EDT - 13 - Physics (2017 Aspirants)
(SOLUTION)

(1) Theory

(2) $I = neAV_d = \frac{V}{R} = \frac{\vec{E}.l}{R}$

$V_d \propto \vec{E}$

(3) Drift velocity is the average velocity of $\bar{e}$.

(4) $i = neAV_d$

If i = constant

$A_1V_{d_1} = A_2V_{d_2}$

$AV_{d_1} = 4A.V_{d_2}$

$V_{d_2} = \frac{V_{d_1}}{4}$

(5) $n = \frac{\text{no. of } \bar{e}}{\text{volum}} = \frac{\frac{\text{mass}}{\text{volm}} \times N_A}{\text{Atomic mass}}$

$i = neAV_d$

$1.1 = \frac{\frac{9\text{ gm}}{63}}{\text{cm}^3} \times 6.023 \times 10^{23} \times 10^{6}\frac{\text{cm}^3}{\text{cm}^3} \times 1.6 \times 10^{-19} \times \pi\frac{(1.0 \times 10^{-3})^2}{4} \times V_d$

$V_d = \frac{1.1 \times 7 \times 4}{6.023 \times \pi \times 1.6 \times 10^4}$

$V_d = \frac{30.8 \times 10^{-4}\ m/s}{96\pi} = 0.1\frac{mm}{s}$

(6) $\frac{R_1}{R_2} = \frac{l_1}{l_2}$

(7) Theory.

(8) Theory.

(9) Theory

(10) $R = \frac{\rho l}{A} = \frac{\rho l}{\pi r^2}$

$\frac{dR}{R} = \frac{dl}{l} - 2\frac{dr}{r}$

Al = constant

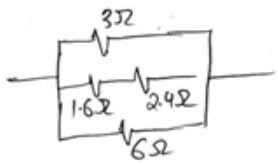
$r^2 l$ = const

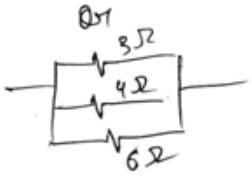
$2\frac{dr}{r} + \frac{dl}{l} = 0$

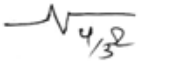
$\frac{dr}{r} = 0.1\%$

$\frac{dR}{R} = -4\frac{dr}{r} = 0.4\%$

(11)







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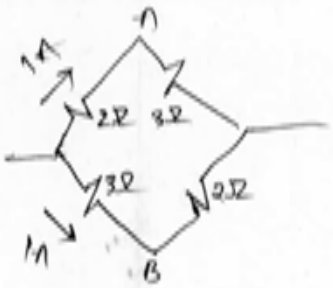


$V_A - 1(3) + 1(2) = V_B$

$V_A - V_B = 1$

(13) $R_{eq} = \frac{100 \times 200}{300} = \frac{200}{3}$

$i = \frac{4}{\frac{200}{3}} = \frac{2\times3}{100} = \frac{6}{100}$ A

$\frac{i_1}{i_2} = \frac{200}{100} = \frac{2}{1}$

$i_1 = \frac{4}{100}$ A & $i_2 = \frac{2}{100}$ A

$V_B - i_1(60) + i_2(110) = V_D$

$V_B - V_D = -\frac{220}{100} + \frac{240}{100} = +.2$ V

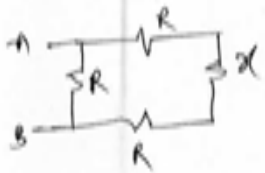
(14) $\frac{i_1}{i_2} = \frac{60}{84} = \frac{5}{2}$

$i_1 + i_2 = 1.4$

$\frac{7}{5} i_1 = 1.4$

$i_1 = \frac{5\times1.4}{7} = 1$A

(15)



$R_{AB} = x$ (then the Req of each column will remain x - only)

