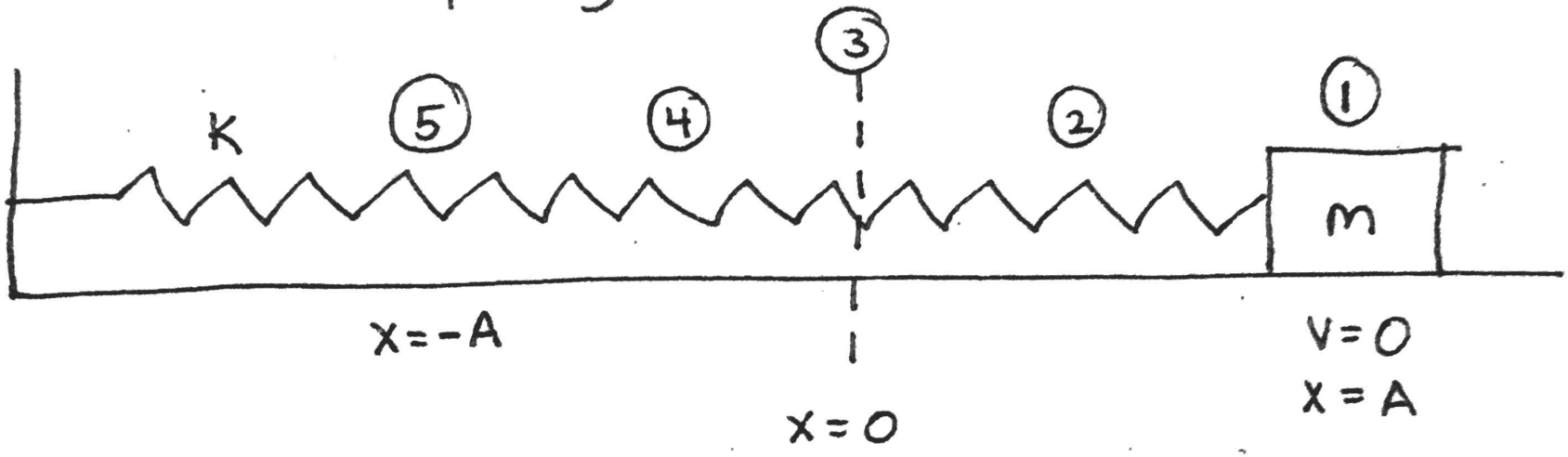
SHM Examples

Horizontal Spring



1 & 5 – Turning points

- Zero velocity
- Zero KE
- Maximum stretch
- Greatest PE
- Greatest force
- Greatest acceleration
- F & a (+) @ 5, (-) @ 1

3– Equilibrium (F=0)

- Zero stretch
- Zero PE
- Zero force
- Zero acceleration
- Greatest speed
- v is (+) when moving right
- Greatest KE

