JEE (Main) 2020
COMPUTER BASED TEST (CBT)
Memory Based Questions & Solutions

Date: 03 September, 2020 (SHIFT-2)  |  TIME : (03.00 p.m. to 06.00 p.m)
Duration: 3 Hours  |  Max. Marks: 300
SUBJECT : CHEMISTRY
1. A mixture of one mole of each of O_2(g), H_2(g), He(g) exists in a container of volume V at temperature T, in which partial pressure of H_2(g) is 2 atm. The total pressure in the container is:
   (1) 6 atm   (2) 18 atm   (3) 33 atm   (4) 24 atm

   Ans. (1)

   Sol. \[ P_{\text{total}} = \frac{n_{\text{gas}}RT}{V} \]

   as n, T & V constant so
   \[ P_{H_2} = P_{O_2} = P_{He} = 2 \text{ atm} \]
   So, \[ P_{\text{total}} = P_{H_2} + P_{O_2} + P_{He} = 6 \text{ atm} \]

2. What is the concentration and % (w/w) of 5.6 V H_2O_2 solution? [Given molar mass of H_2O_2 = 34 g/mol, density = 1 g/mL]
   (1) 0.5, 1.70   (2) 0.25, 1.70   (3) 0.5, 0.85   (4) 0.25, 0.85

   Ans. (1)

   Sol. For H_2O_2
   \[ \text{Molarity} = \frac{\text{Volume strength}}{11.2} = \frac{5.6}{11.2} = 0.5 \text{ M} \]
   \[ \text{Molarity} = \frac{\% (w/w) \times 10 \times d}{\text{GMM}} \]
   \[ 0.5 = \frac{\% (w/w) \times 10 \times 1}{34} \]
   \[ \% (w/w) = \frac{0.5 \times 34}{10} = 1.7 \]

3. Find incorrect statement about manganate and permanganate ions.
   (1) Both manganate and permanganate ions are Paramagnetic
   (2) Manganate ion is green in colour while permanganate ion is purple in colour
   (3) Both manganate and permanganate ions have tetrahedral shape
   (4) In manganate and permanganate ions Mn from p-\pi-d-\pi bond with oxygen.

   Ans. (1)

   Sol. Manganate
   \[ \text{Permanganate} \]
   \[ \text{Paramagnetic, green in colour,} \]
   \[ \text{Tetrahedral & contains p-\pi-d-\pi \text{ bond}} \]
   \[ \text{Diamagnetic, purple in colour,} \]
   \[ \text{Tetrahedral & contains p-\pi-d-\pi \text{ bond}} \]
4. Among the following statements identify the correct set of statements
   (a) Size of Be is smaller than Mg.
   (b) Ionisation energy of Be is greater than Al.
   (c) Both Be and Al form covalent compounds readily.
   (d) Both Be and Al does not react with nitrogen.

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

Answ.  (1)

Sol. Both Be and Al react with nitrogen to form nitride

\[ 3\text{Be} + \text{N}_2(\text{air}) \xrightarrow{\Delta} \text{Be}_3\text{N}_2 \]
\[ 6\text{Al} + 3\text{N}_2 \xrightarrow{\Delta} 6\text{AlN} \]
Remaining all statements are correct.

5. In 0.1 M HCl solution, 0.1 M NaOH solution is added gradually then identify the correct graph this titration.

   (1) pH
   (2) pH
   (3) Volume of NaOH
   (4) Volume of NaOH

Answ.  (2)

Sol. At equivalence point pH is 7 and pH increases with addition of NaOH so correct graph is (2).

