COMPUTER BASED TEST (CBT)
Memory Based Questions & Solutions

Date: 20 July, 2021 (SHIFT-1) | TIME: (9.00 a.m. to 12.00 p.m)
Duration: 3 Hours | Max. Marks: 300
PART: CHEMISTRY

1. Arrange the following complex in increasing order of intensity of colour.

\[
(3) \text{[Co(CN)₆]⁴⁻}, \quad \text{[CoCl₄]²⁻}, \quad \text{Co(H₂O)₆}^{2⁺} \quad \text{(4) Co(H₂O)₆}^{2⁺}, \quad \text{[Co(CN)₆]²⁻}, \quad \text{[CoCl₄]²⁻}
\]

Sol. (1)

<table>
<thead>
<tr>
<th>Complex</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>([\text{Co(CN)}₆]^{4-})</td>
<td>Yellow</td>
</tr>
<tr>
<td>([\text{Co(H₂O)}₆]^{2+})</td>
<td>Pink</td>
</tr>
<tr>
<td>([\text{CoCl₄}]^{2-})</td>
<td>Blue</td>
</tr>
</tbody>
</table>

2. Which of the following does not disproportionate

\[
(1) \text{BrO}^- \quad (2) \text{BrO}_2^- \quad (3) \text{Br}_2 \quad (4) \text{BrO}_3^-
\]

Ans. (4)

Sol. \(\text{BrO}_3^-\) is in maximum oxidation state. So it can only reduce

3. A metal \(M\) on reaction with excess oxygen give \(\text{MO}_2\) type oxide (as main product) then possible metal is

\[
(1) \text{Li} \quad (2) \text{Na} \quad (3) \text{K} \quad (4) \text{Mg}
\]

Ans. (3)
Potassium on reaction with excess oxygen give superoxide

4. Identify the correct increasing order of 1st ionisation energy of following
   Al, Mg, Si, P
   (1) Mg, Al, Si, P, S
   (2) Al, Mg, Si, S, P
   (3) Mg, Al, Si, S, P
   (4) Al, Mg, Si, P, S

   Ans. (2)

   Sol. Mg $3s^2$
   Al $3s^23p^1$
   Si $3s^23p^2$
   P $3s^23p^3$
   S $3s^23p^4$

   So correct order: - Al < Mg < Si < S < P

5. Four moles of a diatomic gas is heated from 0°C to 60°C, find the heat supplied to the gas if work done by it is zero.
   (1) 780 R  (2) 500 R  (3) 100 R  (4) 650 R

   Ans. (2)

   Sol. $w = 0$
   $\Delta E = q_v = nC_v\Delta T$

6. HNO₃ on reaction with P₂O₅ gives an oxide 'A'
   P₂O₅ + HNO₃ $\rightarrow$ A(oxide)

   Nature of oxide A is
   (1) Acidic  (2) Basic  (3) Neutral  (4) Amphoteric

   Sol. P₂O₅ + 4HNO₃ $\rightarrow$ 2N₂O₅ + 4HPO₃

   'A'

   Nature of oxide 'A' is "acidic".

7. An equimolar mixture of benzene (P₄benzene = 70 torr) and methyl benzene (P₄methyl benzene = 20 torr) is prepared, then find mole fraction of benzene in vapour phase.

   Ans. 0.7

   Sol. $P_{\text{total}} = P_{\text{benzene}} X_{\text{benzene}} + P_{\text{methyl benzene}} X_{\text{methyl benzene}}$

   $= (70) \frac{1}{2} + (20) \frac{1}{2}$

   $= 35 + 10$

   $= 45$

   $\frac{1}{45} \text{ benzene} + \frac{1}{45} \text{ methyl benzene}$
8. Find total number of lone pair of electron on central atom in $I_3^-$

Ans. 3

Sol.  
Total lone pair on central atom = 3.

10. Which of the following is most easily economically refined by Fractional distillation.

Ass. (1)
Sol. "Theory Based"
Fractional distillation process utilizes the boiling point difference between metal and that of impurity. Using this process, crude zinc containing Cd, Fe and Pb as impurities can be refined.

