

Mark Scheme - 10

1.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		1	a compound containing hydrogen and carbon only			mixture
(b)		1	each fraction collected across a range of temperatures / several compounds have similar boiling points		melting points	
(c)	(i)	1	(catalytic) cracking			
	(ii)	1	polymerisation			
(d)		2	double bond breaks / turns in to single bond (1) molecules join together to form (long) chains (1)			
(e)		1	non-biodegradable / increased use of landfill / depletion of raw materials produce toxic / harmful gases when burned	can harm wildlife	'harmful' – unless linked to burning	

2.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	1	C_8H_{18}		octane	
	(ii)	1	cracking			
(b)	(i)	1	goes milky/cloudy/white because carbon dioxide is given off			
	(ii)	I	2	(colourless) liquid / water (1) forms when hydrogen burns (1)		
		II	2	no change (1) no carbon dioxide given off because no carbon present in fuel / hydrogen does not burn to give carbon dioxide (1)		

3.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	3	mass carbon and hydrogen divided by respective A_r values e.g. carbon 9/12 and hydrogen 2/1 (1) ratio of 3:8 (1) C_3H_8 (1) ecf possible if formula given is an alkane award (1) mark only for correct answer with no working			
(b)	2	$M_r(C_4H_{10}) = 58$ (1) $(48/58) \times 100 = 82.76$ (1) consequential marking	82.8 / 83		

4.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	2	remains of sea / marine organisms / small sea animals / small plants (1) from millions of years ago / under the effect of heat/pressure / no oxygen (1)			
(b)	(i)	1	evaporated / vaporised	boiled	
	(ii)	1	different boiling points		
(c)	2	nitrogen (1) it has the lowest boiling point (1) do not award second mark if incorrect gas named			

5.

Mark	Guidance
6	<p data-bbox="306 354 1934 500">Indicative content: This method of separation is called fractional distillation. Crude oil is a mixture of hydrocarbons. The crude oil is heated and vaporised before entering the column. Smaller/lower boiling hydrocarbons will rise in the column and condense higher up the column. Hydrocarbons with similar boiling points condense at the same level in the column. (Boiling point depends on the size of the molecule – larger molecules have higher boiling points.)</p> <p data-bbox="306 545 1898 691">5-6 marks: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p data-bbox="306 737 1898 847">3-4 marks: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p data-bbox="306 893 1934 1003">1-2 marks: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p data-bbox="306 1049 1566 1081">0 marks: The candidate does not make any attempt or give a relevant answer worthy of credit.</p>

6.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		2	over millions of years (1) remains of marine organisms (1)	missing 'marine' reference if pressure / heat mentioned		
(b)	(i)	2	as the molecule size increases - the boiling point (range) increases / (colour) darkens / becomes more viscous / more difficult to burn / flame becomes more smoky any two for (1) each	inverse statement		
	(ii)	2	temperature lower during the winter (1) propane easier to ignite (1) butane becomes liquid at low temperature / difficult or problems for the butane to flow (1) any two for (1) each			

7.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	1	compound that contains hydrogen and carbon only			mixture
	(ii)	2	decaying / remains of / dead (marine) organisms (1) heat / pressure over millions of years (1) must have reference to organisms/correct context to award second mark			
(b)	(i)	1	bitumen and naphtha	recalled knowledge e.g. wax		
	(ii)	2	22% (2) award (1) for 156 or 44 ecf possible for incorrect addition (must divide by 2)			
	(iii)	I	1	cracking		
		II	1	polymerisation		

8.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		2	increase (1) carbon dioxide given out during breathing / respiration (1)		breathing	
(b)		2	decrease (1) carbon dioxide removed during photosynthesis / plants take in carbon dioxide (1)			
(c)		2	increase (1) carbon dioxide given out during combustion / burning (of fuels) (1)			

9.

