| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 4 (a) (i) | recall of equation: speed = frequency × wavelength;<br><br>substitution or re-arrangement;<br>correct evaluation;<br>correct answer = 0.013 (m)<br><br>e.g. speed = frequency × wavelength<br>wavelength = speed ÷ frequency<br>wavelength = 330 ÷ 25000<br>wavelength = 0.0132… (m) | allow use of standard symbols e.g. $v = f \times \lambda$<br>condone s for speed<br>reject w for wavelength<br><br>answer to 3sf is 0.0132 (m) | 3 |
| (ii) | amplitude corresponds to 2 squares;<br>2 squares gives 10 V for amplitude; | ecf incorrect number of squares for amplitude<br>e.g. 4 squares giving 20V scores 1 mark | 2 |
| (b) (i) | field lines outside of coil appear to loop from end to end;<br><br>arrow directions self-consistent;<br>no overlapping field lines; | allow field lines approximately uniform through solenoid<br><br>condone incorrect poles | 3 |
| (ii) | any THREE from:<br>MP1. idea of force on coil from magnet;<br><br>MP2. idea of alternating force on card;<br>MP3. card vibrates;<br>MP4. idea that card forces air to vibrate;<br>MP5. longitudinal wave formed; | <br>allow idea of interaction between fields of bar magnet and coil<br><br><br><br>allow idea of series of compressions and rarefactions | 3 |
| (iii) | idea that 25 kHz is outside the range of human hearing;<br>upper limit of human hearing is 20 kHz; | <br>ignore reference to 20Hz or lower limit | 2 |
| (iv) | increase current (amplitude)/<br>increase strength of (bar) magnet/<br>increase number of turns on coil; | allow increase density of turns on coil<br>condone change card for a different material<br>allow change size or shape of card<br>allow moving magnet closer to the coil<br><br>allow higher order answers in terms of resonance | 1 |

Total for Question 4: 14 marks