Learne2i most important questions for JEE Mains 2025 April Session

Welcome to this curated collection of questions designed to reflect key concepts and high-priority topics from past JEE Mains examinations. While these samples aim to highlight recurring themes, they are not exact replicas—the JEE ensures originality in every paper.

Subject Insights

- Mathematics: Strongest predictive patterns due to structured problem-solving frameworks.
- Physics: Moderate consistency in thematic approaches (e.g., mechanics, electromagnetism).
- Chemistry: Least predictable trends, given its diverse topics and experimental formats.

Study Smart

- Master core principles, not just questions.
- Practice varied formats to adapt to new problem structures.
- Use this as a guide, not a substitute for comprehensive preparation.

Disclaimer for Predicted Questions in JEE Mains

The following set of questions has been curated as part of an analytical study aimed at identifying patterns and trends in past JEE Mains examinations. These questions are intended to serve as **sample questions** or representations of **important topics** that have historically appeared in the exam. It is crucial to understand that while these questions provide valuable insight into the types of problems that may be encountered, they are not exact replicas nor guaranteed predictions of future examination content. Instead, they are designed to highlight **key concepts** and areas of focus that students should prioritize during their preparation.

Nature of Predictions and Their Limitations

The methodology behind this analysis involves identifying similarities among questions from previous years, focusing on recurring themes, concepts, and problem-solving approaches. However, it is essential to note that:

1. **Questions will not be repeated verbatim**: JEE Mains strictly adheres to a policy of non-repetition in its question papers. The questions provided here are not exact duplicates but are conceptually similar to those seen in past exams. Students should use them as a tool for understanding the underlying principles and problem-solving techniques rather than expecting identical questions in the future.
2. **Focus on conceptual understanding**: The similarity analysis primarily emphasizes thematic connections between questions rather than their specific wording or structure. This means that while certain topics may appear repeatedly in different forms, the way they are presented can vary significantly. To succeed, students must develop a deep understanding of the concepts behind these sample questions.
3. **Subject-specific variability in prediction accuracy**: The effectiveness of these predictions varies across subjects:
    - **Mathematics**: The predictive accuracy for mathematics is notably higher due to the structured nature of mathematical problems and their reliance on well-defined concepts and formulae. Students can expect a closer alignment between sample questions and exam trends in this subject.
    - **Physics**: Predictions for physics exhibit moderate accuracy. While many physics problems share common themes (e.g., mechanics, electromagnetism), variations in question framing and numerical details can introduce unpredictability.
    - **Chemistry**: Chemistry demonstrates the lowest predictive accuracy due to its diverse range of topics, including organic reactions, inorganic properties, and physical chemistry calculations. The subject's variability makes it challenging to identify consistent patterns across years.

Recommendations for Students

To maximize the utility of these sample questions, students are advised to adopt the following approach:

- **Study the concepts thoroughly**: Treat each question as a gateway to understanding broader concepts rather than an isolated problem. For example, if a question pertains to integration techniques in mathematics or electrostatics principles in physics, focus on mastering those areas comprehensively.
- **Practice applying concepts in varied scenarios**: Since examiners often reframe similar ideas in different ways, students should practice solving problems across multiple formats and difficulty levels within each topic.
- **Do not rely solely on predictions**: While these sample questions provide valuable guidance, they should not replace a complete study plan or comprehensive syllabus coverage. JEE Mains is designed to test a student's grasp of fundamental principles across all topics in the syllabus.
- **Pay attention to weak areas**: Given the variability in prediction accuracy across subjects, students may need to allocate additional time and effort toward subjects like chemistry where trends are less predictable.

Final Note

The sample questions provided here are meant to assist students in identifying high-priority topics and honing their problem-solving skills. However, success in JEE Mains requires more than familiarity with past trends; it demands a robust understanding of core concepts, consistent practice, and adaptability to new challenges. Students are encouraged to use these resources responsibly as part of a balanced preparation strategy that includes textbooks, reference materials, coaching guidance, and mock tests.

By focusing on conceptual clarity and disciplined preparation, students can build the confidence and skills necessary to tackle any variation of questions presented in the examination effectively.

Important Notice: *This material does not include any questions related to Organic Chemistry.*

Question 1: For silver, $C_p(JK^{-1}\,mol^{-1}) = 23 + 0.01\,T$. If the temperature T of 3 moles of silver is raised from 300 K to 1000 K at 1 atm pressure, the value of ΔH will be close to:
Option: (1) 16 kJ
Option: (2) 62 kJ
Option: (3) 13 kJ
Option: (4) 21 kJ
Question 2: The covalent alkaline earth metal halide $X = Cl, Br, I$ is:
Option: (1) CaX_2
Option: (2) MgX_2
Option: (3) SrX_2
Option: (4) BeX_2
Question 3: The structures of beryllium chloride in the solid state and vapour phase, respectively, are:
Option: (1) chain and chain
Option: (2) dimeric and chain
Option: (3) chain and dimeric
Option: (4) dimeric and dimeric
Question 4: The correct statements among I to III regrading group 13 element oxides are,
(I) Boron trioxide is acidic.
(II) Oxides of aluminum and gallium are amphoteric.
(III) Oxides of indium and thallium are basic.
Option: (1) (I) and (III) only
Option: (2) (I) and (II) only
Option: (3) (I), (II) and (III)
Option: (4) (II) and (III) only
Question 5: If the standard electrode potential for a cell is $2V$ at $300K$, the equilibrium constant (K) for the reaction. $Zn(s) + Cu^{2+}(aq) \rightleftharpoons Zn^{2+}(aq) + Cu(s)$ at 300 K is approximately:
($R = 8JK^{-1}\,mol^{-1}, F = 96000Cmol^{-1}$)
Option: (1) e^{-160}
Option: (2) e^{-80}
Option: (3) e^{160}
Option: (4) e^{320}
Question 6: A mixture of 100 m mol of $Ca(OH)_2$ and 2 g of sodium sulphate was dissolved in water and the volume was made up to 100 mL . What is the mass of calcium sulphate formed and the concentration of OH^-in resulting solution, respectively? (Molar mass of $Ca(OH)_2, Na_2SO_4$ and $CaSO_4$ are 74,143 and 136 $g\,mol^{-1}$, respectively; K_{sp} of $Ca(OH)_2$ is 5.5×10^{-6})
Option: (1) 1.9 g, 0.14 $mol\,L^{-1}$
Option: (2) 13.6 g, 0.28 $mol\,L^{-1}$
Option: (3) 1.9 g, 0.28 $mol\,L^{-1}$
Option: (4) 13.6 g, 0.14 $mol\,L^{-1}$
Question 7: Which hydrogen in compound (E) is easily replaceable during bromination reaction in presence of light ?
Option: (1) β-hydrogen

