

**PHYSICAL / INORGANIC
CHEMISTRY
DPP**
DAILY PRACTICE PROBLEMS

DPP No. 26

Total Marks : 46
Max. Time : 46 min.

Topic : Electro Chemistry

Type of Questions

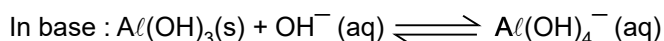
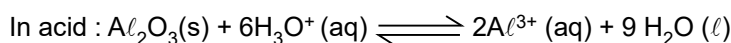
Type of Questions	M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.12	(3 marks, 3 min.) [36, 36]
Multiple choice objective ('-1' negative marking) Q.13	(4 marks, 4 min.) [4, 4]
Comprehension ('-1' negative marking) Q.14 to Q.15	(3 marks, 3 min.) [6, 6]

- In Galvanic cell :
 - Chemical reaction produces electrical energy
 - Electrical energy produces chemical reaction
 - Reduction occurs at anode
 - Oxidation occurs at cathode
- The standard oxidation potentials, E° , for the half-reaction are as
 $Zn = Zn^{2+} + 2e^-$; $E^\circ = + 0.76 V$
 $Fe = Fe^{2+} + 2e^-$; $E^\circ = + 0.41 V$ the E°_{cell} is :
 $Fe^{+2} + Zn \rightleftharpoons Zn^{2+} + Fe$ is :
 (A) $-0.35 V$ (B) $+ 0.35 V$ (C) $+1.17 V$ (D) $- 1.17 V$
- From the following E° values of half cells -
 (i) $A + e^- \rightarrow A^-$; $E^\circ = - 0.24 V$ (ii) $B^- + e^- \rightarrow B^{2-}$; $E^\circ = + 1.25 V$
 (iii) $C^- + 2e^- \rightarrow C^{3-}$; $E^\circ = -1.25 V$ (iv) $D + 2e^- \rightarrow D^{2-}$; $E^\circ = + 0.68 V$
 What combination of two half cells would result in a cell with the largest potential
 (A) (ii) and (iii) (B) (ii) and (iv) (C) (i) and (iii) (D) (i) and (iv)
- The Ni/Ni^{2+} and F^-/F_2 electrode potentials are listed as $+0.25 V$ and $-2.87 V$ respectively (with respect to the standard hydrogen electrode). The cell potential when these are coupled under standard conditions is
 (A) $2.62 V$ and dependent on the reference electrode chosen.
 (B) $3.12 V$ and independent of the reference electrode chosen.
 (C) $3.12 V$ and dependent on the reference electrode chosen.
 (D) $2.62 V$ and independent of the reference electrode chosen.
- E° for some half cell reactions are given below
 $Sn^{+4} + 2e^- \longrightarrow Sn^{2+}$; $E^\circ = 0.151 V$
 $2Hg^{2+} + 2e^- \longrightarrow Hg_2^{+2}$; $E^\circ = 0.92 V$
 $PbO_2 + 4H^+ + 2e^- \longrightarrow Pb^{2+} + 2H_2O$; $E^\circ = 1.45 V$
 based on the given data which statement is correct.
 (A) Sn^{4+} is a stronger oxidising agent than Pb^{+4}
 (B) Sn^{2+} is a stronger reducing agent than Hg_2^{2+}
 (C) Hg^{2+} is a stronger oxidising agent than Pb^{4+}
 (D) Pb^{+2} is a stronger reducing agent than Sn^{2+}

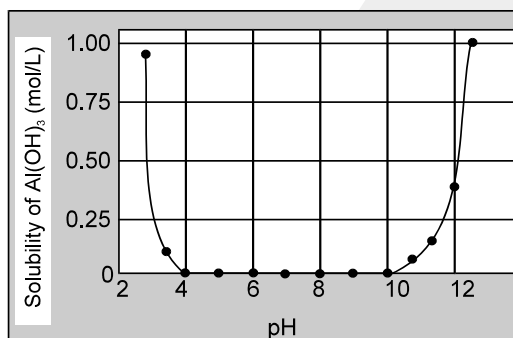
6. For the cell prepared from electrode A and B, electrode A : $\frac{\text{Cr}_2\text{O}_7^{2-}}{\text{Cr}^{3+}}$, $E_{\text{red}}^{\circ} = +1.33 \text{ V}$ and electrode B : $\frac{\text{Fe}^{3+}}{\text{Fe}^{2+}}$, $E_{\text{red}}^{\circ} = 0.77 \text{ V}$, which of the following statement is **not correct?**
- (A) The electrons will flow from B to A (in the outer circuit) when connections are made.
 (B) The standard emf of the cell will be 0.56 V.
 (C) A will be positive electrode.
 (D) None of the above.
7. The standard reduction potentials at 25°C for the following half reactions are given against each -
- | | |
|--|----------|
| $\text{Zn}^{2+}(\text{aq}) + 2\text{e}^{-} \rightleftharpoons \text{Zn}(\text{s})$, | -0.762 V |
| $\text{Cr}^{3+}(\text{aq}) + 3\text{e}^{-} \rightleftharpoons \text{Cr}(\text{s})$, | -0.740 V |
| $2\text{H}^{+} + 2\text{e}^{-} \rightleftharpoons \text{H}_2(\text{g})$, | 0.00 V |
| $\text{Fe}^{3+} + \text{e}^{-} \rightleftharpoons \text{Fe}^{2+}$, | 0.77 V |
- Which is the strongest reducing agent -
- (A) Zn (B) Cr (C) $\text{H}_2(\text{g})$ (D) $\text{Fe}^{3+}(\text{aq})$
8. Hydrogen gas will not reduce -
- (A) heated cupric oxide (B) heated feric oxide
 (C) heated stannic oxide (D) heated aluminium oxide
- [$E_{\text{Sn}^{+4}/\text{Sn}^{+2}}^{\circ} = 0.15\text{V}$; $E_{\text{Cu}^{+2}/\text{Cu}^{+}}^{\circ} = +0.167\text{V}$; $E_{\text{Fe}^{+3}/\text{Fe}^{+2}}^{\circ} = +0.771\text{V}$; $E_{\text{Al}^{+3}/\text{Al}}^{\circ} = -1.67\text{V}$]
9. Four colourless salt solutions are placed in separate test tubes and a strip of copper is dipped in each. Which solution finally turns blue ? (use data from electrochemical series)
- (A) $\text{Pb}(\text{NO}_3)_2$ (B) AgNO_3 (C) $\text{Zn}(\text{NO}_3)_2$ (D) $\text{Cd}(\text{NO}_3)_2$
10. Red hot carbon will remove oxygen from the oxide XO and YO but not from ZO. Y will remove oxygen from XO. Use this evidence to deduce the order of activity of the three metals X, Y, and Z putting the most active first :
- (A) XYZ (B) ZYX (C) YXZ (D) ZXY
11. Which statement about standard reduction potentials is correct
- (A) $E_{\text{H}^{+}/\text{H}_2}^{\circ} = \text{Zero at all temperature}$
 (B) $E_{\text{D}^{+}/\text{D}_2}^{\circ} = \text{zero at 298 K}$
 (C) A redox reaction is feasible if sum of SRP of oxidant and that of reductant is a positive quantity
 (D) $\text{K}_2\text{Cr}_2\text{O}_7$ (acid) is stronger oxidising agent than KMnO_4 (acid)
- [Given : $E_{\text{MnO}_4^{-}/\text{Mn}^{2+}}^{\circ} = 1.51 \text{ V}$; $E_{\text{Cr}_2\text{O}_7^{2-}/\text{Cr}^{3+}}^{\circ} = 1.33 \text{ V}$]
12. The temperature defining the standard electrode potential is
- (A) 298 K (B) 273 K (C) 373 K
 (D) any temperature can be selected but it must remain constant and species must be in their standard states.
13. The standard reduction potentials of some half cell reactions are given below :
- | | |
|--|-------------------------------|
| $\text{PbO}_2 + 4\text{H}^{+} + 2\text{e}^{-} \rightleftharpoons \text{Pb}^{2+} + 2\text{H}_2\text{O}$ | $E^{\circ} = 1.455 \text{ V}$ |
| $\text{MnO}_4^{-} + 8\text{H}^{+} + 5\text{e}^{-} \rightleftharpoons \text{Mn}^{2+} + 4\text{H}_2\text{O}$ | $E^{\circ} = 1.51 \text{ V}$ |
| $\text{Ce}^{4+} + \text{e}^{-} \rightleftharpoons \text{Ce}^{3+}$ | $E^{\circ} = 1.61 \text{ V}$ |
| $\text{H}_2\text{O}_2 + 2\text{H}^{+} + 2\text{e}^{-} \rightleftharpoons 2\text{H}_2\text{O}$ | $E^{\circ} = 1.71 \text{ V}$ |
- Pick out the correct statement :
- (A) Ce^{4+} will oxidise Pb^{2+} to PbO_2 (B) MnO_4^{-} will oxidise Pb^{2+} to PbO_2
 (C) H_2O_2 will oxidise Mn^{+2} to MnO_4^{-} (D) PbO_2 will oxidise Mn^{+2} to MnO_4^{-}

Comprehension # (Q.14 to Q.15)

Amphoteric oxides, such as aluminium oxide, are soluble both in strongly acidic and in strongly basic solutions :

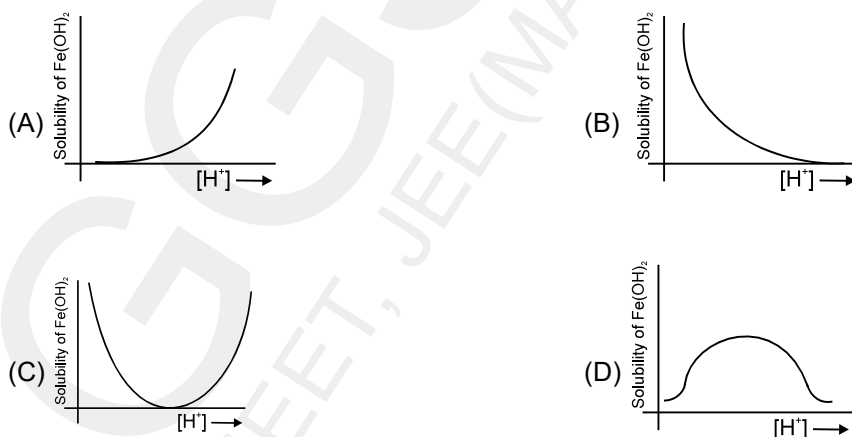


Dissolution of $\text{Al}(\text{OH})_3$ in excess base is just a special case of the effect of complex-ion formation on solubility. $\text{Al}(\text{OH})_3$ dissolves because excess OH^- ions convert it to the soluble complex ion $\text{Al}(\text{OH})_4^-$ (aluminate ion). The effect of pH on the solubility of $\text{Al}(\text{OH})_3$ is shown in figure.



Other examples of amphoteric hydroxides include $\text{Zn}(\text{OH})_2$, $\text{Cr}(\text{OH})_3$, $\text{Sn}(\text{OH})_2$ and $\text{Pb}(\text{OH})_2$, which react with excess OH^- ions to form the soluble complex ions $\text{Zn}(\text{OH})_4^{2-}$ (zincate ion), $\text{Cr}(\text{OH})_4^-$ (chromite ion), $\text{Sn}(\text{OH})_3^-$ (stannite ion), and $\text{Pb}(\text{OH})_3^-$ (plumbite ion), respectively. By contrast, basic hydroxides, such as $\text{Mn}(\text{OH})_2$, $\text{Fe}(\text{OH})_2$, and $\text{Fe}(\text{OH})_3$, dissolve in strong acid but not in strong base.

14. Which of the following curves best represents the variation of solubility of ferrous hydroxide $\text{Fe}(\text{OH})_2$ with the concentration of $[\text{H}^+]$ ions in the solution :



15. At what maximum pH will 5.0×10^{-3} mol of $\text{Al}(\text{OH})_3$ go into 1L solution as Al^{3+} ?
Given $K_{\text{sp}} [\text{Al}(\text{OH})_3] = 5.0 \times 10^{-33}$ and for $[\text{Al}(\text{OH})_4^-] \rightleftharpoons \text{Al}^{3+} + 4\text{OH}^-$, $K_{\text{eq}} = 1.0 \times 10^{-34}$.
- (A) 3.3 (B) 5 (C) 4 (D) 3

PHYSICAL / INORGANIC
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DAILY PRACTICE PROBLEMS

DPP No. 27

Total Marks : 42
Max. Time : 44 min.

Topic : Electro Chemistry

Type of Questions

Type of Questions	M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.10	(3 marks, 3 min.) [30, 30]
Multiple choice objective ('-1' negative marking) Q.11	(4 marks, 4 min.) [4, 4]
Subjective Questions ('-1' negative marking) Q.12 to Q.13	(4 marks, 5 min.) [8, 10]

- E° for $F_2 + 2e^- \rightleftharpoons 2F^-$ is 2.8 V, E° for $\frac{1}{2} F_2 + e^- = F^-$ is -

(A) 2.8 V (B) 1.4 V (C) -2.8 V (D) -1.4 V
- The standard reduction potential of Cu^{2+}/Cu and Cu^{2+}/Cu^+ are 0.337 and 0.153 respectively. The standard electrode potential of Cu^+/Cu half-cell is -

(A) 0.184 V (B) 0.827 V (C) 0.521 V (D) 0.490 V
- $E_{Fe^{3+}/Fe^{+2}}^0 = +0.77 V$; $E_{Fe^{+3}/Fe}^0 = -0.036 V$. What is $E_{Fe^0/Fe^{+2}}^0$ and is Fe^{+2} stable to disproportionation in aqueous solution under standard conditions

(A) +0.44 V, yes (B) -0.44 V, No (C) +0.44 V, No (D) -0.44 V, yes
- Given that $E_{Fe^{2+}/Fe}^0 = -0.44 V$; $E_{Fe^{3+}/Fe^{2+}}^0 = 0.77 V$ if Fe^{2+} , Fe^{3+} and Fe solid are kept together then

(A) Fe^{3+} increases (B) Fe^{3+} decreases
(C) Fe^{2+}/Fe^{3+} remains unchanged (D) Fe^{2+} decreases
- The spontaneous redox reaction/s among the following is/are

(a) $2Fe^{3+} + Fe \longrightarrow 3Fe^{2+}$
(b) $Hg_2^{2+} \longrightarrow Hg^{2+} + Hg$
(c) $3AgCl + NO + 2H_2O \longrightarrow 3Ag + 3Cl^- + NO_3^- + 4H^+$

Given that

$E_{Fe^{3+}/Fe^{2+}}^0 = 0.77 V$	$E_{Fe^{2+}/Fe}^0 = -0.44 V$
$E_{Hg_2^{2+}/Hg}^0 = 0.85 V$	$E_{Hg^{2+}/Hg_2^{2+}}^0 = 0.92 V$
$E_{AgCl/Ag}^0 = 0.22 V$	$E_{NO_3^-/NO}^0 = 0.96 V$

(A) a (B) a, b, c (C) a, b (D) a, c
- ΔG° of the cell reaction $AgCl(s) + \frac{1}{2} H_2(g) \rightleftharpoons Ag(s) + H^+ + Cl^-$ is -21.52 kJ.
 ΔG° of $2AgCl(s) + H_2(g) = 2Ag(s) + 2H^+ + 2Cl^-$ is -

(A) -21.52 kJ (B) -10.76 kJ (C) -43.04 kJ (D) 43.04 kJ
- In a concentration cell, $Zn | Zn^{2+} (1.0M) || Zn^{2+} (0.15 M) | Zn$ as the cell discharges,

(A) reaction proceeds to the right
(B) the two solutions approach each other in concentration
(C) no reaction takes place
(D) water gets decomposed

8. In a half-cell containing $[Tl^{3+}] = 0.1 \text{ M}$ and $[Tl^+] = 0.01 \text{ M}$, the cell potential is -1.2496 V for the reaction $Tl^+ \longrightarrow Tl^{3+} + 2e^-$. The standard reduction potential of the Tl^{3+}/Tl^+ couple at 25°C is
 (A) 1.44 V (B) 0.61 V (C) 2.44 V (D) 1.22 V
9. A galvanic cell is composed of two hydrogen electrodes, one of which is a standard one. In which of the following solutions should the other electrode be immersed to get maximum e.m.f. ($K_a = 10^{-5}$ for acetic acid and $K_a = 10^{-3}$ for phosphoric acid)
 (A) 0.1 M HCl (B) $0.1 \text{ M CH}_3\text{COOH}$ (C) $0.1 \text{ M H}_3\text{PO}_4$ (D) $0.1 \text{ M H}_2\text{SO}_4$
10. The standard electrode potential for the reactions,
 $Ag^+(aq) + e^- \longrightarrow Ag(s)$
 $Sn^{2+}(aq) + 2e^- \longrightarrow Sn(s)$
 at 25°C are 0.80 volt and -0.14 volt , respectively. The emf of the cell $Sn|Sn^{2+} (1 \text{ M}) || Ag^+ (1 \text{ M})|Ag$ is-
 (A) 0.66 volt (B) 0.80 volt (C) 1.08 volt (D) 0.94 volt
11. For the cell $Tl | Tl^+ (0.001 \text{ M}) || Cu^{2+} (0.1 \text{ M}) | Cu$. E_{cell} at 25°C is 0.83 V , which can be increased-
 (A) by increasing $[Cu^{2+}]$ (B) by increasing $[Tl^+]$
 (C) by decreasing $[Cu^{2+}]$ (D) by decreasing $[Tl^+]$
12. Given the standard reduction potentials $Tl^+ + e^- \longrightarrow Tl$, $E^\circ = -0.34 \text{ V}$ and $Tl^{3+} + 2e^- \longrightarrow Tl^+$, $E^\circ = 1.25 \text{ V}$. Examine the spontaneity of the reaction, $3Tl^+ \longrightarrow 2Tl + Tl^{3+}$. Also find E° for this disproportionation.
13. What is the electrode potential of $Mg^{2+} | Mg$ electrode at 25°C , in which the concentration of Mg^{2+} is 0.01 M . $E^\circ (Mg^{2+} | Mg) = -2.36 \text{ V}$.