$\frac{(2R+x)\cdot R}{3R+x} = x$

$x^2 + 2Rx - 2R^2 = 0$

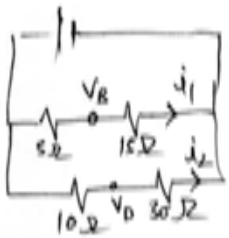
(16) $R = \frac{90}{1}$

$\frac{R_1}{R_2} = \frac{i_2}{i_1} = \frac{1}{3}$

$R_1 = 10\Omega$

$R_2 = 30\Omega$

(17)



$R_{eq} = \frac{20\times40}{60} 3$

$i = \frac{6}{40/3} = \frac{9}{20}$

$\frac{i_1}{i_2} = \frac{40}{20} = \frac{2}{1}$

$i_1 = \frac{6}{20}$ & $i_2 = \frac{3}{20}$

$V_B - \left(\frac{6}{20}\right)15 + \left(\frac{3}{20}\right)30 = V_D$

$V_B - V_D = \frac{90}{20} - \frac{90}{20} = 0$

(18) $\frac{16}{x} = \frac{4}{0.5}$

$x = 2\Omega$

(19)

$R_{eq} = \frac{(20-x)\times x}{20} = 1.8$

$x^2 - 20x + 36 = 0$

$(x-2)(x-18) = 0$

$x = 2$ or 18

(20) $i = \frac{10}{2} = 5A$

$i_1 = i_2 = 2.5A$

$V_A - 2.5(3) + 2.5(1) = V_B$

$V_A - V_B = 5V$

(21) $V_{(across\ X)} = E_2$

$\left(\frac{E_1}{500+x}\right)x = E_2$

$\frac{12x}{500+x} = 2$

$6x = 500 + x$

$x = 100\ \Omega$

(22) $i = \frac{6}{10+1} = \frac{6}{11}A$

$V = E - ir = 6 - \frac{6}{11}.1 = \frac{60}{11}V$

(23) $\frac{dR}{dT} = \alpha R$

here α is coefficient of temp.

$\alpha = \frac{1}{R}\frac{dR}{dt}$

(24) $i = 1.2t + 3 = \frac{dq}{dt}$

$\int dq = \int (1.2t + 3)dt$

$Q = \frac{1.2t^2}{2} + 3t$

$= 0.6 \times 25 + 15 = 30$

(25) Theory

(26) Theory

(27) $V - \frac{i}{3}R - \frac{i}{6}.R - \frac{i}{3}R = 0$

$V = \frac{5iR}{6}$

$\frac{V}{i} = \frac{5R}{6} = R_{eq}$

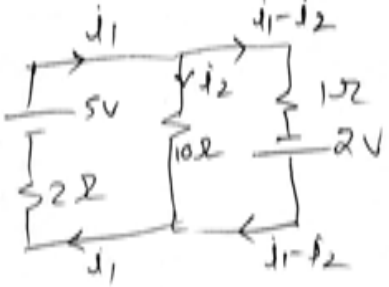
(28) $E_1 - E_2 - E_2 - i_1R_1 = 0$

$3 - 3 - 2 = i_1R_1$

$\frac{-2}{10} = i_1 = -0.2A$

$i_2 = \frac{E_2}{R_2} = \frac{3}{30} = 0.1A$

(29)



$5 - 10i_2 - 2i_1 = 0$

$2i_1 + 10i_2 = 5$ — (1)

$2 + 10i_2 - (i_1 - i_2)1 = 0$

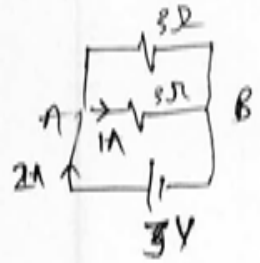
$2 + 11i_2 - i_1 = 0$

$i_1 - 11i_2 = 2$

$10i_2 + 22i_2 = 5 - 4$

$i_2 = +\frac{1}{32} = .03A$

(30)



