

## C1401 Tutorial 4

1. Balance the following reactions:

- a)  $\text{KClO}_3 \rightarrow \text{KCl} + \text{O}_2$
- b)  $\text{CaCO}_3 + \text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
- c)  $\text{PCl}_5 + \text{H}_2\text{O} \rightarrow \text{POCl}_3 + \text{HCl}$
- d)  $\text{FeCl}_2 + \text{Cl}_2 \rightarrow \text{FeCl}_3$
- e)  $\text{ZrCl}_4 + \text{H}_2\text{O} \rightarrow \text{ZrO}_2 + \text{HCl}$
- f)  $\text{Fe} + \text{H}_2\text{O} \rightarrow \text{Fe}_2\text{O}_3 + \text{H}_2$
- g)  $\text{P}_4 + \text{O}_2 \rightarrow \text{P}_4\text{O}_{10}$
- h)  $\text{Pb} + \text{H}_2\text{O} + \text{O}_2 \rightarrow \text{Pb}(\text{OH})_2$
- i)  $\text{Ag} + \text{H}_2\text{S} + \text{O}_2 \rightarrow \text{Ag}_2\text{S} + \text{H}_2\text{O}$
- j)  $\text{Ca}_3(\text{PO}_4)_2 + \text{H}_3\text{PO}_4 \rightarrow \text{Ca}(\text{H}_2\text{PO}_4)_2$

2. Determine the missing formula and balance the equation:

- a)  $\text{Zn} + \text{CuSO}_4 \rightarrow \text{-----} + \text{ZnSO}_4$
- b)  $\text{N}_2 + \text{-----} \rightarrow \text{NH}_3$
- c)  $\text{K} + \text{H}_2\text{O} \rightarrow \text{-----} + \text{-----}$
- d)  $\text{C}_6\text{H}_6 + \text{-----} \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- e)  $\text{AgNO}_3 + \text{-----} \rightarrow \text{Ag}_2\text{O} + \text{H}_2\text{O} + \text{NaNO}_3$

3. Predict what happens when the following pairs of dilute aqueous solutions are mixed

- a)  $\text{Cu}(\text{NO}_3)_2$  and  $(\text{NH}_4)_2\text{SO}_4$
- b)  $\text{FeCl}_3$  and  $\text{AgNO}_3$

4. Write a net ionic equation for any precipitation that occurs when dilute solutions of the following compounds are mixed.

- a)  $\text{NaOH}$  and  $\text{Cu}(\text{NO}_3)_2$
- b)  $\text{Ba}(\text{OH})_2$  and  $\text{MgSO}_4$
- c)  $(\text{NH}_4)_3\text{PO}_4$  and  $\text{K}_2\text{CO}_3$

5. Solid sodium hydroxide reacts with carbon dioxide from air to form a colourless liquid and a white powder. Write a balanced chemical equation for the reaction.

6. How many moles of  $\text{I}_2$  are required to react exactly with 0.429 g of aluminium?

7. Nitric acid,  $\text{HNO}_3$  is extensively used in the manufacturing of fertilizer. A bottle containing 75 mL of nitric acid solution is labelled 6.0 M
- How many moles of  $\text{HNO}_3$  are in the bottle?
  - A reaction needs 5.00 g of  $\text{HNO}_3$ . How many mL of solution are required?
  - 10.0 mL of water are added to the solution, what is the molarity of the resulting solution? (Assuming volumes are additive).
8. Calculate mass of oxygen gas required for the combustion of 702 g of octane  $\text{C}_8\text{H}_{18}$ .
9. A mixture of 5.0 g  $\text{H}_2$  (g) and 10.0 g  $\text{O}_2$  (g) is ignited. Water forms.
- Write a balanced chemical equation for the reaction
  - Which is the limiting reactant?
  - How much water will be produced by the reaction?
10. What is the limiting reagent when 0.25 mol of Cr reacts with 0.50 mol of  $\text{H}_3\text{PO}_4$ .  
According to the following chemical equation:
- $$\text{Cr} + \text{H}_3\text{PO}_4 \rightarrow \text{CrPO}_4 + \text{H}_2$$
11. What is the limiting reagent when 10.0 g of propane is burned with 25 g of oxygen?