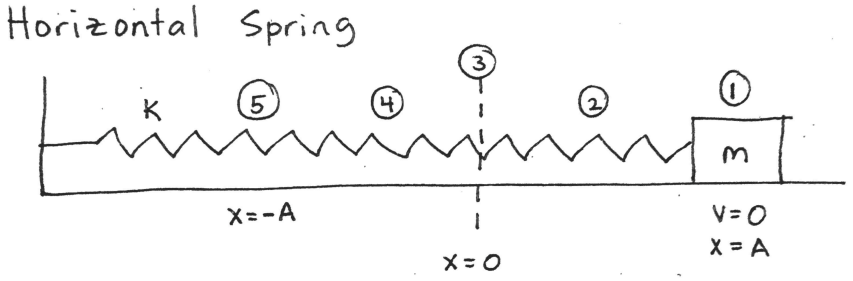
2 & 4

- Stretch ≠ 0
- Speed ≠ 0
- Has both PE & KE

Ex: m = 0.2 kg

A = 15 cm

k = 90 N/m

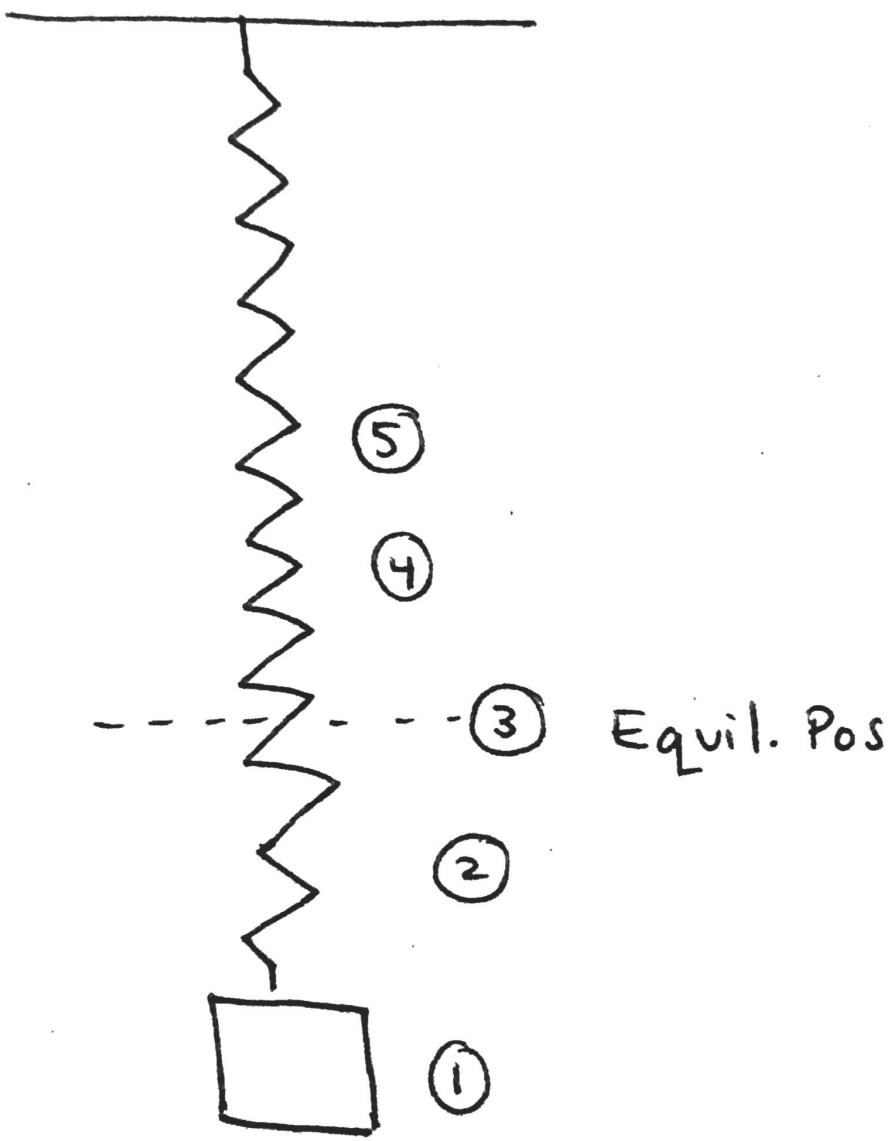


How much energy is stored in the spring at 5?

How fast does the mass travel at 3?

What is the speed of the mass when the spring is stretched 10 cm?

Vertical Spring



*When mass is being dropped/released

- Still has max speed at eq. position and max acceleration/ force at turning point.

Types of Energy:

1. U_s
2. U_s, U_g, K
3. U_s, U_g, K
4. U_s, U_g, K
5. U_g, sometimes U_s (depends if amplitude = distance spring stretches in equilibrium)

Ex: A 5 kg mass is attached to a vertical spring (k = 400 N/m) and is allowed to drop. How far does the spring stretch before the mass reverses direction?

Ex: A vertical spring has a relaxed length of 35 cm. A 200 gram mass is attached to the end and the spring stretches to a length of 49 cm when the mass is in equilibrium. The spring is then stretched 7 cm from equilibrium and released from rest.

A) What is the period of oscillation?

Solve two ways:
B) What is the maximum acceleration?
C) What is the maximum velocity?

Ex: Prove that a ball of mass m dropped into a tunnel that passes through the center of the Earth would oscillate. What would be its period of oscillation?

$$F = -\frac{Gmm}{R^3} r$$