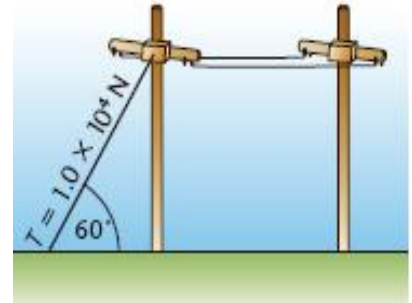# Static Equilibrium – 1st Condition of Static Equilibrium

1. A guy wire with a tension of 1.0 x 10^4 N and at an angle of 60° from the ground is attached to the top of a hydroelectric pole, as shown. What are the horizontal and vertical components of the force exerted by the wire at the top of the pole in order to maintain the system in static equilibrium?
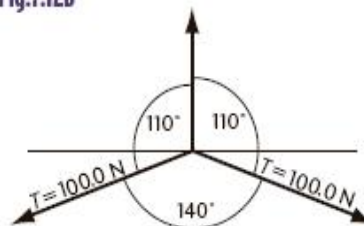
2. A canoe is tethered to a car with ropes, as shown in Fig. 7.12A. What is the tension in the vertical rope if the junction (assumed massless) is held at static equilibrium by the two lower ropes, each with a tension of 100.0 N?

    Fig.7.12A   Fig.7.12B

3. Forces can also be applied by compressing or tensing a rigid object such as a beam. Two beams support a 4.0-kg pail of water above an open well, as shown in Fig. 7.13.

    Fig.7.13

    a) How much compression force is exerted on each beam by the water pail?
    b) What outward force do the two beams exert on the well's wall?
    c) What additional vertical compression is exerted on the bricks under the beams?
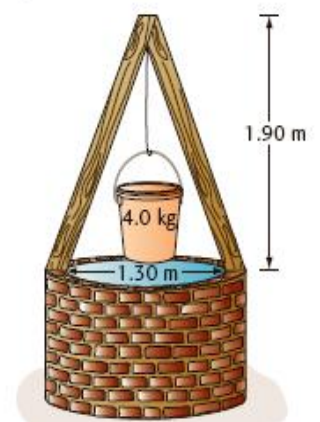
4. A boat of mass 400.0 kg is on a trailer at an angle of 30°, as shown in Fig. 7.14. There is a coefficient of static friction of 0.25 between the boat and the trailer rollers. What must be the tension in the cable to keep the boat in static equilibrium?
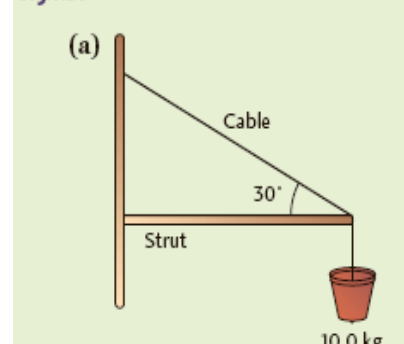
    Fig.7.14
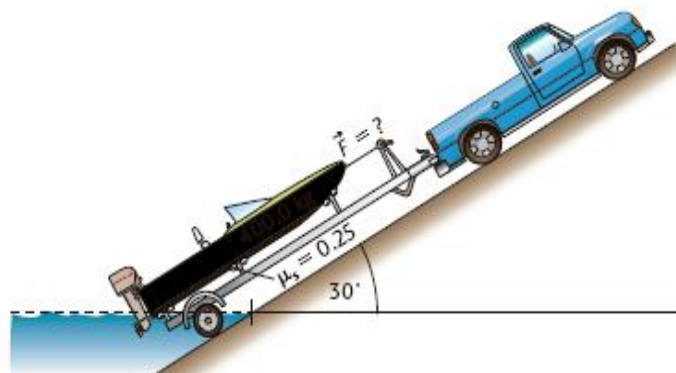
5. A 10.0-kg flowerpot is suspended from the end of a horizontal strut by a cable attached at 30° above the horizontal, as shown in Fig. 7.55.

    Fig.7.55

    a) If the strut has no mass, find the tension in the cable.
   b) How much horizontal force must the strut provide?

6. A 100.0-kg mass is suspended from two ropes, each at an angle of 30° to the vertical. What is the tension in each rope?

7. What maximum mass, m, can be supported by the strut-and-cable arrangement in Fig. 7.56 if the maximum force on the strut is 2500 N?

Fig.7.56
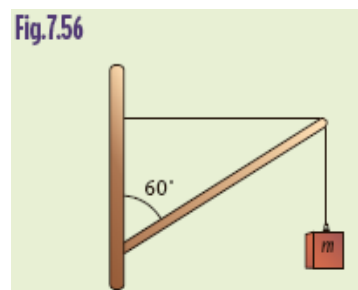
8. A 500-kg load of drywall is lifted up the side of a building by a crane. When the load is pulled to the side by a horizontal rope, the support cable of the crane makes an angle of 12° to the vertical. What is the tension in the support cable? What is the tension in the horizontal rope?

cable

20°

T_{rope}

F_g
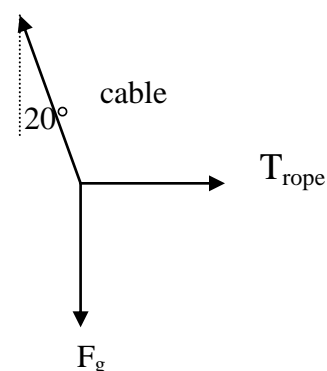
9. A car is stuck in a snow bank, but the driver is very knowledgeable about physics. She ties a rope from her car to a tree 25.0 m away and then pulls sideways on the rope at the midpoint. If she applies a force of 425 N and draws the rope over a horizontal distance of 1.5 m, how much force is applied to the car?

F_A

1.5 m

25 m
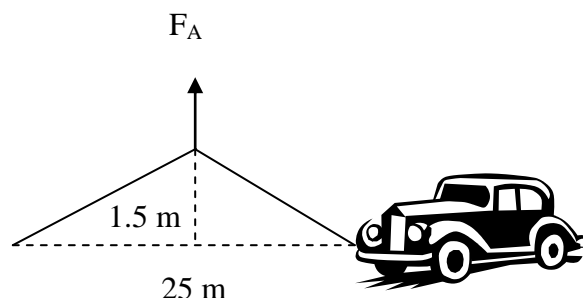
10. A bird lands on a telephone wire midway between two poles 18 m apart. The wire (assumed weightless) sags by 52 cm. If the tension in the wire is 90 N, what is the mass of the bird?

11. When a person's thighbone (femur) is broken, the muscles draw the broken parts so tightly together that the length of healed leg is slightly shorter than its original length. In the past, a traction device (see Fig. 7.57) was used to oppose the natural muscle tension, allowing the bone to heal properly. What is the magnitude and direction of the tension force applied to the femur if the mass of the leg is 3.75 kg?

40°

40°

5 kg