Checkpoint Science Scheme of Work

Chemistry – Year 1

Topic: Acids and bases

Aims
That pupils should be able to:

- use indicators to distinguish acid and alkaline solutions
- use a pH scale
- understand neutralisation and some of its applications

Links
Checkpoint curriculum – Cc 5, Cc 6
IGCSE Syllabus – Section 8.1, IGCSE Co-ordinated Science C 9, IGCSE Combined Sciences Chemistry Topic Four

Words
acid and acidic, alkali and alkaline, neutral, indicator, pH scale.

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
compare between weak and strong acids	Provide a display of acids (vinegar, lemon juice, canned drink, laboratory acids) with hazard labels where appropriate. Discuss the meaning of the hazard labels. Students can discuss and draw a hazard label seen on a sack of chemicals or on a chemical transporter.	Teacher and students to wear safety glasses whenever using acids. Link wash of spillage with dilution of acid.
prepare indicators using crushing and filtering techniques.	Students can prepare dyes from colourful vegetables, fruits, flowers; good examples are turmeric, red cabbage, beetroot.	If stored until another lesson these should be kept out of the light.
use their prepared indicator on some acids and alkalis as the chemical opposite of an acid.	Students test their dye on two named acids and two named alkalis. They can then test three colourless liquids and decide whether they are acid, alkali or neutral.	Teacher and students to wear safety glasses whenever using acids. Practice drawing up a table for observations.
distinguish strong and weak acids and alkalis	Students should see the scale of colours (pH)	Teacher and students to wear safety glasses

using Universal Indicator.	shown by Universal Indicator (mixture of plant dyes) and then test some different substances such as toothpaste, fruit drinks, indigestion tablets, soil shaken in water, to put in position on the scale.	whenever using acids. Coloured pencils are more realistic than pens for charts.
recognise some problems with acidic properties	Students can investigate one or more of these. • Acid rain on buildings (HC*l* and crushed limestone) • pH of soil (test soils to find out which would support which range of plants) • Sour milk (test milk of different ages left in • warm conditions)	Teacher and students to wear safety glasses whenever using acids.
prepare a neutral solution	Students should add alkali a drop at a time to acid containing indicator and identify neutralisation. Similarly add acid to alkali.	Teacher and students to wear safety glasses whenever using acids. Encourage the use of small quantities.
describe the use of neutralisation to solve a problem.	Cures for indigestion (test some powders with indicator). Dissolving scale from kettles. Cleaning teeth. Acidic bites (ants, bees) can eased by adding mild alkali (sodium carbonate), alkaline bites (wasps) can be eased using mild acid (vinegar). Study the labels of cosmetics, shampoos etc. Make a display of magazine pictures of uses of acids and alkalis.	Students should realise that the most effective acids / alkalis are too corrosive to be used in these circumstances.

Resources

http://www.eduref.org
http://www.ncsu.edu/sciencejunction/downloads/pHlessons.pdf

Topic: Heating substances

Aims
That pupils should be able to:

- know about solids, liquids and gases and their inter-conversion
- recognise the reaction of burning
- distinguish between physical and chemical changes

Links
Checkpoint curriculum – Cs 1, Cs 4
IGCSE Chemistry 1, IGCSE Co-ordinated Science C 1, IGCSE Combined Sciences Chemistry Topic One, IGCSE Physical Science 1, 2

Words
melting, boiling, freezing, condensing, evaporating, physical change, chemical change

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
Distinguish solids, liquids and gases.	Students discuss samples of everyday solids, liquids and gases, considering their shape and volume. They should tabulate their identifying properties. Consider tomato sauce (liquid or solid?) and how it could be made more solid or more liquid.	e.g. card, ice, cake, lemonade, boiling water, oil, fat, stick, soap, detergent, perfumed candle, jelly, sand, blown up balloons etc
Describe changes of state.	Students observe changes of state such as • Melting ice, butter, sulphur, wax • Freezing water, sulphur, wax, saturated copper sulphate solution. • Boiling water (kettle), alcohol in hot water, salt solution. • Condensing water, alcohol. Show ice in a test tube and try account for the condensation on the outside of the tube	Safety glasses must be worn. Sulphur must be heated very gently in small quantities. It should be done in a well ventilated space due to the chance of it burning to form sulphur dioxide. The water cycle could be included here.

