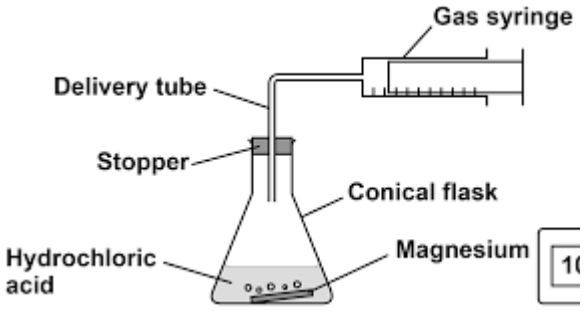
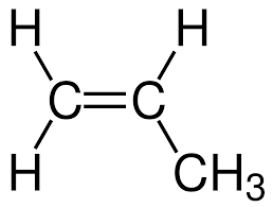
Mark Scheme - Paper 2

Question 1	Answer	Marks
01.1	Formulation	1
01.2	262	2
01.3	Method: ● draw (pencil) start line on (chromatography) paper ● place spot of food colouring on start line ● use of suitable solvent ● place solvent in beaker / container ● place (chromatography) paper in beaker / container ● so (chromatography) paper is in solvent ● but solvent is below start line ● use a lid ● wait for solvent to travel up the (chromatography) paper (until near top) ● mark solvent front ● dry the (chromatography) paper Measurements: ● measure distance between start line and centre of spot ● measure distance between start line and solvent front ● use of measurements to determine R_f value	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced. 5–6 marks **Level 2:** The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced. 3–4 marks **Level 1:** The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear. 1–2 marks
01.4	Y	1
01.5	Pure	1
01.6	= (32 / 262) * 100% ≈ 0.1221 * 100% ≈ 12.21%	1 1 1

Question 2		Marks
02.1	$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$	2
02.2		3
02.3	Add a set mass of the smallest calcium carbonate lumps to the conical flask. Pour a set volume of hydrochloric acid into a conical flask. Measure the volume of gas produced at regular intervals using a gas syringe (eg every 10 - 30s) for a designated time Repeat steps using the **same mass** of the other sizes of calcium carbonate lumps. Must mention keeping the total volume of hydrochloric acid, mass of calcium carbonate and the designated time the same in each experiment.	1 1 1 1
02.4	sensible scales, using at least half the grid for the points all points correct ± ½ small square allow 1 mark if 8 or 9 of the points are correct best fit line	1 1 1 1
02.5	0.09 dm^3 gas formed 0.09/100 = 0.0009 dm^3/s **or** 0.9 cm^3/s *Allow in the range of 0.0008-0.001 dm^3/s*	1 1 1 1
02.6	Steeper initial graph. Levels off at the same point	1 1
02.7	acid particles used up so concentration decreases so less frequent collisions / fewer collisions **per second** so rate decreases / reaction slows down	1 1 1 1

Question 3		Marks
03.1	● weigh (evaporating) basin / dish ● add measured volume of water ● weigh (evaporating) basin / dish and water ● heat to evaporate water ● reweigh ● repeat heating until constant mass obtained ● subtract mass of (evaporating) basin / dish from mass ● repeat and calculate a mean, discarding anomalous results ● calculate the mass in 100 cm^3 water if necessary	**Level 2:** Most steps included and would result in successful analysis. 3–4 marks **Level 1:** Some steps included, procedure would not necessarily lead to a successful analysis. 1–2 marks
03.2	add barium chloride (solution) and (dilute) hydrochloric acid (to water sample) allow barium nitrate (solution) allow (dilute) nitric acid white precipitate (forms)	1 1
03.3	● add hydrochloric acid ● effervescence / fizzing ● bubble gas through limewater ● limewater becomes cloudy	1 1 1 1
03.4	add (platinum / nichrome) wire (for the flame test) Result - red flame	1 1

