# Physics 161

# Lecture 17

# Simple Harmonic Motion

October 31, 2017

# Lecture 17: learning objectives

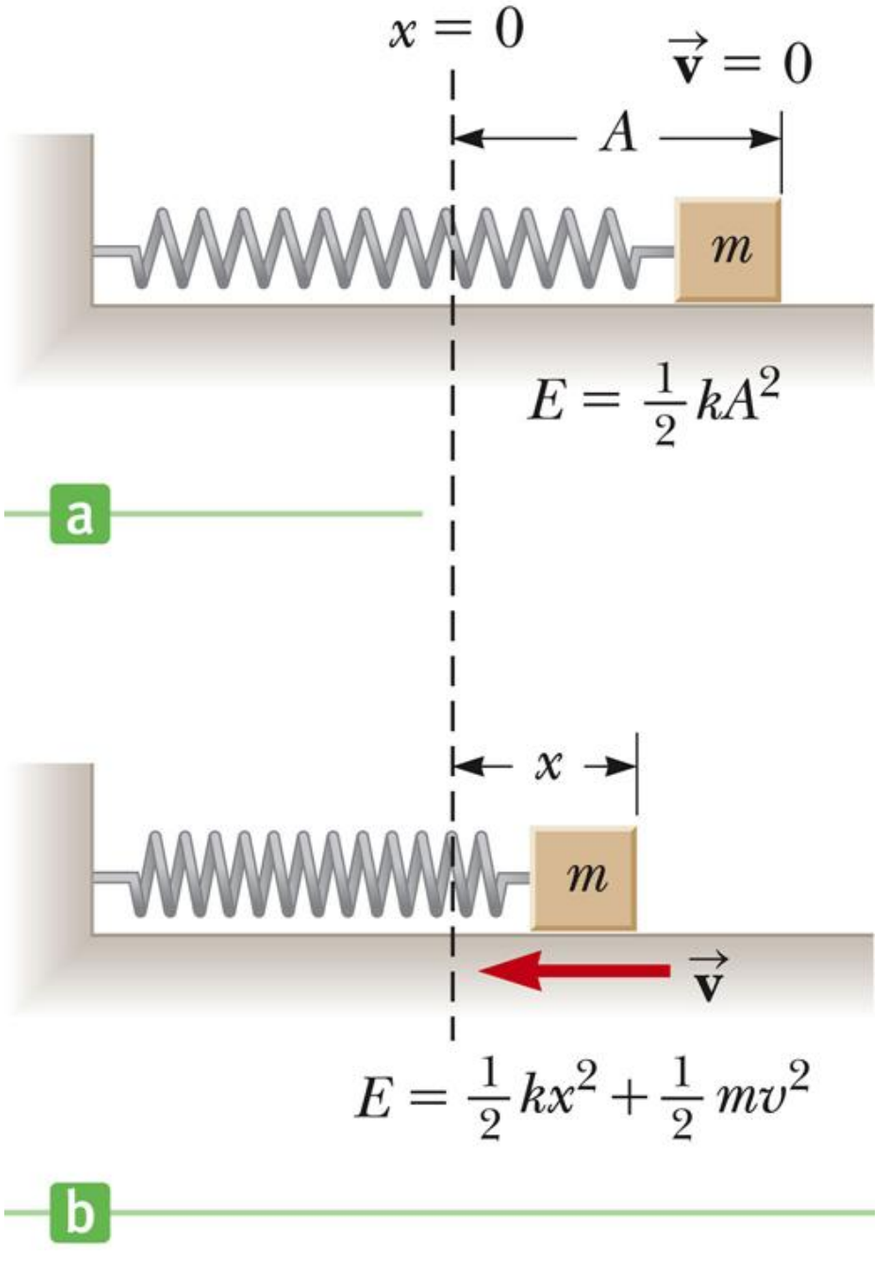
Kinetic Energy and Potential Energy for Hooke's Law.

You will be able to describe the relation between simple harmonic and uniform circular motions.

You will be able to write down the position, velocity and acceleration of simple harmonic oscillators as a function of time.

You will be able to solve problems involving simple pendulum.

# Blocks and springs




A block on a spring undergoes Simple Harmonic Motion (SHM). SHM basically describes simple systems that oscillate back and forth.

From conservation of energy, we can determine the speed of the block as a function of position.

$$v = \pm\sqrt{\frac{k}{m}(A^2 - x^2)}$$

Simple harmonic motion:
An object undergoes simple harmonic motion when it obeys Hooke's law.

