

## Mark scheme – Interpreting and Interacting with Earth Systems (F)

Question			Answer/Indicative content	Marks	Guidance
1			D ✓	1(AO 2.2)	<p><b>Examiner's Comments</b></p> <p>Many candidates realised that option D best described the advantages of instrumental methods, with the remaining choices being fairly evenly split between the others.</p>
			<b>Total</b>	<b>1</b>	
2			C ✓	1(AO 1.1)	<p><b>Examiner's Comments</b></p> <p>Many candidates knew that 'potable water' means safe to drink and chose tap water as the best of the alternatives given.</p>
			<b>Total</b>	<b>1</b>	
3			D ✓	1(AO 1.1)	<p><b>Examiner's Comments</b></p> <p>While most of the higher ability candidates knew that the early atmosphere was formed by volcanic activity, many lower ability candidates were also quite familiar with this.</p>
			<b>Total</b>	<b>1</b>	
4	a	i	Burning fossil fuels ✓	1 (AO1.1)	<p><b>ALLOW</b> respiration / volcanic activity / production of cement or concrete</p> <p><b>DO NOT ALLOW</b> deforestation</p>
		ii	<p><b>Any one from:</b></p> <p>Idea of reducing consumption of fossil fuels ✓</p> <p>Use of biofuels ✓</p> <p>Use renewable energy sources ✓</p> <p>Idea of stopping carbon dioxide escaping when fuels are used ✓</p>	1 (AO1.1)	<p><b>ALLOW</b> specific renewable energy sources eg wind / solar energy / tidal</p> <p><b>ALLOW</b> use carbon capture (and storage)</p>
	b	i	Any value <7 ✓	1 (AO2.1)	
		ii	<p><b>Any one from:</b></p> <p>Acid rain ✓</p> <p>erosion of stonework ✓</p> <p>corrosion of metals ✓</p> <p>kills trees or kills living things in rivers /</p>	1 (AO1.1)	

		lakes ✓ breathing difficulties ✓		
		<b>Total</b>	<b>4</b>	
5		<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p><b>Level 3 (5–6 marks)</b> Describes how incomplete combustion of hydrocarbons such as propane happens. <b>AND</b> Describe the problems of incomplete combustion for campers, including a correct balanced symbol equation. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Level 2 (3–4 marks)</b> Describes how incomplete combustion of hydrocarbons such as propane happens. <b>AND</b> Attempts to describe the problems of incomplete combustion for campers. <b>OR</b> Includes a correct balanced symbol equation. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p><b>Level 1 (1–2 marks)</b> Describes how incomplete combustion of hydrocarbons such as propane happens. <b>OR</b> Attempts to describe the problems of incomplete combustion for campers. <b>OR</b> Attempts a correct balanced symbol equation. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p><b>0 marks</b> <i>No response or no response worthy of credit.</i></p>	6 (AO2 × 1.1) (AO4 × 2.1)	<p><b>AO1.1 Knowledge and understanding of why incomplete combustion happens</b></p> <ul style="list-style-type: none"> <li>• Insufficient oxygen / air</li> <li>• This can happen if there is not enough ventilation, such as in a caravan</li> <li>• Not enough oxygen / air for complete combustion</li> </ul> <p><b>AO2.1 Application of knowledge and understanding of sources of CO and the associated problems</b></p> <ul style="list-style-type: none"> <li>• Carbon monoxide gas is produced, which is toxic</li> <li>• Carbon monoxide combines with haemoglobin / red blood cells</li> <li>• So less oxygen can be carried / there is a lack of oxygen to cells</li> <li>• Can cause unconsciousness / death</li> <li>• Carbon particles / soot produced</li> <li>• Cause blackening of the inside of the caravan</li> <li>• Less energy produced so wastes camping gas / fuel</li> <li>• Takes longer to heat the caravan / to cook food</li> </ul> <p><b>AO2.1 Application of knowledge and understanding to produce a balanced symbol equation</b> Eg <math>C_3H_8 + 3\frac{1}{2}O_2 \rightarrow 3CO + 4H_2O</math> OR <math>C_3H_8 + 3O_2 \rightarrow 2CO + C + 4H_2O</math></p> <p>Other balanced equations are possible</p>
		<b>Total</b>	<b>6</b>	
6	a	(Amount of carbon dioxide was reduced by) photosynthesis (by plants) ✓	1 (AO1.1)	

