

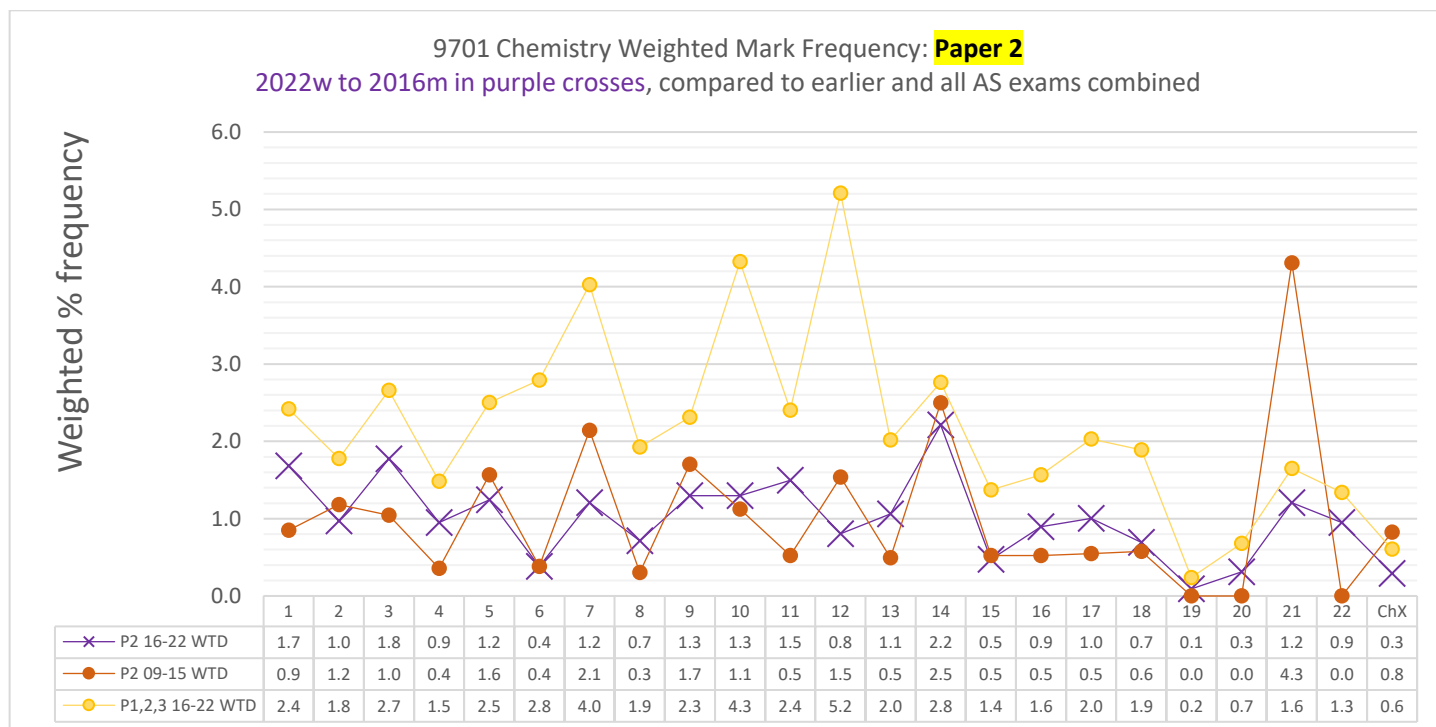
ALvl Chem 20 EQ P2 22w to 09s Paper 2 Polymerisation 17marks

As you start and work through this worksheet you can tick off your progress to show yourself how much you have done, and what you need to do next. The first task is just to read the first question and should take you less than one minutes to complete.

Paper 2 Topic 20

Checklist Tick each task off as you go along

RANK:	P1 Noob	P1 Novice	P1 Bronze	P1 Silver	P1 Gold	P1 ¹ Winner	P1 Hero	P1 Legend
	1 Q started	1 Q done	10% of marks	25% of marks	40% of marks	50% of marks	75% of marks	100% of marks
Topic (marks)	17	3	2	4	7	9	13	17
Time @75s/mark (minutes)	21	4	2	5	9	11	16	21



What the most thoughtful students will get out of their extensive studying will be a capacity to do meaningful brain-based work even under stressful conditions, which is a part of the self-mastery skillset that will continue to deliver value for the whole of their lives. Outstanding grades will also happen, but the most important goal from skillful action in study is being better at any important task, even if circumstances do not feel ideal.

As you are moving through your studies you can learn more about yourself by trying out new ways to manage yourself, and analysing how effective those new techniques were. In this reflective process not only will you get better at working positively and productively to deliver ambitious and successful outcomes, but you will be working towards one aspect of life's highest pursuit, summarised and inscribed on the Temple of Apollo at Delphi: "know thyself".

