KS3 – Year 7

Topic 2: Reactions 1

What's the science story?

This unit explores:

- displacement reactions
- defining acids and alkalis in terms of neutralisation reactions
- the pH scale for measuring acidity/alkalinity; and indicators
- reactions of acids with metals to produce a salt plus hydrogen
- the concept of a pure substance
- mixtures, including dissolving
- diffusion in terms of the particle model
- simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography
- the identification of pure substances

Previous knowledge:

KS2:

• demonstrate that dissolving, mixing and changes of state are reversible changes

• explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.

Next steps…

KS3:

Y8 – Reactions 2

Y9 – Reactions 3

KS4:

Chemistry Paper 1—Chemical change

Chemistry Paper 2—Our atmosphere

Keywords

Chemical	Acid	Alkali	Concentrated	Independent	Acid	Gradient	Mixture	Evaporation	Chromatography
Physical	Acidic	Alkaline	Dilute	Dependent	Metal	Rate	Filtrate	Filter	Chromatogram
Reaction	Corrosive	Indicator	Particles	Control	Hydrogen	Passive	Residue	Residue	Solvent
Reversible	Hydrochloric	Neutral	Solution	Neutralisation	Product		Soluble	Filtrate	Dissolve
Irreversible	Nitric	pH		Compare	Reactant		Insoluble	Distillation	
	Sulphuric			Prediction	Reactivity				

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Lesson No. and Title	Learning objectives - Knowledge	National Curriculum	Working scientifically skills	Practical equipment
1 What is a chemical reaction	ARE: Compare chemical reactions to physical changes AGD: Compare and contrast physical and chemical reactions			**PRAC:** Per group: Lemon juice & bicarbonate of soda Baking powder, plaster of paris, ammonium nitrate, zinc powder & copper sulphate solution, copper sulphate & NaOH solution
2. What is an acid?	ARE: To describe the uses of common acids. AGD: To consider how acids are used in industry.			**DEMO:** Selection of house-hold substances and chemi-cals; Lemon juice, jam, fruit juice, pickled beetroot, jelly, HCl, H_2SO_4, HNO_3 (bottle of each)
3. Natures indicators x 2 lessons	ARE - To identify patterns and classify solutions as acidic or alkaline. AGD - To explain how a conclusion matches the evidence obtained.			**PRAC:** per group: mortar, pestle, 2 teat pipettes, 4 test tubes, measuring cylinder, Access to: red cabbage and beetroot, Dilute solutions (0.1M) of H2SO4and NaOH 0.1M H2SO4is low hazard, 0.1M NaOH is irritant , Methylated spirits, 2 unlabelled bottles, one containing NaOH, the other containing H2SO4

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4. Strong or weak UI	ARE - To identify patterns and classify solutions as acidic, alkaline or neutral using pH value. AGD - To relate the pH value of an acid or alkali to its hazards and corrosiveness.	• the pH scale for measuring acidity/alkalinity; and indicators •		**PRAC:** per group: 5 test-tubes, Access to: 5 unknown solutions with pH values of approx. 1,5,7,9,14, labelled A, B, C, D, E (Possible solutions pH1 0.1M HCl, 5 0.1M boric acid, 7 0.1M ammonium etha-noate, 9 0.1M borax14 1.0M NaOH) (NB Corrosive and safety goggles must be used.)
5. pH and the home	ARE: Use the pH scale to measure acidity and alkalinity AGD: Use a variety of indicators to measure acidity and alkalinity and explain how they work.	• the pH scale for measuring acidity/alkalinity; and indicators		**PRAC:** per group UI, various household chemicals, test tubes
6. Concentrated or dilute	ARE: Describe the differences between concentrated and dilute solutions of an acid AGD: Explain what 'concentrated' and 'dilute' mean, in terms of the numbers of particles present	• Describe the differences between concentrated and dilute solutions of an acid		**PRAC:** Per group:1 mol HCL, 1 mol NaOH, deionised water, pipettes, 10ml measuring cylinders, 7 test tubes, UI
Assessment 1: Acids and Alkalis				

7. Finding the balance	ARE: Describe how pH changes during neutralisation reactions AGD: Interpret a graph of pH changes during a neutralisation reaction.	• defining acids and alkalis in terms of neutralisation reactions		**PRAC:** per group: 7 test tubes, 10ml measuring cylinders, HCl 0.2M, NaOH 0.2M, UI, pH probe (as DEMO)
8. Uses of neutralisation	ARE: State examples of useful neutralisation reactions AGD: Explain why neutralisation reactions are useful in the context of specific examples			iPADS if needed for researching neutralisation reactions.
9. Which indigestion remedy	ARE To investigate and compare a range of antacids. AGD To evaluate date and explain how it could be improved.			**PRAC:** Per group: 5 test tubes, 2 x 100cm3 beakers,spatula, glass rod, 3 teat pipettes, Access to: "stomach acid", (0.1M HCl will do) variety of indigestion remedies, UI or litmus, top-pan balance pH probe (as DEMO Planning sheet, Conclusion and Evaluation sheet (for AGD)
Assessment 2: Neutralisation				

