1. Which of the following is correct?

(1) An orbital is represented by only n, ℓ.
(2) Hydrogen spectrum helps to prove Bohr’s model.
(3) Electron revolve in circular orbit proposed by Bohr’s.
(4) An atomic orbital is the wave function ψ for an electron in an atom.

Ans. (4)
1. An orbital is represented by only n, ℓ, m.
Bohr model fails for explanation of the details of hydrogen atom spectrum.

2. Which of the following have least tendency to liberate H₂(g) on reaction with acidic solution.
   (1) Cu  (2) Fe  (3) Ni  (4) Mn
   Ans. (3)
   Sol. As \( E^{°}_{\text{Cu}^{2+}/\text{Cu}} = 0.34 \text{ V} \), \( E^{°}_{\text{Fe}^{3+/\text{Fe}} = -0.44 \text{ V} \), \( E^{°}_{\text{Ni}^{2+/\text{Ni}} = -0.24 \text{ V} \)
   As \( E^{°}_{\text{Mn}^{2+/\text{Mn}} = 0.0 \text{ V} \)
   So Cu does not liberate H₂(g) on reaction with acid.

3. List-I
   Process/Reaction
   (i) \( \text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3 \)
   (ii) \( 2\text{SO}_2 + \text{O}_2 \rightleftharpoons 2\text{SO}_3 \)
   (iii) Sucrose \( \rightarrow \) Glucose + Fructose
   (iv) \( 4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O} \)

   List-II
   Catalyst
   (a) Fe
   (b) NO
   (c) Pt
   (d) \( \text{H}_2\text{SO}_4 \)

   Identify correct matching
   (i) a  (ii) b  (iii) c  (iv) d
   Ans. (d)

4. Which of the following have square pyramidal geometry:
   CIF, BrF₅, ClF₅, IF₅, BrF₃, I₂C₆, IC₃
   Ans. (3)
5. pH of 0.2M Butyric acid \([K_a (acid) = 2 \times 10^{-5}, \log 2 = 0.3]\)
Is \([x] \times 10^{-4}\) then value of \(x\) is—
(Report your answer to nearest integer for weak acid)

**Ans.** (27)

**Sol.**
\[
\text{pH} = \frac{1}{2} [\log K_a - \log c]
\]
\[
\text{pH} = \frac{1}{2} [4.7 - \log 2 \times 10^{-5}]
\]
\[
\text{pH} = \frac{1}{2} [4.7 - \log 2 + 1]
\]
\[
\text{pH} = \frac{1}{2} [4.7 + 1 - 0.3]
\]
\[
\text{pH} = \frac{1}{2} [5.4]
\]
\[
= 2.7
\]
\[
= 27 \times 10^{-1}
\]

6. K$_2$MnO$_4$ on disproportionation in acidic medium give two products of Mn, A and B the oxidation state of B is less than that of A. Then find magnetic moment (spin only) of B

[Report your answer to nearest integer]

**Ans.** (4)

**Sol.**
\[
3\text{MnO}_4^{2-} + 4\text{H}^+ \rightarrow 2\text{MnO}_2^{4+} + \text{MnO}_2 + 2\text{H}_2\text{O}
\]

Magnetic moment of is MnO$_2$ is

Mn$^{4+}$ = 3$\sigma$ so unpaired $\sigma$ = 3

$\mu$ (spin only) = $\sqrt{(3 + 3)}$

$\mu$ (spin only) = 3.87 BM = 4BM

7. Which set of element have almost same value of electron gain enthalpy

(a) Rb, Cs
(b) At, I
(c) Kr, Ar
(d) Na, K

(1) a, b only
(2) b, c only
(3) a, c only
(4) b, d only

**Ans.** (3)

**Sol.**

<table>
<thead>
<tr>
<th>Element</th>
<th>Rb</th>
<th>Cs</th>
<th>At</th>
<th>I</th>
<th>Kr</th>
<th>Ar</th>
<th>Na</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electron gain enthalpy (kJ/mole)</td>
<td>46</td>
<td>46</td>
<td>233</td>
<td>296</td>
<td>-96</td>
<td>-96</td>
<td>53</td>
<td>48</td>
</tr>
</tbody>
</table>