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DPP No. 28

Total Marks : 43
Max. Time : 45 min.

Topic : Electro Chemistry

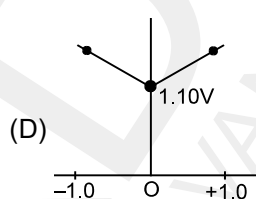
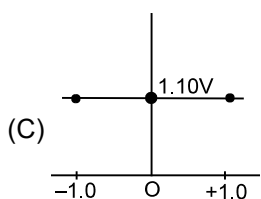
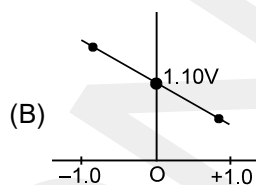
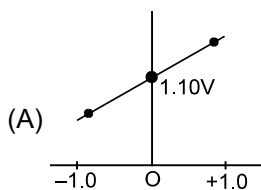
Type of Questions

Type of Questions	M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.7	(3 marks, 3 min.) [21, 21]
Multiple choice objective ('-1' negative marking) Q.8	(4 marks, 4 min.) [4, 4]
Subjective Questions ('-1' negative marking) Q.9 to Q.10	(4 marks, 5 min.) [8, 10]

- Which of the following concentration cells will produce maximum E_{cell} at 298 K.
[Take $p_{\text{H}_2} = 1.0$ atm in each case.]
(A) $\text{Pt} | \text{H}_2(\text{g}) | \text{H}^+(0.01 \text{ M}) || \text{H}^+(0.1 \text{ M}) | \text{H}_2(\text{g}) | \text{Pt}$
(B) $\text{Pt} | \text{H}_2(\text{g}) | \text{NH}_4\text{Cl}(0.01 \text{ M}) || \text{HCl}(0.1 \text{ M}) | \text{H}_2(\text{g}) | \text{Pt}$
(C) $\text{Pt} | \text{H}_2(\text{g}) | \text{H}^+(0.1 \text{ M}) || \text{H}^+(0.2 \text{ M}) | \text{H}_2(\text{g}) | \text{Pt}$
(D) $\text{Pt} | \text{H}_2(\text{g}) | \text{H}^+(\text{pH} = 0.0) || \text{H}^+(\text{pH} = 0.0) | \text{H}_2(\text{g}) | \text{Pt}$
- Given that (at $T = 298 \text{ K}$)
 $\text{Cu}(\text{s}) | \text{Cu}^{2+}(1.0 \text{ M}) || \text{Ag}^+(1.0 \text{ M}) | \text{Ag}(\text{s}) \quad E_{\text{cell}}^{\circ} = 0.46 \text{ V}$
 $\text{Zn}(\text{s}) | \text{Zn}^{2+}(1.0 \text{ M}) || \text{Cu}^{2+}(1.0 \text{ M}) | \text{Cu}(\text{s}) \quad E_{\text{cell}}^{\circ} = 1.10 \text{ V}$
Then E_{cell} for
 $\text{Zn} | \text{Zn}^{2+}(0.1 \text{ M}) || \text{Ag}^+(1.0 \text{ M}) | \text{Ag}$ at 298 K will be
(A) 1.59 V (B) 1.53 V
(C) 2.53 V (D) cannot be calculated due to insufficient data
- What is the value of the reaction quotient, Q , for the cell -
 $\text{Ni}(\text{s}) | \text{Ni}(\text{NO}_3)_2(0.190 \text{ M}) || \text{KCl}(0.40 \text{ M}) | \text{Cl}_2(\text{g}, 0.10 \text{ atm}) | \text{Pt}(\text{s})$
(A) 3×10^{-1} (B) 1.3×10^{-1} (C) 8.0×10^{-2} (D) 3.0×10^{-2}
- A hydrogen electrode placed in a buffer solution of CH_3COONa and CH_3COOH in the molar ratios $x : y$ and $y : x$ has oxidation potentials E_1 and E_2 volts respectively at 298 K. ($p_{\text{H}_2} = 1 \text{ atm}$). The pK_a value of acetic acid will be given by .
(A) $\frac{E_1 - E_2}{0.118}$ (B) $\frac{E_2 - E_1}{0.118}$ (C) $\frac{E_1 + E_2}{0.118}$ (D) None of these
- For the cell $\text{Pt} | \text{H}_2(\text{g}) | \text{solution X} || \text{KCl}(\text{saturated}) | \text{Hg}_2\text{Cl}_2 | \text{Hg} | \text{Pt}$
the observed EMF at 25°C was 600 mV. When solution X was replaced by a standard phosphate buffer with $\text{pH} = 7.00$, the EMF was 718 mV. Find the pH of solution X.
(A) 3 (B) 4 (C) 5 (D) 6
- The dissociation constant for $[\text{Ag}(\text{NH}_3)_2]^+$ into Ag^+ and NH_3 is 10^{-13} at 298 K. If $E_{\text{Ag}^+/\text{Ag}}^{\circ} = 0.8 \text{ V}$, then E° for the half cell $[\text{Ag}(\text{NH}_3)_2]^+ + e^- \longrightarrow \text{Ag} + 2\text{NH}_3$ will be
(A) 0.33 V (B) -0.33 V (C) -0.033 V (D) 0.033 V

7. You are given the following cell at 298 K with $E^{\circ}_{\text{cell}} = 1.10 \text{ V}$
 $\text{Zn(s)} | \text{Zn}^{2+} (\text{C}_1) || \text{Cu}^{2+} (\text{C}_2) | \text{Cu(s)}$
 where C_1 and C_2 are the concentration in mol/lit then which of the following figures correctly correlates E_{cell} as a function of concentrations..

x-axis : $\log \frac{\text{C}_1}{\text{C}_2}$ and y-axis : E_{cell}



8. Make out the right combination of cell and condition for the spontaneity :
- (A) $\text{Pt} (\text{H}_2) | \text{HCl} | \text{Pt} (\text{H}_2) ; P_1 > P_2$ (B) $\text{Zn} | \text{Zn}^{2+} (\text{C}_1) || \text{Zn}^{2+} (\text{C}_2) | \text{Zn} ; \text{C}_2 > \text{C}_1$
 $P_1 \quad 1\text{M} \quad P_2$
- (C) $\text{Pt} (\text{Cl}_2) | \text{Cl}^- (\text{C}_1) || \text{Cl}^- (\text{C}_2) | \text{Pt} (\text{Cl}_2) ; \text{C}_2 > \text{C}_1$ (D) $\text{Pt} (\text{H}_2) | \text{HCl} (\text{C}_1) || \text{HCl} (\text{C}_2) | \text{Pt} (\text{H}_2) ; \text{C}_2 > \text{C}_1$
 $1 \text{ atm} \quad \quad \quad 1 \text{ atm} \quad \quad \quad 1 \text{ atm} \quad \quad \quad 1 \text{ atm}$

Single Integer

9. Depression of freezing point of 0.01 molal aqueous CH_3COOH solution is 0.02046° . 1 molal aqueous urea solution freezes at -1.86°C . Assuming molality to be equal to molarity, calculate pH of CH_3COOH solution.
10. The active ingredient in aspirin is acetyl salicylic acid,
 $\text{HC}_9\text{H}_7\text{O}_4 + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{C}_9\text{H}_7\text{O}_4^-$, $K_a = 6.25 \times 10^{-9}$
 What is the pH of the solution obtained by dissolving two aspirin tablets in 250mL of water ? Assume that each tablet contains 0.36 g of acetyl salicylic acid.

**PHYSICAL / INORGANIC
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DPP No. 29

Total Marks : 34
Max. Time : 38 min.

Topic : Electro Chemistry

Type of Questions

Type of Questions	M.M., Min.
Single choice Objective ('-1' negative marking) Q.1	(3 marks, 3 min.) [3, 3]
Subjective Questions ('-1' negative marking) Q.2 to Q.5	(4 marks, 5 min.) [16, 20]
Comprehension ('-1' negative marking) Q.6 to Q.8	(3 marks, 3 min.) [9, 9]
Short Subjective Questions ('-1' negative marking) Q.9 to Q.10	(3 marks, 3 min.) [6, 6]

- When 0.1 mole HCl gas is added in 1lit of 0.1 M $\text{CH}_3\text{COOH}(\text{aq})$ then which statement is wrong? ($K_a = 2 \times 10^{-5}$, $\log 2 = 0.3$)
 (A) degree of dissociation of CH_3COOH decreases sharply.
 (B) change in pH would be 1.85
 (C) conc of $[\text{Cl}^-] = 0.1 \text{ M}$, $[\text{CH}_3\text{COOH}] = 0.1 \text{ M}$, $[\text{H}^+] = 0.2 \text{ M}$ in final solution
 (D) on addition of HCl, K_a of CH_3COOH does not change.
- Calculate E° and E for the cell $\text{Sn} | \text{Sn}^{2+} (1\text{M}) || \text{Pb}^{2+} (10^{-3} \text{ M}) | \text{Pb}$, $E^\circ (\text{Sn}^{2+} / \text{Sn}) = -0.14\text{V}$.
 $E^\circ (\text{Pb}^{2+} / \text{Pb}) = -0.13\text{V}$. What do you infer from cell EMF?
- Calculate the equilibrium constant for the reaction $\text{Fe} + \text{CuSO}_4 \rightleftharpoons \text{FeSO}_4 + \text{Cu}$ at 25°C . Given
 $E^\circ (\text{Fe}/\text{Fe}^{2+}) = 0.44\text{V}$, $E^\circ (\text{Cu}/\text{Cu}^{2+}) = -0.337 \text{ V}$.
- For a cell $\text{Mg}(\text{s}) | \text{Mg}^{2+}(\text{aq}) || \text{Ag}^+(\text{aq}) | \text{Ag}$, Calculate the equilibrium constant at 25°C . Also find the maximum work that can be obtained by operating the cell. $E^\circ (\text{Mg}^{2+} / \text{Mg}) = -2.37\text{V}$, $E^\circ (\text{Ag}^+/\text{Ag}) = 0.8 \text{ V}$.
- At 25°C the value of K for the equilibrium $\text{Fe}^{3+} + \text{Ag} \rightleftharpoons \text{Fe}^{2+} + \text{Ag}^+$ is 0.531 mol/litre. The standard electrode potential for $\text{Ag}^+ + e \rightleftharpoons \text{Ag}$ is 0.799V. What is the standard potential for $\text{Fe}^{3+} + e \rightleftharpoons \text{Fe}^{2+}$?

Comprehension # (Q.6 to Q.8)

(Read the following passage and answer the questions numbered 5 to 7. They have only one correct option)

Standard reduction potentials (SRP) for different systems can be used to decide the spontaneity of a reaction e.g. $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76\text{V}$, hence for the reaction $\text{Zn} + 2\text{H}^+ \longrightarrow \text{Zn}^{2+} + \text{H}_2$, ΔG° is negative. It has been found experimentally that if (SRP of an oxidant – SRP of a reductant) is more than 1.7V, then their combination may lead to explosion (though it may be prevented by kinetic factors).

Now go through the following data and answer the questions.

Data :	$E^\circ_{\text{Ag}^+/\text{Ag}} = 0.80 \text{ V}$;	$E^\circ_{\text{N}_2/\text{N}_3^-} = -3.09 \text{ V}$
	$E^\circ_{\text{ClO}_4^-/\text{ClO}_3^-} = 1.23 \text{ V}$;	$E^\circ_{\text{Na}^+/\text{Na}} = -2.71 \text{ V}$
	$E^\circ_{\text{Fe}^{3+}/\text{Fe}^{2+}} = 0.77 \text{ V}$;	$E^\circ_{\text{O}_2/\text{H}_2\text{O}_2} = -1.03 \text{ V}$
	$E^\circ_{\text{H}_2\text{O}_2/\text{H}_2\text{O}} = 1.76 \text{ V}$;	$E^\circ_{\text{O}_3/\text{O}_2} = 2.07 \text{ V}$
	$E^\circ_{\text{MnO}_4^-/\text{Mn}^{2+}} = 1.54 \text{ V}$;	$E^\circ_{\text{Cr}_2\text{O}_7^{2-}/\text{Cr}^{3+}} = 1.33 \text{ V}$

6. Which of the following ionic combinations may lead to the formation of explosive substance.
(A) Sodium ion and azide ion (B) Silver ion and perchlorate ion
(C) Silver ion and azide ion (D) All the above
7. Which of the following ions will be capable of causing catalytic decomposition of H_2O_2 .
(A) Fe^{3+} (B) Fe^{2+} (C) both (D) None of these
8. Which is correct about the reaction between H_2O_2 and O_3
(A) It is a case of mutual reduction
(B) O_3 will oxidise H_2O_2 into O_2
(C) It is not a redox reaction
(D) H_2O_2 being a stronger oxidising agent will decompose ozone into oxygen

SINGLE INTEGER

9. The ionization constant of nitrous acid is 4×10^{-4} . Calculate the pH of 0.04 M sodium nitrite solution.
10. For aqueous solution of how many of the following compounds / mixtures, does the pH remains constant even upon dilution :
- | | | |
|--|---|---|
| (1) NH_4Cl | (2) Na_2CO_3 | (3) A 1 : 2 molar ratio mixture of Na_2S and HCl . |
| (4) A 5 : 2 molar ratio mixture of NaOH and H_3PO_4 . | (5) A 5 : 4 molar ratio mixture of CH_3COONa and HCl . | |
| (6) NaH_2PO_4 | (7) A 2 : 1 molar ratio mixture of HCl and NaHCO_3 . | |
| (8) $\text{CH}_3\text{COONH}_4$ | (9) A 4 : 3 molar ratio mixture of NH_4OH and HCl . | |

PHYSICAL / INORGANIC
CHEMISTRY
DPP
DAILY PRACTICE PROBLEMS

DPP No. 30

Total Marks : 39
Max. Time : 44 min.

