ISAAC NEWTON ACADEMY

SCIENCE

AQA

AQA Chemistry (Triple)

Specification Checklists

Name: ___________________________

Teacher: ___________________________

Can you…?	☺	😐	☹
Paper 1 - 4.1 Atomic structure and the periodic table			
4.1.1 A simple model of the atom, symbols, relative atomic mass, electronic charge and isotopes			
use the names and symbols of the first 20 elements in the periodic table, the elements in Groups 1 and 7, and other elements in this specification			
name compounds of these elements from given formulae or symbol equations			
write word equations for the reactions in this specification			
write formulae and balanced chemical equations for the reactions in this specification			
describe, explain and give examples of the specified processes of separation			
suggest suitable separation and purification techniques for mixtures when given appropriate information			
why the new evidence from the scattering experiment led to a change in the atomic model			
the difference between the plum pudding model of the atom and the nuclear model of the atom			
use the nuclear model to describe atoms			
calculate the numbers of protons, neutrons and electrons in an atom or ion, given its atomic number and mass number			
relate size and scale of atoms to objects in the physical world			
calculate the relative atomic mass of an element given the percentage abundance of its isotopes			
represent the electronic structures of the first twenty elements of the periodic table in numbers or diagrams			
4.1.2 The periodic table			
explain how the position of an element in the periodic table is related to the arrangement of electrons in its atoms and hence to its atomic number			
predict possible reactions and probable reactivity of elements from their positions in the periodic table			
describe the steps in the development of the periodic table			
explain the differences between metals and non-metals on the basis of their characteristic physical and chemical properties			
explain how the atomic structure of metals and non-metals relates to their position in the periodic table			
explain how the reactions of elements are related to the arrangement of electrons in their atoms and hence to their atomic number			
explain how properties of the elements in Group 0 depend on the outer shell of electrons of the atoms			
predict properties from given trends down the group			
explain how properties of the elements in Group 1 depend on the outer shell of electrons of the atoms			
predict properties from given trends down the group			
explain how properties of the elements in Group 7 depend on the outer shell of electrons of the atoms			
predict properties from given trends down the group			
4.1.3 Properties of transition metals (chemistry only)			
describe the difference compared with Group 1 in melting points, densities, strength, hardness and reactivity with oxygen, water and halogens			
exemplify these general properties by reference to Cr, Mn, Fe, Co, Ni, Cu			
transition elements have ions with different charges, form coloured compounds and are useful as catalysts			
exemplify these general properties by reference to compounds of Cr, Mn, Fe, Co, Ni, Cu			

Can you…?	☺	😐	☹
Paper 1 - 4.2 Bonding, structure, and the properties of matter			
4.2.1 Chemical bonds, ionic, covalent and metallic			
explain chemical bonding in terms of electrostatic forces and the transfer or sharing of electrons			
draw dot and cross diagrams for ionic compounds formed by metals in Groups 1 and 2 with non-metals in Groups 6 and 7			
work out the charge on the ions of metals and non-metals from the group number of the element, limited to the metals in Groups 1 and 2, and non-metals in Groups 6 and 7			
deduce that a compound is ionic from a diagram of its structure in one of the specified forms			
describe the limitations of using dot and cross, ball and stick, two and three-dimensional diagrams to represent a giant ionic structure			
work out the empirical formula of an ionic compound from a given model or diagram that shows the ions in the structure			
recognise common substances that consist of small molecules from their chemical formula			
draw dot and cross diagrams for the molecules of hydrogen, chlorine, oxygen, nitrogen, hydrogen chloride, water, ammonia and methane			
represent the covalent bonds in small molecules, in the repeating units of polymers and in part of giant covalent structures, using a line to represent a single bond			
describe the limitations of using dot and cross, ball and stick, two and three-dimensional diagrams to represent molecules or giant structures			
deduce the molecular formula of a substance from a given model or diagram in these forms showing the atoms and bonds in the molecule			
Recognise substances as metallic giant structures from diagrams showing their bonding			
4.2.2 How bonding and structure are related to the properties of substances			
predict the states of substances at different temperatures given appropriate data			
explain the different temperatures at which changes of state occur in terms of energy transfers and types of bonding			
recognise that atoms themselves do not have the bulk properties of materials			
(HT only) explain the limitations of the particle theory in relation to changes of state when particles are represented by solid inelastic spheres which have no forces between them			
include appropriate state symbols in chemical equations for the reactions in this specification			
describe the bonding in ionic structures and link this bonding to melting and boiling points and conductivity			
describe the bonding in simple covalent structures and link this bonding to melting and boiling points and conductivity			
use the idea that intermolecular forces are weak compared with covalent bonds to explain the bulk properties of molecular substances			
recognise polymers from diagrams showing their bonding and structure			
4.2.3 Structure and bonding of carbon			
Recognise giant covalent structures from diagrams showing their bonding and structure			
describe the bonding in giant covalent structures (diamond, graphite, graphene, fullerenes) and link this bonding to melting and boiling points and conductivity			
recognise graphene and fullerenes from diagrams and descriptions of their bonding and structure			
give examples of the uses of fullerenes, including carbon nanotubes			
explain why alloys are harder than pure metals in terms of distortion of the layers of atoms in the structure of a pure metal			
describe the bonding in metallic structures and link this bonding to melting and boiling points and conductivity			