Option: (2) δ-hydrogen
Option: (3) α-hydrogen
Option: (4) γ - hydrogen
Question 8: Among the following reactions of hydrogen with halogens, the one that requires a catalyst is:
Option: (1) $H_2 + Cl_2 \rightarrow 2HCl$
Option: (2) $H_2 + I_2 \rightarrow 2HI$
Option: (3) $H_2 + F_2 \rightarrow 2HF$
Option: (4) $H_2 + Br_2 \rightarrow 2HBr$
Question 9: If a reaction follows the Arrhenius equation, the plot $lnkvs\frac{1}{(RT)}$ gives straight line with a gradient $(-y)$ unit. The energy required to activate the reactant is:
Option: (1) y/R unit
Option: (2) y unit
Option: (3) yR unit
Option: (4) $-y$ unit
Question 10: The hydride that is NOT electron deficient is:
Option: (1) SiH_4
Option: (2) B_2H_6
Option: (3) GaH_3
Option: (4) AlH_3
Question 11: The reaction $2X \rightarrow B$ is a zeroth order reaction. If the initial concentration of X is 0.2 M , the half-life is 6 h .
When the initial concentration of X is 0.5 M , the time required to reach its final concentration of 0.2 M will be
Option: (1) 9.0 h
Option: (2) 12.0 h
Option: (3) 18.0 h
Option: (4) 7.2 h
Question 12: Two solids dissociate as follows:

$$A(s) \rightleftharpoons B(g) + C(g); K_{P_1} = xatm^2$$
$$D(s) \rightleftharpoons C(g) + E(g); K_{P_2} = yatm^2$$

The total pressure when both the solids dissociate simultaneously is:
Option: (1) $\sqrt{x+y}$ atm
Option: (2) $x^2 + y^2\ atm$
Option: (3) $(x+y)$ atm
Option: (4) $2\left(\sqrt{x+y}\right)$ atm
Question 13: Consider that d^6 metal ion (M^{2+}) forms a complex with aqua ligands, and the spin only magnetic moment of the complex is 4.90 BM . The geometry and the crystal field stabilization energy of the complex is :
Option: (1) octahedral and $-2.4\Delta_0 + 2P$
Option: (2) tetrahedral and -0.6 Δ_t
Option: (3) octahedral and $-1.6\Delta_0$
Option: (4) tetrahedral and $-1.6\Delta_t + 1P$

Question 14: A mixture of one mole each of H_2, He and O_2 each are enclosed in a cylinder of volume V at temperature T . If the partial pressure of H_2 is 2 atm , the total pressure of the gases in the cylinder is:
Option: (1) 6 atm
Option: (2) 38 atm
Option: (3) 14 atm
Option: (4) 22 atm
Question 15: The increasing order of the reactivity of the following compounds in nucleophile addition reaction is:
Propanal, Benzaldehyde, Propanone, Butanone
Option: (1) Benzaldehyde > Butanone < Propanone < Propanal
Option: (2) Butanone < Propanone < Benzaldehyde < Propanal
Option: (3) Propanal < Propanone < Butanone < Benzaldehyde
Option: (4) Benzaldehyde < Propanal < Propanone < Butanone
Question 16: The incorrect statement(s) among (a) - (c) is (are) :
(a) $W(VI)$ is more stable than $Cr(VI)$.
(b) in the presence of HCl , permanganate titrations provide satisfactory results.
(c) some lanthanoid oxides can be used as phosphors
Option: (1) (b) and (c) only
Option: (2) (a) and (b) only
Option: (3) (b) only
Option: (4) (a) only
Question 17: The one that is NOT suitable for the removal of permanent hardness of water is :
Option: (1) Clark's method
Option: (2) Ion-exchange method
Option: (3) Calgon's method
Option: (4) Treatment with sodium carbonate
Question 18: The bond order and the magnetic characteristic of CN^- are
Option: (1) $2\frac{1}{2}$, diamagnetic
Option: (2) 3 , diamagnetic
Option: (3) 3 , paramagnetic
Option: (4) $2\frac{1}{2}$, paramagnetic
Question 19: Consider the following reactions:
$NaCl + K_2Cr_2O_7 + (Conc.)H_2SO_4 \rightarrow (A) +$ side products
$(A) + NaOH \rightarrow (B) +$ side products
$(B) + (dilute)H_2SO_4 + H_2O_2 \rightarrow (C) +$ side products
The sum of the total number of atoms in one molecule each of (A), (B) and (C) is
Question 20: The correct order of the calculated spin-only magnetic moments of complexes (A) to (D) is:
(A) $Ni(CO)_4$
(B) $[Ni(H_2O)_6]Cl_2$
(C) $Na_2[Ni(CN)_4]$
(D) $PdCl_2(PPh_3)_2$
Option: (1) $(A) \approx (C) < (B) \approx (D)$
Option: (2) $(C) < (D) < (B) < (A)$
Option: (3) $(C) \approx (D) < (B) < (A)$

Option: (4) $(A) \approx (C) \approx (D) < (B)$

Question 21: The true statement amongst the following is:

Option: (1) Both ΔS and S are functions of temperature.