Mark	Answer
6	<p>Indicative content Many fossil fuels contain impurities including sulfur. The sulfur produces sulfur dioxide during combustion which can eventually produce sulfuric acid resulting in acid rain. Lakes can then become acidic damaging aquatic life. Forests and vegetation gets damaged. Limestone buildings are badly affected. Acid rain also attack metal structures such as bridges.</p> <p>5-6 marks: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3-4 marks: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p>1-2 marks: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks: The candidate does not make any attempt or give a relevant answer worthy of credit.</p>

10.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	1	carbon, sulfur and hydrogen	C, S and H	H ₂ oxygen	
	(ii)	1	(fuels that) cannot be replaced (when they are used up) / (fuels that) will run out		'limited amount' needs qualification	
(b)	(i)	1	$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$			
	(ii)	1	produces a '(squeaky) pop' noise when tested with a lighted splint		'pop test'	
	(iii)	2	(large amount of) electricity required to produce hydrogen (1) (storage problem due to its) explosive nature (1)	availability of hydrogen e.g. lack of service stations for vehicles	highly flammable / unsafe / unstable / expensive	

11.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		1	C ₃ H ₆		CH ₂ CHCH ₃	
(b)		1	$ \begin{array}{ccccc} & \text{H} & \text{H} & \text{H} & \\ & & & & \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{H} \\ & & & & \\ & \text{H} & \text{H} & \text{H} & \end{array} $			
(c)		3	<ul style="list-style-type: none"> • double bond opens (1) R • ethene molecules join together • long chain / single chain formed / polymer formed • addition reaction/ addition polymerisation <p>any two for (1) each</p>		<p>becomes single bond loses double bond</p> <p>'additional'</p>	

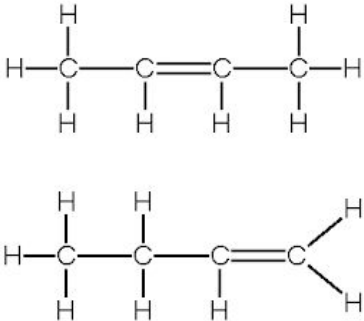
12.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		3	$ \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \end{array} $ (1) C_6H_{14} (1) methane (1)			
(b)	(i)	1	ethene	C_2H_4		polyethene
	(ii)	1	monomers		unsaturated	
(c)	(i)	1	polytetrafluoroethene	PTFE		
	(ii)	1	$ \begin{array}{c} \text{F} \quad \text{F} \\ \quad \\ -\text{C}-\text{C}- \\ \quad \\ \text{F} \quad \text{F} \end{array} $		ignore brackets	

13.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	4	<p><i>Name</i> propene (1)</p> <p><i>Molecular formula</i> CH₄ (1)</p> <p><i>Structural formula</i></p> $ \begin{array}{cccc} & \text{H} & \text{H} & \text{H} & \text{H} \\ & & & & \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{C} - \text{H} \\ & & & & \\ & \text{H} & \text{H} & \text{H} & \text{H} \end{array} $ <p>(1)</p> <p><i>Family of hydrocarbons – both needed</i> (1)</p> <p>alkane</p> <p>alkene</p>			
(b)	2	<p>double bond breaks / changes to single bond (1)</p> <p>many ethene molecules join together / form long chain or polymer (1)</p>			
(c)	1	$ \begin{array}{cc} \text{F} & \text{F} \\ & \\ \text{C} & = \text{C} \\ & \\ \text{F} & \text{F} \end{array} $ <p>ignore 'n' and any brackets used</p>			

14.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	1	either of following 	correct structure for 2-methylpropene		
(b)	4	double bonds open (1R) Reserved mark <ul style="list-style-type: none"> propene molecules join together / form chains (1) (addition) polymerisation (1) repeat unit $\left[\text{C}_3\text{H}_6 \right]_n \quad (1)$ any 2 of high temp / high pressure / catalyst (1) any 3 up to 3 max			condensation polymerisation

15.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		1	C ₄ H ₁₀			
(b)		2	propane (1) $ \begin{array}{ccccc} & \text{H} & & \text{H} & & \text{H} \\ & & & & & \\ \text{H} & - \text{C} & - & \text{C} & - & \text{C} - \text{H} \\ & & & & & \\ & \text{H} & & \text{H} & & \text{H} \end{array} $ (1)			
(c)		1	C ₃ H ₆			

