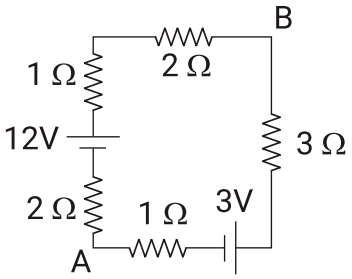
Part - A Physics

Section - I: Single Correct

This section contains a total of 50 questions.
All questions in this section are mandatory.
For every correct response you shall be awarded 1 marks.
For every incorrect response 0 marks shall be deducted.

1. Potential difference $V_B - V_A$ in the network shown is



(a) 7 V (b) 6 V
(c) 5 V (d) 8 V

2. A. The drift velocity of electrons decreases with the increase in the temperature of conductor.
B. The drift velocity is inversely proportional to the area of cross-section of given conductor.
C. The drift velocity does not depend on the applied potential difference to the conductor.
D. The drift velocity of the electrons is inversely proportional to the length of the conductor.
E. The drift velocity increases with the increase in the temperature of conductor.
Choose the correct answer from the options given below:

(a) A and B only
(b) A and D only
(c) B and E only
(d) B and C only

3. A source of emf $E = 15$ V and having negligible internal resistance is connected to a variable resistance so that the current in the circuit increases with time as $I = 1.2t + 3$. Find out the total charge that will flow in first five second?

(a) 10 C (b) 20 C
(c) 30 C (d) 40 C

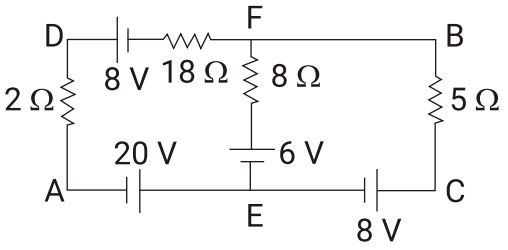
4. The potential difference between the terminals of a cell is found to be 3 volts when it is connected to a resistance of value equal to its internal resistance. The e.m.f. of the cell is

(a) 3 V (b) 6 V
(c) 1.5 V (d) 4.5 V

5. The ratio of the thermal energy released in two resistors R and $3\mathrm{R}$ connected in parallel in an electric circuit is:

(a) $1:1$
(b) $1:3$
(c) $1:27$
(d) $3:1$

6. In the circuit shown in the figure, no current flows through the8Ω resistor, then the potential difference between points A and B ($V_A - V_B$) is

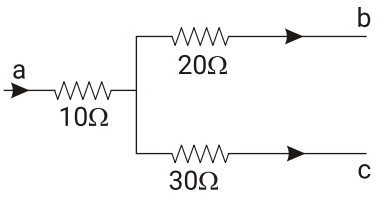


(a) 14V
(b) 12V
(c) −26V
(d) −12V

7. Two cells of e.m.f. E_1 and E_2 are joined in series and the balancing length of the potentiometer wire is 625 cm. If the terminals of E_1 are reversed, the balancing length obtained is 125 cm. Given $E_2 > E_1$, the ratio $E_1 : E_2$ will be

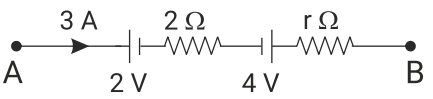
(a) 2 : 3 (b) 5 : 1
(c) 3 : 2 (d) 1 : 5

8. The figure shows a part of an electric circuit. The potentials at points a, b and c are 30 V, 12 V and 2 V respectively. The current through the $20\ \Omega$ resistor will be.



(a) 0.4 A
(b) 0.2 A
(c) 0.6 A
(d) 1.0 A

9.



In the shown part of the circuit, $\mathrm{V_A} - \mathrm{V_B} = 7$ Volt. Find the resistance r.

(a) 1 (b) 2
(c) 1.5 (d) 2.5

10. An electric lamp is marked 60 W, 230 V. The cost of 1 kilowatt hour of power is Rs.1.25. The cost of using this lamp for 8 hours is

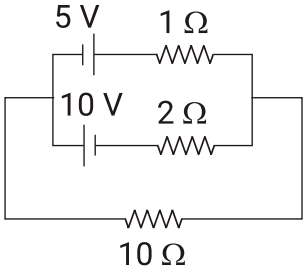
(a) Rs. 1.20

(b) Rs. 4.00

(c) Rs. 0.25

(d) Rs. 0.60

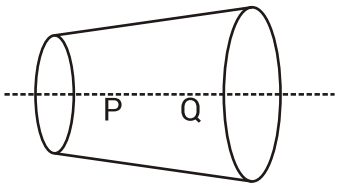
11. Current through 10Ω resistor shown in figure is