Topic : Electro Chemistry

Type of Questions

Type of Questions	M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.5	[15, 15]
Subjective Questions ('-1' negative marking) Q.6 to Q.8	[12, 15]
Match the Following (no negative marking) Q. 9	[8, 10]
True or False (no negative marking) Q.10 & Q.11	[4, 4]

- $E_{Al^{3+}/Al}^{\circ} = -1.66$ V and K_{sp} of $Al(OH)_3 = 1.0 \times 10^{-33}$. Reduction potential of the above couple at pH = 14 is :
 (A) - 2.31 V (B) + 2.31 (C) - 1.01 V (D) + 1.01 V.
- At 298K the standard free energy of formation of $H_2O(l)$ is -257.20 kJ/mole while that of its ionisation into H^+ ion and hydroxyl ions is 80.35 kJ/mole, then the emf of the following cell at 298 K will be : (take $F = 96500$ C) :
 $H_2(g, 1 \text{ bar}) | H^+ (1M) || OH^- (1M) | O_2 (g, 1\text{bar})$
 (A) 0.40 V (B) 0.50 V (C) 1.23 V (D) - 0.40 V
- pH of the solution in the anode compartment of the following cell at 25°C is x when $E_{cell} - E_{cell}^{\circ} = 0.0591$ V, $Pt(H_2) (1 \text{ atm}) | pH = x || Ni^{2+} (1 M) | Ni$ is :
 (A) 4 (B) 3 (C) 2 (D) 1
- The emf of the cell, $Ag | Ag^+ (1 M) || I^- (1 M) | AgI | Ag$ is E
 The solubility product of AgI can be expressed as :
 (A) $K_s = \frac{nF}{2.303 RT} \log E$ (B) $\ln K = nF \left[\frac{\partial E}{\partial T} - E \right]$ (C) $\ln K_s = \frac{nF}{E}$ (D) $\log K_s = \frac{nFE}{2.303 RT}$
- The emf of the cell $Zn | ZnCl_2 (0.05 M) | AgCl(s) | Ag$ is 1.015 V at 298 K and the temperature coefficient of its emf is -4.92×10^{-4} V/K. How many of the reaction thermodynamic parameters ΔG , ΔS and ΔH are negative at 298 K?
 (A) None of them (B) One of them (C) Two of them (D) All of them
- If $E_{Ag^+/Ag}^{\circ} = 0.80$ V at 298 K and K_{sp} ($AgCl$) is 1.56×10^{-10} , calculate E° for $Cl^- | AgCl | Ag$ half-cell.
- Calculate solubility of $AgBr$ in 0.1 M $AgNO_3$ solution.
 Given $Ag^+ + e^- \longrightarrow Ag (s), E^{\circ} = 0.80$ V.
 $AgBr (s) + e^- \longrightarrow Ag (s) + Br^- , E^{\circ} = 0.073$ V.
- At 25°C, $\left(\frac{dE^{\circ}}{dT} \right)_p = -1.25 \times 10^{-3}$ V K⁻¹ and $E^{\circ} = 1.36$ V for the cell, $Pt | H_2(g) | HCl (aq) | Cl_2 (g) | Pt$.
 Calculate the enthalpy and entropy change for cell reaction.
- | Column - I | Column - II |
|----------------------|---------------------------------|
| (A) $H^+ (aq)$ | (p) $\Delta H_f^{\circ} = 0$ |
| (B) $H (gas)$ | (q) $\Delta H_f^{\circ} \neq 0$ |
| (C) $H_2 (gas)$ | (r) $\Delta G_f^{\circ} = 0$ |
| (D) $C (s, diamond)$ | (s) $\Delta H_f^{\circ} > 0$ |
- S_1 : 1 mole O_2 gas at STP has more entropy than 1 mole O_2 gas at 273 K in a volume of 11.2 litre.
 S_2 : Expansion of a sample of ideal gas always represents an increase in entropy of the system.
 S_3 : On keeping a heated metal block into open atmosphere, there occurs an increase in entropy of universe.
 S_4 : 1 mole O_2 gas at STP has more entropy than 1 mole O_2 gas at 273 K and 0.25 atm.
 (A) T T T F (B) T F T F (C) F F F T (D) F T F T
- S_1 : For an irreversible adiabatic compression process, entropy change of surrounding will be equal to zero.
 S_2 : Molar entropy of a substance follows the order $(S_m)_{solid} < (S_m)_{liquid} < (S_m)_{gas}$
 S_3 : Entropy change for the reaction $H_2(g) \longrightarrow 2H(g)$ is +ve.
 S_4 : Molar entropy of a non-crystalline solid will be zero at absolute zero temperature.
 (A) F T T F (B) T T T F (C) T T F T (D) F F T T

Topic : Electro Chemistry

Type of Questions

M.M., Min.

Single choice Objective ('-1' negative marking) Q.1 to Q.11 (3 marks, 3 min.) [33, 33]

1. (a) Which process occurs in the electrolysis of an aqueous tin(II) chloride solution at a tin anode?
 (A) $\text{Sn} = \text{Sn}^{2+} + 2\text{e}^-$ (B) $2\text{Cl}^- = \text{Cl}_2 + 2\text{e}^-$
 (C) $2\text{H}_2\text{O} = \text{O}_2 + 4\text{H}^+ + 4\text{e}^-$ (D) none of these
- (b) In the electrolysis of an aqueous nickel(II) sulphate solution, the process $2\text{H}_2\text{O} = \text{O}_2 + 4\text{H}^+ + 4\text{e}^-$ occurs at the anode. The material of construction of the anode is
 (A) nickel (B) gold (C) copper (D) none of these
2. (a) In the electrolysis of an aqueous potassium sulphate solution, the pH of the solution in the space near an electrode increased. Which pole of the current source is the electrode connected to?
 (A) The positive pole (B) Could be either pole
 (C) The negative pole (D) Cannot be determined
- (b) In the electrolysis of an aqueous solution of a salt, the pH in the space near one of the electrodes increased. A solution of which salt is being electrolyzed?
 (A) none of the following (B) CuCl_2
 (C) $\text{Cu}(\text{NO}_3)_2$ (D) KCl
3. Number of electrons lost during electrolysis of 0.355 g of Cl^- is -
 (A) 0.01 (B) $0.01 N_0$ (C) $0.02 N_0$ (D) $\frac{0.01}{2N_0}$
4. In the electrolysis of a copper(II) chloride solution, the mass of the cathode increased by 3.2 g. What occurred at the copper anode?
 (A) 0.05 mol of Cu^{2+} passed into the solution (B) 0.56 L of O_2 was liberated
 (C) 0.1 mol of Cu^{2+} passed into the solution (D) 0.112 L of Cl_2 was liberated
5. The passage of a constant current through a solution of dilute H_2SO_4 with 'Pt' electrodes liberated 336 cm^3 of a mixture of H_2 and O_2 at S.T.P. The quantity of electricity that was passed is
 (A) 96500 C (B) 965 C (C) 1930 C (D) $\frac{1}{100}$ faraday

6. A very thin copper plate is electro-plated with gold using gold chloride in HCl. The current was passed for 20 min. and the increase in the weight of the plate was found to be 2g. [Au = 197]. The current passed was -
- (A) 0.816 amp (B) 1.632 amp (C) 2.448 amp (D) 3.264 amp
7. In the electrolysis of an aqueous SnCl_2 solution, 4.48 L of chlorine at STP were liberated at the anode. The mass of tin deposited at the cathode was (M of Sn = 118.5)
- (A) 119 g (B) 79.3 g (C) 47.4 g (D) 23.7 g
8. What must be the concentration of Ag^+ in an aqueous solution containing $\text{Cu}^{2+} = 1.0 \text{ M}$ so that both the metals can be deposited on the cathode simultaneously. Given that $E_{\text{Cu}/\text{Cu}^{2+}}^0 = -0.34 \text{ V}$ and $E_{\text{Ag}^+/\text{Ag}}^0 = 0.812 \text{ V}$, $T = 298 \text{ K}$
- (A) nearly 10^{-19} M (B) 10^{-12} M (C) 10^{-8} M (D) nearly 10^{-16} M
9. Electrolytic reduction of 6.15 g of nitrobenzene using a current efficiency of 40% will require which of the following quantity of electricity. [C = 12, H = 1, N = 14, O = 16]
- (A) 0.75 F (B) 0.15 F (C) 0.75 C (D) 0.125 C
10. Electrolysis of a solution of HSO_4^- ions produces $\text{S}_2\text{O}_8^{2-}$. Assuming 75% current efficiency, what current should be employed to achieve a production rate of 1 mole of $\text{S}_2\text{O}_8^{2-}$ per hour ?
- (A) +71.5 amp (B) 35.7 amp (C) 142.96 amp (D) 285.93 amp
11. A current is passed through 2 voltmeters connected in series. The first voltmeter contains XSO_4 (aq.) and second has Y_2SO_4 the relative atomic masses of X and Y are in the ratio of 2 : 1. The ratio of the mass of X liberated to the mass of Y liberated is
- (A) 1 : 1 (B) 1 : 2 (C) 2 : 1 (D) None of the above

PHYSICAL / INORGANIC
CHEMISTRY
DPP
DAILY PRACTICE PROBLEMS

DPP No. 32

Total Marks : 33
Max. Time : 36 min.

Topic : Electro Chemistry

Type of Questions

Type of Questions	M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.3	[9, 9]
Subjective Questions ('-1' negative marking) Q.4 to Q.6	[12, 15]
Comprehension ('-1' negative marking) Q.7 to Q.10	[12, 12]

- Aqueous solution of Na_2SO_4 containing a small amount of HPh (Phenolphthalein) is electrolysed using Pt-electrodes. The colour of the solution after some time will :
(A) remain colourless (B) change from pink to colourless
(C) change from colourless to pink (D) remain pink
- For the electrolytic production of NaClO_4 from NaClO_3 as per the equation,
 $\text{NaClO}_3 + \text{H}_2\text{O} \longrightarrow \text{NaClO}_4 + \text{H}_2$, how many faradays of electricity will be required to produce 0.5 mole of NaClO_4 , assuming 60% efficiency?
(A) 0.835 F (B) 1.67 F (C) 3.34 F (D) 1.6 F
- Identify the true and false statement and answer in given options
1. During electrolysis of 1M NaCl solution Cl_2 does not form at the anode.
2. For a concentration cell with its reaction at equilibrium both E_{cell} and E_{cell}° are zero.
3. The hybridisation of $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ is sp^3d^2 .
(A) F T F (B) T T T (C) F F F (D) F T T
- A current of 0.2 A is passed for 10 minutes through 0.05 dm³ of 0.1 M NaCl. If only chlorine is produced at anode and water is reduced to H_2 at cathode, what is the OH^- concentration in the solution after electrolysis?
- Find the thickness of the electro deposited silver if the surface area over which deposition occurred was 100 cm² and a current of 0.2 A flowed for 1hr with the cathodic efficiency of 80%. Density of Ag = 10 g/cc (Ag = 108).
- A 300 mL solution of NaCl was electrolysed for 6.00 min. If the pH of the final solution was 12.24, calculate the average current used.

Comprehension # (Q.7 to Q.10)

If an electrolytic solution consists of more than two ions and electrolysis is done, it is observed that all the ions are not discharge at the electrodes simultaneously but certain ions are liberate at the electrodes in preferential discharge theory. It states that if more than one type of ions are attracted towards a particular electrode, then the one discharged is the ion which required least energy. The potential at which the ion is discharge or deposited on the appropriate electrode is termed as discharge or depositon potential (E). If current of 1 ampere is passed through an aqueous (1 litre) electrolytic solution having $[\text{Zn}^{2+}] = [\text{Cu}^{2+}] = [\text{Mn}^{2+}] = 0.03 \text{ M}$. The standard electrode potential, $E_{\text{Cu}^{2+}/\text{Cu}}^\circ = 0.34 \text{ V}$, $E_{\text{Zn}/\text{Zn}^{2+}}^\circ = 0.762 \text{ V}$ and $E_{\text{Mn}/\text{Mn}^{2+}}^\circ = 1.8 \text{ V}$ are observed and 1 Faraday = 96500 coulomb.

- Which of the following metal is almost first deposited at cathode ?
(A) Cu (B) Zn (C) Mn (D) All of these.
- What would be the approximate concentration of metal ions Cu^{2+} , Zn^{2+} and Mn^{2+} after 96.5 min respectively?
(A) 0.01 M, 0.03 M, 0.001 M (B) 0.01 M, 0.03 M, 0.03 M
(C) 0 M, 0.03 M, 0.03 M (D) 0.003 M, 0.03 M, 0 M.
- After 106.5 minute the metal deposited is approximately ?
(A) 0.012 mole of Cu (B) 0.03 mole of Zn (C) 0.03 mole of Mn (D) 0.003 mole of Zn
- If current efficiency is 50%, what volume of O_2 gas evolved at NTP after 96.5 minutes ?
(A) 332 mL (B) 168 mL (C) 84 mL (D) 42 mL

PHYSICAL / INORGANIC
CHEMISTRY
DPP
DAILY PRACTICE PROBLEMS

DPP No. 33

Total Marks : 33
Max. Time : 36 min.

Topic : Electro Chemistry

Type of Questions

Single choice Objective ('-1' negative marking) Q.1 to Q.7

(3 marks, 3 min.)

M.M., Min.

[21, 21]

Subjective Questions ('-1' negative marking) Q.8 to Q.10

(4 marks, 5 min.)

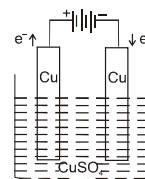
[12, 15]

- To observe the effect of concentration on the conductivity, electrolytes of different nature are taken in two vessel 'A' and 'B'. 'A' contains weak electrolyte e.g., NH_4OH and 'B' contains strong electrolyte e.g., NaCl . In both container concentration of respective electrolyte is increased and conductivity observed :
(A) in 'A' conductivity increases, in 'B' conductivity decreases
(B) in 'A' conductivity decreases while in 'B' conductivity increases
(C) in both 'A' and 'B' conductivity increases
(D) in both 'A' and 'B' conductivity decreases
- The conductivity of 0.1 N NaOH solution is 0.022 S cm^{-1} . To this solution equal volume of 0.1 N HCl solution is added which results into decrease of conductivity of solution to 0.0055 S cm^{-1} . The equivalent conductivity of NaCl solution in $\text{S cm}^2 \text{ equiv}^{-1}$ is :
(A) 0.011 (B) 110 (C) 0.0055 (D) 55.0
- 100 mL of solutions of A and B (containing the same strong electrolyte) fill a conductivity cell with the electrodes being exactly half dipped into the solution and the conductances of 0.01 S and 0.005 S were registered. What would be the conductance if both solution are mixed together and tested upon in the same conductivity cell ?
(A) 0.0075 S (B) 0.015 S (C) 0.03 S (D) none of these
- The specific conductivity is $0.0382 \Omega^{-1} \text{ cm}^{-1}$ for a solution which is 0.1 M in KCl and 0.2 M in NaCl (a strong electrolyte). Calculate $\lambda(\text{Na}^+)$ if the $\lambda(\text{K}^+) = 74$ and $\lambda(\text{Cl}^-) = 76$ resp.
(A) 10 (B) 20 (C) 30 (D) 40
- The solubility of $[\text{Co}(\text{NH}_3)_4\text{Cl}_2] \text{ClO}_4$ if the $\lambda_{\text{Co}(\text{NH}_3)_4\text{Cl}_2^+} = 50$, $\lambda_{\text{ClO}_4^-} = 70$ and the measured resistance was 33.5Ω in a cell with cell constant of 0.20 is _____
(A) 59.7 mmol/L (B) 49.7 mmol/L (C) 39.7 mmol/L (D) 29.7 mmol/L
- For a saturated solution of AgCl at 25°C , $\kappa = 3.4 \times 10^{-6} \text{ S cm}^{-1}$ and that of H_2O (ℓ) used is $2.02 \times 10^{-6} \text{ S cm}^{-1}$. Λ_m° for AgCl is $138 \text{ S cm}^2 \text{ mol}^{-1}$ then the solubility of AgCl in moles per liter will be -
(A) 10^{-5} (B) 10^{-10} (C) 10^{-14} (D) 10^{-16}
- Given that (in $\text{S cm}^2 \text{ eq}^{-1}$) at $T = 298 \text{ K}$:
 $\Lambda_{\text{eq}}^\circ$ for $\text{Ba}(\text{OH})_2$, BaCl_2 & NH_4Cl are 228.8, 120.3 & 129.8 respectively.
Specific conductance for 0.2 N NH_4OH solution is $4.766 \times 10^{-4} \text{ S cm}^{-1}$, then value of pH of the given solution of NH_4OH will be nearly.
(A) 9.2 (B) 11.3 (C) 12.1 (D) 7.9
- The resistance of a $\frac{N}{10}$ KCl solution is 250Ω . Calculate the specific conductance and the equivalent conductance of the solution if the electrodes in the cell are 7 cm apart and each has an area of 7 sq. cm.

