



Title: Finding Gas			
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Course: Science, Language Arts		Duration: One—45 minute period	
Grade Level(s): 7-8			
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 RI.7.7/RI.8.7 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.			
Arkansas Standards:			
Subject:	Grade Level(s):	Code:	Standard:
Science	7	7-ESS3-1	Construct a scientific explanation based on evidence for how the uneven distributions of Earth’s mineral, energy, and groundwater resources are the result of past and current geoscience processes. [Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity



			associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]
Language Arts	7-8	RI.7.1 RI.8.1	Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
		RI.7.2 RI.8.2	Examine a grade-appropriate informational text. <ul style="list-style-type: none"> ● Provide an objective summary. ● Determine a central idea in a text and analyze its development.
		RI.7.4 RI.8.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of a specific word choice on meaning and tone.
		RI.7.7 RI.8.7	Compare and contrast a text to an audio, video, or multimedia version of the text, analyzing each medium's portrayal of the subject (e.g., how the delivery of a speech affects the impact of the words).
		RI.7.10 RI.8.10	By the end of the year, read and comprehend literary nonfiction in the Grades 6-8 text complexity band proficiently, with scaffolding as needed at the high end of the range.
		SL.7.1 SL.8.1	Engage effectively in a range of collaborative discussions <ul style="list-style-type: none"> ● one-on-one ● in groups ● teacher-led with diverse partners on Grade 7-8 topics, texts, and issues, building on others' ideas and expressing their own clearly.
		SL.7.2 SL.8.2	Analyze the main ideas and supporting details that are gained by means other than reading (e.g.,



			texts read aloud; oral presentations of charts, graphs, diagrams; speeches) and explain how the ideas clarify a topic, text, or issue under study.
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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 (Download from Arkansas Energy Rocks website at www.arkansasenergyrocks.com/wp-content/uploads/2020/03/Finding-Gas-Password-Game.pdf)

Resources: These web sites may change over time. If a web site is no longer available, use the key words and phrases to find more current resources.

- How gas and oil are formed: <https://www.youtube.com/watch?v=KoMrzvJc2JU> - Video clip on gas formation)
- Natural gas overview: <http://naturalgas.org/overview/background/> - Background reading for teacher

(See also insert in Teaching Notes below.)

Formative Assessment:

1. KWL entries
2. Password participation

Teaching Notes:

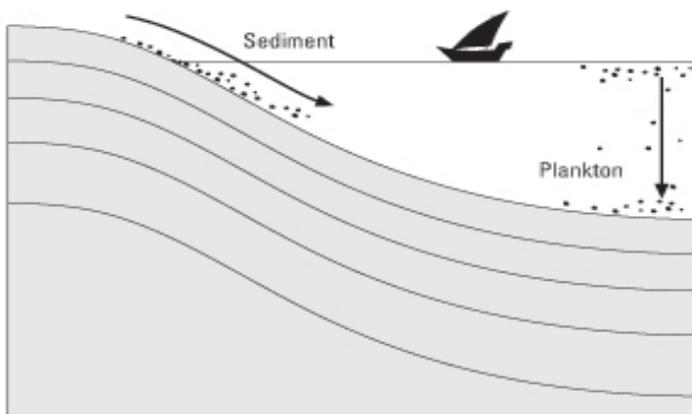
Background information:

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

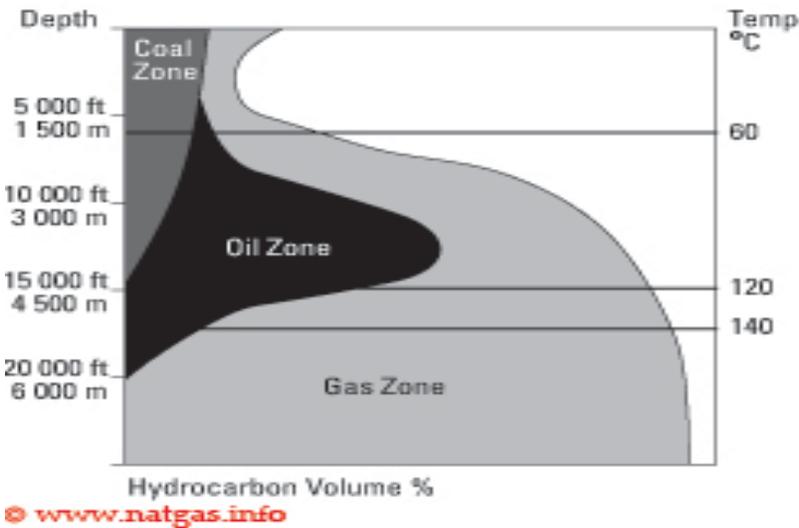
Marine life, from the simplest plankton and single-celled life forms to the more complex crustaceans and fish species, contains carbon molecules. As these animals die and decay over millions of years, carbon molecules, through processes of heat and pressure, degrade into hydrocarbon compounds. Sufficient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



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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 (C₁₃+). 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.

