Solution

CET25P3

Class 12 - Physics

1.

(c) 10%

Explanation: Let original Current In lamp = I

Resistance of Lamp = R

Then power P = I^2R

According to question,

New Current $I_n = I - I \times \frac{5}{100} = \frac{19}{20}I$

Resistance = R

New power $P_n = I_n^2 R = (\frac{19}{20}I)^2 R = \frac{361}{400}I^2R$

Power decrease = $I^2R - \frac{361}{400}I^2R = \frac{39}{400}I^2R$

% Decrease = $\frac{change\ in\ power}{original\ power} \times 100$

$= \frac{\frac{39}{400}I^2R}{I^2R} \times 100 = \frac{39I^2R}{400I^2R} \times 100$

$= \frac{39}{4} = 9.75\% \approx 10\%$

2.

(c) same

Explanation: The amount of copper deposited will be the same because the total charge passed is the same in both cases.

3.

(b) decreases with increase in its conductivity

Explanation: Resistance is defined as the property of a conductor to resist the flow of charges through it. The resistance of the conductor is numerically given as the ratio of potential difference across its length to the current flowing through it. It is denoted by "R" and its SI unit is ohm (Ω)

4. **(a)** metals at low temperature

Explanation: metals at low temperature

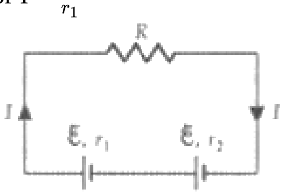
5.

(d) $r_1 - r_2$

Explanation: Given

$V_1 = \varepsilon - Ir_1 = 0$

or I = $\frac{\varepsilon}{r_1}$



Also, I = $\frac{2E}{R + r_1 + r_2}$

or $\frac{\varepsilon}{r_1} = \frac{2\varepsilon}{R + r_1 + r_2}$

or $R + r_1 + r_2 = 2r_1$ or $R = r_1 - r_2$

6.

(d) Charge

Explanation: Charge

7.

(c) 150 s

Explanation: Heater gives energy at a rate of 836 joules per second.

$P = 836\ W$ and $T_1 = 10^0C$ and $T_2 = 40^0C$

Heat energy required to raise temperature of mass *m* of water from T_1 to T_2 is given as,

$Q = \ mS(T_2 - T_1)$
S is specific heat of water = 4.186 J/g°C
Let t be the time required to heat water, then
$Q = Pt$
From above equations,
$\Rightarrow 836 \times t = 1000 \times 4.186 \times (40 - 10)$
$\Rightarrow t = \frac{4186 \times 30}{836}$
$\Rightarrow t \approx 150 \ seconds$

8.

(b) Electric charge

Explanation: As current is given as
$I \ = \ \frac{q}{t}$
$so \ q \ = \ I \times t$
$so \ ampere \ second \ is \ unit \ of \ electric \ charge.$

9.

(d) 20^{o}C

Explanation: 20^{o}C

10.

(c) 2%

Explanation: Power, P = I^2R
$\therefore \frac{\Delta P}{P} \times 100 = 2\frac{\Delta I}{I} \times 100 + \frac{\Delta R}{R} \times 100$
= 2 $\times$ 1% + 0 = 2%

11.

(b) 9P

Explanation: When the bulbs are connected in series,
P = $\frac{V^2}{R_s} = \frac{V^2}{3R}$
When the bulbs are connected in parallel,
$P = \frac{V^2}{R_p} = \frac{V^2}{\frac{R}{3}} = 3\frac{V^2}{R} = 3 \times 3P$ = 9P

12.

(b) 4 A

Explanation: For maximum power, r = R
$I = \frac{E}{R+r} = \frac{E}{2r} = \frac{16}{2 \times 2}$ = 4 A

13.

(d) zero

Explanation: At the temperature of inversion, thermo emf is zero.

14.

(b) 1.25 $\times$ 10^{19}

Explanation: $I = \frac{V}{R} = \frac{200}{100} = 2$ A
Again, $I = \frac{ne}{t}$
or, 2 = ne(since, t = 1 s)
or, $n = \frac{2}{\mathrm{e}}$ = $\frac{2}{1.6 \times 10^{-19}}$
$\therefore$ n = 1.25 $\times$ 10^{19}

15.