(a) Zero (b) 1 A

(c) 1.5 A (d) 2 A

12. A wire has a non-uniform cross-section as shown in the figure. A steady current flows through it. The drift speed of electrons at points P and Q is v_P and v_Q, then



(a) $v_P = v_Q$

(b) $v_P < v_Q$

(c) $v_P > v_Q$

(d) data is insufficient

13. An electric bulb is designed to draw a power P_0 at voltage V_0. If the voltage is V, it draws a power P, then

(a) $P = \left(\frac{V}{V_0}\right)P_0$

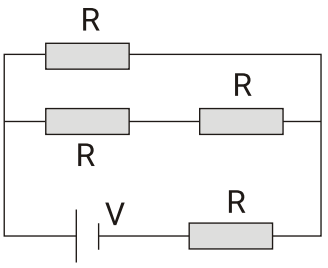
(b) $P = \left(\frac{V_0}{V}\right)P_0$

(c) $P = \left(\frac{V_0}{V}\right)^2 P_0$

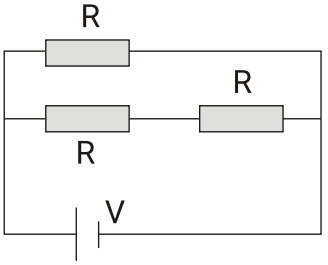
(d) $P = \left(\frac{V}{V_0}\right)^2 P_0$

14. Four circuits are shown below. All the batteries have the same voltage V and all resistors have the same resistance R. In which circuit does the battery deliver the most power?

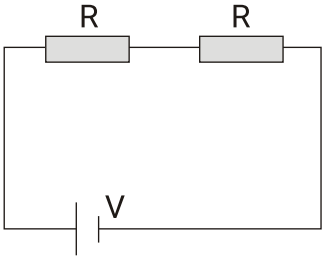
(a)



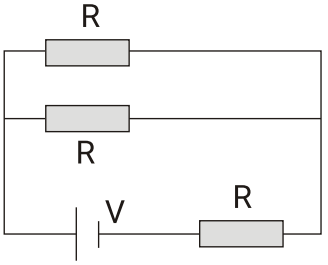
(b)



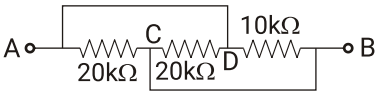
(c)



(d)



15. The equivalent resistance between A and B as shown in the figure is:



(a) $5\ \text{k}\Omega$

(b) $30\ \text{k}\Omega$

(c) $10\ \text{k}\Omega$

(d) $20\ \text{k}\Omega$

16. The resistance of a platinum wire at $0°C$ is $2\ \Omega$ and $6.8\ \Omega$ at $80\ °C$. The temperature coefficient of the resistance of the wire is:

(a) $3 \times 10^{-3}\ °C^{-1}$

(b) $3 \times 10^{-2}\ °C^{-1}$

(c) $3 \times 10^{-1}\ °C^{-1}$

(d) $3 \times 10^{-4}\ °C^{-1}$

17. A (25 W, 200 V) and a (100 W, 200 V) bulb are connected in series to a source of 400 volts. What is the power dissipated in the circuit?

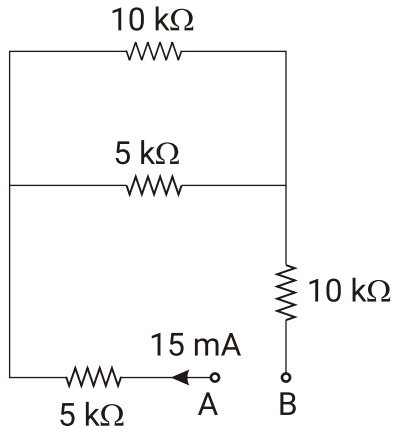
(a) 80 W

(b) 100 W

(c) 200 W

(d) None of the above

18. A current of 15 mA flows in the circuit as shown in figure. The value of potential difference between the points A and B will be



(a) 50 V (b) 75 V

(c) 150 V (d) 275 V

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

(a) 10^6 A/m^2

(b) 10^{-5} A/m^2

(c) 10^5 A/m^2

(d) 10^4 A/m^2

20. There are 8.4×10^{22} free electrons per cm^3 in copper. The current in a copper wire of 1 mm^2 cross-section is 0.21 A ($e = 1.6 \times 10^{-19}$ C). The drift velocity of electrons is