Option: (2) Both S and ΔS are not functions of temperature

Option: (3) S is not a function of temperature but ΔS is a function of temperature

Option: (4) S is a function of temperature but ΔS is not a function of temperature

Question 22: If 80 g of copper sulphate $CuSO_4 \cdot 5\,H_2O$ is dissolved in deionised water to make 5 L of solution. The concentration of the copper sulphate solution is $x \times 10^{-3}\ mol^{-1}$. The value of x is .[0pt]

[Atomic masses Cu : $63.54u, S: 32u, O: 16u, H: 1u$]

Question 23: Given below are two statements:

Statement I : H_2O_2 can act as both oxidising and reducing agent in basic medium.

Statement II : In the hydrogen economy, the energy is transmitted in the form of dihydrogen. In the light of the above statements, choose the correct answer from the options given below:

Option: (1) Both statement I and statement II are false

Option: (2) Both statement I and statement II are true

Option: (3) Statement I is true but statement II is false

Option: (4) Statement I is false but statement II is true

Question 24: $2MnO_4^- + bC_2O_4^{2-} + cH^+ \rightarrow xMn^{2+} + yCO_2 + z_2O$

If the above equation is balanced with integer coefficients, the value of c is . (Round off to the Nearest Integer).

Question 25: In Duma's method of estimation of nitrogen, 0.1840 g of an organic compound gave 30 mL of nitrogen collected at 287 K and 758 mm of Hg pressure. The percentage composition of nitrogen in the compound is

. (Round off to the Nearest Integer).[0pt]

[Given : Aqueous tension at $287\ K = 14\ mm$ of Hg]

Question 26: A and B decompose via first order kinetics with half-lives 54.0 min and 18.0 min respectively. Starting from an equimolar non-reactive mixture of A and B , the time taken for the concentration of A to become 16 times that of B is min. (Round off to the Nearest Integer).

Question 27: The mole fraction of a solute in a 100 molal aqueous solution $\times 10^{-2}$.

(Round off to the Nearest Integer).[0pt]

[Given : Atomic masses: $H: 1.0u, O: 16.0u$]

Question 28: The standard enthalpies of formation of Al_2O_3 and CaO are $-1675\ kJ\ mol^{-1}$ and $-635\ kJ\ mol^{-1}$ respectively.

For the reaction

$3CaO + 2Al \rightarrow 3Ca + Al_2O_3$ the standard reaction enthalpy $\Delta_r H^0 =$ kJ .

(Round off to the Nearest Integer).

Question 29: According to the valence bond theory the hybridization of central metal atom is dsp ^{2} for which one of the following compounds?

Option: (1) $NiCl_2 \cdot 6\,H_2O$

Option: (2) $K_2[Ni(CN)_4]$

Option: (3) $[Ni(CO)_4]$

Option: (4) $Na_2[NiCl_4]$

Question 30: Which one of the following gases is reported to retard photosynthesis?

Option: (1) CO

Option: (2) CFCs

Option: (3) CO_2
Option: (4) NO_2
Question 31: Which of the following molecules does not show stereo isomerism?
Option: (1) 3, 4-Dimethylhex-3-ene
Option: (2) 3-Methylhex-1-ene
Option: (3) 3-Ethylhex-3-ene
Option: (4) 4-Methylhex-1-ene
Question 32: Which one of the following group-15 hydride is the strongest reducing agent?
Option: (1) AsH_3
Option: (2) BiH_3
Option: (3) PH_3
Option: (4) SbH_3
Question 33: If a compound AB dissociates to the extent of 75% in an aqueous solution, the molality of the solution which shows a 2.5 K rise in the boiling point of the solution is molal. (Rounded-off to the nearest integer) [$K_b = 0.52\ K\ kg\ mol^{-1}$].
Question 34: CO_2 gas is bubbled through water during a soft drink manufacturing process at 298 K . If CO_2 exerts a partial pressure of 0.835 bar then x mol of CO_2 would dissolve in 0.9 L of water. The value of x is . (Nearest integer)
(Henry's law constant for CO_2 at 298 K is 1.67×10^3 bar)
Question 35: An accelerated electron has a speed of $5 \times 10^6\ ms^{-1}$ with an uncertainty of 0.02%. The uncertainty in finding its location while in motion is $x \times 10^{-9}\ m$.
The value of x is . (Nearest integer)[0pt]
[Use mass of electron $= 9.1 \times 10^{-31}\ kg$,
$h = 6.63 \times 10^{-34} Js, \pi = 3.14$]
Question 36:
Chlordiazepoxide
The class of drug to which chlordiazepoxide with above structure belongs is :
Option: (1) Analgesic
Option: (2) Tranquillizer
Option: (3) Antacid
Option: (4) Antibiotic
Question 37: Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A) : Heavy water is used for the study of reaction mechanism.
Reason (R): The rate of reaction for the cleavage of $O-H$ bond is slower than that of $O-D$ bond. Choose the most appropriate answer from the options given below :
Option: (1) Both (A) and (R) are true and (R) is the true explanation of (A).
Option: (3) (A) is false but (R) is true.
Option: (2) (A) is true but (R) is false.
Option: (4) Both (A) and (R) are true but (R) is not the true explanation of (A).
Question 38: Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A): Barium carbonate is insoluble in water and is highly stable.
Reason (R): The thermal stability of the carbonates increases with increasing cationic size.
Choose the most appropriate answer from the options given below :
Option: (1) (A) is true but (R) is false.
Option: (2) Both (A) and (R) are true.

