



Chemistry

Separating Mixtures

1. Show knowledge and understanding of the properties of each of the three states of matter
2. Distinguish between a pure substance and a mixture.
3. Distinguish between elements and compounds
4. Investigate some methods of separating mixtures

Evaporation

1. Show knowledge and understanding of evaporation and the factors that influence the evaporation rate
2. Show knowledge and understanding about the dynamic equilibrium of evaporation and condensation
3. Show knowledge and understanding of the boiling point of liquids and the evaporation molar heat
4. Show knowledge and understanding of some applications of evaporation
5. Investigate the evaporation process

Purification

1. Show knowledge and understanding of some commonly used purification techniques
2. Show knowledge and understanding of the stages of the water purification process
3. Investigate the separation of substances by purification

Distillation

1. Show knowledge and understanding of vaporization, condensation and boiling point
2. Show knowledge and understanding of the distillation process
3. Show knowledge and understanding of fractional and destructive distillation

Chromatography

1. Show knowledge and understanding about paper chromatography
2. Show knowledge and understanding about thin layer chromatography
3. Show knowledge and understanding about column chromatography

Enthalpy

1. Show knowledge and understanding of the meaning of enthalpy and enthalpy change
2. Distinguish between endothermic and exothermic reactions
3. Apply Hess's Law to find enthalpies of combustion and enthalpies of formation
4. Investigate endothermic and exothermic reactions.

Acids and Bases

1. Show knowledge and understanding about acids and bases and their models
2. Show knowledge and understanding of neutralization
3. Show knowledge and understanding of the strength of acids and bases
4. Show knowledge and understanding of the pH scale
5. Show knowledge and understanding of buffers

Decomposition

1. Show knowledge and understanding of chemical reactions
2. Show knowledge and understanding of the decomposition chemical reaction and its causes
3. Show knowledge and understanding of different types of chemical decompositions
4. Investigate a range of decomposition reactions

Redox 1

1. Explain the definitions of reduction, oxidation, displacement reactions and redox.
2. Recognize important laboratory reducing and oxidizing agents
3. Explain the trends in the oxidizing ability of halogens and the reducing ability of halide ions
4. Investigate the redox reaction



Redox 2

1. Explain reduction and oxidation in terms of a change in oxidation number
2. Show and explain the changes in oxidation number in elements in redox reactions
3. Construct half equations for the reduction or oxidation of elements and full balanced equations for redox reactions
4. Investigate redox reactions.

Reactivity

1. Explain the concept of electronegativity and how it relates to the reactivity of elements
2. Explain the trends in reactivity of the halogens and the Group I metals
3. Describe the applications and meaning of the metal reactivity series
4. Describe the factors that affect the rates of reactivity for a given compound or element

Salts

1. Investigate techniques used in the identification of salts and their ions
2. Recognize the physical and chemical properties of salts
3. Describe the chemical testing procedures for a range of anionic components of salts
4. Describe the formation and structure of complex ions

Atomic Structure and Ions

1. Show knowledge and understanding of atomic structure
2. Show knowledge and understanding of the Periodic Table
3. Show knowledge and understanding of ions and ionization
4. Investigate the displacement reactions of ions.

Titration

1. Show knowledge and understanding of what a titration experiment is
2. Show knowledge and understanding of the pH scale
3. Show knowledge of what indicators are
4. Show understanding of how to calculate the concentration of a solution

Stoichiometry 1

1. Show knowledge and understanding of the concepts of relative atomic mass, relative molecular mass, the Avogadro constant (L) and moles
2. Use the formula $\text{moles} = \text{mass} / M_r$ to calculate reacting masses of reactants and masses of products formed from numbers of moles (and vice versa)
3. Balance chemical and ionic equations and find the empirical formulae of substances from their relative molecular masses and molar ratios
4. Investigate stoichiometric ratios

Stoichiometry 2

1. Use the formulae $\text{moles} = VC$ (also $\text{moles} = VC / 1000$) and $pV = nRT$ to calculate the numbers of moles of reactants or products in the aqueous or gaseous phase
2. Combine the formula $\text{moles} = \text{Mass} / M_r$ with $\text{moles} = VC$ and $pV = nRT$ to find masses, concentrations and gaseous volumes or products or reactants from balanced equations
3. Investigate further stoichiometric relationships

Conductivity

1. Show knowledge and understanding of the concept of electrical conductivity
2. Recognize how conductivity depends upon the molecular bonding of materials
3. Show understanding of the conductivity of ionic and metal compounds
4. Show knowledge of conductimetric determination
5. Show knowledge and understanding of the classification of materials based upon their conductivity



Electrolysis of Liquids

1. Show understanding of the electrolysis of liquids
2. Recognize the reactions occurring in the electrolysis of liquids
3. Show understanding of Faraday's Laws.
4. Recognize applications of the electrolysis of liquids
5. Investigate the factors that affect the electrolysis of a copper sulphate solution.
6. Investigate the electrolysis of potassium salts.