6. For the reaction, \[ 2\text{A} + 3\text{B} + \frac{3}{2}\text{C} \xrightarrow{\Delta} 3\text{P} \]
   the correct relation between the rate of reaction of species A, B and C is:

   (1) \[ \frac{dn_A}{dt} = \frac{2}{3} \frac{dn_B}{dt} = \frac{4}{3} \frac{dn_C}{dt} \]
   (2) \[ 2\frac{dn_A}{dt} = 3\frac{dn_B}{dt} = 3\frac{dn_C}{dt} \]
   (3) \[ \frac{3}{2} \frac{dn_A}{dt} = \frac{dn_B}{dt} = \frac{3}{4} \frac{dn_C}{dt} \]
   (4) \[ \frac{dn_A}{dt} = \frac{dn_B}{dt} = \frac{dn_C}{dt} \]

Answ.  (1)

Sol. For a given reaction
   \[ \text{rate} = \frac{1}{2} \frac{dn_A}{dt} = \frac{1}{3} \frac{dn_B}{dt} = \frac{2}{3} \frac{dn_C}{dt} \]
   \[ \text{rate} = \frac{2}{3} \frac{dn_A}{dt} = \frac{4}{3} \frac{dn_C}{dt} \]
7. The crystal field configuration of complexes $[\text{Ru(en)}_2]\text{Cl}_2$ and $[\text{Fe(H}_2\text{O)}_6]^{3+}$ respectively is:

1. $t_{2g}^6$, $e_g^0$ and $t_{2g}^5$, $e_g^0$
2. $t_{2g}^6$, $e_g^0$ and $t_{2g}^4$, $e_g^2$
3. $t_{2g}^4$, $e_g^2$ and $t_{2g}^5$, $e_g^0$
4. $t_{2g}^5$, $e_g^0$ and $t_{2g}^5$, $e_g^0$

Ans. (2)

Sol. $[\text{Ru(en)}_2]\text{Cl}_2 \Rightarrow \text{Ru}^{2+} = 4d^6 = t_{2g}^4$, $e_g^0$

$[\text{Fe(H}_2\text{O)}_6]^{3+} \Rightarrow \text{Fe}^{2+} = 3d^6 = t_{2g}^4$, $e_g^2$

So, correct answer is (2).

8. What is the valency of an atom if its successive ionisation energies respectively are 800, 900, 925, 25356, 32456 kJ/mole ?

1. 3
2. 4
3. 5
4. 6

Ans. (1)

Sol. As difference in 3rd and 4th ionisation energies is high so atom contains 3 valence electrons. Hence valency of the atom is 3.

9. For a hypothetical case let value of \( \ell \) is defined as 0,1,2,3…..(n+1) for principle quantum number n

1. Atomic number of 1st noble gas is 8
2. Atomic number of 1st alkali metal is 9
3. Carbon has electron in 2p\(_2\)
4. Element with atomic number 13 has half filled valence shell

Ans. (4)

Sol. For n = 1 value of \( \ell \) = 0,1,2

Electronic configuration = 1s\(^2\) 1p\(^6\) 1d\(^0\)

1. 1st noble gas atomic number is 18
2. 1st alkali metal electronic configuration \( \Rightarrow \) 1s\(^2\) 1p\(^6\) 1d\(^0\) 2s\(^1\) \( \Rightarrow \) (Z =19)
3. Electronic configuration of C (Z = 6) \( \Rightarrow \) 1s\(^2\) 1p\(^4\)
4. Z = 13, Electronic configuration = 1s\(^2\) 1p\(^6\) 1d\(^5\)

So it has half filled electronic configuration.

10. A current of 2A is passed through a dichromate solution for 5 min. Then 0.104 g of Cr\(^{3+}\) ions are formed. What is the percentage efficiency of cell?

[Given \( \text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O} \), Atomic mass of Cr = 52]

Ans. 96.50

Sol. Charge \( q \) = it = 2 \times 5 \times 60

\[ \text{Charge} = \frac{600}{96500} \times F \]

\[ \text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O} \]

Theoretical mass of Cr\(^{3+}\) = \[ \frac{1}{3} \times \frac{600}{96500} \times 52 \] g

So, efficiency = \[ \frac{W_{\text{actual}}}{W_{\text{Theoretical}}} \times 100 = \frac{0.104 \times 3 \times 96500}{52 \times 600} \times 100 = 96.50 \]
11. How much volume of 0.1 N NaOH will neutralize 10 mL of 0.1 N phosphonic acid?

