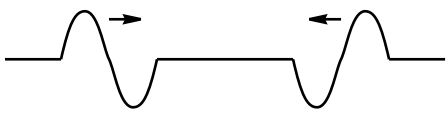
Part I

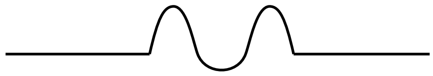
1. Two wave pulses of symmetrical shape approach one another on a string, as shown in the diagram.



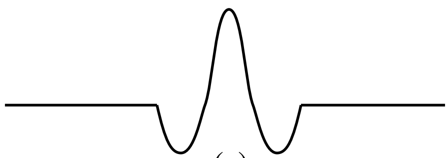
Which one of the following diagrams could not be observed at a later time?



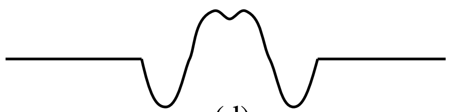
(a)



(b)



(c)



(d)

Answer (b). The displacement in the middle of the combined pulse should be double the two individual displacements.

2. 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.

   Answer (d).

3. 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.

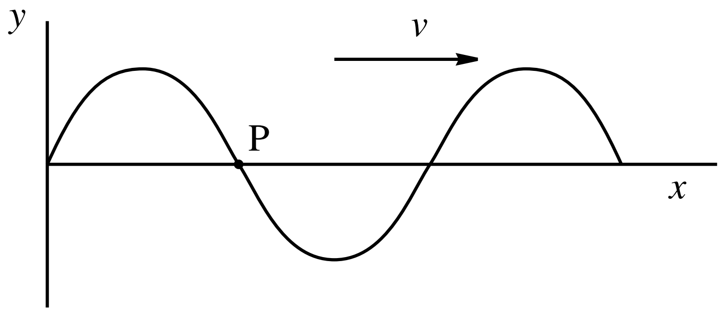
   (b) lower speed.

   (c) higher frequency.

   (d) lower frequency.

   Answer (d). The medium remains the same so the speed is unchanged and hence the frequency must decrease

4. The diagram below shows a wave at a particular moment in time as it travels along a rope in the direction shown




Which one of the following statements is true about the point P

(a) It is moving upwards.

(b) It is moving downwards.

(c) It is stationary but about to move upwards.

(d) It is stationary but about to move downwards.

*Although it is at equilibrium displacement it is moving upwards at maximum speed*

Part II

1. Two Seagulls are observed to be bobbing up and down completely out of phase in the sea. The frequency of their oscillation is 0.4 Hz and the wave speed is 4.0 m/s. What is the shortest possible distance between them?
Since they are out of phase they are separated by half a wavelength. Since $v = \lambda f$ it follows that $\lambda = v/f = 4/0.4 = 10$ m. So the seagulls are 5 m apart.

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.
   The waves from the two towers interfere and set up a standing wave pattern. The distance between two nodes is half a wavelength. $\lambda = c/f$ where in this case $c$ is the speed of light so $\lambda = 3 \times 10^8/1.44 \times 10^6 = 208$ m. So the distance between nodes is 104 m.

   (b) How long does it takes to travel between them?
   Time $t = d/v$ where $v$ is the speed of the car. $v = 50$ km/hr $= 13.9 m/s$ so $t = 104/13.9 = 7.5$ seconds