Integer Answer Type

This section contains 2 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9.

- In the adjacent diagram the electrolytic cell contains 1 L of an aqueous 1 M Copper (II) sulphate solution. If 0.4 mole of electrons are passed through the cell, the molar concentration of copper ion after passage of the charge will be :



- The charge required for discharging 115 gram of Na from molten NaCl is Faradays.

PHYSICAL / INORGANIC
CHEMISTRY
DPP
DAILY PRACTICE PROBLEMS

DPP No. 34

Total Marks : 40
Max. Time : 47 min.

Topic : Electro Chemistry

Type of Questions

		M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Match the Following (no negative marking) Q. 5	(8 marks, 10 min.)	[8, 10]
Subjective Questions ('-1' negative marking) Q.6 to Q.10	(4 marks, 5 min.)	[20, 25]

- Two aqueous solutions A and B containing solute CuSO_4 and NaBr respectively were electrolysed using platinum electrodes. The pH of the resulting solutions will show a/an :
 (A) Increase in both the solutions (B) Decrease in both the solutions
 (C) Increase in A and decrease in B (D) Decrease in A and increase in B
- 'Spin only' magnetic moment of Ni in $[\text{Ni}(\text{dmg})_2]$ is same as that found in :
 (A) Ni in $[\text{NiCl}_2(\text{PPh}_3)_2]$ (B) Mn in $[\text{MnO}_4]^{2-}$
 (C) Co in $[\text{CoBr}_4]^{2-}$ (D) Pt in $[\text{Pt}(\text{H}_2\text{O})_2\text{Br}_2]$
- S_1 : pH of the solution increases when 1M aqueous solution CuSO_4 is electrolysed using platinum electrodes.
 S_2 : At equilibrium, E°_{cell} of a Daniel cell will be equal to zero.
 S_3 : Equivalent conductance of a weak electrolyte solution increases with decreases in concentration of solution.
 (A) FTT (B) FFT (C) TFT (D) TTF
- Statement-1** : On increasing dilution, the conductivity of solution gets increased.
Statement-2 : On increasing dilution, degree of ionization of weak electrolyte increases and mobility of ions also increases.
 (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
 (B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
 (C) Statement-1 is True, Statement-2 is False.
 (D) Statement-1 is False, Statement-2 is True.
- Column – I**
(Quantities)
 (A) Molar conductance
 (B) emf of a cell in operation
 (C) Gibbs energy change (ΔG) for a cell
 (D) Conductivity
- Column – II**
(Factors on which dependency exist)
 (p) Temperature
 (q) Concentration of species involved
 (r) Nature of substance involved
 (s) Stoichiometric coefficient of the cell reaction.
 (t) Presence of complex forming ligand in sufficient concentration.

Integer Answer Type

This section contains 3 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9.

6. Equivalent conductance of 0.2 M aqueous solution of a weak monobasic acid (HA) is $10 \text{ S cm}^2 \text{ equiv}^{-1}$ and that at infinite dilution is $200 \text{ S cm}^2 \text{ equiv}^{-1}$. Hence pH of this solution is.
7. Conductivity of a saturated solution of $\text{Cu}_2[\text{Fe}(\text{CN})_6]$ after subtracting the conductivity of water is $1.28 \times 10^{-5} \Omega^{-1} \text{ cm}^{-1}$. Calculate value of solubility of $\text{Cu}_2[\text{Fe}(\text{CN})_6]$.
 $[\Lambda_m^\infty(\text{CuSO}_4) = 260 \text{ S cm}^2 \text{ mol}^{-1}, \Lambda_m^\infty(\text{K}_2\text{SO}_4) = 300 \text{ S cm}^2 \text{ mol}^{-1}, \Lambda_m^\infty(\text{K}_4\text{Fe}(\text{CN})_6) = 720 \text{ S cm}^2 \text{ mol}^{-1}]$
 Report your answer as (solubility) $\times (10^5)$
8. A dilute solution of KCl was placed between two Pt electrodes 10 cm apart across which a potential difference of 6.0 volts was applied. Calculate how far (in cm) would K^+ ion move in 2 hours 46 minutes and 60 seconds at 25°C . Given that ionic conductivity of K^+ at infinite dilution is $96.50 \text{ S cm}^2 \text{ eq}^{-1}$ at 25°C . (Assume $1\text{F} = 96500 \text{ C}$).
9. Calculate K_{sp} for BaSO_4 with the help of following data at 298 K. Specific conductance of saturated solution of $\text{BaSO}_4 = 4.44 \times 10^{-6} \text{ ohm}^{-1} \times \text{cm}^{-1}$ and that of water used for making the solution = $1.34 \times 10^{-6} \text{ ohm}^{-1} \times \text{cm}^{-1}$, molar ionic conductance at infinite dilution for Ba^{++} and SO_4^{--} are 127.28 and 159.60 respectively.
10. A conductivity cell has a resistance of 250Ω when filled with 0.02 M KCl at 25°C and one of $10^5 \Omega$ when filled with $6 \times 10^{-5} \text{ M NH}_4\text{OH}$ solution, the specific conductivity of 0.02 M KCl is $0.00277 \text{ S cm}^{-1}$ and the $\lambda_e \text{NH}_4^+$ and $\lambda_e \text{OH}^-$ are 73.4 and 198 respectively. Calculate the cell constant and the degree of dissociation of NH_4OH in the $6 \times 10^{-5} \text{ M}$ solution.

PHYSICAL / INORGANIC
CHEMISTRY
DPP
DAILY PRACTICE PROBLEMS

DPP No. 35

Total Marks : 50
Max. Time : 55 min.

Topic : p-block elements (Nitrogen and Oxygen family)

Type of Questions

Type of Questions	M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.7	(3 marks, 3 min.) [21, 21]
Multiple choice objective ('-1' negative marking) Q.8	(4 marks, 4 min.) [4, 4]
True or False (no negative marking) Q.9	(2 marks, 2 min.) [2, 2]
Assertion and Reason (no negative marking) Q. 10	(3 marks, 3 min.) [3, 3]
Subjective Questions ('-1' negative marking) Q.11 to Q. 15	(4 marks, 5 min.) [20, 25]

- Heating of ammonium dichromate produces :
 (A) NH_3 , Cr_2O_3 and H_2O . (B) N_2 , Cr_2O_3 and H_2O .
 (C) NO_2 , CrO_3 and H_2O . (D) N_2O , CrO_3 and H_2O .
- (a) Which of the following oxides is amphoteric in nature ?
 (A) N_2O_3 (B) P_2O_3 (C) Sb_2O_3 (D) Bi_2O_3
 (b) Which of the following compounds does not give nitrogen on heating ?
 (A) NaN_3 (B) $(\text{NH}_4)_2\text{SO}_4$ (C) NH_4NO_2 (D) NH_4ClO_4
- Which of the following oxides of nitrogen is solid ?
 (A) NO_2 (B) NO (C) N_2O (D) N_2O_5
- Which of the following statement is correct ?
 (A) Black phosphorus is thermodynamically most stable allotrope of phosphorus:
 (B) One mole of calcium phosphide on reaction with excess water gives two moles of phosphine
 (C) PbO_2 on treatment with concentrated HNO_3 produces NO_2 gas.
 (D) (A) and (B) both
- (a) One mole of calcium phosphide on reaction with dilute hydrochloric acid gives :
 (A) Two moles of phosphine (B) Two moles of phosphorus pentachloride
 (C) One mole of phosphine (D) One mole of phosphorus trichloride
 (b) Ammonia can be dried by :
 (A) conc. H_2SO_4 (B) P_4O_{10} (C) anhydrous CaCl_2 (D) none
- For H_3PO_3 and H_3PO_4 , the correct choice is:
 (A) H_3PO_3 is stronger acid than H_3PO_4 (B) H_3PO_3 is dibasic and reducing.
 (C) H_3PO_4 is tribasic and reducing (D) (A) and (B) both
- Which of the following statement (s) is/are incorrect ?
 (A) Ammonia is oxidised to NO_2 by oxygen at 800°C in presence of a catalyst platinum.
 (B) Nitric acid on standing slowly turns yellow.
 (C) Colloidal sulphur is formed when H_2S gas is passed through nitric acid solution.
 (D) N_2O_3 gas dissolves in water giving a pale blue solution.
- Which of the following statement (s) is/are true ?
 (A) Ammonia burns in air with a pale yellow flame.
 (B) Calcium carbide reacts with nitrogen gas at 1100°C to form a fertilizer, nitrolim.
 (C) All the elements of nitrogen family are polyatomic.
 (D) The melting point of antimony is less than arsenic.

9. **True/False :**

- (A) Dry ammonia gas can be obtained by passing it through a U-tube containing anhydrous calcium chloride.
 (B) The brown ring test for nitrates depends on the ability of Fe^{2+} to reduce nitrates to nitric oxide which then reacts with Fe^{2+} to form a brown coloured complex.
 (C) Metals like chromium, aluminium dissolves in concentrated nitric acid (80%).
 (A) F T F (B) T F T (C) F T T (D) T F F

10. **Statement-1 :** NO(s) is a neutral oxide, diamagnetic and is not an acid anhydride.

Statement-2 : NO as a ligand is a three electron donor and paramagnetic in gaseous state.

- (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
 (B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
 (C) Statement-1 is True, Statement-2 is False
 (D) Statement-1 is False, Statement-2 is True

11. An orange solid (A) on heating gives a green residue (B), a colourless gas (C) and water vapour. The dry gas (C) on passing over heated magnesium gave a white solid (D). (D) on reaction with water gave a gas (E) which formed dense white fumes with HCl.
 Identify (A) to (E) giving reactions.

12. (a) Why does the reactivity of nitrogen differ from phosphorus ?
 (b) Nitrogen exists as diatomic molecule and phosphorus as P_4 . Why ?
 (c) Explain why NH_3 is basic while BiH_3 is only feebly basic.

13. (a) What happens when CaO in water reacts with phosphorus (white).
 (b) Give equations for the reactions of the following compound with water.
 (a) AlN (b) P_4O_6
 (c) What happens when carbon reacts with concentrated HNO_3 .

14. (a) Why white phosphorus is kept in water ?
 (b) Pure phosphine does not burn in air but impure sample of phosphine burns in air. Why ?
 (c) What happens when solution of PH_3 in water is exposed to light ?

15. **Integer Answer Type**

This question contains 3 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9.

- (i) How many P-P single bonds are present in white phosphorus (P_4) molecule ?
 (ii) In the disproportionation reaction of NaOH with one molecule of P_4 , number of molecules of NaOH reacting are
 (iii) The basicity of phosphorus acid (H_3PO_3) is

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DAILY PRACTICE PROBLEMS

DPP No. 36

Total Marks : 46
Max. Time : 50 min.

Topic : p-block elements (Nitrogen and Oxygen family)

Type of Questions

Type of Questions	M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.8	(3 marks, 3 min.) [24, 24]
Subjective Questions ('-1' negative marking) Q.9 to Q.11, Q.14	(4 marks, 5 min.) [16, 20]
Comprehension ('-1' negative marking) Q.12 to Q.13	(3 marks, 3 min.) [6, 6]

- White phosphorus has :
 (A) six P – P single bonds (B) four lone pairs of electrons
 (C) PPP angle of 60°C (D) all of these
- Consider the following statements.
 (i) β -black phosphorus is a good conductor of electricity
 (ii) Metalloids like Sb and As do form their corresponding metal oxy acid with concentrated HNO_3 .
 (iii) Lead nitrate on heating at a temperature of 673 K liberates only oxygen gas.
 (A) (i) and (ii) are correct only (B) (iii) and (iv) are correct only
 (C) (i), (iii) and (iv) are correct only (D) all are correct.
- (a) The decrease stability of higher oxidation state in p-block with increasing atomic number is due to:
 (A) decrease in bond energy as going down the group.
 (B) energy required to unpair ns^2 – electrons is not compensated by the energy released in forming the two additional bonds.
 (C) both are correct.
 (D) none is correct.
 (b) In group 15, the melting points of the elements :
 (A) increase regularly on moving down the group.
 (B) decrease regularly on moving down the group.
 (C) first decrease upto As and then increase to Bi.
 (D) first increase from N to As and then decrease to Bi.
- The thermal stability of the hydrides of group 15 follows the order :
 (A) $\text{NH}_3 < \text{PH}_3 < \text{AsH}_3 < \text{SbH}_3 < \text{BiH}_3$ (B) $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3 > \text{BiH}_3$
 (C) $\text{PH}_3 > \text{NH}_3 > \text{AsH}_3 > \text{SbH}_3 < \text{BiH}_3$ (D) $\text{AsH}_3 < \text{PH}_3 > \text{SbH}_3 > \text{BiH}_3 > \text{NH}_3$
- Which of the following order(s) is / are incorrect ?
 (A) $\text{H}_3\text{PO}_4 > \text{H}_3\text{PO}_3 > \text{H}_3\text{PO}_2$ (reducing character)
 (B) $\text{N}_2\text{O} < \text{NO} < \text{N}_2\text{O}_3 < \text{N}_2\text{O}_5$ (oxidation state on nitrogen atom.)
 (C) $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3 \geq$ (basicity.)
 (D) $\text{SbH}_3 > \text{NH}_3 > \text{AsH}_3 > \text{PH}_3$ (reducing character.)
- Consider the following statements
 S_1 : Ammonia on heating with concentrated solution of sodium hypochlorite gives N_2H_4 .
 S_2 : The phosphine gas dissolves in water in presence of sunlight and produces phosphonium hydroxide like ammonium hydroxide.
 S_3 : Barium azide on heating gives pure nitrogen gas.
 S_4 : The oxo-acids of phosphorus in which phosphorus has lower oxidation state less than +5 contain either P–P or P–H bonds but not both in addition to P=O and P–OH bonds.
 and arrange in the order of true/false.
 (A) T F T T (B) F F T T (C) T T T F (D) T F T F

7. **Statement-1** : NO_2 and ClO_2 both being odd electron molecules dimerise.
Statement-2 : On dimerisation, NO_2 is converted to stable N_2O_4 molecule with even number of electrons.
 (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
 (B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
 (C) Statement-1 is True, Statement-2 is False
 (D) Statement-1 is False, Statement-2 is True
8. **Statement-1** : The order of densities of the various allotropes of phosphorus is as follows; black phosphorus > red phosphorus > white phosphorus because
Statement-2 : As tendency of polymerisation increases, the compactness of substance also increases.
 (A) Statement 1 and statement 2 are correct and statement 2 is the correct explanation of statement 1.
 (B) Statement 1 and statement 2 are correct but statement 2 is not the correct explanation of statement 1.
 (C) Statement 1 is correct while statement 2 is false.
 (D) Statement 1 is false while statement 2 is correct.
9. Explain the following.
 (a) Single N–N bond is weaker than the single P–P bond.
 (b) BiH_3 is the strongest reducing agent amongst all the hydrides.
 (c) SbH_3 has higher boiling point than NH_3 .
10. (a) Give the disproportionation reaction of HNO_2 and H_3PO_3 ?
 (b) What happens when ?
 (A) White phosphorus reacts with thionyl chloride.
 (B) Sulphur dioxide is chlorinated using PCl_5
11. Match the following (one or more than one)
- | Column - I | Column - II |
|---|---|
| (A) $\text{H}_3\text{PO}_2 \xrightarrow[\text{(ii) } 435\text{K}]{\text{(i) } 415\text{K}}$ | (p) One of the products acts as reducing agent. |
| (B) $\text{PCl}_3 + \text{H}_2\text{O} \xrightarrow{435\text{K}}$ | (q) One of the products is tribasic and non reducing. |
| (C) $\text{NO}_2 + \text{H}_2\text{O} \longrightarrow$ | (r) Dehydration |
| (D) $\text{HNO}_3 + \text{P}_4\text{O}_{10} \xrightarrow{\Delta}$ | (s) In one of the products the central atom is in +5 oxidation state. |

Comprehension # (Q.12 to Q.13)

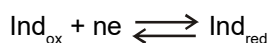
Turning to indicators used in titrations by the oxidation-reduction reaction, we must first work that in some cases it is possible to do without them if the colour of the titration solution undergoes a sharp enough change as the result of the reaction.

