JEE

Advanced With Main

48 + 143

Years (2025-1978)

Sets (2025-2019)

WITH RESPONSE TAGGING

Analyse the question-wise difficulty level in real-time with Correct (C), Wrong (W) and Unattempted (UA) questions response tagging provided by IIT-JEE

CHEMISTRY

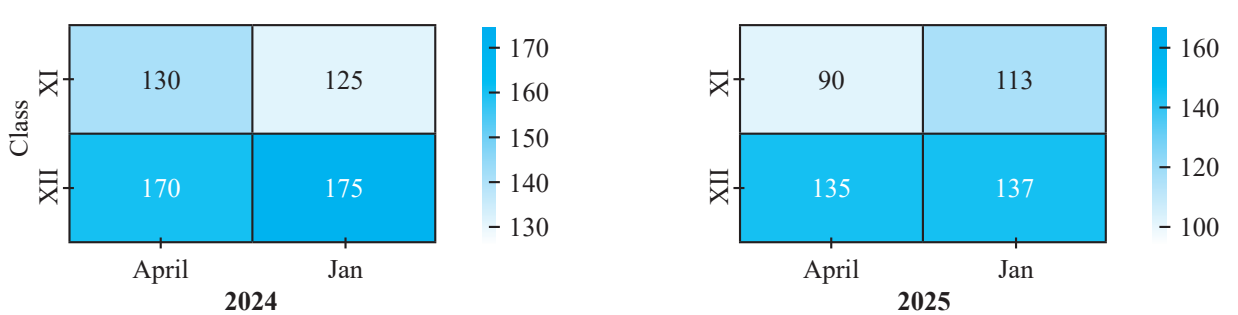
Chapter-wise & Topic-wise Solved Papers

ANSWER KEY VERIFIED FROM OFFICIAL ANSWER KEYS

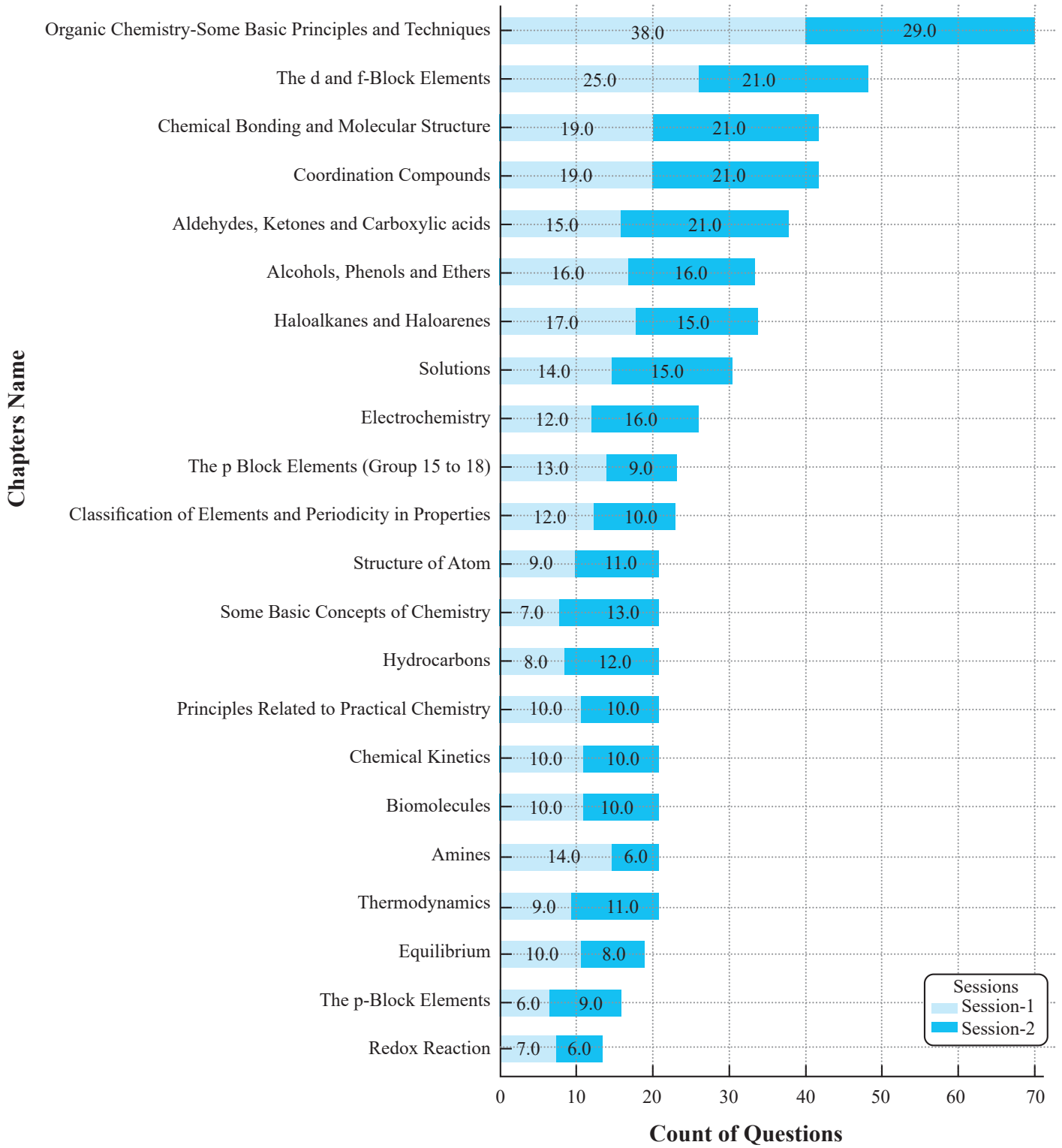
Chapter-wise Weightage Analysis

	Chapter Name	Jan	April
50% Questions Asked from these 8 chapters	Organic Chemistry-Some Basic Principles and Techniques	20	20
	Coordination Compounds	18	22
	Aldehydes, Ketones and Carboxylic Acids	15	18
	Thermodynamics	15	15
	Equilibrium	17	10
	Solutions	11	16
	Chemical Kinetics	12	13
	The d and f-Block Elements	15	9
	Electrochemistry	14	9
	Some Basic Concepts of Chemistry	11	11
	Biomolecules	11	11
	Haloalkanes and Haloarenes	14	7
	Classification of Elements and Periodicity in Properties	14	6
	Structure of Atom	10	9
	Hydrocarbons	13	6
	Amines	10	9
	Alcohols, Phenols and Ethers	8	7
	Chemical Bonding and Molecular Structure	8	6
	Principles Related to Practical Chemistry	5	8
	The p-Block Elements (Group 15 to 18)	4	6
	The p-Block Elements	2	7
	Redox Reactions	3	0

Class-wise Distribution of Question



Chapters Count Per Session-2024



Focus Variability: The number of questions on "Coordination Compounds" increased from Session-1 to Session-2, indicating a shift in emphasis, while "The d and f-Block Elements" and "Solutions" saw a reduction.

Consistent Topics: Chapters like "Aldehydes, Ketones and Carboxylic Acids" and "Amines" had a consistent question count across sessions, suggesting their steady importance in the curriculum.

JEE ADVANCED 2025 Paper Analysis

Paper 1

Section	Question Type	No. of Questions	Marks per Question	Negative marks per question	Total Marks (Section wise)
1	Single Correct MCQs	4	3	–1	12
2	More than One Correct MCQs	3	4	–2	12
3	Non Negative Integer Type Questions	6	4	0	24
4	Matrix Type Questions	3	4	–1	12
	Total Questions per subject	16			60

Paper 2

Section	Question Type	No. of Questions	Marks per Question	Negative marks per question	Total Marks (Section wise)
1	Single Correct MCQs	4	3	–1	12
2	More than One Correct MCQs	4	4	–2	16
3	Numerical Value Based Questions	8	4	0	32
	Total Questions per subject	16			60

Total No. of Questions in Part 1 = 48 Questions
Total No. of Questions in Part 2 = 48 Questions
Each Subject Carries = 60 Marks
Total Marks = 180

Paper Analysis

Paper Difficulty Compared to Last Year	Almost similar to 2024 Paper
Overall Difficulty Level of JEE 2025	
Easy	38%
Moderate	53%
Difficult	9%

Chemistry Topics	Paper 1 Difficulty Level	Paper 2 Difficulty Level	Comments/Remarks	
Physical	Paper 1 almost similar compared to last year	Paper 2 easy to moderate compared to last year		No questions from chapters-some baisc concepts of chemistry, atomic structure and redox reactions.
Inorganic	Almost similar	Almost similar	Only 3 questions from inorganic have been asked in 2025 Paper 2	No questions from chapter-classification of elements & periodicity in properties
Organic	Almost similar	Tougher to moderate		Combined topic Questions: 1 Medium question from [Polymers + Amines + GOC] and 1 hard question from [Hydrocarbons + Aldehydes + Haloalkanes + Ether]

Overall Analysis

Paper Difficulty Compared to Last Year
Easy to moderate Unequal distribution among Physical, Organic, Inorganic in paper 1, slightly more Questions from Inorganic in paper 2, slightly more Questions from Physical 1 question from paper 1 from organic chemistry was tough 2 questions in paper 1 were a bit tricky 5 questions from Paper 1 and 4 Question from paper 2 were very easy Rest of the questions were moderate Chemistry will decide the rank

JEE ADVANCED-6 Year (2024-19) Paper Analysis

Note: Due to unavailability of 2025 paper data we are unable to incorporate the 2025 analysis. As we are coming up with this book before the 2025 result.

Explanation of ★Unique★ Feature

C – Correct, W – Wrong, UA – Unattempted, PC – Partial Correct

C-31 W-22 UA-10 PC-36 represents the % of distribution of correct, wrong, unattempted and partial correct responses by students at any specific question in real time.(Data is taken from JEE Advanced website: https://jeeadv.ac.in/reports.html)

Classification helps students understand the varying **levels of difficulty**.

Easy	Medium	Hard
C > 20%	10% < C ≤ 20%	C ≤ 10%

For Example

22. Which of the following statement(s) is (are) correct regarding the root mean square speed (U_{rms}) and average translational kinetic energy (E_{av}) of a molecule in a gas at equilibrium?

