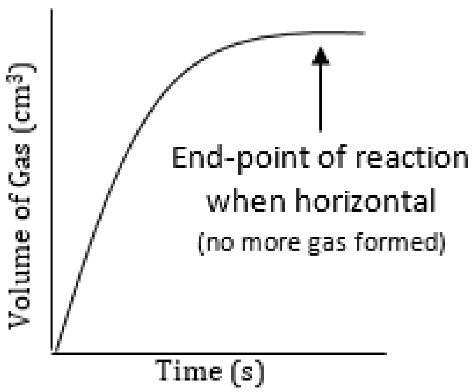
# National 5 Chemistry
# Unit 1.1 Reaction Rates

| Lesson | Traffic Light: Red | Amber | Green |
|---|---|---|---|

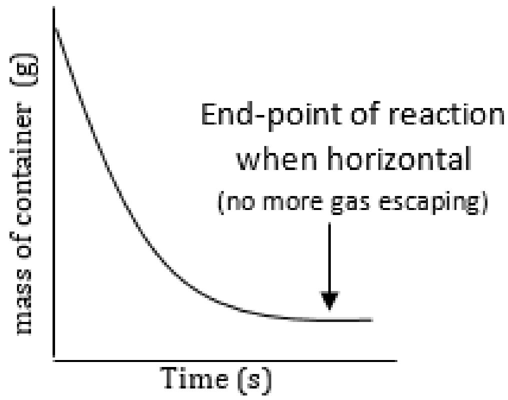
**1**

Progress of chemical reactions through changes in mass and volume can be measured.

quantity of product increases as reaction proceeds




quantity of reactant decreases as reaction proceeds

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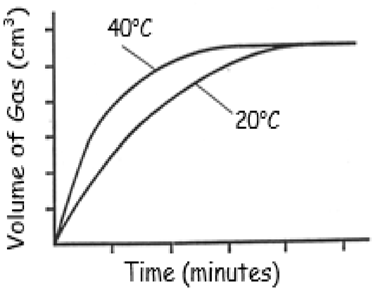
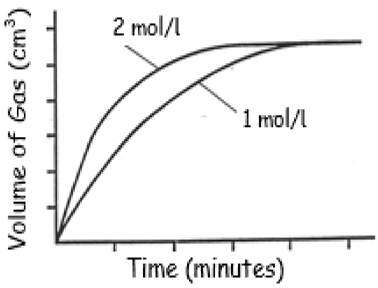
**2a 2b 2c**

Rates of reaction can be increased:

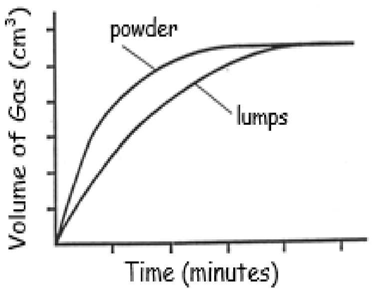
by increasing the temperature




by increasing the concentration of a reactant




by increasing surface area or decreasing particle size

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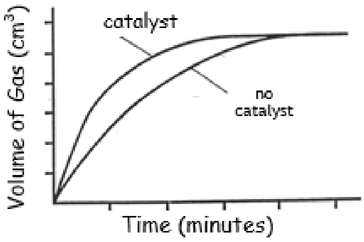
**2d 3**

Rates of reaction can be increased by adding a catalyst

- Catalysts speed up chemical reactions
- Catalysts can be recovered chemically unchanged at the end of the reaction.
  - Same mass of catalyst at start & end of experiment

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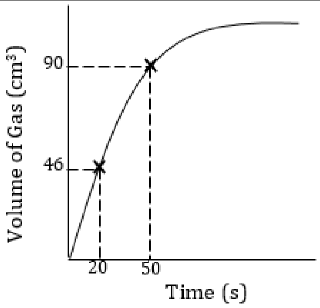
**4**

The average rate of a chemical reaction can be calculated from initial & final quantities and the time interval.
The units of rate can also be worked out.

$$\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{90 - 46}{50 - 20} = \frac{44}{30} = 1.47\ \text{cm}^3\ \text{s}^{-1}$$