11. Among the following pairs which is incorrect regarding similarity in properties.

Ass. (4)
Sol. $B(OH)_3$ is $H_3BO_3$ is acidic in nature.
$Mg(OH)_2$ is basic in nature.

12. Statement-1 : Dihedral angle of $H_2O_2$ in gas is around 90°.
Statement-2 : Dihedral angle of $H_2O_2$ in solid is around 111.5°
are the statements true or false.

Sol. (a) Gas phase
 (b) Solid phase

(a) $H_2O_2$ structure in gas phase, dihedral angle is 111.5°.
(b) $H_2O_2$ structure in solid phase at 110 K, dihedral angle is 90.2°.

The dihedral angle of $H_2O_2$ in gaseous phase is approximate 111.5°. While dihedral angle in solid $H_2O_2$ is affected by hydrogen bonding and it is 90.2° in solid state.
13. A 4.5 gram mass of a substance [molar mass = 90 g/mol] is dissolved in 250 ml solution, then molarity of solution is -

Ans. 0.2

Sol. Molarity (M) = \( \frac{\text{Mass of solute}}{\text{Molar mass} \times \text{Volume of solution}} \)

\[ M = \frac{4.5 \times 1000}{90 \times 250} = \frac{4.5 \times 4}{9} = 0.2 \text{ M} \]

14. What is the magnetic moment (Spin only) of complex [Co(CN)6]^{3+}:

[Report your answer to nearest integer]

15. 10000 KJ energy is needed per day, if heat of combustion of glucose is 2700 KJ/mole. Then how many gram of glucose is needed per day for this. [Report your answer to nearest integer]

Ans. 967

Sol. \( \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O} \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}, \Delta H = 2700 \text{ KJ/mole} \)

Glucose

No. of mole of glucose require for production of 10,000 KJ heat is = \( \frac{10,000}{2700} \) mole.

Total mass of glucose = \( \frac{10,000}{2700} \times 180 = 666.67 \text{ gram.} \)

16. The value of \( \ell \) (azimuthal quantum number) for valence shell electron of Ga^3+ ion is

Ans. 0

\[ \ell = 3 \times 1 - 2 = 1 \]

17. What is the difference in energy between 2\textsuperscript{nd} and 3\textsuperscript{rd} orbit of He^+ ion (in eV) is -

[Report your answer to nearest integer]

Ans. 8

\( (E_{\text{He}^+})_{n=2} = -13.6 \times \frac{(2)^2}{(2)^2} = -13.6 \text{ eV} \)

\( (E_{\text{He}^+})_{n=3} = -13.6 \times \frac{(3)^2}{(3)^2} = -13.6 \times \frac{4}{9} \)

\( (E_{\text{He}^+})_{n=2} - (E_{\text{He}^+})_{n=3} = 13.6 \left[ 1 - \frac{4}{9} \right] \)

\( = 13.6 \left[ \frac{5}{9} \right] = 7.55 \text{ eV} \)
18. Anion of a compound \( X \) gives brown ring test and cation gives deep blue coloration with \( \text{NH}_4\text{OH} \) and also gives precipitate with \( \text{HCl} \) & \( \text{H}_2\text{S} \). Then compound \( X \) is

**Sol.** Nitrates give brown ring test.

\[
\text{Cu}^{2+} + 4\text{NH}_4\text{aq} \rightarrow [\text{Cu(NH}_3)\text{NH}_2^{+}]\text{aq}
\]

Deep Blue

\[
\text{Cu}^{2+} + \text{H}_2\text{S} \rightarrow \text{CuS} \downarrow
\]

Black

19. What is the value of second excitation energy of \( LP^2 \)?

\[
\begin{align*}
(1) & \quad 108.8 \text{ eV} \\
(2) & \quad 81.6 \text{ eV} \\
(3) & \quad 13.8 \text{ eV} \\
(4) & \quad 95.2 \text{ eV}
\end{align*}
\]