Electrochemistry

1. Show understanding of the electroneutrality tendency
2. Recognize the principles of an electrochemical cell
3. Show knowledge and understanding of a reference cell
4. Show knowledge of different types of batteries
5. Show knowledge and understanding of electrolysis

Dispersive Liquids

1. Explain the difference between solutions, suspension and colloidal dispersions at the structural level
2. Describe the categories of colloids that exist between the three main states of matter
3. Distinguish between colloidal dispersions, other types of solid-liquid mixture and other colloids
4. Investigate how concentration affects the formation of a colloid.

Acid Rain

1. Shows knowledge and understanding of what acid rain is
2. Shows knowledge and understanding of the causes of acid rain
3. Shows knowledge and understanding of the natural pH balance
4. Shows knowledge and understanding of the consequences of acid rain

Chemical Bonding

1. Explain the difference between intermolecular and intramolecular bonding
2. Describe ionic bonding, covalent bonding and metallic bonding
3. Predict melting point, conductivity and lattice or molecular structure for simple compounds
4. Investigate the different shapes and structures of lattices and molecular compounds

Solubility

1. Show knowledge and understanding of solubility
2. Show knowledge and understanding of how solubility affects solutions and the factors that influence it
3. Show knowledge and understanding of the molarity of a solution
4. Investigate solubility



Biology

Bones and Joints

1. Identify major bones in the body
2. Identify the structure and composition of bone
3. Identify different joint types

The Human Digestive System

1. Show knowledge and understanding of the structure of the human digestive system
2. Show knowledge and understanding of the function of the human digestive system and its components
3. Investigate the actions of invertase on the hydrolysis of sucrose

Diet

1. Explain the role of different nutrients
2. Explain how diet can affect health and well-being
3. Determine the energy contained within food

Exercise

1. Investigate how heart rate is affected by exercise
2. Investigate how lactic acid build up can affect muscles
3. Identify the effects that exercise has on the body
4. Shows knowledge and understanding of the benefits and risks of exercise
5. Calculates cardiac output

DNA

1. Identify the structure of DNA and RNA
2. Show knowledge and understanding of the process of protein syntheses
3. Show knowledge and understanding of how to extract DNA from fruit

Genetics

1. Outline the basic elements of genetics
2. Show knowledge and understanding of the process of DNA replication
3. Show knowledge and understanding of the cell cycle, mitosis and meiosis
4. Show knowledge and understanding of simple genetic crosses

Evolution

1. Identify the basic principles of evolution
2. Explain the main points of Darwin's theory of evolution
3. Show knowledge of the evidence that supports the theory of evolution
4. Determine how the Hardy Weinberg equation can be used to work out allele frequencies within populations
5. Describe how natural selection has affected the genetics of the peppered moth (*Biston betularia*) populations as a result of industrial melanism

Starch in Foods

1. Show knowledge and understanding of the structure and properties of starch
2. Show knowledge and understanding of how starch tests work

Sugar in Foods

1. Show knowledge and understanding of the structure and properties of sugars
2. Show knowledge and understanding of how sugar tests work



Protein in Foods

1. Show knowledge and understanding of the structure and properties of protein
2. Show knowledge and understanding of how protein tests work

Fat in Foods

1. Recognize reasons for testing foods for fat and oil
2. Investigate two methods commonly used for testing foods for fat and oil
3. Show knowledge and understanding of how fat and oil food tests work

Using a Microscope

1. Outline the main events in the history of microscopy
2. Describe how to use a light microscope to view and measure specimens
3. Outline the main features of electron microscopy
4. Describe how to prepare biological drawings
5. Describe how to prepare specimens for viewing under a microscope

Plant Life Cycles

1. Outline the life cycle of the liverwort
2. Outline the life cycle of the fern
3. Describe how the liverwort is adapted to life on land
4. Describe how the fern is adapted to life on land
5. Investigate the adaptation of plants on land

Reproduction in Flowering Plants

1. Describe the structure of a flowering plant
2. Outline the process of reproduction in a flowering plant
3. Investigate the stages of pollination in a flowering plant

