

JEE Main 2023 Jan 31 Shift 2 Chemistry Question Paper

Total Time Allowed : 180 minutes	Maximum Marks : 300	Total Questions : 90	Questions to be answered : 90
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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.

CHEMISTRY**Section-A**

1. In the following halogenated organic compounds, the one with the maximum number of chlorine atoms in its structure is:

- (1) Chloral
- (2) Gammaxene
- (3) Chloropicrin
- (4) Freon-12

2. Incorrect statement for the use of indicators in acid-base titration:

- (1) Methyl orange may be used for a weak acid vs weak base titration.
- (2) Methyl orange is a suitable indicator for a strong acid vs weak base titration.
- (3) Phenolphthalein is a suitable indicator for a weak acid vs strong base titration.
- (4) Phenolphthalein may be used for a strong acid vs strong base titration.

3. Which of the following compounds are not used as disinfectants? (A) Chloroxylenol

- (B) Bithional
- (C) Veronal
- (D) Prontosil
- (E) Terpeneol

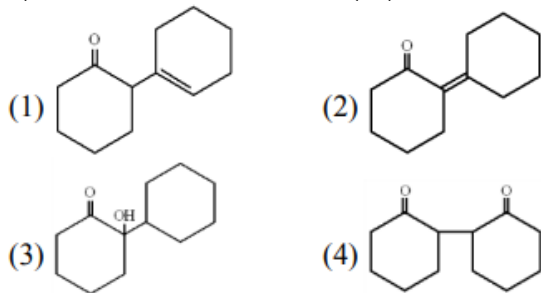
Choose the correct answer from the options given below:

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

4. A hydrocarbon 'X' with formula C_6H_8 uses two moles of H_2 on catalytic hydrogenation of its one mole. On ozonolysis, 'X' yields two moles of methane dicarbaldehyde. The hydrocarbon 'X' is:

- (1) hexa-1, 3, 5-triene
- (2) 1-methylcyclopenta-1, 4-diene
- (3) cyclohexa-1, 3-diene
- (4) cyclohexa-1, 4-diene

5. Cyclohexylamine when treated with nitrous acid yields (P). On treating (P) with PCC results in (Q). When (Q) is heated with dilute NaOH, we get (R). The final product (R) is:



6. Given below are two statements: **Statement I:** Upon heating a borax bead dipped in cupric sulphate in a luminous flame, the colour of the bead becomes green. **Statement II:** The green colour observed is due to the formation of copper(I) metaborate.

In light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both Statement I and Statement II are true
- (2) Statement I is true but Statement II is false
- (3) Both Statement I and Statement II are false
- (4) Statement I is false but Statement II is true

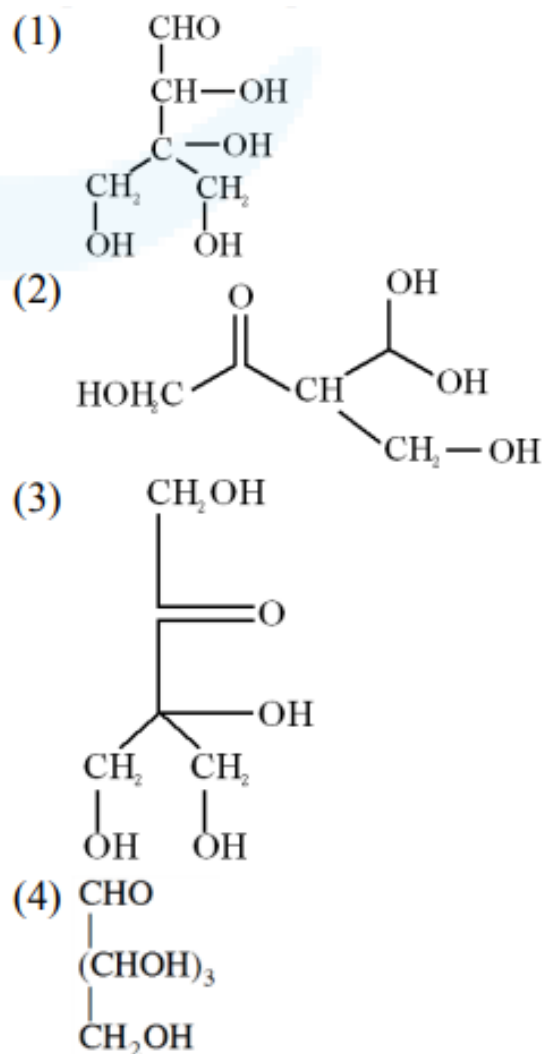
7. Evaluate the following statements for their correctness:

- (A) The elevation in boiling point temperature of water will be same for 0.1 M NaCl and 0.1 M urea.
- (B) Azeotropic mixtures boil without change in their composition.
- (C) Osmosis always takes place from hypotonic to hypertonic solution.
- (D) The density of 32% H_2SO_4 solution having molarity 4.09 M is approximately 1.26 g mL^{-1} .
- (E) A negatively charged sol is obtained when KI solution is added to silver nitrate solution.

