Nishant Jindal

Chapter	Task	Date
Thermodynamics	Notes	Monday, 1 January 2024
	Jee Main Selected PYQS-2	Tuesday, 2 January 2024
	Class	Wednesday, 3 January 2024
Thermochemistry	Notes + Jee Main Selected PYQS-2	Thursday, 4 January 2024
Mole concept	Notes + Jee Main Selected PYQS-2	Friday, 5 January 2024
Concentration Terms	Notes + Jee Main Selected PYQS-2	Saturday, 6 January 2024
		Sunday, 7 January 2024
Chemical Kinetics	Notes	Monday, 8 January 2024
	Jee Main Selected PYQS-2	Tuesday, 9 January 2024
	Class	Wednesday, 10 January 2024
Chemical Equilibrium	Notes + Jee Main Selected PYQS-2	Thursday, 11 January 2024
Ionic Equilibrium	Notes	Friday, 12 January 2024
	Jee Main Selected PYQS-2	Saturday, 13 January 2024
		Sunday, 14 January 2024
Redox Reactions	Notes + Jee Main Selected PYQS-2	Monday, 15 January 2024
Electrochemistry	Notes	Tuesday, 16 January 2024
	Class	Wednesday, 17 January 2024
	Jee Main Selected PYQS-2	Thursday, 18 January 2024
Liquid Solution	Notes + Jee Main Selected PYQS-2	Friday, 19 January 2024
Atomic structure	Notes + Jee Main Selected PYQS-2	Saturday, 20 January 2024
		Sunday, 21 January 2024

13.5

Score 0

Score +1

Score -1

akk 7007

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$$[A]_t = [A]_0 - kt$$

$$\Longrightarrow kt = \ln [A]_0/[A]_t$$

$t_{90\%}$

$[A]_0 = 100$

$[A]_t = 10$

$$\frac{t_{90\%}}{t_{10\%}}$$

[A]	[B]	Rate
		✓

$$t_{1/2} \propto \frac{1}{[A]_0^{n-1}}$$

$$A + 2B \longrightarrow 4C$$

$$\frac{k_A}{1} = \frac{k_B}{2} = \frac{k_C}{4} = k_R$$

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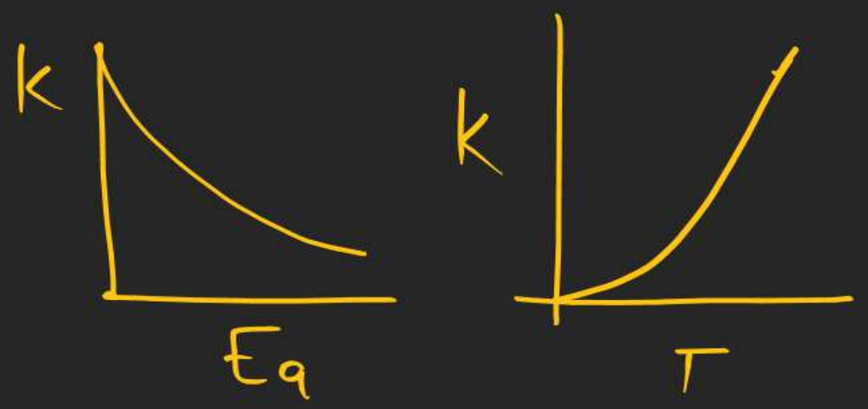
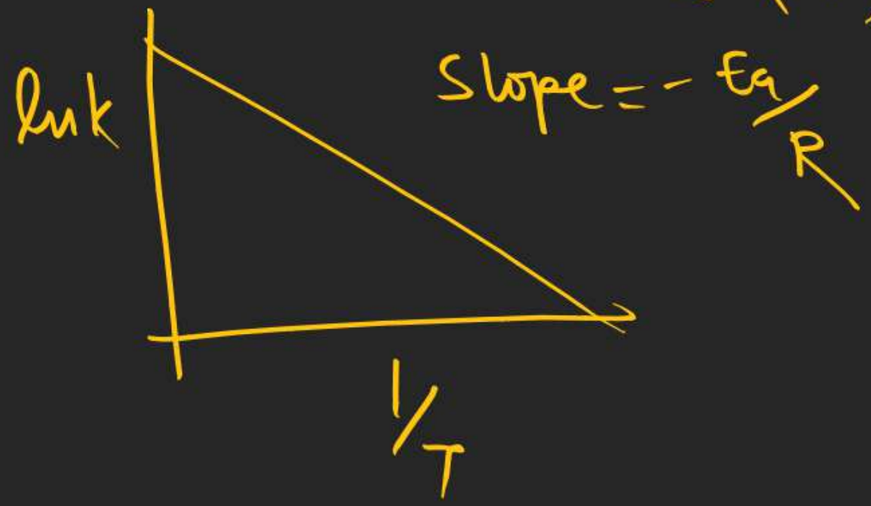
$$k = A\, e^{-E_a/RT}$$



