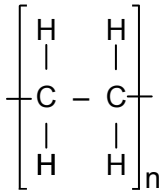
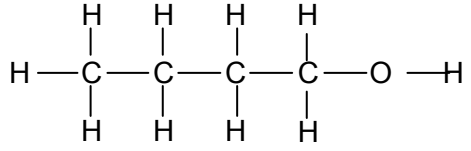
Question	Answer	Marks	Guidance
1 a	idea that amount of CFCs rises at first and then gradually decreases (1) use of CFCs banned (about 1992-1995) (1)	2	**allow** the amount peaked and then went down **ignore** reference to actual years **allow** laws introduced to ban use of CFCs **ignore** idea that there was evidence that CFCs were dangerous
b	**any three from:** (idea that at first CFCs were welcomed because) they had many uses (1) idea that they are inert / non-toxic / do not react (1) idea that later CFCs were linked to ozone depletion (1) idea that scientists wanted (use of) CFCs to be banned (1)	3	 **allow** CFCs were used as refrigerants, aerosols etc seems like a good thing when first discovered / were very useful are **not** sufficient harmless or safe to use are insufficient **allow** reacts with ozone in (upper) atmosphere / destroys the ozone layer / damages the ozone layer / makes ozone holes
	Total	**5**	

Question			answer	Marks	Guidance
2	(a)		(formula) does not contain **only** carbon and hydrogen / (formula) does contain oxygen (1)	1	**not** (formula) contains an oxygen molecule
	(b)		**D** (1)	1	
	(c)		**E** (1)	1	
	(d)		 (1)	1	**allow** or other carbon chain with even number of CH_2 units
			Total	**4**	

Question			answer	Marks	Guidance
3	(a)		(solvent) **D** (1) idea that removes more of the stain than **B**, without damaging the fabric / idea that removes majority of the stain, without damaging the fabric (1)	2	**Second marking point is dependent on correct choice of solvent D** **allow** idea that removes a high percentage of the stain, without damaging the fabric (1)
	(b)		**any two from:** repeat the experiment (at each temperature) (1) carry out the experiment with a greater range of temperatures (1) do the experiment for a longer time (1) test on different types of stain (1) test on different types of cotton (1)	2	**allow** specific aspects related to a fair test (1) e.g. use same amount of solvent **ignore** test on different fabrics
			Total	**4**	

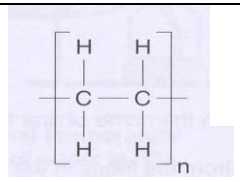
Question			Answer	Marks	Guidance
4	(a		ethene + water → ethanol (1)	1	**allow** = instead of → **allow** correct symbol equation $C_2H_4 + H_2O \rightarrow C_2H_5OH$ or C_2H_6O **allow** steam for water
	(b)	**(i)**	C_3H_7OH (1)	1	**allow** C_3H_8O allow any order of atoms
		(ii)	correct displayed formula (1) 	1	**allow** displayed formula for methylpropan – 1 – ol or methylpropan – 2 – ol or butan-2-ol **allow** OH in displayed formula with no bond between O and H

Question			Answer	Marks	Guidance
	(c)		**Level 3 (5–6 marks)** **Discusses at least one advantage and at least one disadvantage of each process** **AND** **identifies the better process fully justifying their choice.** Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** **EITHER** **Discusses at least one advantage and at least one disadvantage of each process** **OR** **Gives two comments (either advantages or disadvantages) about each process AND identifies the better process and gives a reason for that choice** Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** **Gives two comments (either advantages or disadvantages) about each process** **OR** **identifies the better process and gives a reason for that choice** Quality of written communication impedes communication of the science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit	6	**This question is targeted at grades up to A/A*** **Indicative scientific points may include:** **Relevant points include for hydration process:** **advantages** • making ethanol from ethene is a much quicker process • ethanol can be produced 24/7 from ethene • pure ethanol made so it does not need to be purified • making ethanol from ethene does not produce any waste products as the atom economy is 100% • UK has access to North sea oil. • made by a continuous process **disadvantages** • ethene has to be manufactured from crude oil • crude oil (ethene) is a non renewable source • uses a lot of energy. **Relevant points include for fermentation process:** **advantages** • making ethanol from sugar is greener as the raw sugar is renewable / can be grown • energy costs are cheaper because a lower atmospheric pressure and a lower temperature than hydration is used • catalyst used is not corrosive since it is an enzyme found in yeast **disadvantages** • ethanol has to be purified • takes a long time to make • climate not suitable • uses large areas of arable land. • atom economy not 100% (if carbon dioxide not used) • made in a batch process **Use the L1, L2, L3 annotations in Scoris; do not use ticks**
			Total	**9**	

Question			answer	Marks	Guidance
5	(a		CFCs deplete the ozone (layer) (1) (population exposed to) high**er** levels of ultraviolet light (1)	2	**allow** forms ozone holes / damages the ozone (layer) **not** breaks down ozone atoms **ignore** global warming / is a greenhouse gas **allow** (population has a) great**er** risk of skin cancer
	(b)		C_2HF_5 (1)	1	**allow** other ways of indicating the correct answer e.g. underlining, ticking but answer line takes precedence
			Total	**3**	

