Title: Finding Gas!	
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Course: Science **Grade Level:** 6	**Duration:** One—45 minute period
Objective: The learner will examine evidence of geological processes which have resulted in distribution of natural resources.	
Summary of Lesson: Teacher will read technical description of gas formation asking "What am I?" then show a video clip and have students compare by the RS 7 standard below. Students will complete an anticipation guide, KWL, peer-paired discussion of perception from "heard" and "seen" evidence, and reinforce vocabulary with a game of Password.	
Standards: CCSS, Arkansas State Frameworks, Next Generation Science Standards, Other	
Code:	**Standard:**
NGSS -MS-ESS3A: Natural Resources	Humans depend on Earth's land, ocean, atmosphere, and biosphere many different resources. Minerals, fresh water, and biosphere resources are limited and many are not renewable or replaceable over human lifetimes
NS.1.6.4	Construct and interpret scientific data using • data tables/charts • bar and double bar graphs • line graphs • stem and leaf plots • line graphs
CC for ELA/Literacy in Science: Reading Standards for grade 6	• RS1 – Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text. • RS7 – Compare and contrast the experience of reading a story, drama, or poem to listening to or viewing an audio, video, or live version of the text. Including contrasting what they "see" and "hear" when reading the text to what they perceive when they

	listen or watch. • RS10 – By the end of the year, read and • comprehend literature, including stories, dramas, and poems, in the grades 6-8 text complexity band proficiently, with scaffolding as needed at the high end of the range.
CC for Math grade 6	• Statistics and Probability - #4: Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

Teacher Excellence and Support System:
Domain 1.e (instructional materials and resources, instructional groups)
Domain 2.c (management of classroom groups, transitions, materials and supplies)
Domain 3.a (use of oral and written language)
Domain 3.d (student self-assessment and monitoring of progress)

Instructional Strategies and Practices:

- Non-linguistic representations (Marzano's High Yield Instructional Strategies)
- Visuals, games (Marcia Tate's Instructional Strategies)
- Anticipation guides, peer-pairing and KWL

Bloom's Level: *(Highest Level Only)*
Evaluating - The learner will decide which delivery method (verbal or visual) is more meaningful to them in understanding the formation of natural gas.

Materials and Resources:

Materials:

1. One copy of *Anticipation Guide* for each student (Student Handout 1)
2. One copy of *Geologic Time Scale* for each two students—precut sheets (Student Handout 2)
3. One glue stick for each student
4. One copy of *Gas Formation Student Reading with KWL Chart* for each student (Student Handout 3)
5. Each student should have an interactive notebook or science journal
6. PowerPoint: Password Game (Click here to Download)

Resources:
Video clip on gas formation)
http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&ved=0CDEQtwIwAA&url=http%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3DKoMrzvJc2JU&ei=rEGyUaPhAeHKiwKKqoGIBQ&usg=AFQjCNFluHJf9gseXkiVggvgu-AwOHFFqQ&sig2=3bAwM8POLHlpXpS4-GCkJw&bvm=bv.47534661,d

Background reading for teacher: www.natgas.info/html/gasformation.html
(See also insert in Teaching Notes below.)

Formative Assessment:

1. KWL entries
2. Password participation

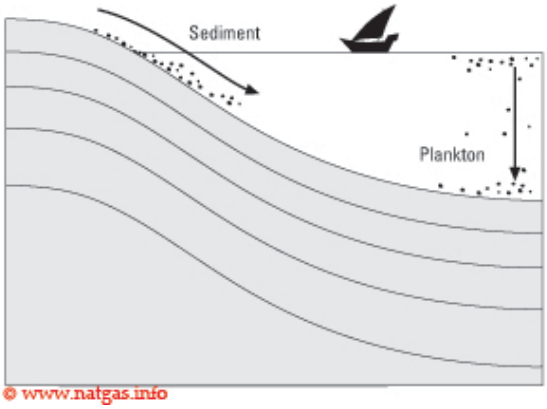
Teaching Notes:
Background information:

Gas Formation

Though there are differing theories on the origin of hydrocarbons, the organic theory is the more widely held and studied hypothesis.