(b) unchanged

Explanation: $R = \rho\frac{l}{A} \Rightarrow R' = \rho\frac{2l}{2A} = R$

16.

(c) $\frac{2}{3}A$

Explanation: As it is balanced wheat stone bridge, so total resistance of the closed loop is

$\frac{1}{R}=\frac{1}{10}+\frac{1}{10}=\frac{2}{10}$

$R\ =\ 5\ \Omega$

$Total\ Circuit\ resis\tan ce\ =\ 10+5\ =15\ \Omega$

$Current\ in\ circuit\ =\ \frac{10}{15}=\ \frac{2}{3}A$

17. **(a)** a water voltameter

Explanation: a water voltameter

18.

(d) wire of cross-sectional area 2 A

Explanation: The resistances of the three wires are

$R_1=\rho\frac{l}{A};\ R_2=\rho\frac{2l}{\frac{A}{2}}=\rho\frac{4l}{A}$

$R_3=\rho\frac{\frac{l}{2}}{2A}=\rho\frac{l}{4A}$

Clearly, the resistance of third wire of cross-sectional area 2 A is minimum.

19. **(a)** flow of current

Explanation: We know that current flows in the direction of the flow of positive charge. Similarly, the electric field exists in the direction of the flow of positive charge. Therefore, the electric field exists in the direction of the flow of current.

20.

(d) 0.2 A

Explanation: I = $\frac{P}{V}=\frac{50\text{ W}}{250\text{ V}}$ = 0.2 A

21. **(a)** potentiometer

Explanation: The instrument among the following which measures the emf of a cell most accurately is a potentiometer.

22.

(c) 200°C

Explanation: $\varepsilon=20\theta-\frac{\theta^2}{20}\Rightarrow\frac{d\varepsilon}{d\theta}=20-\frac{\theta}{10}$

At $\theta=\theta_n,\ \frac{d\varepsilon}{d\theta}=0$

$\therefore 20-\frac{\theta_n}{10}=0$

or $\theta_n=200^\circ\text{C}$

23. **(a)** 0.2

Explanation: I = $\frac{3}{20+10}=\frac{1}{10}A$

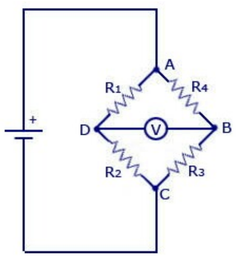
V_{AB} = IR_{AB} = $\frac{1}{10}\times 20$ = 2 V

k = $\frac{2\text{ V}}{10\text{ m}}$ = 0.2 Vm^{-1}

24.

(d) Not change

Explanation: Let initially arrangement is as follow,



For this balanced condition is given as

$\frac{R_1}{R_4}=\frac{R_2}{R_3}$ ....(i)

If position of cell and galvanometer are interchanged, i.e cell across B and D and galvanometer between A and C then balanced condition is given by

$\frac{R_2}{R_1}=\frac{R_3}{R_4}$ ....(ii)

Rearranging equation (ii)

$\frac{R_2}{R_3} = \frac{R_1}{R_4}$

Hence balance point remains same.

25.

(b) 96500 C

Explanation: Let X be the element in electrolytic solution to be deposited.

$X^+ + e^- \rightarrow X(s)$

$\Rightarrow$ 1mole e^- is required to produce 1 mole of X

Now 1 mole electrons $= N_A \times e^-$

$= 6.022 \times 10^{23} \times 1.6 \times 10^{-19}$

= 96500C

26. **(a)** in series with the element through which current is to be determined

Explanation: Ammeter is a device used to measure current. Since it has to allow the complete current flowing in the circuit through it, it has to be connected in series. For this reason, ammeters have very low values of resistances so that they do not add to the value of resistance connected in the circuit.

27.

(c) temperature

Explanation: temperature

28.

(b) 1000 Wh

Explanation: H = $\frac{V^2 t}{R} = \frac{200 \times 200 \times 2 \times 60 \times 60}{80} J$

= $\frac{200 \times 200 \times 2 \times 60 \times 60}{80 \times 3600}$ W = 1000 Wh

29.

