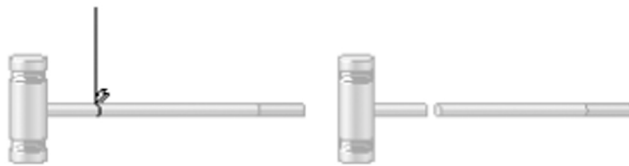


- 1) If the sum of the external forces on an object is zero, then the sum of the external torques on it must also be zero.
A) True B) False
- 2) If the sum of the external torques on an object is zero, then the sum of the external forces on it must also be zero.
A) True B) False
- 3) If the sum of both the external torques and the external forces on an object is zero, then the object must be at rest.
A) True B) False
- 4) When a car is weighed, it is driven slowly on a horizontal floor over a scale that records a reading as the front wheels go over the scale, and then records a second reading as the rear wheels go over the scale. The weight of the car is equal to
A) the average of the two weights.
B) the sum of the two weights.
C) the difference of the two weights.
D) the weight under the rear wheels.
E) the weight under the front wheels.
- 5) A croquet mallet balances when suspended from its center of mass, as shown in the left part of the figure. If you cut the mallet into two pieces at its center of mass, as shown in the right part of the figure, how do the masses of the two pieces compare? (There could be more than one correct choice.)



- A) The piece with the head of the mallet has the smaller mass.
B) The masses are equal.
C) The piece with the head of the mallet has the greater mass.
D) It is impossible to tell.
- 6) A 25-kg piece of equipment can be hung by steel wires of length 1.00 m, 2.00 m, or 3.00 m. If all the wires have the same diameter, which one will stretch the greatest percent?
A) the 1.00-m wire B) the 3.00-m wire
C) the 2.00-m wire D) They will all stretch by the same percent.
- 7) Which of the following are SI units of Young's modulus? (There could be more than one correct choice.)
A) $\text{N/m} \cdot \text{s}^2$ B) $\text{kg} \cdot \text{m/s}^2$ C) $\text{kg/m} \cdot \text{s}^2$ D) kg/m^2 E) $\text{kg} \cdot \text{m}^2/\text{s}^2$
- 8) Two solid spheres are made from the same material, but one has twice the diameter of the other. Which sphere will have the greater bulk modulus?
A) the larger one
B) the smaller one
C) It will be the same for both spheres.

9) Which one of the following would be expected to have the *smallest* bulk modulus?

- A) solid iron
- B) liquid water
- C) liquid mercury
- D) solid uranium
- E) helium vapor

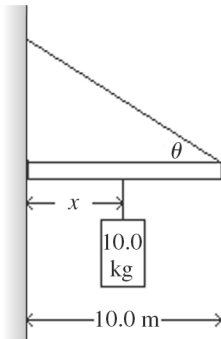
10) A 15-kg child is sitting on a playground teeter-totter, 1.5 m from the pivot. What is the magnitude of the minimum force, applied 0.30 m on the other side of the pivot, that is needed to make the child lift off the ground?

11) An 82-kg painter stands on a long horizontal board 1.55 m from one end. This 27-kg board is uniform, 5.5 m long, and supported at each end by vertical posts.

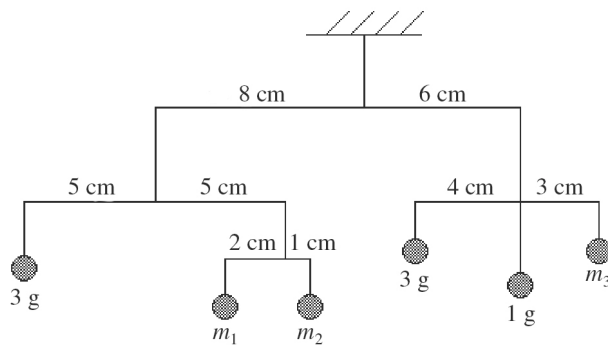
(a) What is the magnitude of the *total* force provided by *both* posts?

(b) With what force does the post that is closest to the painter push upward on the board?

