Fifth Grade
Blizzard Bag
Day 3

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Direction Page

Day 3

Science, Reading and Writing – Read the article, As Arctic ice thaws, landscape fills with craters, lakes, "drunken trees". Answer questions 1-4.

Math – Complete 5.G.3 5.G.4 worksheets 88, 89 and 90.

Read silently for 45 minutes.

As Arctic ice thaws, landscape fills with craters, lakes, "drunken trees"

By Scientific American, adapted by Newsela staff

Sep. 12, 2014 1:00 AM

Scientist Sergey Zimov (right) demonstrates the emission of methane trapped under the ice of a Siberian lake near the town of Chersky, Russia, Oct. 23, 2010. In the last five years, as the Earth has warmed, the permafrost has thawed more rapidly, accelerating the release of methane gas.

As parts of the Arctic covered with ice thaw, scientists are discovering all sorts of oddities: mysterious craters, "megaslumps," drunken trees and ice that burns.

Much of the far northern hemisphere is made up of permafrost, soil that is permanently frozen. Today, some of that permafrost is melting because temperatures in the Arctic are rising. In fact, temperatures in the Arctic are rising twice as fast as they are in the rest of the globe. The thawing is causing some strange phenomena.

The craters in far northern Russia, which look like they were dug by space aliens, are one example.

"There is nothing described in the scientific literature that can really, fully explain those craters," says geologist Guido Grosse, who is headed to Siberia in northern Russia this year.

Flames Above The Ice

Still, scientists have a theory to explain the craters: Methane gas accumulated over centuries underground, and when the ground thawed within the past few years, the methane burst out.

These craters can become lakes, which further thaw the permafrost as their water traps heat from the sun.

Similar lakes are forming across the thawing lumpy Arctic landscape known as thermokarst. Thermokarst lakes and marshes create muddy conditions that are ideal for microbes that break dead plants down into methane gas.

The methane then bubbles out of the lakes and ground. Where it builds up, it can be lit on fire, causing flames to dance above the ice.

Even more common than craters or burning ice are so-called "drunken trees." When permafrost thaws, soil that was once as solid as concrete turns to mud.

Trees Teeter, Roads Crack

Ice takes up more space than water, so when the ice melts, the ground caves in. Trees that are growing on the shifting land tip to the side.

Whole forests now stand tilted, like an army of drunkards.

The caved-in land is also bad news for man-made structures in the Arctic: Roads, pipelines and buildings can sink into mud and crack.

"Long term, there are huge economic and social impacts to permafrost degrading," biogeochemist Kevin Schaefer notes.

The permafrost thaw creates an even worse situation on steep ground: slumps, which are like slow-moving mudslides. Some of these slumps are huge—more than a kilometer across. These megaslumps can eat into the landscape at rates of a kilometer per decade and seem to show no signs of stopping.

One slump in Russia that has mystified scientists extends more than 70 meters deep into the permafrost and has been growing since the 1970s, Grosse says.

Monitoring Methane

Perhaps the biggest concern of thawing permafrost is a massive and sudden release of methane gas from the Arctic.

Methane is a greenhouse gas—it traps heat in our atmosphere and contributes to global warming. Methane traps at least eight times more heat than carbon dioxide (the most common greenhouse gas), driving global warming even faster.

Scientists have seen methane gas emissions from the Arctic increase 8 percent over the last 30 years. And ocean expeditions have observed methane bubbling out of methane ice at the bottom of the Arctic Ocean.

The good news is that satellite information covering large areas of the Arctic shows little change in the concentration of methane gas in the atmosphere.

Most of the greenhouse gases released by this Arctic thaw will be CO2—carbon dioxide.

"You Can't Refreeze It"

The permafrost thaw will continue as more greenhouse gasses in the atmosphere trap more heat. It starts a feedback cycle, in turn further melting the Arctic.

Scientists using computer simulations predict that up to a third of permafrost in Alaska could thaw, at least at the surface, with similar amounts in Canada and Siberia.

