CHEMISTRY

SECTION – A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

1. Which of the following option contains the Nessler's reagent?

(1) $K_2[HgI_4]$ (2) $K_2Cr_2O_7$

(3) $K_4[Fe(CN)_6]$ (4) $K_3[Cu(CN)_4]$

Answer (1)

Sol. Nessler's reagent is $K_2[HgI_4]$

2. Find out depression in freezing point (ΔT_f) for CH_3COOH (α = 20%) dissolved in aqueous solution having 10% (w/w) CH_3COOH in solution.

Given K_F of water = 1.86 K. kg mole^{-1}

(1) 4.13 K (2) 2.13 K

(3) 1.13 K (4) 0.13 K

Answer (1)

Sol. Molality $= \dfrac{10\times1000}{(60)(90)} = \dfrac{100}{54}$

$(\Delta T_F) = (i)\,(K_F)\,(m)$

$= (1.2)\times(1.86)\left(\dfrac{100}{54}\right)$

3. The spin only magnetic moment of Mn^{2+} in $[Mn(H_2O)_6]^{2+}$ is

(1) 2.87 B.M.

(2) 3.87 B.M.

(3) 5.91 B.M.

(4) 1.73 B.M.

Answer (3)

Sol. Mn^{2+} in $[Mn(H_2O)_6]^{2+}$ has $t_{2g}^3e_g^2$ configuration. Thus total unpaired e^- = 5

$\therefore$ Spin only magnetic moment $= \sqrt{5(5+2)}$

= 5.91 B.M.

4. Consider the H_2O_2 and O_2F_2 molecules where X and Y are O – O bond lengths in H_2O_2 and O_2F_2 respectively. Compare X and Y.

(1) X > Y

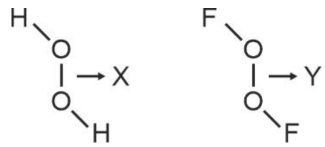
(2) X < Y

(3) X = Y

(4) X and Y cannot be compared

Answer (1)

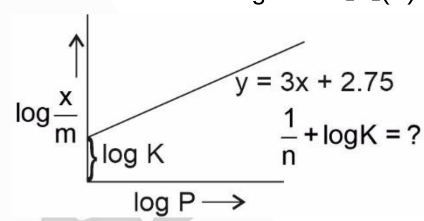
Sol.



Both H_2O_2 and O_2F_2 have open book like structure. According to Bent rule, the more electronegative atom in a molecule extracts higher p-character. In H_2O_2, O-atom is more electronegative than H-atom and hence extracts higher p-character. In O_2F_2, F-atom is more electronegative than O-atom and hence extracts higher p-character. Therefore, O-atom in O_2F_2 will have higher s-character.

Hence, O – O bond length in H_2O_2(X) will be more than O – O bond length in O_2F_2(Y).

5.



(1) 2.75 (2) 3.75

(3) 6.75 (4) 5.75

Answer (4)

Sol. $\log\dfrac{x}{m} = \log K + \dfrac{1}{n}\log P$

On comparison with y = 3X + 2.75

we have

log K = 2.75

$\dfrac{1}{n} = 3$

$\therefore\ \dfrac{1}{n} + \log K = 3 + 2.75$

= 5.75

6. Which of the following acts as a tranquilizer?

(1) Aminoglycoside (2) Chloramphenicol

(3) Aspirin (4) Valium

Answer (4)

Sol. The correct answer is Valium.

7. Which of the following order is correct regarding magnitude of first electron gain enthalpy?

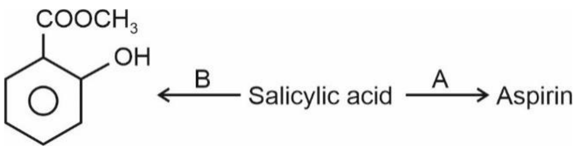
(1) Cl < F (2) O < S

(3) Te < O (4) S < Se

Answer (2)

Sol. $|\Delta H_{eg}|$ order : Cl > F > Br > I

S > Se > Te > O

8. 

Find out correct statement regarding A and B.

(1) A : Methanol/H^+

B : Ethanoic anhydride

(2) A : Ethanol/H^+

B : Ethanoic anhydride

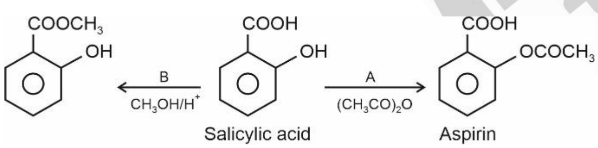
(3) A : Ethanoic anhydride

B : Methanol/H^+

(4) A : Ethanoic anhydride

B : Ethanol/H^+

Answer (3)

Sol. 

