

MJSO 2022
Marking Scheme

Item number		Description	Remarks	Mark
Section A: Comprehension				
1		Weather forecasting Decade climate prediction Projection of future climate	Any two	2
2		Greater warming of arctic than the tropics Greater warming over land than ocean and greater warming at the surface of the sea than in the deeper layers. The troposphere (the lower region of the atmosphere) has warmed, the stratosphere just above it has cooled.		3
3		Low thermal conductivity High density		2
4		Sea level rises because water expands as it is warmed and because water from melting glaciers and ice sheets is added to the oceans.		2
5		Heat-trapping gas		1
6		Causing little or no damage to the environment		1
7		When crops are cultivated and harvested, the carbon dioxide absorbed is mainly lost again to the environment.		2
		Trees store the carbon in their trunks and roots and are therefore better carbon fixing organisms.		2
8		In order to prepare/process food, heat or another electrical appliance is needed. These use/ burn fossil fuels, that release greenhouse gases into the atmosphere.		½ ½ 1
9		Methane		1
10		Ocean acidification		1
11	a	Sulfur dioxide OR Nitrogen dioxide		1
	b	Acid rain		1
	c	SO ₂ + H ₂ O ⇌ H ₂ SO ₃ 2H ₂ SO ₃ + O ₂ → 2H ₂ SO ₄ OR NO ₂ + H ₂ O ⇌ HNO ₃ + HNO ₂ 2HNO ₂ + O ₂ → 2HNO ₃	For each equation: 1 mark for formulae, 1 mark for balancing.	4
Section B: Practicum				

Item number		Description	Remarks	Mark
Biology				
12	a	Set up the respirometer with potassium hydroxide at the bottom of the boiling tube, glass wool and germinating beans on top of the glass wool. (Accept diagram of apparatus) Insert rubber bung with capillary tube and leave to acclimatise for some minutes. Insert a coloured drop at the end of the capillary tubing using the pipette. Start the stopwatch.		3 1 1 1
	b	Test-tube to be stopped well - to stop air entering the boiling tube Acclimatization of boiling tube before taking readings - to absorb carbon dioxide in the air in boiling tube.		1 1
	c	There is no way to verify that all the carbon dioxide in air in the boiling tube has been absorbed.		1
	d	Table of results including time in seconds and distance of coloured bubble from initial value in mm.	Deduct 1/2 mark if units are not given; Accept any correct variation of results	3
	e	Graph with time as the independent variable (x-axis) and rate of respiration Adequate scale Correct plotting of graph and best fit graph		1 1 2
	f	The longer the time taken the higher the rate of respiration.		2
	g	The volume decreases as the plant uses oxygen from air and the carbon dioxide produced is absorbed by KOH.		1 1
	h	The control is important to ensure that the observed results are not random events but a consequence to the respiration of the germinating chickpeas.		2
	i	Boiling denatures the enzymes and kills the cells of the chickpeas.		1
	j	Aerobic bacteria also respire and produce carbon dioxide.		1
	k	A change in temperature and therefore atmospheric pressure will bring about a fluctuation of the coloured bubble.		1
Chemistry				
13	a	Carbon dioxide is a greenhouse gas, and it causes ocean acidification.		1 1
	b	2 diagrams are expected; one for the experiment and the other for the control .	2 marks for each diagram - 1 mark for setup and 1 mark for labels. 1 mark for overall setup.	5
13	c	Description for setup of control. Description for setup of experiment.		4 4

Item number		Description	Remarks	Mark
	d	$\text{CaCO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CaCl}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$	1 mark for formulae, 1mark for balancing, 1 mark for state symbols.	3
	e	Colour of universal indicator mixed with tap water goes from blue to yellow in model with added CO_2 . Increase in temperature of model with CO_2 is larger than the control model.		1 1
	f	At least 2 sources of error must be mentioned. For example, thermometer reads to an accuracy of +/- 0.1 degree Celsius and CO_2 may leak from the plastic container.		2
	g	List of three precautions.		3
Physics				
14	a	Description of the setup of experiment		3
		Description of setup of control		2
	b	Diagram of setup		2
		Labels		1
	c	The filament lamp must be placed equidistant from each thermometer.		1
		Both thermometers should be placed on dark cardboard sheet.		1
	d	Table showing time/min against temp/degrees Celsius for both experimental setup and control setup	2 marks for graph of each setup	4
	e	Title of graph		1
		Labelling of axes		1
		Correct plotting of points		3
		Correct drawing of line graphs	1 mark for each line graph	2

Item number		Description	Remarks	Mark
	f	<p>The temperature in the container rises faster than outside of the container. The end temperature in the container is considerably higher ($\Delta T = 2-4$ degree C) than outside of the container. The surface beneath the container absorbs parts of the light spectrum and emits thermal radiation. This is specially facilitated by the dark background, which imitates the colour of the land surfaces. The Perspex absorbs this thermal radiation and emits it in all directions including partly back into the container. Since there is no new cool air entering the container, the air inside the container heats up more than outside it.</p> <p>Sunlight radiation reaching the earth is partly absorbed and changed into thermal radiation which warms up the atmosphere. Atmospheric gases such as water vapour, carbon dioxide, methane, and nitrous oxide absorb this thermal radiation and emit it in all directions. Part of this heat is released into space and a certain part goes back towards the earth, resulting in the heating up of the atmosphere.</p>		5