Choose the correct answer from the options given below:

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

8. Compound A, $C_5H_{10}O_5$, given a tetraacetate with Ac_2O and oxidation of A with $Br_2 - H_2O$ gives an acid, $C_5H_{10}O_6$. Reduction of A with HI gives isopentane. The possible structure of A is:



9. Arrange the following orbitals in decreasing order of energy? (A) $n = 3, l = 0, m = 0$

(B) $n = 4, l = 1, m = 0$

(C) $n = 3, l = 1, m = 0$

(D) $n = 3, l = 2, m = 1$

The correct option for the order is:

(1) $B > D > C > A$

(2) $D > B > C > A$

(3) $A > C > B > D$

(4) $D > B > A > C$

10. The Lewis acid character of boron tri halides follows the order:

(1) $\text{BCl}_3 > \text{BBr}_3 > \text{BCl}_3 > \text{BF}_3$

(2) $\text{BCl}_3 > \text{BF}_3 > \text{BBr}_3 > \text{BI}_3$

- (3) $\text{BF}_3 > \text{BCl}_3 > \text{BBr}_3 > \text{BI}_3$
 (4) $\text{BI}_3 > \text{BBr}_3 > \text{BCl}_3 > \text{BF}_3$

11. Match List-I with List-II:

List-I	List-II
(A) Physiosorption	I. Single layer adsorption
(B) Chemisorption	II. $20\text{-}40 \text{ kJ mol}^{-1}$
(C) $\text{N}_2(g) + 3\text{H}_2(g) \xrightarrow{\text{Fe}} 2\text{NH}_3(g)$	III. Chromatography
(D) Analytical Application or Adsorption	IV. Heterogeneous catalysis

Choose the correct answer from the options given below:

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

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

Assertion (A): The first ionization enthalpy of 3d series elements is more than that of group 2 metals.

Reason (R): In 3d series of elements, successive filling of d-orbitals takes place.

In light of the above statements, choose the correct answer from the options given below:

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

13. The element playing a significant role in neuromuscular function and interneuronal transmission is:

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

14. Given below are two statements: Statement I: H_2O_2 is used in the synthesis of Cephalosporin. **Statement II:** H_2O_2 is used for the restoration of aerobic conditions to sewage wastes.

In light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both Statement I and Statement II are correct
 - (2) Statement I is incorrect but Statement II is correct
 - (3) Statement I is correct but Statement II is incorrect
 - (4) Both Statement I and Statement II are incorrect
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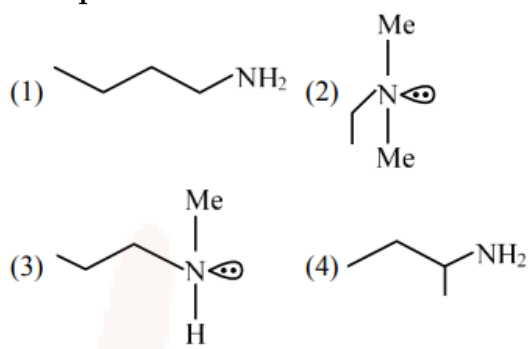
15. The normal rain water is slightly acidic and its pH value is 5.6 because of which one of the following?

- (1) $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$
 - (2) $4\text{NO}_2 + 2\text{H}_2\text{O} \rightarrow 4\text{HNO}_3$
 - (3) $\text{SO}_2 + \text{O}_2 + 2\text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4$
 - (4) $2\text{N}_2\text{O}_5 + \text{H}_2\text{O} \rightarrow 2\text{HNO}_3$
-

16. When a hydrocarbon A undergoes complete combustion it requires 11 equivalents of oxygen and produces 4 equivalents of water. What is the molecular formula of A?

