

JEE Main 2023 Jan 29 Shift 1 Chemistry Question Paper

Total Time Allowed : 60 minutes	Maximum Marks : 100	Total Questions : 30	Questions to be answered :30
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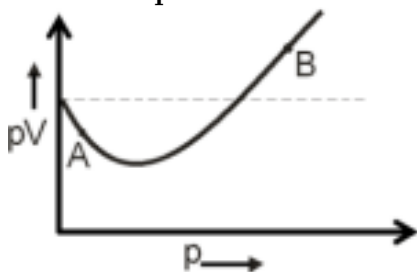
General Instructions

Read the following instructions very carefully and strictly follow them:

- (1) The test is of 1 hour duration.
- (2) The question paper consists of 30 questions. The maximum marks are 100.
- (3) This is the question paper of Chemistry having 30 questions in each part of equal weightage.
- (4) Each part 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.

Section-A

Question 1: For 1 mol of gas, the plot of pV vs p is shown below. p is the pressure and V is the volume of the gas. What is the value of compressibility factor at point A?



- (1) $1 - \frac{a}{RTV}$
- (2) $1 + \frac{b}{V}$
- (3) $1 - \frac{b}{V}$
- (4) $1 + \frac{a}{RTV}$

Question 2: The shortest wavelength of hydrogen atom in the Lyman series is λ . The longest wavelength in the Balmer series of He^+ is:

- (1) $\frac{5}{9}\lambda$
- (2) $\frac{9}{5}\lambda$
- (3) $\frac{36}{5}\lambda$
- (4) $\frac{5}{9}\lambda$

Question 3: Which of the following salt solutions would coagulate the colloid solution formed when FeCl_3 is added to NaOH solution, at the fastest rate?

- (1) 10 mL of $0.2 \text{ mol dm}^{-3} \text{ AlCl}_3$
- (2) 10 mL of $0.1 \text{ mol dm}^{-3} \text{ Na}_2\text{SO}_4$
- (3) 10 mL of $0.1 \text{ mol dm}^{-3} \text{ Ca}_3(\text{PO}_4)_2$
- (4) 10 mL of $0.15 \text{ mol dm}^{-3} \text{ CaCl}_2$

Question 4: The bond dissociation energy is highest for:

- (1) Cl_2
- (2) I_2
- (3) Br_2
- (4) F_2

Question 5: The reaction representing the Mond process for metal refining is:

- (1) $\text{Ni} + 4\text{CO} \xrightarrow{\Delta} \text{Ni}(\text{CO})_4$
- (2) $2\text{K}[\text{Au}(\text{CN})_2] + \text{Zn} \xrightarrow{\Delta} \text{K}_2[\text{Zn}(\text{CN})_4] + 2\text{Au}$
- (3) $\text{Zr} + 2\text{I}_2 \xrightarrow{\Delta} \text{ZrI}_4$
- (4) $\text{ZnO} + \text{C} \xrightarrow{\Delta} \text{Zn} + \text{CO}$

Question 6: Which of the given compounds can enhance the efficiency of a hydrogen storage tank?

- (1) Li/P_4
- (2) SiH_4
- (3) NaNi_5
- (4) Di-isobutylaluminium hydride

Question 7: The correct order of hydration enthalpies is:

- (A) K^+
- (B) Rb^+

- (C) Mg^{2+}
- (D) Cs^+
- (E) Ca^{2+}

Choose the correct answer from the options given below:

- (1) $\text{C} > \text{A} > \text{E} > \text{B} > \text{D}$
- (2) $\text{E} > \text{C} > \text{A} > \text{B} > \text{D}$
- (3) $\text{C} > \text{E} > \text{A} > \text{D} > \text{B}$
- (4) $\text{C} > \text{E} > \text{A} > \text{B} > \text{D}$

Question 8: The magnetic behaviour of Li_2O , Na_2O_2 , and KO_2 , respectively, are:

- (1) diamagnetic, paramagnetic, and diamagnetic
- (2) paramagnetic, paramagnetic, and diamagnetic
- (3) paramagnetic, diamagnetic, and paramagnetic
- (4) diamagnetic, diamagnetic, and paramagnetic

Question 9: "A" obtained by Ostwald's method involving air oxidation of NH_3 , upon further air oxidation produces "B". "B" on hydration forms an oxoacid of nitrogen along with evolution of "A". The oxoacid also produces "A" and gives a positive brown ring test.

