What's a Force?
2 days

LESSON STRUCTURE
Student Friendly Objective: What is a force?
Language Objective: I can discuss, read and annotate to better understand what a force is.
Outcomes: *Engineering Design Cycle Language Outcomes:* - I can contextualize the design problem.
NGSS Practices: - Asking questions (for science) and defining problems (for engineering) - Developing and using models
NGSS Cross-Cutting Concepts: - **Patterns**: Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
Materials Needed: Worksheet Types of Forces Reading (homework - 3 versions) Images for Force diagrams
LESSON PLAN
1. **Do Now:** Do you agree or disagree? Explain. - A wall can push you. _____ - A chair can push you. _____ - A door can pull you. _____ - The floor can push you. _____
2. **Engage:** With a partner standing up. Face each other. Put your hands up with the palms out. Lean and push on each other. What happens? Now grasp hands and lean apart. What happens? What do you feel?  
3. **Mini lesson**: Explore different demonstrations.

- Teacher leans against a poster board that is held up by a student, what happens when you remove the poster board?
- Teacher sits in a chair, what happens when the chair is removed?
- What happens when I pull on the door handle and it's locked? What is pulling back?

4**. Draw Arrows:**
Students work on completing the worksheet and drawing arrows to show where there is a push and pull.

5. **Homework:**
Reading.

6. **Force Diagrams**
Each group gets and image. Based on the homework reading, draw and label the types of forces that are in each image. Be prepared to share and discuss with the class.

Differentiation:
The reading has three different levels.

Assessment:
Assessment ticket at the end of day 1 (formal).
Force Diagram presentations during day 2 (informal).

Constructivist:
The students are experiencing the different forces when we do the activities at the beginning of the first day by leanin on a partner.

Misconceptions:
That force only occurs when there is contact. That inanimate objects cannot exert a force.

Modalities:
Reading in the homework. Listening and speaking in the discussion on the second day.

What's a Force? (day 1)

Do Now: Do you agree or disagree? Explain.

A wall can push you. _____

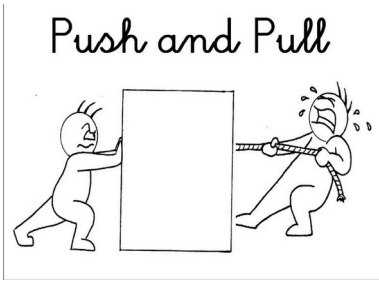
A chair can push you. _____

A door can pull you. _____

The floor can push you. _____

When you push, what does your partner do?

When you pull, what does your partner do?



Draw arrows ⇄ to show push and pull.

Can a wall push you? Explain.

Can a chair push you? Explain.

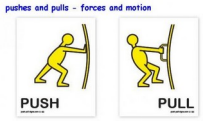
	Can a door pull you? Explain.
	Can the floor push you? Explain.
What is a force?	
Is touch and contact necessary for force to push or pull? Write four examples. • • • •	

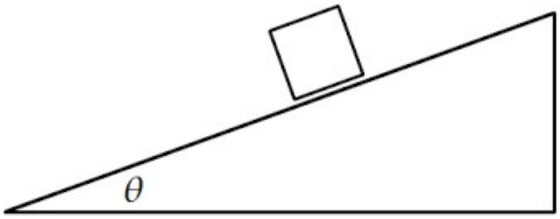
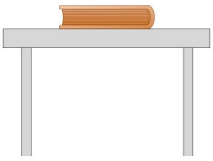
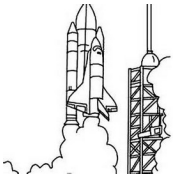
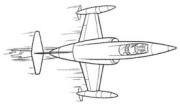
Types of Forces Reading (homework)

Date: _____

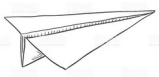
Do Now: Give 3 examples of forces *you* experienced today.

1.
2.
3.

Read and Annotate: Underline words you know	**Translate the key words**
A force is a push or a pull. There are many different forces.  **Gravity** (F_g) is a pull force. Everything with mass has gravity. The Earth has a lot of mass, so the Earth has a lot of gravity. You have gravity, but it is very little.  **Friction** (F_f) is a push force. When you ice skate, you cannot walk on the ice because the ice has less friction. Smooth things have little friction. **Normal force** (F_N) is a push force. When you push on a wall, normal force from the wall supports you so you do not fall. **Air resistance** (F_{air}) is a push force. When objects move through the air, the air pushes them a little. If the object is big and flat, like a parachute, the air pushes it a lot. **Thrust** (F_{th}) is a push force. When a rocket launches, this pushes the the rocket up into the air. In an airplane, the jets push the airplane through the air.	gravity: everything: The Earth: friction: to ice skate: smooth: a wall: to support: to fall: a parachute: a rocket: to launch: an airplane: air:

Type of Force	Diagram: Draw force vector arrows and label them
Gravity (F_g)	  
Friction (F_f)	 
Normal Force (F_N)	 
Air Resistance (F_{air})	 
Thrust (F_{thrust})	 

Draw force vector arrows for all of the forces acting on the paper airplane.



