Science Subject Knowledge Audit

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# Introduction

This audit aims to do several things:

- to help you know what subject knowledge means for your subject

- to help you identify your strengths and areas for development in subject knowledge

- to allow your Academic Trainer and Training Mentors to track your progress in developing subject knowledge and guide you in increasing your knowledge

# Making accurate judgements

At first, you may find it difficult to make accurate judgements about your level of subject knowledge. You may either overestimate or underestimate what you know in relation to the standard at which it needs to be taught. Reading textbooks and course documents, careful observation and your own teaching experience will improve your ability to make more accurate judgements during the course. Your level of subject knowledge will also be assessed by your Academic Trainer and Mentors. You need to keep a copy of your subject knowledge audit in your Professional Learning and Practice Portfolio (PLPP).

# Developing your subject knowledge

The SKA, while a useful indicator of what you may be expected to teach, can seem daunting. You might be thinking that it is a lot to learn, that your degree didn’t cover some of what is listed or that you have simply forgotten much of what you studied. Take comfort from the fact that you will be supported in this journey, that you won’t need to have mastered everything before you start and that this is a **developmental process**. You will discuss your subject knowledge needs with your Academic Tutor; SMART targets will be agreed, and support will be offered from a range of sources.

# Levels of subject knowledge

The audit identifies four levels of subject knowledge. These range from Level 1 as the highest level, though to Level 4 as the lowest level. For each science subject, the definitions are as follows (see below). The definitions focus on your knowledge of the material rather than on the teaching methods needed to teach it.

## Level 1

Very good subject knowledge/skill/understanding, enabling you to teach effectively across the whole ability range at KS3 and KS4 (you can break down concepts, sequence learning logically, answer questions confidently, respond to misconceptions, analyse progress and make effective interventions)

## Level 2

Good subject knowledge – accurate and up to date, but needing some development before being able to provide stretch, challenge and scaffold interventions for full ability range

## Level 3

Subject knowledge secure and sufficient to teach the basics of the topic.

## Level 4

You have never studied the topic, or your knowledge is not sufficient to teach it to any standard. If required to teach this topic, you will need to read text books and schemes of work to see what needs to be taught and the level that is appropriate.

Key Stage 3 science

No matter what your science specialism, you should assess your subject knowledge in KS3 biology, chemistry AND physics

| Subject | Topic | Pre-course starting point level | PRP1 level | PRP2 level | PRP3 level | PRP4 level |
| --- | --- | --- | --- | --- | --- | --- |
| KS3 Biology | Cells and Organisation |  |  |  |  |  |
| The Skeletal and Muscle Systems |  |  |  |  |  |
| Human nutrition, Diet and Digestion |  |  |  |  |  |
| The Breathing (gags exchange) system |  |  |  |  |  |
| Health |  |  |  |  |  |
| Photosynthesis |  |  |  |  |  |
| Cellular Respiration |  |  |  |  |  |
| Relationships in an Ecosystem |  |  |  |  |  |
| Reproduction in Humans |  |  |  |  |  |
| Reproduction in Plants |  |  |  |  |  |
| Inheritance, Chromosomes, DNA Genes and Evolution |  |  |  |  |  |
| KS3 Chemistry | Pure & Impure Substances |  |  |  |  |  |
| The particulate nature of matter |  |  |  |  |  |
| Atoms, Elements, Compounds |  |  |  |  |  |
| Chemical Reactions |  |  |  |  |  |
| Energetics |  |  |  |  |  |
| Acids, Alkalis & Neutralisation |  |  |  |  |  |
| The Periodic Table |  |  |  |  |  |
| Materials |  |  |  |  |  |
| Earth Science and the Atmosphere |  |  |  |  |  |
| KS3 Physics | Energy Changes and Transfers. |  |  |  |  |  |
| Energy, Fuel and the Cost of Fuel |  |  |  |  |  |
| Auditing Change (change in systems/ describing energy changes) |  |  |  |  |  |
| Describing motion |  |  |  |  |  |
| Forces |  |  |  |  |  |
| Pressure Forces |  |  |  |  |  |
| Balanced Forces |  |  |  |  |  |
| Observing waves |  |  |  |  |  |
| Sound waves |  |  |  |  |  |
| Energy and waves |  |  |  |  |  |
| Light waves |  |  |  |  |  |
| Current Electricity |  |  |  |  |  |
| Static Electricity |  |  |  |  |  |
| Magnetism |  |  |  |  |  |
| Matter– Physical Change |  |  |  |  |  |
| Particle Model |  |  |  |  |  |
| Energy in Matter |  |  |  |  |  |
| Space, Stars, Galaxies and Seasons |  |  |  |  |  |