$$\ln k = \ln A - \frac{E_a}{R}\left(\frac{1}{T}\right)$$



$$\ln k = 25 - \frac{100}{T}$$

$$\ln \frac{k_{T_2}}{k_{T_1}} = \frac{E_a}{R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$

T↑ k↑

$$\ln \frac{K_2}{K_1} = \frac{\Delta H}{R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$

$\Delta H > 0$ T↑ K_{eq} ↑

$\Delta H < 0$ T↑ K_{eq} ↓

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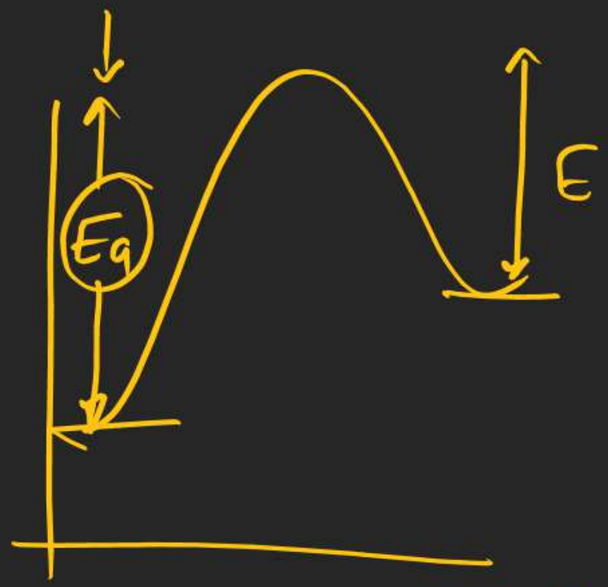

$$\frac{k'}{k} = e^{x/RT}$$

$$k' = k \times e^{x/RT}$$

$$e^{-E_a/RT}$$

$$\text{Rate} = Z_{12} \times e^{-E_a/RT} \times P$$

$$\mu = \frac{k_{T+10}}{k_T}$$

temperature coefficient

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CHEMICAL KINETICS

1. Decomposition of X exhibits a rate constant of 0.05 mg/year. How many years are required for the decomposition of 5 mg of X into 2.5 mg ? [Jee Main, Jan 2019]

(A) 25 (B) 40 (C) 50 (D) 20

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CHEMICAL KINETICS

2. The given plots represent the variation of the concentration of a reactant R with time for two different reactions (i) and (ii). The respective orders of the reactions are : (Chemical Kinetics) [Jee Main, April 2019]

(A) 0, 1 (B) 1, 1 (C) 0, 2 (D) 1, 0

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CHEMICAL KINETICS

3. For an elementary chemical reaction, $A_2 \xrightarrow{k_1} 2A$, the expression for $\frac{d[A]}{dt}$ is:

[Chemical Kinetics] [Jee Main, Jan 2019]

