Some Basic Concepts of Chemistry

Question1

What is the number of hydrogen atoms present in 5.4 g of urea?

MHT CET 2025 5th May Evening Shift

Options:

A.

9.011×10^{23}

B.

6.022×10^{23}

C.

2.168×10^{23}

D.

3.011×10^{23}

Answer: C

Solution:

1 mol urea $= 60$ g urea $(H_2N - CO - NH_2)$

No. of moles of urea $= \frac{5.4}{60} = 0.09$ mol

No. of H -atoms in 1 urea molecule $= 4$

H -atom in 0.09 mol urea molecule $= 0.09 \times 4$

$= 0.36$ mol

$\therefore$ No. of H - atoms in 0.36 moles

$= 0.36 \times 6.022 \times 10^{23}$

$= 2.168 \times 10^{23}$

Question2

Calculate number of molecules present in 5.4 g of urea (Molar mass of urea $= 60\ \text{g mol}^{-1}$)

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Options:

A.

6.022×10^{22}

B.

5.419×10^{22}

C.

4.312×10^{22}

D.

9.933×10^{22}

Answer: B

Solution:

$$\frac{\text{W(g)}}{\text{MW}} = \frac{\text{N}}{\text{N}_\text{A}}$$

$$\begin{aligned}
1 \text{ mol urea } &= 60 \text{ g urea} \\
&= 6.022 \times 10^{23} \text{ molecules} \\
\text{No. of molecules } &= \frac{5.4 \text{ g} \times 6.022 \times 10^{23}}{60 \text{ g mol}^{-1}} \\
&= 5.4 \times 10^{22} \text{ molecules}
\end{aligned}$$

Question3

Find out the total number of electrons present in 3.2 g methane?

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Options:

A. 6.022×10^{23}

B. 1.204×10^{24}

C. 3.201×10^{23}

D. 4.821×10^{22}

Answer: B

Solution:

3.2 g methane $= \frac{3.2}{16} = 0.2$ mol of methane

1 mol of methane contains 6.022×10^{23} molecules of methane

$\therefore$ 0.2 mol of methane contain 12.044×10^{22} molecules of methane

1 molecule of methane (CH_4) contains total 10 electrons (6 from C atom and 1 from each H atom).

$\therefore$ 12.044×10^{22} molecules of methane contain $12.044 \times 10^{22} \times 10 = 1.2 \times 10^{24}$ electrons.

Question4

Calculate % by mass of a H_2O_2 solution that is 67.2 by volume.

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Options:

A. 13.60% by mass

B. 20.40% by mass

C. 22.44% by mass

D. 17.60% by mass

Answer: B

Solution:

$$\text{Molarity (M)} = \frac{\text{volume strength of } H_2O_2}{11.2}$$

$$= \frac{67.2}{11.2} = 6 \text{ mol/L}$$

Assuming a basis of 1 L solution,

$nH_2O_2 = 6$ moles, $V_s = 1$ L

$W_{H_2O_2} = n_{H_2O_2} \times MW_{H_2O_2} = 6 \times 34 = 204$ g/mol

$W_s = V_s \times \rho_s = 1000 \text{ mL} \times 1 \text{ g/mL} = 1000$ g

$\therefore \quad \%$ by mass $= \frac{W_{H_2O_2}}{W_s} \times 100 = \frac{204}{1000} \times 100 = 20.4\%$

Question5

Find the volume of 56 g dinitrogen at STP

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Options:

A. 11.2 Lit.

B. 22.4 Lit.

C. 44.8 Lit.

D. 67.2 Lit.

Answer: C

Solution:

Step 1: Molar mass of dinitrogen

$N_2 = 14 \times 2 = 28$ g/mol

Step 2: Number of moles

$n = \frac{\text{mass}}{\text{molar mass}} = \frac{56}{28} = 2$ mol

Step 3: Volume at STP

At STP, 1 mole of any ideal gas occupies **22.4 L**.

$V = n \times 22.4 = 2 \times 22.4 = 44.8$ L

✅ Final Answer:

Option C: 44.8 Lit.

Question6

Calculate percentage atom economy when 46 g ethanol is obtained from 64.5 g chloroethane and $56\ \mathrm{g KOH_{(aq)}}$.

MHT CET 2025 25th April Morning Shift

Options:

A. 25.25%

B. 38.17%

C. 50.25%

D. 64.17%

Answer: B

Solution:

$$\%\ \text{atom economy} = \frac{\text{Formula weight of the desired product}}{\text{Sum of formula weight of all the reactants used in the reaction}} \times 100$$

$$= \frac{46\ \text{g}}{64.5\ \text{g} + 56\ \text{g}} \times 100 = \frac{46\ \text{g}}{120.5\ \text{g}} \times 100 = 38.17\%$$

Question7

The vapour density of a certain gas is 16 . What is the volume occupied by 8 g of gas at STP assuming ideal behaviour?

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Options:

A. $2.80\mathrm{dm}^3$

B. $5.6\mathrm{dm}^3$

C. $11.2\mathrm{dm}^3$

D. $2.24 \mathrm{dm}^3$

Answer: B

Solution:

Step 1: Recall the relation between vapour density (VD) and molar mass (M)

$M = 2 \times \text{VD}$

$M = 2 \times 16 = 32\,\text{g mol}^{-1}$

So, the molar mass of the gas is **32 g/mol**.

Step 2: Number of moles of 8 g of gas

$n = \frac{\text{mass}}{\text{molar mass}} = \frac{8}{32} = 0.25\,\text{mol}$

Step 3: Molar volume at STP

At STP, **1 mole of gas occupies 22.4 dm³**.

So volume:

$V = n \times 22.4 = 0.25 \times 22.4 = 5.6\,\text{dm}^3$

✅ **Final Answer:**

$\boxed{5.6\,\text{dm}^3}$

Correct option: **B**

Question8

Find out total number of electrons present in 1.6 g methane?

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Options:

A. 6.022×10^{23}

B. 6.022×10^{22}

C. 6.022×10^{21}

D. 4.022×10^{20}

Answer: A

Solution:

1.6 g methane $= \frac{1.6}{16} = 0.1$ mol of methane

1 mol of methane contains 6.022×10^{23} molecules of methane

$\therefore$ 0.1 mole of methane contain 6.022×10^{22} molecules of methane

1 molecule of methane (CH_4) contains total 10 electrons (6 from C atom and 1 from H atom).

$\therefore$ 6.022×10^{22} molecules of methane contain $6.022 \times 10^{22} \times 10 = 6.022 \times 10^{23}$ electrons.

Question9

Find the number of millimoles for 0.160 g sodium hydroxide.

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Options:

A. 0.08

B. 0.20

C. 4.00

D. 40.00

Answer: C

Solution:

Step 1: Molar mass of NaOH

- Na: 23 g/mol
- O: 16 g/mol
- H: 1 g/mol

Total = 23 + 16 + 1 = **40 g/mol**

Step 2: Moles of NaOH

$\text{moles} = \frac{\text{mass}}{\text{molar mass}} = \frac{0.160}{40.0}$

moles $= 0.00400$ mol

Step 3: Convert to millimoles

$0.00400 \text{ mol} \times 1000 = 4.00$ mmol

✅ Correct Answer: **Option C. 4.00**

Question10

A gaseous mixture of O_2 and CH_4 are in the ratio $1:4$ by mass. Find the ratio of their molecules.

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Options:

A. $1:4$

B. $2:3$

C. $1:8$

D. $3:2$

Answer: C

Solution:

$$N = \frac{W}{M} \times N_A$$

$$\frac{\text{Mass of } O_2}{\text{Mass of } CH_4} = \frac{1}{4}$$

$$\frac{\text{no.of molecules of } O_2}{\text{no.of molecules of } CH_4} = \frac{\left(\frac{1}{32} \times N_A\right)}{\left(\frac{4}{16} \times N_A\right)}$$

$$= \frac{1}{32} \times \frac{16}{4} = \frac{1}{8}$$

$\therefore$ The ratio of the molecules of O_2 and CH_4 is $1:8$.

Question11

Find the number of water molecules in 1 mL of water vapours at STP?

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Options:

A. 1.69×10^{19}

B. 2.00×10^{21}

C. 1.05×10^{21}

D. 2.69×10^{19}

Answer: D

Solution:

$$\begin{aligned}\text{Number of moles (n)} &= \frac{\text{Volume of the gas at STP}}{\text{Molar volume of gas}} \\ &= \frac{1 \times 10^{-3}\ \text{L}}{22.4\ \text{L mol}^{-1}} \\ &= 0.0446 \times 10^{-3}\ \text{mol}\end{aligned}$$

$\therefore$ Number of molecules

$= \text{Number of moles} \times 6.022 \times 10^{23}\ \text{molecules mol}^{-1}$

$= 0.0446 \times 10^{-3}\ \text{mol} \times 6.022 \times 10^{23}\ \text{molecules mol}^{-1}$

$= 2.686 \times 10^{19}\ \text{molecules}$

$= 2.69 \times 10^{19}\ \text{molecules}$

Question12

Calculate the number of Cl^-ions in 222 g unhydrous calcium chloride?

