Chemistry in Society

Metals

	RP1	RP2	RP3
Metallic bonding			
Metallic bonding is the electrostatic force of attraction between positively charged ions and delocalised electrons.	Y/N	Y/N	Y/N
Metallic elements are conductors of electricity because they contain delocalised electrons.	Y/N	Y/N	Y/N
Reactions of metals			
Equations, involving formulae, can be written to show the reaction of metals with oxygen, water, and dilute acids:			
➢ metal + oxygen → metal oxide	Y/N	Y/N	Y/N
➢ metal + water → metal hydroxide + hydrogen	Y/N	Y/N	Y/N
➢ metal + dilute acid → salt + hydrogen	Y/N	Y/N	Y/N
Metals can be arranged in order of reactivity by comparing the rates at which they react.	Y/N	Y/N	Y/N
Metals can be used to produce soluble salts. Excess metal is added to the appropriate acid, the mixture is filtered and the filtrate evaporated to dryness.	Y/N	Y/N	Y/N
Redox			
Reduction is a gain of electrons by a reactant in any reaction.	Y/N	Y/N	Y/N
Oxidation is a loss of electrons by a reactant in any reaction.	Y/N	Y/N	Y/N

In a redox reaction, reduction and oxidation take place at the same time.	Y/N	Y/N	Y/N
Ion-electron equations can be written for reduction and oxidation reactions.	Y/N	Y/N	Y/N
Ion-electron equations can be combined to produce redox equations.	Y/N	Y/N	Y/N
Extraction of metals			
During the extraction of metals, metal ions are reduced forming metal atoms.	Y/N	Y/N	Y/N
The method used to extract a metal from its ore depends on the position of the metal in the reactivity series.	Y/N	Y/N	Y/N
Equations can be written to show the extraction of metals. Methods used are:			
➢ heat alone (for extraction of Ag, Au and Hg)	Y/N	Y/N	Y/N
➢ heating with carbon or carbon monoxide (for extraction of Cu, Pb, Sn, Fe and Zn)	Y/N	Y/N	Y/N
➢ electrolysis (for extraction of more reactive metals including aluminium)	Y/N	Y/N	Y/N
Electrolysis is the decomposition of an ionic compound into its elements using electricity.	Y/N	Y/N	Y/N
A d.c. supply must be used if the products of electrolysis are to be identified.	Y/N	Y/N	Y/N
Positive ions gain electrons at the negative electrode and negative ions lose electrons at the positive electrode.	Y/N	Y/N	Y/N

Electrochemical cells			
Electrically conducting solutions containing ions are known as electrolytes.	Y/N	Y/N	Y/N
A simple cell can be made by placing two metals in an electrolyte.	Y/N	Y/N	Y/N
Another type of cell can be made using two half-cells (metals in solutions of their own ions).	Y/N	Y/N	Y/N
An 'ion bridge' (salt bridge) can be used to link the half-cells.	Y/N	Y/N	Y/N
Ions can move across the bridge to complete an electrical circuit.	Y/N	Y/N	Y/N
Electricity can be produced in cells where at least one of the half-cells does not involve metal atoms/ions.	Y/N	Y/N	Y/N
A graphite rod can be used as the electrode in such half-cells.	Y/N	Y/N	Y/N
Different pairs of metals produce different voltages.	Y/N	Y/N	Y/N
These voltages can be used to arrange the elements into an electrochemical series.	Y/N	Y/N	Y/N
The further apart elements are in the electrochemical series, the greater the voltage produced when they are used to make an electrochemical cell.	Y/N	Y/N	Y/N
Electrons flow in the external circuit from the species higher in the electrochemical series to the one lower in the electrochemical series.	Y/N	Y/N	Y/N

For an electrochemical cell, including those involving non-metals, ion-electron equations can be written for:			
♦ the oxidation reaction	Y/N	Y/N	Y/N
♦ the reduction reaction	Y/N	Y/N	Y/N
♦ the overall redox reactions	Y/N	Y/N	Y/N
The direction of electron flow can be deduced for electrochemical cells including those involving non-metal electrodes.	Y/N	Y/N	Y/N