(31) Theory

(32) Theory

(33) $\gamma_{eq} = \frac{n\gamma}{m} = R$

$\frac{n10.5}{m} = 2.5$

$\frac{n}{m} = 5$

$n \times m = 45$

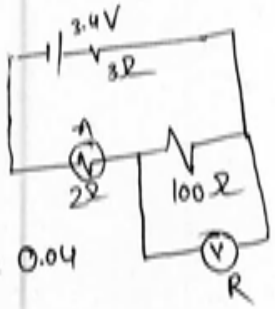
$5m^2 = 45$

$m = 3$

$n = 15$

(34) $R_0\alpha_1 t_1 = R_0\alpha_2 t_2$

(35)



$i = \frac{3.4}{5 + \frac{100R}{100+R}} = 0.04$

$3.4 = 0.2 + \frac{4R}{100+R}$

$4R = 3.2(100+R)$

$0.8R = 320$

$R = 400\Omega$

$V = 3.4 - 5i = 3.4 - 0.2 = 3.2V$

For ideal voltmeter $i = \frac{3.4}{105} = .0323$

$V = 3.4 - 5 \times .0323 = 3.24V$

(38) $100 - 50i = \frac{100}{3}$

$50i = \frac{200}{3}$

$i = \frac{4}{3} = \frac{100}{50 + \frac{50\gamma}{50+\gamma}}$

$50 + \frac{50\gamma}{50+\gamma} = 75$

$50\gamma = (50+\gamma)25$

$25\gamma = 25 \times 50$

$\gamma = 50\Omega$

(39) $\gamma = R\left(\frac{\ell_2}{\ell_1} - 1\right)$

$\gamma = 50\left(\frac{2}{\ell_1} - 1\right) = \frac{100}{\ell_1} - 5 \quad \times 3$

$\gamma = 10\left(\frac{3}{\ell_1} - 1\right) = \frac{30}{\ell_1} - 10 \times 10$

$3\gamma - \gamma = \frac{300}{\ell_1} - 150 - \left(\frac{300-100}{\ell_1}\right)$

$2\gamma = 50$

$\gamma = 25\Omega$

(40) $\ell_1 = 560$

$\ell_2 = 500$

$\gamma = 10\left(\frac{560}{500} - 1\right) = \frac{600}{500} = 1.2\Omega$

(41) $\frac{\ell}{R} = \frac{200}{\ell - 300}$ & $\frac{R}{2} = \frac{350}{\ell - 350}$

$1 = \frac{300 \times 350}{(\ell-300)(\ell-350)}$

$\ell^2 - 650\ell + 300 \times 350 = 300 \times 350$

$\ell = 650$

$\frac{\ell}{R} = \frac{300}{350} \Rightarrow R = \frac{7 \times 2}{6} = \frac{14}{6}$

42 $\ell_1 = 50\ cm$

$\ell_2 = 40\ cm$

$r = 2\left(\frac{5}{4} - 1\right) = \frac{2}{4} = \frac{1}{2}\ \Omega$

(43) $V = k\ell_1$

(44) $r = R\left(\frac{\ell_2}{\ell_1} - 1\right)$

(45) $\frac{R_2}{R_1} = \frac{\ell_2}{\ell_1} = \frac{x}{100 - x}$

EDT - 13 - Chemistry (2017 Aspirants)
(SOLUTION)

(1)

A·46 One of Aluminium is Bauxite.

A·47 Brass is an Alloy of Copper (60%) and zinc (40%).

A·48 Magnetite, Fe_3O_4 is a mineral of Iron.

A·49 Except Lime (50-60%), major constituent of Portland Cement is silica (20-25%).

A·50 Malachite – $Cu(OH)_2 \cdot CuCO_3$ is one of copper.

A·51 Froth Floatation process is widely used for concentration of sulphide ore. Surface of sulphide ore is preferentially wetted by oil while that of gangue is preferentially wetted by water.

