SCIENCE

Example of Differentiation by Learning Profile (& Interest):
Science

Example of Differentiated Science Assignment:

By Michelle Harbin

This example shows differentiation for learning profile because students express what they learn in a mode most compatible to their profile (practical, analytical or creative). It is also somewhat differentiated for interest because students choose which format appeals most to them.

Developing the assignment was based on what students should know, understand and do:

Know:	Understand:	Do:
Term: Collision theory Main points: reactants must collide in order to react The collisions need sufficient energy and proper orientation in order to be successful Factors that effect reaction rate: concentration Temperature Nature of reactants Surface area catalyst	Not all collisions lead to reactions Changes in the five factors effect reaction rates in different ways The factors that effect reaction rates can be explained using collision theory	Use the combined knowledge of collision theory and factors that effect reaction rates to explain one aspect of chemical reactions.

Collision Theory Summative Assessment

Choose one of the following RAFT formats by reading straight across the table. On a separate sheet of paper, complete the assignment. The rubric will be used to assess your product. ALL WORK SHOULD INCLUDE FACTORS THAT EFFECT REACTION RATE AND COLLISION THEORY.

Role	Audience	Format	Topic
Particles that want to react in a chemical reaction	High school students	School Newspaper Editorial	What this school needs in order to make particles react and speed up reaction rates
Food that doesn't want to spoil	Kitchen workers	Memo to the workers	Ways to make sure food doesn't spoil using collision theory and factors
Prosecutor of suspected criminal accused of making a chemical reaction happen too fast	Judge and jury	Closing argument	Why accused criminal is guilty of speeding up a chemical reaction
Catalyst tired of doing all the work to make reactions rates increase	Other reaction rate effectors	Poem or song	How the catalyst is doing all of the work and what else can be done to speed up reaction rates

RUBRIC:

SCORE: 5 max: Student uses one of the RAFT selections above to show complete and accurate understanding of the collision theory and how reaction rate can be affected by the five factors discussed in this unit.

Example of Differentiation by Interest & Learning Profile:
Science

Subject Area: Physics

Topics : Electrostatics - Lightning

Type of Differentiation:

Learning Style – Each group can present the information in their prefered format (either poster or powerpoint)

Interest – Each group picks their partner and lightning safety rule

Know: How lightning is created and how to protect yourself from being struck by lightning

Understand:

- How lightning is created
- Lightning safety rule
- Why the lightning safety rule is true
- Lightning vocabulary terms

Be Able to Do:

- Create a lightning safety poster or Power Point which emphasizes one safety rule

LIGHTNING SAFETY Poster or Power Point Presentation

You have been presented with many details about how lightning occurs and several safety rules for what to do and what not to do during lightning storms.

Lightning Safety Rules

1. Stay indoors.
2. Stay off the telephone and out of the bathtub.
3. Stay away from trees or other tall, isolated objects.
4. Hardtop autos and trucks are excellent lightning shelter.
5. Stay away from wire fences and water.
6. Boaters and swimmers are at risk.
7. Do not gather in groups.
8. If hair stands on end, lightning may strike you.
9. Get into a crouch position with little ground contact.

Directions: Your job is to create a lightning safety poster or Power Point which emphasizes one safety rule. Choose one of the rules above to feature on your poster or Power Point.

Your poster should:

1. Explain how lightning is created,
2. Identify one lightning safety rule,
3. Explain why the lightning safety rule is true, and
4. Include at least 5 of the Lightning Vocabulary Terms (below).

