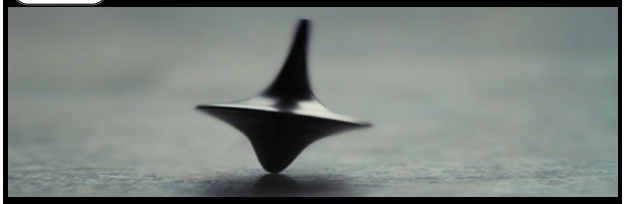
Announcements

PRACTICE	LABS	TESTS
Unit 12 Problems (1-9)	Paper Car Crash Lab (Due Wed. 3/13)	Unit 12 Test Tuesday (3/26/19)

Describing Rotational Motion

Learning Target

12.1 I can describe, interpret, and solve problems involving angular motion.



Key Concepts

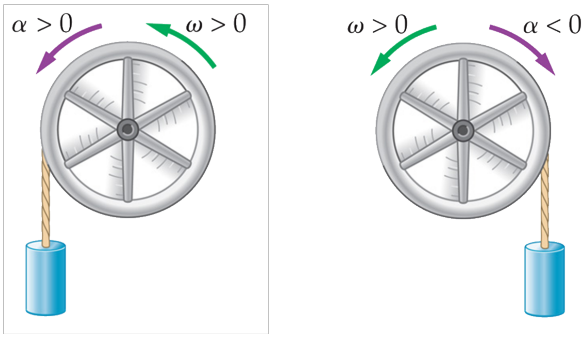
- Angular position and its changes are measured in radians. One complete revolution is 2π rad.
- Angular velocity is given by the following equation.

$$\omega = \frac{\Delta\theta}{\Delta t}$$

- Angular acceleration is given by the following equation.

$$\alpha = \frac{\Delta\omega}{\Delta t}$$

Rotational Kinematics



UNIT 12 IN CLASS PROBLEMS

Do you remember when Mr. Umemoto said "Here are 3 equations that are really important, and we will use them all the time, so don't forget them"?

6. Without looking in your notes, write down the three equations of motion.

Linear to Angular

Linear	Angular
	$\omega = \omega_o + \alpha t$
	$\theta = \theta_o + \omega_o t + \frac{1}{2}\alpha t^2$
	$\omega^2 = \omega_o^2 + 2\alpha\Delta\theta$

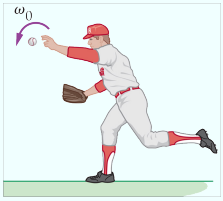
Throw the Duece

Thrown for a Curve

To throw a curve ball, a pitcher gives the ball an initial angular speed of 36.0 rad/s. when the catcher gloves the ball, 0.595 s later, its angular speed has decreased (due to air resistance) to 34.2 rad/s.

a) What is the ball's angular acceleration, assuming it to be constant?

b) How many revolutions does the ball make before being caught?



Thrown for a Curve

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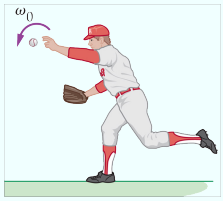
a) What is the ball's angular acceleration, assuming it to be constant?

$$\alpha = \frac{\Delta\omega}{\Delta t} = -3.03 \text{ rad/s}^2$$

b) How many revolutions does the ball make before being caught?

$$\theta_f = \theta_o + \omega_o t + \tfrac{1}{2} \alpha t^2$$

$$\theta = 20.9 \text{ rad} = 3.33 \text{ rev}$$



Linear and Angular Relationships

Table 8-1			
Linear and Angular Measures			
Quantity	**Linear**	**Angular**	**Relationship**
Displacement	d (m)	θ (rad)	$d = r\theta$
Velocity	v (m/s)	ω (rad/s)	$v = r\omega$
Acceleration	a (m/s^2)	α (rad/s^2)	$a = r\alpha$

UNIT 12 IN CLASS PROBLEMS

7. On a certain game show, contestant spin a wheel when it is their turn. One contestant gives the wheel an initial angular speed of 3.40 rad/s. It then rotates through one-and-one-quarter revolutions and comes to rest on the BANKRUPT space. **(a)** Find the angular acceleration of the wheel, assuming it to be constant. **(b)**How long does it take for the wheel to come to rest?

8. A washing machine's spin cycle is 542 rev/min. The diameter of the drum is 44.0 cm. **(a)** What is the angular speed in rad/s? **(b)** What centripetal acceleration do you clothes experience during the spin cycle?

$V = r\omega$

UNIT 12 IN CLASS PROBLEMS

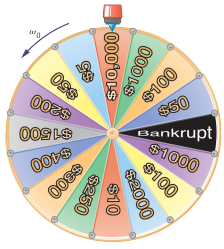
5. On a certain game show, contestant spin a wheel when it is their turn. One contestant gives the wheel an initial angular speed of 3.40 rad/s. It then rotates through one-and-one-quarter revolutions and comes to rest on the BANKRUPT space. **(a)** Find the angular acceleration of the wheel, assuming it to be constant. **(b)**How long does it take for the wheel to come to rest?

(a) $\omega_f^2 = \omega_o^2 + 2\alpha(\theta_f - \theta_o)$

$\alpha = -0.736 \text{ rad/s}^2$

(b) $\omega_f = \omega_o + \alpha t$

$t = 4.62 \text{ s}$



UNIT 12 IN CLASS PROBLEMS

6. A washing machine's spin cycle is 542 rev/min. The diameter of the drum is 44.0 cm. **(a)** What is the angular speed in rad/s? **(b)** What centripetal acceleration do you clothes experience during the spin cycle?

(a) $\frac{542 \text{ rev}}{\text{min}} \times \frac{2\pi \text{ rad}}{1 \text{ rev}} \times \frac{1 \text{ min}}{60 \text{ s}} = 56.8 \text{ rad/s}$

(b) $v = r\omega = 12.5 \text{ m/s}$

$a_c = \frac{v^2}{r} = 710 \text{ m/s}^2$

$a_c = \frac{v^2}{r} = \frac{(r\omega)^2}{r} = \frac{r^2\omega^2}{r}$

$a_c = r\omega^2$