NAME:.....

POINTS: .....

Dr. Fritz Wilhelm, Diablo Valley College, Physics Department

TEST 130 #1(chapter 1-6); October 4, 2005

NOTE: **TO ENSURE FULL CREDIT EMPHASIZE YOUR ANSWERS AND INCLUDE DIMENSIONS. SPECIFY WHICH PRINCIPLES OR LAWS YOU ARE USING. EXPLAIN BRIEFLY WHAT YOU ARE TRYING TO DO. ORGANIZE YOUR WORK LOGICALLY. USE DRAWINGS!**

$G = 6.67\times10^{-11}; h = 6.626\times10^{-34}; \mathrm{R_e} = 6.37\times10^{6}\,m; M_{moon} = 7.36\times10^{22}\,kg; M_{earth} = 5.98\times10^{24}\,kg;$

$M_{sun} = 1.991\times10^{30}\,kg; c = 3.00\times10^{8}\,\frac{m}{s}; 1eV = 1.6\times10^{-19}\,J; m_{electron} = 9.1\times10^{-31}\,kg = 0.511\frac{MeV}{c^2}$

$p = \hbar k;\ E = \hbar\omega : \Delta x\Delta p \geq \frac{\hbar}{2}; \hbar = 1.055\times10^{-34}\,Js; \text{proton}: m_p = 1.67\times10^{-27}\,kg$

---

1. [10] A target at a distance of 500 m, and height of 175 m needs to be hit with a gun which has a muzzle speed of 620 m/s. At which angle does the gun have to be fired? Express y as a function of x. You may want to use the trig identity $\sec^2=1+\tan^2$

tanθ=0.357degrees

2. [10] A curve needs to be embanked so that cars can drive through it at a speed of 52.5 mph without needing friction. If the radius of the curve is 95.0 m, find the angle of embankment. Derive your answer and make a drawing, indicating all exterior forces.

Θ=30.3 degrees

3. A box of mass 25.0 kg is initially at rest on an inclined plane of angle 37.0 degrees with the horizontal. The coefficient of kinetic friction between the box and the plane is 0.300. A woman pushes against the box with a force parallel to the inclined plane. She manages to accelerate the box from 0.000 to 2.50 m/s over a distance of 12.5 m. (MAKE A DRAWING AND INDICATE THE FORCES)

[10] Find the acceleration of the box and the force with which the woman pushes it.

$a=0.25 m/s^2$; F=212N

4. [10] A person walks along a straight line at a speed of 4.00m/s. She then turns at a right angle and walks the same distance at a speed of 10.0m/s. She then returns to the starting point in a circular arc at a speed of 5.00 m/s. What is her average speed?

v=5.38m/s

5. [10] A boy kicks a ball horizontally off a cliff 55.0 m above sea-level. He hears the ball splash into the water 3.70 seconds later. Find the initial velocity of the ball. Assume that the speed of sound in air is 340 m/s (Make a sketch).

V_0=31.5m/s

6. A plane flying at an altitude of 575 m in a direction of 20.0 degrees above the horizontal releases a package. The plane has a velocity of 200 miles per hour. (Make a drawing and show your quantities with directions!)

   a) [5] How far will the package travel horizontally before it hits the ground?

x=1200m; t=14.37 s

   b) [5] Find the velocity of the package when it hits the ground, magnitude and direction.

v=139m/s; angle = -52degrees

7. Our planet Jupiter has a period of revolution of 0.410 days and a radius of 71,398 km, and a mass of $1.90 \cdot 10^{27}$ kg. (Use 4 significant figures.)

[10] Calculate the effective weight (as measured on location) of one kilogram at the equator.

W=22.64N

8. [10] A race car accelerates along a circular racetrack with constant acceleration. It starts from 0 velocity. Find the angle in degrees between the centripetal acceleration and the resultant acceleration after the car has completed two full circles.

$\tan\theta = 1/8\pi$

9. [10] Find the relative velocity of a proton moving at a speed of 0.900 c with respect to another proton moving in the same direction with a speed of 0.755 c. (Relativistic)

0.452c

10. [10]] Find the value of the function f as well as the relative and absolute error:

$$f(r,h,m) = \frac{\pi r^2 h}{m};$$

the variables were measured as follows: r =1.78cm Δr=0.006cm; h =2.34cm Δh=0.005cm; m=13.4 g Δm=0.06g.

f=1.74 cm^3/g ; Δf=0.02 cm^3/g

The following problems are from the other test (b):

11. [10] A gun is fired at an angle of 37.0 degrees and initial velocity of 78.5 m/s. Derive the formula for the highest point y. Start with the kinematic formulas in the x and y direction. Calculate the highest point with the relative and absolute uncertainty. State all your results with the correct number of significant figures. Assume that the absolute error in the angle is 0.01 radians the error in the initial velocity is 0.2m/s.

Y=114m Δy=4m

12. [10] Find the minimum coefficient of static friction for the tires of a car so that it can drive through a horizontal curve without embankment at a maximum speed of 60.0 mph. The radius of the curve is 95.0 m. Derive your answer and make a drawing, indicating all exterior forces with proper directions.

~~μ=0.756~~

13. [10] A person walks along a straight line at a speed of 3.00m/s. She then turns at a right angle and walks twice the distance at a speed of 5.00m/s. She then returns to the starting point in a straight line at a speed of 4.50 m/s. What is her average speed?

v=4.256 m/s

14. [10] A pilot flies his plane in a vertical circular loop of radius 850 m. maintaining the speed of 225 mph. Calculate his apparent weight at the top and at the bottom of the loop, if his regular weight is 1.90E3 N.

W_t=~~380~~ N; W_b=~~4,180~~ N

15. A plane flying at an altitude of 575 m in a direction of 20 degrees below the horizontal releases a package. The plane has a velocity of 200 miles per hour. (Make a drawing and show your quantities with directions!)

c) [5] How far will the package travel horizontally before it hits the ground?

X=682m, t=8.17 s

d) [5] Find the velocity of the package when it hits the ground, magnitude and direction.

V=139 m/s, θ=-52'

16. [10] Find the relative velocity of a proton moving at a speed of 0.900 c with respect to another proton moving in the opposite direction with a speed of 0.650 c. (Relativistic)

v=0.987c