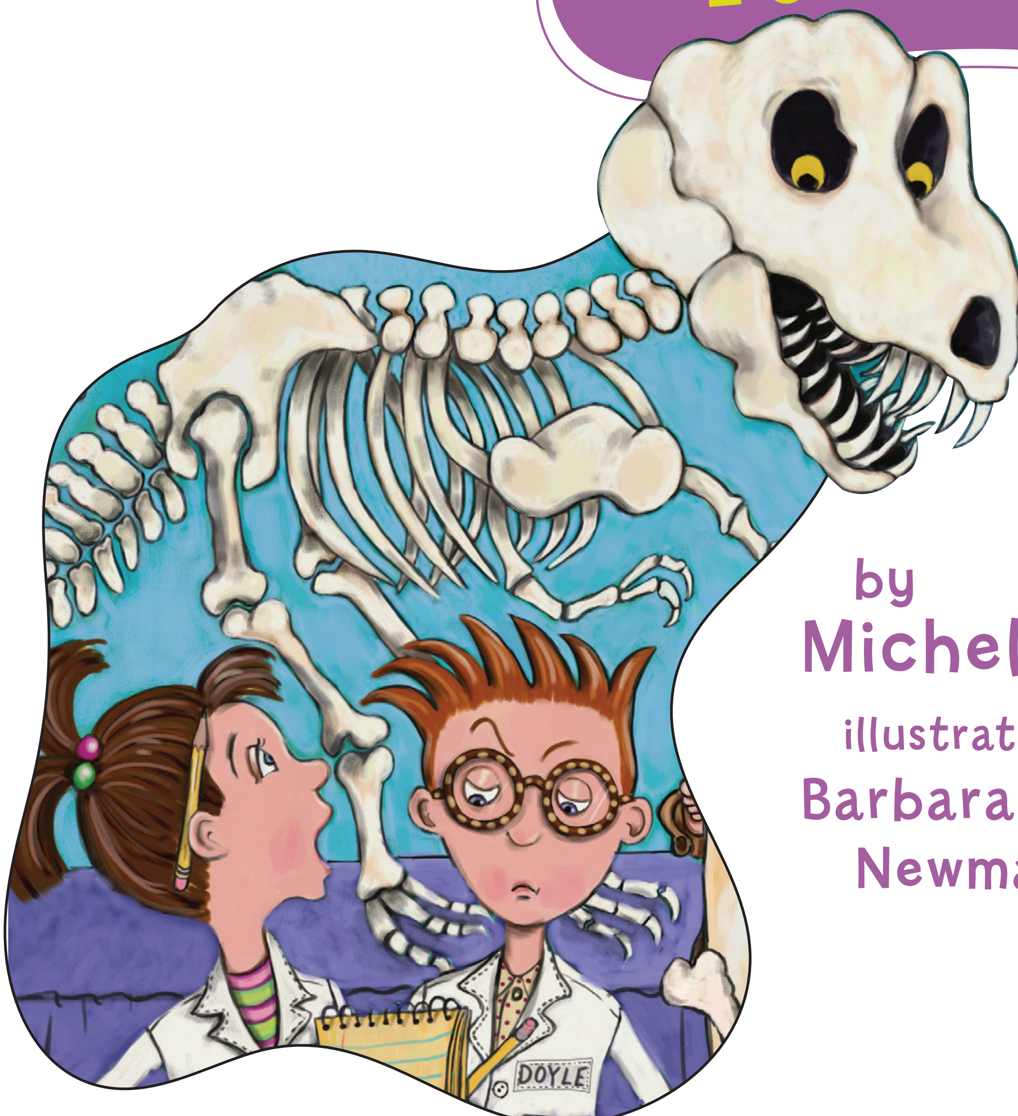
Teacher's Guide

DOYLE AND FOSSEY, SCIENCE DETECTIVES

The Case of the Terrible T. rex



by
Michele Torrey
illustrations by
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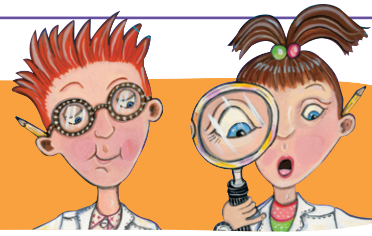
Introduction



After many late nights brainstorming, fueled by cups of decaf and plenty of blueberry muffins, Drake Doyle and Nell Fossey have completed this teacher's guide. The guide provides additional activities that expand on the stories, concepts, and activities introduced in **The Case of the Terrible T. rex,** book six in the **Doyle and Fossey, Science Detectives** series. Drake and Nell invite you to use any or all of the suggestions.