(3)

A·55 Flux + Gangue → Slag
Impurities Fusible substance

A·56 In Hall-Heroult process, following reactions occur:

$$3C + 2Al_2O_3 \rightarrow 4Al + 3CO_2$$

$$4Al^{3+} + 12e \rightarrow 4Al$$

$$\Delta G^\circ = 3\Delta G^\circ_f(CO_2) - 2\Delta G^\circ_f(Al_2O_3)$$

$$= 3(-394) - 2(-1520) = 1858\ kJ$$

$$\Delta G^\circ = -nFE^\circ_{cell}$$

$$-E^\circ_{cell} = \frac{1858 \times 1000}{12 \times 96500} = 1.60\ V$$

A·57 In Extraction of copper, impurities of iron oxide combine with silica (flux) and form insoluble slag.

$$FeO + SiO_2 \rightarrow FeSiO_3$$
Slag

(2)

A·52 Collectors enhance non wettability of mineral acids. Collectors like pine oil, xanthates attach themselves by polar groups to drain minerals which then become water repellant and pass on into froth.

A·53 Calcination is a process in which ore is heated generally in absence of air to expel water from a hydrated oxide.

A·54 NaCN is used as a depressant to seperate Lead sulphide (PbS) ore from zinc sulphide (ZnS) ore. NaCN forms zinc complex, $Na_2[Zn(CN)_4]$ on surface of ZnS thereby preventing it from formation of froth. Only PbS forms froth and hence seperated from ZnS.

(4)

A·58 Zn and Pb in molten state are immiscible and form seperate layers, zinc being lighter forms upper layer. Ag is soluble in both. Hence all statements are correct.

A·59 Process of heating steel to temperature much below to redness and cooling it slowly, is called annealing.

A·60 SiO_2 (silica) is an acidic flux and is added to remove basic impurities like CaO, FeO, etc.

A·61 At 1000°C zinc oxide can be reduced by graphite. $ZnO + C \rightarrow Zn + CO$

A·62 Bond breaking or decomposition processes are endothermic process. Thus, decomposition of $CaCO_3$ is an endothermic process.

A·63 Cathodic Protection of iron involves using another more reactive metal as sacrificial anode. eg: Zinc is used for such purpose. (5)

A·64 Zr and Ti are purified by Van Arkel method to remoove all oxygen and nitrogen present in form of impurity.

$$Zr + 2I_2 \xrightarrow{600^\circ C} ZrI_4 \xrightarrow{1800^\circ C} Zr + 2I_2$$

A·65 Impurities are more soluble in melt than in original metal. Hence, molten zone contains more impurities than original metal.

A·66

$$\underset{3\times12=36}{2Al_2O_3} + 3C \longrightarrow \underset{4\times27=108}{4Al} + 3CO_2$$

For 108 g of Al, 36 g of C is required,

For 270 g of Al require amount of

$$C = \frac{36}{108} \times 270 = 90\,g$$

A·67 Magnetic Moment $\mu = \sqrt{n(n+2)}$ (6)

$$2.83 = \sqrt{n(n+2)}$$
$$(2.83)^2 = n(n+2)$$
$$8 = n^2 + 2n$$
$$n^2 + 2n - 8 = 0$$
$$n^2 + 4n - 2n - 8 = 0$$
$$(n+4)(n-2) = 0$$
$$n = 2 \quad (n \neq -4)$$

From given ions:

Ti^{3+} $3d^1$ $n=1$

Ni^{2+} $3d^8$ $n=2$ Ans

Cr^{3+} $3d^3$ $n=3$

Mn^{2+} $3d^5$ $n=5$

A·68 Ti^{4+} ; $3d^0$; $n=0$

Mn^{2+} ; $3d^5$; $n=5$

V^{4+} ; $3d^1$; $n=1$

Fe^{3+} ; $3d^5$; $n=5$

As Ti^{4+} has no unpaired electrons. It is colourless due to absence of d-d Transition.