- To complete these questions, as important as your answer, is checking your answer against the mark scheme.
- For each page or group of 10-20 marks, convert your mark score into a percentage. This will allow you to see (and feel) your progress as you get more experience and understanding with each topic.
- Multiple choice questions, done carefully where you explain and show yourself your thinking using written notes as you move through each question, can be more useful than just Paper 2 for students aiming for a C or B grade. Paper 2 should be the larger focus for students aiming for A and A* grades, however.
- If you find you get a higher percentage answering short answer questions than multiple choice questions that often means you are NOT using the marking scheme correctly; your correct answer might not be fully complete for all the marks you are awarding. The marks easiest to miss rely on providing the largest amount of detail.

¹ **DO NOT** work on these higher levels of completion in your AS year unless you have also achieved at least a "Silver" (25%) in the same topic in **Paper 1**, which tend also to be easier questions, as well as "Silver" (25%) in the same topic, if it exists, in Paper 3.

20 Polymerisation

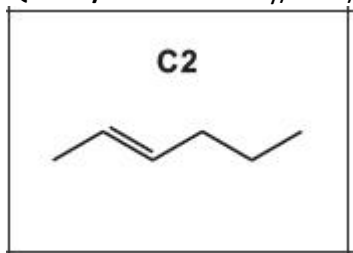
20.1 Addition polymerisation

Learning outcomes

Candidates should be able to:

- 1 describe addition polymerisation as exemplified by poly(ethene) and poly(chloroethene), PVC
- 2 deduce the repeat unit of an addition polymer obtained from a given monomer
- 3 identify the monomer(s) present in a given section of an addition polymer molecule
- 4 recognise the difficulty of the disposal of poly(alkene)s, i.e. non-biodegradability and harmful combustion products

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(d) **C2** forms a polymer when heated gently.

(i) Identify the type of polymer that forms from **C2**.

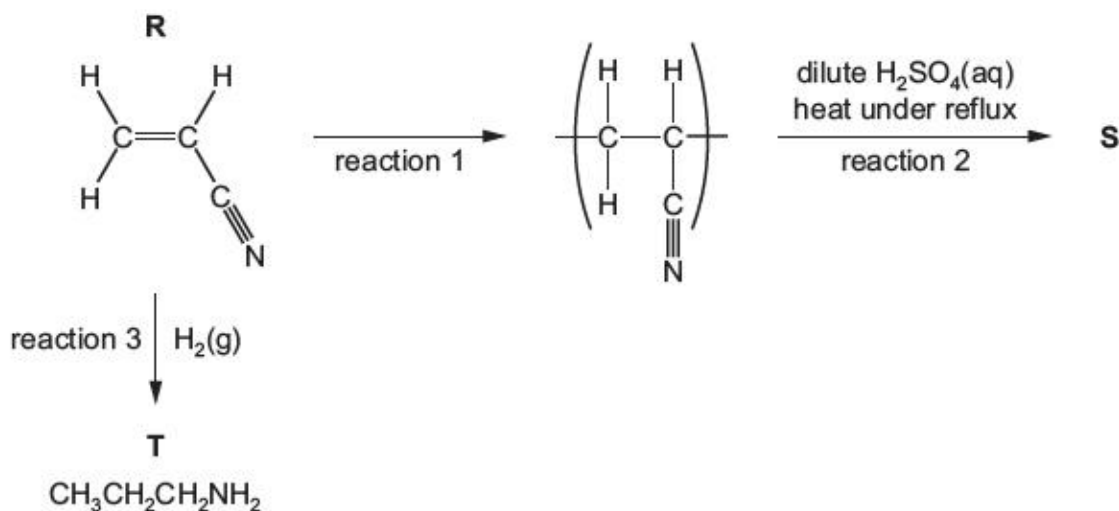
..... [1]

(ii) Draw one repeat unit of the polymer formed from **C2**.

[2]

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(d) The flow chart shows some reactions of **R**.



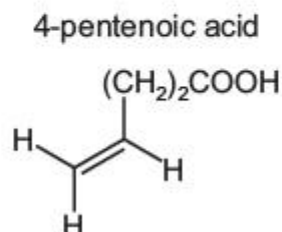
(i) Name the type of reaction shown in reaction 1.

..... [1]

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(c) Fats are compounds made from glycerol and unsaturated carboxylic acids.

4-pentenoic acid is an example of an unsaturated carboxylic acid.



(ii) Draw the repeat unit of the addition polymer that can be formed from 4-pentenoic acid.

[1]

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3 Trihalomethanes are organic molecules in which three of the hydrogen atoms of methane are replaced by halogen atoms, for example CHCl_3 .

(c) CHCl_2F_2 is also used to produce the monomer tetrafluoroethene, C_2F_4 .

This monomer can be used to produce poly(tetrafluoroethene), PTFE.

(i) State the type of polymerisation that occurs during the production of PTFE.

