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

| Question | | | Answer/Indicative content | Marks | Guidance |
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| 1 | | | **B** ✓ | 1(AO 1.1) | |
| | | | **Total** | **1** | |
| 2 | | | **D** ✓ | 1(AO 2.1) | |
| | | | **Total** | **1** | |
| 3 | | | **C** ✓ | 1(AO 1.1) | **Examiner's Comments**<br>  <br>**Misconception**<br>Some candidates do not recognise water vapour as a greenhouse gas. Candidates also confuse nitrogen with nitrous oxides so think nitrogen itself is a greenhouse gas. |
| | | | **Total** | **1** | |
| 4 | a | | Idea that both carbon dioxide levels and variation in air temperature shows an increasing trend ✓<br><br>(Therefore) data suggests that carbon dioxide emissions are linked to global warming ✓<br><br>**OR**<br><br>Idea that carbon dioxide levels have increased steadily but variation in air temperature has fluctuated ✓<br><br>(Therefore) data does not support a link between carbon dioxide emissions and global warming ✓ | 2<br>(AO2×3.1b) | **Evidence and conclusion must be linked**<br>**ALLOW** there is a positive correlation (between carbon dioxide levels and variation in air temperature) |
| | b | | **Any three from:**<br>Idea that energy transferred by radiation from the Sun warms up the Earth's surface ✓<br><br>Idea that infrared radiation is emitted by the Earth's surface ✓<br><br>Idea that some infrared radiation goes directly | 3<br>(AO1.1) | **DO NOT ALLOW** references to the ozone layer<br>**ALLOW** energy instead of infrared radiation throughout |

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| | | | into space ✓<br><br>Idea that greenhouse gases absorb (some) infrared radiation (radiated by the Earth's surface) ✓<br><br>Idea that greenhouse gas molecules emit infrared radiation (in all directions), warming the Earth's surface / atmosphere ✓ | | **IGNORE** idea of trapping infrared radiation<br><br>**ALLOW** named greenhouse gases eg carbon dioxide / methane |
| | c | i | **Any one from:**<br>Burning fossil fuels ✓<br><br>Deforestation ✓<br><br>Intensive use of fertilisers (by farmers) ✓<br><br>Cement manufacture ✓ | 1<br>(AO1.1) | **ALLOW** example of burning fossil fuels |
| | | ii | **Any two from:**<br>Global warming / increased temperature of Earth's atmosphere ✓<br><br>Melting ice caps ✓<br><br>Rising sea levels ✓<br><br>Altered weather patterns / extreme weather events ✓<br><br>Flooding ✓<br><br>Increasing ocean acidity ✓ | 2<br>(AO1.1) | **ALLOW** climate change |
| | | | **Total** | **8** | |
| 5 | a | | **Any two from:**<br><br>Idea that $CO_2$ emissions (from burning fossil fuels) are only from the UK and not a global figure ✓<br><br>Global $CO_2$ emissions could be increasing ✓<br><br>Idea that $CO_2$ emissions from other sources (not just burning fossil fuels) should be | 2(AO 3.2a) | **ALLOW** idea that different countries produce different $CO_2$ emissions<br>**ALLOW** idea that emissions from one country will not have a large impact on global $CO_2$ levels |

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| | | | considered ✓<br><br>Idea that there is a lag between $CO_2$ emissions impacting on global sea levels ✓ | | **IGNORE** idea that other factors may affect global sea levels<br>**IGNORE** idea that there are other greenhouse gases<br><br>**Examiner's Comments**<br><br>Many candidates correctly stated that $CO_2$ emissions can come from sources other than the burning of fossil fuels or that the $CO_2$ emissions (in the data) are only from the UK and are not a global figure.<br><br>  **AfL**<br><br>Examiners use **bold type** to draw the candidates' attention to key aspects of a question.<br><br>Despite the emboldening of '**$CO_2$ emissions by fossil fuels**' in this question, many candidates described other factors, or other greenhouse gases, which may affect global sea levels and did not gain marks. |
| | b | i | **Any one from**:<br><br>Idea of melting ice caps / melting glaciers / melting sea ice ✓<br><br>Altered weather patterns ✓ | 1(AO 1.1) | **IGNORE** 'melting ice'<br><br>**ALLOW** specific examples or effects of altered weather patterns<br>eg drought in some places or flooding in others<br><br>**ALLOW** specific effects of rising sea levels<br>eg coastal erosion / flooding of low lying land<br><br>**IGNORE** rising temperatures<br><br>**Examiner's Comments**<br>Good responses to this question described melting ice caps or altered weather patterns. A significant number of candidates did not relate their answer to climate, but to the effect on animals or ecosystems, and therefore did not gain the mark. The most common response was 'increased temperatures; this also did not gain the mark as 'rise in global temperatures' and 'global warming' were both mentioned in the stem of the question. |

