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| Each topic has a set of boxes which you can tick to show how well how well you know the topic. This is useful for revision. **Bold text** indicates Higher Level. |  |  |  |
| **6.1 Reaction Rates**By the end of this section you should be able to  | **Good** | **Fair** | **Poor** |
| define rate of reactiondefine catalysismonitor the rate of production of oxygen from hydrogen peroxide, using manganese dioxide as a catalystplot reaction rate graphs interpret reaction rate graphsdistinguish between average and instantaneous ratecalculate instantaneous rate from graphs |  |  |  |
| **6.2 Factors Affecting Rates of Reaction** By the end of this section you should be able | **Good** | **Fair** | **Poor** |
| explain what is meant by the nature of reactants describe and explain how concentration, particle size, temperature, nature of reactants, and the presence of a catalyst effects the rate of reactiondescribe how to investigate the effect of (i) particle size and (ii) catalysts on reaction rateexplain why dust explosions occuridentify two examples of catalysts produced by living cells (enzymes)describe catalytic converters in terms of; nature of catalysts, reactions catalysed, environmental benefits and catalyst poisonsinvestigate the effects on the reaction rate of (i) concentration and (ii) temperature, using sodium thiosulfate solution and hydrochloric aciddescribe and explain an experiment to show the oxidation of methanol (methyl alcohol) using a hot platinum or nichrome catalystdefine activation energydescribe and explain the influence of temperature change to changes in reaction ratedraw and interpret reaction profile diagrams use reaction profile diagrams to explain the influence of catalyst on the rate of reaction explain the mechanism of catalysis with reference to surface adsorption and intermediate formation theories of catalysisdescribe and explain an experiment that demonstrates the oxidation of potassium sodium tartrate by hydrogen peroxide, catalysed by cobalt(II) salts |  |  |  |
| * 1. **The periodic table of elements.**

By the end of this section you should be able to  | **Good** | **Fair** | **Poor** |
| describe the periodic table as a list of elements arranged so as to demonstrate trends in their physical and chemical propertiesdefine the term elementassociate the first 36 elements with their elemental symbolsdistinguish between elements and compoundsstate the principle resemblances of elements within each main group, in particular alkali metals, alkaline earth metals, halogens and noble gasesdescribe the reaction between water and lithium, sodium and potassium having seen the reaction demonstrateddescribe by means of a chemical equation the reaction between water and lithium, sodium and potassium having seen the reaction demonstratedoutline the history of the idea of elements, including the contributions of the Greeks, Boyle, Davy and Moseleyoutline the contributions of Mendeleev, **Dobereiner, Newlands and Moseley** to the structure of the modern periodic table compare mendeleev’s periodic table with the modern periodic tablearrange elements in order of relative atromic mass and note differences with modern periodic table |  |  |  |
| **1.2 Atomic Structure** By the end of this section you should be able | **Good** | **Fair** | **Poor** |
| outline the historical development of atomic theory (outline principles only, mathematical treatment not required): *Dalton*: atomic theory; ***Crookes*: vacuum tubes, cathode rays;*****Stoney:* naming of the electron**; *Thomson*: negative charge of the electron; **e/m for electrons (experimental details not required);** ***Millikan*: magnitude of charge of electrons as shown by oil drop experiment (experimental details not required);** *Rutherford***:** discovery of the nucleus as shown by the particle scattering experiment; **discovery of protons in nuclei of various atoms;** *Bohr*: model of the atom; ***Chadwick*: discovery of the neutron**.recall that matter is composed of particles, which may be atoms, molecules or ionsdefine an atomappreciate that atoms are minute particlesstate the law of conservation of massdescribe, relative mass, relative charge and location of a proton, neutron, and electron in an atomdefine atomic number (Z) mass number(*A*) define relative atomic mass (*A*r) using the C12 scaledefine isotopedescribe the composition of isotopes using hydrogen and carbon as examplesdescribe how a mass spectrometer can be used to determine relative atomic massdescribe the principles on which the Mass Spectrometer is based**explain the fundamental processes that occur in a mass spectrometer****calculate the approximate relative atomic masses from abundance of isotopes of given mass number** |  |  |  |
| **1.4 Electronic Structure of Atoms** By the end of this section you should be able | **Good** | **Fair** | **Poor** |
| define and explain energy levels in atomsdescribe the organization of particles in atoms of elements numbers 1-20classify the first twenty elements in the periodic table on the basis of the number of outer electronslist the numbers of electrons in each main energy level in atoms of elements nos. 1–20**describe and explain the emission spectrum of the hydrogen atom using the Balmer series in the emission spectrum as an example****describe and explain the absorption spectrum** use flame tests to provide evidence that energy is absorbed or released in discrete units when electrons move from one energy level to another **explain how flame tests provide evidence that energy is absorbed or released in discrete units when electrons move from one energy level to another** relate energy levels in atoms to everyday applications such as sodium street lights and fireworks**discuss the uses of atomic absorption spectrometry (AAS) as an analytical technique****illustrate how line spectra provide evidence for energy levels****use a spectroscope or a spectrometer to view emission spectra of elements****define and explain energy sub-levels****state the Heisenberg uncertainty principle****state the dual wave-particle nature of the electron (mathematical treatment not required)****define and explain atomic orbitals****describe the shapes of s and p orbitals****build up the electronic structure of the first 36 elements****derive the electronic configurations of ions of s- and p block elements only****describe the arrangement of electrons in individual orbitals of p-block atoms**define and explain atomic radiusexplain the general trends in values of atomic radii (covalent radii only)* down a group
* across a period (main group elements only)