Titration without indicator is possible, for example, various reducing agents are oxidised by MnO_4^- in acid solution. We know that the purple-violet colour of MnO_4^- ion disappears owing to reduction to the almost colourless Mn^{2+} ion. When all the reducing agent has been titrated a single excess drop of MnO_4^- colours the whole solution a distinct pink.

Similarly, reducing agents can be titrated with iodine solution without the use of indicators, because the dark brown colour of iodine disappears as a result of reduction of I_2 to I^- . However, since the colour of I_2 solutions is not very deep, it is convenient in such cases to use an indicator starch solution, which gives an intense blue colour even with very small amount of free iodine. The use of starch is based on its ability to form a blue adsorption compound with iodine, and is unrelated to the oxidising properties of I_2 .

Redox indicators are substances which can be reversibly oxidised or reduced with different colours in the oxidised and reduced forms.

The interconversion can be represented as.



Applying the nernst equation to it, we have

$$E = E^{\circ} + \frac{0.059}{n} \log \frac{[\text{Ind}_{\text{ox}}]}{[\text{Ind}_{\text{red}}]}$$

If we add 1-2 drops of a solution of some redox indicator to a solution of reducing (or oxidising) agent, the $[\text{Ind}_{\text{ox}}]$ and $[\text{Ind}_{\text{red}}]$ will be in the ratio of corresponding potential of the solution. The solution acquires colour corresponding to the ratio. However our eye only detect the colour of one form if the concentration of the given form minimum ten times to the concentration of other form.

12. Diphenylamine is an redox indicator having $E^{\circ} = 0.76 \text{ V}$. For any given reaction $n = 2$. Within what potential difference diphenylamine changes it colour ?
- (A) 0.66 V to 0.86 V (B) 0.7895 V to 0.7306 V
 (C) 0.75 V to 0.77 V (D) None of these
13. What is the range of redox indicator ferroin ? The oxidised form of ferroin is $\text{Fe}(\text{C}_{12}\text{H}_8\text{N}_2)_3^{3+}$ (pale blue). The reduced form of ferroin is $\text{Fe}(\text{C}_{12}\text{H}_8\text{N}_2)_3^{2+}$ (red). For ferroin $E^{\circ} = 1.14 \text{ V}$
- (A) From 1.081 V to 1.199 V (B) From 1.1105 V to 1.199 V
 (C) From 0.963 V to 1.317 V (D) From 1 V to 2 V
14. Find the volume of gases evolved by passing 0.965 A current for 1 hr through an aqueous solution of CH_3COONa at 25°C and 1 atm.

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DPP No. 37

Total Marks : 39
Max. Time : 42 min.

Topic : p-block elements (Nitrogen and Oxygen family)

Type of Questions

		M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.6	(3 marks, 3 min.)	[18, 18]
Multiple choice objective ('-1' negative marking) Q.7	(4 marks, 4 min.)	[4, 4]
True or False (no negative marking) Q.8	(2 marks, 2 min.)	[2, 2]
Assertion and Reason (no negative marking) Q.9	(3 marks, 3 min.)	[3, 3]
Subjective Questions ('-1' negative marking) Q.10	(4 marks, 5 min.)	[4, 5]
Match the Following (no negative marking) Q. 11	(8 marks, 10 min.)	[8, 10]

- (a) Which one of the following reactions will give oxygen gas ?
 (A) A reaction of PbO_2 with concentrated HNO_3 . (B) A reaction of MnO_2 with concentrated H_2SO_4 .
 (C) A reaction of KMnO_4 with concentrated HCl . (D) (A) and (B) both

(b) Which of the following statement is correct ?
 (A) Al_2O_3 , ZnO , TeO_2 and Sb_2O_3 are amphoteric oxides.
 (B) Super oxides dissolve in water forming hydrogen peroxide and liberating oxygen gas.
 (C) CrO_3 , Mn_2O_7 , P_4O_{10} and Cl_2O_7 are acidic oxides.
 (D) All of these.
- Which of the following is used as a bleaching agent ?
 (A) Hydrogen peroxide (B) Ozone (C) calgon (D) (A) and (B) both
- (a) The oxidation number of sulphur in S_2Cl_2 , SF_4 and S_8 respectively are :
 (A) +1, +4 and 0 (B) +2, +4 and -2 (C) 0, +4 and -1 (D) 0, +4 and 0

(b) H_2S cannot be dried by :
 (A) anhydrous CaCl_2 (B) P_2O_5 (C) Conc. H_2SO_4 (D) All of these
- (a) Hot concentrated sulphuric acid dissolves sulphur forming
 (A) SO_3 (B) SO_2 (C) H_2SO_3 (D) $\text{H}_2\text{S}_2\text{O}_3$

(b) $\text{KClO}_3 + \text{H}_2\text{SO}_4 \xrightarrow{\Delta} \text{KHSO}_4 + \text{HClO}_4 + (\text{X}) + \text{H}_2\text{O}$.
 The product [X] is :
 (A) O_2 (B) Cl_2 (C) ClO_2 (D) Cl_2O_3
- Which of the following statement is false for sulphurdioxide ?
 (A) It reacts with dry chlorine in presence of charcoal to form sulphuryl chloride.
 (B) It reduces KIO_3 to iodine in acidic medium.
 (C) It when passed through a solution of sodium sulphide, produces Na_2SO_3 .
 (D) It oxidises SnCl_2 to SnCl_4 in presence of HCl .
- (a) Consider the following statements
 (i) Sulphur dioxide exists as discrete SO_2 molecules in gaseous as well as solid state.
 (ii) Sulphur trioxide exists in several modifications in solid state ; cyclic trimer, and polymeric chain.
 (iii) Bleaching by sulphur dioxide is through reduction process and is temporary.
 Select the correct one from the codes given.
 (A) (i) and (ii) only (B) (i), and (iii) only (C) (i), (ii) and (iii) (D) (ii) and (iii) only.

(b) Which of the following is correct ?
 (A) S_3O_9 – contains no S–S linkage. (B) $\text{S}_2\text{O}_6^{2-}$ – contains –O–O– linkage.
 (C) $(\text{HPO}_3)_3$ – contains P – P linkage (D) $\text{S}_2\text{O}_8^{2-}$ contains S–S linkage

7. (a) Aqueous solution of hydrogen peroxide :
- (A) turns blue litmus pink
 - (B) gives bright blue colour in ether with acidified $K_2Cr_2O_7$ solution.
 - (C) gives yellow or orange coloured solution with an acidified solution of titanium salt.
 - (D) bleaches blue litmus.
- (b) Which of the following statement(s) is / are true for the hydrides of the elements of 16th group?
- (A) Their acidic character increases from H_2O to H_2Te
 - (B) Their thermal stability increases from H_2O to H_2Te
 - (C) Their reducing character increases from H_2S to H_2Te
 - (D) The order of their boiling points is $H_2S < H_2Se < H_2Te < H_2O$
8. (a) Consider the following statements
- S_1 : $(HPO_3)_n$ can be prepared by heating phosphorus acid and bromine in a sealed tube.
- S_2 : Dry iodine reacts with ozone and forms a yellow solid, I_4O_9 .
- S_3 : β -Sulphur is stable below 369 K.
- and arrange in the order of true/false.
- (A) F T F (B) T T F (C) T T T (D) T F F
- (b) True / false.
- S_1 : Sodium thiosulphate with $FeCl_3$ solution develops a pink or violet colour which soon vanishes.
- S_2 : White precipitate of PbS_2O_3 gets soluble when boiled with water.
9. **Statement-1:** Aqueous solution of hydrogen peroxide is kept in glass or metal container containing some urea or phosphoric acid because
- Statement-2 :** Urea or phosphoric acid acts as a negative catalyst for the decomposition of hydrogen peroxide.
- (A) Statement 1 and statement 2 are correct and statement 2 is the correct explanation of statement 1.
 - (B) Statement 1 and statement 2 are correct but statement 2 is not correct explanation of statement 1.
 - (C) Statement 1 is correct but statement 2 is false.
 - (D) Statement 1 is false but statement 2 is correct.
10. (a) There is large difference in the melting and boiling points of oxygen and sulphur. Explain.
- (b) Why solution of sodium thiosulphate turns milky on acidification ?
- (c) Out of following forms of sulphur which one is paramagnetic and why ? S_8 , S_6 and S_2 .
11. Match the following (one or more then one)
- | Column - I | Column - II |
|------------------------|------------------------|
| (A) $H_2Te < H_2O$ | (p) Boiling point |
| (B) $SO_2 < SO_3$ | (q) Thermal stability |
| (C) $H_2O_2 < H_2SO_4$ | (r) Acidic character |
| (D) $PH_3 < NH_3$ | (s) Reducing character |

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DAILY PRACTICE PROBLEMS

DPP No. 38

Total Marks : 33
Max. Time : 35 min.

Topic : p-block elements (Nitrogen and Oxygen family)

Type of Questions

Type of Questions	M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.4	(3 marks, 3 min.) [12, 12]
Multiple choice objective ('-1' negative marking) Q.5	(4 marks, 4 min.) [4, 4]
Assertion and Reason (no negative marking) Q.6 to Q. 8	(3 marks, 3 min.) [9, 9]
Subjective Questions ('-1' negative marking) Q.9 to Q.10	(4 marks, 5 min.) [8, 10]

- $\text{NH}_4\text{ClO}_4 + \text{HNO}_3(\text{dilute}) \longrightarrow \text{HClO}_4 + [\text{X}]$
 $[\text{X}] \xrightarrow{\Delta} \text{Y}(\text{g})$
 $[\text{X}]$ and $[\text{Y}]$ are respectively.
 (A) NH_4NO_3 and N_2O (B) NH_4NO_2 and N_2 (C) HNO_4 and O_2 (D) None
- Match the following
 (A) $\text{H}_2\text{O} > \text{H}_2\text{Te} > \text{H}_2\text{Se} > \text{H}_2\text{S}$ (p) Basic character
 (B) $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3$ (q) Acidic character
 (C) $\text{H}_2\text{O} < \text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te}$ (r) Boiling point
 (D) $\text{KCl} < \text{CaCl}_2 < \text{AlCl}_3 < \text{SnCl}_4$ (s) Ionic character
 (t) Covalent character
 (A) (A) – r ; (B) – p ; (C) – q ; (D) – t (B) (A) – p ; (B) – r ; (C) – q ; (D) – t
 (C) (A) – s ; (B) – p ; (C) – p ; (D) – t (D) (A) – r ; (B) – p ; (C) – q ; (D) – s
- In the following reaction, $2\text{MnO}_4^- + 5\text{H}_2\text{O}_2^{18} + 6\text{H}^+ \rightarrow 2\text{Mn}^{2+} + 8\text{H}_2\text{O} + 5\text{O}_2$
 The radioactive oxygen will appear in :
 (A) H_2O (B) O_2
 (C) both H_2O & O_2 (D) above reaction does not take place
- (a) Which is correct regarding the cyclic trimer of SO_3
 (A) It contains three S – S, σ bonds
 (B) It contains three O – O, σ bonds
 (C) It contains six O – O, π bonds
 (D) The total number of σ and π bonds in it are 12 and 6 respectively
 (b) In SO_2 molecule, there are two σ -bonds and two π -bonds. The two π -bonds are formed by :
 (A) $p\pi - p\pi$ overlap between S and O atoms
 (B) $sp^2 - p$ overlap between S and O atoms
 (C) one by $p\pi - p\pi$ overlap and other by $p\pi - d\pi$ overlap
 (D) both by $p\pi - d\pi$ overlap
- Identify the correct statement(s)
 (A) P_4O_{10} is used as a drying agent
 (B) P_4O_{10} contains $p\pi-p\pi$ back bonding
 (C) In P_4O_{10} each P atom is bonded to three oxygen atoms
 (D) P_4O_{10} hydrolyse in water forming phosphorus acid
- S_1 : H_2O_2 solutions are stored in dark coloured plastic or wax coated glass vessels often with negative catalysts such as urea or sodium stannate added as stabilizers.
 S_2 : With stronger oxidising agents H_2O_2 is oxidised and in such cases O_2 is always evolved.
 S_3 : H_2O_2 is more hydrogen bonded than is water and so has a higher boiling point than water.
 S_4 : In dilute aqueous solution H_2O_2 is more acidic than water.
 (A) T T F T (B) T T T T (C) T T T F (D) T F T T

7. **Statement-1** : Molecular oxygen is attracted by magnetic field.
Statement-2 : Molecular oxygen contains 2 unpaired electrons which occupy two different π – molecular orbitals
 (A) Statement 1 and statement 2 are correct and statement 2 is the correct explanation of statement 1
 (B) Statement 1 and statement 2 are correct but statement 2 is not correct explanation of statement 1
 (C) Statement 1 is correct but statement 2 is false
 (D) Statement 1 is false but statement 2 is correct
8. **Statement-1** : Mercury in contact with ozone loses its mobility and starts sticking to the glass surface.
Statement-2 : This is known as tailing of mercury.
 (A) Statement 1 and statement 2 are correct and statement 2 is the correct explanation of statement 1
 (B) Statement 1 and statement 2 are correct but statement 2 is not correct explanation of statement 1
 (C) Statement 1 is correct but statement 2 is false
 (D) Statement 1 is false but statement 2 is correct
9. What happens when ?
 (a) Hypophosphorus acid is heated.
 (b) Phosphorus penta oxide reacts with PCl_5 .

10. **Integer Answer Type**

This section contains 3 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9.

(i) If Phosphorous acid, Tetrathionic acid and Pyrophosphoric acid have number of acidic hydrogen per molecule respectively as x, y and z, then find the value of $x + y - z$.

(ii) How many orders among following are correct with respect to the properties indicated :

- | | |
|---|-----------------------|
| (1) $\text{NH}_3 < \text{H}_2\text{O} < \text{H}_2\text{S}$ | Boiling point |
| (2) $\text{PH}_3 < \text{AsH}_3 < \text{NH}_3 < \text{SbH}_3$ | Boiling point |
| (3) $\text{BF}_3 < \text{BCl}_3 < \text{BBr}_3$ | Extent of hydrolysis |
| (4) $\text{CH}_3\text{Cl} > \text{CH}_3\text{F} > \text{CH}_3\text{Br} > \text{CH}_3\text{I}$ | Dipole moment |
| (5) $\text{BF}_3 < \text{BCl}_3 < \text{BBr}_3$ | Lewis acidic strength |
| (6) $\text{Na}^+ > \text{Mg}^{+2} > \text{Al}^{+3}$ | Extent of hydration |

(iii) Depending upon the nature of oxides, they are classified as acidic, basic, amphoteric and neutral oxides.