# Describing oscillations

Amplitude: A
Maximum distance from equilibrium position.

Period:T
Time taken for one oscillation.

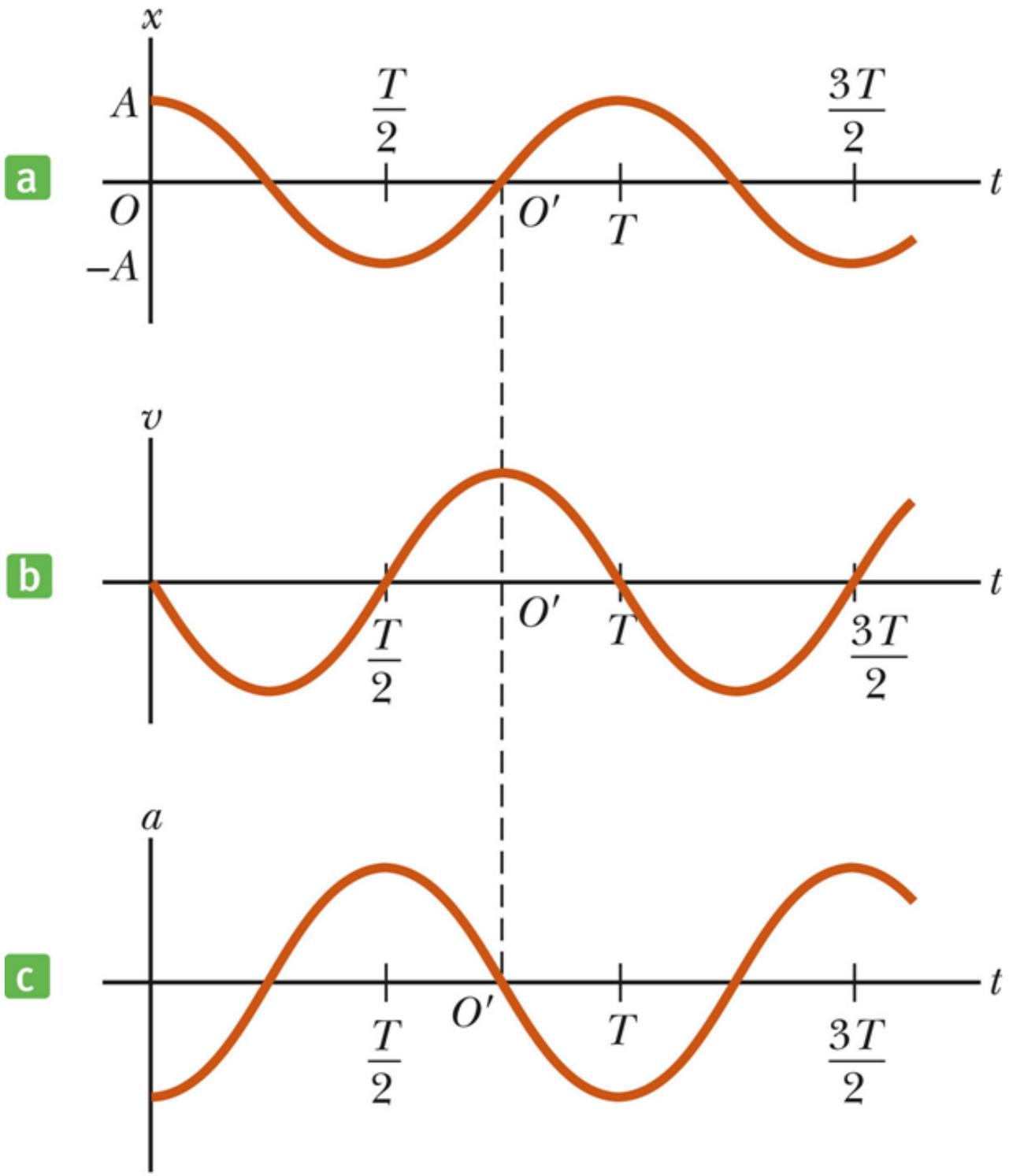
Frequency: f
Number of oscillations per second.

$$f = \frac{1}{T}$$

Angular frequency: $\omega$
Number of revolutions per second.

$$\omega = 2\pi f$$

# Position, velocity, and acceleration




position

$$x(t) = A\cos(\omega t)$$

velocity

$$v(t) = -A\omega\sin(\omega t)$$

acceleration

$$a(t) = -A\omega^2\cos(\omega t)$$