The guide is quite organized. It begins with a section devoted to the language arts; the remainder of the guide is divided into activities and ideas related to the four science concepts introduced in **The Case of the Terrible T. rex:** hot air, pH and water pollution, paleontology, and ham radios.

Oh, one last thing. Drake and Nell have a message for you and your students, "Calling all fellow scientists. Come in, come in . . . Hello? . . . Ah yes, here we go. Greetings, greetings. Keep excellent lab notebooks, follow the scientific method, and don't forget to have fun. We'll be checking in on you later. Now get to work. Over and out."

Cheers,
Michele Torrey
www.micheletorrey.com

Language Arts:

Character Analyses

In this activity, you will help your students analyze the characters in **The Case of the Terrible T. rex**. Have a class discussion regarding the various characters and their traits. Some sample questions: What does this character look like? What kinds of things does this character like? Dislike? If this character could do anything in the world, what do you think it would be?

This is a perfect opportunity to create a character as a class. Using the above character questions as examples, guide the students in a character-creation exercise. As the class begins to generate a character, write the character traits on the wipe board. If there are differences of opinion, allow for discussion and then take a vote. Some additional questions to get the juices flowing might be: How old is the character? Who is the character's family? Where does the character live? In a typical week, what does the character do? What is the character's innermost secret?

For added fun, each student can create his or her own character (see Reproducible #1). Extension ideas can include having the students write a story using the character they've created, and/or presenting their character to the class.

Alliteration

Alliteration is a repetitive sequence of the same sounds. Drake Doyle and Nell Fossey frequently use alliteration, for example, *"Werewolf wailing on Waxberry Hill. Wiley waiting for wescue. . . ."* As a class, identify the different alliterations in **The Case of the Terrible T. rex.**

Does anyone in your class know a tongue twister by heart? Tongue twisters are famous for their use of alliteration. Have the class choose a letter from the alphabet and then create their own tongue twister. Hold a contest: who can say the tongue twister the fastest? Alternatively, divide the class into pairs and assign each pair a letter of the alphabet. Each pair then writes a tongue twister using their assigned letter.

Reader's Theater

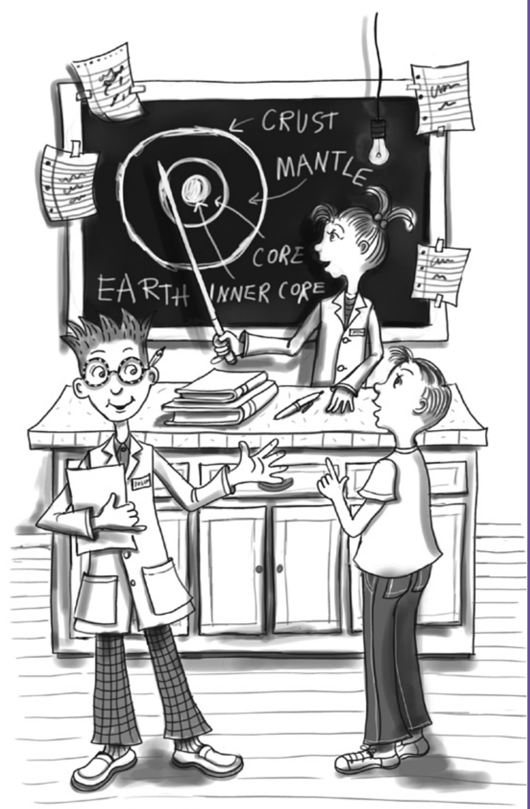
The mysteries in the **Doyle and Fossey, Science Detectives** series make excellent read-alouds, especially for reader's theater. It can be as simple or as complex as desired. The following are some suggestions. Choose one or more to help create an awesome reader's theater:

1. Have the class construct a bulletin board and/or theater stage that reflects the setting, the characters, and/or the science concept.
2. Hold auditions for the various character roles. You will need a narrator in addition to the other characters. The narrator will read everything that's not dialogue.
3. Create costumes for the characters. Don't forget the lab coats and sharpened pencils!
4. Perform the reader's theater. Actors can act or simply read dramatically.