(d) 10%

Explanation: Power, P = I^2R

$\Rightarrow \frac{P_2}{P_1} = \left[\frac{I_2}{I_1}\right]^2$

$\Rightarrow \frac{P_2}{P_1} = \left[\frac{0.95 \times 0.95 I^2}{I^2}\right] = 0.9025$

$\therefore$ Decrease in power $= \left(1 - \frac{P_2}{P_1}\right) \times 100$

Power decrease $\approx$ 10%

30.

(b) is zero

Explanation: At the neutral temperature,

$\frac{d\varepsilon}{dT}$ = 0

31.

(c) $\frac{1}{3}\Omega$

Explanation: Let r Ω be the internal resistance of the battery

In first case: $\frac{\varepsilon}{r+2}$ = 2A

In second case: $\frac{\varepsilon}{r+9}$ = 0.5 A

$\therefore \frac{r+9}{r+2} = 4$ or $r = \frac{1}{3}\Omega$

32.

(b) 87.5 %

Explanation: Input energy when the battery is charged

= VIt = 15 V $\times$ 10 A $\times$ 8 h = 1200 Wh

The energy released when the battery is discharged

= 14 V $\times$ 5 A $\times$ 15 h = 1050 Wh

Watt-hour efficiency of the battery

= $\frac{\text{Energy output}}{\text{Energy input}} = \frac{1050}{1200}$ = 0.875 = 87.5 %

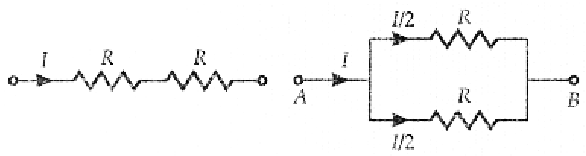
33.

(d) $m^2 V^{-1} s^{-1}$

Explanation: $m^2 V^{-1} s^{-1}$

34. **(a)** 4 : 1

Explanation:



Series combination Parallel combination

$\frac{P_s}{P_p} = \frac{I^2R + I^2R}{(\frac{I}{2})^2R + (\frac{I}{2})^2R}$ = 4 : 1

35.

(c) At any junction of circuit elements, the sum of currents entering the junction must equal the sum of currents leaving it.

Explanation: Kirchhoff's junction rule is based on the principle of conservation of charge. For steady currents, there can be no accumulation of charge in a junction. The currents entering a junction bring charge to the junction and the currents leaving a junction carry away the charge brought to the junction.

36. **(a)** high resistance, low melting point

Explanation: A fuse wire has HIGH resistance & LESS melting point, so that it can protect the electrical appliances by undergoing melting due to excess heat produced because of high resistance. As a result, circuit is not complete, so no current flow in it.

37.

(b) 2000 W

Explanation: For a parallel combination,

$P = P_1 + P_2$ = 1000 + 1000 = 2000 W

38.

(c) $\frac{R_1}{R_3} = \frac{R_2}{R_4}$

Explanation: For null point condition, no current should flow between junction of R_1 - R_3 and R_2 - R_4. This implies bridge balance condition.

Bridge balance condition is given by ,

$\frac{R_1}{R_3} = \frac{R_2}{R_4}$

39.

(b) R

Explanation: In the balanced condition, the resistance R of the galvanometer is ineffective. We now have (R + R) and (R + R) resistances in parallel.

$\therefore R_\alpha = \frac{2R \times 2R}{2R + 2R}$ = R

40.

(d) $\frac{E}{3}$

Explanation: $\frac{E}{3}$

41.

(b) 10 Ω

Explanation: Connecting a resistance in series with the galvanometer does not affect the balanced condition of the bridge. We just have (10 Ω + 10 Ω) and (10 Ω + 10 Ω) resistances in parallel.

$\therefore R_{eq} = \frac{20\times20}{20+20} = 10\Omega$

42. **(a)** 19.2 kW

Explanation: Total resistance of the wires = 150 $\times$ 0.5 = 75 Ω

Current through the wires,

l = $\frac{\Delta V}{\Delta R} = \frac{8}{0.5}$ = 16 A

$P = I^2R = (16)^2 \times 75$ = 19200 W = 19.2 kW

43.

