

Test 3

1) Consider the diatomic molecule hydrogen bromide, HBr. [15 pts]

Determine the moment of inertia, lowest angular velocity and lowest rotational kinetic energy.

2) Consider a 10 kg mass and 40 kg mass attached by a 20 meter rope of mass 20 kg. They rotate around each other at a rate of 2 rad/sec. [15 pts]

Calculate the center of mass, moment of inertia, angular momentum, rotational kinetic energy and tension in the rope. Determine the work required for the 10 kg mass to reel in the rope from 20m to 10m (adding to its mass).

3) A stone grinding wheel with uniform thickness has a diameter of 3 meters and a mass of 1500 kg. Upon starting it undergoes uniform angular acceleration over 10 seconds, from rest to a rate of 2 rotations per second.[15 pts]
Determine the torque and power required to start-up the grinding wheel.

4) Consider a 10 gram mass in the following 1-D potential energy well. [15 pts]

$$PE = \frac{1}{x} + x$$

Determine the equilibrium position and frequency of small oscillations around equilibrium.

5) You hold a 500 gram, 20 cm diameter, circular tray still with your thumb on the top edge and your pointer finger underneath 3 cm in from the edge. A 200 grams apple sits 5 cm in from the opposite edge. [20 pts]

Draw a free body diagram of the system and determine values for all forces on the tray.

Determine the subsequent angular acceleration if you release your thumb.

6) Kieran and Cameron flip a brand new penny to see who will clean the bathroom. The penny travels up to a maximum height of 2 feet above the flip point and rotates 72 times while rising to that height. Determine the total kinetic energy of the penny just after launch and at the peak. [20 pts]