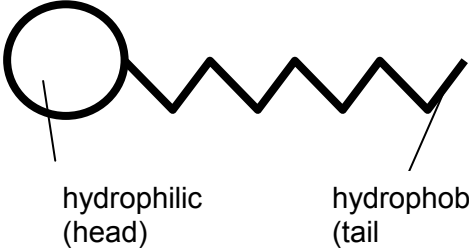
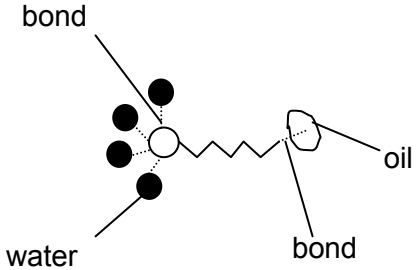


Question	Answer	Marks	Guidance
1 a	(purification processes) do not remove dissolved or soluble substances (1)	1	allow they are soluble / they are dissolved
b	large energy requirement (1) expensive (1)	2	allow heat for energy allow high cost of equipment allow issues related to scaling up / needs lots of water (1) ignore takes a long time
c	Pete is right about A but wrong about B (no mark) A contains copper (ions) because it gives a blue (ppt) with sodium hydroxide (1) A contains sulfate (ions) because it gives a white (ppt) with barium chloride (1) B contains iron(III) (ions) because it gives a brown (ppt) with sodium hydroxide (1) B does not contain sulfate (ions) as it does not give a white (ppt) with barium chloride (1)	4	allow Pete is wrong not Pete is wrong about A for marks about A not Peter is correct for B for marks about B copper sulfate goes blue with sodium hydroxide is not sufficient copper sulfate goes white with barium chloride is not sufficient iron(III) sulfate goes brown with sodium hydroxide is not sufficient B is not iron(III) sulfate because it does not go white with barium chloride is not sufficient allow B does not contain sulfate as it does not give a ppt allow A and B both cannot be sulfates since they do not both go white with barium chloride (2)
	Total	7	

Question	Answer	Marks	Guidance									
5 a	239 (1)	1										
b	FIRST LOOK AT THE ANSWER IF ANSWER = 33% AWARD 2 MARKS 0.33 g (1) 33 (%) (1)	2	allow ecf from wrong mass									
c	C ₂ H ₅ (1)	1	allow any order of symbols not C ² H ⁵ / C2H5 / or use of lower case H									
d	FIRST LOOK AT THE ANSWER IF ANSWER = Fe₂O₃ AWARD 3 MARKS <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>symbols</th> <th>Fe</th> <th>O</th> </tr> </thead> <tbody> <tr> <td>mole ratio</td> <td>$\frac{70}{56}$ or 1.25</td> <td>$\frac{30}{16}$ or 1.875</td> </tr> <tr> <td>simplest mole ratio</td> <td>$\frac{1.25}{1.25}$ or 1</td> <td>$\frac{1.875}{1.25}$ or 1.5</td> </tr> </tbody> </table> mole ratio (1) simplest mole ratio (1) empirical formula is Fe ₂ O ₃ (1)	symbols	Fe	O	mole ratio	$\frac{70}{56}$ or 1.25	$\frac{30}{16}$ or 1.875	simplest mole ratio	$\frac{1.25}{1.25}$ or 1	$\frac{1.875}{1.25}$ or 1.5	3	If fraction is the wrong way around = 0 marks for the question If divide by atomic number = 0 marks for the question If just use ratio of masses = 0 for the question allow ecf from mole ratio allow ecf from simplest ratio allow FeO _{1.5} = 2 marks for the question
symbols	Fe	O										
mole ratio	$\frac{70}{56}$ or 1.25	$\frac{30}{16}$ or 1.875										
simplest mole ratio	$\frac{1.25}{1.25}$ or 1	$\frac{1.875}{1.25}$ or 1.5										
Total		7										

Question	Answer	Marks	Guidance
2 a i	hydrophilic (head) and hydrophobic (tail) (1)	1	 <p>hydrophilic (head) hydrophobic (tail)</p> <p>allow polar (head) and non-polar (tail) (1) allow ionic (head) and hydrocarbon (tail) (1) ignore water loving and water hating</p>
a ii	<p>hydrophobic end or tail is attracted to oil / hydrophobic end or tail forms intermolecular forces with oil / hydrophobic end or tail bonds to oil (1)</p> <p>hydrophilic end or head is attracted to water / hydrophilic end or head forms intermolecular forces with water / hydrophilic end or head bonds to water (1)</p>	2	<p>if no other marks awarded allow tail is surrounded by oil molecules and the head by water molecules</p> <p>allow sticks to or attached or joined or combines with as alternative to 'bonds', but the hydrophobic end goes into oil is not sufficient ignore hydrophilic head loves water / hydrophobic tail loves oil ignore ideas of repelling water / oil all marks can be awarded from a labelled diagram but to get two marks must clearly show bonding to rather than surrounded by</p>  <p>bond oil</p> <p>water bond</p> <p>allow ecf from (a)(i) for 1 mark e.g. hydrophobic head bonds to oil and hydrophilic tail bonds to water, if labels the wrong way round in (a)(i)</p>