Vocabulary and Key Terms

There are likely many words introduced in each **Doyle and Fossey, Science Detectives** book which will be unfamiliar to many students. The suggested activities included in this guide are meant to familiarize students with the vocabulary rather than to achieve total comprehension. While it is important to continue to build on comprehension, it is through context that most of these terms will be truly understood: context within the story itself, and context resulting from the activities, discussions, and experiments that follow.

acid
antenna
base
cast
core
crust
flavin
fossil
frequency
fumerole
ham radio
hypothesis
magma
mantle
Morse code
neutral
observation
pH indicator
pH scale
paleontology
procedure
resonance
satellite
scientific method
solution
specimen
stratification
telegraph
transmission
trilobite
vertebra
wavelength



Games

1. Have a volunteer sit at the front of the room with his or her back to the chalkboard. Write a vocabulary word on the board. Have the class give the volunteer clues as to the identity of the mystery word. For instance, a clue for *satellite* might be, "This orbits the Earth."

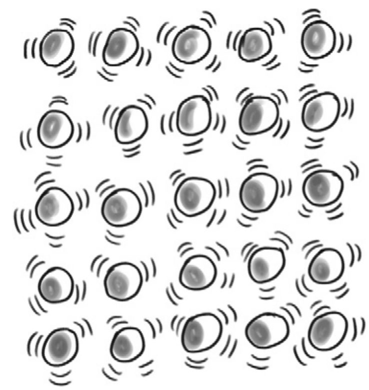
2. Prior to class, write the vocabulary words on the chalkboard. Then write each definition on a scrap of paper and hide the scraps around the room. Place two jars, marked "A" and "B," in the front of the room. Once the class arrives, divide them into A and B teams. Have them hunt for the scraps of paper. When they find a definition, they must write the matching vocabulary word next to the definition and then put it in their team's jar. The team with the most correct answers wins.

See Reproducible #2 for additional vocabulary enrichment.

Science Units

Hot Air

Molecules in cold air



Molecules in warm air

Why Hot Air Rises
The following activity will help students understand how hot air rises:

1. Mark a square on the classroom floor with masking tape, no larger than 7' X 7'.
2. Have students stand inside the square packed tightly together, as many as will fit.
3. Count how many are in the square. Tell them to imagine that they are cold air molecules occupying a particular space.
4. Now heat up the "molecules" by applying a heat source, such as a hair dryer. Tell the students that as they grow warmer, they require more space. Have them begin to spread out their arms until fully outstretched. Eventually students must be no closer to one another than fingertip to fingertip. To accomplish this, some students must step outside the square.
5. Now count how many students are in the square. These are the hot air molecules, occupying the same amount of space.
6. Ask the students, which do you think is heavier, cold air or warm air? Why does hot air rise?
7. Carry it a step further by calculating how much heavier cold air is than warm air, as a percentage of cold air students versus hot air students.

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Hot Air

Up, Up, and Away!

Instructions are provided in the back section of **The Case of the Terrible T. rex** regarding how to build a small hot air balloon powered by a hair dryer. But, consider building a larger hot air balloon as a class, using either solar or fire power. Below are some suggested examples for how to build various types of balloons. (If you don't like any of these, search google.com, or youtube.com for more resources.)

SOLAR

Here are some resources for building a solar-powered hot air balloon:

http://www.youtube.com/watch?v=yy4XQqVfMvk

http://www.solar-balloons.com/ht_tetroon.html

http://www.solar-balloons.com/ht_tube.html

Need a refresher on how a giant hot air balloon works? See **http://science.howstuffworks.com/transport/flight/modern/hot-air-balloon1.htm** for a simple, yet thorough explanation!

FIRE

Fire-powered balloons are fun and have the "Wow!" factor. As with any experiment involving fire though, plan ahead, take precautions, and supervise. Hot air balloons powered by fire are best to fly on a windless day.

Here are some websites for building fire-powered hot air balloons:

http://www.wikihow.com/Make-a-Mini-Flyable-Hot-Air-Balloon-with-Candles

http://www.inventorscolony.com/balloon

http://www.break.com/index/how-to-make-a-hot-air-balloon.html

OTHER HEAT SOURCES (heat gun, camp stove)

http://www.msichicago.org/education/educator-resources/classroom-activities/educator-info/activities/fly-a-hot-air-balloon

http://www.juniorballoonist.com/instructions.html

NOTE: To prevent damage to the environment, please tether all balloons. Do not underestimate how far a balloon will soar! Do not fly balloons near power lines or other obstructions.

