Markscheme

November 2019

Chemistry

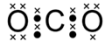
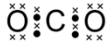
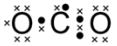
On-screen examination

12 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

Question		Answers	Notes	Total	Criterion
1	a	9		**1**	A
	b	Aluminium: 3 3 Silicon: 4 3 Aluminium: group 3 ***and*** period 3 Silicon: group 4 ***and*** period 3		**2**	A
	c	A.  B.  C.  D.  B		**1**	A

2	a	alloy		**1**	A
	b	***Low carbon steel:*** Would not be strong ***or*** too malleable ***or*** would not hold its shape ***Very high carbon steel:*** Brittle ***or*** not malleable ***or*** not easy to shape	*WTTE*	**2**	A
	c	kg converted to g *n* = m/ram **or** *n* = 405/56 7.23 (moles) 7.2 (moles)	 *Seen or implied. Accept correct answers using 98.15% high carbon steel* *Award 3 marks if only this answer is seen* *Correct answer expressed to 2 sig figs*	**4**	A D
	d	Solid		**1**	A

	e	***Point A (liquid)*** Irregular arrangement of at least 6 particles with at least 4 in contact arranged towards the base of the container ***Point B (solid)*** Regular arrangement of at least 6 particles at the base of the container	*Do **not** accept completely dispersed particles or pairs of particles implying gas molecules*	**2**	A
	f	327 ± 1 (ºC)		**1**	A

3	a	Strontium carbonate + nitric acid → strontium nitrate + Carbon dioxide Water	*Accept correct formulae*	**2**	A
	b	**$SrCO_3 + 2HNO_3 \rightarrow Sr(NO_3)_2 + CO_2 + H_2O$** Correct reactants with correct coefficients Correct formula for $Sr(NO_3)_2$ Equation correctly balanced	*Ignore one subscript error, accept = sign* *no ECF*	**3**	A
	c	Radium is <u>radioactive</u> ***or*** zinc sulphide is not <u>radioactive</u> Radioactivity causes damage to the body	 *WTTE* *accept negative effect on health*	**2**	A

	d	Text Object $^{210}_{84}Po$ $^{210}_{82}Pb$ Text/MCQ/Mini-Cloze Object Protons: 84 82 Neutrons: 126 128 Electrons: 84 82 ***One mark for each correct column*** $^{210}_{84}Po$: p = 84 ***and*** n = 126 ***and*** e = 84 $^{210}_{82}Pb$ p = 82 ***and*** n = 128 ***and*** e = 82		**2**	A
	e	C		**1**	A

4	a	IV: (type of) hydrogel DV: volume of water (not absorbed) ***Any two reasonable CV, for example [max 2]*** • mass of hydrogel • temperature • initial volume of water or 400 cm^3 • time (for absorption) • number of times mixed		**4**	B
	b	Two columns ***or*** rows for IV and DV Labels: hydrogel ***and*** volume (of water) (volume of water) not absorbed Unit of cm^3 in label only	*Ignore order of hydrogels* *Accept "sample"*	**4**	C
	c	Title correctly linking hydrogels with water (not) absorbed y axis scale starts at zero with even intervals ***Axis labelling:*** *x* = type of hydrogel ***or*** sample ***and*** *y* = volume/cm^3 Data for at least three hydrogels correctly plotted as a bar chart	*Accept labels from part b, ECF* *Accept volume of water absorbed if processed data is plotted*	**4**	C
	d	***Any justification from the list [max 1]*** • no ***and*** the raw data measured water not absorbed • yes ***and*** need to process raw data to calculate water absorbed • no ***and*** there were not sufficient trials		**1**	C
	e	Hydrogel 1 (experimental data shows water absorbed) 400 – 340 = 60 cm^3 ***or*** 400 – 60 = 340 cm^3 An explanation that only hydrogel 1 can absorb this volume of water ***or*** more than this volume	*Accept 400 – 350 or 400 - 50*	**3**	C

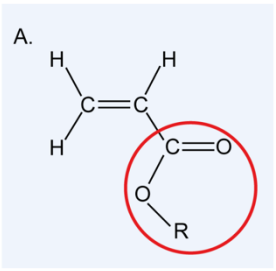
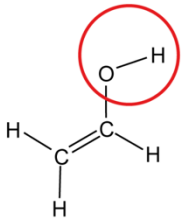
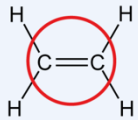
<table>
<tr>
<td>5</td>
<td>a</td>
<td>Any two environmental impacts correctly linked to a specific nappy type, for example [max 2]
• waste water
• pesticides
• energy use
• detergent use