Types of Forces Reading

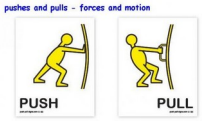
Date: _____

Do Now: Give three examples of forces *you* experienced today.

1.
2.
3.

Read and Annotate: Circle the words you don't know, <u>underline</u> the words that you know

A force is a push or a pull. There are many different types of forces in the universe.



Gravity (F_g) is a pull force. Everything that has mass has gravity. The Earth has a lot of mass, so the Earth has a lot of gravity. When you jump, the Earth pulls you down with gravity. You also have gravity, but it is very little.

Friction (F_f) is a push force. When you go ice skating, you cannot walk on the ice because the ice has less friction. Rough and sticky things have a lot of friction. Smooth things have little friction.

Normal force (F_N) is a push force. Imagine a book on the table. Gravity from Earth pulls the book down onto the table. Normal force from the table supports the book so it does not fall to the floor. When you push on a wall, normal force from the wall supports you so you do not fall.

Air resistance (F_{air}) is a push force. When objects move through the air, the air pushes them a little. If the object is big and flat, like a parachute, the air pushes it a lot.

Thrust (F_{th}) is a push force. When a rocket launches, the explosions push the the rocket up into the air. In an airplane, the jets push the airplane through the air.

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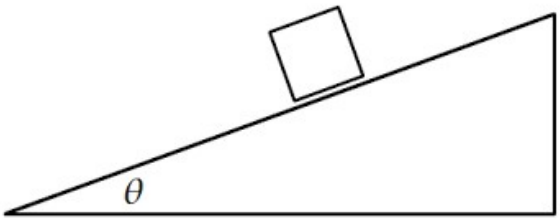
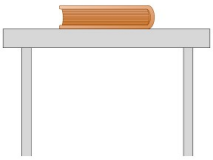
Friction (F_f)	 
Normal Force (F_N)	 
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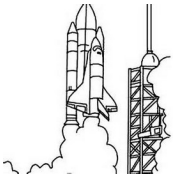
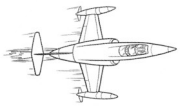
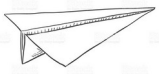
Thrust (F_{thrust})	 

Draw force vector arrows for all of the forces acting on the paper airplane.



Types of Forces Reading

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Do Now: Give three examples of forces *you* experienced today.

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Read and Annotate: Circle the words you don't know, <u>underline</u> the words that you know

Two basketball players are trying to push the ball. One player is trying to push it into the basket, and the other player is trying to push it away from the basket. If both players push the ball at the same time, where will it go? It depends on which player pushes the ball with greater force.

Force is defined as a push or a pull acting on an object. Any time the motion of an object changes, a force has been applied. Force can cause a stationary object to start moving or a moving object to accelerate.	What is force? What does force have to do with the motion of an object?
Gravity Force (F_g) Gravity helped to form our solar system and all the other solar systems in the universe. Gravity has traditionally been defined as a force of attraction between two masses. The effect of gravity is that objects exert a pull on other objects. In fact, gravity can act over very long distances.	What does gravity force do? How did this help form the solar system?
Thrust Force (F_{thrust}) A thrust force is a force that is applied to an object by a person or another object. If Jack Sparrow is pushing a boat across the sand, then there is an applied force acting upon the object.	Draw a picture of something putting applied force on Jack Sparrow. 

Normal Force (F_N) The normal force is the support force exerted upon an object that is in contact with another stable object. For example, if a bird is resting on a rock, then the rock is exerting an upward force upon the bird in order to support the weight of the bird. Normal force can act if a person leans against a wall, the wall pushes horizontally on the person. 	What is exerting normal force on the birds in the picture to the left? What is exerting normal force on you right now?
Friction Force (F_f) Friction is a force that opposes motion between two surfaces that are touching. For example, if a book slides across the surface of a desk, then the desk exerts a friction force in the opposite direction of its motion. Friction occurs because no surface is perfectly smooth.	 In the picture of the polar bear, why is the bear sliding on ice? Use friction in your response. The bear will not slide forever. Which forces could cause the bear to stop, and why?
Air Resistance Force (F_{air}) Air resistance is a special type of frictional force that acts upon objects as they travel through the air. The force of air resistance is often observed to oppose the motion of an object. It is most noticeable for objects that travel at high speeds (e.g. a skydiver or a downhill skier). 	Why is running with a parachute a better workout than running without one? Use the information to the left about air resistance and force in your explanation.

