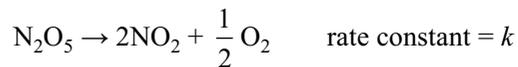# Practice Test Paper–I

Select the Correct Choice

1. The amount of $KMnO_4$ that will be needed to react with one mole of sulphite ion in acidic solution is
   - (a) (2/5) mol
   - (b) (3/5) mol
   - (c) (4/5) mol
   - (d) 1 mol

2. At a given temperature if $\rho(X) = 3\,\rho(Y)$ and and $M(Y) = 2M(X)$, where ρ and M stand for density and molar mass of the gases X and Y, respectively, then the ratio of their pressures would be
   - (a) $p(X)/p(Y) = 1/4$
   - (b) $p(X)/p(Y) = 4$
   - (c) $p(X)/p(Y) = 6$
   - (d) $p(X)/p(Y) = 1/6$

3. The edge length of unit cell of sodium chloride is 564 pm. If the size of Cl^- ion is 181 pm, the size of Na^+ ion would be
   - (a) 101 pm
   - (b) 167 pm
   - (c) 202 pm
   - (d) 383 pm

4. Which of the following statements for crystals having Schottky defect is not correct?
   - (a) Schottky defect arises due to the absence of a cation or anion from the position which it is expected to occupy.
   - (b) Schottky defects are more common in ionic compounds with high coordination number.
   - (c) The density of the crystals having Schottky defect is larger than that of the perfect crystal.
   - (d) The crystal having Schottky defect is electrical neutral as a whole.

5. For a d-electron, the orbital angular momentum is
   - (a) $\sqrt{6}\ (h/2\pi)$
   - (b) $\sqrt{2}\ (h/2\pi)$
   - (c) $(h/2\pi)$
   - (d) $2(h/2\pi)$

6. The energy of an electron in the first Bohr orbit for hydrogen is -13.6 eV. Which one of the following is a possible excited state for electron in Bohr orbit of hydrogen atom?
   - (a) -3.4 eV
   - (b) -6.8 eV
   - (c) -1.7 eV
   - (d) 13.6 eV

7. The correct order of electron affinity is
   - (a) O > S > Se
   - (b) O < S > Se
   - (c) O > S < Se
   - (d) O < S < Se

8. The hybridization of atomic orbitals of nitrogen in NO_2^+, NO_3^- and NH_4^+ respectively are
   - (a) sp, sp^3 and sp^2
   - (b) sp, sp^2 and sp^3
   - (c) sp^2, sp and sp^3
   - (d) sp^2, sp^3 and sp

9. The reaction $NH_4CN(s) + \dfrac{3}{2}\,O_2(g) \rightarrow N_2(g) + CO_2(g) + H_2O(l)$ was carried out in a bomb calorimeter. The heat released was 743 kJ mol^{-1}. The value of ΔH_{300K} for this reaction would be
   - (a) -740.5 kJ mol^{-1}
   - (b) -741.75 kJ mol^{-1}
   - (c) -743.0 kJ mol^{-1}
   - (d) -744.25 kJ mol^{-1}

10. When $NaNO_3$ is heated in a closed vessel, oxygen is liberated and $NaNO_2$ is left behind. At equilibrium
    - (a) addition of $NaNO_2$ favours reverse reaction
    - (b) addition of $NaNO_3$ favours forward reaction
    - (c) Increasing temperature favours forward reaction
    - (d) increasing pressure favours forward reaction

11. Which of the following aqueous solution will be acidic in nature at 40 °C? Given: pK_w° at 40 °C = 13.54.
    - (a) 6.6
    - (b) 6.8
    - (c) 7.0
    - (d) 7.2

12. The solubility of sparingly soluble electrolyte M_mA_a in water is given by the expression
    - (a) $[K_{sp}/(m^m\ a^a)]^{m+a}$
    - (b) $[K_{sp}/(m^a\ a^m)]^{m+a}$
    - (c) $[K_{sp}/(m^a\ a^m)]^{1/(m+a)}$
    - (d) $[K_{sp}/(m^m\ a^a)]^{1/(m+a)}$

13. The density of Cu is 8.94 g cm^{-3}. The quantity of electricity needed to plate an area of 100 cm^2 to a thickness of 10^{-2} cm using $CuSO_4$ solution is
    - (a) 13586 C
    - (b) 20379 C
    - (c) 27172 C
    - (d) 40758 C

