Level	Obj No	C1 Atomic structure 1.1 Atoms	Started (/) Completed (X)	Level Achieved
Grade 4	1	Define the word element.		1 2 3 4 5 6 7 8
	2	Classify familiar substances as elements or compounds.		1 2 3 4 5 6 7 8
	3	Use the Periodic Table to find the symbols or names of given elements.		1 2 3 4 5 6 7 8
Grade 6	4	Describe the basic structure of an atom.		1 2 3 4 5 6 7 8
	5	Explain, including diagrams, the difference between a pure element, a mixture, and a compound.		1 2 3 4 5 6 7 8
	6	Name and give the chemical symbol of the first 20 elements in the Periodic Table.		1 2 3 4 5 6 7 8
Grade 8	7	Use chemical symbols of atoms to produce the chemical formulae of a range of elements and compounds.		1 2 3 4 5 6 7 8
	8	Explain the significance of chemical symbols used in formulae and equations.		1 2 3 4 5 6 7 8

Level	Obj No	C1 Atomic structure 1.2 Chemical equations	Started (/) Completed (X)	Level Achieved
Grade 4	1	Describe familiar chemical reactions in word equations.		1 2 3 4 5 6 7 8
	2	State that mass is conserved in a chemical reaction.		1 2 3 4 5 6 7 8
Grade 6	3	Explain why mass is conserved in a chemical reaction.		1 2 3 4 5 6 7 8
	4	Describe familiar chemical reactions with balanced symbol equations including state symbols.		1 2 3 4 5 6 7 8
	5	Balance given symbol equations.		1 2 3 4 5 6 7 8
Grade 8	6	Justify in detail how mass may appear to change in a chemical reaction.		1 2 3 4 5 6 7 8
	7	Describe unfamiliar chemical reactions with more complex balanced symbol equations, including state symbols.		1 2 3 4 5 6 7 8
	8	Write balanced symbol equations.		1 2 3 4 5 6 7 8

Level	Obj No	C1 Atomic structure 1.3 Separating mixtures	Started (/) Completed (X)	Level Achieved
Grade 4	1	Define the word mixture.		1 2 3 4 5 6 7 8
	2	Identify a mixture and a compound.		1 2 3 4 5 6 7 8
	3	List different separation techniques.		1 2 3 4 5 6 7 8
Grade 6	4	Explain the difference between a compound and a mixture.		1 2 3 4 5 6 7 8
	5	Explain how the chemical properties of a mixture relate to the chemical it is made from.		1 2 3 4 5 6 7 8
	6	Describe different separation techniques.		1 2 3 4 5 6 7 8
Grade 8	7	Use experimental data to explain the classification of a substance as a compound or mixture.		1 2 3 4 5 6 7 8
	8	Suggest an appropriate separation or purification technique for an unfamiliar mixture.		1 2 3 4 5 6 7 8
	9	Explain in detail how multi-step separation techniques work.		1 2 3 4 5 6 7 8

Level	Obj No	C1 Atomic structure 1.4 Fractional distillation and paper chromatography	Started (/) Completed (X)	Level Achieved
Grade 4	1	State when fractional distillation would be used.		1 2 3 4 5 6 7 8
	2	Safely make a paper chromatogram.		1 2 3 4 5 6 7 8
Grade 6	3	Describe the process of fractional distillation.		1 2 3 4 5 6 7 8
	4	Explain the main processes occurring in paper chromatography.		1 2 3 4 5 6 7 8
Grade 8	5	Explain in detail how fractional distillation can separate miscible liquids with similar boiling points.		1 2 3 4 5 6 7 8
	6	Evaluate separation or purification techniques for a given mixture.		1 2 3 4 5 6 7 8

Level	Obj No	C1 Atomic structure 1.5 History of the atom	Started (/) Completed (X)	Level Achieved
Grade 4	1	List the significant models proposed for atoms.		1 2 3 4 5 6 7 8
	2	Identify the key parts of the plum-pudding model and the nuclear model of the atom.		1 2 3 4 5 6 7 8
Grade 8	5	Justify why the model of the atom has changed over time.		1 2 3 4 5 6 7 8
	6	Evaluate the current model of an atom.		1 2 3 4 5 6 7 8

Level	Obj No	C1 Atomic structure 1.6 Structure of the atom	Started (/) Completed (X)	Level Achieved
Grade 4	1	State the relative charges and masses of sub-atomic particles.		1 2 3 4 5 6 7 8
	2	State that atoms have no overall charge (are neutral).		1 2 3 4 5 6 7 8
	3	Label the sub-atomic particles on a diagram of a helium atom.		1 2 3 4 5 6 7 8
Grade 6	4	Describe atoms using the atomic model.		1 2 3 4 5 6 7 8
	5	Explain why atoms have no overall charge.		1 2 3 4 5 6 7 8
	6	Use atomic number and mass numbers of familiar atoms to determine the number of each sub-atomic particle.		1 2 3 4 5 6 7 8
Grade 8	7	Use the Periodic table to find atomic number and mass number data and use it to determine the number of each sub-atomic particle in any given form.		1 2 3 4 5 6 7 8
	8	Recognise and describe patterns in sub-atomic particles of elements listed in the Periodic Table.		1 2 3 4 5 6 7 8
	9	Explain why we can be confident that there are no missing elements in the first 10 elements of the Periodic Table.		1 2 3 4 5 6 7 8

Level	Obj No	C1 Atomic structure 1.7 Ions, atoms, and isotopes	Started (/) Completed (X)	Level Achieved
Grade 4	1	State what an ion is.		1 2 3 4 5 6 7 8
	2	Define an isotope.		1 2 3 4 5 6 7 8
	3	State the relative sizes of an atom and its nucleus.		1 2 3 4 5 6 7 8
Grade 6	4	Describe isotopes using the atomic model.		1 2 3 4 5 6 7 8
	5	Explain why ions have a charge.		1 2 3 4 5 6 7 8
	6	Use atomic number and mass numbers of familiar ions to determine the number of each sub-atomic particle.		1 2 3 4 5 6 7 8
Grade 8	7	Use the Periodic table to find atomic number and use it to determine the number of each sub-atomic particle in an ion.		1 2 3 4 5 6 7 8
	8	Use SI units and prefixes to describe the size of an atom and its nucleus in standard form.		1 2 3 4 5 6 7 8

Level	Obj No	C1 Atomic structure 1.8 Electronic structures	Started (/) Completed (X)	Level Achieved
Grade 4	1	State that electrons are found in energy levels of an atom.		1 2 3 4 5 6 7 8
	2	State the maximum number of electrons in the first three energy levels.		1 2 3 4 5 6 7 8
Grade 6	3	Write the standard electronic configuration notation from a diagram for the first 20 elements.		1 2 3 4 5 6 7 8
	4	Explain why elements in the same group react in a similar way.		1 2 3 4 5 6 7 8
Grade 8	5	Use the Periodic Table to find atomic number and determine the electronic structure for the first 20 elements.		1 2 3 4 5 6 7 8
	6	Make predictions for how an element will react when given information on another element in the same group.		1 2 3 4 5 6 7 8

Level	Obj No	C2 The periodic table 2.1 Development of the periodic table	Started (/) Completed (X)	Level Achieved
Grade 4	1	List the significant models for ordering the elements.		1 2 3 4 5 6 7 8
	2	State how the elements are ordered in the periodic table.		1 2 3 4 5 6 7 8
Grade 6	3	Describe how the elements are arranged in groups and periods in the periodic table.		1 2 3 4 5 6 7 8
	4	Explain why the periodic table was a breakthrough in how to order elements.		1 2 3 4 5 6 7 8
Grade 8	5	Explain how and why the ordering of the elements has changed over time.		1 2 3 4 5 6 7 8

Level	Obj No	C2 The periodic table 2.2 Electronic structures and the periodic table	Started (/) Completed (X)	Level Achieved
Grade 4	1	Define a group and period in the periodic table.		1 2 3 4 5 6 7 8
	2	Describe how electronic structure is linked to the periodic table.		1 2 3 4 5 6 7 8
	3	State that noble gases are unreactive.		1 2 3 4 5 6 7 8
Grade 6	4	Describe how the electronic structure of metals and non-metals are different.		1 2 3 4 5 6 7 8
	5	Explain in terms of electronic structure how the elements are arranged in the periodic table.		1 2 3 4 5 6 7 8
	6	Explain why the noble gases are unreactive and the trend in their boiling		1 2 3 4 5 6 7 8
Grade 8	7	Explain how the electronic structure of metals and non-metals affects their reactivity.		1 2 3 4 5 6 7 8
	8	Use the periodic table to make predictions about the electronic structure and reactions of elements.		1 2 3 4 5 6 7 8
	9	Predict the electronic structure of stable ions for the first 20 elements.		1 2 3 4 5 6 7 8

Level	Obj No	C2 The periodic table 2.3 Group 1- the alkali metals	Started (/) Completed (X)	Level Achieved
Grade 4	1	Name the first three elements in Group 1.		1 2 3 4 5 6 7 8
	2	Describe the Group 1 metals as having low densities.		1 2 3 4 5 6 7 8
	3	Write word equations from descriptions of how Group 1 metals react with water.		1 2 3 4 5 6 7 8
Grade 6	4	Recognise trends in supplied data.		1 2 3 4 5 6 7 8
	5	Explain why the elements in Group 1 react similarly and why the first three elements float on water.		1 2 3 4 5 6 7 8
	6	Describe how you can show that hydrogen and metal hydroxides are made when Group 1 metals react with water.		1 2 3 4 5 6 7 8
Grade 8	7	Illustrate the reactions of Group 1 metals with balanced symbol equations.		1 2 3 4 5 6 7 8
	8	Explain how Group 1 metals form ions with a +1 charge when they react with non-metals.		1 2 3 4 5 6 7 8
	9	Justify how Group 1 metals are stored and the safety precautions used when dealing with them.		1 2 3 4 5 6 7 8

Level	Obj No	C2 The periodic table 2.4 Group 7- the halogens	Started (/) Completed (X)	Level Achieved
Grade 4	1	Name the first four elements in Group 7.		1 2 3 4 5 6 7 8
	2	Recognise a halogen displacement reaction.		1 2 3 4 5 6 7 8
	3	Describe the main properties of halogens.		1 2 3 4 5 6 7 8
Grade 6	4	Recognise trends in supplied data.		1 2 3 4 5 6 7 8
	5	Explain why the elements in Group 7 react similarly.		1 2 3 4 5 6 7 8
	6	Explain how to complete a halogen displacement reaction and explain what happens in the reaction.		1 2 3 4 5 6 7 8
Grade 8	7	Illustrate the reactions of Group 7 metals with balanced symbol equations.		1 2 3 4 5 6 7 8
	8	Explain how Group 7 non-metals form ions with a −1 charge when they react with metals.		1 2 3 4 5 6 7 8
	9	Explain in detail how to compare the reactivity of the Group 7 elements.		1 2 3 4 5 6 7 8

Level	Obj No	C2 The periodic table 2.5 Explaining trends	Started (/) Completed (X)	Level Achieved
Grade 4	1	State the trend in reactivity in Group 1.		1 2 3 4 5 6 7 8
	2	State the trend in reactivity in Group 7.		1 2 3 4 5 6 7 8
Grade 6	3	Explain how electronic structure affects the trend in reactivity of Group 1 and Group 7 elements.		1 2 3 4 5 6 7 8
	4	Use the nuclear model to explain how the outer electrons experience different levels of attraction to the nucleus.		1 2 3 4 5 6 7 8
Grade 8	5	Use electronic structure to explain the trends in physical and chemical properties of Group 1 and Group 7 elements.		1 2 3 4 5 6 7 8
	6	Apply knowledge of reactivity of Groups 1 and 7 to suggest and explain the trend in reactivity of Groups 2 and 6.		1 2 3 4 5 6 7 8

Level	Obj No	C2 The periodic table 2.6 The transition elements	Started (/) Completed (X)	Level Achieved
Grade 4	1	List the typical properties of transition metals and their compounds.		1 2 3 4 5 6 7 8
Grade 6	2	Describe how the properties of Group 1 metals compare with transition metals.		1 2 3 4 5 6 7 8
	3	Interpret the formula and names of familiar transition metal compounds.		1 2 3 4 5 6 7 8
Grade 8	4	Justify the use of a transition metal or its compound in terms of its chemical properties.		1 2 3 4 5 6 7 8
	5	Suggest why Group 1 metals have different properties compared to transition metals.		1 2 3 4 5 6 7 8

