EXOTHERMIC REACTIONS,ENDOTHERMIC REACTIONS & BOND ENERGY 3
Mark scheme

Question 1

Questions	Answers	Extra information	Marks
(a)(i)	activation energy or energy needed to start the reaction		1
(ii)	the reaction is exothermic because the energy level / value of products is less than the energy level / value of reactants	allow the reaction is exothermic because arrow **B** goes down **or** methanol is below methane and oxygen **or** arrow **C** is bigger than arrow **A** for **1** mark allow energy level of products is lower unqualified **or** the energy level of reactants is higher unqualified for **1** mark	2
(b)(i)	use a lid / cover over the calorimeter **or** any mention of how the calorimeter could be safely enclosed / insulated		1
(ii)	a greater mass of methanol was burned therefore the temperature change was greater because more energy was transferred / released	do not allow ether(s)	1 1
(iii)	any one from: • to improve or check repeatability / quality of results • to make it easier to spot an anomalous measurement • to be able to calculate an average mean value		1

(iv)	8820 (J)	for correct answer if answer is incorrect allow one mark for 21 used as the mean temperature change	2
Total marks			9

Question 2

Questions	Answers	Extra information	Marks
(a)	energy of product greater than energy of reactants	allow converse allow energy = heat do not accept temperature for energy allow product / nitrogen oxide is higher than reactants allow less energy / heat given out than taken in allow energy / heat is taken in / gained allow Δ H is positive	1
(b)	(minimum) energy needed to start the reaction / overcome energy barrier	accept (minimum) energy needed for a collision to be successful	1
(c)(i)	bonds broken = 945 + 498 = 1443 (kJ) bonds made = 2 ×630 = 1260 (kJ) energy change = 1443 – 1260 = (+) 183	correct answer with or without working = 3 marks ignore sign allow ecf	1 1 1
(ii)	energy released forming new bonds is less than energy needed to break existing bonds owtte	allow converse accept energy change(ΔH) is + / positive do **not** accept energy needed to form new bonds is less than energy needed to break existing bonds	1
Total marks			6

Question 3

Questions	Answers	Extra information	Marks
(i)	(–)486	correct answer with or without working gains 3 marks if answer is incorrect: (2 x 436) + 498 or 1370 gains **1** mark 4 x 464 or 1856 gains **1** mark correct subtraction of ecf gains **1** mark	3
(ii)	products lower than reactants reaction curve correctly drawn activation energy labelled		1 1 1
Total marks			6

Question 4

Questions	Answers	Extra information	Marks
(a)(i)	11		1
(ii)	4620 (J)	correct answer gains **2** marks with or without working allow 4.62kJ for **2** marks if answer is incorrect: 100 x 4.2 x 11 gains **1** mark or 100 x 4.2 x (their temp. rise) gains **1** mark or 100 x 4.2 x (their temp. rise) correctly calculated gains **2** marks	2
(b)	the temperature increases	allow gets hotter allow heat / energy is given off	1
(c)(i)	(energy of) products lower than (energy of) reactants	allow converse allow arrow C points downwards	1
(c)(ii)	A		1
Total marks			6