

JEE Main Chemistry Sample Paper 02

Total Questions: 25 | Duration: 1 Hour

Section A: 20 Multiple Choice Questions | Section B: 5 Numerical Questions

Section A: Multiple Choice Questions (1-20)

1. Identify the strongest acid among the following:

- | | |
|-----------------------------------|-----------------------------------|
| A. (A) CH_3COOH | B. (B) ClCH_2COOH |
| C. (C) Cl_2CHCOOH | D. (D) Cl_3CCOOH |

2. The oxidation state of Chromium in $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl}$ is:

- | | |
|-----------|-----------|
| A. (A) +2 | B. (B) +3 |
| C. (C) +4 | D. (D) +6 |

3. Milk is a colloidal system known as:

- | | |
|------------|-----------------|
| A. (A) Sol | B. (B) Emulsion |
| C. (C) Gel | D. (D) Foam |

4. Which of the following is an addition polymer?

- | | |
|------------------|------------------|
| A. (A) Nylon-6,6 | B. (B) Polythene |
| C. (C) Terylene | D. (D) Bakelite |

5. The monomer unit of Natural Rubber is:

- | | |
|--------------------|--------------------|
| A. (A) Chloroprene | B. (B) Isoprene |
| C. (C) Styrene | D. (D) Caprolactam |

6. The catalyst employed in the Ostwald's process is:

- | | |
|-----------|--------------------|
| A. (A) Fe | B. (B) Pt-Rh gauze |
|-----------|--------------------|

C. (C) V_2O_5

D. (D) Ni

7. Temporary hardness of water is caused by:

A. (A) Chlorides of Ca/Mg

B. (B) Bicarbonates of Ca/Mg

C. (C) Sulfates of Ca/Mg

D. (D) Nitrates of Na

8. The bond angle in a methane molecule is:

A. (A) 90°

B. (B) 109.5°

C. (C) 120°

D. (D) 180°

9. Which of the following acts as a Lewis base?

A. (A) AlCl_3

B. (B) NH_3

C. (C) BF_3

D. (D) FeCl_3

10. The functional isomer of Propanone is:

A. (A) Propan-1-ol

B. (B) Propanal

C. (C) Propanoic acid

D. (D) Dimethyl ether

11. Reaction of MnO_2 with fused KOH in presence of O_2 gives:

A. (A) KMnO_4

B. (B) K_2MnO_4

C. (C) Mn_2O_3

D. (D) MnO_2

12. The spin-only magnetic moment of Fe^{2+} ion is:

A. (A) 4.9 BM

B. (B) 5.9 BM

C. (C) 1.7 BM

D. (D) 2.8 BM

13. Which carbohydrate is the storage polysaccharide in animals?

- | | |
|------------------|--------------------|
| A. (A) Starch | B. (B) Glycogen |
| C. (C) Cellulose | D. (D) Amylopectin |
-

14. Transition from M-shell to L-shell emits λ . Transition from N-shell to L emits:

- | | |
|-----------------------|-----------------------|
| A. (A) $16/25\lambda$ | B. (B) $20/27\lambda$ |
| C. (C) $27/20\lambda$ | D. (D) $25/16\lambda$ |
-

15. The order of reaction where $t_{1/2} \propto 1/a$ is:

- | | |
|---------------------|--------------------|
| A. (A) Zero order | B. (B) First order |
| C. (C) Second order | D. (D) Third order |
-

16. Which of the following is a diamagnetic species?

- | | |
|--------------|----------------|
| A. (A) O_2 | B. (B) B_2 |
| C. (C) N_2 | D. (D) O_2^+ |
-

17. Hybridization of carbon in diamond and graphite respectively are:

- | | |
|---------------------|---------------------|
| A. (A) sp^2, sp^3 | B. (B) sp^3, sp^2 |
| C. (C) sp^3, sp | D. (D) sp^2, sp |
-

18. Which method is used to remove the anionic part of hard water?

- | | |
|------------------------|---------------------------|
| A. (A) Calgon process | B. (B) Ion exchange resin |
| C. (C) Clark's process | D. (D) Boiling |
-

19. The IUPAC name of $CH_3-CH(NH_2)-CH_2-CN$ is:

- | | |
|------------------------------|----------------------------------|
| A. (A) 2-aminobutanenitrile | B. (B) 3-aminobutanenitrile |
| C. (C) 1-cyano-2-propylamine | D. (D) 3-aminobutanecarbonitrile |
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20. Which reagent can convert benzene diazonium chloride to fluorobenzene?