(At. mass $\mathrm{Ca} = 40, \mathrm{Cl} = 35.5$)

MHT CET 2025 22nd April Morning Shift

Options:

A. $\mathrm{N_A}$

B. $2\ \mathrm{N_A}$

C. $3\ \mathrm{N_A}$

D. $4N_A$

Answer: D

Solution:

Step 1: Find the molar mass of $CaCl_2$

$M(CaCl_2) = M(Ca) + 2 \times M(Cl) = 40 + 2 \times 35.5 = 40 + 71 = 111$ g/mol

Step 2: Calculate the number of moles of $CaCl_2$

$n = \frac{222}{111} = 2$ mol

Step 3: Number of formula units

Each mole contains **Avogadro's number of formula units**:

Formula units $= 2 \times N_A$

Step 4: Chloride ions per formula unit

Each $CaCl_2$ contains **2 chloride ions**.

So total chloride ions:

Number of Cl^- ions $= 2 \times (2N_A) = 4N_A$

✅ Final Answer:

Option D: $4N_A$

Question13

What is vapour density of O_2 gas?

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Options:

A. 8

B. 16

C. 32

D. 22.4

Answer: B

Solution:

We are asked to find the **vapour density of O_2 gas**.

Step 1: Recall the formula

Vapour Density (VD) $= \frac{\text{Molar Mass of gas}}{2}$

Step 2: Molar mass of O_2

$M(O_2) = 2 \times 16 = 32\,\text{g mol}^{-1}$

Step 3: Calculate vapour density

$VD = \frac{32}{2} = 16$

✅ **Final Answer: Option B (16)**

Question14

Calculate the number of Ca^{2+} ion in 222 g anhydrous calcium chloride? (At. Mass $\text{Ca} = 40, \text{Cl} = 35.5$)

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Options:

A. N_A

B. $2\,\text{N}_\text{A}$

C. $3\,\text{N}_\text{A}$

D. $4\,\text{N}_\text{A}$

Answer: B

Solution:

We are tasked to find the number of **Ca^{2+} ions** in 222 g of anhydrous calcium chloride ($CaCl_2$).

Step 1. Find the molar mass of $CaCl_2$.

$M(\text{CaCl}_2) = (40) + 2 \times (35.5) = 40 + 71 = 111\ \text{g/mol}$

Step 2. Find the number of moles of $CaCl_2$.

$n = \frac{\text{Mass}}{\text{Molar mass}} = \frac{222}{111} = 2\ \text{mol}$

Step 3. Relating $CaCl_2$ to Ca^{2+} ions.

Each formula unit of $CaCl_2$ contains **1 Ca^{2+} ion**.

Thus, number of moles of Ca^{2+} ions = number of moles of $CaCl_2$ = 2 mol.

Step 4. Convert moles of Ca^{2+} to number of ions.

$N(\mathrm{Ca}^{2+}) = (2\ \mathrm{mol}) \times N_A = 2N_A$

✅ **Final Answer: Option B:** $2N_A$

Question15

Find the number of moles present in 0.448 L of dihydrogen at STP.

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Options:

A. 0.08 mol

B. 0.06 mol

C. 0.04 mol

D. 0.02 mol

Answer: D

Solution:

At STP (Standard Temperature and Pressure), 1 mole of any ideal gas occupies **22.4 L**.

Given:

Volume of dihydrogen, $V = 0.448$ L

Number of moles, n, is given by:

$$n = \frac{\text{Given Volume}}{\text{Molar Volume at STP}}$$

Substitute the values:

$$n = \frac{0.448\ \text{L}}{22.4\ \text{L/mol}}$$

Let's do the calculation:

$$n = \frac{0.448}{22.4}$$

$$n = 0.02\ \text{mol}$$

Correct answer: Option D (0.02 mol)

Question16

Find out number of carbon atoms present in 0.35 mole of glucose.

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Options:

A. 3.011×10^{24}

B. 6.022×10^{24}

C. 1.264×10^{24}

D. 2.044×10^{24}

Answer: C

Solution:

Given:

- Number of moles of glucose $= 0.35$
- Glucose formula: $C_6H_{12}O_6$ (So, 1 molecule of glucose contains 6 carbon atoms)
- Avogadro's number $= 6.022 \times 10^{23}$

Step 1: Find total number of glucose molecules in 0.35 mole

Number of glucose molecules $= 0.35 \times 6.022 \times 10^{23}$

$= 2.1077 \times 10^{23}$

Step 2: Find total number of carbon atoms

There are 6 carbon atoms in each glucose molecule.

Number of carbon atoms $=$ Number of glucose molecules $\times 6$

$= 2.1077 \times 10^{23} \times 6$

$= 12.6462 \times 10^{23}$

$= 1.26462 \times 10^{24}$

Final Answer:

$\boxed{1.264 \times 10^{24}}$

So, the correct option is **C**.

Question17

What is the mass in grams of 0.25 mol water?

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Options:

A. 1.5 g

B. 2.5 g

C. 4.5 g

D. 3.5 g

Answer: C

Solution:

Given:

Number of moles of water, $n = 0.25$ mol

Molar mass of water, $M = 18$ g mol^{-1}

To find: Mass of water in grams.

Step 1: Recall the relationship

mass (g) = number of moles $\times$ molar mass

Step 2: Substitute the values

mass $= 0.25 \times 18$

Step 3: Calculate

$0.25 \times 18 = 4.5$

Step 4: Write the final answer

Mass $= 4.5$ g

Answer:

Option C, 4.5 g

Question18

If salicylic acid (138 u) reacts with acetic anhydride (102 u) to from aspirin (180 u) calculate \% atom economy.

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Options:

A. 25%

B. 50%

C. 65%

D. 75%

Answer: D

Solution:

Given:

Salicylic acid (molar mass = 138 u)

Acetic anhydride (molar mass = 102 u)

Aspirin (molar mass = 180 u)

The reaction is:

Salicylic acid + Acetic anhydride $\rightarrow$ Aspirin + Byproduct

Step 1: Find the total mass of reactants

Total mass of reactants $= 138\ \text{u} + 102\ \text{u} = 240\ \text{u}$

Step 2: Atom economy formula

Atom economy is given by:

$$\text{Atom Economy} = \frac{\text{Molar mass of desired product}}{\text{Total molar mass of reactants}} \times 100\%$$

Here, desired product is Aspirin (180 u).

Step 3: Substitute values

$$\text{Atom Economy} = \frac{180}{240} \times 100\%$$

Step 4: Simplify

$\frac{180}{240} = \frac{3}{4} = 0.75$

$0.75 \times 100\% = 75\%$

Final Answer:

Option D

$\boxed{75\%}$

Question19

Find the mass of potassium chlorate required to liberate $5.6\mathrm{dm}^3$ of oxygen gas at STP? (molar mass of $\mathrm{KClO_3} = 122.5\ \mathrm{g/mol}$)

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Options:

A. 12.25 g

B. 15.32 g

C. 20.40 g

D. 49.00 g

Answer: C

Solution:

Given:

- Volume of O_2 gas liberated = $5.6\ \mathrm{dm}^3$ (at STP)
- Molar mass of $\mathrm{KClO_3}$ = $122.5\ \mathrm{g/mol}$

Let's solve step by step.

Step 1: Write the balanced chemical equation.

$2\mathrm{KClO_3} \longrightarrow 2\mathrm{KCl} + 3\mathrm{O_2}$

So, 2 moles of $\mathrm{KClO_3}$ produce 3 moles of O_2 gas.

Step 2: Find moles of oxygen gas produced.

At STP, 1 mole of any gas occupies $22.4\ \mathrm{dm}^3$.

Given:

Volume of O_2 liberated $= 5.6\ \mathrm{dm}^3$

So,

Moles of $O_2 = \frac{5.6}{22.4} = 0.25$ moles

Step 3: Find moles of $\mathrm{KClO_3}$ required.

From the equation:

- 3 moles of O_2 comes from 2 moles of $\mathrm{KClO_3}$.

Let x moles of $\mathrm{KClO_3}$ be needed to get 0.25 moles of O_2:

$\frac{2}{3} = \frac{x}{0.25}$

So,

$x = \frac{2}{3} \times 0.25 = \frac{0.5}{3} = 0.1667$ moles

Step 4: Find the mass of $KClO_3$ required.

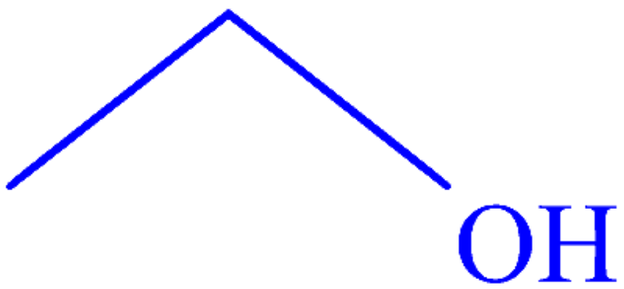
Mass = moles × molar mass = $0.1667 \times 122.5 \approx 20.4\,g$

Step 5: Final answer

Option C: $20.40\,g$

Question20

What is the molar mass of compound represented by following structure formula?



