JEE (Main) 2022
PAPER-1 (B.E./B. TECH.)

COMPUTER BASED TEST (CBT)
Memory Based Questions & Solutions

Date: 28 June, 2022 (SHIFT-2) | TIME: (3.00 a.m. to 6.00 p.m)
Duration: 3 Hours | Max. Marks: 300

SUBJECT: CHEMISTRY

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PART : CHEMISTRY

1. How many of following have N–N bond N₂O, N₂O₄, N₂O₃, N₂O₅

AnS. (3)

Sol. N=O  \[ \text{N} \equiv \text{N} \]  \[ \text{N} \equiv \text{N} \]

[IO-PBC-XV] M

N→N→O

113 pm  119 pm

Linear
2. Isotopes of hydrogen have different
   (1) Proton (2) Neutron (3) Electron (4) Proton & Neutron

   Ans. (2)

   Sol. Isotopes have same proton & electron but different neutron.

3. How many of following compounds have sulphur atom in two different oxidation state.
   (a) H₂SeO₃ (b) H₂SeO₄ (c) H₂SeO₅ (d) H₂SeO₆

   Ans. (2)

   Sol. H₂SeO₃ ⇒ \( \text{H}_2\text{SeO}_3 \) (S (-2))
        H₂SeO₄ ⇒ \( \text{H}_2\text{SeO}_4 \) (S (+6))
        H₂SeO₅ ⇒ \( \text{H}_2\text{SeO}_5 \) (S (+6))
        H₂SeO₆ ⇒ \( \text{H}_2\text{SeO}_6 \) (S (+6))

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4. Identify the correct statement regarding \( \text{SF}_4 \)

   (1) It have one lone pair at equatorial position with two lone pair - bond pair repulsion at 90°
   (2) It have one lone pair at axial position with two lone pair - bond pair repulsion at 90°
   (3) It have one lone pair at equatorial position with three lone pair - bond pair repulsion at 90°
   (4) It have one lone pair at axial position with three lone pair - bond pair repulsion at 90°

   Ans. (1)

   Sol.

   Lone pair at equatorial position with 2 lone pair – bond pair repulsion at 90°

5. Which of the following oxide is basic in nature.

   (1) \( \text{SiO}_2 \) (2) \( \text{CaO} \) (3) \( \text{Al}_2\text{O}_3 \) (4) \( \text{SO}_2 \)

   Ans. (2)

   Sol. Acidic ⇒ \( \text{SiO}_2 \), \( \text{SO}_2 \)
        Amphoteric ⇒ \( \text{Al}_2\text{O}_3 \)
        Basic ⇒ \( \text{CaO} \)
6. Which set of complex ions represent paramagnetic character?
   (i) [Fe(CN)₆]³⁻  (ii) [Fe(CN)₅]⁴⁻  (iii) [Ti(CN)₆]³⁻  (iv) [Co(CN)₅]³⁻  (v) [Ni(CN)₆]⁴⁻
   (1) (i), (ii), (iii)  (2) (i), (iii), (v)  (3) (i), (ii), (iv)  (4) (i), (iii), (iv)

   Ans. (2)

   Sol. Complex  Electronic configuration  Unpaired electron
   (i) [Fe(CN)₆]³⁻  Fe³⁺ 3d⁶  →  bg²,²,², e⁶  1
   (ii) [Fe(CN)₅]⁴⁻  Fe⁴⁺ 3d⁶  →  bg²,²,², e⁶  0
   (iii) [Ti(CN)₆]³⁻  Ti³⁺ 3d¹  →  bg²,²,², e⁶  1
   (iv) [Co(CN)₅]³⁻  Co³⁺ 3d⁶  →  bg²,²,², e⁶  0
   (v) [Ni(CN)₆]⁴⁻  Ni⁴⁺ 3d⁶  →  bg²,²,², e⁶  2

7. In extraction of copper following reaction take place
   FeO + SiO₂ → FeSiO₃
   In which FeO and FeSiO₃ act as
   (1) Flux, Slag  (2) Slag, Flux  (3) Gangue, Slag  (4) Slag, Flux

   Ans. (3)

   Sol. FeO + SiO₂ → FeSiO₃
   Gangue  Flux  Slag

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8. How many two of the following show cis-trans isomers?
   (i) CoCl₄·4NH₃  (ii) CoCl₅·5NH₃  (iii) CoCl₅·5NH₂  (iv) CoCl₅·3NH₃

   Ans. (1)

   Sol. (i) CoCl₄·4NH₃  [Co(NH₃)₄Cl]Cl  (ii) CoCl₅·5NH₃  [Co(NH₃)₅Cl]Cl₂
   (iii) CoCl₅·5NH₂  [Co(NH₂)₅Cl]  (iv) CoCl₅·3NH₃  [Co(NH₃)₃Cl]₃

9. pH of a buffer solution of CH₃CH₂COOH(aq) & CH₃CH₂COONa(aq) is 4. How many two of the following show cis-trans isomers?
   CH₃CH₂COOH  CH₃CH₂COONa