Chart temperatures	The temperature of a low melting solid, warmed and then allowed to cool, is taken at intervals to note its change with time. The constant temperature is the melting point. Similarly a constant temperature is given when water boils.	Temperatures can be plotted against time. Stearic acid can be used.
Describe evaporation	A dish of sea water can be left for a period of time on a top pan balance. Students can investigate processes which can speed up evaporation but note that it does not take place at constant temperature. They can account for the residue and link with salt extraction.	
Describe burning	Students observe **small** quantities of various materials burning, wood, cloth, steel wool, wax, drop of alcohol, test-tube full of hydrogen, etc and record their observations. Students can see that these changes are irreversible.	A safety demonstration about burning oil could be included here showing that water must not be used for extinguishing but oxygen excluded with covers. Supply only small quantities and use safety glasses
Compare melting and burning	By considering materials melted and burned, such as lard or butter, students can look for common characteristics of burning such as formation of new materials, non-reversible nature of process, exothermic nature.	
Distinguish physical and chemical changes	Students can reverse simple physical processes such as boiling water from an ink solution and then condensing the steam. They consider whether it is possible to reverse a chemical process such as burning. Heating copper carbonate or hydrated copper sulphate provides challenges to decide what on the type of change.	Safety glasses for boiling and for heating solids.

Resources

http://www.sciencespot.net/Media/bnpopstates.pdf
http://www.eduref.org

Topic: Investigating everyday materials

Aims
That pupils should be able to:

- distinguish between metals and non-metals
- describe everyday materials and their physical properties

Links
Checkpoint curriculum – Cm 4, Cm 5
IGCSE Chemistry 10.1, IGCSE Co-ordinated Science C 16, IGCSE Combined Sciences Chemistry Topic Two, IGCSE Physical Science 8.1

Words
property, absorbent, transparent, opaque, brittle, high / low density, malleable, flexible.

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
give examples of properties of materials.	Students compare a few household items, pans, doors, shoes, string etc and suggest reasons for the choice of materials. They might consider the results of interchanging the materials, wooden shoes, plastic pans etc. A class might jointly come up with a property list and research definitions.	
distinguish between absorbent and waterproof materials.	Students can study the different materials which make up buildings (local or comparing different parts of the world or old with new). Absorption can be investigated by finding the mass of water absorbed by a tissue or mopping cloth. A soaked brick can be put in the freezer to show the damage resulting.	
recognise brittle, flexible and malleable materials.	Students can investigate these properties using easily obtained materials, e.g. brittle – dried	Safety goggles must be worn if forces are applied to brittle materials.

	pasta, “squashability” – synthetic foam, malleability – dough / plasticene.	
recognise transparent and opaque materials.	This is an opportunity for students to investigate the properties of glass including transparency, melting and solidifying, forming into narrow tubes etc Nylon granules can be heated gently and drawn into threads.	Safety glasses must be worn for heating.
distinguish between good and bad conductors of heat	A comparative investigation between metals can be carried out by heating one end of rods of different materials. They can be wax-coated with light weight pins or rice grains set in the wax, which drop off as the heat is conducted along. One or two non-metals can be included such as wood or slate to show that no conduction can be detected.	Safety glasses must be worn for heating. Uses include saucepans and copper pipes.
distinguish between good and bad conductors of electricity.	A simple circuit with a gap for inserting different materials will quickly show that only metals and graphite conduct appreciably at room temperature. Students could study the materials used in a plug, which are insulators and which are conductors.	Consider copper wiring, aluminium overhead cables, glass fibres for communication.
distinguish between metals and non-metals	Students consider the properties of metals and non-metals and then distinguish some from a group provided. Challenging ones are graphite, iodine, magnesium.	Properties include shine, strength, density, hardness, melting points and conduction. Graphite from pencils will be satisfactory. Iodine must be demonstrated to students.
recall new words	Crosswords and wordsearches are useful where many new words have been introduced.	

Resources

http://school.discovery.com/lessonplans/programs/metalsandnonmetals/

Topic: Particle Theory

Aims

That pupils should be able to:

- use simple kinetic particle theory to explain changes of state, dissolving and diffusion.

