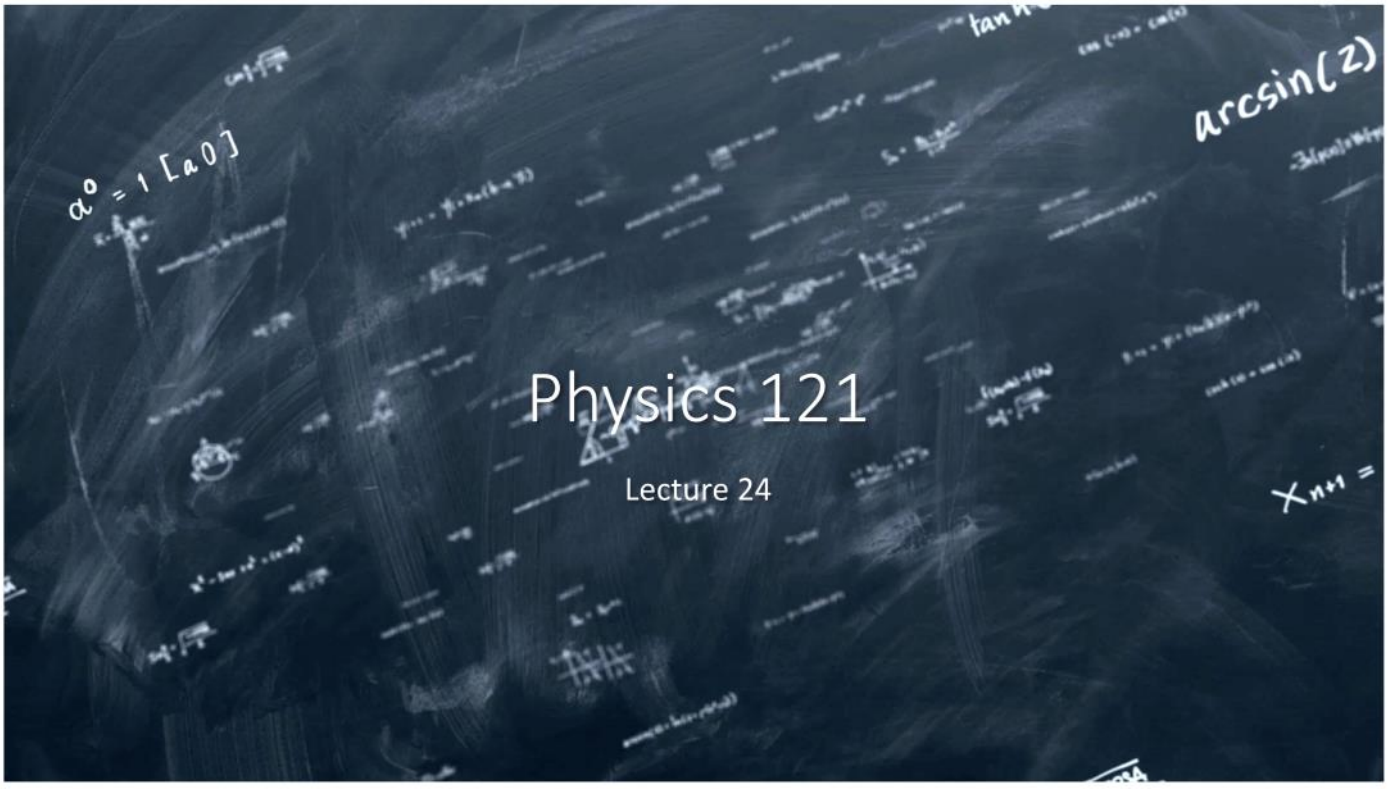
Lecture 24 Review 3 - 4.4

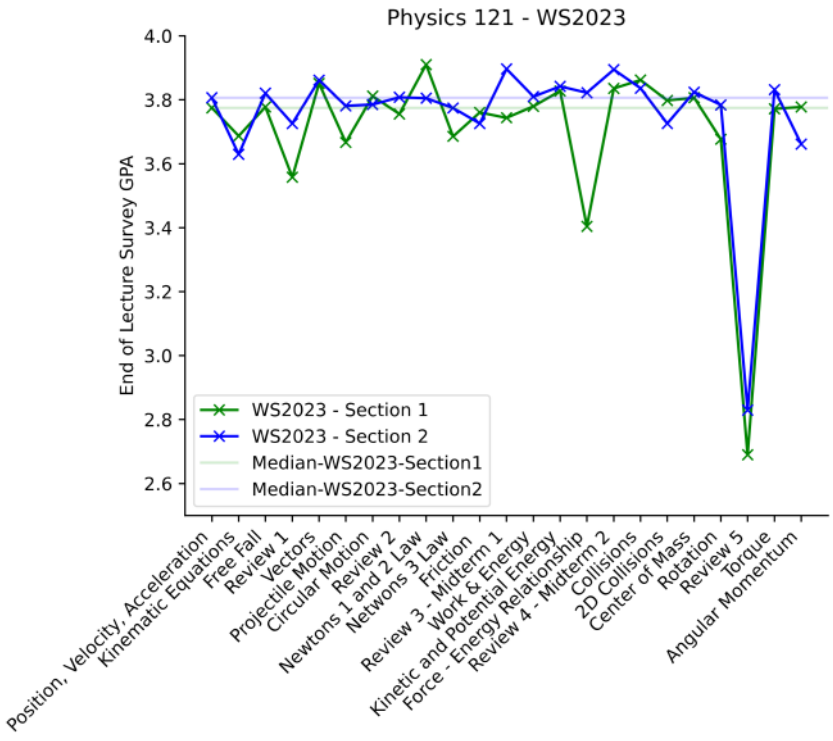
Thursday, April 6, 2023 8:41 AM



A word on Quantum Entanglement

This is NOT an issue. Do NOT keep a safe distance from your computer.

Welcome to another Snowy April!


Physics 121 - WS2023
End of Lecture Survey GPA
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
WS2023 - Section 1
WS2023 - Section 2
Median-WS2023-Section1
Median-WS2023-Section2
Position, Velocity, Acceleration
Kinematic Equations
Free Fall
Review 1
Vectors
Projectile Motion
Circular Motion
Review 2
Newtons 1 and 2 Law
Networks 3 Law
Friction
Review 3 - Midterm 1
Work & Energy
Kinetic and Potential Energy
Force - Energy Relationship
Review 4 - Midterm 2
Collisions
2D Collisions
Center of Mass
Rotation
Review 5
