PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

CHEMISTRY



MARK SCHEME

TOPIC 8: FUELS AND EARTH SCIENCE: FUELS (PAPER 2)

SCORE	PERCENTAGE
/114	%

STEMUP

These questions belong to Pearson Edexcel, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by Pearson Edexcel. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with Pearson Edexcel and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. Pearson Edexcel has not endorsed, approved or been involved in the production of it. Pearson Edexcel and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

Pearson Edexcel publishes its past papers, mark schemes and examiner reports. Always check the current specification at qualifications.pearson.com before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Mark Scheme

Q1.

Question number	Answer	Additional guidance	Mark
(i)	as the number of carbon atoms in the molecule increases, the boiling point increases (1)	accept reverse argument	(1)

Question number	Answer	Additional guidance	Mark
(ii)	relative formula mass = (3 X 12) + (8 X 1) (1) = 44	Award mark if correct answer given with no working	(1)

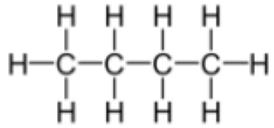
Question number	Answer	Additional guidance	Mark
(iii)	propane + oxygen → carbon dioxide + water LHS (1) RHS (1)	ignore air allow reactants on LHS and products on RHS in either order allow $C_3H_8 + 5\,O_2 \rightarrow 3CO_2 + 4H_2O$ (2) incorrect balancing of correct species max 1 mark ignore state symbols even if incorrect allow = for →	(2)

Question number	Answer	Additional guidance	Mark
(iv)	An explanation that combines identification - understanding (1 mark) and reasoning/justification - understanding (1 mark): **EITHER** carbon monoxide/CO formed (1) toxic/poisonous/restricts the amount of oxygen carried (by the blood) (1) **OR** carbon/smoke/soot formed (1) damages lungs/chokes people/breathing difficulties /makes things dirty (1)	ignore carbon dioxide ignore dangerous/harmful allow the second mark if an incorrect gas is given *e.g.* methane allow second mark if 'gas' stated, but no name is given allow less energy released ignore dangerous/harmful allow blocks fuel jets allow less energy released	**(2)**

(**Q03b 1SC0/2CF/S2, SAM**)

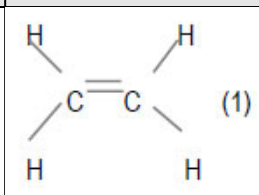
Q2.

Question Number	Answer	Acceptable answers	Mark
(i)	An explanation including any two of the following • same general formula (1) • have similar/same chemical reactions/properties (1) • both saturated/(both only) have single bonds / (both) have no double bonds (1)	C_nH_{2n+2} = 2 marks allow both hydrocarbons / both contain hydrogen and carbon (only) allow both end in -ane allow (molecular) formulae differ by CH_2	**(2)**

Question Number	Answer	Acceptable answers	Mark
(ii)	fully correct (displayed) formula of butane (2)  M1 four carbon atoms joined by single bonds (1) M2 rest of molecule correct (1)	M2 dependent on M1 If methylpropane drawn fully correctly 1 mark	**(2)**

(**Q16 1SC0/2CF, June 2015**)

Q3.

	Answer	**Acceptable answers**	**Mark**
(a)	 (1) Propene (1)	Allow $CH_2=CH_2$ Allow prope(e)n(e) only	**(2)**
(b)(i)	(molecule contains a) **double** bond	multiple bond(s) ignore spare bonds	**(1)**
(b)(ii)	(colour change) from orange (1) to colourless (1)	red/yellow/brown decolorised ignore clear/ discoloured	**(2)**
(c)	**1st mark** long {molecules/ hydrocarbon / alkane/ chain} **or** break down/ decompose/ split (1) **2nd mark** into smaller {molecules / alkane / alkene / hydrocarbon/ chain} **or** more useful product		**(2)**
(d)(i)	**D**polymerisation		**(1)**
(d)(ii)	An explanation linking **two** of the following • poly(ethene) does not rot/biodegrade (1)		**(2)**

	• remains for many years in landfill/ fills up land(fill) (1) • (may) harm animals / landfill unsightly (1)		

(**Q27 1SC0/2CF, June 2013**)

Q4.

Question number	Answer	Additional guidance	Mark
(i)	pH meter	allow pH probe allow universal indicator/ UI reject any other indicators ignore pH paper/ pH strips/ pH scale/ pH indicator	**(1)** **AO3-3a**

Question number	Answer	Additional guidance	Mark
(ii)	An explanation linking one pair from: • use {sulfuric / sulfurous} acid (rather than hydrochloric acid) (1) • because acid rain contains {sulfuric / sulfurous} acid / does not contain hydrochloric acid (1) OR • use rainwater rather than pure water (1) • because rainwater {does not have a pH 7 of / is not pure water} (1) OR • use acid with a higher pH / a pH between pH 4 and pH 6 (1) • because acid rain has a higher pH than 2 (1)	allow formulae allow use a less concentrated acid allow use a range of pH values (1) so that the effect of different pH can be found (1) allow a specific control variable e.g: kept at same light levels (1) because the plants may grow faster in different light conditions (1) ignore: use more plants/ use a variety of plants / leave for a longer time / have several sets of the experiment / repeat the experiment / water every day	(2) AO3-3b

(**QU03d 1SC0/2CH, June 2023**)

Q5.