Among the following, the total number of acidic oxides are :



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DPP No. 39

**Total Marks : 41
Max. Time : 43 min.**

Topic : p-block elements (Halogens and Noble gas)

Type of Questions

		M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.2	(3 marks, 3 min.)	[6, 6]
Multiple choice objective ('-1' negative marking) Q.3 to Q.4	(4 marks, 4 min.)	[8, 8]
True or False (no negative marking) Q.5 & Q.9	(2 marks, 2 min.)	[10, 10]
Comprehension ('-1' negative marking) Q.10 to Q.12	(3 marks, 3 min.)	[9, 9]
Subjective Questions ('-1' negative marking) Q.13 to Q.14	(4 marks, 5 min.)	[8, 10]

- (a) Which of the following is a mixed anhydride ?
 (A) Cl_2O_7 (B) Cl_2O_3 (C) ClO_2 (D) Cl_2O_5

(b) KClO_3 on heating disproportionates to :
 (A) $\text{KClO}_2, \text{KClO}_4$ (B) $\text{KClO}, \text{KClO}_4$ (C) $\text{Cl}_2, \text{KClO}_4$ (D) $\text{KClO}_4, \text{KCl}$
- (a) The correct order of the thermal stability of hydrogen halides (H – X) is
 (A) $\text{HI} > \text{HBr} > \text{HCl} > \text{HF}$ (B) $\text{HF} > \text{HCl} > \text{HBr} > \text{HI}$
 (C) $\text{HCl} < \text{HF} < \text{HBr} < \text{HI}$ (D) $\text{HI} > \text{HCl} < \text{HF} < \text{HBr}$

(b) $\text{H}_2\text{SO}_4 + \text{NaCl (s)} \longrightarrow \text{NaHSO}_4 + \text{HCl}$. Hydrochloric acid is liberated because
 (A) H_2SO_4 is a reducing agent. (B) HCl is a smaller molecule than H_2SO_4
 (C) HCl is more volatile than H_2SO_4 (D) (B) and (C) Both

(c) Concentrated HNO_3 reacts with I_2 to give :
 (A) HI (B) HOI (C) HIO_3 (D) HOIO_3
- Iodine (I_2) is soluble in :
 (A) KI solution (B) Water
 (C) Carbon tetrachloride (D) Alcohol
- ClO^- formed in the following reaction

$$\text{Cl}_2 + 2\text{OH}^- \longrightarrow \text{ClO}^- + \text{Cl}^- + \text{H}_2\text{O}$$
 In this reaction :
 (A) Cl_2 has undergone disproportionation
 (B) Cl_2 has been reduced to ClO^- and Cl^-
 (C) equivalent mass of Cl_2 is equal to its molar mass
 (D) equivalent mass of Cl_2 is half of its molar mass
- Consider the following statements
Statement-1 : Hydrofluoric acid can not be kept in glass vessel.
Statement-2 : Hydrochloric acid can be dried by passing it through concentrated H_2SO_4 .
Statement-3 : Chlorine monoxide is evolved when KClO_3 is treated with conc. H_2SO_4 .
Statement-4 : Chlorine reacts with hot and concentrated NaOH to form NaCl and NaClO_3 .
 and arrange in the order of true/false.
 (A) F T F T (B) F F F T (C) T T F T (D) F T T F
- Consider the following statements
Statement-1 : Fluorine oxidises water to oxygen.
Statement-2 : Bromine reacts with water to form HBr and HOBr .
Statement-3 : Iodide (I^-) can be oxidised by oxygen in acidic medium.
Statement-4 : Thermally stable oxide of fluorine at room temperature is OF_2 .
 and arrange in the order of true/false.
 (A) T T T T (B) F T F T (C) T F T F (D) T T F F

7. Consider the following statements
Statement-1 : HBr is a stronger acid than HI because of hydrogen bonding.
Statement-2 : F^- ion has higher hydration energy than Cl^- .
Statement-3 : O_3 is more powerful oxidising agent than F_2 because it contains three 'O'.
Statement-4 : fluorine does not form polyhalides.
 and arrange in the order of true/false.
 (A) T T T F (B) F T F T (C) T F T F (D) F F T T
8. (a) **Statement-1** : The red liquid bromine reacts with sodium carbonate solution and forms sodium bromide and sodium bromate.
Statement-2 : Sodium bromide reacts with conc. H_2SO_4 to form HBr.
 (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
 (B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
 (C) Statement-1 is True, Statement-2 is False
 (D) Statement-1 is False, Statement-2 is True
 (b) **Statement-1** : All halogens except fluorine exhibit +1, +3, +5 and +7 oxidation states in addition to -1 oxidation state.
Statement-2 : Except fluorine all other halogens have d-orbitals and, therefore, can expand their octets.
 (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
 (B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
 (C) Statement-1 is True, Statement-2 is False
 (D) Statement-1 is False, Statement-2 is True
 (c) **Statement-1** : Most of the reactions of fluorine, are exothermic.
Statement-2 : It forms small and strong bond with other elements.
 (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
 (B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
 (C) Statement-1 is True, Statement-2 is False
 (D) Statement-1 is False, Statement-2 is True
9. (a) **Statement-1** : ClO_2 is anhydride of chloric acid.
Statement-2 : $2ClO_2 + H_2O \longrightarrow HClO_2 + HClO_3$.
 (A) If both statement-1 and statement-2 are true and statement-2 is a correct explanation of statement-1.
 (B) If both statement-1 and statement-2 are true and statement-3 is not a correct explanation of statement-1.
 (C) If statement-1 is true but statement-2 is false.
 (D) If statement-1 is false but statement-2 is true.
 (b) **Statement-1** : Bond energy of F_2 is greater than Cl_2 .
Statement-2 : F-atom is smaller in size than Cl-atom.
 (A) If both statement-1 and statement-2 are true and statement-2 is a correct explanation of statement-1.
 (B) If both statement-1 and statement-2 are true and statement-3 is not a correct explanation of statement-1.
 (C) If statement-1 is true but statement-2 is false.
 (D) If statement-1 is false but statement-2 is true.
 (c) **Statement-1** : Chlorine and sulphur dioxide both are bleaching agents.
Statement-2 : The bleaching action of chlorine is performed through the process of oxidation.
 (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
 (B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
 (C) Statement-1 is True, Statement-2 is False
 (D) Statement-1 is False, Statement-2 is True
 (d) **Statement-1** : Iodine stains are removed with the help of sodium thiosulphate solution.
Statement-2 : Sodium thiosulphate solution reacts with iodine to form colourless sodium iodide and sodium tetrathionate ($Na_2S_4O_6$).
 (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
 (B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
 (C) Statement-1 is True, Statement-2 is False
 (D) Statement-1 is False, Statement-2 is True

Comprehension # (Q.10 to Q.12)

When sodium chloride is treated with concentrated sulphuric acid, a colourless gas, X, which fumes in moist air, is formed. When sodium iodide is treated in the same way a coloured vapour, Y, is produced.

If 90% phosphoric (v) acid is used instead of sulphuric acid a colourless gas is produced in each reaction.

A number of oxoanions of chlorine are known ; examples include ClO^- , ClO_3^- and ClO_4^- , ClO^- is formed when chlorine reacts with aqueous alkali.

10. Gases X and Y are respectively :
 (A) Cl_2 , I_2 (B) HCl , I_2 (C) HCl , HI (D) HClO , I_2
11. With 90% phosphoric acid (H_3PO_4), colourless gases formed are :
 (A) HCl , HI (B) Cl_2 , I_2 (C) HCl , I_2 (D) Cl_2 , HI
12. Behaviour of H_2SO_4 and H_3PO_4 is different towards NaI because :
 (A) H_2SO_4 is stronger acid than H_3PO_4
 (B) H_2SO_4 is a strong oxidising agent and oxidises colourless gas to coloured vapour Y
 (C) H_3PO_4 is tribasic acid
 (D) H_2SO_4 is a dibasic acid
13. Give an example of oxidation of one halide by another halogen. Explain the feasibility of reaction.

14. **Integer Answer Type**

This section contains 2 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9.

- (i) How many Si—O—Si bridge are present in wollastonite molecule ?
- (ii) In Cl_2O_7 , the Cl—O bonds showing double bond character are.

PHYSICAL / INORGANIC
CHEMISTRY
DPP
DAILY PRACTICE PROBLEMS

DPP No. 40

Total Marks : 47
Max. Time : 52 min.

Topic : p-block elements (Halogens and Noble gas)

Type of Questions

Type of Questions	M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.5	(3 marks, 3 min.) [15, 15]
Comprehension ('-1' negative marking) Q.6 to Q.8	(3 marks, 3 min.) [9, 9]
Subjective Questions ('-1' negative marking) Q.9	(4 marks, 5 min.) [4, 5]
Match the Following (no negative marking) Q.10 to Q.11	(8 marks, 10 min.) [16, 20]
Short Subjective Questions ('-1' negative marking) Q.12	(3 marks, 3 min.) [3, 3]

- (a) F_2 is formed by reacting K_2MnF_6 with
 (A) SbF_5 (B) MnF_3 (C) $KSbF_6$ (D) MnF_5

(b) Which of the following product is formed, when dilute alkali reacts with fluorine ?
 (A) HOF (B) OF_2 (C) O_2F_2 (D) O_2
- (a) Which one is the anhydride of $HClO_4$
 (A) Cl_2O (B) ClO_2 (C) Cl_2O_6 (D) Cl_2O_7

(b) When dry chlorine is passed through silver chlorate heated to $90^\circ C$, then which of the oxide of chlorine is obtained ?
 (A) ClO_2 (B) Cl_2O (C) Cl_2O_3 (D) Cl_2OS
- Which one of the following statements regarding helium is incorrect :

(A) It is used to produce and sustain powerful superconducting magnets
 (B) It is used as a cryogenic agent for carrying out experiments at low temperatures
 (C) It is used to fill gas balloons instead of hydrogen because it is lighter and non-inflammable
 (D) It is used in gas-cooled nuclear reactors
- (a) S_1 : Argon is used in arc welding of metals or alloys to provide an inert atmosphere.
 S_2 : XeF_2 , XeF_4 and XeF_6 are colourless crystalline solids and sublime readily at 298K.
 S_3 : XeF_2 , XeF_4 and XeF_6 are readily hydrolysed.
 S_4 : Xenon fluorides react with fluoride ion acceptor to form cationic species and fluoride ion donors to form fluoro anions.
 (A) FFFF (B) TFTF (C) TTTT (D) FTFT

(b) S_1 : XeO_3 is a colourless explosive solid and has a pyramidal molecular structure.
 S_2 : XeF_2 is not a better oxidising agent.
 S_3 : Xe, Kr and Ne all form clathrate compounds.
 S_4 : Fluorine in dilute solution of sodium hydroxide disproportionates in fluoride and hypofluorite.
 (A) TFFF (B) TFTF (C) TTTT (D) FTFT
- (a) **Statement-1** : Finely divided iron does not form ferric chloride with hydrochloric acid.
Statement-2 : Hydrochloric acid produces hydrogen gas with iron.
 (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
 (B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
 (C) Statement-1 is True, Statement-2 is False
 (D) Statement-1 is False, Statement-2 is True

(b) **Statement-1** : XeF_6 reacts with small quantities of water to form XeOF_4 .

Statement-2 : XeF_6 reacts with glass and form XeOF_4 .

- (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
 (B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
 (C) Statement-1 is True, Statement-2 is False
 (D) Statement-1 is False, Statement-2 is True

(c) **Statement-1** : Noble gases have positive electron gain enthalpy.

Statement-2 : Noble gases have highest value of ionization enthalpy.

- (A) If both statement-1 and statement-2 are true and statement-2 is a correct explanation of statement-1.
 (B) If both statement-1 and statement-2 are true and statement-3 is not a correct explanation of statement-1.
 (C) If statement-1 is true but statement-2 is false.
 (D) If statement-1 is false but statement-2 is true.

Comprehension # 1 (Q.6 to Q.8)

The chemical reactivity of noble gases involves the loss of electrons and hence it can form compounds with highly electronegative elements like F and O. Although Xe forms several fluorides, Xenon tetrafluoride is the most important among fluorides. The various compounds of xenon involve xenon in first second or third excited states.

6. The type of hybridisation and number of lone pair(s) of electrons of Xe in XeOF_4 respectively are :
 (A) sp^3d and 1 (B) sp^3d and 2 (C) sp^3d^2 and 1 (D) sp^3d^2 and 2.
7. The type of hybridisation and shape of XeF_2 respectively are
 (A) sp^3d and angular (B) sp^3d and pyramidal (C) sp^3d and linear (D) sp and linear
8. XeF_4 and XeF_6 are expected to be
 (A) oxidising (B) reducing (C) unreactive (D) strongly basic.
9. Complete the following reactions
 (A) $\text{SiO}_2(\text{s}) + \text{F}_2(\text{g}) \longrightarrow$ (B) $\text{Na}_2\text{S}_2\text{O}_3 + \text{H}_2\text{O} + \text{Cl}_2 \longrightarrow$
 (C) $\text{I}_2 + \text{H}_2\text{O} + \text{Cl}_2(\text{excess}) \longrightarrow$ (D) $\text{IO}_3^- + \text{HSO}_3^- \longrightarrow$
 (E) $\text{KMnO}_4 + \text{HCl} \longrightarrow$

10. Match the following :

Column-I

- (A) $\text{XeF}_4 + \text{H}_2\text{O} \longrightarrow$
 (B) $[\text{HXeO}_4]^- + 2\text{OH}^- \longrightarrow$
 (C) $\text{H}_2\text{O} + \text{F}_2$ (2:2 by mole) \longrightarrow
 (D) $\text{NOCl} + \text{O}_2 \longrightarrow$

Column-II

- (p) disproportionation
 (q) one of the products is a gas which is paramagnetic
 (r) one of the products is used in light bulbs
 (s) one of the products is corrosive to glass and is stored in wax-lined bottles.

11.

Column I

- (A) XeF_6
 (B) XeOF_2
 (C) XeOF_4
 (D) XeO_2F_2

Column II

- (p) sp^3d hybridisation
 (q) one lone pair
 (r) sp^3d^2 hybridisation
 (s) sp^3d^3 hybridisation
 (t) See-saw shape

12. Find the sum of average oxidation number of S in H_2SO_5 (peroxy monosulphuric acid) and $\text{Na}_2\text{S}_2\text{O}_3$ (sodium thiosulphate).

PHYSICAL / INORGANIC
CHEMISTRY
DPP
DAILY PRACTICE PROBLEMS

DPP No. 41

Total Marks : 38
Max. Time : 40 min.

Topic : Solid State

Type of Questions

M.M., Min.

Single choice Objective ('-1' negative marking) Q.1 to Q.10 (3 marks, 3 min.) [30, 30]

Match the Following (no negative marking) Q.11 (8 marks, 10 min.) [8, 10]

1. Column A describe nature of bonding and Column B the solid having that type of bonding :

A (Nature of bonding)	B (solid)
I. Van der Waals	P. Al, Cd
II. Ionic	Q. CO ₂ , H ₂
III. Metallic	R. Si, diamond
IV. Covalent	S. MgO, NaCl

Correct matching of A and B is in alternate :

I	II	III	IV	I	II	III	IV
(A) P	Q	R	S	(B) Q	S	P	R
(C) Q	P	R	S	(D) S	P	Q	R

2. (a) The most unsymmetrical crystal system is:

- (A) Cubic (B) Hexagonal (C) Triclinic (D) Orthorhombic

(b) The number of crystal systems known are :

- (A) 7 (B) 8 (C) 6 (D) 4

3. (a) Tetragonal crystal system has the following unit cell dimensions:

- (A) $a = b = c$ and $\alpha = \beta = \gamma = 90^\circ$ (B) $a = b \neq c$ and $\alpha = \beta = \gamma = 90^\circ$
(C) $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90^\circ$ (D) $a = b \neq c$ and $\alpha = \beta = 90^\circ, \gamma = 120^\circ$

(b) The lattice parameters of a given crystal are $a = 5.62 \text{ \AA}$, $b = 7.41 \text{ \AA}$ and $c = 9.48 \text{ \AA}$. The three coordinate axes are mutually perpendicular to each other. The crystal is :

- (A) tetragonal (B) orthorhombic (C) monoclinic (D) trigonal.

4. (a) Which of the following is not a crystal system ?

- (A) Triclinic (B) Rhombohedral (C) Tetragonal (D) Isomorphous.

