Physics 2610: General Physics I

Final Exam

1.) (**Conceptual**)

A.) The moon is about 380,000 Km away. It was apparently formed much closer to the earth, having been formed only a few earth radii away. Precision measurements indicate that its orbit is actually getting bigger by about 3 centimeters per year. Use this to get a crude estimate of the age of the moon.

B.) A diver jumps off a diving board, making an arc into the water. Determine the acceleration at the top of the arc. Which way does the acceleration point when the diver is halfway into the water?

C.) The following projectiles are shot at the same time on level ground. Which of them reaches the ground first?

D.) A mass is spiral into a point, on a trajectory as shown. If the acceleration is constant, must the object be speeding up, staying at constant speed OR slowing down?

E.) Newton's third law states that forces come in equal but oppositely directed pairs. A motorcycle is racing down a level road. Where is the pair force to the weight of the motorcycle? Short answer only!

F.) What are the two types of waves, **and** give an example for each type.

1.)

2.)

G.) A solid ball (M=.5 Kg, R=.23m), a solid can (M=.1Kg, R=.32m) and hollow can (M=.5Kg, R=.19m) are launched up the same ramp with the same velocity of 4.0 $\frac{m}{s}$. They all roll without slipping. Which of the following are true? (Circle the correct answers)

a.) The solid ball goes furthest up the ramp, then the solid can followed by the hollow can which goes the shortest distance up the ramp.
b.) The hollow can goes furthest up the ramp, followed by the solid can and then the solid ball which goes the shortest distance up the ramp.
c.) The solid can goes furthest up the ramp, followed by the hollow can and then the solid ball which goes the shortest distance up the ramp.
d.) They all go the same height up the ramp.
e.) The ordering of heights to which the objects roll up the ramp is not determined by the given data. Can't tell.

2.) (Chapter 2, Problem 81) A brick is thrown upward at 2.50 $\frac{m}{s}$ off the roof of a building. It hits the ground at the base of the building 3.2 seconds after being thrown.

Compute the height of the building.

3.) (Chapter 5, Problem 71 simplified) Two masses (12 Kg and 7 Kg) are connected by a spring of K=223 $\frac{N}{m}$ as shown. Find the force in the top wire and the acceleration of the system if the spring is .14 meters elongated from its unstretched length.

4.) (Chapter 6, Problem 35) You are a passenger in a car rounding a banked turn of radius 95 meters. The curve's design speed is 75 Km/Hr.

You notice that you are travelling faster than that speed and the fuzzy dice on your dash hang out an angle of 20 degrees with respect to the 'vertical' as seen from inside the car, that is, as measured relative to the mirror stem. What is the radius of the curve and the speed you are are actually travelling at?

5.) (Chapter 7, Problem 67) An athlete (M=70Kg) can bike (m=15Kg) up a 3^o slope at 7.2 $\frac{m}{s}$. There is a drag force of 8.5 newtons due to the tires and the air. Compute the athlete's power output in watts.

6.) (Chapter 9, Problem 11) You are standing underneath a filled spherical water tank that is 11 m in radius. Use the fact that water has a mass of 1000 $\frac{Kg}{m^3}$ (that is, 1000 Kg per cubic meter) to determine by what fraction your weight (as measured by a scale at your feet) is reduced.

7.) (Chapter 11, Problem 61) A ball of mass 1.0kg moving at 3.5 $\frac{m}{s}$ collides in a glancing blow with a ball of mass .2kg that was at rest. The lighter ball goes off at an angle of 80^o degrees from the initial direction of the heavier ball. Compute the speed of the lighter ball and the velocity vector of the heavier ball given that the collision is elastic.

8.) (Chapter 13, Problem 37) A 17Kg dog standing in the center of a turntable which is freely rotating at 2.0 radians per second walks to the out edge and drops off. The turntable has a mass of 23 Kg and a radius of .5 meter. What is the final angular velocity of the turntable?

9.) (Chapter 15, Problem 69) A spring ($K = 25\ \frac{N}{m}$) is attached to a mass ($1.5\ Kg$) and at rest when struck by a bullet (m = .038Kg) which embeds inside the block. The system after the impact executes oscillation with an amplitude of .25m. Determine the initial velocity of the bullet and the final frequency of oscillation.