Physics **Practice Problems: Levers and CG**

On a separate piece of paper, write-out the solutions to each problem. Each solution must include:

1) a sketch of the problem
2) a lever diagram with labeled lever-arms and fulcrum
3) write a balanced torque equation
4) solve for the unknown quantity

1) Two children balance each other on a seesaw with the fulcrum in the middle. One weighs 500-N and sits at one end of a 4-m seesaw.

a) Why can you ignore the weight of the see-saw?
b) Where should the other child be seated if the bar is uniform and the second child weighs 750 N?

2) Suppose you setup a solitary see-saw like you did in lab to balance a 1000-g mass at the 0-cm mark. If the meterstick has a mass of 200 g, where should the fulcrum be located?

3) A bridge, which is 100 meters long, has a 10-ton truck 65 meters from one end. Neglecting the weight of the bridge, what fraction of the weight of the truck must each end of the bridge support?

4) A tapered pole (one end is thicker than the other) 10 meters long is carried by two men, one at each end. One man exerts a force of 600 N and the other 300 N.

a) What is the weight of the pole?
b) Where is the CG of the pole?

5) A uniform plank, which is 32 ft long and weighs 80 lb projects 8 ft horizontally from the top of a cliff. How far can a daredevil who weighs 160 lb, "walk the plank" beyond the cliff before it will tip down?

6) Two men lift a 20-m pole that weighs 250 N. The CG of the pole is 8 m from one end.

a) How much does each man exert against the pole at each end?
b) What is the sum of the forces each man exerts?

7) A man is cutting a wire by using a pair of wire-cutters. He exerts a force of 50 N at a distance of 10 cm from the fulcrum. The wire is positioned for cutting on the blades at a distance of 0.5 cm from the fulcrum.

a) What force does each blades exert on the wire?
b) What is the net force on the wire due to the two blades?
c) What is compressive force is exerted on the wire by the two blades?

8) The CG of a wheelbarrow and its load is 12 inches from the axle. A woman lifts the load by applying a force of 24 lb on the handle a distance 3 ft from the axle. What is the combined weight of the load and the wheelbarrow?

9. A rectangular 40-lb raft is oriented with its front side towards the shore. Initially, the front of the raft is 12 feet from the shore. Rocky, a 10-lb dog, walks from the far end to the front end of an 8-ft raft. As the dog walks forward, the raft moves backwards (conservation of momentum). Assuming no friction between the raft and the water, how far is Rocky from the shore?