10. Metals and acids	ARE: Describe what a salt is and predict the salts formed when acids react with metals or bases AGD: Predict the formulae for products of reactions between acids and metals, or acids and bases and suggest how temperature changes may be linked with reactivity	• reactions of acids with metals to produce a salt plus hydrogen		**PRAC:** per group: 6 test tubes, thermometer OR temperature probes Mg , Zn, Fe + sulfuric acid (0.1M)Mg, Zn, Fe + hydrochloric acid (0.1M)
11. Pure substances	ARE: Explain how to identify pure substances. AGD: Comment on a substance's purity by interpreting temperature change data	• the concept of a pure substance • the identification of pure substances		**PRAC:** Per group: Mixture A: iron filings and flour Mixture B: sand and water Mixture C: sugar and dried peas , glass beakers , conical flasks, funnel, filter paper, sieves, magnifying glass, distilled water, measuring cylinders, evaporating basin
12. Solutions	ARE: Use the particle model to explain dissolving. Explain what a saturated solution is. Explain the meaning of solubility AGD: Draw particle diagrams to represent solutions and pure substances Explain what a solubility graph shows	• mixtures, including dissolving		**PRAC:** per group: Salt, sugar, flour, chalk, sand, fruit cordial, coffee, pepper, glass paint, jelly cube, beaker, stirring rod, teaspoon, timer Kettle Bucket & sieve for disposal
Assessment 3: Solubility				

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13. Diffusion	ARE – To investigate which factors affect diffusion. AGD – To explain why particles diffuse more quickly at higher temperatures	• diffusion in terms of the particle model		**DEMO:** can of deodorant potassium permanganate, large beaker
14. Filtration	ARE: Explain how filtration works AGD: Explain whether or not filtering can be Used in given situations	• simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography		**PRAC:** per group: Sample of dirty water, tights, filter paper cloth, muslin, funnels,.
15. Evaporation	ARE: Use the particle model to explain evaporation AGD: Justify whether evaporation or distillation would be suitable for obtaining given substances from solution .	• simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography		**PRAC:** per group: Copper oxide, sulfuric acid, filter paper, funnels, conical flasks, spatulas, splints, evaporating dishes.

16. Distillation	ARE: Explain how distillation works AGD: Discuss whether evaporation or distillation would be suitable for separating a mixture	• simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography		**DEMO**: —Liebig condenser
Assessment 4: Separating mixtures				
17. Chromatography	ARE: Explain how chromatography separates mixtures and analyse chromatograms to identify substances in mixtures. AGD: Explain how chromatography can be used in different scenarios	• simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography		**PRAC:** per group: Felt tip pens, filter paper, beakers, paperclips Spinach leaves (and other green leaves) pestle & mortar, filter paper, solvent (acetone) capillary tubing, 250ml beakers.

Assessment Criteria (part 1)

Assessment No. & Title	Working Towards	Age Related Expectations	At Greater Depth
n/a	State some signs of a chemical reaction	Compare chemical reactions to physical changes	Compare and contrast physical and chemical reactions
1. Dilute and concentrated	Name some common properties of acids and alkalis	Compare the properties of acids and alkalis	Compare the different particles found in acids and alkalis.
	State that concentrated acids are more harmful than dilute acid	Describe the differences between concentrated and dilute solutions of an acid	Explain what 'concentrated' and 'dilute' mean, in terms of the numbers of particles present
	Describe, in simple terms, what the key words 'concentrated' and 'dilute' mean.	Use the pH scale to measure acidity and alkalinity	Use a variety of indicators to measure acidity and alkalinity and explain how they work.
2. Neutralisation	State that indicators will be different colours in acids, alkalis, and neutral solutions	Describe how pH changes during neutralisation reactions	Interpret a graph of pH changes during a neutralisation reaction.
	State simply what happens during a neutralisation reaction	State examples of useful neutralisation reactions	Explain why neutralisation reactions are useful in the context of specific examples
	Give one example of a neutralisation reaction	Describe what a salt is	Predict the formulae for products of reactions between acids and metals, or acids and bases
n/a	State the type of chemical made when an acid and alkali react.	Predict the salts formed when acids react with metals or bases	

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Assessment Criteria (part 2)

Assessment No. & Title	Working Towards	Age Related Expectations	At Greater Depth
n/a	Match the type of salt that will form from the type of acid used.	Explain how to identify pure substances.	Comment on a substance's purity by interpreting temperature change data
	State that different substances in mixtures have their own melting points.	Use the particle model to explain dissolving.	Draw particle diagrams to represent solutions and pure substances
3. Solubility	Identify a solvent, solute, and solution in a given scenario.	Explain what a saturated solution is	Explain what a solubility graph shows
	Describe how temperature affects solubility	Explain the meaning of solubility	
4. Separating mixtures	State some situations in which filtering is used	Explain how filtration works	Explain whether or not filtering can be Used in given situations
	State some mixtures that can be separated using evaporation and distillation.	Explain how distillation works	Discuss whether evaporation or distillation would be suitable for separating a mixture
n/a	Describe what a chromatogram looks like	Explain how chromatography separates mixtures	Explain how chromatography can be used in different scenarios
		Analyse chromatograms to identify substances in mixtures.	