Lightning Vocabulary Terms:

Electric Charge	Static Discharge	Insulator
Positive Charge	Force or Electric Force	Induction
Negative Charge	Friction	Conductor
Static Electricity	Proton(s)	Conduction
Electron(s)	Gravitational Force	Neutron(s)

Be sure to **follow the grading rubric** on the back
*** of this page to see how you will be graded. ***

Group Members: _____

Lightning Safety Information & Presentation Rubric

Poster / Power Point Requirements	0-2pts	3-5pts	6-7pts
Explanation of Lightning	How lightning is created is not explained.	How lightning is created is explained but not clearly.	How lightning is created is explained clearly.
Explanation of Safety Rule	The safety rule is not explained.	The safety rule is explained but not clearly.	Poster / Power Point clearly explains how or why the safety rule protects people.
Vocabulary	0-2 lightning vocabulary terms are used correctly.	3-4 lightning vocabulary terms are used correctly.	5 or more lightning vocabulary terms are used correctly.
Illustration	The poster / Power Point lacks clear illustrations of the rule addressed.	The poster / Power Point contains color illustrations but little effort was made.	The poster / Power Point contains color illustrations and effort was made.
Neatness	Lacks organization and errors were not corrected.	Most of the poster / Power Point is organized and errors are fixed.	Very organized and neat.
Cooperation	Students were on task less than 50% of the time given. Students did not work cooperatively.	Students were on task most of the time but had to be redirected or were loud during poster / Power Point creation.	All students in the group contributed to the poster / Power Point. The group was on task and focused during class time.

Poster / Power Point Total: _____/42pts

Presentation			
Participation	Not all members of the group participate. **0pts**	All members speak but not equally on the topic. **1pt**	All members of the group participate equally to present the poster / Power Point. **2pt**
Vocalization	Speakers were not able to be heard or understood by the audience. **0pts**	Most speakers were clear and spoke appropriately to the audience. **1-2pts**	Each speaker was clear and spoke appropriately to the audience. **3pts**
Explanation	Explanation is not focused. Students not able to explain how or why the rule should be followed. **0-1pts**	Explanation is mostly focused. Students explain how or why the rule should be followed. **2-3pts**	Explanation is clear and articulate. Students explain how or why the rule should be followed. Students are able to phrase things in their own words. **4-5pts**

Presentation Total: _____/10pts

Final Grade: /52pts

Example of Differentiation by Interest:
Science

Energy Scenarios in Everyday Life

Pick at least 10 questions you'd like to know the answer to and discuss with your partner.

1. How can it be that our feet or hands get cold but not the rest of our bodies?

2. When one steps from a shower on a cold morning, why does the tile floor seem so much colder than the air?

3. Place a wooden spoon and a metal spoon in the freezer. Which will cool faster? After several hours, what would they feel like?

4. To keep warm on a cold day, should you wear a fur coat with the hair inside, or out?

5. How does a swan stand on a frozen lake in the middle of winter and not have its feet freeze?

6. In Alaska, a lack of snow allowed the ground to freeze down to a depth of about one meter, causing buried pipes to freeze and burst. Why did a *lack* of snow lead to this situation?

7. Several days after the end of a snowstorm, the roof of a house is completely covered with snow, another house's roof has no snow. which house is probably better insulated?

8. How do surface active small mammals such as kangaroo rats and ground squirrels and small lizards such as the Desert Iguana and Common Side-blotched Lizard avoid over heating in our western desert?

9. The sun goes down; snow falls on cement playground and on an asphalt road. Why does the snow on the road melt sooner than on the cement?

10. Should you lower the blinds and draw the curtains on a hot day?

11. Why do people become "flushed" when overheated?

12. Why is a freezer less effective when its cooling coils are iced over?

13. Should you close or open drapes near a window on a cold day?

14. How can you get water droplets dancing on a hot pan?

15. Two different materials at the same temperature have different emissivities. Which one glows the brightest?

16. Why are fireplace pokers made of iron and not copper?

17. Some animals have hair which is composed of solid tubular strands, while others have hollow, air-filled tubes. Where would one more likely find the latter animal: in cold climates or warm climates?

18. Steel Reinforcemement bars add stability to concrete walls. Do they also enhance the insulating value of concrete?

19. You are going backpacking. What kinds of food can you bring that have high energy content but do not weigh much?

20. Suppose a human could live for two hours unclothed in air at 45 degrees F. Ho long could he live in water at 45 degrees F? (How do the thermal conductivities of water and air compare?)