define and explain first ionisation energy **explain the general trends in first ionisation energy values:*** **down a group**
* **across a period (main group elements) and**

**explain the exceptions to the general trends across a period****define and explain second and successive ionisation energies****describe how second and successive ionisation energies provide evidence for energy levels****recognise the relationship and trends in successive ionisation energies of an individual element**explain how chemical properties of elements depend on their electronic structureexplain how atomic radius, screening effect and nuclear charge account for general trends in properties of elements in groups I and VII |  |  |  |
| **1.5 Oxidation and Reduction** By the end of this section you should be able | **Good** | **Fair** | **Poor** |
| define oxidation and reduction in terms of electron transferuse simple examples , e.g. Na with Cl2, Mg with O2, Zn with Cu2+ to describe oxidation and reduction in terms of electron transferapply knowledge of oxidation and reduction to explain the rusting of irondefine oxidising agent and reducing agentarrange the electrochemical series of metals in order of their ease of oxidation (reactions, other than displacement reactions, not required)carry out an experiment to show that halogens act as oxidising agents(reactions with bromides, iodides, Fe2+ and sulfites; half equations only required)carry out an experiment to demonstrate the displacement reactions of metals (Zn with Cu2+, Mg with Cu2+)explain what happens at each electrode during the electrolysis of:* copper sulfate solution with copper electrodes
* acidified water with inert electrodes

**(half equations only required)****describe and account for the observations of what happens at each electrode during the electrolysis of (teacher demo)*** **aqueous sodium sulfate (using universal indicator)**
* **aqueous potassium iodide (using phenolphthalein indicator) with inert electrodes (half equations only required)**

describe the extraction of copper by displacements using scrap irondescribe and explain ionic movement as observed during teacher demonstrationdescribe the following electrolytic processes: purification of copper, chrome and nickel plating. Give one everyday application of chrome and nickel plating e.g. cutlery  |  |  |  |
| **2.1 Chemical Compounds** By the end of this section you should be able to  | Good | Fair | Poor |
| understand that compounds can be represented by chemical formulasrelate the stability of noble gasses to their electron configurationsdescribe bonding and valency in terms of the attainment of a stable electronic structurestate the octet ruleexplain its limitations use the octet rule to predict the formulas of simple binary compounds of the first 36 elements (excluding d-block elements) binary compounds of the first 36 elements (excluding d-block elements) and the hydroxides, carbonates, nitrates, hydrogencarbonates, sulfites and sulfates of these elements (where such exist).recognise that Cu, Fe, Cr and Mn have variable valenciesrelate the uses of helium and argon to their chemical unreactivity |  |  |  |
| **2.2 Ionic Bonding** By the end of this section you should be able | Good | Fair | Poor |
| define ion, positive ion, negative ionappreciate the minute size of ionsexplain ionic bonding in terms of electron transferrepresent ionic bonds using dot and cross diagramsdescribe the structure of a sodium chloride crystal having reviewed modelsassociate ionic substances with their characteristics outline two uses of ionic materials in everyday lifetest for anions in aqueous solutions: chloride, carbonate, nitrate, sulfate, phosphate, sulfite, hydrogencarbonate |  |  |  |
| **2.3 Covalent Bonding** By the end of this section you should be able to  | Good | Fair | Poor |
| define moleculeappreciate the minute size of molecules explain covalent bonding in terms of the sharing of pairs of electrons (Single, double and triple covalent bonds)represent covalent bonds in molecules using dot and cross diagramsdistinguish between sigma and pi bondingdistinguish between polar and non-polar covalent bondingtest a liquid for polarity using a charged plastic rod give examples of polar and non-polar materials in everyday life (two examples in each case)associate covalent substances with their characteristicstest the solubility of ionic and covalent substances in different solvents |  |  |  |
| **2.4 Electronegativity** By the end of this section you should be able | Good | Fair | Poor |
| define electronegativityrecognise the trends in electronegativity values down a group and across a periodexplain the general trends in electronegativity values* down a group
* across a period.