Question			Answer	Marks	Guidance
6	(a)		**any two from:** all the readily extractable resources will be used up in the future (1) will have to find replacements / AW (1) idea of not enough fuel to power vehicles or homes / make electricity / make chemicals (1) conflict between making petrochemicals and fuels (1) UK dependent on oil and gas from politically unstable countries / AW (1)	2	**allow** (all) it / oil / coal / fossil fuels will run out / be used up (1) **allow** crude oil will have to be extracted from more inaccessible areas (1) **allow** crude oil will become very expensive / may lead to rationing / may lead to conflicts (1)
	(b)		bitumen (1)	1	**allow** phonetic spelling
	(c)	(i)	C_4H_{10} (1)	1	**not** C4H10 / C^4H^{10} **allow** $H_{10}C_4$
		(ii)	propane and butane contain carbon and hydrogen (atoms) (1) only (1) has (carbon to carbon) single bonds **only** / contains single (covalent) bonds **only** (1)	3	**not** is a mixture of carbon and hydrogen (only) **not** contains carbon and hydrogen molecules Only must be linked to first marking point and is not independent **allow** has no (carbon to carbon) double bonds (1) **allow** they are saturated compounds (1) **allow** has general formula C_nH_{2n+2} (1) **ignore** has the maximum amount of hydrogen atoms
			Total	**7**	

Question			Answer	Marks	Guidance
7			**C** because it is flexible, waterproof and breathable (2)	2	marks are for evaluation, not for the choice of **C** but for two marks properties must relate to correct choice of **C** for two marks **all three** properties must be listed **allow** one mark for choice of **C** with **two** properties listed **allow** one mark for **E** and because it is flexible and waterproof ignore reference to not breathable if **E** mentioned.
			Total	**2**	

Question			Answer	Marks	Guidance
8	(a)	(i)	contains a double bond (between carbon atoms) (1)	1	**not** double bond between carbon molecules **ignore** does not have the maximum amount of hydrogen atoms
	(b)	(i)	addition reaction (1)	1	**allow** bromination
		(ii)	a dibromocompound (1)	1	**allow** saturated / halogenocompound
	(c)		 correct repeat unit drawn with open bonds at both ends (1) correct use of brackets and n (1)	2	**second mark is dependent on first mark** **allow** multiples of this structure eg $-(CH_2CH_2CH_2CH_2-)_n-$ for two marks **allow** one mark for a section of the polymer that has at least two repeat units with open ends at both ends
			Total	**5**	

Question			Answer	Marks	Guidance
9			**[Level 3]** Answer describes how an ester is made in a laboratory, including that the reactants must be mixed or heated together **AND** applies knowledge of safety and risk assessment to give at least two safety precautions used in the preparation of an ester, one involving the problems of heating a flammable liquid. Quality of written communication does not impede communication of science at this level. **(5–6 marks)** **[Level 2]** Candidates recall the names of <u>both</u> reactants **AND** applies knowledge of safety and risk assessment to give two safety precautions used in the preparation of an ester. Quality of written communication partly impedes communication of science at this level. **(3–4 marks)** **[Level 1]** Candidates recall the name of <u>one</u> reactant used to make an ester **OR** applies knowledge of safety and risk assessment to give at least one safety precaution used in the preparation of an ester. Quality of written communication impedes communication of science at this level. **(1–2 marks)** **[Level 0]** Insufficient or irrelevant science such as repeating the question. Answer not worthy of credit. **(0 marks)**	6	**This question is targeted up to grade C** **Indicative scientific points may include:** • safety precautions include use of safety glasses, gloves, safety screen, fire extinguisher, water bath, laboratory coats etc • reagents are heated together in a beaker or in a test tube in a water bath • reagents are heated together • the reagents are mixed together • alcohols react with acids to make ester • higher level answers may refer to methods that use refluxing and distillation • sulfuric acid added as a catalyst to the reaction mixture • reaction mixture is added to sodium carbonate solution **Use the L1, L2, L3 annotations in scoris. Do not use ticks.**
			Total	**6**	

Question			Answer	Marks	Guidance
10	(a)		hydrophilic end bonds to water molecule (1) hydrophobic end bonds to oil molecule (1)	2	**allow** attracted to / sticks into / joins to or forms intermolecular forces with as alternative to bonding **allow** head bonds to water molecule and tail bonds to oil molecule for two marks **allow** one mark for water molecules surround the hydrophilic end **and** oil molecules surround the hydrophobic end **allow** one mark for one end is bonded to water **and** the other to oil **allow** one mark for hydrophilic end stays in or likes water **and** hydrophobic stays in or likes oil **not** hydrophobic is bonded to water and hydrophilic is bonded to oil
	(b)		shape of protein (molecules permanently) changes (1)	1	**allow** protein (molecule) is denatured **allow** protein (molecule) is destroyed **ignore** enzyme is denatured
	(c)		$2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$ formulae correct (1) balancing (1)	2	balancing mark is dependent on correct formulae **allow** = instead of → **allow** any correct multiples of this equation **allow** one mark for correct balanced equation with minor errors of superscripts, subscript or case. eg $2NAHCO_3 \rightarrow Na_2CO_3 + CO^2 + H2O$
			Total	**5**	