Nature's Chemistry

Systematic carbon chemistry

	RP1	RP2	RP3
Compounds containing **only single carbon–carbon** bonds are described as **saturated**.	Y/N	Y/N	Y/N
Compounds containing at **least one carbon–carbon double bond** are described as **unsaturated**.	Y/N	Y/N	Y/N
Compounds containing **carbon–carbon double bonds** can take part in **addition** reactions.	Y/N	Y/N	Y/N
In an **addition** reaction, **two molecules combine** to form a **single molecule**.	Y/N	Y/N	Y/N
It is possible to **distinguish** an **unsaturated compound** from a **saturated compound** using **bromine solution**.	Y/N	Y/N	Y/N
Unsaturated compounds **quickly decolourise bromine solution**.	Y/N	Y/N	Y/N
The **structure** of any molecule can be **drawn** as a **full** or a **shortened structural formula**.	Y/N	Y/N	Y/N
Isomers: ♦ are compounds with the **same molecular formula** but **different structural formulae**	Y/N	Y/N	Y/N
♦ may **belong to different homologous series**	Y/N	Y/N	Y/N
♦ usually have **different physical properties**	Y/N	Y/N	Y/N
Given the **name** or a **structural formula** for a compound, an **isomer can be drawn**.	Y/N	Y/N	Y/N
Isomers can be **drawn** for a **given molecular formula**.	Y/N	Y/N	Y/N

The **solubility**, **boiling point** and **volatility** (**ease of evaporation**) of a compound **can be predicted** by considering:			
♦ the **presence** of **O-H** or **N-H** bonds, which **implies hydrogen bonding**	Y/N	Y/N	Y/N
♦ the **spatial arrangement** of **polar covalent bonds** which could result in a **molecule possessing a permanent dipole**	Y/N	Y/N	Y/N
♦ **molecular size** which would **affect London dispersion forces**	Y/N	Y/N	Y/N
♦ the **polarities** of **solute** and **solvent**.	Y/N	Y/N	Y/N
Polar or **ionic compounds** tend to be **soluble in polar solvents**, **non-polar compounds** tend to be **soluble in non-polar solvents**	Y/N	Y/N	Y/N
Solubility, **boiling point** and **volatility** can be explained in terms of the **type** and **strength** of **intermolecular forces** present.	Y/N	Y/N	Y/N

Nature's Chemistry

Alcohols

	RP1	RP2	RP3
An **alcohol** is a molecule containing a **hydroxyl** functional group, **—OH** group.	Y/N	Y/N	Y/N
Straight-chain and **branched alcohols** can be **systematically named**, indicating the **position of the hydroxyl group** from **structural formulae** containing no more than eight carbon atoms in their longest chain.	Y/N	Y/N	Y/N
A **molecular formula** can be **written** or a **structural formula drawn** from the **systematic name** of a straight-chain or branched alcohol that contains no more than eight carbon atoms in its longest chain.	Y/N	Y/N	Y/N
Alcohols can be **classified** as **primary**, **secondary** or **tertiary**.	Y/N	Y/N	Y/N
Alcohols containing **two hydroxyl groups** are called **diols**, and those containing **three hydroxyl groups** are called **triols**.	Y/N	Y/N	Y/N
Hydroxyl groups make alcohols **polar** and this gives rise to **hydrogen bonding**.	Y/N	Y/N	Y/N
Hydrogen bonding can be used to explain the **properties of alcohols**, including boiling points, melting points, viscosity and solubility/miscibility in water.	Y/N	Y/N	Y/N

