Quiz 7 - Relativity

Solutions

1. Define the following terms:

(a) Inertial Reference Frame
   A Reference Frame is a point from which observations are made. An Inertial Reference Frame is a reference frame which is moving with constant velocity (not accelerating in any way).

(b) Wave
   A Wave is a disturbance in a medium.

2. Label the following statements as True or False.

(a) The velocity of a wave depends on the velocity of its source.
   False

(b) The velocity of a particle depends on the velocity of its source.
   True

(c) The measured velocity of a wave depends on the velocity of the detector.
   True

(d) The velocity of a particle depends on the velocity of the medium.
   True

3. Consider the following question:
   “A dog is sitting in a boat that is travelling at 5 m/s with respect to the lake. If the dog gets up and starts to walk at 2 m/s (with respect to the boat) in the same direction as the boat is travelling, what is the speed of the dog?”

(a) What essential piece of information is needed for this question to make sense?
   We need to know in which reference frame to calculate the speed of the dog.

(b) Make a reasonable choice to fill in this missing information and answer the question.
   We can figure out the speed of the dog with respect to the lake as follows:

   \[ u = \text{“The speed of the boat with respect to the lake”} = 5 \text{ m/s} \]
   \[ v' = \text{“The speed of the dog with respect to the boat”} = 2 \text{ m/s} \]
   \[ v = \text{“The speed of the dog with respect to the lake”} = ? \]
   \[ v = u + v' = 5 + 2 = 7 \text{ m/s}. \]