(b) 0.5 Ω

Explanation: r = $\frac{E}{I} - R = \frac{2.1}{0.2}$ - 10 = 10.5 - 10 = 0.5 Ω

44. **(a)** 36 $\times$ 10^5 J

Explanation: 1 kWh = 1000 W $\times$ 3600 s = 36 $\times$ 10^5 J

45.

(d) current flows from A to B via G

Explanation: current flows from A to B via G

46.

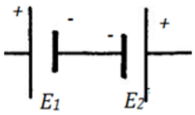
(b) Ionization of salt

Explanation: Conductivity of an electrolyte is affected by concentration of ions in solution. The higher the concentration of ions in solution, the higher its conductivity will be. More is the ionization more will be number of charge carriers hence more will be the conductivity.

47.

(c) E_2 - E_1

Explanation: When cells are connected in opposition the equivalent emf is the difference of their emfs.



48.

(d) for Si increases and for Cu decreases

Explanation: Si is a semiconductor, its resistivity increases with the decrease in temperature. Cu is a conductor, its resistivity decreases with the decrease in temperature.

49. **(a)** very weakly temperature-dependent resistivity

Explanation: Nichrome and manganin have very low-temperature dependent resistivity.

50. **(a)** -r and ε

Explanation: V = ε - Ir

or V = -rI + ε

On comparing with y = mx + c, we get slope = -r and intercept = ε

51.

(b) 0.2

Explanation: 0.2

52.

(c) 10.6 Ω

Explanation: R = $\frac{V^2}{P} = \frac{115 \times 115}{1250}$ = 10.6 Ω

53.

(b) Cu, Ag and Au

Explanation: Cu, Ag and Au are the good conductors of electricity.

54.

(d) 0.01 $\times$ 10^{-2}

Explanation: R = R_{Cu} + R_{Al} = $[\rho_{Cu} + \rho_{Al}]\ \frac{l}{A}$

= $\frac{(1 \cdot 69 + 2 \cdot 75) \times 10^{-8} \times 20 \times 10^{-2}}{50 \times 10^{-6}} \Omega$

= 1.776 $\times$ $10^{-4} \approx 0 \cdot 01 \times 10^{-2} \Omega$

55.

(c) 3 Ω

Explanation: The series combination of 1 Ω and 2 Ω is in parallel with 3 Ω resistor.

$\therefore$ R = $\frac{3 \times 3}{3 + 3} = \frac{9}{6} = \frac{3}{2} \Omega$

I = $\frac{V}{R} = \frac{1-5}{\frac{3}{2}}$ = 1.0 A

Current through the 3 Ω resistor = $\frac{3}{6} \times$ 1 = 0.5 A

56. **(a)** I^2R

Explanation: The power dissipated

$P = V \times I$

Since $V = IR$

$P = I^2R$

57.

(b) $\frac{P}{4}$

Explanation: $\frac{P}{4}$

it is given that the element of a heater is rated (P, V). If it is connected across a source of voltage V' = **V/2**.

we have to find **power consumed** by element of the heater.

here resistance of element, R = V^2/P

thus P' = $(V/2)^2/(V^2/P)$

P' = P/4

58.

(c) 12 Ω

Explanation: Input power = VI = 200 $\times$ 10 = 2000 W

Output power = 40% of 2000 W = 800 W

Power loss in heating the armature = 1200 W

I^2R = 1200

$\therefore R = \frac{1200}{10 \times 10}$ = 12 Ω

59.

(b) both very high value resistances and very low value resistances

Explanation: Wheatstone bridge is suitable for measurement of medium value resistances because to ensure sensitivity, other resistors must be of comparable values.

60. **(a)** not change

Explanation: Resistivity depends on the nature of the material and not on the dimensions of the conductor.

61.

(b) 20.4 V

Explanation: As V = ε - Ir

In first case: 20 = ε - 0.2 r or 200 = 10 ε - 20 r

In second case: 16 = ε - 2r

On subtracting, 184 = 9 ε or ε = 20.4 V

62.