Once the melt has begun—and the frozen dead plants of thawed permafrost become food for CO2-producing microbes—the process is irreversible.

"You can't refreeze it," Schaefer says. "Once the decay turns on you can't turn it off, and it persists for centuries."

The permafrost holds vast amounts of carbon, as much as 1.7 trillion metric tons—more than twice as much as is in the atmosphere today. Not all of that will thaw in the near future, as some of it goes down 700 meters below the surface. Still, up to 120 billion metric tons could be released by 2100.

That's enough to raise global average temperatures by nearly a third of a degree Celsius.

Complicated Natural Forces

"These are big numbers," Schaefer notes. But he said they are in fact small when compared to those from burning fossil fuels like coal, oil and natural gas. "Those emissions are just immense."

The computer models that estimate how much carbon might be released assume the permafrost will thaw gradually. Now, some scientists question those assumptions because thawing processes like slumps and lakes are happening faster and affecting larger regions than expected.

Thawing creates complicated natural forces—some contribute to more warming, and some fight it. Trees and shrubs will continue to move north, thanks to warmer temperatures and a longer growing season. Yet, those trees in turn suck CO2 out of the air, keeping it out of the atmosphere. Even the newly created lakes might be burying some carbon deep under the ground.

"What Are The Limits?"

It's difficult to predict how much thawing will occur in Arctic, and how quickly it will happen. The speed of the ongoing meltdown could accelerate and happen in decades or slowly thaw over centuries and millennia.

"What are the limits of permafrost thaw?" Grosse asks. "We don't really know."

Scientists continue to expand monitoring of the Arctic, but huge gaps remain because of the huge land area and harsh conditions. Observations so far are usually in places where it's easy for scientists to get to, not necessarily the best place for measurements.

For now, the thawing situation remains a "known unknown," according to the National Academy of Sciences—something we know we must research more.

Scientists do know one thing: the impact of human civilization has not been healthy for permafrost in the Arctic.

"This situation is unprecedented," Schaefer says. "The faster you burn fossil fuels, the faster the Arctic is going to warm."

Quiz

1. According to the article, which of the following sentences is CORRECT?
   (a) Thawing produces more greenhouse gases than the burning of fossil fuels.
   (b) Scientists have revealed that thawing is occurring at an accelerated pace.
   (c) Some of the craters in the Arctic are believed to have been dug by aliens.
   (d) The thawing of permafrost mostly produces carbon dioxide.

2. All of the following are the effects of permafrost degrading EXCEPT:
   (a) It leads to the tilted growth of trees.
   (b) It leads to damage to man-made structures.
   (c) It favors the growth of microbes that produce carbon dioxide.
   (d) It leads to an abundance of methane that bubbles out of cracks.

3. Circle the paragraph from the section "Monitoring Methane" that describes the characteristics of one of the gases responsible for global warming.

4. The article draws a connection between which of the following?
   (a) carbon dioxide and dancing trees
   (b) thermokarst and natural gas
   (c) methane and drunkards
   (d) permafrost and Siberia

Name_____

5.G.3, 5.G.4

A **polygon** is a closed plane figure formed by three or more line segments with two sides meeting at each vertex.


triangle

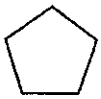

quadrilateral

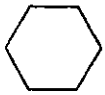

square


rectangle


rhombus


parallelogram

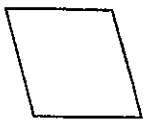

pentagon


hexagon


octagon


trapezoid

Identify each figure. Then, circle all of the quadrilaterals.