8. How many of the following species are paramagnetic in character

B$_2$, He$^+$, O$_2^-$, O$_3^-$, C$_2$, O$_2^2-$

**Ans.** (4)

**Sol.**
\[
\text{He}^+ (1s^2) \times \text{(1s)}^1
\]
\[
\text{B}_2 : (1s)^2 (\text{2s})^2 (\text{2p})^2 \times (2p_x = 2p_y) (2p_z)\]
\[
\text{O}_2^- : (1s)^2 (\text{2s})^2 (\text{2p})^2 \times (2p_x = 2p_y) (2p_z = 2p_y)
\]

<table>
<thead>
<tr>
<th>Species</th>
<th>$B_2$</th>
<th>He$^+$</th>
<th>O$_2^-$</th>
<th>O$_3^-$</th>
<th>C$_2$</th>
<th>O$_2^2-$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetic character</td>
<td>PM</td>
<td>PM</td>
<td>DM</td>
<td>PM</td>
<td>DM</td>
<td>PM</td>
</tr>
</tbody>
</table>

9. Identify incorrect relation from the following
10. Clark method is used to remove temporary hardness of water. Which of the following product are formed during this process.

(1) Mg(OH)₂ & Ca(OH)₂  
(2) Na₂CO₃, MgCO₃
(3) CaCO₃, & Mg(OH)₂  
(4) Na₂CO₃, Ca(OH)₂

Ans. (3)

Sol. Clark method

\[
\begin{align*}
\text{Ca} (\text{HCO}_3)^2 + \text{Ca(OH)}_2 &\rightarrow 2\text{CaCO}_3 + 2\text{H}_2\text{O} \\
\text{Mg} (\text{HCO}_3)^2 + 2\text{CaCO}_3 + \text{Mg(OH)}_2 &\rightarrow 2\text{CaCO}_3 + \text{Mg(OH)}_2 + 2\text{H}_2\text{O}
\end{align*}
\]

11. A metal crystallize in bcc structure with edge length of unit cell 300 pm. If density of solid is 6 gram/cc, than number of atom present in 180 gram of solid is \( [x] \times 10^{23} \), than value of \( x \) is.

[Report your answer in nearest integer]

Ans. (22)

Sol. 

\[
\begin{align*}
\text{d} &= \frac{Z \times M}{N_A \times \text{volume}} \\
M &= \frac{2 \times M}{6.02 \times 10^{23} \times (3 \times 10^{-8})^3} \\
M &= \frac{6 \times 0.02 \times 10^{-23} \times 2.71 \times 10^{-24}}{2} \\
M &= 48.762 \text{ gram} \\
\text{No. of atom in 180 gram} &= \frac{180}{48.762} \\
&= 22.22 \times 10^{23}
\end{align*}
\]

12. Half life of a first order reaction is 0.30 minutes. Then find the ratio of initial concentration to final concentration after 2min.

Ans. (100)

Sol. 

\[
\begin{align*}
T_{1/2} &= \frac{0.693}{k} \\
k &= \frac{0.693}{0.30} = 2.303 \text{ min}^{-1}
\end{align*}
\]

\[
\begin{align*}
C_0 &= C_t e^{kt} \\
C_0 &= e^{2.303 \times 2} \\
C_0/C_t &= e^{0.693} = e^{\ln(10)} \\
C_0/C_t &= 100
\end{align*}
\]

13. Which of the following statement is incorrect

(1) LiF is less soluble in water due to less hydration enthalpy
(2) Na has higher density than K
(3) KO is paramagnetic
(4) Sodium solution in liquid ammonia conduct electricity

Ans. (1)

