April 1, 2013 Physics 132 Prof. W. Losert

Outline

Oscillations and Waves

Office hours Thursday 4/4: 3-4.30

Oscillations

- What is the solution to the following equation? $$\frac{d^2 A(t)}{dt^2} = -\omega_0^2 A(t)$$

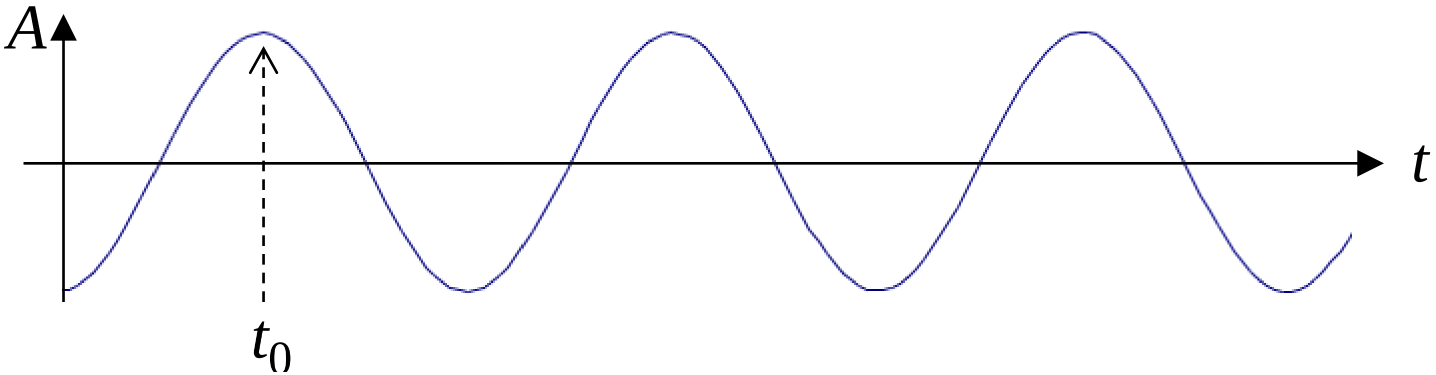
$$A(t) = A_0 \cos(\omega_0 t)$$

$$A(t) = A_0 \sin(\omega_0 t)$$

- Interpretation: DRAW graph
  - Sketch in A=0

Oscillations

- A typical oscillation



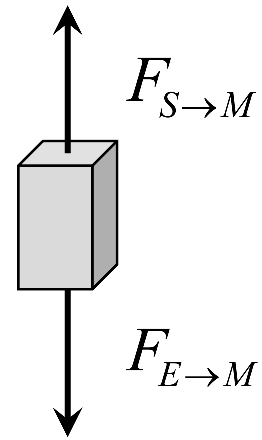
$$A(t) = A_0 \cos(\omega_0 (t - t_0))$$

$$= A_0 \cos(\omega_0 t - \omega_0 t_0) = A_0 \cos(\omega_0 t - \phi)$$

Examples of oscillations

- How general are the equations we just studied?