Hot Air

Extensions / Variations:

1. This activity requires a long leash, a fairly small balloon, and works best on a cool day outdoors in an open area. Try to allow the balloon to fly its natural course without tugging on its tether.
   a. Have students mark the launch point of the hot air balloon.
   b. Record the duration of the flight.
   c. Mark the landing point.
   d. Measure the distance between, and calculate mph.
   e. Have students speculate as to the effects of wind and air temperature upon the balloon. Using a compass, have students determine the direction of the flight path and the wind.
   f. Fly the same balloon three times, recording the data each time and calculating the average.
   g. Assuming the balloon has enough fuel, have students calculate how long the balloon would take to travel 25 miles, 100 miles, 5,000 miles, or around the Earth.
   h. Ask the students to explain why a hot air balloon eventually comes back down.
2. Instead of building one hot air balloon as a class, divide the class into teams of three to five students. Have each team research various types of hot air balloons, and then engineer and construct their own. (Depending upon the age of your students, you may want to provide parameters such as, no using fire, or no balloon bigger than "x".) Once the balloons are constructed, hold a hot air balloon festival outdoors during which each team presents their balloon, explaining its construction and demonstrating its flying ability. Consider adding to the festivities by providing treats and sparkling cider. (Sparkling champagne is traditional with balloonists!)

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Hot Air

a. OPTION: Rather than have students provide their own heat source, provide the same heat source for all the balloons (except solar) by using the heat from a small camp stove. Cover the camp stove with an 24" long section of stove pipe with a diameter large enough to fit down over the stove (see photo in **http://scientificsonline.com/product.asp_Q_pn_E_3031333**).

   Each balloon will then "fill up" with hot air at the top of the piping and then release, minimizing the risk of injury or fire damage.

Geologic Hot Air

Fumeroles 101

This demonstration illustrates what happens when steam is under pressure, such as in a fumerole.

1. Place two sheets of aluminum foil *tightly* over a kettle of water. Poke a small hole through the center of the foil.

Be sure to **take precautions** against burns by wearing oven mitts.

2. Bring the water to boil. Ask your students to describe what is happening, and how it compares to a fumerole.
3. Duplicate the werewolves-Wiley-tent effect by holding a small drycleaner bag over the "fumerole." When it is filled, let it go. (Be careful it does not touch the burner!)
4. Demonstrate the effects of multiple fumeroles (as on Waxberry Hill) by making additional holes in the foil. Ask the students to explain the results.

ADDITIONAL RESOURCES:

1. See **http://videos.howstuffworks.com/hsw/19549-natural-phenomena-geothermal-activities-and-geysers-video.htm** for an excellent 20-minute video explaining geothermal activity.
2. See the following video for an animation of how a geyser erupts: **http://www.classzone.com/books/earth_science/terc/content/visualizations/es1403/es1403page01.cfm?chapter_no=visualization**
3. See **http://www.lexic.us/definition-of/fumeroles**

FYI – Fumeroles differ from geysers in that they don't have much water in their vent system. Fumerole channels extend deep into the earth where there is magma, but little water. What water is present instantly converts to steam. Sometimes the pressure in a fumerole is too great, and the steam will create new fumeroles to ease the pressure. Eventually, some fumeroles will cease due to the lack of water, or the cooling of the magma.

pH and Water

Water World

Educating students about water is vital. Here are some ideas for helping them understand how critical water is to our world:

1. Hold a discussion regarding the importance of water. Include as part of your discussion:
    a. The Earth's water cycle
    b. Water facts regarding your local region. Expand the discussion to include your state or province, country, and world.
    c. Water availability and consumption, to include the imbalance of water consumption and availability worldwide. Provide statistics on worldwide water consumption.
        i. Have students list the various daily activities that require water. (For a surprising twist on "hidden" water consumption, refer to this article: **http://www.treehugger.com/files/2009/06/how-many-gallons-of-water.php)**
        ii. Have students calculate, in terms of percentage, how much water they use (as a "per capita" average) as opposed to someone in sub-Saharan Africa.
    d. The importance of water conservation. Have students list some of the ways they can conserve.
    e. The sources and effects of water pollution.

Water World

2. As an activity, divide the students into seven teams. Assign each team a continent. Each team's task is to research the water situation on their continent. For instance, Team Australia would research such things as water sources, water availability, and water pollution specific to Australia and with regard to the different geographical areas. Have each team create a "water map" of their continent and share it with the rest of the class.

3. As a class, write, design, and create a video about water. Possible sub-themes could include the water cycle, pollution, consumption and conservation, and the worldwide water crisis. Post your video on YouTube. Send the link to the author at mtorrey@micheletorrey.com. Who knows, she may post your class's video on her website!