Key Stage 4 science

No matter what your science specialism, you should assess your subject knowledge in KS4 biology, chemistry AND physics

| Subject | Topic | Pre-course starting point level | PRP1 level | PRP2 level | PRP3 level | PRP4 level |
| --- | --- | --- | --- | --- | --- | --- |
| KS4 Biology | Cell Biology Cell structure of Eukaryotes and prokaryotes, Cell structure of animal and plant cells, Cell specialisation, Cell differentiation, Microscopy, Chromosomes, Mitosis and the cell cycle, Stem Cells, Diffusion, Osmosis, Active transport |  |  |  |  |  |
| Organisation  Cells as building blocks, The human digestive system, The heart and blood vessels, Blood, Coronary heart disease: a non-communicable disease, Health issues, The effect of lifestyle on some non-communicable diseases, Cancer, Plant tissue, Plant organ system |  |  |  |  |  |
| Infection and response Communicable disease, Viral diseases, Bacterial diseases, Fungal diseases, Protist diseases, Human defence systems, Vaccination, Antibiotics and painkillers, Discovery and development of drugs |  |  |  |  |  |
| Bioenergetics Photosynthetic reaction, Rate of photosynthesis, Uses of glucose from photosynthesis, Respiration, Response to exercise, Metabolism |  |  |  |  |  |
| Homeostasis & response  Homeostasis, The human nervous system, Human endocrine system, Control of blood glucose concentration, Hormones in human reproduction, Contraception, The use of hormones to treat infertility, Negative feedback |  |  |  |  |  |
| Inheritance, variation and evolution Reproduction, Meiosis, DNA and genome, Genetic inheritance, Inherited disorders, Sex determination, Variation, Evolution, Selective breeding, Genetic engineering, Evidence for evolution, Fossils, Extinction, Resistant bacteria, Classification of living organisms |  |  |  |  |  |
| Ecology Communities, Abiotic factors, Biotic factors, Adaptations, Levels of organisation, How materials are cycled, Biodiversity, Waste management, Land use, Deforestation, Global warming, Maintaining biodiversity |  |  |  |  |  |
| KS4 Chemistry | 5.1 - Atomic structure and the periodic table Atoms, elements and compounds, Mixtures, The development of the model of the atom, Relative electrical charges of subatomic particles, Size and mass of atoms, Relative atomic mass, Electronic structure, The periodic table, Development of the periodic table, Group 0, Group 1, Group 7 |  |  |  |  |  |
| 5.2 - Bonding, structure and the properties of matter Chemical bonds, Ionic bonds, Ionic compounds, Covalent bonding, Metallic bonding, States of matter, State symbols, Properties of ionic compounds, Properties of small molecules, Polymers, Giant covalent structures, Properties of metals and alloys, Metals as conductors, Diamond, Graphite, Graphene and fullerenes. |  |  |  |  |  |
| 5.3 - Quantitative chemistry Conservation of mass and balanced symbol equations, Relative formula mass, Mass changes when a reactant or product is a gas, Chemical measurements, Moles, Amounts of substance in equations, Using moles to balance equations, Limiting reagents, Concentration of solutions (moles) |  |  |  |  |  |
| 5.4 - Chemical changes Metal oxides, The reactivity series, Extraction of metals and reduction, Oxidation and reduction in terms of electrons, Reactions of acids with metals, Neutralisation of acids and salt production, Soluble salts, The pH scale and neutralisation, Strong and weak acids, The process of electrolysis, Electrolysis of molten ionic compounds, Using electrolysis to extract metals, Electrolysis of aqueous solutions, Representation of reactions at electrodes as half equations |  |  |  |  |  |
