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CLC TECH, INTEGRATED SCIENCE 9-12
EARTH SCIENCE: CALIFORNIA OIL INDUSTRY
LESSON PLAN SAMPLE

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
INTEGRATED SCIENCE	**<u>Lecture:</u> California oil industry, including geographic features leading to formation of oil, stratigraphy of oil producing formation, use of alternative fuels such as biodiesel; students take lecture notes** **<u>SMART Board:</u> *Oil & Gas in California* storyboard** **http://www.consrv.ca.gov/DOG/kids_teachers/Tr34/tr34pg1.html** **<u>Demonstrate:</u> separation of oil and water using cooking oil and water in clear plastic cup** **<u>Lab:</u> each table prepare gas formation bottle in experiment *Formation of Natural Gas and Oil: It's a Gas!*** **<u>SLL Modification:</u> pair SLL student with native speaker; bilingual aid assistance when needed** **<u>Video:</u> *Home Grown:***	**<u>Lab:</u> record daily observations regarding gas formation in bottle** **<u>Vocabulary:</u> Complete *Oil Industry Vocabulary* worksheet** **<u>SLL Modification:</u> include vocabulary words in Spanish and English when possible** **Objective**-vocabulary building with key terms pertinent to the oil industry **Materials**-pencil; worksheet **Standards-**Earth Science: California Geology 9a-c The geology of California underlies the state's wealth of natural resources as well as its natural hazards **Foundational**	**<u>Lab:</u> record daily observations regarding gas formation in bottle** **<u>Lecture:</u> Kern County oil industry, including both geologic and financial impact-both positive and negative; discuss potential local career opportunities; complete worksheet labeling parts:** ***Common Oil Rigs and Parts*** **Use overheads based on website:** **Picture of a Drill Rig** **http://www.consrv.ca.gov/DOG/picture_a_well/gh_drill_rig.htm** **Picture of a Well** **http://www.consrv.ca.gov/DOG/picture_a_well/gh_well.htm**	**<u>Lab:</u> record daily observations regarding gas formation in bottle** **<u>Lab:</u> *Playing with Polymers* from website www.reachoutmichigan.org/funexperiments/agesubject/lessons/polymer.html; review of chemical compounds formed from long chains of the same molecule group; discuss potential career opportunities** **<u>SLL Modification:</u> pair SLL student with native speaker; bilingual aid assistance when needed** **Objective**-introduction to chemical compounds, polymers and elasticity; review commercial uses of polymers; educate regarding career opportunities in industry **Materials**-pencil; water, borax powder, white latex glue, talcum powder, cup, stir stick, zipper closure sandwich bag, cooked spaghetti (2 types), teaspoon, measuring cup, eye goggles, soap,	**<u>Lab:</u> record daily observations regarding gas formation in bottle; class discussion regarding results of natural gas formation due to decomposition** **<u>Assessment:</u> complete *Earth Science Quiz-California Oil Industry*** **<u>SLL Modification:</u> have bilingual aid assist students in small group with test completion, if needed** **Objective-**assessment of comprehension of key concepts presented during week regarding stratigraphy, decomposition of carbon based resources into oil and natural gas, traditional and non-traditional fuels, oil industry vocabulary, economic factors and job opportunities, polymer formation and uses of same **Materials-**copy of *Earth Science Quiz-California Oil Industry*, pencil **Standards-**Earth Science: California Geology 9a-c The