4.2.4 Bulk and surface properties of matter including nanoparticles (chemistry only)			
compare 'nano' dimensions to typical dimensions of atoms and molecules			
given appropriate information, evaluate the use of nanoparticles for a specified purpose			
explain that there are possible risks associated with the use of nanoparticles			

Can you…?	☺	😐	☹
Paper 1 - 4.3 Quantitative chemistry			
4.3.1 Chemical measurements, conservation of mass and the quantitative interpretation of chemical equations			
understand the use of the multipliers in equations in normal script before a formula and in subscript within a formula			
calculate relative formula mass			
explain any observed changes in mass in non-enclosed systems during a chemical reaction given the balanced symbol equation for the reaction and explain these changes in terms of the particle mode			
represent the distribution of results and make estimations of uncertainty			
use the range of a set of measurements about the mean as a measure of uncertainty			
4.3.2 Use of amount of substance in relation to masses of pure substances			
(HT) understand that the measurement of amounts in moles can apply to atoms, molecules, ions, electrons, formulae and equations, for example that in one mole of carbon (C) the number of atoms is the same as the number of molecules in one mole of carbon dioxide (CO2).			
(HT) use the relative formula mass of a substance to calculate the number of moles in a given mass of that substance and vice versa			
(HT) calculate the masses of substances shown in a balanced symbol equation			
(HT) calculate the masses of reactants and products from the balanced symbol equation and the mass of a given reactant or product			
(HT) balance an equation given the masses of reactants and products			
(HT) change the subject of a mathematical equation.			
(HT) explain the effect of a limiting quantity of a reactant on the amount of products it is possible to obtain in terms of amounts in moles or masses in grams			
calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution			
(HT only) explain how the mass of a solute and the volume of a solution is related to the concentration of the solution			
4.3.3 Yield and atom economy of chemical reactions (chemistry only)			
calculate the percentage yield of a product from the actual yield of a reaction			
(HT only) calculate the theoretical mass of a product from a given mass of reactant and the balanced equation for the reaction			
calculate the atom economy of a reaction to form a desired product from the balanced equation			
(HT only) explain why a particular reaction pathway is chosen to produce a specified product given appropriate data such as atom economy (if not calculated), yield, rate, equilibrium position and usefulness of by-products			
4.3.4 Using concentrations of solutions in mol/dm3 (chemistry only) (HT only)			
explain how the concentration of a solution in mol/dm3 is related to the mass of the solute and the volume of the solution			
4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)			
calculate the volume of a gas at room temperature and pressure from its mass and relative formula mass			
calculate volumes of gaseous reactants and products from a balanced equation and a given volume of a gaseous reactant or product			
change the subject of a mathematical equation			