Level	Obj No	C3 Structure and bonding 3.1 States of matter	Started (/) Completed (X)	Level Achieved
Grade 4	1	Identify the three states of matter and their state symbols.		1 2 3 4 5 6 7 8
	2	Describe the process of melting, freezing, boiling, and condensing.		1 2 3 4 5 6 7 8
	3	Use the particle model to draw a representation of how particles are arranged in the three states of matter.		1 2 3 4 5 6 7 8
Grade 6	4	Use data to determine the state of a substance at a given temperature.		1 2 3 4 5 6 7 8
	5	Explain, in terms of particles, the energy and temperature of a substance when it is at the melting point or boiling point.		1 2 3 4 5 6 7 8
	6	Describe the factors that affect rate of evaporation.		1 2 3 4 5 6 7 8
Grade 8	7	Use the particle model to describe how energy, movement, and attraction between particles change as a substance is heated or cooled.		1 2 3 4 5 6 7 8
	8	Suggest why substances have different melting and boiling points from each other.		1 2 3 4 5 6 7 8
	9	(H) Evaluate a model, explaining its limitations.		1 2 3 4 5 6 7 8

Level	Obj No	C3 Structure and bonding 3.2 Atoms in ions	Started (/) Completed (X)	Level Achieved
Grade 4	1	State the particles involved in ionic and covalent bonding.		1 2 3 4 5 6 7 8
	2	Describe, with an example, how a Group 1 metal atom becomes a positive ion.		1 2 3 4 5 6 7 8
	3	Describe, with an example, how a Group 7 non-metal atom becomes a negative ion.		1 2 3 4 5 6 7 8
Grade 6	4	Draw dot and cross diagrams of compounds formed between Group 1 and Group 7 elements.		1 2 3 4 5 6 7 8
	5	Explain how electron transfer allows ionic bonding to occur in the compound formed when a Group 1 metal reacts with a Group 7 non-metal.		1 2 3 4 5 6 7 8
Grade 8	6	Draw dot and cross diagrams of unfamiliar ionic compounds.		1 2 3 4 5 6 7 8
	7	Suggest and explain the charge of a monatomic ion based on its position in the periodic table.		1 2 3 4 5 6 7 8

Level	Obj No	C3 Structure and bonding 3.3 Ionic bonding	Started (/) Completed (X)	Level Achieved
Grade 4	1	State that opposite charges attract.		1 2 3 4 5 6 7 8
	2	Write the charges of ions of Group 1, Group 2, Group 6, and Group 7 elements.		1 2 3 4 5 6 7 8
	3	Describe an ionic lattice.		1 2 3 4 5 6 7 8
Grade 6	4	Explain how the position of an element in the periodic table relates to the charge on its most stable monatomic ion.		1 2 3 4 5 6 7 8
	5	Explain, in terms of electronic structure, how unfamiliar elements become ions.		1 2 3 4 5 6 7 8
	6	Interpret the formulae of familiar ionic compounds to determine the number and type of each ion present.		1 2 3 4 5 6 7 8
Grade 8	7	Suggest the charge on unfamiliar ions using the position of the element in the periodic table.		1 2 3 4 5 6 7 8
	8	Explain the ratio of metal and non-metal ions in compounds.		1 2 3 4 5 6 7 8
	9	Generate the formulae of a wide range of ionic compounds when the charges of the ions are given.		1 2 3 4 5 6 7 8

Level	Obj No	C3 Structure and bonding 3.4 Giant ionic structures	Started (/) Completed (X)	Level Achieved
Grade 4	1	State that ionic compounds have high melting points and can dissolve in water.		1 2 3 4 5 6 7 8
	2	State that ionic compounds can conduct electricity when molten or dissolved in water.		1 2 3 4 5 6 7 8
	3	Describe an ionic lattice		1 2 3 4 5 6 7 8
Grade 6	4	Explain why ionic compounds have a high melting point.		1 2 3 4 5 6 7 8
	5	Describe, in terms of ions, how an ionic compound can conduct electricity.		1 2 3 4 5 6 7 8
	6	Explain the movement of ions in solution or when molten.		1 2 3 4 5 6 7 8
Grade 8	7	Explain in detail why ionic compounds cannot conduct electricity when they are solid but can when molten or in solution.		1 2 3 4 5 6 7 8
	8	Justify in terms of properties that a compound has ionic bonding.		1 2 3 4 5 6 7 8
	9	Apply the ionic model to make predictions of the physical properties of ionic compounds.		1 2 3 4 5 6 7 8

Level	Obj No	C3 Structure and bonding 3.5 Covalent bonding	Started (/) Completed (X)	Level Achieved
Grade 4	1	Describe a covalent bond		1 2 3 4 5 6 7 8
	2	Recognise a covalent compound from its formula, name, or diagram showing bonds.		1 2 3 4 5 6 7 8
	3	Name familiar examples of small molecules which contain covalent bonds.		1 2 3 4 5 6 7 8
Grade 6	4	Explain how a covalent bond forms in terms of electronic structure.		1 2 3 4 5 6 7 8
	5	Draw dot and cross diagrams and ball and stick diagrams for H2, Cl2, O2, N2,		1 2 3 4 5 6 7 8
	6	Draw dot and cross diagrams and ball and stick diagrams for unfamiliar small molecules.		1 2 3 4 5 6 7 8
Grade 8	7	Draw dot and cross diagrams and ball and stick diagrams for unfamiliar small molecules.		1 2 3 4 5 6 7 8
	8	Suggest how double and triple covalent bonds can be formed.		1 2 3 4 5 6 7 8
	9	Suggest how the properties of a double covalent bond could be different to the properties of a single covalent bond.		1 2 3 4 5 6 7 8

Level	Obj No	C3 Structure and bonding 3.6 Simple molecules	Started (/) Completed (X)	Level Achieved
Grade 4	1	State that small molecules have low melting and boiling points.		1 2 3 4 5 6 7 8
	2	State that small molecules do not conduct electricity.		1 2 3 4 5 6 7 8
	3	Describe an intermolecular force.		1 2 3 4 5 6 7 8
Grade 6	4	Explain how the size of molecules affects melting and boiling points.		1 2 3 4 5 6 7 8
	5	Explain why small molecules and polymers do not conduct electricity.		1 2 3 4 5 6 7 8
	6	Identify substances that would have weak intermolecular forces.		1 2 3 4 5 6 7 8
Grade 8	7	Predict the physical properties of unfamiliar covalently bonded substances.		1 2 3 4 5 6 7 8
	8	Compare and contrast the properties of substances with different bonding.		1 2 3 4 5 6 7 8
	9	Justify the use of a model to explain the physical properties of a small molecule and discuss the limitations of various molecular models.		1 2 3 4 5 6 7 8

Level	Obj No	C3 Structure and bonding 3.7 Giant covalent structures	Started (/) Completed (X)	Level Achieved
Grade 4	1	List the main physical properties of diamond and graphite.		1 2 3 4 5 6 7 8
	2	State that giant covalent structures have high melting points.		1 2 3 4 5 6 7 8
	3	Describe the structure of graphite in terms of layers of carbon atoms.		1 2 3 4 5 6 7 8
Grade 6	4	Recognise the structure of diamond and graphite from information provided in written or diagrammatic form.		1 2 3 4 5 6 7 8
	5	Explain the properties of diamond in terms of its bonding.		1 2 3 4 5 6 7 8
	6	Explain the properties of graphite in terms of its bonding.		1 2 3 4 5 6 7 8
Grade 8	7	Use a molecular model of an unfamiliar giant covalent structure to predict and explain its physical properties.		1 2 3 4 5 6 7 8
	8	Justify in detail a use for graphite based on its properties.		1 2 3 4 5 6 7 8
	9	Justify in detail a use for diamond based on its properties.		1 2 3 4 5 6 7 8

Level	Obj No	C3 Structure and bonding 3.8 Fullerenes and graphene	Started (/) Completed (X)	Level Achieved
Grade 4	1	Describe the relationship between graphite and graphene.		1 2 3 4 5 6 7 8
	2	List the main physical properties of fullerenes.		1 2 3 4 5 6 7 8
	3	State the molecular formula of buckminsterfullerene.		1 2 3 4 5 6 7 8
Grade 6	4	Recognise the structure of a fullerene or nanotube in diagrams and prose.		1 2 3 4 5 6 7 8
	5	Explain the structure of fullerenes.		1 2 3 4 5 6 7 8
	6	List the properties and consequent uses of fullerenes and carbon nanotubes.		1 2 3 4 5 6 7 8
Grade 8	7	Describe and explain the applications of fullerenes.		1 2 3 4 5 6 7 8
	8	Use molecular models of graphene, nanotubes, and fullerenes to explain their properties.		1 2 3 4 5 6 7 8
	9	Justify in detail a use for graphene, nanotubes, and fullerenes, based on their properties.		1 2 3 4 5 6 7 8

Level	Obj No	C3 Structure and bonding 3.9 Bonding in metals	Started (/) Completed (X)	Level Achieved
Grade 4	1	State that metals form a giant structure.		1 2 3 4 5 6 7 8
	2	Recognise metallic bonding in diagrams.		1 2 3 4 5 6 7 8
Grade 6	3	Describe metallic bonding.		1 2 3 4 5 6 7 8
	4	Recognise and represent metallic bonding diagrammatically.		1 2 3 4 5 6 7 8
Grade 8	5	Explain how metal atoms form giant structures.		1 2 3 4 5 6 7 8
	6	Evaluate different models of metallic bonding.		1 2 3 4 5 6 7 8

Level	Obj No	C3 Structure and bonding 3.10 Bonding in metals	Started (/) Completed (X)	Level Achieved
Grade 4	1	List the physical properties of metals.		1 2 3 4 5 6 7 8
	2	Describe the structure of a pure metal.		1 2 3 4 5 6 7 8
Grade 6	3	Explain key physical properties of metals using the model of metallic bonding.		1 2 3 4 5 6 7 8
	4	Describe why metals are alloyed.		1 2 3 4 5 6 7 8
Grade 8	5	Explain in detail, including labelled diagrams, how alloying affects the structure and bonding in metals and its effect on properties.		1 2 3 4 5 6 7 8
	6	Justify in detail why alloys are more often used than pure metals.		1 2 3 4 5 6 7 8

Level	Obj No	C3 Structure and bonding 3.11 Nanoparticles	Started (/) Completed (X)	Level Achieved
Grade 4	1	State a definition of nanoscience.		1 2 3 4 5 6 7 8
	2	Describe how surface area to volume ratio increases as particle size decreases.		1 2 3 4 5 6 7 8
	3	Recognise that the negative indices in standard form used in nanoscience represent very small numbers.		1 2 3 4 5 6 7 8
Grade 6	4	Describe the size of nanoparticles.		1 2 3 4 5 6 7 8
	5	Explain why surface area to volume ratio increases as particle size decreases.		1 2 3 4 5 6 7 8
	6	Convert lengths into standard form.		1 2 3 4 5 6 7 8
Grade 8	7	Classify a particle as coarse, fine, or nanoparticle based on its size.		1 2 3 4 5 6 7 8
	8	Quantitatively explain the relationship between surface area to volume ratio and particle size and its effect on properties.		1 2 3 4 5 6 7 8
	9	Convert standard form into a variety of length units.		1 2 3 4 5 6 7 8

Level	Obj No	C3 Structure and bonding 3.12 Applications of nanoscience	Started (/) Completed (X)	Level Achieved
Grade 4	1	State that nanoparticles can be used in sun cream.		1 2 3 4 5 6 7 8
	2	List a variety of uses of nanoparticles.		1 2 3 4 5 6 7 8
Grade 6	3	List the advantages and disadvantages of using nanoparticles.		1 2 3 4 5 6 7 8
	4	Explain why nanoparticles can have new applications.		1 2 3 4 5 6 7 8
Grade 8	5	Evaluate the use of nanoparticles in their applications, including sun cream.		1 2 3 4 5 6 7 8
	6	Decide and justify in detail why nanotechnology research should continue.		1 2 3 4 5 6 7 8

