

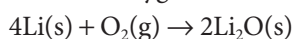
Answers to worksheet questions

Chapter 8

Worksheet 8.1

1 The metals of Group I in the Periodic Table are called the *alkali* metals. They are a family of very *reactive* metals. They tarnish rapidly in air, but are *shiny* when freshly cut. They conduct heat and *electricity* well but are *soft*, have low densities and *low* melting and boiling points.

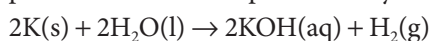
2 a lithium + oxygen → lithium oxide



b

Metal	Reaction with water
lithium	<i>floats and fizzes steadily</i>
sodium	<i>melts and skates around on surface</i>
potassium	<i>melts, skates around on surface and gas catches fire</i>

c potassium + water → potassium hydroxide + hydrogen



Worksheet 8.2

1 a i tungsten ii sodium iii tungsten

b they all conduct electricity

c mercury

d because it has a very high melting point

e It would sink because it is denser than mercury.

2

Property	Alkali metals	Transition metals
reactivity	<i>very reactive</i>	<i>less reactive</i>
density	<i>can float on water</i>	<i>sink in water</i>
melting and boiling point	<i>low</i>	<i>high</i>
colour of salts	<i>colourless</i>	<i>often coloured</i>

3 Metals have many *properties* that make them useful. Most metals react with other substances such as *air* and *water*. Because of this, most metals are found combined with other elements as *ores*. The method used to extract the metal depends on how *reactive* it is. Moderately reactive metals can be extracted by *reducing* the oxide with *carbon*. The most reactive metals must be extracted by *electrolysis*. Some metal compounds react with acids – they are called *bases*. When an acid reacts with a base, a *salt* is formed.

Worksheet 8.3

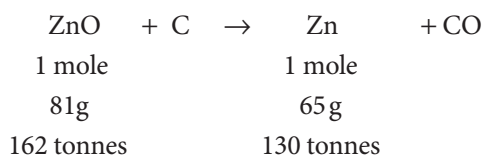
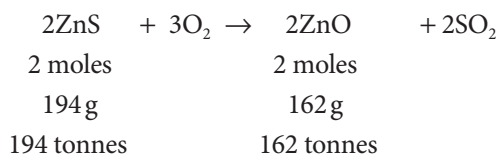
- 1** Zinc will displace copper from a solution of copper sulfate, and magnesium will displace zinc from a solution of zinc sulfate.
- a** zinc + copper sulfate → zinc sulfate + copper
magnesium + zinc sulfate → magnesium sulfate + zinc
- b** $\text{Zn(s)} + \text{CuSO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{Cu(s)}$
 $\text{Mg(s)} + \text{ZnSO}_4(\text{aq}) \rightarrow \text{MgSO}_4(\text{aq}) + \text{Zn(s)}$
- c** $\text{Zn(s)} + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu(s)}$
 $\text{Mg(s)} + \text{Zn}^{2+}(\text{aq}) \rightarrow \text{Mg}^{2+}(\text{aq}) + \text{Zn(s)}$
- d** They are redox reactions because there is exchange of electrons / some atoms are losing electrons while some ions are gaining them.
- e** copper < zinc < magnesium
- 2** When a more reactive metal is dipped in a solution containing a less reactive metal, a *displacement* reaction takes place.
- An example of this type of reaction is when a piece of *zinc* is dipped in *copper* sulfate solution, where the *more* reactive metal displaces the less reactive from solution. Studying these reactions helps us to draw up a *reactivity* series of the metals.
- 3** **a** All three metals became the negative electrode.
b $A > C > B$ (> copper)
c **i** A and B: 2.0 V
ii B and C: 0.2 V
d **i** A is the negative terminal.
ii C is the negative terminal.

Worksheet 8.4

- 1** **a** Copper is being deposited on the surface of the zinc electrode.
b The copper ions that make the solution blue are being discharged to form the copper on the zinc electrode so the solution goes colourless.
c The reaction is an exothermic reaction so the temperature rises.
- 2** $\text{Zn(s)} \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{e}^-$
- 3** $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu(s)}$
- 4** Electrons move from the zinc atoms to the copper ions.
- 5** The zinc reacts with the acid and dissolves, and bubbles of hydrogen gas are given off.
- 6** There is no reaction between copper and the acid.
- 7** **a** The electrons flow from zinc to copper in the external circuit.
b The zinc electrode gets smaller / shrinks / loses mass.
c The zinc electrode becomes negatively charged.
d The zinc electrode could be changed for a more reactive metal, magnesium, for example / the copper electrode could be changed for a less reactive metal, silver, for example.
e **i** anode: the zinc electrode
cathode: the copper electrode
ii These charges on the electrodes are the opposite way round to those in an electrolytic cell.

Worksheet 8.5

1 1 mole ZnS = 65 + 32 = 97 g

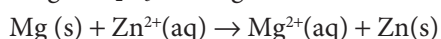
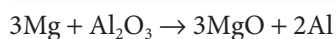


- 2 The zinc evaporates from the mixture in the furnace and is condensed in the upper part of the furnace.
- 3 SO₂ is reacted with oxygen to make sulfur trioxide. This is then dissolved in water to make sulfuric acid.
 $2\text{SO}_2 + \text{O}_2 \rightleftharpoons 2\text{SO}_3$
 $\text{SO}_3 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4$
- 4 $2\text{CuS} + 3\text{O}_2 \rightarrow 2\text{CuO} + 2\text{SO}_2$
- 5 $2\text{CuO} + \text{C} \rightarrow 2\text{Cu} + \text{CO}_2$
- 6 carbon dioxide and water
- 7 copper
- 8 anode: the impure copper
cathode: pure copper

Worksheet 8.6

Most reactive $\xrightarrow{\hspace{15em}}$ Least reactive
 magnesium > aluminium > zinc > iron > copper

	Aluminium	Copper	Iron	Magnesium	Zinc
Aluminium sulfate		no reaction	no reaction	✓	no reaction
Copper sulfate	✓		✓	✓	✓
Iron sulfate	✓	no reaction		✓	✓
Magnesium sulfate	no reaction	no reaction	no reaction		no reaction
Zinc sulfate	✓	no reaction	no reaction	✓	



Worksheet 8.7

- 1**
 - a** A and D
 - b** In **B** there is no oxygen – it has been boiled out of the water.
In **C** there is no water – the drying agent (calcium chloride) removes any water.
- 2** Rusting would be fastest in **D** because salt water promotes rusting.
- 3** by sacrificial protection / blocks of a more reactive metal than iron (magnesium or zinc) are attached to the hull or legs / these blocks are corroded in preference to the iron
- 4**
 - a** by making the cutlery out of stainless steel (containing chromium)
 - b** by galvanising the car body and by painting