# PHYS 2425 - Dr. Honan - Test 2 - A  Name _____

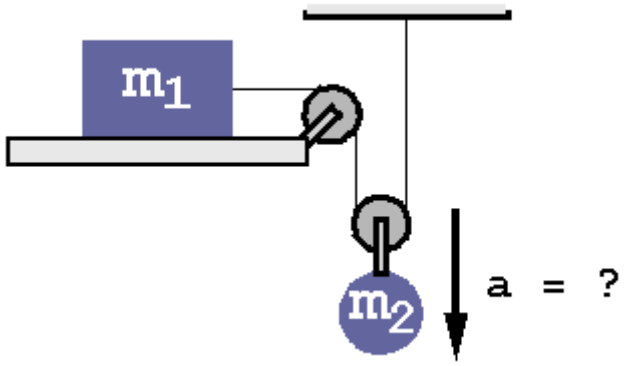
**Possibly Useful Information:** $g = 9.80 m/s^2$

**Problem 1** Short answer (4 points each)

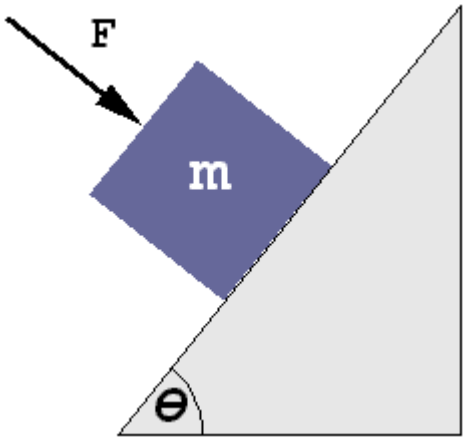
_____ [i] The coefficients of kinetic and static friction between a 1000 lb refrigerator and floor are 0.40 and 0.45 . When at rest the refrigerator is pushed with a horizontal force of 300 lb. What is the force of friction between the refrigerator and floor? (a) 300 lbs (b) 400 lbs (c) 450 lbs (d) 850 lbs (e) 1000 lbs (f) 1300 lbs (g) none of the above

_____ [ii] A car drives up a hill at a constant speed. What are the signs of the changes in kinetic energy and potential energy? (a) $\Delta K > 0, \Delta U > 0$ (b) $\Delta K > 0, \Delta U = 0$ (c) $\Delta K > 0, \Delta U < 0$ (d) $\Delta K = 0, \Delta U > 0$
(e) $\Delta K = 0, \Delta U = 0$ (f) $\Delta K = 0, \Delta U < 0$ (g) $\Delta K < 0, \Delta U > 0$ (h) $\Delta K < 0, \Delta U = 0$
(i) $\Delta K < 0, \Delta U < 0$ (j) It cannot be determined.

**Problem 2** A mass $m_1$ slides on a horizontal surface with a coefficient of kinetic friction $\mu_k$. It is connected by a rope to a hanging mass $m_2$ over the pulley arrangement shown. What is the downward acceleration of the hanging mass $m_2$? (9 points)




**Problem 3** (7 points each)
(a) If the coefficient of static friction between the incline and block is 0.30, then what is the minimum force F needed to prevent the block from sliding? m = 20 kg and $\theta = 50°$




(b) A 300 g glider moves at 0.3 m/s on an air track toward a 200 g glider moving in the opposite direction at 0.6 m/s. If the collision is elastic then what are both final velocities?

 **Name _____**

**Problem 4** (6 points each)

(a) If the two masses $m$ and $M$ are separated by a distance $d$ then how far is the center of mass from $M$.

(b) A 1500 kg car drives at the bottom of a trough with an effective radius of 80 m at a speed of 20 m/s. What is the normal force of the road on the car?

(c) A 0.06 kg bullet moving horizontally at 300 m/s collides with and passes through a 2 kg block, initially at rest. The bullet exits the block at 100 m/s. This causes the block to slide along the floor a distance of 12 m before stopping. What is the coefficient of kinetic friction between the block and the floor?

(d) Before being hit by a bat, a 0.15 kg baseball has a velocity of $-40\ \text{m/s}\,\hat{x}$. It leaves the bat with velocity $\vec{v} = \langle 45,35 \rangle\ \text{m/s}$. If the bat and ball are in contact for 0.03 s then what is the average force of the bat on the ball?

(e) What is the angle between $\vec{A} = \langle -3,6,-4 \rangle$ and the positive x-axis?

(f) A car moving at 3 m/s hits a truck, with twice the car's mass, moving in *opposite direction* at 2 m/s. It the bumpers lock and the car and truck stick together, then what is their final velocity?

 **Name _____**

**Problem 5** (7 points each)

(a) A mass *m* swings in a vertical circle at the end of a rope of length *L*. What is the minimum speed the mass must have at the bottom for it to pass over the top without the string collapsing?

(b) A banked curve has a turn radius of *R* and is banked at an angle of $\theta$. At exactly what speed could a car take the curve without slipping on a very icy day when there is no friction?

(c) A 0.30 kg mass slides on a horizontal surface with friction. Initially the mass compresses a horizontal spring (with a spring constant of 45 N/m) by 0.20 m. After it is released the mass moves a total distance of 1.5m before stopping. What is the coefficient of kinetic friction between the mass and surface?

**Problem 6** (6 points each)

(a) A space station with a radius of 120 m rotates once every 70 s to create artificial gravity. If the astronaut has an earth weight of 160 lbs, then what is its artificial weight?

(b) A 2000N crate initially at rest is dragged along a horizontal floor a distance of 3m by a rope with a tension of 800N at an angle of 35° from horizontal while a 500N friction force acts backward. What is the final speed of the crate?