**Patterns of reactivity**

1. When a metal tarnishes, it reacts with a gas in the air.
   
   i. What is the name of this gas? ..............................................................

   ii. What sort of metal compound is formed in this reaction? .........................

   b. When iron tarnishes in air, it also reacts with water and forms a brown solid on the surface of the metal. What is the name of this brown solid?

   ...............................................................................................

   c. Name a metal that does not tarnish when exposed to air. ..............................

2. Small pieces of three very reactive metals are dropped into water. The water is then tested with Universal Indicator.

The table shows the results from this experiment.

<table>
<thead>
<tr>
<th>Very reactive metal</th>
<th>Observation when metal is dropped into water</th>
<th>Result of test with Universal Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>lithium</td>
<td>steady bubbling, metal moves around surface of water</td>
<td>purple</td>
</tr>
<tr>
<td>potassium</td>
<td>violent bubbling, gas ignites, metal shoots around surface</td>
<td>purple</td>
</tr>
<tr>
<td>sodium</td>
<td>fast bubbling, metal moves quickly on surface</td>
<td>purple</td>
</tr>
</tbody>
</table>

a. Name (a) the gas and (b) the metal compound produced in these reactions.

   a. .................................................................................... b. ..............................................................

b. Use information in the table to write these alkali metals in order of reactivity, starting with the most reactive.

   ..............................................................................................

c. What does the Universal Indicator colour show you about the water?

   ..............................................................................................

d. Complete this word equation for the reaction of sodium with water.

   sodium + water → ................................................................. + ..........................................................
Patterns of reactivity (continued)

3a This table shows how some metals react with dilute hydrochloric acid.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Observation in cold hydrochloric acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>copper</td>
<td>no reaction</td>
</tr>
<tr>
<td>iron</td>
<td>a few bubbles</td>
</tr>
<tr>
<td>magnesium</td>
<td>vigorous bubbling</td>
</tr>
<tr>
<td>zinc</td>
<td>steady bubbling</td>
</tr>
</tbody>
</table>

Use the information in the table to write the four metals in order of reactivity, starting with the most reactive.

b Describe a test to prove that hydrogen is the gas given off.

4 Small pieces of zinc are added to solutions containing the nitrates of four other metals. The results of this displacement experiment are shown in the table.

<table>
<thead>
<tr>
<th>Metal nitrate in solution</th>
<th>Observation of piece of zinc</th>
</tr>
</thead>
<tbody>
<tr>
<td>copper</td>
<td>turns brown</td>
</tr>
<tr>
<td>iron</td>
<td>turns black</td>
</tr>
<tr>
<td>magnesium</td>
<td>no change</td>
</tr>
<tr>
<td>silver</td>
<td>turns black</td>
</tr>
</tbody>
</table>

a i From the results in the table, which metal is more reactive than zinc?

ii Explain how the results show this.

b Complete this word equation for the reaction of zinc with iron nitrate.

\[
\text{zinc} + \text{iron nitrate} \rightarrow \text{...} + \text{...}
\]
Patterns of reactivity (continued)

5 Complete the following passage by crossing out the words that are wrong.

The reactivity sequence/series is a list of metals with the most/least reactive at the top and the most/least reactive at the bottom. Silver corrodes easily so it is above/below gold.

6 In the Thermit reaction, aluminium powder is mixed with iron oxide. The reaction is violent, giving off sparks and clouds of smoke. Molten iron is produced.
   a What does this reaction tell you about the positions of aluminium and iron in the reactivity series?

   b Write a word equation for the reaction.

   c Which two observations tell you that this reaction releases a lot of energy?

   d Give one use of the Thermit reaction.

7 In a piece of gold ore, small pieces of the yellow metal can be seen. In a piece of iron ore, no iron metal can be seen. The iron ore contains iron oxide.

   Explain this difference.

8 Use ideas about the properties of metals to explain each of the following statements.

   a Copper is used instead of iron to make water pipes.

   b Gold is used instead of calcium to make jewellery.

   c Aluminium is used instead of iron to make aeroplane bodies.