| Question | Answers | Extra information | Mark | AO /  Spec ref. |
| --- | --- | --- | --- | --- |
| **01** | particles  bonds  temperature  activation  catalyst |  | 1  1  1  1  1 | AO1  C6.1.3  C6.1.4 |
| **02.1** | temperature  pressure | Must be in this order. | 1  1 | AO1  C6.1.2 |
| **02.2** | reversible |  | 1 | AO1  C6.2.1 |
| **02.3** | equilibrium  reactants  products | Second and third points can be either way around. | 1  1  1 | AO1  C6.2.3  WS1.2 |
| **03** | Any **three** from:   * reaction is reversible * backwards/reverse reaction is exothermic * reaction goes backwards in cooler conditions * ammonia and hydrogen chloride combine/react. |  | 3 | 1 × AO1  2 × AO2  C6.2.1  C6.2.2 |
| **04** | Increasing ethene temperature ─ more collisions every second **and** more collisions with enough energy to react.  Adding a catalyst ─ more collisions every second with enough energy to react.  Increasing ethene pressure ─ more collisions every second. | If more than three lines are drawn, deduct one mark for each incorrect line. | 1  1  1 | AO2  C6.1.2  C6.1.4  WS1.2 |
| **05.1** | At least five points plotted correctly;  all points correct;  smooth curve avoiding anomalous point. | ± half a small square | 1  1  1 | 2 × AO2  1 × AO3  C6.1.2  MS4a, 4c |
| **05.2** | Any **one** from:   * clock started too late * clock stopped too soon * sodium thiosulfate solution more concentrated * sodium thiosulfate solution warmer. | Accept any other sensible suggestions.  Must be an error that leads to an anomalous point that is too low. | 1 | AO3  C6.1.2  WS3.7 |
| **05.3** | Rate increases **or** time taken decreases as concentration increases;  particles closer together **or** more particles in a given volume;  particles collide more frequently/ more collisions in a given time. | Do not accept more collisions or more successful collisions. | 1  1  1 | AO2  C6.1.3  WS1.2 |
| **06** | **Level 3 (5**–**6 marks):** Two or three valid comparisons linked to explanations. | | 6 | AO3  C6.1.2  WS1.2  MS5c |
| **Level 2 (3–4 marks):** One valid comparison linked to an explanation. | |
| **Level 1 (1–2 marks):** One or more valid comparison(s). | |
| **Level 0 (0 marks):** No relevant content. | |
| **Indicative content:**  Comparison:   * powder reacts more quickly/has higher reaction rate than chips * both reactions (gradually) slow down * final volumes of gas equal.   Linked explanation:   * powder has greater surface area to volume ratio * powder has more collisions per unit time/more frequent collisions * acid concentration falls **or** marble gets used up * same volume of acid and/or same mass of marble.   This indicative content is not exhaustive, other creditworthy responses should be awarded marks as appropriate. | |