Question#1

The work done by the force of a body of mass m with initial speed $v_1 = 2 \times 10^4 \ m/s$ **/ To final speed**

$v_2 = 4 \times 10^4 \ m/s$ **is** $w = 1.2 \times 10^7 \ joule$ **. Find the mass of the body in grams.**

Sol:

$v_1 = 2 \times 10^4 \ m/s$

$v_2 = 4 \times 10^4 \ m/s$

$w = 1.2 \times 10^7 \ joule$

$find \ mass = ?$

$w = \dfrac{1}{2} mv_2^2 - \dfrac{1}{2} mv_1^2$

$w = \dfrac{1}{2}(mv_2^2 - mv_1^2)$

$1.2 \times 10^7 = \dfrac{1}{2}(m(4 \times 10^4)^2 - m(2 \times 10^4)^2)$

$1.2 \times 10^7 = \dfrac{1}{2} m(4 \times 10^4)^2 - (2 \times 10^4)^2$

$1.2 \times 10^7 = \dfrac{1}{2} m(16 \times 10^8) - (4 \times 10^8)$

$1.2 \times 10^7 = \dfrac{1}{2} m(16 \times 10^8 - 4 \times 10^8)$

$1.2 \times 10^7 = \dfrac{1}{2} m(12 \times 10^8 \ m/s)$

$1.2 \times 10^7 = m(6 \times 10^8 \ m/s)$

$\dfrac{1.2 \times 10^7}{6 \times 10^8 \ m/s^{-1}} = m$

$0.2 \times 10^{7-8} = m$

$0.2 \times 10^{-1} = m$

$0.02 kg = m$

$0.02 \times 10^3 g = m$

$0.02 \times 1000 g = m$

$20g = m$

$Hence \ proved$

Question#2

Check whether the force field F= 2xyi +(x²- z²) j - 2yzk Is conservative or not.

Sol:

$F = 2xyi + (x^2 + y^2) - 2yxk$

$\nabla \times F = 0$

$$\nabla \times F = \begin{vmatrix} i & j & k \\ \dfrac{\partial}{\partial x} & \dfrac{\partial}{\partial y} & \dfrac{\partial}{\partial z} \\ 2xy & x^2 - z^2 & -2yz \end{vmatrix}$$

$\nabla \times F = \dfrac{\partial}{\partial y}(-2yz) - \dfrac{\partial}{\partial z}(x^2 - z^2)i - \dfrac{\partial}{\partial x}(-2yz) - \dfrac{\partial}{\partial z}(2xy)j + \dfrac{\partial}{\partial x}(x^2 - z^2) - \dfrac{\partial}{\partial y}(2xy)k$

$\nabla \times F = (-2z + 2z)i - 0j + (2x - 2x)k$

$\quad = 0i - 0j + 0k$

$\quad = 0$

the force field Is conservative.