in parallel. The new resistance is –
(A) 12 Ω (B) 1.5 Ω
(C) 3 Ω (D) 6 Ω

Q.9 The current in the given circuit is



(A) 0.1 A (B) 0.2 A
(C) 0.3 A (D) 0.4 A

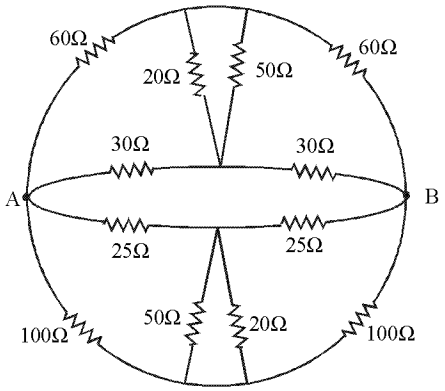
Q.10 Potentiometer wire of length 1 m is connected in series with 490Ω resistance and 2V battery. If 0.2 mV/cm is the potential gradient, then resistance of the potentiometer wire is
(A) 4.9Ω (B) 7.9Ω
(C) 5.9Ω (D) 6.9Ω

Q.11 A steady current flows through the potentiometer wire. When an unknown emf is measured the balance point is found to be at the position of 45cm from positive end of the potentiometer wire. When a standard cell with emf 1.018 V is used, the jockey position is 30 cm at balance. What is the unknown emf?

(A) 1.018 V (B) 0.679 V

(C) 1.527 V (D) none of the above.

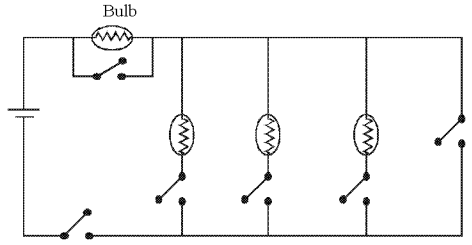
Q.12 Equivalent resistance is 10xΩ between points A and B. Find the value of x. Values of resistance are as shown in figure.



(A) 1 (B) 2

(C) 3 (D) 4

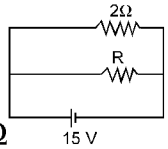
Q.13 In the circuit shown what is the maximum number of switches that must be closed to turn on the bulb



(A) 1 (B) 2

(C) 3 (D) 4

Q.14 If energy consumption of this circuit is 150 watt then find the value of resistance –



(A) 2 Ω (B) 4 Ω

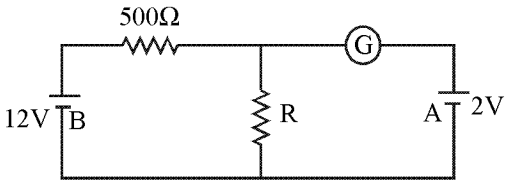
(C) 6 Ω (D) 8 Ω

Q.15 The resistance of the series combination of two resistance is S. When they are joined in parallel the total resistance is P. If S = n P then the minimum possible value of n is –

(A) 4 (B) 3

(C) 2 (D) 1

Q.16 In the circuit, the galvanometer G shows zero deflection. If the batteries A and B have negligible internal resistance, the value of the resistor R will



(A) 200 Ω (B) 100 Ω

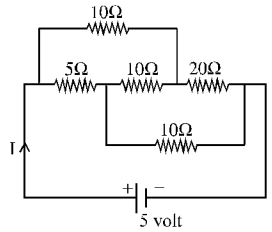
(C) 500 Ω (D) 1000 Ω

Q.17 A material 'B' has twice the specific resistance of 'A'. A circular wire made of 'B' has twice the diameter of a wire made of 'A'. then for the two wires to have the same resistance, the ratio ℓ_B/ℓ_A of their respective lengths must be –