Nature's Chemistry

Carboxylic acids

	RP1	RP2	RP3
A **carboxylic acid** is a molecule containing the **carboxyl** functional group, —**COOH**.	Y/N	Y/N	Y/N
Straight-chain and **branched** carboxylic acids can be **systematically named** from **structural formulae** containing no more than eight carbons in the longest chain.	Y/N	Y/N	Y/N
A **molecular formula** can be **written** or a **structural formula** drawn from the **systematic name** of a **straight-chain** or **branched-chain** carboxylic acid that contains no more than eight carbon atoms in its longest chain.	Y/N	Y/N	Y/N
Carboxylic acids can **react** with **bases**:	Y/N	Y/N	Y/N
metal oxide + carboxylic acid → salt + water	Y/N	Y/N	Y/N
metal hydroxide + carboxylic acid → salt + water	Y/N	Y/N	Y/N
metal carbonate + carboxylic acid → salt + water + carbon dioxide	Y/N	Y/N	Y/N
The **name** of the **salt** produced depends on the acid and base used.	Y/N	Y/N	Y/N

Nature's Chemistry

Esters, fats and oils

	RP1	RP2	RP3
An **ester** is a molecule containing an **ester link**: —***COO***—.	Y/N	Y/N	Y/N
Esters can be **named** given the:			
♦ **names** of their parent alcohol and carboxylic acid	Y/N	Y/N	Y/N
♦ **structural formulae** of esters formed from primary, straight-chain alcohols containing no more than eight carbons and straight-chain carboxylic acids containing no more than eight carbons	Y/N	Y/N	Y/N
Molecular formulae can be written and **structural formulae** drawn for esters given the:			
♦ **systematic names** of **esters** formed from primary, straight-chain alcohols containing no more than eight carbons and straight-chain carboxylic acids containing no more than eight carbons	Y/N	Y/N	Y/N
♦ **structural formulae** of their **parent alcohol** and **carboxylic acid**	Y/N	Y/N	Y/N
Esters are used as **flavourings** and **fragrances** as many have **pleasant, fruity smells**.	Y/N	Y/N	Y/N
Esters are also used as **solvents** for **non-polar compounds** that **do not dissolve in water**.	Y/N	Y/N	Y/N
Esters are formed by a **condensation** reaction between an **alcohol** and a **carboxylic acid**.	Y/N	Y/N	Y/N
In a **condensation** reaction, **two molecules** are **joined together** with the **elimination of a small molecule**.	Y/N	Y/N	Y/N

When an **ester link** is formed by the reaction between a **hydroxyl** group and a **carboxyl** group, the small molecule eliminated is **water**.	Y/N	Y/N	Y/N
Esters can be **hydrolysed** to produce an **alcohol** and a **carboxylic acid**.	Y/N	Y/N	Y/N
In a **hydrolysis** reaction, a molecule **reacts with water** to **break down** into **smaller molecules**.	Y/N	Y/N	Y/N
The products of the **hydrolysis** of an **ester** can be **named** given the:			
♦ **name** of the **ester**	Y/N	Y/N	Y/N
♦ **structural formula** of an **ester** formed from a straight-chain or branched alcohol and a straight-chain or branched carboxylic acid, each containing no more than eight carbons in their longest chain	Y/N	Y/N	Y/N
Molecular formulae can be written and **structural formulae** can be drawn for the products of the hydrolysis of an ester given the:			
♦ **systematic names** of **esters** formed from primary, straight-chain alcohols containing no more than eight carbons and straight-chain carboxylic acids containing no more than eight carbons	Y/N	Y/N	Y/N
♦ **structural formula** of the **ester**	Y/N	Y/N	Y/N
Edible fats and **edible oils** are **esters** formed from the **condensation** of **glycerol** (**propane1,2,3-triol**) and **three carboxylic acid** molecules.	Y/N	Y/N	Y/N
The carboxylic acids are known as '**fatty acids**' and can be saturated or unsaturated straight-chain carboxylic acids, usually with **long chains of carbon atoms**.	Y/N	Y/N	Y/N
Edible oils have **lower melting points** than edible fats.	Y/N	Y/N	Y/N

