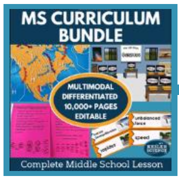
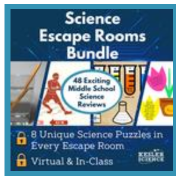
# What Can Kesler Science Do for You?

**4th - 8th grade science teachers love our Life, Earth, and Physical Science materials! With these easy and engaging materials, teachers can save planning time and put their focus back on the teaching that really matters.**




## 5E LESSONS

Two-week lessons with over 100 topics




## ESCAPE ROOMS

Engaging activities for review


## INQUIRY LABS

Three different levels to fit every student


## AMAZING ANCHORS

Anchoring phenomenon to book-end your lessons


## SUB PLANS

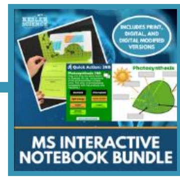
Never worry about planning for a sub again.


## WARM-UPS

Bellringers for the entire year

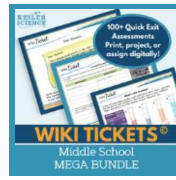

## STATION LABS

Student-led exploration




## INTERACTIVE NOTEBOOKS

Bring science journals to life.

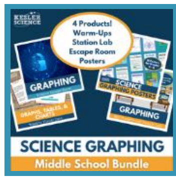



## WIKI TICKETS

Quick formative assessments


## STEM CHALLENGES

Real-world STEM problem-solving




## GRAPHING

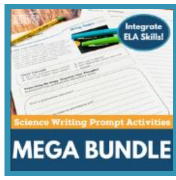
Table and charts and graphs ... OH MY!


## SCIENCE READING COMPREHENSION

Leveled reading passages with mini-activities

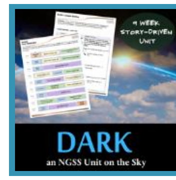

## SPANGLER COLLABORATION

Exclusive Steve Spangler lessons and videos




## WRITING PROMPTS

Writing activities covering 100+ topics




## EXPLORIES

Story-driven units with integrated activities

**The Kesler Science Professional Learning Network (PLN) group on Facebook has a huge community of engaged and supportive science teachers - come join us!**

Weekly Phenomenon
Graphing Activity

Name: ______________________________

Date: ______________________________

# The Hidden Physics of Winter Roads

Many places across the U.S. were hit by a winter blast recently, including some sunny cities that usually stay much warmer. Some people had their first chance to learn what it feels like when you hit the brakes and your car keeps going! 😬

Slippery ice is a well-known hazard, but have you ever wondered ***why*** ice is slippery?

You might think the answer is obvious, but scientists have debated it for nearly 200 years!

Scientists agree that if an object--like a tire or ice skate--hits the surface of ice, a thin, slippery layer forms between the ice and object. This layer lets the object glide across the frozen water. What scientists haven't agreed on is exactly what the layer is and how it forms.

One explanation in the 1800's suggested that **pressure** from an object on the ice lowers the melting point. The ice then melts just enough to form a slippery layer. This theory has a problem, though. Scientists figured out it would take ten hockey players standing on one skate to create enough pressure to change the melting point!

In the 1930's, a science team used an ice tunnel in the Swiss Alps to test their theory that **friction** made ice slippery. Scientists realized this theory also had a problem. Friction does warm up ice as an object moves, but it only creates a melted layer in a trail ***behind*** the object. It doesn't explain why ice is slippery in the first spot you step on!

Still another theory emerged. This one said the outside surface of ice always has a layer of water that is **almost melted**. This theory says that the the top layer of ice molecules are exposed to the warmer outside air, keeping them soft. This not-quite-melted ice would be easier to push around. The problem is, ice is still extremely slippery even in deep cold, when the outer air is too cold to cause pre-melting.

Now, a research group is testing an exciting new theory. Molecules of ice have an **electrical charge** that works like magnetism, causing them to be attracted or repelled by different materials. When an object with a strong attraction, like your shoe, connects with ice, the attraction causes tiny cracks to form on the surface. The ice then begins to microscopically crumble as you step on it, creating a thin layer of broken, frozen water molecules. These loose molecules slip and slide around under your foot like microscopic marbles!