Question number	Answer	Mark
(i)	**C** surfacing roads fuel for trains fuel for large ships is the only correct answer **A** and **B** are incorrect as bitumen is not used as a fuel for large ships **D** is not correct as diesel oil is not used for fuel for large ships	**(1)** **AO1-1**

Question number	Answer	Additional guidance	Mark
(ii)	An explanation linking • (viscosity increases down the column) as molecules are {larger/ longer/ more carbons} (1) • because there are stronger {intermolecular forces / forces **between** molecules} (1)	allow ORA allow stronger **intermolecular** bonds/ forces of attraction/ (surface area of) contact allow more **intermolecular** forces	**(2)** **AO1-1**

(**QU06a 1SC0/2CH, June 2023**)

Q6.

Question number	Answer	Mark
(i)	3 / three	**(1)** **AO2 1**

Question number	Answer	Additional guidance	Mark
(ii)	hydrogen	ignore H or H_2	**(1)** **AO1 1**

Question number	Answer	Mark
(iii)	**D** **X**, **Y** and **Z** is the only correct answer **A**, **B** and **C** are incorrect as every molecule is a hydrocarbon	**(1)** **AO2 1**

STEMUP.CO.UK

Question number	Answer	Mark
(iv)	**C** **X** and **Z** only is the only correct answer. **A**, **B** and **D** are incorrect as **Y** has 2 extra hydrogen atoms	**(1)** **AO2** **1**

(**QU03a 1SC0/2CF, June 2024**)

Q7.

Question number	Answer	Additional guidance	Mark
(i)	a description including • add {ice/ cold water} to beaker(1)	 allow add ice/cold water around tube A reject add condenser / cool delivery tube ignore cobalt chloride paper/ anhydrous copper	(2) AO3 3a
	• add limewater to tube B (1)	sulfate allow answer on diagram	

Question number	Answer		Mark
(ii)	• moles of carbon = 26.4 / 44 = 0.6 (1) • moles of hydrogen = (2 x 5.4) = 0.6 (1) • ratio = 1 : 1 / empirical formula = CH / x = y (1) • **C_6H_6** (1)	allow moles of carbon dioxide = 0.6 moles of water/ hydrogen = 0.3 scores 0 for MP2 allow ECF for MP3 only depending on calculated moles 0.6: 0.3 (from MP2) = 2: 1 / C_2H / x = 2y scores MP1 and MP3 allow ratio of moles CO_2 : H_2O = 2:1 for MP3 no ECF for MP4 C_6H_6 or H_6C_6 is a stand alone mark for **MP4 only** the other 3 marks must be shown to be scored	(4) AO2 1

(**QU04b 1SC0/2CH, June 2024**)

Q8.

Question Number	Answer	Additional guidance	Mark
(i)	hydrogen + oxygen → **water**	allow $2H_2 + O_2 \rightarrow 2H_2O$: this must be fully correct and balanced with correct subscripts reject 'hydrogen and oxygen', hydrogen oxide, hydrogen hydroxide if word and symbol equation given or mixture of symbols and words, ignore all symbols allow = for →	**(1)** AO 2 1

Question Number	Answer	Additional guidance	Mark
(ii)	B **and** D	For B allow SO_2 For D allow CO_2 reject answers containing any other letters/ names	**(1)** AO 3 2a

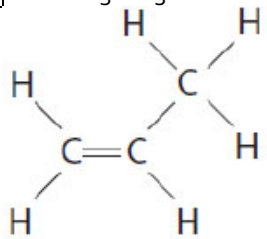
(**Q16 1SC0/2CF, June 2018**)

Q9.

Question Number	Answer	Additional guidance	Mark
	380 000 with or without working scores 3 382 500 with or without working scores 2 OR $\frac{45}{100}$ (1) = (0.45) (0.45) x 850 000 (1) = (382 500) = 380 000 (1) OR $\frac{850\,000}{100}$ (1) (= 8500) (8500) x 45 (1) (= 382 500) 380 000 (1) OR 4x10% = 340 000 **and** 1x5% = 42 500 (1) 340 000 + 42 500 (= 382 500) (1) 380 000 (1)	allow ECF throughout (answers based on 55%) 470 000 scores 2 467 500 scores 1 allow alternative chunking methods that add to 45% The clear rounding of any worked out final answer (using data provided) to 2 sig figs scores 1	**(3)** AO 2 1

(**Q14 1SC0/2CF, June 2018**)

Q10.

