1. 5.0 g sample of magnesium reacts completely with a hydrochloric acid solution after 150 s. Express the average rate of consumption of magnesium,in units of g/min.

2. How long will it take to completely react 45.0 g of $CaCO_3(s)$ with dilute HCl(aq) if the reaction proceeds at an average rate of 2.35 g $CaCO_3(s)$/min under a given set of conditions?

3. The electrolysis of water produces oxygen gas at the rate of 32.5 mL/min in a certain experiment. What volume of oxygen gas can be produced in 7.50 min?

4. Which of the following are acceptable units for expressing reaction rate?
   (a) moles/second (c) (moles/litre)/second (e) millilitres/hour

   (b) minutes/metre (d) grams/litre (f) grams/minute

5. Hydrogen and oxygen gas react in a fuel cell to produce water according to the equation:
   $2\ H_2(g) + O_2(g) \longrightarrow 2\ H_2O(l)$.
   If the rate water production is 1.34 mol/min, what is the rate of oxygen gas consumption expressed in mol/min?

6. The following data was obtained for the above reaction (mass includes beaker and contents).
   Plot the above data on the graph below.

Now answer the following questions.

(a) Why is the mass decreasing?

(b) What is the slope of the line in the above graph, using: slope = RISE/RUN?

(c) What are the units of: (i) the RISE? (ii) the RUN? (iii) the slope?

(d) What units would you expect to use for the rate of this reaction?

(e) What relationship exists between the slope of the graph and the rate of the reaction? State the value found for the experimentally-determined reaction rate.

7. When measuring the rate at which the mass of copper metal decreases during a reaction with nitric acid, why can't you just put the reaction vessel on a digital balance and record the decrease in mass as the copper is used up?

8. (a) Solutions of Cu?*(aq) are blue, while solutions of Ag*(aq) are colourless. Use only this information to describe how you would measure the rate of the reaction:
$2Ag^{+}(aq) + Cu(s) \longrightarrow 2\ Ag(s) + Cu^{2+}(aq) + 35\ kJ.$

(b) Suggest two more methods that could be used to determine the rate of the reaction in part (a). For each method, state the property that you are monitoring.

9. (a) You are to measure the rate of the reaction:
$H_2(g) + Cl_2(g) \longrightarrow 2\ HCl(g).$
Why is gas pressure NOT a good property to monitor in order to determine the reaction rate?

(b) Calculate the reaction rate, in mol HCl/s, if 1.2 g of HCl(g) are produced in 2.0 min.

(c) If the rate of consumption of hydrogen gas under certain conditions is 0.200 L/min, what is the rate of production of HCl(g)?