(b) The most unsymmetrical and the most symmetrical crystal systems based on lattice parameters (i.e., unit cell lengths and angles), are respectively represented by the examples

- (A) CuSO₄ · 5H₂O, NaCl (B) Monoclinic sulphur, diamond
(C) rhombic sulphur, NaCl (D) diamond, NaCl

5. (a) The crystal system in which $a \neq b \neq c$ and the angles $\alpha \neq \beta \neq \gamma$ is
 (A) Triclinic (B) monoclinic (C) hexagonal (D) cubic
- (b) The unit cell parameters of a rhombohedral crystal are
 (A) $a \neq b \neq c, \alpha = \beta = \gamma = 90^\circ$ (B) $a = b = c, \alpha = \beta = \gamma \neq 90^\circ$
 (C) $a \neq b \neq c, \alpha \neq \beta \neq \gamma \neq 90^\circ$ (D) $a = b \neq c, \alpha = \beta = \gamma = 90^\circ$
6. (a) Three elements P, Q and R crystallize in a cubic solid lattice. The P atoms occupy the corners, Q atoms the cube centres and R atoms the edges. The formula of the compound is:
 (A) PQR (B) PQR_2 (C) PQR_3 (D) PQ_3R .
- (b) A compound alloy of gold and copper crystallises in a cubic lattice in which the gold atoms occupy the lattice points at the corner of a cube and the copper atoms occupy the centres of each of the cube faces. Hence compound alloy has formula :
 (A) AuCu (B) Au_3Cu (C) Au_2Cu (D) $AuCu_3$
7. In a face centred cubic arrangement of A and B atoms whose A atoms are at the corner of the unit cell and B atoms at the face centres. One of the A atom is missing from one corner in unit cell. The simplest formula of the compound is
 (A) A_7B_3 (B) AB_3 (C) A_7B_{24} (D) A_2B_3
8. The compound AB crystallizes in cubic lattice in which both the elements have co-ordination number of eight. The crystal class is :
 (A) simple cubic (B) face-centered cubic
 (C) body-centered cubic (D) None of these.
9. (a) TiO_2 is well known example of
 (A) Triclinic system (B) Tetragonal system
 (C) Monoclinic system (D) None
- (b) In the primitive cubic unit cell, the atoms are present at the :
 (A) corners of the unit cell (B) centre of the unit cell
 (C) centre of each face of the unit cell (D) one set of faces of the unit cell
10. (a) Which has no axis of rotation of symmetry ?
 (A) Hexagonal (B) Orthorhombic (C) Cubic (D) Triclinic
- (b) A compound is formed by elements A and B. This crystallises in the cubic structure where the A atoms are at the corners of the cube and B atoms are at the body centres. The simplest formula of the compound is :
 (A) A_8B_4 (B) AB_6 (C) AB (D) A_6B
11. **Column-I** and **Column-II** contains four entries each. Entries of **Column-I** are to be matched with some entries of **Column-II**. One or more than one entries of **Column-I** may have the matching with the same entries of **Column-II**.

Column-I (Bravais Lattice(s))	Column-II [Crystal system]
(A) Primitive, face centered, body centered, end centered	(p) Cubic
(B) Primitive, face centered, body centered	(q) Orthorhombic
(C) Primitive, body centered	(r) Hexagonal
(D) Primitive only	(s) Tetragonal

**PHYSICAL / INORGANIC
CHEMISTRY
DPP**
DAILY PRACTICE PROBLEMS

DPP No. 42

**Total Marks : 46
Max. Time : 50 min.**

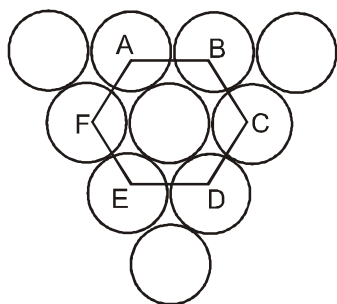
Topic : Solid State

Type of Questions

Type of Questions	M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.9	(3 marks, 3 min.) [27, 27]
Fill in the Blanks ('-1' negative marking) Q.10	(3 marks, 3 min.) [3, 3]
Subjective Questions ('-1' negative marking) Q.11 to Q.14	(4 marks, 5 min.) [16, 20]

- The contribution to the unit cell by an atom present at the edge centre is :
(A) 1/8 (B) 1/2 (C) 1/4 (D) 1
- (a) In a face centred cubic lattice the number of nearest neighbours for a given lattice point are
(A) 6 (B) 8 (C) 12 (D) 14
(b) How many 'nearest' and 'next nearest' neighbours respectively does potassium have in b.c.c. lattice
(A) 8, 8 (B) 8, 6 (C) 6, 8 (D) 8, 2
- A metal crystallizes in two cubic phases i.e., FCC and BCC whose unit cell lengths are 3.5Å and 3.0 Å respectively. The ratio of their densities is :
(A) 3.12 (B) 2.04 (C) 1.26 (D) 0.72
- If a metal has a bcc crystal structure, the coordination number is 8, because :
(A) each atom touches four atoms in the layer above it, four in the layer below it and none in its own layer.
(B) each atom touches four atoms in the layer above it, four in the layer below it and one in its own layer.
(C) two atoms touch four atoms in the layer above them, four in the layer below them, and none in their own layer.
(D) each atom touches eight atoms in the layer above it, eight in the layer below it and none in its own layer.
- A metal has face centered cubic arrangement. If length of the edge of the cell is x cm and M is its atomic mass, then density will be equal to (N_0 is Avogadro number):
(A) $[(M)/(X^3 \times N_0)] \text{ g cm}^{-3}$ (B) $[(M \times N_0) (X^3)] \text{ g cm}^{-3}$
(C) $[(4M)/(X^3 \times N_0)] \text{ g cm}^{-3}$ (D) $[(M)/(4X^3 \times N_0)] \text{ gm cm}^{-3}$
- (a) In a ccp structure, the :
(A) first and third layers are repeated
(B) first and fourth layers are repeated
(C) second and fourth layers are repeated
(D) first, third and sixth layers are repeated.
(b) The numbers of tetrahedral and octahedral holes in a ccp array of 100 atoms are respectively
(A) 200 and 100 (B) 100 and 200 (C) 200 and 200 (D) 100 and 100
- In a face centred cubic arrangement of metallic atoms, what is the relative ratio of the sizes of tetrahedral and octahedral voids?
(A) 0.543 (B) 0.732 (C) 0.414 (D) 0.637

8. The percentage packing efficiency of the two dimensional arrangement of sphere for plane ABCDEF shown below is :



- (A) 90.64% (B) 74.05% (C) 68.02% (D) 78.54%
9. A solid has a structure in which 'W' atoms are located at the corners of cubic lattice, 'O' atoms at the centre of edges and 'Na' atoms at the centre of the cube. The formula for the compound is :
 (A) NaWO_2 (B) NaO_3W (C) Na_2WO_3 (D) NaWO_4
10. If the ratio of co-ordination no. P to that of Q be $Y : Z$, then the formula of the solid is _____.
11. A mineral having formula AB_2 crystallize in the cubic close packed lattice, with the A atoms occupying the lattice points. What is the co-ordination no. of A atoms? of the B atoms? what fraction of tetrahedral sites is occupied by B atoms.
12. Krypton crystallizes with four atoms per unit cell and unit cell is a cube. If the density of krypton is 3.19g/ml, what is the edge length of the unit cell? What is the minimum distance between the two nearest neighbours?
13. Potassium crystallizes in body centred cubic lattice with a unit cell length $a = 5.2 \text{ \AA}$
 (A) What is the distance between nearest neighbours
 (B) What is the distance between next nearest neighbours
 (C) How many nearest neighbours does each K atom have
 (D) How many next nearest neighbours does each K have
 (E) What is calculated density of crystalline K.
14. Potassium crystallizes in a body centred cubic lattice. What is the approximate number of unit cells in 4.0g of potassium? Atomic mass of potassium = 39.

**PHYSICAL / INORGANIC
 CHEMISTRY
 DPP**
 DAILY PRACTICE PROBLEMS

DPP No. 43

**Total Marks : 42
 Max. Time : 45 min.**

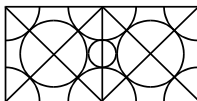
Topic : Solid State

Type of Questions

Type of Questions	M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.7	(3 marks, 3 min.) [21, 21]
Subjective Questions ('-1' negative marking) Q.8 to Q.11	(4 marks, 5 min.) [12, 15]
Comprehension ('-1' negative marking) Q.12 to Q.14	(3 marks, 3 min.) [9, 9]

- The density of KBr is 2.75 gm/cc length of the unit cell is 654 pm. $K = 38$, $Br = 80$, then what is true about the predicted nature of the solid.
 - Solid has F.C.C. structure with co-ordination number = 6
 - Solid has simple cubic structure with co-ordination number = 4
 - Solid has F.C.C. structure with co-ordination numbers-1
 - None of these
- CsBr has b.c.c. structure with edge length 4.3 Å. The shortest inter ionic distance in between Cs^+ and Br^- is:
 - 3.72
 - 1.86
 - 7.44
 - 4.3
- The number of nearest neighbours and next near neighbours of a Na^+ ion in a crystal of NaCl are respectively
 - $6Na^+$, $12Cl^-$
 - $6Cl^-$, $6Na^+$
 - $12Cl^-$, $6Na^+$
 - $6Cl^-$, $12Na^+$
- A solid has a b.c.c. structure. If the distance of closest approach between the two atoms is 1.73 Å. The edge length of the cell is ;
 - $\sqrt{2}$ pm
 - $\sqrt{(3/2)}$ pm
 - 200 pm
 - 142.2 pm
- The radius of metal atom can be expressed in terms of the length of a unit cell is :
 - it is $a/2$ for simple cubic lattice
 - it is $(\sqrt{3}a/4)$ for b.c.c. lattice
 - it is $(a/2\sqrt{2})$ for F.C.C. lattice
 - All of the above.
- Fraction of the total volume occupied by atoms in a simple cube is
 - $\pi/6$
 - $\sqrt{3}\pi/8$
 - $\sqrt{2}\pi/6$
 - $\pi/3$
- Lithium borohydride crystallizes in an orthorhombic system with 4 molecules per unit cell. The unit cell dimensions are $a = 6.8 \text{ \AA}$, $b = 4.4 \text{ \AA}$ and $c = 7.2 \text{ \AA}$. If the molar mass is 21.76, then the density of crystals is :
 - 0.6708 g cm^{-2}
 - 1.6708 g cm^{-3}
 - 2.6708 g cm^{-3}
 - None of these.
- Show by drawing a diagram that in the NaCl lattice each Cl^\ominus ion occupies an octahedral void space provided by Na^\oplus ions. How many Cl^\ominus ions surround each Cl^\ominus ion in the lattice?
- A simple cubic lattice consists of eight identical spheres of radius R in contact, placed at the corners of a cube. What is the volume of the cubical box that will just enclose these eight spheres and what fraction of this volume is actually occupied by the spheres?

10. Copper has a face-centred cubic structure with a unit-cell edge length of 3.61Å. What is the size of the largest atom which could fit into the interstices of the copper lattice without distorting it?



(Hint.: Calculate the radius of the smallest circle in the figure)

BooSt YoUr PreVious ConCept

Integer Answer Type

11. This section contains 2 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9.
- (i) Potassium dichromate in alkaline solution, with 30% H_2O_2 produces K_3CrO_8 . How many peroxide linkages are found in the structure of K_3CrO_8 ?
- (ii) The sum of bond order and number of π -bond in C_2 molecule on the basis of molecular orbital theory is :

Comprehension # (Q.12 to Q.14)

A hydrogen atom when bonded with highly electronegative atom such as fluorine, oxygen etc acquires a positive charge. In consequence of this, such a hydrogen atom exerts an electro static attraction on other highly electronegative atom like fluorine, nitrogen or oxygen. There is thus a dipole-dipole or dipole ion attraction, which has been given name, hydrogen bond. This may be represented as, $\overset{\delta-}{X} - \overset{\delta+}{H} \cdots \overset{\delta-}{Y} - A$

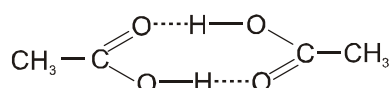
Where X and Y are strongly electronegative atoms of fluorine, oxygen and nitrogen.

The hydrogen bond, a sort of polar link, is formed as the attraction between H and Y outweighs the repulsion between X and Y. But Y must be a small electronegative atom such as fluorine, oxygen or nitrogen.

Such a bonding is significant only with hydrogen because of the minute size of the almost bare proton which enables Y to make a close approach to the positive charge.

Maximum energy of H bond = 45 KJ/mol.

12. Hydrogen bonding with chlorine is rarely observed because :
- (A) Chlorine atom is not sufficiently electronegative to form hydrogen bond.
 (B) The charge density of the chlorine atom is greater.
 (C) The electron affinity of chlorine is highest among the halogen.
 (D) The size of the chlorine is greater.
13. Which of the following statement is true regarding the existence of X – H – Y type bond -
- (A) The given type of bond rarely occurs because a hydrogen atom can accommodate two electrons only in the 1s orbital. The use of 2s will involve much higher energy.
 (B) The hydrogen atom has metal like properties. The valency of hydrogen is always limited to one. Thus X–H–Y type of bond never exists.
 (C) X–H–Y type of bonding may occur in the electron deficient molecules. The formation of X–H–Y type of bond occur like the three centre two electron bond in the electron deficient molecules.
 (D) Both (A) & (C) are correct.
14. Acetic acid CH_3COOH , can form dimer $(CH_3COOH)_2$ in gaseous state



At 25°C equilibrium constant for dimerisation is 10^3 atm and for dimerisation ΔS° is, -0.16 KJ/mole/K

The dimerisation reaction is $2CH_3COOH \rightleftharpoons (CH_3COOH)_2$

What is the H bond energy in dimer of acetic acid in gaseous state for per mole hydrogen bond.

- (A) 64.769 KJ (B) 32.385 KJ (C) 22.562 KJ (D) 50.79 KJ

PHYSICAL / INORGANIC
CHEMISTRY
DPP
DAILY PRACTICE PROBLEMS

DPP No. 44

Total Marks : 33
Max. Time : 34 min.

Topic : Solid State

Type of Questions

		M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.3	(3 marks, 3 min.)	[9, 9]
Subjective Questions ('-1' negative marking) Q.4 to Q.8	(4 marks, 5 min.)	[20, 25]
Match the Following (no negative marking) Q.9	(8 marks, 10 min.)	[8, 10]

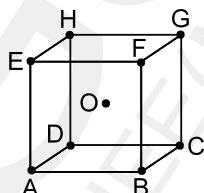
Integer Answer Type

Subjective Questions ('-1' negative marking) Q.10	(4 marks, 5 min.)	[4, 5]
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BooSt YoUr PreVious ConCept

Single choice Objective ('-1' negative marking) Q.11	(3 marks, 3 min.)	[3, 3]
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- A metallic element has simple cubic arrangement. The number of unit cells in 100 g of this metal (edge length = 288 pm, density = 7.2 g cm⁻³) are 5.8×10^{23} . The total number of atoms in 100 g of the metal is :
(A) 5.8×10^{24} (B) 5.8×10^{23} (C) 0.58×10^{23} (D) 58×10^{24}
- An fcc lattice has lattice parameter $a = 400$ pm. Calculate the molar volume of the lattice including all the empty space:
(A) 10.8 mL (B) 96 mL (C) 8.6 mL (D) 9.6 mL
- A body centred cubic arrangement is show :



- O is the body centre ; A, B, C, D, , H are the corners. What is the magnitude of the angle AOB?
(A) 120° (B) 109° 28' (C) 104° 31' (D) 70° 32'
- Radii of A⁺ and that of X⁻ and Y⁻ have been given as:
A⁺ 1.00 pm
X⁻ 1.00 pm
Y⁻ 2.00 pm

Assign structure of AX and AY crystals and also determine volume of the unit cell of AZ and AY crystals.