Links

Checkpoint curriculum – Cs2
IGCSE Chemistry 1, IGCSE Co-ordinated Science C 1, IGCSE Physical Science 1

Words

particles, dissolving, solution, diffusion

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
describe a particle model for a gas	Students can try to compress air in syringes or balloons. Give explanations in terms of trying to force things together. Drawings of boxes of particles in the gaseous state show particles well separated.	Small sealed plastic syringes without needles should be used. Introduce the idea of particles too small to see.
describe a particle model for a liquid	Pour 'particles' of different size to model the movement of smaller particles e.g. peas, rice grains, dry sand. Drawings of boxes of particles in liquids show the particles as close together but not in regular arrangement.	Remind students that sand is also hard if you drop onto it and the solids can be seen under the microscope.
describe a particle model for a solid	Glue particles (e.g. polystyrene balls) together in regular shapes and show that they cannot be poured, have flat faces, are hard and dense. Drawings of boxes of particles in a solid show the particles as close together and in a regular arrangement.	Particles still have movement, i.e. vibration about their mean position.
describe the properties of ice and water	Observe a suitable solid as it freezes. Observe ice floating in water. Problems of (burst pipes) and uses of (protecting	Try to explain these in terms of particles. Water can be frozen in an upright measuring cylinder and / or in a sealed plastic coke bottle.

	pond life) freezing water can be demonstrated using a freezer. Care will be needed to achieve a water / ice mix at the right stage and to break safely a container.	
describe and explain dissolving	This can be introduced by putting a teaspoon of instant coffee into hot and cold water. Students can investigate how much sugar can be dissolved in a small quantity of water. If cubes are available they can observe the dissolving process carefully. They can compare hot and cold liquid.	Encourage explanations of dissolving in terms of particles.
know about the gases in the air and how pressure is caused.	Students can burn e.g. a candle, in a limited supply of air to observe that only part of the air appears to take part in the reaction. The oxygen test can be introduced here.	Pressure observed in a balloon or syringe as above is caused by the speed with which the particles hit the inner surfaces of their containers.
explain diffusion.	Diffusion through air can be demonstrated by releasing a strong perfume at a point in the room and detecting as it spreads. Air freshener sprayed on to a watch glass supported on the hand goes cold, showing that energy is needed for evaporation. Teacher demonstration can show a reaction when two gases diffuse together. Textbooks will supply details of this reaction of conc. hydrochloric acid and ammonia. Potassium (VII) manganate diffuses through water if a few crystals are placed at a point and left undisturbed.	Safety precautions must be observed.

Resources

http://www.nyu.edu/pages/mathmol/modules/water/density_lab.html

Topic: Mixtures and Separating Techniques

Aims
That pupils should be able to:

- explain what is meant by a mixture
- describe a variety of methods of obtaining pure substances from different mixtures

Links
Checkpoint curriculum – Cm 3, Cs 3
IGCSE Chemistry 2.2, IGCSE Combined Sciences Chemistry Topic 1, IGCSE Physical Science 2

Words
mixtures, solutes, solvents, filter, filtrate, residue, chromatography, distil

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
explain what is meant by a mixture	Students can research the composition of air, seawater, fruit juice etc and suggest how it changes depending on situation e.g. added pollution. They can mix squashes or ingredients for cake or pizza.	No chemical reaction is required to separate the constituents although it may not be particularly easy to do.
explain what is meant by a solution	Students can investigate the solubility of sugar at different temperatures and at different sizes of granule. Other solids such as copper sulphate, cobalt chloride, salt can be compared. Other solvents should be tried such as nail varnish remover.	
use a magnet for separating mixtures containing iron.	Students can be challenged to separate iron filings from sulphur powder without allowing iron to collect on the magnet.	
separate mixtures using a filter	A mixture of powdered chalk or flour in water should be filtered and the filtrate and residue identified.	A cloth strainer will work satisfactorily. Link to treatment of water for drinking.

separate a mixture of solids, one of which is soluble.	Salt and pepper can be separated by dissolving the salt in water and then filtering / drying to achieve the constituents. Alternatively obtaining salt from rock is an old favourite.	
separate mixtures using distillation.	A simple distillation can be set up by students to see how a clear liquid vaporises from an ink solution, the distillate can be identified. A condenser can be demonstrated.	Safety glasses must be used for heating.
separate mixtures using chromatography.	Students can run chromatograms from ink, felt pens, dissolved sweets, crushed plants materials. Colours extracted with alcohol must use alcohol for the separation.	Explain how a chromatogram can be used to identify a particular dye e.g. in forensics.

Resources

http://www.learn.co.uk
http://www.bbc.co.uk/education/gcsebitesize/science_chemistry/structures_of_materials/separation_techniques_rev.shtml#top