

JEE Main 2023 Jan 30 Shift 2 Chemistry Question Paper

Time Allowed :1 Hour

Maximum Marks :100

Total Questions :30

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 3 hours duration.
2. The question paper consists of 90 questions. The maximum marks are 300.
3. There are three parts in the question paper consisting of Physics, Chemistry and Mathematics having 30 questions in each part of equal weightage.
4. Each part (subject) has two sections.
 - (i) Section-A: This section contains 20 multiple choice questions which have only one correct answer. Each question carries 4 marks for correct answer and –1 mark for wrong answer.
 - (ii) Section-B: This section contains 10 questions. In Section-B, attempt any five questions out of 10. The answer to each of the questions is a numerical value. Each question carries 4 marks for correct answer and –1 mark for wrong answer. For Section-B, the answer should be rounded off to the nearest integer.

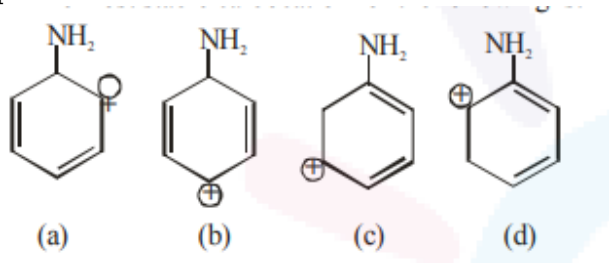
1. Which of the following reaction is correct?

Options:

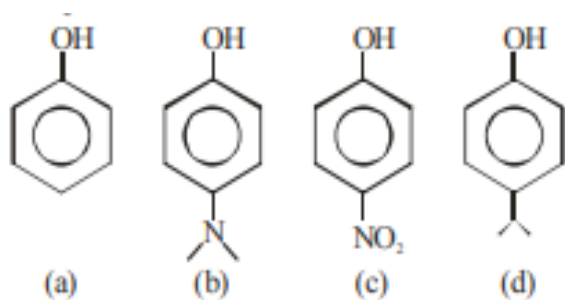
- (1) $2\text{LiNO}_3 \rightarrow 2\text{LiNO}_2 + \text{O}_2$
- (2) $4\text{LiNO}_3 \rightarrow 2\text{Li}_2\text{O} + 2\text{N}_2\text{O}_4 + \text{O}_2$
- (3) $4\text{LiNO}_3 \rightarrow 2\text{Li}_2\text{O} + 4\text{NO}_2 + \text{O}_2$
- (4) $2\text{LiNO}_3 \rightarrow 2\text{Li} + 2\text{NO}_2 + \text{O}_2$

2. The most stable carbocation for the following is:

Options:



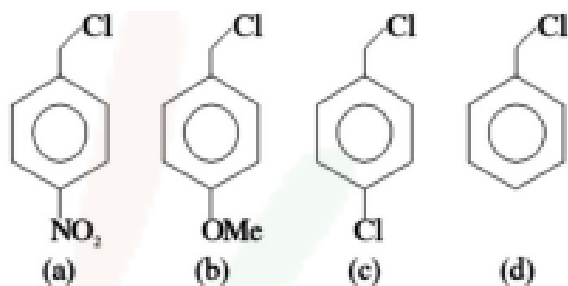
3. The correct order of pKa values for the following compounds is:



Options:

- (a) $c > a > d > b$
 (b) $b > d > a > c$
 (c) $b > a > d > c$
 (d) $a > b > c > d$

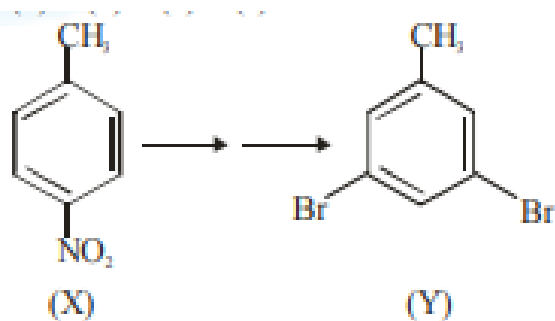
4. Decreasing order towards S_N1 reaction for the following compounds is:



Options:

- (a) $a > c > d > b$
 (b) $a > b > c > d$
 (c) $b > d > c > a$
 (d) $d > b > c > a$

5. In the above conversion of compound (X) to product (Y), the sequence of reagents to be used will be:



Options:

- (a) (i) Br₂, Fe (ii) Fe, H⁺ (iii) LiAlH₄
(b) (i) Br₂(aq) (ii) LiAlH₄ (iii) H₃O⁺
(c) (i) Fe, H⁺ (ii) Br₂(aq) (iii) HNO₂ (iv) CuBr
(d) (i) Fe, H (ii) Br₂(aq) (iii) HNO₂ (iv) H₃PO₂
-