Ans. (10.00)

Sol. Phosphonic acid is phosphorous acid (H₃PO₃).

\[ \text{NaOH} + \text{H₃PO₃} \rightarrow \text{NaH₂PO₃} + \text{H₂O} \]

For neutralization

\[ (\text{N}_1 \times V_1)_{\text{acid}} = (\text{N}_2 \times V_2)_{\text{base}} \]

\[ 0.1 \times 10 = 0.1 \times (V_{\text{ML}})_{\text{NaOH}} \]

\[ V_{\text{NaOH}} = 10 \text{ mL} \]

12. In isotonic solution of protein A and protein B, 0.73 gram of protein A is dissolved in 250 ml of solution while 1.65 gram of protein B is dissolved in 1 L solution, then what is the ratio of molecular mass of Protein A and protein B?

Ans. (01.77)

Sol. For isotonic solution

\[ i_1 C_1 = i_2 C_2 \]

\[ C_1 = C_2 \]

\[ \Rightarrow \quad \frac{0.73 \times 1000}{M_A \times 250} = \frac{1.65}{M_B \times 1} \]

\[ M_A = \frac{0.73 \times 4}{1.65} = 1.77 \]

13. \(6.022 \times 10^{22}\) molecules of a compound X has mass 10 g. What is the molarity of solution containing 5g of \('X'\) in 2 Lit. solution, answer as P [Where M = \(P \times 10^{-3}\) Mole/Lit]

Ans. (25.00)

Sol. Number of mole of \(X\) = \[
\frac{6.022 \times 10^{22}}{6.022 \times 10^{23}} = \frac{10}{\text{Molar mass of } X}
\]

So molar mass of \(X\) = 100 g

Molarity = \[
\frac{5}{100 \times 2} = 0.025 \text{M}
\]

Ans. = 0.025 M

M = \(25 \times 10^{-3}\)

So P = 25

14. Write down nucleophilic substitution (S_n2) order for following.

(i) \(\text{CH}_3\text{Cl} \quad \text{NO}_2 \quad \text{NO}_2 \)

(ii) \(\text{CH}_3\text{Cl} \quad \text{O}_2\text{N} \quad \text{NO}_2 \)

(iii) \(\text{CH}_2\text{Cl} \quad \text{NO}_2 \quad \text{NO}_2 \)

(iv) \(\text{CH}_2\text{Cl} \quad \text{NO}_2 \quad \text{NO}_2 \)

(1) \(i > ii > iii > iv\)

(2) \(iv > iii > ii > i\)

(3) \(i > iii > ii > iv\)

(4) \(iii > i > ii > iv\)

Ans. (3)

Sol. S_n2 reaction depend upon \(-I, -M\) effect on substrate. On increase \(-I, -M\) effect rate of S_n2 reaction increase.
15. Identify structure of A in following reaction sequence.

\[
A \xrightarrow{(i) \text{CH}_3\text{MgBr}} B \xrightarrow{(ii) \text{H}_2\text{O}^+} C \xrightarrow{\text{O}_2 \xrightarrow{\text{Zn/H}_2\text{O}}} D + E \xrightarrow{\text{Ba(OH)}_2 \xrightarrow{\Delta}} \text{PhCOO}^-\text{K}^+ + \text{Ph}^-\text{CH}_2\text{OH}
\]

\[\text{(1)} \quad \begin{array}{c}
\text{\text{O}} \\
\text{\text{CH}_2-\text{C-CH}_3}
\end{array} \quad \text{(2)} \quad \begin{array}{c}
\text{\text{O}} \\
\text{\text{CH}_2-\text{CH}_2-\text{CHO}}
\end{array} \quad \text{(3)} \quad \begin{array}{c}
\text{\text{O}} \\
\text{\text{C-CH}_3-\text{CH}_3}
\end{array} \quad \text{(4)} \quad \begin{array}{c}
\text{\text{O}} \\
\text{\text{CH}_3}
\end{array}
\]