21. If you had to design thermally comfortable housing for people in a space station, in a desert home and 2000 m deep in the ocean, how variable would the external thermal environment be and what modes of heat transfer would be important in your design?

Substance	Thermal Conductivity k[J/(s-m-C)]
Styrofoam	0.010
Glass	0.80
Air	0.026
Concrete	1.1
Wool	0.040
Iron	79
Copper	410
Wood	0.15
Aluminum	240
Body Fat	0.20
Silver	420
Water	0.60
Diamond	2450

22. When you get into your car in the morning, and your windshield has a covering of ice on it:

a. Why is there ice on your windshield and not on your driveway or lawn?

b. When you squirt it with washer fluid and run your windshield wipers, explain the energy transfers that result in clearing your windshield.

23. You are scheduled to run a marathon tomorrow. What are the advantages and disadvantages to eating a large pasta dinner tonight?

24. You are heating up a pound of frozen turkey in a pan. Describe the heat transfers. What is the best strategy to cook this the fastest? How would you compare the energy efficiency of the pan method vs. a microwave?

Example of Differentiation by Interest:
Science

The Nuclear Chemistry Dinner Menu Project
Created by Eric Bjornstad & Kathy Briestansky

The type of differentiation in this project is for interest. Students are allowed to choose the nuclear chemistry topic they find most interesting.

A description of the assignment explains that each student must do an "appetizer" worksheet that involves vocabulary of their topic and an answer key. The "main menu" item is the research about one of the topics listed below. The "dessert" is the powerpoint presentation created and given by the student.

For a full set of handouts pertaining to this assignment including a rubric, please email: mharbin@lths.net

What students should know, understand and do for each topic can be summarized as follows:

Know	Understand	Do: Create a worksheet, powerpoint, and present information
Vocabulary for each topic Three main content items for each topic	<u>That Radioactivity-</u> Is defined as a process at an atomic level (spontaneous radioactive decay). Has important historical figures and that contributed to our knowledge of radioactivity. <u>That Medical Applications of nuclear chemsitry-</u> are radioactive isotopes made for medical purposes. are used for medical diagnosis and treatment. <u>That Nuclear Reactors-</u> generates electricity through nuclear fusion. Can be represented and explained using a diagram of a reactor. are relevant in light of what occurred in Japan from the tsunami <u>That Nuclear Energy-</u> Can come from fission and fusion. Can be compared by describing how each method works (fuel, reactor type, amount of energy produced) and discussing the pros and cons of each method.	Define and discuss the process at an atomic level (spontaneous radioactive decay). Discuss important historical figures and their contribution to our knowledge of radioactivity. Explain how the radioactive isotopes used for medical purposes are made. Discuss how they are used for medical diagnosis and treatment. Explain how a nuclear fission reactor works and how it generates electricity. Include a diagram of a reactor. Discuss what is happening in Japan. Compare the use of fission and fusion as sources of energy. Briefly describe how each method works (fuel, reactor type, amount of energy produced) and discuss the pros and cons of each method.

	That Nuclear Waste- has a specific description. problems are associated with nuclear waste ,and methods used for storage and disposal.	Explain what nuclear waste is, the problems associated with nuclear waste ,and methods used for storage and disposal.
	That Nuclear Weapons- Fission Bombs- Have the same reaction as in a nuclear reactor but are much different.	Explain the difference between fission in nuclear reactors & fission in (atomic) bombs. Describe a fission bomb & how it works. Include a simple diagram of a fission bomb. Discuss the history and use of this type of bomb.
	That Nuclear Weapons-Fusion Bombs-are (hydrogen) bombs and work in a specific way.	Explain how fusion (hydrogen) bombs work. Describe a fusion bomb and include a simple diagram. Discuss the history and use of this type of bomb.
	That Radiation & the Environment- involve distinguish between ionizing and nonionizing radiation. involve background radiation& its sources. Can be measured and described using the effect of radiation exposure on cells.	Define radiation and distinguish between ionizing and nonionizing radiation. Discuss background radiation& its sources. Discuss the effect of radiation exposure on cells.