	Answer	Acceptable answers	Mark
(a)	C – CH_3CH_3		
(b)		carbon skeleton correct including double bond (1) rest of molecule correct (1) allow CH_3	(2)
(c)	$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ • reactant formulae (1) • product formulae (1) • balancing of correct formulae (1)	accept multiples reject incorrect use of cases and non-subscripts	(3)

		Indicative Content	
QWC	***(d)**	advantages • renewable / sustainable • more plants can be grown • crops use up carbon dioxide and produce oxyg growing /photosynthesising • carbon neutral because the carbon produced c combustion is used when growing the plants • does not use up crude oil/non-renewable resou disadvantages • crops grown for bio-fuels use up land • land could otherwise be used to provide home farmland available for growing food crops • lots of crops required to provide a small amou bio-methane • bad season reduces availability • carbon emissions due to transport and produc qualified	
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. using bio-methane conserves fossil fuels and uses up carbon dioxide when plants are grown • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. growing plants to produce biomethane is sustainable and conserves fossil fuels but uses up lots of farm land which could be used to grow plants for food • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• detailed description e.g growing plants remove carbon dioxide from the air during photosynthesis and conserves fossil fuels but lots of crops are required to make biomethane and this uses up farm land which could otherwise be used to grow crops for food • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

(**Q24 1SC0/2CH, June 2013**)

Q11.

Question number	Answer	Mark
	$2C_{10}H_{22} + 31O_2 \rightarrow 20CO_2 + 22H_2O$ • LHS (1) • RHS both numbers correct (1)	(2)

(**Q03ciii 1SC0/2CH, SAM 2016**)

Q12.

	Answer	Acceptable answers	Mark
QWC	*	An explanation including some of the following **water** • causes condensation • damp walls etc • damages decoration • greenhouse gas/ keeps in heat **carbon dioxide** • greenhouse gas/ keeps in heat • may contribute to global warming • consequences of global warming eg flooding/ drought / crop failure / disease/ melting ice caps / climate change etc **carbon** • soot • makes things dirty/ black • damages decoration • flues or jets could be blocked • can cause breathing problems • can cause fires **carbon monoxide** • toxic (ignore harmful etc) • (also) odourless and colourless • "silent killer" • (therefore) difficult to detect • combines with haemoglobin • in red blood cells • prevents oxygen being circulated	**(6)**

		In general references to pollution, environment etc are ignored	
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description (about one product) e.g. carbon monoxide is toxic because it joins to blood • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description (developed description of one product) eg carbon dioxide absorbs sun's heat and causes global warming which means ice caps melt **or** (limited description of two) e.g. carbon monoxide combines with haemoglobin so is toxic and carbon dioxide is a greenhouse gas causing global warming. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description (developed description of one and limited description of one) or (limited description of three or more) e.g. toxic carbon monoxide cannot be detected and prevents the blood from carrying oxygen so is toxic: carbon dioxide is a greenhouse gas which causes global warming. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

(**Q36 1SC0/2CF, June 2013**)

Q13.

Question number	Answer	Additional guidance	Mark
	C_2H_4	Allow H_4C_2	**(1) AO2**

(**Q06b 1SC0/2CH, Nov 2021**)

Q14.

Question number	Answer	Additional guidance	Mark
	$N_2 + 2O_2 \rightarrow 2NO_2$ (2) or NO_2 (1)	other incorrect balancing max 1	**(2) AO2**

(**Q02c 1SC0/2CH, Nov 2021**)

Q15.

Question number	Answer	Additional guidance	Mark
	$N_2 + 2O_2 \rightarrow 2NO_2$ (2) or NO_2 (1)	other incorrect balancing max 1	**(2)** **AO2**

(**Q06c 1SC0/2CF, Nov 2021**)

Q16.

Question number	Answer	Additional guidance	Mark
	gas / gases (1) high(er) (1) carbon / carbon monoxide / carbon dioxide / water / soot (1)	allow LPG reject other named gases allow greater / more / larger ignore increased accept correct formulae for a product accept sulfur dioxide ignore particulates / nitrogen oxides	**(3) AO1 1**

(**QU03b 1SC0/2CF, June 2024**)

Q17.