(A) $2k_1[A_2]-2k_{-1}[A]^2$ ✓

(B) $k_1[A_2]-k_{-1}[A]^2$

(C) $2k_1[A_2]-k_{-1}[A]^2$

(D) $k_1[A_2]+k_{-1}[A]^2$

$$A_2 \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} 2A$$

$$\frac{d[A]}{dt} = k_1[A_2] \times 2$$

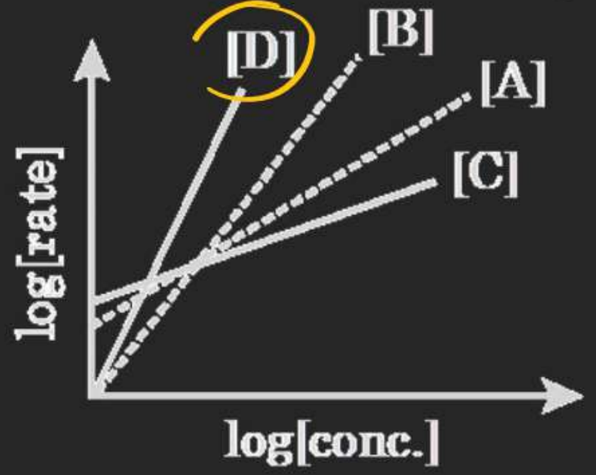
$$\left(-\frac{d[A]}{dt}\right) = k_{-1}[A]^2 \times 2$$

CHEMICAL KINETICS

5. Consider the following reactions

$A \rightarrow P1$; $B \rightarrow P2$; $C \rightarrow P3$; $D \rightarrow P4$,

The order of the above reactions are a, b, c and d, respectively. The following graph is obtained when log[rate] vs. log[conc.] are plotted : [Jee Main, 2020]



$rate = k(conc)^n$

Among the following, the correct sequence for the order of the reactions is :

(A) d > b > a > c

(B) a > b > c > d

(C) c > a > b > d

(D) d > a > b > c

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CHEMICAL KINETICS

6. The rate of a certain biochemical reaction at physiological temperature (T) occurs 10^6 times faster with enzyme than without. The change in the activation energy upon adding enzyme is : [Jee Main, 2020]

(A) + 6RT

(B) –6(2.303)RT

(C) +6(2.303)RT

(D) –6RT

$$e^{x/RT} = 10^6$$

$$x/RT = 6 \ln 10 = 6 \times 2.303$$

$$x = 6 \times 2.303 \times RT$$

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CHEMICAL KINETICS

7. Gaseous cyclobutene isomerizes to butadiene in a first order process which has a 'k' value of

$3.3 \times 10^{-4} s^{-1}$ at 153°C. The time in minutes it takes for the isomerization to proceed 40% to completion at this temperature is_____ (Rounded off to the nearest integer)

[JEE Main, Feb 2021]

$$t = \frac{1}{k} \ln \frac{100}{60}$$

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CHEMICAL KINETICS

8. The inactivation rate of a viral preparation is proportional to the amount of virus. In the first minute after preparation, 10% of the virus is inactivated. The rate constant for viral inactivation is _____ $\times 10^{-3}$ min^{-1}. (Nearest integer)

[JEE Main, July 2021]

[Use : ln 10 = 2.303 ; $\log_{10} 3 = 0.477$; property of logarithm : $\log x^y = y \log x$]

$$k = \frac{1}{t} \ln \frac{100}{90}$$

CHEMICAL KINETICS

10. $2\,NO(g) + Cl_2(g) \rightleftharpoons 2\,NOCl(s)$

This reaction was studied at –10°C and the following data was obtained

run	$[NO]_0$	$[Cl_2]_0$	r_0
1	0.10	0.10	0.18
2	0.10	0.20	0.35
3	0.20	0.20	1.40

$[NO]_0$ and $[Cl_2]_0$ are the initial concentrations and r_0 is the initial reaction rate.

The overall order of the reaction is _____. [JEE Main, March 2021]

(Round off to the Nearest Integer).