C-31 W-22 UA-10 PC-36 (JEE Adv. 2019)

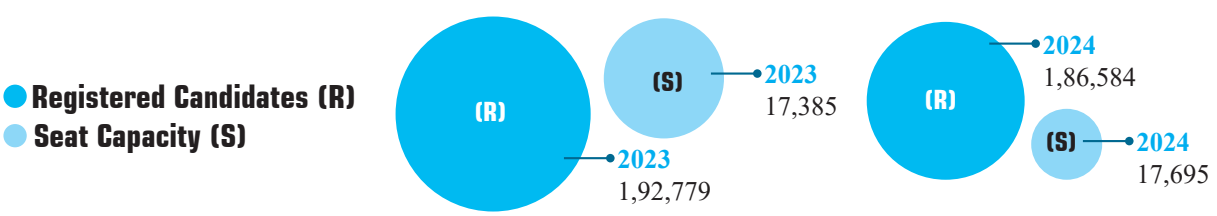
(*a*) U_{rms} is inversely proportional to the square root of its molecular mass

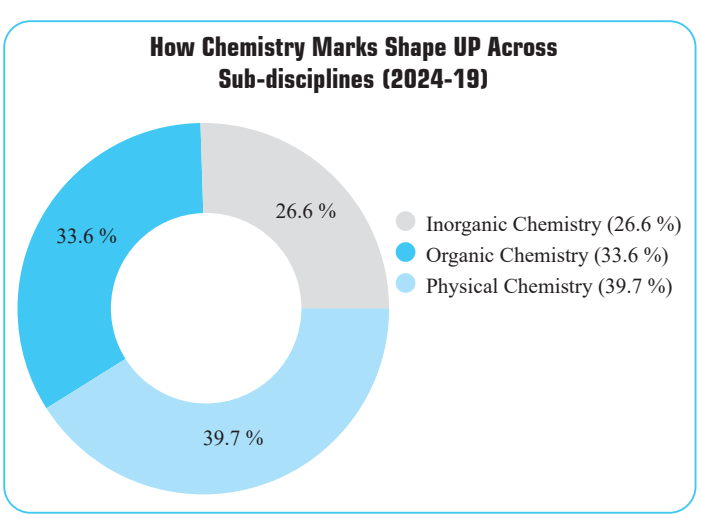
(*b*) U_{rms} is doubled when its temperature is increased four times

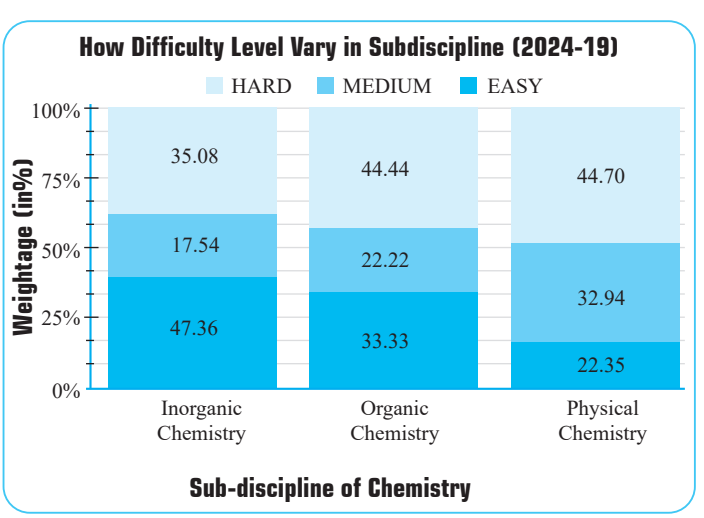
(*c*) E_{av} is doubled when its temperature is increased four times

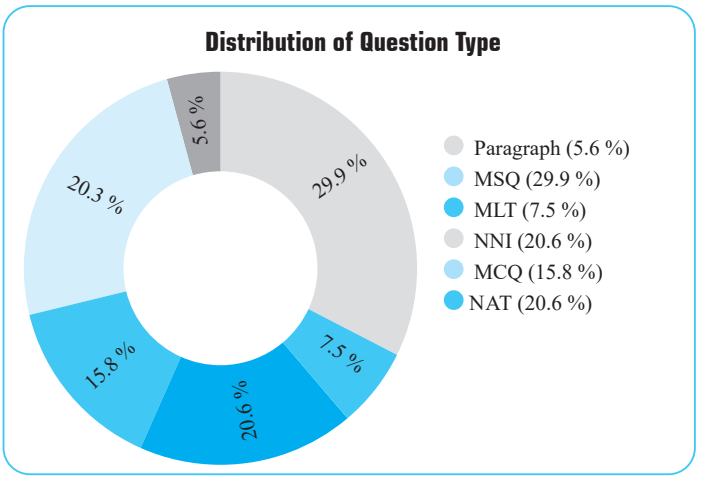
(*d*) E_{av} at a given temperature does not depend on its molecular mass

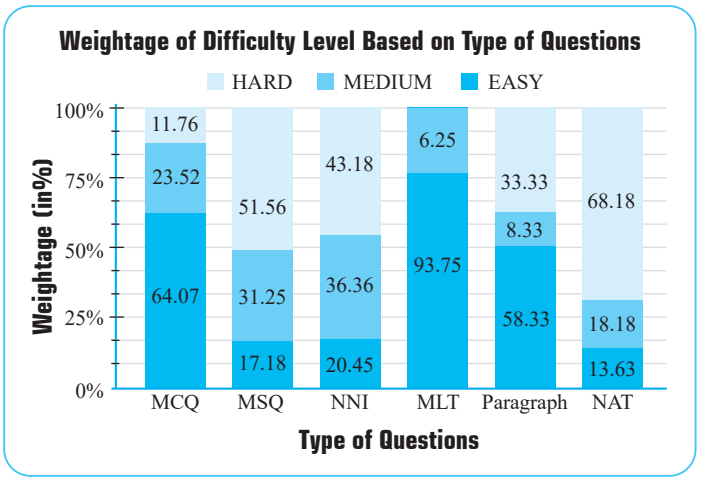
Question is considered EASY as Correct response recorded was greater than **20%**

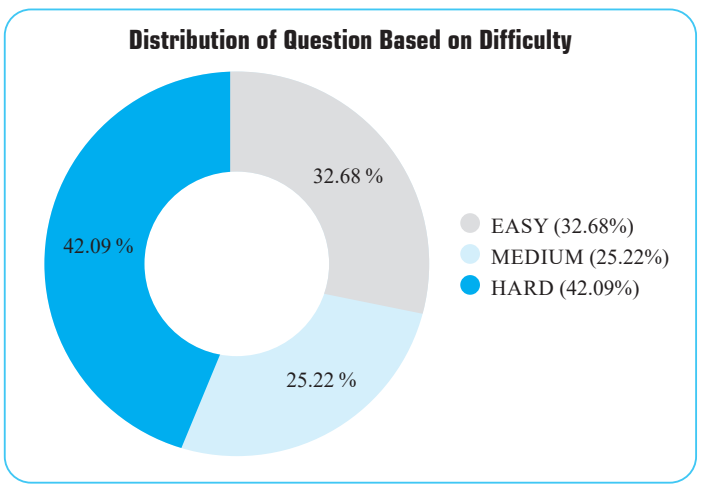


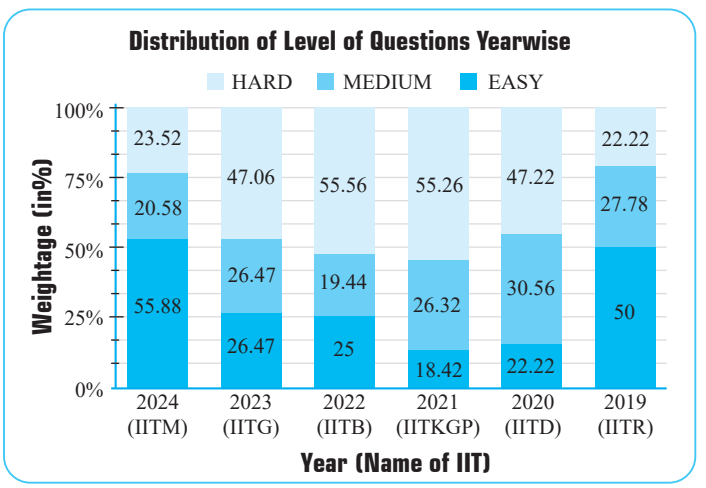












Chapter wise Weightage and count of Difficulty level of JEE Advanced Questions

Chapters Name	EASY	MEDIUM	HARD	Chapterwise Weightage(in %)
Aldehydes, Ketones and Carboxylic acids	6	4	10	**9.34**
Hydrocarbons	6	2	5	**6.07**
The d- and f-Block Elements and Qualitative analysis of Inorganic salts	6	3	5	**6.54**
Thermodynamics	0	5	7	**5.60**
The p-Block Elements (Group 15 to 18)	8	2	4	**6.54**
Electrochemistry	0	4	7	**5.14**
Equilibrium	0	2	7	**4.20**
Coordination Compounds	7	3	3	**6.07**
Amines	3	2	5	**4.67**
General Principles and Processes of Isolation of Elements	1	2	5	3.73
Chemical Kinetics	4	1	5	4.67
Organic Chemistry-Some Basic Principles and Techniques	2	2	4	3.73
Chemical Bonding and Molecular Structure	4	2	1	3.27
Biomolecules	3	2	3	3.73
Structure of Atom	4	2	2	3.73
Solutions	3	1	3	3.27

CONTENTS

2025

JEE Advanced Solved Paper

Chemistry Paper-1

SECTION 1 (Maximum Marks: 12)

- This section contains **FOUR (04)** questions.
- Each question has **FOUR** options (*a*), (*b*), (*c*) and (*d*). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +3 If **ONLY** the correct option is chosen;
Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);
Negative Marks : –1 In all other cases.

1. The heating of NH4NO2 at 60 −70° C and NH4NO3 at 200 −250°C is associated with the formation of nitrogen containing compounds X and Y, respectively. X and Y, respectively, are

(*a*) N_2 and N_2O (*b*) NH_3 and NO_2
(*c*) NO and N_2O (*d*) N_2 and NH_3

2. The correct order of the wavelength maxima of the absorption band in the ultraviolet-visible region for the given complexes is

(*a*) $[Co(CN)_6]^{3-} < [Co(NH_3)_6]^{3+} < [Co(NH_3)_5(H_2O)]^{3+} < [Co(NH_3)_5(Cl)]^{2+}$

(*b*) $[Co(NH_3)_5(Cl)]^{2+} < [Co(NH_3)_5(H_2O)]^{3+} < [Co(NH_3)_6]^{3+} < [Co(CN)_6]^{3-}$

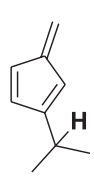
(*c*) $[Co(CN)_6]^{3-} < [Co(NH_3)_5(Cl)]^{2+} < [Co(NH_3)_5(H_2O)]^{3+} < [Co(NH_3)_6]^{3+}$

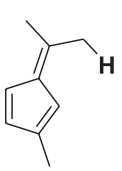
(*d*) $[Co(NH_3)_6]^{3+} < [Co(CN)_6]^{3-} < [Co(NH_3)_5(Cl)]^{2+} < [Co(NH_3)_5(H_2O)]^{3+}$

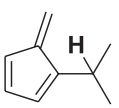
3. One of the products formed from the reaction of permanganate ion with iodide ion in neutral aqueous medium is

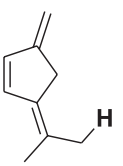
(*a*) I_2 (*b*) IO_3^- (*c*) IO_4^- (*d*) IO_2^-

4. Consider the depicted hydrogen (H) in the hydrocarbons given below. The most acidic hydrogen (H) is

(*a*) 

(*b*) 

(*c*) 

(*d*) 

SECTION 2 (Maximum Marks: 12)

- This section contains **THREE (03)** questions.
- Each question has **FOUR** options (*a*), (*b*), (*c*) and (*d*). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 **ONLY** if (all) the correct option(s) is(are) chosen;
Partial Marks : +3 If all the four options are correct but **ONLY** three options are chosen;
Partial Marks : +2 If three or more options are correct but **ONLY** two options are chosen, both of which are correct;
Partial Marks : +1 If two or more options are correct but **ONLY** one option is chosen and it is a correct option;
Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);
Negative Marks: –2 In all other cases.