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Options:

A. $36\ g\ mol^{-1}$

B. $46\ g\ mol^{-1}$

C. $22\ g\ mol^{-1}$

D. $32\ g\ mol^{-1}$

Answer: B

Solution:

For the given structure, molecular formula is C_2H_6O.

$\therefore$ Molar mass of the compound

= (Mass of C × 2) + (Mass of H × 6)+ (Mass of 0 × 1)

$= (12 \times 2) + (1 \times 6) + (16 \times 1)$
$= 24 + 6 + 16$
$= 46 \text{ g mol}^{-1}$

Question21

What is the volume occupied by 0.5 mol of CO_2 at STP?

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Options:

A. 5.6 dm^3

B. 11.2 dm^3

C. 16.8 dm^3

D. 22.4 dm^3

Answer: B

Solution:

At Standard Temperature and Pressure (STP), **1 mole** of any ideal gas occupies 22.4 dm^3.

Given:

Number of moles, $n = 0.5$ mol

To find:

Volume occupied by 0.5 mol of CO_2 at STP.

Step 1:

Volume occupied by 1 mol at STP = 22.4 dm^3

Step 2:

Volume occupied by 0.5 mol:

Volume $= 0.5 \times 22.4 \text{ dm}^3 = 11.2 \text{ dm}^3$

So, the correct answer is Option B: 11.2 dm^3.

Question22

In a chemical reaction, sum of formula weight of all reactants is 274 u and atom economy is 50%, calculate formula weight of desired product?

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Options:

A. 137 u

B. 274 u

C. 167 u

D. 254 u

Answer: A

Solution:

Given:

- Sum of formula weights of all reactants = $274\,u$
- Atom economy $= 50\%$

The formula for atom economy is:

$$\text{Atom economy} = \frac{\text{Formula weight of desired product}}{\text{Sum of formula weights of all reactants}} \times 100$$

Let the formula weight of the desired product be x.

So,

$$\text{Atom economy} = \frac{x}{274} \times 100 = 50$$

Now, solve for x:

$$\frac{x}{274} \times 100 = 50$$

$$\frac{x}{274} = \frac{50}{100}$$

$$\frac{x}{274} = 0.5$$

$$x = 0.5 \times 274$$

$$x = 137\,u$$

Correct option: A

Question23

Calculate mass in kg of 2.5 mole ammonia.

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Options:

A. 5.10×10^{-2} kg

B. 4.25×10^{-2} kg

C. 1.72×10^{-2} kg

D. 3.44×10^{-2} kg

Answer: B

Solution:

To calculate the mass of 2.5 moles of ammonia (NH_3) in kilograms, we need to use the molar mass of ammonia. The molar mass of NH_3 can be determined by summing the atomic masses of nitrogen and hydrogen:

Nitrogen (N): 14.01 g/mol

Hydrogen (H): 1.01 g/mol

The molar mass of ammonia (NH_3) is calculated as:

Molar Mass of $NH_3 = 14.01\,\text{g/mol} + 3 \times 1.01\,\text{g/mol} = 17.04\,\text{g/mol}$

Using the formula to convert moles to mass:

Mass (g) = Number of moles $\times$ Molar Mass (g/mol)

Plug in the values:

Mass (g) $= 2.5\,\text{moles} \times 17.04\,\text{g/mol} = 42.6\,\text{g}$

To convert this mass into kilograms:

Mass (kg) $= 42.6\,\text{g} \times \frac{1\,\text{kg}}{1000\,\text{g}} = 0.0426\,\text{kg}$

So, the mass of 2.5 moles of ammonia is $0.0426\,\text{kg}$.

This corresponds to Option B: 4.25×10^{-2} kg.

Question24

Find the number of moles of sodium atoms in 6.9×10^{-2} kg (Atomic mass $= 23\ \text{g mol}^{-1}$)

MHT CET 2024 16th May Morning Shift

Options:

A. 1.5

B. 0.3

C. 3.0

D. 2.3

Answer: C

Solution:

$$\text{Number of moles} = \frac{\text{Mass of a substance}}{\text{Molar mass of the substance}} = \frac{6.9 \times 10^{-2} \times 1000\ \text{g}}{23\ \text{g mol}^{-1}} = 3\ \text{moles}$$

Question25

What is the percentage by mass of oxygen in NaOH ?(Atomic mass of $\mathrm{Na} = 23\mathrm{u}, \mathrm{O} = 16\mathrm{u}, \mathrm{H} = 1\mathrm{u}$)

MHT CET 2024 15th May Morning Shift

Options:

A. 16

B. 20

C. 40

D. 60

Answer: C

Solution:

To find the percentage by mass of oxygen in sodium hydroxide (NaOH), first determine the molar mass of NaOH by adding together the atomic masses of each of its constituent elements:

The atomic mass of Na (sodium) is 23 u.

The atomic mass of O (oxygen) is 16 u.

The atomic mass of H (hydrogen) is 1 u.

The molar mass of NaOH is the sum of these atomic masses:

Molar mass of NaOH $= 23\,\text{u} + 16\,\text{u} + 1\,\text{u} = 40\,\text{u}$

Next, calculate the percentage by mass of oxygen in NaOH by dividing the atomic mass of oxygen by the molar mass of NaOH and multiplying by 100:

Percentage by mass of oxygen $= \left(\frac{16\,\text{u}}{40\,\text{u}}\right) \times 100$

$= 40\%$

Therefore, the percentage by mass of oxygen in NaOH is 40%. Thus, the correct option is **Option C: 40**.

Question26

What is value of percent atom economy when reactants having sum of formula weight 78 u results in the formation of a product with formula weight 65 u ?

MHT CET 2024 15th May Morning Shift

Options:

A. 70%

B. 83%

C. 78%

D. 65%

Answer: B

Solution:

Percent atom economy is a measure of the efficiency of a chemical reaction in terms of how much of the reactants end up in the desired product. It is calculated using the formula:

$$\text{Percent Atom Economy} = \left(\frac{\text{Formula Weight of Desired Product}}{\text{Sum of Formula Weights of All Reactants}}\right) \times 100$$

Given :

Formula weight of the desired product = 65 u

Sum of formula weights of all reactants = 78 u

Substituting these values into the formula gives:

Percent Atom Economy $= \left(\frac{65}{78}\right) \times 100$

Calculating this:

Percent Atom Economy $= (0.8333) \times 100$

Percent Atom Economy $= 83.33\%$

Thus, the closest option for the percent atom economy is **Option B: 83%**.

Question27

How many molecules of carbon dioxide are formed when 0.6 g carbon is burnt in air?

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Options:

A. 3.01×10^{22}

B. 2.01×10^{23}

C. 6.02×10^{22}

D. 5.02×10^{23}

Answer: A

Solution:

$$\underset{\substack{12\text{ g} \\ 0.6\text{ g}}}{\text{C}} + \underset{32\text{ g}}{\text{O}_2} \xrightarrow{\Delta} \underset{\substack{44\text{ g} \\ ?}}{\text{CO}_2\uparrow}$$

$\therefore$ 12 g of C will give 44 g of CO_2

0.6 g of C will give

$$= \frac{44 \times 0.6}{12} = 2.2 \text{ g of } CO_2$$

Number of CO_2 molecules

$$= \frac{2.2 \times 6.023 \times 10^{23}}{44} = 3.01 \times 10^{22}$$

Question28

Which of the following pair of compounds cannot demonstrate law of multiple proportion?

MHT CET 2024 11th May Morning Shift

Options:

A. NO, NO_2

B. CO, CO_2

C. H_2O, H_2O_2

D. Na_2S, NaF

Answer: D

Solution:

The Law of Multiple Proportions states that if two elements can form more than one compound with each other, the ratios of the masses of one element that combine with a fixed mass of the other element will be ratios of small whole numbers.

Evaluating the options provided:

Option A: NO, NO_2

In NO and NO_2, nitrogen combines with oxygen in different proportions. The mass of oxygen that combines with a fixed mass of nitrogen is in the ratio $1 : 2$. They follow the Law of Multiple Proportions.

Option B: CO, CO_2

In CO and CO_2, carbon combines with oxygen in different proportions. The mass of oxygen that combines with a fixed mass of carbon is in the ratio $1 : 2$. They follow the Law of Multiple Proportions.

Option C: H_2O, H_2O_2

In H_2O and H_2O_2, hydrogen combines with oxygen in different proportions. The mass of oxygen that combines with a fixed mass of hydrogen is in the ratio $1 : 2$. They follow the Law of Multiple Proportions.

Option D: Na_2S, NaF

These compounds involve different pairs of elements: sodium with sulfur (Na_2S) and sodium with fluorine (NaF). Therefore, these do not form multiple compounds from the same elements, and the Law of Multiple Proportions does not apply.

Therefore, the pair of compounds that cannot demonstrate the Law of Multiple Proportions is:

Option D: Na_2S, NaF

Question29

What is the percentage atom economy when formula weight of product obtained is 70 u and the sum of formula weight of reactant is 140 u ?

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Options:

A. 30%

B. 35%

C. 50%

D. 75%

Answer: C

Solution:

$$\% \text{ atom economy} = \frac{\text{Formula weight of the desired product}}{\text{Sum of formula weight of all the reactants used in the reaction}} \times 100$$

$$= \frac{70\text{u}}{140\text{u}} \times 100 = 50\%$$

Question30

Which law is illustrated by compounds H_2O and H_2O_2 formed from two different elements, H and O ?

