Chemistry JEE Solutions 2022

1. Which of the following has least spin only magnetic moment.
   (1) Fe$^{3+}$   (2) Fe$^{2+}$
   (3) Cu$^{2+}$   (4) Ni$^{2+}$

Sol. Answer (3)

Electronic configurations are,
Fe$^{3+}$ = [Ar] 3d$^5$ (5 unpaired electrons)
Fe$^{2+}$ = [Ar] 3d$^6$ (4 unpaired electrons)
Cu$^{2+}$ = [Ar] 3d$^9$ (1 unpaired electrons)
Ni$^{2+}$ = [Ar] 3d$^8$ (2 unpaired electrons)

:. least spin only magnetic moment is of Cu$^{2+}$.

2.\[\text{OH} \xrightarrow{\text{NaH}} \text{P} \quad \text{Cl} \]

(1) \[\text{O} \text{CH}_3 \text{CH}_2 \text{OH} \]
(2) \[\text{O} \text{CH}_3 \text{CH} \text{CH}_2 \text{OH} \]
(3) \[\text{O} \text{CH}_3 \text{CH} = \text{CH} \text{Cl} \]
(4) \[\text{O} \text{CH} = \text{CH} \text{Cl} \]

Sol. Answer (1)

NaH is a very strong base and will undergo acid base reaction very quickly

3. Dettol has two components, A has 6π e−s.
   What is B
   (1) Terpineol   (2) Bithionol
   (3) Chloroxylenol   (4) none of these

Sol. Answer (1)

B is terpineol. Its structure is

\[
\begin{align*}
&\text{CH}_3 \\
&\text{H}_2\text{C} = \text{C} \text{CH}_3 \\
&\text{OH} \\
&\text{H}_2\text{C} \hspace{1cm} \text{OH} \\
&\text{Br}
\end{align*}
\]

4. \[\text{O} \xrightarrow{\text{Br}_2, \text{MeOH}} ? \]

(1) \[\text{Br} \text{O} \text{OMe} \]
(2) \[\text{Br} \text{OMe} \text{O} \text{Br} \]
(3) \[\text{MCO} \text{O} \text{Br} \]
(4) \[\text{OMe} \text{O} \text{Me} \]

Sol. Answer (1)

5. \( t_{1/2} \) of a reaction and pressure of reactant is given. Find the order of reaction

<table>
<thead>
<tr>
<th>( P_0 )</th>
<th>( t_{1/2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 atm</td>
<td>5 min</td>
</tr>
<tr>
<td>20 atm</td>
<td>10 min</td>
</tr>
</tbody>
</table>

(1) 1st order   (2) 2nd order
(3) zero order   (4) ½ order

Sol. Answer (3)

Since, \( t_{1/2} \) of reaction is directly proportional to the initial pressure of the reactant. Hence, reaction will be zero order.

For zero order

\( t_{1/2} \propto P_0 \)
6. **Assertion:** from a mixture of benzoic acid and naphthalene, benzoic acid can be separated using benzene.
   **Reason:** Benzoic acid is soluble in hot water.
   **Sol.** Answer (Assertion is false, Reason is true)
   **Assertion:** Benzoic acid is soluble in alcohol, ether and benzene.
   But a mixture of benzoic acid and naphthalene cannot be separated using benzene because both are soluble. (like dissolves like concept)
   \[ \therefore \] Assertion is false
   Benzoic acid is poorly soluble in water at room temperature and more soluble in hot water.
   Hence reason a true.

7. **Correct order of electron gain enthalpy in magnitude is,**
   (1) \( F > Cl > Te > Po \)
   (2) \( Cl > F > Te > Po \)
   (3) \( Po > Te > Cl > F \)
   (4) \( Cl > Te > Po > F \)
   **Sol.** \( \text{Answer (2)} \)

8. **Arrange the following species in decreasing order to their standard reduction potential value**
   1. \( Cl^/Cl^- \)
   2. \( F^/F^- \)
   3. \( Na^+/Na \)
   4. \( Li^+/Li^- \)
   (1) \( 2 > 1 > 5 > 3 > 4 \)
   (2) \( 5 > 4 > 3 > 1 > 1 \)
   (3) \( 2 > 1 > 4 > 5 > 3 \)
   (4) \( 5 > 1 > 2 > 4 > 3 \)
   **Sol.** \( \text{Answer (1)} \)

9. If electron, proton, neutron and alpha particle have same value of kinetic energy, then what is the correct order of wavelength according to De-Broglie
   (1) \( \lambda_p = \lambda_n = \lambda_e = \lambda_\alpha \)
   (2) \( \lambda_e < \lambda_n < \lambda_\alpha < \lambda_o \)
   (3) \( \lambda_p < \lambda_e < \lambda_n < \lambda_\alpha \)
   (4) \( \lambda_n < \lambda_p < \lambda_\alpha < \lambda_e \)
   **Sol.** \( \text{Answer (2)} \)

