Markscheme

November 2020

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
	Text 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* (words to that effect) in the Notes column.

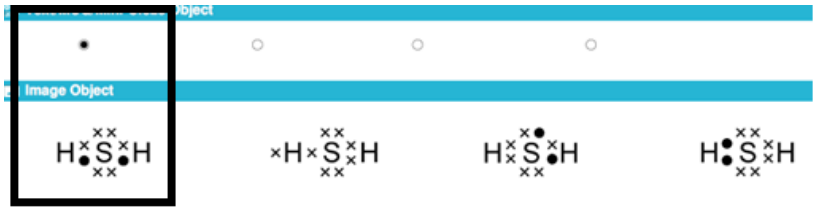
16 When incorrect answers are used correctly in subsequent question parts the follow through rule applies. Award the mark and add *ECF* (error carried forward) to the candidate response.

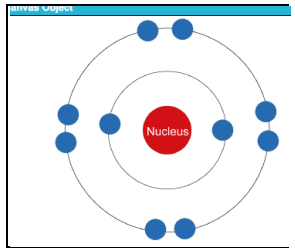
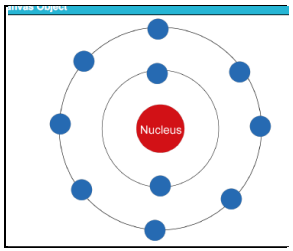
17 The order of marking points does not have to be the same as in the Answer column unless stated otherwise.

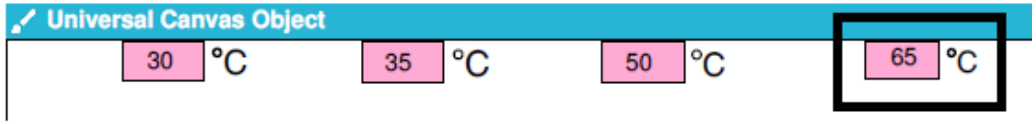
18 Marks should not be awarded where there is a contradiction in an answer. Add *CON* to the candidate response at the point where the contradiction is made.

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	solidification		1	A
	b	Table Object Oxide / Formula silicon dioxide / SiO_2 magnesium oxide / MgO	*Do **not** accept silicon oxide*	2	A
	c	basaltic		1	A
	d	$mSiO_2$ = 1.16 x 100 /2.00 g = 58.0 % 58.0 % SiO_2		2	C
	e	andesitic	*ECF from part d*	1	C
2	a	the gases dissolve in water to form acids (SO_2 or HCl) with pH approx. 0.1		2	A
	b			1	A
	c	(Period) 3		1	A
	d	P-10 N-12 E-10		3	A

	e	 ***or***  Only 2 electrons in the inner shell Only 8 electrons in the outer shell	*Award each mark independently*	**2**	A
3	**a**	Alkene		**1**	A
	b	Ethene Propene		**2**	A
	c	C_5H_{12}	*do not accept pentane,* $CH_3(CH_2)_3CH_3$	**1**	A
	d	neutralize acidic gases	*Accept remove toxic gases*	**1**	A
	e	boiling	*Accept water turning into steam* *Do* ***not*** *accept evaporation*	**1**	A
	f	***Accept any two reasonable responses, for example [max 2]*** • waste should not contain any materials that could produce hazardous/toxic/explosive substances during incineration • atmospheric emissions should be controlled with the proper equipment		**1**	A
	g	A — C — B (increasing size) A had the fastest rate of biodegradability / breakdown rate of reaction increases with decreasing particle size ***or*** the smaller the particles, the higher the surface area and the faster the reaction	*Accept correct decreasing order only if explained in words*	**3**	A

4	**a**	a chemical which speeds up the rate of a reaction ***or*** lowers the activation energy without itself being used up	*WTTE* *WTTE*	**2**	A
	b	Ester		**1**	A
	c			**1**	C
	d	temperature time taken for the glow stick to stop glowing ***Any two reasonable control variables [max 2]*** • type **or** colour of glow stick • volume of water • time to equilibrate	 *WTTE* *Do **not** accept amount of water*	**4**	B
	e	if the temperature increases then the length of time the glow stick will glow will decrease because the rate of the reaction increases		**3**	B
	f	330 ± 10 Minutes ***or*** min(s)		**2**	C

	g	rate = molecules/time = 6.58 x 10^5 / 260 = 2530(. 0769 . . .) molecules min^{-1} ***or*** 42.2 molecules s^{-1}	*Seen or implied* *Award the unit mark separately*	**4**	C D
5	**a**	Aurum		**1**	C
	b	sunlight consists of all the different wavelengths/colours/frequencies of light UV lamp only emits a narrow band of light / UVA only	*WTTE*	**2**	C

