**Putting the mole to use**

**(This sheet accompanies the video experiment)**

**Aim:** To use mole theory to predict the mass of product in a reaction.

**Background**

You have just learnt mole theory. Why is it important? One reason is that it allows chemical industries to calculate the exact amounts of reactants they need and to predict the mass of product they will get. Making chemicals on a large scale should not be a random affair.

**Example question.**

A company sets out to make 1000 kg of methane, formula CH4.

Knowing the formula says 4 hydrogen atoms for every 1 carbon,

what mass of carbon should they use and what mass of hydrogen?

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The answer might surprise you (it is at the end of this sheet). You need a much greater mass of carbon because each carbon atom weighs 12 times as much as each hydrogen atom.

**Part A**: The reaction

When magnesium metal is added to hydrochloric acid a vigorous reaction occurs.

1. Write a balanced equation for this reaction.

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2. a. If you are observing this reaction, what will you see?

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b. What will each product look like? PAUSE

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**Watch the reaction on video.**

3. Outline how you might prove that the other product is magnesium chloride. Also, how could

you find out the mass of this magnesium chloride?

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**Part B**: Mass prediction

**Mg(s) + 2HCl(aq) 🡪 MgCl2(aq) + H2(g)**

Look carefully at this equation to answer the questions below.

If you start with 1 magnesium atom, how many MgCl2 can you form? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If you start with 6 magnesium atoms, how many MgCl2 can you form? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If you start with 265 magnesium atoms, how many MgCl2 can you form? \_\_\_\_\_\_\_\_\_\_\_\_\_

If you start with 8 mole of magnesium, how many mole of MgCl2 can you form? \_\_\_\_\_\_\_

4. If I start with a 4 cm piece of magnesium how can I calculate the expected amount of MgCl2?

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**Experiment**

Record each of the following from the video, the mass of magnesium used, the mass of the evaporating basin and the mass of the crucible and residue.

**Mass prediction**

5. Calculate the number of mole of magnesium in the magnesium ribbon.

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6. How many mole of magnesium chloride should form? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. Calculate the mass of the magnesium chloride in Q.6.

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8. How does the mass in the experiment compare to the mass predicted?

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9. Suggest two reasons the actual mass was slightly lower than expected.

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**Extension**

10. There has been a big assumption all through this experiment about the hydrochloric acid

used. What might that assumption be?

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*Answer to intro qn. % C in methane = 12/16 x 100 = 75 % => 25 % H*

*Need 750 kg C and 250 kg H*