COMPUTER BASED TEST (CBT)
Memory Based Questions & Solutions

Date: 27 July, 2021 (SHIFT-1)   TIME : (9.00 a.m. to 12.00 p.m)

SUBJECT: CHEMISTRY

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PART : CHEMISTRY

1. A weak acid HA of concentration 0.001 mol/litre have conductance $2 \times 10^{-6}$ S cm$^{-2}$ and molar conductivity at infinite dilution is 190 S cm$^{-2}$ mole$^{-1}$ then value of $K_a$ of weak acid is $[x] \times 10^{-6}$, then value of $x$ in nearest integer is:

   Ans. 11

   Sol. $\frac{1}{C_m} = K \times 10^{10} = \frac{2 \times 10^{-6} \times 10^3}{10^{-3}} = 20 \text{ S cm}^{-2} \text{ mole}^{-1}$

   For weak acid (a) $\frac{C_m^2}{C_r} = \frac{15}{100} \times \frac{20}{150} = \frac{2}{19}$

   $K_a = \frac{C_m^2}{C_r} = 0.01 \times 10^{-3} = 1.1 \times 10^{-6}$

2. List I

   (a) NaOH  
   (b) Be(OH)$_2$  
   (c) Co(OH)$_2$  
   (d) Al(OH)$_3$

   List II

   (i) Acid  
   (ii) Base  
   (iii) Amphoteric
Correct Matching of List-I and List-II is:

1. (a) - (ii), (b) - (ii), (c) - (ii), (d) - (i), (e) - (i)
2. (a) - (ii), (b) - (ii), (c) - (ii), (d) - (ii), (e) - (ii)
3. (a) - (ii), (b) - (ii), (c) - (ii), (d) - (ii), (e) - (i)
4. (a) - (ii), (b) - (ii), (c) - (ii), (d) - (ii), (e) - (ii)

Ans. (1)

Sol. Species Nature
(a) Be(OH)₂ Amphoteric
(b) Al(OH)₃ Amphoteric
(v) B(OH)₃ Acidic

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3. Lattice Parameter for a crystal Lattice is \( a = b = c \) and \( \alpha = 90^\circ, \gamma = 90^\circ, \beta = 120^\circ \) this represent which type of Bravais Lattice.

(1) Monoclinic (2) Triclinic (3) Hexagonal (4) Orthorhombic

Ans. (1)

Sol. Unit Cell Lattice Parameter
(1) Monoclinic \( a = b = c \) & \( \alpha = 90^\circ, \gamma = 90^\circ, \beta = 120^\circ \)

Seven Crystal System

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Crystal System</th>
<th>Edge length</th>
<th>Angles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cubic</td>
<td>( a = b = c )</td>
<td>( \alpha = \beta = \gamma = 90^\circ )</td>
</tr>
<tr>
<td>2</td>
<td>Tetragonal</td>
<td>( a = b = c )</td>
<td>( \alpha = \beta = \gamma = 90^\circ )</td>
</tr>
<tr>
<td>3</td>
<td>Orthorhombic</td>
<td>( a = b \neq c )</td>
<td>( \alpha = \beta = \gamma = 90^\circ )</td>
</tr>
</tbody>
</table>

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4. Number of Geometrical isomers of complex's \([\text{Ni(CO)}_4], [\text{PtCl}_2(\text{NH}_3)_2], [\text{RuCl}(\text{NH}_3)_3] \) are respecively:

(1) 0, 2, 2
(2) 2, 2, 2
(3) 0, 1, 2
(4) 0, 0, 2

Ans. (1)

Sol. Complex Number of G.I.
(1) \([\text{Ni(CO)}_4]\) 0
(2) \([\text{PtCl}_2(\text{NH}_3)_2]\) 2
5. Identify the correct hybridisation and magnetic nature of complex $[\text{MnCl}_6]^{2-}$
   
   (1) sp$^3$d$^2$, Diamagnetic
   
   (2) sp$^4$, Paramagnetic
   
   (3) d$^6$, Paramagnetic
   
   (4) d$^5$, Diamagnetic

   Ans. (2)