Torque
Angular Momentum

Please provide End of Semester Feedback!

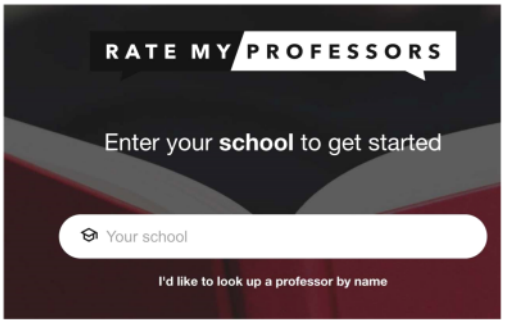
Student Response Data: PHSCS 121 - Winter 2023

Tuesday, April 4th, 2023 6:15 AM

Total Students Enrolled (All Sections)	480
Total Completed Ratings	38
Response Rate	7.92

Total Students Enrolled (100 and 200 Level Sections)	480
Total Completed Ratings	38
Response Rate	7.92
Composite 100-200	N/A

Tenure time – Please all leave official class reviews. This stuff matters a lot!



I will teach 121 for the next few years. Consider leaving pointers to future BYU students on ratemyprofessor.com

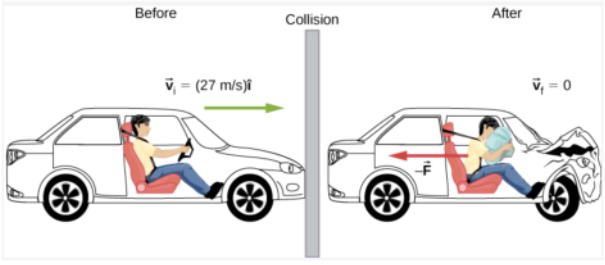
Review – Lecture 17

Momentum $\vec{\mathbf{p}} = m\vec{\mathbf{v}}$

LAW OF CONSERVATION OF MOMENTUM

The total momentum of a closed system is conserved:

