Standard Supplies Sheet

IcePod *is a packet of instruments collecting highly detailed and accurate images of the polar ice sheets. '**Bergy Bits**' are simple activities introducing science concepts through student experimentation, tying these concepts to real glacier physics. Named for small pieces of ice found in both the Arctic and Antarctic, 'bergy bits' in nature are small pieces of floating ice that break from an iceberg, ice shelf or glacier.*

Note*:* Before you begin the activities, older students can read "Bits and Bytes: Introduction to IcePod Science" to gain a deeper understanding of the project, why it is important, and how this data is collected in the polar regions.

Supplies Needed

At home alternatives noted in italics

- 1/3 batch of glacier goo for each student set up (recipe options below)
- Lightweight plastic storage box: *Tupperware container*
- Section of mat board to fit inside each box: *Cardboard, small book or pamphlet*
- Laminated grid sheet (attached) – select metric or English units measurements.
  No lamination: stretch saran wrap tightly around the grid sheet and board and tape to stabilize.
- Foil or something to create a channel shape on the matboard surface
- Erasable marker pen: *white board markers or any washable markers*
- Toothpicks
- Small 6 inch ruler with both metric and English measures
- Stopwatch or timer
- Object to tape on board to create drag: *Legos, building blocks, any small toy*

Glacier Goo

Also commonly referred to as slime

Recipe 1:

Mix#1:

- One 20 oz cup
- 1 stirring stick
- 3/4 cup warm water
- 1 cup Elmers white glue
- one 8 oz cup

Mix#2:

- 1/2 cup warm water
- one stirring stick (for the 8 oz cup)
- 2 tsp. Borax powder
- 1 qt plastic zip lock ba

Mix # 1:
In the large cup, add 3/4 cup warm water and 1 cup glue. Stir until well mixed.

Mix # 2:
In the smaller cup, measure 1/2 cup warm water. Add 2 tsp. of Borax powder.
Stir until the powder is dissolved.

- Pour Mix 2 (the powder mix) into the glue mix stirring the entire time. Keep stirring until a glob forms and most of the water is mixed in. This happens quickly! Knead and work the mix for 2 – 3 minutes. Most, if not all, of the water will be incorporated into the mixture.
- Place the glacier goo in the zip lock bag.
- The mixture will store for a few months.

***Recipe 2*:**

Materials:

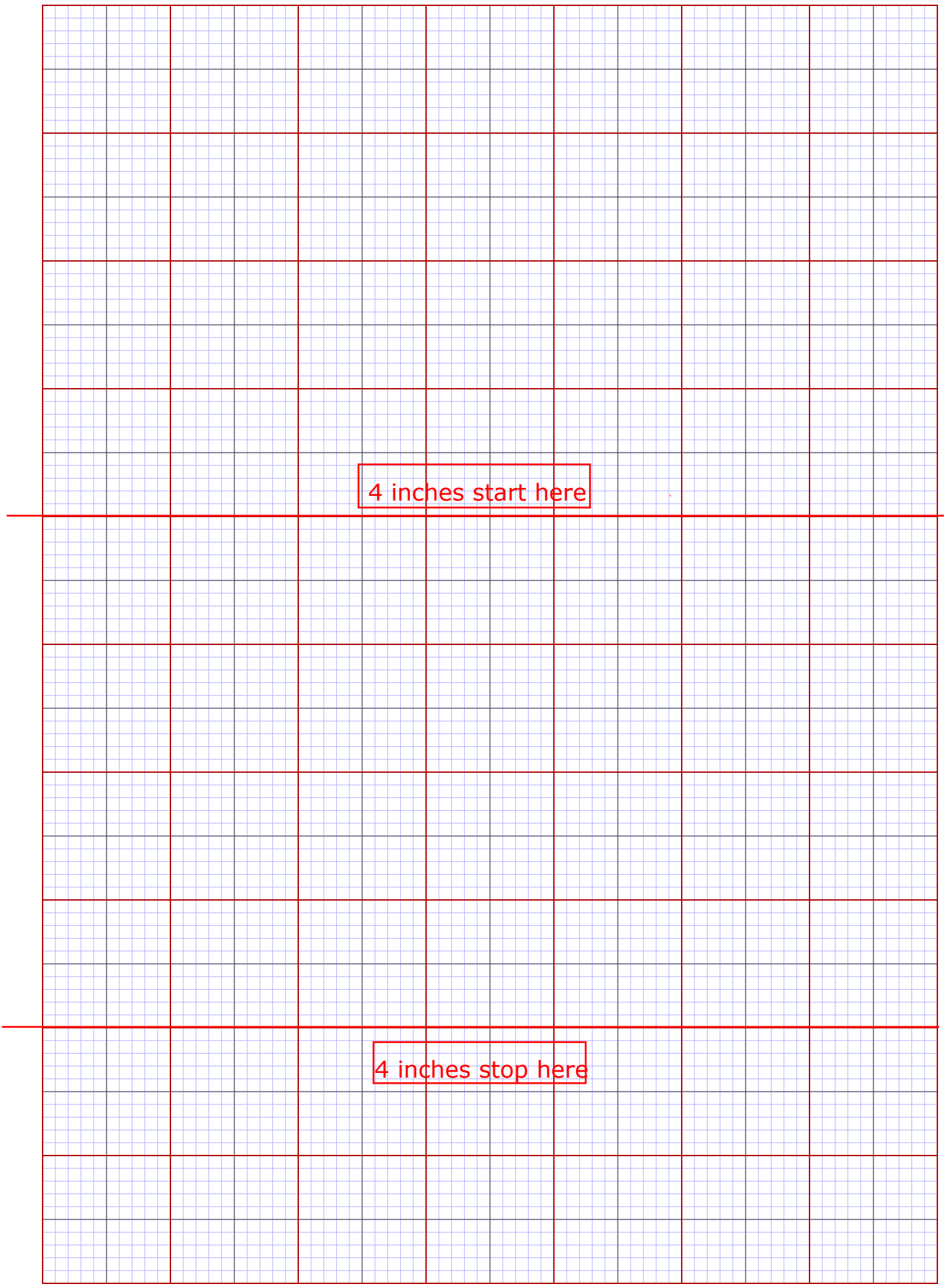
- 1 bottle of elmer's glue (6 oz)
- ½ teaspoon of baking soda
- 1 ½ Tablespoon of Contact lens solution
    - MUST CONTAIN: Boric Acid and Sodium Borate
    - **Renu Fresh** or **Equate** brands are both good

Steps:

- Get a bowl to mix your Glacier Goo ingredients
- Pour your entire 6 oz Elmer's glue into the bowl
- Add your ½ teaspoon of baking soda and mix thoroughly
- Slowly add in your contact lens solution. Add it in slowly and mix if possible so that you can adjust and ensure you do not add too much. We like to add a few teaspoons at a time and then mix.
- Knead and mix thoroughly before adding more as you do not want to add too much or your glacier goo will get too hard. You may not need the full amount so take this step slowly.
- Mix until your Glacier Goo forms and begins to harden.
- Take it out and knead, knead, knead! If it's not the desired consistency, keep kneading