Level	Obj No	C4 Chemical calculations 4.1 Relative masses and moles	Started (/) Completed (X)	Level Achieved
Grade 4	1	Use the periodic table to identify the relative atomic mass for the first 20 elements.		1 2 3 4 5 6 7 8
	2	Calculate the relative formula mass for familiar compounds when the formula is supplied and is without brackets.		1 2 3 4 5 6 7 8
Grade 6	3	Use the periodic table to find the relative atomic mass of all elements.		1 2 3 4 5 6 7 8
	4	Calculate the relative formula mass for unfamiliar compounds when the formula is given.		1 2 3 4 5 6 7 8
	5	(H) State the units for the amount of substance.		1 2 3 4 5 6 7 8
Grade 8	6	Explain why relative atomic masses may not be a whole number.		1 2 3 4 5 6 7 8
	7	Explain why some elements have the same relative atomic mass as each other.		1 2 3 4 5 6 7 8
	8	(H) Calculate the number of moles or mass of a substance from data supplied.		1 2 3 4 5 6 7 8

Level	Obj No	C4 Chemical calculations 4.2 Atomic masses	Started (/) Completed (X)	Level Achieved
Grade 6	1	Explain why chemical equations must be balanced.		1 2 3 4 5 6 7 8
	2	Calculate the relative formula mass for one substance when the relative formula masses are given for all the other substances in a balanced symbol equation.		1 2 3 4 5 6 7 8
Grade 8	3	Interpret balanced symbol equations in terms of mole ratios.		1 2 3 4 5 6 7 8
	4	Use balanced symbol equations to calculate reacting masses.		1 2 3 4 5 6 7 8

Level	Obj No	C4 Chemical calculations 4.3 Equations	Started (/) Completed (X)	Level Achieved
Grade 6	1	Explain why chemical equations must be balanced.		1 2 3 4 5 6 7 8
	2	Identify the limiting reactant in a chemical reaction.		1 2 3 4 5 6 7 8
Grade 8	3	Explain the effect of a limiting reactant on the amount of product made.		1 2 3 4 5 6 7 8
	4	Explain the effect of a limiting reactant on the amount of product made.		1 2 3 4 5 6 7 8

Level	Obj No	C4 Chemical calculations 4.4 Yield of a chemical reaction	Started (/) Completed (X)	Level Achieved
Grade 4	1	State the definition of theoretical yield, actual yield, and percentage yield.		1 2 3 4 5 6 7 8
	2	Calculate percentage yield when actual yield and theoretical yield are given.		1 2 3 4 5 6 7 8
Grade 6	3	Calculate percentage yield when the actual yield is given and the mass of the limiting reactant is given.		1 2 3 4 5 6 7 8
	4	List reasons why actual yield is often lower than theoretical yield.		1 2 3 4 5 6 7 8
Grade 8	5	Calculate the percentage yield using a variety of units and conversions.		1 2 3 4 5 6 7 8
	6	Justify why percentage yield can never be above 100%.		1 2 3 4 5 6 7 8

Level	Obj No	C4 Chemical calculations 4.5 Atom economy	Started (/) Completed (X)	Level Achieved
Grade 4	1	Calculate the formula mass of substances when the formula is given.		1 2 3 4 5 6 7 8
	2	Balance simple equations		1 2 3 4 5 6 7 8
	3	State a definition of atom economy		1 2 3 4 5 6 7 8
Grade 6	4	Calculate the atom economy for a given chemical reaction.		1 2 3 4 5 6 7 8
	5	Explain why using reactions with high atom economy is important.		1 2 3 4 5 6 7 8
Grade 8	6	Evaluate different reactions to decide the best production method of a chemical.		1 2 3 4 5 6 7 8
	7	Explain why the sum of the formula masses of the reactants is the same as the sum of the formula masses of the products.		1 2 3 4 5 6 7 8

Level	Obj No	C4 Chemical calculations 4.6 Expressing concentrations	Started (/) Completed (X)	Level Achieved
Grade 4	1	Describe what the concentration of a solution is.		1 2 3 4 5 6 7 8
	2	Calculate the concentration of a solution in g/dm3 when given the mass of solute in g and volume of solution in dm3.		1 2 3 4 5 6 7 8
Grade 6	3	(H) Explain how concentration of a solution can be changed.		1 2 3 4 5 6 7 8
	4	Calculate the mass of solute (in g) in a solution when given the concentration in g/dm3 and volume in dm3 or cm3.		1 2 3 4 5 6 7 8
Grade 8	5	Calculate the mass of a chemical when any volume and concentration is given.		1 2 3 4 5 6 7 8
	6	Explain the concentration of a solution in terms of particles.		1 2 3 4 5 6 7 8

Level	Obj No	C4 Chemical calculations 4.7 Titrations	Started (/) Completed (X)	Level Achieved
Grade 4	1	Accurately read the volume on a burette to 1 decimal place.		1 2 3 4 5 6 7 8
	2	Identify concordant results		1 2 3 4 5 6 7 8
Grade 6	3	Calculate a titre.		1 2 3 4 5 6 7 8
	4	Describe how an indicator can be used to determine the end point.		1 2 3 4 5 6 7 8
	5	Explain how accuracy can be improved in a titration.		1 2 3 4 5 6 7 8
Grade 8	6	Justify the use of a pipette and burette for a titration, evaluating the errors involved in reading these instruments.		1 2 3 4 5 6 7 8
	7	Explain how precise results are obtained in a titration.		1 2 3 4 5 6 7 8
	8	Justify the use of an indicator in an acid–base titration.		1 2 3 4 5 6 7 8

Level	Obj No	C4 Chemical calculations 4.8 Titration calculations	Started (/) Completed (X)	Level Achieved
Grade 6	1	Calculate the concentration of a solution in mol/dm3 when given the amount of solute in moles and volume of solution in dm3.		1 2 3 4 5 6 7 8
	2	Calculate the amount of acid or alkali needed in a neutralisation reaction.		1 2 3 4 5 6 7 8
	3	Calculate the mole and mass of solute (in g) in a solution when given the concentration in mol/dm3 and volume in dm3 or cm3.		1 2 3 4 5 6 7 8
Grade 8	4	Calculate the unknown concentration of a reactant in a neutralisation reaction when the volumes are known and the concentration of one reactant is also known.		1 2 3 4 5 6 7 8
	5	Extract data from given information to perform multi-step calculations independently.		1 2 3 4 5 6 7 8

Level	Obj No	C4 Chemical calculations 4.9 Volumes of gases	Started (/) Completed (X)	Level Achieved
Grade 6	1	Calculate the amount in moles of gas in a given volume at room temperature and pressure.		1 2 3 4 5 6 7 8
	2	Convert units		1 2 3 4 5 6 7 8
Grade 8	3	Suggest how the volume of gas would change when temperature or pressure was changed.		1 2 3 4 5 6 7 8
	4	Calculate the moles or volume of a gaseous substance involved in a chemical reaction.		1 2 3 4 5 6 7 8

Level	Obj No	C5 Chemical changes 5.1 The reactivity series	Started (/) Completed (X)	Level Achieved
Grade 4	1	List the order of common metals in the reactivity series.		1 2 3 4 5 6 7 8
	2	Use general equations to write specific word equations for metals listed in the reactivity series reacting with oxygen, water, and acid.		1 2 3 4 5 6 7 8
	3	Safely make and record observations.		1 2 3 4 5 6 7 8
Grade 6	4	Describe oxidation and reduction in terms of gain or loss of oxygen.		1 2 3 4 5 6 7 8
	5	Write word equations for the metals listed in the reactivity series reacting with oxygen, water, and acid, and balance given symbol equations.		1 2 3 4 5 6 7 8
	6	Predict observations for the metals listed in the reactivity series reacting with oxygen, water, and acid.		1 2 3 4 5 6 7 8
Grade 8	7	Justify uses of metals in the reactivity series based on their chemical reactivity.		1 2 3 4 5 6 7 8
	8	Write balanced symbol equations, with state symbols, for the metals listed in the reactivity series reacting with oxygen, water, and acid.		1 2 3 4 5 6 7 8
	9	Evaluate in detail the investigation of metals plus acid, assessing the control of variables and the validity of conclusions drawn from the data collected.		1 2 3 4 5 6 7 8

Level	Obj No	C5 Chemical changes 5.2 Displacement reactions	Started (/) Completed (X)	Level Achieved
Grade 4	1	Recall a definition of a displacement reaction.		1 2 3 4 5 6 7 8
	2	Use the reactivity series to determine whether a reaction between a metal and a different metal salt will occur.		1 2 3 4 5 6 7 8
	3	Safely make and record observations.		1 2 3 4 5 6 7 8
Grade 6	4	Explain why a displacement reaction occurs.		1 2 3 4 5 6 7 8
	5	Write word equations and straightforward balanced symbol equations for displacement reactions.		1 2 3 4 5 6 7 8
	6	Predict observations for the metals listed in the reactivity series reacting with a different metal salt.		1 2 3 4 5 6 7 8
Grade 8	7	(H) Describe displacement reactions using an ionic equation.		1 2 3 4 5 6 7 8
	8	Write balanced symbol equations, with state symbols, for displacement reactions.		1 2 3 4 5 6 7 8
	9	(H) Determine and explain which species is oxidised and which species (metal atom or ion) is reduced in a displacement reaction in terms of electron transfer.		1 2 3 4 5 6 7 8

Level	Obj No	C5 Chemical changes 5.3 Extracting metals	Started (/) Completed (X)	Level Achieved
Grade 4	1	Define oxidation and reduction in terms of oxygen.		1 2 3 4 5 6 7 8
	2	Describe how metals can be extracted.		1 2 3 4 5 6 7 8
Grade 6	3	Identify species that are being oxidised and reduced in a chemical reaction.		1 2 3 4 5 6 7 8
	4	Explain why some metals are found uncombined in the Earth's crust.		1 2 3 4 5 6 7 8
Grade 8	5	Explain how carbon or hydrogen can be used to reduce an ore.		1 2 3 4 5 6 7 8
	6	Evaluate the extraction process to obtain a metal from its ore.		1 2 3 4 5 6 7 8

Level	Obj No	C5 Chemical changes 5.4 Salts from metals	Started (/) Completed (X)	Level Achieved
Grade 4	1	Recall a definition of a salt.		1 2 3 4 5 6 7 8
	2	Name a salt formed between a metal and sulfuric acid or hydrochloric acid.		1 2 3 4 5 6 7 8
	3	Recall a general equation for a metal reacting with an acid and use it to write specific word equations.		1 2 3 4 5 6 7 8
Grade 6	4	Describe how to make a salt by reacting a metal with an acid.		1 2 3 4 5 6 7 8
	5	Write a balanced symbol equation to describe a reaction between a metal and sulfuric acid or hydrochloric acid.		1 2 3 4 5 6 7 8
	6	Identify the chemical formula of the salt produced from the reaction between an acid and a metal.		1 2 3 4 5 6 7 8
Grade 8	7	(H) Explain the reaction between a metal and an acid.		1 2 3 4 5 6 7 8
	8	(H) Write ionic and half equations, including state symbols, to describe a reaction between a metal and sulfuric acid or hydrochloric acid.		1 2 3 4 5 6 7 8
	9	(H) Identify and explain in detail which species is oxidised and which is reduced.		1 2 3 4 5 6 7 8

Level	Obj No	C5 Chemical changes 5.5 Salts from insoluble bases	Started (/) Completed (X)	Level Achieved
Grade 4	1	Safely prepare a pure, dry sample of a soluble salt from an insoluble base and a dilute acid.		1 2 3 4 5 6 7 8
	2	Name a salt formed between a metal hydroxide or metal oxide and sulfuric acid or hydrochloric acid.		1 2 3 4 5 6 7 8
	3	Recall a general equation for a base reacting with an acid and use it to write specific word equations.		1 2 3 4 5 6 7 8
Grade 6	4	Describe a method to prepare a pure, dry sample of a soluble salt from an insoluble substance and a dilute acid.		1 2 3 4 5 6 7 8
	5	Write a balanced symbol equation to describe a reaction between a metal hydroxide or oxide and sulfuric acid or hydrochloric acid.		1 2 3 4 5 6 7 8
	6	Explain why the reaction between a base and a dilute acid is a neutralisation reaction.		1 2 3 4 5 6 7 8
Grade 8	7	(H) Explain the reaction between a metal oxide or metal hydroxide and an acid, including an ionic equation.		1 2 3 4 5 6 7 8
	8	Generate the formulae of salts given the names of the metal or base and		1 2 3 4 5 6 7 8

