Markscheme

May 2022

Integrated Sciences

On-screen examination

15 pages

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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

Marking 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.

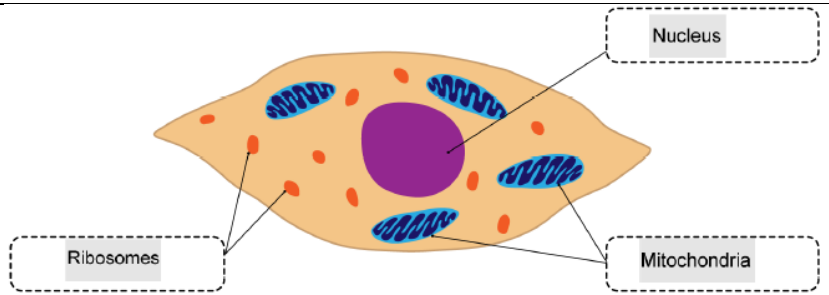
16 When incorrect answers are used correctly in subsequent question parts the follow through rule applies. Award the mark and add ECF (error carried forward) to the candidate response.

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.

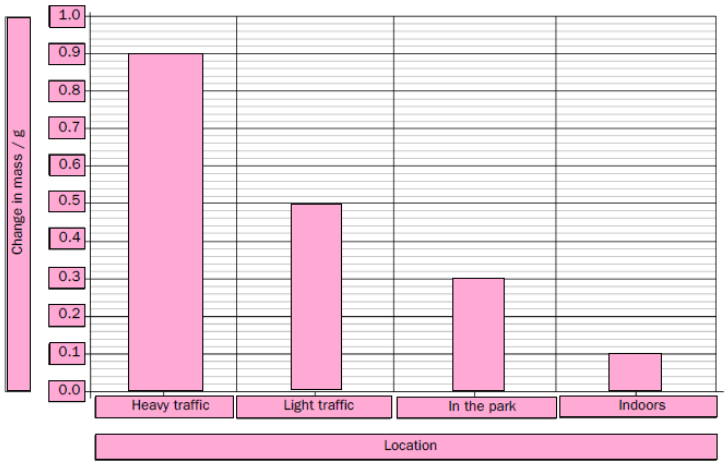
		Answers	Notes	Total	Crit
1	a	Organ system		1	A
	b	 One correct All correct		2	A
	c	(Muscles are frequently) contracting ***or*** extending ***or*** moving ***or*** exercising (muscles require) high demand for energy ***or*** ATP (provided by cellular) respiration (in mitochondria) hence more mitochondria in muscle cells	*WTTE, Accept answers in any box* *Do **not** award M4 unless at least one other mark is awarded*	4	A
	d	Graph A Justification: Reference to acidic conditions in the stomach ***or*** the stomach has a low pH	*Only award second mark if first mark is awarded*	2	A

2	**a**	Friction ***or*** resistive force ***or*** retarding force ***or*** resistance		**1**	A
	b	45 (N) Forwards ***or*** in the direction of the 80N force	 *Accept to the right, award this mark separately*	**2**	A
	c	Moves to the right with increasing speed		**1**	A
	d	Gravitational potential		**1**	A
	e	W = f x d or W= m x g x d W= 900 J ***or*** joules ***or*** kgm^2s^{-2} ***or*** Nm	*Seen or implied* *Accept 883 if 9.81 Nkg^{-1} is used* *Award this mark separately*	**3**	A D
	f	Both forces are <u>equal</u> ***and*** in <u>opposite</u> directions ***or*** Every action has an <u>equal</u> and <u>opposite</u> reaction The athlete applies a force / pulls on the band to the left ***or*** Pulls on the band towards her The band applies a force on (the athlete) and pulls (her) to the right	*The first marking point may be included in points 2 or 3 below* *Accept clear references to direction in place of left and right, do **not** accept push*	**3**	A

3	**a**	Input: Electrical Useful output: Kinetic		**2**	A
	b	Resistance= 120/2.8 42.9 (ohms) ***or*** 42.86 ***or*** 42.857(14...) Correctly expressed to 2 sig figs: 43 (ohms)	*Ohm's Law seen or implied* *Award two marks if* 42.9 or 42.86 or 42.857(14…) is seen without calculation *Award full marks if only 43 is seen*	**3**	A D
	c	(Concentration of) lactic acid increases with increased running speed (as a result of) <u>anerobic</u> respiration (because) not enough oxygen supplied ***or*** more oxygen needed ***or*** reference to oxygen debt	*Accept positive correlation* *Do not accept respiration alone* *WTTE*	**3**	A