Advantages and disadvantages correctly linked to a specific nappy type, for example [max 2]
• time needed to wash
• need to buy new nappies each time
• hygiene considerations about washing nappies
• cost of energy to wash

A concluding appraisal linked to earlier arguments</td>
<td>Do not credit the same idea in both categories</td>
<td>5</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td colspan="3">
<table>
<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>Variables</td><td>some variables implied</td><td>IV (type of nappy) or DV (volume of water) 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>Equipment</td><td>equipment suggested but not relevant</td><td>equipment to measure DV or to control one CV</td><td>equipment to measure DV and to control two CV</td><td></td></tr>
<tr><td>Sufficient data</td><td>reference to different brands or trials</td><td>all five brands or three trials</td><td>all five brands and three trials</td><td>all five brands, three trials and calculates mean</td></tr>
<tr><td>Method</td><td>attempt at method but may be not relevant</td><td>attempt at method, insufficient detail and not likely to give relevant data</td><td>method described, could be followed, will produce relevant data</td><td>complete method fully explained and could be replicated</td></tr>
</table>
</td>
<td>15</td>
<td>B</td>
</tr>
</table>

6	a	***Any three reasonable statements correctly linked to the <u>data</u>, for example [max 3]*** • not supported ***and*** the most absorbent nappy is Pugs • not supported ***and*** Pugs has the least amount of hydrogel • the fluff pulp also affects volume of water absorbed • volume absorbed depends on the composition of fluff pulp and hydrogel		**3**	C
	b	***If:*** the total mass of absorbent material increases ***then:*** the mass of water absorbed increases ***because:*** fluff pulp and hydrogel both absorb water **or** hydrogel absorbs more than fluff pulp ***or*** ***If:*** the mass of hydrogel increases ***then:*** the mass of water <u>absorbed by the hydrogel</u> increases ***because****:* hydrogel absorbs a larger proportion of the total water absorbed (compared to FP) **or** ***If:*** the mass of fluff pulp is greater ***then:*** the mass of water <u>absorbed by the fluff pulp</u> increases ***because:*** fluff pulp absorbs water		**3**	B
	c	Fluff pulp removes ions ***or*** impurities ***or*** minerals from the urine (so) the hydrogel absorbs the water	*WTTE*	**2**	B

7	a	Dye C Because it has the same spot pattern ***or*** it is an irritant	*WTTE*	**2**	C
	b	The other dyes do not have the same components Dye B only has two pigments in common Dye D has an additional pigment which is not present in the sample	*WTTE*	**3**	C
	c	***Appropriate measurements:*** Yellow spot 1.5-1.9 (cm) ***and*** solvent front 3.7 (cm) Any Rf value calculated correctly Rf value links to yellow spot in Dye C 0.48 ± 0.05	*Accept correct measurements for other spots for this first mark. Examiners will need to measure incorrect spots* *Can award first two marks for any spot*	**3**	C

8	a	A.  Ester B.  Alcohol C.  Alkene		**3**	A

	b	***Any two properties, for example [max 2]*** • heat resistant ***or*** appropriate melting temperature • cheap • waterproof • strong • rigid ***Any advantage, for example [max 1]*** • PLA can biodegrade • made from renewable material • does not release harmful toxins • saves greenhouse gases during production • higher heat capacity • can be reused • uses less oil during production ***Any disadvantage, for example [max 1]*** • limited production capacity • more expensive ***Any two further advantages or disadvantages [max 2]*** ***A conclusion linking all arguments***		**7**	D

9

	1	2	3	4
Sustainability (including costs of a one-use product)	oil-based plastics are unsustainable ***or*** algae-based plastics are sustainable is implied	a clear statement that oil-based plastics are unsustainable ***or*** algae is sustainable	a clear statement that oil-based plastics are unsustainable ***and*** algae-based are sustainable	a clear statement that oil-based plastics are unsustainable ***and*** algae-based are sustainable supported with scientific reasoning
Environmental	an environmental impact of oil-based plastics ***or*** algae-based plastics is implied	a clear statement of an environmental impact of oil-based plastics ***or*** algae-based plastics	a clear statement of an environmental impact of oil-based plastics ***and*** algae-based plastics	a clear statement of an environmental impact of oil-based plastics ***and*** algae-based plastics ***and*** an additional environmental impact of either plastic (at any stage)
Social impacts (jobs and production time, social or health effects of environmental damage)	one social impact is implied	a clear statement of one social impact	clear statements of two social impacts (at any stage)	clear statements of social impact of production ***and*** use ***and*** end of use
Appraisal	a concluding statement			

13 D