Summary with Equations: Mass on a spring



$$a = \frac{1}{m} F^{net} \qquad F^{net} = -kx$$

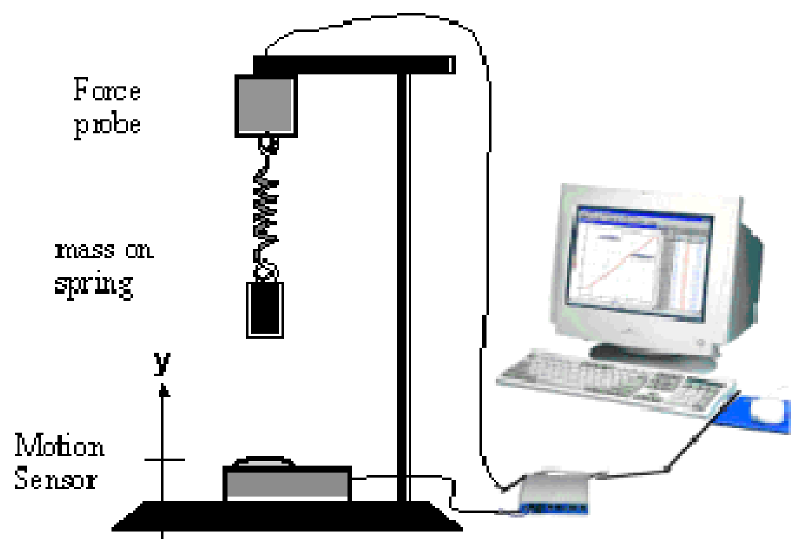
Measured from where?

$$a = -\omega_0^2 x \qquad \omega_0^2 = \frac{k}{m}$$

$$A(t) = A_0 \cos(\omega_0 t + \phi)$$

$$\omega_0 = \frac{2\pi}{T}$$

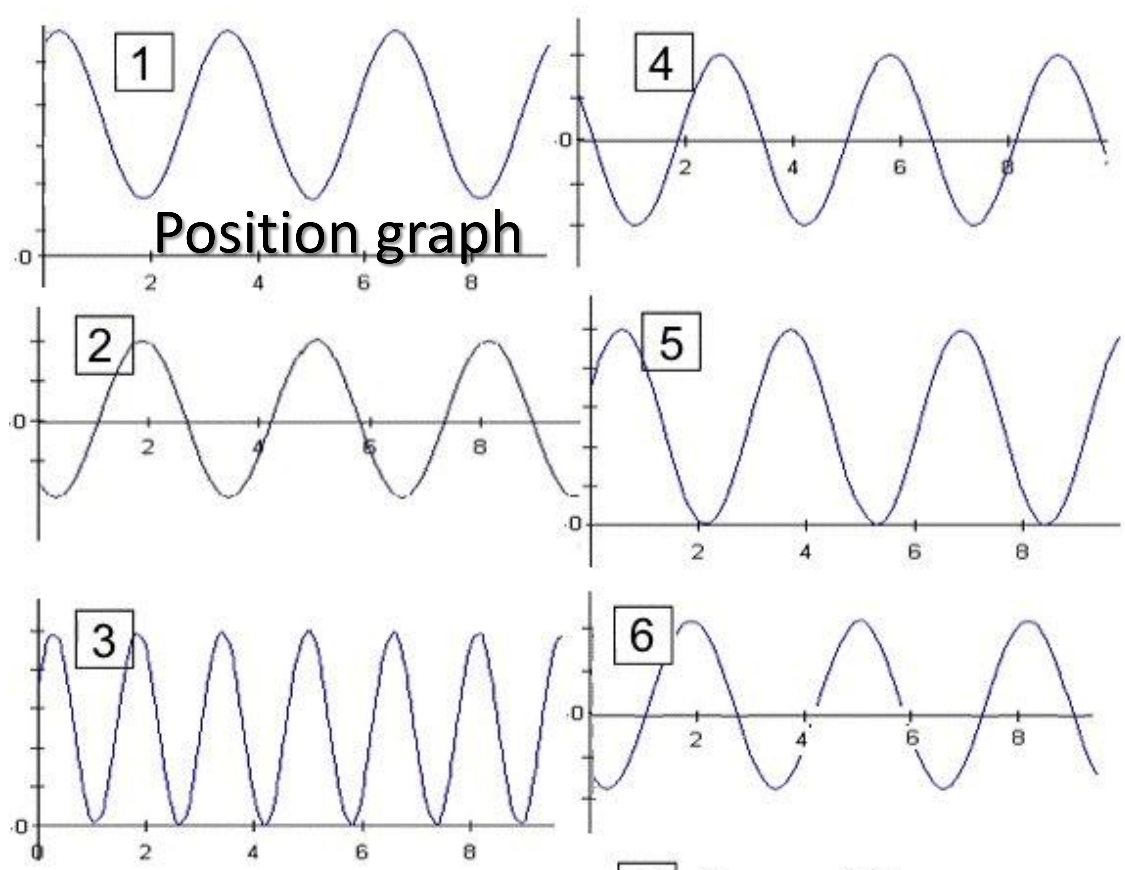
Interpret!