	Biodiesel **http://www.pbs.org/now/shows/302/index.html** **Objective**-instruction regarding California resources based on geologic timetable; review importance of oil industry to economy of state and Kern County **Materials**-pencil; paper; SMART Board; computer; lab supplies-organic substances (tuna, beef, egg), lettuce leaves, drink bottles, sand, balloon, pond water, masking tape, balance scale **Standards-**Earth Science: California Geology 9a-c The geology of California underlies the state's wealth of natural resources as well as its natural hazards **Foundational Standards-**Plate tectonics 1a-g Plate tectonics accounts for important features of Earth's surface and major geologic events; Shaping Earth's Surface 2a-d Topography is reshaped by the weathering of rock and soil, and by the transportation deposition of sediment	**Standards-**Plate tectonics 1a-g Plate tectonics accounts for important features of Earth's surface and major geologic events; Shaping Earth's Surface 2a-d Topography is reshaped by the weathering of rock and soil, and by the transportation deposition of sediment	**Picture of an Offshore Platform** **http://www.consrv.ca.gov/DOG/picture_a_well/offshore_platform.htm** **<u>Vocabulary Review:</u> complete worksheet-*California Oil Industry Wordsearch*** **Objective**-review of oil rigs and parts; oil industry vocabulary **Materials**-pencil; worksheets-*California Oil Industry Wordsearch; Common Oil Rigs and Parts*; overhead copies of oil rig parts (3 sections); lab project bottles **Standards-**Earth Science: California Geology 9a-c The geology of California underlies the state's wealth of natural resources as well as its natural hazards **Foundational Standards-**Plate tectonics 1a-g Plate tectonics accounts for important features of Earth's surface and major geologic events;	shaving cream **Standards-**Earth Science: California Geology 9a-c The geology of California underlies the state's wealth of natural resources as well as its natural hazards **Foundational Standards-**Plate tectonics 1a-g Plate tectonics accounts for important features of Earth's surface and major geologic events; Shaping Earth's Surface 2a-d Topography is reshaped by the weathering of rock and soil, and by the transportation deposition of sediment	geology of California underlies the state's wealth of natural resources as well as its natural hazards **Foundational Standards-**Plate tectonics 1a-g Plate tectonics accounts for important features of Earth's surface and major geologic events; Shaping Earth's Surface 2a-d Topography is reshaped by the weathering of rock and soil, and by the transportation deposition of sediment

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Name ____
Date ______________ Homeroom ________________

EARTH SCIENCE: CALIFORNIA OIL INDUSTRY
VOCABULARY WORDS

<u>DIRECTIONS:</u> Write the meaning of each word.

barrel

biofuel

bit

blowout

cap rock

carbon

casing

coal

cogeneration

core sample

cracking

crude oil

directional drilling

discovery well

drill

drilling fluid

drilling rig

fault

formation

geologist

gusher

horizontal drilling

horsehead pump

hydrocarbons

mud

natural gas

offshore platform

oil

outcrop

permeability

petroleum

porosity

pumping unit

refining

reservoir

salt dome

samples

sedimentary rock

seep

trap

Name ____
Date _____________ Homeroom _______________

LAB EXPERIMENT: IT'S A GAS!

Materials:

- 10 g organic substance (tuna, beef, egg)
- lettuce leaves
- clear drink bottle
- 50 g sand
- balloon
- pond water
- masking tape
- balance scale
- funnel

Procedure:

1. Measure 10 g of an organic substance and put into bottle
2. Tear lettuce leaves into small pieces and put into bottle
3. Use balance scale to measure 50 g sand; using funnel, carefully pour sand into bottle so it covers the organic substance and lettuce; do not shake the bottle
4. Measure 10 ml of water; slowly pour the water into the bottle; make it run down the inside of the bottle instead of pouring directly onto the sand
5. Stretch the opening of a balloon over opening of bottle; seal with masking tape
6. Put the bottle in a warm place (preferably outside as contents could produce a strong odor)
7. Predict what will happen over the next few days
8. Design a chart and record daily observations (changes in the balloon, content changes)

Prediction: Explain in writing what you think will happen.

Chart: Prepare observation chart on back of form.

Questions: Answer questions on back of form.

1. What scientific principles are demonstrated in this experiment?
2. What happens to the material in the bottle?
3. What effect does heat have on this process?
4. What causes the balloon to expand?

Reflection: Could today's scientists create petroleum and natural gas? Why or why not? Explain your reasons on back of form.

Playing With Polymers

About This Lesson Adapted by John Nees and LeAnn Fu

Recommended Age Level: Later Elementary, Middle School

Time Required: 1 hour

Guiding Question

What is a polymer?

Objectives

Concepts:

A polymer is a chemical compound formed from long chains of the same molecule group, repeating over and over.

Principles:

- Polymers are stretchable, pliable, and flexible.
- Polymers are not brittle, hard, or rigid.
- When cross-links are formed in a polymer, its chains of molecules are connected in several places, producing a stronger and more elastic polymer.
- The elasticity of some (thermoplastic) polymers is affected by temperature.

Facts:

- Some polymers occur naturally, as in the juice of rubber or aloe plants, and some are manmade.
- Polymers tend to be dense, strong, and flexible. Examples are plastic bottles, styrofoams, latex paints, and chewing gum.