10. Which of the following is/are correct
    **S-I:** BOD of polluted water may be 17 ppm
    **S-II:** BOD represent the amount of oxygen to decompose biodegradable and non-biodegradable substances
    (1) \( S - 1 \) is correct \( S - 2 \) is correct
    (2) \( S - 1 \) is not correct \( S - 2 \) is not correct
    (3) \( S - 1 \) is correct \( S - 2 \) is not correct
    (4) \( S - 1 \) is not correct \( S - 2 \) is correct
    **Sol.** \( \text{Answer (2)} \)

11. Match the following correctly
    (i) Zymase \( \text{(A) Stomach} \)
    (ii) Urease \( \text{(B) Yeast} \)
    (iii) Diastage \( \text{(C) Malt} \)
    (iv) Pepsin \( \text{(D) Soyabean} \)
    (1) \( (i) - B \) \( (i) - C \)
    (2) \( (ii) - D \) \( (ii) - A \)
    (3) \( (i) - D \) \( (i) - B \)
    (4) \( (iv) - D \) \( (iv) - A \)
The enzyme and sources are,
Pepsin – stomach
Diastase – Malt
Urease– Soyabean
Zymase – Yeast

12. The product is

(1)  
(2)  
(3)  
(4) None of these

13. 0.10 M. 10 ml of acid reacts with 30 ml of 0.05 M Ca(OH)₂ completely, then basicity of the acid is

(1) 1  (2) 2  (3) 3  (4) 4

14. Which of the following statement is correct

(I) H₂O is amphoteric, because it acts as lewis acid as well as lewis base.
(II) H₂O react like a base with NH₃ and acid with BF₃

(1) (I) is correct, (II) is not correct
(2) (I) is not correct, (II) is incorrect
(3) (I) and (II) are correct, (II) is not the correct explanation of (I)

15. 0.7 gm of a solute having Mₖ(96) is dissolved in 42 gm of H₂O, then percentage association of solute in H₂O assuming dimerisation is,

(1) 60  (2) 80  (3) 76  (4) 40

16. Which of the following will absorb minimum wavelength of light

(1) K₄[Fe(CN)₆]  
(2) K₄[FeCl₆]  
(3) K₂[Fe(CN)₄(H₂O)]  
(4) K₂[FeCl₄]
Higher is the CFSE (crystal field splitting energy) value lower is the wavelength of the light absorbed.

Higher CFSE \[\Rightarrow\] strong field ligands

\[\therefore \text{ option (1) is the correct answer.}\]

17. Statement 1: In Electrolytic refining of copper blister, copper gives precious metal.
   Statement 2: In electrolysis of copper blister, anode is made of copper.

- (1) Statement 1 and 2 both are correct
- (2) Statement is correct but statement 2 is incorrect
- (3) Statement 1 is incorrect but statement 2 is correct
- (4) Statement 1 and 2 both are incorrect

Sol. Answer (1)

In electrolytic refining of blister Cu, precious metals like Au, Ag & Pt are deposited as anode mud.

So, statement 1 is true.

In electrolytic refining of Cu, anode is made of impure Cu and cathode is made of pure Cu

So, statement 2 is correct

\[\therefore \text{ Option (1) is correct answer}\]

18. Heat of combustion for benzene and acetylene are \(-3900\) and \(-642\) joule. Then calculate heat of reaction (per mole) for following reaction

\[3C_2H_2 \xrightarrow{\Delta H_R} C_2H_6\]

\[\Delta H_R = 3(\Delta H_c)_{\text{Acetylene}} - (\Delta H_c)_{\text{Benzene}}\]

\[= 3(-642) - (-3900)\]

\[= -1926 + 3900\]

\[= 1974 \text{ J for 3 mole}\]

\[\therefore \Delta H_R \text{ for 1 mole} = 658 \text{ J/mole}\]

19. Pb(NO\(_3\))\(_2\) on heating gives A + PbO + O\(_2\) A-dimerizes to give B. How many bridged oxygen atoms are present in B?

- (1) 0
- (2) 1
- (3) 2
- (4) 3

Sol. Answer (1)

\[\text{Pb(NO}_3\text{)}\_2 \xrightarrow{\Delta} \text{PbO + 2NO}_2 + \frac{1}{2} \text{O}_2 \ldots \ldots \ldots \text{(A)}\]

\[2\text{NO}_2 \xrightarrow{\text{dimerises}} \text{N}_2\text{O}_4 \ldots \ldots \ldots \text{(B)}\]

\[\text{Bridged oxygen atoms is 0.}\]

20. The threshold frequency for a metal is \(1.3 \times 10^5\) Hz. Then, minimum energy required to eject the electron from metal surface is \(\frac{h}{6.62 \times 10^{-34} \text{ JS}}\)