Double bonds in fatty acid chains **prevent** oil molecules from **packing closely together**, so the **greater the number of double bonds** present, the **weaker the van der Waals forces** of attraction.	Y/N	Y/N	Y/N
The **greater** the **degree of unsaturation**, the **lower** the **melting point**.	Y/N	Y/N	Y/N
Unsaturated compounds **quickly decolourise bromine solution**.	Y/N	Y/N	Y/N
The **bromine** molecules **add across the carbon-carbon double bonds** in an **addition** reaction.	Y/N	Y/N	Y/N
The **greater** the number of **double bonds** present in a substance, the **more bromine solution** can be **decolourised**.	Y/N	Y/N	Y/N

Nature's Chemistry

Proteins

	RP1	RP2	RP3
Proteins are the **major structural materials** of **animal tissue** and are also involved in the **maintenance** and **regulation** of **life processes**.	Y/N	Y/N	Y/N
Enzymes are **proteins** which act as **biological catalysts**.	Y/N		
		Y/N	Y/N
Amino acids, the **building blocks** from which **proteins** are formed, are **relatively small molecules** which all contain an **amino** group, —NH_2, and a **carboxyl** group, —**COOH**.	Y/N		
		Y/N	Y/N
Proteins are made of **many amino acid molecules linked together** by **condensation** reactions.	Y/N		
		Y/N	Y/N
In these reactions, the **amino** group of **one amino acid** and the **carboxyl** group of **another amino acid** join, with the **elimination of water**.	Y/N		
		Y/N	Y/N
The **link** which forms **between two amino acids** is known as a **peptide link**, —**CONH**—, or also as an **amide link**.	Y/N		
		Y/N	Y/N
Proteins which **fulfil different roles** in the body are formed by **linking together differing sequences** of amino acids.	Y/N		
		Y/N	Y/N
The **body cannot make** all of the **amino acids** required for **protein synthesis** and certain amino acids, known as **essential amino acids**, **must** be **acquired** from the **diet**.	Y/N		
		Y/N	Y/N
During **digestion**, **enzyme hydrolysis** of **protein** produces **amino acids**.	Y/N		
		Y/N	Y/N
		Y/N	Y/N

The **structural formulae** of **amino acids** obtained from the **hydrolysis** of a **protein** can be **drawn** given the **structure of a section of the protein**.	Y/N		
The **structural formula** of a **section of protein** can be **drawn** given the **structural formulae of the amino acids** from which it is formed.	Y/N	Y/N	Y/N
Within **proteins**, the **long-chain molecules** form **spirals**, **sheets**, or other **complex shapes**.	Y/N	Y/N	Y/N
The chains are held in these forms by **intermolecular bonding between the side chains** of the **constituent amino acids**.	Y/N	Y/N	Y/N
When proteins are **heated**, these **intermolecular bonds are broken**, allowing the proteins to **change shape** (**denature**).	Y/N	Y/N	Y/N
The **denaturing of proteins** in **foods** causes the **texture to change** when it is **cooked**.	Y/N	Y/N	Y/N

Nature's Chemistry

Oxidation of food

	RP1	RP2	RP3
For **carbon compounds**:			
♦ **oxidation** is an **increase** in the **oxygen to hydrogen ratio**	Y/N	Y/N	Y/N
♦ **reduction** is a **decrease** in the **oxygen to hydrogen ratio**	Y/N	Y/N	Y/N
Hot copper(II) oxide or acidified dichromate(VI) solutions can be used to **oxidise**:			
♦ **primary alcohols** to **aldehydes** and then to **carboxylic acids**	Y/N	Y/N	Y/N
♦ **secondary alcohols** to **ketones**	Y/N	Y/N	Y/N
During these reactions **black copper(II) oxide** forms a **brown solid**, and **orange dichromate solution** turns **green**.	Y/N	Y/N	Y/N
Tertiary alcohols cannot be **oxidised** using these **oxidising agents**.	Y/N	Y/N	Y/N
Aldehydes and **ketones** are molecules containing a **carbonyl** functional group **C=O**.	Y/N	Y/N	Y/N
Straight-chain and **branched aldehydes** and **ketones** can be **systematically named** from **structural formulae** containing no more than eight carbons in the longest chain.	Y/N	Y/N	Y/N
Molecular formulae can be **written** and **structural formulae** drawn, from the **systematic names** of straight-chain and branched aldehydes and ketones, containing no more than eight carbons in the longest chain.	Y/N	Y/N	Y/N
Aldehydes, but **not ketones**, can be **oxidised** to **carboxylic acids**.	Y/N	Y/N	Y/N