		Carbon dioxide dissolved into the oceans ✓ Shell formation by sea creatures ✓		
	b	(Amount of carbon dioxide) increases / AW ✓	1 (AO3.1a)	Must have the trend, not just the start and end amounts
		<b>Total</b>	<b>2</b>	
7	a	CO <sub>2</sub> emissions (in the UK) have decreased (from 1993 to 2013 / from 2006) ✓  Global sea levels have risen (from 1993 to 2013) ✓  (Therefore) data suggests that CO <sub>2</sub> emissions are not the (only) cause of rising sea levels / Idea that factors other than CO <sub>2</sub> emissions contribute to rising sea levels / data does not support a link (between human activity and climate change) ✓	3(AO 3.1b)	<b>ALLOW</b> idea that there is a negative correlation between CO <sub>2</sub> emissions and global sea levels / CO <sub>2</sub> emissions and global sea levels are inversely proportional <b>for 2 marks</b>  <b>ALLOW</b> idea that sea levels were still rising when CO <sub>2</sub> emissions were decreasing <b>for 2 marks</b>  <b>ALLOW</b> idea that the data does not completely support a link <b>ALLOW</b> idea that there is a mismatch between the data, ie one is UK but one is global  <b>Examiner's Comments</b>  The whole of this question was common with the Higher Tier paper.  Many candidates successfully described the trends of the two lines. However, some assumed that the graph illustrated what they were expecting and made statements such as 'this shows that humans have a massive impact on global warming'. Some lower ability candidates clearly did not understand that the two lines on the chart referred to different Y axes, so discussed sea level and CO <sub>2</sub> emissions being equal in 2008 or 2010.
	b	<b>Any two from:</b>  Idea that CO <sub>2</sub> emissions (from burning fossil fuels) are only from the UK and not a global figure ✓  Global CO <sub>2</sub> emissions could be increasing ✓  Idea that CO <sub>2</sub> emissions from other sources (not just burning fossil fuels) should be considered ✓	2(AO 3.2a)	<b>ALLOW</b> idea that different countries produce different CO <sub>2</sub> emissions <b>ALLOW</b> idea that emissions from one country will not have a large impact on global CO <sub>2</sub> levels  <b>IGNORE</b> idea that other factors may affect global sea levels

			Idea that there is a lag between CO <sub>2</sub> emissions impacting on global sea levels ✓		<p><b>IGNORE</b> idea that there are other greenhouse gases</p> <p><b>Examiner's Comments</b></p> <p>Some candidates gained credit for realising that there were other sources of CO<sub>2</sub> but the majority discussed factors other than CO<sub>2</sub> such as methane emissions. These answers could not be given credit because the question was specifically about the link between CO<sub>2</sub> emissions and global sea levels. A significant minority of candidates mentioned difficulty of acquiring data on CO<sub>2</sub>.</p>
	c	i	<p><b>Any one from:</b></p> <p>Idea of melting ice caps / melting glaciers / melting sea ice ✓</p> <p>Altered weather patterns ✓</p>	1(AO 1.1)	<p><b>IGNORE</b> 'melting ice'</p> <p><b>ALLOW</b> specific examples or effects of altered weather patterns eg drought in some places or flooding in others</p> <p><b>ALLOW</b> specific effects of rising sea levels eg coastal erosion / flooding of low lying land</p> <p><b>IGNORE</b> rising temperatures</p> <p><b>Examiner's Comments</b></p> <p>Many candidates went no further than the stem, stating that temperatures would rise. Examiners were looking for a little more detail than this. There were many references to the ozone layer, the greenhouse effect, acid rain and global warming, which were not creditworthy.</p>
		ii	<p><b>Any one from:</b></p> <p>Reduce consumption of fossil fuels ✓</p> <p>Use biofuels ✓</p> <p>Use renewable energy sources ✓</p> <p>Stop carbon dioxide escaping when fuels are used ✓</p>	1(AO 1.1)	<p><b>ALLOW</b> specific examples eg car share / cycle to work / use public transport / use electric cars / don't leave appliances on standby</p> <p><b>ALLOW</b> specific renewable energy sources eg wind / solar energy / tidal</p> <p><b>IGNORE</b> use carbon neutral energy sources <b>ALLOW</b> use carbon capture (and storage)</p>

		Plant more trees / reduce deforestation / AW ✓		<b>Examiner's Comments</b> This question was very well answered, with suggestions ranging from tree planting to increased use of public transport. This was clearly an issue that candidates have discussed.
		<b>Total</b>	<b>7</b>	
8	a	$(150\,000 \div 750\,000) \times 100$ (1) 20 (1)	2	
	b	600 000:900 000 (1) 2:3 (1)	2	
		<b>Total</b>	<b>4</b>	
9		S + O <sub>2</sub> → SO <sub>2</sub> (1) 2SO <sub>2</sub> + O <sub>2</sub> ⇌ 2SO <sub>3</sub> (1) SO <sub>3</sub> + H <sub>2</sub> O → H <sub>2</sub> SO <sub>4</sub> (1)	4	One mark for each correct balanced equation  One mark for reversible reaction sign
		<b>Total</b>	<b>4</b>	
10		<b>Any two from:</b>  Number of vehicles has not increased (1) More use of public transport / cycling / walking / car sharing (1) New cars more efficient with less carbon dioxide being produced (1) Tax lower on low emission vehicles therefore more smaller engine vehicles being used (1)	2	
		<b>Total</b>	<b>2</b>	
11		Neutralisation (1)	1	
		<b>Total</b>	<b>1</b>	
12		B	1	
		<b>Total</b>	<b>1</b>	
13		B	1	
		<b>Total</b>	<b>1</b>	