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THERMOCHEMISTRY

2. Enthalpy of sublimation of iodine is 24 cal g^{-1} at 200°C. If specific heat of $I_2(s)$ and $I_2(g)$ are 0.055 and 0.031 cal g^{-1} K^{-1} respectively, then enthalpy of sublimation of iodine at 250°C in cal g^{-1} is: [Jee Main, April 2019]

(A) 2.85 (B) 22.8 (C) 11.4 (D) 5.7

$$I_2(s) \rightarrow I_2(g)$$

$$\Delta H_{250^\circ C} = \Delta H_{200^\circ C} + (0.031 - 0.055)(50)$$

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THERMOCHEMISTRY

4. The average S–F bond energy in kJ mol^{-1} of SF_6 is _____.(Rounded off to the nearest integer) [Given : The values of standard enthalpy of formation of $SF_6(g)$, S(g) and F(g) are –1100, 275 and 80 kJ mol^{-1} respectively.] [JEE Main, Feb 2021]

$$SF_6 \longrightarrow S + 6F$$

$$6 \times BE_{S-F} = \Delta H_r = \Delta H_f(Pr) - \Delta H_f(R)$$

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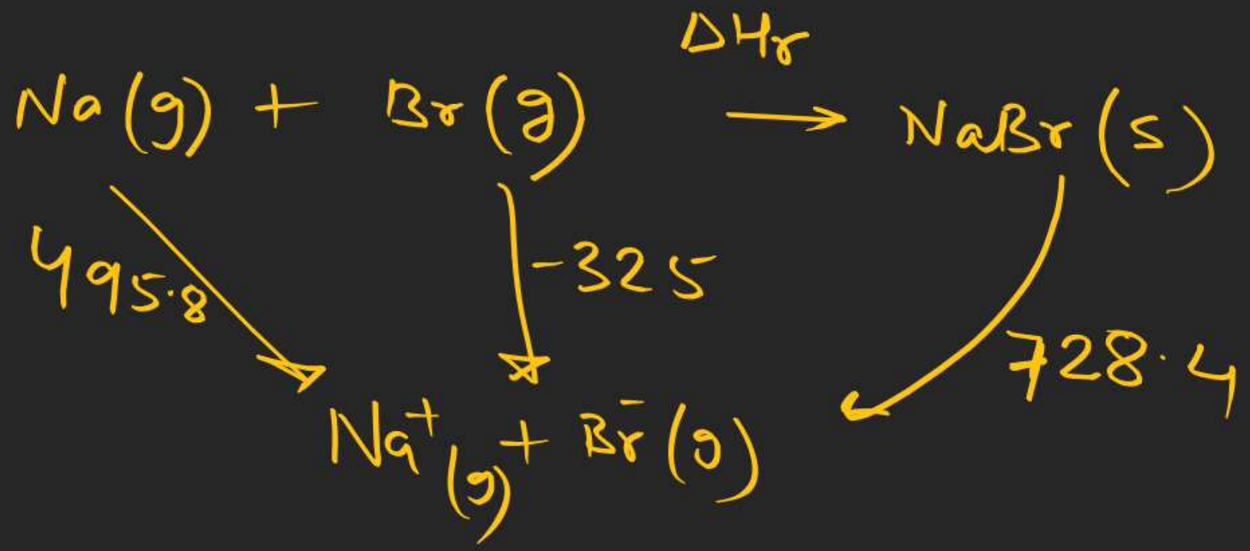
THERMOCHEMISTRY

5. The ionization enthalpy of Na^+ formation from $Na_{(g)}$ is 495.8 kJ mol^{-1}, while the electron gain enthalpy of Br is –325.0 kJ mol^{-1}. Given the lattice enthalpy of NaBr is +728.4 kJ mol^{-1}. The energy for the formation of NaBr ionic solid is (–) _____ × 10^{-1} kJ mol^{-1}.

[JEE Main, Feb 2021]



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THERMOCHEMISTRY

6. 200 mL of 0.2 M HCl is mixed with 300 mL of 0.1 M NaOH. The molar heat of neutralization of this reaction is –57.1 kJ. The increase in temperature in °C of the system on mixing is $x \times 10^{-2}$. The value of x is _____ . (Nearest integer)

[Given : Specific heat of water = 4.18 J g^{-1} K^{-1} Density of water = 1.00 g cm^{-3}]

(Assume no volume change on mixing) [JEE Main, August 2021]