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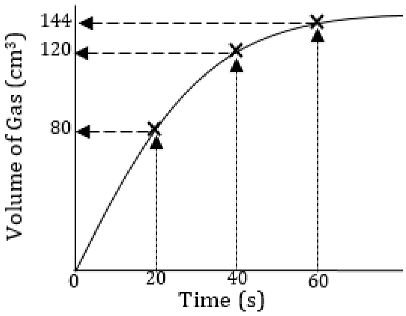
**5**

The rate of a reaction can be shown to decrease over time by calculating the average rate at different stages of the reaction.

| Time Interval: | 0-20s | 20-40s | 40-60s |
|---|---|---|---|
| Rate Equation: | Rate = $\frac{\Delta\text{quantity}}{\Delta\text{time}}$ | Rate = $\frac{\Delta\text{quantity}}{\Delta\text{time}}$ | Rate = $\frac{\Delta\text{quantity}}{\Delta\text{time}}$ |
| Insert Numbers: | Rate = $\frac{80 - 0}{20 - 0}$ | Rate = $\frac{120 - 80}{40 - 20}$ | Rate = $\frac{144 - 120}{60 - 40}$ |
| Subtraction: | Rate = $\frac{80}{20}$ | Rate = $\frac{40}{20}$ | Rate = $\frac{24}{20}$ |
| Answer: | Rate = 4.0 $cm^3\ s^{-1}$ | Rate = 2.0 $cm^3\ s^{-1}$ | Rate = 1.2 $cm^3\ s^{-1}$ |

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# Past Paper Question Bank
# Unit 1.1 Reaction Rates

JABchem

| Outcome | Original Specimen Paper | New Specimen Paper | Nat5 2014 | Nat5 2015 | Nat5 2016 | Nat5 2017 | Nat5 2018 | Nat5 2019 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | L1a L1c | L1c | | | L3b(ii) | | L5d | | | | | | | | | |
| 2a 2b 2c | | | | | mc2 L3b(iii) | | mc1 | | | | | | | | | |
| 2d 3 | L13c | | | | | | | | | | | | | | | |
| 4 | L1b | L1b | mc1 | L1a | L3b(i) | mc1 | L1b(i) | mc1 mc2 | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | |
| Marking Scheme | Back of Paper | Back of Paper | SQA Nat5 2014 Msch | SQA Nat5 2015 Msch | SQA Nat5 2016 Msch | SQA Nat5 2017 Msch | SQA Nat5 2018 Msch | SQA Nat5 2019 Msch | | | | | | | | |

| MC Qu | Answer | % Correct | Reasoning |
|---|---|---|---|
| 2014 1 | A | 91 | $\text{rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{60-0}{20-0} = 3\ cm^3\ s^{-1}$ |
| 2016 2 | C | 79 | ☒A temperature would have to be above 40°C to have reaction time less than 10s<br>☒B temperature would have to be between 30-40°C to have time between 10-20s<br>☑C temperature is less than 30°C ∴ reaction time must be more than 20s<br>concentration is more than 0.1 ∴ reaction time must be less than 60s<br>☒D concentration would have to be 0.1mol $l^{-1}$ and temperature below 20°C |
| 2017 1 | D | 91 | $\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{2g}{30s} = 0.0667\ g\ s^{-1}$ |
| 2018 1 | A | - | ☑A Increasing particle size decreases the reaction rate<br>☒B Increasing particle size increases the reaction rate<br>☒C Increasing concentration increases the reaction rate<br>☒D Adding a catalyst increases the reaction rate |
| 2019 1 | C | - | $\text{Rate} = \frac{\Delta\text{Quantity}}{\Delta\text{Time}} = \frac{5\ cm^3}{2\ min} = 2.5\ cm^3\ min^{-1}$ |
| 2019 2 | B | - | $\text{Rate} = \frac{\Delta\text{Quantity}}{\Delta\text{Time}} = \frac{5\ cm^3}{2\ min} = 2.5\ cm^3\ min^{-1}$ |

