AQA Style

GCSE

CHEMISTRY

H

Higher Tier Chemistry Paper 2

Mark Scheme

BEYOND SCIENCE

Question 1

Question	Answers	Extra information	Mark
01.1	a mixture designed as a useful product	Accept a description of a mixture.	**1**
01.2	X	If more than one box is ticked, award no marks.	**1**
01.3	sample/batch C is correct/ contains the right ingredients	Sample/batch C is the only one that is correct/contains the correct ingredients receives marking points 1 and 3.	**1**
	(because) it matches the correct medicine/ has the same dots/pattern/ the substances travelled the same distances	Sample/batch C is the only one that matches the correct medicine, has the same dots/ pattern, they travelled the same distances receives marking points 2 and 4.	**1**
	samples/batches A, B and D are not correct/do not contain the right ingredients		**1**
	(because) they do not match the correct medicine/they have different dots/patterns/ the substances travelled different distances		**1**
01.4	it stayed on the start line/ didn't move		**1**
	(because) it was not soluble (in the solvent used)		**1**
01.5	$\frac{8}{40}$	Accept $R_f = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$	**1**
	0.2		**1**
Total			**10**

Question 2

Question	Answers	Extra information	Mark
02.1	Any **two** from: • extracting and/or processing of raw materials • manufacturing/making the product and/or packaging • using the product during its lifetime • disposal (at the end of its useful life • transport/distribution at each stage	For each step, allow a clear description of the process or a specific example related to a named product.	**2**
02.2	**Level 2:** The ways in which relevant features are similar/ different is made clear. The magnitude of the difference is described.		**3-4**
	Level 1: There is a simple comparison of the indicator for each type of bag.		**1-2**
	No relevant content.		**0**
	Indicative content: • Comparison: Producing paper bags uses more water than producing plastic bags. • Magnitude: Producing paper bags uses 700/3.5× more litres of water than producing plastic bags. • Comparison: Producing paper bags releases more CO_2 than producing plastic bags. • Magnitude: Producing paper bags releases 3kg/3× more CO_2 than producing plastic bags. • Comparison: Plastic bags are more likely to end up as litter than paper bags. • Magnitude: There is a 5× higher risk of plastic bags becoming litter compared to paper bags/The risk of a plastic bag becoming litter is 1 but the risk of a paper bag becoming litter is only 0.2.		

02.3	Any **one** from: • not all impacts are easy to calculate/ some impacts require human judgements/ it is not a purely objective process • different people may come up with different judgements • judgements may be biased/ misused	Accept a specific example, e.g. to support advertising claims.	**1**
Total			**7**

Question 3

Question	Answers	Extra information	Mark
03.1	methane	Accept CH_4. Accept water vapour. Accept nitrous oxide. Accept ozone.	**1**
03.2	Any **two** from: • burning fossil fuels/ combustion (to generate electricity, heat homes or run vehicles) • deforestation • grazing cattle • rice fields • disposing of waste in landfill sites	If no mark has been awarded for grazing cattle or rice fields allow **1** mark for farming/ agriculture.	**2**
03.3	the results are peer-reviewed to prevent false claims	Accept checked by other scientists. Accept to check that the data/ results are reproducible. Accept to check the results are valid.	**1** **1**

03.4	**Level 3:** A judgement is supported by a range of logically linked reasons. There is at least one statement from each section of the indicative content.	**5-6**
	Level 2: Some logically linked reasons are given. There may also be a simple judgement. There is at least one statement from each section of the indicative content.	**3-4**
	Level 1: Relevant points are made that do not need to be linked. Two marks can be awarded for two valid statements.	**1-2**
	No relevant content.	**0**
	Points in support of the statement: • The trend in **Figure 3** shows a decrease in temperature. • **Figure 2** shows that the global temperature regularly decreases for a few years. • The trend in **Figure 3** fits the pattern of fluctuations/ increases and decreases shown in **Figure 2**. **Points against the statement:** • **Figure 2** shows an upward trend in temperature since 1964. • **Figure 3** shows an increase in temperature between 2018 and 2019. • The decrease in 2018 in **Figure 3** is unlikely to be anomalous as it fits the pattern of results in **Figure 2**. • **Figure 3** only includes four years of data (while **Figure 2** includes 140). • **Figure 3** includes data only from March each year. • **Figure 3** includes data from one location while **Figure 2** includes data from across the world. • So the calculation of the mean temperature is more accurate in **Figure 2**. • The data and methods in **Figure 2** have been peer reviewed/ verified but the data in **Figure 3** has not. • Therefore, the data in **Figure 2** is more likely to be valid.	
Total		**11**

