Practice Problems

Units:	energy = joules	work = joules
	Weight = newtons	power = watts
	Height = meters	acceleration = m/s^2
	Mass = kilograms	Force = newtons
	Speed = m/s	Velocity = m/s in a specific direction

Section 1: Calculating Potential and Kinetic Energy

Formula: Potential energy = weight x height (PE = W x H)
Kinetic energy = ½ (Mass x Velocity^2) or (K.E. = $1/2mv^2$)

1. You serve volleyball with a mass of 2.1 kg. The ball leaves your hand with a speed of 30 m/s. The ball has Kinetic energy. Calculate it. $KE = \frac{1}{2}(m \times v^2)$

$\frac{1}{2}(2.1kg \cdot (30 m/s)^2)$ $\frac{1}{2}(1890)$

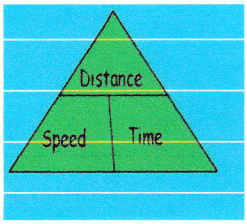
$\frac{1}{2}(2.1kg \cdot 900 m/s^2)$ **945J**

2. A cinder block is sitting on a platform 20 m high. It weighs 79 N. The block has potential energy. Calculate it.

$PE = w \times h$

$79N \times 20m =$ **1580J**

Section 2: Speed (velocity is speed with direction) and Acceleration



$S = \frac{D}{T}$ $D = S \times T$

$T = \frac{D}{S}$

1. Find the velocity of a truck that travels 75 miles north in 2.5 hours.

$\frac{75 miles}{2.5 hr} =$ **30 miles per hour North**

2. Find the speed of a bicyclist who took an hour and a half to travel 10 kilometers.

$S = \frac{D}{T} = \frac{10km}{1.5hr}$ **6.67 Km/hr**

3. If a runner maintains a constant speed of 12 miles/hour, how long will it take to complete a half marathon race of 13.1 miles?

$T = \frac{D}{S} = \frac{13.1 miles}{12 miles/hr} =$ **1.09 hours**

4. A helium balloon is carried by the wind at a constant speed of 10.17 mph. How far did the balloon travel in one day?

$D = S \times T$ $10.17 mph \times 24 hrs$

$a = \frac{v_f - v_i}{t}$

Slowing Down = Negative acceleration (deceleration)

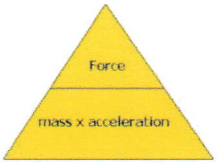
A paperboy rode his bike at 3 m/s. After being chased by a dog for 8 seconds, he was traveling 6 m/s. What is his acceleration?

$\frac{6\text{m/s} - 3\text{m/s}}{8\text{s}} = \frac{3\text{m/s}}{8\text{s}} = .375\text{m/s}^2$

6. A soccer player is running at 6 m/s. He then stumbles over an opponent's foot falling and rolling to a stop. This took 4 seconds. What was his acceleration?

$\frac{0\text{m/s} - 6\text{m/s}}{4\text{s}} = \frac{-6\text{m/s}}{4\text{s}} = -1.5\text{m/s}$

Section 3: Force



$F = m \cdot A \qquad m = \frac{F}{A} \qquad A = \frac{F}{m}$

1. How much force is needed to accelerate a mass of 160 kg by 2 m/s^2?

$F = m \times A = 160\text{kg} \times 2\text{m/s}^2 = 320\text{N}$

2. How much force is required to accelerate a 5 kg mass at 20 m/s^2?

$F = mA = 5\text{kg} \times 20\text{m/s}^2 = 100\text{N}$

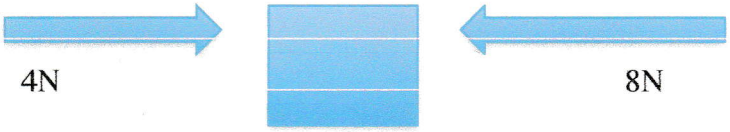
3. What is the acceleration of a 10 kg mass pushed by a 5 N force?

$A = \frac{F}{m} \quad \frac{5\text{N}}{10\text{kg}} = .5\text{ m/s}^2$

4. Given a force of 56N and acceleration of 7 m/s^2, what is the mass?

$m = \frac{F}{A} = \frac{56\text{N}}{7\text{m/s}^2} = 8\text{ kg}$

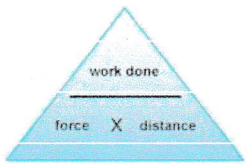
5. Find the acceleration of the 2 kg block in the following diagram.



net force is $8\text{N} - 4\text{N} = 4\text{N}$

$A = \frac{F}{m} = \frac{4\text{N}}{2\text{kg}} = 2\text{m/s}^2$

Section 4: Work



$W = F \times D$ $\quad F = \frac{W}{D}$ $\quad D = \frac{W}{F}$

1. A watermelon weighing 10 newton is lifted 2 meters. How much work is done?

$W = F \times D \quad 10N \times 2m = 20J$

2. A force of 15 newtons is used to push a box along the floor a distance of 3 meters. How much work was done?

$W = F \times D = 15N \times 3m = 45J$

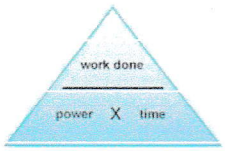
3. It took 50 joules to push a chair 5 meters across the floor. With what force was the chair pushed?

$F = \frac{W}{D} = \frac{50J}{5m} = 10N$

4. A force of 100 Newtons was necessary to lift a rock. A total of 150 joules of work was done. How far was the rock lifted?

$D = \frac{W}{F} = \frac{150J}{100N} = 1.5m$

Section 5 Power



$P = \frac{W}{T}$ $\quad W = P \times T$ $\quad T = \frac{W}{P}$

1. A mechanic uses a jack to lift a truck and does 7258J of work. If he lifts the truck .45m, what was the power output?

NOT Given all variables

2. How much work is done in order to cook a bag of popcorn in a 500-watt microwave oven for 5.5 minutes?

$W = P \times T \quad 500w \times 5.5min = 2750J$

3. If a runner exerts 350J of work to make 125W of power, then how long did it take the runner to do the work?

$T = \frac{W}{P} = \frac{350J}{125w} = 2.8s$