AS level Chemistry A

H032/02 Depth in chemistry

Question Set 14

1. This question is about the properties and reactions of the Group 2 element strontium.

(a) The relative atomic mass of strontium can be determined using a mass spectrometer.

(i) Explain what is meant by the term **relative atomic mass** of an element. **[2]**

weighted average mass of all isotopes of an element, relative to 1/12 the mass of an atom of C-12.

(ii) A sample of strontium has a relative atomic mass of 87.73.

The sample consists of:

- 82.9% Sr-88
- 6.9% Sr-87
- one other isotope.

Determine the other isotope of strontium in the sample. **[2]**

$$87.73 = \frac{(82.9 \times 88) + (6.9 \times 87) + (10.2 \times x)}{100}$$

$$8773 = 7295.2 + 600.3 + 10.2x$$

$$10.2x = 877.5$$

$$x = 86.03$$

∴ the other isotope is Sr-86

(b) The table below shows two physical properties of the element strontium.

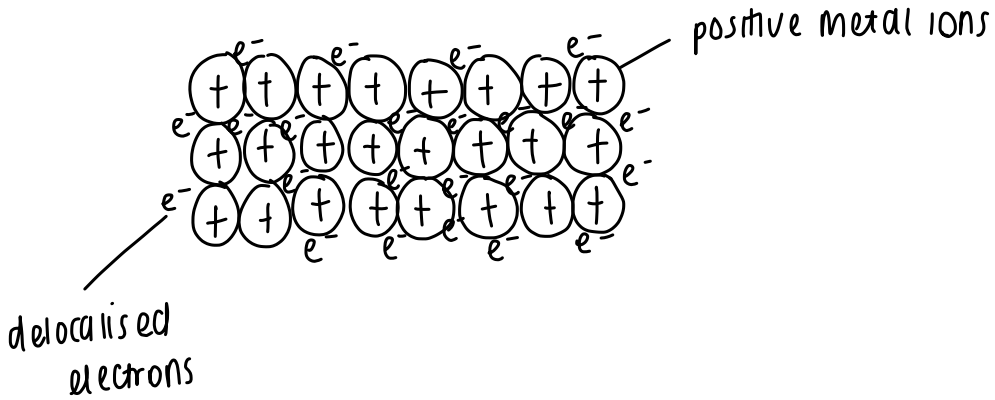
Melting point	high
Electrical conductivity	very good

Explain these physical properties of strontium, in terms of bonding and structure. Include a labelled diagram in your answer. **[5]**

strontium has a giant metallic structure ; a lattice of positive metal ions existing in a sea of delocalised electrons.

high melting point due to strong electrostatic forces of attraction between nuclei of metal ions and delocalised electrons; strong metallic bonds require lots of energy to break.

Strontium can conduct electricity because the delocalised electrons are free to move and carry the electric current throughout the structure.



(c) A student adds a small amount of strontium to water.

When the reaction has finished, the student measures the pH of the final solution.

(i) Write the equation for the reaction of strontium with water. **[1]**

$Sr_{(s)} + 2H_2O_{(l)} \longrightarrow Sr(OH)_{2(aq)} + H_{2(g)}$

(ii) Describe **two** observations which would be different if the student had used calcium in place of strontium. **[2]**

less effervescence

pH would be lower (more acidic)

(d) When hydrated strontium chloride is heated, the water of crystallisation is removed, leaving a residue of anhydrous strontium chloride.

A student carries out an experiment to find the value of x in the formula of hydrated strontium chloride, $SrCl_2 \cdot xH_2O$.

The student's method is outlined below.

Step 1
Weigh an empty crucible.
Add $SrCl_2 \cdot xH_2O$ to the crucible and reweigh.

Step 2
Heat the crucible and contents for 10 minutes.
Allow to cool and reweigh.

Step 3
Heat the crucible and residue for another 5 minutes.
Allow to cool and weigh the crucible and residue.

Repeat step 3 a further two times.

The student's results are shown below:

Mass of empty crucible / g	15.96
Mass of crucible + $SrCl_2 \cdot \mathbf{x}H_2O$ / g	18.65
First mass of crucible + residue / g	17.66
Second mass of crucible + residue / g	17.61
Third mass of crucible + residue / g	17.58
Fourth mass of crucible + residue / g	17.58

(i) Calculate the value of **x** in $SrCl_2 \cdot \mathbf{x}H_2O$.

Give your answer to **2** significant figures.

$SrCl_2 \cdot xH_2O$ **[3]**

$18.65 - 17.58 = 1.07g$ of water

mass of $SrCl_2 \cdot xH_2O = 18.65 - 15.96 = 2.69g$

$2.69 - 1.07 = 1.62g$ of $SrCl_2$

moles of $SrCl_2 = \frac{1.62}{158.6} = 0.010214$

moles of $H_2O = \frac{1.07}{18} = 0.05944$

$0.0594 \div 0.0102 = 5.8199$

$x = 5.8$

(ii) Suggest why the student takes four readings of the mass of the crucible and residue. **[1]**

to ensure all of the water has been evaporated from the sample

(iii) Suggest **two** modifications to the method that would reduce the percentage uncertainty in the mass of the residue. **[2]**

1. Only heat the salt twice; each time for 20 minutes
2. use a larger mass of the salt

Total Marks for Question Set 1: 18