A mass is hanging from a spring. The position of the mass is measured by a sonic ranger sitting 25 cm under the mass's equilibrium position. At some time, the mass is started oscillating.

At a later time, the sonic ranger begins to take data.

Which graph could represent the **velocity** of the mass?

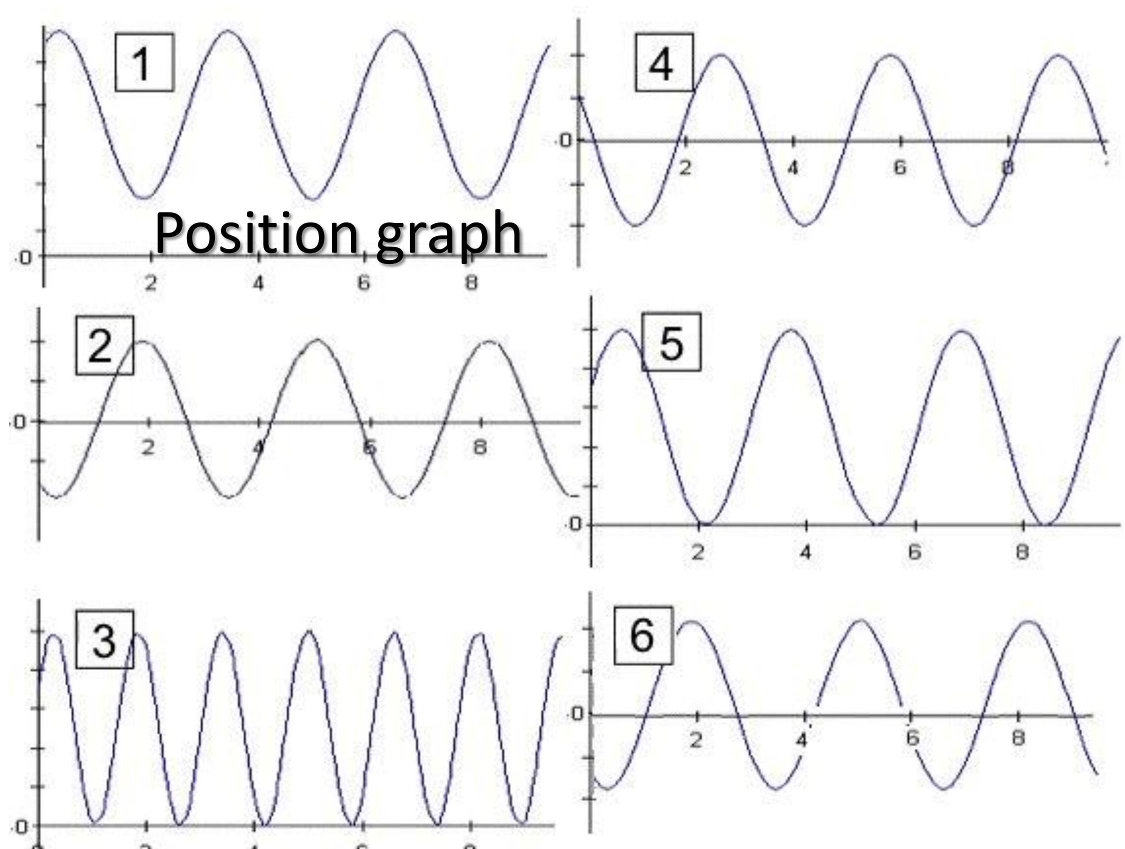


7 None of these

A mass is hanging from a spring. The position of the mass is measured by a sonic ranger sitting 25 cm under the mass's equilibrium position. At some time, the mass is started oscillating.