Level	Obj No	C5 Chemical changes 5.6 Making more salts	Started (/) Completed (X)	Level Achieved
Grade 4	1	Safely make a salt by reacting a metal carbonate with a dilute acid.		1 2 3 4 5 6 7 8
	2	Write a general word equation for metal carbonates and alkalis reacting with dilute acids and use this to make specific word equations.		1 2 3 4 5 6 7 8
Grade 6	3	Describe how to make a dry sample of a salt from reacting a metal carbonate or an alkali with a dilute acid.		1 2 3 4 5 6 7 8
	4	Write balanced symbol equations for neutralisation reactions.		1 2 3 4 5 6 7 8
Grade 8	5	Explain the reaction between ammonia and dilute acids to produce salts and the agricultural importance of the salts.		1 2 3 4 5 6 7 8
	6	Describe neutralisation using ionic equations, including the ionic equation for a carbonate plus an acid.		1 2 3 4 5 6 7 8

Level	Obj No	C5 Chemical changes 5.7 Neutralisation and the pH scale	Started (/) Completed (X)	Level Achieved
Grade 4	1	Safely use universal indicator to classify a solution as acidic or alkaline.		1 2 3 4 5 6 7 8
	2	Describe the pH scale.		1 2 3 4 5 6 7 8
	3	Recall an example of an alkaline, neutral, basic, and acidic chemical.		1 2 3 4 5 6 7 8
Grade 6	4	Describe how universal indicator can be used to classify a chemical as acidic or alkaline.		1 2 3 4 5 6 7 8
	5	Describe how solutions can be acidic or alkaline.		1 2 3 4 5 6 7 8
	6	Describe the relationship between alkalis and bases.		1 2 3 4 5 6 7 8
Grade 8	7	Evaluate how universal indicator or a data logger can be used to determine the approximate pH of a solution.		1 2 3 4 5 6 7 8
	8	Use ionic equations to explain how solutions can be acidic or alkaline.		1 2 3 4 5 6 7 8
	9	Explain how the pH of a solution changes as acid or alkali is added		1 2 3 4 5 6 7 8

Level	Obj No	C5 Chemical changes 5.8 Electronic structures	Started (/) Completed (X)	Level Achieved
Grade 6	1	Recall examples of strong and weak acids.		1 2 3 4 5 6 7 8
	2	Describe how an acid or alkali can be concentrated or dilute.		1 2 3 4 5 6 7 8
	3	Describe how an acid or alkali can be weak or strong.		1 2 3 4 5 6 7 8
Grade 8	4	Explain the difference between concentration and strong or weak in terms of acids and alkalis.		1 2 3 4 5 6 7 8
	5	Use ionic equations to explain how acids can be strong or weak.		1 2 3 4 5 6 7 8
	6	Quantatively explain how the concentration of hydrogen ions relates to the pH number.		1 2 3 4 5 6 7 8

Level	Obj No	C6 Electrolysis 6.1 Introduction to electrolysis	Started (/) Completed (X)	Level Achieved
Grade 4	1	Define electrolysis.		1 2 3 4 5 6 7 8
	2	Write a word equation to describe the electrolysis of a molten ionic compound.		1 2 3 4 5 6 7 8
Grade 6	3	Describe electrolysis in terms of movement of ions.		1 2 3 4 5 6 7 8
	4	Write a balanced symbol equation including state symbols for the overall electrolysis of a molten ionic compound.		1 2 3 4 5 6 7 8
	5	Predict the products at each electrode for the electrolysis of a molten ionic compound.		1 2 3 4 5 6 7 8
Grade 8	6	Explain why electrolysis can only occur when an ionic compound is molten or in aqueous solution.		1 2 3 4 5 6 7 8
	7	(H) Describe electrolysis with half equations at the electrodes.		1 2 3 4 5 6 7 8
	8	Explain the classification of the reactions at each electrode as oxidation or reduction.		1 2 3 4 5 6 7 8

Level	Obj No	C6 Electrolysis 6.2 Changes at the electrodes	Started (/) Completed (X)	Level Achieved
Grade 4	1	State that oxygen can be produced at the anode when some solutions are electrolysed.		1 2 3 4 5 6 7 8
	2	State that hydrogen can be produced at the cathode when some solutions are electrolysed.		1 2 3 4 5 6 7 8
	3	Write a word equation to describe electrolysis of a solution.		1 2 3 4 5 6 7 8
Grade 6	4	Describe electrolysis of solutions in terms of movement of ions.		1 2 3 4 5 6 7 8
	5	Write a balanced symbol equation including state symbols for the overall		1 2 3 4 5 6 7 8
	6	Predict the products at each electrode for the electrolysis of a molten ionic compound or its solution.		1 2 3 4 5 6 7 8
Grade 8	7	Explain how hydrogen ions and hydroxide ions can be present in solutions, including a balanced symbol equation with state symbols, for the reversible reaction in which water ionises.		1 2 3 4 5 6 7 8
	8	(H) Describe electrolysis with half equations at the electrodes.		1 2 3 4 5 6 7 8
	9	Explain the classification of reactions at the electrodes as oxidation or reduction.		1 2 3 4 5 6 7 8

Level	Obj No	C6 Electrolysis 6.3 Extraction of aluminium	Started (/) Completed (X)	Level Achieved
Grade 4	1	State that aluminium can be extracted from aluminium oxide using electrolysis.		1 2 3 4 5 6 7 8
	2	Write a word equation to describe the electrolysis of aluminium oxide.		1 2 3 4 5 6 7 8
Grade 6	3	Describe the electrolysis of aluminium oxide.		1 2 3 4 5 6 7 8
	4	Explain why electrolysis is an expensive metal extraction method and illustrate this with the extraction of aluminium.		1 2 3 4 5 6 7 8
	5	Explain why cryolite is added to aluminium oxide in the industrial extraction of aluminium.		1 2 3 4 5 6 7 8
Grade 8	6	Explain why electrolysis is used to extract aluminium from compounds.		1 2 3 4 5 6 7 8
	7	(H) Describe electrolysis with half equations at the electrodes.		1 2 3 4 5 6 7 8
	8	(H) Explain the classification of the reactions at each electrode as oxidation or reduction.		1 2 3 4 5 6 7 8

Level	Obj No	C6 Electrolysis 6.4 Electrolysis of aqueous solutions	Started (/) Completed (X)	Level Achieved
Grade 4	1	State the products of the electrolysis of brine and a use for each.		1 2 3 4 5 6 7 8
	2	Safely electrolyse a solution, with guidance provided.		1 2 3 4 5 6 7 8
Grade 6	3	Describe how to electrolyse brine in terms of ions moving.		1 2 3 4 5 6 7 8
	4	Predict the products of electrolysis of a solution.		1 2 3 4 5 6 7 8
	5	Plan and carry out an electrolysis investigation.		1 2 3 4 5 6 7 8
Grade 8	6	(H) Explain the electrolysis of brine using half equations, classifying reactions at the electrode as oxidation or reduction.		1 2 3 4 5 6 7 8
	7	Evaluate in detail an investigation they have planned and carried out, commenting on their methodology and quality of the data collected.		1 2 3 4 5 6 7 8
	8	Compare and contrast the electrolysis of a compound in solution with its electrolysis as a molten compound.		1 2 3 4 5 6 7 8

Level	Obj No	C7 Energy changes 7.1 Exothermic and endothermic reactions	Started (/) Completed (X)	Level Achieved
Grade 4	1	Define exothermic and endothermic reactions.		1 2 3 4 5 6 7 8
	2	State that energy is conserved in a chemical reaction.		1 2 3 4 5 6 7 8
	3	Safely complete a calorimetry experiment for a reaction that takes place in solution.		1 2 3 4 5 6 7 8
Grade 6	4	Describe examples of exothermic and endothermic reactions.		1 2 3 4 5 6 7 8
	5	Explain, using observations from calorimetry, how to classify a reaction as exothermic or endothermic.		1 2 3 4 5 6 7 8
	6	Explain in detail how to carry out a calorimetry experiment.		1 2 3 4 5 6 7 8
Grade 8	7	Explain a chemical reaction in terms of energy transfer.		1 2 3 4 5 6 7 8
	8	Plan, carry out, and evaluate the errors in a calorimetry investigation.		1 2 3 4 5 6 7 8

Level	Obj No	C7 Energy changes 7.2 Using energy transfers from reactions	Started (/) Completed (X)	Level Achieved
Grade 4	1	State a use of an exothermic reaction and an endothermic reaction.		1 2 3 4 5 6 7 8
	2	Write word equations for familiar reactions.		1 2 3 4 5 6 7 8
Grade 6	3	Explain how an energy change from a chemical reaction can be used.		1 2 3 4 5 6 7 8
	4	Write balanced symbol equations for familiar reactions.		1 2 3 4 5 6 7 8
Grade 8	5	Suggest a chemical reaction for a specific purpose based on the energy change for the reaction.		1 2 3 4 5 6 7 8
	6	Evaluate in detail the uses of exothermic and endothermic reactions.		1 2 3 4 5 6 7 8

Level	Obj No	C7 Energy changes 7.3 Reaction profiles	Started (/) Completed (X)	Level Achieved
Grade 4	1	Define activation energy.		1 2 3 4 5 6 7 8
	2	Sketch a generic reaction profile diagram for an exothermic or endothermic reaction.		1 2 3 4 5 6 7 8
Grade 6	3	Label activation energy on a reaction profile diagram.		1 2 3 4 5 6 7 8
	4	Generate a specific reaction profile diagram for a given chemical reaction when its energy change is also supplied.		1 2 3 4 5 6 7 8
	5	(H) Identify bonds broken in reactants and new bonds made in products of a reaction.		1 2 3 4 5 6 7 8
Grade 8	6	Explain why chemical reactions need activation energy to start them.		1 2 3 4 5 6 7 8
	7	Use the particle model to explain how a chemical reaction occurs.		1 2 3 4 5 6 7 8
	8	(H) Explain energy change in terms of the balance between bond making and bond breaking.		1 2 3 4 5 6 7 8

Level	Obj No	C7 Energy changes 7.4 Bond energy calculations	Started (/) Completed (X)	Level Achieved
Grade 4	1	State when fractional distillation would be used.		1 2 3 4 5 6 7 8
	2	Safely make a paper chromatogram.		1 2 3 4 5 6 7 8
Grade 6	3	Explain, using the particle model, how reactants become products in a chemical reaction.		1 2 3 4 5 6 7 8
	4	Explain why bond breaking is endothermic and bond making is exothermic.		1 2 3 4 5 6 7 8
	5	Define bond energy and identify all the bonds that break and are made in a chemical reaction.		1 2 3 4 5 6 7 8
Grade 8	6	Calculate the energy needed to break the reactant bonds and the energy released when the product bonds are made.		1 2 3 4 5 6 7 8
	7	Calculate the energy change for a reaction, including the correct unit.		1 2 3 4 5 6 7 8
	8	Explain in terms of bond energies how a reaction is either exothermic or endothermic.		1 2 3 4 5 6 7 8

Level	Obj No	C7 Energy changes 7.5 Chemical cells and batteries	Started (/) Completed (X)	Level Achieved
Grade 4	1	Describe a simple cell.		1 2 3 4 5 6 7 8
	2	Describe a battery		1 2 3 4 5 6 7 8
	3	Give an example of a non-rechargeable battery		1 2 3 4 5 6 7 8
Grade 6	4	Explain how a hydrogen fuel cell produces electricity.		1 2 3 4 5 6 7 8
	5	List the advantages and disadvantages of hydrogen fuel cells.		1 2 3 4 5 6 7 8
	6	Explain why hydrogen fuel cells are an alternative to rechargeable cells and batteries.		1 2 3 4 5 6 7 8
Grade 8	7	Describe an electrochemical cell with half equations and ionic equations.		1 2 3 4 5 6 7 8
	8	Explain why the reactions in an electrochemical cell are redox reactions and determine which species is oxidised or reduced in an electrochemical cell.		1 2 3 4 5 6 7 8
	9	Evaluate the use of non-rechargeable cells.		1 2 3 4 5 6 7 8