9. Which of the following given complexes has 2 isomers?

(1) $\left[Co(NH_3)_5NO_2\right]^{2+}$

(2) $\left[Co(NH_3)_5Cl\right]^{2+}$

(3) $\left[Co(NH_3)_6\right]^{3+}$

(4) $\left[Co(NH_3)_5Br\right]^{+2}$

Answer (1)

Sol. : $\left[Co(NH_3)_5NO_2\right]^{+2}$ can show linkage isomerism so, correct answer is option (1)

10. Which of the following reactions will not result in the formation of H_2O_2.

(1) $BaO_2.8H_2O(s) + H_2SO_4(aq)$

(2) 2-ethylanthraquinol $\xrightarrow{O_2}$

(3) $KO_2 + H_2O \rightarrow$

(4) $Na_2O + H_2O \rightarrow$

Answer (4)

Sol. $BaO_2.8H_2O(s) + H_2SO_4(aq) \rightarrow BaSO_4(s) + H_2O_2(aq) + 8H_2O$

2-ethylanthraquinol $\underset{H_2/Pd}{\overset{O_2}{\rightleftharpoons}}$ H_2O_2 + oxidised product

$2KO_2 + 2H_2O \rightarrow 2KOH + O_2 + H_2O_2$

$Na_2O + H_2O \rightarrow 2NaOH$

Hence correct answer in option (4)

11. Which of the following industry contributes maximum to global warming?

(1) Oil industry (2) Fertilizer industry

(3) Paper industry (4) Ice factory

Answer (1)

Sol. Oil industry contributes maximum to the global warming.

12. An electron in Be^{3+} goes from n = 4 to n = 2. Find out energy released in eV.

(Ground state energy of H-atom = 13.6 eV)

(1) 40.8 eV (2) 122.4 eV

(3) 217.6 eV (4) 21.17 eV

Answer (1)

Sol. Energy released

$$= 13.6 \times (Z)^2 \left(\frac{1}{(2)^2} - \frac{1}{(4)^2}\right)$$

$$= 13.6 \times 16 \times \left(\frac{1}{4} - \frac{1}{16}\right)$$

$$= 13.6 \times 16 \left(\frac{3}{16}\right)$$

= 40.8 eV

13. **Assertion :** Gypsum is used to slow down the setting of cement.

Reason : Gypsum is unstable at high temperature.

(1) Both Assertion and Reason are correct

(2) Assertion is correct, Reason is incorrect

(3) Assertion is incorrect, Reason is correct

(4) Both Assertion and Reason are incorrect

Answer (1)

Sol. Gypsum is added in small amount to slow down the setting of cement. So, assertion is correct.

Gypsum is thermally instable at high temperature as it undergoes dehydration up to 300°C and dissociates at high temperature to CaO and SO_3. So, reason is also correct.

14. Compare enthalpy of vaporisation (ΔH_{vap}) for H_2O, D_2O & T_2O

(1) $H_2O > D_2O > T_2O$

(2) $H_2O > T_2O > D_2O$

(3) $T_2O > D_2O > H_2O$

(4) $T_2O > H_2O > D_2O$

Answer (3)

Sol. : ΔH_{vap} $H_2O = 40.66\ \dfrac{kJ}{mole}$

$$D_2O = 41.61\ \frac{kJ}{mole}$$

15. The correct order of bond strength of C–C, Si–Si, Ge–Ge, Sn–Sn is____?

(1) C–C > Si–Si > Ge–Ge > Sn–Sn

(2) C–C > Si–Si > Ge–Ge $\simeq$ Sn–Sn

(3) C–C < Si–Si < Ge–Ge < Sn–Sn

(4) C–C > Si–Si > Sn–Sn > Ge–Ge

Answer (1)

Sol. Bond strength decreases on moving down. For carbon family

16. Consider the following reaction

$$\underset{(g)}{PCl_5} \rightleftharpoons \underset{(g)}{PCl_3} + \underset{(g)}{Cl_2}$$

Select the correct statement about the above equilibrium.

(1) On adding He gas at constant volume equilibrium shift in forward direction

(2) On adding He gas at constant pressure equilibrium shift in forward direction

(3) On adding He gas at constant pressure equilibrium shift in backward direction

(4) On adding He gas at constant volume, equilibrium shift in backward direction

Answer (2)

Sol. On adding He gas at constant volume equilibrium remains unaffected.

On adding He gas at constant pressure equilibrium shift in that direction in which number of gaseous molecule are greater.

Hence the correct answer is 2.

17. Which of the following option contains all the isoelectronic species?

(1) N^{3-}, O^{2-}, F, Na

(2) S^{-2}, $Cl^{\ominus}$, $K^{\oplus}$, Ca^{+2}

(3) NH_3, CH_4, PF_5, $Na^{\oplus}$

(4) Ne, $Na^{\oplus}$, F, N^{-3}

Answer (2)

Sol. S^{2-}, $Cl^{\ominus}$, $K^{\oplus}$ and Ca^{2+} all the species contain 18 electrons.