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Options:

A. Law of Constant proportion.

B. Law of Conservation of mass.

C. Law of Multiple proportion.

D. Avogadro's law.

Answer: C

Solution:

The compounds H_2O and H_2O_2 illustrate the **Law of Multiple Proportions**.

The Law of Multiple Proportions states that if two elements (in this case, hydrogen and oxygen) combine to form more than one compound, then the ratios of the masses of the second element that combine with a fixed mass of the first element will be simple whole numbers.

For H_2O and H_2O_2:

In H_2O, two atoms of hydrogen combine with one atom of oxygen.

In H_2O_2, two atoms of hydrogen combine with two atoms of oxygen.

This implies that the mass ratio of oxygen combining with hydrogen in H_2O_2 is twice that in H_2O (1:2), which is a simple whole number ratio, consistent with the Law of Multiple Proportions.

Question31

What is the volume of oxygen required for complete combustion of 0.25 mole of methane at S.T.P.?

MHT CET 2024 10th May Morning Shift

Options:

A. $22.4\ dm^3$

B. $5.6\ dm^3$

C. $11.2\ dm^3$

D. $7.46\ dm^3$

Answer: C

Solution:

The complete combustion of methane (CH_4) with oxygen (O_2) is represented by the balanced chemical equation:

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

From the equation, 1 mole of methane requires 2 moles of oxygen for complete combustion.

For 0.25 mole of methane:

Number of moles of oxygen required = 0.25 moles $CH_4 \times \frac{2 \text{ moles O}_2}{1 \text{ mole CH}_4} = 0.5$ moles O_2

At standard temperature and pressure (S.T.P.), the molar volume of a gas is $22.4 \sim dm^3$ per mole.

Thus, volume of oxygen required is:

$0.5 \text{ moles } \times 22.4 \sim \mathrm{dm}^3/\text{mole} = 11.2 \sim \mathrm{dm}^3$

Therefore, the volume of oxygen required is 11.2 dm^3. Hence, the correct option is:

Option C: $11.2\ \mathrm{dm}^3$

Question32

Chlorine exists in two isotopic forms $^{35}\mathrm{Cl}$, $^{37}\mathrm{Cl}$. If average atomic mass of chlorine is 35.5 , what is the percentage abundance of these isotopes respectively?

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Options:

A. $25\%, 75\%$

B. $75\%, 25\%$

C. $50\%, 50\%$

D. $35\%, 65\%$

Answer: B

Solution:

Average atomic mass

$$= \frac{\text{atomic mass of } {}^{35}\mathrm{Cl} \times \text{ percentage } + \text{atomic mass of } {}^{37}\mathrm{Cl} \times \text{ percentage}}{100}$$

Let the % abundance of $^{35}\mathrm{Cl}$ isotope $= x$.

% abundance of $^{37}\mathrm{Cl}$ isotope $= 100 - x$.

Average atomic mass $= 35.5$

From formula, Average atomic mass

$$= \frac{35 \times x + 37 \times (100 - x)}{100} = 35.5$$

$$35x + 3700 - 37x = 35.5 \times 100$$

$$-2x = -3700 + 3550$$

$$2x = 150$$

$$x = 75$$

Percentage abundance of

$^{35}\mathrm{Cl} = 75\%$ and $^{37}\mathrm{Cl} = (100 - 75) = 25\%$

Question33

Chlorine has two isotopes $^{35}\mathrm{Cl}$ and $^{37}\mathrm{Cl}$ with average atomic mass of 35.5 . What is the ratio of their relative abundance respectively?

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Options:

A. 1 : 1

B. 2 : 1

C. 1 : 3

D. 3 : 1

Answer: D

Solution:

Average atomic mass

$$= \frac{(\text{atomic mass of } {}^{37}\mathrm{Cl} \times \text{ percentage}) + (\text{atomic mass of } {}^{37}\mathrm{Cl} \times \text{ percentage})}{100}$$

Let the $\%$ abundance of $^{35}\mathrm{Cl}$ isotope $= x$.

$\%$ abundance of $^{37}\mathrm{Cl}$ isotope $= 100 - x$.

Average atomic mass $= 35.5$

From formula, average atomic mass

$$= \frac{35 \times x + 37 \times (100 - x)}{100} = 35.5$$

$$\therefore \quad 35x + 3700 - 37x = 35.5 \times 100$$

$$\therefore \quad -2x = -3700 + 3550$$

$$\therefore \quad -2x = -150$$

$$\therefore \quad x = 75\% \text{ and } (100 - x) = 25\%$$

Ratio of relative abundance

$$= \frac{\%\text{ abundance of } {}^{35}\mathrm{Cl}}{\%\text{ abundance of } {}^{37}\mathrm{Cl}} = \frac{75}{25} = 3 : 1$$

Question34

Calculate mass in kg of $4.48\mathrm{dm}^3$ carbon dioxide at STP.

MHT CET 2024 9th May Evening Shift

Options:

A. 2.2×10^{-3}

B. 4.4×10^{-3}

C. 6.6×10^{-3}

D. 8.8×10^{-3}

Answer: D

Solution:

To calculate the mass of carbon dioxide (CO_2) at Standard Temperature and Pressure (STP), first determine the number of moles of the gas, and then use that to find the mass.

At STP, 1 mole of any ideal gas occupies $22.4\,\mathrm{dm}^3$. Given $4.48\,\mathrm{dm}^3$ of CO_2, the number of moles (n) can be calculated as:

$$n = \frac{\text{Volume}}{\text{Volume of 1 mole at STP}} = \frac{4.48\ \mathrm{dm}^3}{22.4\ \mathrm{dm}^3/\text{mole}}$$

Performing the calculation gives:

$n = \frac{4.48}{22.4} = 0.2\,\text{moles}$

Next, the molar mass of CO_2 (Carbon Dioxide) is the sum of the atomic masses of carbon (C) and oxygen (O):

Atomic mass of $C = 12.01\,\text{g/mol}$

Atomic mass of $O = 16.00\,\text{g/mol}$ (since there are two oxygen atoms, this becomes 2×16.00)

Thus, the molar mass of CO_2 is:

Molar mass of $CO_2 = 12.01 + 2 \times 16.00 = 44.01\,\text{g/mol}$

Now, calculate the mass (m) using the formula:

$m = n \times \text{Molar Mass} = 0.2\,\text{moles} \times 44.01\,\text{g/mol}$

Calculating this gives:

$m = 8.802\,\text{g}$

Convert the mass from grams to kilograms:

$m = 8.802\,\text{g} \times \frac{1\,\text{kg}}{1000\,\text{g}} = 8.802 \times 10^{-3}\,\text{kg}$

Rounding the final result, the mass in kg is:

$8.8 \times 10^{-3}\,\text{kg}$

Therefore, the correct option is **Option D:** 8.8×10^{-3}.

Question35

What is the volume occupied by 1 molecule of water, if its density is $1\ \text{g cm}^{-3}$?

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Options:

A. $9.0 \times 10^{-23}\ \text{cm}^3$

B. $2.98 \times 10^{-23}\ \text{cm}^3$

C. $6.023 \times 10^{-23}\ \text{cm}^3$

D. $5.50 \times 10^{-23}\ \text{cm}^3$

Answer: B

Solution:

Mass of 6.022×10^{23} molecules of water $= 18\ \text{g}$

$\therefore$ Mass of 1 molecule of water

$$= \frac{18\ \text{g} \times 1}{6.022 \times 10^{23}} = 2.98 \times 10^{-23}\ \text{g}$$

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

$\therefore$ Volume occupied by 1 molecule of water

$$= \frac{\text{mass}}{\text{density}} = \frac{2.98 \times 10^{-23}\ \text{g}}{1\ \text{g cm}^{-3}} = 2.98 \times 10^{-23}\ \text{cm}^3$$

Question36

What is the number of moles of Cl atoms and N atoms respectively present in n moles of tear gas?

MHT CET 2024 9th May Morning Shift

Options:

A. 3 nCl and nN

B. 2 nCl and 2 nN

C. nCl and nN

D. nCl and 2 nN

Answer: A

Solution:

Tear gas, also known as chloropicrin, has the chemical formula CCl_3NO_2. This molecule contains:

3 chlorine (Cl) atoms

1 nitrogen (N) atom

When you have n moles of tear gas, the number of moles of each type of atom can be calculated based on the number of each type of atom present in one molecule of tear gas:

For chlorine (Cl) atoms, since each molecule contains 3 Cl atoms, there would be $3n$ moles of Cl atoms in n moles of tear gas.

For nitrogen (N) atoms, since each molecule contains 1 N atom, there would be n moles of N atoms in n moles of tear gas.

Therefore, the number of moles of Cl and N atoms in n moles of tear gas are $3n$ and n, respectively.

So, the correct answer is **Option A: 3 nCl and nN**.

Question37

Calculate number of moles present in 9.10×10^{-2} kg of water.

