Markscheme

May 2022

Chemistry

On-screen examination

15 pages

The following are the annotations available to use when marking responses.

Annotation	Explanation
	Correct point, place at the point in the response where it is clear that the candidate deserves the mark. For use in analytically marked questions only.
	Omission, incomplete
CON	Contradiction
	Valid part (to be used when more than one element is required to gain the mark)
	Error carried forward
	Dynamic annotation, it can be expanded to surround work
	Horizontal wavy line that can be expanded
	Highlight tool that can be expanded to mark an area of a response

Annotation	Explanation
	Not good enough
	The candidate has given a response but it is not worthy of any marks
	Test box used for additional marking comments
	Seen; must be stamped on all blank response areas and on duplicate pages of concatenated responses
	Vertical wavy line that can be expanded
	Words to that effect
	Award 1, 2, 3, 4 marks. For use in holistically marked questions only

Markscheme instructions

1 Mark positively. Give candidates credit for what they have achieved and what is correct. Do not deduct marks for incorrect responses. Do not deduct marks for spelling errors.

2 Follow the markscheme provided and award only whole marks.

3 Each marking point appears on a separate line.

4 The maximum mark for each subpart is indicated in the "Total" column.

5 Where a mark is awarded a tick should be placed in the text at the precise point where it is clear the candidate deserves the mark.

6 Each marking point in a question part should be awarded separately unless there is an instruction to the contrary in the Notes column.

7 A question subpart may have more marking points than the total allows. This will be indicated by the word "***max***" in the Answer column. Further guidance may be given in the Notes column.

8 Additional instructions on how to interpret the markscheme are in bold italic text in the Answer column.

9 Alternative wording may be indicated in the Answer column by a slash (/). Either alternative is equally acceptable but the candidate cannot be rewarded for both as they are associated with the same marking point.

10 Alternative answers are indicated in the Answer column by "***or***". Either alternative is equally acceptable but the candidate cannot be rewarded for both as they are associated with the same marking point.

11 If two related points are required to award a mark, this is indicated by "***and***" in the answer column.

12 Words in brackets ( ) in the Answer column are not necessary to gain the mark.

13 Words that are <u>underlined</u> are essential for the mark.

14 In some questions a reverse argument is also acceptable. This is indicated by the abbreviation *ORA (or reverse argument)* in the Notes column. Candidates should not be rewarded for reverse arguments unless *ORA* is given in the Notes column.

15 If the candidate's response has the same meaning or is clearly equivalent to the expected answer the mark should be awarded. In some questions this is emphasized by the abbreviation *WTTE (or words to that effect)* in the Notes column.

16 When incorrect answers are used correctly in subsequent question parts the follow through rule applies. Award the mark and add ECF (error carried forward) to the candidate response.

17 The order of marking points does not have to be the same as in the Answer column unless stated otherwise.

18 Marks should not be awarded where there is a contradiction in an answer. Add CON to the candidate response at the point where the contradiction is made.

19 Do not penalize candidates for errors in units or significant figures unless there is specific guidance in the Notes column.

20 Questions with higher mark allocations will generally be assessed using a level response method using task specific clarifications developed with reference to the criteria level descriptors. A candidate's work should be reviewed to determine holistically the mark for each row of the holistic grid and a mark awarded for each row.

Question		Answers	Notes	Total	Crit
1	a	Unreactive		1	A
	b	Aluminium oxide or Aluminium (III) oxide Fe_2O_3	*Subscripts must be present*	2	A
	c	Chlorine ***or*** Cl		1	A
	d	Mass number = number of protons + number of neutrons Mass number is 37	*Evidence of this calculation ECF from part c* *Award 2 marks for correct answer with no additional working required. Ignore units if present.*	2	A
	e	Molar mass of water = 18 ($g\ mol^{-1}$) (so) 5 mole $CaSO_4.2H_2O$ contains 10 moles H_2O (so) 180 g water	*Unit required for third mark. Award 3 marks for correct answer and unit if no working is seen.*	3	A
2	a	Copper ***and*** Cu ***or*** Tungsten ***and*** W ***or*** Gold ***and*** Au		1	A
	b	Calcium ***or*** Ca		1	A