| 5.5 - Energy changes Energy transfer during exothermic and endothermic reactions, Reaction profiles, The energy change of reactions |  |  |  |  |  |
| 5.6 - The rate and extent of chemical change Calculating rates of reaction, Factors which affect the rates of chemical reactions, Collision theory and activation energy, Catalysts, Reversible reactions, Energy changes and reversible reactions, Equilibrium, The effect of changing conditions on equilibrium, The effect of changing concentration on equilibrium, The effect of temperature changes on equilibrium, The effect of pressure changes on equilibrium |  |  |  |  |  |
| 5.7 - Organic chemistry Crude oil, hydrocarbons and alkanes, Fractional distillation and petrochemicals, Properties of hydrocarbons, Cracking and alkenes |  |  |  |  |  |
| 5.8 - Chemical analysis Pure substances, Formulations, Chromatography, Test for hydrogen, Test for oxygen, Test for carbon dioxide, Test for chlorine |  |  |  |  |  |
| 5.9 - Chemistry of the atmosphere The proportions of different gases in the atmosphere, The Earth's early atmosphere, How oxygen increased, How carbon dioxide decreased, Greenhouse gases, Human activities which contribute to an increase in greenhouse gases in the atmosphere, Global climate change, The carbon footprint and its reduction, Atmospheric pollutants from fuels, Properties and effects of atmospheric pollutants |  |  |  |  |  |
|  | 5.10 - Using resources Using the Earth's resources and sustainable development, Potable water, Waste water treatment, Alternative methods of extracting metals, Life cycle assessment, Ways of reducing the use of resources |  |  |  |  |  |
| KS4 Physics | 6.1 – Energy Energy stores and systems, Changes in energy, Energy changes in systems, Power, Energy transfers in systems, Efficiency, National and global energy resources |  |  |  |  |  |
| 6.2 – Electricity Standard circuit diagram symbols, Electrical charge and current, Current, resistance and potential difference, Resistors, Series and parallel circuits, Direct and alternating potential difference, Mains electricity, Power, Energy transfers in everyday appliances, The National Grid |  |  |  |  |  |
| 6.3 - Particle model of matter Density of materials, Changes of state, Internal energy, Temperature changes in a system & specific heat capacity, Changes of heat and specific latent heat, Particle motion in gases |  |  |  |  |  |
| 6.4 - Atomic structure Atoms and isotopes, The structure of the atom, Mass number, atomic number and isotopes, The development of the model of the atom, Radioactive decay and nuclear radiation, Nuclear equations, Half-lives and the random nature of radioactive decay, Radioactive contamination |  |  |  |  |  |
| 6.5 – Forces Scalar and vector quantities, Contact and non-contact forces, Gravity, Resultant forces, Work done and energy transfer, Forces and elasticity, Describing motion along a line, Distance and displacement, Speed, Velocity, The distance-time relationship, Acceleration, Newton's first law, Newton's second law, Newton's third law, Stopping distances, Reaction time, Factors affecting braking distances, Momentum, Conservation of momentum |  |  |  |  |  |
| 6.6 – Waves Transverse and longitudinal waves, Properties of waves, Types of electromagnetic waves, Properties of electromagnetic waves, Uses and applications of electromagnetic waves |  |  |  |  |  |
| 6.7 - Magnetism and electromagnetism Poles of a magnet, Magnetic fields, The motor effect, Electromagnetism, Fleming's left-hand rule, Electric motors |  |  |  |  |  |