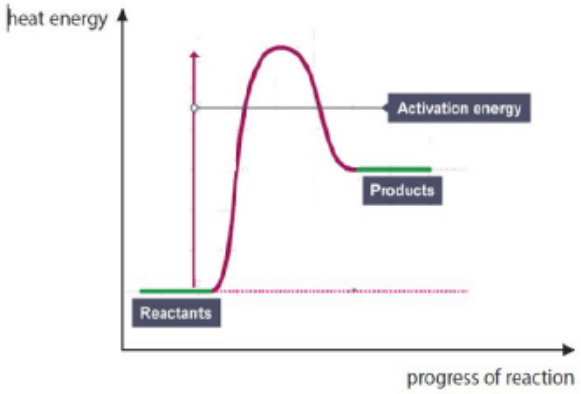
Question number	Answer	Additional guidance	Mark
(i)	methane + oxygen (1) → water + carbon dioxide (1)	ignore symbols reject other substances on either side for that mark	**(2)**

Question number	Answer	Additional guidance	Mark
(ii)	limited supply of oxygen	ignore air	**(1)**

(**Q04a 1SC0/2CF, Nov 2020**)

Q18.

Question Number	Answer	Mark
(i)	fuel oil	**(1)** AO 3 2a

Question Number	Answer	Additional guidance	Mark
(ii)	• reactant(s) and product(s) labelled in their correct positions (1)	example of diagram 	(3) AO 1 1
	• activation energy labelled (1)	ignore arrow heads	
	• energy of reactants lower than energy of products (1)	allow unlabelled diagram of an endothermic reaction showing the basic outline shape if exothermic reaction profile shown, allow (1) for reactants and products in correct position and (1) for correct labelling of activation energy	

Question Number	Answer	Additional guidance	Mark
(iii)	C_6H_{14}		(1) AO 2 1

(**Q15 1SC0/2CH, June 2018**)

Q19.

	Answer	Acceptable answers	Mark
	remove delivery tube from water <u>before stopping heating</u>	other words which make sequence clear use of (Bunsen) valve	(1)

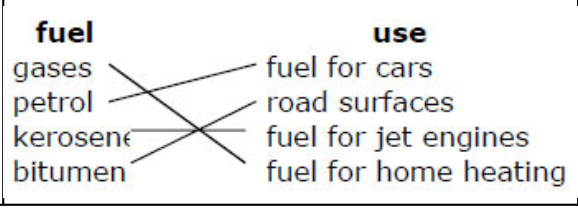
(**Q27 1SC0/2CH, June 2013**)

Q20.

	Answer	Acceptable answers	Mark
(a)	remove delivery tube from water <u>before stopping heating</u>	other words which make sequence clear use of (Bunsen) valve	(1)
(b)	B C_4H_8		(1)
(c)	contains a {double/multiple} bond	ignore "spare bonds" ignore reference to number of hydrogen atoms attached.	(1)
(d)	A description to include • bromine water is orange (1) • propane: (remains) orange / no colour change (1) • propene: becomes colourless /decolourises (1)	 red / yellow / brown any combination of these ignore clear /discolours	(3)
(e)	An explanation linking any**two** of • shorter chain molecules are more useful ORA (1) • demand for shorter chain molecules ORA (1) • meets demand • reduces the excess of longer chain molecules (1) • (cracking) produces alkenes (1) • alkenes used to make polymers (1)	 reject long chain molecules are useless named fraction/use/fuel named fraction /use/fuel	(2)

(**Q22 1SC0/2CH, June 2013**)

Q21.

	Answer	Acceptable answers	Mark
	3 correct – 2 marks 1 or 2 correct – 1 mark  		**(2)**

(**Q35 1SC0/2CF, June 2013**)

Q22.

Question number	Answer	Additional guidance	Mark
	M_r of CH_2 = 12 + (2x1) = 14 (1) $\frac{56}{14}$ = 4 (1) formula of Y = 4 x CH_2 = C_4H_8 (1) formula of X = (C_6H_{14} + C_4H_8 =) $C_{10}H_{22}$ (1)	allow ecf throughout MP1 must be for CH_2 allow 14 x 4 = 56 allow Y has 4C and 8H C_4H_8 without working scores MP3 only. C_4H_8 = (4 x 12) + (8 x 1) = 56 scores MP1, 2 and 3 for MP4 must be written as formula $C_{10}H_{22}$ without working scores MP4 only ecf can be awarded for MP4 as long as working for alkene to be added is seen ignore formula of X = (C_6H_{14} + CH_2 =) C_7H_{16}	**(4)** **AO3-1**

(**QU06b 1SC0/2CH, June 2023**)

Q23.

	Answer	Acceptable answers	Mark
	1st mark long {molecules/ hydrocarbon / alkane/ chain} **or** break down/ decompose/ split		**(2)**

	(1) **2nd mark** into smaller {molecules / alkane / alkene / hydrocarbon/ chain} **or** more useful product		

(**Q31 1SC0/2CF, June 2013**)

Q24.

