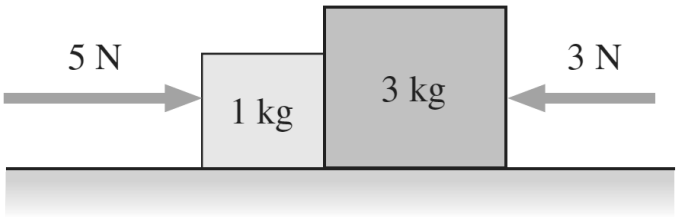
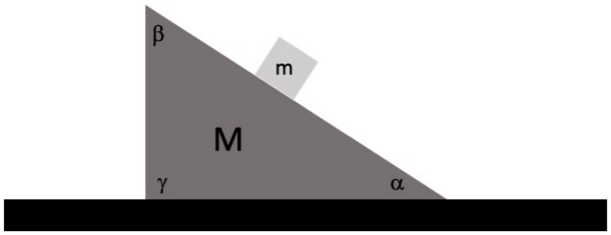
Chapter 4 Written Homework Problems
DUE: February 10 at the beginning of class
SHOW ALL WORK FOR FULL CREDIT
EXPRESS ALL ANSWERS IN *SI* UNITS

1. What is the net force on *(a)* the 3-kg-block and *(b)* the 1-kg-block?



2. A locomotive is pulling three train cars with a horizontal force, sometimes referred to as the 'tractive effort', $\boldsymbol{F_L}$. The car immediately behind the locomotive has mass of m_1, the next a mass of m m_2, and the last a mass of m_3. What is the tension in the coupler between the cars of mass m_1 and m_2 and the coupler between the cars of mass m_2 and m_3? Take $\boldsymbol{F_L}$ = 500 kN, $m_1 = 6 \times 10^4$ kg, $m_2 = 1 \times 10^5$ kg, and $m_3 = 4 \times 10^4$ kg.

3. A block of mass *m* rests on an inclined plane of mass *M* as shown in the Figure. The inclined plane is fixed to the Earth and the surface between the block and plane is frictionless. The block slides down the plane with acceleration *a*. What is the magnitude of the normal force on the block in terms of *a*, *g*, and *m*? Take $\gamma = 90^o$



4. As in problem 3 above a block of mass *m* rests on an inclined plane of mass *M* as shown in the Figure. However now the surfaces between *M* and the Earth and *M* and *m* are both frictionless. If we want to prevent mass *m* from moving in the vertical direction, *(a)* What must be the acceleration of *M* (relative to the Earth)? *(b)* What horizontal force must be applied to *M* to keep *m* from moving vertically? Take $\alpha = 30^o$ and $\gamma = 90^o$.

5. Again as in Problem 3 however now the inclined plane is fixed to the floor of an elevator. The surface between the block and plane is frictionless. What is the acceleration of the block relative to the incline if the elevator is *(a)* lowered at a constant velocity, $\boldsymbol{v_e}$; *(b)* raised at a constant velocity, $\boldsymbol{v_e}$; *(c)* lowered with an acceleration $\boldsymbol{a_e}$, *(d)* lowered with a deceleration $\boldsymbol{a_e}$. *(e)* dropped because the cable breaks.

6. You hang on one end of a rope that passes over a frictionless, massless pulley. The mass of the block is 1.1 times your mass. To prevent the block from moving, with what acceleration must you climb the rope?