(a) 2.12×10^{-5} m/s

(b) 0.78×10^{-5} m/s

(c) 1.56×10^{-5} m/s

(d) none of these

21. The charge flowing in a conductor changes with time as $Q(t) = \alpha t - \beta t^2 + \gamma t^3$. Where α, β and γ are constants. The minimum value of the current is:

(a) $\alpha - \frac{\gamma^2}{3\beta}$

(b) $\alpha - \frac{\beta^2}{3\gamma}$

(c) $\alpha - \frac{3\beta^2}{\gamma}$

(d) $\beta - \frac{\alpha^2}{3\gamma}$

22. A galvanometer has a resistance of $50\ \Omega$ and it allows maximum current of 5 mA. It can be converted into a Voltmeter to measure upto 100 V by connecting in series a resistor of resistance:

(a) $20050\ \Omega$

(b) $5975\ \Omega$

(c) $19950\ \Omega$

(d) $19500\ \Omega$

23. A potential difference of 5 V is applied across a conductor of length 10 cm. If drift velocity of electrons is 2.5×10^{-4} m/s, then electron mobility will be

(a) $5 \times 10^{-4}\ m^2\ V^{-1}\ s^{-1}$

(b) $5 \times 10^{-6}\ m^2\ V^{-1}\ s^{-1}$

(c) $5 \times 10^{-2}\ m^2\ V^{-1}\ s^{-1}$

(d) Zero

24. A potentiometer is an accurate and versatile device to make electrical measurements of E.M.F, because the method involves:

(a) Cells

(b) Potential gradients

(c) A condition of no current flow through the galvanometer

(d) A combination of cells, galvanometer and resistances

25. A galvanometer of resistance $100\ \Omega$ when connected in series with a resistance of $400\ \Omega$ measures a voltage of upto 10 V. The value of resistance required to convert the galvanometer into an ammeter to read upto 10 A is $x \times 10^{-2}\ \Omega$. The value of x is:

(a) 2

(b) 800

(c) 20

(d) 200

26. An electric bulb rated 50 W – 200 V is connected across a 100 V supply. The power dissipation of the bulb is:

(a) 12.5 W

(b) 25 W

(c) 50 W

(d) 100 W

27. **Statement I**: To a metal wire of diameter d and length L when the applied voltage is doubled, drift velocity gets doubled.
Statement II: For a constant voltage when the length is doubled, drift velocity will be halved but drift velocity is independent of diameter.

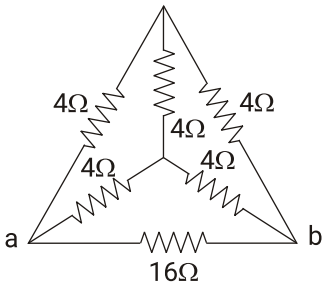
(a) Statement I and Statement II are true and the Statement II is the correct explanation of Statement I.

(b) Statement I and Statement II are true but the Statement II is not the correct explanation of Statement I.

(c) Statement I is true but Statement II is false.

(d) Statement I and Statement II are false.

28. The equivalent resistance of the circuit shown below between points a and b is:



(a) $24\ \Omega$

(b) $3.2\ \Omega$

(c) $20\ \Omega$

(d) $16\ \Omega$

29. The temperature coefficient of the resistance of a wire is 0.00125°/C . At 300 K its resistance is one Ohm. The resistance of the wire will be 2 ohm at:

(a) 1300 K

(b) 1200 K

(c) 1400 K

(d) 1100 K

30. In an ammeter, 5% of the main current passes through the galvanometer. If the resistance of the galvanometer is G, the resistance of ammeter will be

(a) $200\ \mathrm{G}$

(b) $\dfrac{\mathrm{G}}{199}$

(c) $199\ \mathrm{G}$

(d) $\dfrac{\mathrm{G}}{20}$

31. A uniform metallic wire carries a current 2 A, when a 3.4 V battery is connected across it. The mass of the wire is 8.92×10^{-3} kg, density is 8.92×10^{3} kg/m^3 and resistivity is $1.7\times10^{-8}\ \Omega\mathrm{m}$. The length of the wire is:

