

Mole, molecule, atom, molarity and volume problems

1. How many moles are in 25.0 g of KCl?

$$n = \frac{m}{mm} = \frac{25.0g}{74.55g/mol} = 0.335 \text{ mol}$$

2. How many molecules are in 5.00 g of NaCl?

$$n = \frac{m}{mm} = \frac{5.00g}{58.44g/mol} = 0.085557837 \text{ mol} \times 6.02 \times 10^{23} \text{ molec} = 5.15 \times 10^{22} \text{ molecules}$$

3. How many hydrogen atoms are in 250 g of H₂O?

$$n = \frac{m}{mm} = \frac{250g}{18.02g/mol} = 13.87347392 \text{ mol} \times 6.02 \times 10^{23} \text{ molec} \times 2 \text{ atoms} = 1.7 \times 10^{25} \text{ H atoms}$$

4. How many moles of NaCl are in 950 mL of a 4.1 M solution?

$$\frac{4.1 \text{ mol}}{L} = \frac{x}{0.95L} = 3.9 \text{ mol} \text{ OR } n = c \times v = \frac{4.1 \text{ mol}}{L} \times 0.95L = 3.9 \text{ mol}$$

5. What volume of a 1.5 M solution of H₂O contains 3.0 g of solute?

$$n = \frac{m}{mm} = \frac{3.0g}{18.02g/mol} = 0.166481687 \text{ mol} = \frac{1.5 \text{ mol}}{L} = 0.11L$$

6. Calculate the molarity of a solution by dissolving 15 g of KOH in enough water to make 3.75 L of solution.

$$n = \frac{m}{mm} = \frac{15g}{56.1g/mol} = 0.267332026 \text{ mol} = \frac{0.267332026 \text{ mol}}{3.75L} = 0.071 \text{ mol/L}$$

7. There are 650 g / 420 mL of H₂O. What is the molar concentration?

$$\frac{650g}{0.42L} = \frac{x}{1L} = \frac{1547.619048g}{18.02g/mol} = 86 \text{ mol/L}$$

8. How many grams of NaCl are in 450 ml of a 1.75 M solution?

$$m = n \times mm = 0.7875 \text{ mol} \times 58.44g/mol = 46g$$

$$\frac{1.75 \text{ mol}}{L} = \frac{x}{0.45L} \text{ OR } \frac{1.75 \text{ mol}}{L} \times 0.45L = 0.7875 \text{ mol}$$

9. Which of the following solutions has the highest concentration in g/L?

- A- 5.5 mol in a 3.0 L of KBr
- B- 5.5 mol in a 3.0 L of NaOH

$$m = n \times mm$$

$$5.5 \times 119.00g/mol = 654.5g$$

$$\frac{654.5g}{3.0L} = 220g/L$$

$$5.5 \times 40.00g/mol = 220g$$

$$\frac{220g}{3.0L} = 73g/L$$