

## Worksheet 3: Mole Problems

- 1- How many atoms are there in 75.0 g of gold?
- 2- How many moles of zinc, sulphur and oxygen are present in 5.0 moles of zinc thiosulphate? How many atoms are there in total?
- 3- a) What is the mass of  $8.56 \times 10^{23}$  molecules of  $\text{SO}_3$ ?  
b) If you have the same mass of zinc bromide, how many molecules of zinc bromide will you have?
- 4- What is the density of carbon disulphide gas at STP?
- 5- What mass of nitrogen dioxide gas will there be in 78.5 L of the gas at RTP?
- 6- Find the identity of the gaseous element with a density of 1.31 g/L at RTP.
- 7- a) What mass of carbon monoxide gas is present in 125 L of gas at STP?  
b) What volume would be occupied by a similar mass of ammonia at RTP?
- 8- Which element has the most atoms per millilitres of substance, zinc or potassium? The density of zinc is 7.14 g/mL and the density of potassium is 0.86 g/mL.
- 9- Iron has a density of 7.86 g/mL. How many atoms are present in 25.0 mL of iron?
- 10- Mercury has a density of 13.6 g/mL. What is the volume of 1 atom of mercury?

### ANSWERS

- 1- ? atoms Au =  $(6.02 \times 10^{23} \text{ atoms / mole}) (1 \text{ mole / } 197.0 \text{ g}) (75.0 \text{ g}) = 2.29 \times 10^{23} \text{ atoms Au}$
- 2- Zinc thiosulphate =  $\text{ZnS}_2\text{O}_3$   
5.0 moles of  $\text{ZnS}_2\text{O}_3$  contain: 5.0 moles Zn atoms, 10. moles S atoms, 15 moles O atoms.  
Total # atoms =  $(6.02 \times 10^{23} \text{ atoms/mole}) (30. \text{ moles}) = 1.8 \times 10^{25} \text{ atoms}$
- 3- a) 114 g of  $\text{SO}_3$                       b)  $3.05 \times 10^{23}$  molecules of  $\text{ZnBr}_2$
- 4- ? g / L =  $(76.2 \text{ g/mole}) (1 \text{ mole}/22.4 \text{ L}) = 3.40 \text{ g / L}$
- 5- Mass = 147 g of  $\text{NO}_2$
- 6- The element is oxygen,  $\text{O}_2$ .
- 7- a) Mass = 156 g of CO                      b) Volume = 225 L of  $\text{NH}_3$
- 8- ? atoms<sub>Zn</sub>/mL =  $(6.02 \times 10^{23} \text{ atoms/mole}) (1 \text{ mole}/65.4 \text{ g})(7.14 \text{ g/mL}) = 6.57 \times 10^{22} \text{ atoms Zn per mL}$   
? atoms<sub>K</sub>/mL =  $1.3 \times 10^{22} \text{ atoms K per mL}$   
There are more Zn atoms per mL than there are K atoms.
- 9- There are  $2.12 \times 10^{24}$  atoms of iron.
- 10- An atom of mercury has a volume of  $2.45 \times 10^{-23}$  mL.