

Q 4 A body of mass 0.5 kg travels in a straight line with velocity $v = ax^{\frac{3}{2}}$ where $a = 5m^{-\frac{1}{2}} s^{-1}$. What is the work done by the net force during its displacement from $x = 0$ to $x = 2$ m?

Sol. Mass of the body, $m = 0.5$ kg

The velocity of the body is governed by the equation, $v = ax^{\frac{3}{2}}$ where

Initial velocity of the body, u (at $x = 0$) = 0

Final velocity of the body, v (at $x = 2$ m) = $5m^{-\frac{1}{2}} s^{-1} \times (2m)^{\frac{3}{2}} = 10\sqrt{2}m/s$

Work done, $W =$ Change in kinetic energy

$$= \frac{1}{2}m (v^2 - u^2)$$

$$= \frac{1}{2} \times 0.5 [((10\sqrt{2})^2 - (0)^2)]$$

$$= \frac{1}{2} \times 0.5 \times 10 \times 10 \times 2$$

$$= 50 \text{ J}$$

Hence, the work done by the force during displacement is 50 J.