

Friction

5E Lesson

The 5E model is a scientifically proven method to improve student engagement and learning in your classroom

- ✓ Engagement
- ✓ Exploration
- ✓ Explanation
- ✓ Elaborate
- ✓ Evaluate



Complete Teacher Instructions

Friction 5E Lesson

Grades 8-11	Friction	Ongoing
Lesson Objective: Students will learn about: - What friction is - What causes friction - How friction relates to Newton's Laws - Static and kinetic friction - Coefficients of friction - Friction applications		
Possible Student Misconceptions: - Friction only occurs on rough surfaces - Motion always increases when friction is reduced - Friction is bad		
Materials: 1 device (smartphone, Chromebook, laptop, tablet, or computer) - A means of projecting a PowerPoint presentation - Internet access - Textbook - Ruler - Balloons for each student - CDs for each student - Sport bottle tops for each student - Glue		
Teacher Notes: - All videos can be accessed directly from the PowerPoint. To retrieve them, click on the video icon while in slideshow mode and it will automatically open for you. If they don't open, right-click on the image and click Edit Hyperlink or something similar. - I've created a video walkthrough if needed. It can be accessed here - https://youtu.be/oCIKIP9SaDQ - I don't believe in long lessons. If you feel your students are lost, stop the PowerPoint and give them a 5-minute break. If you'd recommend my video collection here - http://www.teachwithfergy.com are tons of brain-break videos to choose from all grouped by category.		

Friction – 5E Lesson

Engagement Phase Your students will watch the video "Friction is cool! (So are CD Hovercrafts!)". Once they're done, have them make a CD hovercraft. The video can be found here: http://www.teachwithfergy.com/friction-is-cool/ Teacher Notes: - If the video doesn't work for one reason or another, go to www.youtube.com and type in "Friction is cool! (So are CD Hovercrafts!)" - The video is about one minute long - You may need to show the video more than once	Duration: 2 Teacher Role: learning and understanding ☐ Connect : experience ☐ Create in ☐ Ask ques ☐ Understand of the les
Exploration Phase Exploration – Lab Station Activity - In groups of 2-3, have your students complete <i>Exploration – Friction Lab Station Activity</i>. Once they're done, they will submit their passport to you. Teacher Notes: - The complete instructions for my Lab Station activity can be found in the <i>START HERE – Instructions</i> file.	Duration: 1 Teacher Role: learning and understanding ☐ Students experience ☐ Students creative t ☐ Students observati ☐ results, a connect
Explanation Phase PowerPoint Lesson and Challenge Lab - The lesson is found in the folder – <i>Explanation – Lesson and Challenge Lab</i> - There are embedded videos and plenty of opportunity to engage, interact and check for your students' understanding throughout the lesson - The lessons cover the following topics: - What is friction and what causes it? - Friction summary - Friction and Newton's Laws - Static and Kinetic Friction - Coefficients of Friction - Applications of Friction - Practice Problems	Duration: 1 Teacher Role: concepts by material fou presentation

Teacher Notes: - All videos can be accessed directly from the PowerPoint. To retrieve them, click on the video icon while in slideshow mode and it will automatically open for you. If they don't open, right-click the image and select Edit Hyperlink or something similar. - I've created a video walkthrough if needed. It can be accessed here - https://youtu.be/oCIKIP9SaDQ - I have also enclosed a .PDF version of both the teacher and student versions	Goals - Students develop understanding of the content - Observations and experiences are discussed and critiqued - Students develop vocabulary - Students are able to connect the content presented to previous experiences
Elaborate Phase Elaborate – Scavenger Hunt Your students will complete – <i>Elaborate – Friction Scavenger Hunt</i> . This activity will require your students to move beyond what was covered directly in the lesson and allow them to further develop their understanding. Teacher Notes: - Students will work individually or in small groups - Students will need one device per group	Duration: 1 hour Teacher Role – Facilitate learning and keep students focused Goal Students use their newly obtained knowledge to propose solutions and extend their learning to new situations
Evaluate Phase Quiz Have your students complete - <i>Evaluate – Friction – Quiz</i> All quiz questions will come from the lesson and lab station activity. Teacher Notes: - It's sometimes best to have the students peer evaluate - Placing students in small groups and having them exchange papers to mark will accomplish two things - Provide immediate feedback on the quiz they just completed - Significantly reduce your marking time - Peer evaluation is not needed, only suggested when appropriate	Duration: 30 min Teacher Role – Distribute and collect evaluation Goal Students are given the opportunity to demonstrate their understanding and evaluate their own progress

Each phase is clearly described

A Complete Lesson

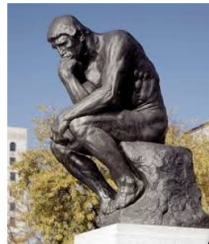
Friction

- Friction...
 - resists motion
 - acts to oppose motion.
 - is caused by electrical forces between two surfaces



Friction

- What causes friction?
- What affects the amount of friction two objects experience?
- Describe how your life would be different if friction didn't exist.



Why couldn't they separate the books?



← Make sure your students are on track

Videos embedded right into your slideshow
Student copies with blanks

Two types – Static and Kinetic

- Static friction
 - _____
- Kinetic friction
 - _____
- The magnitude of friction depends on
 - the surfaces in contact with each other (i.e. shoe and floor).
 - the weight of the object due to its mass.

Interactive and Engaging Activities

Challenge Lab - Finding μ_s

Your Task:

- Students are to determine the coefficient of static friction between various objects that slide (nothing that rolls) and an angled textbook surface. The only permitted measuring instrument is a ruler.
- You must perform this task with 2 different pairs of items.
- You will be in groups of 4.

What you need to submit:

1. Determine the general equation to calculate μ_s in **SIMPLEST** be able to determine it using just a ruler.
 - Recall: $F_{s\max} = F_N \times \mu_s$
 - Hint: Your general equation can't be: $\mu_s = F_{s\max} / F_N$
2. Perform an experiment to determine the experimental value sets of pairs using the formula found in #1.
 - Increase the angle of the book until the static friction is overcome (object slides).
 - Take 3 measurements for each pair and use the average to ensure accuracy.
 - You may only use a ruler, no protractors.
3. You will create a FBD with all labeled forces. Make it large u page. Since both FBD's will be similar, only complete one dr
4. Research the actual value of μ_s for your item pairs and deter error.
 - You may need to do some research here.
5. Connect the concept of a friction coefficient (μ) to an everyday. I.e. Speaking specially about friction, why are certain materi others? For instance, tires are made of rubber partially due friction they experience with road surfaces.
 - For a given situation, you need to compare the pair use not used and state why it is so (frictionally speaking).
 - You will definitely need to do some research here.

Hints:

- Remember to change your x and y-axis.
- Think about what static friction is.
- Use components and trig identities.

Friction

Lab Station Activ

7 Lab Station Activities to get your kids out of their seats and engaged in their learning

Device-Based Scavenger Hunt

Friction

Includes

- 5 Unique Locations
- Online form submission
- Answer Key

Works on all smartphones, tablets, Chromebooks and laptops

- 100% Digital
- Simulations
- Quizzes
- Videos
- Games
- Word Scramble
- and more

Get away from tired practices and unengaged students



Provide a Scientifically-Proven means of instruction



Incorporate Technology and Increase Collaboration