Can you…?	☺	😐	☹
Paper 1 - 4.4 Chemical changes			
4.4.1 Reactivity of metals			
explain reduction and oxidation in terms of loss or gain of oxygen			
recall and describe the reactions, if any, of potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper with water or dilute acids and where appropriate, to place these metals in order of reactivity			
explain how the reactivity of metals with water or dilute acids is related to the tendency of the metal to form its positive ion			
deduce an order of reactivity of metals based on experimental results			
interpret or evaluate specific metal extraction processes when given appropriate information			
Identify the substances which are oxidised or reduced in terms of gain or loss of oxygen			
(HT) write ionic equations for displacement reactions			
(HT) identify in a given reaction, symbol equation or half equation which species are oxidised and which are reduced			
4.4.2 Reactions of acids			
(HT) explain in terms of gain or loss of electrons, that these are redox reactions			
(HT) identify which species are oxidised and which are reduced in given chemical equations			
predict products from given reactants for salt production			
use the formulae of common ions to deduce the formulae of salts			
describe how to make pure, dry samples of named soluble salts from information provided			
Required practical 1: *preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate using a Bunsen burner to heat dilute acid and a water bath or electric heater to evaporate the solution.*			
describe the use of universal indicator or a wide range indicator to measure the approximate pH of a solution			
use the pH scale to identify acidic or alkaline solutions			
describe how to carry out titrations using strong acids and strong alkalis only (sulfuric, hydrochloric and nitric acids only) to find the reacting volumes accurately			
(HT Only) calculate the chemical quantities in titrations involving concentrations in mol/dm3 and in g/dm3			
Required practical 2: *(chemistry only) determination of the reacting volumes of solutions of a strong acid and a strong alkali by titration. (**HT only) determination of the concentration of one of the solutions in mol/dm3 and g/dm3 from the reacting volumes and the known concentration of the other solution.***			
(HT) use and explain the terms dilute and concentrated (in terms of amount of substance), and weak and strong (in terms of the degree of ionisation) in relation to acids			
(HT) describe neutrality and relative acidity in terms of the effect on hydrogen ion concentration and the numerical value of pH (whole numbers only)			
4.4.3 Electrolysis			
describe what happens during the process of electrolysis			
(HT) write half equations for the reactions occurring at the electrodes during electrolysis, and may be required to complete and balance supplied half equations			
predict the products of the electrolysis of binary ionic compounds in the molten state			
explain why a mixture is used as the electrolyte in the extraction of aluminium			
explain why the positive electrode must be continually replaced in the extraction of aluminium			
predict the products of the electrolysis of aqueous solutions containing a single ionic compound			
Required practical 3: *investigate what happens when aqueous solutions are electrolysed using inert electrodes. This should be an investigation involving developing a hypothesis*			

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Paper 1 - 4.5 Energy changes			
4.5.1 Exothermic and endothermic reactions			
distinguish between exothermic and endothermic reactions on the basis of the temperature change of the surroundings			
evaluate uses and applications of exothermic and endothermic reactions given appropriate information			
Required practical 4: *investigate the variables that affect temperature changes in reacting solutions such as, eg acid plus metals, acid plus carbonates, neutralisations, displacement of metals*			
draw simple reaction profiles (energy level diagrams) for exothermic and endothermic reactions showing the relative energies of reactants and products, the activation energy and the overall energy change, with a curved line to show the energy as the reaction proceeds			
use reaction profiles to identify reactions as exothermic or endothermic			
explain that the activation energy is the energy needed for a reaction to occur			
(HT) calculate the energy transferred in chemical reactions using bond energies supplied			
4.5.2 Chemical cells and fuel cells (chemistry only)			
interpret data for relative reactivity of different metals and evaluate the use of cells			
evaluate the use of hydrogen fuel cells in comparison with rechargeable cells and batteries			
(HT only) write the half equations for the electrode reactions in the hydrogen fuel cell.			

