Practice Quiz (Equilibrium and rotation)

1) A 15.0-kg child is sitting on a playground teeter-totter, 1.50 m from the pivot. What force, applied 0.300 m on the other side of the pivot, is needed to make the child lift off the ground?
   A) 75.0 N  
   B) 736 N  
   C) 44.1 N  
   D) 66.2 N  
   Answer: B

2) An 82.0-kg diver stands at the edge of a light 5.00-m diving board, which is supported by two pillars 1.60 m apart, as shown in Figure. Find the force exerted by pillar A.
   A) 1.71 kN downwards  
   B) 1.71 kN upwards  
   C) 2.51 kN downwards  
   D) 2.51 kN upwards  
   Answer: A

3) A 120-kg refrigerator, 2.00 m tall and 85.0 cm wide has its center of mass at its geometrical center. You are attempting to slide it along the floor by pushing horizontally on the side of the refrigerator. The coefficient of static friction between the floor and the refrigerator is 0.300. Depending on where you push, the refrigerator may start to tip over before it starts to slide along the floor. What is the highest distance above the floor that you can push the refrigerator so that it won't tip before it begins to slide?
   A) 1.00 m  
   B) 1.21 m  
   C) 1.42 m  
   D) 1.63 m  
   Answer: C

4) A 5.00-m-long ladder, weighing 200 N, rests against a smooth vertical wall with its base on a horizontal rough floor, a distance of 1.30 m away from the wall. The center of mass of the ladder is 2.50 m from its base, and the coefficient of static friction between the ladder and the floor is 0.200. How far up the ladder, measured along the ladder, can a 600-N person climb before the ladder begins to slip?
   A) 1.26 m  
   B) 1.05 m  
   C) 3.95 m  
   D) 4.12 m  
   Answer: D

5) A store's sign, with a mass of 20.0 kg and 3.00 m long, has its center of gravity at the center of the sign. It is supported by a loose bolt attached to the wall at one end and by a wire at the other end, as shown in Figure. The wire makes an angle of 25.0° with the horizontal. What is the magnitude of the force exerted by the bolt on the sign?
A) 464 N  
B) 232 N  
C) 196 N  
D) 297 N
Answer: B

6) A meter stick balances at the 50.0-cm mark. If a mass of 50.0 g is placed at the 90.0-cm mark, the stick balances at the 61.3-cm mark. What is the mass of the meter stick?
A) 127 g  
B) 178 g  
C) 32.6 g  
D) 73.4 g
Answer: A

7) A 3.50-g bullet, traveling at 250 m/s, hits a hinged, light board at right angles, at a distance of 65.0 cm from its hinges, and emerges on the other side of the board with a speed of 150 m/s. The board is initially stationary but is free to rotate about its hinges and has a moment of inertia of 0.275 kg•m². What is the angular speed of the board after the bullet emerges?
A) 0.827 rad/s  
B) 3.05 rad/s  
C) 0.0212 rad/s  
D) 22.6 rad/s
Answer: A

8) A solid wood door, 90.0 cm wide by 2.00 m tall has a mass of 35.0 kg. It is ajar and at rest. A ball with a mass of 500 g is thrown perpendicular to the door with a speed of 20.0 m/s and hits the door 60.0 cm from the hinged side. The ball rebounds with a speed of 16.0 m/s along the same line. What is the angular speed of the door after the collision?
A) 0.127 rad/s  
B) 0.925 rad/s  
C) 1.14 rad/s  
D) 4.57 rad/s
Answer: C

9) You are holding a finishing sander with your right hand. The sander has a flywheel which spins counterclockwise as seen from behind the handle. You are sanding a wall in front of you. As you turn the sander towards the right, you feel a tendency in the sander to
A) turn upward.  
B) turn downward.  
C) push toward you.  
D) pull away from you.
Answer: B
10) When you ride a bicycle, in what direction is the angular velocity of the wheels?
A) to your left
B) to your right
C) forwards
D) backwards
Answer: A

11) A merry-go-round spins freely when Janice moves quickly to the center along a radius of the merry-go-round. It is true to say that
A) the moment of inertia of the system decreases and the angular speed increases.
B) the moment of inertia of the system decreases and the angular speed decreases.
C) the moment of inertia of the system increases and the angular speed increases.
D) the moment of inertia of the system increases and the angular speed decreases.
Answer: A

12) You are walking holding on to the axle of a spinning bicycle wheel with one hand on either side of the wheel. The top part of the wheel is moving away from you and the bottom is moving toward you and the axle is horizontal. As you start to turn left, you feel the right side of the axle
A) push on your right hand toward you.
B) pull on your right hand away from you.
C) push on your right hand vertically up.
D) push on your right hand vertically down.
Answer: D