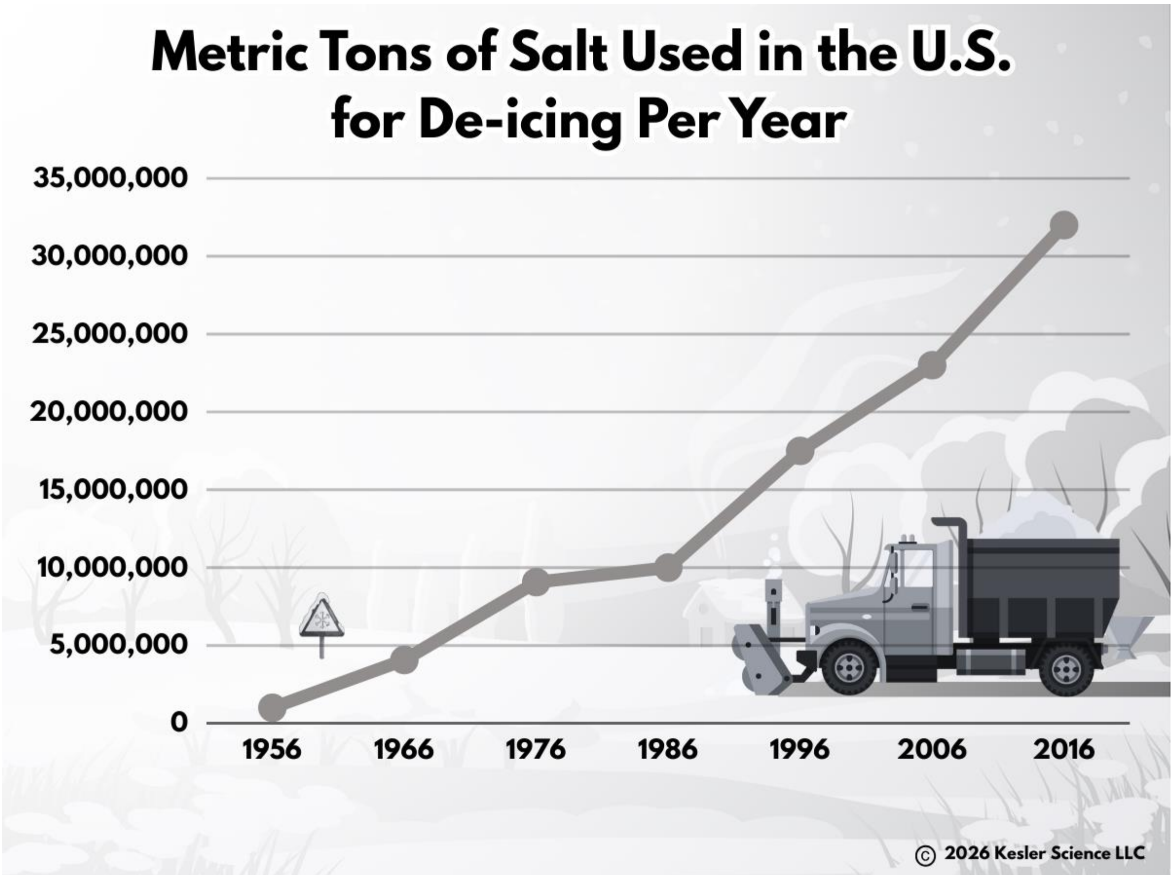
We may be close to understanding why ice is slippery, but as many drivers recently learned, the real challenge of ice is how to make it less slippery.

The most common solution for roads is spreading different types of salt to melt the ice. Salt lowers the freezing point of water, so the water stays liquid at colder temperatures. The salt-and-water mixture runs off the roads, though, so they need more salt all winter long. The U.S. spread over **50 billion pounds** of ice-melting chemicals on driving surfaces last winter.

Some communities great creative with more long-term solutions. Holland, Michigan, has a system of pipes installed below many of the city's roads. Waste heat from local power plants warms a special fluid flowing around in the pipes. The pipes melt snow at a rate of one inch per hour! 😮

Japan also has a long history of clearing icy roadways in creative ways. In the 1960's, the country installed small sprinklers in certain roads. During winter weather, the sprinklers pop up and spray water warmed by geothermal energy to keep the roads from freezing. Some cities in Japan use road panels that are heated by the warmth of sewage pipes!

