No clickers & YES calculators.

Get the mini-lab from the podium.

Have your notebook ready!!

Mar 24-9:24 AM

8.3 Equilibrium

I. Center of mass (Def.)

A. The point on an object that moves in the same way that a point particle would move.

B. Look at Fig. 8 - 11 on page 211 of the wrench -

C. How to find the center of mass

1) Suspend an object from any point and draw a vertical line when the object stops swinging from that the suspension point.

2) Suspend an object using another point and draw a second vertical line when the object stops swinging from that point.

3) Where the 2 vertical lines intersect is the center of mass

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D. Center of mass for the HUMAN body

1) Arms are down at your side = few cm below the navel. 1/2 way between the front and back.

2) If you lift your arms up - Center of mass rises up 6-10 cm

3) pg. 212 figure 8-12 Ballet dancer

4) Fork trick - Center of mass allows the forks to balance

E. Stability-

1) If the center of mass is above the point of support then torque in each direction = 0 (use the big box)

An **unstable object**, the center of mass is OUTSIDE the base of the object.

Stable object requires a external force to tip it. A force acts to apply a torque on the object. Weight apply torque in opposite direction.

2) Broad base = stable object

3) Taller objects have higher center of mass which means:(Figure 8-14 pg. 213)

Low vehicles Lower center of mass Taller vehicles higher center mass

An object is more likely to not tip if its center of mass is Low

4) Mini lab pg. 213

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Correct pg. 208 21 - 24 for accuracy.

21. When r is doubled, I is multiplied by a factor of 4.
22. The more of the mass that is located far from the center, the greater the moment of inertia. Thus, the hollow ball has a greater value of I.
23. The moment of inertia is greater when rotating around sphere A.
24. rotation about sphere A = $5mr^2$ = 0.020 kg m^2
rotation about sphere C = $2mr^2$ = .0080 kg m^2

pg. 210 25 - 29 all for completion

25. 16 rev/s
26. 9.0 N
27. 5.5 N
28. 4.3 N
29. 7.7 N

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F. Conditions for Equilibrium

1. Static equilibrium
   - a) velocity and angular velocity = 0
     or are constant
   - b) Object must be in translational equilibrium
     (net force on an object = 0)
   - c) Object must be in rotational equilibrium
     (net torque on an object = 0)

G. Rotating Frames of reference

1. Centrifugal "Force"
   - a) NOT a true force
   - b) Feeling of being thrown out of rotational motion
     (fall out a door when going around a corner)
     pulled toward the outer edge of a rotating object
   - c) Actually due to Inertia
     - body wants to go straight
   - d) Rotating frames of reference are: accelerated
   - e) Centripetal acceleration is proportional to the distance from the axis of rotation and depends on the SQUARE of the angular velocity.

Ex: the rotational frequency = 6
the centripetal acceleration increases by a factor of 36

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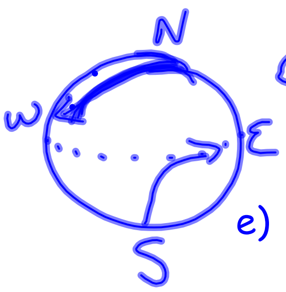
2) Coriolis "Force"
   - a) reference frame is rotating
   - b) Toss ball while spinning on a chair
     - 1) Path of outside observer: Straight path
     - 2) Path of person on chair: Curved path
   - d) Path of weather in N & S hemispheres
     - 1) Northern Hemisphere winds rotate:
       Counterclockwise around Low pressure areas
     - 2) Southern Hemisphere winds rotate:
       Clockwise around low pressure areas
   - e) Path of projectile Figure 8 - 17 pg. 217



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① Mini Lab
1-10

② 8.3 Study Guide
16-18

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