14. The reduction potential of hydrogen half-cell will be negative if
    (a) $p(H_2) = 1$ atm and $[H^+] = 1$ M
    (b) $p(H_2) = 1$ atm and $[H^+] = 2$ M
    (c) $p(H_2) = 2$ atm and $[H^+] = 2$ M
    (d) $p(H_2) = 2$ atm and $[H^+] = 1$ M
15. The freezing point of equimolal aqueous solutions will be highest for
    (a) $C_6H_5NH_3Cl$ (anilinium chloride)
    (b) $Ca(NO_3)_2$
    (c) $La(NO_3)_3$
    (d) $C_{12}H_{22}O_{11}$ (sucrose)
16. For the chemical equations

    $$N_2O_5 \rightarrow 2NO_2 + \frac{1}{2} O_2 \qquad \text{rate constant} = k$$

    $$2N_2O_5 \rightarrow 4NO_2 + O_2 \qquad \text{rate constant} = k'$$

    which of the following expressions is correct?
    (a) $k = k'$
    (b) $k = 2k'$
    (c) $2k = k'$
    (d) $k = 3k'$
17. The highest bond enthalpy is shown by halogen
    (a) F_2
    (b) Cl_2
    (c) Br_2
    (d) I_2
18. In the dichromate ion
    (a) 3Cr—O bonds are equivalent
    (b) 4Cr—O bonds are equivalent
    (c) 6Cr—O bonds are equivalent
    (d) 7Cr—O bonds are equivalent
19. Hypophosphorous acid is
    (a) monobasic
    (b) dibasic
    (c) tribasic
    (d) neutral
20. Which of the following statements is not correct?
    (a) The complexes $[Ni(CO)_4]$ and $[NiCl_4]^{2-}$ differ in the state of hybridization.
    (b) The complexes $[Ni(CO)_4]$ and $[NiCl_4]^{2-}$ differ in the magnetic properties
    (c) The complexes $[Ni(CO)_4]$ and $[NiCl_4]^{2-}$ differ in the primary valencies of nickel
    (d) The complexes $[Ni(CO)_4]$ and $[NiCl_4]^{2-}$ have nickel in different oxidation states
21. Which of the following statements is not correct?
    (a) $Ti(NO_3)_4$ is a colourless compound
    (b) $[Cu(NCCH_3)_4]^+ BF_4^-$ is a colourless compound
    (c) $[Cr(NH_3)_6]^{3+} 3Cl^-$ is a coloured compound
    (d) $K_3[VF_6]$ is a colourless compound
    (**Given:** Atomic numbers of Ti, Cu, Cr and V are 22, 29, 24 and 23, respectively.)
22. Dien is an example of
    (a) monodentate ligand
    (b) bidentate ligand
    (c) tridentate ligand
    (d) hexadentate ligand
23. Which of the following is the $4n + 1$ radioactive series?
    (a) Thorium series
    (b) Neptunium series
    (c) Uranium series
    (d) Actinium series
24. Which of the following statements regarding alkanes is not correct?
    (a) Bromination takes place with greater difficulty than chlorination
    (b) Chlorine has a much lesser tendency to replace tertiary hydrogen in preference to secondary or primary
    (c) More reactive reagent shows less selectivity in reaction
    (d) Chlorination of methane is retarted in the presence of oxygen
25. An alkene on reductive ozonolysis gives 2 molecules of $CH_2(CHO)_2$. The compound is
    (a) 2,4-hexadiene
    (b) 1,3-cyclohexadiene
    (c) 1,4-cyclohexadiene
    (d) 1-methyl-1, 3-cyclopentadiene
26. Which of the following orders regarding base strength is correct?
    (a) $CH_3COO^- > CH_3CH_2O^- > HC \equiv C^-$
    (b) $CH_3COO^- < CH_3CH_2O^- < HC \equiv C^-$
    (c) $HC \equiv C^- > CH_3COO^- > CH_3CH_2O^-$
    (d) $HC \equiv C^- > CH_3CH_2O^- > CH_3COO^-$
27. Which of the following sequences regarding activating effects of the given o, p-directors is correct?
    (a) $—O^- < —OH < —OCOCH_3$
    (b) $—O^- < —OH > —OCOCH_3$
    (c) $—O^- > —OH < —OCOCH_3$
    (d) $—O^- > —OH > —OCOCH_3$
28. Which of the following alcohols does not give iodoform test?
    (a) $(CH_3)_2CH(OH)CH_3$
    (b) $PhCH(OH)CH_2CH_3$
    (c) 1-methylcyclohexanol
    (d) $CH_3CH_2 CH(OH)CH_3$