   Given k₄ = 10⁻⁶
   (1) 0.1  (2) 10  (3) 0.2  (4) 20

   Ans. (1)

   Sol. pH = pK₄ + log [CH₃CH₂COO⁻]
   4 = 5 + log [CH₃CH₂COO⁻]  
   [CH₃CH₂COO⁻] = \frac{10}{1} = 0.1

10. A compound contains 86.4% mass of hydrogen, 74% mass of carbon and 17.36% mass of nitrogen and have molecular mass 162. Then possible compound is

   (1) C₆H₁₂N₂  (2) C₆H₁₄N₂  (3) C₄H₁₀N  (4) C₆H₁₄N₄

   Ans. (2)

   Sol. GM of C₆H₁₂N₂  = 120 + 14 + 28 = 162

11. Using following statements identify correct set of statements
   (i) n can have value 1, 2, 3, 4, ...
   (ii) Number of orbital for given value of n is (2n + 1)
   (iii) Value of spin quantum numbers is always ±\frac{1}{2}

   (1) (i) (2) (iii) (3) (i), (ii) (4) (i) (ii) (iii)
(iv) For \( \ell = 5 \) total number of orbital is 9

\[
(1) (\ell_o, \ell_i, \ell_s) \\
(2) (\ell_i, \ell_s, \ell_o) \\
(3) (\ell_s, \ell_o, \ell_i) \\
(4) (\ell_i, \ell_o, \ell_s)
\]

Ans. \( (1) \)

Sol. For \( \ell = 5 \) total number of orbital is \( (2 \ell + 1) = 11 \)

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12. The value of \( E^0_{\text{Sn}^{4+} / \text{Sn}^{2+}} \) is \( \_ \times 10^{-2} \text{V} \)

\[
\begin{align*}
E^0_{\text{Sn}^{4+} / \text{Sn}^{2+}} &= -0.14 \text{V} \\
E^0_{\text{Sn}^{2+} / \text{Sn}^{0}} &= +0.15 \text{V}
\end{align*}
\]

\[ \text{given} \]

\[ \Delta G^0 = -2F(-0.14) \]

\[ \Delta G^0 = -2F(0.15) \]

\[ \text{Target:} \quad \text{Sn}^{4+} + 2e^- \rightarrow \text{Sn}^{2+} \]

\[ \Delta G^0 = -2F(E^0_{\text{Sn}^{4+} / \text{Sn}^{2+}}) \]

\[ \text{Target Equation:} \quad \Delta G^0 = \Delta G^0 \text{(ii)} - \Delta G^0 \text{(i)} \]

\[ -2F(E^0_{\text{Sn}^{4+} / \text{Sn}^{2+}}) = -2F(0.15) \]

\[ E^0_{\text{Sn}^{2+} / \text{Sn}^{4+}} = \frac{4 \times 0.15 + 2 	imes 0.14}{2} = 0.30 + 0.14 = 0.44 \text{V} = 44 \times 10^{-2} \text{V} \]

Ans. \( (4) \)

Sol. \( (i) \) \( \text{Sn}^{2+} + 2e^- \rightarrow \text{Sn} \quad E^0_{\text{Sn}^{2+} / \text{Sn}^{0}} = +0.15 \text{V} \)

\[ \Delta G^0 = -2F(0.15) \]

\( (ii) \) \( \text{Sn}^{4+} + 4e^- \rightarrow \text{Sn} \quad E^0_{\text{Sn}^{4+} / \text{Sn}^{2+}} = -0.14 \text{V} \)

\[ \Delta G^0 = -2F(-0.14) \]

\[ \Delta G^0 = -2F(0.15) \]

\[ \Delta G^0 = -2F(0.15) \]

Target: \( \text{Sn}^{4+} + 2e^- \rightarrow \text{Sn}^{2+} \quad E^0 = ? \)

\[ \Delta G^0 = -2F(E^0_{\text{Sn}^{4+} / \text{Sn}^{2+}}) \]

\[ -2F(E^0_{\text{Sn}^{4+} / \text{Sn}^{2+}}) = -2F(0.15) \]

\[ E^0_{\text{Sn}^{2+} / \text{Sn}^{4+}} = \frac{4 \times 0.15 + 2 	imes 0.14}{2} = 0.30 + 0.14 = 0.44 \text{V} = 44 \times 10^{-2} \text{V} \]

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13. Match the column

<table>
<thead>
<tr>
<th>Column – I</th>
<th>Column – II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(I) Positive Colloid</td>
<td>(a) FeOx + H2O</td>
</tr>
<tr>
<td>(II) Macro molecular colloid</td>
<td>(b) CDS</td>
</tr>
<tr>
<td>(III) Negative Colloid</td>
<td>(c) Starch</td>
</tr>
<tr>
<td>(IV) Gel</td>
<td>(d) Cheese</td>
</tr>
</tbody>
</table>

Correct match is

\[
\begin{array}{cccc}
(1) & (a) & (c) & (b) \\
(2) & (a) & (b) & (c) \\
(3) & (b) & (c) & (a) \\
(4) & (a) & (c) & (d)
\end{array}
\]

Ans. \( (1) \)
14. 2.5 gram of a protein dissolve in 500 gram of water at 300K. The observed value of osmotic pressure is 0.410 atm. Then number of glycein unit present in protein is: [PC-SCP] E

Ans. (4)

Sol. $\pi = CRT$

$\pi = \frac{2.5 \times 1000}{M\text{wt.} \times 500 \times 0.082 \times 300}$

$\pi = \frac{2.5 \times 2 \times 0.082 \times 300}{M\text{wt.}}$

$\pi = \frac{123}{M\text{wt.}}$

$M\text{wt.} = 300 \text{ g/mol.}$

Molar mass of glycein = 75 g/mol.