Chemistry in Society			
(b) Plastics			
Addition polymerisation	**RP1**	**RP2**	**RP3**
Plastics are examples of materials known as **polymers**.	Y/N	Y/N	Y/N
Polymers are **long chain molecules** formed by **joining together** a **large number** of **small molecules** called **monomers**.	Y/N	Y/N	Y/N
Addition polymerisation is the name given to a **chemical reaction** in which **unsaturated monomers** are **joined**, forming a **polymer.**	Y/N	Y/N	Y/N
The **names** of **addition polymers** are **derived** from the **name of the monomer** used. Note: brackets can be used in polymer names to aid identification of the monomer unit.	Y/N	Y/N	Y/N
Representation of the structure of monomers and polymers			
A **repeating unit** is the **shortest section of polymer chain** which, if repeated, would **yield the complete polymer chain** (except for the end-groups).	Y/N	Y/N	Y/N
The **structure** of a **polymer** can be **drawn** given either the **structure** of the **monomer** or the repeating unit.	Y/N	Y/N	Y/N
From the **structure** of a **polymer**, **the monomer** or **repeating unit** can be **drawn**.	Y/N	Y/N	Y/N

Chemistry in Society			
Nuclear Chemistry			
Radiation	**RP1**	**RP2**	**RP3**
Radioactive decay involves changes in the nuclei of atoms.	Y/N	Y/N	Y/N
Unstable nuclei (radioisotopes) can become more stable nuclei by giving out alpha, beta or gamma radiation.	Y/N	Y/N	Y/N
Alpha particles (α) consist of two protons and two neutrons and carry a double positive charge.	Y/N	Y/N	Y/N
They have a range of only a few centimetres in air and are stopped by a piece of paper.	Y/N	Y/N	Y/N
Alpha particles will be attracted towards a negatively charged plate.	Y/N	Y/N	Y/N
Beta particles (β) are electrons ejected from the nucleus of an atom.	Y/N	Y/N	Y/N
They are able to travel over a metre in air but can be stopped by a thin sheet of aluminium.	Y/N	Y/N	Y/N
Beta particles will be attracted towards a positively charged plate.	Y/N	Y/N	Y/N
Gamma rays (γ) are electromagnetic waves emitted from within the nucleus of an atom.	Y/N	Y/N	Y/N
They are able to travel great distances in air.	Y/N	Y/N	Y/N
They can be stopped by barriers made of materials such as lead or concrete. Gamma rays are not deflected by an electric field.	Y/N	Y/N	Y/N

Nuclear equations			
Balanced nuclear equations can be written using nuclide notation.	Y/N	Y/N	Y/N
In nuclear equations:	Y/N	Y/N	Y/N
♦ an alpha particle can be represented as $^{4}_{2}He$	Y/N	Y/N	Y/N
♦ a beta particle can be represented as $^{0}_{-1}e$	Y/N	Y/N	Y/N
♦ a proton can be represented as $^{1}_{1}p$	Y/N	Y/N	Y/N
♦ a neutron can be represented as $^{1}_{0}n$	Y/N	Y/N	Y/N
In the course of any nuclear reaction:			
♦ The sum of the atomic numbers on the left of the reaction arrow is equal to the sum of the atomic numbers on the right of the reaction arrow.	Y/N	Y/N	Y/N
♦ The sum of the mass numbers on the left of the reaction arrow is equal to the sum of the mass numbers on the right of the reaction arrow.	Y/N	Y/N	Y/N
Half-life			
Half-life is the time for half of the nuclei of a particular isotope to decay.	Y/N	Y/N	Y/N
The half-life of an isotope is a constant, unaffected by chemical or physical conditions.	Y/N	Y/N	Y/N
Radioactive isotopes can be used to date materials.	Y/N	Y/N	Y/N
The half-life of an isotope can be determined from a graph showing a decay curve.	Y/N	Y/N	Y/N
Calculations can be performed using the link between the number of half-lives, time and the proportion of a radioisotope remaining.	Y/N	Y/N	Y/N

Use of radioactive isotopes Radioisotopes have a range of uses in medicine and in industry. (You do not need to be able to name the isotope used in a particular application.) Given information on the type of radiation emitted and/or half-lives, the suitability of an isotope for a particular application can be evaluated.	Y/N Y/N	Y/N Y/N	Y/N Y/N

Chemistry in Society

Fertilisers

	RP1	RP2	RP3
Commercial production of fertilisers			
Growing plants require nutrients, including compounds containing nitrogen, phosphorus or potassium.	Y/N	Y/N	Y/N
Fertilisers are substances which restore elements, essential for healthy plant growth, to the soil.	Y/N	Y/N	Y/N
Ammonia and nitric acid are important compounds used to produce soluble, nitrogen containing salts that can be used as fertilisers.	Y/N	Y/N	Y/N
Ammonia is a pungent, clear, colourless gas which dissolves in water to produce an alkaline solution.	Y/N	Y/N	Y/N
Ammonia solutions react with acids to form soluble salts. ammonia solution + an acid → an ammonium salt + water	Y/N	Y/N	Y/N
Haber and Ostwald processes			
The Haber process is used to produce the ammonia required for fertiliser production.	Y/N	Y/N	Y/N
$N_2 (g) + 3H_2 (g) \rightleftharpoons 2NH_3 (g)$	Y/N	Y/N	Y/N
At low temperatures the forward reaction is too slow to be economical.	Y/N	Y/N	Y/N
If the temperature is increased, the rate of reaction increases but, as the temperature increases, the backward reaction becomes more dominant.	Y/N	Y/N	Y/N
An iron catalyst is used to increase reaction rate.	Y/N	Y/N	Y/N
		Y/N	Y/N