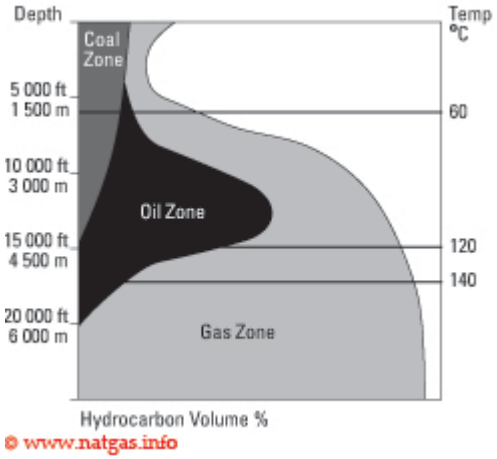
Petroleum scientists are particularly interested in the association between hydrocarbons and sedimentary rocks. Sedimentary rocks (rocks formed from fragments of other rocks or chemically precipitated) are much more likely to have properties that allow hydrocarbons to generate, migrate, and be stored between their grains. Sedimentary rocks that accumulate in water-rich environments, such as lakes and oceans in particular, tend to preserve and generate hydrocarbons more efficiently

Marine life, from the simplest plankton and single-celled life forms to the more complex crustaceans and fish species, contains carbon molecules. As these animals die and decay over millions of years, carbon molecules, through processes of heat and pressure, degrade into hydrocarbon compounds. Sufficient volumes of accumulations may form oil and gas reservoirs over time.



Increasing heat and pressure help to encourage decomposition of carbon compounds from the remains of marine life. Larger organic molecules crack to form lower weight compounds leading to the separation between the volatile products (hydrogen and simpler chain carbons such as methane) and liquid products (C_{13+}). The transformation of this organic material, called kerogen, into oil and gas hydrocarbons leads to the progressive increase of the hydrogen/carbon ratio.

Generally, the lower the temperature and shallower the depth, the heavier the hydrocarbon component formed. Though temperature is the critical factor, the amount of time that the organic material is exposed to heat and pressure is also an important factor in the production of hydrocarbons. These factors determine the relative amounts of natural gas versus oil that is found in a particular reservoir. The figure below shows the relationship between depth, temperature, and probable petroleum production.



In a simple sense, gas, oil, and solid hydrocarbons such as coal are merely different stages in the creation of hydrocarbons from organic matter.

Any sediment capable of becoming a source rock for oil may also produce gas. In this case, gas produced will be associated gas, occurring in the same reservoir and coexisting with

crude oil. However, not all sediment capable of producing gas will also produce oil, leading to the huge reserves of non-associated gas, or gas without oil, which is found in many parts of the world.

Much like a kitchen sponge appears to be solid, but once it is squeezed, liquid drains out, rocks may appear solid, but contain liquids inside the void spaces between rock grains. A bucket of beach sand is another analogy. If a glass of water is poured onto the sand, the water appears to disappear into the sand. It actually fills the empty pore spaces between the individual sand grains. As more water is added, it continues to fill the entire pore space until there is no more empty space, forcing the water to overflow from the bucket. Oil and gas fill the pores of rocks in the same way as the water in the bucket. Imagine if two solid layers like the faces of a steel vise squeeze the bucket of sand. If the bucket is tightly packed with sand, the grain structure of the sand in the bucket prevents the bucket from deforming. If a hole is drilled through the steel faces of the vise, any liquid in the pores of the rock will squirt out. A well drilled into an oil or gas reservoir acts the same way. If the oil and gas reservoir pressure is higher than the pressure in the well, the hydrocarbon is forced to come out of the well.