Need to brush up on your world water facts?
Here are some handy-dandy resources:

http://www.unwater.org/worldwaterday/faqs.html

http://www.globalchange.umich.edu/globalchange2/current/lectures/freshwater_supply/freshwater.html

http://www.worldwatercouncil.org/index.php?id=25

http://www.treehugger.com/files/2009/06/we-use-how-much-water.php

Water World

Real Life Heroes

Using the resources listed on page 82 of **The Case of the Terrible T. rex**, find a local waterway and adopt it as a class project. Have students keep lab notebooks regarding the waterway, including observations, actions taken, dates, any experiments or tests performed, and so on. Make a map of the waterway.

World Water Day

In 2010, the United Nations declared that clean water and sanitation were a fundamental human right. Currently, there are 900 million people worldwide who do not have access to clean drinking water. Raise awareness by celebrating World Water Day, a UN sponsored event, on March 22nd of each year (see **http://www.unwater.org/worldwaterday**). Here are some possible activities:

1. Have the students write a letter to a government leader, asking them to support legislation for clean water locally, nationally, and globally.
2. Paint or draw posters that illustrate the importance of clean water and/or the harmful effects of pollution.
3. Paint a mural for the school illustrating World Water Day.
4. Take a field trip to a local waterway or water treatment plant.
5. Make it an event! Send photos and descriptions of your event to info@worldwaterday2010.info. Watch to see if your photos are featured online!

Here is a great video to watch as a class:
http://www.youtube.com/watch?v=L2B98SSWdVo

Water World

pH

The exploration of acids, bases and the pH scale can be fun, and even a bit "magical." Here are some suggestions for teaching pH while amazing students at the same time.

Acids, Bases, Everywhere . . .

For this activity, you will need plenty of masking tape and markers, clear plastic cups, eyedroppers or pipettes, teaspoons for measuring, stir sticks, a full-color pH scale, plus eye protection and an apron or lab coat for each student. (See Reproducible #3 for student instructions.)

1. Make plenty of purple cabbage juice pH indicator in advance. (Refer to pages 76-78 in **The Case of the Terrible T. rex.**)
2. Divide students into teams of two or three. Have the students test the pH of some common household items such as ammonia, lemon juice, salt, dish soap, baking soda, toothpaste, vinegar, tomato juice, lemon/lime soda pop, ash, white chalk, and distilled water. (First prepare samples for testing as appropriate, such as crushing the chalk into dust.)
   a. Each student team should have a sample of each substance in a separate cup (properly labeled). Each team should also have a cup of indicator, which is also the control. (TIP: Do a trial run first, in order to determine the quantities necessary for testing.)
   b. Prior to testing, you may want to lead students in performing observations regarding the substances. For instance, you could ask one student to taste the lemon juice, and describe it. Ask another student to smell the vinegar, or the baking soda. Of course, use good sense. For instance, be careful that students do not inhale any powders or taste the ammonia!
   c. As students test, be sure to instruct regarding proper laboratory technique, such as not cross-contaminating with stir sticks, and the purpose of a control.

Ammonia is a powerful base. Be careful not to breathe the fumes. Instruct students as to proper safety.

Water World

3. Have students record the entire experiment from start to finish in their lab notebooks, including their predictions.

4. Carry the experiment a step further by having the students graph the results.

The Mystery of the Magic Potion!
Amaze your students with this cool demonstration—making “magic potion” out of water! (CAUTION: This potion is **not** for drinking!)

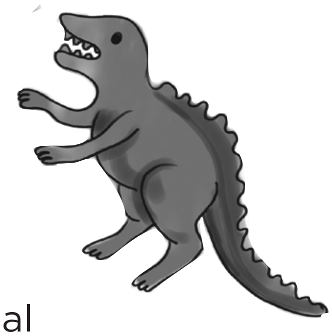
PREPARATION:
Materials: 3 glass jars or beakers, 1 quart non-see-through pitcher, phenolphthalein solution, ammonia, and white vinegar.

1. Into jar #1, place 1 teaspoon ammonia.
2. Into jar #2, place 18 drops phenolphthalein solution.
3. Into jar #3, place 2 teaspoons white vinegar.
4. Fill the pitcher with regular water.

Phenolphthalein can be purchased online. Please **exercise safety** when using phenolphthalein: use protective eyewear, gloves, and a lab coat.