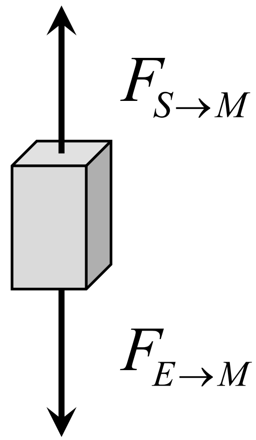
At a later time,
the sonic ranger
begins to take data.

Which graph could
represent the
net force
on the mass?



7 None of these

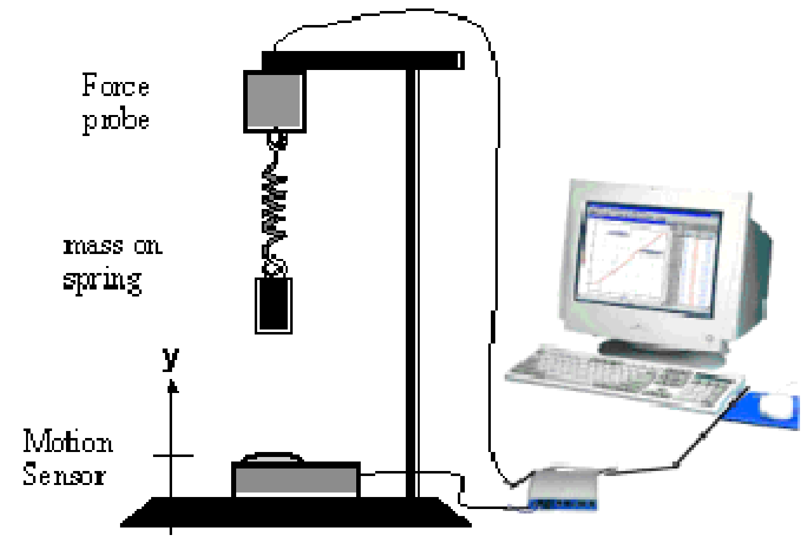
Summary with Equations: Mass on a spring (Energy)



Measured from where?