Skills

- Measuring
- Following Directions
- Making Inferences
- Using Metric Units

Materials

1. Gallon of water
2. Gallon of borax-water Solution (Mix borax with water until saturated)
3. Original Elmer's White Glue, or similar latex glue
4. Talcum powder
5. Food coloring
6. For Each Student:
    - 5-8-oz. Cup
    - Stirring stick (preferably wood)
    - Plastic sandwich bag, preferably with zipper-type closure

7. [optional] two batches of cooked spaghetti, one cooked without stirring so that it is a tangled mat of cooked noodles and one with a bit of oil stirred in after cooking to keep the noodles from sticking together.
8. Teaspoon
9. Metric measuring cup
10. Optional: Protective eye goggles

Room Preparation

Need ample desk or table space for each student to mix ingredients; blackboard and sink are handy.

Safety Precautions

Borax is moderately toxic. Wash hands if handling borax and after holding polymer material. Warn participants not to rub eyes without washing hands first, as borax can irritate the eye. It may stain or mar. Clean up spills with soap and water. Label borax solution "Borax - Do Not Drink."

Procedures and Activity

Introduction

1. Share the definition of polymers, and how they are long chains of molecules, just like spaghetti noodles.
2. Share that plastics are polymers and ask for examples of them in daily life. What are some characteristics of polymers? Use their polymer examples to see that they are usually strong, flexible, durable, sometimes strechable and bendable.
3. Ask for examples of things that are NOT polymers (such as bricks, glass, metals) to see whether they have the idea.
4. Why use polymers in things like car bumpers, garbage bags, plastic dishes and utensils, countertops, etc.? Reinforce their characteristics.
5. Show the two different batches of cooked spaghetti and ask for input on how they are different and yet the same. When stuck together, a mass of noodles is springier and stretchier than the individual noodles of the oiled spaghetti.
6. Let them do pulling experiments with individual noodles, pulling slowly and watching how the noodles stretch, then quickly to see them break abruptly. Polymers behave like this.
7. The mass of noodles can be pulled and stretched quite a bit before breaking apart, because it has a lot more bonds holding it together. In this experiment, we are going to take a natural polymer (the latex in Elmer's Glue) and add borax to make it form cross-links.

Activity

Today, we are going to make polymers.

- Pass out cup, stirrer, and Baggie to each student.
- Have polymer recipe on blackboard or countertop chart.

    1. Measure 20 ml water into cup.
    2. Add 25 ml Elmer's-type glue. Mix with stirrer.
    3. Add 1 level teaspoon talcum powder. Stir 2 minutes until compound is made—or ingredients are thoroughly mixed together.

4. May add up to 5 drops of food coloring—AND NO MORE! Decisions about mixing colors should be made *before* the five-drop limit is reached. More coloring makes too big a mess on hands, clothing, and surroundings.

5. Add 5-8 ml or 1 teaspoon of saturated borax-and-water [***Be careful!*** Students should be warned that the borax solution can burn their eyes a little, so they should take care not to splash it. They should also not rub their eyes until they have washed their hands. Younger children should have the borax solution measured out for them.] Stir 2 minutes.

6. Remove polymer from cup. Pull off extra material from stirrer. Form a glob.

7. Dispose of cup. When done playing with polymer, store in plastic bag. If you plan to keep it awhile, store in the refrigerator.

- Have students play with the material—see if it has the "polymer" characteristics discussed earlier: flows, stretches; is flexible, durable. Try pulling apart chunk quickly. See clean break of molecules. See flowing when pulled apart slowly. Don't forget the old Silly Putty favorites of imprinting a design, from a coin or a sealing wax impresser, and picking up print from the color comics pages of the Sunday newspaper.

  Note that we are using scientific skills such as precise measuring and following directions, experimenting, observing, making hunches or forming a hypothesis, and testing a hypothesis.

- Brainstorm how we could use our material and why it would be a good material for our applications (examples: plug up holes in walls, use as a shock-absorbing material within sole of shoe, glob to hold pins or paper clips, etc.)

Closing - Original Question

- Review original question and activity topic: "What is a polymer?"
- Share definition of polymer. Review examples and non-examples of polymers.
- Go over characteristics or principles of polymers.