Option: (3) (A) is false but (R) is true.
Option: (4) Both (A) and (R) are false.
Question 39: If the activation energy of a reaction is $80.9\ kJ\ mol^{-1}$, the fraction of molecules at 700 K , having enough energy to react to form products is e^{-x}. The value of x is (Rounded off to the nearest integer) [Use $R = 8.31\ J\ K^{-1}\ mol^{-1}$]
Question 40: Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A) : Synthesis of ethyl phenyl ether may be achieved by Williamson synthesis.
Reason (R): Reaction of bromobenzene with sodium ethoxide yields ethyl phenyl ether.
In the light of the above statements, choose the most appropriate answer from the options given below.
Option: (1) Both (A) and (R) are correct but (R) is NOT the
Option: (2) (A) is correct but (R) is not correct correct explanation of (A)
Option: (3) (A) is not correct but (R) is correct
Option: (4) Both (A) and (R) are correct and (R) is the correct explanation of (A)
Question 41: Which one of the following is used to remove most of plutonium from spent nuclear fuel?
Option: (1) BrO_3
Option: (2) I_2O_5
Option: (3) ClF_3
Option: (4) $O_2\ F_2$
Question 42: If the Thomson model of the atom was correct, then the result of Rutherford's gold foil experiment would have been:
Option: (1) All of the α-particles pass through the gold foil without decrease in speed.
Option: (3) All α-particles get bounced back by $180°$.
Option: (2) α-particles are deflected over a wide range of angles.
Option: (4) α-particles pass through the gold foil deflected by small angles and with reduced speed.
Question 43: Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Treatment of bromine water with propene yields 1-bromopropan-2-ol.
Reason (R) : Attack of water on bromonium ion follows Markovnikov rule and results in 1-bromopropan-2-ol.
In the light of the above statements, choose the most appropriate answer from the options given below :
Option: (1) Both (A) and (R) are true but (R) is NOT the correct explanation of (A).
Option: (2) (A) is false but (R) is true.
Option: (3) Both (A) and (R) are true and (R) is the correct explanation of (A).
Option: (4) (A) is true but (R) is false.
Question 44: In which one of the following sets all species show disproportionation reaction?
Option: (1) $ClO_4^-, MnO_4^-, ClO_2^-$ and F_2
Option: (2) $MnO_4^{2-}, ClO_2^-, Cl_2$ and Mn^{3+}
Option: (3) $Cr_2O_7^{2-}, MnO_4^-, ClO_2^-$ and Cl_2
Option: (4) ClO_2^-, F_2, MnO_4^- and $Cr_2O_7^{2-}$
Question 45: Two statements are given belwo :

Statement I : The melting point of monocarboxylic acid with even number of carbon atoms is higher than that of with odd number of carbon atoms acid immediately below and above it in the series.
Statement II : The solubility of monocarboxylic acids in water decreases with increase in molar mass.
Choose the most appropriate option :
Option: (1) Both Statement I and Statement II are correct.
Option: (2) Both Statement I and Statement II are incorrect.
Option: (3) Statement I is correct but Statement II is incorrect.
Option: (4) Statement I is incorrect but Statement II is correct.
Question 46: A 0.166 g sample of an organic compound was digested with conc. H_2SO_4 and then distilled with NaOH . The ammonia gas evolved was passed through 50.0 mL of $0.5NH_2SO_4$. The used acid required 30.0 mL of 0.25 N NaOH for complete neutralization. The mass percentage of nitrogen in the organic compound is
Question 47: Hex-4-ene-2-ol on treatment with PCC gives 'A'. 'A' on reaction with sodium hypoiodite gives ' B ', which on further heating with soda lime gives ' C '. The compound ' C ' is
Option: (1) 2-pentene
Option: (2) proponaldehyde
Option: (3) 2-butene
Option: (4) 4-methylpent-2-ene
Question 48: PCl_5 dissociates as $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$5 moles of PCl_5 are placed in a 200 litre vessel which contains 2 moles of N_2 and is maintained at 600 K . The equilibrium pressure is 2.46 atm . The equilibrium constant K_p for the dissociation of PCl_5 is $\times 10^{-3}$. (nearest integer) (Given: $R = 0.082\ L\ atm\ K\ K^{-1}\ mol^{-1}$; Assume ideal gas behaviour)
Question 49: 0.2 g of an organic compound was subjected to estimation of nitrogen by Dumas method in which volume of N_2 evolved (at STP) was found to be 22.400 mL . The percentage of nitrogen in the compound is - [nearest integer] (Given: Molar mass of N_2 is $28\ g\ mol^{-1}$, Molar volume of N_2 at STP : 22.4 L)
Question 50: The number of sp^3 hybridised carbons in an acyclic neutral compound with molecular formula $C_4\,H_5\,N$ is
Question 51: Match List-I with List-II

List I	**List II**
A. Nylon 6, 6	III. Bristles of brushes
B. Low density polythene	IV. Toys
C. High density polythene	I. Buckets
D. Teflon	II. Non-stick utensils

Choose the correct answer from the options given below
Option: (1) A - III, B - I, C - IV, D - II
Option: (2) A - III, B - IV, C - I, D - II
Option: (3) A - II, B - I, C - IV, D - III
Option: (4) A - II, B - IV, C - I, D - III
Question 52: Number of electron deficient molecules among the following
$PH_3,\ B_2H_6, CCl_4, NH_3, LiH$ and BCl_3 is
Option: (1) 0
Option: (2) 1