4	**a**	As water evaporates The concentration (of the solution) increases So salt crystals form ***or*** As the temperature decreases The solubility (of NaCl) decreases So salt crystals form	*Do **not** award M3 unless at least one other mark is awarded* *Do **not** award M3 unless at least one other mark is awarded*	**3**	B
	b	***IV:*** Type of compound ***or*** different compounds ***Accept any two CV, [max 2]*** • Volume of water • Same duration *or* time • (Initial) temperature of water • All solutions to be kept at the same room temperature ***or*** in the same place • Length of stick in the solution • Type of water (distilled vs tap)	*Do **not** accept mass of compound* *Do **not** accept mass of compound or amount of water or amount of compound*	**3**	B
5	**a**	***If:*** the (initial) temperature of the water is increased ***Then:*** the mass of crystals (formed) will increase ***Because:*** more sugar is dissolved as the (kinetic) energy of the water molecules is higher ***or*** there are more collisions	*ORA for all marking points if correctly followed through* *WTTE*	**4**	B

<table>
<tr>
<td>5</td>
<td>b</td>
<td>
<table>
<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>V</td><td>IV and DV implied</td><td>IV identified as temperature and DV explicitly identified as the mass of crystals
or
IV identified as temperature or DV explicitly identified as the mass of crystals and 1 CV is identified.</td><td>IV identified as the temperature and DV explicitly identified as mass of crystals and at least 1 CV explicitly identified</td><td>IV identified as the temperature and DV explicitly identified as mass of crystals and at least 2 CV</td></tr>
<tr><td>E</td><td>Some equipment is listed</td><td>Equipment to change or measure temperature (IV)
and
Equipment to measure their DV</td><td>Thermometer or temperature probe to measure temperature (IV)
and balance to measure mass of crystals (DV)
and
equipment to monitor one CV</td><td>Thermometer or temperature probe to measure temperature (IV)
and balance to measure mass of crystals (DV)
and
equipment to monitor two CV</td></tr>
<tr><td>D</td><td>Reference to different initial temperatures or different number of trials</td><td>At least five different initial temperatures or three trials</td><td>At least five different initial temperatures and three trials</td><td>At least five different initial temperatures and three trials and calculates mean mass</td></tr>
<tr><td>M</td><td>An attempt at the method has been made but detail is insufficient to follow</td><td>Method can be followed but detail is incomplete or incorrect</td><td>Complete method to vary temperature is described, fully explained and could easily be followed (details of how to prepare saturated is needed but the term saturated is not required)</td><td></td></tr>
<tr><td>S</td><td>A safety precaution linked to the use of hot equipment</td><td></td><td></td><td></td></tr>
</table>
</td>
<td>16</td>
<td>B</td>
</tr>
</table>

<table>
<tr>
<td>6</td>
<td>a</td>
<td>
Table Object
<table>
<tr><th>Location</th><th>Total initial mass of 3 leaves / g</th><th>Total final mass of 3 leaves / g</th><th>Change in mass / g</th></tr>
<tr><td>Heavy traffic</td><td>15.0</td><td>15.9</td><td>0.9</td></tr>
<tr><td>Light traffic</td><td>15.7</td><td>16.2</td><td>0.5</td></tr>
<tr><td>In the park</td><td>16.0</td><td>16.3</td><td>0.3</td></tr>
<tr><td>Indoors</td><td>15.1</td><td>15.2</td><td>0.1</td></tr>
</table>
All correct
</td>
<td></td>
<td>1</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>


Title linking location and change in mass

X axis: location and y axis: <u>change</u> in mass

Unit on y axis: g

Y axis scale from 0 (to 1.0) with equal increments

Two locations plotted correctly (±0.02)

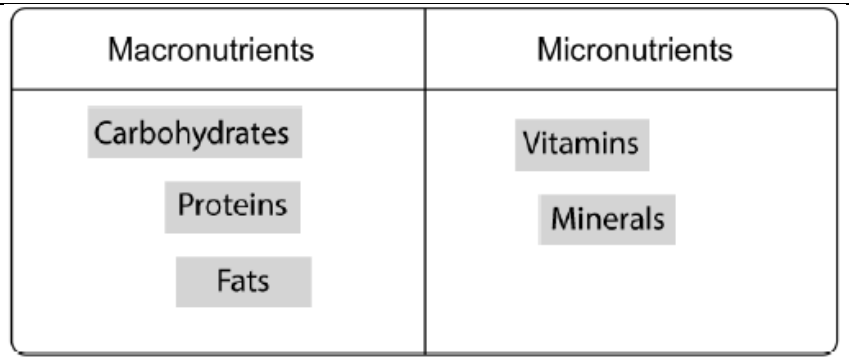
All locations plotted correctly
</td>
<td>
ECF from part a