Level	Obj No	C7 Energy changes 7.6 Fuels cells	Started (/) Completed (X)	Level Achieved
Grade 4	1	Describe a hydrogen fuel cell.		1 2 3 4 5 6 7 8
	2	State some uses for hydrogen fuel cells.		1 2 3 4 5 6 7 8
	3	State that hydrogen fuel cells could be an alternative to rechargeable cells and batteries.		1 2 3 4 5 6 7 8
Grade 6	4	Explain how a hydrogen fuel cell produces electricity.		1 2 3 4 5 6 7 8
	5	List the advantages and disadvantages of hydrogen fuel cells.		1 2 3 4 5 6 7 8
	6	Explain why hydrogen fuel cells are an alternative to rechargeable cells and batteries.		1 2 3 4 5 6 7 8
Grade 8	7	(H) Describe the reactions in fuel cells using balanced symbol and half equations.		1 2 3 4 5 6 7 8
	8	Evaluate the use of hydrogen fuel cells instead of rechargeable cells and batteries.		1 2 3 4 5 6 7 8
	9	Determine and explain which species is oxidised and which is reduced in a hydrogen fuel cell.		1 2 3 4 5 6 7 8

Level	Obj No	C8 Rates and equilibrium 8.1 Rate of reaction	Started (/) Completed (X)	Level Achieved
Grade 4	1	Recall a definition for rate of reaction.		1 2 3 4 5 6 7 8
	2	Safely describe and follow a method to monitor rate of reaction.		1 2 3 4 5 6 7 8
	3	State the units for rate of reaction		1 2 3 4 5 6 7 8
Grade 6	4	Explain how there can be different units for measuring rate of reaction.		1 2 3 4 5 6 7 8
	5	Calculate the mean rate of reaction.		1 2 3 4 5 6 7 8
	6	Calculate the rate of reaction at a specific time.		1 2 3 4 5 6 7 8
Grade 8	7	Plot and use a graph to calculate the gradient to measure the initial rate of reaction.		1 2 3 4 5 6 7 8
	8	Justify a chosen method for a given reaction to monitor the rate of reaction.		1 2 3 4 5 6 7 8
	9	Explain why there is more than one unit for rate of reaction.		1 2 3 4 5 6 7 8

Level	Obj No	C8 Rates and equilibrium 8.2 Collision theory and surface area	Started (/) Completed (X)	Level Achieved
Grade 4	1	Describe how surface area of a solid can be increased.		1 2 3 4 5 6 7 8
	2	State that chemical reactions can only occur when a collision occurs with enough energy.		1 2 3 4 5 6 7 8
	3	List the factors that can affect the rate of a chemical reaction.		1 2 3 4 5 6 7 8
Grade 6	4	Use collision theory to explain how changing temperature alters the rate of reaction.		1 2 3 4 5 6 7 8
	5	Calculate mean rates of reaction.		1 2 3 4 5 6 7 8
Grade 8	6	Use collision theory to explain in detail how increasing surface area increases the rate of reaction.		1 2 3 4 5 6 7 8
	7	Use a graph to calculate the rate of reaction at specific times in a chemical reaction.		1 2 3 4 5 6 7 8
	8	Explain why many collisions do not lead to a chemical reaction.		1 2 3 4 5 6 7 8

Level	Obj No	C8 Rates and equilibrium 8.3 The effect of temperature	Started (/) Completed (X)	Level Achieved
Grade 4	1	Describe how temperature affects the rate of reaction.		1 2 3 4 5 6 7 8
	2	Safely complete an experiment on how temperature affects the rate of a reaction.		1 2 3 4 5 6 7 8
Grade 6	3	Use collision theory to explain how changing temperature alters the rate of reaction.		1 2 3 4 5 6 7 8
	4	Calculate mean rates of reaction.		1 2 3 4 5 6 7 8
Grade 8	5	Use a graph to calculate the rate of reaction at specific times in a chemical reaction.		1 2 3 4 5 6 7 8
	6	Calculate 1 / t and plot a graph with a more meaningful line of best fit.		1 2 3 4 5 6 7 8

Level	Obj No	C8 Rates and equilibrium 8.4 The effect of concentration and pressure	Started (/) Completed (X)	Level Achieved
Grade 4	1	Describe how changing concentration affects the rate of reaction.		1 2 3 4 5 6 7 8
	2	Describe how changing pressure affects the rate of gas phase reactions.		1 2 3 4 5 6 7 8
Grade 6	3	Use collision theory to explain how changing concentration or pressure alters the rate of reaction.		1 2 3 4 5 6 7 8
	4	Calculate mean rates of reaction.		1 2 3 4 5 6 7 8
	5	Explain how to change gas pressure.		1 2 3 4 5 6 7 8
Grade 8	6	Interpret a rate of reaction graph, including calculating the rate of reaction at specific times in a chemical reaction.		1 2 3 4 5 6 7 8
	7	Explain why changing pressure has no effect on the rate of reaction for some reactions.		1 2 3 4 5 6 7 8
	8	Justify quantitative predictions and evaluate in detail their investigation into the effect of concentration on rate of reaction.		1 2 3 4 5 6 7 8

Level	Obj No	C8 Rates and equilibrium 8.5 The effect of catalysts	Started (/) Completed (X)	Level Achieved
Grade 4	1	Define a catalyst		1 2 3 4 5 6 7 8
	2	Describe how adding a catalyst affects the rate of reaction.		1 2 3 4 5 6 7 8
	3	Describe and carry out a method to safely investigate which catalyst is best for a reaction.		1 2 3 4 5 6 7 8
Grade 6	4	Use collision theory to explain how adding a catalyst alters the rate of reaction.		1 2 3 4 5 6 7 8
	5	Explain, with an example, the industrial use of a catalyst.		1 2 3 4 5 6 7 8
	6	Calculate the mean rate of reaction.		1 2 3 4 5 6 7 8
Grade 8	7	Use a reaction profile diagram to explain in detail the effect of adding a catalyst.		1 2 3 4 5 6 7 8
	8	Justify the use of catalysts in industry and in household products.		1 2 3 4 5 6 7 8
	9	Explain what an enzyme is and how it works.		1 2 3 4 5 6 7 8

Level	Obj No	C8 Rates and equilibrium 8.6 Reversible reactions	Started (/) Completed (X)	Level Achieved
Grade 4	1	Define a reversible reaction.		1 2 3 4 5 6 7 8
	2	Write a word equation for a familiar reversible reaction.		1 2 3 4 5 6 7 8
	3	State an example of a reversible reaction.		1 2 3 4 5 6 7 8
Grade 6	4	Explain, using a familiar example, how a reaction can be reversible.		1 2 3 4 5 6 7 8
	5	Describe a familiar reversible reaction using a balanced symbol equation.		1 2 3 4 5 6 7 8
	6	Predict the observations of a familiar reversible reaction when the conditions are changed.		1 2 3 4 5 6 7 8
Grade 8	7	Describe an unfamiliar reversible reaction, using a balanced symbol equation with state symbols.		1 2 3 4 5 6 7 8
	8	Justify the use of reversible reactions in the lab and items available in the home.		1 2 3 4 5 6 7 8
	9	Justify the classification of a reaction as reversible.		1 2 3 4 5 6 7 8

Level	Obj No	C8 Rates and equilibrium 8.7 Energy and reversible reactions	Started (/) Completed (X)	Level Achieved
Grade 4	1	State whether a reversible reaction is exothermic or endothermic in the reverse direction if the forward direction is stated.		1 2 3 4 5 6 7 8
	2	Write a word equation for the reversible reaction of dehydration/hydration of copper		1 2 3 4 5 6 7 8
	3	sulfate.		1 2 3 4 5 6 7 8
Grade 6	4	Explain why the energy change in a reversible reaction is exothermic in one direction and endothermic in the reverse direction.		1 2 3 4 5 6 7 8
	5	Generate balanced symbol equations for reversible reactions from information provided.		1 2 3 4 5 6 7 8
	6	Make predictive observations of familiar reversible reactions when information is supplied.		1 2 3 4 5 6 7 8
Grade 8	7	Explain in detail the energy changes in an equilibrium system.		1 2 3 4 5 6 7 8
	8	Suggest and explain a simple laboratory test which could be completed using a reversible reaction.		1 2 3 4 5 6 7 8
	9	Make predictive observations of unfamiliar reversible reactions when information is supplied.		1 2 3 4 5 6 7 8

Level	Obj No	C8 Rates and equilibrium 8.8 Dynamic Equilibrium	Started (/) Completed (X)	Level Achieved
Grade 4	1	Define a dynamic equilibrium		1 2 3 4 5 6 7 8
	2	Describe a closed system		1 2 3 4 5 6 7 8
Grade 6	3	Describe how to achieve dynamic equilibrium.		1 2 3 4 5 6 7 8
	4	Describe how rate of the forward reaction compares to rate of the backward reaction in a dynamic equilibrium.		1 2 3 4 5 6 7 8
	5	(H) Describe Le Chatelier's Principle.		1 2 3 4 5 6 7 8
Grade 8	6	Explain dynamic equilibrium.		1 2 3 4 5 6 7 8
	7	(H)Explain why the concentration of chemicals in a dynamic equilibrium remains constant.		1 2 3 4 5 6 7 8
	8	(H)Predict the effect on the rate of forward and reverse reactions by applying the Le Chatelier's Principle when the conditions of a dynamic equilibrium are changed.		1 2 3 4 5 6 7 8

Level	Obj No	C8 Rates and equilibrium 8.9 Altering Conditions	Started (/) Completed (X)	Level Achieved
Grade 6	1	Explain how changing conditions for a system at dynamic equilibrium affects the rate of the forward and reverse reactions.		1 2 3 4 5 6 7 8
	2	Predict the effect on yield of changing temperature, concentration, or pressure I a given equilibrium system.		1 2 3 4 5 6 7 8
Grade 8	3	Explain why changing pressure has no effect on some systems.		1 2 3 4 5 6 7 8
	4	Justify, in detail, the compromise conditions chosen in given industrial processes.		1 2 3 4 5 6 7 8

Level	Obj No	C9 Crude oil and fuels 9.1 Hydrocarbons	Started (/) Completed (X)	Level Achieved
Grade 4	1	Describe the composition of crude oil.		1 2 3 4 5 6 7 8
	2	State a definition of a hydrocarbon.		1 2 3 4 5 6 7 8
	3	State a definition of an alkane.		1 2 3 4 5 6 7 8
Grade 6	4	Describe the process of cracking, including conditions.		1 2 3 4 5 6 7 8
	5	Generate a balanced symbol equation to describe cracking.		1 2 3 4 5 6 7 8
	6	Describe a chemical test to show an alkene is present.		1 2 3 4 5 6 7 8
Grade 8	7	Explain why fractional distillation is used to separate crude oil into fractions.		1 2 3 4 5 6 7 8
	8	Apply a general formula to generate a molecular formula and a displayed formula for a straight-chain alkane.		1 2 3 4 5 6 7 8
	9	Classify and justify the classification of a chemical as an alkane.		1 2 3 4 5 6 7 8

Level	Obj No	C9 Crude oil and fuels 9.2 Fractional distillation of oil	Started (/) Completed (X)	Level Achieved
Grade 4	1	Name the different fractions from crude oil.		1 2 3 4 5 6 7 8
	2	State a use for each fraction from crude oil.		1 2 3 4 5 6 7 8
Grade 6	3	Explain the differences between complete and incomplete combustion.		1 2 3 4 5 6 7 8
	4	Write balanced symbol equations for the complete and incomplete combustion of hydrocarbons.		1 2 3 4 5 6 7 8
	5	Explain how to test for the products of complete combustion.		1 2 3 4 5 6 7 8
Grade 8	6	Explain in detail how fractional distillation is used to separate crude oil into fractions.		1 2 3 4 5 6 7 8
	7	Explain how chain length affects the properties of crude oil fractions.		1 2 3 4 5 6 7 8
	8	Make predictions about the properties of crude oil fractions from the fraction's hydrocarbon chain length.		1 2 3 4 5 6 7 8

