Markscheme

May 2021

Integrated Sciences

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
	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.

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 underlined 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.

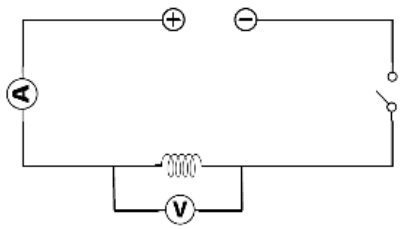
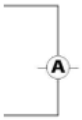
19 Do not penalize candidates for errors in units or significant figures unless there is specific guidance in the Notes column.

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	 Any three in the correct sequence All correct		2	A
	b	$C_6H_{12}O_6 + 6O_2 \rightarrow$ [6] $CO_2 +$ [6] H_2O 6 6		2	A
	c	***Accept any reasonable structural difference, for example [max 1]*** • Fewer internal walls • membranes • sections • smaller (internal surface) area (in diseased alveoli)	*WTTE* *Do **not** accept fewer alveoli or colour change*	1	A
	d	Diseased lungs have damaged alveoli Gas exchange occurs through <u>diffusion</u> (Damaged ***or*** fewer alveoli means) smaller (surface) area through which the exchange of gases can occur Rate of gas exchange ***or*** diffusion is slower/less efficient		4	A

2	**a**	***Accept two reasonable sources of air pollution, for example [max 2]*** • Industry ***or*** building • Burning fossil fuels • Farming • Transportation ***or*** cars • Cooking • Mining • Smoking • Natural events (eruption, forest fires)	*Accept specific examples for different types of sources* *Accept only one example of burning fossil fuels*	**2**	**A**
	b	Correct value 0.0000025 (m) Value in standard form 2.5×10^{-6} (m)	 *ECF for second mark* *Award two marks if only the number in standard form is seen*	**2**	**D**
	c	56 – 150 (µg m^{-3})		**1**	**A**
	d	Country A range = 0 – 12 ***and*** Country B range = 0 – 35 (so) difference in range is 23 (µg m^{-3}) (so) Country A has higher standards for air quality	*Seen or implied* *Award two marks if only 23 is seen* *ORA* *Do not award marking point 3 unless at least one other mark is awarded*	**3**	**A**

3	**a**	Alkaline ▾		**1**	**A**
	b	Cellular respiration The process occurring in every cell that converts energy from food to ATP. Breathing The process of moving air into and out of the lungs.		**2**	**A**
	c	(Increased breathing rate means) more CO_2 is breathed out (so) less CO_2 in blood (so) pH of blood rises (again) ***or*** pH returns to initial ***or*** normal values ***or*** pH is balanced ***or*** acidity decreases	*Do **not** accept regulate the pH as it is given in the question. Do not award the third marking point unless the second mark is awarded.*	**3**	**A**
	d	***Accept any two responses from the following, [max 2]*** • Less oxygen ***or*** carbon dioxide (transported through) the blood • Concentration (gradient) of oxygen ***or*** carbon dioxide is reduced ***or*** diffusion is affected • (Cell respiration process) is less efficient/reduced/less ATP produced or energy production reduced	*WTTE*	**2**	**A**
	e	RQ linking time at altitude with change in haemoglobin percentage ***or*** concentration ***or*** mass	*Accept a statement or a question* *Do not accept any reference/comparison to sea level*	**1**	**B**

4	**a**	 Switch and copper wire coil correctly connected Ammeter in series Voltmeter in parallel with coil	Do ***not*** award the first mark if a cell or other additional components are seen. Do not accept a resistor in place of the coil. Accept poor presentation of ammeter if it is clearly in series eg  Accept poor presentation of voltmeter if it is clearly in parallel with the coil	**3**	**B**
	b	***Accept any two pairs of control variable and correctly linked justification [max 4]*** Material of wire Different materials have different resistivity ***or*** Length of wire Increased length means increased resistance ***or*** Cross-sectional area ***or*** thickness Increased CSA means decreased resistance ***or*** Same ammeter Consistent errors in same device ***or*** Same voltmeter Consistent errors in same device	*Do **not** accept power supply* *Do **not** accept type of wire* *accept resistance* *ORA* *ORA*	**4**	**B**

