VIDYAPEETH ACADEMY
SINCE 2013
IIT JEE | NEET | FOUNDATION

Head Office: 2nd Floor, Grand Plaza, Fraser Road, Dak Bunglow, Patna - 01

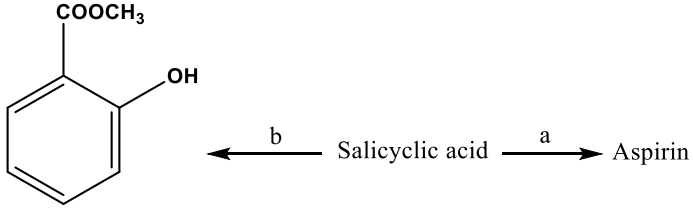
JEE Main 2023 (Memory based)

1st February 2023 - Shift 2

Answer & Solutions

CHEMISTRY

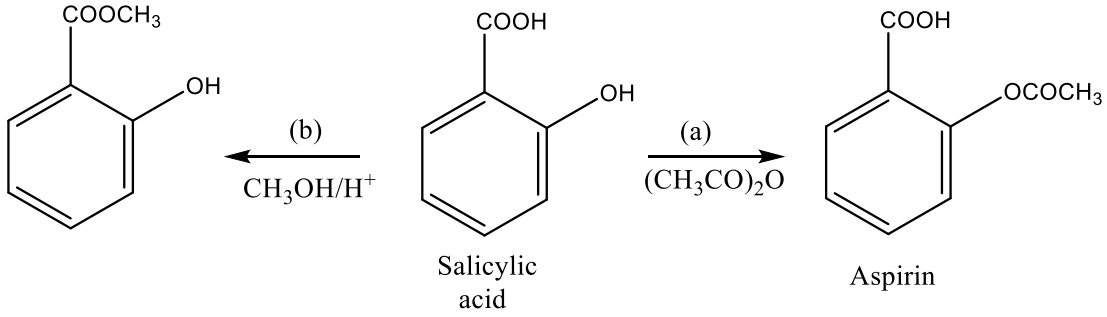
1. Find out the correct statement regarding a and b.



A. (a) Methanol/H^+
   (b) Ethanoic anhydride
B. (a) Ethanol/H^+
   (b) Ethanoic anhydride
C. (a) Ethanoic anhydride
   (b) Methanol/H^+
D. (a) Ethanoic anhydride
   (b) Ethanol/H^+

Answer (C)

Solution:



2. Assertion: Gypsum is used to slow down the setting of cement.
Reason: Gypsum is unstable at higher temperatures

A. Both (A) and (R) are correct
B. (A) is correct and (R) is incorrect
C. (A) is incorrect and (R) is correct

D. Both (A) and (R) are incorrect

Answer (A)

Solution:

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

Gypsum is thermally unstable at high temperature as it undergoes dehydration at $373\ K$ to form calcium sulphate hemihydrate and upon heating above 373 K it converts to dead burnt plaster ($CaSO_4$.

So, Reason is correct.

3. Compare the enthalpy of vaporization (ΔH_{vap}) for H_2O, D_2O, and T_2O.

A. $H_2O > D_2O > T_2O$
B. $H_2O > T_2O > D_2O$
C. $T_2O > D_2O > H_2O$
D. $T_2O > H_2O > D_2O$

Answer (C)

Solution:

Enthalpy of vaporization (ΔH_{vap}) α strength of intermolecular force of attraction.

And strength of intermolecular forces of attraction is α mass

Therefore, the correct order of enthalpy of vaporization (ΔH_{vap}) is $T_2O > D_2O > H_2O$.

4. Consider the following reaction
$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$
Select the incorrect statement about the above equilibrium reaction

A. On adding He gas at constant volume, equilibrium shift in forward reaction
B. On adding He gas at constant pressure, equilibrium shift in forward reaction
C. On adding He gas at constant pressure, equilibrium shift in backward reaction
D. On adding He gas at constant volume, equilibrium shift in backward reaction

Answer (B)

Solution:

On adding He gas at constant volume equilibrium remains unaffected.

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

Hence the correct answer is option (B).

