OCR GCSE GATEWAY PHYSICS A · J249

# PHYSICS



## MARK SCHEME

### P1.1 THE PARTICLE MODEL

| SCORE | PERCENTAGE |
| --- | --- |
| /43 | % |

STEMUP

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 1 | | | Conversion of cm to m (1)<br><br>Calculation of volume: 0.2 × 0.3 × 1.2 = 0.072 $m^3$ (1)<br><br>Re-arrangement of formula for mass (1)<br><br>Substitution: 180 × 0.072 (1)<br><br>Answer: 13 (1)<br><br>Units: kg (1) | 6 | **ALLOW** 12.96 |
| | | | **Total** | **6** | |
| 2 | | | B | 1 | |
| | | | **Total** | **1** | |
| 3 | | | C | 1 | |
| | | | **Total** | **1** | |
| 4 | a | | 1.9(333) ($g/cm^3$) | 1 | **Examiner's Comments**<br><br>This calculation was mostly correct. |
| | b | | 2.7 (g) [2]<br><br>**BUT** if answer is incorrect then 0.9 x 3 scores [1] | 2 | **Examiner's Comments**<br><br>This calculation was mostly correct. |
| | c | | Mark explanation only<br><br>B is heaviest [0]<br><br>Unknown liquid is denser than water [1]<br><br>Unknown liquid is denser than oil [1]<br><br>and is liquid X [1] | 3 | If answer is A then it is still possible to gain up to 2 marks<br><br>If no clear reference to density of water or oil is made then **allow** unknown liquid is heavier than oil / water [1]<br><br>**Examiner's Comments**<br><br>Most chose beaker B as the response and went on to select liquid X [1]. Better answers also described the unknown liquid as denser than water [1] and oil [1]. |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| | d | i | Oil (linear) reduction in density with increasing temperature / ORA [1] | 1 | **Examiner's Comments**<br><br>Most chose beaker B as the response and went on to select liquid X [1]. Better answers also described the unknown liquid as denser than water [1] and oil [1]. |
| | | ii | Water density rises up to 5° and then falls (non-linearly) as temperature increases AW [1] | 1 | **Eg.** water's maximum density is at 5°C [1]<br><br>**Allow** 3°C – 6°C tolerance<br><br>**Examiner's Comments**<br><br>Most answers restricted their descriptions of the graph to the portion after 60C. This meant they missed out the key points of density rising to a peak at 5 or 6°C and then falling with increased temperature. |
| | | iii | Any two from:<br><br>Ice (at 0°C) is less dense (than water at 0°C) [1]<br><br>Density of water increases up to 5°C [1]<br><br>(Idea that) water warm**er** as depth **increases** [1] | 2 | e.g. 'warmest water at the **bottom**' scores [1]<br><br>**Examiner's Comments**<br><br>In this question most stated that ice floated on water as its density is lower than water. Very few realised the water's temperature increased with depth. |
| | | | **Total** | **10** | |