Example of Differentiation by Interest,& Readiness
Science

Subject Area: Chemistry

Topic: Ionic Compounds

Type of Differentiation:

Interest – Students get to choose their topic
Readiness Level – Some students will be given websites or books to help guide their search,others will not be given help with their search

Know: Definition of an Ionic Compound

Understand:

- Format for chemical formulas and names of ionic compounds
- How an ionic compound is formed
- Ionic compounds have a crystal structure
- Ionic compounds have different uses

Be Able to Do:

- Search for information on an ionic compound
- Create a word document that clearly shows the information found
- Present their findings to the class

Directions: Projected in Powerpoint
Mini – Research Project – Ionic Compounds

1. Choose an Ionic Compound other that NaCl
2. Write down the correct Chemical Formula
3. Write down the Compound Name
4. Find a picture of the Crystal Structure of your ionic compound
5. List at least one use of your ionic compound
6. Your can cut and paste all the information into a word document.
7. Make certain to cite your source(s)
8. Be prepared to present your ionic compound to the class

Teacher Note:
While the students are working, make certain students are not choosing the same ionic compound. I had my students tell me what compounds they were going to research and if two students choose the same one, I ask them to pick a different compound. You can also start with a list of ionic compounds and have the students pick one from a list.
A list of ionic compounds can be found on:
http://www.quia.com/jg/825303list.html

Example of Differentiation by Readiness:
Science

Biology CCI Differentiation Example: **Investigating Breathing**

Type of Differentiated Instruction: **Readiness**

Students vary greatly in their science comprehension and students were grouped based on their MAP Science score. Each lab group consisted of only a few members of similar MAP Science test scores. There are three different versions of the questions after the analysis page.

Objectives: KUD
Students must know...
Students understand...
Students do...

Instructions: Please understand all students perform the lab in the same manner and answer all the same questions on the first 3 pages of the lab. The last page(s) of questions in the analysis section was differentiated. Students with a lower MAP Science test score were given a lab packet with part "1) Directions" page 4 attached. Thus, it was pages 1-4 for the lowest readiness. Students who fell in the middle range of test scores were given a lab packet that did not have "1) Directions" but instead included part "2) Directions." Thus, pages 1-3, 5 for the middle readiness group. Finally, the highest performing students received a lab packet with "3) Directions" having pages 1-3, 6-7 copied. All the labs looked identical except for the last page(s).

Example of Differentiation by Readiness:
Science

Name _____ Date_____ Period _____

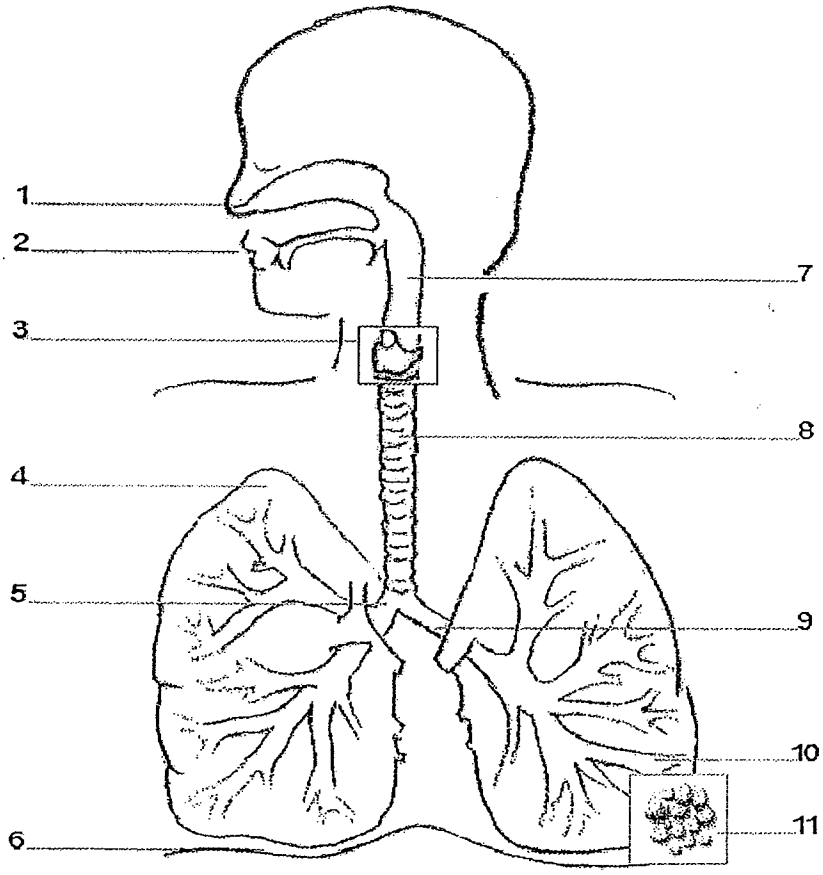
Laboratory Investigation: Investigating Breathing

