| Question | Answers | Extra information | Mark | AO / Spec ref. |
| --- | --- | --- | --- | --- |
| **01** | particlesbondstemperatureactivationcatalyst |  | 11111 | AO1C6.1.3C6.1.4 |
| **02.1** | temperaturepressure | Must be in this order. | 11 | AO1C6.1.2 |
| **02.2** | reversible |  | 1 | AO1C6.2.1 |
| **02.3** | equilibriumreactantsproducts | Second and third points can be either way around. | 111 | AO1C6.2.3WS1.2 |
| **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 × AO12 × AO2C6.2.1C6.2.2 |
| **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. | 111 | AO2C6.1.2C6.1.4WS1.2 |
| **05.1** | At least five points plotted correctly;all points correct;smooth curve avoiding anomalous point. | ± half a small square | 111 | 2 × AO21 × AO3C6.1.2MS4a, 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 | AO3C6.1.2WS3.7 |
| **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. | 111 | AO2C6.1.3WS1.2 |
| **06** | **Level 3 (5**–**6 marks):** Two or three valid comparisons linked to explanations. | 6 | AO3C6.1.2WS1.2MS5c |
| **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. |