$30 \times 10^{-3} \times 57.1 \times 10^{3} = m\, s\, \Delta T$

$= 500 \times 1 \times 4.18 \times \Delta T$

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MOLE CONCEPT

1. Complex A has a composition of $H_{12}O_6C_{13}Cr$. If the complex on treatment with conc. H_2SO_4 loses 13.5% of its original mass, the correct molecular formula of A is:

[Given: atomic mass of Cr = 52 amu and Cl = 35 amu] [Jee Main, 2020]

(A) $[Cr(H_2O)_5Cl]Cl_2 . H_2O$

(B) $[Cr(H_2O)_4Cl_2]Cl . 2H_2O$

(C) $[Cr(H_2O)_6]Cl_3$

(D) $[Cr(H_2O)_3Cl_3] . 3H_2O$

$$\frac{n \times 18}{M} \times 100 = 13.5$$

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MOLE CONCEPT

2. The minimum amount of $O_2(g)$ consumed per gram of reactant is for the reaction : (Given atomic mass : Fe = 56, O = 16, Mg = 24, P = 31, C = 12, H = 1) (Mole Concept)

(A) $4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$ [Jee Main, April 2019]

(B) $C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$

(C) $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$

(D) $P_4(s) + 5O_2(g) \rightarrow P_4O_{10}(s)$

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MOLE CONCEPT

4. 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}] [Jee Main, Jan 2019]

(A) 0.84 (B) 8.4 (C) 16.8 (D) 33.6

$$2NaHCO_3 + H_2C_2O_4 \rightarrow Na_2C_2O_4 + 2CO_2 + 2H_2O$$

10^{-5} mol

$\frac{0.25 \times 10^{-3}}{25 \times 10} = 10^{-5}$ mol

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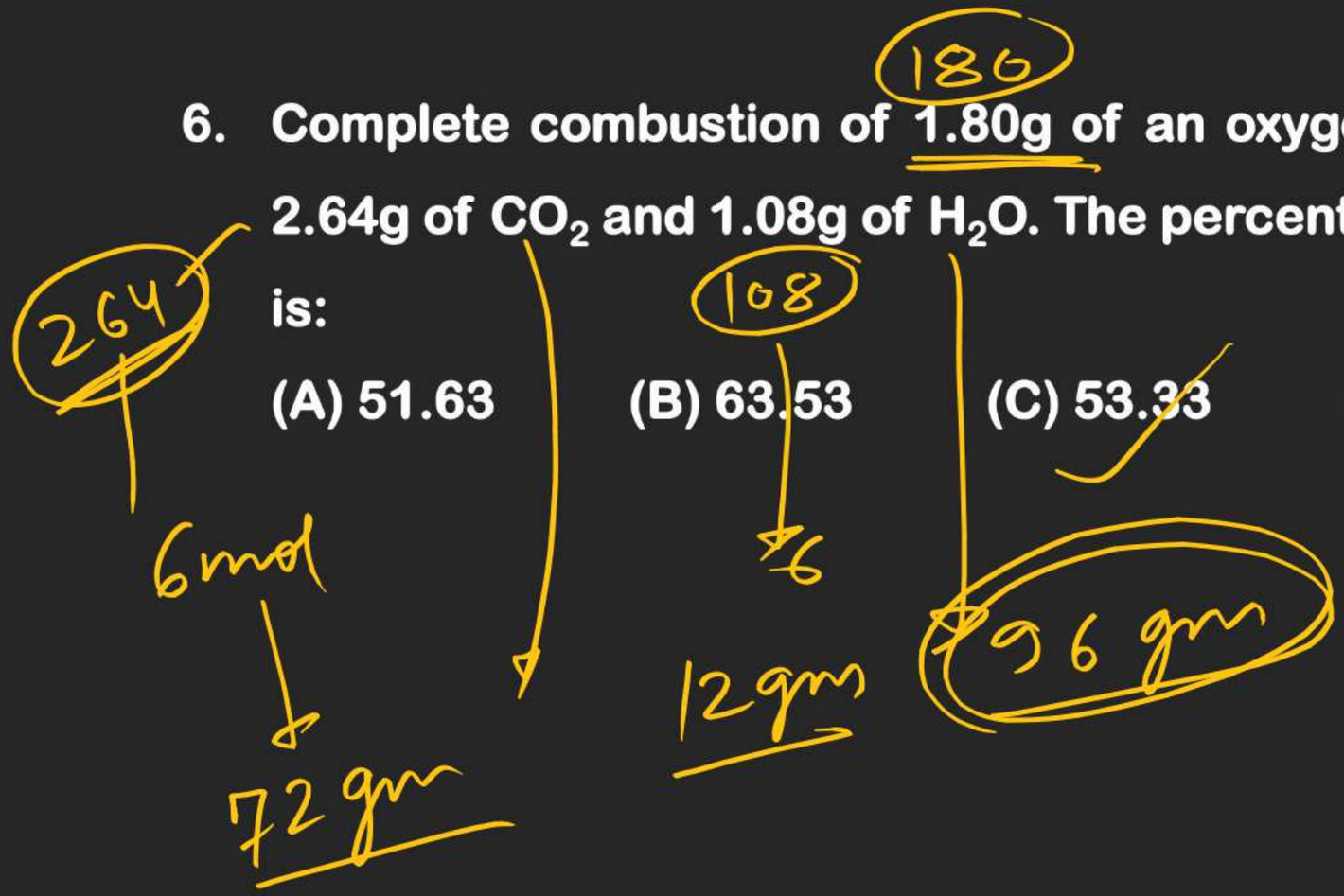
MOLE CONCEPT

