Chapter 5 Answers

13. In each case, divide the mass by the molar mass $\left(n = \frac{m}{M}\right)$.

(a) $n = \frac{0.453\ \text{g}}{159.7\ \text{g/mol}} = (2.84)(10^{-3})\ \text{mol}$

(b) $n = \frac{50.7\ \text{g}}{98.09\ \text{g/mol}} = 0.517\ \text{mol}$

(c) $n = \frac{(1.24)(10^{-2})\ \text{g}}{152.00\ \text{g/mol}} = (8.15)(10^{-5})\ \text{mol}$

14. In each case, divide by the Avogadro constant $\left(n = \frac{N}{N_A}\right)$.

(a) $n = \frac{(4.27)(10^{21})}{(6.02)(10^{23})\text{mol}^{-1}} = (7.09)(10^{-3})\ \text{mol}$

(b) $n = \frac{(7.39)(10^{23})}{(6.02)(10^{23})\text{mol}^{-1}} = 1.23\ \text{mol}$

(c) $n = \frac{(5.38)(10^{22})}{(6.02)(10^{23})\text{mol}^{-1}} = (8.94)(10^{-2})\ \text{mol}$

15.

Isotope	Molar Mass (g/mol)	Sample Mass (g)	Number of Molecules	Number of Moles of Molecules	Number of Moles of Atoms
NaCl	58.44	58.44	$(6.02)(10^{23})$	1.00	2.00
NH_3	17.04	24.8	$(8.79)(10^{23})$	1.46	5.84
H_2O	18.02	1.58	$(5.28)(10^{22})$	$(8.77)(10^{-2})$	$(2.63)(10^{-1})$

16. (a) $PtBr_2$: $M = 195.08\ \text{g/mol} + 2(79.90)\ \text{g/mol} = 354.88\ \text{g/mol}$

(b) $C_3H_5O_2H$:

$M = 3(12.01)\ \text{g/mol} + 5(1.01)\ \text{g/mol} + 2(16.00)\ \text{g/mol} + 1.01\ \text{g/mol}$
$= 74.09\ \text{g/mol}$

18. C_6H_6: $M = 78.12\ \text{g/mol}$ and given $m = 45.6\ \text{g}$

$n = \frac{m}{M} = \frac{45.6\ \text{g}}{78.12\ \text{g/mol}} = 0.584\ \text{mol}$

Using $n = \frac{N}{N_A}$, the number of molecules is

Chapter 6 Answers

14. Consider a 100 g sample.

Element	$n = \frac{m}{M}$ (mol)	Ratio to Smallest n	Revised Ratio
C	$\frac{80.2}{12.01} = 6.677$	10.498	21
O	$\frac{10.18}{16.00} = 0.636$	1.00	2
H	$\frac{9.62}{1.01} = 9.524$	14.975	30

The empirical formula is $C_{21}O_2H_{30}$.

15. Consider a 100 g sample.

Element	$n = \frac{m}{M}$ (mol)	Ratio to Smallest n	Revised Ratio
Na	$\frac{17.6}{22.99} = 0.766$	1.00	2
Cr	$\frac{39.7}{52.00} = 0.763$	1.00	2
O	$\frac{42.8}{16.00} = 2.675$	3.50	7

The empirical formula is $Na_2Cr_2O_7$.

21. Mass of $FeSO_4 \bullet xH_2O = 2.78$ g

Mass of $FeSO_4 = 1.52$ g

Mass of H_2O in sample $= 2.78 \text{ g} - 1.52 \text{ g} = 1.26$ g

$$\text{Moles of } FeSO_4 = \frac{1.52 \text{ g}}{151.92 \text{ g/mol}} = 0.01 \text{ mol } FeSO_4$$

$$\text{Moles of } H_2O = \frac{1.26 \text{ g}}{18.02 \text{ g/mol}} = 0.07 \text{ mol } H_2O$$

Divide moles of iron sulfate and water by 0.01 mol, this gives the ratio 1 mol $FeSO_4$: 7 mol H_2O

Therefore, $x = 7$ and the formula for the compound is $FeSO_4 \bullet 7H_2O$.