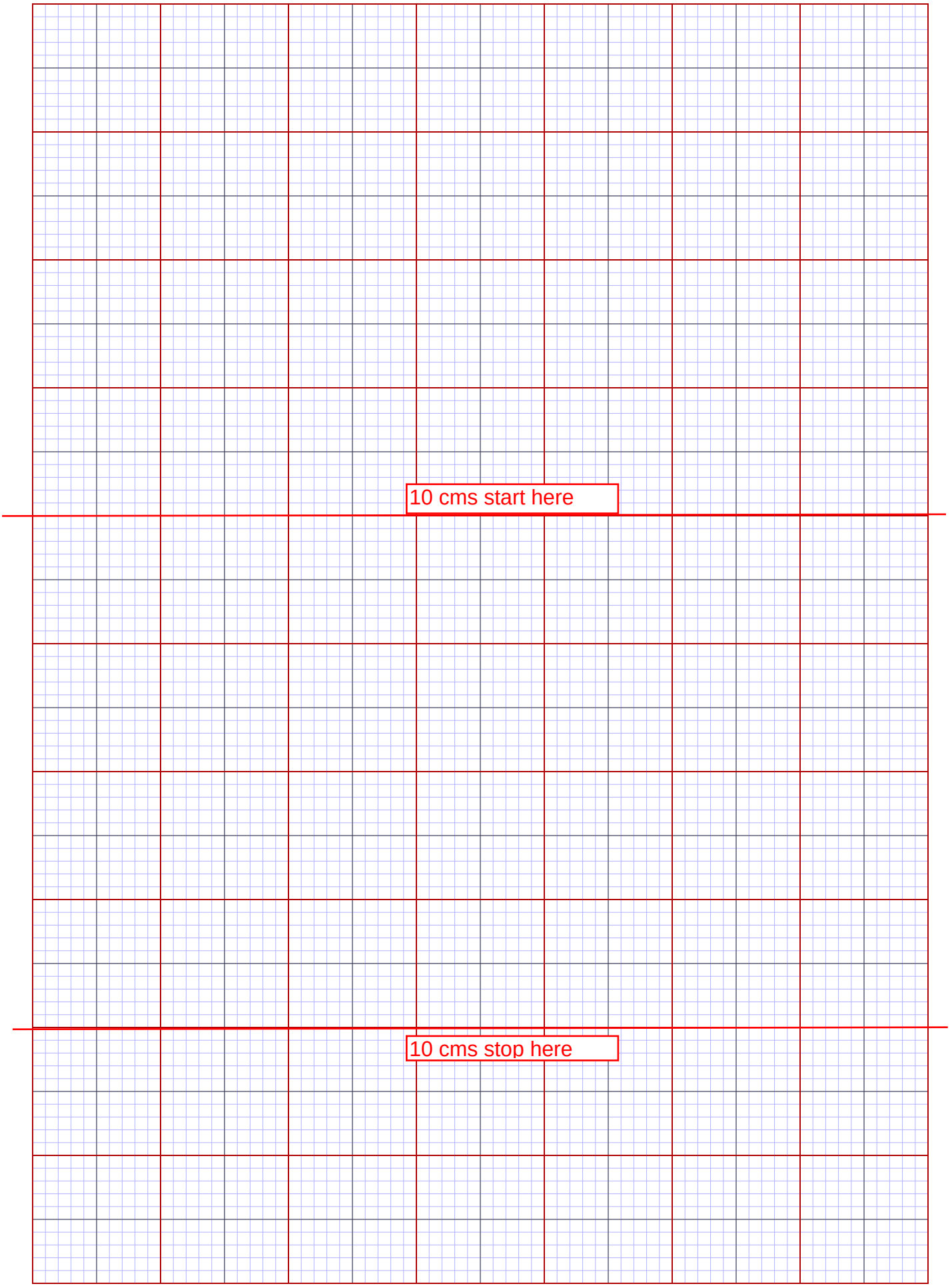
Edible Glacier Goo (Slime) Options:
Option 1: https://littlebinsforlittlehands.com/edible-marshmallow-fluff-slime/
Option 2: https://hip2save.com/2018/07/26/diy-play-dough-pudding-slime/

**Disclaimer*: We have yet to test out these edible recipes so we are unsure of its viscosity or whether it will adequately flow for the experiments. However, you can try these fun experiments at home and let us know how it works!



Free Multi-color Graph Paper from http://incompetech.com/graphpaper/multicolor/

metric option



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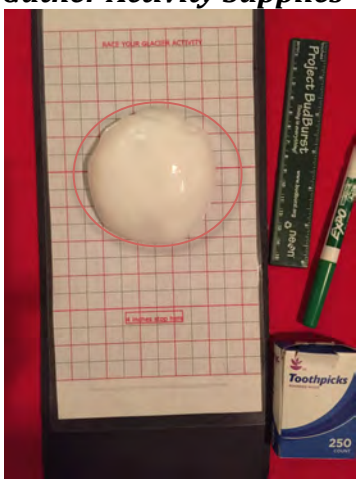
IcePod's Bergy Bits Activities ~ Fun with Ice: Its Simple Physics!
CONCEPT: Gravity Drives Ice Flow

IcePod *is a packet of instruments collecting highly detailed and accurate images of the polar ice sheets.* ***'Bergy Bits'*** *are simple activities introducing science concepts through student experimentation, tying these concepts to real glacier physics. Named for small pieces of ice found in both the Arctic and Antarctic, 'bergy bits' in nature are small pieces of floating ice that break from an iceberg, ice shelf or glacier.*

What is Gravity? Gravity is a force of attraction between two objects. It acts like a magnet pulling objects together. The Earth has gravity pulling objects towards it. Earth's gravity causes the ice in a glacier to flow downhill. Even when the surface seems flat, mounded ice flows from where it is highest to where it is lowest/thinnest

Gather Activity Supplies – *see supplies sheet for Bergy Bits activities*



1) Place the matboard flat on a table and pile goo in the center. Use erasable marker to draw a circle around the goo. What do you think – will the goo stay inside the circle or not? Why?

