Formulas needed

New Ones

$F = ma$

$W = mg$

OLD ONES

#2 $a = \frac{(v_f - v_i)}{t}$

#4 $s = \frac{1}{2}at^2$ if $v_i = 0\,m/s$

#5 $v_f^2 - v_i^2 = 2as$

Name KEY

UNIT 2 PROBLEM SET

$1N \doteq .22\,lbs$ (Note a quarter pound burger after cooking is .22 lbs so should be called a NewTon Burger)

1. A 70 kg object is accelerated by a force of 20 N. Calculate the acceleration.

m F a = ?

Since $F = ma$; $a = \frac{F}{m} = \frac{20N}{70Kg} = \frac{2\,Kg\,m/s^2}{7\,Kg} \doteq 0.286\,m/s^2$

2. A 500 kg boat starts from rest and accelerates over a distance of 270 m in 12 seconds. Assuming uniform acceleration, calculate the force applied by the engine on the boat.

m v_i s t

My plan is to find acc. first Then $F = ma = (500Kg)(3.75\,m/s^2) = 1875N$

#4 $s = \frac{1}{2}at^2$ so $a = \frac{2s}{t^2} = \frac{2(270m)}{(12s)^2} = \frac{540m}{144s^2} \doteq 3.75\,\frac{m}{s^2}$

3. An 800 kg dragster is uniformly accelerated from rest by a force of 12,000 N.

m v_i F

a. Calculate the dragster's velocity after 3 seconds. PLAN: Calc. acc first using $F = ma$ Then v_f

v_f t

$F = ma$ so $a = \frac{F}{m} = \frac{12000N}{800Kg} = \frac{120\,Kg\,m/s^2}{8\,Kg} = 15\,m/s^2$ Then #2 $v_f = at = (15\,m/s^2)(3s) = 45\,m/s$

b. How far does the dragster travel during this time?

s = ?

#4 $s = \frac{1}{2}at^2 = \frac{1}{2}(15\,m/s^2)(3s)^2 = (7.5\,m/s^2)(9s^2) = 67.5\,m$

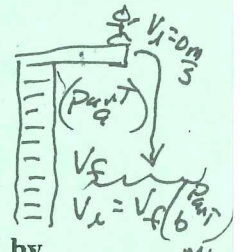
4. A 65 kg high diver dives down from a 10 m high board. $v_i = 0\,m/s$ $a = g = 9.8\,m/s^2$

m s

a. Calculate the diver's velocity when he enters the water.

v_f

$v_f^2 = 2as$ Thus $v_f = \sqrt{2as} = \sqrt{2(9.8\,m/s^2)(10m)} \doteq 14\,m/s$



b. If the diver comes to a stop 2 m below the water surface, calculate the net force exerted by the water on the diver to bring him to a stop.

Plan: Calculate acc. first Then $F = ma$

note answer to 4b.

#5 with $v_f = 0\,m/s$

$-v_i^2 = 2as$ Thus $a = \frac{-v_i^2}{2s} = \frac{-(14\,m/s)^2}{2(2m)} = \frac{-196\,m^2/s^2}{4m} = -49\,m/s^2$

$F = ma = (65Kg)(-49\,m/s^2) = -3185N$

5. a. Determine your own weight in Newtons.

SINCE $1N = .22\,lbs$ my weight $185\,lbs \times \frac{1N}{.22\,lbs} = 840.91N$

b. A large crate has a mass of 30 kg. Determine its weight in Newtons.

$W = mg = (30Kg)(9.8\,m/s^2) = 294N$

6. An astronaut who weighs 700 N on Earth takes a trip to planet Thrae where the gravitational acceleration is 3.7 m/s². Calculate the astronaut's weight on planet Thrae.

E T

$W = 700N$ and $W = mg$

so $m = \frac{W}{g} = \frac{700\,Kg\,m/s^2}{9.8\,m/s^2} \doteq 71.43\,Kg$

same mass both planets

Now $W = mg$

$W = (71.43Kg)(3.7\,\frac{m}{s^2})$

$W = 264.3N$

OR set up proportion

$\frac{700N}{9.8\,\frac{m}{s^2}} = \frac{xN}{3.7\,m/s^2}$

$xN = \frac{(3.7)(700)}{9.8}N$

$x = 264.3N$