29. The correct sequence regarding the activity of the given acid derivatives is
    (a) $RCOCl > RCON_3 > (RCO)_2O$
    (b) $RCOCl > (RCO)_2O > RCON_3$
    (c) $RCON_3 > RCOCl > (RCO_2)_2O$
    (d) $RCON_3 > (RCO)_2O > RCOCl$
30. Which of the following polymers contains amide linkages?
    (a) Terylene
    (b) Bakelite
    (c) Nylon 6
    (d) Styron

⟺ ANSWERS

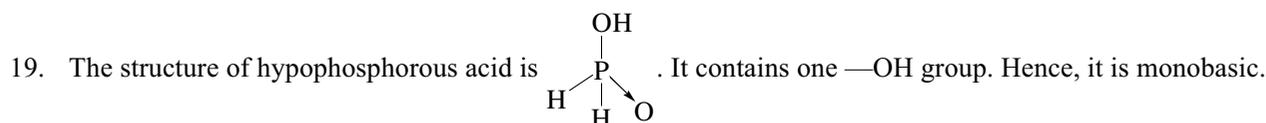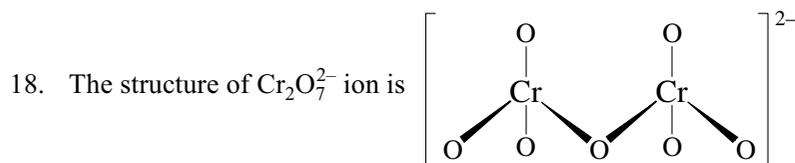|					
1. (a)	2. (c)	3. (a)	4. (c)	5. (a)	6. (a)
7. (b)	8. (b)	9. (b)	10. (c)	11. (a)	12. (d)
13. (c)	14. (d)	15. (d)	16. (b)	17. (b)	18. (c)
19. (a)	20. (a)	21. (d)	22. (c)	23. (b)	24. (b)
25. (c)	26. (b)	27. (d)	28. (b)	29. (a)	30. (c)

⟺ HINTS AND SOLUTIONS

1. The reaction is $2MnO_4^- + 5SO_3^{2-} + 6H^+ \longrightarrow 2Mn^{2+} + 5SO_4^{2-} + 3H_2O$

   Hence, 1 mol $SO_3^{2-} \equiv (2/5)$ mol MnO_4^{2-}

2. We have $pV = nRT = (m/M)RT \Rightarrow pM = (m/V) RT = \rho RT$

   Hence $\dfrac{p(X)}{p(Y)} = \dfrac{\rho(X)}{\rho(Y)} \dfrac{M(Y)}{M(X)} = (3)(2) = 6$

3. In NaCl crystal, $r(Na^+) + r(Cl^-) = a/2$. Hence $r(Na^+) = (564 \text{ pm}/2) - 181 \text{ pm} = 101 \text{ pm}$
4. In Schottky defect, lesser number of ions as compared to a perfect crystal are present. Hence, the density of the crystal exhibiting Schottky defect will be less as compared to that of the perfect crystal.

5. The expression of orbital angular momentum is $L = \sqrt{l(l+1)} \ (h/2\pi)$. For d-electron, $l = 2$. Hence $L = \sqrt{6} \ (h/2\pi)$.

