2. (a) Due to tidal motion, the depth of sea water around a particular harbour varies from 20 m at 12 noon to 30 m at 6.00 pm and then back to 20 m again at 12 midnight. To stay in the harbour, a ship requires a sea water depth of 22.5 m. The ship sails near the harbor around noon. From what time to what time can the ship stay in the harbor?

State any assumption in your calculation.

[6 marks]

[2 pm to 10 pm]

2. (b) (i) A stationary sound source emits sound waves of frequency 256 Hz. The sound waves hit an object moving directly away from the sound source and are reflected back to the source. A beat of frequency 7 Hz is detected between the emitted waves and the reflected waves. Given that the speed of the sound waves emitted is 340 ms^{-1}, what is the speed of the moving object?

[9.6 ms^{-1}]

(ii) Suppose the sound source now starts to move with a constant speed of 5.0 ms^{-1} towards the moving object [still moving with the same speed as in part(i)]. What will be the beat frequency between the emitted waves and the reflected waves?

[3.4 Hz]

[4 marks]