

Mark Scheme 2813/01
January 2006

How FAR | How FAST?



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| Abbreviations, annotations and conventions used in the Mark Scheme | / = alternative and acceptable answers for the same marking point ; = separates marking points NOT = answers which are not worthy of credit () = words which are not essential to gain credit _____ = (underlining) key words which must be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument | |
| Question | Expected Answers | Marks |
| 1(a) | (a reaction) that releases energy/ (a reaction) that releases heat/ a reaction with a negative ΔH (1) | 1 |
| (b)(i) | diagram to show upward hump (1) $\text{CO}_2 + (2)\text{H}_2\text{O}$ / carbon dioxide and water below reactants (1) | 2 |
| (ii) | E_a marked (1) if an arrowhead is included, it must be upwards | 1 |
| (c) | sketch distribution to show axes labelled number/ fraction of molecules/atoms and energy (1) shape starting at origin, maximum, approaching but not crossing x axis (1) for both graphs explanation of distribution 2 from no molecules with no energy few very energetic molecules most have average amounts of energy area under curve is the number of molecules (2) distribution at higher temperature shown on diagram hump lower than original (1) and to RHS of original (1) E_a marked (1) rate increases with an increase in temperature (1) since more molecules have energy $> E_a$ (1) | 9 |
| | | Total: 13 |

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| Question | Expected Answers | Marks |
| 2(a) | (heat/ energy change) when 1 mole of substance is formed (1) from its elements (1) | 2 |
| (b) | $C(s) + 2H_2(g) \rightarrow CH_4(g)$ balanced equation (1) state symbols (1) | 2 |
| (c) | cycle drawn/ sum of enthalpy changes products – sum of enthalpy changes reactants (1) $-75 - 242 + x = -110$ (1) $\Delta H = 207$ (kJ mol ⁻¹) (1) | 3 |
| (d) | any industrial use, examples include manufacture of ammonia/ for Haber process manufacture of margarine/ hydrogenation of alkenes | 1 Total: 8 |

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| Question | Expected Answers | Marks |
| 3(a) | to overcome activation energy (1) reaction is endothermic (1) to break bonds – if type of bonds stated must be ionic or covalent (1) A2 answer based on polarisation of carbonate by Ca ²⁺ is acceptable | 2 |
| (b)(i) | rate forward > rate backward (1) | 1 |
| (ii) | rate forward = rate backward (1) | 1 |
| (iii) | equilibrium moves to RHS (1) use of le Chatelier (1) | 3 |
| (c)(i) | more CaO /product / less CaCO ₃ / reactant present (1) CaCO ₃ (s) + 2HCl(aq) → CaCl ₂ (aq) + CO ₂ (g) + H ₂ O(l) CaO(s) + 2HCl(aq) → CaCl ₂ (aq) + H ₂ O(l) each balanced equation 1 mark (2) | 3 |
| (ii) | all state symbols (1) CaCO ₃ fizzes/ gas given off/ gas evolved / carbon dioxide evolved (1) | 1 |
| | | Total: 11 |

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| Question | Expected Answers | Marks |
| 4(a) | anywhere in range 30 - 40% (1) if range given all values must be in this range | 1 |
| (b)(i) | increases (1) | 1 |
| (ii) | more moles of A and B (1) equilibrium moves in direction of less moles (1) | 2 |
| (c) | endothermic (marks for explanation) an increase in temperature converts more A (1) equilibrium moves in direction to lower temperature/ forward reaction must tend to lower temperature/ an increase in temperature favours the endothermic process (1) | 2 |
| (d)(i) | a substance that alters/increases the rate of reaction/lowers E_a (1) but remains unchanged after the reaction /is not used up (1) | 2 |
| (ii) | to save energy/money + reason eg by allowing process to run at a lower temperature/ by lowering E_a (1) goes faster to save time / allows the process to run continuously (1) | 2 |
| (e) | not enough time was allowed for the equilibrium to establish/ other products were formed (1) | 1 |
| (f) | two important catalysts, examples include iron in Haber process/ manufacture of ammonia vanadium(V) oxide in Contact process/ manufacture of sulphuric acid nickel in hydrogenation of alkenes/ manufacture of margarines phosphoric acid in the conversion ethene to ethanol enzyme/ named enzyme with corresponding function Pt/Pd/Rh in catalytic converter (any 1 metal) Ziegler catalyst in alkene polymerisation any named acid (except nitric) in esterification zeolites/ platinum in catalytic cracking | 2 Total: 13 |