Nature's Chemistry

Fragrances

	RP1	RP2	RP3
Essential oils are **concentrated extracts** of the **volatile, non-water soluble, aroma** compounds from **plants**.	Y/N	Y/N	Y/N
They are **mixtures** of **many different compounds**.	Y/N	Y/N	Y/N
They are **widely used** in **perfumes**, **cosmetic products**, **cleaning products** and as **flavourings in foods**.	Y/N	Y/N	Y/N
Terpenes are **key components** in **most essential oils**.	Y/N	Y/N	Y/N
They are **unsaturated compounds** formed by **joining together isoprene (2-methylbuta-1,3-diene) units**.	Y/N	Y/N	Y/N
Terpenes can be **oxidised within plants** to produce some of the compounds responsible for the **distinctive aromas** of **spices**.	Y/N	Y/N	Y/N
Given the **structural formula** for a **terpene-based molecule**:			
♦ an **isoprene unit** can be **identified** within the molecule	Y/N	Y/N	Y/N
♦ the **number** of **isoprene units joined together** within the molecule can be stated	Y/N	Y/N	Y/N

Nature's Chemistry

Skincare

	RP1	RP2	RP3
Ultraviolet (UV) **radiation** is a **high-energy form of light**, present in **sunlight**.	Y/N	Y/N	Y/N
UV light can **provide sufficient energy** to **break bonds** within **molecules**.	Y/N	Y/N	Y/N
This causes **sunburn** and **accelerates ageing** of the **skin**.	Y/N	Y/N	Y/N
Sun-block products **prevent UV** light **reaching the skin**.	Y/N	Y/N	Y/N
When **UV light breaks bonds**, **free radicals** are formed.	Y/N	Y/N	Y/N
Free radicals are **atoms or molecules** that are **highly reactive** due to the presence of **unpaired electrons**.	Y/N	Y/N	Y/N
Free radical **chain reactions** include the following **steps**: **initiation**, **propagation** and **termination**.	Y/N	Y/N	Y/N
Equations can be **written** for **reactions involving free radicals**.	Y/N	Y/N	Y/N
An equation involving free radicals can be **recognised** as representing an **initiation**, **propagation** or **termination** step.	Y/N	Y/N	Y/N
Free radical scavengers are molecules that **react with free radicals** to form **stable molecules** and **prevent chain reactions** from occurring.	Y/N	Y/N	Y/N
Free radical scavengers are **added to many products** including **cosmetics**, **food products** and **plastics**.	Y/N	Y/N	Y/N

Oxidising agents can be used to **differentiate between** an **aldehyde** and a **ketone**.	Y/N	Y/N	Y/N
With an **aldehyde**:			
♦ **blue Fehling's solution** forms a **brick red precipitate**	Y/N	Y/N	Y/N
♦ **clear, colourless Tollens' reagent** forms a **silver mirror**	Y/N	Y/N	Y/N
♦ **orange acidified dichromate solution** turns **green**	Y/N	Y/N	Y/N
Many **flavour** and **aroma** molecules are **aldehydes**.	Y/N	Y/N	Y/N
Oxygen from the **air** causes the **oxidation of food**.	Y/N	Y/N	Y/N
The **oxidation** of **edible oils** gives food a **rancid flavour**.	Y/N	Y/N	Y/N
Antioxidants:			
♦ are molecules that **prevent unwanted oxidation** reactions occurring	Y/N	Y/N	Y/N
♦ are substances that are **easily oxidised**, and **oxidise in place of** the compounds they have been **added to protect**	Y/N	Y/N	Y/N
♦ can be identified as the **substance being oxidised** in a **redox equation**	Y/N	Y/N	Y/N