

Name of the Student: _____

Max. Marks : 25 Marks

Time : 25 Minutes

Q1.

Figure 1 shows a wine glass being driven into oscillation at its natural frequency by a high-power loudspeaker. The loudspeaker is close to, but not touching, the glass. The loudspeaker is driven by a sine-wave generator.



Figure 1



Figure 2

In Figure 2, the amplitude of vibration of the glass has become so large that the glass shatters.

(a) (i) Name the effect being demonstrated.

(1)

.....

(ii) Explain why this effect occurs.

(2)

.....

.....

.....

.....

(b) A rubber band may be placed around the glass to provide some damping. This would reduce the amplitude of vibration and prevent the glass from shattering.

Explain how a rubber band around the glass would provide damping.

.....

.....

.....

.....

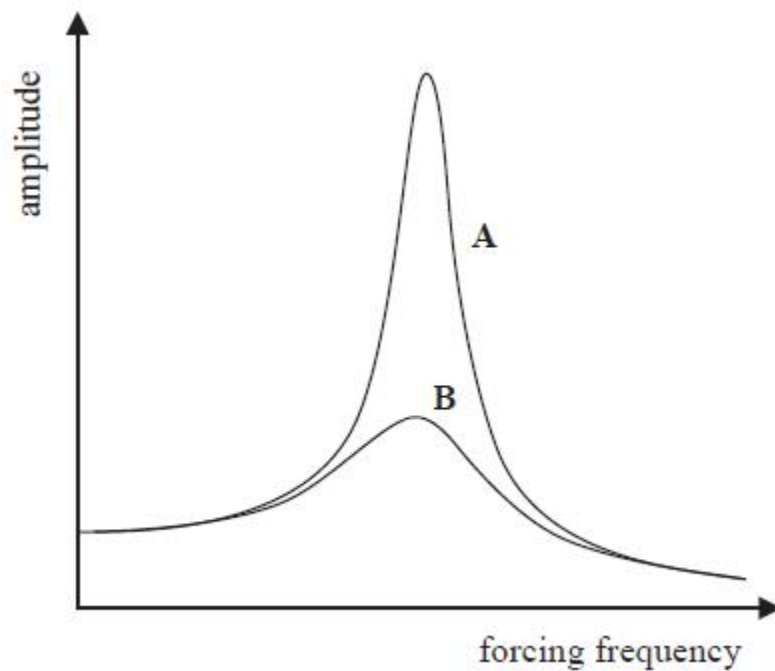
(Total for question = 5 marks)

Q2.

* A student uses the apparatus shown below to investigate the behaviour of a mass-spring system when it is forced into oscillation.



The graph shows how the amplitude of the oscillating mass varies over a range of forcing frequencies.



Curve A shows the results of the investigation using the apparatus as shown.

The student repeats the investigation with the oscillating mass in a beaker of water.

Curve B shows these results.

Making reference to important features in the graph, describe and explain the two sets of results.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 4 marks)

Q3.

The photograph shows a 'singing bowl'.



When the handles are rubbed with both hands the bowl 'sings', producing a loud note with a frequency of 720 Hz. A vibration generator is attached to the bowl and connected to a signal generator. The signal generator is adjusted to produce frequencies from 600 Hz to 800 Hz. At all frequencies in this range the bowl produces a sound at the applied frequency. The sound is quiet for all frequencies except 720 Hz, when it is much louder. Explain these observations.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

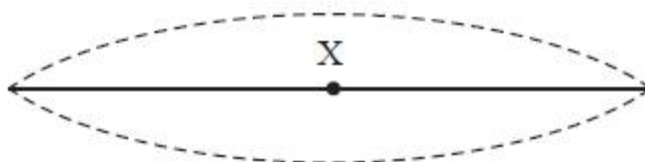
(Total for question = 6 marks)

Q4.

Guitar strings can oscillate with simple harmonic motion.



Shortly after the string is plucked, a standing wave exists on the string. The simplified diagram below shows a string in three positions of the standing wave.



(a) State what is meant by simple harmonic motion.

(2)

.....

.....

.....

(b) (i) Describe the acceleration of point X on the string as it moves between the extreme positions of its motion.

(2)

.....

.....

.....

.....

(ii) Comment on the energy changes in the string as it moves between the extreme positions of its motion.

(3)

.....

.....

.....

.....

.....

.....

(c) The oscillating string has a length of 0.53 m. Calculate the frequency of the sound emitted when the string oscillates as shown previously.

speed of the wave on the string = 270 m s^{-1}

(3)

.....

.....

.....

.....

Frequency =

(Total for question = 10 marks)