5. Identify the correct order of bond dissociation energy of halogens.

A. $F_2 > Cl_2$
B. $Br_2 > F_2$
C. $I_2 > F_2$
D. $Br_2 > Cl_2$

Answer (B)

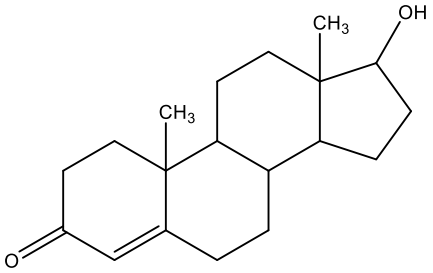
Solution:

The correct bond dissociation energy of halogens is

$Cl_2 > Br_2 > F_2 > I_2$

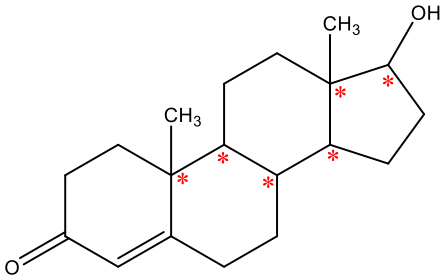
The bond dissociation energy of F_2 is less than Cl_2 and Br_2 because of lp – lp repulsions in case of F_2.

6. No of chiral carbons in 1 molecule of testosterone.



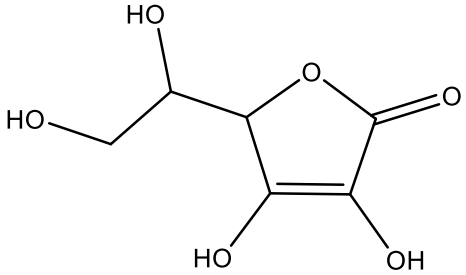
Answer (6)

Solution:



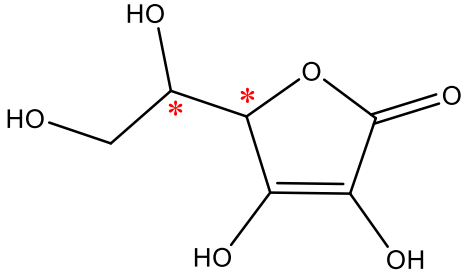
Testosterone

7. Find the number of asymmetric carbons in structure of Vitamin C.



Answer (2)

Solution:



2 – Chiral Carbons

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

Answer (100)

Solution:

$t_{3/4}$ is the time taken for consumption of 3/4th of the reactant and it is equal to 2 times the , $t_{1/2}$.

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

Therefore, $t_{3/4}$ will be 100 minutes.

9. Which of the following option is Nessler's reagent?

A. $K_2[HgI_4]$
B. $K_2Cr_2O_7$
C. $K_4[Fe(CN)_6]$
D. $K_3[Cu(CN)_4]$

Answer (A)

Solution:

Nessler's reagent is $K_2[HgI_4]$

10. 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 = $1.86 \frac{K.kg}{mole}$

A. 4.13 K
B. 2.13 K
C. 1.13 K
D. 0.13 K

Answer (A)

Solution:

$(\Delta T_f) = (i)(K_f)(m)$

$(\Delta T_f) = (i)(1.86)(m)$

Let's calculate molality

$$m = \frac{\%w/w \times 10 \times W_{solution}}{MM_{solute} \times W_{solvent}}$$

$$molality = \frac{10 \times 10 \times 100}{(60)(90)} = \frac{100}{54}$$

Let's calculate vant Hoff's factor (i)

$CH_3COOH \rightleftharpoons CH_3COO^- + H^+$

1	0	0
(1 - ∝)	∝	∝

$$i = \frac{total\ final\ moles}{total\ initial\ moles} = \frac{1+\propto}{1} == 1.2$$

$$= (1.2) \times (1.86) \times \frac{100}{54}$$

$$= 4.133\ K$$

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

A. 2.87 B.M.
B. 3.87 B.M.
C. 5.91 B.M.
D. 1.73 B.M.

Answer (C)

Solution:

Mn^{2+} in $[Mn(H_2O)_6]^{2+}$ has $(t_{2g})^3(e_g)^2$ configuration. Thus, total unpaired electrons are 5.

Hence, spin only magnetic moment = $\sqrt{5(5+2)} = 5.91\ B.M.$

12. Consider the H_2O_2 and O_2F_2 molecules where X and Y are O-O bond length in H_2O_2 and O_2F_2 respectively. Compare X and Y.

A. X > Y
B. X < Y
C. X = Y
D. X and Y cannot be compared

Answer (A)

Solution:

Both H_2O_2 and O_2F_2 have open book like structure. According to Bent's 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 highest 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).