Sol. LiF is less soluble in water due to high value of lattice energy
14. List I

<table>
<thead>
<tr>
<th>Cell reaction</th>
<th>Type of cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>(I) Zn(Hg) + HgO(s) → ZnO(s) + Hg(l)</td>
<td>(a) Primary cell</td>
</tr>
<tr>
<td>(II) Pb(s) + PbO_2(s) + 2H_2SO_4(aq) → 2PbSO_4(s) + 2H_2O(l)</td>
<td>(b) Fuel cell</td>
</tr>
<tr>
<td>(III) 2H_2(g) + O_2(g) → 2H_2O(l)</td>
<td>(c) Secondary cell</td>
</tr>
<tr>
<td>(IV) Cd(s) + 2Ni(OH)_2(s) → CdO(s) + 2Ni(OH)_2(s) + H_2O(l)</td>
<td>(d) discharging reaction of Secondary cell</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>List II</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>d</td>
<td>b</td>
<td>c</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Ans. (1)

Sol. Zn(Hg) + HgO(s) → ZnO(s) + Hg(l) – Primary cell

Pb(s) + PbO_2(s) + 2H_2SO_4(aq) → 2PbSO_4(s) + 2H_2O(l) – discharging reaction of Secondary cell

2H_2(g) + O_2(g) → 2H_2O(l) – Fuel cell

Cd(s) + 2Ni(OH)_2(s) → CdO(s) + 2Ni(OH)_2(s) + H_2O(l) – Secondary cell

15. List I (Reactant)

<table>
<thead>
<tr>
<th>(I) NH_4CrO_4</th>
<th>(a) H_2</th>
</tr>
</thead>
<tbody>
<tr>
<td>(II) KMnO_4 + HCl</td>
<td>(b) N_2</td>
</tr>
<tr>
<td>(III) Al + NaOH + H_2O</td>
<td>(c) O_2</td>
</tr>
<tr>
<td>(IV) NaNO_2</td>
<td>(d) O_2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>List II</th>
</tr>
</thead>
</table>

<table>
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<th>I</th>
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<tbody>
<tr>
<td>a</td>
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<td>d</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Ans. (1)

Sol. (I) NH_4CrO_4 → NH_4(g) + CrO_3(s) + H_2O

(II) MnO_4^- + Cl^- → Cl_2(g) + MnO_4^2-

(III) Al + NaOH + H_2O → NaAl(OH)_4 + H_2(g)

(IV) NaNO_2(s) → NaNO_3(s) + O_2(g)

16. 1 mole of X, 1 mole of Y and 0.05 mole Z on reaction give XYZ_3. Then yield of XYZ_3 is ... gram [given Atomic masses of X, Y, Z are : 10, 20, 30 gram/mole]

Ans. (2)

Sol. X + Y + 3Z → XYZ_3

Initial mole 1 mol 1 mol 0.05 mol

LR is Z

\[
\begin{align*}
1 & - 0.05 \\
3 & - 0.05 \\
0 & 0.05 \\
\end{align*}
\]

Molar mass of XYZ_3 is \([10 + 20 + 90] = 120 \text{ gram} \]

yield of XYZ_3 = \[\frac{0.05}{3} \times 120 = 2 \text{ gram} \]

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17. Find total number of isomers of [Co(en)(SCN)_2]^+ which is more stable than this compound.

Ans. (6)

Sol. [Co(en)(NCS)(SCN)]^+ & [Co(en)(NCS)_2]^+ Both are more stable than [Co(en)(SCN)_2]^+ and both of these complex have total 6 isomer.

(i) [Co(en)(NCS)(SCN)]^+ \[\xrightarrow{cis} \text{ cis} + \text{ trans} \Rightarrow 3 \]

(ii) [Co(en)(NCS)_2]^+ \[\xrightarrow{cis} \text{ cis} + \text{ trans} \Rightarrow 3 \]
18. An organic compound is formed by carbon, hydrogen and oxygen. 0.462 gram of this compound on complete combustion give 0.7838 gram of CO₂ (g) and 0.4428 gram of H₂O, then % of oxygen in compound is—

[Report your answer to nearest integer]

Ans. (42)

Sol. C₄H₀₂O₃ + O₂(g) → CO₂(g) + H₂O

0.462gram 0.7838gram 0.4428gram

Mass of carbon = [0.7838 × 12] = 0.2165 gram

Mass of hydrogen = [0.4428 × 2] = 0.0492 gram

Total mass of oxygen = 0.4620 - (0.2165 + 0.0492) = 0.1963 gram

% of oxygen = (0.1963 × 100) / 0.4620 = 42.48%

= 42.49

19. When 10.2 gram of ascorbic acid (GMM = 176 gram/mole) is dissolved in 500 gram of CH₃COOH then depression is freezing point is [X] x 10⁻² K. The value of X is —

