

Physics 101Rec
Quiz#5-Sect04
Chapter 7

Name: _____

Key

Id: _____

A force $\mathbf{F} = 10x^2 \mathbf{i} - 2y \mathbf{j} + 5 \mathbf{k}$ acts on a 2.0 kg object that moves from a position with coordinates (-1 m, 3 m, 5m) to a position with coordinates (0, 5 m, 10 m) in three seconds.

(a) Find the work done by the force in the three seconds interval.

$$\begin{aligned} W &= \int_{x_i}^{x_f} F_x dx + \int_{y_i}^{y_f} F_y dy + \int_{z_i}^{z_f} F_z dz \\ &= \int_{-1}^0 10x^2 dx + \int_3^5 -2y dy + \int_5^{10} 5 dz \\ &= 10 \left. \frac{x^3}{3} \right|_{-1}^0 - \left. \frac{2y^2}{2} \right|_3^5 + 5 \left. z \right|_5^{10} \\ &= \frac{10}{3} [(0)^3 - (-1)^3] - [(5)^2 - (3)^2] + 5(10 - 5) \\ &= \frac{10}{3} (+1) - 16 + 25 = \boxed{12.3 \text{ J}} \end{aligned}$$

(b) Find the average power delivered by the force during the three seconds time interval.

$$P_{\text{avg}} = \frac{W}{t} = \frac{12.3}{3} = \boxed{4.11 \text{ Watts}}$$