MHT CET 2024 4th May Evening Shift

Options:

A. 0.9

B. 1.8

C. 3.0

D. 5.0

Answer: D

Solution:

To calculate the number of moles of water in 9.10×10^{-2} kg, use the formula:

$$\text{moles} = \frac{\text{mass}}{\text{molar mass}}$$

The molar mass of water (H_2O) is approximately 18 g/mol or equivalently 0.018 kg/mol.

Substitute the given values into the formula:

$$\text{moles} = \frac{9.10 \times 10^{-2} \text{ kg}}{0.018 \text{ kg/mol}}$$

Calculate the moles:

$$\text{moles} = \frac{9.10 \times 10^{-2}}{0.018} = 5.0555\ldots$$

So the number of moles is approximately 5.0.

Thus the correct answer is:

Option D - 5.0

Question38

"A given compound always contains the same proportion of elements" is a statement of -

MHT CET 2024 3rd May Evening Shift

Options:

A. Law of combining volumes of gases

B. Law of conservation of mass

C. Law of multiple proportions

D. Law of definite proportions

Answer: D

Solution:

The statement "A given compound always contains the same proportion of elements" refers to the **Law of Definite Proportions**.

According to the Law of Definite Proportions, also known as the Law of Constant Composition, a chemical compound always contains exactly the same proportion of elements by mass, regardless of the quantity or source of the compound. This fundamental principle of chemistry highlights the fixed composition of compounds, reinforcing that chemical substances are made of specific sets of elements combined in precise ratios.

Question39

Which of the following pair of compounds does not demonstrate the law of multiple proportion?

MHT CET 2024 3rd May Morning Shift

Options:

A. CuO, Cu_2O

B. $NaNO_3, CaCO_3$

C. CO, CO_2

D. $N_2O_4,\ N_2O_5$

Answer: B

Solution:

Option B, $NaNO_3$ and $CaCO_3$, does not demonstrate the law of multiple proportions.

The law of multiple proportions states that when two elements combine to form more than one compound, the weights of one element that combine with a fixed weight of the other are in a ratio of small whole numbers.

For the given pairs:

Option A: CuO and Cu_2O differ in the amount of oxygen per fixed amount of copper.

Option C: CO and CO_2 differ in the amount of oxygen per fixed amount of carbon, following the law of multiple proportions.

Option D: N_2O_4 and N_2O_5 differ in the amount of oxygen per fixed amount of nitrogen, again demonstrating the law.

Despite containing similar elements, $NaNO_3$ and $CaCO_3$ do not count because they do not reflect a scenario where different amounts of one element (e.g., oxygen) combine with a fixed amount of another element. They are entirely distinct compounds with different formulas and ratios of sodium, nitrogen, calcium, carbon, and oxygen, rather than varying ratios of the same two elements.

Question40

What is the molar mass of third member of homologous series if the molar mass of first member is 46 g ?

MHT CET 2024 2nd May Evening Shift

Options:

A. 60 g

B. 74 g

C. 138 g

D. 80 g

Answer: B

Solution:

Two successive homologues differ by one $-CH_2$ - (methylene) unit, i.e. by a molar mass of $(12+2)\text{gmol}^{-1} = 14 \text{ g mol}^{-1}$.

Molar mass of first member $= 46$ g

$\therefore$ Molar mass of third member $= 46 + 14 + 14 = 74$ g

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Question41

How many moles of carbon atoms are present in 3.6 kg of carbon?

MHT CET 2024 2nd May Evening Shift

Options:

A. 3.0×10^2 mole

B. 1.8×10^2 mole

C. 2.4×10^2 mole

D. 4.8×10^2 mole

Answer: A

Solution:

To determine the number of moles of carbon atoms in 3.6 kg of carbon, we need to use the molar mass of carbon and Avogadro's number.

The molar mass of carbon (C) is approximately 12 g/mol.

First, convert kilograms to grams:

$3.6\,\text{kg} = 3600\,\text{g}$

Use the formula for calculating moles:

$\text{Number of moles} = \frac{\text{Mass in grams}}{\text{Molar mass}}$

Substitute the given values:

$\text{Number of moles of carbon} = \frac{3600\,\text{g}}{12\,\text{g/mol}} = 300\,\text{moles}$

Therefore, the number of moles of carbon atoms in 3.6 kg of carbon is:

Option A: 3.0×10^2 **mole**

Question42

What is the mass in kg of 5 mole of acetic acid $\left(\text{mol. mass} = 60\ \text{g mol}^{-1}\right)$?

MHT CET 2024 2nd May Morning Shift

Options:

A. 0.3 kg

B. 3.0 kg

C. 30 kg

D. 300 kg

Answer: A

Solution:

To calculate the mass of 5 moles of acetic acid, use the formula:

$\text{Mass} = \text{Number of Moles} \times \text{Molar Mass}$

Given:

Number of Moles = 5 moles

Molar Mass of acetic acid = 60 g/mol

Substitute the values into the formula:

$\text{Mass} = 5\ \text{moles} \times 60 \frac{\text{g}}{\text{mol}} = 300\ \text{g}$

Convert grams to kilograms:

$300\ \text{g} = 0.3\ \text{kg}$

Thus, the mass of 5 moles of acetic acid is **0.3 kg** (Option A).

Question43

Which of the following pair of compounds demonstrates the law of multiple proportions?

MHT CET 2023 14th May Evening Shift

Options:

A. CH_4, CCl_4

B. BF_3, NH_3

C. CO, CO_2

D. NO_2, CO_2

Answer: C

Solution:

The Law of Multiple Proportions states that when two elements form more than one compound, the masses of one element that combine with a fixed mass of the other element are in the ratio of small whole numbers. To identify which pair of compounds demonstrates the law of multiple proportions, let's analyze each option:

Option A: CH_4, CCl_4

This pair does not demonstrate the law of multiple proportions, as the compounds have different elements (hydrogen in CH_4 and chlorine in CCl_4) combining with carbon, without a fixed mass of one element combining with varying masses of the other.

Option B: BF_3, NH_3

This option is also not an example of the law of multiple proportions, as these compounds do not contain the same two elements combining in different ratios; BF_3 contains boron and fluorine whereas NH_3 contains nitrogen and hydrogen.

Option C: CO, CO_2

This option correctly represents the law of multiple proportions. Both CO and CO_2 consist of carbon and oxygen. In carbon monoxide (CO), one atom of carbon combines with one atom of oxygen, whereas in carbon dioxide (CO_2), one atom of carbon combines with two atoms of oxygen. Here, the fixed mass of carbon combines with varying masses of oxygen in a ratio of 1:2 (for the oxygen atoms).

Option D: NO_2, CO_2

Like Option A and B, this choice does not follow the law of multiple proportions because each compound has different elements combining with each other; NO_2 has nitrogen and oxygen, while CO_2 has carbon and oxygen.

The correct answer is therefore Option C: CO, CO_2, as these two compounds consist of the same two elements, carbon and oxygen, which combine in different simple numerical ratios, fulfilling the criteria of the law of multiple proportions.

Question44

What is number of atoms present in $2.24\ \mathrm{dm}^3\ \mathrm{NH}_{3(\ g)}$ at STP?

MHT CET 2023 14th May Morning Shift

Options:

A. 6.022×10^{22}

B. 2.4088×10^{23}

C. 1.8066×10^{22}

D. 6.022×10^{23}

Answer: B

Solution:

To determine the number of atoms present in $2.24\ \mathrm{dm}^3$ of $\mathrm{NH}_{3(\ g)}$ at standard temperature and pressure (STP), we should first recall the concept of molar volume. At STP, one mole of any ideal gas occupies $22.4\ \mathrm{dm}^3$. We can use this information to calculate the number of moles of ammonia gas in the given volume.

The number of moles (n) is given by:$n = \frac{\text{Volume}}{\text{Molar Volume}}$

For NH_3 at STP:$n = \frac{2.24\ \mathrm{dm}^3}{22.4\ \mathrm{dm}^3/\mathrm{mol}} = 0.1\ \mathrm{mol}$

Each molecule of ammonia (NH_3) contains 1 nitrogen atom and 3 hydrogen atoms, totalling 4 atoms. To find the total number of atoms in 0.1 mole of ammonia, we multiply the number of atoms in one molecule by Avogadro's number (approximately 6.022×10^{23} atoms/mol), which tells us the number of particles (atoms, molecules, ions, etc.) in one mole of a substance.

The total number of atoms in 0.1 mole of NH_3 is:
Total Number of Atoms = moles $\times$ Avogadro's number $\times$ atoms per molecule
$= 0.1$ moles $\times\ 6.022 \times 10^{23}$ atoms/mol $\times\ 4$ atoms/molecule

Now we calculate the total number of atoms:Total Number of Atoms $= 0.1 \times 6.022 \times 10^{23} \times 4$
$= 0.1 \times 4 \times 6.022 \times 10^{23} = 2.4088 \times 10^{22}$ atoms

Therefore, the correct answer is Option B: 2.4088×10^{23} atoms.

Question45

Calculate the percent atom economy when a product of formula weight $175\mathrm{u}$ is obtained in a chemical reaction using $225\mathrm{u}$ formula weight reactant.