- For example, in a question, if (*a*), (*b*) and (*d*) are the **ONLY** three options corresponding to correct answers, then
choosing ONLY (*a*), (*b*) and (*d*) will get +4 marks;
choosing ONLY (*a*) and (*b*) will get +2 marks;
choosing ONLY (*a*) and (*d*) will get +2 marks;
choosing ONLY (*b*) and (*d*) will get +2 marks;
choosing ONLY (*a*) will get +1 mark;
choosing ONLY (*b*) will get +1 mark;
choosing ONLY (*d*) will get +1 mark;
choosing no option (i.e. the question is unanswered) will get 0 marks; and choosing any other combination of options will get –2 marks.

5. Regarding the molecular orbital (MO) energy levels for homonuclear diatomic molecules, the **INCORRECT** statement(s) is(are)

(*a*) Bond order of Ne_2 is zero.

(*b*) The highest occupied molecular orbital (HOMO) of F_2 is σ-type.

(*c*) Bond energy of O_2^+ is smaller than the bond energy of O_2.

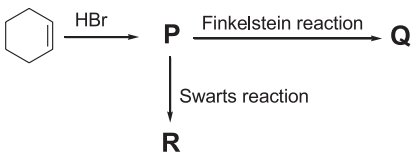
(*d*) Bond length of Li_2 is larger than the bond length of B_2.

6. The pair(s) of diamagnetic ions is(are)

(*a*) La^{3+}, Ce^{4+} (*b*) Yb^{2+}, Lu^{3+}

(*c*) La^{2+}, Ce^{3+} (*d*) Yb^{3+}, Lu^{2+}

7. For the reaction sequence given below, the correct statement (s) is(are)



(In the options, X is any atom other than carbon and hydrogen, and it is different in **P**, **Q** and **R**)

(*a*) C−X bond length in **P**, **Q** and **R** follows the order **Q** > **R** > **P**.

(*b*) C−X bond enthalpy in **P**, **Q** and **R** follows the order **R** > **P** > **Q**.

(*c*) Relative reactivity toward S_N2 reaction in **P**, **Q** and **R** follows the order **P** > **R** > **Q**.

(*d*) pK_a value of the conjugate acids of the leaving groups in **P**, **Q** and **R** follows the order **R** > **Q** > **P**.

SECTION 3 (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- The answer to each question is a **NON-NEGATIVE INTEGER**.
- For each question, enter the correct integer corresponding to the answer using the mouse and the on screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If **ONLY** the correct integer is entered;

Zero Marks : 0 In all other cases.

8. In an electrochemical cell, dichromate ions in aqueous acidic medium are reduced to Cr^{3+}. The current (in amperes) that flows through the cell for 48.25 minutes to produce 1 mole of Cr^{3+} is _____.

Use: 1 Faraday = 96500 C mol^{-1}

9. At 25°C, the concentration of H^+ ions in 1.00×10^{-3} M aqueous solution of a weak monobasic acid having acid dissociation constant (K_a) of 4.00×10^{-11} is **X** $\times 10^{-7}$ M. The value of **X** is _____.

Use: Ionic product of water (K_w) = 1.00×10^{-14} at 25°C

10. Molar volume (V_m) of a van der Waals gas can be calculated by expressing the van der Waals equation as a cubic equation with V_m as the variable. The ratio (in mol dm^{-3}) of the coefficient of V_m^2 to the coefficient of V_m for a gas having van der Waals constants a = 6.0 dm^6 atm mol^{-2} and b = 0.060 dm^3 mol^{-1} at 300 K and 300 atm is _____.

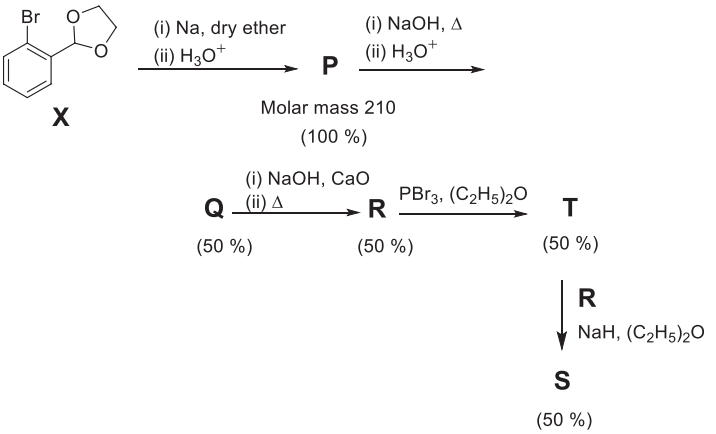
11. Considering ideal gas behavior, the expansion work done (in kJ) when 144 g of water is electrolyzed completely under constant pressure at 300 K is _____.

Use: Universal gas constant (R) = 8.3 J K^{-1} mol^{-1}; Atomic mass (in amu): H = 1, O = 16

12. The monomer (X) involved in the synthesis of Nylon 6,6 gives positive carbylamine test. If 10 moles of X are analyzed using Dumas method, the amount (in grams) of nitrogen gas evolved is _____.

Use: Atomic mass of N (in amu) = 14

13. The reaction sequence given below is carried out with 16 moles of X. The yield of the major product in each step is given below the product in parentheses. The amount (in grams) of S produced is_____.



Use: Atomic mass (in amu): H = 1, C = 12, O = 16, Br = 80

SECTION 4 (Maximum Marks: 12)

- This section contains **FOUR (04)** Matching List Sets.
- Each set has **ONE** Multiple Choice Question.
- Each set has **TWO** lists: **List-I** and **List-II**.
- **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5).
- **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +3 **ONLY** if the option corresponding to the correct combination is chosen;

Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);

Negative Marks : –1 In all other cases.

Chemistry Paper-2

SECTION 1 (Maximum Marks: 12)

- This section contains **FOUR (04)** questions.
- Each question has **FOUR** options (*a*), (*b*), (*c*) and (*d*). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated **according to the following marking scheme:**

Full Marks : +3 If **ONLY** the correct option is chosen;
Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);
Negative Marks : –1 In all other cases.

1. During sodium nitroprusside test of sulphide ion in an aqueous solution, one of the ligands coordinated to the metal ion is converted to

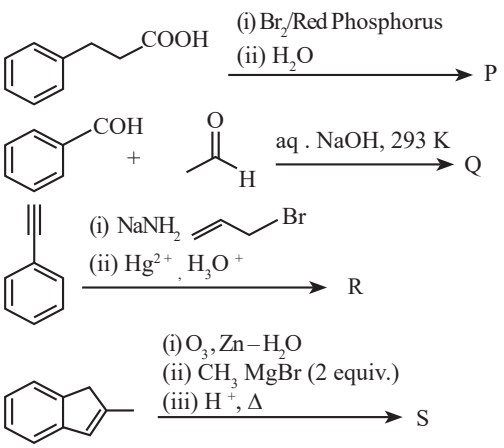
(*a*) NOS^- (*b*) SCN^- (*c*) SNO^- (*d*) NCS^-

2. The complete hydrolysis of ICl, ClF_3 and BrF_5, respectively, gives

(*a*) IO^-, ClO_2^- and BrO_3^- (*b*) IO_3^-, ClO_2^- and BrO_3^-

(*c*) IO^-, ClO^- and BrO_2^- (*d*) IO_3^-, ClO_4^- and BrO_2^-

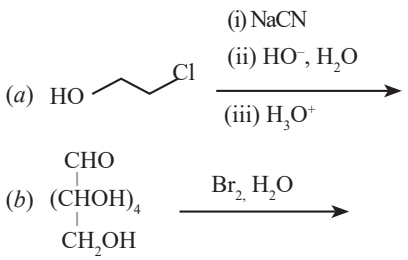
3. Monocyclic compounds P, Q, R and S are the major products formed in the reaction sequences given below.

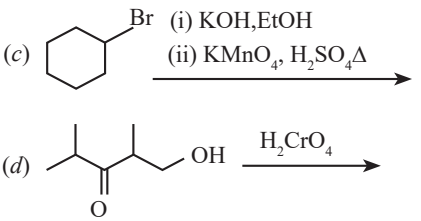


The product having the highest number of unsaturated carbon atom(s) is

(*a*) P (*b*) Q (*c*) R (*d*) S

4. The correct reaction/reaction sequence that would produce a dicarboxylic acid as the major product is





SECTION 2 (Maximum Marks: 16)

- This section contains **FOUR (04)** questions.
- Each question has **FOUR** options (*a*), (*b*), (*c*) and (*d*). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated **according to the following marking scheme:**

Full Marks : +4 **ONLY** if (all) the correct option(s) is(are) chosen;
Partial Marks : +3 If all the four options are correct but ONLY three options are chosen;
Partial Marks : +2 If three or more options are correct but ONLY two options are chosen, both of which are correct;
Partial Marks : +1 If two or more options are correct but ONLY one option is chosen and it is a correct option;
Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);
Negative Marks : –2 In all other cases.

- For example, in a question, if (*a*), (*b*) and (*d*) are the ONLY three options corresponding to correct answers, then

choosing ONLY (*a*), (*b*) and (*d*) will get +4 marks;
choosing ONLY (*a*) and (*b*) will get +2 marks;
choosing ONLY (*a*) and (*d*) will get +2 marks;
choosing ONLY (*b*) and (*d*) will get +2 marks;
choosing ONLY (*a*) will get +1 mark;
choosing ONLY (*b*) will get +1 mark;
choosing ONLY (*d*) will get +1 mark;
choosing no option (i.e. the question is unanswered) will get 0 marks;
and choosing any other combination of options will get –2 marks.

5. The correct statement(s) about intermolecular forces is(are)

(*a*) The potential energy between two point charges approaches zero more rapidly than the potential energy between a point dipole and a point charge as the distance between them approaches infinity.

