

Question	Expected Answers	Marks
2 a i	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{O}-\text{H} \\ \\ \text{H} \end{array}$ <p>allow -OH</p>	1
2 a ii	$\begin{array}{c} \text{H} \\ \cdot\cdot \\ \text{H} \cdot \text{C} \cdot \cdot \text{O} \cdot \text{H} \\ \cdot\cdot \\ \text{H} \end{array}$ <p>lone pairs on oxygen (1); rest of molecule allow $\cdot\cdot$ along line of bond</p>	2
2 a iii	104 – 110 (Accept without degree sign) ecf from diagram - 120 for one lone pair, NOT 180 from no lone pairs	1
2 b	alkane(s)	1
2 c i	(fuel) ignites/catches fire/burns/lights/explodes/combusts (AW)(1) reaction with air implied without a spark/flame/ by itself/spontaneously/automatically/on compression (1) IGNORE references to heat and high temperature second mark depends on reaction being mentioned	2
2 c ii	straight chain/unbranched NOT long chain ora	1
2 d i	13	1
2 d ii	C ₁₃ H ₂₆ O ₂ C ₁₃ (with ecf) and O ₂ (1); H ₂₆ (1). allow (1) for correct total of C, H, O in a structural formula	2
2 e i	incomplete/ not enough oxygen(1); combustion (of the fuel/hydrocarbons/carbon)(1)	2
2 e ii	oxygen ACCEPT O, =O, -O- NOT O ₂ , "molecule"	1
2 f	six marking points, place dot over each one scored. Two dots per mark, round UP. enthalpy change/energy (or heat) given out/energy (NOT heat) change: when 1 mole; in context is burnt/combusted/oxidised/ (enthalpy change) of combustion; in excess oxygen/complete combustion; standard conditions; 1 atm pressure/298 K both these together can score the "standard conditions" sub-mark also.	3
2 g i	33.4 (4)(kJ) Accept 33	1
2 g ii	Ans to (g)(i) x 214 (1) for number: 33.4 gives 7150 (7148) 33.44 gives 7160 (7156) (1) for negative sign mark separately. for > 4 sf (and "number" mark scored), write "sf" in body of script near mark. Do NOT deduct marks	2

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4 a	Speeds up chemical reaction (1); Unchanged (at the end)/ not used up/ not affected itself/lowers activation enthalpy/energy/provides alternative route (1) <i>IGNORE "does not take part"</i>	2	
4 b i	Nitrogen (<i>NOT "from fuel" - con</i>) and oxygen react/burn/combust (1); (<i>accept "nitrogen oxidised" or balanced equation</i>) in the heat/spark/high temperature (of the engine) (1) <i>Mark separately "in exhaust" is con.</i>	2	
4 b ii	750 dm ³ <i>must have units</i>	1	
4 b iii	Fewer moles/molecules (on right hand side) (1); fewer ways of arrangement (<i>IGNORE type of particles</i>)/ increased order/ decreased disorder/less chaotic/ more organised(1) <i>Mark separately</i>	2	
4 b iv	Bonds form (1) <i>NOT sufficient on diagram only</i> between <u>nitrogen</u> (atoms)(1) and <u>carbon and oxygen</u> (atoms) (1) <i>NOT molecules</i> <i>ALLOW oxygen atoms combine and oxidise carbon for second mark</i> the products diffuse away from/leave surface/bonds break with surface (AW)(1) <i>NOT sufficient on diagram only</i> products are carbon dioxide and nitrogen (<i>names or correct formulae</i>) (1)(<i>if on diagram, correct bonds must be shown (eg C=O)</i>)	5	
4 c	(Lead compounds) are adsorbed (<i>NOT absorbed</i>) (on to surface)/ bond <u>to surface</u> / bind <u>to surface</u> (1); <i>NOT deposits/ covers. (chemical process at surface implied)</i> stopping catalyst working / poisoning catalyst/ stopping reactants reaching /reacting with catalyst surface /catalyst becomes inactive/useless(AW) <i>implies stopped totally</i> (1)	2	
4 d	needs to be hot/ high temperature/warmed up <i>ora</i> <i>ACCEPT answers in terms of kinetic theory</i>	1	
4 e	<i>any pair:</i> (unburnt) hydrocarbons/C _x H _y / formula >C ₃ sulphur oxide/ sulphur dioxide/ sulphur trioxide/SO _x . (<i>NOT other formulae or names</i>) hydrogen sulphide carbon particles lead <u>compounds</u> water	<p>smog /greenhouse gas*/toxic (<i>allow for any hydrocarbon</i>)</p> <p>acid rain*/toxic/respiratory problems (<i>allow for any oxide of sulphur</i>) <i>NOT greenhouse</i></p> <p>toxic</p> <p>lung disease.</p> <p>toxic</p> <p><i>greenhouse gas* scores (1) only</i></p> <p>* allow effects of greenhouse gases or acid rain</p>	2