Evaluation

You may do an informal evaluation during the closing discussion. Or come back to these kinds of questions another day:

1. What is a polymer?
2. What are some examples of polymers we use and see all the time?
3. What are some principles or characteristics of polymers?
4. Why are polymers used today? What makes them such neat and useful materials?
5. What jobs and careers are related to using polymers?

Extension Ideas

1. Do experiments to measure the ***elasticity*** of your polymer ball. You could try dropping it from different heights and measuring how high it bounces. Will it bounce farther from a short height or a long one? Such results could be charted to make interpretation of data easier.

2. See how elasticity changes with temperature. When warmed by handling, your polymer will stretch a certain amount before breaking apart. What happens if it is chilled in the refrigerator first? What happens if it is frozen? (Hint: the shattering of a frozen ball when thrown at the floor will prove that this is a ***thermoplastic*** polymer.)

3. Demonstrate ***dehydration.*** Leave some of the material we made outside of the plastic bag for a period of time. Observe and feel how it gets harder and less flexible. Why? Dehydration is happening—water molecules are evaporating. See if you can rehydrate the material by adding some water to it in the plastic bag.

4. Observe the ***strength*** of polymers by filling a plastic sandwich bag 2/3 full with water. Twist tie top. Take a freshly sharpened pencil and stick it through the bag. See how polymer flexibility allows the material of the baggie to mold around the pencil and keep water from pouring out. Is this process reversible? See that it is NOT by holding the bag of water with pencil through it over a sink or bucket. Pull pencil out; water flows out. Polymer is not capable of sealing back together, re-joining molecules that were severed and torn apart. Students love to do this experiment themselves: keep bags over a sink or bucket!

5. ***Can polymers shrink?*** Try shrinking globs of the material. Do experiments to promote evaporation of water. Have students recall from original recipe that it is more than 1/2 water. Ideas are to just play and handle the material. See water on hands and its reduction in size/mass. Place a glob on a piece of material which absorbs water, like a paper towel. See decrease in size over time and water/moisture on material. Leave glob out on a sunny shelf. Observe and record what happens to it over time.

6. ***Observe saturation*** by looking at how the borax and water mixture was made. Try putting borax into gallon container of water to the point that no more will dissolve and particles can be seen at the bottom of the jug. See that, after a point, the water simply can't take in more borax. Try making the polymer material with a solution that is past saturation: that has more borax in it than will dissolve. Students will feel the difference: material is not soft but has lumps and a gritty feel. Try stirring other powders into water to the point of saturation. Students may chart experiments to see how many cups of sugar, salt, and borax a gallon of water can hold before it becomes saturated. Or try mixing coffee, instant tea, and cocoa mixes with water and/or milk.

Careers Related to Lesson Topic

- Auto Body Workers
- Auto Engineers
- Chemical Engineers
    - Tour: University of Michigan Chemical Engineering
- Chemists
    - Tour: University of Michigan Chemistry Department
    - Wizard: Whiz Bang Chemistry
- Fabric Designers
- Filter Makers

- Furniture Makers
- Furniture Restorers
- Material Designers
- Materials Engineers
    - Career Presentation: UM ROTC, Careers in the US Navy
    - Career Presentation: EMU ROTC, Careers in the US Army
- Physicists
    - Career Presentation: John Nees

Prerequisite Vocabulary

Compound
: A substance made of more than one element

Elastic
: Capable of resuming former size and shape after being stretched

Molecule
: The smallest bit of a substance that still has all the properties of the substance. Molecules have one or more atoms.