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Paper 2 - 4.6 The rate and extent of chemical change			
4.6.1 Rate of reaction			
calculate the mean rate of a reaction from given information about the quantity of a reactant used or the quantity of a product formed and the time taken			
draw, and interpret, graphs showing the quantity of product formed or quantity of reactant used up against time			
draw tangents to the curves on these graphs and use the slope of the tangent as a measure of the rate of reaction			
(HT only) calculate the gradient of a tangent to the curve on these graphs as a measure of rate of reaction at a specific time			
recall how changing concentration, pressure, surface area, temperature and catalyst affects the rate of chemical reactions			
Required practical 5: *investigate how changes in concentration affect the rates of reactions by a method involving measuring the volume of a gas produced and a method involving a change in colour or turbidity.*			
predict and explain using collision theory the effects of changing conditions of concentration, pressure and temperature on the rate of a reaction			
predict and explain the effects of changes in the size of pieces of a reacting solid in terms of surface area to volume ratio			
use simple ideas about proportionality when using collision theory to explain the effect of a factor on the rate of a reaction			
identify catalysts in reactions from their effect on the rate of reaction and because they are not included in the chemical equation for the reaction			
explain catalytic action in terms of activation energy			
4.6.2 Reversible reactions and dynamic equilibrium			
explain what is meant by a reversible reaction and how we show this			
explain how reversible reactions and endothermic/exothermic reactions are linked			
describe what is meant by (dynamic) equilibrium			
(HT) make qualitative predictions about the effect of changes on systems at equilibrium when given appropriate information (le chatelier's principle)			
(HT) interpret appropriate given data to predict the effect of a change in concentration of a reactant or product on given reactions at equilibrium			
(HT) interpret appropriate given data to predict the effect of a change in temperature on given reactions at equilibrium			
(HT) interpret appropriate given data to predict the effect of pressure changes on given reactions at equilibrium			

Can you…?	☺	😐	☹
Paper 2 - 4.7 Organic chemistry			
4.7.1 Carbon compounds as fuels and feedstock			
recognise substances as alkanes given their written or drawn formulae for the first four alkanes			
explain how fractional distillation works in terms of evaporation and condensation			
recall how boiling point, viscosity and flammability change with increasing molecular size			
write balanced equations for the complete combustion of hydrocarbons with a given formula			
describe in general terms the conditions used for catalytic cracking and steam cracking			
recall the colour change when bromine water reacts with an alkene			
balance chemical equations as examples of cracking given the formulae of the reactants and products			
give examples to illustrate the usefulness of cracking. They should also be able to explain how modern life depends on the uses of hydrocarbons			
4.7.2 Reactions of alkenes and alcohols (chemistry only)			
recognise substances as alkanes given their written or drawn formulae for the first four alkenes			
describe the reactions and conditions for the addition of hydrogen, water and halogens to alkenes			
draw fully displayed structural formulae of the first four members of the alkenes and the products of their addition reactions with hydrogen, water, chlorine, bromine and iodine			
recognise substances as alkanes given their written or drawn formulae for the first four alcohols			
describe what happens when any of the first four alcohols react with sodium, burn in air, are added to water, react with an oxidising agent			
recall the main uses of these alcohols			
know the conditions used for fermentation of sugar using yeast			
recognise substances as alkanes given their written or drawn formulae for the first four carboxylic acids			
describe what happens when any of the first four carboxylic acids react with carbonates, dissolve in water, react with alcohols			
(HT only) explain why carboxylic acids are weak acids in terms of ionisation and pH			
do not need to know the names of esters other than ethyl ethanoate			
4.7.3 Synthetic and naturally occurring polymers (chemistry only)			
recognise addition polymers and monomers from diagrams in the forms shown and from the presence of the functional group C=C in the monomers			
draw diagrams to represent the formation of a polymer from a given alkene monomer			
relate the repeating unit to the monomer			
explain the basic principles of condensation polymerisation by reference to the functional groups in the monomers and the repeating units in the polymers			
(HT) describe what amino acids are and how they make proteins			
describe what DNA is and describe the structure			
name the types of monomers from which DNA, proteins, starch and cellulose are made			