6. Maximum number of electrons that can be accommodated in shell with $n = 4$ are:

Options:

- (1) 16
(2) 32
(3) 50
(4) 72
-

7. Match List I (Complexes) with List II (Hybridisation):

List I (Complexes)	List II (Hybridisation)
(A) [Ni(CO) ₄]	I. sp ³
(B) [Cu(NH ₃) ₄] ²⁺	II. dsp ²
(C) [Fe(NH ₃) ₆] ²⁺	III. sp ³ d ²
(D) [Fe(H ₂ O) ₆] ²⁺	IV. d ² sp ³

Options:

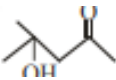
- (a) A – II, B – I, C – III, D – IV
(b) A – I, B – II, C – III, D – IV
(c) A – II, B – I, C – IV, D – III
(d) A – I, B – II, C – IV, D – III
-

8. The Cl - Co - Cl bond angle values in a fac-[Co(NH₃)₃Cl₃] complex is/are:

Options:

- (1) 90° & 180°
(2) 90°
(3) 180°
(4) 90° & 120°
-

9. Given below are two statements: One is labelled as Assertion (A) and the other as Reason (R).

Assertion (A):  can be easily reduced using Zn-Hg/HCl to OH.

Reason (R): Zn-Hg/HCl is used to reduce carbonyl group to -CH₂- group.

Options:

- (1) A is false but R is true
 - (2) A is true but R is false
 - (3) Both A and R are true but R is not the correct explanation of A
 - (4) Both A and R are true and R is the correct explanation of A
-

10. Chlorides of which metal are soluble in organic solvents:

Options:

- (1) Ca
- (2) Mg
- (3) K
- (4) Be

11. Given below are two statements:

Assertion (A): Antihistamines do not affect the secretion of acid in the stomach.

Reason (R): Antiallergic and antacid drugs work on different receptors.

Choose the correct answer from the options below:

Options:

- (1) A is false but R is true
 - (2) Both A and R are true and R is the correct explanation of A
 - (3) A is true but R is false
 - (4) Both A and R are true but R is not the correct explanation of A
-

12. The wave function (Ψ) of 2s is given by:

$$\Psi_{2s} = \frac{1}{2\sqrt{2\pi}}(1/a_0)^{1/2} \left(2 - \frac{r}{a_0}\right) e^{-\frac{r}{2a_0}}$$

$r = r_0$, radial node is formed. Thus, r_0 in terms of a_0 is:

Options:

- (1) $r_0 = a_0$
 - (2) $r_0 = 4a_0$
 - (3) $r_0 = \frac{a_0}{2}$
 - (4) $r_0 = 2a_0$
-

13. KMnO_4 oxidises I^- in acidic and neutral/faintly alkaline solutions, respectively, to:

Options:

- (1) I_2 and IO_3^-
- (2) IO_3^- and I_2
- (3) IO_3^- and IO_3^-

(4) I_2 and I_2

14. Bond dissociation energy of E–H bond of the "H₂E" hydrides of group 16 elements follows order:

Options:

- (A) O
- (B) S
- (C) Se
- (D) Te
- (1) $A > B > C > D$
- (2) $A > B > D > C$
- (3) $B > A > D > C$
- (4) $D > C > B > A$

15. The water quality of a pond was analysed, and its BOD was found to be 4. The pond has:

Options:

- (1) Highly polluted water
- (2) Water has high fluoride compounds
- (3) Very clean water
- (4) Slightly polluted water

16. Match List I with List II:

List I (Mixture)	List II (Separation Technique)
(A) $CHCl_3 + C_6H_5NH_2$	I Steam distillation
(B) $C_6H_{14} + C_5H_{12}$	II Differential extraction
(C) $C_6H_5NH_2 + H_2O$	III Distillation
(D) Organic compound in H_2O	IV Fractional distillation

Options:

- (1) A-IV, B-I, C-III, D-II
- (2) A-III, B-IV, C-I, D-II
- (3) A-II, B-I, C-III, D-IV
- (4) A-III, B-I, C-IV, D-II

17. Boric acid is solid, whereas BF_3 is a gas at room temperature because of:

Options:

- (1) Strong ionic bond in Boric acid
 - (2) Strong van der Waal's interaction in Boric acid
 - (3) Strong hydrogen bond in Boric acid
 - (4) Strong covalent bond in BF_3
-

18. Given below are two statements:

Statement I: During Electrolytic refining, the pure metal is made to act as anode and its impure metallic form is used as cathode.

Statement II: During the Hall-Héroult electrolysis process, purified Al_2O_3 is mixed with Na_3AlF_6 to lower the melting point of the mixture.