Level	Obj No	C9 Crude oil and fuels 9.3 Burning hydrocarbon fuels	Started (/) Completed (X)	Level Achieved
Grade 4	1	Define complete and incomplete combustion.		1 2 3 4 5 6 7 8
	2	Write a word equation to describe the complete combustion of a hydrocarbon.		1 2 3 4 5 6 7 8
	3	Write a word equation to describe the incomplete combustion of a hydrocarbon.		1 2 3 4 5 6 7 8
Grade 6	4	Describe how the trend in colour, viscosity, flammability, and boiling point changes as the length of the hydrocarbon chain changes.		1 2 3 4 5 6 7 8
	5	Describe how the properties of a fraction of crude oil make it appropriate for its use.		1 2 3 4 5 6 7 8
Grade 8	6	(H) Justify the use of a given fuel over another.		1 2 3 4 5 6 7 8
	7	Explain in detail how the production of carbon monoxide in incomplete combustion can be lethal.		1 2 3 4 5 6 7 8
	8	(H) Use balanced symbol equations to calculate amounts of reactants or products in a combustion reaction.		1 2 3 4 5 6 7 8

Level	Obj No	C9 Crude oil and fuels 9.4 Cracking hydrocarbons	Started (/) Completed (X)	Level Achieved
Grade 4	1	Define the process of cracking.		1 2 3 4 5 6 7 8
	2	Generate a word equation to describe cracking.		1 2 3 4 5 6 7 8
	3	Recognise and give examples of alkenes.		1 2 3 4 5 6 7 8
Grade 6	4	Describe how the trend in colour, viscosity, flammability, and boiling point changes as the length of the hydrocarbon chain changes.		1 2 3 4 5 6 7 8
	5	Describe how the properties of a fraction of crude oil make it appropriate for its use.		1 2 3 4 5 6 7 8
Grade 8	6	Use examples to explain the process of cracking and why it is so important to the petrochemical industry.		1 2 3 4 5 6 7 8
	7	Explain the similarities and differences between alkanes and alkenes.		1 2 3 4 5 6 7 8
	8	Explain, using balanced symbol equations, the reaction between bromine water and an alkene.		1 2 3 4 5 6 7 8

Level	Obj No	C10 Organic reactions	Started (/) Completed (X)	Level Achieved
		C10 Organic reactions		
Grade 4	1	State a definition of an alkene.		1 2 3 4 5 6 7 8
	2	Name the first four alkenes.		1 2 3 4 5 6 7 8
	3	State the product of a combustion and an addition reaction of an alkene.		1 2 3 4 5 6 7 8
Grade 6	4	Draw the displayed structural formulae for the first four alkenes.		1 2 3 4 5 6 7 8
	5	Draw the displayed structural formulae for the products of the addition reactions between alkenes and hydrogen, water (steam), or a halogen.		1 2 3 4 5 6 7 8
	6	Predict the word and balanced symbol equations for the complete combustion of an alkene when the number of carbon atoms is given.		1 2 3 4 5 6 7 8
Grade 8	7	Predict the word and balanced symbol equations to describe reactions between alkenes and hydrogen, water (steam), or a halogen.		1 2 3 4 5 6 7 8
	8	Compare and contrast the reactivity of alkanes and alkenes.		1 2 3 4 5 6 7 8
	9	Predict the general formula of an alkene.		1 2 3 4 5 6 7 8

Level	Obj No	C10 Organic reactions 10.2 Structures of alcohols, carboxylic acids, and esters	Started (/) Completed (X)	Level Achieved
Grade 4	1	Recognise the functional group in an alcohol and a carboxylic acid.		1 2 3 4 5 6 7 8
	2	Name for the first four primary alcohols and the first four carboxylic acids.		1 2 3 4 5 6 7 8
	3	Name ethyl ethanoate from its formula.		1 2 3 4 5 6 7 8
Grade 6	4	Classify an organic compound as an alcohol, a carboxylic acid, or an ester.		1 2 3 4 5 6 7 8
	5	Draw the structural and displayed formulae for the first four primary alcohols and the first four carboxylic acids.		1 2 3 4 5 6 7 8
	6	Draw the structural and displayed formulae for ethyl ethanoate.		1 2 3 4 5 6 7 8
Grade 8	7	Predict the word and balanced symbol equations to describe reactions between alkenes and hydrogen, water (steam), or a halogen.		1 2 3 4 5 6 7 8
	8	Compare and contrast the reactivity of alkanes and alkenes.		1 2 3 4 5 6 7 8
	9	Predict the general formula of an alkene.		1 2 3 4 5 6 7 8

Level	Obj No	C10 Organic reactions 10.3 Reactions and uses of alcohols	Started (/) Completed (X)	Level Achieved
Grade 4	1	State that fermentation can be used to make ethanol.		1 2 3 4 5 6 7 8
	2	List some chemical properties of the first four alcohols.		1 2 3 4 5 6 7 8
	3	Recognise the formula and structure of ethanol and state some of its uses.		1 2 3 4 5 6 7 8
Grade 6	4	Describe fermentation to make aqueous solutions of ethanol, including a word equation.		1 2 3 4 5 6 7 8
	5	Describe the reactions of alcohols, including using word equations.		1 2 3 4 5 6 7 8
	6	Explain the relationship between ethanol and ethanoic acid.		1 2 3 4 5 6 7 8
Grade 8	7	Explain why solutions of ethanol have a pH of 7.		1 2 3 4 5 6 7 8
	8	Describe complete combustion reactions of a range of alcohols using balanced symbol equations.		1 2 3 4 5 6 7 8
	9	Plan an investigation to determine the relative energy transferred to the surroundings by the combustion of different alcohols.		1 2 3 4 5 6 7 8

Level	Obj No	C10 Organic reactions 10.4 Carboxylic acids and esters	Started (/) Completed (X)	Level Achieved
Grade 4	1	Recognise a carboxylic acid from its name or formula.		1 2 3 4 5 6 7 8
	2	List some chemical properties of carboxylic acids.		1 2 3 4 5 6 7 8
	3	Describe an ester and state some uses of this class of compounds.		1 2 3 4 5 6 7 8
Grade 6	4	Describe why carboxylic acids are acidic.		1 2 3 4 5 6 7 8
	5	Use word equations to describe the reactions of carboxylic acids with metal carbonates and with alcohols.		1 2 3 4 5 6 7 8
	6	Describe how to make an ester.		1 2 3 4 5 6 7 8
Grade 8	7	Explain, using ionic equations, why carboxylic acids are weak acids.		1 2 3 4 5 6 7 8
	8	Predict the products of the reactions of a range of carboxylic acids with metal carbonates and with alcohols.		1 2 3 4 5 6 7 8
	9	Explain the term volatile in terms of molecular forces.		1 2 3 4 5 6 7 8

Level	Obj No	C11 Polymers 11.1 Addition polymerisation	Started (/) Completed (X)	Level Achieved
Grade 4	1	Define a monomer and a polymer.		1 2 3 4 5 6 7 8
	2	State some uses of poly(ethene) and poly(propene).		1 2 3 4 5 6 7 8
	3	Write a word equation for the formation of poly(ethene) and poly(propene).		1 2 3 4 5 6 7 8
Grade 6	4	Describe how monomers become polymers.		1 2 3 4 5 6 7 8
	5	Draw the monomer for an addition polymer when the structure of the polymer is given.		1 2 3 4 5 6 7 8
	6	Draw an addition polymer structure when the structure of the monomer is given.		1 2 3 4 5 6 7 8
Grade 8	7	Explain why monomers for addition polymers must be unsaturated.		1 2 3 4 5 6 7 8
	8	Explain the process of addition polymerisation in detail, including using balanced symbol equations and the concept of atom economy.		1 2 3 4 5 6 7 8
	9	Explain how the repeating unit of a polymer relates to the monomer.		1 2 3 4 5 6 7 8

Level	Obj No	C11 Polymers 11.2 Condensation polymerisation	Started (/) Completed (X)	Level Achieved
Grade 6	1	Describe condensation polymerisation.		1 2 3 4 5 6 7 8
	2	Draw a simplified structure of the monomers for a condensation polymer when the structure of the polymer is given.		1 2 3 4 5 6 7 8
	3	Draw a simplified structure of a condensation polymer when the structure of the monomers are given.		1 2 3 4 5 6 7 8
Grade 8	4	Predict the products of condensation polymerisation.		1 2 3 4 5 6 7 8
	5	Explain the process of condensation polymerisation in detail, including using equations.		1 2 3 4 5 6 7 8
	6	Compare and contrast in detail, giving appropriate examples, the two methods of polymerisation.		1 2 3 4 5 6 7 8

Level	Obj No	C11 Polymers 11.3 Natural polymers	Started (/) Completed (X)	Level Achieved
Grade 4	1	State an example of a natural polymer.		1 2 3 4 5 6 7 8
	2	Describe the relationship between sugar as a monomer and starch or cellulose as a polymer.		1 2 3 4 5 6 7 8
	3	Describe the relationship between amino acids as a monomer and protein as a polymer.		1 2 3 4 5 6 7 8
Grade 6	4	Identify the monomer from the structural formula of a polymer.		1 2 3 4 5 6 7 8
	5	(H) Describe the structure of an amino acid.		1 2 3 4 5 6 7 8
Grade 8	6	(H) Predict the products of condensation polymerisation using natural monomers.		1 2 3 4 5 6 7 8
	7	Explain in detail the process of condensation polymerisation with natural monomers, including using equations.		1 2 3 4 5 6 7 8
	8	(H) Explain how amino acids react together in an acid–base reaction.		1 2 3 4 5 6 7 8

Level	Obj No	C11 Polymers 11.4 DNA	Started (/) Completed (X)	Level Achieved
Grade 4	1	State that DNA is an example of a natural polymer.		1 2 3 4 5 6 7 8
	2	State what DNA stands for.		1 2 3 4 5 6 7 8
	3	Name the type of monomers used to make DNA.		1 2 3 4 5 6 7 8
Grade 6	4	Describe the main structure of DNA.		1 2 3 4 5 6 7 8
	5	Describe the importance of DNA for living systems.		1 2 3 4 5 6 7 8
	6	Sketch the shape of a DNA strand.		1 2 3 4 5 6 7 8
Grade 8	7	Explain the shape of the DNA polymer.		1 2 3 4 5 6 7 8
	8	Explain how nucleotides form DNA.		1 2 3 4 5 6 7 8
	9	Explain the purpose of DNA.		1 2 3 4 5 6 7 8

Level	Obj No	C12 Chemical analysis 12.1 Pure substances and mixtures	Started (/) Completed (X)	Level Achieved
Grade 4	1	State what a pure substance is.		1 2 3 4 5 6 7 8
	2	Describe how melting point and boiling point data can be used to identify pure substances.		1 2 3 4 5 6 7 8
	3	State what a formulation is.		1 2 3 4 5 6 7 8
Grade 6	4	Describe the difference between pure substances, impure substances, and formulations.		1 2 3 4 5 6 7 8
	5	Explain how melting point and boiling point data can be used to determine the purity of a substance.		1 2 3 4 5 6 7 8
	6	State uses of formulations.		1 2 3 4 5 6 7 8
Grade 8	7	Justify the classification of pure substances, impure substances, and formulations when data is supplied.		1 2 3 4 5 6 7 8
	8	Explain in detail the use of formulations.		1 2 3 4 5 6 7 8
	9	Calculate percentage composition of components in a range of formulations.		1 2 3 4 5 6 7 8

Level	Obj No	C12 Chemical analysis 12.2 Analysing chromatograms	Started (/) Completed (X)	Level Achieved
Grade 4	1	Describe and safely carry out a method to make a paper chromatogram.		1 2 3 4 5 6 7 8
	2	Describe how to calculate Rf values.		1 2 3 4 5 6 7 8
	3	Describe a use of chromatography.		1 2 3 4 5 6 7 8
Grade 6	4	Explain how chromatography separates solutes.		1 2 3 4 5 6 7 8
	5	Calculate Rf values from given data.		1 2 3 4 5 6 7 8
	6	Use a chromatogram to determine if a sample is pure or impure.		1 2 3 4 5 6 7 8
Grade 8	7	Explain why different substances and different conditions will have different Rf values.		1 2 3 4 5 6 7 8
	8	Calculate Rf values from a chromatogram, using an appropriate number of significant figures.		1 2 3 4 5 6 7 8
	9	Interpret a chromatogram to identify unknown substances.		1 2 3 4 5 6 7 8