Question Number	Answer	Mark
	fuel oil	**(1)** AO 3 2b

(**Q13 1SC0/2CF, June 2018**)

Q25.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. AO1 (6 marks) PROPERTY DIFFERENCES • boiling point of kerosene is low**er** (than fuel oil) • viscosity of kerosene is low**er** (than fuel oil) • ease of ignition of kerosene is greater (than fuel oil) • kerosene is **more** volatile / **more** flammable • kerosene is light**er** in colour (than fuel oil) • kerosene burns with clean**er** flame (than fuel oil) USES • kerosene used as jet fuel / in lamps / cooking etc. • fuel oil used as fuel for ships / power stations etc. CRACKING • process is known as cracking • using high temperature • and catalyst (of aluminium oxide / ceramic) • fewer carbon and hydrogen atoms in a molecule of kerosene • long chain hydrocarbons (fuel oil) broken into shorter chains (kerosene) • cracking also produces alkenes	**AO1 1 (6)**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of chemical understanding, some of which is inaccurate. Understanding of scientific, enquiry, techniques and procedures lacks detail. (AO1) • Presents a description which is not logically ordered and with significant gaps. (AO1)
Level 2	3–4	• Demonstrates chemical understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas, enquiry, techniques and procedures is not fully detailed and/or developed. (AO1) • Presents a description of the procedure that has a structure which is mostly clear, coherent and logical with minor steps missing. (AO1)
Level 3	5–6	• Demonstrates accurate and relevant chemical understanding throughout. Understanding of the scientific ideas, enquiry, techniques and procedures is detailed and fully developed. (AO1) • Presents a description that has a well-developed structure which is clear, coherent and logical. (AO1)

Level	Mark	Descriptor	Additional Guidance
	0	No rewardable material.	Read whole answer and ignore all incorrect material/ discard any contradictory material then:
Level 1	1–2	Additional Guidance Full description of **one** aspect OR Description of two aspects	Possible candidate response • Fuel oil is more viscous than kerosene (1) • Fuel oil has a high**er** boiling point and viscosity (2) • Fuel oil is used in ships and kerosene is used in planes (2) • Fuel oil is heated with a catalyst to form kerosene (2) • Kerosene has low bpt **and** fuel oil high bpt (1) • Kerosene is used as jet fuel and is easier to ignite than fuel oil (2) • Kerosene **and** fuel oil are fuels (1) • Kerosene is a fuel (0)
Level 2	3–4	Additional Guidance Full description of **two** aspects OR Full description of one aspect AND description of other two aspects	Possible candidate response • Fuel oil is cracked by passing it over a catalyst to form kerosene. Kerosene is then used as jet fuel (3) • Fuel oil is a fuel in ships and kerosene in aeroplanes. Fuel oil is harder to ignite and is more viscous (4) • Kerosene is used in planes and fuel oil is used in ships. Fuel oil has a higher boiling point than kerosene, and can be cracked (4)
Level 3	5–6	Additional Guidance Full description of **three** aspects	Possible candidate response • Fuel oil is a fuel in ships and kerosene in aeroplanes. Fuel oil is harder to ignite and is more viscous. Fuel oil can be converted to kerosene using cracking (5) • Fuel oil is a fuel in ships and kerosene in aeroplanes. Fuel oil is harder to ignite and is more viscous. Fuel oil can be converted to kerosene using cracking with a catalyst (6)

(**QU06d 1SC0/2CF, June 2025**)

Q26.

Question number	Answer	Mark
(i)	x = 6	(1)

Question number	Answer	Additional guidance	Mark
(ii)	allow 2 for correct answer with or without working 170 (g) dodecane forms 114 (g) octane 1 (g) dodecane forms $\frac{114}{170}$ (g) octane (1) 340 (g) dodecane forms $\frac{114}{170}$ x 340 (1) (= 228(g))	 OR $\frac{340}{170}$ (1) (= 2) 2 x 114 (1) (= 228 (g))	(2)

(**Q04d 1SC0/2CF, Nov 2020**)

Q27.

Question number	Indicative content
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (6 marks)** Answers must compare advantages of using hydrogen instead of diesel • plenty of water/raw material • limited supplies of crude oil • hydrogen produces only water as waste • diesel also produces carbon dioxide • carbon dioxide emissions may cause global warming • diesel undergoes incomplete combustion • diesel also produces carbon and/or carbon monoxide • carbon is formed as soot and makes objects dirty • carbon monoxide is a toxic gas • hydrogen can be obtained from the water produced. with disadvantages of using hydrogen instead of diesel • hydrogen gas has to be manufactured • energy/electricity is needed to produce hydrogen • producing electricity from non-renewable resources produces carbon dioxide • hydrogen is expensive to produce • problems of storage of large volumes of flammable gas • stronger/heavier/bigger fuel tanks needed • hydrogen is a gas and leaks easily if the fuel system is damaged • there are limited outlets for buying hydrogen.