Question 4

Question	Answers	Extra information	Mark
04.1	a glowing splint relights	 Accepts bursts into flame. Do not accept a lit splint burns brighter or faster.	**1** **1**
04.2	$C_3H_8 + \mathbf{5}O_2 \longrightarrow 3CO_2 + \mathbf{4}H_2O$	Allow multiples.	**1**
04.3	$\frac{(12 \times 3)}{44} \times 100$ 81.8181.... 81.8	Accept $\frac{36}{44} \times 100$ An answer of 81.8 with no working shown scores **3** marks. $\frac{12}{44} \times 100 = 27.2727...$ scores **1** mark. An answer of 27.3 scores **2** marks.	**1** **1** **1**
04.4	incomplete combustion will occur Any **three** from: • (therefore) carbon monoxide will be produced • which is a toxic gas • that is colourless/odourless/ not easily detected • (therefore) particulate carbon/particulates/soot will be produced • which can irritate the lung linings/make asthma worse/ cause cancer	Allow reference to less oxygen available for combustion. Effects of the pollutants must be linked to the correct pollutant. Allow description of effects of inhaling carbon monoxide.	**1** **3**
Total			**10**

Question 5

Question	Answers	Extra information	Mark
05.1	**Level 3:** There is a clear description of a method and results that would identify the three solutions.		**5-6**
	Level 2: There is a description of a method and results that would identify either the positive **or** negative ions.		**3-4**
	Level 1: Relevant statements of the method or results. Two marks can be awarded for two valid statements.		**1-2**
	No relevant content.		**0**
	Indicative content: **Flame Test** • dip splint in solution • hold splint in the Bunsen burner flame (Accept any sensible method of introducing the solution to the flame.) • result: sodium compounds give yellow/orange flame • result: potassium compounds give lilac flame **Halide Test** • add dilute nitric acid • add silver nitrate solution • result: chloride solutions will give a (white) precipitate • result: potassium sulfate will not react/produce a precipitate **Sulfate Test** • add dilute hydrochloric acid • add barium chloride solution • result: potassium sulfate will produce a (white) precipitate • result: potassium chloride and sodium chloride will not react/produce a precipitate		
05.2	react with nitric acid	Accept add nitric acid.	**1**
	to produce calcium nitrate		**1**
	and phosphoric acid		**1**
	phosphoric acid is neutralised/reacted with ammonia (to produce ammonium phosphate)	Accept add ammonia.	**1**
Total			**10**

Question 6

Question	Answers	Extra information	Mark
06.1	Any **two** from: • size/surface area of marble chips • volume of acid • temperature of the acid • atmospheric pressure • whether or not the reaction is stirred • mass of marble chips • type of acid • angle of the gas syringe		**2**
06.2	Any **one** from: • some gas may be lost before the bung is inserted • timer not started at the start of the reaction • gas syringe does not allow precise measurements/error reading volume of gas	Allow a description of adding the marble chips, the bung and starting the timer at the same time.	**1**
06.3	all points correctly plotted curve of best fit ignoring the anomalous point at (60, 35)	Allow a tolerance of ± ½ a small square. Allow **1** mark for 5 or 6 points plotted correctly. Allow correct line of best fit for incorrectly plotted points.	**2** **1**

06.4	(rate of reaction) decreases (rate decreases) more slowly as time increases (rate) becomes zero at 68 seconds	Allow the rate is fastest at the beginning. Accept a reference to a time period where the rate is slower than at the start. Allow reaction stops at 68 seconds. Accept time in the range of 64 to 76 seconds.	**1** **1** **1**
06.5	tangent drawn at 40s attempt at $\frac{\text{change in y}}{\text{change in x}}$ for their tangent an answer in the range of 0.62 to 0.68 cm^3/s	At least one of Δx or Δy must be correct for their tangent.	**1** **1** **1** **1**
Total			**13**

Question 7

Question	Answers	Extra information	Mark
07.1	to bind together the glass or silica particles	Accept either glass particles or silica particles.	**1**
07.2	(thermosoftening polymers) melt at high temperatures so would fall out/get damaged with hot food/ drinks	 Accept any description of the filling that suggests it is no longer effective.	**1** **1**
07.3	**Level 2:** Some logically linked reasons are given. There is at least one statement from each section of the indicative content. There may be a simple judgement.		**3-4**
	Level 1: Relevant points about the materials are made. Two relevant points awards two marks.		**1-2**
	No relevant content.		**0**
	Indicative content: **Amalgam fillings:** • are stronger/more durable/more resistant to wear • (so) are more likely to withstand chewing forces/are less likely to get damaged • last longer than composite fillings/amalgam fillings last 15 years and composite fillings only last 7-10 years • (so) they will need to be replaced less often **Composite fillings:** • can be the same colour as teeth • (so) they are more cosmetically pleasing/they look nicer • only need a small part/need a smaller part of the tooth removed • (so) less damage occurs to the teeth/so more of the tooth remains		

