1. The *work-energy theorem* states that the change in kinetic energy of a body is the work done by the net force on the body.

$$K_f - K_i = W_{net}$$

2. A force is *conservative* if (i) work done by it on an object is path independent and depends only on the end points $\{x_i, x_j\}$, or (ii) the work done by the force is zero for an arbitrary closed path taken by the object such that it returns to its initial position.

3. For a conservative force in one dimension, we may define a *potential energy* function $V(x)$ such that

$$F(x) = -\frac{dV(x)}{dx}$$

or

$$V_i - V_f = \int_{x_i}^{x_f} F(x)\,dx$$

4. The principle of conservation of mechanical energy states that the total mechanical energy of a body remains constant if the only forces that act on the body are conservative.

5. The *gravitational potential energy* of a particle of mass m at a height x about the earth's surface is

$$V(x) = m\,g\,x$$

where the variation of g with height is ignored.

6. The elastic potential energy of a spring of force constant k and extension x is

$$V(x) = \frac{1}{2}k\,x^2$$

7. The scalar or dot product of two vectors **A** and **B** is written as **A.B** and is a scalar quantity given by : $\mathbf{A}\cdot\mathbf{B} = AB\cos\theta$, where θ is the angle between **A** and **B**. It can be positive, negative or zero depending upon the value of θ. The scalar product of two vectors can be interpreted as the product of magnitude of one vector and component of the other vector along the first vector. For unit vectors :

$$\hat{\mathbf{i}}\cdot\hat{\mathbf{i}} = \hat{\mathbf{j}}\cdot\hat{\mathbf{j}} = \hat{\mathbf{k}}\cdot\hat{\mathbf{k}} = 1 \text{ and } \hat{\mathbf{i}}\cdot\hat{\mathbf{j}} = \hat{\mathbf{j}}\cdot\hat{\mathbf{k}} = \hat{\mathbf{k}}\cdot\hat{\mathbf{i}} = 0$$

Scalar products obey the commutative and the distributive laws.

Physical Quantity	Symbol	Dimensions	Units	Remarks
Work	W	$[ML^2T^{-2}]$	J	$W = \mathbf{F.d}$
Kinetic energy	K	$[ML^2T^{-2}]$	J	$K = \frac{1}{2}mv^2$
Potential energy	$V(x)$	$[ML^2T^{-2}]$	J	$F(x) = -\frac{dV(x)}{dx}$
Mechanical energy	E	$[ML^2T^{-2}]$	J	$E = K + V$
Spring constant	k	$[MT^{-2}]$	N m^{-1}	$F = -kx$ $V(x) = \frac{1}{2}kx^2$
Power	P	$[ML^2T^{-3}]$	W	$P = \mathbf{F.v}$ $P = \frac{dW}{dt}$