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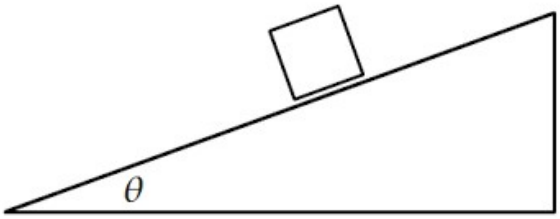
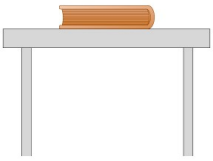
Friction (F_f)	 
Normal Force (F_N)	 
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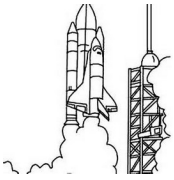
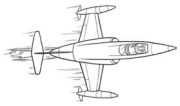
Thrust (F_{thrust})	 

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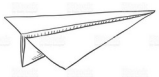
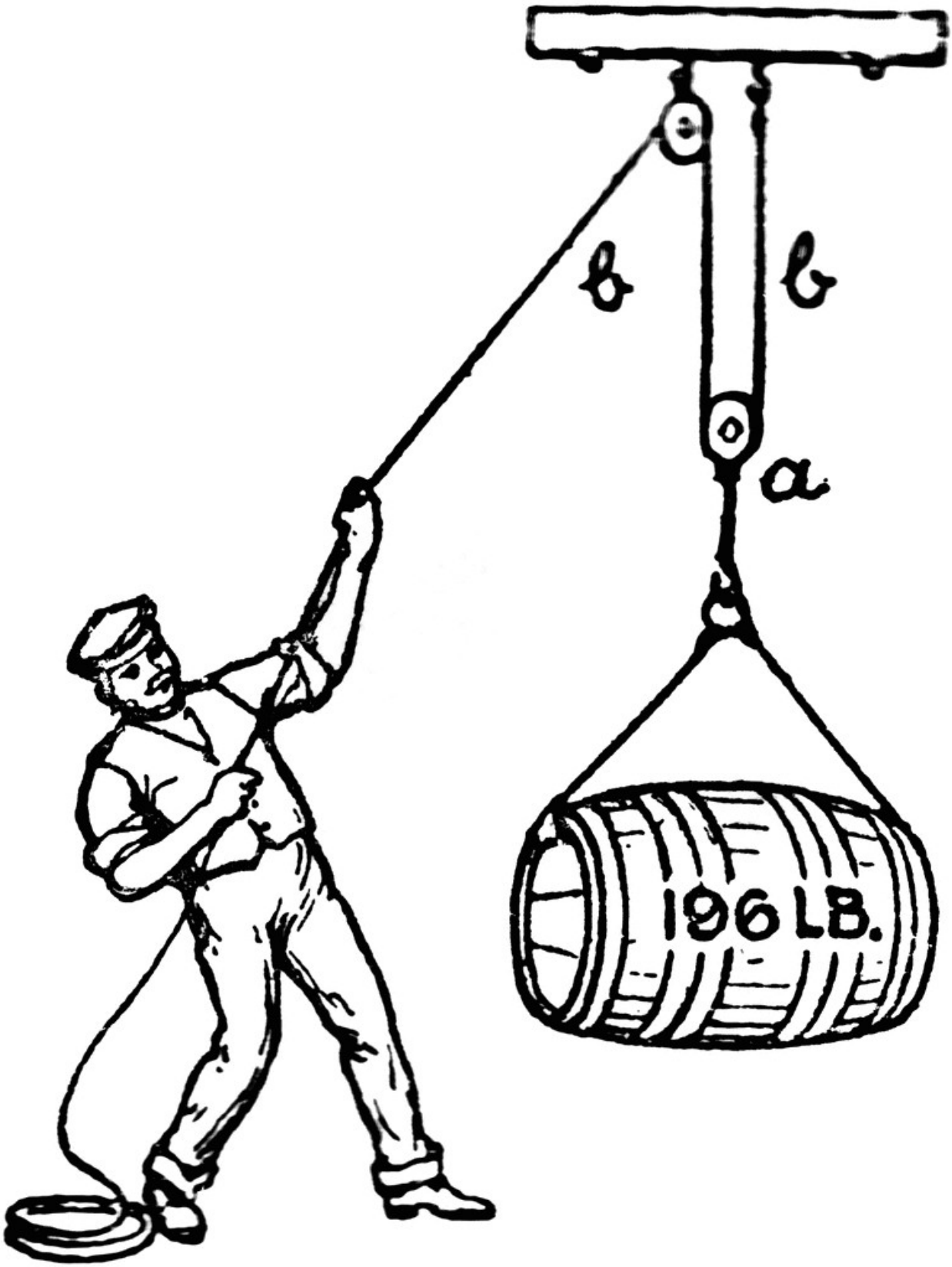


(day 2)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