[Given Kᵣ (CH₃COOH) = 3.9 K·g/mole]

(Report your answer to nearest integer)

Ans. (5)

Sol. ΔTr = Kᵣ x m

= 3.9 [10.2 x 1000 / 176 x 500]

= 0.4520

= 4.52 x 10⁻² K

---

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JEE MAIN-2022 | DATE: 28-07-2022 (SHIFT-1) | PAPER-1 | MEMORY BASED | CHEMISTRY

20. Which of the following reaction is involved in leaching process.

(1) Al₂O₃(s) + 2NaOH(aq) + 3H₂O(l) → 2NaAl(OH)₄(aq)
(2) Cu₂O + Cu₂S → 6Cu + SO₂
(3) 2PbS + 3O₂ → 2PbO + 2SO₂
(4) Ca₃O₄ + Al → Al₂O₃ + Cr

Ans. (1)

Sol. Al₂O₃(s) + 2NaOH(aq) + 3H₂O(l) → 2NaAl(OH)₄(aq) — Leaching process

2Cu₂O + Cu₂S → 6Cu + SO₂ — Self-reduction method

2PbS + 3O₂ → 2PbO + 2SO₂ — Roasting

2Al + Cr₂O₃ → Al₂O₃ + 2Cr (melted) — Thermite reaction.

21. Enzyme inhibitors are of two types

1. Competitive Inhibitor
2. Non Competitive Inhibitor

Which of the following statements is correct

(1) Competitive inhibitor bind to allosteric site and non competitive inhibitor bind to active site
(2) Competitive inhibitor bind to active site and non competitive inhibitor bind to allosteric site
(3) Both competitive inhibitor and non competitive inhibitor bind to active site
(4) Both competitive inhibitor and non competitive inhibitor bind to allosteric site

Ans. (2)

Sol. From NCERT
22. (i) (A) Spiro compound
   (ii) (B) Bicyclo compound
   (iii) (C) Aromatic compound
   (iv) (D) Heterocyclic nonplanar

(1) (i) – (D), (ii) – (A), (iii) – (B), (iv) – (C)
(2) (i) – (D), (ii) – (A), (iii) – (C), (iv) – (B)
(3) (i) – (A), (ii) – (D), (iii) – (B), (iv) – (C)
(4) (i) – (D), (ii) – (B), (iii) – (A), (iv) – (C)

Ans. (4)

Sol. Heterocyclic nonplanar
    Bicyclo compound
    Spiro compound
    Aromatic compound

---

23. Terephene is composed of
(1) 1,4- benzene dicarboxylic acid & ethane-1,2-diol
(2) 1,3- benzene dicarboxylic acid & ethane-1,2-diol
(3) 1,4- benzene dicarboxylic acid & propane-1,2-diol
(4) 1,3- benzene dicarboxylic acid & propane-1,2-diol

Ans. (1)

Sol. Monomers of Terephene (Dacron) are 1,4- benzene dicarboxylic acid & ethane-1,2-diol

24. Correct pyranose structure of the following compound

Ans. (1)

Sol. 1. BnH₂
    2. CH₃
    CH₂=CH=CH₂ → A
(1) Product A is formed by Markownikoff's rule & product B is formed by Anti Markownikoff's rule.
(2) Product A is formed by Anti Markownikoff's rule & product B is formed by Markownikoff's rule.
(3) Product A is formed by Markownikoff's rule & product B is formed by Markownikoff's rule.
(4) Product A is formed by Anti Markownikoff's rule & product B is formed by Anti Markownikoff's rule.

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28. Which of the following indicate H-atom has lowest value of pKa

(1) CH₃-COOH  
(2) CH₃-C-C₃H₆  
(3) HO-CH₂-COOH  
(4) HO-CH₂-C₂H₆

Ans. (2)
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