(A) 1/4 (B) 2

(C) 1 (D) 1/2

Q.18 The current I drawn from the 5 volt source will be –



(A) 0.67 A

(B) 0.17 A

(C) 0.33 A

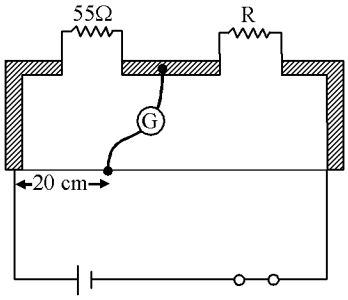
(D) 0.5 A

Q.19 In a metre bridge experiment null point is obtained at 20 cm from one end of the wire when resistance X is balanced against another resistance Y. If X < Y, then where will be the new position of the null point from the same end, if one decides to balance a resistance of 4X against.

(A) 50 cm (B) 80 cm

(C) 40 cm (D) 70 cm

Q.20 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

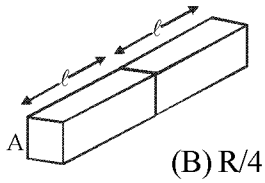
(A) 220 Ω (B) 110 Ω

(C) 55 Ω (D) 13.75 Ω

Q.21 If a wire is stretched to make it 0.1% longer, its resistance will :
(A) increase by 0.05%
(B) increase by 0.2%
(C) decrease by 0.2%
(D) decrease by 0.05%

Q.22 A galvanometer of resistance 25Ω gives full scale deflection for a current of 10 milliampere, is to be changed into a voltmeter of range 100 V by connecting a resistance of 'R' in series with galvanometer. The value of resistance R in Ω is
(A) 10000 (B) 10025
(C) 975 (D) 9975

Q.23 In the given figure, the current through the combination is I & the resistance of the combination R_c is (Given resistance of one block is R)



(A) R/2 (B) R/4
(C) (3/4) R (D) 2R

Q.24 The resistance of a heating element is 99 Ω at room temperature. What is the temperature of the element if the resistance is found to be 116Ω?
(Temperature coefficient of the material of the resistor is $1.7 \times 10^{-4}\ C^{-1}$)
(A) 999.9°C (B) 1005.3°C
(C) 1020.2°C (D) 1037.1°C

Q.25 The current in a wire varies with time according to the equation I = 4 + 2 t, where I is in ampere and t is in second. The quantity of charge which has to be passed through a cross–section of the wire during the time t = 2 s to t = 6 s is
(A) 40 C (B) 48 C
(C) 38 C (D) 43 C

Q.26 Resistivities of insulators are –
(A) 10^{18} times greater than metals more.
(B) 10^{18} times lesser than metals.
(C) 10^{8} times greater than metals.
(D) 10^{8} times lesser than metals.

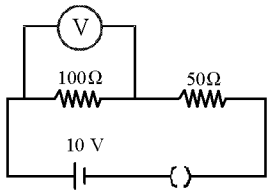
Q.27 If there are n cells of emf $\varepsilon_1, ..., \varepsilon_n$ and of internal resistances $r_1,...., r_n$ respectively, connected in parallel, the combination is equivalent to a single cell of emf ε_{eq} and internal resistance r_{eq} given

(A) $\frac{1}{r_{eq}} = \frac{1}{r_1} + ... + \frac{1}{r_n}, \frac{\varepsilon_{eq}}{r_{eq}} = \frac{\varepsilon_1}{r_1} + ... + \frac{\varepsilon_n}{r_n}$

(B) $r_{eq} = r_1 + ... + r_n, \frac{r_{eq}}{\varepsilon_{eq}} = \frac{r_1}{\varepsilon_1} + ... + \frac{r_n}{\varepsilon_n}$

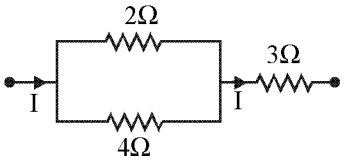
(C) both (A) and (B)
(D) None of the above

Q.28 In the given circuit, the voltmeter records 5 volts. The resistance of the voltmeter in ohms is