1 Some Basic Concepts of Chemistry

JEE-Main

Equilibrium in Physical and Chemical Processes

1. Choose the **correct** statements.

(A) Weight of a substance is the amount of matter present in it.

(B) Mass is the force exerted by gravity on an object.

(C) Volume is the amount of space occupied by a substance.

(D) Temperatures below 0°C are possible in Celsius scale, but in Kelvin scale negative temperature is not possible.

(E) Precision refers to the closeness of various measurements for the same quantity.

Choose the **correct** answer from the options given below:

[29 Jan, 2025 (Shift-I)]

(*a*) (B), (C) and (D) Only (*b*) (C), (D) and (E) Only

(*c*) (A), (B) and (C) Only (*d*) (A), (D) and (E) Only

2. The candela is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 'A' $\times 10^{12}$ hertz and that has a radiant intensity in that direction of $\frac{1}{'B'}$ watt per steradian. 'A' and 'B' are respectively.

[09 April, 2024 (Shift-II)]

(*a*) 540 and $\frac{1}{683}$ (*b*) 540 and 683

(*c*) 450 and $\frac{1}{683}$ (*d*) 450 and 683

Uncertainty in Measurement and Laws of Chemical Combinations

3. Which of the following have same number of significant figures?

[8 April, 2023 (Shift-II)]

(A) 0.00253 (B) 1.0003

(C) 15.0 (D) 163

Choose the correct answer from the options given below

(*a*) A, B and C only (*b*) C and D only

(*c*) A, C and D only (*d*) B and C only

4. Using the rules for significant figures, the correct answer for the expression $\frac{0.02858\times 0.112}{0.5702}$ **[29 June, 2022 (Shift-II)]**

(*a*) 0.005613 (*b*) 0.00561

(*c*) 0.0056 (*d*) 0.006

5. The number of significant figure in 0.00340 is _____.

[25 July, 2021 (Shift-II)]

6. The number of significant figures in 50000.020×10^{-3} is_____.

[26 Feb, 2021 (Shift-I)]

Dalton's Atomic Theory

7. Choose the Incorrect Statement about Dalton's Atomic Theory

[04 April, 2024 (Shift-II)]

(*a*) Compounds are formed when atoms of different elements combine in any ratio

(*b*) All the atoms of a given element have identical properties including identical mass

(*c*) Matter consists of indivisible atoms

(*d*) Chemical reactions involve recorganization of atoms

8. The incorrect postulates of the Dalton's atomic theory are:

(A) Atoms of different elements differ in mass.

(B) Matter consists of divisible atoms.

(C) Compounds are formed when atoms of different element combine in a fixed ratio.

(D) All the atoms of given element have different properties including mass.

(E) Chemical reactions involve reorganisation of atoms.

Choose the correct answer from the options given below:

[05 April, 2024 (Shift-I)]

(*a*) (B), (D), (E) only (*b*) (A), (B), (D) only

(*c*) (C), (D), (E) only (*d*) (B), (D) only

Atomic & Molecular Masses

9. The average molar mass of chlorine is 35.5 g mol^{-1}. The ratio of ^{35}Cl to ^{37}Cl in naturally occurring chlorine is close to:

[6 Sept, 2020 (Shift-II)]

(*a*) 4 : 1 (*b*) 3 : 1 (*c*) 2 : 1 (*d*) 1 : 1

Mole Concept and Molar Masses

10. 20 mL of sodium iodide solution gave 4.74 g silver iodide when treated with excess of silver nitrate solution. The molarity of the sodium iodide solution is _____ M. (Nearest Integer value)

(Given : $Na = 23, I = 127, Ag = 108, N = 14, O = 16$ g mol^{-1})

[08 April, 2025 (Shift-II)]

11. The amount of calcium oxide produced on heating 150 kg limestone (75% pure) is_____kg. (Nearest integer)

Given : Molar mass (in g mol^{-1}) of Ca-40, O-16, C-12

[04 April, 2025 (Shift-II)]

12. Mass of magnesium required to produce 220 mL of hydrogen gas at STP on reaction with excess of dil. HCl is

Given : Molar mass of Mg is 24 g mol^{-1}.

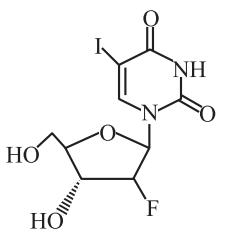
[03 April, 2025 (Shift-II)]

(*a*) 235.7 g (*b*) 0.24 mg (*c*) 236 mg (*d*) 2.444 g

13. Among 10^{-9} g (each) of the following elements, which one will have the highest number of atoms?
Element : Pb, Po, Pr and Pt **[03 April, 2025 (Shift-I)]**

(*a*) Po (*b*) Pr (*c*) Pb (*d*) Pt

14. 0.1 mol of the following given antiviral compound (P) will weigh _____ $\times 10^{-1}$ g **[02 April, 2025 (Shift-I)]**



(P)

(Given: molar mass in g mol^{-1} H: 1, C : 12, N : 14, O : 16, F : 19, I : 127)

15. On complete combustion 1.0 g of an organic compound (X) gave 1.46 g of CO_2 and 0.567 g of H_2O. The empirical formula mass of compound (X) is _____ g.
(Given molar mass in g mol^{-1} C : 12, H : 1, O : 16)

[02 April, 2025 (Shift-I)]

(*a*) 30 (*b*) 45 (*c*) 60 (*d*) 15

16. 0.01 mole of an organic compound (X) containing 10% hydrogen, on complete combustion produced 0.9 g H_2O. Molar mass of (X) is _____ g mol^{-1}. **[23 Jan, 2025 (Shift-II)]**

17. 2.8×10^{-3} mol of CO_2 is left after removing 10^{21} molecules from its '*x*' mg sample. The mass of CO_2 taken initially is
Given: $N_A = 6.02 \times 10^{23}$ mol^{-1} **[23 Jan, 2025 (Shift-I)]**

(*a*) 48.2 mg (*b*) 98.3 mg
(*c*) 150.4 mg (*d*) 196.2 mg

18. 0.05 cm thick coating of silver is deposited on a plate of 0.05 m^2 area. The number of silver atoms deposited on plate are _____ $\times 10^{23}$. (At mass Ag = 108, $d = 7.9$ g cm^{-3})

[30 Jan, 2024 (Shift-I)]

19. The number of molecules and moles in 2.8375 litres of O_2 at STP are respectively **[10 April, 2023 (Shift-I)]**

(*a*) 7.527×10^{22} and 0.250 mol (*b*) 1.505×10^{23} and 0.250 mol
(*c*) 7.527×10^{23} and 0.125 mol (*d*) 7.527×10^{22} and 0.125 mol

20. Match List-I with List-II. **[10 April, 2023 (Shift-II)]**

LIST-I		LIST-II	
A.	16g of CH_4(g)	I.	Weighs 28 g
B.	1g of H_2(g)	II.	60.2×10^{23} electrons
C.	1 mole of N_2(g)	III.	Weighs 32g
D.	0.5 mol of SO_2(g)	IV.	Occupies 11.4 L volume at STP

Choose the correct answer from the options given below:

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

21. When 0.01 mol of an organic compound containing 60% carbon was burnt completely, 4.4 g of CO_2 was produced. The molar mass of compound is _____ g mol^{-1} (Nearest integer)

[29 Jan, 2023 (Shift-II)]

22. Production of iron in blast furnace follows the following equation
$Fe_3O_4(s) + 4CO(g) \longrightarrow 3Fe(l) + 4CO_2(g)$
When 4.640 kg of Fe_3O_4 and 2.520 kg of CO are allowed to react then the amount of iron (in g) produced is:
[Given: Molar Atomic mass (g mol^{-1}); Fe = 56
Molar Atomic mass (g mol^{-1}); O = 16
Molar Atomic mass (g mol^{-1}); C = 12] **[29 June, 2022 (Shift-I)]**

(*a*) 1400 (*b*) 2200 (*c*) 3360 (*d*) 4200

23. SO_2Cl_2 on reaction with excess of water results into acidic mixture

$$SO_2Cl_2 + 2H_2O \rightarrow H_2SO_4 + 2HCl$$

16 moles of NaOH is required for the complete neutralisation of the resultant acidic mixture. The number of moles of SO_2Cl_2 used is:

[25 July, 2022 (Shift-I)]

(*a*) 16 (*b*) 8 (*c*) 4 (*d*) 2

24. Hemoglobin contains 0.34% of iron by mass. The number of Fe atoms in 3.3 g of hemoglobin is (Given: Atomic mass of Fe is 56 u, $N_A = 6.022 \times 10^{23}$ mol^{-1}.) **[26 July, 2022 (Shift-II)]**

(*a*) 1.21×10^5 (*b*) 12.0×10^{16} (*c*) 1.21×10^{20} (*d*) 3.4×10^{22}

25. 250 g solution of D-glucose in water contains 10.8% of carbon by weight. The molality of the solution is nearest to
(Given: Atomic weights are, H = 1u ; C = 12u ; O = 16u)

[27 July, 2022 (Shift-I)]

(*a*) 1.03 (*b*) 2.06 (*c*) 3.09 (*d*) 5.40

26. The number of N atoms in 681 g of $C_7H_5N_3O_6$ is $x \times 10^{21}$. The value of x is_____.
($N_A = 6.02 \times 10^{23}$ mol^{-1}) (Nearest Integer)

[25 June, 2022 (Shift-I)]

27. A protein 'A' contains 0.30% of glycine (molecular weight 75). The minimum molar mass of the protein 'A' is _____ $\times 10^3$ g mol^{-1} [nearest integer] **[25 June, 2022 (Shift-II)]**

28. CNG is an important transportation fuel. When 100 g CNG is mixed with 208 g oxygen in vehicles, it leads to the formation of CO_2 and H_2O and produces large quantity of heat during this combustion, then the amount of carbon dioxide produced in grams is_____. (nearest integer)
[Assume CNG to be methane] **[26 June, 2022 (Shift-II)]**

29. 56.0 L of nitrogen gas is mixed with excess of hydrogen gas and it is found that 20 L of ammonia gas is produced. The volume of unused nitrogen gas is found to be___ L. **[25 July, 2022 (Shift-II)]**

30. Chlorophyll extracted from the crushed green leaves was dissolved in water to make 2 L solution of Mg of concentration 48 ppm. The number of atoms of Mg in this solution is $x \times 10^{20}$ atoms. The value of x is _____. (Nearest Integer)

(Given: Atomic mass of Mg is 24 g mol^{-1}; $N_A = 6.02 \times 10^{23}$ mol^{-1})

[26 July, 2022 (Shift-I)]

31. 1 L aqueous solution of H_2SO_4 contains 0.02 m mol H_2SO_4. 50% of this solution is diluted with deionized water to give 1 L solution (A). In solution (A), 0.01 m mol of H_2SO_4 are added. Total m mols of H_2SO_4 in the final solution is _____ $\times 10^3$ m moles.