Level	Obj No	C12 Chemical analysis 12.3 Testing for gases	Started (/) Completed (X)	Level Achieved
Grade 4	1	Safely carry out the laboratory test for hydrogen, oxygen, carbon dioxide, and chlorine.		1 2 3 4 5 6 7 8
	2	Describe how to safely carry out the laboratory test for chlorine gas.		1 2 3 4 5 6 7 8
	3	Identify hydrogen, carbon dioxide, and oxygen from a laboratory test.		1 2 3 4 5 6 7 8
Grade 6	4	Explain why limewater turns milky when it reacts with carbon dioxide.		1 2 3 4 5 6 7 8
	5	Interpret results to identify a gas that is present.		1 2 3 4 5 6 7 8
	6	Explain why hydrogen 'pops' near a naked flame.		1 2 3 4 5 6 7 8
Grade 8	7	Write balanced symbol equations, including state symbols, for the reactions of limewater with carbon dioxide and hydrogen with oxygen.		1 2 3 4 5 6 7 8
	8	Explain why a glowing splint re-ignites in oxygen.		1 2 3 4 5 6 7 8
	9	Explain why chlorine gas turns damp indicator paper colourless.		1 2 3 4 5 6 7 8

Level	Obj No	C12 Chemical analysis 12.4 Tests for positive ions	Started (/) Completed (X)	Level Achieved
Grade 4	1	Safely carry out a flame test.		1 2 3 4 5 6 7 8
	2	Safely carry out testing for metal ions using sodium hydroxide.		1 2 3 4 5 6 7 8
	3	Write a word equation for the reaction between sodium hydroxide and a specified metal salt solution.		1 2 3 4 5 6 7 8
Grade 6	4	Identify a metal ion from the colour of a flame or the colour of the hydroxide precipitate.		1 2 3 4 5 6 7 8
	5	Write balanced symbol equations, including state symbols, for the production of an insoluble metal hydroxide.		1 2 3 4 5 6 7 8
	6	Explain why a flame test cannot be used to identify a mixture of metal solutions.		1 2 3 4 5 6 7 8
Grade 8	7	Evaluate flame tests as a method for identifying of positive metal ions.		1 2 3 4 5 6 7 8
	8	(H) Write balanced ionic equations, including state symbols for the production of an insoluble metal hydroxide.		1 2 3 4 5 6 7 8
	9	Explain why iron(II) hydroxide solution often changes colour when it stands in air.		1 2 3 4 5 6 7 8

Level	Obj No	C12 Chemical analysis 12.5 Tests for negative ions	Started (/) Completed (X)	Level Achieved
Grade 4	1	Safely carry out testing for carbonates, halides, and sulfate ions.		1 2 3 4 5 6 7 8
	2	Write a word equation for the reaction when a specific carbonate, halide, or		1 2 3 4 5 6 7 8
	3	sulfate is being tested with support.		1 2 3 4 5 6 7 8
Grade 6	4	Identify the presence of carbonate, a specific halide, or sulfate ions from simple laboratory tests.		1 2 3 4 5 6 7 8
	5	Write balanced symbol equations, including state symbols for the reactions in the simple laboratory tests for carbonate, halide, or sulfate ions.		1 2 3 4 5 6 7 8
	6	Explain why it can be difficult to identify halides using this method.		1 2 3 4 5 6 7 8
Grade 8	7	Evaluate the halide ion test.		1 2 3 4 5 6 7 8
	8	Write balanced ionic equations, including state symbols, for simple laboratory tests for carbonate, halide, or sulfate ions.		1 2 3 4 5 6 7 8
	9	Explain in detail how to identify a compound from the results of simple laboratory tests.		1 2 3 4 5 6 7 8

Level	Obj No	C12 Chemical analysis 12.6 Instrumental analysis	Started (/) Completed (X)	Level Achieved
Grade 4	1	List some of the advantages and disadvantages of instrumental techniques.		1 2 3 4 5 6 7 8
	2	State an example of an instrumental technique.		1 2 3 4 5 6 7 8
	3	State a use for flame emission spectroscopy.		1 2 3 4 5 6 7 8
Grade 6	4	Compare and contrast instrumental techniques with simple laboratory tests.		1 2 3 4 5 6 7 8
	5	Describe the main processes of flame emission spectroscopy.		1 2 3 4 5 6 7 8
	6	Explain how flame emission spectroscopy is an improvement on flame tests.		1 2 3 4 5 6 7 8
Grade 8	7	Evaluate the use of instrumental techniques.		1 2 3 4 5 6 7 8
	8	Explain how metal ions emit light when in a flame.		1 2 3 4 5 6 7 8
	9	Interpret results from flame emission spectroscopy when data is given.		1 2 3 4 5 6 7 8

Level	Obj No	C13 The Earth's atmosphere 13.1 History of our atmosphere	Started (/) Completed (X)	Level Achieved
Grade 4	1	Describe the Earth's early atmosphere.		1 2 3 4 5 6 7 8
	2	Describe how oxygen was formed in the development of the atmosphere.		1 2 3 4 5 6 7 8
Grade 6	3	State the composition, including formulae, of the Earth's early atmosphere.		1 2 3 4 5 6 7 8
	4	Describe a theory for the development of the Earth's atmosphere.		1 2 3 4 5 6 7 8
	5	Explain, using word equations, how gases were formed in the atmosphere and how oceans were formed.		1 2 3 4 5 6 7 8
Grade 8	6	Use a theory to explain in detail how the atmosphere developed.		1 2 3 4 5 6 7 8
	7	Explain the limits of the theory for the development of the Earth's atmosphere and why it has changed.		1 2 3 4 5 6 7 8
	8	Use balanced symbol equations to explain how gases were formed in the atmosphere and explain how oceans were formed.		1 2 3 4 5 6 7 8

Level	Obj No	C13 The Earth's atmosphere 13.2 Our evolving atmosphere	Started (/) Completed (X)	Level Achieved
Grade 4	1	State that the levels of carbon dioxide have decreased in the atmosphere.		1 2 3 4 5 6 7 8
	2	List the names and symbols of the gases in dry air.		1 2 3 4 5 6 7 8
	3	State where methane and ammonia in the atmosphere may have come from.		1 2 3 4 5 6 7 8
Grade 6	4	Describe how the proportion of carbon dioxide in the early atmosphere was reduced.		1 2 3 4 5 6 7 8
	5	State the composition of dry air.		1 2 3 4 5 6 7 8
	6	Use word equations to show how carbon dioxide can form sedimentary rocks.		1 2 3 4 5 6 7 8
Grade 8	7	Use a theory to explain in detail how the early atmosphere developed to form the atmosphere today.		1 2 3 4 5 6 7 8
	8	Explain why the composition of the Earth's atmosphere has not changed much for 200 million years.		1 2 3 4 5 6 7 8
	9	Use balanced symbol equations to explain how carbon dioxide forms sedimentary rock and how methane and ammonia were removed from the atmosphere.		1 2 3 4 5 6 7 8

Level	Obj No	C13 The Earth's atmosphere 13.3 Greenhouse gases	Started (/) Completed (X)	Level Achieved
Grade 4	1	Describe the greenhouse effect.		1 2 3 4 5 6 7 8
	2	Name three greenhouse gases		1 2 3 4 5 6 7 8
	3	State some human activities that affect the proportion of greenhouse gases in the atmosphere.		1 2 3 4 5 6 7 8
Grade 6	4	Explain the greenhouse effect		1 2 3 4 5 6 7 8
	5	Explain how greenhouse gases increase the temperature of the atmosphere.		1 2 3 4 5 6 7 8
	6	Explain how human activity can change the proportion of greenhouse gases in the atmosphere.		1 2 3 4 5 6 7 8
Grade 8	7	Justify why scientists, as well as the public, disagree about the cause of climate change.		1 2 3 4 5 6 7 8
	8	Explain the difference between global warming and the greenhouse effect.		1 2 3 4 5 6 7 8
	9	Evaluate evidence to suggest if global warming is man-made or natural.		1 2 3 4 5 6 7 8

Level	Obj No	C13 The Earth's atmosphere 13.4 Global climate change	Started (/) Completed (X)	Level Achieved
Grade 4	1	List some of the possible outcomes of climate change.		1 2 3 4 5 6 7 8
	2	State a definition for carbon footprint.		1 2 3 4 5 6 7 8
	3	List some ways to reduce a carbon footprint.		1 2 3 4 5 6 7 8
Grade 6	4	Explain the possible effects of global climate change and why they are difficult to predict.		1 2 3 4 5 6 7 8
	5	Explain possible methods to reduce greenhouse gas emissions.		1 2 3 4 5 6 7 8
	6	Explain some of the problems in trying to reduce greenhouse gas emissions.		1 2 3 4 5 6 7 8
Grade 8	7	Evaluate the scale, risk, and environmental impact of global climate change.		1 2 3 4 5 6 7 8
	8	Justify why reducing greenhouse gas emissions can be difficult to achieve.		1 2 3 4 5 6 7 8
	9	Evaluate the use of products, services, or events in terms of their carbon footprint.		1 2 3 4 5 6 7 8

Level	Obj No	C13 The Earth's atmosphere 13.5 Atmospheric pollutants	Started (/) Completed (X)	Level Achieved
Grade 4	1	List some atmospheric pollutants.		1 2 3 4 5 6 7 8
	2	Describe how carbon monoxide and soot (carbon) can be made from the		1 2 3 4 5 6 7 8
	3	Complete word equations to describe how atmospheric pollutants can be made.		1 2 3 4 5 6 7 8
Grade 6	4	Explain how sulfur dioxide and nitrogen oxides are made when fossil fuels are combusted.		1 2 3 4 5 6 7 8
	5	Describe the health impacts of atmospheric pollutants.		1 2 3 4 5 6 7 8
	6	Use balanced symbol equations to show how atmospheric pollutants are formed.		1 2 3 4 5 6 7 8
Grade 8	7	Predict the products of combustion of a fuel given appropriate information about the composition of the fuel and the conditions in which it is used.		1 2 3 4 5 6 7 8
	8	Evaluate the negative social, economic, and environmental consequences of atmospheric pollution.		1 2 3 4 5 6 7 8
	9	Suggest and explain methods to reduce atmospheric pollution.		1 2 3 4 5 6 7 8

Level	Obj No	C14 The Earth's resources 14.1 Finite and renewable resources	Started (/) Completed (X)	Level Achieved
Grade 4	1	List some human uses of the Earth's resources.		1 2 3 4 5 6 7 8
	2	Give examples of a finite and a renewable resource.		1 2 3 4 5 6 7 8
	3	State an example of a natural product that is supplemented or replaced by		1 2 3 4 5 6 7 8
Grade 6	4	Describe and classify a resource as finite or renewable when information is given.		1 2 3 4 5 6 7 8
	5	Explain the use of natural, sustainable, and finite resources.		1 2 3 4 5 6 7 8
	6	Interpret information from different formats including graphs, charts, tables, and prose.		1 2 3 4 5 6 7 8
Grade 8	7	Understand data and interpret information using orders of magnitude to compare.		1 2 3 4 5 6 7 8
	8	Explain the role of chemistry in improving agricultural and industrial processes.		1 2 3 4 5 6 7 8
	9	Draw conclusions consistent with information provided from graphs, charts, tables, and prose and evaluate the validity of the data.		1 2 3 4 5 6 7 8

