Question number	Answer	Mark
1(a)	C	**(1)**

Question number	Answer	Mark
1(b)(i)	(oil well) C	**(1)**

Question number	Answer	Mark
1(b)(ii)	(oil well) A	**(1)**

Question number	Answer	Additional guidance	Mark
1(c)(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 ethane passes over hot porous pot	**(3)**

Question number	Answer	Mark
1(c)(ii)	B	**(1)**

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

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	fuel oil		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	gases	gas	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(iii)	diesel oil	diesel	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)	C hydrogen		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)(i)	• $2CH_4$ + **<u>3</u>** O_2 (1) • $2CO$ + **<u>4</u>** H_2O (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)(ii)	An description linking • (carbon monoxide) combines with haemoglobin/red blood cells (1) • lack of **oxygen** (to brain/cells) (1)	forms carboxyhaemoglobin reacts with/joins (on to) haemoglobin so less/no **oxygen** can be carried carbon monoxide replaces **oxygen** Ignore suffocation	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(d)	An explanation linking two of • uses up (farm)land/space/area (to grow crops for fuel) (1) M1 • less (farm)land to grow crops for **food** (1) M2 • can cause food prices to rise (1) M3 • (could lead to) food shortages/famine/starvation/ poverty (1) M4 • (could lead to) deforestation/soil erosion (1) M5	less **food** produced/grown Ignore reference to habitats Ignore decrease in biodiversity Ignore reference to carbon dioxide levels/greenhouse effect	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	An explanation linking **two** of the following points • break down of (hydrocarbons/molecules / alkanes) (1) • into smaller (hydrocarbons/molecules / alkanes) (1)	**Ignore** 'chains **of** …..'/ polymers Ignore 'separating Ignore reasons for cracking	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b) (ii)	an explanation linking the following • (molecule) containing (carbon-carbon) double / multiple bond (1) • contains (atoms of) carbon and hydrogen (1) • only (1)	Allow references to addition reactions. Ignore 'alkene', 'spare bonds', 'doesn't have max no of atoms or H bonded' Can only score third point if second point scored	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(b)(iii)	a description including the following • from orange/brown/yellow (1) • to colourless (1)	Allow red-brown but no other mention of red **Ignore** clear / discolour	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)	hydrocarbons		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)	**D** power station furnaces		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ correct formulae on left $CH_4 + O_2$ (1) correct formulae on right $CO_2 + H_2O$ (1) balancing of correct formulae(1)	**Allow** multiples or halves **Allow** = for → **Reject** obvious incorrect symbols and subscripts once only	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	48 (kJ) (1) or 5472 /114 = 48 (kJ) (1) or 5472/114 (1)		**(1)**

Number			
4(c)(iii)	Any two of easy to ignite / low boiling point / low viscosity (1) {burns readily/easily} / (in)flammable(1) not produce too much {soot/ash/ smoke} / burns with {clean/blue} flame / burns cleanly (1) easy to {store/contain} (1) easy to {transport/transfer} (1) high energy output per unit {mass /volume} (1) does not produce {toxic gases/carbon dioxide/sulfur dioxide/greenhouse gases} / contains a low amount of sulfur (1) fuel is {readily available/easy to obtain/will not run out/long lasting/renewable} (1) carbon neutral (1)	**Ignore** burns for a long time **Ignore** just 'releases a lot of energy' **Ignore** references to cost **Ignore** vague answers eg doesn't cause pollution/harmful gases **Ignore** answers written in the form of questions or statements that do not show a characteristic of a **good** fuel eg how easy is it to ignite the fuel? how much energy it produces **Allow** a little produces a lot of energy **Allow** produces a lot of {miles/km} per {gallon/litre}	**(2)**

Question Number	Answer	Acceptable answers	Mark
5 (a)	D		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)	An explanation linking the following • carbon dioxide / water vapour (released into the atmosphere) (1) • absorbs OWTTE heat (radiated from Earth)(1)	Ignore reference to greenhouse gases or global warming Mention of ozone layer forbids award of second point	**(2)**

Question Number	Answer	Acceptable answers	Mark
5 (c)(i)	(biofuels) renewable / plants remove carbon dioxide from atmosphere / conserves fossil fuels	(almost) carbon neutral ignore biofuels don't run out the word sustainable must be explained to score	**(1)**

Question Number	Answer	Acceptable answers	Mark
5 (c)(ii)	an explanation linking the following • (growing crops for biofuels) requires land (1) • less land for food production / less food / deforestation / destroys habitat / food prices increase (1)	ignore cost of biofuels v fossil fuels note biofuels are crops so food crops must be specified	**(2)**

Question Number		Indicative content	Mark
QWC	***5(d)**	an explanation linking some of the following: **Production** • lack of / insufficient oxygen • {blocked burner jets / poor servicing} leads to lack of oxygen • poor ventilation leads to lack of oxygen • complete combustion cannot take place **Product** • produces carbon / soot • produces carbon monoxide **Effects** • wastes fuel • soot stains / damages decorations etc • soot causes health problems • soot may block gas jets • carbon monoxide is toxic • combines with haemoglobin / forms carboxyhaemoglobin • prevents blood carrying oxygen • no oxygen reaches cells / no respiration / death	**(6)**
Level	**0**	No rewardable content	
1	**1-**	• a limited explanation e.g. in limited air carbon monoxide forms • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, puncuation and grammar are used with limited accuracy	
2	**3-**	• a simple explanation e.g. 'incomplete combustion of methane is caused by lack of oxygen and forms carbon monoxide which is a toxic gas' • 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 explanation e.g. 'if a room is poorly ventilated, the heater will have a limited supply of air causing incomplete combustion. Carbon monoxide gas is formed. Carbon monoxide combines with haemoglobin and is therefore toxic' • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	