[25 June, 2022 (Shift-I)]

32. Two elements A and B forms 0.15 moles of A_2B and AB_3 type compounds. If both A_2B and AB_3 weigh equally, then the atomic weight of A is_____ times of atomic weight of B.

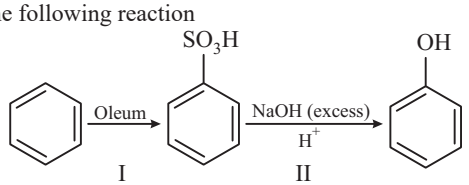
[27 June, 2022 (Shift-I)]

33. Number of grams of bromine that will completely react with 5.0 g of pent-1-ene is _____ $\times 10^{-2}$ g. (Atomic mass of Br = 80 g/mol) (Nearest Integer) **[25 June, 2022 (Shift-I)]**

34. The moles of methane required to produce 81 g of water after complete combustion is_____ $\times 10^{-2}$ mol. (nearest integer)

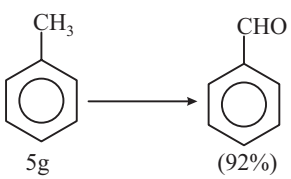
[26 June, 2022 (Shift-II)]

35. In the following reaction



The % yield for reaction I is 60% and that of reaction II is 50%. The overall yield of the complete reaction is_____% [Nearest integer] **[27 July, 2022 (Shift-I)]**

36. In the below reaction, 5g of toluene is converted into benzaldehyde with 92% yield. The amount of benzaldehyde produced is_____ $\times 10^{-2}$ g. (Nearest integer) **[27 July, 2022 (Shift-II)]**



37. A reaction of 0.1 mole of Benzylamine with bromomethane gave 23g of Benzyl trimethyl ammonium bromide. The number of moles of bromomethane consumed in this reaction are $n \times 10^{-1}$, when n = ____ (Round off to the nearest integer) [Given: Atomic masses: C: 12.0 u, H : 1.0u, N : 14.0u, Br : 80.0u] **[18 March, 2021 (Shift-I)]**

38. 4g equimolar mixture of NaOH and Na_2CO_3 contains x g of NaOH and y g of Na_2CO_3. The value of x is _____ g. (Nearest Integer)

[20 July, 2021 (Shift-II)]

39. Consider the complete combustion of butane, the amount of butane utilized to produce 72.0 g of water is_____ $\times 10^{-1}$g, (in nearest integer) **[25 July, 2021 (Shift-I)]**

40. The number of atoms in 8 g of sodium is $x \times 10^{23}$. The value of x is _____. (Nearest integer)

[Given: $N_A = 6.02 \times 10^{23}$ mol^{-1}, Atomic mass of Na = 23.0 u]

[1 Sept, 2021 (Shift-I)]

41. The $NaNO_3$ weighed out to make 50 mL of an aqueous solution containing 70.0 mg Na^+ per mL is____g. (Rounded off to the nearest integer) **[26 Feb, 2021 (Shift-II)]**

[Given; Atomic weight in g mol^{-1} –Na : 23; N :14; O :16]

42. The minimum number of moles of O_2 required for complete combustion of 1 mole of propane and 2 moles of butane is _____.

[5 Sept, 2020 (Shift-I)]

43. The mass of ammonia in grams produced when 2.8 kg of dinitrogen quantitatively reacts with 1 kg of dihydrogen is _____.

[4 Sept, 2020 (Shift-I)]

44. Ferrous sulphate heptahydrate is used to fortify foods with iron. The amount (in grams) of the salt required to achieve 10 ppm of iron in 100 kg of wheat is _____

Atomic weight: Fe = 55.85; S = 32.00; O = 16.00

[8 Jan, 2020 (Shift-I)]

45. $NaClO_3$ is used, even in spacecraft, to produce O_2. The daily consumption of pure O_2 by a person is 492L at 1 atm, 300 K. How much amount of $NaClO_3$, in grams, is required to produce O_2 for the daily consumption of a person at 1 atm, 300 K?

$NaClO_3(s) + Fe(s) \rightarrow O_2(g) + NaCl(s) + FeO(s)$

R = 0.082 L atm mol^{-1} K^{-1}. **[8 Jan, 2020 (Shift-II)]**

46. At 300 K and 1 atmospheric pressure, 10 mL of a hydrocarbon required 55 mL of O_2 for complete combustion and 40 mL of CO_2 is formed. The formula of the hydrocarbon is:

[10 April, 2019 (Shift-I)]

(*a*) C_4H_8 (*b*) C_4H_7Cl (*c*) C_4H_{10} (*d*) C_4H_6

47. 5 moles of AB_2 weigh 125×10^{-3} kg and 10 moles of A_2B_2 weigh 300×10^{-3} kg. The molar mass of $A_{(M_A)}$ and molar mass of $B_{(M_B)}$ in kg mol^{-1} are: **[12 April, 2019 (Shift-I)]**

(*a*) $M_A = 50 \times 10^{-3}$ and $M_B = 25 \times 10^{-3}$

(*b*) $M_A = 25 \times 10^{-3}$ and $M_B = 50 \times 10^{-3}$

(*c*) $M_A = 5 \times 10^{-3}$ and $M_B = 10 \times 10^{-3}$

(*d*) $M_A = 10 \times 10^{-3}$ and $M_B = 5 \times 10^{-3}$

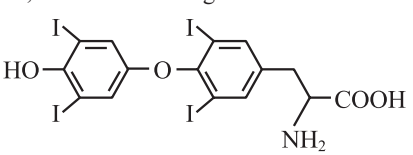
Percentage Composition and Empirical & Molecular Formula

48. On combustion 0.210 g of an organic compound containing C, H and O gave 0.l27 g H_2O and 0.307 gCO_2. The percentages of hydrogen and oxygen in the given organic compound respectively are: **[08 April, 2025 (Shift-II)]**

(*a*) 53.41, 39.6 (*b*) 6.72, 53.41

(*c*) 7.55, 43.85 (*d*) 6.72, 39.87

49. Thyroxine, the hormone has given below structure.



The percentage of iodine in thyroxine is.....%. (nearest integer)

(Given molar mass in g mol^{-1} C:12, H:1, O:16, N:14, I:127)

[07 April, 2025 (Shift-I)]

50. An organic compound weighing 500 mg , produced 220 mg of CO_2, on complete combustion. The percentage composition of carbon in the compound is.....%. (nearest integer)

(Given molar mass in g mol^{-1} of C : 12, O : 16)

[07 April, 2025 (Shift-I)]

51. The elemental composition of a compound is 54.2% C, 9.2% H and 36.6% O.

If the molar mass of the compound is 132 g mol^{-1}, the molecular formula of the compound is :

[Given : The relative atomic mass of C : H : O = 12 : 1 : 16]

[24 Jan, 2025 (Shift-II)]

(*a*) $C_6H_{12}O_3$ (*b*) $C_4H_8O_2$ (*c*) $C_4H_9O_3$ (*d*) $C_6H_{12}O_6$

52. Quantitative analysis of an organic compound (X) shows following % composition.

C: 14.5% Cl: 64.46%

H: 1.8%

Empirical formula mass of the compound (X) is _____ $\times 10^{-1}$

(Given molar mass in g mol $^{-1}$ of C:12, H:1, O:16, Cl:35.5)

[28 Jan, 2025 (Shift-I)]

53. A sample of $CaCO_3$ and $MgCO_3$ weighed 2.21 g is ignited to constant weight of 1.152 g. The composition of mixture is:

(Given molar mass in g mol^{-1} $CaCO_3$: 100, $MgCO_3$: 84)

[31 Jan, 2024 (Shift-II)]

(*a*) 1.187 g $CaCO_3$ + 1.023 g $MgCO_3$

(*b*) 1.023 g $CaCO_3$ + 1.023 g $MgCO_3$

(*c*) 1.187 g $CaCO_3$ + 1.187 g $MgCO_3$

(*d*) 1.023 g $CaCO_3$ + 1.187 g $MgCO_3$

54. 10 mL of gaseous hydrocarbon on combustion gives 40 mL of CO_2(g) and 50 mL of water vapour. Total number of carbon and hydrogen atoms in the hydrocarbon is _____.

[01 Feb, 2024 (Shift-II)]

55. An organic compound has 42.1% carbon, 6.4% hydrogen and remainder is oxygen. If its molecular weight is 342, then its molecular formula is: **[05 April, 2024 (Shift-I)]**

(*a*) $C_{11}H_{18}O_{12}$ (*b*) $C_{12}H_{20}O_{12}$ (*c*) $C_{14}H_{20}O_{10}$ (*d*) $C_{12}H_{22}O_{11}$

56. A metal chloride contains 55.0% of chlorine by weight. 100 mL vapours of the metal chloride at STP weigh 0.57 g. The molecular formula of the metal chloride is

(Given: Atomic mass of chlorine is 35.5 u)

[12 April, 2023 (Shift-I)]

(*a*) MCl_2 (*b*) MCl_4 (*c*) MCl_3 (*d*) MCl

57. An organic compound gives 0.220 g of CO_2 and 0.126 g of H_2O on complete combustion. If the % of carbon is 24, then the % hydrogen is _____ $\times 10^{-1}$. (Nearest integer) **[13 April, 2023 (Shift-I)]**

58. 0.5 g of an organic compound (X) with 60% carbon will produce _____ $\times 10^{-1}$ g of CO_2 on complete combustion.

[8 April, 2023 (Shift-I)]

59. 120 g of an organic compound that contains only carbon and hydrogen gives 330 g of CO_2 and 270 g of water on complete combustion. The percentage of carbon and hydrogen, respectively are **[24 June, 2022 (Shift-I)]**

(*a*) 25 and 75 (*b*) 40 and 60 (*c*) 60 and 40 (*d*) 75 and 25

60. Compound A contains 8.7% Hydrogen, 74% Carbon and 17.3% Nitrogen. The molecular formula of the compound is,

Given: Atomic masses of C, H and N are 12, 1 and 14 amu respectively. The molar mass of the compound A is 162 g mol^{-1}.

[28 June, 2022 (Shift-II)]

(*a*) $C_4H_6N_2$ (*b*) C_2H_3N (*c*) C_5H_7N (*d*) $C_{10}H_{14}N_2$

61. 116 g of a substance upon dissociation reaction yields 7.5 g of hydrogen, 60g of oxygen and 48.5 g of carbon. Given that the atomic masses of H, O and C are 1,16 and 12 g/mol respectively. The data agrees with how many formulae of the following?