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of chemical understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents a discussion with some structure and coherence. (AO1)
Level 2	3–4	• Demonstrates chemical understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents a discussion that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5–6	• Demonstrates accurate and relevant chemical understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents a discussion that has a well-developed structure which is clear, coherent and logical. (AO1)

(**Q06c 1SC0/2CF, SAM 2016**)

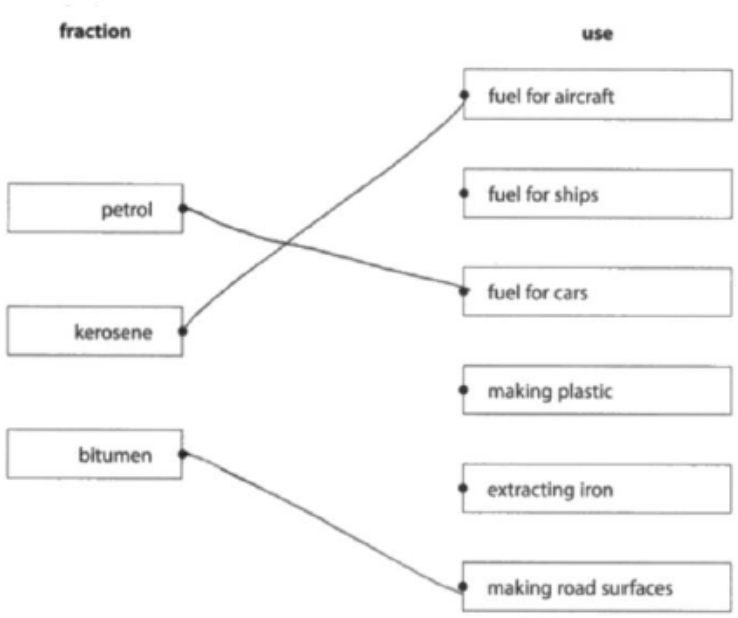
Q28.

Question number	Indicative content	Mark
	Answers will be credited according to candidates' deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic markscheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **Pollutants** • carbon monoxide combines with haemoglobin so is toxic • nitrogen oxides are acidic / toxic • nitrogen oxides lead to acid rain • references to effects of acid rain - e.g. damages buildings/kills plants etc • carbon dioxide is a greenhouse gas • greenhouse gases cause global warming • references to effects of global warming - e.g sea levels rising etc • particulates cause breathing difficulties/ make buildings dirty **Petrol/diesel comparison** • compared to diesel, petrol: - releases less nitrogen oxides -releases less particulates • compared to diesel, petrol: -releases more carbon monoxide -releases more carbon dioxide **Catalytic converter** • reduces carbon monoxide • reduces nitrogen oxides **Overall comparison** • Petrol car improved with catalytic converter as two pollutants reduced • Diesel better than petrol for carbon oxides • Diesel is worse for particulates and nitrogen oxides All incorrect/ irrelevant/ vague information to be ignored, unless contradictory. Ignore references to ozone layer.	**(6)**

Level	Mark	Descriptor	Example responses
	0	No rewardable material.	
Level1	1-2	Demonstrates elements of chemical knowledge some of which is inaccurate. Presents a discussion with some structure and coherence. States differences between engines using information from the table or explains the problem of one of the pollutants.	e.g. The diesel engine gives off the least carbon dioxide (1) carbon dioxide causes the greenhouse effect (1) the diesel engine only gives off particulates which cause breathing problems (2)
Level2	3-4	Demonstrates elements of chemical knowledge and understanding some of which is mostly relevant but which may contain some inaccuracies. Presents a discussion that has structure and is mostly coherent. Describes two or three differences between engines using information from the table and explains the problems of some of the pollutants.	e.g. the petrol engines give off carbon dioxide but the one with a catalytic converter gives off less nitrogen oxides. The carbon dioxide is a greenhouse gas which causes global warming and the nitrogen oxide cause acid rain (4)
Level3	5-6	Demonstrates accurate and relevant chemical knowledge and understanding. Presents a discussion and comparison with some structure and coherence. Describes three or four differences between engines using information from the table and explains the problem of some of the pollutants. Explains why one of the engines causes the least most damage to the environment.	e.g. the petrol engines give off carbon dioxide but the one with a catalytic converter gives off less nitrogen oxides. The diesel engine gives off less carbon dioxide but more nitrogen oxides. The carbon dioxide is a greenhouse gas which causes global warming and the nitrogen oxide cause acid rain. The diesel engine gives off the least carbon monoxide which is toxic. Overall the petrol car with no catalytic converter because it gives off the a lot of carbon dioxide and more carbon monoxide so it would cause the most global warming and breathing problems from the CO (6)