A·69 Eating Animals poisoned with Mercury (Hg^{2+}) causes Minimata disease. (7)

A·70 As Size of Cu^{2+} is smaller than Cu^+, Lattice energy released for Cu^{2+} compounds is much more negative than that of Cu^+ compounds, hence providing stability.

A·71 General Electronic Configuration of d-block elements is $(n-1)d^{1-10}, ns^{1-2}$

A·72 Cuprous ion is colourless as it has complete d orbital i.e. $3d^{10}4s^0$ while cupric ion is coloured as it has incomplete d-orbital $3d^9 4s^0$.

A·73 Being hygroscopic or deliquescent, $Na_2Cr_2O_7$ cannot be used in Volumetric Analysis.

A·74 Melting Point of transition elements first increase to maximum and then fall as Atomic number increases. Order of M.P is: (8)

$Ti < V < Cr > Mn$

Mn has Low M·P due to stable configuration and weak intermetallic bonding.

A·75 In Electrochemical Series, Metals with Positive Standard potential are placed below hydrogen. Out of given Metals only Cu is below hydrogen, hence it has Positive sign for standard potential.

A·76 $Cr_2O_7^{2-} + 14H^+ + 6I^- \rightarrow 2Cr^{3+} + 7H_2O + 3I_2$

A·77 Fe^{2+} : $3d^6$; Zn : $3d^{10}$; Hg^{2+} : $5d^{10}$;

Ti^{4+} : $3d^0$; Only Fe^{2+} is paramagnetic as it contains unpaired electrons.

(9)

A·78 In General, oxides in Lower Oxidation State of metals are basic and in higher oxidation states are acidic. Hence

In Mn_2O_7; Mn is in +7 Oxidation State; It is highly Acidic.

CrO is basic, as Cr exhibits lower Oxidation State of +2.

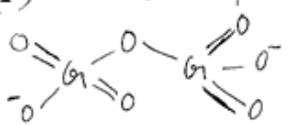
While V_2O_5 is amphoteric.

A·79 Generally d-block elements form complexes, Lead is a p-block element. So Ammonia does not form complex with Pb^{2+}.

A·80 K_2TiO_4 does not exist. As Ti possesses +6 Oxidation State which is not possible.

(10)

A·81 Structure of $Cr_2O_7^{2-}$ ion is



Thus it has no Cr–Cr bonds and no O–O bonds.

A·82 $2K_2CrO_4 + H_2SO_4 \longrightarrow K_2Cr_2O_7 + K_2SO + H_2O$

Potassium Chromate	Potassium Dichromate
Yellow Colour	Orange Colour
Monocentric Complex	Dicentric Complex

A·83 It shows axial and orbital motion of electrons in same direction, because it has 5 unpaired electrons in same spin.

A·84 Zr^{4+} and Hf^{4+} have similar ionic radius due to Lanthanoid Contraction.

A·85 Ti^{4+} has empty d orbitals while Cu^{+} has fully filled d orbitals. Hence both are colourless due to absence of d-d transition.

(11)

A·86 Earlier members of Lanthanoid Series resemble Calcium in some of their chemical properties. eg: hydroxides of both of them are ionic and basic.

A·87 $Ce^{2+}: 4f^2$; $Sm^{2+}: 6f^6$; $Eu^{2+}: 6f^7$; $Yb^{2+}: 6f^{14}$; Yb^{2+} is diamagnetic as it has no unpaired electrons.

A·88 Across Lanthanide series due to Lanthanoid contraction size of cation decreases.

A·89 $Ce^{4+}: [Xe]\ 4f^0\ 5d^0\ 6s^0$

As it attains nearest Noble gas configuration Hence it is most Stable.

A·90 Energy difference between 5f and 6d orbitals is less than 4f and 5d orbitals. Hence Actinoids (having 5f and 6d valence electrons) exhibits more number of Oxidation States.