[27 June, 2022 (Shift-II)]

(*a*) CH_3COOH (*b*) HCHO

(*c*) CH_3OOCH_3 (*d*) CH_3CHO

62. A 2.0 g sample containing MnO_2 is treated with HCl liberating Cl_2. The Cl_2 gas is passed into a solution of KI and 60.0 mL of 0.1 M $Na_2S_2O_3$ is required to titrate the liberated iodine. The percentage of MnO_2 in the sample is____. (Nearest integer)

[Atomic masses (in u) Mn = 55; Cl = 35.5; O = 16, I = 127, Na = 23, K = 39, S = 32] **[28 June, 2022 (Shift-I)]**

63. On complete combustion 0.30 g of an organic compound gave 0.20 g of carbon dioxide and 0.10 g of water. The percentage of carbon in the given organic compound is _____. (Nearest integer)

[26 June, 2022 (Shift-I)]

64. The complete combustion of 0.492 g of an organic compound containing 'C', 'H' and 'O' gives 0.793g of CO_2 and 0.442 g H_2O. The percentage of oxygen composition in the organic compound is _____. (nearest integer) **[28 June, 2022 (Shift-II)]**

65. In the estimation of bromine, 0.5 g of an organic compound gave 0.40 g of silver bromide. The percentage of bromine in the given compound is _____% (Nearest integer)

(Relative atomic masses of Ag and Br are 108 u and 80 u, respectively). **[28 June, 2022 (Shift-II)]**

66. Complete combustion of 1.80 g of an oxygen containing compound ($C_x H_y O_z$) gave 2.64 g of CO_2 and 1.08g of H_2O. The percentage of oxygen in the organic compound is **[25 Feb, 2021 (Shift-I)]**

(*a*) 53.33 (*b*) 50.33 (*c*) 63.53 (*d*) 51.63

67. Complete combustion of 750g of an organic compound provides 420 g of CO_2 and 210 g of H_2O. The percentage composition of carbon and hydrogen in organic compound is 15.3 and _____ respectively. (Round off to the nearest Integer).

[16 March, 2021 (Shift-I)]

68. Methylation of 10 g of benezene give 9.2 g of toluene. Calculate the percentage yield of toluene _____ . (Nearest integer)

[22 July, 2021 (Shift-II)]

69. The percentage composition of carbon by mole in methane is:

[8 April, 2019 (Shift-II)]

(*a*) 80% (*b*) 25% (*c*) 75% (*d*) 20%

70. A 10 mg effervescent tablet containing sodium bicarbonate and oxalic acid releases 0.25 ml of CO_2 at T = 298.15 K and p = 1 bar. If molar volume of CO_2 is 25.0 L under such condition, what is the percentage of sodium bicarbonate in each tablet?[Molar mass of $NaHCO_3$ = 84 g mol^{-1}] **[11 Jan, 2019 (Shift-I)]**

(*a*) 0.84 (*b*) 33.6 (*c*) 16.8 (*d*) 8.4

Stoichiometry & Stoichiometric Calculations

71. Butane reacts with oxygen to produce carbon dioxide and water following the equation given below.

$$C_4H_{10(g)} + \frac{13}{2}O_{2(g)} \rightarrow 4CO_{2(g)} + 5H_2O(l)$$

If 174.0 kg of butane is mixed with 320.0 kg of O_2, the volume of water formed in litres is ____.(Nearest integer)

[Given: (a) Molar mass of C, H, O are 12, 1, 16 g mol^{-1} respectively, (b) Density of water = 1 g mL^{-1}] **[07 April, 2025 (Shift-II)]**

72. $CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g)\ H_2O(l)$

Consider the above reaction, what mass of $CaCl_2$ will be formed if 250 mL of 0.76 M HCl reacts with 1000 g of $CaCO_3$?

(Given: Molar mass of Ca, C, O, H and Cl are 40, 12, 16, 1 and 35.5 g mol^{-1}, respectively) **[02 April, 2025 (Shift-I)]**

(*a*) 3.908 g (*b*) 2.636 g (*c*) 10.545 g (*d*) 5.272 g

73. Some CO_2 gas was kept in a sealed container at a pressure of 1 atm and at 273 K. This entire amount of CO_2 gas was later passed through an aqueous solution of $Ca(OH)_2$. The excess unreacted $Ca(OH)_2$ was later neutralized with 0.1 M of 40 mL HCl. If the volume of the sealed container of CO_2 was x, then x is _____ cm^3 (nearest integer).
[**Given :** The entire amount of $CO_2(g)$ reacted with exactly half the initial amount of $Ca(OH)_2$ present in the aqueous solution.]
[22 Jan, 2025 (Shift-I)]

74. When 81.0 g of aluminium is allowed to react with 128.0 g of oxygen gas, the mass of aluminium oxide produced in grams is _____. (Nearest integer)
Molar mass of Al is 27.0 g mol^{-1}
Molar mass of O is 16.0 g mol^{-1} **[23 Jan, 2025 (Shift-II)]**

75. Consider the following reaction occurring in the blast furnace:
$Fe_3O_{4(s)} + 4CO_{(g)} \rightarrow 3Fe_{(l)} + 4CO_2(g)$
'x' kg of iron is produced when 2.32×10^3 kg Fe_3O_4 and 2.8×10^2 kg CO are brought together in the furnace. The value of 'x' is _____. (nearest integer)
{Given:
molar mass of Fe_3O_4 = 232 g mol^{-1}
molar mass of CO = 28 g mol^{-1}
molar mass of Fe = 56 g mol^{-1}} **[24 Jan, 2025 (Shift-I)]**

76. Mass of methane required to produce 22 g of CO_2 after complete combustion is _____ g.
(Given Molar mass in g mol^{-1}
C = 12.0
H = 1.0
O = 16.0) **[27 Jan, 2024 (Shift-I)]**

77. Number of moles of methane required to produce 22g $CO_{2(g)}$ after combustion is x × 10^{-2} moles. The value of x is
[31 Jan, 2024 (Shift-I)]

78. A compound (x) with molar mass 108 g mol^{-1} undergoes acetylation to give product with molar mass 192 g mol^{-1}. The number of amino groups in the compound (x) is ____. **[31 Jan, 2024 (Shift-II)]**

79. Consider the following reaction:
$3PbCl_2 + 2(NH_4)_3PO_4 \rightarrow Pb_3(PO_4)_2 + 6NH_4Cl$
If 72 mmol of $PbCl_2$ is mixed with 50 mmol of $(NH_4)_3PO_4$, then amount of $Pb_3(PO_4)_2$ formed is _____ mmol. (nearest integer)
[01 Feb, 2024 (Shift-I)]

80. Combustion of glucose ($C_6H_{12}O_6$) produces CO_2 and water. The amount of oxygen (in g) required for the complete combustion of 900 g of glucose is: [Molar mass of glucose in $gmol^{-1}$) = 180
[08 April, 2024 (Shift-I)]
(*a*) 480 (*b*) 960 (*c*) 800 (*d*) 32

81. If 279 g of aniline is reacted with one equivalent of benzenediazonium chloride, the maximum amount of aniline yellow formed will be _____ g (nearest integer).
(consider complete conversion) **[08 April, 2024 (Shift-I)]**

82. 9.3 g of pure aniline upon diazotisation followed by coupling with phenol gives an orange dye. The mass of orange dye produced (assume 100% yield/ conversion) is _____ g. (nearest integer)
[06 April, 2024 (Shift-I)]

83. The number of moles of methane required to produce 11g $CO_2(g)$ after complete combustion is:
(Given molar mass of methane in g mol^{-1} : 16)
[05 April, 2024 (Shift-II)]
(*a*) 0.75 (*b*) 0.25 (*c*) 0.35 (*d*) 0.5

84. X g of enthanamine was subjected to reaction with $NaNO_2$/HCl followed by hydrolysis to liberate N_2 and HCl. The HCl generated was completely neutralised by 0.2 moles of NaOH. X is ____ g.
[05 April, 2024 (Shift-II)]

85. In the Claisen-Schmidt reaction to prepare 351 g of dibenzalacetone using 87 g of acetone, the amount of benzaldehyde required is _____g. (Nearest integer)
[05 April, 2024 (Shift-II)]

86. 9.3 g of pure aniline is treated with bromine water at room temperature to give a white precipitate of the product 'P'. The mass of product 'P' obtained is 26.4 g. The percentage yield is ____%.
[05 April, 2024 (Shift-I)]

87. X g of ethylamine is subjected to reaction with $NaNO_2$/HCl followed by water; evolved dinitrogen gas which occupied 2.24 L volume at STP. X is _____ × 10^{-1} g. **[04 April, 2024 (Shift-I)]**

88. From 6.55 g of aniline, the maximum amount of acetanilide that can be prepared will be ___ ×10^{-1} g.
[04 April, 2024 (Shift-II)]

89. When a hydrocarbon A undergoes combustion in the presence of air, it requires 9.5 equivalents of oxygen and produces 3 equivalents of water. What is the molecular formula of A?
[29 Jan, 2023 (Shift-II)]
(*a*) C_8H_6 (*b*) C_9H_9 (*c*) C_6H_6 (*d*) C_9H_6

90. 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? **[31 Jan, 2023 (Shift-II)]**
(*a*) C_9H_8 (*b*) $C_{11}H_4$ (*c*) C_5H_8 (*d*) $C_{11}H_8$

91. 1 g of a carbonate (M_2CO_3) on treatment with excess HCl produces 0.01 mol of CO_2. The molar mass of M_2CO_3 is ___ g mol^{-1}. (Nearest integer) **[13 April, 2023 (Shift-II)]**

92. On complete combustion, 0.492 g of an organic compound gave 0.792 g of CO_2. The % of carbon in the organic compound is _____ (Nearest integer) **[31 Jan, 2023 (Shift-I)]**

93. Number of hydrogen atoms per molecule of a hydrocarbon A having 85.8% carbon is _____
(Given: Molar mass of A = 84 g mol^{-1}) **[25 Jan, 2023 (Shift-II)]**

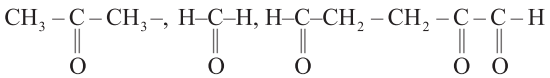
94. Zinc reacts with hydrochloric acid to give hydrogen and zinc chloride. The volume of hydrogen gas produced at STP from the reaction of 11.5 g of zinc with excess HCl is _____ L (Nearest integer)
(Given : Molar mass of Zn is 65.4g mol^{-1} and Molar volume of H_2 at STP = 22.7L) **[31 Jan, 2023 (Shift-I)]**

95. Assume carbon burns according to following equation:
$2C_{(s)} + O_{2(g)} \rightarrow 2CO(g)$
When 12 g carbon is burnt in 48 g of oxygen, the volume of carbon monoxide produced is _____× 10^{-1} 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}] **[31 Jan, 2023 (Shift-II)]**

