$$= \frac{q}{c}\left(\frac{\partial E_z}{\partial y} - \frac{\partial E_y}{\partial z}\right) i + j\, \frac{q}{c}\left(\frac{\partial E_z}{\partial x} - \frac{\partial E_x}{\partial z}\right)$$

either read

$$+ k\, \frac{q}{c}\left(\frac{\partial E_y}{\partial x} - \frac{\partial E_x}{\partial y}\right)$$ (As we Put E_x, E_y & E_z in equations)

$$= \frac{q}{c}(0 + 0 + 0)$$

$$\text{Curl } \vec{E} = \frac{q}{c}(0) = 0$$

⇒ This curl is zero. Hence the electric field of force is conserved field of force.

In similar way we can Prove That Gravational is conserved also

Gravational field is conserved:-

we know That Gravational Force is given By;

$$F = -G\frac{m_1 m_2}{r^2}\,\hat{r}$$ (-ve singe due to attractive force)

$$\vec{F} = -\frac{G m_1 m_2}{r^3}\,\hat{r}\,r$$

$$F = -\frac{G m_1 m_2}{r^3}\,\vec{r}$$

As we Know That

$$F = F_x i + F_y j + F_z k$$

$$\vec{r} = x i + y j + z k$$

$$|r| = (x^2 + y^2 + z^2)^{1/2}$$

$$r^3 = (x^2 + y^2 + z^2)^{3/2}$$

9

Then we can write as

$$\left(F_x i + F_y j + F_z k\right) = -G m_1 m_2 \left(\frac{xi + yj + zk}{(x^2+y^2+z^2)^{3/2}} \right)$$

$$\left(F_x i + F_y j + F_z k\right) = -G m_1 m_2 \left(\frac{xi}{(x^2+y^2+z^2)^{3/2}} + \frac{yj}{(x^2+y^2+z^2)^{3/2}} + \frac{zk}{(x^2+y^2+z^2)^{3/2}} \right)$$

Comparing the co-efficient of i, j & k we get

$$F_x = -G m_1 m_2 \left(\frac{x}{(x^2+y^2+z^2)^{3/2}} \right)$$

$$F_y = -\frac{G m_1 m_2 (y)}{(x^2+y^2+z^2)^{3/2}}$$

$$F_z = -G m_1 m_2 \frac{z}{(x^2+y^2+z^2)^{3/2}}$$

Now we took the curl F $\Rightarrow$

$$\text{Curl } F = \begin{vmatrix} i & j & k \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ F_x & F_y & F_z \end{vmatrix}$$

$$\text{Curl } \vec{F} = i\left(\frac{\partial F_z}{\partial y} - \frac{\partial}{\partial z} F_y\right) + j\left(\frac{\partial F_z}{\partial x} - \frac{\partial F_x}{\partial z}\right) + k\left(\frac{\partial}{\partial x} F_y - \frac{\partial F_x}{\partial y}\right)$$

$$= i(0) + j(0) + k(0)$$

$$\text{Curl } F = 0$$

Hence it shows that Gravitational field is conserved field.

Grad U:

Grade U is the maximum increase of scalar at a given Pt. along a Particular field. grad U is a vector quantity.

Show That $\vec{F} = -\operatorname{grad} U$.

If U is a scalar point function. Then

$$\operatorname{grad} u = \frac{\partial u}{\partial x} i + \frac{\partial u}{\partial y} j + \frac{\partial u}{\partial z} k$$

Now taking curl of grad u $\Rightarrow$

$$\operatorname{Curl}(\operatorname{grad} u) = \begin{vmatrix} i & j & k \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ \frac{\partial u}{\partial x} & \frac{\partial u}{\partial y} & \frac{\partial u}{\partial z} \end{vmatrix}$$

$$= \sum i \left(\frac{\partial}{\partial y}\left(\frac{\partial u}{\partial z}\right) - \frac{\partial}{\partial z}\left(\frac{\partial u}{\partial y}\right) \right)$$

$$= \sum i \left(\frac{\partial^2 u}{\partial y \partial z} - \frac{\partial^2 u}{\partial z \partial y} \right)$$

