UNIT 5: CIRCULAR AND HARMONIC MOTION

1. Define what is meant by "uniform circular motion".

2. Define the terms period (T) and frequency (f), state their metric units, and describe how they are related.

3. Given the necessary data, calculate centripetal speed, acceleration, and force during uniform circular motion.

4. Explain what causes acceleration during uniform circular motion.

5. Differentiate between the directions of the velocity and acceleration vectors during uniform circular motion.

6. Differentiate between the terms centripetal and centrifugal.

7. Define and apply the Law of Universal Gravitation and explain who formulated it.

8. Explain why astronauts feel weightless when orbiting Earth.

9. Explain who determined Earth's mass and how it was done.

10. Define what is meant by "simple harmonic motion" and give some examples.

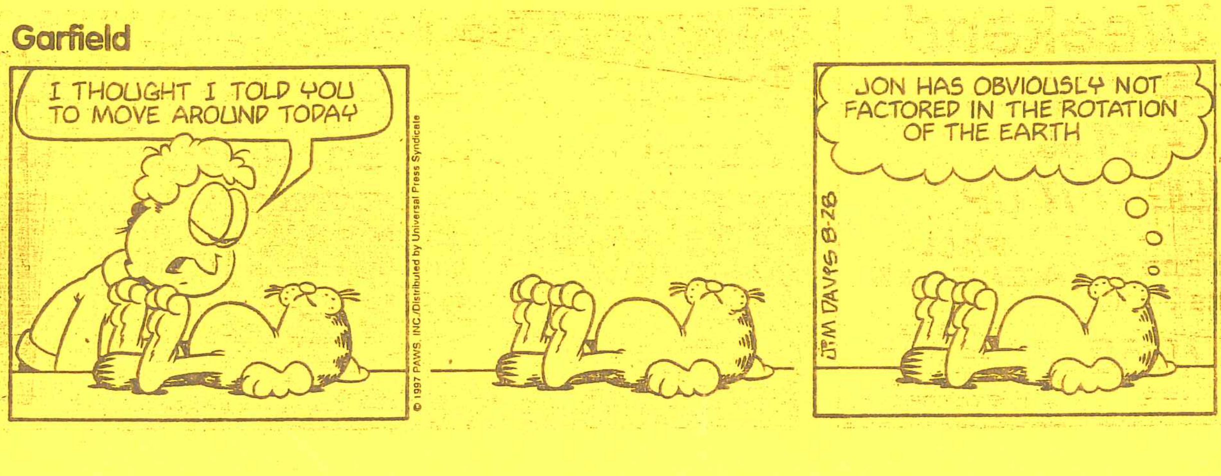
11. Explain on what variables the oscillation of a simple pendulum depends, and construct a graph which displays the relationship of these variables for a swinging pendulum.

12. Define and apply Hooke's Law to a spring-mass system, and construct a graph which displays the relationship among variables for a static and dynamic application of the law.

Reference: Holt Physics (Serway/Faughn), chapters 7.1-7.3, 11.1-11.2

Homework: Homework problem set (on back of this sheet)

Labs: "g" on an Egg, Airplanes/Airplanes!, Simple Pendulum, Hooke's Law



CIRCULAR & HARMONIC MOTION PROBLEMS

1. A 13 g rubber stopper is attached to a 0.95 m string. The stopper is swung in a horizontal circle overhead, making one revolution in 1.20 seconds. Calculate the:
   a. velocity of the stopper.
   b. centripetal acceleration acting on the stopper.
   c. centripetal force acting on the stopper.

2. How would your answers to problem #1 above (all 3 parts) change, if at all, if:
   a. mass of the stopper is doubled?
   b. radius is doubled?
   c. period of revolution is halved?

3. A race car going 32 m/s rounds a curve 56 m in radius.
   a. What is the car's centripetal acceleration?
   b. What is the coefficient of static friction required to keep the car from skidding off the track?

4. A coin is placed on a turntable making 33 ⅓ rev/min.
   a. Calculate the magnitude of the centripetal acceleration when the coin is placed 5.0 cm from the center of the record.
   b. How would your answer to 4a above change if the coin is placed at 10.0 cm?

5. Calculate the centripetal acceleration acting on a person at Earth's equator and use it to explain why nothing on Earth flies off into space.

6. A Cavendish apparatus is used for a gravitation experiment. A large 5.9 kg lead ball is 0.055 m from a small 0.047 kg lead ball. Calculate the force of attraction between them.

7. a. A 24 N weight is hung on a 15 cm-long spring with a spring constant k = 500 N/m. Calculate the new length of the spring.
   b. If the mass-spring system is stretched and set into oscillation, calculate the period T for one cycle.