Part I

1. A wave of frequency 5.0 Hz travels along a string with a speed of 20 m/s. The phase difference between the oscillations of the string separated by 1.0 m along the wave is

   (a) $\pi/4$

   (b) $\pi/2$

   (c) π

   (d) 2π

2. Two identical sinusoidal waves of wavelength 2 m and amplitude 0.5 m approach each other on the same string from opposite directions. As the waves pass through each other

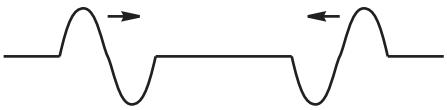
   (a) there will be nodes and the separation between neighbouring nodes will be 1 m.

   (b) there will be nodes and the separation between neighbouring nodes will be 2 m.

   (c) nodes and the separation between neighbouring nodes will be 2 m.

   (d) no nodes.

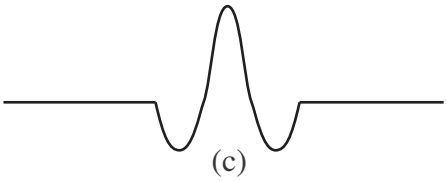
3. Two wave pulses of symmetrical shape approach one another on a string, as shown in the diagram.



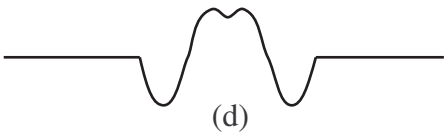
   Which one of the following diagrams could not be observed at a later time?

(a)

(b)



(c)



(d)

4. In a standing wave

   (a) the nodes are positions of maximum amplitude.

   (b) all points of the wave vibrate with the same amplitude.

   (c) the distance between successive nodes is one wavelength.

   (d) all the points between every other pair of nodes vibrate in phase.

5. Two sinusoidal waves travel in the same medium but one with twice the wavelength of the other. Which of the following statements is true? The wave with the longer wavelength has

   (a) higher speed.

   (b) lower speed.

   (c) higher frequency.

   (d) lower frequency.

6. Two air columns are identical except that one is open at both ends while the other is closed at one end. When they oscillate at their fundamental frequency, which one of the following quantities is the same for the sound wave associated with each column.

   (a) Wavelength

   (b) Frequency

   (c) Wave speed

   (d) Number of antinodes.

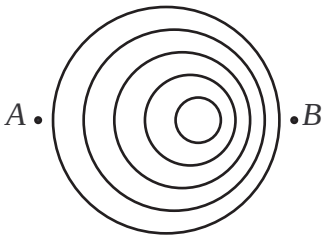
7. Two observers A and B listen to sound from a moving source. The diagram on the right shows the wave fronts of crest of a wave. Which of the following statements is true

   (a) The wavefronts move faster at A than at B

   (b) The wavefronts move faster at B than at A

   (c) The frequency of the sound is highest at A

   (d) The frequency of the sound is highest at B



8. A rescue vehicle rapidly approaches a casualty who has had a mishap at the base of a cliff. The casualty observes that the frequency of the siren has shifted higher due to the Doppler effect. The sound of the siren reflects off the cliff and is heard as an echo by the rescuers. The frequency of the echo that they hear is

   (a) is the same as the sound the casualty hears.

   (b) is higher than the sound the casualty hears.

   (c) is lower than the sound the casualty hears hears, but higher than the sound of the siren.

   (d) is identical to the sound of the siren.

Part II

1. Suppose the velocity of a wave in a string is 10 m/s. The string has length 50 cm and has a mass of 0.5 g.

   (a) Find the tension in the string.

   (b) What is the smallest wave frequency such that a standing wave is formed.

   (c) Write down the wave function for this standing wave, assuming the amplitude at the antinode is 1.0 cm.

   (d) Find the maximum velocity of the point at the antinode.

2. Two radio transmitters $T1$ and $T2$ emit electromagnetic waves at a frequency of 1.44 MHz. A car is driving along the line joining them at 50 km/hr. The driver is tuned in to this station and notices that the he loses his reception for a brief moment and that this occurs at regular intervals on his journey.

   (a) Find the distance between two gaps in reception.

   (b) How long does it takes to travel between them?

3. Challenge Question: It is observed that a pulse requires 0.1 s to travel from one end of a stretched string to the other. The tension in the string is provided by passing the string over a pulley to a weight with a mass 100 times the mass of the string. What is the length of the string?