96. If 5 moles of $BaCl_2$ is mixed with 2 moles of Na_3PO_4, the maximum number of moles of $Ba_3(PO_4)_2$ formed is
(Nearest integer) **[6 April, 2023 (Shift-I)]**

97. The volume of hydrogen liberated at STP by treating 2.4 g of magnesium with excess of hydrochloric acid is _____ $\times 10^{-2}$ L.
Given: Molar volume of gas is 22.4 L at STP. Molar mass of magnesium is 24 g mol^{-1}. **[11 April, 2023 (Shift-II)]**

98. 17 mg of a hydrocarbon (M.F. $C_{10}H_{16}$) takes up 8.40 mL of the H_2 gas measured at 0ºC and 760 mm of Hg. Ozonolysis of the same hydrocarbon yields. **[29 Jan, 2023 (Shift-I)]**



The number of double bond/s present in the hydrocarbon is

99. If a rocket runs on a fuel ($C_{15}H_{30}$) and liquid oxygen, the weight of oxygen required and CO_2 released for every litre of fuel respectively are: **[24 June, 2022 (Shift-I)]**
(Given: density of the fuel is 0.756 g/mL)
(*a*) 1188 g and 1296 g (*b*) 2376 g and 2592 g
(*c*) 2592 g and 2376 g (*d*) 3429 g and 3142 g

100. Consider the reaction
$4HNO_3(l) + 3KCl(s) \rightarrow Cl_2(g) + NOCl(g) + 2H_2O(g) + 3KNO_3(s)$
The amount of HNO_3 required to produce 110.0 g of KNO_3 is
(Given: Atomic masses of H, O, N and K are 1, 16, 14 and 39, respectively) **[29 July, 2022 (Shift-II)]**
(*a*) 32.2g (*b*) 69.4g (*c*) 91.5g (*d*) 162.5g

101. $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$
20g 5g
Consider the above reaction, the limiting reagent of the reaction and number of moles of NH_3 formed respectively are:
[29 July, 2022 (Shift-I)]
(*a*) H_2, 1.42 moles (*b*) H_2, 0.71 moles
(*c*) N_2, 1.42 moles (*d*) N_2, 0.71 moles

102. The normality of H_2SO_4 in the solution obtained on mixing 100 mL of 0.1 M H_2SO_4 with 50 mL of 0.1 M NaOH is _____ $\times 10^{-1}$ N. (Nearest Integer) **[27 July, 2022 (Shift-I)]**

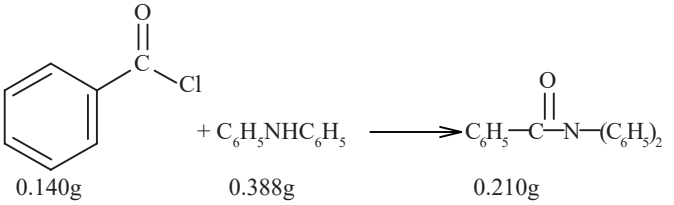
103. In the given reaction, $X + Y + 3Z \rightleftharpoons XYZ_3$
If one mole of each of X and Y with 0.05 mol of Z gives compound XYZ_3. (Given: Atomic masses of X, Y and Z are 10, 20 and 30 amu, respectively.) The yield of XYZ_3 is _____ g. (Nearest integer)
[28 July, 2022 (Shift-I)]

104. 2L of 0.2 M H_2SO_4 is reacted with 2L of 0.1 M NaOH solution, the molarity of the resulting product Na_2SO_4 in the solution is _____ millimolar (Nearest integer) **[28 July, 2022 (Shift-II)]**

105. When 200 mL of 0.2 M acetic acid is shaken with 0.6 g of wood charcoal, the final concentration of acetic acid after adsorption is 0.1M. The mass of acetic acid adsorbed per gram of carbon is ___ g.
[24 June, 2022 (Shift-II)]

106. 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 0.5 N H_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_____.
[24 June, 2022 (Shift-I)]

107.



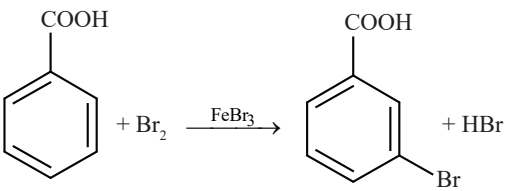
0.140g 0.388g 0.210g

Consider the above reaction. The percentage yield of amide product is _____.
(Round off to the nearest integer).
(Given: Atomic mass: C : 12.0u, H : 1.0 u, N : 14.0 u, O : 16.0 u, Cl : 35.5 u) **[17 March, 2021 (Shift-II)]**

108. The formula of a gaseous hydrocarbon which requires 6 times of its own volume of O_2 for complete oxidation and produces 4 times its own volume of CO_2 is C_xH_y. The value of y is _____.
[24 Feb, 2021 (Shift-II)]

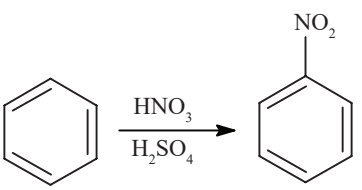
109. _____ grams of 3-Hydroxy propanal (MW = 74) must be dehydrated to produce 7.8g of acrolein (MW = 56) (C_3H_4O) if the percentage yield is 64. (Round off to the nearest integer).
[18 March, 2021 (Shift-I)]
[Given: Atomic masses : C : 12.0u, H : 1.0u, O : 16.0u]

110.



Consider the above reaction where 6.1 g of Benzoic acid is used to get 7.8g of m- bromo benzoic acid. The percentage yield of the product is_____. (Round off to the nearest integer).
[Given: Atomic masses: C : 12.0u, H : 1.0u, O : 16.0u, Br : 80.0 u]
[18 March, 2021 (Shift-II)]

111.



In the above reaction, 3.9 g of benzene on nitration gives 4.92 g of nitrobenzene. The percentage yield of nitrobenzene in the above reaction is_____ %
(Round off to the nearest integer).
(Given atomic mass: C: 12.0u, H:1.0u, O:16.0u, N:14.0u)
[17 March, 2021 (Shift-I)]

112. Complete combustion of 3g of ethane gives $x \times 10^{22}$ molecules of water. The value of x is _____. (Round off to the nearest integer).
[Use : $N_A = 6.023 \times 10^{23}$; Atomic masses in u: C:12.0, O:16.0; H:1.0] **[17 March, 2021 (Shift-I)]**

113. 100 g of propane is completely reacted with 1000 g of oxygen. The mole fraction of carbon dioxide in the resulting mixture is $x \times 10^{-2}$. The value of x is _____. (Nearest integer)
[Atomic weight: H = 1.008; C = 12.00; O = 16.00]
[27August 2021 (Shift-II)]

114. The first and second ionisation enthalpies of a metal are 496 and 4560 kJ mol^{-1}, respectively. How many moles of HCl and H_2SO_4, respectively, will be needed to react completely with 1 mole of the metal hydroxide?

[9 Jan, 2020 (Shift-II)]

(*a*) 1 and 1 (*b*) 1 and 2

(*c*) 2 and 0.5 (*d*) 1 and 0.5

115. 5 g of zinc is treated separately with an excess of
(A) dilute hydrochloric acid and
(B) aqueous sodium hydroxide.
The ratio of the volumes of H_2 evolved in these two reactions is:

[9 Jan, 2020 (Shift-II)]

(*a*) 1 : 4 (*b*) 1 : 1 (*c*) 1 : 2 (*d*) 2 : 1

116. The ammonia(NH_3) released on quantitative reaction of 0.6 g urea (NH_2CONH_2) with sodium hydroxide(NaOH) can be neutralized by **[7 Jan, 2020 (Shift-II)]**

(*a*) 100 mL of 0.1 N HCl (*b*) 100 mL of 0.2 N HCl

(*c*) 200 mL of 0.2 N HCl (*d*) 200 mL of 0.4 N HCl

117. A solution of phenol in chloroform when treated with aqueous NaOH gives compound P as a major product. The mass percentage of carbon in P is _____. (to the nearest integer) (Atomic mass: C = 12 ; H = 1 ; O = 16) **[6 September, 2020 (Shift-II)]**

118. For the following reaction, the mass of water produced from 445 g of $C_{57}H_{110}O_6$ is:

$2C_{57}H_{110}O_6$ (s) + 163 O_2 (g) → 114 CO_2 (g) + 110 H_2O (l)

[9 Jan, 2019 (Shift-II)]

(*a*) 490 g (*b*) 445 g (*c*) 495 g (*d*) 890 g

119. 50 mL of 0.5 M oxalic acid is needed to neutralize 25 ml of sodium hydroxide solution. The amount of NaOH in 50 mL of the given sodium hydroxide solution is: **[12 Jan, 2019 (Shift-I)]**

(*a*) 40 g (*b*) 10 g (*c*) 20 g (*d*) 80 g

120. For a reaction,

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$;

Identify dihydrogen (H_2) as a limiting reagent in the following reaction mixtures. **[9 April, 2019 (Shift-I)]**

(*a*) 14 g of N_2 + 4 g of H_2 (*b*) 28 g of N_2 + 6 g of H_2

(*c*) 56 g of N_2 + 10 g of H_2 (*d*) 35 g of N_2 + 8 g of H_2

JEE-Advanced

Mole Concept, Percentage Composition, Molar Masses, and Empirical Formula

Single Correct

1. An aqueous solution of 6.3 g oxalic acid dihydrate is made up to 250 mL. The volume of 0.1 N NaOH required to completely neutralise 10 mL of this solution is **(IIT JEE 2001)**

(*a*) 40 mL (*b*) 20 mL (*c*) 10 mL (*d*) 4 mL

2. The normality of 0.3M phosphorus acid (H_3PO_3) is **(IIT JEE 1999)**

(*a*) 0.1 (*b*) 0.9 (*c*) 0.3 (*d*) 0.6

3. In which mode of expression, the concentration of a solution remains independent of temperature? **(IIT JEE 1998)**

(*a*) Molarity (*b*) Normality

(*c*) Formality (*d*) Molality

4. The volume strength of 1.5 NH_2O_2 is **(IIT JEE 1990)**

(*a*) 4.8 (*b*) 8.4 (*c*) 3.0 (*d*) 8.0

5. A molal solution is one that contains one mole of solute in **(IIT JEE 1986)**

(*a*) 1000 g of solvent (*b*) 1.0 L of solvent

(*c*) 1.0 L of solution (*d*) 22.4 L of solution

6. If 0.50 mole of $BaCl_2$ is mixed with 0.20 mole of Na_3PO_4, the maximum number of moles of $Ba_3(PO_4)_2$ that can be formed is **(IIT JEE 1981)**

(*a*) 0.70 (*b*) 0.50 (*c*) 0.20 (*d*) 0.10

7. The total number of electrons in one molecule of carbon dioxide is **(IIT JEE 1979)**

(*a*) 22 (*b*) 44 (*c*) 68 (*d*) 88

Numerical/Integer Type

8. To form a complete monolayer of acetic acid on 1g of charcoal, 100 mL of 0.5M acetic acid was used. Some of the acetic acid remained unadsorbed. To neutralize the unadsorbed acetic acid, 40 mL of 1 M NaOH solution was required. If each molecule of acetic acid occupies $P \times 10^{-23}\ \mu^2$ surface area on charcoal, the value of P is _____.