To Lessons by Subject or Age Group

To Michigan Reach Out! Home

Let us know what you think! E-mail our webmaster

This lesson was last revised in May 2003

Name ____________________________________

Date ____________ Homeroom ______________

CALIFORNIA OIL INDUSTRY WORDSEARCH

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a i h m w c i y c f t d t s m r l c t y s
y y g u s h e r l e r r a b f o g o t o i
d p l s c a s i n g i h a i r e t c a b o
s e d i m e n t m n t y e o a b e a l o e
t a e a g l a a o l m d s d c i m s i e s
i n n n u n c o n f o r m i t y s l o d e
y p o r i r d p t d g o e e u p f c e a r
a n t i c l i n e s r g n s r i e r d s o
n o s y t i c i r t c e l e e d p u u o y
e c d o n c l n e a r n a l m r o d r i e
g a n l i a u l y k s o d s e u v e c n b
y p a a o i t d f s a t l g f w t o k o i
x r s s p g w u o b a d u e f a a i i b t
o o e e l i k s r r n s p o u l u l b r e
a c i n l c a c m a p i s l h m t l u a f
a k o d i s a u a n l s h o a c r m t c i
o n c r p f w i t l i g l g t n n m o a s
m a r h s a e l i l b i a i f e k i t e s
t e a d t f n r o t c e p s o r p t p a e
d l c e o m a g n e t i c t i s a m o i o
t a r s e e p v n e g f i k y s o r r n c
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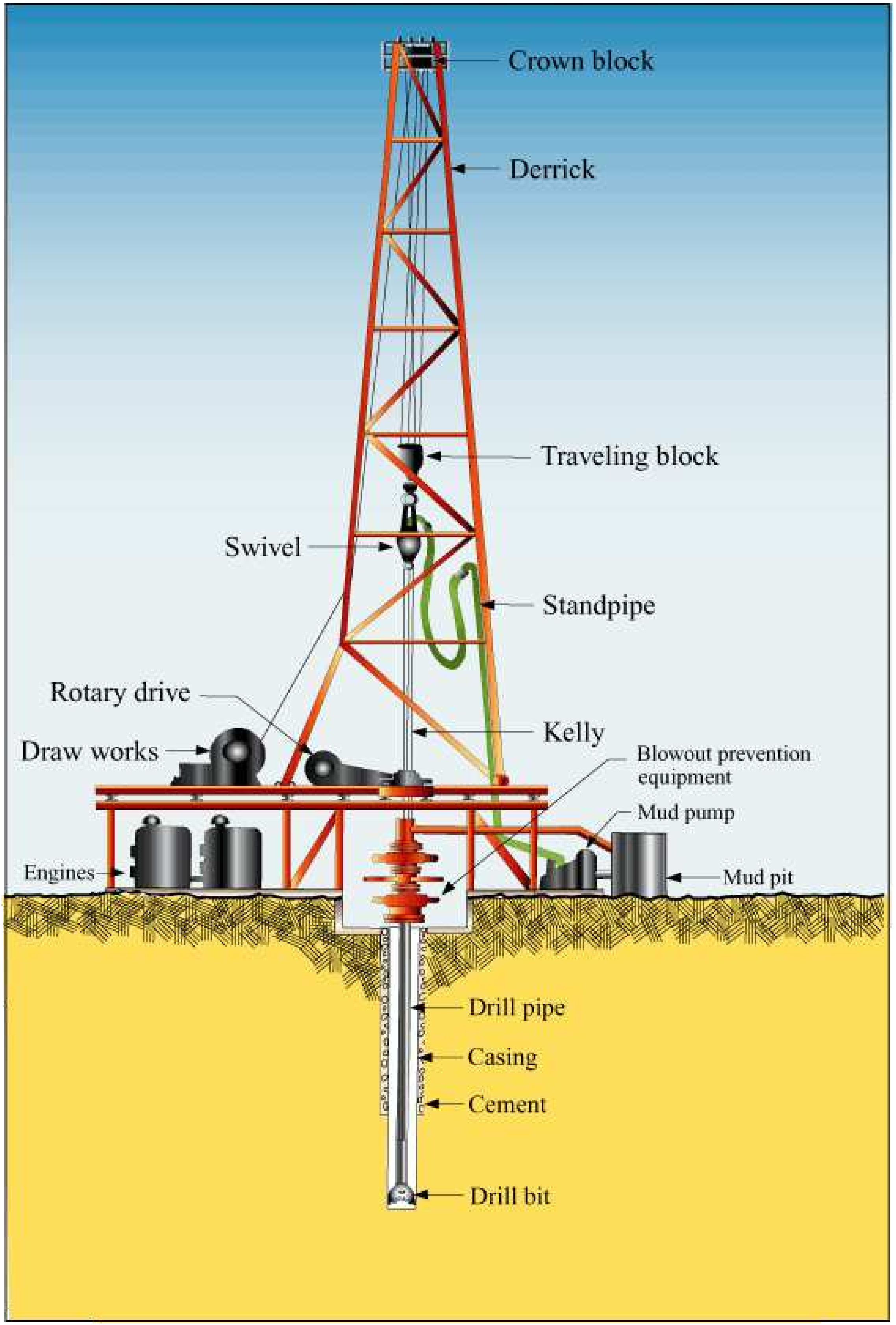
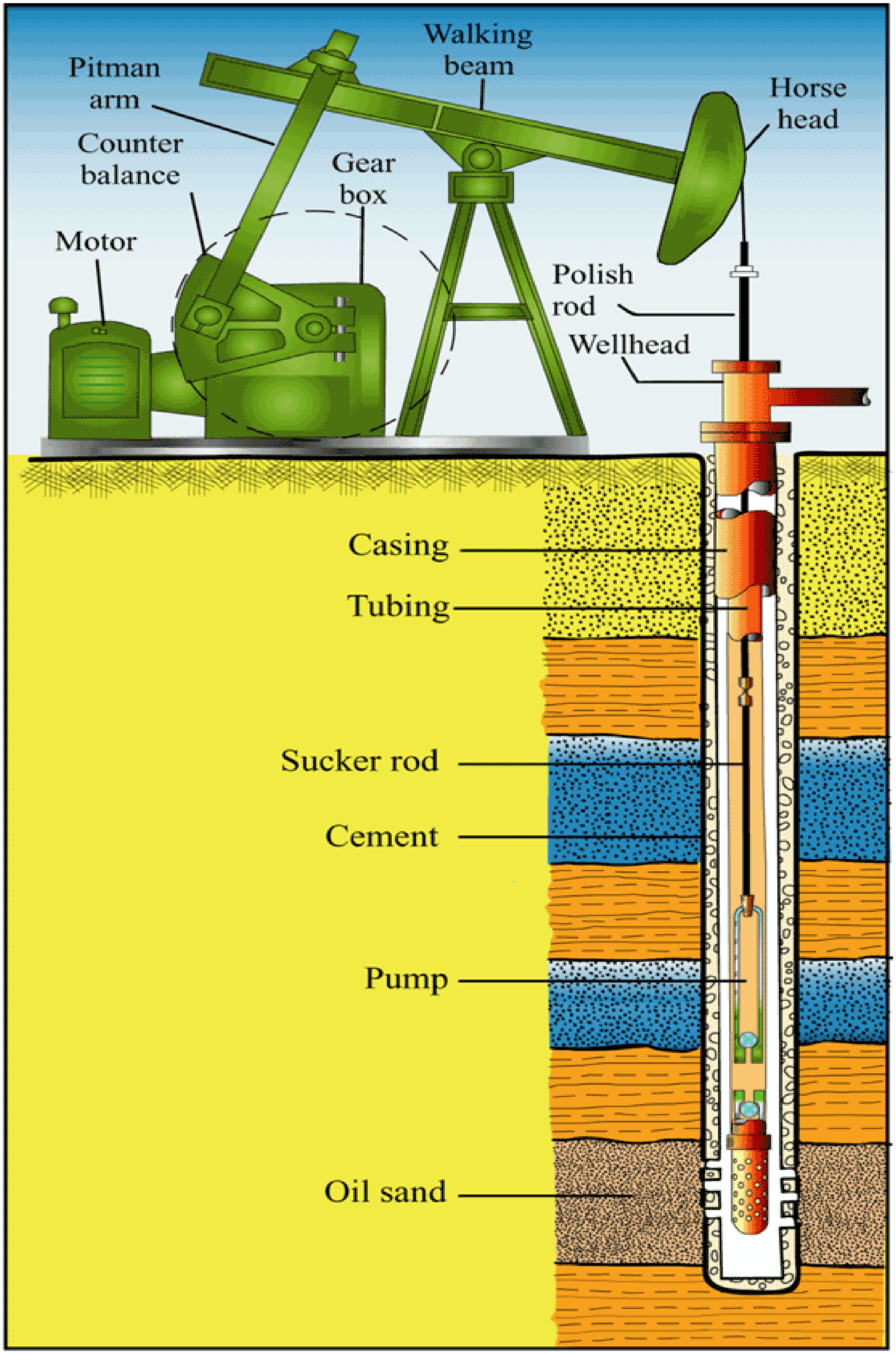
algae
anticline
asphalt
bacteria
barrel
biodiesel
bitumen
blackgold
caprock
carbon
casing
coal
crudeoil
crudeoil
derrick
diatom
electricity
fault
fossil
fracture
geologist
gusher
hydrogen
magnetic
montereyformation
naturalgas
oil
oilfield
oxygen
petroleum
pinchout
plankton
production
prospector
refinery
reservoir
sanandreasfault
sandstone
sediment
seismic
spillpoint
syncline
tar
tarseep
unconformity
water
well
wildcat