Option: (3) 2
Option: (4) 3
Question 53: Match the following correctly

List I	List II
(i) Zymase	(b) Yeast
(ii) Urease	(d) Soyabean
(iii) Diastase	(c) Malt
(iv) Pepsin	(a) Stomach

Option: (1) (i)-B;(ii) D(iii)-C; (iv)-A
Option: (2) (i)-B; (ii)-A; (iii)-C; (iv)-D
Option: (3) (i)-A; (ii)-B; (iii)-C; (iv)-D
Option: (4) (i)-D; (ii)-C; (iii)-B; (iv)-A
Question 54: Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R. Assertion A : LiF is sparingly soluble in water. Reason R : The ionic radius of Li^{+}ion is smallest among its group members, hence has least hydration enthalpy.
In the light of the above statements, choose the most appropriate answer from the options given below.
Option: (1) Both A and R are true and R is the correct explanation of A
Option: (2) Both A and R are true but R is NOT the correct explanation of A
Option: (3) A is true but R is false
Option: (4) A is false but R is true
Question 55: $2NO + 2H_2 \rightarrow N_2 + 2\,H_2\,O$
The above reaction has been studied at $800^{\circ}C$. The related data are given in the table below
Reaction Data:

Reaction serial number	Initial pressure of H22 (kPa)	Initial pressure of NO (kPa)	Initial rate (−dp/dt)(−*dp*/*dt*) (kPa/s)
1	65.6	40.0	0.135
2	65.6	20.1	0.033
3	38.6	65.6	0.214
4	19.2	65.6	0.106

The order of the reaction with respect to NO is
Question 56: On the surface of polar stratospheric clouds, hydrolysis of chlorine nitrate gives A and B while its reaction with HCl produces B and C . A. B and C are, respectively
Option: (1) $HOCl, HNO_3, Cl_2$
Option: (2) $Cl_2, HNO_3, HOCl$
Option: (3) $HClO_2, HNO_2, HOCl$
Option: (4) $HOCl, HNO_2, C_2\,O$
Question 57: The metal salts formed during softening of hardwater using Clark's method are
Option: (1) $CaOH_2$ and $MgOH_2$
Option: (2) $CaCO_3$ and $MgOH_2$
Option: (3) $CaOH_2$ and $MgCO_3$
Option: (4) $CaCO_3$ and $MgCO_3$
Question 58: Given below are two statements :
Statement I : In polluted water values of both dissolved oxygen and BOD are very low.
Statement II : Eutrophication results in decrease in the amount of dissolved oxygen.

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

Option: (1) Both Statement I and Statement II are true

Option: (2) Both Statement I and Statement II are false

Option: (3) Statement I is true but Statement II is false

Option: (4) Statement I is false but Statement II is true

Question 59: For the given first order reaction $A \rightarrow B$ the half life of the reaction is 0.3010 min. The ratio of the initial concentration of reactant to the concentration of reactant at time 2.0 min will be equal to . (Nearest integer)

Question 60: Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R

Assertion A : Aniline on nitration yields ortho, meta \& para nitro derivatives of aniline.

Reason R : Nitrating mixture is a strong acidic mixture.

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

Option: (1) Both A and R are true and R is the correct explanation of A

Option: (2) Both A and R are true but R is NOT the correct explanation of A

Option: (3) A is true but R is false

Option: (4) A is false but R is true

Question 61: Nitrogen gas is obtained by thermal decomposition of:

Option: (1) $NaNO_2$

Option: (2) $NaNO_3$

Option: (3) $Ba(N_3)_2$

Option: (4) $Ba(NO_3)_2$

Question 62: Number of lone pairs of electrons in the central atom of SCl_2, O_3, ClF_3 and SF_6, respectively, are

Option: (1) 0,1,2&2

Option: (2) 2,1,2&0

Option: (3) 1,2,2&0

Option: (4) None of these

Question 63: When coal of purity 60% is allowed to burn in presence of insufficient oxygen, 60% of carbon is converted into ' CO ' and the remaining is converted into ' CO_2 '.

The heat generated when 0.6 kg of coal is burnt is

Option: (1) 1600 kJ

Option: (2) 3200 kJ

Option: (3) 4400 kJ

Option: (4) 6600 kJ

Question 64: In liquation process used for tin Sn , the metal

Option: (1) is reacted with acid

Option: (2) is dissolved in water

Option: (3) is brought to molten form which is made to flow

Option: (4) is fused with NaOH , on a slope

Question 65: Which of the following is NOT a natural polymer?