| Nat5 | Answer | Reasoning |
|---|---|---|
| 2015 1a | 0.8 $cm^3\ s^{-1}$ | Rate = $\frac{\Delta quantity}{\Delta time} = \frac{120 - 96}{90 - 60} = \frac{24}{30}$ = 0.8 $cm^3\ s^{-1}$ |
| 2016 3b(i) | 0.85 | Rate = $\frac{\Delta quantity}{\Delta time} = \frac{29 - 12}{30 - 10} = \frac{17}{20}$ = 0.85 $cm^3\ s^{-1}$ |
| 2016 3b(ii) | 60 | Maximum volume of hydrogen released = 37$cm^3$<br>Time at which 37$cm^3$ is achieved = 60s |
| 2016 3b(iii) | increased reaction rate | Zinc powder has a lower particle size than zinc lumps<br>Lower the particle size the faster the chemical reaction. |
| 2018 1b(i) | 0.5 $cm^3\ s^{-1}$ | Rate = $\frac{\Delta Quantity}{\Delta Time} = \frac{77 - 62\ cm^3}{50 - 20\ s}$ = 0.5 $cm^3\ s^{-1}$ |
| 2018 5d | 44 | Total volume given off is the maximum height attained by the graph. |

# Past Paper Question Bank
# Unit 1.1 Reaction Rates

JABchem

| Outcome | Int2 2000 | Int2 2001 | Int2 2002 | Int2 2003 | Int2 2004 | Int2 2005 | Int2 2006 | Int2 2007 | Int2 2008 | Int2 2009 | Int2 2010 | Int2 2011 | Int2 2012 | Int2 2013 | Int2 2014 | Int2 2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | L7b(i) | | | | | | | | L4b(ii) | L2a(ii) | | L1b(i) | |
| 2a 2b 2c | | mc5 L14c | | mc2 | mc4 | mc1 L3d | | mc2 | mc1 L15c | mc3 | mc1 | mc3 | mc2 L4b | | | mc6 |
| 2d 3 | | | | | | | L7b(iv) | | | | L5c(ii) | | | | | |
| 4 | mc5 | mc7 | L13b(ii) | L7b(ii) | mc3 | L3c | | L2a | | | mc2 | L4b(iii) | L2a(i) | L3b | L1b(iii) | mc5 |
| 5 | | | | | | | | | | | | | | | | |
| Marking Scheme | Not Published | Not Published | Not Published | SQA Int2 2003 MSch | SQA Int2 2004 MSch | SQA Int2 2005 MSch | SQA Int2 2006 MSch | SQA Int2 2007 MSch | SQA Int2 2008 MSch | SQA Int2 2009 MSch | SQA Int2 2010 MSch | SQA Int2 2011 MSch | SQA Int2 2012 MSch | SQA Int2 2013 MSch | SQA Int2 2014 MSch | SQA Int2 2015 MSch |