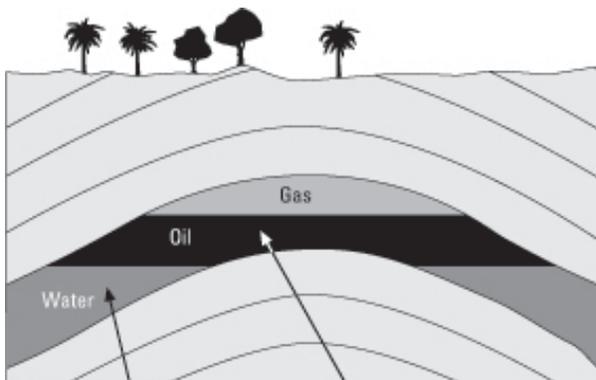
Much like a kitchen sponge appears to be solid, but once it is squeezed, liquid drains out, rocks may appear solid, but contain liquids inside the void spaces between rock grains. A bucket of beach sand is another analogy. If a glass of water is poured onto the sand, the water appears to disappear into 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.



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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, but do not include the title of the article.)

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, contain 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.
<https://www.youtube.com/watch?v=KoMrzvJc2JU> or find a current video showing the formation of natural gas.
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.

Student Handouts: See web site for a printable copy:

<http://www.arkansasenergyrocks.com/educators/lesson-plans-k-8/>



**Finding Gas
Student Worksheet 1
Anticipation Guide**

After hearing the information read aloud by your teacher “anticipate” the topic of the article.

Name _____ Date: _____ Period _____

Topic: (Anticipate the topic of the article)	Were you right? Yes / No	If you were correct, what helped you decide on the topic?
After hearing the passage read aloud , agree or disagree with the statements below	After reading the passage myself agree or disagree with the statements below.	Reflect/Revise
Scientists think that hydrocarbons can be found in sedimentary rocks. Agree / Disagree	Agree / Disagree	Were you right? Why or why not? (explain)
Sedimentary rocks that accumulate in water-rich environments are less likely to generate hydrocarbons Agree / Disagree	Agree / Disagree	Were you right? Why or why not? (explain)
Scientists think that oil and gas are made of dead plants and animals. Agree / Disagree	Agree / Disagree	Were you right? Why or why not? (explain)



Before viewing the video, answer the question below.	After viewing the video...	
There are many interesting careers associated with petroleum exploration, processing and production. Agree / Disagree	Agree/ Disagree	Were you right? Why or why not? (explain)

GEOLOGIC TIME SCALE

ERA	PERIOD	EPOCH	SUCCESION OF LIFE
CENOZOIC <i>recent life</i>	QUATERNARY 0-1 Million Years Rise of Man	Recent Pleistocene	
	TERTIARY 62 Million Years Rise of Mammals	Pliocene Miocene Oligocene Eocene	
MESOZOIC <i>middle life</i>	CRETACEOUS 72 Million Years Modern seed bearing plants, Dinosaurs		
	JURASSIC 46 Million Years First birds		
	TRIASSIC 49 Million Years Cycads, first dinosaurs		
PALEOZOIC <i>ancient life</i>	PERMIAN 50 Million Years First reptiles		
	PENNSYLVANIAN 30 Million Years First insects		
	MISSISSIPPIAN 35 Million Years Many crinoids		
	DEVONIAN 60 Million Years First seed plants, cartilage fish		
	SILURIAN 20 Million Years Earliest land animals		
	ORDOVICIAN 75 Million Years Early bony fish		
	CAMBRIAN 100 Million Years Invertebrate animals, Brachiopods, Trilobites		
	PRECAMBRIAN Very few fossils present (bacteria-algae-pollen?)		



Student Handout 3 Finding Gas

Gas Formation Student Reading

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K	W	L
What I Know!	What I Want to Know!	What I Learned!