Year 11 Chemistry NAME_____

Chemical Calculations Assignment

Moles and Mass

1.
   (a) Use an analogy to explain the mole concept. “A mole is like...” /2
   (b) State why a mole is a more useful quantity in chemistry than mass. /1

2. Calculate the molar mass of the following substances, showing full working:
   (a) Na_2CO_3 /2
   (b) $Mg(NO_3)_2$ /2
   (c) $FeSi_2O_3.3H_2O$ /2

3. For each species in the equation below, write its formula and molar mass:
   $2H_2 + O_2 \rightarrow 2H_2O$ /6

4. Calculate the number of moles in the following masses:
   (a) 2.50 g of sodium carbonate (105.99 g mol^{-1}) /2
   (b) 0.62 g of NH_4Cl /3
   (c) 1.0 kg of copper sulfate pentahydrate (249.66 g mol^{-1}) /3

5. Calculate the mass of the following:
   (a) 1.0 moles of nitric acid (63.01 g mol^{-1}) /2
   (b) 0.0200 moles of mercury metal /3

6. Consider the balanced chemical equation below:
   $8H^+ + 5Fe^{2+} + MnO_4^- \rightarrow 5Fe^{3+} + Mn^{2+} + 4H_2O$
   (a) Write the mole ratio $\frac{n(MnO_4^-)}{n(Fe^{2+})}$. /1
   (b) Write the mole ratio for one other pair of species. /2

7. Consider a reaction in which 3.00 moles of CH_4 is burnt with excess oxygen according to this equation:
   $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
   (a) State what it means for oxygen to be in 'excess'. /1
   (b) State the limiting reactant. /1
   (c) Suggest one reason why the oxygen is in excess when this reaction is carried out. /1
   (d) Explain why 3.00 moles of CO_2 will be produced in this reaction. /2
   (e) State the mole ratio $\frac{n(H_2O)}{n(CH_4)}$. /1
   (f) Hence determine the number of moles of water produced in this reaction. /1
   (g) Hence calculate the mass of water produced. /2

8. If 7.4 mol of hydrogen gas and 3.6 mol of oxygen gas are ignited, the following reaction occurs:
   $2H_2 + O_2 \rightarrow 2H_2O$
   (a) Determine which reactant is in excess. /3
   (b) Determine the number of moles of water produced. /2

Chemical Calculations Assignment

Moles and Mass

Learning Intentions

To be able to:

- Define mole and molar mass
- Determine molar masses from the periodic table
- Convert between mass and moles
- Write mole ratios from balanced chemical equations
- Define excess and limiting reactants
- Determine number of moles that would exactly react (given moles of other reactant)
- Determine number of moles that would be produced (given one reactant in excess)
- Determine excess and limiting reactants (given moles of each reactant)