- (1) \(8.6 \times 10^{-19}\) J
- (2) \(7.8 \times 10^{-16}\) J
- (3) \(2.3 \times 10^{-19}\) J
- (4) \(6.4 \times 10^{-19}\) J

Sol. Answer (1)

\[\therefore \text{ Minimum energy Required to eject the electron}\]

\[= 6.62 \times 10^{-34} \times 1.3 \times 10^{15}\]

\[= 8.606 \times 10^{-19}\]

\[\therefore \text{ option (1) is correct answer}\]

21. The solubility product \((K_{\text{SP}})\) of Bi\(_2\)S\(_3\) is \(1.08 \times 10^{-73}\) at a certain temperature. The molar solubility of the salt at this temperature is \(1 \times 10^{-x}\) M. The value of x is?

Sol. Answer (15)

\[\text{Bi}_2\text{S}_3 \xrightarrow{s^+} 2\text{Bi}^{3+} + 3\text{S}^{2-}\]

Where \(s = \text{solubility of Bi}_2\text{S}_3\)

\[K_{\text{SP}} = [\text{Bi}^{3+}]^2[\text{S}^{2-}]^3\]
\[
K_{SP} = (2s)^2(3s)^3
\]
\[
1.08 \times 10^{-72} = 4 \times 27s^5
\]
\[
s^5 = 1 \times 10^{-75}
\]
\[
s = 1 \times 10^{-15}
\]
\[
\therefore \text{The value of } x = 15
\]

22. Which of the following has net dipole moment non-zero.
BeF\(_2\), NH\(_3\), H\(_2\)O, CCl\(_4\), HCl

Sol. Answer (NH\(_3\), H\(_2\)O, HCl)

\[
\begin{align*}
\text{F} & \text{Be} & \text{F} & \mu_{\text{net}} = 0 \\
\text{N} & \text{H} & \text{H} & \mu_{\text{net}} \neq 0 \\
\text{H} & \text{H} & \text{Cl} & \mu_{\text{net}} = 0 \\
\end{align*}
\]

23. \(T_{1/2}\) of the reaction is 340 sec. If the initial pressure of reactant is 55.8 kPa and \(t_{1/2}\) of the reaction is 170 sec. If the initial pressure of reactant is 27.8 kPa.

Determine the order of the reaction

Sol. Answer (0)

\[
(P_0)_1 = 55.8 \text{ kPa} \quad t_{1/2} = 340 \text{ sec}
\]
\[
(P_0)_2 = 27.8 \text{ kPa} \quad t_{1/2} = 170 \text{ sec}
\]
\[
\therefore t_{1/2} \propto \text{initial pressure of reactant}
\]
\[
i.e \ t_{1/2} \propto \text{initial concentration of reactant}
\]
\[
\therefore \text{Order of reaction is zero order.}
\]

24. During electrolysis process of FeSO\(_4\), 0.374 g of Fe is deposited on cathode, when 1.5 A current is passed through the solution for 'x' minutes.

Then the value of x is

[Assume current efficiency as 100% and molar mass of Fe is 56 g/mol]

Sol. Answer (14.32)

\[
\text{No of equivalents of Fe deposited} = \text{No. of faradays of charge passed}
\]
\[
\therefore \text{No. of faradays} = \frac{0.374}{(56/2)} = \frac{0.748}{56}
\]
\[
\text{No. of faradays} = \frac{i \times t}{96500}
\]
\[
0.748 = \frac{1.5 \times t}{96500}
\]
\[
\Rightarrow t = 859.31 \text{ sec} \quad \text{or} \quad 14.32 \text{ min}
\]

Value of x = 14.32 min

25. In an organic compound containing protein, amount of protein is 0.3%. Then minimum molecular weight of organic compound (in g/mole) is

\[
\text{[m.wt. of protein} = 75]
\]

Sol. Answer (25000)

For min. molecular weight of organic compound, 1 molecule of protein must be present

\[
\therefore \text{Min molecular weight of organic compound} = \frac{75 \times 100}{0.3}
\]
\[
= 25000 \text{ g/mole}
\]

26. Nitrogen gas is filled in a rigid container. At 6:00 AM, the pressure is 30 atm at 27\(^\circ\)C, and at 3:00 PM, pressure becomes 'p' atm at 45\(^\circ\)C.

Find the value of 'p'

[Round off to the nearest integer]

Sol. Answer (32)

Since the container is rigid so, V and n remains constant

\[
\therefore \frac{P_1}{P_2} = \frac{T_1}{T_2}
\]
\[
\Rightarrow \frac{30}{300} = \frac{318}{P_2}
\]
\[
\Rightarrow P_2 = 31.8 \text{ atm}
\]
\[
\therefore \text{Value of } P = 31.8 \text{ atm}
\]

Rounded off to nearest integer = 32 atm