MHT CET 2023 14th May Morning Shift

Options:

A. 70.1%

B. 77.7%

C. 90.5%

D. 95.0%

Answer: B

Solution:

Atom economy is a measure of how efficiently a chemical reaction converts reactants into desired products. It is expressed as a percentage and is calculated using the formula:

$$\text{Atom Economy} = \left(\frac{\text{Molecular weight of the desired product}}{\text{Total molecular weight of reactants}}\right) \times 100\%$$

In the given problem, we have a product with a formula weight of 175u that is obtained from a reactant with a formula weight of 225u. Using the formula for atom economy, we can calculate:

$$\text{Atom Economy} = \left(\frac{175\mathrm{u}}{225\mathrm{u}}\right) \times 100\%$$

Now, divide 175 by 225 to find the value:

$$\text{Atom Economy} = \left(\frac{175}{225}\right) \times 100\% \text{Atom Economy} = 0.7777\ldots \times 100\% \text{Atom Economy} = 77.77\ldots\%$$

Rounding to one decimal place, the atom economy is approximately 77.8%. Among the options given, the closest answer is:

Option B77.7%

Hence, option B is the correct answer.

Question46

According to reaction,

$$\mathrm{Mg}(s) + 2\mathrm{HCl}(aq) \longrightarrow \mathrm{MgCl_2}(aq) + \mathrm{H_2}(g) \uparrow.$$

Calculate the mass of Mg required to liberate $4.48\ \mathrm{dm}^3\ \mathrm{H}_2$ at STP?

(Molar mass of $\mathrm{Mg} = 24\ \mathrm{g\ mol}^{-1}$)

MHT CET 2023 13th May Evening Shift

Options:

A. 12 g

B. 4.8 g

C. 6 g

D. 2.4 g

Answer: B

Solution:

For the given reaction

$\mathrm{Mg}(s) + 2\mathrm{HCl}(\mathrm{aq}) \longrightarrow \mathrm{MgCl}_2(\mathrm{aq}) + \mathrm{H}_2(aq) \uparrow$

Mass of $\mathrm{Mg} = ?$

Molar mass of $\mathrm{Mg} = 24\ \mathrm{g/mol}$ at STP

Using the formula of number of moles,

$$n = \frac{V}{22.4}$$

$$\frac{\text{Mass of Mg}}{\text{Molar mass of Mg}} = \frac{4.48}{22.4}$$

$$\frac{\text{Mass of Mg}}{24} = \frac{4.48}{22.4}$$

$$\Rightarrow \text{ Mass of Mg} = \frac{4.48 \times 24}{22.4} = 4.8\ \mathrm{g}$$

Question47

What is the value of percent atom economy when an organic compound of formula weight $75\ \mathrm{u}$ is obtained from reactants having sum formula weight $225\ \mathrm{u}$?

MHT CET 2023 11th May Evening Shift

Options:

A. 13.5

B. 33.3

C. 40.4

D. 70.5

Answer: B

Solution:

$$\% \text{ atom economy} = \frac{\text{Formula weight of the desired product}}{\text{Sum of formula weight of all the reactants used in the reaction}} \times 100$$

$$\% \text{ atom economy } = \frac{75}{225} \times 100 = 33.3$$

Question48

Which from following substances consists of total 1 mole atoms in it? (Molar mass of $NH_3 = 17, H_2O = 18,\ N_2 = 28, CO_2 = 44$)

MHT CET 2023 11th May Evening Shift

Options:

A. 4.25 g NH_3

B. 1.8 g H_2O

C. 2.8 g N_2

D. 4.4 g CO_2

Answer: A

Solution:

$4.25 \text{ g } NH_3 = \frac{4.25}{17} \text{ mol } NH_3$
$= 0.25 \text{ mol } NH_3$
$1 \text{ mol } NH_3 = 1 \text{ mol N-atoms } + 3 \text{ mol H-atoms}$
$\therefore \quad 0.25 \text{ mol } NH_3 = 0.25 \times 4$
$= 1 \text{ mol atoms}$

Question49

How many moles of nitrogen atoms are present in 8 g of ammonium nitrate?

(Molar mass of ammonium nitrate = 80)

MHT CET 2023 10th May Evening Shift

Options:

A. 0.1 mol

B. 0.2 mol

C. 0.4 mol

D. 0.8 mol

Answer: B

Solution:

To find out the number of moles of nitrogen atoms present in 8 g of ammonium nitrate NH_4NO_3, we first need to calculate the number of moles of ammonium nitrate itself. We can do this using its molar mass.

The molar mass of ammonium nitrate is given as 80 g/mol.

Using the formula

Number of moles $= \frac{\text{Mass}}{\text{Molar Mass}}$

We substitute the mass of ammonium nitrate and its molar mass and get

Number of moles of ammonium nitrate $= \frac{8 \text{ g}}{80 \text{ g/mol}}$Number of moles of ammonium nitrate $= 0.1$ mol

Now, in one molecule of ammonium nitrate, there are two nitrogen atoms (one in the ammonium ion NH_4^+ and one in the nitrate ion NO_3^-.

To find the total number of moles of nitrogen atoms, we then need to multiply the number of moles of ammonium nitrate by the number of nitrogen atoms per molecule of ammonium nitrate.

Number of moles of nitrogen atoms = Number of moles of ammonium nitrate × Number of nitrogen atoms per molecule
Number of moles of nitrogen atoms = 0.1 mol × 2Number of moles of nitrogen atoms = 0.2 mol

Therefore, 8 g of ammonium nitrate contains 0.2 mol of nitrogen atoms. The correct answer is:

Option B0.2 mol

Question50

Calculate the pH of a buffer solution containing 0.01 M salt and 0.004 M weak acid.

$(\mathrm{pK_a} = 4.762)$

MHT CET 2023 10th May Evening Shift

Options:

A. 4.36

B. 4.76

C. 5.16

D. 5.36

Answer: C

Solution:

$$\begin{aligned}
\mathrm{pH} &= \mathrm{pK_a} + \log_{10} \frac{[\,\text{Salt}\,]}{[\,\text{Acid}\,]} \\
&= 4.762 + \log_{10} \frac{0.01}{0.004} \\
&= 4.762 + (\log_{10} 5 - \log_{10} 2) \\
&= 4.762 + (0.699 - 0.3010) \\
&= 4.762 + 0.398 \\
&= 5.16
\end{aligned}$$

Question51

What volume of ammonia is formed when $10\ \mathrm{dm^3}$ dinitrogen reacts with $30\ \mathrm{dm^3}$ dihydrogen at same temperature and pressure?

MHT CET 2023 9th May Evening Shift

Options:

A. 30 dm^3

B. 20 dm^3

C. 15 dm^3

D. 10 dm^3

Answer: B

Solution:

$$\underset{[1\ L]\ [10\ dm^3]}{Nitrogen_{(g)}} + \underset{[3\ L]\ [30\ dm^3]}{Hydrogen_{(g)}} \longrightarrow \underset{[2\ L]\ [20\ dm^3]}{Ammonia_{(g)}}$$

Question52

Identify number of moles of donor atoms in 2n mole of SCN^-.

MHT CET 2023 9th May Morning Shift

Options:

A. 3n

B. 6n

C. 4n

D. n

Answer: C

Solution:

SCN^- has two donor atoms nitrogen and sulfur either of which links to metal atom/ion when in forms a coordinate bond. Therefore, 1 mole of SCN^- will have 2 moles of donor atoms. Hence, 2n moles of SCN^- will have 4n moles of

donor atoms.

Question53

Which of the following concentration terms depends on temperature?

MHT CET 2023 9th May Morning Shift

Options:

A. Molality

B. Molarity

C. Mole fraction

D. Percent by mass

Answer: B

Solution:

Among the given options, the concentration term that depends on temperature is :

- **Option B - Molarity**

Molarity is defined as the number of moles of solute per liter of solution. Because the volume of a solution changes with temperature due to thermal expansion or contraction, molarity is temperature-dependent. As temperature increases, the volume of the solution can increase, causing the molarity to decrease, and vice versa.

The other options are not temperature-dependent :

- **Option A - Molality :** Molality is the number of moles of solute per kilogram of solvent. Since it's based on mass, which does not change with temperature, molality is independent of temperature.

- **Option C - Mole Fraction :** Mole fraction is the ratio of the number of moles of a component to the total number of moles in the mixture. Since it is a ratio of moles and does not involve volume, it is not affected by temperature changes.

- **Option D - Percent by Mass :** Percent by mass (or weight percent) is the ratio of the mass of the solute to the total mass of the solution, multiplied by 100. Since mass is not affected by temperature, this concentration term is also temperature-independent.

Therefore, molarity is the term among the given options that is affected by changes in temperature.

Question54

What is the mass in gram of 1 atom of an element if its atomic mass is 10 u ?

MHT CET 2023 9th May Morning Shift

Options:

A. 2.06056×10^{-22} g

B. 1.66056×10^{-23} g

C. 1.06056×10^{-24} g

D. 3.66056×10^{-25} g

Answer: B

Solution:

Atomic mass is the mass of an atom of the element.

Mass of 1 atom of the element $= 10$u

Now, $1\text{u} = 1.66056 \times 10^{-24}$ g

Therefore, $10\text{u} = 1.66056 \times 10^{-23}$ g

Question55

How many gram of H_2O are present in 0.25 mol of it?

