THE DUSTON SCHOOL
Knowledge itself is power
4-19

Year 11 Science Knowledge Booklet

Term 4

Name:	Class:

Knowledge Booklet: **GCSE Chemistry Practicals**

Big Questions and Vocabulary

- How do I make an experiment valid?
- What are the variables in this experiment?
- What can you conclude from this data?
- How do I carry out this experiment?
- Why is this experiment repeatable?

Hypothesis	A scientific statement that explains certain facts or observations	**Anomaly**	A result that does not fit the pattern
Prediction	This describes what you think will happen in an experiment	**Accuracy**	How close the reading is to the true value
Independent variable	This is the variable that is changed during an investigation. There should only be one of these.	**True value**	This is the real value of a measurement in an experiment
Dependent variable	This is the variable that changes as a result of a change in the independent variable	**Precision**	This is determined by the scale on the measuring apparatus e.g. a ruler marked mm is more precise than one in cm
Control variable	Variables that remain constant, to make sure that an investigation is valid	**Resolution**	The smallest change that can be read from a measuring device for example a ruler measured in mm or cm
Fair test	This is where only the independent variable is changed and the others controlled	**Calibration**	When we make sure that measuring apparatus is making correct readings e.g. the temperature of melting ice is 0 degrees Celsius
Valid	The results and conclusions will be this if the variables are correctly controlled	**Measurement error**	The difference between the real value and the measured value
Categoric variable	A variable that can be described by a label or category such as colour or surface	**Random error**	This error causes measurements to be spread around the true value – can be reduced by taking repeats and calculating a mean
Continuous variable	A variable which can have any numerical value	**Zero error**	When a piece of measuring equipment should be reading zero but it doesn't
Interval	This is the difference between the values of your independent variable	**Systematic error**	This is an error that is always the same for each repeat – usually because of an error in the equipment used
Range	The maximum and minimum values of the independent or dependent variables e.g. 'from 10cm to 50cm'	**Uncertainty**	When the results obtained are not as accurate as they could be due to the procedure carried out
Data	Information or measurements that you collect	**Repeatable**	If the same person can get the same reading using the same equipment and method
Datum	One piece of information	**Reproducible**	If another person can get the same result (trend/specific results) using the same method and equipment or with different method or equipment.

Chemistry required practicals

Topic	Title	What to do	Video link
C4	Prepare a salt from an insoluble metal carbonate or oxide.	Prepare with the appropriate apparatus and techniques, a pure, dry sample of a soluble salt from an insoluble carbonate or oxide.	https://www.youtube.com/watch?v=qIOMlwBoe_4
C4	Investigate the electrolysis of a solution.	Investigate the electrolysis of different aqueous solutions using inert electrodes.	https://www.youtube.com/watch?v=tCHE_7QeRUc
C5	Investigating temperature changes.	Use appropriate apparatus to investigate the variables that affect energy changes in reactions involving at least one solution.	https://www.youtube.com/watch?v=tKxcQYZ2YH8
C6	Investigating the effect of concentration on rate of reaction.	Investigate how changes in concentration affect rates of reactions using a method involving measuring the volume of a gas produced and a method involving a change in colour or turbidity.	https://www.youtube.com/watch?v=WlitM81qGqE
C8	Calculate Rf values.	Use paper chromatography to find out the Rf values of the dyes found in different food colourings.	https://www.youtube.com/watch?v=pnTGNAfu6GE
C10	Purify and test water	Analyse and purify water from different sources, including pH, dissolved solids and distillation.	https://www.youtube.com/watch?v=Ea3PH_q3kus

1 – Preparation of a pure, dry, salt

Preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate using a Bunsen burner to heat dilute acid and a water bath or electric heater to evaporate the solution.

1. Measure acid (e.g. sulfuric acid) into beaker
2. **Heat** the acid gently using a Bunsen burner
3. Add small amounts of insoluble base (e.g. copper oxide until it is **in excess**, when no more reacts (*figure a*)
4. **Filter** the solution to remove the excess insoluble base (*figure b*)
5. **Evaporate** the solution using a water bath until crystals start to form (*figure c*)
6. Leave the crystallising dish in a cool place for at least 24 hours
7. Gently pat the crystals **dry** between two pieces of filter paper

