Forces, Friction, and Motion

1) A bus brakes suddenly and a passenger appears to move forward. Explain why the passenger is thrust forward and which forces are acting on the bus.

2) A 940 kg refrigerator is at rest on a frictionless floor. One person pulls 78 N left, another pulls 120 N right. Find the refrigerator's acceleration (magnitude and direction).

3) A 1200 kg car accelerates from rest to 16 m/s in 5.0 s. Find the net force required.

4) In space, an 86 kg astronaut pushes a 2.4 kg ball from rest, giving the ball an acceleration of 3.3 m/s^2.
    a. Compare the force on the ball and the force on the astronaut.
    b. Find the astronaut's acceleration (magnitude and direction).

5) A **42 kg** crate sits on a horizontal floor. The coefficients of friction are μ_s **= 0.40** and μ_k **= 0.30**.
    a. A worker pulls horizontally with **150 N**. Does the crate move?
    b. The worker now pulls horizontally with **220 N**. Find the crate's **acceleration**.
    c. Starting from rest under the **220 N** pull, how far does the crate move in **4.0 s**?

6) A 38 kg crate is on a horizontal floor. It takes 170 N to start it moving and 120 N to keep it sliding at constant speed.
    a. Find μ_s.
    b. Find μ_k.

7) A car (m=1000 kg) travels 18 m/s on level pavement. The wheels lock and the kinetic friction coefficient is 0.62. Find the stopping distance.

8) A **6.0 kg** block Type equation here.rests on a horizontal table (coefficients: μ_s **= 0.30**, μ_k **= 0.25**). It's connected by a light string over a frictionless pulley to a **4.0 kg** hanging block.
    a. Will the system start moving? Justify quantitatively.
    b. If it moves, find the **acceleration** of the system.
    c. Find the **tension** in the string while it moves.

9) A 3.2 kg wooden block is held between two vertical hands that press horizontally on opposite sides. The static friction coefficient is 0.53. What minimum pressing force must **each** hand apply so the block doesn't fall?

10) Mass M= **8.0 kg** rests on a horizontal table with μ_k **= 0.20**. It's connected on the left over a frictionless pulley to a **5.0 kg** hanging mass m_L, and on the right over another frictionless pulley to a **7.0 kg** hanging mass m_R. Strings and pulleys are ideal.
    a. Determine the **direction of motion** and the **magnitude of the acceleration** of the system.
    b. Find the **tension** in the **left** string and in the **right** string.
    c. After the system moves **3.0 m**, compute the **work done by friction** on the tabled mass.