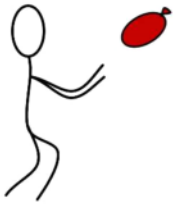
$$\sum_{j=1}^{N} \vec{\mathbf{p}}_j = \text{constant.}$$



Two kinds of collisions

ELASTIC
- Objects collide and bounce
- Kinetic energy is conserved
- No permanent deformation of the objects

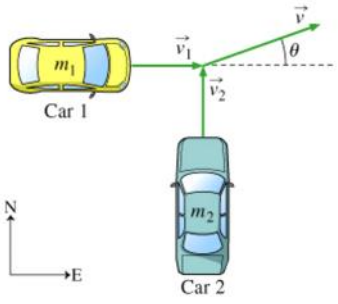
INELASTIC
- Objects collide and stick
- Kinetic energy is NOT conserved
- Objects stick because they lock together, or are permanently bent, or chemical reaction, or...



"Impulse"

$$\Delta p = (F) \times (\Delta t) = p_{\text{final}} - p_{\text{initial}}$$

Review – Lecture 18



$$v_{1f} = 2v_{CM} - v_1$$

Two kinds of collisions

ELASTIC
- Objects collide and bounce
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INELASTIC
- Objects collide and stick
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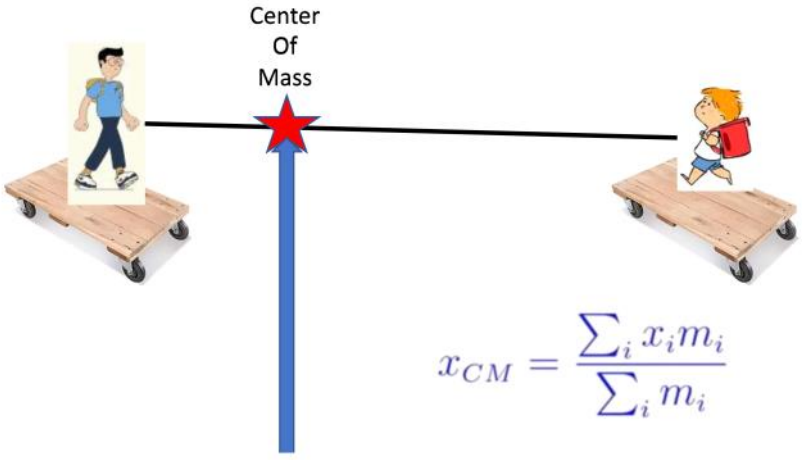
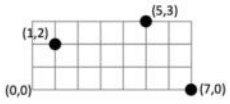


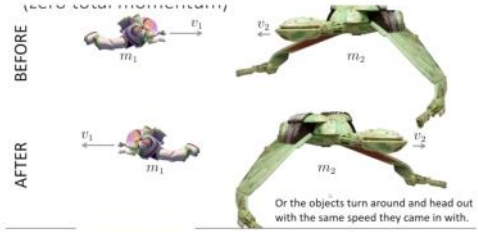
$$x_{CM} = \frac{\sum_i x_i m_i}{\sum_i m_i}$$

Review – Lecture 19



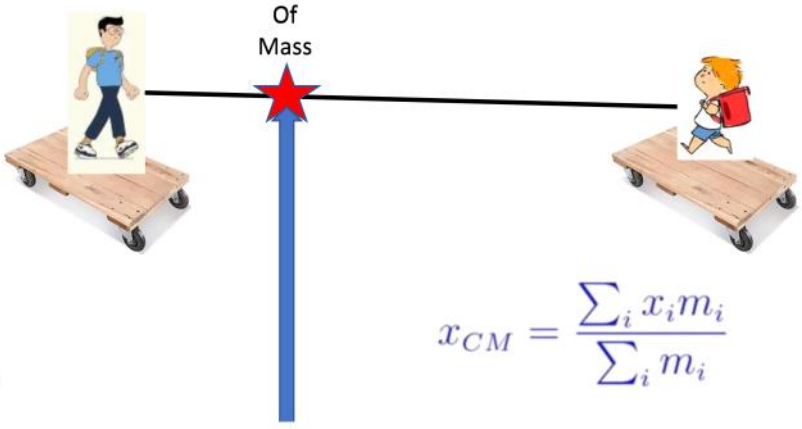
$$x_{CM} = \frac{m_1x_1 + m_2x_2 + m_3x_3}{m_1 + m_2 + m_3} \qquad y_{CM} = \frac{m_1y_1 + m_2y_2 + m_3y_3}{m_1 + m_2 + m_3}$$

$$v_{CM} = \frac{\sum_i v_i m_i}{\sum_i m_i}$$



ZERO tota momentum in COM frame of reference!