2) Kanderdlussuaq glacier flowing from the center of the icesheet to the Greenland coast.

3) Helheim glacier flowing from the center of the icesheet to the Greenland coast.

Glacier Gravity Activity:
Students lay the matboard flat on the table and mound their glacier goo in the middle of it. Draw a circle around it. Predict what will happen to the goo.

Describe your observations:

1) What happened to the glacier goo? Did it stay inside the circle?
2) The matboard is lying flat, so what is causing the glacier goo to flow moving the goo outside of the circle (hint: see the notes above in 'What is gravity?')
3) Images (2) Kangerdlussuaq and (3) Helheim are real glaciers on the southeast coast of Greenland. Look at the ice in the photos. How do you think the activity you did relates to these real glaciers moving in the polar-regions?

ICEPOD'S BERGY BITS ACTIVITIES ~ Fun with Ice: Its Simple Physics

CONCEPT: Basal Friction Slows Ice Flow

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What is Friction? Friction occurs when one surface or object rubbing against another. Friction always slows a moving object down.

'***Basal***' means at the bottom layer or the base of something; here it refers to the bottom of the glacier or ice sheet where it touches the land below.

Gather Activity Supplies – *see supplies sheet for Bergy Bits activities*

Glacier Ice Flow Activity:

- Place the matted grid board in the plastic box to create a ramp.
- Mound the glacier goo into a ball and insert a toothpick straight into the center

  Make a prediction: will the top flow faster than the bottom? Or will the bottom flow faster than the top? If the top flows faster, the toothpick will tip forward. If the bottom flows faster, the toothpick will tip backwards.

Note*: Do not let students see picture (2) or (3) until the end of the activity*

1) Mound goo and toothpick is inserted perpendicular to the glacier pointing straight up.

2) As goo begins to flow watch what happens to the top of the toothpick.

3) As goo continues to flow watch what happens to the toothpick.

Describe your observations:

1) What happened to the toothpick?
2) What part of the glacier is flowing the fastest?
3) Friction slows things down. Where is the 'friction' on the ice in this activity?
4) How do you think this activity relates to a real glacier moving in the polar-regions?

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ICEPOD'S BERGY BITS ACTIVITIES ~ Fun with Ice: Its Simple Physics!
CONCEPT: Channel Friction Affects Flow

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What is Friction? Friction is one surface or object rubbing against another. Friction always slows a moving object down.

Gather Activity Supplies – *see supplies sheet for Bergy Bits activities*

Glacier Channel Ice Flow Activity:

- Place the matted grid board in the plastic box to create a ramp
- Create a channel for the glacier goo to flow through by taping rolled foil to the laminated grid on the matboard.
- Mound the glacier goo to fill across the top region of the foil frame.
- Draw a straight line is sketched horizontally across the surface of the goo photo (1).
- Make a prediction: Will the center or the edges flow faster? If the center flows faster the line will become a smiley face, if the edges flow faster it will be a frown. Let the glacier flow.

Note*: Do not let students see picture (2) or (3) until the end of the activity*

1) Position the glacier goo and draw a straight line across the face.

2) Observe: what happens to the straight line.

3) Real world photo of a glacier on Ellesmere Island, NW Canada.

Describe your observations:

1) What happened to the straight line you drew across the goo, smile or frown?
2) What part of the glacier is flowing the most quickly?
3) Where there is friction it slows down the ice. Where is the 'friction' in this activity?
4) Look at image 3. This is a glacier on Ellesmere Island, Canada just across Baffin Bay from Greenland. Think of the glacier goo, what part of this glacier do you think is flowing the fastest?

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IcePod's Bergy Bits Activities ~ Fun with Ice – Its Simple Physics!
CONCEPT: 'Drag' Redirects Ice Flow