6. The energy expression is $E_n = - R_H /n^2$. For $n = 2$, $E = - 3.4$ eV.
7. The compact configuration in oxygen atom makes electron affinity lesser than that of sulphur atom.
8. NO_2^+ is linear, NO_3^- is planar and NH_4^+ is tetrahedral.
9. We have $\Delta H = \Delta U + (\Delta v_g) RT = [- 743 + (1/2)(8.314 \times 10^{-3})(300)]$ kJ mol^{-1} $= - 741.75$ kJ mol^{-1}
10. The reaction is endothermic. Hence, increasing temperature favours forward direction of the reaction.
11. $pH < (1/2) pK_w^\circ$ for acidic solution.
12. For the electrolyte M_mA_a, we have

    $$M_mA_a \rightleftharpoons mM^{a+} + a A^{m-}$$
    $$K_{sp} = [M^{a+}]^m [A^{m-}]^a = (ms)^m (as)^a . \text{ Hence } s = (K_{sp}/m^m a^a)^{1/(m+a)}$$
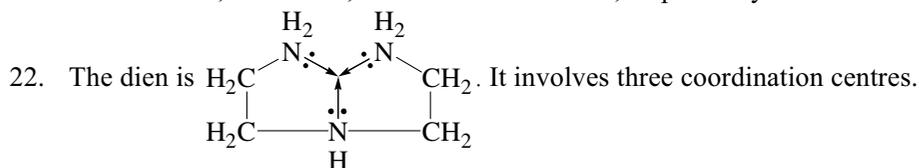
13. Since, $m = (Q/F)(M/|v_e|)$, we have
    $$Q = mF|v_e|/M = (\rho V) F|v_e|/M = [(8.94 \times 1)(96500 \times 2)/63] \text{ C} = 27172 \text{ C}$$

14. For the reaction $2H^+ + 2e^- = H_2$, we have $E = -\dfrac{RT}{2F} \ln \dfrac{p_{H_2}}{[H^+]^2}$

    For $p_{H_2} = 2$ atm and $[H^+] = 1$ M, E is negative.

15. Being sucrose a nonelectrolyte, $- \Delta T_f$ will be least, hence T_f will be highest.
16. We will have $-\dfrac{d[N_2O_5]}{dt} = k[N_2O_5]$ and $-\dfrac{1}{2}\dfrac{d[N_2O_5]}{dt} = k'[N_2O_5]$

    To have the same value of $- d[N_2O_5]/dt$, we will have $k = 2k'$.
17. Because of backbonding in Cl_2, the bond acquires partial double character, hence the highest bond enthalpy.

18. The structure of $Cr_2O_7^{2-}$ ion is

$$\left[\begin{array}{c} \overset{\displaystyle O}{\underset{\displaystyle O}{Cr}} \overset{\displaystyle O}{\underset{\displaystyle O}{Cr}} \end{array} \right]^{2-}$$

19. The structure of hypophosphorous acid is

$$\underset{\underset{H}{H}}{\overset{OH}{P}}\diagdown O$$

. It contains one —OH group. Hence, it is monobasic.

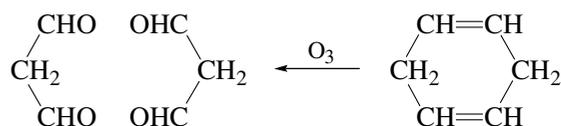20. Both $Ni(CO)_4$ and $[NiCl_4]^{2-}$ involve sp^3 hybridization of Ni orbitals.

21. The ions Ti^{4+}, Cu^+, Cr^{3+} and V^{3+} have $(3d)^0$, $(3d)^{10}$, $(3d)^3$ and $(3d)^1$ configurations. Their given compounds will be colourless, colourless, coloured and coloured, respectively.

22. The dien is

$$\begin{array}{c} \overset{H_2}{N} \qquad \overset{H_2}{N} \\ H_2C \diagup \qquad \diagdown CH_2 \\ | \qquad \qquad | \\ H_2C \!\!-\!\!-\!\! \underset{H}{N} \!\!-\!\!-\!\! CH_2 \end{array}$$

. It involves three coordination centres.

23. Thorium, Neptunium, Uranium and Actinium series are $4n$, $4n + 1$, $4n + 2$ and $4n + 3$ radioactive series, respectively.

24. The order of reactivity is $3° > 2° > 1°$.

25. We have

$$\begin{array}{c} \underset{CHO}{\overset{CHO}{CH_2}} \qquad \underset{OHC}{\overset{OHC}{CH_2}} \xleftarrow{O_3} \underset{CH=CH}{\overset{CH=CH}{CH_2 \qquad CH_2}} \end{array}$$

26. The order of acid strength is $CH_3COOH > CH_3CH_2OH > HC \equiv CH$

Their negative ions will follow reverse base strength.