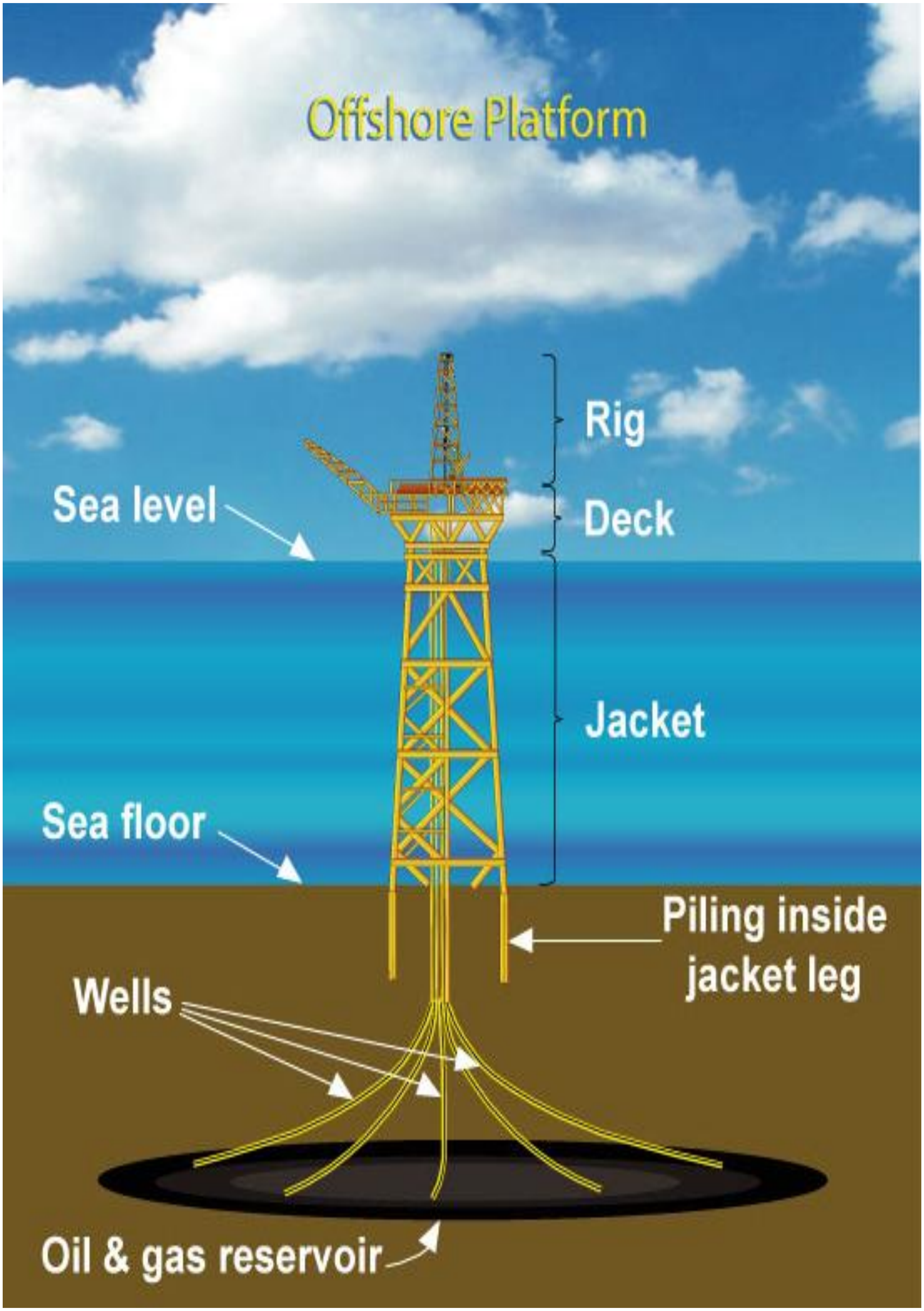
DRILLING RIG



HORSEHEAD PUMP



OFFSHORE PLATFORM



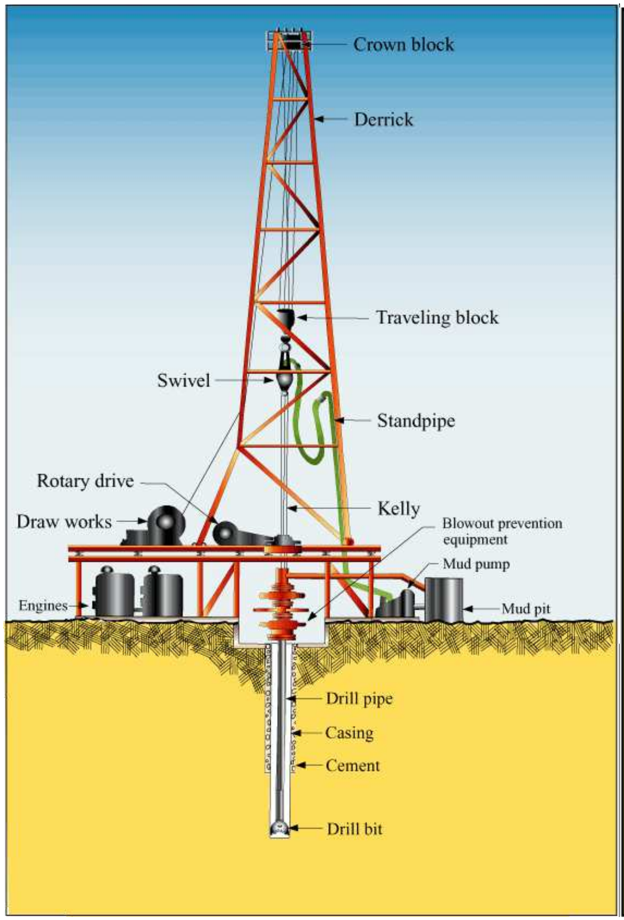
Name ____

Date ____________ Homeroom ___________________