Option: (1) Protein

Option: (2) Starch

Option: (3) Rubber

Option: (4) Rayon

Question 66: Given below are two statements. One is labelled as Assertion A and the other is labelled as Reason R.
Assertion A : Amylose is insoluble in water.
Reason R : Amylose is a long linear molecule with more than 200 glucose units.
In the light of the above statements, choose the correct answer from the options given below.
Option: (1) Both A and R are correct and R is the correct explanation of A.
Option: (2) Both A and R are correct and R is NOT the correct explanation of A.
Option: (3) A is correct but R is not correct.
Option: (4) A is not correct but R is correct.
Question 67: Spin only magnetic moment of $[MnBr_6]^{4-}$ is B.M. (round off to the closest integer)
Question 68: In the given reaction
the number of sp^2 hybridised carbon (s) in compound $/X/$ is .
Question 69: Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R
Assertion A: In an Ellingham diagram, the oxidation of carbon to carbon monoxide shows a negative slope with respect to temperature.
Reason R: CO tends to get decomposed at higher temperature.
In the light of the above statements, choose the correct answer from the options given below
Option: (1) Both A and R are correct and R is the correct explanation of A
Option: (3) (3) Both A and R are correct but R is NOT the correct explanation of A
Option: (2) A is not correct but R is correct
Option: (4) A is correct but R is not correct
Question 70: At what pH , given half cell $MnO_4^-(0.1M) \mid Mn^{2+}(0.001M)$ will have electrode potential of 1.282 V ? (Nearest Integer)
Given $E^o_{MnO_4^-/Mn^{2+}} = 1.54\,V, \frac{2.303RT}{F} = 0.059\,V$
Question 71: Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) : Cu^{2+} in water is more stable than Cu^{+}.
Reason (R) : Enthalpy of hydration for Cu^{2+} is much less than that of Cu^{+}.
In the light of the above statements, choose the correct answer from the options given below :
Option: (1) Both (A) and (R) are correct and (R) is the
Option: (2) (A) is correct but (R) is not correct. correct explanation of (A).
Option: (3) (A) is not correct but (R) is correct.
Option: (4) Both (A) and (R) are correct but (R) is not the correct explanation of (A).
Question 72: The number of species having a square planar shape from the following is
$XeF_4, SF_4, SiF_4, BF_4^{--}, BrF_4^-, [Cu(NH_3)_4]^{2+}, [FeCl_4]^{2-}, [PtCl_4]^{2-}$
Question 73: Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.
Assertion A : Physical properties of isotopes of hydrogen are different.
Reason R : Mass difference between isotopes of hydrogen is very large.
In the light of the above statements, choose the correct answer from the options given below:
Option: (1) Both A and R are true and R is the correct explanation of A
Option: (3) A is true but R is false
Option: (2) A is false but R is true
Option: (4) Both A and R are true but R is NOT the correct explanation of A

Question 74: The maximum number of lone pairs of electron on the central atom from the following species is ClO_3^-, XeF_4, SF_4 and I_3^-

Question 75: A certain quantity of real gas occupies a volume of $0.15 dm^3$ at 100 atm and 500 K when its compressibility factor is 1.07 . Its volume at 300 atm and 300 K (When its compressibility factor is 1.4) is - ---- $\times 10^{-4} dm^3$ (Nearest integer)

Question 76:

The products formed in the above reaction are

Option: (1) One optically active and one meso product

Option: (2) Two optically inactive products

Option: (3) Two optically active products

Option: (4) One optically inactive and one meso product

Question 77: 0.400 g of an organic compound (X) gave 0.376 g of AgBr in Carius method for estimation of bromine. % of bromine in the compound (X) is (Given: Molar mass $AgBr = 188\ g\ mol^{-1} Br = 80\ g\ mol^{-1}$

Question 78: At 298 K , the standard reduction potential for Cu^{2+}/Cu electrode is 0.34 V . Given :

$spCuOH2 = 1 \times 10^{-20}$

Take $\frac{2.303RT}{F} = 0.059\ V$ The reduction potential at $pH = 14$ for the above couple is $(-)x \times 10^{-2}\ V$. The value of x is

Question 79: Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Beryllium has less negative value of reduction potential compared to the other alkaline earth metals

Reason R : Beryllium has large hydration energy due to small size of Be^{2+} but relatively large value of atomisation enthalpy.

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

Option: (1) A is correct but R is not correct

Option: (2) Both A and R are correct and R is the correct explanation of A

Option: (3) A is not correct but R is correct

Option: (4) Both A and R are correct and R is NOT the correct explanation of A

Question 80: Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R

Assertion A :- Carbon forms two important oxides CO and CO_2. CO is neutral whereas CO_2 is acidic in nature.

Reason R: CO_2 can combine with water in a limited way to form carbonic acid, while CO is sparingly soluble in water.

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

Option: (1) Both A and R are correct but R is NOT the correct explanation of A.

Option: (2) Both A and R are correct and R is the correct explanation of A.

Option: (3) A is not correct but R is correct.

Option: (4) A is correct but R is not correct.

Question 81. Match List I with List II.}

Choose the correct answer from the options given below :-

List I	List II

A. Propanamine and N-Methylethanamine	I. Metamers
B. Hexan-2-one and Hexan-3-one	II. Positional isomers
C. Ethanamide and Hydroxyethanimine	IV. Tautomers
D. o-nitrophenol and p-nitrophenol	III. Functional isomers

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

Question 82: Match List I with List II

List I	**List II**
A. [CoCl(NH3)5]2+[CoCl(NH3)5]2+	I. 310
B. [Co(NH3)6]3+[Co(NH3)6]3+	II. 475
C. [Co(CN)6]3−[Co(CN)6]3−	III. 535
D. [Cu(H2O)4]2+[Cu(H2O)4]2+	IV. 600

Choose the correct answer from the options given below :-
Option: (1) A - IV, B - I, C - III, D - II
Option: (2) A - III, B - II, C - I, D - IV
Option: (3) A - III, B - I, C - II, D - IV
Option: (4) A - II, B - III, C - IV, D - I

Question 83: Match List I with List II

List I (Amines)	**List II (pKb)**
A. Aniline	III. 9.38
B. Ethanamine	II. 3.00
C. N-Ethylethanamine	IV. 3.29
D. N, N-Diethylethanamine	I. 3.25

Choose the correct answer from the options given below:-
Option: (1) A-I, B-IV, C-II, D-III
Option: (2) A-III, B-II, C-I, D-IV
Option: (3) A-III, B-II, C-IV, D-I
Option: (4) A-III, B-IV, C-II, D-I