Can you…?	☺	😐	☹
Paper 2 - 4.8 Chemical analysis			
4.8.1 Purity, formulations and chromatography			
use melting point and boiling point data to distinguish pure from impure substances			
identify formulations given appropriate information			
explain how paper chromatography separates mixtures			
suggest how chromatographic methods can be used for distinguishing pure substances from impure substances			

interpret chromatograms and determine Rf values from chromatograms			
provide answers to an appropriate number of significant figures			
Required practical 6: *investigate how paper chromatography can be used to separate and tell the difference between coloured substances. Students should calculate Rf values*			
4.8.2 Identification of common gases			
describe the tests for hydrogen, oxygen, carbon dioxide and chlorine			
4.8.3 Identification of ions by chemical and spectroscopic means (chemistry only)			
identify species from the results of flame tests			
write balanced equations for the reactions to produce the insoluble hydroxides			
describe the test (and positive test result) for a carbonate			
describe the test (and positive test result) for the halides			
describe the test (and positive test result) for a sulfate			
Required practical 7: *use of chemical tests to identify the ions in unknown single ionic compounds*			
state advantages of instrumental methods compared with the chemical tests in this specification			
interpret an instrumental result given appropriate data in chart or tabular form, when accompanied by a reference set in the same form, limited to flame emission spectroscopy			

Can you…?	☺	😐	☹
Paper 2 - 4.9 Chemistry of the atmosphere			
4.9.1 The composition and evolution of the Earth's atmosphere			
describe the proportions of different gases in the atmosphere			
interpret evidence and evaluate different theories about the Earth's early atmosphere			
describe how oxygen increased			
describe how carbon dioxide decreased			
4.9.2 Carbon dioxide and methane as greenhouse gases			
describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter			
recall two human activities that increase the amounts of each of the greenhouse gases carbon dioxide and methane			
evaluate the quality of evidence in a report about global climate change given appropriate information			
describe uncertainties in the evidence base			
recognise the importance of peer review of results and of communicating results to a wide range of audiences			
describe briefly four potential effects of global climate change			
discuss the scale, risk and environmental implications of global climate change			
describe actions to reduce emissions of carbon dioxide and methane			
give reasons why actions may be limited			
4.9.3 Common atmospheric pollutants and their sources			
describe how carbon monoxide, soot (carbon particles), sulfur dioxide and oxides of nitrogen are produced by burning fuels			
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			
describe and explain the problems caused by increased amounts of carbon monoxide, sulfur dioxide, nitrogen oxides and particulates in the air			

Can you…?	☺	😐	☹
Paper 2 - 4.10 Using resources			
4.10.1 Using the Earth's resources and obtaining potable water			
state examples of natural products that are supplemented or replaced by agricultural and synthetic products			
distinguish between finite and renewable resources given appropriate information			
extract and interpret information about resources from charts, graphs and tables			
use orders of magnitude to evaluate the significance of data			
distinguish between potable water and pure water			
describe the differences in treatment of ground water and salty water			
give reasons for the steps used to produce potable water			
Required practical 8: *analysis and purification of water samples from different sources, including pH, dissolved solids and distillation*			
comment on the relative ease of obtaining potable water from waste, ground and salt water			
(HT) evaluate alternative biological methods of metal extraction, given appropriate information			
4.10.2 Life cycle assessment and recycling			
carry out simple comparative LCAs for shopping bags made from plastic and paper			
evaluate ways of reducing the use of limited resources, given appropriate information			
4.10.3 Using materials (chemistry only)			
describe experiments and interpret results to show that both air and water are necessary for rusting			
explain sacrificial protection in terms of relative reactivity			
recall a use of each of the alloys specified (bronze, brass, jewellery gold, steels)			
interpret and evaluate the composition and uses of alloys other than those specified given appropriate information			
explain how low density and high density poly(ethene) are both produced from ethene			
explain the difference between thermosoftening and thermosetting polymers in terms of their structures			
recall some examples of composites			
compare quantitatively the physical properties of glass and clay ceramics, polymers, composites and metals			
explain how the properties of materials are related to their uses and select appropriate materials			
4.10.4 The Haber process and the use of NPK fertilisers (chemistry only)			
describe the Haber process			
(HT) interpret graphs of reaction conditions versus rate			
apply the principles of dynamic equilibrium to the Haber process			
explain the trade-off between rate of production and position of equilibrium			
explain how the commercially used conditions for the Haber process are related to the availability and cost of raw materials and energy supplies, control of equilibrium position and rate			
recall the names of the salts produced when phosphate rock is treated with nitric acid, sulfuric acid and phosphoric acid			
compare the industrial production of fertilisers with laboratory preparations of the same compounds, given appropriate information			