Question	Answer	Marks	Guidance
b	protein (molecules) (1) permanently change shape / irreversible change of shape (1)	2	allow polypeptide (molecules) (1) ignore enzymes allow proteins become cross-linked (2) allow molecular structure changes permanently (1) allow one mark for denaturing if no other mark awarded
	Total	5	

Question	Answer	Marks	Guidance
3 a	absorbs or takes in energy (in the light) (1) (then) releases or emits energy (in the dark) (1)	2	allow stores energy from light in the day (1) allow light instead of energy not reference to radioactive emissions
b	reacts with oxygen / it is oxidised (1)	1	
	Total	3	

Question	Answer	Marks	Guidance
4 (a)	<p>Level 3 (5–6 marks) Comprehensively explains the process of fractional distillation in terms of molecular size, intermolecular forces and boiling points AND Applies knowledge of temperature gradient in fractionating tower to correctly list the fractions in the order they ‘exit’ the tower. Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Attempts to explain the process of fractional distillation in terms of molecular size and/or intermolecular forces and boiling points AND Applies knowledge of temperature gradient in fractionating tower to list the fractions in the order they ‘exit’ the tower. Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Describes the process of fractional distillation, but answer may be simplistic and lacking in detail OR lists the fractions in the correct order. Quality of written communication impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to A*.</p> <p>Indicative scientific points at levels 2 and 3 may include:</p> <ul style="list-style-type: none"> • smaller molecules, eg LPG / petrol / paraffin, have weaker or fewer intermolecular forces / ora • smaller molecules have lower boiling points with weaker or fewer intermolecular forces / ora • during boiling the weak intermolecular forces break but covalent bonds within the molecule do not. <p>Indicative scientific points at Level 1 may include:</p> <ul style="list-style-type: none"> • crude oil is heated • fractionating column has temperature gradient (cold at top and hot at bottom) • order of fractions, from top, is: <ul style="list-style-type: none"> LPG petrol paraffin heating oil fuel oils bitumen <p>Use the L1, L2, L3 annotations in scoris; do not use ticks.</p>

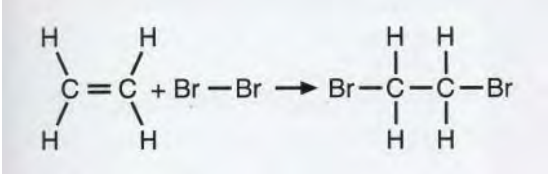
Question		Answer	Marks	Guidance
	(b)	$\text{C}_3\text{H}_8 + 3\frac{1}{2}\text{O}_2 \rightarrow 3\text{CO} + 4\text{H}_2\text{O}$ formulae (1) balancing (1)	2	<p>allow any correct multiple, including fractions</p> <p>allow = / = instead of →</p> <p>not and / &</p> <p>balancing mark is dependent on the correct formula but</p> <p>allow 1 mark for a balanced equation with minor errors of case, subscripts, superscripts, etc</p> <p>eg $\text{C}_3\text{H}_8 + 3\frac{1}{2}\text{O}_2 \rightarrow 3\text{CO} + 4\text{H}_2\text{O}$</p>
		Total	8	

Question		Answer	Marks	Guidance
5	(a)	<p>nonane (1)</p> <p>largest temperature change / greatest temperature rise – dependent on correct choice of hydrocarbon (1)</p>	2	<p>second mark is dependent on first mark</p> <p>allow nonane (1) because the temperature rise is 27 (1) but only if all of the temperature changes are calculated</p> <p>not highest temperature obtained</p> <p>allow nonane (1) because it is the largest molecule (1)</p>
	(b)	29 (1)	1	
		Total	3	

Question		Answer	Marks	Guidance
6	(a)	$\frac{34}{267} \times 100$ (1)	1	allow $\frac{34}{(233 + 34)} \times 100$ / $\frac{34}{(98 + 169)} \times 100$ the mark is for the working out and not the answer
	(b)	$\frac{18}{20} \times 100$ / $\frac{18}{20}$ (1) 90 (1)	2	allow $\frac{am}{pm} \times 100$ for one mark if answer incorrect allow full marks for 90(%) with no working out
	(c)	because the atom economy is low / lots of atoms are wasted in the reaction (1)	1	allow lots of waste made / produces waste products / produces barium sulfate which is not used not reference to percentage yield
		Total	4	

