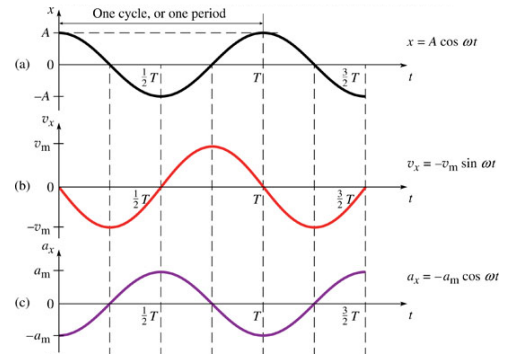


# Physics 2A

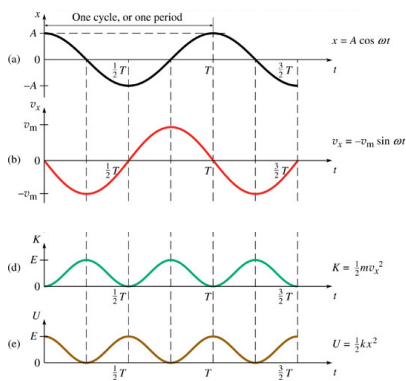
## Oscillations

Simple Harmonic Motion  
 Energy in SHM  
 Resonance

### Simple Harmonic Motion



### Energy in SHM



### Resonance

⇒ when a vibrating system is set into motion and left alone, it will vibrate at its natural frequency

free oscillations

*natural frequency* ⇒ the frequency that an object or system “wants” to vibrate at

⇒ All objects have a natural frequency, for example:

$$f_{\text{spring-mass}} = \frac{1}{2\pi} \sqrt{\frac{k}{m}} \quad f_{\text{pendulum}} = \frac{1}{2\pi} \sqrt{\frac{g}{L}}$$

### ***Resonance***

⇒ an object can be forced to oscillate at a different frequency by applying an external force (driving force)

↓  
forced or driven oscillations

***resonance*** ⇒ the dramatic increase in amplitude that occurs when the frequency of the driving force matches the object's natural frequency

When  $f_{\text{driving force}} = f_{\text{natural}}$  :



### ***Resonance***

⇒ Some examples of resonance are:

- pushing a child on a swing
- tuning a radio station
- sympathetic tuning forks
- Tacoma Narrows Bridge collapse
- singer shattering glass
- shattering a kidney stone
- annoying rattle in car at certain speeds
- “Calvin” bathtub tidal wave
- soldier’s breaking step
- yo-yo
- loud bass music vibrating internal organs