Question 4		Marks
04.1	**Reasonable judgement on energy costs** - quite energy intensive to mine clay and iron ore. Extracting iron and making steel takes more energy Paper cups weigh less per unit so they use less energy to transport to their point of use Trees are renewable Iron ore, coal and clay are finite Paper cups use the least packaging so conserve raw materials Paper cups need less transportation overall as more plates fit in a box Paper cups are single use so must be replaced most often Steel cups last the longest so need replacing less often steel / ceramic cups take up landfill which is running out, but steel can be recycled Paper / steel can be used to make new products Recycling conserves raw materials **Reasoned judgement**	**Level 3:** All 3 cups should be evaluated against most criteria listed. Also a reasoned judgement should be included. 5 - 6 marks **Level 2:** Some information has been evaluated or only 2 types of cup have been compared. A judgement might be included but may not be fully reasoned. 3 - 4 marks **Level 1:** Some information has been compared, no judgement has been attempted 1 - 2 marks
04.2	High carbon steel is strong but brittle. Low carbon steel is softer and more easily shaped. Stainless steels are hard and resistant to corrosion.	1 1 1
04.3	magnesium is more reactive (than iron) (so magnesium) provides sacrificial protection by corroding first	1 1
04.4	Paint provides a barrier between the steel and water in the air Water cannot come in contact with the steel so no rusting occurs	1 1

Question 5		Marks
05.1	crude oil is heated to vaporise the hydrocarbons there is a temperature gradient in the fractionating column the gases condense at different levels because of their different boiling points	1 1 1 1
05.2	$C_5H_{12} + 8O_2 \rightarrow 6H_2O + 5CO_2$	2
05.3	High temperature and steam or High temperature and catalyst	2
05.4	$C_{20}H_{42} \rightarrow C_2H_4 + C_{18}H_{38}$	1
05.5	Add bromine water Decolourises	1 1
05.6		2
05.7	A - alcohol B - carboxylic acid	1 1
05.8	Amino acid	1

<table>
<tr><th>Question 6</th><th>Answer</th><th>Marks</th></tr>
<tr><td>06.1</td><td>
<table>
<tr><th>Gas</th><th>Estimated percentage in the Early atmosphere of Earth</th><th>Current percentage i Earth's atmosphere</th></tr>
<tr><td>nitrogen</td><td>1.8</td><td>78.09</td></tr>
<tr><td>oxygen</td><td>0.2</td><td>20.95</td></tr>
<tr><td>Carbon dioxide</td><td>96.0</td><td>0.04</td></tr>
<tr><td>Other gases</td><td>2</td><td>0.92</td></tr>
</table>
</td><td>1
1
1</td></tr>
<tr><td>06.2</td><td>Plants and algae took in carbon dioxide
and released oxygen by photosynthesis
Carbon dioxide + water → glucose + oxygen</td><td>1
1
2</td></tr>
<tr><td>06.3</td><td>Any 2 from:
carbon monoxide, soot (carbon particles), sulfur dioxide and oxides of nitrogen

Associated problems:
Carbon monoxide is a toxic gas. It is colourless and odourless and so is not easily detected. Sulfur dioxide and oxides of nitrogen cause respiratory problems in humans and acid rain.
Particulates cause global dimming and health problems for humans.</td><td>2

2</td></tr>
<tr><td>06.4</td><td>Relights
Glowing splint</td><td>1
1</td></tr>
</table>

Question 7	Answer	Marks
07.1	The rate of reaction will increase as More particles collide successfully more frequently More particles have sufficient activation energy The position of equilibrium would shift to the left as the forward reaction is exothermic Higher costs as higher temperature uses more energy	1 1 1
07.2	higher pressure gives higher rate because of more frequent collisions higher pressure shifts the position of equilibrium to the right because more molecules on left-hand side higher pressure uses more energy/requires stronger reaction vessels so increases costs	1 1 1
07.3	Catalyst speeds up the rate of reaction, as it lowers the activation energy. No effect on position of equilibrium	1 1 1