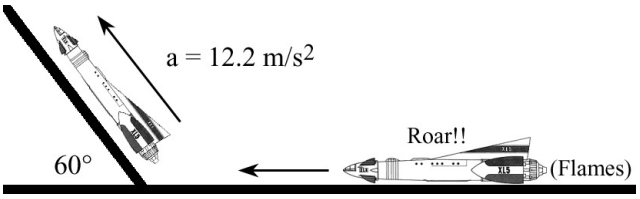
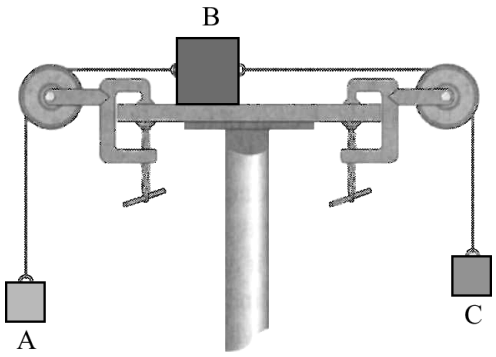
**Quiz 2, Phyx 135-1, Fall 2009, Solutions**

1) The retro-beyond-retro, black-and-white TV show *Fireball XL5* started every episode with the spaceship roaring along a level track. Then it hit a 60° ramp and blazed upwards to its next thrilling adventure! Suppose Fireball XL5 has a **net** acceleration of 12.2 m/s$^2$ **along** the ramp as it rises. If the pilot's chair faces forward inside the ship (seat is parallel to the ramp, chair's back is perpendicular to the ramp), what force is pressing against the chair's seat and back, respectively, if the pilot has a mass of 80 kg?


**Solution:** The force of gravity acting on the pilot is F = mg = (80 kg)(9.8 m/s$^2$) = 784 N. The force direction is down, so the component along the ramp is (784 N) sin(60°) = 679 N, and the component normal to the ramp is (784 N) cos(60°) = 392 N. The acceleration of Fireball XL5 is entirely along the ramp, so the weight on the chair's seat is just the normal component, 392 N. The weight on the chair's back must include the ship's acceleration, so F = 679 N + (80 kg)(12.2 m/s$^2$) = 1655 N.

2) In the figure at right, the masses of the three blocks are A = 5.6 kg, B = 3.4 kg, and C = 1.2 kg. Mass B is setting on a horizontal, frictionless surface. A and C are connected to B by massless cords rolling over frictionless wheels.
a) What is the acceleration of mass B? Also specify the direction.
b) What is the difference in tension between the left and right cords?




**Solution:**
a) The net force acting on the system is the difference in the weights of A and C, or F = g(5.6 kg – 1.2 kg) = 43.1 N. The acceleration of the system is then a = F/m = 43.1/(5.6 + 3.4 + 1.2) = 4.23 m/s$^2$. Mass B is accelerating at 4.23 m/s$^2$ to the left.

b) If mass B is accelerating at 4.23 m/s$^2$, then there is a net force acting on it of F = (3.4 kg)(4.23 m/s$^2$) = 14.4 N. Since the only forces acting on mass B are the two tensions, the difference between them must be 14.4 N.