Number of glycein unit per molecule of protein = $\frac{300}{75} = 4$

15. 0.456 gram of an organic compound containing Carbon, Hydrogen & Oxygen on complete combustion give 0.735 gram CO$_2$ and 0.45 gram of water, then mass % of oxygen in compound is (Report your answer to nearest integer) [PC-MOL] M

Ans. (44)

Sol. $C_H_2O_x \rightarrow CO_2(g) + H_2O(g)$

$0.456 \text{ g } C \text{ excess } 0.735 \text{ g } CO_2, 0.45 \text{ g } H_2O$

$W_{\text{Carbon}} = \left( \frac{0.732}{44} \right) \times 12 = 0.2 \text{ gram}$

$W_{\text{Water}} = \left( \frac{0.45}{18} \right) \times 2 = 0.05 \text{ gram}$

Total weight of carbon & hydrogen = 0.25 g

Mass of oxygen = $0.456 - 0.25 = 0.20 \text{ g}$

Mass % of oxygen = $\left( \frac{0.20}{0.45} \times 100 \right) = 44.44\% \\ at 44$
17. \[ \text{OH} \xrightarrow{\text{H}^+, \Delta} \text{OC} \] Major product is \[ \text{(1)} \] \[ \text{(2)} \] \[ \text{(3)} \] \[ \text{(4)} \]

Ans. \( \text{(1)} \)

Sol. \[ \text{Me shift} \]

18. Find correct option regarding the reaction

\[ \text{NH}_2 \xrightarrow{\text{HNO}_3, \text{H}_2\text{SO}_4} \]

(a) \( \text{HNO}_3 \) acts as acid
(b) \( \text{H}_2\text{SO}_4 \) acts as acid
(c) Major product is formed at ortho, meta
(d) Major product is formed at para, meta position

\[ \text{(1)} \ a, b, c, d \quad \text{(2)} \ b, d \quad \text{(3)} \ a, c, d \quad \text{(4)} \ c, d \]

Ans. \( \text{(2)} \)

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Sol. \[ \text{NH}_2 \xrightarrow{\text{HNO}_3, \text{H}_2\text{SO}_4} \]

\[ \text{H}_2\text{SO}_4 \text{is strong acid, hence} \]

\[ \text{NH}_2 + \text{H}_2\text{SO}_4 \xrightarrow{\text{HSO}_4} \]

19. \[ \text{OC} \]

Nomenclature the structure?

(1) 2-methyl-6-nitro-3-oxohex-4-enal
(2) 2,6-dimethyl-6-nitro-oxohex-4-enal
(3) 2-methyl-6-nitrohept-4-en-1,3-dione
(4) 2-methyl-6-nitro-3-oxo hept-3-enal

Ans. \( \text{(1)} \)

Sol. \[ \text{O} = \text{N} \]
20. Structure of Tegamet is:

\[ \text{Ans. (1)} \]

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21. Photochemical smog is mixture of:

- (1) \( NO_2 + O_3 + PAN \)
- (2) \( H_2O + O_3 + CH_4 \)
- (3) \( NO + NO_2 \)
- (4) \( SO_2 + SO_3 + NO_2 \)

\[ \text{Ans. (1)} \]

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21. Isobutyl aldehyde + formaldehyde

\[ \text{Ans. (1)} \]

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23. Disacharide \( x \) on hydrolysis gives A and B. A on \( \text{HNO}_3 \) treatment gives saccharic Acid and B is levarotatory.

\[ \text{Ans. (1)} \]
24. **Statement-I**: Natural rubber is linear polymer of isoprene unit with cis isomer.

**Statement-II**: Polymer of isoprene is polar and has coil like structure.

(1) Statement-I is correct only.
(2) Statement-II is correct only.
(3) Both statement-I & II are correct.
(4) None of the statement is correct.

**Ans.** (3)

**Sol.**

Natural rubber is a polymer of isoprene, and obtained from natural source-latex tree. In natural rubber, isoprene units are joined together in head-to-tail fashion and all double bonds in the polymer chain have cis configurations as shown in the given figure.

The polymer contains cis repeating units and has a molecular weight ranging from 100,000 upto 1,000,000. The cis arrangement of the double bonds in natural rubber prevents the rubber molecules from fitting into an ordered structure. Thus, rubber is an amorphous polymer. Because of the random coiling of its polymer chains, rubber stretches easily. When stretched, the rubber molecules are forced into a higher energy state when the tension is released, rubber snaps back to its original random coiled state.