<table>
<tr><th>Int2</th><th>Answer</th><th>% Correct</th><th>Reasoning</th></tr>
<tr><td>2000 5</td><td>C</td><td>48</td><td>$\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{1.00 - 0.25}{20 - 0} = \frac{0.75}{20} = 0.0375 \text{ mol l}^{-1}\text{ s}^{-1}$</td></tr>
<tr><td>2001 5</td><td>B</td><td>79</td><td><table><tr><th>Variable</th><th>Particle Size</th><th>Concentration</th></tr><tr><td>Faster</td><td>Powder</td><td>4mol $l^{-1}$</td></tr><tr><td>Slower</td><td>Ribbon</td><td>2mol $l^{-1}$</td></tr></table></td></tr>
<tr><td>2001 7</td><td>D</td><td>59</td><td>$\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{60 - 0}{20 - 0} = \frac{60}{20} = 3 \text{ cm}^3\text{ s}^{-1}$</td></tr>
<tr><td>2003 2</td><td>C</td><td>26</td><td><table><tr><th>Change</th><th>Effect on Reaction Rate</th><th>Effect on Volume of Gas Produced</th></tr><tr><td>Decrease in Concentration</td><td>Slower (less successful collisions)</td><td>Same (still same quantity of reactants)</td></tr></table></td></tr>
<tr><td>2004 3</td><td>B</td><td>51</td><td>$\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{1.00 - 0.25}{25 - 0} = \frac{0.75}{25} = 0.3 \text{ mol l}^{-1}$</td></tr>
<tr><td>2004 4</td><td>C</td><td>73</td><td><table><tr><th>Experiment</th><th>Mass of Mg</th><th>Concentration</th><th>Temp</th><th>Time</th><th>Reasoning</th></tr><tr><td>3</td><td>0.5g</td><td>0.2 mol $l^{-1}$</td><td>30°C</td><td>20s</td><td>Last experiment has a lower temperature</td></tr><tr><td>5</td><td>0.5g</td><td>0.2 mol $l^{-1}$</td><td>25°C</td><td>Above 20s</td><td>so reaction time is greater than 20s</td></tr></table>Reaction Time is higher than experiment 3 ∴ time is greater than 20s<table><tr><th>Experiment</th><th>Mass of Mg</th><th>Concentration</th><th>Temp</th><th>Time</th><th>Reasoning</th></tr><tr><td>2</td><td>0.5g</td><td>0.1 mol $l^{-1}$</td><td>25°C</td><td>60s</td><td>Last experiment has lower concentration</td></tr><tr><td>5</td><td>0.5g</td><td>0.2 mol $l^{-1}$</td><td>25°C</td><td>Below 20s</td><td>so reaction time is less than 20s</td></tr></table>Reaction time is lower then experiment 2 ∴ time is less than 60s</td></tr>
<tr><td>2005 1</td><td>B</td><td>38</td><td>☒A Graph Q is faster initially but no change to particle size so initial rate is same<br>☑B 0.5g of magnesium would half the gas volume and powder is faster than ribbon<br>☒C same mass of magnesium so final volume of gas given off would remain the same<br>☒D increased mass of magnesium would increase volume of gas given off</td></tr>
<tr><td>2007 2</td><td>D</td><td>74</td><td>☒A A colour change is one sign that a chemical reaction has taken place<br>☒B A Gas given off is one sign that a chemical reaction has taken place<br>☒C Temperature rising is one sign that a chemical reaction has taken place<br>☑D Solid disappearing is dissolving and a physical change not a chemical reaction</td></tr>
</table>

| | | | |
|---|---|---|---|
| 2008<br>1 | B | 86 | ☒A Fastest: smallest particle size (powder) and highest concentration (4 mol $l^{-1}$)<br>☑B Slowest: largest particle size (ribbon) and lowest concentration (2 mol $l^{-1}$)<br>☒C Medium: smallest particle size (powder) and lowest concentration (2 mol $l^{-1}$)<br>☒D Medium: Largest particle size (ribbon) and highest concentration (4 mol $l^{-1}$) |
| 2009<br>3 | D | 95 | ☒A zinc is below magnesium in the reactivity series so zinc reacts slower<br>☒B magnesium lumps react slower than magnesium powder due larger particle size<br>☒C zinc is below magnesium in the reactivity series so zinc reacts slower<br>☑D Fastest: most reactive metal + highest concentration + smallest particles size |
| 2010<br>1 | A | 89 | ☑A Ice Melting is a physical change as no new chemical has been formed<br>☒B Iron rusting produces a new chemical: $4Fe + 3O_2 \rightarrow 2Fe_2O_3$<br>☒C Methane burns to form carbon dioxide and water: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$<br>☒D Acid neutralises to form water: $H^+ + OH^- \rightarrow H_2O$ |
| 2010<br>2 | D | 75 | $\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{5 - 0}{20 - 0} = \frac{5}{20} = 0.25\text{cm}^3\ \text{s}^{-1}$ |
| 2011<br>3 | A | 84 | ☑A increasing the volume of acid would not change the rate of reaction<br>☒B decreasing the size of marble chips would increase the rate of reaction<br>☒C decreasing the concentration of acid would decrease the rate of reaction<br>☒D increasing the temperature would increase the rate of reaction |
| 2012<br>2 | B | 95 | ☒A magnesium powder reacts faster than magnesium ribbon<br>☑B magnesium reacts faster than zinc and powder reacts faster than ribbon<br>☒C magnesium reacts faster than zinc<br>☒D magnesium reacts faster than zinc |
| 2015<br>5 | C | 60 | $\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{1.00 - 0.25}{25 - 0} = \frac{0.75}{25} = 0.03\text{mol}\ l^{-1}\ \text{s}^{-1}$ |
| 2015<br>6 | D | 89 | ☒A magnesium powder is faster than magnesium ribbon<br>☒B magnesium powder is faster than magnesium ribbon<br>☒C 4mol $l^{-1}$ hydrochloric acid is faster than 2mol $l^{-1}$ hydrochloric acid<br>☑D 2mol $l^{-1}$ hydrochloric acid and magnesium ribbon would be the slowest reaction |