**Ans.**

\[
\begin{align*}
\begin{array}{c}
\text{n = 3} \\
\text{2^{nd} excited state}
\end{array}
\end{align*}
\]

**Sol.**

\[
\begin{align*}
\text{n = 2} & \quad \text{1^{st} excited state} \\
\text{n = 1} & \quad \text{Ground state}
\end{align*}
\]

\[
\Delta E_{nP} = 13.6 \times 2^2 \left[ \frac{1}{n_1^2} - \frac{1}{n_2^2} \right]
\]

\[
= 13.6 \times 9 \left[ \frac{8}{9} \right] = 13.6 \times 6 = 108.8 \text{ eV}
\]

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20. \( P + \text{CHCl}_3 \rightarrow \text{Q} \)

Identify compound \( P \) and \( Q \) respectively

(1) Primary amine, secondary amine
(2) Primary amine, Primary amine
(3) Primary amine, Isonitrile
(4) Secondary amine, Isonitrile

**Ans.** (3)

**Sol.** Only 1\(^{st} \) amines give carbylamines reaction

\[
\begin{align*}
\text{R} + \text{NH}_2 + \text{CHCl}_3 + 3\text{KOH} & \rightarrow \text{R} = \text{NC} + 3\text{KCl} + 3\text{H}_2\text{O} \\
\text{(Primary) (Product)}
\end{align*}
\]

21. In which of the following carboxation are resonance stabilised

\[
\begin{align*}
(1) & \quad \text{A, B} \\
(2) & \quad \text{A, C} \\
(3) & \quad \text{A, D} \\
(4) & \quad \text{A, B, C}
\end{align*}
\]

**Ans.** (3)

**Sol.**

\[ \text{are resonance stabilised carboxations.} \]
22. When ethanol reacts with 3-Bromo-2,2-dimethyl butane then product formed is:

(1) 2, 2-Dimethyl-3-ethoxybutane      (2) 2-Ethoxy-2,3-dimethyl butane
(3) 2-Ethoxy-2-methyl pentane         (4) 3-Ethoxy-2,2-Dimethyl butane

Ans. (2)

Sol.

2-Ethoxy-2,3-dimethyl butane

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23. Ninhydrin + \(-\text{NH}_2-\text{CH-COOH}\) → Product is?

\(\alpha\)-amino acid

(1) \(\alpha\)-amino acid 
(2) \(\beta\)-amino acid 
(3) \(\gamma\)-amino acid 
(4) \(\delta\)-amino acid

Ans. (1)

Sol.

Ninhydrin is useful for identification of \(\alpha\)-amino acid which react with ninhydrin and give deep blue colour.

24. A, B are respectively:

A (1) both diol 
(2) both dicarboxylic acid 
(3) A is dicarboxylic acid and B is diol 
(4) A is diol and B is dicarboxylic acid

Ans. (3)

Sol.
26. Which of the following is better for green chemistry in day to day life (Domestic Purpose)

(1) ClO₂ = CCl₂ as dry cleaning agent liquid
(2) CCl₄ gas as bleaching agent of paper
(3) CCl₄ as dry cleaning agent
(4) CO₂ for cloth cleaning

Ans. (2)

Sol. CCl₄ = CCl₂ was earlier used as solvent for dry cleaning agent but it is carcinogen. So liquid CO₂ is used. Replacement of halogenated solvent by liquid CO₂ will result in less harm to ground water.

27. Which of the following is incorrect:

Ans. (1)

28. How many mole of CH₃MgBr are required to convert ethyl ethanoate to 2-methylpropan-2-ol:

Ans. (2)

Sol. H₂C=OCH₂CH₃ + CH₃MgBr → H₃C=OCH₂CH₃ + CH₃MgBr
(ethyl ethanoate) (1) CH₃MgBr
(2) H₂O
H₃C=OCH₂CH₃ + H₂O → H₂C=OCH₂CH₃ + CH₃OH
2-methylpropan-2-ol