(a) $l = 100$ m

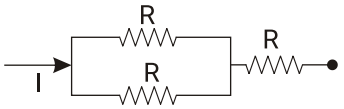
(b) $l = 6.8$ m

(c) $l = 10$ m

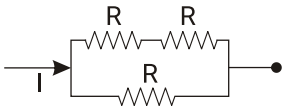
(d) $l = 5$ m

32. Different combinations of 3 resistors of equal resistance R are shown in the figures. The increasing order for power dissipation is:

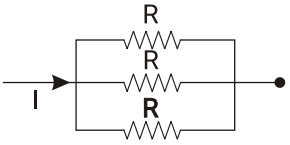
(A)



(B)



(C)



(D)

(a) $\mathrm{P_A} < \mathrm{P_B} < \mathrm{P_C} < \mathrm{P_D}$

(b) $\mathrm{P_C} < \mathrm{P_D} < \mathrm{P_A} < \mathrm{P_B}$

(c) $\mathrm{P_B} < \mathrm{P_C} < \mathrm{P_D} < \mathrm{P_A}$

(d) $\mathrm{P_C} < \mathrm{P_B} < \mathrm{P_A} < \mathrm{P_D}$

33. Of the two bulbs in a household circuit, one glows brighter than the other, which of the two bulbs has a large resistance?

(a) The bright bulb

(b) The dim bulb

(c) Both have the same resistance

(d) The brightness does not depend upon the resistance

34. A galvanometer of resistance $100\ \Omega$ gives full defection for a current of 10^{-5} A. The value of the shunt required to convert it into an ammeter of range 1 ampere, is :-

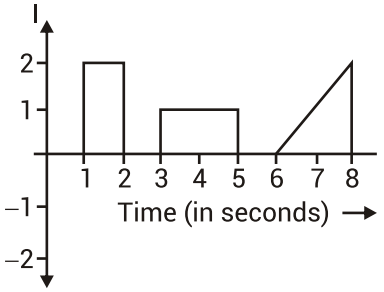
(a) $1\ \Omega$

(b) $10^{-3}\ \Omega$

(c) $10^{-5}\ \Omega$

(d) $100\ \Omega$

35. The plot represents the flow of current through a wire for different time intervals. The ratio of charges flowing through the wire corresponding to these time intervals is (see figure):-



(a) 2 : 1 : 2

(b) 1 : 2 : 3

(c) 1 : 1 : 1

(d) 1 : 3 : 3

36. A potentiometer wire has a resistance $40\ \Omega$ and its length is 10 m. It is connected to a resistance of $760\ \Omega$ in series. If the emf of the battery is 2 V, the potential gradient across the potentiometer wire is

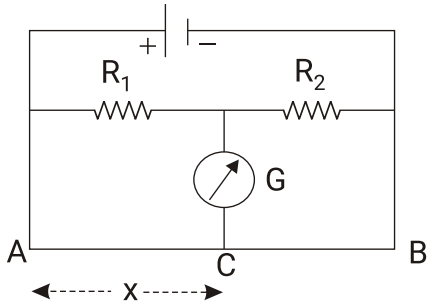
(a) 0.5×10^{-6} V/m

(b) 1×10^{-6} V/m

(c) 1×10^{-2} V/m

(d) 2×10^{-6} V/m

37. In the shown arrangement of the experiment of a meter bridge if AC, corresponding to null deflection of galvanometer, is x then what would be its value if the radius of the wire AB is doubled :-



(a) x

(b) $\frac{\mathrm{x}}{4}$

(c) $4\mathrm{x}$

(d) $2\mathrm{x}$

38. A wire of length 10 cm and radius $\sqrt{7} \times 10^{-4}$ m is connected across the right gap of a meter bridge. When a resistance of $4.5\ \Omega$ is connected on the left gap by using a resistance box, the balancing length is found to be at 60 cm from the left end. If the resistivity of the wire is $\mathrm{k} \times 10^{-7}\ \Omega$m, the value of k is

(a) 35

(b) 63

(c) 70

(d) 66

39. A galvanometer having coil resistance $10\ \Omega$ shows a full-scale deflection for a current of 3 mA. For it to measure a current of 8 A, the value of the shunt should be:

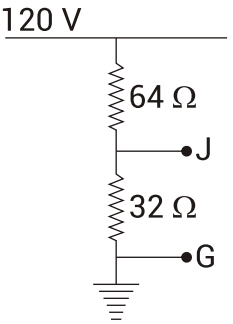
(a) $3 \times 10^{-3}\ \Omega$

(b) $4.85 \times 10^{-3}\ \Omega$

(c) $3.75 \times 10^{-3}\ \Omega$

(d) $2.75 \times 10^{-3}\ \Omega$

40. Find the potential of J with respected of 'G' :-



(a) 40 V (b) 60 V

(c) 20 V (d) 30 V

41. An unknown resistance R_1 is connected in series with a resistance of $10\ \Omega$. This combination is connected to one gap of a metre bridge while a resistance R_2 is connected in the other gap. The balance point is at 50 cm. Now, when the $10\ \Omega$ resistance is removed, the balance point shifts to 40 cm. The value of R_1 is (in Ohm)