| Int2 | Answer | Reasoning |
|---|---|---|
| 2001<br>14c | increases<br>rate of reaction | A catalyst speeds up a chemical reaction without being used up itself. The larger the surface area of the catalyst the more sites where the reaction can be catalysed exist and the faster the chemical reaction. |
| 2002<br>13b(ii) | $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$ | $Zn \rightarrow Zn^{2+} + 2e^-$<br>$Cu^{2+} + 2e^- \rightarrow Cu$<br>Add together equations cancelling out electrons<br>$Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$ |
| 2003<br>7b(i) | 0.006 | Time / Concentration / Change in concentration<br>0s: 0.010 mol $l^{-1}$; 400s: 0.004 mol $l^{-1}$<br>Change in concentration: 0.010 – 0.004 = 0.006 mol $l^{-1}$ |
| 2003<br>7b(ii) | 0.000015<br>or $1.5 \times 10^{-5}$ | $\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{0.010 - 0.004}{400 - 0} = \frac{0.006}{400} = 0.000015\ cm^3\ s^{-1}$ |
| 2005<br>3c | 1.8±0.05 | $\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{72 - 0}{40 - 0} = \frac{72}{40} = 1.8\ cm^3\ s^{-1}$ |
| 2005<br>3d | Greater number of collisions so faster reaction | Collision Theory can explain changes to reaction rate:<br>Change / Effect / Collision Theory<br>Increase Concentration, Increase Temperature, Decrease Particle Size / Reaction Rate increases / Increases the number of successful collisions giving increased reaction rate. |
| 2006<br>7b(iv) | 1g | Catalyst is not used up during the experiment and full mass of catalyst is left over at the end of the experiment. |
| 2007<br>2a | 1.45 | $\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{29 - 0}{20 - 0} = \frac{29}{20} = 1.45\ cm^3\ s^{-1}$ |
| 2008<br>15c | Powders react too fast | Powders react much faster than lumps |
| 2010<br>5c(ii) | Lowers temperature cracking takes place | Catalyst are used to speed up reactions and are not used up in the reaction. Catalyst can be used to lower the temperature a reaction takes place at, often for safety reasons. |
| 2011<br>4b(ii) | 34-35 | Problem Solving: Estimation of end of reaction |
| 2011<br>4b(iii) | 0.1 | $\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{2.2 - 1.2}{20 - 10} = \frac{1}{10} = 0.1\ \text{bar min}^{-1}$ |
| 2012<br>2a(i) | 2.75 | $\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{32 - 10}{10 - 2} = 2.75\ l\ ms^{-1}$ |
| 2012<br>2a(ii) | 4.5 | Problem Solving: Reading values from a line graph |
| 2012<br>4b | Increased surface area allows more collisions | The greater the surface of a substance, the greater the surface on which the reaction can take place.<br>∴ greater the number of collisions ∴ greater reaction rate |
| 2013<br>3b | 18 | $\text{rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{72-0}{40-0} = 18\ cm^3\ s^{-1}$ |

| | | |
|---|---|---|
| 2014 1b(i) | Use syringe to collect gas | All gases can be collected in a gas syringe and their volumes measured against the scale on the gas syringe. Gases which are insoluble can also be collected over water as shown in the diagram. |
| 2014 1b(iii) | 10 | Rate = $\frac{\Delta \text{quantity}}{\Delta \text{time}}$ = $\frac{86 - 46}{6 - 2}$ = 10 $cm^3$ $min^{-1}$ |