	c	Mass of Na_2O=5.3 (g) Molar mass of Na_2O = 62 (Moles of Na_2O in sample =) 0.0854838… 0.085	*ECF if molar mass is incorrect*	**4**	A D
	d	B		**1**	A
	e	pH=2.1		**1**	A
	f	39 ***and*** °C (+) 14 (°C)	*Do not accept just degrees, C alone can be accepted* *Award 1 mark for 15 (ECF from incorrect reading of meniscus in first marking point)*	**2**	A
	g	Exothermic		**1**	A
	h	2 HF + Ca(OH)$_2$ → [ ] CaF_2 + 2 H_2O ***Reactant coefficient:*** *2HF* ***Product coefficient:*** *CaF_2* ***Product:*** *CaF_2* ***Product coefficient:*** *$2H_2O$*	*Do **not** award mark if ? is present*	**4**	A

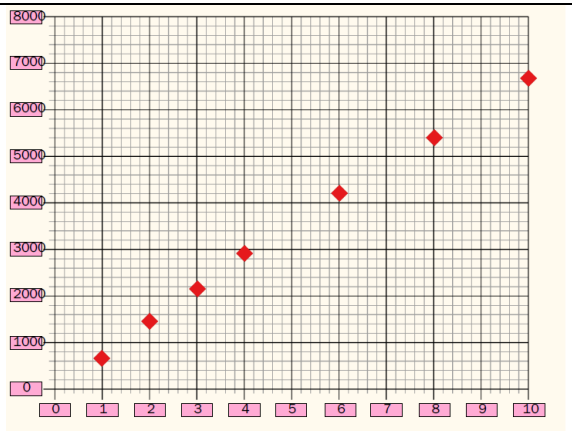
3	**a**	C		**1**	D
	b	A		**1**	A
	c	4-6 (%)		**1**	C
	d	6 (hours) ***or*** more than 6 hours		**1**	C
	e	(Two-step process) because it removes more or more efficient at removing bacteria during this time 4 hours and over	*Ref to two-step process can be implied* *Only award the second mark if the first mark is awarded*	**2**	C
4	**a**	Collect gas in a test tube It relights a glowing splint	 *Do not accept a lit split* *Accept use of Oxygen probe*	**2**	A
	b	If the catalyst is a solution Then the rate of decomposition will be higher ***Third marking point from the list [max 1]*** • because the number of collisions is higher • greater chance of collision • higher frequency of collision • particles can move more freely	*ORA for solid catalyst* *Do **not** award the first marking point without correct link to the second marking point*	**3**	B
	c	IV: (type of) catalyst used DV: time for flame to burn ***or*** stop burning ***Accept any two reasonable CV, for example [max 2]*** • mass ***or*** volume of catalyst • volume of H_2O_2 used • type of fuel used • mass of fuel used • how the fuel is lit	 *WTTE. Do not accept rate* *Do not accept amount or quantity or equipment*	**4**	B

	d	***First explanation linked to rate of production, for example [max 1]*** • as the rate of decomposition would be faster for the best catalyst • (so) the burn time would be shorter for the best catalyst • a longer burn would come from a smaller rate of reaction ***Second explanation linked to oxygen, for example [max 1]*** • total volume of oxygen would the same for all catalysts • steady burning does not necessarily mean it is the fastest rate of oxygen production • a good catalyst might produce oxygen too quickly for it to be burnt ***Final mark:*** (so) the hypothesis is invalid	*WTTE* *Do not award final mark unless at least one correct explanation is given*	**3**	C
	e	Average volume = 44 (cm^3) Value of rate: 44/30=1.47 (accept 1.5) Unit of rate: cm^3s^{-1}	*ECF from first marking point* *Accept cm^3/s or ml/s, 88.2 cm^3min^{-1}*	**3**	C
	f	***Accept any two errors, for example [max 2]*** • the stopper is not inserted into the test tube • the tubing is not in the eudiometer • the eudiometer was not filled up completely with water • the timing was longer than 30 seconds ***Correctly linked justification [max 1]*** • the volume of gas collected will be too low as not enough water displaced • (Not filled with water) the volume of the gas will be too high • (the length of the trial was too long) so more gas was collected		**3**	C

