

**CHEM 101+103 SECOND SEMISTER 1431-1432H
FIRST EXAM SOLUTINS**

1. The number of hydrogen "H" atoms present in 6.20 g of table sugar "C₁₂H₂₂O₁₁" is:

A) 2.4×10^{23} B) 2.6×10^{23} C) 2.7×10^{23} D) 2.9×10^{23}

SOLUTION

$$n = \frac{m}{M} = \frac{6.2}{342} = 0.018 \text{ mol}$$

1 mol C₁₂H₂₂O₁₁ contains 22 mol H

0.018 mol C₁₂H₂₂O₁₁ contains n mol H

$$n = \frac{22 \times 0.018}{1} = 0.399 \text{ mol}$$

$$N = n \times N_A = 0.399 \times 6.022 \times 10^{23} = 2.4 \times 10^{23} \text{ atom}$$

2. The mass (in g) of sodium "Na" present in 30.0 g of Na₂SO₄ is:

A) 12.2 B) 11.8 C) 10.5 D) 9.7

SOLUTION

1 mol Na₂SO₄ contains 2 mol Na

$$\frac{30}{140} = 0.21 \text{ mol Na}_2\text{SO}_4 \text{ contains } 0.42 \text{ mol Na}$$

$$m = n \times M = 0.42 \times 23 = 9.66 \text{ g}$$

3. Copper "Cu" is usually added to gold "Au" to obtain a hard alloy suitable for making jewelry. A 24.0 g piece of such jewelry contains 5.70×10^{22} atom of Cu. The percentage by mass of gold in this jewelry is:

A) 72.72% B) 74.94% C) 76.85% D) 78.75%

SOLUTION

$$\frac{N}{N_A} \times 100 = \frac{5.7 \times 10^{22}}{6.022 \times 10^{23}} = 0.095 \text{ mol}$$

$$m = n \times M = 0.095 \times 63.54 = 6.02 \text{ g}$$

$$m_{\text{Au}} = m_{\text{total}} - m_{\text{Cu}} = 24 - 6.02 = 17.98 \text{ g}$$

$$\text{Au \%} = \frac{m_{\text{Au}}}{m_{\text{total}}} \times 100 = \frac{17.98}{24} \times 100 = 74.95 \%$$

4. The empirical formula of a certain pesticide which has the percentage by mass composition of 19.36% Ca, 34.26% Cl and 46.38% O is:

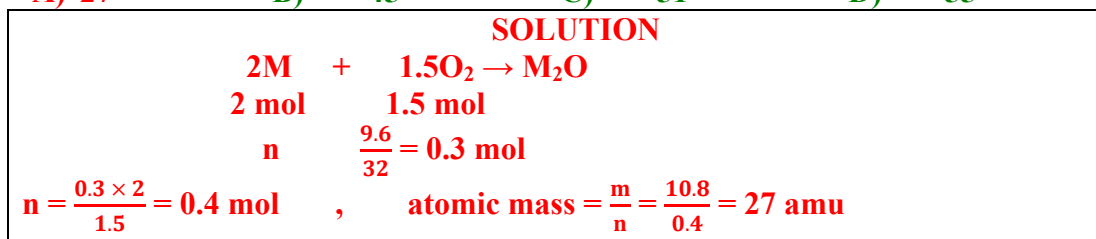
A) CaCl₂O₃ B) CaCl₂O₄ C) CaCl₂O₆ D) CaCl₃O₄

SOLUTION

Ca	:	Cl	:	O
<u>19.36</u>	:	<u>34.26</u>	:	<u>46.38</u>
40	:	35.45	:	16
0.484	:	0.966	:	2.899
1	:	2	:	6
"CaCl₂O₆"				

5. A metal "M" reacts with oxygen to give M_2O_3 metal oxide. If 9.6 g of oxygen combines with 10.8 g of this metal, the atomic mass (in a.m.u.) of this metal is:

A) 27 B) 45 C) 51 D) 55

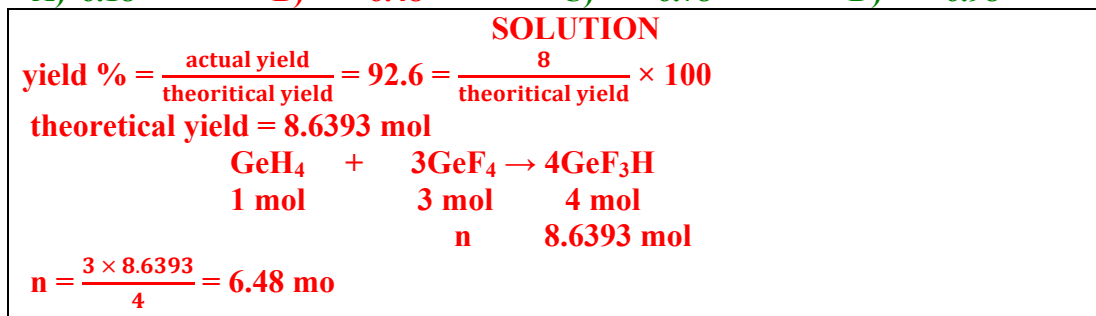


6. GeF_3H is formed from GeH_4 and GeF_4 in the combination reaction:

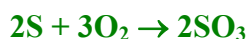


If the reaction yield is 92.6%, the numbers of moles of GeF_4 needed to produce 8.0 moles of GeF_3H are:

A) 6.18 B) 6.48 C) 6.78 D) 6.98

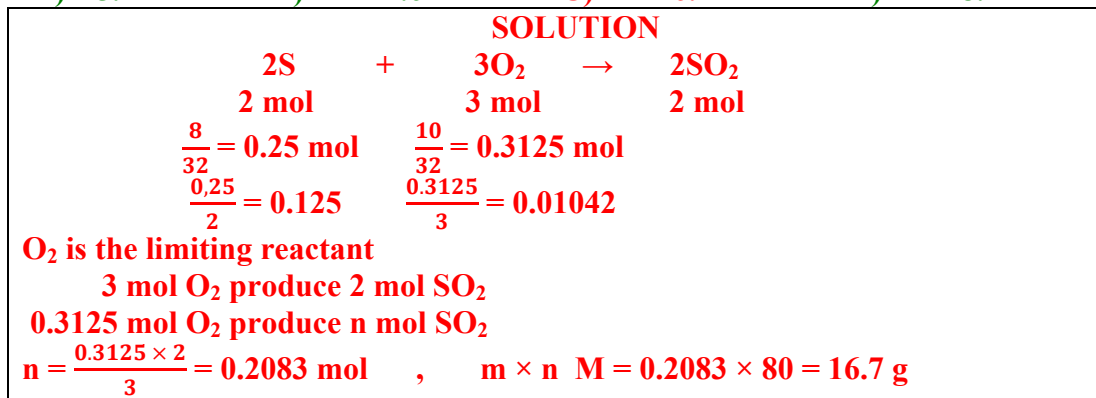


7. According to the following reaction:



The maximum mass of SO_3 (in g) that can be produced by the reaction of 8.0 g of sulfur, S, with 10.0 g of oxygen " O_2 " gas is:

A) 15.2 B) 17.6 C) 16.7 D) 18.4



8. The volume (in mL) of 0.251 M potassium iodide "KI" solution that contains 13.5 g KI is:

A) 385 B) 368 C) 346 D) 324

SOLUTION

$$V \text{ (L)} = \frac{n_{\text{solute}}}{\text{molarity}} = \frac{\frac{m}{M}}{0.251} = \frac{\frac{13.5}{166}}{0.251} = 0.324 \text{ L} = 324 \text{ mL}$$

9. The molality "m" of a 25% by mass of glucose "C₆H₁₂O₆" solution is:

- A) 1.85 B) 1.75 C) 2.25 D) 2.15

SOLUTION

$$\text{molality} = \frac{n_{\text{solute}}}{m_{\text{solvent}}(\text{kg})} = \frac{\frac{m}{M}}{100 - 25} = \frac{\frac{25}{180}}{75} = 1.85 \text{ molal}$$

10. The number of moles of NH₃ gas present in 50 L cylinder at 31.5°C and a pressure equals 20.0 atm is:

- A) 40 B) 42 C) 45 D) 50

SOLUTION

$$n = \frac{PV}{RT} = \frac{20 \times 50}{0.0821 \times 304.5} = 40 \text{ mol}$$

11. 18.39 g of Freon gas occupies 3 L at STP. Therefore, the molar mass of this gas is:

- A) 142.6 B) 137.4 C) 132.8 D) 128.7

SOLUTION

$$M = \frac{mRT}{PV} = \frac{18.39 \times 0.0821 \times 273}{1 \times 3} = 137.4 \text{ g/mol}$$

12. The density (in g.L⁻¹) of N₂O₅ gas at 33°C and 1.0 atm pressure is:

- A) 4.3 B) 3.9 C) 3.6 D) 3.2

SOLUTION

$$d = \frac{PM}{RT} = \frac{1 \times 108}{0.0821 \times 306} = 4.3 \text{ g/L}$$

13. The volume (in L) of oxygen gas "O₂" at 153°C and 0.820 atm that can be produced by the decomposition of 22.4 g of KClO₃ is:



- A) 10.5 L B) 10.8 L C) 11.2 L D) 11.7 L

SOLUTION

$$\begin{array}{rcccl} 2\text{KClO}_3 & \rightarrow & 2\text{KCl} & + & 3\text{O}_2 \\ 2 \text{ mol} & & & & 3 \text{ mol} \\ \frac{22.4}{122.45} & = & 0.183 \text{ mol} & & n \\ n = \frac{0.183 \times 3}{2} & = & 0.274 \text{ mol} & & \\ V = \frac{nRT}{P} & = & \frac{0.274 \times 0.0821 \times 426}{0.82} & = & 11.7 \text{ L} \end{array}$$

14. Two identical balloons are filled at the same temperature and pressure. One contains Argon gas "Ar" and the other contains Helium "He" gas. The argon gas leaks out of its balloon at a rate of 150 mL per hour. Therefore, the rate of leakage (in mL per hour) of helium gas of its balloon is:

- A) 1497 B) 848 C) 474 D) 424

SOLUTION

$$\frac{r_{\text{Ar}}}{r_{\text{He}}} = \sqrt{\frac{M_{\text{He}}}{M_{\text{Ar}}}} \quad , \quad \frac{150}{r_{\text{He}}} = \sqrt{\frac{4}{40}} \quad , \quad r_{\text{He}} = 474 \text{ mL/hr}$$

15. At STP, the average kinetic energy of the molecules of N₂ gas, O₂ gas and Cl₂ gas is:

- A) equal for the three gases.
B) the greatest for the N₂ gas molecules.
C) the greatest for the O₂ gas molecules.
D) the greatest for the Cl₂ gas molecules.

SOLUTION

Because T is the same, KE is the same.