MHT CET 2021 24th September Evening Shift

Options:

A. 0.25 g

B. 5.4 g

C. 4.5 g

D. 6.1 g

Answer: C

Solution:

To determine how many grams of H_2O (water) are present in 0.25 mol of it, we need to use the molecular weight of water.

The molecular weight of H_2O can be calculated by adding the atomic masses of hydrogen and oxygen. The atomic masses are approximately:

$H = 1\,\text{g/mol}$

$O = 16\,\text{g/mol}$

Since there are 2 hydrogen atoms and 1 oxygen atom in a molecule of water, the molecular weight of H_2O is:

$2 \times 1\,\text{g/mol} + 16\,\text{g/mol} = 18\,\text{g/mol}$

This means that 1 mol of H_2O weighs 18 grams. To find out the weight of 0.25 mol of H_2O, we simply multiply 0.25 mol by the molecular weight of water:

$0.25\,\text{mol} \times 18\,\text{g/mol}$

Performing the calculation:

$0.25 \times 18 = 4.5\,\text{g}$

Therefore, the correct answer is Option C: 4.5 g.

Question56

What is percentage atom economy during conversion of reactant to product if formula weight of reactants is 246 u and of product is 123 u?

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Options:

A. 40.00%

B. 50.00%

C. 47.00%

D. 21.5%

Answer: B

Solution:

To determine the percentage atom economy during the conversion of reactants to products, we use the formula:

$$\text{Atom Economy} = \left(\frac{\text{Formula weight of desired product}}{\text{Formula weight of all reactants}}\right) \times 100$$

Given:

Formula weight of reactants $= 246\,u$

Formula weight of product $= 123\,u$

Now, substituting the given values into the formula:

Atom Economy $= \left(\frac{123}{246}\right) \times 100$

Let's simplify that:

Atom Economy $= \left(\frac{123}{246}\right) \times 100 = 0.5 \times 100 = 50\%$

Thus, the percentage atom economy is 50.00%. Therefore, the correct answer is:

Option B: 50.00%

Question57

Identify the change in colour when NaCl solution is titrated against $\mathrm{AgNO_3}$ solution using fluorescein indicator.

MHT CET 2021 24th September Morning Shift

Options:

A. Colourless to reddish pink

B. Pale yellow to reddish pink

C. Reddish pink to colourless

D. Colourless to pale yellow

Answer: B

Question58

What is percent dissociation of acetic acid in it's $0.01\ \mathrm{M}$ solution if dissociation of acid is 1.34×10^{-2} ?

MHT CET 2021 24th September Morning Shift

Options:

A. 13.4%

B. 4.02%

C. 2.68%

D. 1.34%

Answer: D

Solution:

$$\begin{aligned}\text{Percent dissociation} &= \propto \times 100 \\ &= 1.34 \times 10^{-2} \times 100 \\ &= 1.34\end{aligned}$$

Question59

How many molecules are present in $22400\ \text{cm}^3$ of a gas at STP?

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Options:

A. 22.4×10^{20}

B. 6.022×10^{23}

C. 6.022×10^{20}

D. 22.4×10^{23}

Answer: B

Solution:

$22400\ \text{cm}^3$ of a gas at STP $= 1$ mole of gas $= 6.022 \times 10^{23}$ molecules

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Question60

Calculate osmotic pressure exerted by a solution containing $0.822\ \mathrm{g}$ of solute in $300\ \mathrm{mL}$ of water at $300\ \mathrm{K}$.

(Molar mass of solute $= 340\ \mathrm{g\ mol^{-1}}, \mathrm{R} = 0.0821\ \mathrm{L\ atm\ mol^{-1}\ K^{-1}}$)

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Options:

A. 0.5 atm

B. 0.2 atm

C. 0.1 atm

D. 0.4 atm

Answer: B

Solution:

$$\mathrm{W_2} = 0.822\ \mathrm{g},\ \mathrm{V} = 300\ \mathrm{mL} = 0.3\ \mathrm{L},\ \mathrm{T} = 300\ \mathrm{K},$$
$$\mathrm{M_2} = 340\ \mathrm{g\ mol^{-1}}, \mathrm{R} = 0.0821\ \mathrm{L\ atm\ K^{-1}\ mol^{-1}}, \pi = ?$$
$$\pi = \frac{\mathrm{W_2 RT}}{\mathrm{M_2\ V}}$$
$$= \frac{0.822\ \mathrm{g} \times 0.0821 \mathrm{L atm K^{-1}\ mol^{-1}} \times 300\ \mathrm{K}}{340\ \mathrm{g\ mol^{-1}} \times 0.3\ \mathrm{L}}$$
$$= 0.2\ \mathrm{atm}$$

Question61

The pH of monoacidic weak base is 10.9. Calculate the percent dissociation in 0.02 M solution.

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Options:

A. 7.92%

B. 3.95%

C. 6.25%

D. 2.51%

Answer: B

Solution:

$$\text{pOH} = 14 - \text{pH} = 14 - 10.9 = 3.1$$
$$\text{pOH} = -\log_{10}[\text{OH}]$$
$$\therefore \quad \log_{10}[\text{OH}] = -\text{pOH}$$
$$= -3.1$$
$$= -3 - 0.1 - 1 + 1$$
$$= \bar{4} + 0.9 = \bar{4}.9$$

$$\therefore \quad [\text{OH}] = \text{antilog}(\bar{4}.9) = 7.943 \times 10^{-4}$$

For monoacidic base,

$$\text{BOH}_{(\text{aq})} \rightleftharpoons \text{B}^{+}_{(\text{sq})} + \text{OH}^{-}_{(\text{aq})}$$
$$[\text{OH}] = \propto \text{c}$$

$$\therefore \quad \propto = \frac{[\text{OH}^{-}]}{\text{c}}$$
$$= \frac{7.943 \times 10^{-4}}{0.02} = 3.97 \times 10^{-2}$$

Percent dissociation $= \propto \times 100$
$$= 3.97 \times 10^{-2} \times 100$$
$$= 3.97$$

Question62

Lithium shows diagonal relationship with

MHT CET 2021 24th September Morning Shift

Options:

A. Mg

B. Al

C. Be

D. Na

Answer: A

Solution:

In the periodic table, elements often show similarities with the element **diagonally adjacent** to them due to similar **charge density, electronegativity, and ionic size.**

Lithium (Li), in Group 1 and Period 2, shows a diagonal relationship with:

👉 **Magnesium (Mg)** (Group 2, Period 3)

That's why the correct answer is **Mg.**

Question63

How many molecules of ammonia gas are present in 67.2 dm^3, measured at S.T.P.?

MHT CET 2021 23rd September Evening Shift

Options:

A. 2.0×10^{24}

B. 1.0×10^{23}

C. 1.8×10^{22}

D. 5.0×10^{24}

Answer: C

Solution:

$22.4\ dm^3\ \text{of}\ NH_3 = 6.022 \times 10^{23}\ \text{molecules of}\ NH_3\ \text{at STP}$

$\therefore 67.2\ dm^3\ \text{of}\ NH_3 = \dfrac{6.022 \times 10^{23} \times 67.2}{22.4}$

$= 1.8 \times 10^{22}\ \text{molecules}$

Question64

What is the SI unit of density?

MHT CET 2021 23rd September Evening Shift

Options:

A. kg dm^3

B. kg m^{-3}

C. kg m^3

D. kg dm^{-3}

Answer: B

Solution:

The SI unit of density is given by the mass per unit volume. Density can be expressed by the formula:

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

In the SI system, the unit of mass is the kilogram (kg) and the unit of volume is the cubic meter (m^3). Therefore, the SI unit of density is kg m^{-3}.

Hence, the correct answer is:

Option B: kg m^{-3}

Question65

How many moles of urea are present in 5.4 g ? (Molar mass = 60)

MHT CET 2021 22th September Evening Shift

Options:

A. 2.9

B. 0.09

C. 1.2

D. 2.4

Answer: B

Solution:

To find the moles of urea in a given sample, we can use the formula:

$$\text{moles} = \frac{\text{mass of the substance}}{\text{molar mass of the substance}}$$

Given that the mass of the urea is 5.4 g and the molar mass of urea ($CO(NH_2)_2$) is 60 g/mol, we can plug these values into our formula:

$$\text{moles of urea} = \frac{5.4\ \text{g}}{60\ \text{g/mol}}$$

$$\text{moles of urea} = 0.09\ \text{mol}$$

Therefore, there are 0.09 moles of urea present in 5.4 g of the sample. The correct answer is Option B: 0.09.

Question66

What is the mass of potassium chloride produced when 12.25 g potassium chlorate undergo decomposition? (At mass: $\mathrm{K} = 39, \mathrm{Cl} = 35.5, \mathrm{O} = 16$)

MHT CET 2021 22th September Morning Shift

Options:

A. 16.0 g

B. 14.9 g

C. 7.45 g

D. 4.25 g

Answer: C

Solution:

To determine the mass of potassium chloride (KCl) produced when potassium chlorate ($KClO_3$) decomposes, we first need to understand the chemical reaction involved. The decomposition of potassium chlorate is represented by the following balanced chemical equation:

$$2KClO_3 \rightarrow 2KCl + 3O_2$$

This equation tells us that 2 moles of potassium chlorate decompose to produce 2 moles of potassium chloride and 3 moles of oxygen gas. Therefore, the molar ratio of potassium chlorate to potassium chloride is 1:1.