DEMONSTRATION:
1. Fill all the jars with water from the pitcher. They will all be clear.
2. Pour all the jars of “water” back into the pitcher, except for jar #3 (the one with the vinegar). The water in the pitcher will now be pink. (The ammonia in jar #1 reacted with the phenolphthalein solution in jar #2. Phenolphthalein solution turns pink when it comes in contact with a base.)
3. Refill jars #1-2 with the pink solution from the pitcher.
4. Pour solutions from ALL jars back into the pitcher.
5. Once again, fill all the jars. The water should again be colorless. (Phenolphthalein only reacts with bases, so the acidic vinegar turned the phenolphthalein solution back to colorless.)
6. Ask your students to try and explain what happened at each step.

Paleontology

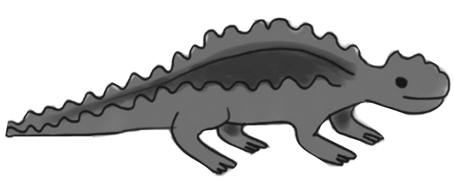


Mapping a Dig

The site map, or field map, on page 85 of **The Case of the Terrible T. rex** is a "bare bones" site map. Site maps by actual paleontologists are far more detailed. Help your students understand the complexities by creating a site map of your classroom, or a portion of your classroom. (Also see VARIATION below.*)

1. Divide the classroom into a grid. Tape string to the floor along each grid line. Tape an arrow next to the grid to provide orientation (like a map).

	A	B	C	D	E	F	G	H	I	J
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										



See http://www.ehow.com/how_2099359_dig-fossils.html for more details on how to dig for fossils, including a supplies list.

2. Provide each student with a square piece of paper and assign him or her a grid square, such as C9. (The paper should be scaled so that it corresponds easily to the grid. For instance, if each grid square is 2' by 2', then the papers can be 1' by 1' or 6" by 6" [50% or 25% scale].)

3. Students should label their square with grid number, and draw an arrow to indicate orientation (as when you are duplicating a map, you first draw an arrow pointing North).

4. Have each student draw the contents of their grid square, paying close attention to exact placement of objects. (For ease and consistency, have them draw using simple lines only, with rectangles representing desks and circles representing chairs.)

5. Using the arrows to orient all the papers in the same direction, tape the grid squares together to create a site map. Have students fix any inaccuracies.

6. Discuss how such a map would enable scientists to recreate a dig site, or enable them to answer questions regarding their fossil.

*VARIATION: Instead of creating a site map of your classroom, choose an area outdoors, such as a sandbox or an area of soft soil. Prep the area first by burying numerous objects. Then, as a class, use stakes and string to mark the grid. (Because of variations in topography, the string should be tied to the stakes to keep the string above the ground.) Have students excavate the site. As at a real dig site, all "fossils" found are merely uncovered and left in position. Once all the "fossils" have been exposed, have students draw the map in their lab notebooks.

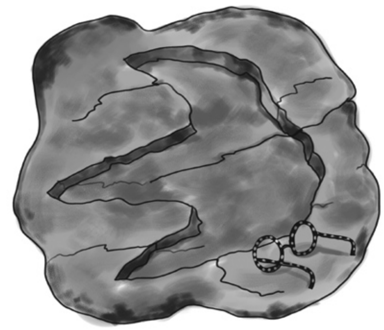
For great examples of real site maps, go to:

http://www.paleotrek.com/EnlargedLocation.html

http://www.nature.nps.gov/geology/paleontology/pub/fossil_conference_6/breithaupt.htm

http://www.jpaleontologicaltechniques.org/pasta3/JPT%20N5/Bulletin_intro.html

Making Tracks



In chapters six and seven, Frisco introduces a fossilized (though fake) dinosaur footprint, also known as a cast. In this activity students can make their own casts.

1. Mix up a simple batch of dough. This can be done either ahead of time, or as a class. For every two students, mix together:
   a. **1 c. flour**
   b. ½ **c. salt**
   c. ½ **c. cold brewed coffee**
   d. **1 c. used coffee grounds**

(If dough is too sticky, add more flour. If too dry, add more brewed coffee. This recipe provides enough dough for each student to make one large or two small fossil prints.)

2. Divide the dough into enough balls for each student (baseball-sized) and spread the dough out on waxed paper. The dough should be fairly thick, like pizza crust.
3. Press objects into the dough, such as seashells, bones, leaves, and ferns. Or, recreate dinosaur footprints.
4. Leave objects embedded in the dough for 24 hours.
5. Remove the objects and let the dough dry for approximately 2-3 days.