(A) 200 (B) 100
(C) 10 (D) 50

Q.29 In the circuit shown in figure heat developed across 2Ω, 4Ω and 3Ω resistances are in the ratio of



(A) 2 : 4 : 3 (B) 8 : 4 : 12
(C) 4 : 8 : 27 (D) 8 : 4 : 27

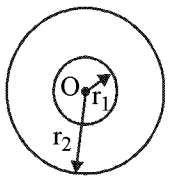
Q.30 A resistance R is to be measured using a meter bridge. Student chooses the standard resistance S to be 100Ω. He finds the null point at $\ell_1 = 2.9$ cm. He is told to attempt to improve the accuracy. Which of the following is a useful way?
(A) He should measure ℓ_1 more accurately.
(B) He should change S to 1000Ω and repeat the experiment.
(C) He should change S to 3Ω and repeat the experiment.
(D) He should give up hope of a more accurate measurement with a meter bridge.

Q.31 The current density J is given by

(A) $J = \frac{ne^2}{m}E$ (B) $J = \frac{ne^2}{m}\tau E$

(C) $J = \frac{2ne^2}{m}\tau E$ (D) $J = \frac{ne^2}{2m}\tau E$

Q.32 Space between two concentric spheres of radii r_1 and r_2, such that $r_1 < r_2$, is filled with a material of resistivity ρ. Find the resistance between inner and outer surface of the material.



(A) $\frac{r_1}{r_2}\frac{\rho}{2}$ (B) $\frac{r_2 - r_1}{r_1 r_2}\frac{\rho}{4\pi}$

(C) $\frac{r_1 r_2}{r_2 - r_1}\frac{\rho}{4\pi}$ (D) None of these

Q.33 Resistances P, Q, S and R are arranged in a cyclic order to form a balanced Wheatstone's network. The ratio of power consumed in the branches (P + Q) and (R + S) is

(A) 1 : 1 (B) R : P

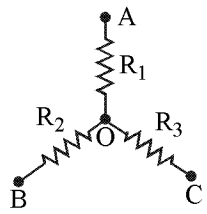
(C) $P^2 : Q^2$ (D) $P^2 : R^2$

Q.34 In the series combination of n cells each cell having emf ε and internal resistance r. If three cells are wrongly connected, then total emf and internal resistance of this combination will be

(A) $n\varepsilon$, $(nr - 3r)$ (B) $(n\varepsilon - 2\varepsilon)$, nr

(C) $(n\varepsilon - 4\varepsilon)$, nr (D) $(n\varepsilon - 6\varepsilon)$, nr

Q.35 A circuit has a section ABC as shown in figure. If the potentials at points A, B and C are V_1, V_2 and V_3 respectively. The potential at point O is –



(A) $V_1 + V_2 + V_3$

(B) $\left[\frac{V_1}{R_1} + \frac{V_2}{R_2} + \frac{V_3}{R_3}\right]\left[\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right]^{-1}$

(C) Zero

(D) $\left[\frac{V_1}{R_1} + \frac{V_2}{R_2} + \frac{V_3}{R_3}\right](R_1 + R_2 + R_3)$

Q.36 The relation of equation $\rho_T = \rho_0 [1 + \alpha (T - T_0)$ implies that a graph of ρ_T plotted against T would be a

(A) parabola (B) straight line

(C) semi–cirele (D) hyperbola

Q.37 Nichrome or Manganin is widely used in wire bound standard resistors because of their

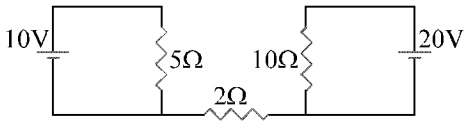
(A) temperature independent resistivity.

(B) very weak temperature dependent resistivity.

(C) strong dependence of resistivity with temperature.

(D) mechanical strength.

Q.38 Find the value of current through 2Ω resistance for the given circuit.



