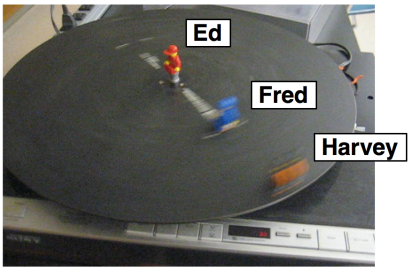
Cycle 19 Circular Motion

Review (hints & answers at mrmont.com)

QUESTIONS

1. Ed (center), Fred (half-way out), Harvey (on the edge):



a) Which one has the most angular velocity?

Trick question! All the same.

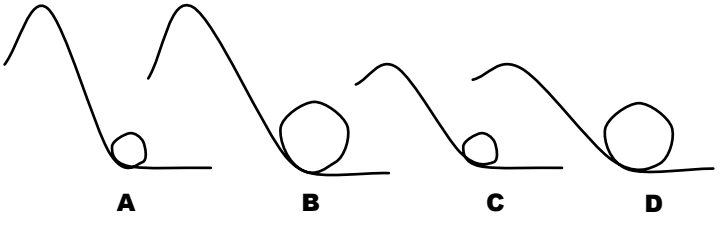
b) Which one has the most tangential velocity?

Harvey

c) Which one has the most angular acceleration & g's?

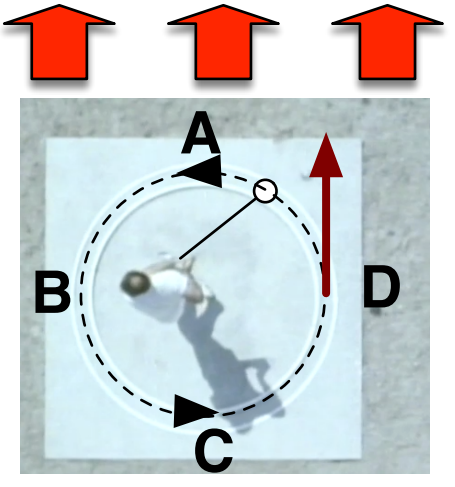
Harvey

2. Which coaster is the most dangerous? Explain why.



A. A big hill means a lot of velocity, and it goes into a very tight turn.

3. At what point should the hammer thrower let the hammer go so that it goes in the direction of the arrows? Draw its path at it leaves.



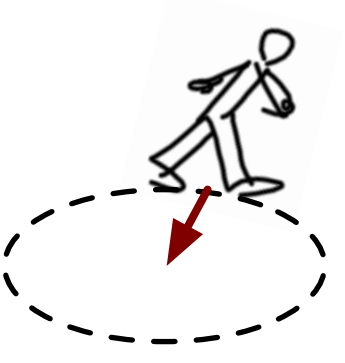
D

RANDY BARNES	USA	23.12 m
YURIY SEDYKH	USSR	86.74 m

4. Which one is the hammer throw record and which one is the shotput world record? Why is one so much bigger than the other?

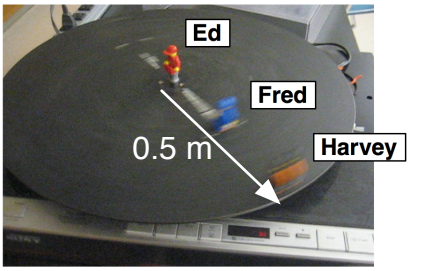
Hammer throw is the larger one (86.74 m). The hammer is farther out in the circle and has a larger tangential velocity. Therefore when released it goes farther.

5. The person is walking in a circle. What force provides the centripetal force (without which he does not stay in the circle?) For his position in the circle shown, draw an arrow on the diagram to show the direction that force would have to act.



Friction provides the centripetal force and acts toward the center.

PROBLEMS



1. Ed is at the center, Harvey is 0.5 m away. The turntable spins 5 times every 10 seconds.

a) What is Harvey's angular velocity?

$$\text{ang v} = \frac{5(2\pi)}{10} = \pi \text{ rad/s}$$

b) What is Harvey's tangential velocity?

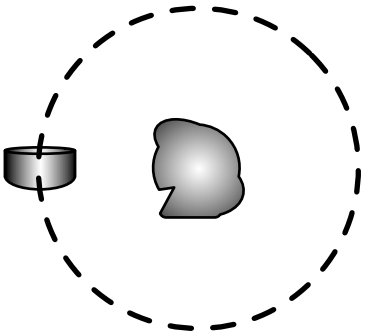
$$V_T = (\text{ang v})(\text{radius}) = (\pi)(0.5) = 1.57 \text{ m/s}$$

c) What is Harvey's angular acceleration? How many g's is that?

$$a_C = \frac{V_T^2}{r} = \frac{1.57^2}{0.5} = 4.9 \text{ m/s}^2 \qquad 0.49 \text{ g's}$$

d) What are the answers to (a), (b) & (c) for Ed?

π rad/s, 0 and 0.



2. Far out in space, a 200 kg space probe is moving in a circular orbit around an asteroid at 500 m/s. The radius of its orbit is 1,000 m. What is the force of gravity on the space probe?

$$F_C = \frac{mV_T^2}{r} = \frac{(200)(500^2)}{1{,}000} = 50{,}000 \text{ N}$$

The force of gravity is providing the centripetal force and would have to be 50,000 N.

3. The 50 kg person moves around the ferris wheel at a steady 4 m/s.

a) What is the required centripetal force?

b) What is the Normal Force on the person at the top?

c) What is the Normal Force on the person at the bottom?

$$F_C = \frac{mV_T^2}{r} = \frac{(50)(4^2)}{10} = 80 \text{ N}$$