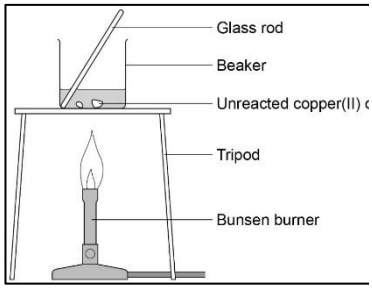


Figure a

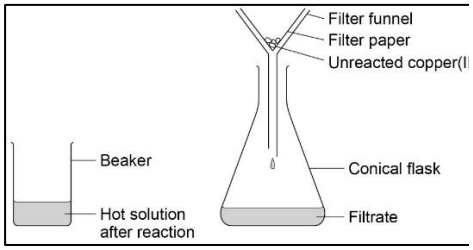


Figure b

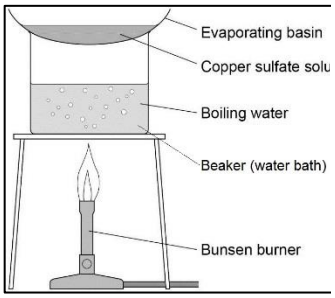
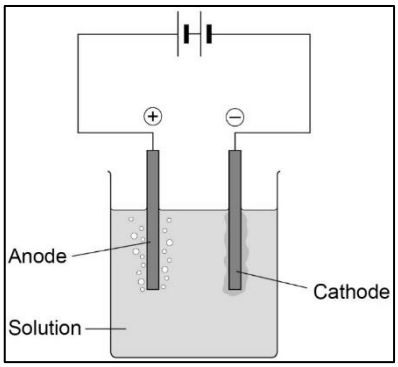


Figure c

3 – Electrolysis

Investigate what happens when aqueous solutions are electrolysed using inert electrodes.

1. Add about 50cm^3 of salt solution to a beaker
2. Add the lid and insert carbon rods (**electrodes**) through the holes. The rods must not touch each other
3. Attach crocodile leads to the electrodes. Connect the rods to the dc (red and black) terminals of a low voltage power supply
4. Switch the power supply on
5. Record observations at each electrode



Additional information

- Gas produced at the positive electrode, which bleaches damp blue litmus paper, is chlorine.
- If a gas is produced at the negative electrode, it is hydrogen.

4 – Temperature changes

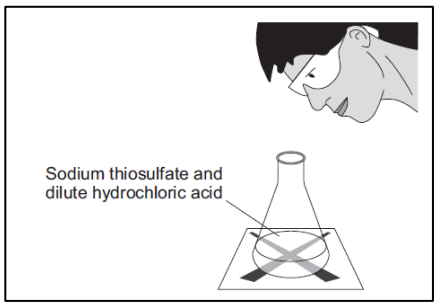
Investigate the variables that affect temperature change in chemical reactions e.g. acid plus alkali.

1. Measure 25cm^3 of acid into a polystyrene cup
2. Stand the cup inside the beaker (this will make it more stable)
3. **Measure and record the temperature** of the acid
4. Measure 5cm^3 of alkali and add it to the polystyrene cup
5. Put a lid on the cup and gently stir the solution with the thermometer through the hole in the lid
6. **When the reading on the thermometer stops changing**, record the temperature
7. Repeat steps 4 and 5 to add further 5 cm^3 amounts of alkali to the cup. A total of 40 cm^3 needs to be added
8. Repeat steps 1–7
9. **Calculate the mean maximum temperature** reached for each of the sodium hydroxide volumes

5 – Rates of reaction

Activity 1: Observing colour change

Investigate how changes in concentration affect the rate of reactions by monitoring a change in colour.

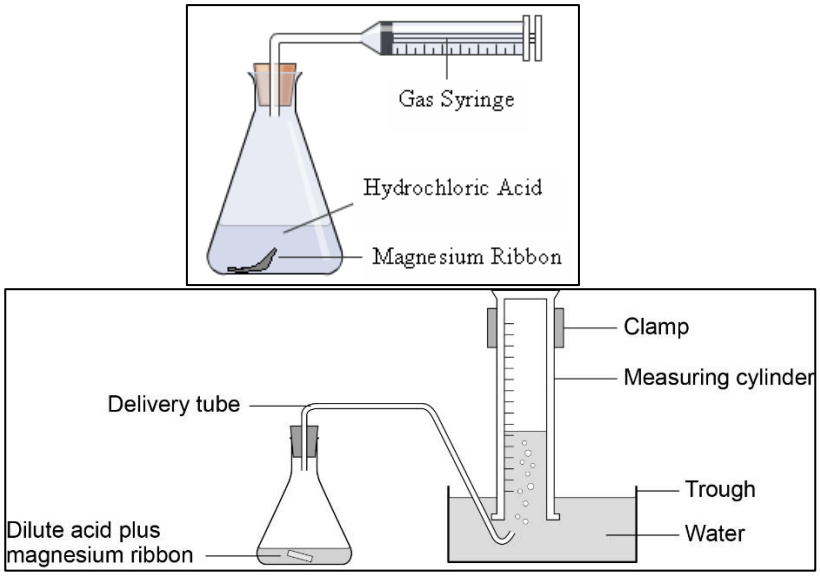


1. Measure 10 cm^3 sodium thiosulfate solution into the conical flask
2. Measure 40 cm^3 water and add it to the conical flask
3. Put the conical flask on the black cross
4. Measure 10 cm^3 of dilute hydrochloric acid
5. Add the acid to the flask. At the same time, swirl the flask gently and start the stopclock
6. Look down through the top of the flask. Stop the clock when you can no longer see the cross and record the time taken
7. Repeat steps 1–6 four times, using different volumes of sodium thiosulfate and water. This will change the concentration of sodium thiosulfate
8. Repeat steps 1-7 twice more
9. Calculate the mean time for each of the sodium thiosulfate concentrations

Activity 2: Measuring the volume of gas produced

Investigate how changes in concentration affect the rate of reactions by measuring the volume of a gas produced.