18. Identify the correct bond dissociation energy of halogens.

(1) $F_2 > Cl_2$

(2) $Br_2 > F_2$

(3) $I_2 > F_2$

(4) $Br_2 > Cl_2$

Answer (2)

Sol. The correct bond dissociation energy of halogens is

$Cl_2 > Br_2 > F_2 > I_2$

19. Given : $\lambda^{o}_{M\,NO_3^-} = 71.5\ S\ cm^2\ mol^{-1}$

$$\lambda^{o}_{M\,Br^-} = 78.1\ S\ cm^2\ mol^{-1}$$

$$\lambda^{o}_{M\,Ag^+} = 61.9\ S\ cm^2\ mol^{-1}$$

Find out conductivity of solution when 1 mole of $AgNO_3$ is dissolved in 1 L of AgBr saturated solution. (K_{sp} of AgBr = 10^{-13})

(1) 133.4×10^{-3} S cm^{-1} (2) 62.4×10^{-3} S cm^{-1}

(3) 78.1×10^{-3} S cm^{-1} (4) 96.5×10^{-3} S cm^{-1}

Answer (1)

Sol. AgBr conductivity is negative.

For Ag^+,

$$61.9 = \frac{K \times 1000}{1}$$

$$K_{Ag^+} = 61.9 \times 10^{-3}$$

For NO_3^-,

$$71.5 = \frac{K \times 1000}{1}$$

$$K_{NO_3} = 71.5 \times 10^{-3}$$

$$K_{total} = (61.9 + 71.5) \times 10^{-3}$$
$$= 133.4 \times 10^{-3}\ S\ cm^{-1}$$

20.

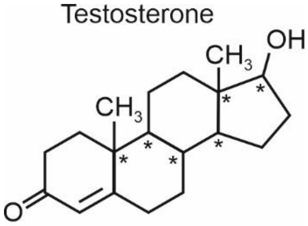
SECTION - B

Numerical Value Type Questions: This section contains 10 questions. In Section B, attempt any five questions out of 10. The answer to each question is a **NUMERICAL VALUE.** For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the second decimal place; e.g. 06.25, 07.00, –00.33, –00.30, 30.27, –27.30) using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.

21. Number of Chiral carbons in 1 molecule of testosterone

Answer (06.00)

Sol. Testosterone



6 Chiral Carbons

22. An atom forms two lattice FCC and BCC. The edge length of FCC lattice is 2.5 Å and edge length of BCC lattice is 2 Å. Then find the ratio of density of FCC to density of BCC. (Round off to nearest integer)

Answer (1)

Sol. For FCC

$$\sqrt{2} \times 2.5 = 4r$$

$$\therefore \quad r = \frac{2.5 \times \sqrt{2}}{4}$$

$$\therefore \quad d_{FCC} = \frac{4 \times M}{a^3}$$

For BCC

$$\sqrt{3} \times 2 = 4r$$

$$r = \frac{\sqrt{3} \times 2}{4}$$

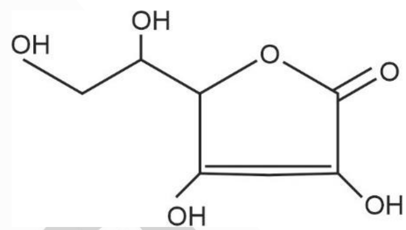
$$d_{BCC} = \frac{2 \times M}{a^3}$$

$$\therefore \quad \frac{d_{FCC}}{d_{BCC}} = \frac{4 \times M}{(2.5)^3} \times \frac{(2)^3}{2 \times M}$$

$$= 1.024$$

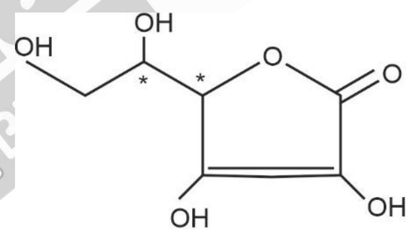
$$\approx 1$$

23. Find number of asymmetrical carbon in structure of vitamin C (Given in question).



Answer (2)

Sol.



2 Chiral Carbons

24. For a first order reaction half-life ($t_{1/2}$) is 50 minutes. Then find the $t_{3/4}$ (in minutes) of the reaction?

Answer (100)

Sol. $1 \xrightarrow{t_{1/2}} \frac{1}{2} \xrightarrow{t_{1/2}} \frac{1}{4}$

$\therefore$ $t_{3/4}$ will be 100 minutes.

25.

26.

27.

28.

29.

30.