Photosynthesis

1. Recognize the different stages of photosynthesis
2. Identify the factors that can limit the rate of photosynthesis
3. Investigate the storage of starch in plant leaves
4. Investigate the effect of light intensity on photosynthesis

Nutrient Cycles

1. Identifies the stages of the carbon cycle
2. Shows knowledge and understanding of the causes of increasing carbon dioxide levels
3. Identifies the stages of the nitrogen cycle
4. Shows knowledge and understanding of the consequences of the over-use of nitrogen based fertilizers

Plant Growth

1. Identify the different ways in which plants can respond to external stimuli
2. Identify the factors that can affect plant growth
3. State the effect of plant growth substances on plant growth
4. Describe the effect of mineral deficiencies on plant growth

Osmosis

1. Describe the process of osmosis
2. Define the terms water potential, solute potential and pressure potential
3. Describe the effect of osmosis in plant and animal cells
4. Determine the solute potential (concentration of cell sap) of plant cells by studying the osmotic effect of different concentrations of sucrose solution on those plant cells
5. Examine the effect of osmosis on living plant cells



Human Reproduction

1. Recognize the structure and function of the parts of the male and female reproductive systems
2. Outline the process of egg and sperm development
3. Describe the processes of fertilization and implantation
4. Outline the process of embryo development
5. Describe the processes of birth and lactation
6. Outline the role of hormones in sexual development
7. Describe the role of hormones in the menstrual cycle
8. Explain the role of hormones in pregnancy
9. Describe the role of hormones in lactation

Cells and the Brain

1. Identify cell organelles as seen under an electron microscope
2. Describe how a motor neurone cell is adapted to its function
3. Describe how nerve impulses are transmitted along nerve cells
4. Identify the functions of the major parts of the brain
5. Show knowledge of the features of cell organelles

Animal Classification and Life Cycles

1. Show knowledge and understanding of the process of biological classification
2. Chart the development of the main animal body structures through the main animal phyla
3. List the main characteristics of some of the main animal phyla
4. Describe the habitats and breeding habits of frogs in temperate regions
5. Describe the stages in the development of tadpoles
6. Show knowledge and understanding of the process of metamorphosis

Food Chains

1. Show knowledge and understanding of what happens to energy in food chains
2. Identify different types of food chain
3. Show knowledge and understanding of the advantages and disadvantages of pyramids of number, biomass and energy
4. Compare net primary production values

Oil Pollution

1. Investigate the main sources of oil pollution
2. Investigate ways of cleaning up oil pollution
3. Investigate the damage that oil can cause to wildlife and the environment

Global Warming

1. Identify that one of the main causes of global warming is the increasing levels of greenhouse gases in the atmosphere.
2. Describe some of the effects of global warming including rising sea levels and habitat change.
3. Recognize how using renewable energy sources is an important step to reduce global warming.

Habitats

1. Identify the biotic features of habitats
2. Identify the abiotic features of habitats
3. Describe the different features of soil
4. Describe the climatic conditions found in different habitats
5. Investigate the measurement of species within a habitat



Recycling

1. Identify the advantages and disadvantages of landfill sites
2. Identify how landfill sites can result in water pollution
3. Recognize the importance of conserving the Earth's natural resources
4. Explain how energy can be produced from waste
5. Outline the process of recycling metals, plastics, textiles, paper and glass
6. Describe the composting process

The Water Cycle

1. Explain the importance of water
2. Identify the stages of the water cycle
3. Recognizes how certain conditions can affect the water cycle
4. Identifies the causes of acid rain
5. Describes the impact of acid rain on the environment

Fossils

1. Identify how fossils support the theory of evolution
2. Describe the development of the horse through its fossil record
3. Describe the different processes of fossilization

Ecology

1. Identify the different levels of ecology
2. Describe the different approaches to ecology
3. Describe the process of succession
4. Recognize the effect of human intervention on natural succession
5. Investigate how to measure members of a community

The Human Circulatory System

1. Show knowledge and understanding of the human circulatory system and its function
2. Show knowledge and understanding of the cardiac cycle

The Human Respiratory System

1. Show knowledge and understanding of the structure of the human respiratory system
2. Show knowledge and understanding of the function of the human respiratory system and its components
3. Show knowledge and understanding of the different lung volumes and capacities within the human body



Physics

Effects of Forces

1. Show knowledge and understanding of the effects of force
2. Resolve forces into two perpendicular directions
3. Draw free-body force diagrams
4. Measure forces at an angle

Springs and Elasticity

1. Show knowledge and understanding of the concepts of stress and strain
2. Show understanding of the concepts of elasticity and plasticity
3. Show knowledge and understanding of the Young's Modulus of materials