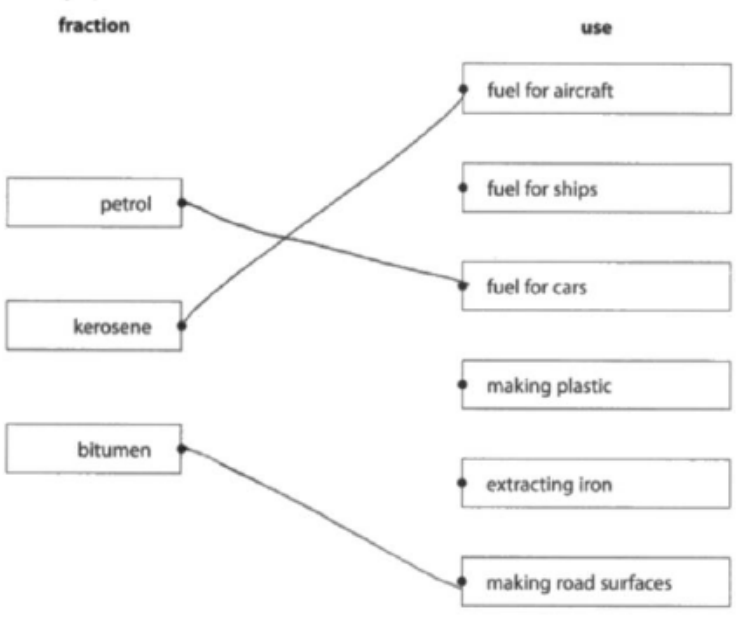
(**Q06c 1SC0/2CH, Nov 2020**)

Q29.

Question number	Answer	Additional guidance	Mark
		reject more than one line from each fraction	(3) AO1 1

(**QU03b 1SC0/2CF, June 2019**)

Q30.

Question number	Answer	Additional guidance	Mark
		reject more than one line from each fraction	(3) AO1 1

(**QU03b 1SC0/2CF, June 2022**)

Q31.

Question number	Answer	Mark
	An answer that provides a description by making reference to: • adds carbon dioxide/adds water vapour (1) • removes oxygen (1)	**(2)**

(**Q01b 1SC0/2CH, SAM 2016**)

Q32.

	Answer	Acceptable answers	Mark
(a)	$C_2H_4 + H_2o \rightarrow C_2H_5OH$ C_2H_4 as **reactant** (1) rest of equation correct conditional on C_2H_4 as a reactant (1)	do not allow H2O / H^2O / lower case h/HOH allow C_2H_6O for ethanol ignore state symbols	**(2)**
(b)	A description including any two from • dissolve sugar in water/sugar solution (1) • (add) yeast (1) • warm / any temperature or range within 15 to 40°C (1) • anaerobic / {no/little}{air/oxygen} can enter the apparatus (1)	 allow glucose solution ignore carbohydrate allow room temperature ignore heat unless specified temperature ignore optimum temperature do not allow just 'sealed container' ignore fractional distillation	**(2)**
(c)	An explanation linking Marking point 1 – sugar- one from • sugar obtained from {plants /crops/specific crop} (1) • (plenty of) land available to grow {plants /crops/specific crop} (for fermentation)(1)	ignore answers that just repeat the information in the question ignore vague answers such as carbon neutral/environmentally friendly for marking point 1 **OR**2, allow plants renewable/{crude oil/ethene} non-renewable (1)	**(3)**

	Marking point 2 - ethene • ethene obtained from {crude oil / fractional distillation /cracking} (1) Marking point 3 – cost/energy – one from • cannot afford to buy crude oil (1) • crude oil is too expensive (1) • more expensive to {use/buy/produce} ethene (1) • cheaper to use fermentation (1)	allow {little/no} {heat/energy} required for fermentation (1) allow {high temperature /high pressure} required for hydration of ethene (1)	
(d)	An explanation including any two from • formulae differ by CH_2 • same general formula • all have {OH/hydroxyl group}	general formula is $C_nH_{2n+1}OH$ (2) allow increase by {CH_2/1 carbon **and** 2 hydrogens} do not allow incorrect general formula allow have similar **chemical** {reactions /properties}/same functional group/OH from an incorrect general formula ignore 'hydroxide'/all end in (an)ol /all alcohols ignore physical properties maximum (1) if hydroxide ions /carboxyl group	**(2)**

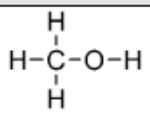
(**Q36 1SC0/2CH, June 2013**)

Q33.