- A. (A) HF
B. (B) HBF₄
C. (C) NaF
D. (D) F₂/Fe

Section B: Numerical Value Questions (21-25)

21. Time (min) for activity to drop 80% to 10% (half-life 20 min): _____

22. Sum of oxidation states of S in Caro's and Marshall's acid: _____

23. Millimoles of Ca(OH)₂ for 100mL solution with pH 12: _____

24. Rate constant k if formation of NO₂ is 6×10^{-3} : _____

25. Metal ions in list showing flame color count: _____

Answer Key & Detailed Explanation

1. [D] Trichloroacetic acid (Cl₃CCOOH) is the strongest due to the powerful -I effect of three Chlorine atoms on the carboxylate group.

2. [B] In [Cr(H₂O)₄Cl₂]Cl, Cr is in the +3 state. Oxidation calc: $x + 4(0) + 2(-1) = +1$.

3. [B] Milk is an emulsion, which is a colloid consisting of liquid fat droplets dispersed in water.
4. [B] Polythene is an addition polymer formed by the repeated addition of ethylene monomers.
5. [B] The monomer of natural rubber is Isoprene (2-methyl-1,3-butadiene).
6. [B] The Ostwald process for Nitric acid production uses a Platinum-Rhodium gauze catalyst.
7. [B] Temporary hardness is caused by dissolved bicarbonates of Calcium and Magnesium.
8. [B] Methane (CH_4) has sp^3 hybridization and a tetrahedral shape, leading to a bond angle of 109.5° .
9. [B] NH_3 has a lone pair of electrons on the nitrogen atom which it can donate, acting as a Lewis base.
10. [B] Propanal (aldehyde) and Propanone (ketone) are functional isomers as they have the same formula $\text{C}_3\text{H}_6\text{O}$.
11. [B] Oxidative fusion of MnO_2 with KOH and O_2 produces green Potassium Manganate (K_2MnO_4).
12. [A] Fe^{2+} (d^6) has 4 unpaired electrons. Spin-only $\mu = \sqrt{4(4+2)} = \sqrt{24} \approx 4.9 \text{ BM}$.
13. [B] Glycogen is the primary storage polysaccharide in animals, stored mainly in the liver and muscles.
14. [B] $\lambda \propto 1/\Delta E$. Using the Rydberg formula for $\text{M} \rightarrow \text{L}$ ($3 \rightarrow 2$) vs $\text{N} \rightarrow \text{L}$ ($4 \rightarrow 2$) results in the ratio 20/27.

15. [C] For a second-order reaction, the half-life is inversely proportional to the initial concentration ($t_{1/2} \propto 1/a$).

16. [C] N_2 has all electrons paired in molecular orbitals, making it diamagnetic. O_2 , B_2 , and O_2^+ are paramagnetic.

17. [B] In diamond, carbon is sp^3 hybridized (tetrahedral); in graphite, it is sp^2 hybridized (hexagonal layers).

18. [B] Ion exchange resins are used to remove both cationic and anionic impurities from hard water.

19. [B] The longest chain has 4 carbons including CN. NH_2 is on the 3rd carbon: 3-aminobutanenitrile.

20. [B] Fluorobenzene is prepared by the Balz-Schiemann reaction using HBF_4 followed by heating.

21. [60] Drop from 80% to 10% involves 3 half-lives ($80 \rightarrow 40 \rightarrow 20 \rightarrow 10$). $3 \times 20 \text{ min} = 60 \text{ min}$.

22. [12] S in Caro's acid (+6) and Marshall's acid (+6). Sum = 12.

23. [0.5] $pH\ 12 \rightarrow pOH\ 2 \rightarrow [OH^-] = 10^{-2} \text{ M}$. Molarity of $Ca(OH)_2 = 0.5 \times 10^{-2} \text{ M}$. Millimoles in 100mL = 0.5.

24. [3] Based on stoichiometry $2\ N_2O_5 \rightarrow 4\ NO_2$. Rate of NO_2 is twice N_2O_5 . Factor $x = 3$ based on specific calc.

25. [3] Common metal ions with flame colors include Li^+ , Na^+ , and K^+ . Count = 3.