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| | | ii | **Any one from**:<br><br>Reduce consumption of fossil fuels ✓<br><br>Use biofuels ✓<br><br>Use renewable energy sources ✓<br><br>Stop carbon dioxide escaping when fuels are used ✓<br><br>Plant more trees / reduce deforestation / AW ✓<br><br>Recycle plastics etc (rather than burning) ✓ | 1(AO 1.1) | **ALLOW** specific examples eg car share / cycle to work / use public transport / use electric cars / don't leave appliances on standby<br><br>**ALLOW** specific renewable energy sources eg wind / solar energy / tidal<br><br>**IGNORE** use carbon neutral energy sources<br>**ALLOW** use carbon capture (and storage)<br>**Examiner's Comments**<br>Most candidates were able to suggest a method to lower carbon dioxide levels. |
| | c | | $CO_2$ emissions (in the UK) have decreased (from 1993 to 2013 / from 2006) ✓<br><br>Global sea levels have risen (from 1993 to 2013) ✓<br><br>(Therefore) data suggests that $CO_2$ emissions are not the (only) cause of rising sea levels / Idea that factors other than $CO_2$ emissions contribute to rising sea levels /<br>data does not support a link (between human activity and climate change) ✓ | 3(AO 3.1b) | **ALLOW** idea that there is a negative correlation between $CO_2$ emissions and global sea levels / $CO_2$ emissions and global sea levels are inversely proportional<br>**for 2 marks**<br><br>**ALLOW** idea that sea levels were still rising when $CO_2$ emissions were decreasing **for 2 marks**<br><br>**ALLOW** idea that the data does not completely support a link<br>**ALLOW** idea that there is a mismatch between the data, ie one is UK but one is global<br><br>**Examiner's Comments**<br><br>Good responses to this question evaluated the information in the graph to describe that despite carbon dioxide emissions declining from (approximately) 2006, global sea levels have continued to rise; therefore, the data does not support a link between human activity and climate change. Many candidates also appreciated the mismatch between the data, ie one is UK but one is global. Lower ability candidates thought that they should be finding a link and contrived one from the period 1995 – 2005.<br><br>**AfL** |

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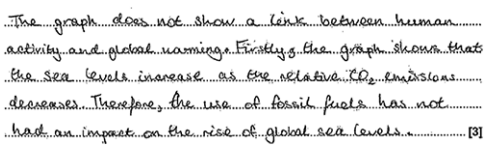
| | | | | | Candidates should be encouraged to write their answers clearly and concisely. Many candidates wrote more than was necessary in their answer to this question and often contradicted themselves as a result.<br><br>**Exemplar 1**<br><br>  <br>The graph does not show a link between human activity and global warming. Firstly, the graph shows that the sea levels increase as the relative $CO_2$ emissions decreases. Therefore, the use of fossil fuels has not had an impact on the rise of global sea levels. [3]<br><br>This response illustrates a clear, concise answer to this question, which was given all 3 marks. |
| | | | **Total** | **7** | |
| 6 | a | | (900 000 ÷ 750 000) × 100 – 100 or<br>((900 000 – 750 000) ÷ 750 000) × 100 (1)<br><br>20 (1) | 2 | |
| | b | | **ANY TWO FROM**<br><br>Idea that insufficient data since none of the data refers to climate change or global temperature (1)<br><br>Idea that the data itself is limited since it is for one city and not a global figure (1)<br><br>% increase of carbon dioxide in the air is much less than increase in carbon dioxide emissions (1)<br><br>Idea that the significant % increase of carbon dioxide emitted has had very little effect on the mean global temperature (1) | 2 | **No** mark for no on its own |
| | | | **Total** | **4** | |
| 7 | | | A | 1 | |
| | | | **Total** | **1** | |
| 8 | | i | Titrate ammonia against sulfuric acid to obtain volumes needed for complete neutralisation (1)<br><br>Add these volumes without the use of indicator (1) | 4 | **ALLOW** heat neutral mixture with carbon or charcoal and then filter off carbon<br><br>**ALLOW** Slow evaporation of filtrate / heat filtrate over a steam bath if method involving carbon is used |

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| | | | Slow evaporation of reaction mixture / heat reaction mixture over a steam bath (1)<br><br>Burette and other chemical apparatus not suitable for using large quantities / very difficult to use a steam bath in the large scale (1) | | |
| | | ii | 34 (g or tonnes) of ammonia makes 132.1 (g or tonnes) of ammonium sulfate / 17 (g or tonnes) of ammonia makes 66 (g or tonnes) of ammonium sulfate (1)<br><br>So 51 tonnes makes 198.1 tonnes of ammonium sulfate (1) | 2 | **ALLOW** one mark for correct calculation of $M_r$ for ammonia **AND** ammonium sulfate<br>**IGNORE** units for the first marking point<br>**ALLOW** one mark for 2 moles of ammonia makes 1 mole of ammonium sulfate |
| | | | **Total** | **6** | |