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

\[\text{Sol.} \quad \begin{array}{c}
\text{\text{CH}_2-\text{C-CH}_3} \\
(i) \text{CH}_3\text{MgBr} \\
(iii) \text{H}_2\text{O}^+ \\
\text{O}_2 \xrightarrow{\text{Zn/H}_2\text{O}} \\
\text{CH}_3-\text{C-CH}_3
\end{array} \quad \begin{array}{c}
\text{\text{CH}_2-\text{C-CH}_3} \\
\text{OH} \\
\text{\text{C-CH}_3}
\end{array} \quad \begin{array}{c}
\text{\text{CH}_3} \\
\text{\text{CH}_3}
\end{array}
\]

16. Calculate $\text{C=}$ in given structure of peptide chain.

\[\text{Asp-Gly-Lys}
\]

\[\text{Ans. 4}
\]

\[\text{Sol.} \quad \begin{array}{c}
\text{Aspartic acid} \\
\text{HOOC-CH}_2-\text{CH-CONH}
\end{array} \quad \begin{array}{c}
\text{Glycine} \\
\text{NH}_2-\text{CH}_2-\text{COOH}
\end{array} \quad \begin{array}{c}
\text{Lysine} \\
\text{NH}_2-(\text{CH}_2)_4-\text{CHCOOH}
\end{array}
\]

\[\text{\text{H}_2\text{N-CH-C-NH-CH}_2-\text{C-NH-CH-CONH}}
\]

\[\begin{array}{c}
\text{CH}_2 \\
\text{COOH}
\end{array} \quad \begin{array}{c}
\text{(CH}_2)_4 \\
\text{NH}_2
\end{array}
\]

\[\text{Asp} \quad \text{Gly} \quad \text{Lys}\]
17. Match the columns

**Column-I**
(A) Chloramphenicol  
(B) Ranitidine  
(C) Phenelzine (nardil)  
(D) Morphine

**Column-II**
(1) Antacid  
(2) Antihistamine  
(3) Antibiotic  
(4) Analgesic  
(5) Antidepressant

**Ans.**
(1) A–1 B–2 C–4 D–5  
(2) A–3 B–2 C–5 D–4  
(3) A–2 B–4 C–5 D–1  
(4) A–3 B–2 C–1 D–5

**Sol.**

![Chemical structures of drugs and classifications]

18. Find product of above reaction.

**Ans.** (1)
This is an example of $E_2$ reaction and due to bulky base final product is Hoffmann alkene.

19.

(A) B is less water soluble than A
(B) B is more crystalline in nature than A
(C) B has more boiling point than A

Select correct statement regarding above structures.
(1) A, B are correct
(2) B, C are correct
(3) Only C are correct
(4) A, B, C all are correct

Ans. (2)

Sol. Due to inter molecular H-Bonding in B, than A, B is more soluble and having more B.P point than A.

20. Write down decreasing order of Nucleophilic addition reaction of following Propanal, Butanone, Propanone, Benzaldehyde
(1) Propanal > Butanone > Propanone > Benzaldehyde
(2) Propanal > Benzaldehyde > Propanone > Butanone
(3) Propanone > Propanal > Butanone > Benzaldehyde
(4) Propanone > Butanone > Benzaldehyde > Propanal

Ans. (2)

Sol. Rate of NAR $\propto \text{I-M on substrate}$

1 > 4 > 2 > 3

21. Which of the following statements are incorrect statement(s) for acid rain
(A) It corrodes water pipes
(B) It is not harmful for trees and plants
(C) It does not cause breathing problem in human being and animals
(D) It damages building and other structures made of stone or metal.

(1) A & B
(2) B & C
(3) A & C
(4) B & D

Ans. (2)

Sol. (B) It is harmful for trees and plants
(C) It causes breathing problem in human being and animals