(A) 5A (B) 2A

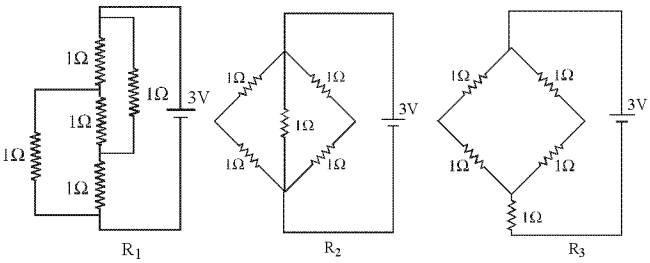
(C) zero (D) 4A

Q.39 A resistance of 2Ω is connected across one gap of a meter-bridge (the length of the wire is 100 cm.) and an unknown resistance, greater 2Ω, is connected across the other gap. When these resistances are interchanged, the balance point shifts by 20 cm. Neglecting end corrections, the unknown resistance is –

(A) 3Ω (B) 4Ω

(C) 5Ω (D) 6Ω

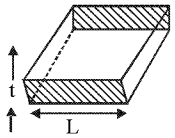
Q.40 Figure shows three resistor configurations R_1, R_2 and R_3 connected to 3V battery. If the power dissipated by the configuration R_1, R_2 and R_3 is P_1, P_2 and P_3, respectively, then –



(A) $P_1 > P_2 > P_3$ (B) $P_1 > P_3 > P_2$

(C) $P_2 > P_1 > P_3$ (D) $P_3 > P_2 > P_1$

Q.41 Consider a thin square sheet of side L and thickness t, made of a material of resistivity ρ. The resistance between two opposite faces, shown by the shaded areas in the figure is –



(A) directly proportional to L

(B) directly proportional to t

(C) independent of L

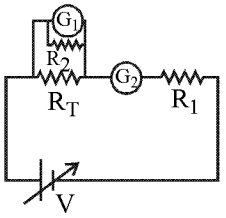
(D) independent of t

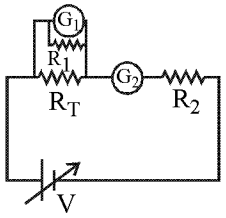
Q.42 Incandescent bulbs are designed by keeping in mind that the resistance of their filament increases with increase in temperature. If at room temperature, 100 W, 60 W and 40 W bulbs have filament resistances R_{100}, R_{60} and R_{40}, respectively, the relation between these resistance is –

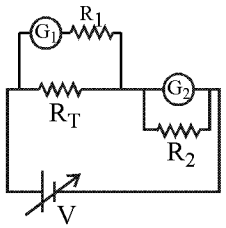
(A) $\frac{1}{R_{100}} = \frac{1}{R_{40}} + \frac{1}{R_{60}}$ (B) $R_{100} = R_{40} + R_{60}$

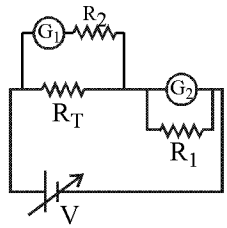
(C) $R_{100} > R_{60} > R_{40}$ (D) $\frac{1}{R_{100}} > \frac{1}{R_{60}} > \frac{1}{R_{40}}$

Q.43 To verify Ohm's law, a student is provided with a test resistor R_T, a high resistance R_1, a small resistance R_2, two identical galvanometers G_1 and G_2, and a variable voltage source V. The correct circuit to carry out the experiment is–

(A) 

(B) 

(C) 

(D) 

Q.44 When a wire of uniform cross-section a, length ℓ and resistance R is bent into a complete circle, resistance between any two of diametrically opposite points will be –

(A) R/4 (B) 4R

(C) R/8 (D) R/2

Q.45 A 5A fuse wire can withstand a maximum power of 1W in circuit. The resistance of the fuse wire is

(A) 0.2Ω (B) 5Ω

(C) 0.4 Ω (D) 0.04 Ω