Background Information:

Breathing is a mechanical process that involves the exchange of oxygen and carbon dioxide. Some animals, like you, use lungs for breathing; other animals breathe with gills or through their skins. In this investigation, you will examine some of the characteristics of breathing.

Prelab Question:

Remember the parts of the respiratory system? Use your notes and your brain to record them in the diagram to the right.



Problem:

How much air can your lungs hold? What activities can change your lung capacity?

Materials:

- Timer/ watch
- Spirometer machine
- Disposable mouthpiece
- Meter sticks
- Calculator

Procedure:

Part One: Breathing

1. Working with a partner, record your normal breathing rate for **one minute**. One person should breathe normally for one minute while their partner counts their breaths (NOTE: Breathing IN plus breathing OUT counts as one breath).

2. **The breather should record the number of breaths you took below.** This represents your normal breathing rate.

   Normal breathing rate = _____ breaths per minute

3. Now, switch roles. The breather becomes the counter and the counter becomes the breather. Repeat steps one and two.

Part Two: Normal Lung Capacity

4. To measure the air that normally moves in and out of your lungs, use the lung capacity device called a spirometer. To do so, exhale into the disposable mouthpiece with a normal breath. Have members of your lab station watch how the far the small ring moves across the markings. Record the farthest the ring reached. Each marking on the spirometer is .1L. After you record your measurement convert liters into milliliters.

Normal Lung Capacity = _____ L x 1000mL = _____mL

Part Three: Vital Lung Capacity

5. Take a few practice deep breaths. Take as much air into your lungs as possible and exhale as much air as you can.

6. Repeat the measuring of your lung capacity, this time inhaling and exhaling as much air as possible into the spirometer. You have now measured your vital lung capacity. After you record your measurement convert liters into milliliters.

Vital Lung Capacity = _____ L x 1000mL = _____mL

Part Four: Lung Comparison by Height

7. Your vital lung capacity is one indicator of your physical fitness. To compare your vital lung capacity to a standard for your age and height, do the following:
   a. Look at the **Height Conversion Chart** on your lab table and record your height in centimeters.

      Your height = _____ cm

   b. Calculate your standard lung capacity and **show your work below**. Multiply your height in centimeters by 20 (for females) or by 23 (for males). The result is your standard lung capacity in milliliters. In other words, this is the amount an average person your size can breathe.

      Females: _____ (your height) x 20 = _____ mL

      Males: _____ (your height) x 23 = _____mL

Analysis and Conclusions

1. Compare your normal lung capacity number to your vital lung capacity number. To do this, divide your **vital lung capacity** by your **normal lung capacity**. Both numbers are found in the previous sections of your lab.

Vital Lung Capacity / Normal Lung Capacity = _____ → put this number in the blank below

My vital lung capacity is _____ times bigger than my normal lung capacity.

Review Questions: Name which part of the respiratory system the statement describes. Words can be used more than once or not at all.