Question	Answer	Marks	Guidance
7 a	no undesired products made / no waste products made / all the atoms that react end up in the product / only one product made (1)	1	not the same number of atoms on each side of the equation
b i	idea that 164g of sodium ethanoate makes 120g of ethanoic acid / idea that 82g of sodium ethanoate makes 60g of ethanoic acid (1) but mass is 6 (2)	2	units not needed
b ii	$\frac{(2 \times 60)}{(2 \times 60) + 142} \times 100$ or $\frac{120}{262} \times 100$ or $\frac{(2 \times 60)}{(2 \times 82) + 98} \times 100$ or $\frac{120}{164 + 98} \times 100$ (1) but 45.8% (2)	2	allow full marks for correct answer despite working out allow 46% (2)
c i	46 % (2) but 46.2 / 46.15 / 46.154 (1)	2	answer must have two sig figs for two marks allow one mark for $\frac{2.4}{5.2} \times 100$
ii	waste a lot of starting material / wastes reactants (1)	1	ignore waste products ignore just 'a lot of waste' ignore wastes lots of resources
	Total	8	

Question		Answer	Marks	Guidance
8	(a)	<p>any two from: all the readily extractable resources will be used up in the future (1)</p> <p>will have to find replacements / AW (1)</p> <p>idea of not enough fuel to power vehicles or homes / make electricity / make chemicals (1)</p> <p>conflict between making petrochemicals and fuels (1)</p> <p>UK dependent on oil and gas from politically unstable countries / AW (1)</p>	2	<p>allow (all) it / oil / coal / fossil fuels will run out / be used up (1)</p> <p>allow crude oil will have to be extracted from more inaccessible areas (1)</p> <p>allow crude oil will become very expensive / may lead to rationing / may lead to conflicts (1)</p>
	(b)	bitumen (1)	1	allow phonetic spelling
	(c)	(i) C ₄ H ₁₀ (1)	1	<p>not C₄H₁₀ / C⁴H¹⁰</p> <p>allow H₁₀C₄</p>
		(ii) propane and butane contain carbon and hydrogen (atoms) (1) only (1)	3	<p>not is a mixture of carbon and hydrogen (only)</p> <p>not contains carbon and hydrogen molecules</p> <p>Only must be linked to first marking point and is not independent</p> <p>allow has no (carbon to carbon) double bonds (1)</p> <p>allow they are saturated compounds (1)</p> <p>allow has general formula C_nH_{2n+2} (1)</p> <p>ignore has the maximum amount of hydrogen atoms</p>
		Total	7	

Question		answer	Marks	Guidance
9	(a)	contains single (covalent) bonds only / AW (1)	1	allow does not have a double bond allow fits the general formula C_nH_{2n+2} ignore reference to saturation
	(b)	ethene		allow C_2H_4 / correct displayed formula / ethylene
	(c)	$C_2H_4O_2$	1	allow symbols in any order ignore CH_3COOH not $C_2H_4O_2$ / $C_2H^4O_2$ / $C^2H^4O^2$
	(d)	$C_2H_4 + Br_2 \rightarrow C_2H_4Br_2$	1	allow correct equation using displayed formulae or mixture of molecular, correct structural and correct displayed formulae  allow = for \rightarrow not and & for +
		Total	4	

Question		Answer	Marks	Guidance	
10	(a)	petrol (1)	1	allow C ₅ – C ₁₀ (1)	
	(b)	<p>any two from oil slicks (1)</p> <p>idea of damage to wildlife (1)</p> <p>damage to beaches (1)</p>	2	<p>allow oil leaks/oil spills (1)</p> <p>allow named wildlife eg kills sea birds / fish (1) allow destroys habitats (1)</p> <p>allow harms tourist trade (1) allow damage to the local economy or fishing industry (1) ignore risk of explosion</p>	
	(c)	(i)	percentage made is less than the percentage needed ora (1)	1	allow only 5% is produced when 22% is needed (1)
		(ii)	<p>idea that cracking converts large (hydrocarbon) molecules into smaller (more useful) ones or petrol (1)</p> <p>and</p> <p>any one condition from catalyst / high temperature (1)</p>	2	<p>allow correct references to just hydrocarbons or (hydrocarbon) chains allow hydrocarbon molecules are split or hydrocarbon molecules are broken down allow breaks named large fractions into named smaller fractions eg breaks bitumen down into petrol (1)</p> <p>ignore references to pressure</p> <p>allow heat it (1)</p>
			Total	6	