   Sol. $\text{MnCl}_6^{2-}$
   
   $\text{Mn}^{2+}$ $\rightarrow$ $3d^5$ $\rightarrow$ $t_{2g}^3e_{g}^2$ $\rightarrow$ sp$^4$ Hybridisation $\rightarrow$ Paramagnetic

6. Difference between bond order of CO and NO is $\frac{3}{2}$, then value of $x$ to the nearest integer

   Ans. 0

   Sol. Species Bond order
   
   (i) CO 3
   
   (ii) NO $\frac{3}{2}$

   So value of $x = 0$

7. The value of $(\Delta H - AU)$ for vaporisation of water at 100°C is $x \times 10^2$ J/mole, assume water vapour to be an ideal gas (Take $R = 8.31$ J/mole K)

   [report your answer to nearest integer]

   Ans. 3100
Sol. 
\[ \text{H}_2\text{O}(l) \rightarrow \text{H}_2\text{O}(g) \]
\[ \Delta H^\circ = \Delta U^\circ + \Delta n RT \]
\[ \Delta H^\circ - \Delta U^\circ = \Delta n RT \]
\[ = 4 \times 8.3 \times 373 \]
\[ = 3089.63 \text{ J/Mole} \]
\[ = 30.8963 \times 10^7 \text{ J/Mole} \]
\[ = 31 \times 10^7 \text{ J/Mole} \]

Ans. 31.00

Sol. Let volume of solution is x one
So mass of solution = 1.2 x
& mass of water (solvent) = x gram
So mass of solute = 0.2 x gram

Molarity = \( \frac{\text{W}_{\text{solute}} \times 1000}{\text{GMM}_{\text{solute}} \times \text{W}_{\text{solvent}}} \)
\[ = \frac{0.2x \times 1000}{40} \times \frac{200}{40} = 5 \text{ m} \]

Ans. 5 m

9. Identify the wrong statement from following about Ellingham diagram:
(1) It gives rate of reaction
(2) It tells about the stability of oxide
(3) It gives idea about reduction of metal oxide
(4) It gives idea about free energy of reduction.

Ans. (1)

10. The main product of electrolysis of conc. H₂SO₄ is:
(1) SO₃
(2) H₂SO – OSO₂H
(3) H₂O₅SO – OSO₄H
(4) O₂

Ans. (2)

Sol. Main product of electrolysis of conc. H₂SO₄ is H₂S₂O₇ that is HO₂SO – OSO₂H
Statement-II: Bohr's model is not in accordance with Heisenberg's uncertainty principle

(1) Both statements are true
(2) Both statements are false
(3) Statement-I is true and Statement-II is false
(4) Statement-I is false and Statement-II is true

Ans. (1)

Sol. Theory Based

13. Statement-I: Generally halides of Li are covalent
Statement-II: Lithium has high polarising power
(1) Both Statement-I & Statement-II are correct
(2) Statement-I is correct and Statement-II is incorrect
(3) Statement-I is incorrect and Statement-II is correct
(4) Both Statement-I & Statement-II are incorrect

Ans. (2)

14. Unit of rate constant of nth order reaction is:
   (1) mole\(^{-n}\) L\(^{-1}\) Sec\(^{-1}\)
   (2) mole\(^{-n}\) L\(^{-1}\) Sec\(^{-1}\)
   (3) mole\(^{-n}\) L\(^{-1}\) Sec\(^{-1}\)
   (4) mole\(^{-n}\) L\(^{-1}\) Sec\(^{-1}\)

Ans. (1)

Sol. \[ \text{Rate} = k[A]^n \]

\[ \frac{\text{mol}}{L \cdot \text{Sec}} = k \left( \frac{\text{mol}}{L} \right)^n \]

\[ \Rightarrow \text{Unit of } k = (\text{mol})^n (L)^{-n} \text{ Sec}^{-1} \]

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15. Equilibrium constant \( K_e \) for dissociation of \( PCl_3(g) \) according to \( PCl_3(g) \rightleftharpoons PCl(g) + Cl(g) \) is 1.844.

