SPH3U 5.3 Types of Energy and the Law of Conservation of Energy

1. Types of energy

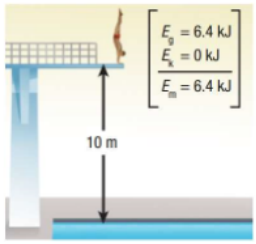
Form of Energy	Type of Energy	Description
Potential and Kinetic	mechanical.	Gravity + kinetic
	radiant (light).	Electromagnetic fields
	electrical (current).	Flowing charges
	thermal (heat).	Randomly moving molecules
	sound.	Oscillating molecules
Potential	gravitational.	Gravity
	electrical (static).	Static charges
	nuclear	Protons and neutrons
	elastic.	Stretched materials
	chemical.	Molecular bonds

Energy transformation:	change energy from one type to another.
example	photosynthesis (radiant → chemical).

2. The law of conservation of energy

Law of conservation of energy:	the total amount of energy in the universe is conserved. Energy is not created or destroyed, it can only change forms.

A 65.0 kg diver dives from a 10.0 m high platform into the water below. What is his mechanical energy when he is on the platform (before diving)?

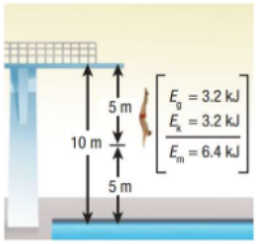


$E_g = mgh = (65)(9.8)(10)$

$= 6370\,J = 6.37\,kJ$

$E_k = 0.$ $E_m = E_g + E_k = 6.37\,kJ.$

What is his mechanical energy when he is halfway to the water?



$E_g = mgh = (65)(9.8)(5) = 3185\,J.$

$E_k = \frac{1}{2}mv^2$ $\quad v_f^2 = v_i^2 + 2a\Delta d$

$v_f = \sqrt{2a\Delta d} = \sqrt{2(-9.8)(-5)} = 9.9\,m/s.$

$E_k = \frac{1}{2}(65)(9.9)^2 = 3185\,J.$ $\quad E_m = E_k + E_g = 2(3185) = 6.37\,kJ.$

What is his mechanical energy when he reaches the surface of the water?

$E_m = 6.37\,kJ.$

3. Applying the law of conservation of energy

A 1.1 kg camera slips out of a photographer's hands while he is taking a photograph. The camera falls 1.4 m to the ground below.

a. What is the camera's gravitational potential energy relative to the ground when it is in the photographer's hands?

$E_g = mgh = (1.1)(9.8)(1.4)$

$= 15\,J.$

b. Using the law of conservation of energy, determine the camera's kinetic energy at the instant it hits the ground.

$E_g = 0\,J.$ $\quad (E_m = E_g + E_k,\ E_m \text{ is conserved}).$

$\therefore E_k = 15\,J.$

c. Use the camera's kinetic energy to determine its speed when it hits the ground.

$E_k = 15\,J = \frac{1}{2}mv^2$

$v = \sqrt{\frac{2E_k}{m}} = \sqrt{\frac{2(15)}{1.1}} = 5.2\,m/s.$

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