$$E = \tfrac{1}{2} mv^2 + mgh + \tfrac{1}{2} k (\mathrm{D} l)^2$$

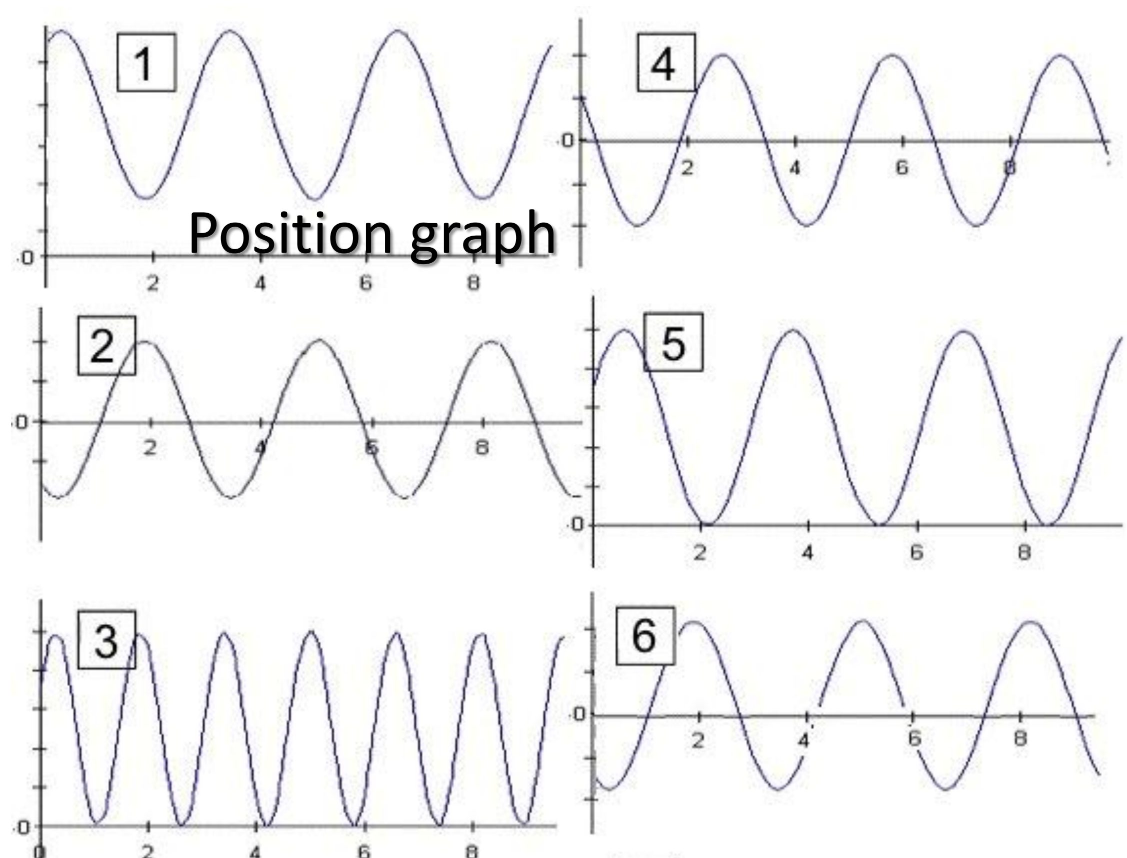
$$E_i = E_f$$



A mass is hanging from a spring. The position of the mass is measured by a sonic ranger sitting 25 cm under the mass's equilibrium position. At some time, the mass is started oscillating.

At a later time, the sonic ranger begins to take data.

Which graph could represent the **potential energy** of the spring?

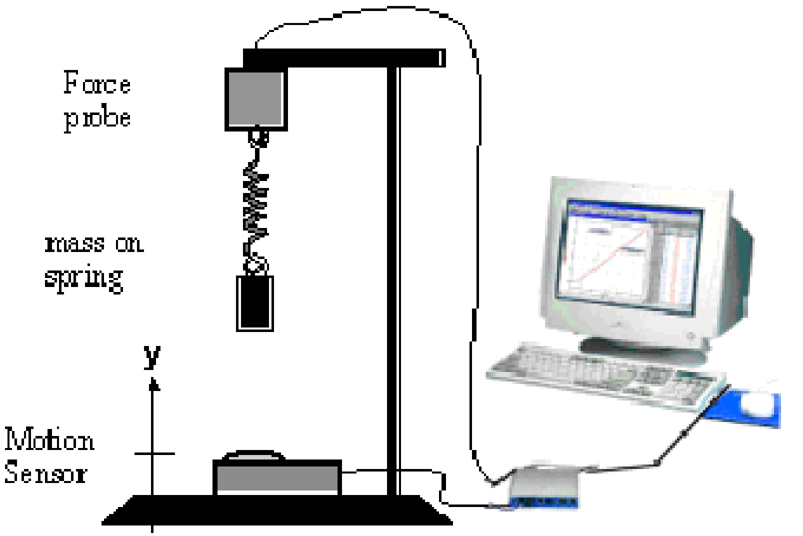


7 None of these

When we pull the mass down from its equilibrium, what happens to the energies?

The gravitational PE

A. increases
B. decreases
C. remains the same
D. you can't tell from the information given.



When we pull the mass down from its equilibrium, what happens to the energies?

The spring PE

A. increases
B. decreases
C. remains the same
D. you can’t tell from the information given.