Question 84. Match List I with List II

List I (Name of polymer)	**List II (Uses)**
A. Glyptal	III. Paints and Lacquers
B. Neoprene	IV. Gaskets
C. Acrilan	II. Synthetic wool
D. LDP	I. Flexible pipes

Choose the correct answer from the options given below :-
Option: (1) A - III, B - II, C - IV, D - I
Option: (2) A - III, B - IV, C - II, D - I
Option: (3) A - III, B - IV, C - I, D - II
Option: (4) A - III, B - I, C - IV, D - II

Question 85: Number of cyclic tripeptides formed with 2 amino acids A and B is:
Option: (1) 2
Option: (2) 3
Option: (3) 5
Option: (4) 4

Question 86: Consider the cell

aq, $1M \mid Fe^{3+}$ aq, Fe^{2+} aq Pt s

When the potential of the cell is 0.712 V at 298 K , the ratio Fe^{2+}/Fe^{3+} is (Nearest integer)

Given: $Fe^{3+} + e^- = Fe^{2+}, E°Fe^{3+}, Fe^{2+}Pt = 0.771 \frac{2.303RT}{F} = 0.06\,V$

Question 87: $1\,L, 0.02M$ solution of $[Co(NH_3)_5SO_4]Br$ is mixed with $1\,L, 0.02M$ solution of $[Co\int_5 Br]SO_4$. 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:

1 L Solution (X) $+AgNO_3$ solution (excess) $\rightarrow Y$

1 L Solution (X) $+BaCl_2$ solution (excess) $\rightarrow Z$

The number of moles of Y and Z respectively are

Option: (1) 0.02,0.02

Option: (2) 0.01,0.01

Option: (3) 0.02,0.01

Option: (4) 0.01,0.02

Question 88: Given below are two statements:

Statement (I) : The NH_2 group in Aniline is ortho and para directing and a powerful activating group. Statement (II) : Aniline does not undergo FriedelCraft's reaction (alkylation and acylation).

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

Option: (1) Both Statement I and Statement II are correct

Option: (2) Both Statement I and Statement II are incorrect

Option: (3) Statement I is incorrect but Statement II is correct

Option: (4) Statement I is correct but Statement II is incorrect

Question 89: The potential for the given half cell at 298 K is $\times 10^{-2}\,V$.

$$2H^+_{(aq)} + 2e^- \rightarrow H_2(g)$$

$$H^+ = 1M, P_{H_2} = 2\,atm$$

(Given2.303 RT / F $= 0.06\,V, log2 = 0.3$)

Question 90: The number of unpaired d-electrons in $[Co(H_2O)_6]^{3+}$ is

Option: (1) 2

Option: (2) 1

Option: (3) 0

Option: (4) 4

Question 91: Vanillin compound obtained from vanilla beans, has total sum of oxygen atoms and π electrons is

Question 92: Number of σ and π bonds present in ethylene molecule is respectively :

Option: (1) 4 and 1

Option: (2) 5 and 2

Option: (3) 3 and 1

Option: (4) 5 and 1

Question 93:

List I (Pair of compounds)	List II (Isomerism)
A. n-propanol and Isopropanol	II. Chain Isomerism

B. Methoxypropane and ethoxyethane	I. Metamerism
C. Propanone and propanal	IV. Functional Isomerism
D. Neopentane and Isopentane	III. Position Isomerism

Choose the correct answer from the options given below :
Option: (1) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
Option: (2) (A)-(III), (B)-(I), (C)-(II), (D)-(IV)
Option: (3) (A)-(I), (B)-(III), (C)-(IV), (D)-(II)
Option: (4) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
Question 94: Total number of species from the following with central atom utilising sp^2 hybrid orbitals for bonding is
. $NH_3, SO_2, SiO_2, BeCl_2, C_2H_2, C_2H_4, BCl_3, HCHO, C_6H_6, BF_3, C_2H_4Cl_2$
Question 95: Number of molecules from the following which are exceptions to octet rule is
$CO_2, NO_2, H_2SO_4, BF_3, CH_4, SiF_4, ClO_2, PCl_5, BeF_2, C_2H_6, CHCl_3, CBr_4$
Question 96: The total number of species from the following in which one unpaired electron is present, is $N_2, O_2, C_2^-, O_2^-, O_2^{2-}, H_2^+, CN^-, He_2^+$
Question 97: Number of ambidentate ligands among the following is
$NO_2^-, SCN^-, C_2O_4^{2-}, NH_3, CN^-, SO_4^{2-}, \mathrm{H_2}\,O$.
Question 98:
Match List I with List II

List I	**List II**
A. K2[Ni(CN)4]*K*2[Ni(CN)4]	I. sp3*sp*3
B. [Ni(CO)4][Ni(CO)4]	II. sp3d2*sp*3*d*2
C. [Co(NH3)6]Cl3[Co(NH3)6]Cl3	III. dsp2*dsp*2
D. Na3[CoF6]Na3[CoF6]	IV. d2sp3*d*2*sp*3

Choose the correct answer from the options given below:
Option: (1) A-III, B-I, C-IV, D-II
Option: (2) A-III, B-I, C-II, D-IV
Option: (3) A-I, B-III, C-II, D-IV
Option: (4) A-III, B-II, C-IV, D-I
Question 99: In chromyl chloride test for confirmation of Cl^-ion, a yellow solution is obtained. Acidification of the solution and addition of amyl alcohol and $10\%H_2O_2$ turns organic layer blue indicating formation of chromium pentoxide. The oxidation state of chromium in that is
Option: (1) +6
Option: (2) +5
Option: (3) +10
Option: (4) +3
Question 100: In alkaline medium. MnO_4^-oxidises $I^-$to
Option: (1) IO_4^-
Option: (2) IO^-
Option: (3) I_2
Option: (4) IO_3^-
Question 101: In which one of the following metal carbonyls, CO forms a bridge between metal atoms?
Option: (1) $[Co_2(CO)_8]$
Option: (2) $[Mn_2(CO)_{10}]$