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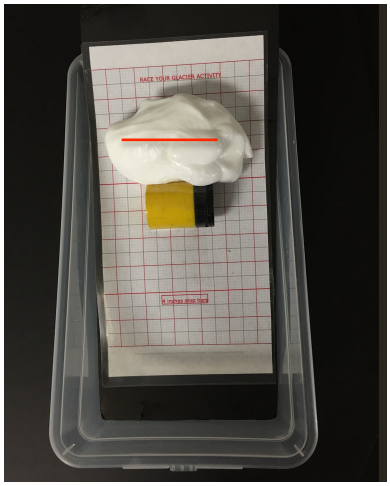
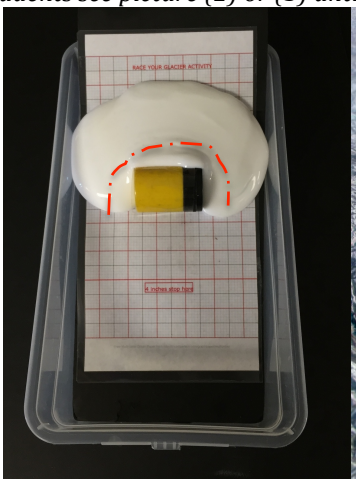
What is Drag? *Drag* is a type of friction or resistance that happens when forces act opposite to the motion of a moving object. *Drag* can result from two fluids or a solid and a fluid, and in this case glacial ice behaves like a fluid. We placed an object in front of the 'glacier' creating drag for the goo that is flowing.

Gather Activity Supplies *using supplies sheet for Bergy Bits activities.*
Glacier Gravity Activity:

- Place the matted grid board in the plastic box to create a ramp
- Select an object (we used a pencil sharpener) that fits across about 1/3 of the width of the container.
- Secure carefully to the board using clear packing tape
- Position the Glacier Goo above it.
- Make a prediction: Will it flow more quickly over the object or around the edges?

Note*: Do not let students see picture (2) or (3) until the end of the activity*


1) Tape an object just below the 'start line' on the matboard. Place glacier goo above in a ball.


2) Let the glacier goo begin to flow and see how it moves on the board.


3) Russell glacier flows around a landform in western Greenland. (photo P. Spector)

Describe your observations:

1) How did the glacial goo move when it met the obstacle you placed in its path?
2) 'Drag' occurs when something flows into something else, slowing it down. What created the 'drag' in your activity?
3) Image (3) shows Russell glacier in western Greenland. it flows from the edge of the Greenland ice sheet towards the ocean. Recall the activity you just did, how do you think this mound of land affects the speed of the ice in this section of Russell glacier?

ICEPOD'S BERGY BITS ACTIVITIES ~ Fun with Ice: Its Simple Physics

CONCEPT: Ice Shelves Apply 'Force'

IcePod *is a packet of instruments collecting highly detailed and accurate images of the polar ice sheets.* ***'Bergy Bits'*** *are simple activities introducing science concepts through student experimentation, tying these concepts to real glacier physics. Named for small pieces of ice found in both the Arctic and Antarctic, 'bergy bits' are small pieces of floating ice that break from an iceberg, ice shelf or glacier.*

What is Force? *Force* is the push or pull on one object as a result of its interaction with another object. Every interaction between two objects results in a *force* on each object.
What is an Ice Shelf? *An ice shelf* is a floating platform of ice that is connected to a land mass. It forms when a glacier or ice sheet flows from land into the cold ocean. Ice sheets are critically important because they create back pressure on the glaciers, slowing the flow of land ice into the ocean where it contributes to sea level rise.

Gather Activity Supplies using supplies sheet for Bergy Bits activities
Ice Shelf and Ice Flow Activity:

- Place the matted grid board in the plastic box to create a ramp
- Place the glacier goo at the 'start line' of the grid with the ruler just below acting as an ice shelf applying *force.. H*old in place for 2 minutes, remove ruler & observe.
- In nature, if an ice shelf shrinks or collapses through melting, the f*orce* against it is reduced or lost and the glacier flow speeds up.

Note*: Do not let students see picture (2) or (3) until the end of the activity*

1) Position the glacier goo and place ruler beneath it on the ramp and hold for 2 minutes.

2) Observe the glacier goo once the ruler representing the ice shelf is removed.

3) Real world photo of the Pine Island Ice Shelf in West Antarctica. The Pine Island Glacier is being slowed by the *force* of the ice shelf in front of it.

Describe your observations:

1) What happened when the ruler was held below the glacier goo?
2) What happened when the ruler was removed?
3) When we think of *force* as a *push* it sounds like a shove, but it can be just steady pressure of one object against another. Where is the *force* in this activity?
4) Image (3) is a large ice shelf in West Antarctica. Behind the floating ice shelf you can just see the glacier. What if providing the 'force' in this situation? Make a prediction. What will be the effect on the glacier if this ice shelf shrinks or collapses?