

Question	Answer	Marks	AO Element	Notes	Guidance
1	any two from: - same amount of solid / same mass of solid - same volume of water - same amount of stirring	2			
2	make sure temperature change is the same throughout / make sure that there are no hot spots / no local heating	1			
3	Q	1			
4	R	1			
	T	1			
5	exothermic and heat released / heat given out	1			
6	third box ticked / exothermic	1			
7	plastics	1			
8(a)	hexane	1			
8(b)	hexane	1			

- Mark Scheme

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Question	Answer	Marks	AO Element	Notes	Guidance
9	any two from: <ul style="list-style-type: none">• (same) volume of water• (same) distance of flame from beaker• (same) height of flame	2			
10	temperature rises	1			
11	temperature goes down / temperature decreases / temperature falls	1			OWTTE
12	temperature rises / heat given off	1			
13	endothermic	1			
14	B	1			
15	exothermic	1			
16	C - The beaker feels warmer.	1			
17(a)	4 (NO)	1			

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Question	Answer	Marks	AO Element	Notes	Guidance
17(b)	heat released / heat given out	1			
17(c)	oxygen added (to NO)	1			
17(d)	acidic oxide AND nitrogen is a non-metal	1			
18	heat given out / heat evolved	1			
19	energy (level) of the products is greater than the energy of the reactants ORA	1			
20(a)	Br ₂ on left (1) 2 (HBr) (1)	2			
20(b)	the energy of the reactants is more than the energy of the products / energy of the products is less than the energy of the reactants / the reactants lose energy when they form products	1			
21(a)	2 (Na ₂ S ₂ O ₃) (1) 2 (NaI) (1)	2			

Question	Answer	Marks	AO Element	Notes	Guidance
21(b)	the energy of the reactants is more than the energy of the products / the energy of the products is less than the energy of the reactants / the reactants lose energy when they form products	1			
22(a)	chromium(III) oxide loses oxygen / it loses oxygen / oxidation number of chromium decreases	1			
22(b)	energy of reactants greater than energy of products ORA	1			
23	absorbs heat / takes in heat	1			
24	endothermic AND heating / absorbs heat	1			
25(a)	oxygen / O ₂	1			
25(b)	carbon + oxygen → carbon dioxide	1			
25(c)	reactants on the left and product on the right (both required)	1			

Question	Answer	Marks	AO Element	Notes	Guidance
26(a)	oxygen (on left) (1) water (on right) (1)	2			
26(b)	exothermic because energy level of reactants above energy level of products / exothermic because the arrow is going downwards	1			
27	energy level of reactants above energy level of products / the arrow is going downwards / energy (level) goes down / product has less energy than reactants	1			
28	releases heat / heat given out	1			
29(a)	correct structure of ethane showing all of the atoms and all of the bonds	1			
29(b)	3 (H ₂)	1			
29(c)	takes in heat (from surroundings) / absorbs heat / absorbs thermal energy	1			

Question	Answer	Marks	AO Element	Notes	Guidance
30	the energy of the reactants is greater than the energy of the products / the product has less energy than the reactants / the arrow is going down (from reactants to product)	1			
31(a)	(zinc oxide) loses oxygen	1			
31(b)	reactant level below product level / reactants have less energy than products ORA	1			
32	C - The reaction is endothermic.	1			
33	A	1			
34	C - calcium carbonate decomposing when heated	1			
35	B	1			
36	A	1			
37	A - If the reaction is endothermic, the temperature decreases and energy is taken in.	1			

Question	Answer	Marks	AO Element	Notes	Guidance
38(a)	4728	1			
38(b)	6004	1			
38(c)	-1276	1			ecf (a) – (b)
39(a)	(bond breaking) = 1221 or (326 × 3) + 243 (1) OR (ignoring 3P–Cl on each side) bond breaking = 243 (1)	1			
39(b)	(bond forming) = 1630 or (326 × 5) (1) OR (ignoring 3P–Cl on each side) bond forming = 652 or (326 × 2) (1)	1			
39(c)	energy change = -409 kJ (1) negative sign essential	1			ecf for (a) – (b)

Question	Answer	Marks	AO Element	Notes	Guidance
39(d)	exothermic AND energy released when bonds form is greater than energy absorbed to break bonds OR exothermic AND overall energy change has a negative sign	1			
40(a)	bonds broken: $[4 \times 3 \times 391] + [5 \times 498]$ $= 4692 + 2490 = 7182$	1			
40(b)	bonds formed: $[4 \times 587] + [12 \times 464]$ $= 2348 + 5568 = 7916$	1			
40(c)	M1 energy change = $7182 - 7916 = -734$ M2 = $M1 / 4 = -734 / 4 = -183.5$	2			ecf (a) – (b)
					[Total: 67]