Markscheme

May 2019

Chemistry

On-screen examination

13 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.

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.

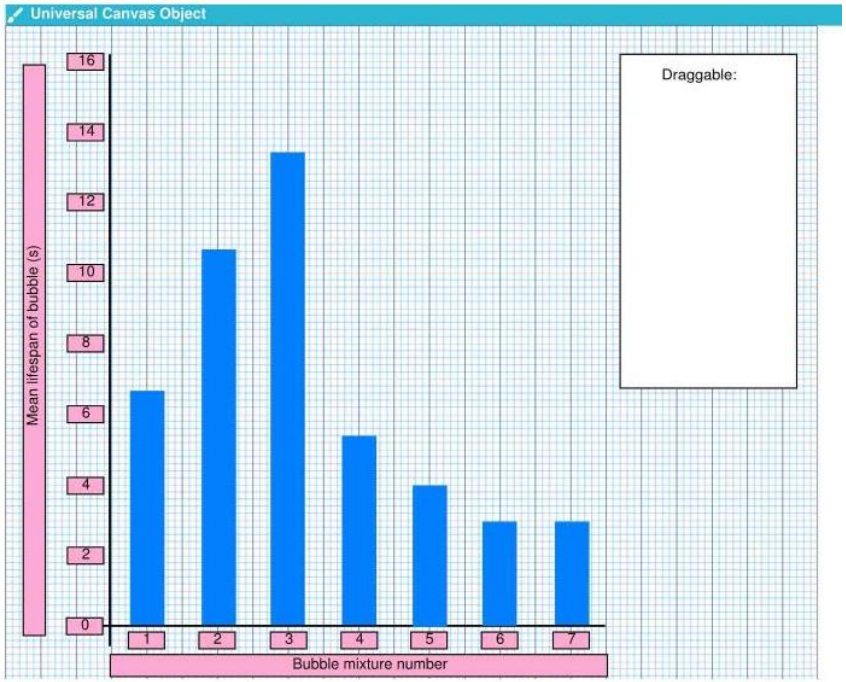
Question		Answers	Notes	Total	Criterion
1	a	***Accept any ~~of the following~~ [1 max]:*** • any noble gas • any element ~~from 209 to 280~~ • any actinide or lanthanide except Th or U • Sc or Ga or Ge or Hf		**1**	A
	b	lanthanides or actinides very small quantities of these elements exist ***or*** many are not naturally occurring ***or*** noble / inert gases / group 0 / group 18 / group VIII unreactive ***or*** not found in compounds **or** technology not available to isolate them	*Reason should be correctly linked to named group*	**2**	A
	c	Number of protons = 26 Number of neutrons = 32		**2**	A
	d	Iron / Fe	*ecf from part (c)*	**1**	A

2	a	Image Object  Text/MCQ/Mini-Cloze Object ○ ○ ●	*Check the position of the dot carefully, it is not always aligned directly under the correct structure*	**1**	A
	b	4 NO_2 (g) + O_2 (g) + 2 H_2O (l) → 4 HNO_3 (aq) ***First mark:*** any two coefficients are correct ***Second mark:*** all coefficients are correct		**2**	A
	c	acidic ***or*** contains an acid ***or*** low pH		**1**	A
	d	Group 6 Period 3	*Do **not** award any marks if the group and period are switched*	**2**	A
	e	98 ***or*** 0.098 g ***or*** kg	*Accept gmol^{-1}* *Award unit mark separately* *unit and value must agree*	**2**	A
	f	Text/MCQ/Mini-Cloze Object Class: Ester Text/MCQ/Mini-Cloze Object Name: Ethyl ethanoate Text/MCQ/Mini-Cloze Object Class: Alcohol Text/MCQ/Mini-Cloze Object Name: Propan-1-ol		**4**	A

3	a	***Any two from the list [2 max]:*** • good thermal / heat conductivity • malleable • high melting point • rigid / solid	*Do **not** accept conductivity alone, high boiling point, long lasting*	**2**	A
	b	+3 ***or*** 3+ <u>Oxidized</u> (because) electrons are lost from the Al atom ***or*** (because) oxidation state or number increases	*Award marks independently* *Accept half equation showing oxidation but the word oxidized must also be seen*	**3**	A
	c	covalent ***and*** metallic Teflon™ forms a protective coating (metals can produce) ions which are soluble ***or*** Teflon™ is not soluble coating prevents ions from forming ***or*** avoids health issues from ions	*Ignore polar*	**4**	A

4	a	***Any one of the following [1 max]:*** • constant colour (of solution) • volume or amount of water • type of glass or cup		**1**	B
	b	the time taken for diffusion to be complete [decreases] the kinetic energy increases with increasing temperature so the tea "particles" mix with the water molecules more quickly ***or*** diffusion occurs more quickly	*WTTE* *Award marks independently*	**3**	B
	c	400 ± 10 (seconds) seconds / s	*Award separately*	**2**	C
	d	record data points at intermediate temperatures carry out more than one trial calculate an average		**3**	C