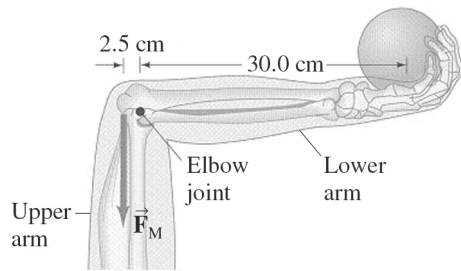
12) As shown in the figure, a 10.0 m long bar is attached by a frictionless hinge to a wall and held horizontal by a light rope that makes an angle $\theta = 49^\circ$ with the bar. The bar is uniform and weighs 66.5 N. What distance x from the hinge should a 10.0 kg mass be suspended for the tension in the rope to be 177 N?



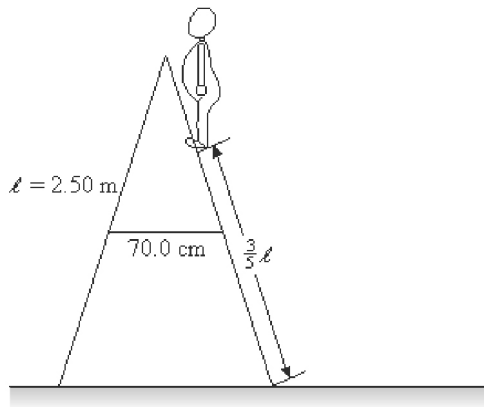
13) The mobile shown in the figure is perfectly balanced, and the horizontal supports have insignificant masses. What must be the masses of the suspended objects m_1 , m_2 , and m_3 to maintain balance?



- 14) An athlete holds a 7.5-kg shot put in his hand with his lower arm horizontal, as shown in the figure. His lower arm has a mass of 2.8 kg and its center of gravity (or center of mass) is 12 cm from the elbow-joint pivot. How much force must the extensor muscle (which is $\vec{F}_M$ in the figure) in the upper arm exert on the lower arm?



- 15) A stepladder consists of two halves that are hinged at the top and connected by a tie rod which keeps the two halves from spreading apart. In this particular instance, the two halves are 2.5 m long, the tie rod is connected to the center of each half and is 70 cm long. An 800-N person stands $3/5$ of the way up the stepladder, as shown in the figure. The ladder is light enough that we can neglect its weight, and it rests on an extremely smooth floor. What is the tension in the tie rod? (Note: To solve this problem, it is helpful to imagine cutting the ladder in half vertically and consider the forces and torques acting on each half of the ladder.)



- 16) A steel wire, 3.2 m long, has a diameter of 1.2 mm. The wire stretches 1.6 mm when it bears a load. Young's modulus for steel is 2.0×10^{11} Pa. The mass of the load is closest to
- 17) A 1200-kg car is being raised with a constant acceleration of 2.53 m/s^2 by a crane, using a 20-m long steel cable that is 1.5 cm in diameter. Young's modulus for steel is $2.0 \times 10^{11} \text{ N/m}^2$. What is the change in length of the cable caused by lifting the car?
- 18) A 12-L volume of oil is subjected to pressure which produces a volume strain of -3.0×10^{-4} . The bulk modulus of the oil is 6.0×10^9 Pa and is independent of the pressure. The reduction in the volume of the oil in milliliters is closest to
- 19) A shear force of 400 N is applied to one face of an aluminum cube having sides of 30 cm each. What is the resulting displacement of this face of the cube if the opposite face is held fixed? The shear modulus for aluminum is $2.5 \times 10^{10} \text{ N/m}^2$.

- 20) A 25-kg television set rests on four rubber pads, each one having a height of 1.0 cm and a radius of 0.60 cm. A 200-N horizontal force is applied to the television set. How far does it move sideways due to the deformation of the rubber pads if the pads do not slide on the floor? The shear modulus of these rubber pads is 2.6×10^6 Pa.

Answer Key

Testname: HW_CH09_STATICS_ELASTYICITY

- 1) B
- 2) B
- 3) B
- 4) B
- 5) C, D
- 6) D
- 7) C
- 8) C
- 9) E
- 10) 740 N
- 11) (a) 1100 N (b) 710 N
- 12) 10 m
- 13) $m_1 = 1 \text{ g}$, $m_2 = 2 \text{ g}$, and $m_3 = 4 \text{ g}$
- 14) 1000 N
- 15) 140 N
- 16) 12 kg.
- 17) 8.4 mm
- 18) 3.6 mL.
- 19) $5.3 \times 10^{-8} \text{ m}$
- 20) 1.7 mm