As it is Perfect Rotation

$$\Rightarrow \frac{\partial^2 u}{\partial y \partial z} = \frac{\partial^2 u}{\partial z \partial y} \Rightarrow$$

$$= \sum i \left(\frac{\partial^2 u}{\partial y \partial z} - \frac{\partial^2 u}{\partial y \partial z} \right)$$

$$\operatorname{Curl}(\operatorname{grad} u) = 0 \quad — (1)$$

In Previous article we have shown that Curl F = 0 — (2)

from eq (1) & (2) we get

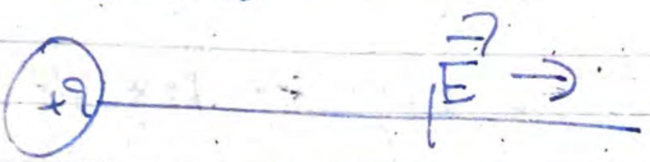
$$\text{Curl } F = \text{curl}(\text{grad } u)$$

or

$$F = \text{grad } u$$

In order that scalar function has a physical meaning it assign a -ve sign with it i.e.

$$\boxed{\vec{F} = -\text{grad } u}$$

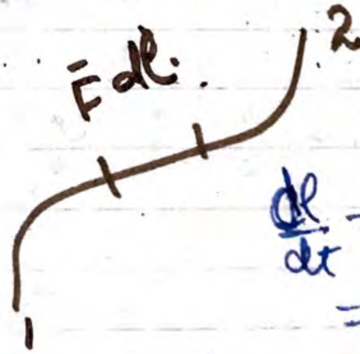


$$E = -\text{grad } V$$

V is Potential in field.

Conservative Theorm of Energy:

$$W_{12} = \int_1^2 \bar{F}\cdot d\bar{l}$$



$V = \frac{s}{t}$

$Vdt = dl$

$\frac{dl}{dt}$

$\frac{dl}{dt} = v \quad dl = vdt$

$$W_{12} = \int_1^2 m\frac{dv}{dt}\cdot v\,dt$$

$$= \frac{m}{2}\int_1^2 2\left(\frac{dv}{dt}\cdot v\right)dt$$

$$W_{12} = \frac{m}{2}\int_1^2 \frac{d}{dt}(\bar{v}\cdot\bar{v})\,dt$$

$\frac{d}{dt}(v\cdot v)$

$= \frac{dv}{dt}\cdot v + v\cdot\frac{dv}{dt}$

$= 2v\cdot\frac{dv}{dt}$

$\frac{d}{dt}(v\cdot v) = 2\left(v\cdot\frac{dv}{dt}\right)$

$$w_{12} = \frac{m}{2}\int_1^2 \frac{d}{dt}(v^2)\,dt$$

$$= \frac{m}{2}\left| v^2 \right|_1^2$$

$$w_{12} = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$$

Now Put $T_1 = \frac{1}{2}mv_1^2$

$T_2 = \frac{1}{2}mv_2^2$

$$\boxed{w_{12} = T_2 - T_1} \longrightarrow A$$

And

$$w_{12} = +\int_1^2 -\text{grad}\,u.dl$$

$$= -\int_1^2 \left(\frac{\partial u}{\partial x}i + \frac{\partial u}{\partial y}j + \frac{\partial u}{\partial z}k\right).(dxi+dyj+dz$$

As $\text{grad}\,u = \frac{\partial u}{\partial x}i + \frac{\partial u}{\partial y}j + \frac{\partial u}{\partial z}k$

$dl = dxi + dyj + dzk$

$$w_{12} = -\int_1^2 \left(\frac{\partial u}{\partial x}dx + \frac{\partial u}{\partial y}dy + \frac{\partial u}{\partial z}dz\right)$$

$$w_{12} = -\int_1^2 (du)$$

$$= -\left|u\right|_1^2$$

$$w_{12} = -(u_2 - u_1)$$

$$= -u_2 + u_1 = u_1 - u_2$$

$$w_{12} = u_1 - u_2 \longrightarrow B$$

from equation (A) & (B) we get

$$U_1 - U_2 = T_2 - T_1$$

$$\boxed{U_1 + T_1 = U_2 + T_2}$$ Ans.

Statement:
Conservations theorms ~~for~~ of energy for a Particle states that if forces acting on Particle are Conservative. Then the total Energy of Particle remain Conserved.

Mechanics of system of Particles:

System of Particle:-

A collection of Particles form a system of Particles. Two type of forses act upon ~~each other~~. the system of particles.

(1) External Forcses:-

It is the force acting upon a Particle of the system due to the ~~interaction of the other Particle of the system and~~ Source out side of the system.

(2) Internal Forces:-

It is the force on the Particle of the system due to the interaction of the other Particle of the system

Considring the Particles of the