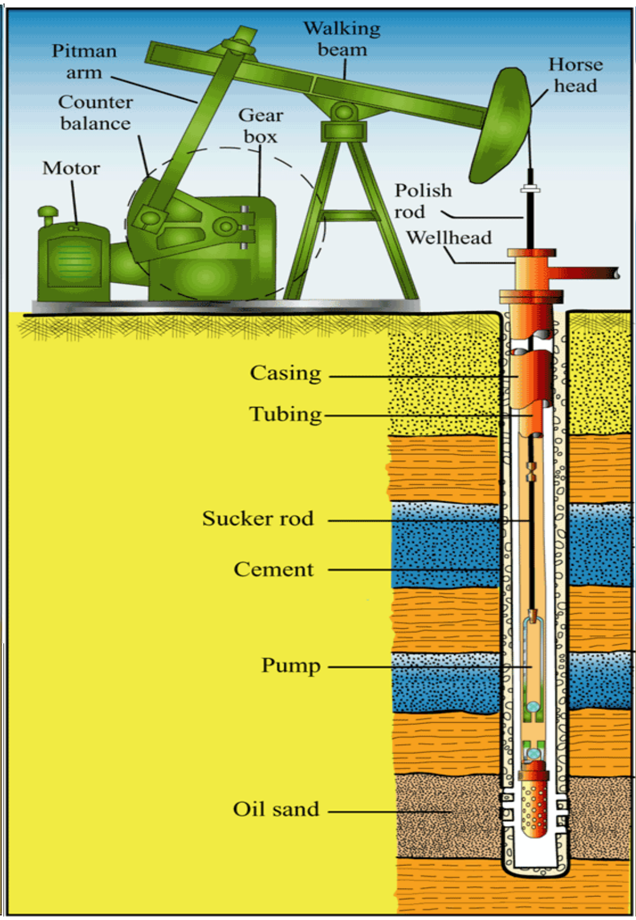
COMMON OIL RIGS AND PARTS

<u>Directions:</u> Label each part in the diagram.

1. DRILLING RIG



2. HORSEHEAD PUMP



3. OFFSHORE PLATFORM