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General Physics I, Final 1
PHYS10400, Class year 100
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SN:_____, Name:_____

Note:
This is an NOT open-book examine. You can NOT use any material you brought.
ABSOLUTELY NO CHEATING!

Problems (Total 5 problems, 100%)

1. A light, rigid rod of length $\ell = 1.00$ m joins two particles, with masses $m_1 = 4.00$ kg and $m_2 = 3.00$ kg, at its ends. The combination rotates in the *xy* plane about a pivot through the center of the rod (Figure shown to the right). Determine the angular momentum of the system about the origin when the speed of each particle is 5.00 m/s.

2. One end of a uniform 4.00-m-long rod of weight F_g is supported by a cable at an angle of $\theta = 37°$ with the rod. The other end rests against the wall, where it is held by friction as shown in Figure on the right. The coefficient of static friction between the wall and the rod is $\mu_s = 0.500$. Determine the minimum distance *x* from point *A* at which an additional object, also with the same weight F_g, can be hung without causing the rod to slip at point *A*.

3. A 1.00-mol sample of hydrogen gas is heated at constant pressure from 300 K to 420 K. Calculate (a) the energy transferred to the gas by heat, (b) the increase in its internal energy, and (c) the work done on the gas.

4. An ideal gas is taken *P* through a quasi-static process described by $P = \alpha V^2$, with $\alpha = 5.00$ atm/m^6, as shown in Figure on the right. The gas is expanded to twice its original volume of 1.00 m^3. How much work is done on the expanding gas in this process?

5. If a sound wave has a speed *v* and frequency *f*.   What is the detected frequency when the source is moving at speed v_s towards the detector and the detector is stationary? (10%) Derive this.