Nat5
Traffic Lights

# Past Paper Question Bank
# Unit 1.1 Reaction Rates

| Outcome | 2000 Credit | 2001 Credit | 2002 Credit | 2003 Credit | 2004 Credit | 2005 Credit | 2006 Credit | 2007 Credit | 2008 Credit | 2009 Credit | 2010 Credit | 2011 Credit | 2012 Credit | 2013 Credit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | 12a | | | | | 13b(i) | | | 11a | | | |
| 2a 2b 2c | | | | | 12c | | 12c | | | 13c | 12d | | 11b(i) 11b(ii) | 18a(ii) | | |
| 2d 3 | 11c(i) | | | | | 12b(ii) | | | | | | 16b(i) | | | | |
| 4 | | | | | | | | | | | | | 13b(ii) | | | |
| 5 | | | | | | | | | | | | | | | | |

| SG Credit | Answer | Reasoning |
|---|---|---|
| 2000C 11c(ii) | Less energy used or lower temperature required for reaction | Catalyst speed up reactions without being used up in the reaction. A catalyst can reduce the temperature required to achieve a successful reaction (so can be safer) |
| 2004C 12a | gas produced escapes from flask | carbon dioxide gas produced will escape from flask which make the mass inside flask lighter |
| 2004C 12c | 0.8g | Hydrochloric acid is in excess ∴ marble chips chemically run out<br>Same mass of marble chips in flask ∴ same mass of gas escapes |
| 2005C 12b(ii) | lower temperature or less energy required | Catalyst can use less energy to perform the same reaction improving safety and efficiency/costs |
| 2006C 12c | 36-40 | value must be higher than 35 but not higher than maximum volume of 40 |
| 2009C 13b(i) | Gas given off | The flask loses mass as the gas produced by the chemical reaction leaks out of the top. |
| 2009C 13c | Answer: 0.81 – 0.86 | The mass loss must be greater than 0.80g but cannot be higher than 0.86g as this is the mass loss at the end of the reaction. |
| 2010C 12d | $53cm^3$ | Reaction with dilute sulphuric acid was finished at 60seconds<br>At a higher concentration of sulphuric acid will finish before 60seconds but will still produce same final volume of gas ($53cm^3$) |
| 2011C 16b(i) | Lowers temperature reaction takes place at | Catalysts speed up a chemical reactions but are not used up in reaction<br>Catalysts can lower the temperature at which the reaction can take place at. |
| 2012C 11a | 2 | The reaction is finished when the line becomes horizontal.<br>Lines 1 and 3 become horizontal before Line 2. |
| 2012C 11b(i) | one from: | Decrease in concentration or increase in particle size |
| 2012C 11b(ii) | 0.5g | Line 3 gives off half the volume of gas as Line 1.<br>∴ As there is excess hydrochloric acid, mass of zinc must be halved. |
| 2012C 13b(ii) | 1.5 | $\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{55-40}{30-20} = \frac{15}{10} = 1.5\ cm^3/s$ |
| 2013C 18a(ii) | 37 | Increasing the temperature will increase the rate of reaction and the gas will be given off quicker. However, the final volume of gas given off will be $37cm^3$ as the volume of gas given off is fixed by the quantities of reactants used (which are the same in both experiments) |

| Nat5<br>Traffic Lights | Past Paper Question Bank<br>Unit 1.1 Reaction Rates | Copyright<br>JABchem |
|---|---|---|

| Outcome | 2000 General | 2001 General | 2002 General | 2003 General | 2004 General | 2005 General | 2006 General | 2007 General | 2008 General | 2009 General | 2010 General | 2011 General | 2012 General | 2013 General | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 16a<br>16b | | 18b(i) | | | | | | | | | | | | |
| 2a 2b<br>2c | | 16c | | | | | 9b | 13c | 13a(ii) | | | 19a(i)<br>19b(ii) | | | | |
| 2d<br>3 | | 11a<br>16d | | | 17a(i)<br>17a(ii)<br>17b | 9c | | 14c(i) | 16c<br>18b(i) | 13a | 15c(iii) | | | 15c | | |
| 4 | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | |

| SG General | Answer | Reasoning |
|---|---|---|
| 2001G<br>11a | speeds up chemical reaction | A catalyst speeds up a chemical reaction but the catalyst is not used up in the reaction and can be fully recovered at the end of the reaction. |
| 2001G<br>16a | 40cm$^3$ | Problem Solving: Reading Information from a line graph |
| 2001G<br>16b | same final volume of gas given off | If the same conditions are used in both experiments (apart from the changing temperature) then the same volume of gas will be given off at the end of the reaction |
| 2001G<br>16c | line is steeper at beginning | The gradient of the line is the rate of reaction.<br>The steeper the line the faster the reaction |
| 2001G<br>16d | 0.2g | Catalysts speed up reactions with being used up in the reaction<br>Same mass of catalyst can be recovered at the end of the reaction |
| 2003G<br>18b(i) | no gas given off or mass is same | The experiment will release carbon dioxide gas as the reaction is proceeding. The reaction is over when the gas is stopped being produced and no more mass is lost on the balance. |
| 2004G<br>17a(i) | speeds up chemical reaction | A catalyst speeds up a chemical reaction but the catalyst is not used up in the reaction and can be fully recovered at the end of the reaction. |
| 2004G<br>17a(ii) | 0.1g | Same mass of catalyst at beginning and end |
| 2004G<br>17b | 50cm$^3$ of 2mol/l hydrogen peroxide<br>0.1g manganese dioxide | In a fair test, only one variable can change at one time:<br>• Question identifies TEMPERATURE as the variable which is changing<br>    ○ Temperature is increased from 25°C to 35°C<br>• Volume of hydrogen peroxide solution must remain constant (50cm$^3$)<br>• Concentration of hydrogen peroxide solution must remain constant (2mol/l)<br>Mass of manganese dioxide must remain constant (0.1g) |
| 2005G<br>9c | a substance which speeds up a reaction | Catalysts speed up reactions but are not used up in the reaction.<br>Same mass of catalyst left at end of reaction. |

| | | |
|---|---|---|
| 2006G<br>9b | less time taken | Smaller particle size after crushing makes reaction faster, making gas pressure inside tub increase faster |
| 2007G<br>13c | Increases | Methods to increase rate of chemical reaction:<br>increase concentration<br>increase temperature<br>decrease particle size |
| 2007G<br>14c(i) | 0.1g | Catalysts are chemically unchanged during reactions<br>∴ same mass of catalyst at start and end of reaction |
| 2008G<br>13a(ii) | speed increases | Powdered zinc has a smaller particle size than lumps of zinc so powdered zinc reacts faster than lumps of zinc. |
| 2008G<br>16c | 25°C<br>20cm$^3$<br>1g | In a fair test, only one variable changes at the time. From question, concentration is the variable which is being altered.<br>• Volume of hydrogen peroxide stays at 20cm$^3$<br>• Temperature stays at 25°C<br>Mass of vegetable stays at 1g |
| 2008G<br>18b(i) | to speed up reaction<br>or<br>less energy/heat required | Catalysts speed up chemical reactions without being used up in the reaction. |
| 2009G<br>13a | 0.8g or<br>the same | Catalysts are chemically unchanged during reactions<br>∴ same mass of catalysts at start and end of reaction |
| 2010G<br>15c(iii) | Speeds up chemical reaction | A catalyst speeds up a chemical reaction but the catalyst is not used up in the reaction and can be fully recovered at the end of the reaction. |
| 2011G<br>19a(i) | 5 | Total volume must be the same in each experiment at 25cm$^3$ |
| 2011G<br>19a(ii) | Experiment 2 is slower | Experiment 2 is slower than experiment 1 as it has less concentrated acid.<br>the lower the concentration, the slower the reaction |
| 2013G<br>15c | 0.7g | Catalyst is not used up in reaction so original mass will remain |