relate differences in electronegativity to polarity of bondspredict bond type using electronegativity differences |  |  |  |
| **2.5 Shapes of Molecules and Intermolecular Forces** By the end of this section you should be able | Good | Fair | Poor |
| describe the shapes of simple moleculesuse appropriate modeling techniques to illustrate molecular shapeexplain the basis for electron pair repulsion theoryuse electron pair repulsion theory to explain the shapes of molecules for up to four pairs of electrons around the central atom refer to bond angles (Shapes of molecules with pi bonds not to be considered) explain the relationship between symmetry and polarity in a molecule (dipole moments not required)describe and distinguish between intramolecular bonding and intermolecular forces (van der Waals’, dipole-dipole, hydrogen bonding)describe the effects of intermolecular forces on the boiling point of covalent substancesrelate the differences in boiling points of H2 and O2 , C2H2 and HCHO and of H2O and H2S to the effect of intermolecular forces |  |  |  |
| **2.6 Oxidation Numbers** By the end of this section you should be able | Good | Fair | Poor |
| define oxidation number, oxidation statedefine oxidation and reduction in terms of change of oxidation numbersstate the rules for oxidation numbers (exclude peroxides, except for hydrogen peroxide)calculate oxidation numbers of transition metals in their compounds and of other elementsuse oxidation numbers in nomenclature of transition metal compoundsgive an example of an oxidising and a reducing bleach |  |  |  |
| 3 Stoichiometry, Formulas and Equations |
| **3.1 States of Matter** By the end of this section you should be able to  | Good | Fair | Poor |
| describe the motion of particles in solids, liquids and gasesexplain diffusiondemonstrate diffusion (Graham’s law not required) using simple chemicals |  |  |  |
| **3.3 The Mole** By the end of this section you should be able | Good | Fair | Poor |
| define the Avogadro constantdefine the mole calculate relative molecular mass from relative atomic massesdefine s.t.pdefine molar volume at s.t.p., molar mass, relative molecular mass (Mr)convert moles to grams, litres and number of particles convert grams, litres and number of particles to moles convert moles to number of atoms of a molecular speciesexplain how a mass spectrometer can be used to determine relative molecular mass(Mr) (limited to simple treatment interpretation of mass spectra not required )determine the relative molecular mass of a volatile liquid using suitable apparatus |  |  |  |
| **3.4 Chemical Formulas** By the end of this section you should be able | Good | Fair | Poor |
| define empirical formula , molecular formulacalculate empirical formulas given the percentage composition by masscalculate empirical formulas given the masses of reactants and productscalculate molecular formulas given the empirical formulas and the relative molecular masses (examples should include simple biological substances, such as glucose and urea)calculate percentage composition by massdefine structural formuladeduce, describe and explain structural formulas (simple examples) |  |  |  |
| **3.5 Chemical Equations** By the end of this section you should be able | Good | Fair | Poor |
| recall that chemical equations are used to represent chemical reactions construct chemical equationsbalance simple chemical equationsbalance redox equations (ionic equations only – ignore spectator ions)perform calculations based on balanced equations using the mole concept (calculations in g and kg. Calculations may involve masses and volumes)perform calculations based on balanced equations involving excess of one reactant (calculations in g and kg. Calculations may involve masses and volumes) |  |  |  |
| 4 Volumetric Analysis |
| **4.1 Concentration of Solutions** By the end of this section you should be able to  | Good | Fair | Poor |
| define solutiondefine concentrationdefine molarityexpress concentration of solutions in mol-1(molarity), g l -1 and also in % (w/v), % (v/v), % (w/w)appreciate the everyday use of % v/v e.g. in alcoholic beveragescalculate molarity from concentration in grams per litre and vice versa calculate number of moles from molarity and volumeperform simple calculations involving percentage concentrationscalculate the effect of dilution on concentrationapply knowledge of concentrations of solutions to everyday examplesdescribe how colour intensity can be used as an indicator of concentrationDefine a primary standard and a standard solutionprepare standard solution of sodium carbonate |  |  |  |
| **4.3 Volumetric Analysis** By the end of this section you should be able | Good | Fair | Poor |
| identify appropriate apparatus used in volumetric analysisuse correct titrimetric procedure when carrying out titrationssolve volumetric problems, using the formula methodsolve volumetric problems from first principlescarry out a titration between hydrochloric acid and sodium hydroxide solutions and use this titration to make a sample of sodium chloride (OL only)standardise a hydrochloric acid solution using a standard solution of sodium carbonatecalculate the relative molecular mass of a compound and of the amount of water of crystallisation in a compound from titration data (balanced equations will be given in all volumetric problems)determine the concentration of ethanoic acid in vinegardetermine the amount of water of crystallisation in hydrated sodium carbonatecarry out a potassium manganate(VII)/ammonium iron(II) sulfate titrationdetermine the amount of iron in an iron tabletcarry out an iodine/thiosulfate titrationdetermine the percentage (w/v) of hypochlorite in bleach |  |  |  |