07.4	poly(methacrylic acid) is produced by addition polymerisation whereas nylon is produced by condensation polymerisation		**1**
	poly(methacrylic acid) is produced from one monomer whereas nylon is produced from two monomers		**1**
	poly(methacrylic acid) is the only product formed whereas the reaction to produce nylon also produces water	Allow a small molecule for water.	**1**
Total			**10**

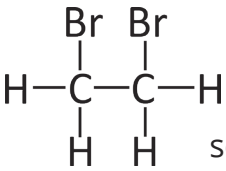
Question 8

Question	Answers	Extra information	Mark
08.1	Any **two** from: • copper can be extracted from low grade ores • mining is not required • no need to move/transport/ dispose of large amounts of rock	Allow copper can be extracted from contaminated land. Allow consequences of less mining. Allow less energy required. Allow fewer emissions of greenhouse gases/carbon dioxide.	**2**
08.2	iron is more reactive than copper (so) iron displaces copper (from copper sulfate)	Allow iron reduces copper ions.	**1** **1**
08.3	M_r $CuSO_4$ = 159.5 $\frac{0.957}{159.5}$ = 0.006 (mol)	Allow correct use of incorrectly calculated value for M_r. Allow 6×10^{-3} (mol). An answer of 0.006 or 6×10^{-3} (mol) with no working shown scores 3 marks.	**1** **1** **1**
08.4	(amount of hydrated copper sulfate) decreases (because) the equilibrium/ system shifts to the left/in the endothermic direction	Allow the equilibrium/ system shifts to reduce the temperature/to counteract the change. Allow favours the reverse/ endothermic reaction.	**1** **1**
Total			**9**

Question 9

Question	Answers	Extra information	Mark
09.1	(banded iron formations) require oxygen		**1**
	which was first produced 2.7 billion years ago (by algae)	Allow there was no oxygen produced before 2.7 billion years ago for **2** marks.	**1**
09.2	(limestone is) formed from the carbonate compounds/ calcium carbonate (shells/ skeletons) of sea organisms/ animals/plankton		**1**
09.3	C_nH_{2n+2}		**1**
09.4	petrol has shorter/smaller molecules/chains		**1**
	(so) it has a lower boiling point		**1**
	(therefore) it condenses higher up the (fractionating) column		**1**
	because the column is cooler at the top	Allow because there is a temperature gradient.	**1**
09.5	cracking		**1**
	breaks larger molecules/ kerosene into smaller molecules		**1**
Total			**10**

Question 10

Question	Answers	Extra information	Mark
10.1	4 × H and 2 × Br bonded to the carbon atoms a single bond between the two carbon atoms	 scores **2** marks.	**1** **1**
10.2	colour change from orange to colourless		**1**

10.3	Any **three** from: • hydration of ethene happens at 300°C while fermentation happens between 25-35°C • hydration of ethene requires a high pressure whereas fermentation requires a normal pressure • hydration of ethene requires a catalyst/ phosphoric acid whereas fermentation uses the enzymes in yeast as a catalyst • fermentation requires anaerobic conditions • raw materials used for fermentation are renewable whereas the raw materials for hydration of ethene are not • hydration of ethene produces a pure product whereas the products of fermentation need further processing to purify them • hydration of ethene produces a higher yield of ethanol • hydration of ethanol is a faster reaction	Accept high and low temperature in place of values. Accept hydration of ethene requires more energy than fermentation. Accept 60-70atm for hydration of ethene and 1atm for fermentation. Accept absence of oxygen. Accept needs an air lock. Accept correctly named raw materials (sugar/fructose/ glucose for fermentation and crude oil for hydration). Accept fermentation products need to be distilled. Accept hydration of ethene has 100% atom economy whereas fermentation produces a by-product/CO_2/impure ethanol.	**3**

10.4	oxidation		**1**
10.5	ethyl ethanoate		**1**
10.6	ethanoic acid is a weaker acid because it is only partially ionised	 Allow has a lower concentration of hydrogen/H^+ ions. Allow converse argument for sulfuric acid.	**1** **1**
Total			**10**