16.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		1	$C_nH_{2n+1}OH$	$C_nH_{2n+2}O$		
(b)		2	$ \begin{array}{ccccccc} & H & H & H & & & \\ & & & & & & \\ H & -C & -C & -C & -O & -H & \\ & & & & & & \\ & H & H & H & & & \end{array} $ <p style="text-align: right;">(1)</p> $ \begin{array}{ccccccc} & H & H & H & & & \\ & & & & & & \\ H & -C & -C & -C & -H & & \\ & & & & & & \\ & H & OH & H & & & \end{array} $ <p style="text-align: right;">(1)</p>	$CH_3CH_2CH_2OH$ $CH_3CH_2CH_3$ $\quad $ $\quad OH$		
(c)		2	propene	(1)		
			$ \begin{array}{ccccccc} & H & H & H & & & \\ & & & & & & \\ H & -C & =C & -C & -H & & \\ & & & & & & \\ & & & H & & & \end{array} $ <p style="text-align: right;">(1)</p>			

17.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		3	methane (1)			
			C_3H_8 (1)			
			$ \begin{array}{cccc} H & H & H & H \\ & & & \\ H-C & -C & -C & -C-H \\ & & & \\ H & H & H & H \end{array} $ (1)			
(b)	(i)	1	A			
	(ii)	1	E			

18.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	2	A and C - both needed (1) B and D - both needed (1)	correct formulae/names for both correct formulae/names for both		
	(ii)	1	E	propene		
(b)		1	$C_{10}H_{22}$	$H_{22}C_{10}$		

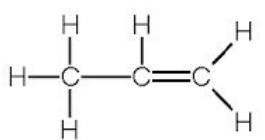
19.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	2	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array} \quad (1)$ C_2H_6 (1)			
	(ii)	1	C_8H_{18}			
(b)	(i)	1	ethanol		alcohol	
	(ii)	1	C			
	(iii)	1	wine / beer / alcoholic drinks fuels / biofuels solvents antibacterial gels perfumes / aftershaves any one for (1)		alcohol / drinking / drinks / medicine / cleaning	

20.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	1	C_8H_{18}			
	(ii)	2	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3-\text{CH}_2-\text{CH}-\text{CH}_3 \end{array} \quad (1)$ $\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3-\text{C}-\text{CH}_3 \\ \\ \text{CH}_3 \end{array} \quad (1)$			
(b)	(i)	1	C_nH_{2n}			
	(ii)	1	$\begin{array}{c} \text{H} & \text{H} & \text{H} \\ & & \\ \text{H}-\text{C} & = & \text{C}-\text{C}-\text{H} \\ & & \\ & & \text{H} \end{array}$			
(c)		1	<p>B</p> <p>contains C=C peak</p> <p>both needed for (1)</p>			

21.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		1	shape memory polymer → regains original shape when heated thermoplastic → softens when heated thermoset → does not change when heated			
(b)	(i)	1	ethene		C ₂ H ₄ alkene	
	(ii)	2	D (1) fluorine atoms present / hydrocarbons include carbon and hydrogen atoms only / doesn't contain hydrogen atoms (1)			
	(iii)	2	B (1) it has a double bond (1)	ethene it is unsaturated		
(c)		1				

22.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		2	fractions have different length of hydrocarbon / chains / relative mass / M_r (1) must be correct to award second mark which have different boiling points (1)			
(b)		4	conditions – heat / catalyst (1) explanation <ul style="list-style-type: none">• breaks down large / less useful fractions into smaller more useful ones• increases amount of fuels obtained from the crude oil• produces raw materials or monomers for use in making plastics• less waste / more profit any three for (1) each up to max 3	break bonds between C atoms products more useful than reactants		

23.

Mark	Answer
6 QWC	<p>Indicative content</p> <ul style="list-style-type: none">• ethene (monomer) contains a C=C bond/ ethene (monomer) is unsaturated• double bonds in ethene molecules 'open'• ethene molecules join together• long chain molecule formed/ polymer formed/ single molecule formed• balanced symbol equation, showing repeating unit• monomer & repeating unit, for example, for polypropene from propene/ PVC from chloroethene / polytetrafluoroethene from tetrafluoroethene <p>5-6 marks: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3-4 marks: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p>1-2 marks: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks: The candidate does not make any attempt or give a relevant answer worthy of credit.</p>

24.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	1	polytetrafluoroethene / PTFE		Teflon	
	(ii)	I	1			
		II	1			additional
(b)		2	<p>both have long or large molecules / long chains of carbon atoms / polymer chains (1)</p> <p>(only) thermosets have crosslinking / strong bonds between chains (1)</p>			reference to layers