Initially 3 mole of \( PCl_3 \) is present in a flask of 1 L., then number of moles of \( PCl_3 \) after equilibrium is set up is:

Ans. 1.60

Sol. \[ PCl_3(g) \rightleftharpoons PCl(g) + Cl(g) \]

\( K_e = \frac{[PCl][Cl]}{[PCl_3]} = 1.844 \)

Initially 3 0 0

\[ K_e = \frac{x^2}{3 - x} = 1.844 \]

\[ 1.844(3 - x) = x^2 \]

\[ x^2 - 1.844x - 5.532 = 0 \]

\[ x = \frac{-1.844 \pm \sqrt{(1.844)^2 - 4(1)(-5.532)}}{2} \]

On solving

\[ x = 1.60 \]

So at equilibrium number moles of \( PCl_3 \) = 1.60

16. According to Freundlich adsorption isotherm \( \left( \frac{x}{m} \right) = kP^n \) when pressure increased 2 times, then extent
of adsorption becomes 64 times. Find the value of $\lambda$.

Sol. $\left(\frac{x}{m}\right) = k(2\pi)^{n}$

64 $\left(\frac{x}{m}\right) = k(2\pi)^{n}$

From equation (i) to (ii)

So, $\frac{1}{n} = 6$

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JEE MAIN-2021 | DATE : 27-07-2021 | SHIFT-1 | PAPER-1 | MEMORY BASED | CHEMISTRY

17. [Diagram of a molecule with chemical reactions]

Product (Y) is:

18. [Diagram of a molecule with chemical reactions]

What shall be added so the reaction proceeds in one direction:

(1) $\text{HIO}_3$  (2) $\text{HCl}$  (3) $\text{NH}_3$  (4) $\text{HNO}_2$

Ans. (1)

Sol.

19. [Diagram of a molecule with chemical reactions]

Reaction is reversible due to reducing nature of HI. Oxidizing agent like $\text{HNO}_3$, $\text{HIO}_3$ should be added to make it irreversible (one direction).

Ans. (1)

Sol.

20. Carbohydrates are polyhydroxy aldehydes and ketones. Carbohydrates may have an aldehyde group (aldoses) or a ketone group. Barfoed's test distinguishes monosaccharides from disaccharides. In this test, copper acetoacetate in dilute acid is reduced in 30 seconds by monosaccharides whereas disaccharides take several minutes.

Ans. (3)

Sol.

21. In DNA complementary base Thymine is:

(1) Uracil  (2) Adenine  (3) Cytosine  (4) Guanine

Ans. (2)

Sol. In DNA thymine bind with adenine by to hydrogen bonding.
21. **Statement-1**: Aniline is less basic than Acetamide

**Statement-2**: In Aniline, the lone pair delocalised so electron density reduces

(1) Statement-1 is True. Statement-2 is True: Statement-2 is a correct explanation for Statement-1.

(2) Statement-1 is False. Statement-2 is False.

**Ans.** (2)

22. Which of the following given statements on Eutrophication are not correct?

(1) Eutrophication decrease oxygen level in water.

(2) <5ppm oxygen values can't survive.

(3) Eutrophication involve anaerobic respiration.

(4) Eutrophication increase oxygen level in water.

**Ans.** (4)

23. Match the column:

<table>
<thead>
<tr>
<th>Column-I</th>
<th>Column-II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Furamine</td>
<td>(a) Antiseptic</td>
</tr>
<tr>
<td>(ii) Dimethyl</td>
<td>(b) Synthetic antihistamine</td>
</tr>
</tbody>
</table>

**Ans.** (2)

24. What is formula of mustard gas?

(1) Cl

(2) Cl

(3) Br

(4) I

**Ans.** (1)
25. Stability of glucon molecules is:

\[ \text{H}^+ - \text{C} = \text{C}_2 \quad \text{C}_2 = \text{C}^+ \quad \text{CH}_2 = \text{CH} \]

(i) (ii) (iii) (iv)

1) \( i > ii > iii > iv \)  
2) \( i > ii > iv > iii \)  
3) \( i > ii > iii > iv \)  
4) \( iv > iii > i > ii \)

Ans. (1)

26. Staggered and eclipsed form of ethane are:

(1) Enantiomer (2) Anomer (3) Epiomer (4) Rotamer

Ans. (4)