5

	1	**2**	**3**	**4**
Variables	A variable is identified	Independent variable ***and*** dependent variable identified	Independent variable ***and*** dependent variable identified ***and*** one control variable is stated	
Additional equipment	One piece of additional equipment (not stopwatch, eudiometer, test tube) is listed	One piece of equipment to measure the catalyst ***and*** one piece of additional equipment	Balance to measure mass of catalyst ***and*** equipment to measure the volume of H_2O_2	
Method	Attempt at a method	States how one CV will be controlled	States how one CV will be controlled ***and*** their method can be repeated but the data will not be valid	States how their CV will be controlled ***and*** can be replicated to give valid data ***and*** clearly states how rate will be calculated from measured data
Data	One catalyst is investigated	All catalysts are investigated	All catalysts are investigated with at least 3 repeats	All catalysts are investigated with repeats ***and*** plans to calculate means
Safety	A safety precaution is stated	A safety precaution is stated ***and*** linked to oxidizing hazard or flammability		

16 B

6	**a**	as the length of time increases hydrogen peroxide reacts with the hair more ***or*** the hair becomes lighter as it is in contact for more time ***or*** more collisions ***or*** If the hair is darker it will take longer to become lighter More pigment removed The hair changes colour more	*WTTE*	**3**	C
	b	 At least five data points plotted correctly Title linking x and y Concentration on x axis and signal strength on y axis Scale with even increments Concentration ***and*** %	*Y axis does not need to start at 0* *Ignore any line of best fit if present* *ECF for labels*	**5**	C

	c	3500 +/- 200	ECF from part b	**1**	C
	d	***First marking point*** Average does not give the value of an individual bottle ***or*** The average is not a reliable measure of concentration (of each bottle) ***or*** The average gives no info about range of concentrations ***Second marking point*** (so) the concentration in each bottle could be higher or lower than the average		**2**	C

7	**a**	***Accept any reasonable response, for example [max 1]*** • malleable • easy to fold • strong • keeps its shape • can be coloured		1	A
	b	***Accept any reasonable response, for example [max 1]*** • waterproofing • wo give a glossy appearance • to protect (from air, heat)	*Ignore "stronger"*	**1**	D
	c	(When using hydrogen peroxide the) Oxygen produced is not toxic ***or*** (Use of chlorine) a toxic gas is produced	*Do **not** accept chlorine is toxic*	**1**	D
	d	An advantage of papyrus A disadvantage of papyrus An advantage of acid-free paper A disadvantage of acid-free paper A conclusion is stated Further justification of the conclusion		**6**	D

<table>
<tr>
<td>8</td>
<td></td>
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<tr><th></th><th>1 mark</th><th>2 marks</th><th>3 marks</th><th>4 marks</th></tr>
<tr><td>Env
(Environment)</td><td>one impact on the environment is implied</td><td>one impact on the environment is stated and linked to one type of paper production
or
same impact on the environment is stated for both types of paper production</td><td>comparison of one impact on the environment for both types of paper production is stated
or
two impacts on the environment for one type of paper production are stated</td><td>comparison of more than one impact on the environment is stated for both types of paper production</td></tr>
<tr><td>Eco
(Economy)</td><td>one impact on the economy is implied</td><td>one impact on the economy is stated and linked to one type of paper production
or
one impact on the economy for both types of paper production is stated</td><td>comparison of one impact on the economy for both types of paper production is stated
or
two impacts on the economy for one type of paper production is stated</td><td>comparison of more than one impact on the economy is stated for both types of paper production</td></tr>
<tr><td>Con
(Conclusion)</td><td>a conclusion is stated</td><td>conclusion is stated with justification</td><td></td><td></td></tr>
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</td>
<td>10</td>
<td>D</td>
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9		***Accept any reasonable advantage of paper, for example [max 1]*** • preservation of cultural knowledge and memory • accessible without technology ***Accept any reasonable advantage of electronic information storage, for example [max 1]*** • easily accessible • interactive • safe storage ***Accept any reasonable disadvantage of paper, for example [max 1]*** • paper degrades • can be destroyed or lost or stolen • it can be hard to find or search information ***Disadvantage of electronic information storage, for example [max 1]*** • technology may advance so information may not be accessible • it can be deleted or manipulated • it is not healthy to use technology all the time Conclusion stated Justification of conclusion linked to culture		**6**	D