<table>
<tr>
<td></td>
<td>c</td>
<td>
<table>
<tr><td>Voltage / V</td><td>Current /A</td></tr>
<tr><td>0</td><td>0.0</td></tr>
<tr><td>1</td><td>0.3</td></tr>
<tr><td>2</td><td>0.5 or 0.6</td></tr>
<tr><td>3</td><td>0.8</td></tr>
<tr><td>5</td><td>1.3</td></tr>
<tr><td>10</td><td>2.4</td></tr>
<tr><td>11</td><td>2.7</td></tr>
<tr><td>12</td><td>2.9</td></tr>
</table>

V and A as units

Any two correct pairs of voltage (0 dp) and current (1 dp)

0V – 0(.0)A or 1V – 0.3A included

12V – 2.9A included
</td>
<td>All possible values are included in the table for reference. Candidates will have added two data points to complete the table.

Accept Volts and Amperes / Amps</td>
<td>4</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>d</td>
<td>X axis scale has numbers at equal increments and starts at zero with plotted points taking up at least half the graph

y axis scale has numbers at equal increments with plotted points taking up at least half the graph

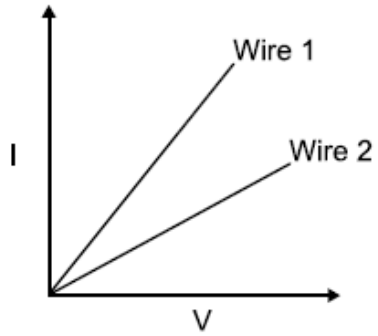
Two data points plotted correctly

Five data points plotted correctly

Best fit line roughly going through all or most points and intercepting the y axis</td>
<td>Refer to data table in part c for information

Accept through (0,0) no ECF for incorrectly plotted points</td>
<td>5</td>
<td>C</td>
</tr>
</table>

	e	***Method one*** Resistance is 1/gradient Use of two data points to calculate gradient Gradient calculation Resistance = 4 ± 0.2 Ohms or Ω ***Method two*** Resistance is V/I Calculation of resistance using at least 5 data points from the graph or 5 points taken from line of best fit Line of best fit used in calculation of gradient ***or*** Calculation using mean of five resistances in marking point 2 Resistance = 4 ± 0.2 Ohms or Ω	*Two possible ways of answering ECF from part d* *seen or implied* *Only award marking point 4 if calculation linked to is shown* *Only award marking point 4 if calculation is shown*	**5**	**C**
	f	***Accept any reasonable weakness and correctly linked improvement, for example [max 2]*** Only one trial Do multiple trials ***and*** take average ***or*** Coil temperature not controlled A suggestion of how the coil temperature could be monitored or controlled	*Award two marks if only one trial is implied*	**2**	**C**

	g	As the voltage increases, current increases too (as the) graph shows a straight line passing through the origin ***or*** current is proportional to voltage	*Award two marks if only the second statement is seen*	**2**	**C**
	h	 A higher voltage is required in wire 2 than in wire 1 for the same current to flow ***or*** Gradient is 1/R ***or*** line is less steep for higher R in wire 2 (so) wire 2 has a higher resistance (So therefore suggestion is) incorrect	*ORA* *Only award the third mark if the first two marks are awarded*	**3**	**C**

5	**a**	Protons 60 Neutrons 84 Electrons 60		**3**	**A**
	b	1.2 (rotations per second) 72 (rotations per minute)	*Award 2 marks for 72 only*	**2**	**C**
	c	***IV***: number of magnets ***Accept any two reasonable CV, for example [max 2]*** • material of wire • length of wire • mass of wire • diameter of wire • number of turns of the wire • voltage • Same battery ***or*** same type of battery • shape of dancer	*CV must be explicitly stated. Do not award material or battery alone.*	**3**	**B**

