At-a-glance unit content, assessment criteria and guidance

To help you with assignment writing as well as assessing assignments, this table maps the Unit 5 content against the Unit 5 assessment criteria and assessment guidance, taken from the specification. For further advice and help on writing and assessing assignments please contact TeachingScience@pearson.com.

Unit 5 Learning Aim A – Investigate and understand enthalpy changes associated with chemical reactions

Unit content	Assessment criteria	Assessment guidance
A.1 Exothermic and endothermic reactions: a. exothermic reactions as reactions that give out heat energy b. endothermic reactions as reactions that take in heat energy c. measurement of temperature changes for straightforward exothermic and endothermic reactions d. classification of temperature	**1A.1** Measure the temperature changes associated with chemical reactions.	To achieve **1A.1**, learners should carry out at least one exothermic and one endothermic reaction, **measure** the temperature changes and record these changes. Learners should correctly identify that the temperature increased or decreased but do not need to make the link to the reaction taking in heat or giving out heat. A proforma could be used to allow learners to achieve this criterion.
	2A.P1 Investigate temperature changes associated with exothermic and endothermic reactions using primary data.	More understanding is required at level 2. To achieve **2A.P1**, learners should **carry out** two exothermic reactions and one endothermic reaction, and conclude, from the measurements of temperature change, that the reaction was exothermic (gave out heat) or endothermic (took in heat). They must understand the meanings of those terms.

changes as positive or negative e. temperature changes linked to heat energy evolved or absorbed f. reactions for which enthalpy changes may be measured should include (but are not limited to) dissolution of sodium carbonate and ammonium chloride in water, neutralisation of acids, combustion of alcohols g. heat/enthalpy change associated with bond-breaking and bond-making h. overall enthalpy change for a reaction as a combination of bond-breaking and bond-making enthalpy changes i. use the equation: $q = m\ C\ \Delta T$ heat energy absorbed by water (J) = mass of water (g) x specific heat capacity ($J\ K^{-1}\ g^{-1}$) x temperature change (K) to determine the amount of heat energy absorbed by water in contact with the reaction j. simple energy profile	**2A.M1** Explain why an overall reaction is exothermic or endothermic.	To achieve **2A.M1,** learners must be able to **explain** clearly the link between the sign of the temperature change and the heat absorbed by the water, in contact with the reaction (or increase/decrease in temperature) and whether the reaction gives out heat or takes in heat. The words ‘exothermic’ and ‘endothermic’ should be used correctly. The role of the water in absorbing heat or supplying heat must be explained.
	2A.D1 Calculate the energy changes that take place during exothermic and endothermic reactions.*	To achieve **2A.D1**, learners must be able to **calculate** the heat absorbed by or taken from the water, in contact with the reaction using the equation $mC\Delta T$ and relate this to the enthalpy changes for reactions in terms of breaking bonds (which requires heat) and making bonds (which releases heat).

diagrams k. heat packs/cold packs.		

Unit 5 Learning Aim B – Investigate organic compounds used in society

Unit content	Assessment criteria	Assessment guidance
B.1 Fractional distillation of crude oil: a. fractional distillation of crude oil based on boiling ranges of components b. link between boiling ranges of hydrocarbons and length of hydrocarbon chain c. uses of fractions based on sizes of molecules – gases, petrol, kerosene, diesel oil, fuel oil, bitumens, waxes d. uses of alkanes as fuels – natural gas (methane), bottled gas (propane and butane), petrol, diesel, kerosene.	**1B.2** Identify the uses of the main fractions from the distillation of crude oil.	To achieve **1B.2**, learners should research and **identify** the uses of crude oil fractions. They must specifically state the uses of the gases: propane and butane. This could be done by the preparation of a poster or by detailed labelling of a fractional distillation diagram.
	2B.P2 Describe the fractional distillation of crude oil to produce a range of useful products.	To achieve **2B.P2**, learners must show that they can **describe** how fractional distillation of crude oil works and be able to identify the uses of a range of the fractions. That could be done by producing an annotated diagram of a fractional distillation column. They must specifically state the uses of propane and butane, petrol, diesel and kerosene.
	2B.M2 Explain how fractional distillation separates compounds due to different boiling ranges.	To achieve **2B.M2**, learners need to **explain** the boiling ranges of the different fractions to show how compounds are separated. This could be achieved by the use of secondary data such as a table or detailed annotation on a fractional distillation column diagram.

	2B.D2 Analyse the relationship between boiling range and length of carbon chain of fractions.	To achieve **2B.D2**, learners must be able to **analyse** and explain the link between the boiling point of the fractions and the length of their carbon chains.
B.2 Structural and displayed formulae of organic molecules: a. alkanes – methane, ethane, propane, butane b. alkenes – structure of ethene, propene c. other organic molecules – poly(ethene), ethanol, ethanoic acid, chloroethene, poly(chloroethene) (PVC), dichloromethane d. use of a line to denote a single covalent bond/shared pair of electrons and two lines to denote a double bond/two shared pairs of electrons.	**1B.3** Name alkanes and alkenes from structural and displayed formulae.	To achieve **1B.3**, learners must be able to **name**, from a representation of the structural and displayed formulae, methane, ethane, propane, butane, ethene and propene.
	2B.P3 Draw accurately the structural and displayed formulae of organic molecules.	To achieve **2B.P3**, learners must be able to accurately draw/provide a representation of straight chain alkanes, with 1–6 carbon atoms, ethene, chloromethanes, chloroethene, poly(ethene), ethanol and ethanoic acid.
	2B.M3 Describe the bonding and structure of organic molecules.	To achieve **2B.M3**, learners must be able to **describe** single and double bonding as covalent and **explain** that the lines in the displayed formulae represent a shared pair of electrons.
B.3 Test tube reactions to identify classes of organic molecules: a. alkenes decolourise bromine water (addition) b. carboxylic acids effervesce when sodium carbonate is added (neutralisation) c. alcohols oxidised by acidified dichromate (VI) solution which changes from	**1B.4** Identify an alkene and an alkane using primary observations.	To achieve **1B.4**, learners should, under supervision, **identify** an alkane and an alkene from primary observations. The alkane and alkene may be identified on the basis of being insoluble in water. The alkene may be identified by its ability to decolourise bromine water rapidly.
	2B.P4 Identify an alkene and carboxylic acid using primary observations.	To achieve **2B.P4**, learners should follow guidance to **identify** an alkene and a carboxylic acid (for example, ethanoic acid) from primary observations. Learners will be expected to identify an alkene in the way described in 1B.4. For ethanoic acid this is by its pH and its reaction with sodium carbonate. The guidance given to the learners could be in the form of a flowchart.

