

### Solution Calculations - Maple TA type questions

1. Calculate the molarity of the solution that was prepared by diluting 9.46 mL of 1.4 M  $\text{BaCl}_2$  solution to 91.8 mL?

This is a dilution problem. Use dilution equation  $C_1V_1 = C_2V_2$ .

- $M_1 = 1.4 \text{ M}$
- $V_1 = 9.46 \text{ mL}$
- $V_2 = 91.8 \text{ mL}$

**Answer: 0.14 M**

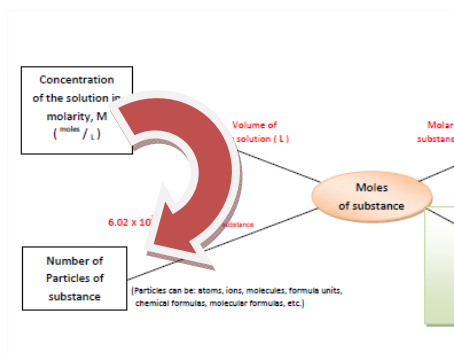
2. If a student withdraws 21.9 mL from a 5.9 M KOH solution in order to prepare a 2.534 M KOH solution, what is the final volume of the dilute solution in liters?

This is a dilution problem. Use dilution equation  $C_1V_1 = C_2V_2$ .

- $M_1 = 5.9 \text{ M}$
- $V_1 = 21.9 \text{ mL}$
- $M_2 = 2.534 \text{ M}$

**Answer: 0.051 L**

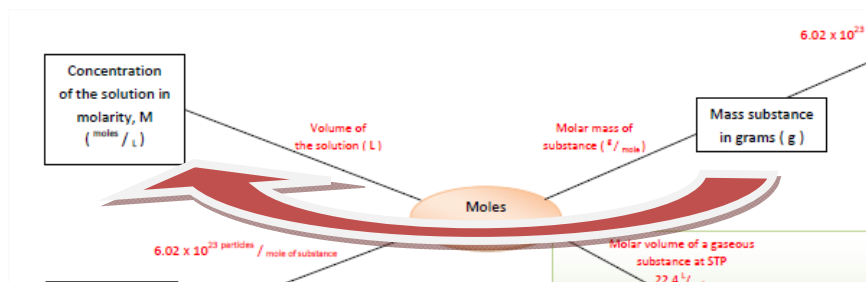
3. A  $\text{KNO}_3$  solution is 2.500 M. How many  $\text{K}^+$  ions are in 3.00 milliliters of solution?



$$(2.500 \text{ moles/L}) \cdot (0.00300 \text{ L}) \cdot (6.023 \times 10^{23} \text{ potassium ions/mole})$$

**Answer:  $4.52 \times 10^{21}$  K<sup>+</sup> ions**

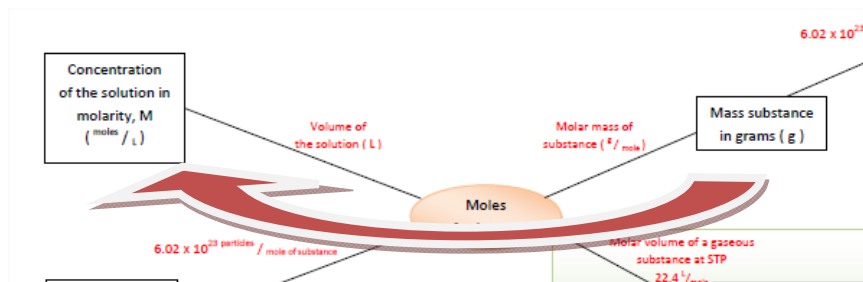
4. Calculate the concentration in M (molarity) of a nitric acid,  $\text{HNO}_3$ , solution that contains 208.9 mg of nitric acid,  $\text{HNO}_3$ , in 20.00 mL of solution.



$$\text{Concentration} = \frac{\frac{0.2089 \text{ g}}{63.012 \text{ g/mole}}}{0.02000 \text{ L}}$$

**Answer: 0.1658 M**

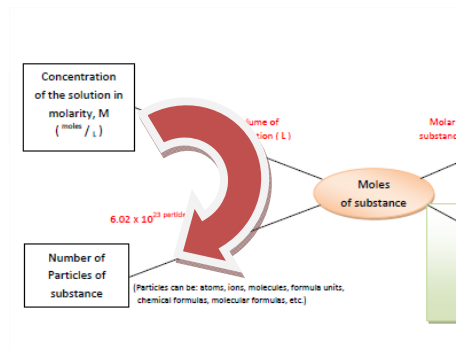
5. When 406.5 grams of sugar,  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ , is dissolved in 250.0 mL, the concentration of the sugar solution is



$$\text{Concentration} = \frac{\frac{406.5 \text{ g}}{342.297 \text{ g/mole}}}{0.2500 \text{ L}}$$

**Answer: = 4.750 M**

6. A  $\text{BaCl}_2$  solution is 2.500 M. How many  $\text{Cl}^-$  ions are in 8.00 milliliters of solution?



$$2.500 \frac{\text{moles BaCl}_2}{L} \cdot 0.00800 L \cdot 6.02 \times 10^{23} \frac{\text{BaCl}_2}{\text{mole BaCl}_2} \cdot 2 \frac{\text{Cl}^- \text{ ions}}{\text{BaCl}_2}$$

**Answer:  $2.4 \times 10^{22}$   $\text{Cl}^-$  ions**

7. If a student withdraws 38.4 mL from a 5.4 M  $\text{H}_2\text{SO}_4$  solution in order to prepare a 3.288 M  $\text{H}_2\text{SO}_4$  solution, what is the final volume of the dilute solution in liters?

This is a dilution problem. Use dilution equation  $C_1V_1 = C_2V_2$ .

- $M_1 = 5.4 \text{ M}$
- $V_1 = 38.4 \text{ mL}$
- $M_2 = 3.288 \text{ M}$

**Answer: 0.06307 L**

8. Calculate the molarity of the solution that was prepared by diluting 8.41 mL of 1.3 M NaCl solution to 83.7 mL?

This is a dilution problem. Use dilution equation  $C_1V_1 = C_2V_2$ .

- $M_1 = 1.3 \text{ M}$
- $V_1 = 8.41 \text{ mL}$
- $V_2 = 83.7 \text{ mL}$

**Answer: 0.13 M**

9. A student wants to prepare 3.43 liter of a 3.527 M  $\text{H}_2\text{SO}_4$  solution. How many milliliters of the 6.5 M  $\text{H}_2\text{SO}_4$  solution do they need?

This is a dilution problem. Use dilution equation  $C_1V_1 = C_2V_2$ .

- $M_1 = 6.5 \text{ M}$
- $M_2 = 3.527 \text{ M}$
- $V_2 = 3.43 \text{ L}$

**Answer: 1860 mL**

10. In order to make 500.0 mL of a 0.066 M  $\text{AlCl}_3$  solution, a student needs to pipet 0.00834 L from a more concentrated  $\text{AlCl}_3$  solution. What must be the molarity of the more concentrated  $\text{AlCl}_3$  solution?

This is a dilution problem. Use dilution equation  $C_1V_1 = C_2V_2$ .

- $M_2 = 0.066 \text{ M}$
- $V_1 = 0.00834 \text{ L}$
- $V_2 = 500.0 \text{ mL}$

**Answer: 4.0 M**