Ham Radio and Morse Code

The activities in this next section can all be part of a larger celebration, a fiesta of all things radio related! Read through the suggestions in their entirety first, so you can plan an overall approach to the fiesta. Then circle a date on the calendar, send out invitations, and voila! you'll have your own fabulous fiesta, as well as help your class become truly excited about radios.

Researching Radios

Divide the class into teams of four or five. Assign each team one of the following subject areas to research (it's okay if there is some overlap):

- Samuel Morse and Morse code
- The history of telegrams
- The history of radio
- The science of radio waves
- Hams and ham radios
- Radio today

After researching a topic, have each team create a display. Displays should be set up around the room.

MORSE CODE

A •–	S •••
B –•••	T –
C –•–•	U ••–
D –••	V •••–
E •	W •––
F ••–•	X –••–
G ––•	Y –•––
H ••••	Z ––••
I ••	1 •––––
J •–––	2 ••–––
K –•–	3 •••––
L •–••	4 ••••–
M ––	5 •••••
N –•	6 –••••
O –––	7 ––•••
P •––•	8 –––••
Q ––•–	9 ––––•
R •–•	0 –––––

Fox Hole (Crystal) Radios

During WWII, soldiers whiled away their time in fox holes by building crystal radios. Crystal radios require no external power source to pick up AM frequencies.

1. Building a crystal radio can be exacting, but can also be extremely rewarding. This activity can be done either as a class or in teams. (It also makes a great Science Fair project!) Crystal radios vary in terms of component parts and complexity. Here are some good resources:

    a. **http://www.midnightscience.com/oat-box-project.html**

b. http://www.youtube.com/watch?v=skKmwT0EccE&NR=1

c. http://www.sciencebuddies.org/science-fair-projects/project_ideas/Elec_p014.shtml?gclid=CLWvnM2or5kCFRBbagodvAIEIw

d. http://scitoys.com/scitoys/scitoys/radio/homemade_radio.html

e. http://durealeyes.com/crystal.html

2. As a class, decorate a bulletin board with information on crystal radios, including the history of the crystal radio, photos, instructions, and drawings of the various component parts and their functions. Finally, display the model(s) of the students' radio(s) for visitors to see and perhaps to try for themselves.

FIESTA TIME!

It's the big day, the celebrtion of all things radio. Besides the displays listed above, here are some ideas to help make this day memorable:

1. Of course, no fiesta is complete without décor. Decorate your class with piñatas, balloons, streamers, and tune into a Latin music radio station. (Don't forget to play Para Bailar La Bamba!)

2. Make a tres leche cake. Here are some links for recipes:

   a. http://www.foodnetwork.com/recipes/alton-brown/tres-leche-cake-recipe/index.html

   b. http://allrecipes.com//Recipe/tres-leches-milk-cake/Detail.aspx

   c. http://www.grouprecipes.com/52373/tres-leches-cake.html

3. Invite parents or students from other classrooms to see your radio displays.

4. Perform a reader's theater of the Loco Oven scenario in **The Case of the Terrible T. rex.**

5. Arrange to visit and tour a radio station. Who knows? Maybe with some pre-planning, your class could get a little "air time!"

6. Invite a local ham radio operator to speak to your class. Alternatively, arrange to visit a ham radio operator to see him or her in action.

NAME ___________________________________ **Reproducible #1**

Create your own character

In this activity you will create your own character. Just use your imagination and have fun!

Name of your character: ___________________________________

What does your character look like? (Eye color, hair color, big elbows, etc.)

____

____

What kinds of things does your character like? Dislike?___________________

____

____

What will your character be when he/she grows up? ___________________

____

____

What is the most unusual thing about your character?___________________

____

____

What secret does your character have? ___________________________

____

____

How would your character interact with Drake Doyle and Nell Fossey?____________

____

____

How would your character interact with James Frisco and Baloney?______________

____

____

If you met your character in real life, do you think you would like him or her? Why or why not?____

