

19. What is the mass of 7.67×10^{20} molecules of methane, CH_4 ?

$$7.67 \times 10^{20} \text{ molecules Methane} \times \frac{1 \text{ mol CH}_4}{6.022 \times 10^{23} \text{ molecules CH}_4} \times \frac{16.04 \text{ g CH}_4}{1 \text{ mol CH}_4} = 0.0204 \text{ g CH}_4$$

20. What is the total number of ions present in 7.3 moles of potassium phosphate?

$$7.3 \text{ mol K}_3\text{PO}_4 \times \frac{6.022 \times 10^{23} \text{ f. units K}_3\text{PO}_4}{1 \text{ mol K}_3\text{PO}_4} \times \frac{4 \text{ ions}}{1 \text{ f unit K}_3\text{PO}_4} = 1.8 \times 10^{25} \text{ ions}$$

21. What is the total number of atoms in 425 grams of water?

$$425 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18.01 \text{ g H}_2\text{O}} \times \frac{6.022 \times 10^{23} \text{ molecules H}_2\text{O}}{1 \text{ mol H}_2\text{O}} \times \frac{3 \text{ atoms}}{1 \text{ molecule H}_2\text{O}} = 4.26 \times 10^{25} \text{ atoms}$$

22. What is the total mass of a mixture of 3.50×10^{23} formula units of Na_2SO_4 , 0.500 moles of water, and

7.23 grams of silver chloride?

$$3.50 \times 10^{23} \text{ fu Na}_2\text{SO}_4 \times \frac{1 \text{ mol Na}_2\text{SO}_4}{6.022 \times 10^{23} \text{ fu Na}_2\text{SO}_4} \times \frac{142.05 \text{ g Na}_2\text{SO}_4}{1 \text{ mol Na}_2\text{SO}_4} = 82.6 \text{ g Na}_2\text{SO}_4$$

$$0.500 \text{ mol H}_2\text{O} \times \frac{18.01 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = 9.01 \text{ g H}_2\text{O}$$

82.6 g Na_2SO_4 + 9.01 g H_2O = 91.61 g

23. How many iodide ions are in 32.4 moles of barium iodide?

$$32.4 \text{ mol BaI}_2 \times \frac{6.022 \times 10^{23} \text{ fu BaI}_2}{1 \text{ mol BaI}_2} \times \frac{2 \text{ I}^- \text{ ions}}{1 \text{ fu BaI}_2} = 3.90 \times 10^{25} \text{ I}^- \text{ ions}$$

= 98.8 g total

24. Dimethylnitrosamine ($(\text{CH}_3)_2\text{N}_2\text{O}$), is a cancer causing agent that may be formed in foods, beverages, or gastric juices from the reaction of nitrite ions (used as a food preservative) with other substances.

a. Calculate the molar mass of dimethylnitrosamine.

$$\textcircled{a} = 2(12.01) + 6(1.0079) + 2(14) + 16 = 74.0674 \text{ g/mol } (\text{CH}_3)_2\text{N}_2\text{O}$$

$$\textcircled{b} 500.0 \text{ mg } (\text{CH}_3)_2\text{N}_2\text{O} \times \frac{1 \text{ g } (\text{CH}_3)_2\text{N}_2\text{O}}{1000 \text{ mg } (\text{CH}_3)_2\text{N}_2\text{O}} \times \frac{1 \text{ mol } (\text{CH}_3)_2\text{N}_2\text{O}}{74.0674 \text{ g } (\text{CH}_3)_2\text{N}_2\text{O}} = 0.006751 \text{ mol } (\text{CH}_3)_2\text{N}_2\text{O}$$

$$\textcircled{c} 1.00 \text{ g } (\text{CH}_3)_2\text{N}_2\text{O} \times \frac{1 \text{ mol } (\text{CH}_3)_2\text{N}_2\text{O}}{74.0674 \text{ g } (\text{CH}_3)_2\text{N}_2\text{O}} \times \frac{2 \text{ N atoms}}{1 \text{ mol } (\text{CH}_3)_2\text{N}_2\text{O}} = 0.0270 \text{ atoms of N}$$

22. Identify the representative particle (atom, molecule, formula unit, or ion) for each of the following.

a. FeCl_2 formula unit

b. Fe^{3+} ion

c. Hg atom

d. H_2O_2 molecule

e. NaClO_3 formula unit

f. H_2 molecule

23. Explain the difference between an atom and a molecule.

Atoms bond together to form molecules.

24. Explain the difference between an ion and a formula unit.

An ion is a charged particle. Formula units are made up of ions.

25. Explain how a molecular compound can be distinguished from an ionic compound?

Molecular compounds are composed of nonmetals only. Ionic compounds are composed of at least one metal and nonmetal atom.

26. How are molar mass and Avogadro's number related?

The molar mass is how much one mole of particles, 6.022×10^{23} particles (Avogadro's #), weighs.