(a) 20

(b) 10

(c) 60

(d) 40

42. Three copper wires are there with lengths and cross-sectional area as $(\ell,\ \mathrm{A})$; $\left(2\ell, \frac{\mathrm{A}}{2}\right)$ and $\left(\frac{\ell}{2}, 2\mathrm{A}\right)$. Resistance is

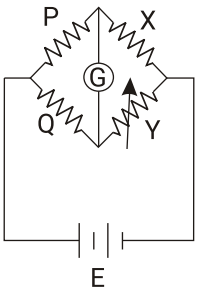
(a) minimum for the wire of cross-sectional are $\frac{\mathrm{A}}{2}$

(b) minimum for the wire of cross-sectional are A

(c) minimum for the wire of cross-sectional area 2A

(d) same for all the three cases

43. 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:



(a) should be approximately equal and small

(b) should be very large and unequal

(c) do not play any significant role

(d) should be approximately equal to $2\mathrm{X}$

44. The number of electrons flowing per second in the filament of a 110 W bulb operating at 220 V is:
(Given $e = 1.6 \times 10^{-19}$ C)

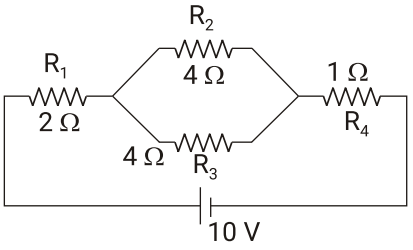
(a) 31.25×10^{17}

(b) 6.25×10^{18}

(c) 6.25×10^{17}

(d) 1.25×10^{19}

45. In the given circuit, the current in the resistance R_3 is:



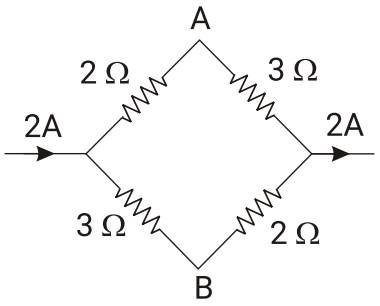
(a) 1.5 A

(b) 1 A

(c) 2.5 A

(d) 2 A

46. A current of 2 ampere flows in a system of conductors as shown in the following figure. Find out the potential difference $(V_A - V_B)$



(a) $+2$

(b) $+1$

(c) -1

(d) -2

47. The resistance per centimeter of a meter bridge wire is r . With $X\ \Omega$ resistance in the left gap, the balancing length from the left end is at 40 cm with $25\ \Omega$ resistance in the right gap. Now the wire is replaced by another wire of $2\ r$ resistance per centimeter. The new balancing length for the same settings will be at

(a) 10 cm

(b) 20 cm

(c) 40 cm

(d) 80 cm

48. In a Neon discharge tube 2.9×10^{18} Ne^+ ions move to the right each second, while 1.2×10^{18} electrons move to the left per second; electron charge is 1.6×10^{-19} C. The current in the discharge tube is :-

(a) 1 A towards right

(b) 0.66 A towards right

(c) 0.66 A towards left

(d) zero

49. **Statement I**: Potentiometers are more accurate than voltmeters.
Statement II: Voltmeters have very high resistance, but not infinite and change the original current in the circuit (even if it is by a very small amount).

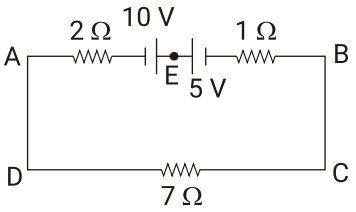
(a) Statement I and Statement II are true and the Statement II is the correct explanation of Statement I.

(b) Statement I and Statement II are true but the Statement II is not the correct explanation of Statement I.

(c) Statement I is true but Statement II is false.

(d) Statement I and Statement II are false.

50. The magnitude and direction of the current in the following circuit is:-



(a) 0.5 A from A to B through E

(b) $\frac{5}{9}$ A from A to B through E

(c) 1.5 A from B to$A$ through E

(d) 0.2 A from B to A through E