- A metallic element has cubic lattice. Each edge of the unit cell is 3.0Å. The density of the metal is 8.5 g/cc. How many unit cells will be present in 50 g of the metal?
- A solid A⁺B⁻ has NaCl type close packed structure. Compute the radius of the cation when the radius of anion is 250 pm.
Can a cation C⁺ having a radius of 180 pm be accommodated into the tetrahedral site of the crystal A⁺B⁻?
Give reason for your answer

7. At 1425°C Fe crystallised in a body-centred cubic lattice whose edge length is 2.93 Å. Assuming the atoms to be packed spheres, calculate :
- the radius of the spheres,
 - the distance between centres of neighbouring spheres,
 - the number of atoms of Fe per unit lattice, and
 - the total volume occupied by an atom of Fe.
8. Metallic gold crystallizes in the face, centered cubic lattice. The length of cubic unit cell is $a = 4.07\text{Å}$
- What is closest distance between gold atoms
 - What is the distance between next nearest neighbours
 - How many nearest neighbours does each gold atom have
 - How many next nearest neighbours does each gold have
 - What is calculated density of crystalline gold
 - What is packing efficiency of gold ?
9. **Column - I** **Column - II**
- | | |
|------------------------------|--|
| (A) 74% occupancy of space | (p) cubic close packing of identical spheres. |
| (B) Coordination number = 6 | (q) hexagonal close packing of identical spheres. |
| (C) 68% occupancy of space | (r) body centred cubic packing of identical spheres. |
| (D) Coordination number = 12 | (s) simple cubic packing of identical spheres. |
| | (t) AB AB AB type of close packing of identical spheres. |

Integer Answer Type

10. This section contains 2 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9.
- The coordinate no. of barium ion Ba^{2+} in BaF_2 is 8. What must be the C.N. of F^- ion.
 - The coordination number of each atom in the crystalline structure of Na is

BooSt YoUr PreVious ConCept

11. (a). In the reaction, $x\text{VO} + y\text{Fe}_2\text{O}_3 \longrightarrow \text{FeO} + \text{V}_2\text{O}_5$. What is the value of x and y respectively ?
- (A) 1, 1 (B) 2, 3 (C) 3, 2 (D) None of these
- (b). 20 mL of H_2O_2 solution is reacted with 80 mL of 0.05 M KMnO_4 in acidic medium then what is the volume strength of H_2O_2 ?
- (A) 2.8 (B) 5.6 (C) 11.2 (D) None of these

PHYSICAL / INORGANIC
CHEMISTRY
DPP
DAILY PRACTICE PROBLEMS

DPP No. 45

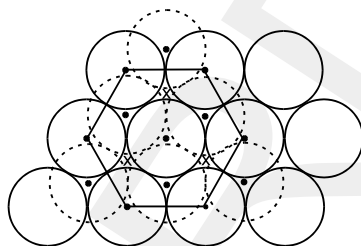
Total Marks : 50
Max. Time : 57 min.

Topic : Solid State

Type of Questions

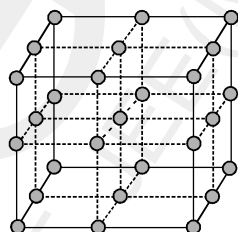
		M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.2	(3 marks 3 min.)	[6, 6]
Multiple choice objective ('-1' negative marking) Q.3	(4 marks 4 min.)	[4, 4]
Comprehension ('-1' negative marking) Q.4 to Q.6	(3 marks 3 min.)	[9, 9]
Assertion and Reason (no negative marking) Q.7	(3 marks 3 min.)	[3, 3]
Subjective Questions ('-1' negative marking) Q.8 to Q.12	(4 marks 5 min.)	[20, 25]
Match the Following (no negative marking) Q. 13	(8 marks 10 min.)	[8, 10]

1. (a) In hexagonal close packing of sphere in three dimensions.



- (A) In one unit cell there are 12 octahedral voids and all are completely inside the unit cell.
 (B) In one unit cell there are six octahedral voids and all are completely inside the unit cell.
 (C) In one unit cell there are six octahedral void and of which three are completely inside the unit cell and other three are partially inside the unit cell.
 (D) In one unit cell there are 12 tetrahedral voids, all are completely inside the unit cell.

- (b) The following diagram shows arrangement of lattice point with $a = b = c$ and $\alpha = \beta = \gamma = 90^\circ$. Choose the correct options.



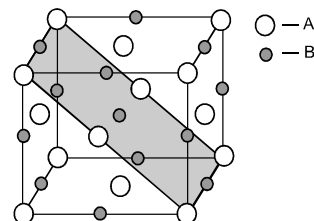
- (A) The arrangement is SC with each lattice point surrounded by 6 nearest neighbours.
 (B) The arrangement is SC with each lattice point surrounded by 8 nearest neighbours.
 (C) The arrangement is FCC with each lattice point surrounded by 12 nearest neighbours.
 (D) The arrangement in BCC with each lattice point surrounded by 8 nearest neighbours

2. (a) A crystal is made of particle X, Y & Z. X forms FCC packing, Y occupies all octahedral voids of X and Z occupies all tetrahedral voids of X, if all the particles along one body diagonal are removed then the formula of the crystal would be -

- (A) XYZ_2 (B) X_2YZ_2 (C) $X_8Y_4Z_5$ (D) $X_5Y_4Z_8$

- (b) A crystal is made of particles A and B. A forms FCC packing and B occupies all the octahedral voids. If all the particles along the plane as shown in figure are removed, then, the formula of the crystal would be :

- (A) AB (B) A_5B_7
 (C) A_7B_5 (D) None of these.



- 3.* In the fluorite structure if the radius ratio is $\left(\frac{\sqrt{3}}{2} - 1\right)$, how many ions does each cation touch ?
 (A) 4 anions (B) 12 cations (C) 8 anions (D) No cations

Comprehension # (Q.4 to Q.6)

Only those atoms which form four covalent bonds produce a repetitive three dimensional structure using only covalent bonds, e.g., diamond structure. The latter is based on a **FCC** lattice where lattice points are occupied by carbon atoms. Every atom in this structure is surrounded tetrahedrally by four others. Germanium, silicon and grey tin also crystallize in the same way as diamond. (Given : $N_A = 6 \times 10^{23}$, $\sin 54^\circ 44' = 0.8164$).

4. If edge length of the cube is 3.60\AA , then radius of carbon atom is
 (A) 0.78\AA (B) 0.92\AA (C) 0.64\AA (D) 0.35\AA .
5. If the edge length is 3.60\AA , density of diamond crystal is :
 (A) 3.92 gm/cc (B) 2.40 gm/cc (C) 3.37 gm/cc (D) 2.58 gm/cc .
6. Total number of diamond unit cells in 1.2 gm of diamond sample is :
 (A) 6.0×10^{21} (B) 6.0×10^{22} (C) 7.5×10^{21} (D) 5.0×10^{22} .
7. **(a) Statement-1** : In ZnS zinc blende structure Zn^{2+} form FCC while alternate tetrahedral voids are occupied by S^{2-} .

Statement-2 : Positions of Zn^{2+} and S^{2-} in zinc blende structure are similar.

- (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
 (B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
 (C) Statement-1 is True, Statement-2 is False.
 (D) Statement-1 is False, Statement-2 is True.

(b) Statement-1 : In ZnS crystal, Zn^{2+} ions are placed at 50% of tetrahedral voids (at alternate positions) created by S^{2-} ion in c.c.p. lattice.

Statement-2 : Ratio of number of S^{2-} ion and number of tetrahedral voids is 2 : 1 where as ratio of number of S^{2-} ion and number of Zn^{2+} ion is 1 : 1 in zinc blende.

- (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
 (B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
 (C) Statement-1 is True, Statement-2 is False.
 (D) Statement-1 is False, Statement-2 is True.

8. Lithium forms a b.c.c lattice. If the lattice constant is $3.50 \times 10^{-10}\text{ m}$ and the experimental density is $5.30 \times 10^2\text{ kg m}^{-3}$ and, calculate the percentage occupancy of Li metal. ($\text{Li} = 7$)
9. In a cubic lattice, the closed packed structure of mixed oxides of the lattice is made up of oxide ions ; one eighth of the tetrahedral voids are occupied by divalent ions (A^{2+}) while one half of the octahedral voids are occupied by trivalent ions (B^{3+}). What is the formula of the oxides ?
10. A cubic unit cell contains manganese ions at the corners and fluoride ions at the centre of each edge.
 (a) What is the empirical formula
 (b) What is the C.N. of the Mn ion ?
 (c) Calculate the edge length of the unit cell if the radius of a Mn ion is 0.65\AA and that of F^- ion is 1.36\AA .
11. Metallic gold crystallizes in the face-centred cubic lattice. The edge length of the cubic unit cell, $a = 4.070\text{\AA}$. Calculate the closest distance between gold atoms and the density of gold. Atomic mass of $\text{Au} = 197\text{ amu}$.
12. A certain metal forms a face centered cubic lattice. The edge of unit cell is 4.07\AA and its density is 19.4 g/cm^3 .
 (i) What is the shortest distance between the metal atoms ?
 (ii) How many nearest neighbours are there for each atom of the metal?
 (iii) What is the molar mass of the metal?
 (iv) What is the ratio of the volume occupied by the atoms of the total volume the unit cell?

13. Column - I

- (A) 74% occupancy of space
 (B) Coordination No -8
 (C) Ca^{2+} ion in CaF_2
 (D) Coordination No. - 12

Column - II

- (p) Coordination No. of cation in fluorite structure
 (q) Cubic close packing
 (r) Hexagonal close packing
 (s) body centred cubic packing.

PHYSICAL / INORGANIC
CHEMISTRY
DPP
DAILY PRACTICE PROBLEMS

DPP No. 46

Total Marks : 48
Max. Time : 51 min.

Topic : Solid State

Type of Questions

		M.M., Min.
Single choice Objective ('-1' negative marking) Q.1 to Q.3	(3 marks 3 min.)	[9, 9]
Multiple choice objective ('-1' negative marking) Q.4 to Q.6	(4 marks 4 min.)	[12, 12]
Comprehension ('-1' negative marking) Q.7 to Q.11	(3 marks 3 min.)	[12, 12]
Match the Following (no negative marking) Q.12	(8 marks 10 min.)	[8, 10]
Assertion and Reason (no negative marking) Q.13	(3 marks 3 min.)	[3, 3]

Integer Answer Type

Subjective Questions ('-1' negative marking) Q.14	(4 marks 5 min.)	[4, 5]
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- A hypothetical ionic compound AB (mol. wt. = 240 g/mole), having co-ordination number of anion equal to 6, has a closest anion-anion distance of $4\sqrt{2}$ Å. Determine the density of ionic compound AB in gm/cc.
(A) 6.24 (B) 3.12 (C) 1.56 (D) 0.78
 - Which of the following is incorrect
(A) The defect is known as schottky defect
(B) Density of compound in the defect decreases
(C) NaCl(s) is example which generally shows this defect
(D) Stoichiometry of compound will change slightly.
- | | | | | | | | |
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- Analysis show that nickel oxide consist of nickel ion with 96% ions having d^8 configuration and 4% having d^7 configuration. Which amongst the following best represents the formula of the oxide.
(A) $Ni_{1.02}O_{1.00}$ (B) $Ni_{0.96}O_{1.00}$ (C) $Ni_{0.98}O_{0.98}$ (D) $Ni_{0.98}O_{1.00}$
 - * The correct statement(s) regarding defects solids is (are)
(A) Schottky defect is usually favoured by small difference in the sizes of cation and anion.
(B) Schottky defect lowers the density of solids.
(C) Compounds having F-centres are diamagnetic.
(D) Frenkel defect is a dislocation defect.
 - * Which of the following is/are incorrect for Rock salt crystal :
(A) If all Na^+ ions occupied at body centre are removed according to schottky defect then formula of resulting ionic compound would be Na_3Cl_4 .
(B) If Na^+ ions would be present in alternate tetrahedral voids then formula would be Na_2Cl .
(C) If some Cl^- get displaced from the lattice in the presence of Na vapours then colour of compound will change.
(D) If interionic distance in crystal is 4.2 Å then edge length of unit cell becomes equal to 8.4 Å.
 - * Select the correct statement(s) related to hexagonal close packing of identical spheres in three dimensions:
(A) In one unit cell there are 12 octahedral voids and all are completely inside the unit cell
(B) In one unit cell there are six octahedral voids and all are completely inside the unit cell.
(C) In one unit cell there are six octahedral void and out of which three are completely inside the unit cell and other three are from contributions of octahedral voids which are partially inside the unit cell
(D) Co-ordination number of every sphere is 12 in hcp lattice.

Comprehension # (Q.7 to Q.11)

Sodium chloride structure is composed of Na^+ and Cl^- . Chloride ions are arranged in ccp while Na^+ ions are in octahedral holes. Each Na^+ is surrounded by six Cl^- ions while each Cl^- is surrounded by six Na^+ . Cadmium oxide crystallizes in NaCl type of crystal lattice. The compound is however usually non stoichiometric with approximate formula $\text{CdO}_{0.95}$. The defect arise due to some cationic positions are occupied by neutral Cd-atom instead of Cd^{2+} ions and equivalent number of anion sites are vacant. (Mt.wt. of $\text{CdO} = 128$). Assume anion-anion contact.

7. What % of anion sites are vacant :
 (A) 95% (B) 5% (C) 10% (D) 50%
8. If edge length of unit cell is 470 pm what would be the density of $\text{CdO}_{0.95}$ solid?
 (A) $\frac{4 \times 128}{N_A \times (4.7)^3}$ gm/cc (B) $\frac{4 \times 128}{N_A \times (4.7)^3 \times 10^{-24}}$ gm/cc
 (C) $\frac{4 \times 127.2}{N_A \times (4.7)^3}$ gm/cc (D) $\frac{4 \times 127.2}{N_A \times (4.7)^3 \times 10^{-24}}$ gm/cc
9. What will be the packing fraction of a NaCl type solid if ions along an axis connecting opposite face centres are absent :
 (A) $\frac{\pi}{3\sqrt{2}} \left[\left(\frac{r^+}{r^-} \right)^3 + 1 \right]$ (B) $\frac{\pi}{4\sqrt{2}} \left[\left(\frac{r^+}{r^-} \right)^3 + 1 \right]$ (C) $\frac{\pi}{2\sqrt{2}} \left[\left(\frac{r^+}{r^-} \right)^3 + 1 \right]$ (D) $\frac{4\pi}{3} \left[\left(\frac{r^+}{r^-} \right)^3 + 1 \right]$
10. What will be the packing fraction of NaCl type solid if ions along an axis connecting opposite edge centres along one phase are absent :
 (A) $\frac{7\pi}{24\sqrt{2}} \left[\left(\frac{r^+}{r^-} \right)^3 + 1 \right]$ (B) $\frac{7\pi}{8\sqrt{2}} \left[\left(\frac{r^+}{r^-} \right)^3 + 1 \right]$ (C) $\frac{7\pi}{12\sqrt{2}} \left[\left(\frac{r^+}{r^-} \right)^3 + 1 \right]$ (D) $\frac{\pi}{12\sqrt{2}} \left[\left(\frac{r^+}{r^-} \right)^3 + 1 \right]$
11. What will be the packing fraction when ions along opposite edge centres are missing :
 (A) $\frac{\pi}{12\sqrt{2}} \left[\frac{5}{2} \left(\frac{r^+}{r^-} \right)^3 + 4 \right]$ (B) $\frac{\pi}{12\sqrt{2}} \left[\frac{5}{2} \left(\frac{r^+}{r^-} \right)^3 + 2 \right]$ (C) $\frac{7\pi}{24\sqrt{2}} \left[\left(\frac{r^+}{r^-} \right)^3 + 1 \right]$ (D) $\frac{7\pi}{12\sqrt{2}} \left[\left(\frac{r^+}{r^-} \right)^3 + 1 \right]$

12. **Column-I** (p) Coordination number of cation and anion are equal.
 (A) Zinc blende structure (q) $r_+ + r_- = \frac{a_{\text{fcc}} \sqrt{3}}{4}$
 (B) Rock salt structure (r) Coordination number of cation < 6
 (C) Antifluorite structure (s) $r_+ + r_- = \frac{a_{\text{sc}} \sqrt{3}}{2}$
 (D) Cesium chloride structure (t) Anion forms fcc lattice.

13. **Statement-1** : In NaCl crystal each Na^+ ion is touching 6 Cl^- ions but these Cl^- ions do not touch each other.
Statement-2 : The radius ratio $r_{\text{Na}^+}/r_{\text{Cl}^-}$ is greater than 0.414, required for exact fitting.
 (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
 (B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
 (C) Statement-1 is True, Statement-2 is False
 (D) Statement-1 is False, Statement-2 is True

Integer Answer Type

14. This section contains 2 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9.
 (i) In F.C.C. arrangement of identical spheres, distance between two nearest octahedral void is 8.51Å. The distance between two nearest tetrahedral voids would be ?
 (ii) How many of the following ionic compounds have coordination number of either cation or anion equal to 6 or more : ZnS , KCl , K_2O , CsBr , NaBr , CaF_2