Ignore different widths of bars

Order of locations on x axis is not important
</td>
<td>6</td>
<td>C</td>
</tr>
</table>

	c	Air pollutants ***or*** particulate matter (Sticks to the leaves and) increases the mass	*WTTE* *Accept "weight"*	**2**	C
	d	Average mass= 0.9/3= 0.3(g) 300 (milligrams)	 *Award this mark separately. Award 2 marks if only 300 is seen*	**2**	C
	e	There is more pollution in heavy traffic locations But there is not 5 times more pollution than any other location pollution is 1.8 times more in heavy traffic compared to light ***or*** pollution is 3 times more in heavy traffic compared to in a park (so) the hypothesis is not valid ***or*** partially valid	*The first marking point can be implied in marking points 2 or 3* *Do not award the final mark unless at least one other mark is awarded*	**4**	C

	f	***Accept any reasonable weakness, [max 2]*** • environmental conditions are difficult to control • only three leaves used in each location • experiment was done over four days only • weekdays or weekends were not specified ***Accept any correctly linked improvement, [max 2]*** • conduct more trials to reduce the effect of outliers • more trials would help to exclude outliers • a longer duration would give more comprehensive data • conduct the experiment on weekdays only	*WTTE*	**4**	C
	g	***Accept any reasonable change in IV, for example [max 1]*** • altitude • weather conditions • effect of different industries	*Do **not** accept different locations*	**1**	C
	h	***A comment implying a comparison between plastic and leaves, for example [max 1]*** • the plastic will give a controlled surface area • Vaseline in the plastic would be lost due to high temp/wind • the Vaseline would not stick well to the plastic • the plastic would not rot or be affected by the weather conditions. ***A comment about how the mass or result would be affected, for example [max 1]*** • better control of surface area means data are more reliable or reproducible or fewer outliers • the total mass would be less affected (by weather etc) than leaves. • the total mass would be more affected/decreased (because particulates would not stick to the plastic easily) ***A correctly linked comment about the validity of using plastic [max 1]*** • (so) the method is less valid • (so) the method is more valid	*Do not award the third mark unless at least one other mark is awarded*	**3**	C

7	**a**	 All correct		**1**	A
	b	***Nutritional benefits, [max 1]*** • protein is higher • fibre is higher • phosphorus is higher • iron is higher • vitamin C is higher ***Correctly linked health benefit, [max 1]*** • protein is needed for (muscle) growth, repair, enzymes • fibre is important for digestive health • phosphorus in needed for healthy bones, teeth, nervous system • iron is needed for haemoglobin • vit C is needed for repair, immune system, collagen, growth	*Comparison must be made but this could be done by quoting two values* *WTTE*	**2**	D
	c	***Hazard:*** Toxic/Poisonous ***Accept any correct, reasonable precaution, [max 1]*** • protective equipment or gloves or goggles or glasses • keep away from the eyes • wash hands after using pesticides • store safely		**2**	D

	d	***Living parts of the environment: Accept any reasonable suggestion [max 1]*** • pesticides could affect animals (who eat the crops) • pesticides could affect the health of human beings • could alter the biodiversity of the soil or kill soil microbes • removing pests will affect the food web • bioaccumulation ***or*** build up in the food chain **Non-living parts of the environment:** ***Accept any reasonable suggestion [max 1]*** • can affect the water supply • can affect air quality (in the local area) • affect pH of soil • affect pH of water	*WTTE*	**2**	D

8				**1**	**2**	**3**	**4**	**16**	D
			1 GM	One statement about the GM technology	Two statements about GM technology ***or*** one statement about GM technology with justification	Two statements about GM technology with justification for future food supply for at least one ***or*** one statement about GM technology with two justifications for future food supply			
			2. A (Advantages to environment, organisms, ecosystem, biotic factors)	Attempt at an advantage of the production of Bt corn	One relevant advantage of the production of Bt corn	One relevant advantage of the production of Bt corn with justification ***or*** More than one relevant advantage of the production of Bt corn	One relevant advantage of the production of Bt corn with more than one justification ***or*** More than one relevant advantage of the production of Bt corn with justification for at least one		
			3. D (Disadvantages to environment, organisms, ecosystem, biotic factors)	Attempt at a disadvantage of the production of Bt corn	One relevant disadvantage the production of Bt corn is stated	One relevant disadvantage of the production of Bt corn with justification ***or*** More than one relevant disadvantage of the production of Bt corn	One relevant disadvantage of the production of Bt corn with more than one justification ***or*** More than one relevant disadvantage of the production of Bt corn with justification for at least one		
			4. E (Economic considerations)	A statement of an economic consideration	A statement of an economic consideration with justification ***or*** A statement of more than one economic consideration	At least two statements of economic considerations with at least one justified			
			5. C (Concluding appraisal with justification)	A concluding appraisal giving their opinion	A concluding appraisal giving their opinion with a justification				