13. Which of the following act as a tranquilizer.

A. Aminoglycoside
B. Chloramphenicol
C. Aspirin
D. Valium

Answer (D)

Solution:

Aminoglycoside - Antibiotic
Chloramphenicol – Antibiotic
Aspirin - Analgesic
Valium - Tranquilizer

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

A. Cl < F
B. O < S

C. Te < O

D. S < Se

Answer (B)

Solution:

ΔH_{ege} decreases down the group due to decrease in Z_{eff}

ΔH_{ege} also decreases due to interelectronic repulsions.

Therefore, the expected order in case of Group-16 elements is O > S > Se > Te but due to interelectronic repulsions in O the actual order becomes S > Se > Te > O.

The expected order in case of Group-17 elements is F > Cl > Br > I but due to interelectronic repulsions in F the actual order becomes Cl > F > Br > I.

15. Which of the following given complexes has 2 isomers.

A. $[Co(NH_3)_5NO_2]^{2+}$

B. $[Co(NH_3)_5Cl]^{2+}$

C. $[Co(NH_3)_5I]^{2+}$

D. $[Co(NH_3)_5Br]^{2+}$

Answer (A)

Solution:

$[Co(NH_3)_5NO_2]^{2+}$ can show linkage isomerism. So, the correct answer is option(A).

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

A. Oil industry

B. Fertilizer industry

C. Paper industry

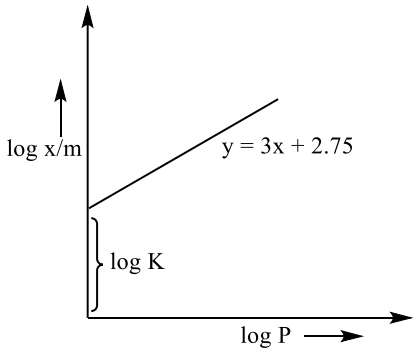
D. Ice factory

Answer (A)

Solution:

Oil industry contributes maximum to the global warming.

17. Consider the given graph. Find the value of $\frac{1}{n} + \log K$



A. 2.75
B. 3.75
C. 6.75
D. 5.75

Answer (D)

Solution:

$log\frac{x}{m} = \log K + \frac{1}{n}\log P$

On comparison with y = 3x +2.75

We have, log K = 2.75

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

$$\frac{1}{n} + \log K = 3 + 2.75 = 5.75$$

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

A. $BaO_2.8H_2O(s) + H_2SO_4(aq)$
B. $2 - ethylanthraquinol \overset{O_2}{\rightarrow}$
C. $KO_2 + H_2O \rightarrow$
D. $Na_2O + H_2O \rightarrow$

Answer (D)

Solution:

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

$2 - ethylanthraquinol \overset{O_2}{\rightarrow} H_2O_2 + 2 - ethylanthraquinone$

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

$Na_2O + H_2O \rightarrow 2NaOH$

Hence the correct answer is option (D)

19. A 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)

E. 40.8 eV
F. 122.4 eV
G. 217. 6 eV
H. 21.17 eV

Answer (A)

Solution:

Energy released,

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

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

$= 13.6 \times 16\left(\frac{3}{16}\right) = 40.8\ eV$

20. The correct order of bond strength of C- C, Si -Si, Ge – Ge, Sn – Sn is

A. C-C > Si-Si > Ge-Ge > Sn-Sn
B. C-C > Si- Si > Ge- Ge ≈ Sn - Sn
C. C- C > Si -Si < Ge – Ge < Sn – Sn
D. C- C > Si – Si > Sn – Sn > Ge - Ge

Answer (A)

Solution:

Bond strength decreases on moving down for carbon family

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

A. N^{3-}, O^{2-}, F, Na
B. $S^{-2}, Cl^{-}, K^{+}, Ca^{2+}$
C. NH_3, CH_4, PF_5, Na^{+}
D. Ne, Na^{+}, F, N^{3-}

Answer (B)

Solution:

$S^{-2}, Cl^{-}, K^{+}, Ca^{2+}$ all the species contain 18 electrons

22. An atom forms two lattices FCC and BCC. The edge length of FCC lattice is 2.5Å and edge length of BCC lattice is 2Å. Then find the ratio of density of FCC to density of BCC.

Answer (1)

Solution:

For FCC,

$$d_{fcc} = \frac{4 \times M}{a^3} \text{ ---------(1)}$$

For BCC,

$$d = \frac{2 \times M}{a^3} \text{ ---------(2)}$$

$$\frac{d_{fcc}}{d_{bcc}} = \frac{4 \times M}{(2.5)^3} \times \frac{(2)^3}{2 \times M} = 1.024 \approx 1$$