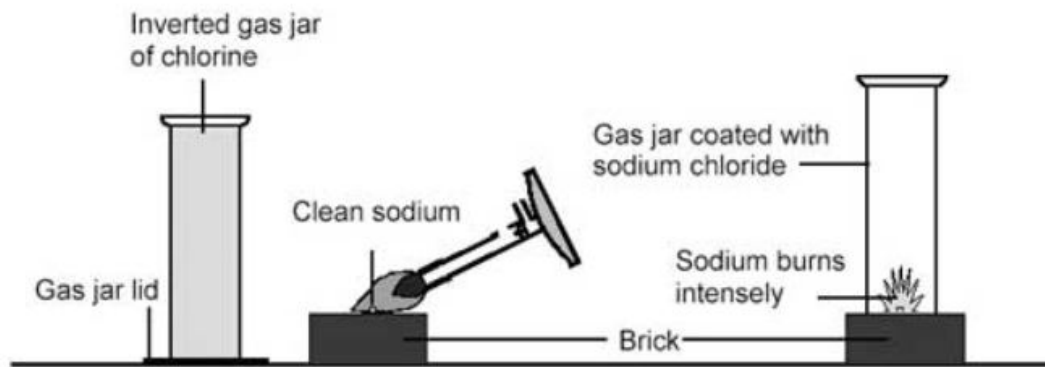# Ionic Formulae

1. A piece of 0.5g piece of sodium is burned in chlorine to produce 1.27g of sodium chloride.

   (a) How many moles of sodium were used in the reaction?
   (b) What mass of chlorine was added to the sodium during the reaction?
   (c) How many moles of chlorine were added to the sodium?
   (d) What is the ratio of Na : Cl ?
   (e) Give the empirical formula of sodium chloride.
   (f) What is the formula of the sodium ion?
   (g) What is the formula of the chloride ion?
   (h) Draw a sodium ion and a chloride ion, including the charges for the ions outside the square brackets. This is the dot-and-cross diagram for sodium chloride.

2. 0.084g of magnesium is burned in chlorine and 0.3325g of which magnesium chloride powder is formed.

   (a) How many moles of magnesium were used in the reaction?
   (b) What mass of chlorine was added to the magnesium during the reaction?
   (c) How many moles of chlorine were added to the magnesium?
   (d) What is the ratio of Mg : Cl ?
   (e) Give the empirical formula of magnesium chloride.
   (f) A magnesium ion has a 2+ charge.
       Draw a magnesium atom and a magnesium ion.
       Explain why this results in the empirical formula you have determined.

3. A teacher burns 1.2g of aluminium in chlorine gas to form aluminium chloride. After scraping out the white solid produced in the reaction she weighs 5.93g of product.

   (a) How many moles of aluminium were used in the reaction?
   (b) What mass of chlorine was added to the aluminium during the reaction?
   (c) How many moles of chlorine were added to the aluminium?
   (d) Give the empirical formula of aluminium chloride.
   (e) What is the formula of the aluminium ion?
   (f) Draw a dot-and-cross diagram for aluminium. [Remember that you will need to draw more than one chloride ion – check the formula you have calculated.]

4. Using your answers to Questions 1-3, explain how the charge on a metal ion is linked to group number.

5. Suggest formulae for the following:

   (a) Calcium chloride
   (b) Potassium chloride
   (c) Rubidium chloride
   (d) Beryllium chloride
   (e) Strontium fluoride
       [HINT: fluorine is in the same group as chlorine]

6. A student sets up apparatus like the one below to burn sodium (not magnesium) in air. She weighed crucible three times and got the following results:
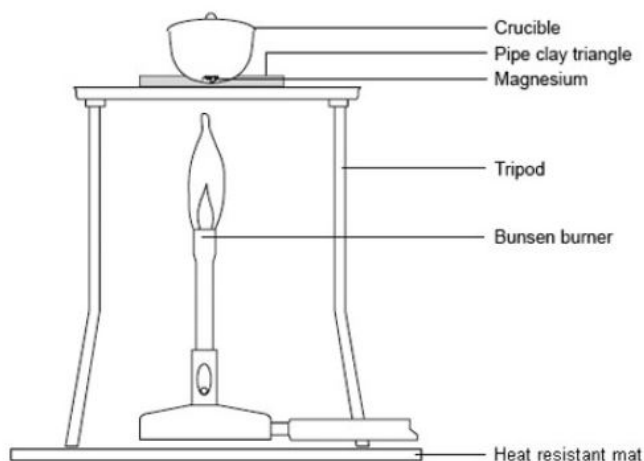
Mass of the crucible and lid (g)	26.20
Mass of the crucible, lid and sodium before heating (g)	26.960
Mass of the crucible, lid and contents after heading (g)	27.224

(a) How many moles of sodium were used in the reaction?
(b) What mass of oxygen was added to the sodium during the reaction?
(c) How many moles of oxygen were added to the sodium?
(d) Give the empirical formula of sodium oxide.
(e) What is the formula of the oxide ion?
(f) Draw a dot-and-cross diagram for sodium oxide.
(g) What do you notice about the charge on the oxide ion compared to the chloride ion?

7. Another student used a special gas chamber to burn sodium in nitrogen using a similar method. He attained the following results:

Mass of the crucible and lid (g)	24.13
Mass of the crucible, lid and sodium before heating (g)	25.11
Mass of the crucible, lid and contents after heading (g)	25.31

(a) How many moles of sodium were used in the reaction?
(b) What mass of nitrogen was added to the sodium during the reaction?
(c) How many moles of nitrogen were added to the sodium?
(d) Give the empirical formula of sodium nitride.
(e) What is the formula of the nitride ion?
(f) Draw a dot-and-cross diagram for sodium nitride.
(g) What do you notice about the charge on the oxide ion compared to the chloride ion?

8. Using your answers to Questions 1, 6 and 7, explain how the charge on a non-metal ion is linked to group number.

9. Suggest formulae for the following:

(a) Potassium oxide
(b) Rubidium nitride
(c) Caesium sulphide
(d) [HINT: sulphur is in the same group as oxygen]