1. 
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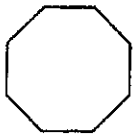
2. 
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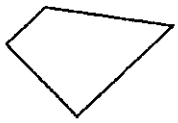
3. 
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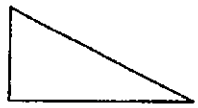
4. 
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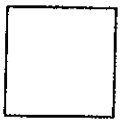
5. 
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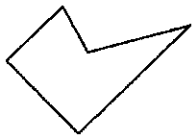
6. 
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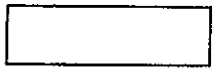
7. 
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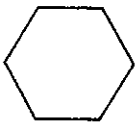
9. 
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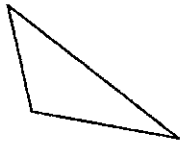
10. 
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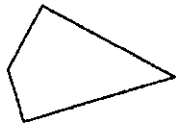
11. 
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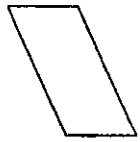
12. 
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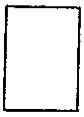
13. 
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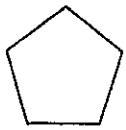
14. 
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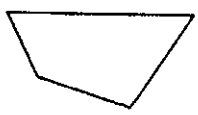
15. 
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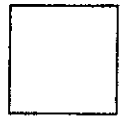
16. 
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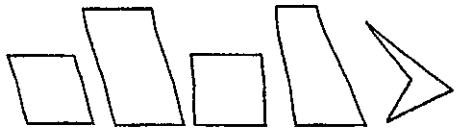
- ☐ I understand that two-dimensional figures within a category share the same attributes.
- ☐ I can classify two-dimensional figures into categories.

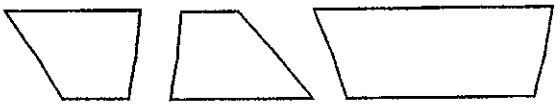
Name_____

5.G.3, 5.G.4

A **quadrilateral** has 4 sides.

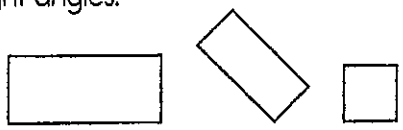


A **trapezoid** is a quadrilateral that has exactly 1 pair of parallel sides.

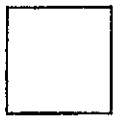


A **parallelogram** is a quadrilateral that has 2 pairs of parallel sides.

A **rectangle** is a parallelogram that has 4 right angles.



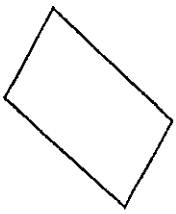
A **square** is a rectangle that has four equal sides.

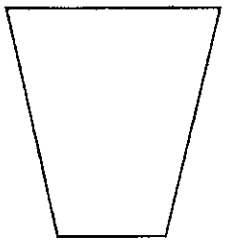


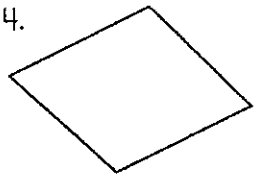
Classify the following quadrilaterals. Some shapes may have more than one correct classification.

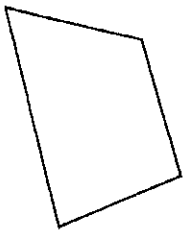
(A) quadrilateral (B) trapezoid (C) parallelogram (D) rectangle (E) square

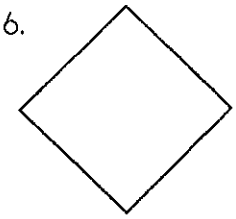
1.  _____

2.  _____

3.  _____

4.  _____

5.  _____

6.  _____

- ❑ I understand that two-dimensional figures within a category share the same attributes.
- ❑ I can classify two-dimensional figures into categories.

Name_____

5.G.3, 5.G

Name the quadrilateral(s) described.

1. I have 4 sides and 4 right angles.

2. I have 4 sides, and opposite sides are parallel.

3. I have 4 sides and only 1 pair of parallel sides.

4. I have 4 congruent sides, and opposite sides are parallel.

5. I have 4 sides, 2 obtuse angles, and 2 acute angles.

6. I have 4 congruent sides, and opposite angles are equal.

- ☐ I understand that two-dimensional figures within a category share the same attribu
- ☐ I can classify two-dimensional figures by their attributes.