# The Hidden Physics of Winter Roads




1. Here is a graph showing the amount of salt (sodium chloride, calcium chloride, and magnesium chloride) used for de-icing roads in the United States. Around what year did the amount of salt used exceed 30 million metric tons? How many kilograms of salt is that?

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2. U.S. roads have increased in length about 13 percent since 1960. What percentage has salt use increased between 1956 and 2016? Does there appear to be a connection between increased road length and salt use?

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3. Some freshwater streams in the Northeast U.S. are now saltier than the ocean. How could this graph help explain what is happening?

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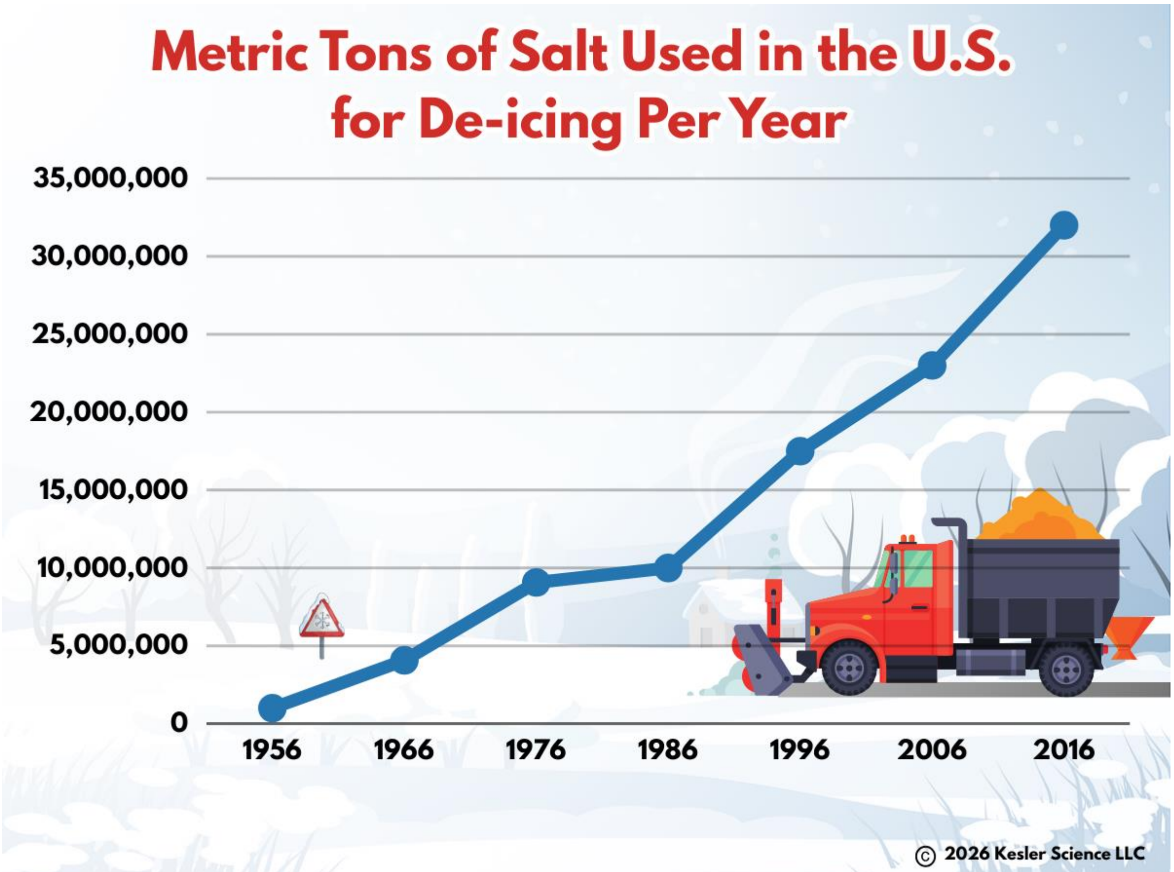


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Weekly Phenomenon
Graphing Activity
Teacher Key