Question Number	Answer	Acceptable answers	Mark
(a)	**B** add yeast, temperature of 35°C		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)	C_2H_4 (1) + H_2O (1) → C_2H_5OH award one mark max if incorrectly balanced	allow correct molecular formula C_2H_6O allow H_4C_2 correct multiples ignore state symbols	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	A description linking any two from • same **general** formula (1) • same functional group (1) • (consecutive) compounds differ by CH_2 (1) • gradual variation in physical properties (1) • {similar / same} chemical {properties / reactions} (1)	 allow $C_nH_{2n+1}OH$ (2) allow C_nH_{2n} or any correct general formula (2) ignore same properties/physical properties allow a correct trend, e.g. bp increases with number of carbon atoms (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)		allow –OH allow correct dot and cross diagram	**(1)**

Question Number	Answer	Acceptable answers	Mark
(d)(i)	oxidation		**(1)**

Question Number	Answer	Acceptable answers	Mark
(d)(ii)	A description including any two from • effervescence/fizzing/bubbling (1) • solid disappears (1) • colourless solution (1)	 ignore incorrectly named gases ignore gas given off/evolved allow magnesium floats on surface of acid allow solid dissolves (1) ignore solution <u>turns</u> colourless ignore clear	**(2)**

(**Q11 1SC0/2CH, June 2014**)

Q34.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (3 marks) AO2 (3 marks)** • sulfur burns at the same time as the hydrocarbon • sulfur reacts with oxygen • sulfur dioxide gas is formed • sulfur dioxide is an acidic gas • sulfur dioxide dissolves in clouds • to form sulfurous acid • which is then oxidised to form sulfuric acid • rain water becomes acidic • acid rain damages buildings / statues • damages plants/trees • runs into rivers / waterways • makes rivers/waterways acidic • kills fish/insects/waterlife • increases corrosion of metals	**(6)**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	acid rain damages plants and erodes buildings
Level 2	3–4	sulfur dioxide is formed which dissolves in clouds and then acid rain runs into waterways and kills fish
Level 3	5–6	sulfur burns to form sulfur dioxide which dissolves in clouds to form sulfuric acid, the acid rains can erode limestone statues and will increase corrosion of metals making them weaker.

(**Q06e 1SC0/2CF, Nov 2021**)

Q35.

Question number	Answer	Additional guidance	Mark
(i)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (2 marks): • when the decane is heated it vaporises/turns to a gas (1) • decane vapour/gas breaks down as it comes in contact with hot porous pot (1) • large molecules of decane produce smaller molecules, including ethene (1)	Do not allow this point if ethene passes over hot porous pot.	(3)

Question number	Answer	Mark
(ii)	B	(1)

(**Q06d 1SC0/2CF, SAM 2016**)

Q36.

Question number	Answer	Additional guidance	Mark
	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (2 marks): • when the decane is heated it vaporises/turns to a gas (1) • decane vapour/gas breaks down as it comes in contact with hot porous pot (1) • large molecules of decane produce smaller molecules, including ethene (1)	Do not allow this point if ethane passes over hot porous pot	(3)

(**Q03ci 1SC0/2CH, SAM 2016**)

Q37.

Question number	Answer	Additional guidance	Mark
	An explanation linking any 3 from: • **sulfur/ S** (is present as an impurity) (1) • (when fuel burns) {impurity/sulfur} is {burned/ combusted/ oxidised/ reacts with oxygen} (1) • sulfur dioxide/ SO_2 (formed) (1) • sulfur dioxide dissolves in {rain/ water/ clouds} (1) • sulfuric acid is formed (1)	ignore any references to nitrogen oxides/ nitric acid $S + O_2 \rightarrow SO_2$ scores MP1, MP2 and MP3 allow sulfur dioxide reacts with {rain/ water/ clouds} ignore sulfur dioxide mixes with {rain/ water/ clouds} allow forms sulfurous acid. suitable equation forming H_2SO_3 or H_2SO_4 scores MP3, MP4 and MP5	**(3) AO1-1**

(**QU03c 1SC0/2CH, June 2023**)

Q38.

Question number	Answer		Mark
	an explanation linking CARBON – max 2 • **carbon dioxide / CO_2** (1) • (carbon dioxide is a) greenhouse gas/ contributes to global warming (1) SULFUR – max 2 • **sulfur dioxide / SO_2** (1) • (sulfur dioxide causes) acid rain (1)	**MP2 depends on MP1 for both gases** ignore formation of water/ carbon monoxide/ carbon allow causes climate change allow specific effects of global warming allow sulfur trioxide ignore sulfur oxide(s) but allow ECF for MP3 allow forms sulfuric acid allow specific environmental effects – kills fish/ kills trees / breathing problems	(4) AO1 1

(**QU03b 1SC0/2CH, June 2024**)

Q39.

Question number	Answer	Additional guidance	Mark
	An explanation linking • {carbon dioxide / water} produced (1) • (the gases) absorb heat radiated from earth (1) re-radiate heat back into the atmosphere (1)	 allow formula allow traps the heat	**(3)** **AO2**

(**Q06d 1SC0/2CF, Nov 2021**)

Q40.

Question number	Answer	Additional guidance	Mark
	An explanation linking • {carbon dioxide / water} produced (1) • (the gases) absorb heat radiated from earth (1) • re-radiate heat back into the atmosphere (1)	 allow formula allow traps the heat	**(3)**

(**Q02d 1SC0/2CH, Nov 2021**)