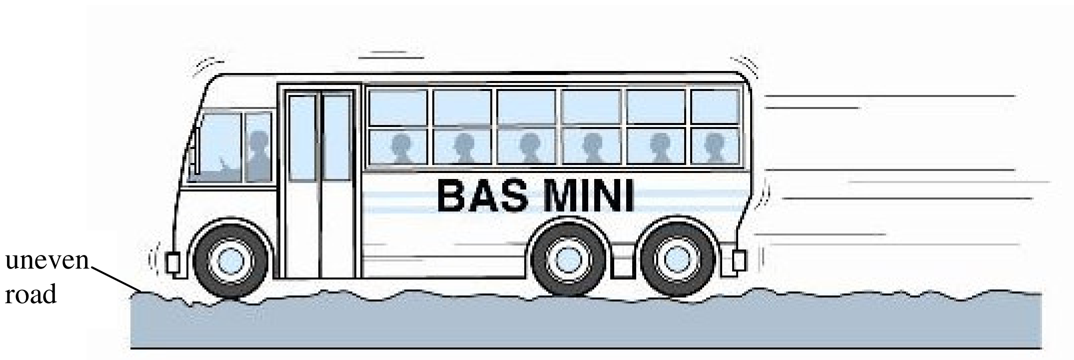
CHAPTER 6: WAVES

Extra Info

Have you notice?



When a bus is travelling on an uneven road surface, it is **forced** to oscillate vertically at a certain frequency *f*.

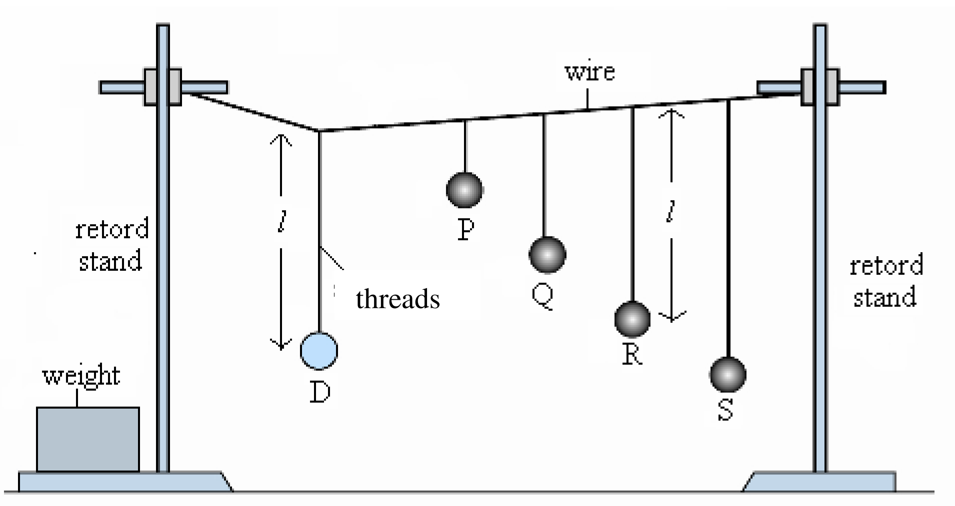
When the bus is moving at a certain speed, this forcing frequency *f* might be equal to the natural frequency of the vibration of the bus.

Resonance occurs and the bus vibrates at a maximum amplitude to produce a loud noise.

Extra Activity

Resonance in a Barton's Pendulum

Aim : To study resonance in a Barton's pendulum
Materials: Wire, cotton threads, pendulum bobs and weights
Apparatus: Two retort stands
Procedure:



1. Five pendulum bobs *D*, *P*, *Q*, *R* and *S* connected to cotton threads are attached to a wire between two retort stands as shown in the above diagram. *D* and *R* have the same length *l*.
2. Pendulum *D* acts as the driver pendulum to force *P*, *Q*, *R* and *S* into forced oscillations.
3. Pendulum *D* is pulled aside and then released to set it into oscillation.
4. The oscillations of pendulums *P*, *Q*, *R* and *S* are observed.

Observations:

1. Pendulums *P*, *Q*, *R* and *S* are in forced oscillations following the frequency of *D*.
2. Only pendulum *R* oscillates with maximum amplitude.

Discussion:

1. For a simple pendulum,

   Period, $T = 2\pi\sqrt{\frac{l}{g}}, l = \text{length of the string}$

2. Natural frequency, $f_0 = \frac{1}{T}$

$$= \frac{1}{2\pi}\sqrt{\frac{g}{l}}$$

$$\therefore f_0 \;\alpha\; \frac{1}{\sqrt{l}}$$

3. Pendulums *R* and *D* have the same natural frequency as they have the same length, *l*.

4. Since pendulum *R* is forced to oscillate at its natural frequency f_0, it produces resonance.

Conclusion:

1. When pendulum *R* is forced to oscillate at its natural frequency f_0, resonance occurs.
2. Pendulum *R* receives the maximum energy from the forcing or driver pendulum, and therefore *R* oscillates with maximum amplitude.