

Unit 5: Rotation



cds | Cheongna Dalton School

5.Rotation

Earlier on in the year we investigated the topics of Newton's Laws of Motion, Energy and Momentum. In those units we were restricted to objects moving translationally. In Unit 5 we explore the concepts of rotation. Rotational motion is all around us. Think about how a bicycle moves, there is rotational motion in the wheels, the pedals, and the crankshaft. Even the handlebars rotate when you wish to turn.

Unit Priority Standards

- INT-6 When a physical system involves an extended rigid body, there are two conditions of equilibrium—a translational condition and a rotational condition.
- INT-7 A net torque acting on a rigid extended body will produce rotational motion about a fixed axis.
- CHA-4 There are relationships among the physical properties of angular velocity, angular position, and angular acceleration.
- CON-5 In the absence of an external torque, the total angular momentum of a system can transfer from one object to another within the system without changing the total angular momentum of the system.

Unit Transfer Goals

- The ability to approach a complex problem using logical steps and mathematical reasoning and skills.

| Unit Essential questions | |
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| <ol style="list-style-type: none"> 1. How can you safely make the London Eye turn when the number of passengers can always be changing? How do you make it stop or prevent it turning further than you'd like? 2. How is rotational motion related to riding a bicycle? | |
| Acquisition of Knowledge Skill | |
| <p><i>Students will know...</i></p> <ol style="list-style-type: none"> 1. how to calculate torque and apply Newton's 2nd Law for rotation 2. how to determine the moment of inertia for regular multidimensional shapes. 3. How to apply the conservation of energy for objects that rotate 4. that there are angular kinematic relationships for objects experiencing a uniform angular acceleration (rotational suvat). 5. how to apply the conservation of angular momentum. | <p><i>Students will be skilled at...I can...</i></p> <ol style="list-style-type: none"> 1. Students will be able to build a device capable of protecting an egg from a high fall. 2. Students will be able to understand the relationship between Newton's Laws of Motion and momentum change. |

Unit Plan

501. Rotation of Rigid Bodies

Goals: Students should understand how to use the kinematics equations for rotational motion
 Introduce moment of inertia

Group activity – Linear-rotational equivalence

Homework #17: Rotation of Rigid Bodies Handout

502. Torque

Goals: To understand torque and how it changes rotation.

Introduce torque and Newton's 2nd Law for rotational motion

Homework #18: Torque Handout

503. Moment of Inertia

Goals: To understand how different geometries have different moments of inertia and how to calculate them

Homework #19: Moment of Inertia Handout

504. Torque and Machines Lab (Experiment)

Goals: To find the mass of a ruler using a torque balance and how machines reduce input force

Experiment 1 – Torque

Homework: Write up Experiment

505. Rotational Dynamics and Rotational Energy

Goals: To understand linear-rotational relationship between energy

Introduce rotational kinetic energy and work done by torque

Homework #20: Rotational Dynamics and Rotational Energy

506. Angular Momentum

Goals: To understand angular momentum and its conservation

Introduce angular momentum and conservation of angular momentum

Homework #21: Angular momentum Handout

507. Angular Momentum Example Problem Class

Goals: Give students the chance to see how to answer a selection of questions on angular momentum to aid understanding

Homework: No Homework

508. Rolling Motion

Goals: Calculate and predict the path of objects that are rolling rather than sliding

Introduce rolling motion and why different shaped objects roll at different speeds on an incline

Homework #22: Rolling Motion Handout

509. Rolling Motion (Experiment)

Goals: Calculate and predict the path of objects that are rolling rather than sliding

Experiment 2 – Rolling Motion

Homework: Write up Experiment

217. Rotational Motion Quiz

Goals: Check understanding of the chapter's information

Activity: Group review and question time

Quiz #2: Covers classes 207-216

510. Problems Workshop Class

Goals: Give students the chance to answer a selection of questions and go through past problems to aid understanding

Homework: Finish class handouts

511. Unit 5 AP Classroom Personal Progress Check

Goals: To check current understanding of Rotation

Activity: Personal Progress Check

Activity: Review questions / answers to check for misunderstandings

Homework: review concepts of difficulty

512. Unit 5: Rotation Quiz

Goals: To check understanding of covered topics

Activity: Group review and question time

Quiz #5: Covers classes Unit 5: Rotation

Homework: No Homework

513. Quiz Review

Goals: To check understanding of covered topics

Activity: Group review and question time

Assessment Details

| Evidence | |
|---|--|
| I will check students' understanding throughout the unit by... | |
| <p>Summative</p> <p>Homework Questions</p> <ul style="list-style-type: none"> After each regular class (non lab / quiz day) the students will be given a homework sheet that checks for understanding. Questions will be both conceptual and mathematical. <p>Quizzes</p> <ul style="list-style-type: none"> The quizzes will be in the AP test format with a mixture of MCQ and FRQ questions. All tests will be weighted on the AP scale to reflect your performance better. <p>Lab Reports</p> <ul style="list-style-type: none"> Students are required to conduct lab experiments and communicate their findings in a report. Lab Report Rubric | <p>Formative</p> <p>Group Activities</p> <ul style="list-style-type: none"> The class engages in small group activities to help each other and get help and feedback from myself. These group activities usually involve simulations / demonstrations or practice problems. <p>Workshop Classes</p> <ul style="list-style-type: none"> Each unit will have a dedicated workshop day where students can practice questions of varying difficulty. <p>AP Classroom Progress Checks</p> <ul style="list-style-type: none"> Collegeboard offers a wonderful tool for checking progress on their website. |