- (1) C_9H_8
 - (2) C_{11}H_4
 - (3) C_5H_8
 - (4) C_{11}H_8
-

17. An organic compound [A] ($\text{C}_4\text{H}_{11}\text{N}$) shows optical activity and gives N_2 gas on treatment with HNO_2 . The compound [A] reacts with PhSO_2Cl producing a compound which is soluble in KOH. The structure of A is:



18. Which one of the following statements is incorrect?

- (1) Boron and Indium can be purified by zone refining method.
- (2) Van Arkel method is used to purify tungsten.
- (3) Cast iron is obtained by melting pig iron with scrap iron and coke using hot air blast.

(4) The malleable iron is prepared from cast iron by oxidizing impurities in a reverberatory furnace.

19. Which of the following elements have half-filled f-orbitals in their ground state? (Given: atomic number Sm = 62; Eu = 63; Tb = 65; Gd = 64; Pm = 61) (A) Sm

- (B) Eu
- (C) Tb
- (D) Gd
- (E) Pm

Choose the correct answer from the options given below:

- (1) B and D only
 - (2) A and E only
 - (3) A and D only
 - (4) C and D only
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20. In Dumas method for the estimation of N_2 , the sample is heated with copper oxide and the gas evolved is passed over:

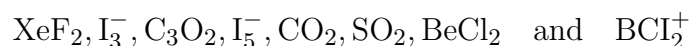
- (1) Ni
 - (2) Copper gauze
 - (3) Pd
 - (4) Copper oxide
-

Section-B

21. If the CFSE of $[Ti^{3+}(H_2O)_6]^{3+}$ is -96.0 kJ/mol, this complex will absorb maximum at wavelength __ nm. (nearest integer)

Assume Planck's constant $h = 6.4 \times 10^{-34}$ J s, speed of light $c = 3.0 \times 10^8$ m/s, and Avogadro's constant $N_A = 6 \times 10^{23}$ mol⁻¹.

22. Amongst the following, the number of species having the linear shape is:

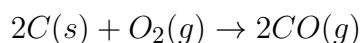


23. The resistivity of a 0.8 M solution of an electrolyte is $5 \times 10^{-3} \Omega \text{ cm}$. Its molar conductivity is $__ \times 10^4 \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$ (Nearest integer).

24. At 298 K, the solubility of silver chloride in water is $1.434 \times 10^{-3} \text{ g L}^{-1}$. The value of $-\log K_{\text{sp}}$ for silver chloride is:
(Given mass of Ag is 107.9 g mol^{-1} and mass of Cl is 35.5 g mol^{-1})

25. A sample of a metal oxide has formula $M_{0.83}O_{1.00}$. The metal M can exist in two oxidation states +2 and +3. In the sample of $M_{0.83}O_{1.00}$, the percentage of metal ions existing in the +2 oxidation state is __ % (nearest integer).

26. Assume carbon burns according to the following equation:

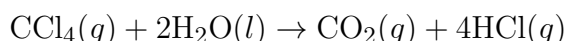


When 12 g of carbon is burnt in 48 g of oxygen, the volume of carbon monoxide produced is $_ \times 10^{-1} \text{ L}$ at STP (nearest integer).

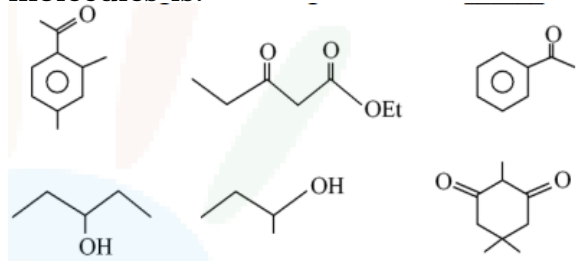
Given: Assume CO as ideal gas, Mass of C is 12 g mol^{-1} , Mass of O is 16 g mol^{-1} , and molar volume of an ideal gas at STP is 22.7 L mol^{-1} .

27. The number of alkali metal(s), from Li, K, Cs, Rb having ionization enthalpy greater than 400 kJ mol^{-1} and forming stable super oxides is __

28. Enthalpies of formation of $\text{CCl}_4(g)$, $\text{H}_2\text{O}(l)$, $\text{CO}_2(g)$ and $\text{HCl}(g)$ are -105, -242, -394, and -92 kJ/mol respectively. The magnitude of enthalpy of the reaction given below is __ kJ/mol (nearest integer):



29. The number of molecules which gives haloform test among the following molecules is:



30. The rate constant for a first order reaction is 20 min^{-1} . The time required for the initial concentration of the reactant to reduce to its $\frac{1}{32}$ level is $_ \times 10^{-2} \text{ min}$. (Nearest integer) (Given: $\ln 10 = 2.303$, $\log 2 = 0.3010$)
