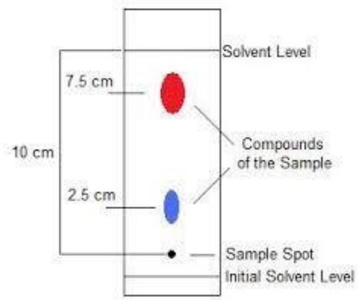
Chemistry Knowledge Organiser
C12 - Chemical Analysis

Chromatography and Rf values

- When carrying out chromatography we can calculate an Rf (retention factor) value/
- The retention factor is a ratio between the distance travelled by the solvent and the distance travelled by a compound.
- Chromatography has two phases- a stationary phase where particles can't move (the filter paper in most cases), a mobile phase where particles can move (a solvent for example water).
- Different compounds will have different Rf values in different solvents, this allow us to see whether a substance is pure or impure.
- To calculate Rf value you need to divide the distance moved by the solvent by the distance moved by the spot.
- For example to work out the Rf for the spot further up the paper:
- Rf= $\frac{B}{A}$ Rf= $\frac{7.5}{10} = 0.75$
- There are no units as the answer is a ratio
- The higher the Rf the further the spot has moved up the paper, compared to the solvent.



Transition Metals

- The central block (between group 2 and 3) of the Periodic Table is known as the transition metals.
- Compared to group 1 elements, transition metals have different physical properties. For example transition metals have a higher melting point and are more dense.
- The exception is mercury which is a liquid at room temperature.
- Transition metals also have different physical properties to group 1. They are much less reactive and do not react vigorously with oxygen or water.

Key Terms	Definitions
Retention Factor	The ratio between the distance travelled by the substance and the distance travelled by the solvent.

Equation	Meanings of terms in equation and units
Rf= $\frac{B}{A}$	*Rf = Retention Factor (no units)* *B = Distance travelled by substance (cm)* *A= Distance travelled by solvent (cm)*

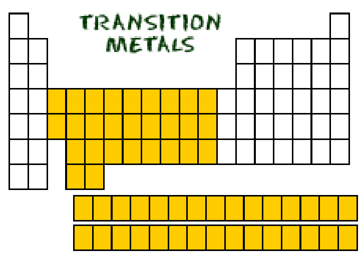
Melting Point and Boiling point

- A chemically pure substance will melt or boil at a very specific temperature.
- If a substance is chemically impure it will melt or boil at a lower temperature and across a broader range.
- The closer the substance is to the melting point the purer the substance.

Formulations

- Formulations are mixtures made using a precise amount of each substance, so they can serve a particular purpose.
- For example in paints or in pills.

Transition Metals



Chemistry Knowledge Organiser
C12 - Chemical analysis – triple students only

Testing for positive ions

Positive ions (metal ions) can be identified by flame tests:

Metal and ion	Colour of flame test
Sodium Na^+	Yellow
Lithium Li^+	Crimson
Potassium K^+	Purple
Copper Cu^{2+}	Green
Calcium Ca^{2+}	Red/Orange

To carry out a flame test you need to do the following:

1. Dip metal loop in dilute HCl, hold in Bunsen burner flame (blue flame), until no colour is seen.
2. Dip the loop into the sample you are testing
3. Place this into the flame and observe the colour

Testing for negative ions

Ion	Test	Equation
Carbonate (CO_3^{2-})	Add metal carbonate to dilute acid in a boiling tube. Connect the boiling tube to a test tube containing limewater. If the limewater turns cloudy then a carbonate ion is present	$K_2CO_3 + 2HCl \rightarrow 2KCl + CO_2 + H_2O$
Sulphate (SO_4^{2-})	Add 5 drops of dilute HCl, followed by 5 drops of barium chloride. If sulphate ions are present then a white precipitate will be formed.	$Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$ This is the ionic equation for the reaction.
Halides (Cl^{-1}, Br^{-1}, I^{-1})	Add 5 drops of dilute nitric acid and 5 drops of silver nitrate, the colour of the silver halide precipitate formed will vary depend on the halogen Cl^{-1} – White Br^{-1}- Cream I^{-1}-Yellow	$Ag^+ + Cl^- \rightarrow AgCl$ This is the ionic equation for the reaction.

More tests for metal ions

Some metal hydroxides are insoluble. Therefore if some drops of sodium hydroxide are added to a solution of the metal hydroxide a precipitate may form. Transition metal hydroxides are usually coloured. Where as main group elements normally form a white precipitate.

Gas	Colour of precipitate	Ionic Equation
Magnesium Mg^{2+}	White	$Mg^{2+} + 2OH^- \rightarrow Mg(OH)_2$
Calcium Ca^{2+}	White	$Ca^{2+} + 2OH^- \rightarrow Ca(OH)_2$
Iron(II) Fe^{2+}	Green	$Fe^{2+} + 2OH^- \rightarrow Fe(OH)_2$
Iron(III) Fe^{3+}	Brown	$Fe^{3+} + 3OH^- \rightarrow Fe(OH)_3$
Copper Cu^{2+}	Blue	$Cu^{2+} + 2OH^- \rightarrow Cu(OH)_2$
Aluminium Al^{3+}	White initially. In excess NaOH it dissolves to form a colourless solution.	$Al^{3+} + 3OH^- \rightarrow Al(OH)_3$