6. Complete combustion of 1.80g of an oxygen containing compound ($C_xH_yO_z$) gave 2.64g of CO_2 and 1.08g of H_2O. The percentage of oxygen in the organic compound is:

[JEE Main, Feb 2021]

(A) 51.63 (B) 63.53 (C) 53.33 (D) 50.33



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MOLE CONCEPT

7. Consider an imaginary ion $^{48}_{22}X^{3-}$. The nucleus contains 'a'% more neutrons than the number of electrons in the ion. The value of 'a' is_____[nearest integer]

[JEE Main, July 2022]

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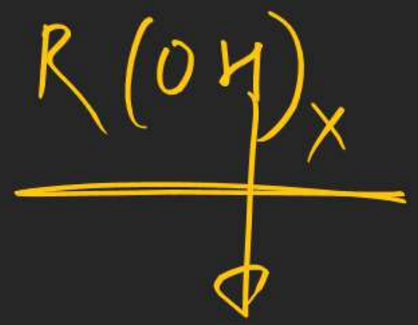
MOLE CONCEPT

8. A 1.84 mg sample of polyhydric alcoholic compound 'X' of molar mass 92.0 g/mol gave 1.344 mL of H_2 gas at STP. The number of alcoholic hydrogens present 1n compound 'X' is _____.

[JEE Main, July 2022]



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MOLE CONCEPT

10. The ratio of the mass percentages of 'C & H' and 'C & O' of a saturated acyclic organic compound 'X' are 4 : 1 and 3 : 4 respectively. Then, the moles of oxygen gas required for complete combustion of two moles of organic compound 'X' is _____.

[Jee Main, 2020]

C : H

$3 \times (4 : 1)$

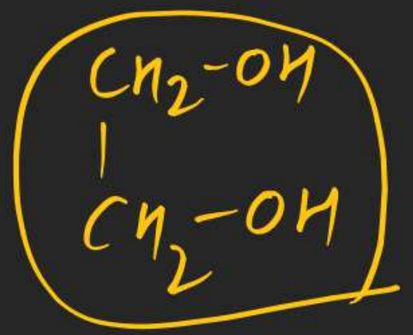
C : O

$(3 : 4) \times 4$

C	H	O
$\frac{12}{12}$	$\frac{3}{1}$	$\frac{16}{16}$
1	3	1

CH_3O

$C_2H_6O_2$



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CONCENTRATION TERMS

3. What would be the molality of 20% (mass/mass) aqueous solution of KI?
(molar mass of KI = 166 g mol^{-1})

(A) 1.48 (B) 1.35 (C) 1.08 (D) 1.51

[Jee Main, April 2019]

CONCENTRATION TERMS

4. In Carius method of estimation of halogen. 0.45 g of an organic compound gave 0.36 g of AgBr. Find out the percentage of bromine in the compound.