5	a	1 cm^3 pipette		**1**	B
	b	10.666666 (s) 10.7 (s)	*Award two marks if only 10.7 is seen* *Please check table for 10.7 in addition to response box*	**2**	C

	c	 ***scale*:** evenly spaced increments that start at zero ***x axis:*** bubble mixture ***y axis*:** lifespan ***y axis unit*:** s ***Plotting*:** additional mark for all points plotted correctly ***Title*:** correctly links dependent and independent variable		**6**	C
	d	***Independent variable*:** volume of glycerine ***Dependent variable*:** lifespan of bubble		**2**	B

	e	bubbles are different sizes in method 2/ wand ***or*** bubbles are moving in method 2/wand and are static in method 1/straw ***or*** bubbles are affected differently by gravitational field in method 2/wand bubbles in method 2/wand are not reproducible bubbles in method 1/straw will give the most reliable data	*Method 1 uses a straw to form the bubble on a bench* *Method 2 uses a wand*	**3**	C
	f	convert 1 min 10 seconds to 70 ***and*** 1¼ min to 75 seconds method of calculation of mean is seen final answer 74 (s)	*Award 2nd mark independently (mean can be incorrect)* *no ecf award full marks is correct answer is seen* *accept 1 min 14 s*	**3**	C
	g	not valid because the two additives show different trends sugar causes a decrease in the lifespan of the bubble	*WTTE*	**2**	C

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<tr>
<td>6</td>
<td>a</td>
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<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>1.V

(Variables)</td><td>either independent or dependent variable is identified</td><td>independent and dependent variables are identified</td><td></td><td></td></tr>
<tr><td>2.CV

(Control variables)</td><td>one control variable is stated</td><td>two control variables are stated</td><td></td><td></td></tr>
<tr><td>3.E
(Equipment)</td><td>straw or wand and bubble mix are listed</td><td>straw or wand and bubble mix
and
timer or measuring equipment are listed</td><td>straw or wand and bubble mix
and
timer and measuring equipment are listed</td><td></td></tr>
<tr><td>4. Meth

(Method)</td><td>• make bubbles</td><td>• make bubbles
• add at least one additive mentioned
• time (until they burst)</td><td>• make bubbles
• all additives are mentioned
• time until they burst</td><td>• make and measure a bubble solution
• all additives are measured and added
• time until bubble bursts</td></tr>
<tr><td>5. Meas

(Measurements)</td><td>time for one additive is measured</td><td>time for one additive is measured and size of bubble controlled</td><td>time for all additives is measured and the size of the bubble is controlled</td><td></td></tr>
<tr><td>6. D

(Sufficient data)</td><td>at least three trials for an additive</td><td>at least three trials for all additives</td><td>at least three trials for all additives and plans to calculate average</td><td></td></tr>
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<td></td>
<td>b</td>
<td>Graph C</td>
<td>Accept Graph A</td>
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<table>
<tr><th></th><th>1</th><th>2</th><th>3</th></tr>
<tr><td>1.L

(Impact of landfills)</td><td>mention of landfills</td><td>with recycling only 10 % of waste goes to landfills or there is a 90% reduction in waste going to landfill with recycling</td><td></td></tr>
<tr><td>2.P

(Effects of pollution)</td><td>if plastics are recycled or re-used there will be less plastic polluting the environment
or
when plastics are used to generate electricity they are removed and will not pollute the environment</td><td>if plastics are not recycled there will be more plastic polluting the environment
and
when plastics are used to generate electricity they are removed and will not pollute the environment</td><td></td></tr>
<tr><td>3.B

(use of by-products)</td><td>if plastics are re-used or recycled useful by-products are produced
or
plastics can be recycled and used to generate electricity</td><td>if plastics are re-used or recycled useful by-products are produced
and
plastics can be recycled and used to generate electricity</td><td>if plastics are re-used or recycled useful by-products are produced
and
plastics can be recycled and used to generate electricity
and
plastics which are not recycled produce no useful by-products</td></tr>
<tr><td>4.R

(Re-use of raw materials)</td><td>same amount of raw material is consumed or lost whether or not the plastic is recycled</td><td></td><td></td></tr>
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<td>8</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td colspan="2">Any two reasonable responses, for example [2 max]:
• can be reused
• can be recycled at the end of life
• less material is processed
• product can put back into washed bottles
• fewer chemicals are released to the environment
• economic benefits or decrease in production costs</td>
<td>WTTE</td>
<td>2</td>
<td>D</td>
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<table>
<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>1. Eff

(Efficiency - to what extent are ions removed can be positive or negative)</td><td>efficiency of one method</td><td>efficiency of both methods</td><td>efficiency of both methods compared to each other</td><td>efficiency of both methods with comparison compared to each other and scientific justification</td></tr>
<tr><td>2. Env

(Environmental impact)</td><td>environmental impact of one method</td><td>environmental impact of both methods</td><td>environmental impact of both methods with scientific reasoning for both</td><td></td></tr>
<tr><td>3.Eco

(Economic impact)</td><td>economic impact of one method</td><td>economic impact of both methods</td><td></td><td></td></tr>
<tr><td>4.G
(Green chemistry)</td><td>one aspect of green chemistry is mentioned eg preventing waste, being energy efficient, using renewable raw materials</td><td>two aspects of green chemistry are mentioned eg preventing waste, being energy efficient, using renewable raw materials</td><td></td><td></td></tr>
<tr><td>5.C

(Complexity)</td><td>complexity of one method</td><td>complexity of both methods</td><td>complexity of both methods with comparison</td><td>complexity of both methods with comparison and scientific justification</td></tr>
<tr><td>6. F

(Final choice)</td><td>final choice stated</td><td>final choice with justification</td><td></td><td></td></tr>
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<td>D</td>
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