Key Stage 4 Core Practicals

No matter what your science specialism, you should assess your subject knowledge in KS4 biology, chemistry AND physics core practicals

| Subject | Topic | Pre-course starting point level | PRP1 level | PRP2 level | PRP3 level | PRP4 level | Progress log: origin of knowledge (degree course etc.), gaps in knowledge, actions taken |
| --- | --- | --- | --- | --- | --- | --- | --- |
| KS4 Biology | Use a light microscope to observe, draw and label a selection of plant and animal cells. A magnification scale must be included. |  |  |  |  |  |  |
| Investigate the effect of antiseptics or antibiotics on bacterial growth using agar plates and measuring zones of inhibition. |  |  |  |  |  |  |
| Investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue. |  |  |  |  |  |  |
| Investigate the effect of pH on the rate of reaction of amylase enzyme. |  |  |  |  |  |  |
| Use qualitative reagents to test for a range of carbohydrates, lipids and proteins. To include: Benedict’s test for sugars; iodine test for starch; and Biuret reagent for protein. |  |  |  |  |  |  |
| Investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed. |  |  |  |  |  |  |
| Plan and carry out an investigation into the effect of a factor on human reaction time. |  |  |  |  |  |  |
| Investigate the effect of light or gravity on the growth of germinated seedlings. |  |  |  |  |  |  |
| Measure the population size of a common species in a habitat. |  |  |  |  |  |  |
| Use sampling techniques to investigate the effect of a factor on the distribution of this species. |  |  |  |  |  |  |
| Investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change. |  |  |  |  |  |  |
| KS4 Chemistry | 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. |  |  |  |  |  |  |
| Determination of the reacting volumes of solutions of a strong acid and a strong alkali by titration. HT only - Determination of the concentration of one of the solutions in mol/dm3 and g/dm3 from the reacting volumes and the known concentration of the other solution. |  |  |  |  |  |  |
| Investigate what happens when aqueous solutions are electrolysed using inert electrodes. |  |  |  |  |  |  |
| Investigate the variables that affect temperature changes in reacting solutions, eg acid plus metals, acid plus carbonates, neutralisations, displacement of metals. |  |  |  |  |  |  |
| Investigate how changes in concentration affect the rates of reactions by a method involving measuring the volume of a gas produced and a method involving a change in colour or turbidity. |  |  |  |  |  |  |
| Investigate how paper chromatography can be used to separate and tell the difference between coloured substances. Students should calculate Rf values. |  |  |  |  |  |  |
| Use of chemical tests to identify the ions in unknown single ionic compounds |  |  |  |  |  |  |
| Analysis and purification of water samples from different sources, including pH, dissolved solids and distillation. |  |  |  |  |  |  |
| KS4 Physics | Investigation to determine the specific heat capacity of one or more materials. The investigation will involve linking the decrease of one energy store (or work done) to the increase in temperature and subsequent increase in thermal energy stored. |  |  |  |  |  |  |
| Investigate the effectiveness of different materials as thermal insulators and the factors that may affect the thermal insulation properties of a material. |  |  |  |  |  |  |
| Use circuit diagrams to set up and check appropriate circuits to investigate the factors affecting the resistance of electrical circuits. This should include: the length of a wire at constant temperature; combinations of resistors in series and parallel. |  |  |  |  |  |  |
| Use circuit diagrams to construct appropriate circuits to investigate the I-V characteristics of a variety of circuit elements including a filament lamp, a diode and a resistor at constant temperature. |  |  |  |  |  |  |
| Use appropriate apparatus to make and record the measurements needed to determine the densities of regular and irregular solid objects and liquids. Volume should be determined from the dimensions of regularly shaped objects and by a displacement technique for irregularly shaped objects. Dimensions to be measured using appropriate apparatus such as a ruler, micrometer or Vernier callipers. |  |  |  |  |  |  |
| Investigate the reflection of light by different types of surface and the refraction of light by different substances. |  |  |  |  |  |  |
| Investigate the relationship between force and extension for a spring. |  |  |  |  |  |  |
| Investigate the effect of varying the force on the acceleration of an object of constant mass and the effect of varying the mass of an object on the acceleration produced by a constant force. |  |  |  |  |  |  |
| Make observations to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in a solid and take appropriate measurements. |  |  |  |  |  |  |
| Investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface. |  |  |  |  |  |  |