[JEE Main, July 2022]

(Molar masses : AgBr = 188 g mol^{-1}: Br = 80 g mol^{-1})

(A) 34.04% (B) 40.04% (C) 36.03% (D) 38.04%

CONCENTRATION TERMS

5. Which of the following is 'a' FALSE statement? [JEE Main, Feb 2021]

(A) Carius tube is used in the estimation of sulphur in an organic compound

(B) Carius method is used for the estimation of nitrogen in an organic compound

(C) Phosphoric acid produced on oxidation of phosphorus present in an organic compound is

precipitated as $Mg_2P_2O_7$ by adding magnesia mixture.

(D) Kjeldahl's method is used for the estimation of nitrogen in an organic compound

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CONCENTRATION TERMS

6. The molarity of the solution prepared by dissolving 6.3 g of oxalic acid ($H_2C_2O_4.2H_2O$) in 250 mL of water in mol L^{-1} is $x \times 10^{-2}$. The value of x is _____. (Nearest integer)

[Atomic mass : H : 1.0, C : 12.0, O : 16.0]

[JEE Main, August 2021]

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CONCENTRATION TERMS

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

Atomic weight : Fe = 55.85; S = 32.00; O = 16.00 [Jee Main, 2020]

$FeSO_4 \cdot 7H_2O$

$\frac{1}{56} \times M$

10^6 gm → 10 gm iron

10^5 gm → 1 gm

100 kg → $\frac{1\text{ gm}}{56}$ mol Fe

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CONCENTRATION TERMS

8. When 800 mL of 0.5 M nitric acid is heated in a beaker, its volume is reduced to half and 11.5 g of nitric acid is evaporated. The molarity of the remaining nitric acid solution is $x \times 10^{-2}$ M. (Nearest Integer) (Molar mass of nitric acid is 63 g mol^{-1})

[JEE Main, July 2022]

$V_f = 400\,ml$

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CONCENTRATION TERMS

9. An aqueous KCl solution of density 1.20 g mL^{-1} has a molality of 3.30 mol kg^{-1}. The molarity of the solution in mol L^{-1} is _____ (Nearest integer)

[Molar mass of KCl = 74.5]

[JEE Main, August 2021]

$m \longrightarrow M$

1000 gm solvent ——— 3.3 mol KCl

3.3×74.5 gm

$W_{solution} = (1000 + 3.3 \times 74.5)$ gm

$V_{solution} = \dfrac{(1000 + 3.3 \times 74.5)}{1.2}$ ml

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CONCENTRATION TERMS

10. 250 mL of 0.5 M NaOH was added to 500 mL of 1 M HCl. The number of unreacted HCl molecules in the solution after complete reaction is _____ × 10^{21}. (Nearest integer)

($N_A = 6.022 \times 10^{23}$)

[JEE Main, July 2021]

125 mmol

500 mmol

0

375 mmol

$375 \times 10^{-3} \times 6 \times 10^{23}$

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CONCENTRATION TERMS

11. The volume strength of 8.9 M H_2O_2 solution calculated at 273 K and 1 atm is _____.

(R=0.0821 L atm K^{-1} mol^{-1}) (rounded off the nearest integer) [Jee Main, 2020]

Vol str = M × 11.2

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CONCENTRATION TERMS

12. A sample of 0.125 g of an organic compound when analysed by Duma's method yields 22.78 mL of nitrogen gas collected over KOH solution at 280K and 759 mm Hg. The percentage of nitrogen in the given organic compound is ____. (Nearest integer). [JEE Main, July 2022]

(a) The vapour pressure of water at 280 K is 14.2 mm Hg

(b) $R = 0.082\ L\ atm\ K^{-1}\ mol^{-1}$

$P_{N_2} = 759 - 14.2 = 744.8$

$PV = nRT$

$W_{N_2} = n \times 28$