Alveoli	Artery	Bronchi	Bronchioles	
Capillary	Diaphragm	Larynx	Nose	Trachea
Pharynx				

1. This part is also called the voice box. _____
2. The two places that filter out foreign particles are _____ and _____.
3. The two main tubes leading into the lungs are called the _____.
4. The air sacs where oxygen enters our bloodstream is the _____.
5. The muscle that contracts to bring in air into our body is called the _____.
6. Your food and air enter a common pathway called the _____.
7. This part is also called the windpipe. _____
8. The two bronchi branch into many smaller branches called the _____.
9. The part that is covered in cartilage rings is the _____.
10. This part is the source of sound because it contains your vocal cords. _____

1) Directions: Rewrite each question in your own words. Then, answer the question. Be sure all your work is neat and is written in complete sentences.

1. How does YOUR vital lung capacity compare with the standard lung capacity you calculated for an average person of the same sex and size?

Rewrite the question in your own words:

_____

_____

Answer the question:

_____

_____

2. What is the difference in the lung capacity of males compared to females?

Rewrite the question in your own words:

_____

_____

Answer the question:

_____

_____

3. Is your lung capacity different from other class members of your same sex?

Rewrite the question in your own words:

_____

_____

Answer the question:

_____

_____

4. What might cause these differences?

Rewrite the question in your own words: _____

Answer the question: _____

_____

2) Directions: Answer the questions below. Be sure all your work is neat and is written in complete sentences.

Respiratory Rate is also known as breathing frequency. During Part I of this lab you determined your respiratory rate. The average respiratory rate reported in a healthy adult at rest is usually given as 12-18 breaths per minute, but estimates do vary between sources. For example, some sources cite 12-20 breaths per minute, 10-14 breaths per minute and even 16-18 breaths per minute.

1. Does your respiratory rate fall within the normal range for healthy adults?

2. What kinds of illnesses do you think could cause decreased lung capacity? (Be specific and list at least two)

3. How might lung capacity be increased?

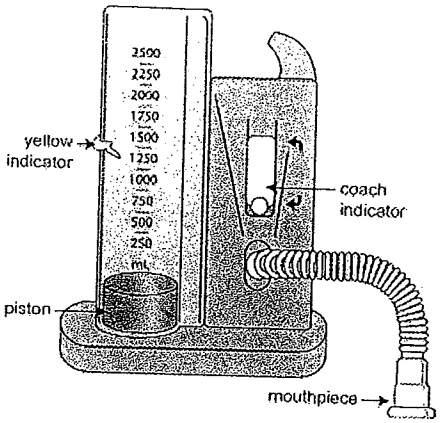
4. Do you think athletes or non-athletes would have a greater lung capacity? WHY?

5. How do you think smoking might affect lung capacity?

6. How would lung capacity be important to some musicians?

3) Directions: Read the following passage and answer the questions below. Be sure all your work is neat and is written in complete sentences.

You are a doctor who specializes in helping patients who have respiratory issues. A new device called an Incentive Spirometer has *come on the market*. An Incentive Spirometer is a medical device used to help patients improve the functioning of their lungs. It is meant for patients who have had any surgery that might *jeopardize* respiratory function, especially patients who have had surgery on the lungs. The incentive spirometer is also meant for patients recovering from rib damage to help minimize the chance of fluid build-up in the lungs. It can be used as well by wind instrument players, who want to improve their air flow.



The patient breathes in from the device as slowly and as deeply as possible. An indicator provides a gauge of how well the patient's lung or lungs are functioning. The patient is generally asked to do many repetitions a day while measuring his or her progress by way of the gauge.

1.) What does the phrase '*come on the market*' mean?

2.) What does the word '*jeopardize*' mean here?

3.) Why do you think they want the patient to do many repetitions?

4.) Do you think the Incentive Spirometer will actually have an affect on patients' lung function? Why or why not?

5.) If you directed a patient to use the Incentive Spirometer after surgery for two weeks, what would you expect to see change for that patient?

6.) Do you think a healthy patient will benefit from using a spirometer? Why or why not?

_____

_____

_____

_____