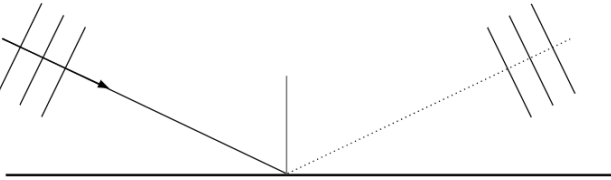


Question number	Answer	Notes	Marks
11 (a) (i)	line drawn at 90 degrees to side of boat at point where direction of travel touches boat;	ignore normal inside boat	1
(ii)	66 (degrees);	accept in range 64-68 degrees	1
(iii)	<p>three wavefronts parallel and constant wavelength;</p> <p>to the right of the normal and above boat surface;</p> <p>correct angle of reflection;</p> 	<p>by eye;</p> <p>condone different wavelength to incident wavefronts</p> <p>by eye;</p> <p>allow 'reflected ray' if no other mark awarded</p>	3
(b) (i)	<p>transverse (waves/particles) vibrate at right angles to the direction of travel of the wave;</p> <p>longitudinal (waves/particles) vibrate along line of direction of travel of the wave;</p>	<p>allow 'vibrations/oscillates at...'</p> <p>allow 'perpendicular to' for 'at right angles'</p> <p>allow 'energy transfer' for 'travel'</p> <p>allow '(anti-)parallel to' for 'along'</p>	2
(ii)	<p>wavelength or distance between wavefronts smaller;</p> <p>speed of waves is constant;</p> <p>reference to wave equation $v = f\lambda$;</p>	<p>if no other marks awarded, 1 mark for reference to Doppler effect</p>	3

(Total for Question 11 = 10 marks)