- (1) NO_2 , N_2O_5
- (2) NO_2 , N_2O_4
- (3) NO , NO_2
- (4) N_2O_3 , NO_2

Question 10: The standard electrode potential ($\text{M}^{3+}/\text{M}^{2+}$) for V, Cr, Mn, and Co are -0.26 V, -0.41 V, +1.57 V, and +1.97 V, respectively. The metal ions which can liberate H_2 from a dilute acid are:

- (1) V^{2+} and Mn^{2+}
- (2) Cr^{2+} and Co^{2+}
- (3) V^{2+} and Cr^{2+}
- (4) Mn^{2+} and Co^{2+}

Question 11: Correct statement about smog is:

- (1) NO_2 is present in classical smog
- (2) Both NO_2 and SO_2 are present in classical smog
- (3) Photochemical smog has a high concentration of oxidizing agents
- (4) Classical smog also has a high concentration of oxidizing agents

Question 12: Chiral complex from the following is:

- (1) $\text{cis-}[\text{PtCl}_2(\text{en})_2]^{2+}$
 (2) $\text{trans-}[\text{PtCl}_2(\text{en})_2]^{2+}$
 (3) $\text{cis-}[\text{PtCl}_2(\text{NH}_3)_2]$
 (4) $\text{trans-}[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$

Question 13: Identify the correct order for the given property for the following compounds:

(A) Boiling Point: $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl} < \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl} < \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$

(B) Density: $\text{CH}_3\text{CH}_2\text{Br} < \text{CH}_3\text{CH}_2\text{CH}_2\text{Cl} < \text{CH}_3\text{CH}_2\text{CH}_2\text{I}$

(C) Boiling Point: $\text{CH}_3\text{CH}_2\text{Br} < \text{CH}_3\text{CH}(\text{Br})\text{CH}_2\text{Br} < \text{CH}_3\text{C}(\text{Br})_2\text{CH}_2\text{Br}$

(D) Density: $\text{CH}_3\text{CH}_2\text{CH}_2\text{I} < \text{CH}_3\text{CH}_2\text{CH}_2\text{Br} < \text{CH}_3\text{CH}(\text{Br})\text{CH}_2\text{Cl}$

(E) Boiling Point: $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl} > \text{CH}_3\text{CH}_2\text{CH}(\text{Cl})\text{CH}_3 > \text{CH}_3\text{C}(\text{Cl})_2\text{CH}_3$

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Choose the correct answer from the option given below :-

- (1) (B), (C), and (D) only
 (2) (A), (C), and (E) only
 (3) (A), (C), and (D) only
 (4) (A), (B), and (E) only

Question 14: The increasing order of pK_a for the following phenols is:

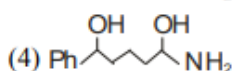
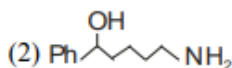
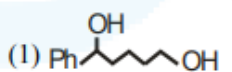
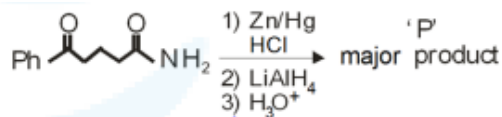
- (1) 2,4-Dinitrophenol
 (2) 4-Nitrophenol
 (3) 2,4,5-Trimethylphenol
 (4) Phenol
 (5) 3-Chlorophenol

Question 15: Match the reactions in List-I with the reagents in List-II:

List-I (Reaction)	List-II (Reagents)
(A) Hoffmann Degradation	(I) Conc. KOH, Δ
(B) Clemenson Reduction	(II) CHCl_3 , NaOH/ H_3O^+
(C) Cannizzaro Reaction	(III) Br_2 , NaOH
(D) Reimer-Tiemann Reaction	(IV) Zn-Hg/HCl

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

Question 16: The major product 'P' for the following sequence of reactions is:



Question 17: During the borax bead test with CuSO_4 , a blue-green colour of the bead was observed in the oxidizing flame due to the formation of:

- (1) Cu_3B_2
- (2) Cu
- (3) $\text{Cu}(\text{BO}_2)_2$
- (4) CuO

Question 18: Match List I with List II:

List I (Antimicrobials)	List II (Names)
(A) Narrow Spectrum Antibiotic	(I) Furacin
(B) Antiseptic	(II) Sulphur Dioxide
(C) Disinfectants	(III) Penicillin-G
(D) Broad Spectrum Antibiotic	(IV) Chloramphenicol

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

Question 19: Number of cyclic tripeptides formed with 2 amino acids A and B is:

- (1) 2
- (2) 3
- (3) 5
- (4) 4

Question 20: Compound that will give positive Lassaigne's test for both nitrogen and halogen is:

- (1) $\text{N}_2\text{H}_4 \cdot \text{HCl}$
 - (2) $\text{CH}_3\text{NH}_2 \cdot \text{HCl}$
 - (3) NH_4Cl
 - (4) $\text{NH}_2\text{OH} \cdot \text{HCl}$
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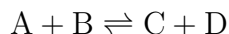
Section-B

Question 21: Millimoles of calcium hydroxide required to produce 100 mL of the aqueous solution of pH 12 is $x \times 10^{-1}$. The value of x is — (Nearest integer). Assume complete dissociation.

