CHAPTER 7

Potential energy and energy conservation

CONTENTS

1. Gravitational potential energy.
2. Conservative and non-conservative forces.
3. Force and potential energy.

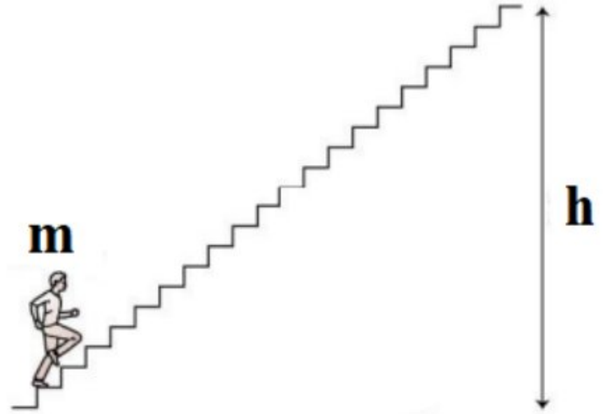
1.GRAVITATIONAL POTENTIAL ENERGY

The potential energy is the energy stored in the object because of its position.

$$\text{Potential energy} = \text{weight} \times \text{height}$$

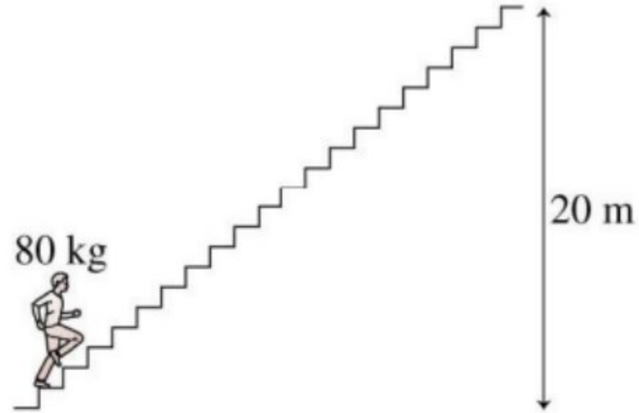
$$U = mgh \qquad \text{(J=Joule)}$$

Where **h** is the height of the object from the ground.



Example 7.1:

A student of mass 80 kg run up the stairs. Calculate its potential energy as shown in the figure.



Solution:

$$U = mgh = 80 \times 9.8 \times 20 = 15680\ \text{J}$$

Example 7.2:

Calculate the gravitational potential energy of a body of mass 40 kg at the height of 2.4m above the ground?

Solution:

$$U = mgh = 40 \times 9.8 \times 2.4 = 941\ J$$

Example 7.3:

what is the potential energy of a 2.14 kg book that is on bookshelf 1.0 m above the floor ?

Solution:

$$U = mgh = 2.14 \times 9.8 \times 1 = 21\ J$$

2.CONSERVATIVE AND NON- CONSERVATIVE FORCES

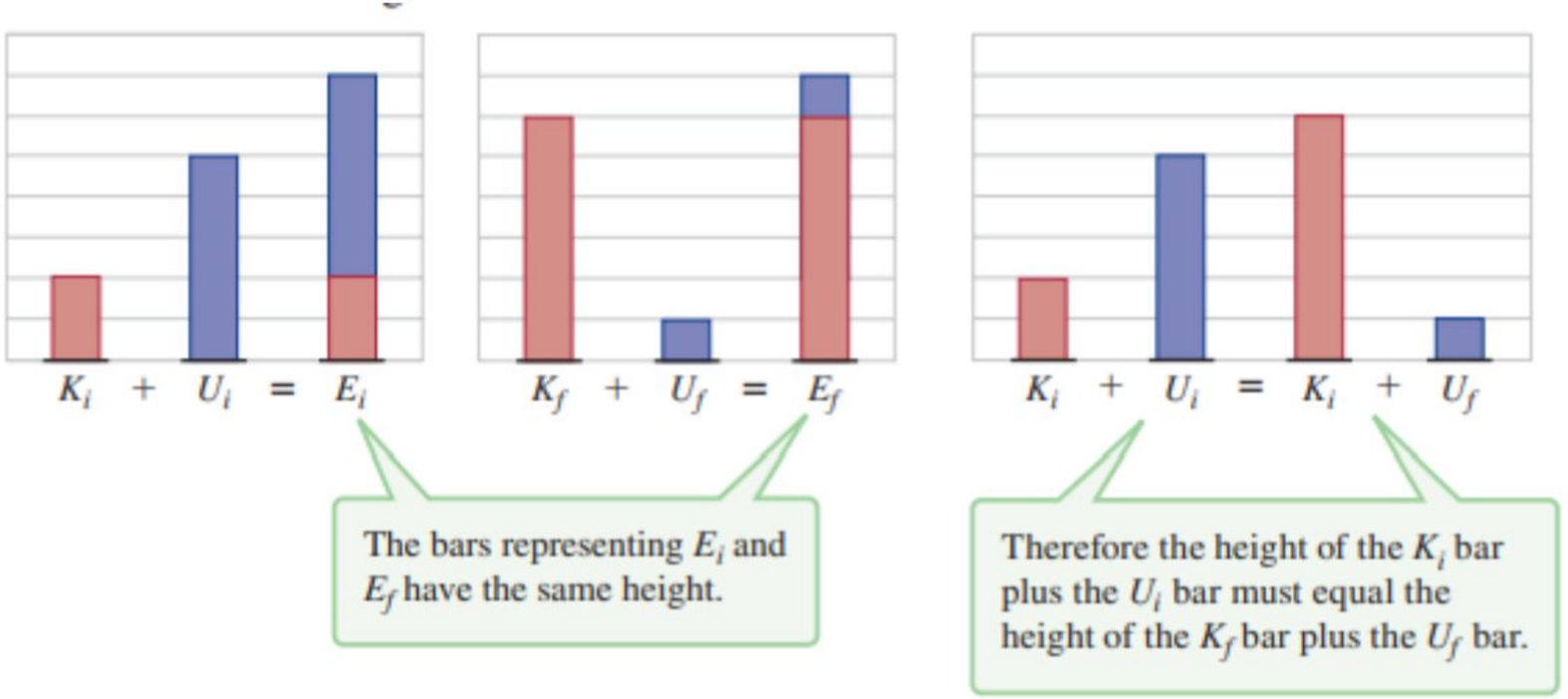
Forces that can store useful energy which is conserved (without lost energy) are **conservative forces.**

Forces such as friction that cannot store useful energy are **nonconservative forces.**

Conservative forces	Non-conservative forces
Gravitational force	Tension force
Spring force	Friction force
Electric force	Air resistance force

For an isolated system (work=0), mechanical Energy is conserved.

$$K + U = E = \text{constant}$$



3. FORCE AND POTENTIAL ENERGY

The force on an object is the negative of the derivative of the potential function U. We can find the corresponding force function using the potential energy function as follows:

$$F = -\frac{dU}{dx}$$