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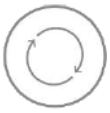
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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 5 | | i | **Any two from:**<br><br>The old model has no protons / ORA ✓<br><br>The old model has no neutrons / ORA ✓<br><br>There is no nucleus in the old model / ORA ✓<br><br>The electrons are in fixed positions in the old model / ORA ✓<br><br>The positive particles are in a nucleus in the current model ✓<br><br>The negative particles/electrons are outside / surround the nucleus in the current model ✓ | 2 (AO2 × 1.1) | <u>Examiner's Comments</u><br><br>**Misconception**<br><br>It is important to be clear which model/view point/thing the candidate is writing about in these type of question. Candidates will not be credited when they expect the examiner to interpret what their answer implies. It is better to state clearly "the old model." rather than "one of the models …"<br><br>A number of candidates read the first statement about the old atomic model as implying that atoms had a positive charge. Several candidates did not achieve both marks because they were not clear about which model they were talking about. |
| | | ii | **Any two from:**<br><br>new evidence ✓<br><br>more experiments completed ✓<br><br>previous model couldn't explain new observations ✓ | 2 (AO2 × 1.1) | **ALLOW** mention of Rutherford, Geiger/Marsden<br><br><u>Examiner's Comments</u><br><br>Most candidates recognised the role of Rutherford/Geiger/Marsden which was expected. Several candidates mentioned Niels Bohr and/or John Dalton, which was unexpected in this context. |
| | | | **Total** | **4** | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 6 | | | C ✓ | 1 (AO1.1) | Examiner's Comments<br><br>The great majority of candidates gave the correct answer C. |
| | | | Total | 1 | |
| 7 | | | A ✓ | 1 (AO 2.2) | Examiner's Comments<br>This was the most challenging question in Section A. The most common response was distractor D, where candidates multiplied the numbers together rather than dividing wave speed by wavelength.<br><br><br><br>AfL<br><br>For these type of questions candidates should be encouraged to insert the numbers into the equation. When they do this they will see that the equation needs to be rearranged. Alternatively, candidates could rearrange the equation so that the unknown quantity is on the left-hand side of the equal sign. |
| | | | Total | 1 | |
| 8 | | | B ✓ | 1 (AO1.1) | Examiner's Comments<br><br>The majority of the candidates correctly recalled the diameter of the atom. A small but significant number of candidates incorrectly chose response A. |
| | | | Total | 1 | |
| 9 | | | D ✓ | 1 (AO2.1) | Examiner's Comments<br><br>Most candidates correctly substituted the numbers into the given equation. |
| | | | Total | 1 | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 10 | | | C ✓ | 1 (AO2.1) | Examiner's Comments<br><br>Candidates knew the order in which the states needed to be put. Option A is the correct answer. Option D was a common misunderstanding where candidates had not placed the states of matter '...in density order, starting with the lowest density.' |
| | | | Total | 1 | |
| 11 | | | B ✓ | 1 (AO2.1) | |
| | | | Total | 1 | |
| 12 | | | A | 1 (AO2.1) | |
| | | | Total | 1 | |
| 13 | a | i | FIRST CHECK THE ANSWER ON ANSWER LINE<br>If answer = 0.001 / $1x10^{-3}$ ($m^3$) award 2 marks<br>0.1 x 0.1 x 0.1 ✓<br>= 0.001 / $1x10^{-3}$ ($m^3$) ✓ | 2 (AO2x2.2) | |
| | | ii | Density = mass/volume / density is proportional to mass ✓<br><br>(Cube B has 10 x mass of cube A, so) density of cube B is 10 x density of cube A ✓ | 2 (AO1.2)<br><br>(AO2.2) | ALLOW density is 10 times larger<br>ALLOW numerical values used to show density of cube B is 10 x density of cube A |
| | b | | Particles (in solid) are close(r) together / (more) compact / ORA / AW✓ | 1 (AO1.1) | Assume answer refers to a solid unless indicated otherwise |
| | | | Total | 5 | |
| 14 | | | D | 1 (AO1.1) | |
| | | | Total | 1 | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 15 | a | | Positively ✓<br><br>Negatively ✓<br><br>Neutrons ✓<br><br>Nucleus ✓ | 4<br>(AO1.1 x 4) | |
| | b | i | **FIRST CHECK THE ANSWER ON ANSWER LINE**<br>**If answer = 997 (kg/m$^3$) award 2 marks**<br><br>9970 ÷ 10 ✓<br>= 997 (kg/m$^3$) ✓ | 2<br><br>(AO 2.1)<br>(AO 2.1) | |
| | | ii | C B A | 1<br>(AO1.1) | Correct order only |
| | | iii | **Any one from:**<br>C has more/the most particles (for the same volume) ✓<br><br>A has fewer/the least particles (for the same volume) ✓ | 1<br>(AO 1.1) | **ALLOW** C has particles closest together/least spread out/most tightly packed<br><br>**ALLOW** A has particles furthest apart/most spread out/least tightly packed<br><br>**ALLOW** correct identification of C = solid, (B = liquid,) A = gas |
| | | | **Total** | 8 | |

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