Question 22: The number of molecules or ions from the following, which do not have an odd number of electrons, are —.

- (A) NO_2
 - (B) ICl_4^-
 - (C) BrF_3
 - (D) ClO_2
 - (E) NO_2^+
 - (F) NO
-

Question 23: Consider the following reaction approaching equilibrium at 27°C and 1 atm pressure:



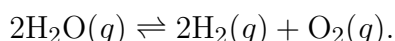
$$K_f = 10^3, \quad K_r = 10^2$$

The standard Gibbs energy change ($\Delta_r G^\circ$) at 27°C is (–) — kJ mol $^{-1}$ (Nearest integer).
(Given: $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$ and $\ln 10 = 2.3$)

Question 24: Solid lead nitrate is dissolved in 1 litre of water. The solution was found to boil at 100.15°C . When 0.2 mol of NaCl is added to the resulting solution, it was observed that the solution froze at -0.8°C . The solubility product of PbCl_2 formed is — $\times 10^{-6}$ at 298 K (Nearest integer).

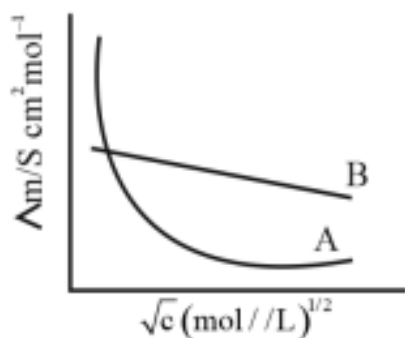
$$\text{Given: } K_b = 0.5 \text{ K kg mol}^{-1}, \quad K_f = 1.8 \text{ kg mol}^{-1}.$$

Question 25: Water decomposes at 2300 K:



The percent of water decomposing at 2300 K and 1 bar is — (Nearest integer).
Equilibrium constant for the reaction is 2×10^{-3} at 2300 K.

Question 26: Following figure shows the dependence of molar conductance of two electrolytes on concentration. Λ_m° is the limiting molar conductivity. The number of Incorrect statement(s) from the following is —.



- (A) Λ_m^0 for electrolyte A is obtained by extrapolation.
- (B) For electrolyte B, $\sqrt{c}$ vs. Λ_m graph is a straight line with intercept equal to Λ_m^0 .
- (C) At infinite dilution, the value of degree of dissociation approaches zero for electrolyte B.
- (D) Λ_m^0 for any electrolyte A or B can be calculated using λ^0 for individual ions.

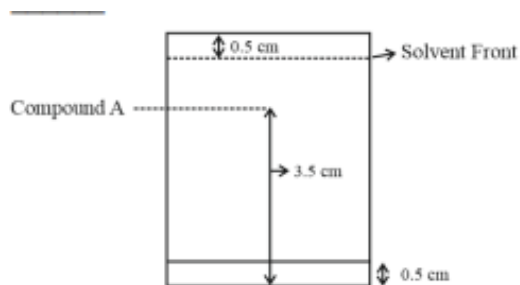
Question 27: For a certain chemical reaction $X \rightarrow Y$, the rate of formation of the product is plotted against time as shown in the figure. The number of Correct statement(s) from the following is —.

Statements:

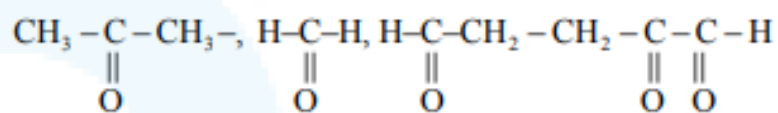
- (A) Overall order of this reaction is one.
- (B) Order of this reaction can't be determined.
- (C) In region-I and III, the reaction is of first and zero order respectively.
- (D) In region-II, the reaction is of first order.
- (E) In region-II, the order of the reaction is in the range of 0.1 to 0.9.

Question 28: The sum of bridging carbonyls in $\text{W}(\text{CO})_6$ and $\text{Mn}_2(\text{CO})_{10}$ is —.

Question 29: Following chromatogram was developed by adsorption of compound A on a 6 cm TLC glass plate. The retardation factor of the compound A is — $\times 10^{-1}$.



Question 30: 17 mg of a hydrocarbon (Molecular Formula: $C_{10}H_{16}$) takes up 8.40 mL of H_2 gas measured at $0^\circ C$ and 760 mmHg. Ozonolysis of the hydrocarbon yields:



The number of double bonds present in the hydrocarbon is ____.