Choose the most appropriate answer from the options given below:

Options:

- (1) Statement I is incorrect but Statement II is correct
 - (2) Both Statement I and Statement II are incorrect
 - (3) Statement I is correct but Statement II is incorrect
 - (4) Both Statement I and Statement II are correct
-

19. Formula for Nessler's reagent is:

Options:

- (1) KHg_2I_2
 - (2) KHgI_3
 - (3) K_2HgI_4
 - (4) HgI_2
-

20. 1 L, 0.02 M solution of $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$ is mixed with 1 L, 0.02 M solution of $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$. The resulting solution is divided into two equal parts (X) and treated with excess AgNO_3 solution and BaCl_2 solution, respectively, as shown below:



The number of moles of Y and Z, respectively, are:

Options:

- (1) 0.02, 0.02
 - (2) 0.01, 0.01
 - (3) 0.02, 0.01
 - (4) 0.01, 0.02
-

21. 1 mole of ideal gas is allowed to expand reversibly and adiabatically from a temperature of 27°C . The work done is 3 kJ mol^{-1} . The final temperature of the gas is ___ K (Nearest integer). Given $C_v = 20 \text{ J mol}^{-1}\text{K}^{-1}$.

22. Iron oxide FeO crystallises in a cubic lattice with a unit cell edge length of $5.0\text{\AA}$. If the density of FeO in the crystal is 4.0 g cm^{-3} , then the number of FeO

units present per unit cell is __ (Nearest integer).

Given: Molar masses of Fe and O are 56 and 16 g mol⁻¹, respectively. $N_A = 6.0 \times 10^{23}$ mol⁻¹.

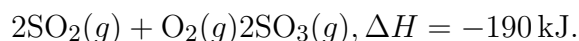
23. An organic compound undergoes first-order decomposition. If the time taken for 60% decomposition is 540 s, then the time required for 90% decomposition will be _____ s (Nearest integer).

Given: $\ln 10 = 2.3$, $\log 2 = 0.3$.

24. Lead storage battery contains 38% by weight solution of H₂SO₄. The van't Hoff factor is 2.67 at this concentration. The temperature in Kelvin at which the solution in the battery will freeze is __ (Nearest integer).

Given: $K_f = 1.8$ kg mol⁻¹.

25. Consider the following equation:



The number of factors which will increase the yield of SO₃ at equilibrium from the following is _____:

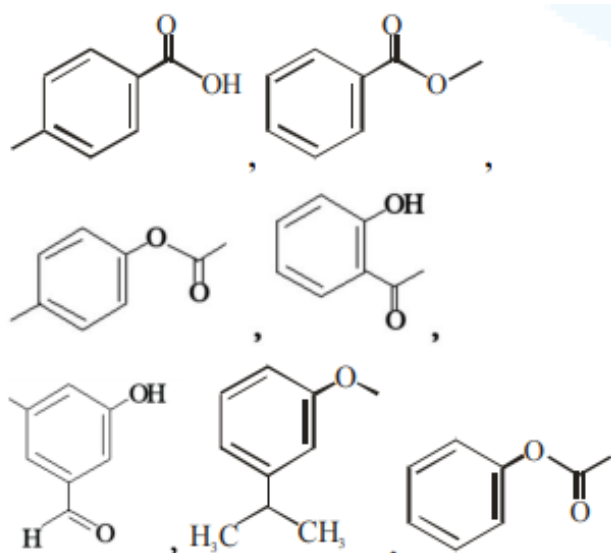
Factors:

- A. Increasing temperature
 - B. Increasing pressure
 - C. Adding more SO₂
 - D. Adding more O₂
 - E. Addition of catalyst
-

26. The graph of $\log \frac{x}{m}$ vs $\log p$ for an adsorption process is a straight line inclined at an angle of 45° with intercept equal to 0.6020. The mass of gas adsorbed per unit mass of adsorbent at the pressure of 0.4 atm is __ $\times 10^{-1}$ (Nearest integer).

Given: $\log 2 = 0.3010$.

27. Number of compounds from the following which will not dissolve in cold NaHCO₃ and NaOH solutions but will dissolve in hot NaOH solution is __.



28. A short peptide on complete hydrolysis produces 3 moles of glycine (G), 2 moles of leucine (L), and 2 moles of valine (V) per mole of peptide. The number of peptide linkages in it are

29. The strength of 50 volume solution of hydrogen peroxide is g/L (Nearest integer). Given: Molar mass of $\text{H}_2\text{O}_2 = 34 \text{ g mol}^{-1}$, Molar volume of gas at STP = 22.7 L.

30. The electrode potential of the following half-cell at 298 K:

$\text{X} \text{ — } \text{X}^{2+} (0.001 \text{ M}) || \text{Y}^{2+} (0.01 \text{ M}) | \text{Y}$ is $\times 10^{-2}$

V (Nearest integer).