orange to green (oxidation).	**2B.M4** Explain how a series of experiments can be used to identify organic compounds based upon their solubility and reactions	To achieve **2B.M4**, learners should be able to **explain** the basis on which the identifications were made for an unknown alkane, alkene and carboxylic acid compound using their practical observations.
	2B.D3 Explain the results of the experiments to identify organic compounds in terms of their reaction type, structural and displayed formulae, and bonding.	To achieve **2B.D3**, learners need to use the results of the experiments to identify organic compounds using their reaction type, formulae and bonding in terms of their functional group, such as a double bond in an alkene and carboxylic acid functional group.
B.4 Uses of organic molecules in society: a. ethene in the manufacture of poly(ethene) and ethanol b. ethanol (made by fermentation/from ethene) in alcoholic drinks, biofuels, solvents, cosmetics c. ethanoic acid in vinegar and making esters d. dichloromethane in paint stripper and solvents e. chloroethene in polymerisation to PVC and uPVC f. Teflon™ (PTFE) in non-stick coatings and low-friction bearings g. problems of organic molecules (toxicity of compounds and products formed on combustion,	**1B.5** Identify uses of ethene, ethanol and ethanoic acid.	To achieve **1B.5**, learners should state or provide a very brief description of a use of ethene, a use of ethanol and a use of ethanoic acid.
	2B.P5 Describe the uses of organic compounds in our society.	To achieve **2B.P5**, learners should provide a brief account of the use of: • ethene as a feedstock – including as a raw material for ethanol manufacture • ethene in polymerisation • ethanol in alcoholic drinks – as a solvent, as a sterilisation agent, as a feedstock and as a fuel • poly(ethene) • poly(vinyl chloride) (PVC) – plasticised and unplasticised • ethanoic acid in vinegar – as a pickling agent and as a feedstock for making esters.
	2B.M5 Explain the problems associated with the use of organic molecules.	To achieve **2B.M5**, learners should **explain** the problems of at least two of these uses/applications in detail.
	2B.D4 Evaluate the benefits and drawbacks of using organic	To achieve **2B.D4**, learners should be able to contrast the benefits and drawbacks of using two organic materials, for

flammability and non-biodegradability).	molecules.	example, PVC. Benefits like cost, stability, versatility and low toxicity could be contrasted with drawbacks like the coupling with endocrine disrupting plasticisers and the production of dioxins when incinerated. They should be able to arrive at a judgement about whether the benefits outweigh the risks.

Unit 5 Learning Aim C – Explore the uses of nanochemicals and new materials

Unit content	Assessment criteria	Assessment guidance
		It is important for learners to understand that scientific research has always included the discovery of new materials and their applications.
C.1 Introduction to nanochemistry: a. nanoscale b. carbon nanostructures (fullerenes – buckyballs and nanotubes) c. production of nanotubes. **C.2** Uses of nanochemistry (sun creams, mascara, textiles, sports equipment, single crystal nanowires for processors, mobile phone batteries). **C.3** Implications of nanochemistry: a. safety and environmental	**1C.6** Define nanochemicals.	To achieve **1C.6**, learners should be able to **define** the term 'nanochemical'.
	2C.P6 Describe a use of nanochemicals, smart and specialised materials.	To achieve **2C.P6**, learners should **describe**, in detail, the use of at least one smart material, one application involving nanochemicals and one application of another sort of specialised material. Where the materials are used as part of a formulation/in conjunction with other materials, this should be described.
	2C.M6 Explain the benefits of using nanochemicals, smart and specialised materials.	To achieve **2C.M6**, learners should be able to **explain** the benefits of using these nanochemicals, smart and specialised materials.
	2C.D5 Evaluate the benefits and drawbacks of using nanochemicals, smart and specialised materials.	To achieve **2C.D5**, learners should explain the benefits and drawbacks of using nanochemicals, smart and specialised materials, and provide a reasoned judgement about whether the benefits outweigh the risks. Learners should research public concerns about nanochemicals, for example, the possibility of nanochemicals passing through cell walls and causing disruption. They should be able to assess these concerns by providing a brief description and stating the source(s) of their

issues b. ethical issues surrounding the use of nanochemicals whose properties are not fully understood. **C.4** Smart materials whose properties change in response to an external stimulus. **C.5** Examples of materials that are highly specialised and their properties, e.g. Kevlar®, GORE-TEX®, Thinsulate®, titanium dioxide.		information, and arguing whether the information is likely to be reliable on the basis of its source(s).