Level	Obj No	C14 The Earth's resources 14.2 Water safe to drink	Started (/) Completed (X)	Level Achieved
Grade 4	1	Describe why potable water is important.		1 2 3 4 5 6 7 8
	2	List the key processes to make drinking water.		1 2 3 4 5 6 7 8
	3	Safely distill salty water		1 2 3 4 5 6 7 8
Grade 6	4	Explain why the method of obtaining potable water depends on the local conditions.		1 2 3 4 5 6 7 8
	5	Explain reasons for filtration and sterilisation in water treatment.		1 2 3 4 5 6 7 8
	6	Describe and explain in detail how to safely distil salty water.		1 2 3 4 5 6 7 8
Grade 8	7	Explain the difference between pure water and potable water.		1 2 3 4 5 6 7 8
	8	Justify the choice of potable water supply in a given scenario.		1 2 3 4 5 6 7 8
	9	Explain in detail why desalination is not often used to generate safe clean		1 2 3 4 5 6 7 8

Level	Obj No	C14 The Earth's resources 14.3 Treating waste water	Started (/) Completed (X)	Level Achieved
Grade 4	1	List what is removed from waste water before it can be released.		1 2 3 4 5 6 7 8
	2	State the main processes in sewage treatment.		1 2 3 4 5 6 7 8
	3	State uses of sewage slurry.		1 2 3 4 5 6 7 8
Grade 6	4	Explain why waste water should be treated before it is released into the environment.		1 2 3 4 5 6 7 8
	5	Describe the main processes in sewage treatment.		1 2 3 4 5 6 7 8
	6	Explain uses of sewage slurry.		1 2 3 4 5 6 7 8
Grade 8	7	Evaluate the ease of obtaining potable water from waste, ground, or salt water.		1 2 3 4 5 6 7 8
	8	Explain in detail how and why waste water is processed before it is released		1 2 3 4 5 6 7 8

Level	Obj No	C14 The Earth's resources 14.4 Extracting metals from ores	Started (/) Completed (X)	Level Achieved
Grade 6	1	Describe the processes of phytomining and bioleaching.		1 2 3 4 5 6 7 8
	2	Write balanced symbol equations to explain metal extraction techniques.		1 2 3 4 5 6 7 8
	3	Explain the need for new ways of extracting metals (in particular copper).		1 2 3 4 5 6 7 8
Grade 8	4	Explain in detail how phytomining and bioleaching extract metals.		1 2 3 4 5 6 7 8
	5	Write ionic equations to explain metal extraction techniques and identify the		1 2 3 4 5 6 7 8
	6	Evaluate biological methods of metal extraction.		1 2 3 4 5 6 7 8

Level	Obj No	C14 The Earth's resources 14.5 Life Cycle Assessments	Started (/) Completed (X)	Level Achieved
Grade 4	1	State the different stages of an LCA in the correct order.		1 2 3 4 5 6 7 8
	2	Carry out an LCA for shopping bags made from plastic or paper		1 2 3 4 5 6 7 8
Grade 6	3	Explain the importance of LCA and how it can be misused.		1 2 3 4 5 6 7 8
	4	Carry out LCAs for different products when data is supplied.		1 2 3 4 5 6 7 8
Grade 8	5	Explain the limits of LCAs.		1 2 3 4 5 6 7 8
	6	Evaluate products in detail using LCAs.		1 2 3 4 5 6 7 8

Level	Obj No	C14 The Earth's resources 14.6 Reduce, reuse, and recycle	Started (/) Completed (X)	Level Achieved
Grade 4	1	List some products that can be reused or recycled.		1 2 3 4 5 6 7 8
	2	Describe how metal can be reused and recycled.		1 2 3 4 5 6 7 8
	3	Describe how glass can be reused and recycled.		1 2 3 4 5 6 7 8
Grade 6	4	Explain the importance of reusing and recycling products.		1 2 3 4 5 6 7 8
	5	Explain why some recycling can be difficult.		1 2 3 4 5 6 7 8
	6	Evaluate ways of reducing the use of limited resources when information is		1 2 3 4 5 6 7 8
Grade 8	7	Evaluate the environmental, economic, and social impacts of reusing and recycling products.		1 2 3 4 5 6 7 8
	8	Evaluate ways of reducing the use of limited resources.		1 2 3 4 5 6 7 8
	9	Suggest ways of minimising the environmental impact of exploiting raw materials.		1 2 3 4 5 6 7 8

Level	Obj No	C15 Using our resources 15.1 Rusting	Started (/) Completed (X)	Level Achieved
Grade 4	1	Define the term corrosion		1 2 3 4 5 6 7 8
	2	State what is required for iron to rust.		1 2 3 4 5 6 7 8
	3	List some ways to prevent rusting.		1 2 3 4 5 6 7 8
Grade 6	4	Describe an experiment to investigate the conditions required for rusting to occur.		1 2 3 4 5 6 7 8
	5	With the help of equations, describe the process of rusting.		1 2 3 4 5 6 7 8
	6	Explain how different corrosion prevention techniques work.		1 2 3 4 5 6 7 8
Grade 8	7	Explain in detail why corrosion is a problem.		1 2 3 4 5 6 7 8
	8	Write balanced equations to describe rusting and identify species that are oxidised and reduced.		1 2 3 4 5 6 7 8
	9	Evaluate rust prevention techniques and suggest which is best for a specific purpose.		1 2 3 4 5 6 7 8

Level	Obj No	C15 Using our resources 15.2 Useful alloys	Started (/) Completed (X)	Level Achieved
Grade 4	1	State the difference between a metal before and after being alloyed.		1 2 3 4 5 6 7 8
	2	State the elements in steel and bronze.		1 2 3 4 5 6 7 8
	3	List some common examples of alloys and their uses.		1 2 3 4 5 6 7 8
Grade 6	4	Explain in detail why pure metals are often alloyed before they are used.		1 2 3 4 5 6 7 8
	5	Sdescribe how different amounts of carbon affect the properties of iron.		1 2 3 4 5 6 7 8
	6	Identify an appropriate purpose for an alloy when given data on its properties.		1 2 3 4 5 6 7 8
Grade 8	7	Explain the term carat.		1 2 3 4 5 6 7 8
	8	Use data on the properties of unfamiliar alloys to explain a suitable alloy for a given purpose.		1 2 3 4 5 6 7 8
	9	Evaluate an alloy in terms of its properties and uses.		1 2 3 4 5 6 7 8

Level	Obj No	C15 Using our resources 15.3 Properties of polymers	Started (/) Completed (X)	Level Achieved
Grade 4	1	Describe the properties of a thermosetting plastic.		1 2 3 4 5 6 7 8
	2	Describe the properties of a thermosoftening plastic.		1 2 3 4 5 6 7 8
	3	Describe the difference between LD and HD poly(ethene).		1 2 3 4 5 6 7 8
Grade 6	4	Explain how thermosetting plastics and thermosoftening plastics are different in terms of structure and bonding.		1 2 3 4 5 6 7 8
	5	Describe the different conditions used to make poly(ethene).		1 2 3 4 5 6 7 8
	6	Epxlain how the structure of poly(ethene) affects its properties and therefore its uses.		1 2 3 4 5 6 7 8
Grade 8	7	Explain in detail, giving examples, how the properties of plastics can be changed.		1 2 3 4 5 6 7 8
	8	When data about the properties of plastics is give, suggest a suitable plastic for a given purpose.		1 2 3 4 5 6 7 8
	9	Evaluate a plastic in terms of its properties and uses.		1 2 3 4 5 6 7 8

Level	Obj No	C15 Using our resources 15.4 Glass, ceramic, and composites	Started (/) Completed (X)	Level Achieved
Grade 4	1	Describe how to make soda-lime glass and borosilicate glass.		1 2 3 4 5 6 7 8
	2	Describe how to make clay ceramics.		1 2 3 4 5 6 7 8
	3	State examples of clay ceramics and composites.		1 2 3 4 5 6 7 8
Grade 6	4	Describe what a composite is.		1 2 3 4 5 6 7 8
	5	Explain the difference between a composite and an advanced composite.		1 2 3 4 5 6 7 8
	6	Compare quanitatively the physical properties of glass and clay ceramics, polymers, composites, and metals.		1 2 3 4 5 6 7 8
Grade 8	7	Explain the properties of ceramics and composites in terms of structure and bonding.		1 2 3 4 5 6 7 8
	8	When data about the properties of a material is provided, classify it and suggest a suitable material for a given purpose.		1 2 3 4 5 6 7 8
	9	Evaluate materials in terms of their properties and uses.		1 2 3 4 5 6 7 8

Level	Obj No	C15 Using our resources 15.5 Making ammonia – the Haber process	Started (/) Completed (X)	Level Achieved
Grade 4	1	State the purpose of the Haber process.		1 2 3 4 5 6 7 8
	2	State the conditions for the Haber process.		1 2 3 4 5 6 7 8
	3	Write a word equation to describe the Haber process.		1 2 3 4 5 6 7 8
Grade 6	4	Describe how the raw materials are turned into the reactants for the Haber process.		1 2 3 4 5 6 7 8
	5	Describe how the Haber process is a reversible reaction.		1 2 3 4 5 6 7 8
	6	Describe the Haber process with the help of a balance symbol equation including state symbols.		1 2 3 4 5 6 7 8
Grade 8	7	Evlauate the Haber process using atom economy and LCA to determine its environmental impact.		1 2 3 4 5 6 7 8
	8	Explain how costs are kept to a minimum in the Haber process.		1 2 3 4 5 6 7 8
	9	Explain, with the use of balanced symbol equations, where the reactants come from for the Haber process.		1 2 3 4 5 6 7 8

Level	Obj No	C15 Using our resources 15.6 The economics of the Haber process	Started (/) Completed (X)	Level Achieved
Grade 6	1	Explain the effect of changing temperature on the yield of the Haber process.		1 2 3 4 5 6 7 8
	2	Explain the effect of changing pressure on the yield of the Haber process.		1 2 3 4 5 6 7 8
	3	Explain why the conditions used in the Haber process are a compromise.		1 2 3 4 5 6 7 8
Grade 8	4	Justify why the conditions used in the Haber process are a compromise.		1 2 3 4 5 6 7 8
	5	Explain the effect of an iron catalyst on the rate and position of equilibrium in the Haber process.		1 2 3 4 5 6 7 8
	6	Use data to predict and explain the effect on the equilibrium and rate of reaction of changing conditions in the Haber process.		1 2 3 4 5 6 7 8

Level	Obj No	C15 Using our resources 15.7 Making fertilisers in the lab	Started (/) Completed (X)	Level Achieved
Grade 4	1	State what a fertiliser is.		1 2 3 4 5 6 7 8
	2	Identify the fertiliser produced from a reaction.		1 2 3 4 5 6 7 8
	3	Write a word equation for the formation of the chemicals in NPK fertiliser.		1 2 3 4 5 6 7 8
Grade 6	4	Explain the importance of fertilisers for agriculture.		1 2 3 4 5 6 7 8
	5	Describe in detal how fertilisers are produced in the laboratory.		1 2 3 4 5 6 7 8
	6	Write balanced symbol equations for the reactions to make components of NPK fertilisers.		1 2 3 4 5 6 7 8
Grade 8	7	Evaluate the importance of fertilisers for agriculture.		1 2 3 4 5 6 7 8
	8	Write ionic equations for reactions to make fertilisers.		1 2 3 4 5 6 7 8
	9	Calculate the concentration of an ammonia solution from the results of a titration.		1 2 3 4 5 6 7 8

Level	Obj No	C15 Using our resources 15.8 Making fertilisers in industry	Started (/) Completed (X)	Level Achieved
Grade 4	1	Name the elements in NPK fertilisers.		1 2 3 4 5 6 7 8
	2	Describe where the raw materials for NPK fertilisers come from.		1 2 3 4 5 6 7 8
	3	Name and give formulae of the chemicals in NPK fertilisers.		1 2 3 4 5 6 7 8
Grade 6	4	Describe production of fertilisers in industry.		1 2 3 4 5 6 7 8
	5	Compare and contrast the industrial and laboratory production of fertilisers.		1 2 3 4 5 6 7 8
	6	Write balanced symbol equations for the reactions to make components of NPK fertilisers.		1 2 3 4 5 6 7 8
Grade 8	7	Evaluate the composition of fertilisers.		1 2 3 4 5 6 7 8
	8	Evaluate different processes to make NPK fertilisers.		1 2 3 4 5 6 7 8
	9	Write ionic equations to illustrate the reactions to make NPK fertilisers.		1 2 3 4 5 6 7 8