Next, we calculate the molar mass of potassium chlorate ($KClO_3$).

Molar mass of $KClO_3$:

$\mathrm{K} = 39\,\mathrm{g/mol}$,

$\mathrm{Cl} = 35.5\,\mathrm{g/mol}$,

$3\mathrm{O} = 3 \times 16\,\mathrm{g/mol} = 48\,\mathrm{g/mol}$.

Therefore, the molar mass of $KClO_3$ is:

$39 + 35.5 + 48 = 122.5\,\mathrm{g/mol}$.

Now we calculate the number of moles of $KClO_3$ in 12.25 g:

Number of moles of $KClO_3$:

$\frac{12.25\,\mathrm{g}}{122.5\,\mathrm{g/mol}} = 0.1\,\mathrm{mol}$.

Since the molar ratio of $KClO_3$ to KCl is 1:1, 0.1 moles of $KClO_3$ will produce 0.1 moles of KCl.

Next, we calculate the molar mass of KCl:

Molar mass of KCl:

$\mathrm{K} = 39\,\mathrm{g/mol}$,

$\mathrm{Cl} = 35.5\,\mathrm{g/mol}$.

Therefore, the molar mass of KCl is:

$39 + 35.5 = 74.5\,\mathrm{g/mol}$.

Now we calculate the mass of KCl produced:

Mass of KCl produced:

$0.1\,\mathrm{mol} \times 74.5\,\mathrm{g/mol} = 7.45\,\mathrm{g}$.

Therefore, the mass of potassium chloride produced is 7.45 g. The correct answer is Option C: 7.45 g.

Question67

Which from following formulae is a correct formula to determine percent atom economy?

MHT CET 2021 22th September Morning Shift

Options:

A. $\%$ Atom economy $=$ Formula weight of product $\times 100$

B. $\%$ Atom economy $=$ Sum of formula weight of all reactants $\times 100$

C. $\%$ Atom economy $= \frac{\text{Formula weight of desired product}}{\text{Sum of formula}} \times 100$

D. $\%$ Atom economy $= \frac{\text{Sum of formula weight of all reactants}}{\text{Formula weight of desired product}} \times 100$

Answer: C

Solution:

The correct formula to determine percent atom economy is:

Option C

$$\% \text{ Atom economy} = \frac{\text{Formula weight of desired product}}{\text{Sum of formula weight of all reactants}} \times 100$$

Explanation: Percent atom economy is a measure used in green chemistry to evaluate the efficiency of a chemical reaction in terms of how well atoms are utilized. It is calculated by dividing the formula weight of the desired product by the sum of the formula weights of all reactants, then multiplying by 100 to express it as a percentage. This helps in understanding how much of the reactants' mass is successfully converted into the final product, with a higher atom economy indicating a more efficient reaction.

Question68

What is the volume (in dm^3) occupied by 75 g ethane at S.T.P. ?

MHT CET 2021 21th September Morning Shift

Options:

A. 60.0

B. 56.0

C. 22.4

D. 44.8

Answer: B

Solution:

$\underset{\text{Ethane}}{C_2H_6} \rightarrow$ Molar mass $= 30 \text{ g mol}^{-1}$

30 g of ethane $= 22.4 \text{ dm}^3$ at STP

$\therefore$ 75 g of ethane $= \frac{22.4 \times 75}{30} = 56.0 \text{ dm}^3$

Question69

"Mass can neither be created nor destroyed" is the statement of

MHT CET 2021 20th September Evening Shift

Options:

A. Gay Lussac Law of gaseous volume

B. Law of definite proportion

C. Law of conservation of mass

D. Law of multiple proportions

Answer: C

Solution:

The statement "Mass can neither be created nor destroyed" corresponds to :

Option C

Law of conservation of mass.

The **Law of Conservation of Mass** states that mass is neither created nor destroyed during a chemical reaction. This means that the total mass of the reactants in a chemical reaction will always equal the total mass of the products.

For example, when water is formed from hydrogen and oxygen :

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$$

If you were to take 4 grams of hydrogen gas and 32 grams of

oxygen gas, you would produce 36 grams of water, and no mass would be lost or gained in the process.

Question70

What amount of oxygen is used at S.T.P. to obtain 9 g water from sufficient amount of hydrogen gas?

MHT CET 2021 20th September Morning Shift

Options:

A. 5.6 dm^3

B. 22.4 dm^3

C. 16.8 dm^3

D. 11.2 dm^3

Answer: A

Solution:

$H_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow H_2O_{(l)}$

11.2 dm^3 of O_2 gives 18 g water at STP

$\therefore$ 9 g water is obtained from $\frac{11.2 \times 9}{18} = 5.6\ dm^3$ of O_2

Question71

What is value of percent atom economy if formula weight of product is 46 u and sum of formula weight of all reactants is 92 u?

MHT CET 2021 20th September Morning Shift

Options:

A. 35%

B. 50%

C. 40%

D. 45%

Answer: B

Solution:

$$\% \text{ atom economy } = \frac{\text{Formula weight of the desired product}}{\text{Sum of formula weight of all the reactant used in the reaction}} \times 100$$
$$= \frac{46}{92} \times 100 = 50\%$$

Question72

60 g CH_3COOH dissolved in 1 dm^3 solvent, what is molality of solution?

(density = 1.25 g/cm^3)

MHT CET 2020 16th October Evening Shift

Options:

A. 0.8 m

B. 0.4 m

C. 0.2 m

D. 0.6 m

Answer: A

Solution:

Given,

$$\begin{aligned} \text{Volume} &= 1\text{dm}^3 = 10^3 \text{ cm}^3 \\ \text{Density} &= 1.25 \text{ g/cm}^3 \\ \text{Mass} &= 60 \text{ g} \end{aligned}$$

$$\text{We know that, molality } (M) = \frac{\text{Moles}}{\text{Mass of solvents}}$$

$$\therefore \text{ Moles } = \frac{\text{Given mass}}{\text{Molar mass}}$$

$$= \frac{60 \text{ g}}{60 \text{ g/mol}}$$

$$= 1 \text{ mol}$$

$$\text{Molality } (m) = \frac{\text{Moles}}{\text{Volume } \times \text{ Density}}$$

$$m = \frac{1}{1000 \text{ cm}^3 \times 1.25 \text{ g/cm}^3}$$

$$= \frac{1}{1.25 \text{ g} \times 10^3} \Rightarrow \frac{1}{1.25 \text{ kg}}$$

$$= 0.8 \text{ m}$$

Question73

What is the molarity of solution containing 3.2 g of NaOH (molar mass 40 g mol^{-1}) in 250 cm^3 of water?

MHT CET 2020 16th October Morning Shift

Options:

A. 0.032 mol dm^{-3}

B. 0.02 mol dm^{-3}

C. 0.32 mol dm^{-3}

D. 0.512 mol dm^{-3}

Answer: C

Solution:

Given, mass of $\mathrm{NaOH} = 3.2$ g

Molecular mass of $\mathrm{NaOH} = 40$ g mol^{-1}

Volume of solution $(V) = 250$ $\mathrm{cm}^3 = 0.25$ dm^3

$$\therefore \text{ Molarity } = \frac{\text{Given mass of NaOH}}{\text{Molecular mass of NaOH} \times \text{ Volume}}$$
$$= \frac{3.2 \text{ g}}{40 \text{ g mol}^{-1} \times 0.25 \text{ dm}^3}$$
$$= 0.32 \text{ mol dm}^{-3}$$

Question74

The combining ratios of hydrogen and oxygen in water and hydrogen peroxide are $1:8$ and $1:16$. Which law is illustrated in this example?

MHT CET 2019 3rd May Morning Shift

Options:

A. Law of definite proportions

B. Law of conservation of mass

C. Gay Lussac's law of combining volumes of gases

D. Law of multiple proportions

Answer: D

Solution:

The combining ratios of hydrogen and oxygen in water and hydrogen peroxide are 1 : 8 and 1 : 16. It is an example of law of multiple proportions. According to this law, if two elements combine together to form several compounds then weight of one of these elements, which combines with a fixed weight of the other, are in ratio of simple whole numbers.

Question75

What is the percentage of carbon in urea? (Atomic mass $C = 12, H = 1, N = 14, O = 16$)

MHT CET 2019 2nd May Morning Shift

Options:

A. 20%

B. 26.6%

C. 6.67%

D. 46.0%

Answer: A

Solution:

Molar mass of urea (i.e. NH_2CONH_2)

$= 2\times$ atomic mass of $N + 4\times$ atomic mass of $H + 1\times$ atomic mass of $O + 1\times$ atomic mass of C .

$= 2 \times 14 + 4 \times 1 + 1 \times 16 + 1 \times 12 = 60g$

As we know that,

Percentage or mass % of an element

$= \frac{\text{Mass of that element in the compound}}{\text{Molar mass of the compound}} \times 100$

$\therefore$ Percentage of $C = \frac{1\times12}{60} \times 100 = 20\%$
