

Chapter 6

Terms

Be able to define or discuss the following terms and ideas, with their SI units if appropriate.

1. system
2. surroundings
3. conservation of energy
4. open system
5. closed system
6. work
7. positive work
8. negative work
9. kinetic energy
10. gravitational potential energy
11. elastic potential energy
12. mechanical energy
13. Hooke's law
14. spring stiffness (i.e. spring constant)
15. conservative force
16. power

Equations

Understand the meaning and know the SI units of all symbols in these equations; know how to perform each mathematical operation, such as trig functions; know how to solve for any unknown quantity; understand how changing one quantity affects another quantity (if all other quantities remain constant); be able to apply one or more equations to solve a problem.

- elastic force (i.e. force *on* a spring or force *by* a spring)

$$|\vec{F}_{spring}| = kx \quad (1)$$

- for a closed system:

$$E_i = E_f \quad , \quad \Delta E = 0 \quad (2)$$

- for an open system:

$$E_i + (\text{sum of inputs and outputs}) = E_f \quad , \quad \Delta E = \text{sum of inputs and outputs} \quad (3)$$

- work

$W = (\text{amount of force exerted in the direction of motion}) \times (\text{distance over which the force is exerted})$

$$W = F_{\parallel} |\Delta \vec{r}|$$

- kinetic energy

$$KE = \frac{1}{2}mv^2 \quad (4)$$

- gravitational potential energy

$$PE_{grav} = mgy \quad (5)$$

- elastic potential energy

$$PE_{elas} = \frac{1}{2}kx^2 \quad (6)$$

$$P = \frac{\Delta E}{\Delta t} \quad (7)$$

Skills

1. Apply Newton's second law to a system that includes a spring and solve for an unknown.
2. Calculate work done by a force on an object.
3. Apply conservation of energy to an open system and solve for an unknown.
4. Apply conservation of energy to a closed system and solve for an unknown.

Lab Skills

1. Measure the stiffness of a spring by measuring the force applied to a spring and the distance stretched and analyzing a graph of force vs. distance stretched.