Friction

1. Show knowledge and understanding of friction between solids and different types of friction
2. Show knowledge and understanding about the laws related to friction
3. Show knowledge of how to calculate the coefficient of friction between different materials

Speed and Velocity

1. Show knowledge and understanding of distance and displacement, and how they are measured
2. Show knowledge and understanding of speed and velocity, and how they are calculated
3. Show knowledge and understanding of instantaneous and average speed

Newton's Second Law

1. Use Newton's Second Law of Motion to calculate the net force and acceleration
2. Show knowledge and understanding of the Law of Conservation of Momentum
3. Use Newton's Second Law of Motion to calculate the net force and acceleration
4. Explore how increasing the force acting on a cart increases its acceleration

Pendulum

1. Show knowledge about the pendulum and its properties
2. Show understanding of the concepts of 'simple harmonic motion' and frequency
3. Use an equation to calculate the frequency of a pendulum

Acceleration

1. Show knowledge of the Equations of Motion and how to use them
2. Show knowledge and understanding of the behavior of projectile motion and to analyze problems on it

Moments and Levers

1. Recognize the operation of a lever and identify types of levers
2. Show understanding of the concepts of mechanical advantage and conservation of energy
3. Show understanding of the concepts of moment of a force and balanced moments
4. Calculate the moment of a force



Work and Energy

1. Show knowledge and understanding of the concept of energy and energy transfer processes
2. Show understanding of the principle of conservation of energy
3. Show understanding of the concept of power
4. Perform calculations involving force, work and energy
5. Make measurements of factors used in the calculation of energy

Magnetism

1. Show knowledge and understanding of magnetism
2. Show knowledge and understanding of induced magnets.
3. Show knowledge and understanding of magnetic fields

Electrical Conductivity

1. Show knowledge and understanding of the atomic structure of solids, liquids and gases
2. Show knowledge and understanding of the mechanism of electrical conduction in solids
3. Show knowledge and understanding of how resistance is affected by shape
4. Investigate the conductivity of components

Electrical Components

1. Show knowledge and understanding of how to obtain characteristics of components
2. Show knowledge and understanding of Ohm's Law

Series and Parallel Circuits

1. Show knowledge and understanding of cells in series and parallel
2. Show knowledge and understanding of resistors in series and parallel
3. Investigate cells and resistors in series and parallel.

Static Electricity

1. State the law of charges and Coulomb's Law
2. Show knowledge and understanding of charge imbalance
3. Show knowledge and understanding of the behavior of charges in an electrostatic field
4. Investigate properties of static electricity

Electromagnetism

1. Show knowledge and understanding of the magnetic effect on an electric current
2. Show knowledge and understanding of electromagnets.
3. Show knowledge and understanding of simple electric motors, generators and transformers

Sound Waves

1. Show knowledge and understand of the workings of the human ear
2. Show knowledge and understanding of the properties of sound
3. Show knowledge and understanding of the Doppler Effect



Propagation of Sound

1. Show knowledge and understanding of the similarities and differences between mechanical and electromagnetic waves
2. Show knowledge and understanding of the similarities and differences between longitudinal and transverse waves
3. Show knowledge and understand of some wave properties

Alternative Energy

1. Show understanding of the concept of 'alternative energies'.
2. Show knowledge and understanding of the most important renewable energy sources
3. Investigate how light levels affect the power available from a solar panel

Resonance

1. Show knowledge and understanding of resonance
2. Show knowledge and understanding of resonance in strings and pipes

Light Levels

1. Show knowledge of some of the sensing elements used for the measurement of light intensity
2. Show knowledge and understanding about the units of light intensity
3. Show knowledge and understanding of the Inverse-Square Law for illumination and distance

Light Rays

1. Show knowledge and understanding of the reflection of light rays
2. Show knowledge and understanding of the refraction of light rays
3. Show knowledge and understanding of how lenses use refraction
4. Investigate reflection and refraction

Fluid Properties

1. Show knowledge and understanding of the relationship between pressure and depth in a fluid
2. Show knowledge and understanding of adhesion, cohesion, surface tension and capillarity
3. Show knowledge and understanding of viscosity

Density

1. Show knowledge and understanding of the concept of density
2. Calculate the density of different substances

Measurement

1. Show knowledge and understand of a range of instruments used to measure length
2. Show knowledge and understanding of errors and percentage errors
3. Show knowledge and understanding the principles of measurement
4. Measure accurately.

Experimental Design

1. Show knowledge and understanding of the scientific inquiry process