Same momentum, but bullet has more kinetic Energy!



$$x_{CM} = \frac{\sum_i x_i m_i}{\sum_i m_i}$$

Review Lecture 20

$$\theta = \frac{s}{r}$$

Angular Position

Rotational
$\theta_f = \theta_0 + \bar{\omega}t$
$\omega_f = \omega_0 + \alpha t$
$\theta_f = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2$
$\omega_f^2 = \omega_0^2 + 2\alpha(\Delta\theta)$

counterclockwise rotations as being positive and clockwise rotations as negative.

$$\omega = \lim_{\Delta t \to 0} \frac{\Delta\theta}{\Delta t} = \frac{d\theta}{dt},$$

Angular Velocity

$$\vec{\mathbf{v}} = \vec{\boldsymbol{\omega}} \times \vec{\mathbf{r}}.$$

Angular Velocity Vector

$$v_t = r\omega$$

Tangential Velocity

Review – Lecture 22

Torque equals moment arm times force: $\tau = rF\sin\theta$

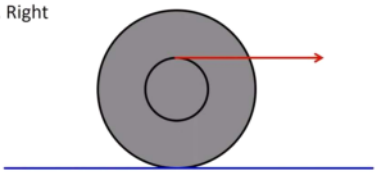
The direction of the torque is given by the right-hand rule: $\vec{\tau} = \vec{r} \times \vec{F}$

Unbalanced torques cause angular accelerations: $\tau = I\alpha$

Q3a: If I pull on this string, what way will the spool move?

A. Left

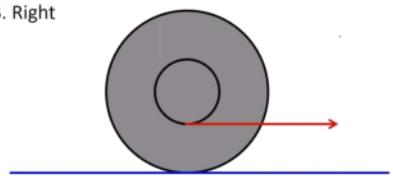
B. Right



Q3b: What about now? Which way will the spool move?

A. Left

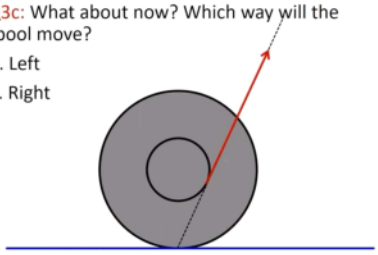
B. Right



Q3c: What about now? Which way will the spool move?

A. Left

B. Right



Consider the Pivot Points!

Difference to bike tire. Axis of rotation

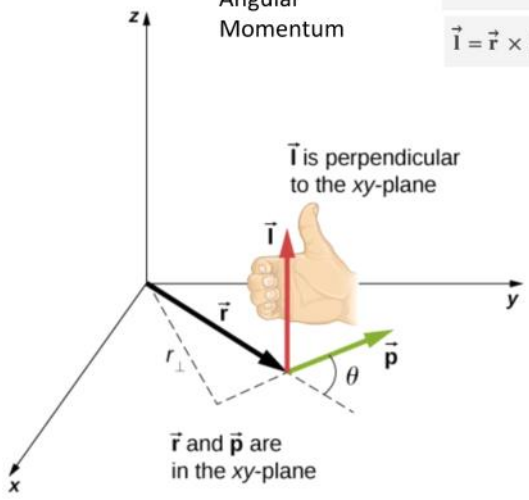
What happens if you pull the front break?

Review – Lecture 23

Angular Momentum

$L = I\omega$ Rigid Body

$\vec{l} = \vec{r} \times \vec{p}.$ Point Mass Body



Conservation of Angular Momentum

$$\frac{d\vec{L}}{dt} = 0$$

$$\vec{L} = \vec{l}_1 + \vec{l}_2 + \cdots + \vec{l}_N = \text{constant.}$$

Rotation of Wheel

Exit Poll

- Please provide a letter grade for todays lecture:

A. A
B. B
C. C
D. D
E. Fail