Ammonia is the starting material for the commercial production of nitric acid.	Y/N		
The Ostwald process uses ammonia, oxygen and water to produce nitric acid.	Y/N	Y/N	Y/N
A platinum catalyst is used in this process.	Y/N	Y/N	Y/N

Chemistry in Society			
Chemical Analysis			
Common chemical apparatus You must be familiar with the use(s) of the following types of apparatus:	**RP1**	**RP2**	**RP3**
♦ conical flask	Y/N	Y/N	Y/N
♦ beaker	Y/N	Y/N	Y/N
♦ measuring cylinder	Y/N	Y/N	Y/N
♦ delivery tube	Y/N	Y/N	Y/N
♦ dropper	Y/N	Y/N	Y/N
♦ test tubes/boiling tubes	Y/N	Y/N	Y/N
♦ funnel	Y/N	Y/N	Y/N
♦ filter paper	Y/N	Y/N	Y/N
♦ evaporating basin	Y/N	Y/N	Y/N
♦ pipette with safety filler	Y/N	Y/N	Y/N
♦ burette	Y/N	Y/N	Y/N
♦ thermometer	Y/N	Y/N	Y/N

General practical techniques			
Candidates must be familiar with the following practical techniques:	Y/N	Y/N	Y/N
♦ simple filtration using filter paper and a funnel to separate the residue from the filtrate	Y/N	Y/N	Y/N
♦ use of a balance	Y/N	Y/N	Y/N
♦ methods for the collection of gases including:			
— collection over water (for relatively insoluble gases)	Y/N	Y/N	Y/N
— downward displacement of air (for soluble gases that are less dense than air)	Y/N	Y/N	Y/N
— upward displacement of air (for soluble gases that are more dense than air)	Y/N	Y/N	Y/N
♦ methods of heating using Bunsen burners and electric hotplates	Y/N	Y/N	Y/N
♦ preparation of soluble salts by the reaction of acids with metals, metal oxides, metal hydroxides and metal carbonates	Y/N	Y/N	Y/N
♦ preparation of insoluble salts by precipitation	Y/N	Y/N	Y/N
♦ testing the electrical conductivity of solids and solutions	Y/N	Y/N	Y/N
♦ setting up an electrochemical cell using a salt bridge and either metal or carbon electrodes	Y/N	Y/N	Y/N
♦ electrolysis of solutions using a d.c. supply	Y/N	Y/N	Y/N
♦ determination of E_h	Y/N	Y/N	Y/N

Analytical methods			
Titration is used to determine, accurately, the volumes of solution required to reach the end-point of a chemical reaction.	Y/N	Y/N	Y/N
An indicator is normally used to show when the end-point is reached.	Y/N	Y/N	Y/N
Titre volumes within 0·2 cm^3 are considered concordant.	Y/N	Y/N	Y/N
Solutions of accurately known concentration are known as standard solutions.	Y/N	Y/N	Y/N
Flame tests can identify metals present in a sample.	Y/N	Y/N	Y/N
Simple tests can be used to identify oxygen, hydrogen and carbon dioxide gases.	Y/N	Y/N	Y/N
Precipitation is the reaction of two solutions to form an insoluble salt called a precipitate.	Y/N	Y/N	Y/N
Information on the solubility of compounds can be used to predict when a precipitate will form.	Y/N	Y/N	Y/N
The formation of a precipitate can be used to identify the presence of a particular ion.	Y/N	Y/N	Y/N

Reporting experimental work			
Labelled, sectional diagrams can be drawn for common chemical apparatus.	Y/N	Y/N	Y/N
Data can be presented in tabular form with appropriate headings and units of measurement.	Y/N	Y/N	Y/N
Data can be presented as a bar, line or scatter graph with suitable scale(s) and labels.	Y/N	Y/N	Y/N
A line of best fit (straight or curved) can be used to represent the trend observed in experimental data.	Y/N	Y/N	Y/N
Average (mean) values can be calculated from data.	Y/N	Y/N	Y/N
Given a description of an experimental procedure and/or experimental results, an improvement to the experimental method can be suggested and justified.	Y/N	Y/N	Y/N
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