<table>
<tr>
<td>5</td>
<td>c</td>
<td>
<table>
<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>V (Variables)</td><td>some variables implied</td><td>IV or DV and one CV identified</td><td>IV and DV and one CV identified</td><td>IV and DV and two CV identified</td></tr>
<tr><td>E (Equipment)</td><td>equipment suggested but not relevant</td><td>equipment to monitor one CV</td><td>equipment to monitor two CVs</td><td></td></tr>
<tr><td>M (Method)</td><td>attempt at a method but may not be relevant</td><td>attempt at a method but detail is insufficient for another student to follow and is not likely to give relevant data</td><td>method is described, could be followed by another student producing relevant data</td><td>complete method is described, fully explained and could be repeated by another student</td></tr>
<tr><td>D (Data)</td><td>plans to test one type of chemical</td><td>plans to test each type of chemical</td><td>plans to use at least three samples of each type of chemical</td><td>plans to use at least three samples of each type of chemical and calculates a mean</td></tr>
<tr><td>S (Safety)</td><td>a safety consideration is given</td><td>a safety consideration is given related to a specific hazard</td><td></td><td></td></tr>
</table>
</td>
<td></td>
<td>17</td>
<td>B</td>
</tr>
<tr>
<td>6</td>
<td>a</td>
<td>compare the number of beads that have changed colour after exposure for each chemical

if titanium dioxide has the lowest number of beads that have changed, then the RQ is supported</td>
<td></td>
<td>2</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>Accept any reasonable response, for example [max 1]:
• combinations of chemicals/ingredients/compounds
• different length of time
• exposure to sunlight/ light source
• different concentration of chemical</td>
<td>Do not accept repeat the experiment</td>
<td>1</td>
<td>C</td>
</tr>
</table>

	c	Title – A title that links Absorbance and concentration (of chemical X) two data points plotted correctly all data points plotted correctly line of best fit to start at (0,0) and go through all points except 70μmol dm^{-3} axis labels: concentration on x axis and absorbance on y axis unit of concentration μmol dm^{-3}	*Ignore any units of absorbance*	**6**	C
	d	anomalous data point at 70 (μmol dm^{-3}) ***or*** there is only one trial ***or*** averages are not plotted	*WTTE* *No ecf from incorrect plotting in part (c)*	**1**	C
7	**a**	***Accept any reasonable suggestion, for example:*** • lack of fruit for food/diet • lack of medical products • loss of species • destruction of habitat • an impact on respiratory health ***Justification*** (because) fewer plants, so less photosynthesis is taking place ***or*** less glucose is synthesized ***or*** an increase in the level of carbon dioxide		**2**	D
	b	$Fe_{(s)} + CO_{2(g)} + H_2O_{(l)} \rightarrow FeCO_3(s) + H_2(g)$ one correct all correct	*Do **not** accept $H_2O(aq)$*	**2**	D

	c	Iron (II) carbonate		**1**	D
	d	oxidation number of iron has increased **or** has lost electrons (from 0 to) +2 (so) iron has been <u>oxidised</u>		**3**	D
	e	***All reactants correct:*** $2H_2 + O_2$ ***Product correct:*** $2H_2O$	Do ***not*** accept $?O_2$	**2**	D
	f	Only product is water ***or*** no CO_2 ***or*** no NOx ***or*** no SOx is produced product is non-toxic ***or*** pollutant	*Do **not** accept reference to energy density* *ORA accept combustion of petrol produces a pollutant gas for this mark only*	**2**	D

8

	1	2	3	4
Carb (Why there is a need for carbon sinks)	attempt at need for carbon dioxide sink	a statement about need for carbon dioxide sink	a statement about need for carbon dioxide sink supported by science	
Eco (Economic impact)	an economic impact for one system is implied	an economic impact for one system is stated	an economic impact for both systems is stated	
Soc (Social impact)	a social impact for one system is implied	a social impact for one system is stated	a social impact for both systems is stated	
Sci (Scientific link to advantages and disadvantages)	attempt at advantage ***or*** disadvantage of one system	advantage ***or*** disadvantage of one system	advantage and disadvantage of one system ***or*** an advantage or disadvantage of both systems	advantage ***and*** disadvantage of both systems
Con (Concluding appraisal)	a concluding statement	a concluding choice with justification		

15 D