2013-14 Lab PHYSICS

MIDYEAR TEST REVIEW

Complete the following problems. SHOW ALL WORK for full credit. This includes givens, formulas, units and circle final answers.

Motion in One Dimension:

- 1. Draw position-time and velocity-time graphs to show
 - a. An object at rest.
 - b. An object moving with a constant velocity.
 - c. An object moving with a constant acceleration.

- 2. A car starts from rest and accelerates with a constant positive acceleration. The car moves through a distance of 100m in 10 seconds.
 - a. Find the acceleration of the car. (Ans.2.0 m/s^2)

b. What is the velocity of the car after 5 seconds? (Ans.(10 m/s)

- 3. A train experiences an acceleration of -2.0m/s². If the initial velocity of the train is 50m/s,
 - a. Find the time taken by the train to come to a stop. (Ans. 25 s)

b. Find the distance traveled by the train before it stops. (Ans. 625 m)

- 4. A ball is tossed straight up with a vertical velocity of 10 m/s.
 - a. What is the velocity of the ball at its highest point?
 - b. Find the maximum height reached by the ball. (Ans. 5.1 m)
 - c. Find the total time that the ball is in the air. (Ans. 1.0 s)

Motion in 2-D

A plane flies due south with a velocity of 140m/s. It experiences a wind velocity of 20 m/s west. Draw a diagram and find the resultant velocity (magnitude and direction - include angle) of the plane. (Ans. 141 m/s at 8.2° W of 5 or 81.8° 5 of W)

6. A river flows due east at 1.5 m/s. A boat crosses the river from the south shore to the north shore by maintaining a constant velocity of 10 m/s due north relative to the water. Draw a vector diagram and find the resultant velocity of the boat (magnitude and direction - include angle). (Ans. 10.1 m/s at 8.5° East of North or 81.5° N of East)

7. A rock is thrown horizontally from a 100m high cliff. It strikes level ground 90m from the base of the cliff. At what speed was it thrown? (19.9m/s)

- 8. A scared kangaroo once cleared a fence by jumping with a speed of 8.42m/s at an angle of 55.2° with respect to the ground.
 - a. If the jump lasted 1.4s, how high was the fence? (2.4m)
 - b. What was the kangaroo's horizontal displacement? (6.7m)

Newton's Laws and Forces

- 9. Andrew pulls a 0.75 kg toy car with a horizontal applied force of 4.3 N. The car is moving with a constant velocity.
 - a. Draw a free-body diagram including F_A , F_f , F_g , and F_N .
 - b. Calculate the force of friction. (Ans. 4.3 N)
 - c. Calculate the coefficient of friction between the car tires and the floor. Is this the coefficient of static or kinetic friction? (Ans. 0.58)

d. If Andrew pulls the car for 2.3 m, how much work does he do on the car? (Ans. 9.9J)

- 10. Amber pushes a 1.35 kg book across the desk accelerating it at a constant rate. The coefficient of friction between the book and the desk is 0.088. If she is applying a constant horizontal force of 6.40 N,
 - a. Draw a free-body diagram and calculate the force of friction. (Ans. 1.17 N)

- b. Calculate the horizontal net force. (Hint: Write an equation for the net horizontal force on the book using the force of friction and the horizontal applied force.) (Ans. 5.23 N)
- c. Calculate the horizontal acceleration of the book. (Ans. 3.9 m/s^2)

Circular Motion and Universal Gravitation

- 11. A 5kg dog is attached to a leash that is 6m long. He runs in circles chasing a squirrel while his owner applies a force of 15N.
 - a. What is the speed of the dog? (Ans: 4.24 m/s)
 - b. What is the dog's period? (Ans: 8.9 s)
 - c. What is the frequency of the dog? (Ans: 0.11 Hz or 0.11 rev/s)
- 12. A 20 kg car travels at 18 m/s around a curve with radius 100m. What minimum coefficient of friction between the tires and road will allow the car to round the curve safely? (Ans: 0.33)

13. The gravitational force between Dan and Carl is 4×10^{-7} N. If Dan has a mass of 45kg and Carl has a mass of 60 kg then how far apart are Dan and Carl? (Ans: 0.67m)

- 14. Planet X has a mass of 3×10^{26} kg and radius of 5.5×10^7 m. a. What is the acceleration due to gravity on planet X? (Ans: 6.61 m/s²)
 - b. What is the orbital velocity of a moon 7.5×10^8 m away from planet X? (Ans: 5165 m/s)

c. What is the orbital period of the moon? (Ans: 912370 s)