EDT - 13 - Botany (2017 Aspirants)
(SOLUTION)

91. (4) Pollination and fertilization in angiosperm depend on water
92. (4) Both by hormonal and structural changes in plant
93. (2) Androecium
94. (1) Parthenocarpy
95. (1) Pollen grains
96. (1) New organism without fusion of gametes
97. (1) Variable in different species
98. (4) Ovary
99. (3) A : Stigma, B : Style, C : Ovary, D : Thalamus
100. (1) Fertilized ovule
101. (2) Two microsporangia
102. (3) Microsporangium
103. (2) Circular
104. (4) Black paper and bect
105. (2) Tapetum
106. (4) A : Style, B : Stigma, C : Anther, D : Petal, E : Filament, F : Sepal, G : Nectariferous area, H : Ovule, I : Ovary
107. (2) Tapetum
108. (1) A : Synergids, B : Egg, C : Central cell, D : 2 polar nuclei, E : Antipodals
109. (4) R, Q, P, S
110. (2) n
111. (3) Microsporongesis
112. (2)
113. (2) 2n
114. (3) Rooting branch
115. (2)
116. (3) Strawberry
117. (3) A : Vegetative cell, B : Generative cell
118. (3) They are made up of sporopollenin
119. (1) Scutellum
120. (1) 2n, 2n, n, n,n, 2n
121. (2) Oogonium is placed in the upper part and Anthredium in the lower part
122. (3) Bryophyllum
123. (3) > 60% Angiosperm plant
124. (1)
125. (2) Vegetative cell
126. (4) General metabolic activity of embryo is high
127. (3) (P)-(iii), (Q)-(ii), (R)-(i), (S)-(iv)
128. (4) Mitotic division in generative cell
129. (4) 4

130. (2) *Parthenium*
131. (1)
132. (2)
133. (2) Nitrogen $\left(-196^{\circ}C\right)$
134. (2) More than one pistil fused together
135. (1) A : Plumule, B : Cotyledons, C : Hypocotyl, D : Radicle, E : Root cap
136. (1) Cotyledons
137. (1) Funiculus
138. (2) Hilum
139. (2) Chalaza
140. (3) Embryo sac
141. (4) All are correct
142. (2) The megaspore that only develops in female gametophyte
143. (3) 3n
144. (3) 2n, 2n, n, n
145. (2) 3
146. (2) Strictly free nuclear not immediately followed by cell wall formation
147. (1) 7-celled 8 nucleate
148. (2) Megaspore tetrad
149. (2) Both of the male and female gametes are non-motile and they need to be brought together for fertilization
150. (1)
151. (1)
152. (1) 7 cells
153. (2) Typical stamen
154. (2) Transfer of pollen grain to stigma of pistil
155. (3) Both (1) and (2)
156. (2) A : Vacuoles, B : Nucleus
157. (1) Major
158. (4) All are correct
159. (1) Anemophily
160. (4) A : Pericarp, B : Endosperm, C : Scutellum, D : Coleoptile, E : Plumule, F : Radicle, G : Coleorhiza
161. (2) Because they require water for fertilization
162. (3)
163. (4) P, Q, R, and S
164. (1) A : Polar nuclei, B : Male gametes
165. (2) Bees
166. (2) A : Pollen tube, B : Antipodal, C : Polar nuclei, D : Egg cell, E : Synergid
167. (3) A : Suspensor, B : Radicle, C : Plumule, D : Cotyledon
168. (4) Grasses
169. (4) Groundnut
170. (1) Globular embryo
171. (4) P, Q and S
172. (4) Pollen grain
173. (2) 5
174. (1)

175. (2) Generative cell
176. (3) P,Q, R,S,T
177. (1) A : Seed coat, B : Endosperm, C : Cotyledon, D : Hypocotyl root axis
178. (2) Tetragonal
179. (1) Gynoecium
180. (2) A : Line of dehiscence, B : Filament (Stalk), C : Pollen sacs, D : Pollen grains