1. Measure 50 cm^3 of 2 mol/dm^3 hydrochloric acid using one of the measuring cylinders. Pour the acid into the 100 cm^3 conical flask
2. Set up the apparatus as shown in one of the diagrams below

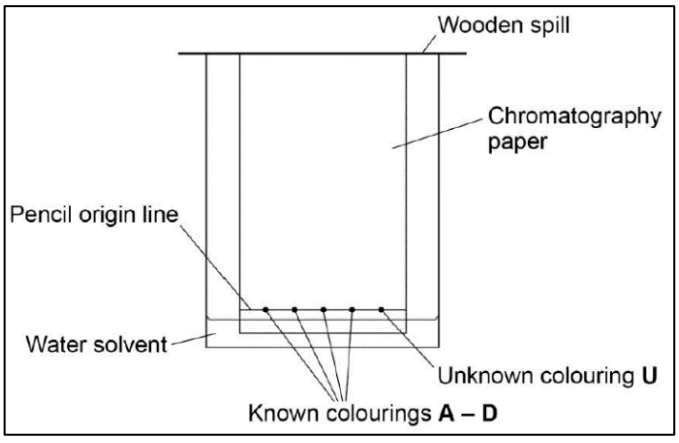


3. Add a 3 cm strip of magnesium ribbon to the flask and put the bung back into the flask. At the same time, start the stopclock
4. Record the volume of hydrogen gas given off every 10 seconds. Stop when no more gas is given off
5. Repeat steps 1-4 using 1 mol/dm^3 hydrochloric acid
6. Plot a graph of 'volume of gas produced' against 'time'. Draw two curves, one for each concentration of acid

6 – Chromatography

Investigate how paper chromatography can be used to separate and tell the difference between coloured substances. Students should calculate Rf values.

1. Draw a horizontal pencil line 2 cm from a short edge of the chromatography paper. Mark pencil spots at equal intervals across the line. Keep at least 1 cm away from each end
2. Use a glass capillary tube to put a small spot of each colouring on the pencil spots. Label each spot in pencil
3. Pour water into the beaker to a depth of no more than 1 cm
4. Suspend the paper in the beaker so that bottom edge of the paper dips into the water
5. Wait for the water solvent to travel at least three quarters of the way up the paper. Remove the paper and draw another pencil line on the dry part of the paper as close to the wet edge as possible
6. Hang the paper up to dry thoroughly
7. Calculate the R_f values for each spot



Additional information

- Ensure that the pencil line is above the water surface, otherwise the colouring spots will dissolve into the water rather than rise up the paper
- Ensure that the sides of the paper do not touch the beaker wall

8 – Water purification

Analysis and purification of water samples from different sources. To include pH measurement, removal of dissolved solids and distillation.

Activity 1: Analysing a sample of water

1. Use universal indicator or a pH probe to test the pH of the water
2. Measure and record the mass of an empty evaporating basin
3. Pour 10 cm^3 water into it and evaporate the water using Bunsen burner until the majority of the water has evporated (*figure a*)
4. Once the evaporating basin s is cool, reweigh and record the change in mass. Calculate the mass of dissolved solids in the water

Activity 2: Purifying a sample of water by distillation

1. Place the water sample in a conical flask and set up the apparatus for distillation (*figure b*)
2. Heat the water gently using a Bunsen burner until it boils. Then reduce the heat so the water boils gently

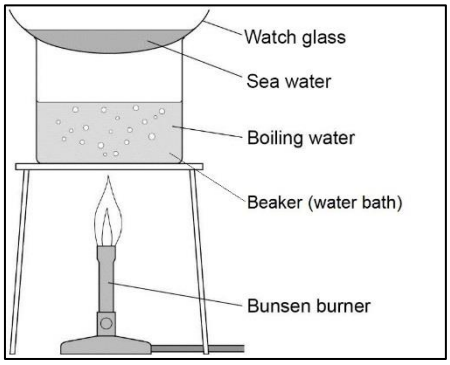


Figure a

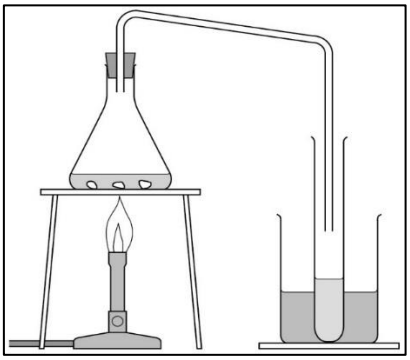


Figure b

3. Collect around 1 cm depth of water in the cooled test tube, then stop heating
4. Analyse the water you have distilled with cobalt chloride paper

AQA

The Periodic Table of Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	[285] **Cn** copernicium 112	[286] **Nh** nihonium 113	[289] **Fl** flerovium 114	[289] **Mc** moscovium 115	[293] **Lv** livermorium 116	[294] **Ts** tennessine 117	[294] **Og** oganesson 118

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

* The Lanthanides (atomic numbers 58 – 71) and the Actinides (atomic numbers 90 – 103) have been omitted.

Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.