____

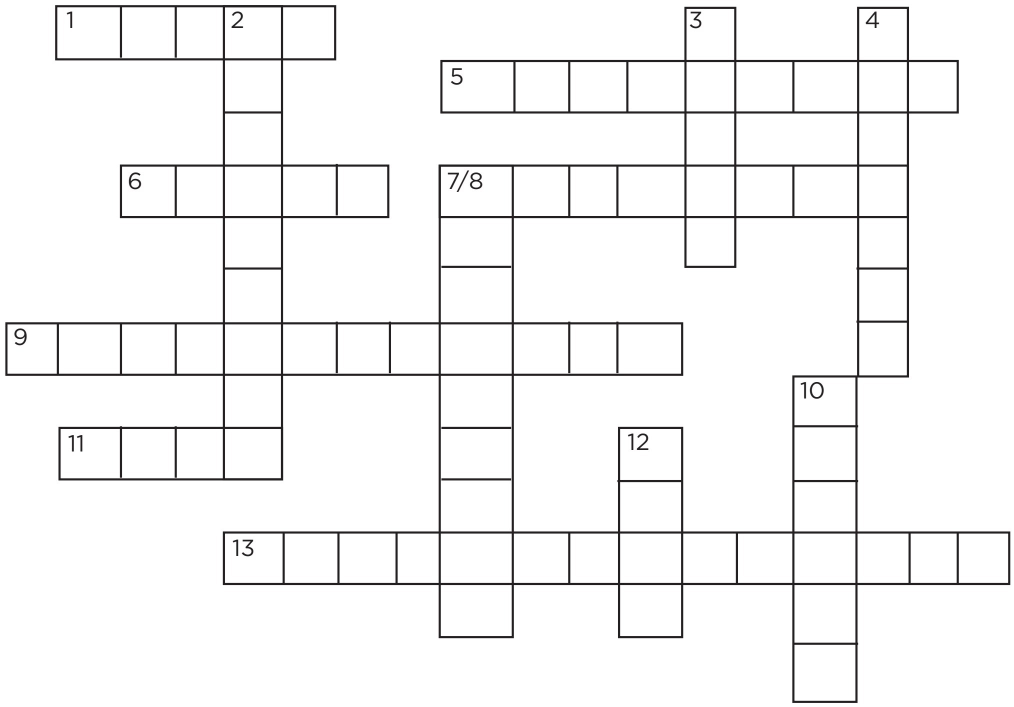
____

NAME ____ **Reproducible #2**

Operation Crossword

Using the clues, fill in the crossword puzzle.
Use each word only once:

Transmit
Paleontology
Bases
Fumeroles
Morse code
Trilobite
Crust
Neutral
Magma
Core
Acid
Stratification
Mantle



ACROSS

1. Hot, liquid rock found in the Earth's outer core.
5. The Earth releases steam out of these vents.
6. The opposite of acids.
7. Walkie-talkies are two-way radios; they can _____________ as well as receive.
9. The study of prehistoric life.
11. The very center of the Earth.
13. Dirt and rock divided into layers according to age.

DOWN

2. This method of communication uses dots and dashes.
3. The outer, solid layer of the Earth.
4. On a pH scale, clean water is usually _____________.
8. A sea creature that existed between 250 and 520 million years ago.
10. The layer of Earth between the crust and the outer core.
12. Lemon juice is an example of one of these.

NAME ____________________________________ **Reproducible #3**

Acids, Bases, Everywhere . . .

They're everywhere. You can't escape them. Just when you think you're safe, there's an acid or a base lurking . . . waiting . . . egads! In this experiment you will test some common household items to determine which are acids, which are bases, and which are neutral. Put on your safety goggles, button up your lab coats, and open your lab notebooks, because here we go!

MATERIALS

- Masking tape
- Permanent marker
- Clear plastic cups
- Various substances to test (your teacher will provide these)
- Purple cabbage juice indicator
- Eye dropper or pipette
- Teaspoon for measuring
- Stir sticks

SAFETY NOTE: Use caution around all substances for testing. Do not breathe in any fumes or let any substance come into contact with your skin, unless instructed otherwise by your teacher. Remember the purple cabbage juice indicator will stain clothing.

Procedure

1. Using masking tape and permanent marker, label each cup according to the substance to be added. (For instance, if you are going to add lemon juice, label the cup "lemon juice.") Label the cup with cabbage indicator, "Indicator / Control."
2. Follow your teacher's instructions regarding how to add each substance to each cup.
3. Make your predictions as to which substances will be acidic, basic, or neutral.
4. Using the eye dropper/pipette, add approximately one teaspoon of indicator to the first cup and stir using a stir stick.
5. Compare the resulting color to a pH chart and record your observations.
6. Repeat steps #3 and #4 for each cup.

NAME ________________________________

Final Analysis

1. According to your findings, which substance was the most acidic? __________

____

2. The most basic? ____

3. Were there any neutral substances? If so, what were they? _______________

____

4. Were your predictions accurate? ___________________________________

5. Were you surprised by any of your findings? Why or why not? ____________

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