

EXOTHERMIC REACTIONS, ENDOTHERMIC REACTIONS & BOND ENERGIES 2

MARK SCHEME

Q1.

Question	Answer	Extra information	Marks
(a)	A = energy / enthalpy change / difference	allow heat change or ΔH allow energy released	1
	B = activation energy / EA	allow definition of activation energy	1
	C = carbon dioxide and water	accept products	1
(b)	exothermic	allow combustion / redox / oxidation ignore reduction / burning	1
Total marks			4

Q2.

Question	Answer	Extra information	Marks
(a)	M1: (bonds broken) = 2148 (kJ) M2: (bonds made) = 2354 (kJ) M3: change in energy = (-) 206 (kJ)	correct answer with or without working = 3 marks	1
		ecf	1
		ignore sign	1
(b)	energy released from forming new bonds is greater than energy needed to break existing bonds	allow the energy needed to break bonds is less than the energy released in forming bonds do not accept energy needed to	1

		form bonds	
Total marks			4

Q3.

Question	Answer	Extra information	Marks
(a)	electricity / (high) temperatures	allow lightning / heat ignore energy	1
(b)	nitrogen + oxygen → nitrogen oxide / monoxide	allow any oxide of nitrogen	1
(c)	more than		1
(d)(i)	A		1
(ii)	C		1
Total marks			5

Q4.

Question	Answer	Extra information	Marks
(a)	e.g. plastic (beaker) / insulation / lid / cover or any mention of enclosed	any sensible modification to reduce heat loss ignore prevent draughts ignore references to gas loss	1
(b)	all the substances react or all (the substances) react fully / completely or heat evolved quickly or distribute heat	accept to mix them 'so they react' is insufficient for the mark accept increase chances of (successful) collisions / collision rate increase do not accept rate of reaction increase / make reaction faster	1
(c)	experiment 2 and different / higher / initial / starting temperature	accept experiment 2 and the room is hotter / at higher temperature do not accept temperature change / results higher	1
(d)	temperature change does not fit pattern	accept anomalous / odd or it is the lowest or it is lower than the others or it is different <u>to the others</u> 'results are different' is insufficient	1
(e)	7 / 7.0		1
(f)	$(100 \times 4.2 \times 7) = 2940$	ecf from (e)	1

(g)	diagram A and reaction exothermic / heat evolved / ΔH is negative / temperature rises	accept energy is lost (to the surroundings)	1
Total marks			7

Q5.

Question	Answer	Extra information	Marks
(a)(i)	energy / heat of products less than energy of reactants	owtte allow products are lower than reactants allow more energy / heat given out than taken in allow methanol is lower allow converse allow energy / heat is given out / lost allow ΔH is negative	1
(ii)	lowers / less activation energy	owtte allow lowers energy needed for reaction or it lowers the peak/ maximum do not allow just 'lowers the energy'	1
(b)(i)	bonds broken: $(2 \times 435) + 498 = 1368$ bonds made: $(2 \times 805) + (2 \times 464) = 2538$ energy change: $1368 - 2538 = (-)1170$	allow: $(8 \times 435) + 498 = 3978$ allow: $(6 \times 435) + (2 \times 805) + (2 \times 464) = 5148$ allow: $3978 - 5148 = (-)1170$ ignore sign allow ecf correct answer (1170) = 3 marks	1 1 1
(ii)	energy released forming new bonds is greater than energy needed to break existing bonds owtte	allow converse do not accept energy needed to form new bonds greater than energy needed to break existing bonds	1
Total marks			6

Q6.

Question	Answer	Extra information	Marks
(a)	<p>either:</p> <p>calculations: all correct (ethanol = 6, methanol = 3, peanut oil = 10, vegetable oil = 15)</p> <p>or</p> <p>implication of correct calculation</p> <p>(vegetable oil) gives largest temperature / heat increase per gram (owtte)</p>	<p>ignore repetition of data from table unqualified</p> <p>allow 'produced most heat in proportion to the fuel used' owtte for 1 mark</p>	2
(b)	<p>any one from:</p> <ul style="list-style-type: none"> • smoke • soot • carbon • carbon monoxide • carbon dioxide • global warming / climate change / greenhouse gases • (air) pollution • harmful/poisonous scrub / wash the gases owtte 	<p>owtte</p> <p>ignore references to crops/food</p> <p>filter / remove (gases / fumes / appropriate named substance) owtte</p> <p>(add extra oxygen) can burn more efficiently owtte</p> <p>use a cleaner fuel owtte</p> <p>plant more trees or similar linked to CO₂</p> <p>any sensible answer</p> <p>'don't burn so much fuel'</p> <p>insufficient alone</p> <p>ignore extractor fans / air conditioning</p>	<p>1</p> <p>1</p>
(c)(i)	A		1
(ii)	B		1
Total marks			6