..... [1]

(ii) Draw the repeat unit of PTFE.

[1]



(iii) Suggest why PTFE is used as a coating for cooking pans.

.....
.....
.....
..... [1]

(iv) Waste disposal can cause litter problems.

State two **other** difficulties associated with the disposal of PTFE.

1
.....
2
..... [2]

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(c) Cracking one mole of dodecane, $C_{12}H_{26}$, produces two moles of ethene and one mole of another hydrocarbon molecule.

The ethene can be used in the production of poly(ethene).

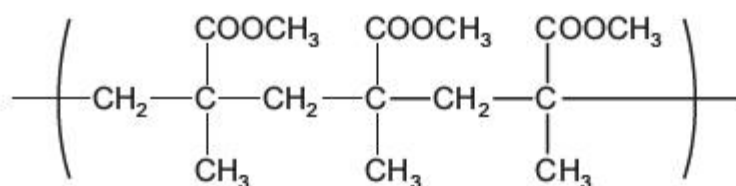
(ii) Give the full name of the process used to produce poly(ethene) from ethene.

..... [1]

(iii) Give **two** reasons why poly(ethene) should be reused or recycled rather than just thrown away.

.....
.....
..... [2]

(iv) Part of a polymer chain, produced by the same type of process as poly(ethene), is shown.

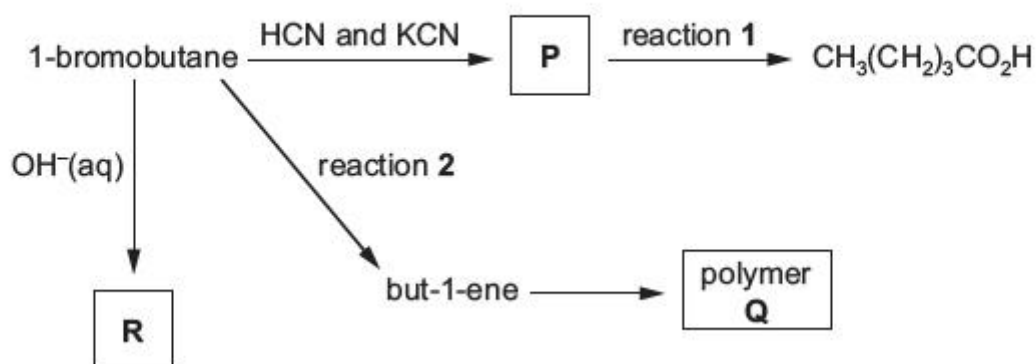


Give the **displayed** formula of the monomer used to produce this polymer.

[2]

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3 (a) A series of reactions starting from 1-bromobutane is shown.



(iii) Draw the structure of the repeat unit of polymer **Q**.

[2]

Mark Scheme ALvl Chem 20 EQ P2 22w to 09s Paper 2 Polymerisation 17marks

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4(d)(i)	addition	1
4(d)(ii)	$\begin{array}{c} \text{H} \quad \text{CH}_2\text{CH}_2\text{CH}_3 \\ \quad \\ \text{---C---C---} \\ \quad \\ \text{H}_3\text{C} \quad \text{H} \end{array}$ <p>correct carbon backbone including 'dangling' bonds for ONE repeat unit</p>	1
	rest of structure correct	1

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3(d)(i)	addition polymerisation	1
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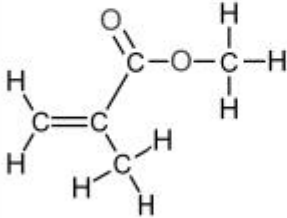
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3(c)(ii)	$\begin{array}{c} \text{H} \quad (\text{CH}_2)_2\text{COOH} \\ \quad \\ -\text{C}-\text{C}- \\ \quad \\ \text{H} \quad \text{H} \end{array}$	1
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3(c)(i)	addition	1
3(c)(ii)	$\begin{array}{c} \text{F} \quad \text{F} \\ \quad \\ -\text{C}-\text{C}- \\ \quad \\ \text{F} \quad \text{F} \end{array}$	1
3(c)(iii)	molecule unreactive / inert	1
3(c)(iv)	non-biodegradable creates toxic / harmful gases / HF / CO ₂ / CO if burnt	2

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2(c)(ii)	addition polymerisation	1
2(c)(iii)	<i>two from</i> save space in landfill avoid litter prevent eyesore non-biodegradable conserves non-renewable resources harmful incineration products harmful to wildlife	2
2(c)(iv)		
	correct monomer	1
	fully displayed	1

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3(a)(iii)	$\left(\begin{array}{c} \text{H} \quad \text{C}_2\text{H}_5 \\ \quad \\ -\text{C}-\text{C}- \\ \quad \\ \text{H} \quad \text{H} \end{array} \right)$ <p>C-C backbone with dangling bonds rest of structure</p>	2
		1
		1

