QUIZ#6- CHAPTER 7
DATE: 21/10/19

Name: Key Id#: Sect.#:

1. A machine applies a constant force $\vec{F} = 3\hat{i} + 2\hat{j} + 5\hat{k}\ (N)$ on a 4.00 kg box. The box is carried from an initial position of $\overrightarrow{d1} = 1\hat{i} + 2\hat{j} - 2\hat{k}\ (m)$to a final position of $\overrightarrow{d2} = 6\boldsymbol{i} - 3\boldsymbol{j} - 2\boldsymbol{k}\ (m)$ in 12.0 s. Find the average power of the machine's force on the box in this time interval of 12.0 s.

$P_{avg} = \frac{W}{\Delta t}$ $\quad W = \vec{F} \cdot \vec{d}$

$\vec{d} = \vec{d_2} - \vec{d_1} = 5\hat{i} - 5\hat{j} -$

$W = (3\hat{i} + 2\hat{j} + 5\hat{k}) \cdot (5\hat{i} - 5\hat{j}) = 15 - 10 = 5$

$P_{avg} = \frac{5}{12} =$ **0.42W**

2. A single force acts on a 2.0 kg object whose position is given by $x = 4 - 5t + 2t^3$, with x in meters and t in seconds. Find the average of work done by this force from t = 1s to t = 3s.

$W = \Delta K = \frac{1}{2} m (v_f^2 - v_i^2)$

$v = \frac{dx}{dt} = -5 + 6t^2$

$t = 1s \quad v_i = -5 + 6 = 1\ m/s$

$t = 3s \quad v_f = -5 + 54 = 49\ m/s$

$W = \frac{1}{2} \times 2 (49^2 - 1^2) =$ **2400 J**

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1. An elevator is designed to carry a load of 20.0×10^3 N from the ground to a height of 87.5 m in a time of 18.0 seconds. What is the average power that must be supplied by the motor of the elevator to lift this load?

$$\Delta K = W_{net} = W_g + W_{motor} = 0$$

20×10^3 N

$V_i = 0$ & $V_f = 0$

$$W_{motor} = -W_g = -(-mgd) = (mg)d$$

$$= 20\times10^3 \times 87.5 = 1.75\times10^6 \text{ J}$$

$$P_{avg} = \frac{W_{motor}}{\Delta t} = \frac{1.75\times10^6}{18} = \boxed{9.72\times10^4 \text{ W}}$$

2. A certain force $\vec{F}$ acting on a body of mass m = 3.0 kg and changes its velocity from an initial value $\vec{v_i} = 6\boldsymbol{i} - 2\boldsymbol{j}$ (m/s) to a final value $\vec{v_f} = 8\boldsymbol{i} + 4\boldsymbol{j}$ (m/s). Calculate the work done by the force $\vec{F}$.

$$W = \Delta K = \frac{1}{2}m(v_f^2 - v_i^2)$$

$$v_i^2 = 6^2 + 2^2 = 40$$

$$v_f^2 = 8^2 + 4^2 = 80$$

$$W = \frac{1}{2}\times 3 \times (80 - 40) = \boxed{60 \text{ J}}$$

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50 Kg

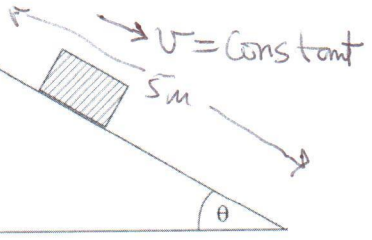
1. A boy run up from the 1st floor to the 2nd floor using the stairs in 12 s. The stairs are made up 30 stairs, each 10 cm heigh. Calculate the average power requried by the boy.

$$P_{avg} = \frac{W}{\Delta t} \qquad \Delta K = W_{boy} + W_g = 0$$

$$W_{boy} = -W_g = -(-mgh) = mgh = 50 \times 9.8 \times 30 \times 0.1$$
$$= 1470\,J$$

$$P_{avg} = \frac{1470}{12} = \boxed{123\,W}$$

2. A 10 kg box slides with a constant speed a distance of 5.0 m downward along a rough slope that makes an angle θ with the horizontal (see the figure). If the work done by the force of gravity is 360 J, what is the angle θ.



$$W_g = mgh = 360$$

$$\Rightarrow h = \frac{360}{mg} = \frac{360}{10 \times 9.8} = 3.67\,m$$

$$\sin\theta = \frac{h}{d} \Rightarrow \theta = \sin^{-1}\left(\frac{h}{d}\right) = \sin^{-1}\left(\frac{3.67}{5}\right)$$

$$\boxed{\theta = 47^\circ}$$