Option: (3) $[Os_3(CO)_{12}]$
Option: (4) $[Ru_3(CO)_{12}]$
Question 102: Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R :
Assertion A : Aryl halides cannot be prepared by replacement of hydroxyl group of phenol by halogen atom.
Reason R : Phenols react with halogen acids violently.
In the light of the above statements, choose the most appropriate from the options given below:
Option: (1) Both A and R are true but R is NOT the correct explanation of A
Option: (3) A is true but R is false
Option: (2) A is false but R is true
Option: (4) Both A and R are true and R is the correct explanation of A
Question 103: Given below are the two statements: one is labeled as Assertion (A) and the other is labeled as Reason (R).
Assertion (A): There is a considerable increase in covalent radius from N to P. However from As to Bi only a small increase in covalent radius is observed.
Reason (R): covalent and ionic radii in a particular oxidation state increases down the group.
In the light of the above statement, choose the most appropriate answer from the options given below:
Option: (1) (A) is false but (R) is true
Option: (2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
Option: (3) (A) is true but (R) is false
Option: (4) Both (A) and (R) are true and (R) is the correct explanation of (A)
Question 104: A and B formed in the following reactions are:

$$CrO_2Cl_2 + 4NaOH \rightarrow A + 2NaCl + 2\,H_2O$$
$$A + 2HCl + 2H_2O_2 \rightarrow B + 3\,H_2O$$

Option: (1) $A = Na_2CrO_4, B = CrO_5$
Option: (2) $A = Na_2Cr_2O_4, B = CrO_4$
Option: (3) $A = Na_2Cr_2O_7, B = CrO_3$
Option: (4) $A = Na_2Cr_2O_7, B = CrO_5$
Question 105: Alkaline oxidative fusion of MnO_2 gives " A " which on electrolytic oxidation in alkaline solution produces
B . A and B respectively are:
Option: (1) Mn_2O_7 and MnO_4^-
Option: (2) MnO_4^{2-} and MnO_4^-
Option: (3) Mn_2O_3 and MnO_4^{2-}
Option: (4) MnO_4^{2-} and Mn_2O_7
Question 106: The four quantum numbers for the electron in the outer most orbital of potassium (atomic no. 19) are
Option: (1) $n = 4, l = 2, m = -1, s = +\frac{1}{2}$
Option: (2) $n = 4, l = 0, m = 0, s = +\frac{1}{2}$
Option: (3) $n = 3, l = 0, m = -1, s = +\frac{1}{2}$
Option: (4) $n = 2, l = 0, m = 0, s = +\frac{1}{2}$
Question 107:

List I (Partial Derivatives)	List II

A. $(\partial G \partial T)P(\partial T \partial G)P$	II. $-S-S$
B. $(\partial H \partial T)P(\partial T \partial H)P$	I. $CpCp$
C. $(\partial G \partial P)T(\partial P \partial G)T$	IV. VV
D. $(\partial U \partial T)V(\partial T \partial U)V$	III. $CvCv$

Match List - I with List - II.
Choose the correct answer from the options given below :
Option: (1) (A)-(II), (B)-(I),(C)-(III), (D)-(IV)
Option: (2) (A)-(I), (B)-(II), (C)-(IV), (D)-(III)
Option: (3) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
Option: (4) (A)-(II), (B)-(III), (C)-(I), (D)-(IV)

Question 108: For a reaction, $N_2O_{5(g)} \rightarrow 2NO_{2(g)} + \frac{1}{2}O_{2(g)}$ in a constant volume container, no products were present initially. The final pressure of the system when 50% of reaction gets completed is
Option: (1) 5 times of initial pressure
Option: (2) $5/2$ times of initial pressure
Option: (3) $7/2$ times of initial pressure
Option: (4) $7/4$ times of initial pressure

Question 109: Match the LIST-I with LIST-II

List I (Redox Reaction)	**List II (Type of Redox Reaction)**
A. CH4(g)+2O2(g)→CO2(g)+2H2O(l)CH4(g)+2O2(g)→CO2(g)+2H2O(l)	I. Disproportionation reaction
B. 2NaH(s)→2Na(s)+H2(g)2NaH(s)→2Na(s)+H2(g)	II. Combination reaction
C. V2O5(s)+5Ca(s)→2V(s)+5CaO(s)V2O5(s)+5Ca(s)→2V(s)+5CaO(s)	III. Decomposition reaction
D. 2H2O2(aq)→O2(g)+2H2O(l)2H2O2(aq)→O2(g)+2H2O(l)	IV. Displacement reaction

Choose the correct answer from the options given below:
Option: (1) A-II, B-III, C-I, D-IV
Option: (2) A-III, B-IV, C-I, D-II
Option: (3) A-IV, B-I, C-II, D-III
Option: (4) A-II, B-III, C-IV, D-I

Question 110: O_2 gas will be evolved as a product of electrolysis of : (A) an aqueous solution of $AgNO_3$ using silver electrodes. (B) an aqueous solution of $AgNO_3$ using platinum electrodes. (C) a dilute solution of H_2SO_4 using platinum electrodes. (D) a high concentration solution of H_2SO_4 using platinum electrodes. Choose the correct answer from the options given below :
Option: (1) (A) and (C) only
Option: (2) (B) and (C) only
Option: (3) (A) and (D) only
Option: (4) (B) and (D) only