<table>
<tr>
<td>5</td>
<td>d</td>
<td>
<table>
<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>RQ</td><td>How is the dancer affected by the magnets or
How does the speed of the dancer change</td><td>How does the number of magnets affect the speed of the dancer</td><td>How does the number of magnets affect the <u>rotational</u> speed or number of <u>rotations</u> per minute of the dancer</td><td></td></tr>
<tr><td>Equipment</td><td>Any equipment related to the experiment</td><td>Equipment to measure time (eg timer, video camera, stopwatch) and equipment to monitor one CV</td><td>Equipment to measure time (eg timer, video camera, stopwatch) and equipment to monitor two CV</td><td></td></tr>
<tr><td>Method</td><td>Attempt at a method but detail is insufficient to follow</td><td>Method can be followed but detail is incomplete or incorrect</td><td>Complete method is described, fully explained and could easily be followed</td><td></td></tr>
<tr><td>Data</td><td>Method implies a range of values</td><td>Method includes 5 values of IV or 3 trials</td><td>Method includes 5 values of IV and 3 trials</td><td>Method includes 5 values of IV and 3 trials and plans to calculate average</td></tr>
<tr><td>Safety</td><td>Safety precaution linked to specific hazard (heating of wires or battery, toxicity or strength of Nd magnet, cutting wires or use of pliers, toxicity of battery)</td><td>Safety precaution justified with reference to specific hazard (heating of wires or battery, toxicity or strength of Nd magnet, cutting wires or use of pliers, toxicity of battery)</td><td></td><td></td></tr>
</table>
</td>
<td>15</td>
<td>B</td>
</tr>
</table>

6	**a**	***Any reasonable suggestion, for example [max 2]*** • Size of the population/high density • Inadequate building practices and regulations • Dense concentration of building with high occupancy • The absence of warning systems • Lack of public awareness on earthquake risks • Location of the city (near to the sea, mountains)		**2**	**D**
	b	***Any two reasonable suggestions, for example [max 2]*** • Clear emergency plans in place • Building regulations • Ensure proper functionality and preparedness of health facilities • Early warning systems • Invest in community preparedness/education • Shelters ***Correctly linked justification, for example [max 2]*** • Allow evacuation or treatment of casualties or clear communication of information • To ensure enough space or appropriate materials are used ***or*** structure is designed not to collapse • Hospitals are prepared to receive large number of casualties ***or*** hospitals have power generators • Allow people to leave or shelter prior to earthquake • Communities are often the first responders ***or*** allows people to take personal responsibility	*WTTE*	**4**	**D**
	c	Speed=distance/time or Time= 80/4 Time= 20 (seconds)	*Award 2 marks for correct final answer*	**2**	**C**

	d					**15**	**D**

	1	2	3	4
App	EWS senses earthquake ***and*** warning sent via app			
Function	A statement of a strength ***or*** a limitation of the function of the EWS app	A statement of strength ***and*** a limitation of the function of the EWS app ***or*** two strengths or limitations	A statement of a strength ***and*** a limitation of the function of the EWS app ***and*** a further strength or limitation	Statements of more than one strength ***and*** more than one limitation of the function of the EWS app
Social (Individual)	A statement of an impact on an individual	A statement of an impact on an individual with justification ***or*** more than one statement of an impact on an individual	More than one statement of an impact on an individual ***and*** one of these impacts is justified	More than one statement of an impact on an individual ***and*** both impacts are justified
Economic	A statement of an impact on a government	A statement of an impact on a government with justification ***or*** more than one statement of an impact on a government	More than one statement of an impact on a government ***and*** one of these impacts is justified	More than one statement of an impact on a government ***and*** both impacts are justified
Conclusion	An opinion is given	An opinion is given with justification		