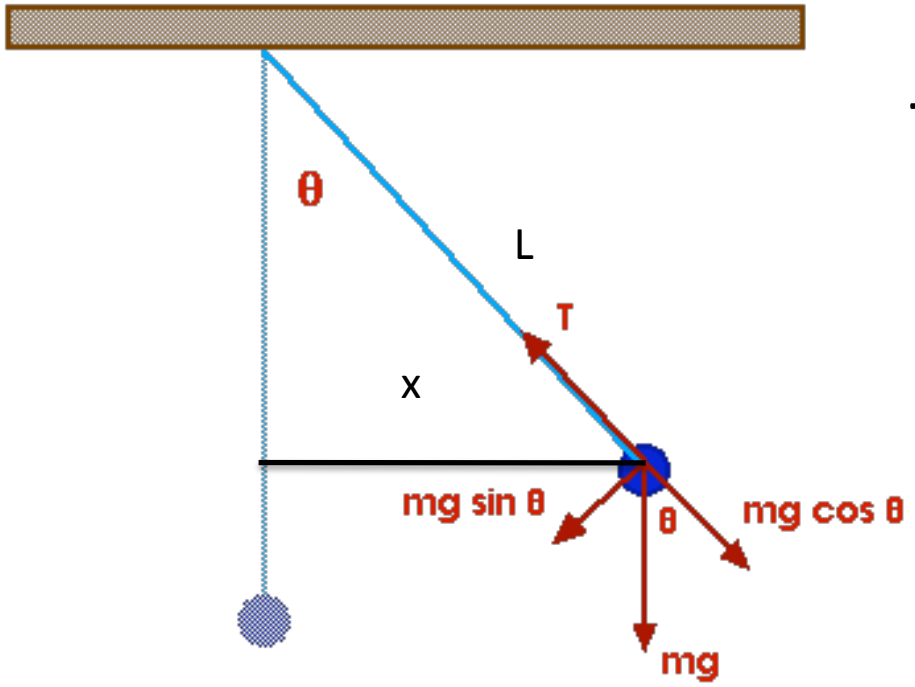
The Simple Pendulum



The Simple Pendulum

Restoring Force: $F = -mg\sin\theta$

If θ is small, $\sin\theta \approx \frac{x}{L}$

$$F = -mg\frac{x}{L}$$

Hooke's Law where k = mg/L

$$\omega = \sqrt{\frac{k}{m}} = \sqrt{\frac{mg}{mL}} = \sqrt{\frac{g}{L}}$$

$$T = \frac{2\pi}{\omega}$$

$$T = 2\pi\sqrt{\frac{L}{g}}$$

Ex1: A simple pendulum has a period of 6.5 s on Earth.

A) What is its length?

B) What is its period on Jupiter?

Ex2: A simple pendulum has a mass of 0.92 kg and a length of 0.65 m. It is displaced through an angle of 10^{o} and released from rest (on Earth).

A) What is its frequency of oscillation?

B) What is its maximum speed?

C) What is the maximum restoring force that acts on the bob?

D) What is the maximum acceleration of the bob?

E) What is the speed of the pendulum when it is half the height to its equilibrium position?

F) What is the maximum tension in the string?

G) What is the minimum tension in the string?

Ex3: Does a pendulum oscillate if it is in free fall? Does a pendulum oscillate differently if it is in an accelerating elevator?