Blog Link: https://blog.keslerscience.com/phenomenon-and-graphing/the-hidden-physics-of-winter-roads

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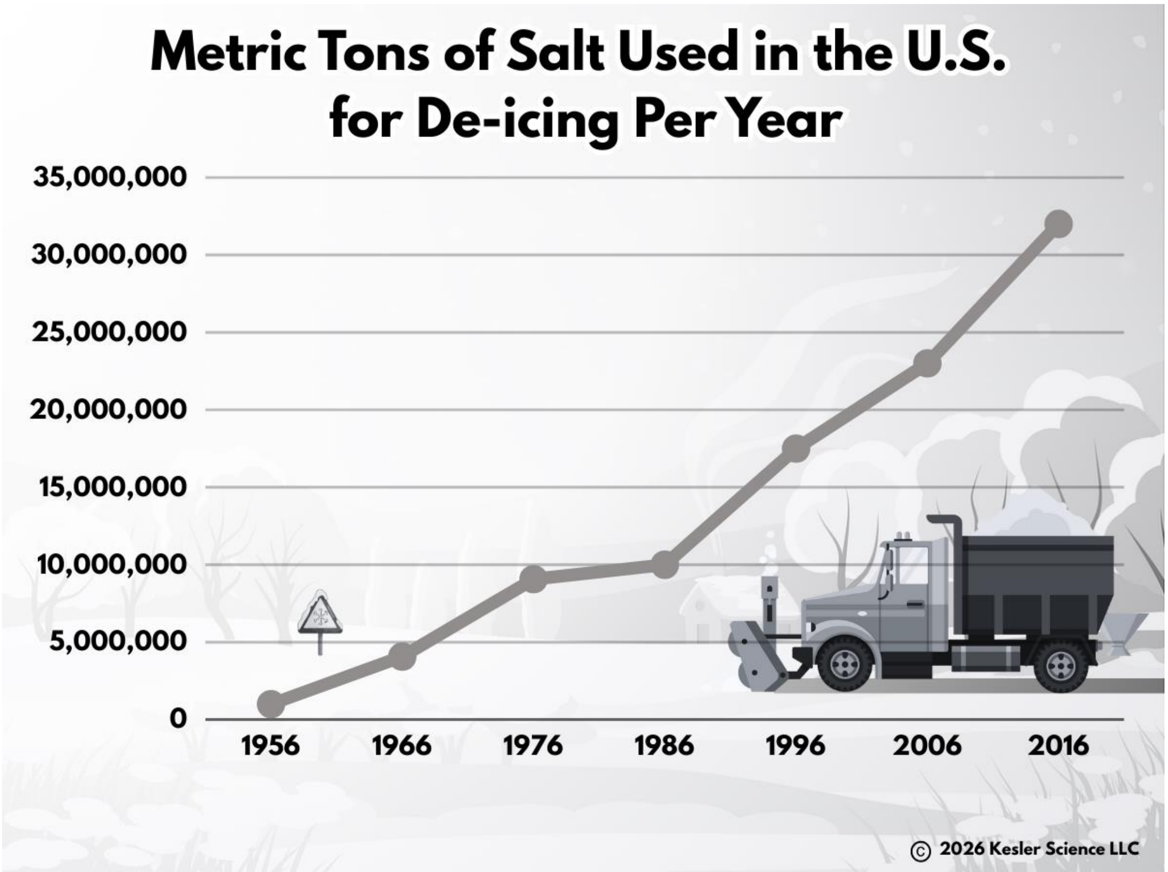
# The Hidden Physics of Winter Roads
# ANSWER KEY

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   ***Around 2014, more than 30 million metric tons were used. That is the same as 30 billion kilograms of salt.***

2. U.S. roads have increased in length about 13 percent since 1960. What percentage has salt use increased between 1960 and 2020? Does there appear to be a connection between increased road length and salt use?

   ***There has been a 1000% increase in salt use compared to 13% increased length. That does not suggest a strong connection between road length and salt use.***

3. Some freshwater streams in the Northeast U.S. are now saltier than the ocean. How could this graph help explain what is happening?

   ***Student answers may vary but may include: the increased salt on the roads might be running off into the local waterways.***