[Use given data: Surface area of charcoal = $1.5 \times 10^2\ m^2g^{-1}$; Avogadro's number ($N_A$) = $6.0 \times 10^{23}\ mol^{-1}$]

C-15.73 W-60.25 UA-24.03 (JEE Adv. 2024)

9. Aluminium reacts with sulphuric acid to form aluminium sulphate and hydrogen. What is the volume of hydrogen gas in litre (L) produced at 300 K and 1.0 atm pressure, when 5.4 g of aluminium and 50.0 mL of 5.0 M sulphuric acid are combined for the reaction? (Use molar mass of aluminium as 27.0 g mol^{-1}, R = 0.082 atm L $mol^{-1}\ K^{-1}$) **C-18.21 W-64.19 UA-17.6 PC-0 (JEE Adv. 2020)**

10. The mole fraction of urea in an aqueous urea solution containing 900 g of water is 0.05. If the density of the solution is 1.2 g cm^{-3}, the molarity of urea solution is ___.

(Given data: Molar masses of urea and water are 60 g mol^{-1} and 18 g mol, respectively) **C-17.05 W-70.35 UA-12.61 (JEE Adv. 2019)**

11. The mole fraction of a solute in a solution is 0.1. At 298 K, molarity of this solution is the same as its molality. Density of this solution at 298 K is 2.0 g cm^{-3}. The ratio of the molecular weights of the solute and solvent, $\left(\frac{m_{solute}}{m_{solvent}}\right)$ is ...

C-28.66 W-66.23 UA-5.11 (JEE Adv. 2016)

12. A compound H_2X with molar weight of 80 g is dissolved in a solvent having density of 0.4 g mL^{-1}. Assuming no change in volume upon dissolution, the molality of a 3.2 molar solution is

C-39.97 W-51.56 UA-8.47 (JEE Adv. 2014)

13. 29.2% (w/W) HCl stock solution has density of 1.25 g mL^{-1}. The molecular weight of HCl is 36.5 g mol^{-1}. The volume (mL) of stock solution required to prepare a 200 mL solution 0.4 M HCl is

C-15.53 W-67.67 UA-16.8 (IIT JEE 2012)

Fill in the Blanks

14. 3.0 g of a salt of molecular weight 30 is dissolved in 250 g water. The molality of the solution is ..... **(IIT JEE 1983)**

15. The total number of electrons present in 18 mL of water is .....

(IIT JEE 1980)

Subjective

16. 20% surface sites have adsorbed N_2. On heating N_2 gas evolved from sites and were collected at 0.001 atm and 298 K in a container of volume is 2.46 cm^3. Density of surface sites is $6.023 \times 10^{14}/cm^2$ and surface area is 1000 cm^2, find out the number of surface sites occupied per molecule of N_2. **(IIT JEE 2005)**

17. Calculate the amount of calcium oxide required when it reacts with 852 g of P_4O_{10}. **(IIT JEE 2005)**

18. In a solution of 100 mL 0.5 M acetic acid, one gram of active charcoal is added, which adsorbs acetic acid. It is found that the concentration of acetic acid becomes 0.49M. If surface area of charcoal is 3.01×10^2 m^2, calculate the area occupied by a single acetic acid molecule on the surface of charcoal. **(IIT JEE 2003)**

19. Find the molarity of water. Given: $\rho = 1000$ kg/m^3 **(IIT JEE 2003)**

20. How many millilitres of 0.5M H_2SO_4 are needed to dissolve 0.5 g of copper (II) carbonate? **(IIT JEE 1999)**

21. An aqueous solution containing 0.10 g KIO_3 (formula weight = 214.0) was treated with an excess of KI solution. The solution was acidified with HCl. The liberated I_2 consumed 45.0 mL of thiosulphate solution decolourise the blue starch-iodine complex. Calculate the molarity of the sodium thiosulphate solution. **(IIT JEE 1998)**

22. To a 25 mL H_2O_2 solution, excess of acidified solution of potassium iodide was added. The iodine liberated required 20 mL of 0.3 N sodium thiosulphate solution. Calculate the volume strength of H_2O_2 solution **(IIT JEE 1997)**

23. A 5.0 cm^3 solution of H_2O_2 liberates 0.508 g of iodine from an acidified KI solution. Calculate the strength of H_2O_2 solution in terms of volume strength at STP. **(IIT JEE 1995)**

24. 8.0575×10^{-2} kg of Glauber's salt is dissolved in water to obtain 1 dm^3 of solution of density 1077.2 kg m^{-3}. Calculate the molality, molarity and mole fraction of Na_2SO_4 in solution.**(IIT JEE 1994)**

25. Upon mixing 45.0 mL, 0.25 M lead nitrate solution with 25.0 mL of a 0.10 M chromic sulphate solution, precipitation of lead sulphate takes place. How many moles of lead sulphate are formed? Also calculate the molar concentrations of species left behind in the final solution. Assume that lead sulphate is completely insoluble.

(IIT JEE 1993)

26. Calculate the molality of 1.0 L solution of 93% H_2SO_4, (weight/volume). The density of the solution is 1.84 g/mL. **(IIT JEE 1990)**

27. n-butane is produced by monobromination of ethane followed by Wurtz's reaction. Calculate volume of ethane at NTP required to produce 55 g n-butane, if the bromination takes place with 90% yield and the Wurtz's reaction with 85% yield. **(IIT JEE 1989)**

28. A sugar syrup of weight 214.2 g contains 34.2 g of sugar ($C_{12}H_{22}O_{11}$). Calculate (i) molal concentration and (ii) mole fraction of sugar in syrup **(IIT JEE 1988)**

29. An unknown compound of carbon, hydrogen and oxygen contains 69.77%C and 11.63%H and has a molecular weight of 86. It does not reduce Fehling's solution but forms a bisulfite addition compound and gives a positive iodoform test. What is the possible structure(s) of unknown compounds? **(IIT JEE 1987)**

30. The density of a 3M sodium thiosulphate solution ($Na_2S_2O_3$) is 1.25 g per mL. Calculate (i) the percentage by weight of sodium thiosulphate (ii) the mole fraction of sodium thiosulphate and (iii) the molalities of Na^+ and $S_2O_3^{2-}$ ions. **(IIT JEE 1983)**

31. In the analysis of 0.5 g sample of feldspar, a mixture of chlorides of sodium and potassium is obtained, which weighs 0.1180 g. Subsequent treatment of the mixed chlorides with silver nitrate gives 0.2451 g of silver chloride. What is the percentage of sodium oxide and potassium oxide in the sample? **(IIT JEE 1979)**

32. The vapor density (hydrogen = 1) of a mixture consisting of NO_2 and N_2O_4 is 38.3 at 26.7°C. Calculate the number of moles of NO_2 in 100 g of the mixture. **(IIT JEE 1979)**

Uncertainty in Measurement and Laws of Chemical Combinations, Atomic and Molecular Masses, Stoichiometry and Stoichiometric Calculation

Single Correct

33. 2.76 g of silver carbonate on being strongly heated yields a residue weighing **(IIT JEE 1979)**

(*a*) 2.16 g (*b*) 2.48 g (*c*) 2.32 g (*d*) 2.64 g

34. When the same amount of zinc is treated separately with excess of sulphuric acid and excess of sodium hydroxide, the ratio of volumes of hydrogen evolved is **(IIT JEE 1979)**

(*a*) 1:1 (*b*) 1:2

(*c*) 2:1 (*d*) 9 : 4

35. The largest number of molecules is in **(IIT JEE 1979)**

(*a*) 36 g of water

(*b*) 28 g of CO

(*c*) 46 g of ethyl alcohol

(*d*) 54 g of nitrogen pentoxide (N_2O_5)

36. A gaseous mixture contains oxygen and nitrogen in the ratio of 1:4 by weight. Therefore, the ratio of their number of molecules is

(IIT JEE 1979)

(*a*) 1:4 (*b*) 1:8 (*c*) 7:32 (*d*) 88

Multiple Correct

37. To check the principle of multiple proportions, a series of pure binary compounds (P_mQ_n) were analyzed and their composition is tabulated below. The correct option(s) is(are)

C-14.77 W-26.73 UA-39.64 (JEE Adv. 2022)

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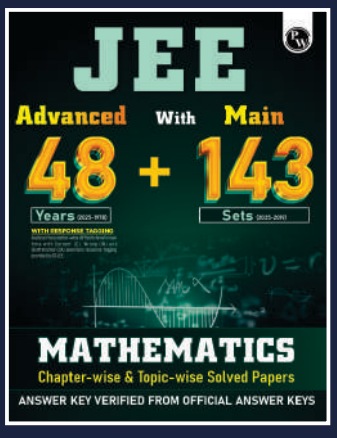

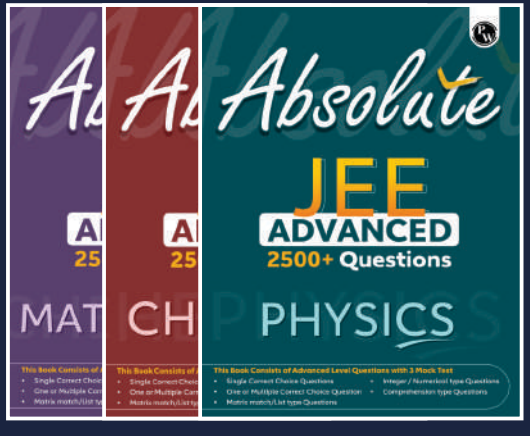

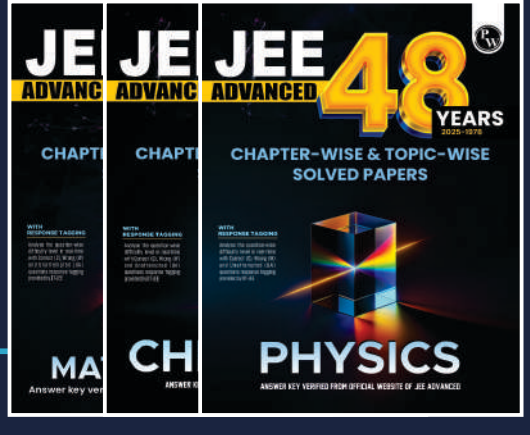

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