Classical Mechanics:

The classical mechanics describes the behavior of objects in terms of two equations .

One equation expresses the fact that the total energy is constant in the absence of external forces .

The other equation expresses the response of particles to the forces on them .

Velocity $= \frac{X2-X1}{t2-t1} = \frac{dX}{dt} = \dot{X}$

Acceleration $= \frac{\dot{X}2-\dot{X}1}{t2-t1} = \frac{d^2X}{dt^2} = \frac{d\dot{X}}{dt} = \ddot{X}$

from Newton second law

$F(x) = m\ddot{X}$

F= force , m= mass , $\ddot{X}$ = acceleration

$F(q) = m\ddot{q}$, q= x, y, z

Newton second law that the acceleration of particle is proportional to the force it experiences .

Total energy of a particle is the sum of the kinetic energy ,(E_k or T) of the particle , the energy arising from the motion of the particle , and potential energy (Ep or V) the energy arising from the position of the particle in a field of force .

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$E_{(T)} = E_k + E_p$

$E_k + E_p$= constant

T+ V= constant

Conservative system is any system of particles and forces whose total energy (the sum of its kinetic and potential energies does not vary with time .

a Conservative system, both the internal and external forces can be represented as the negative gradient of some potential function (V).

to consider the case of a single particle constrained to move in one dimension , the x direction .

The force (F) is related to the potential energy by

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

The kinetic energy of a particle of mass (m) travelling with a speed v is :

$E_k = \frac{1}{2} m v^2$

from Newton second law

$F(x) = m\frac{d^2x}{dt^2}$

$F(x) = m\frac{dX.}{dt}$

$m\frac{dX.}{dt} = -\frac{dV}{dX}$

$m\frac{dX\, dX.}{dt} = -dV$

$mX.\, dX. = -d\,V$ by integration $m\int X.\, dX. = -\int dV$

$\frac{m X^2}{2} = -V + C$

$\frac{1}{2} m X^2 + V = C$

T+ V= constant

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