(c) The work done per unit charge by the source in taking the charge from lower to higher potential energy

Explanation: An electric field exists in the electrolyte between the positive and negative terminals of the battery. In the external circuit, the current flows from the positive electrode to the negative electrode. To maintain continuity, in the electrolyte, the current (positive charges) flow from the negative electrode (lower potential) to the positive electrode (higher potential). Work done by the source in taking unit positive charge from lower to higher potential is called electromotive force.

63.

(c) 26.4 ohms

Explanation: Let a resistance M be put in parallel to S and the equivalent resistance of the parallel combination be X. In the bridge balance condition

$\frac{X}{R} = \frac{Q}{P}$

$\Rightarrow X = R \times \left(\frac{Q}{P}\right)$

$X = 4 \times \frac{11}{9} = \frac{44}{9}$

In the parallel combination of S and M,

$\frac{1}{X} = \frac{1}{S} + \frac{1}{M}$

$\frac{1}{M} = \frac{1}{X} - \frac{1}{S}$

$\Rightarrow \frac{1}{M} = \frac{9}{44} - \frac{1}{6} = \frac{10}{264}$

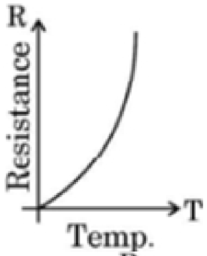
thus resistance equal to :-
$M = 26.4\Omega$

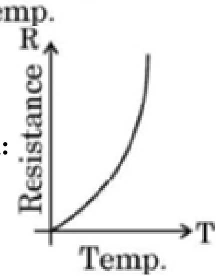
64.

(b) the average of the velocities of all the free electrons at an instant is non-zero

Explanation: The average of the velocities of all free electrons at an instant is non-zero, if not current is passed through a conductor.

65.

(b) 

Explanation: 

66.

(d) 1.5Ω

Explanation: Let r be the resistance of each lamp and R be equivalent resistance when connected in parallel. Then r and R are related as,

$\frac{1}{R} = \frac{1}{r} + \frac{1}{r}$

$\Rightarrow R = \frac{r}{2}$

Now, power is given as

$P = \frac{V^2}{R}$

$\Rightarrow 48 = \frac{6 \times 6}{R}$

$\Rightarrow R = \frac{3}{4}$

$\therefore r = \frac{3}{2}$

$\Rightarrow r = 1.5\Omega$

67. **(a)** 5.0×10^{17}

Explanation: 5.0×10^{17}

68.

(d) charge

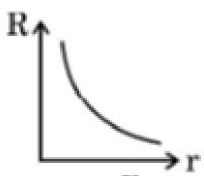
Explanation: charge

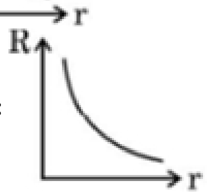
69.

(c) $\frac{2}{3}E$

Explanation: $\frac{2}{3}E$

70.

(c) 

Explanation: 

71.

(b) 25 W

Explanation: Resistance of the bulb = R

$R = \frac{V^2}{P}$

or, $R = \frac{220^2}{100}$

$\therefore$ R = 484 Ω

Power consumed by the bulb when connected to 110 V is $\frac{V^2}{R} = \frac{110^2}{484} = 25$ W

72.

(c) copper decreases and silicon increases.

Explanation: copper decreases and silicon increases.

73.

(d) 2 Ω

Explanation: Current for series combination = Current for the parallel combination

$\therefore \frac{2\varepsilon}{2r+2} = \frac{\varepsilon}{\frac{r}{2}+2}$

or $2\left(\frac{r}{2}+2\right)$ = 2 r + 2 or r = 2 Ω

74.

(b) 1 : 5

Explanation: The resistance of the first wire is:

$R_1 = \rho\frac{(5L)}{A}$

The resistance of the second wire is:

$R_2 = \rho\frac{(3L)}{3A} = \rho\frac{L}{A}$

Dividing R_1 by R_2, we get:

$\frac{R_1}{R_2} = \left[\rho\frac{\frac{(5L)}{A}}{\rho\frac{L}{A}}\right] = 5$

Therefore, the ratio of their resistances is 5 : 1, which simplifies to 5 : 1 or 1 : 5.

75.

(b) current in the circuit

Explanation: current in the circuit