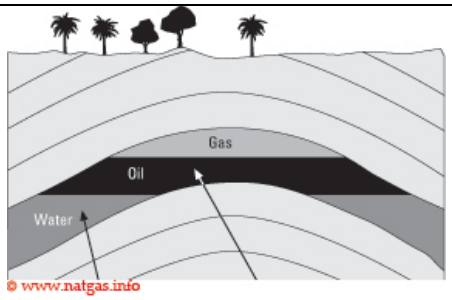
Gas traps

Gas accumulates in a particular location if nature provides the following geologic conditions:

- A source rock with sufficient decomposing organic matter.
- Reservoir rock with favorable porosity and permeability. Typically, sedimentary rocks such as sandstones and certain limestones are the best reservoirs connected via migration paths to the source rock. Porosity refers to the proportion of void space between the rock grains and permeability measures the ability of fluid to pass through the rock.
- The presence of a rock formation or layer, usually above the reservoir rock, that has low permeability, thus sealing the reservoir and preventing the gas from escaping. Typically, these cap rocks are shales, salts, and clays.
- The presence of a trap, or specific geologic/geometric configuration, which prevents lateral escape of gas.

Because of density differences, oil will accumulate above the water layer, and gas, if present, will accumulate above the oil layer and collect in the highest part of the trap, forming a gas cap above the liquid layers. Density also helps to explain why oil and gas migrate to the highest point in a formation, if sufficient porosity and permeability conditions exist. Natural gas components may also exist dissolved within the oil layers, separating on the surface when the pressure is reduced.

A classic gas trap is an anticlinal trap, as shown in below.



Student Activity:

1. Distribute one *Anticipation Guide Handout 1* and one *Geologic Time Scale Handout 2* to each student. (See Student Handout section.)
2. Have students glue these in their interactive notebooks or science journals then listen to the reading included below. Without giving away the topic, "natural gas," ask students to anticipate the topic from hearing the reading of the text only. Have them complete the *Anticipation Guide* based on the text selection as it is read aloud. The teacher should not reveal the title of the reading, "Gas Formation!"

   (READ ALOUD, <u>but do not include the title of the article</u>.)

   Gas Formation
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   > Marine life, from the simplest plankton and single-celled life forms to the more complex crustaceans and fish species, contains carbon molecules. As these animals die and decay over millions of years, carbon molecules, through processes of heat and pressure, degrade into hydrocarbon compounds. Sufficient volumes of accumulations may form oil and gas reservoirs over time.

3. Students should take about 2 minutes to record information on their *Anticipation Guide*.
4. Next, distribute the student handout *Gas Formation Student Reading with KWL* Chart. Instruct students to fill in the topic on the *Anticipation Guide* with "Gas Formation." Students will silently read the text and add information to the KWL chart and *Anticipation Guide*, then glue both KWL and passage in interactive notebooks or science

journals. Both the silent reading and KWL chart initial notes should take no more than 7 minutes.

5. Next the teacher will show a video clip of gas formation—9 minutes. http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&ved=0CDEQtwIwAA&url=http%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3DKoMrzvJc2JU&ei=rEGyUaPhAeHKiwKKqoGIBQ&usg=AFQjCNFluHJf9gseXkiVggvgu-AwOHFFqQ&sig2=3bAwM8POLHlpXpS4-GCkJw&bvm=bv.47534661,d
6. Students will add to their KWL charts (2-3 minutes).
7. Students will then discuss the experience with their face partner or shoulder partner. They should compare what they "see" and "hear" when reading the text to what they "perceive" when they listen or watch.
8. Play the Password Game: Students will form 2 groups (use left and right sides of room). One student from each group will be seated in front of the group facing away from the video screen. Display the PowerPoint for the Password game (See link in Materials and Resources section). It may be necessary to review the rules included on the first slide with students. If they are already familiar with the rules, skip to the screen for the first word and begin the game.

See Student Handouts