Differentiating Secondary Science—

Giving every Student a reasonable chance at success

Presented by:
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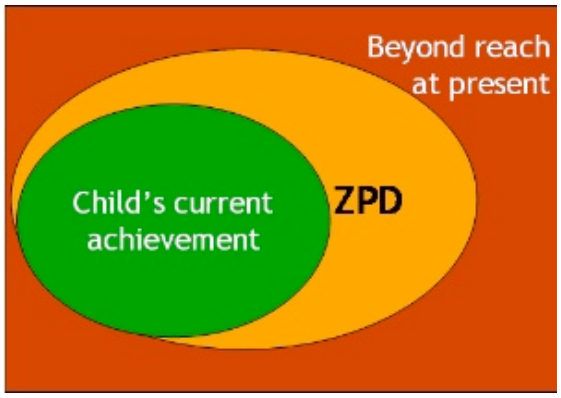
What does a differentiated classroom look like?

- Teacher responds to the variations in students' readiness.
- Teacher responds to the myriad of students' interest.
- Teacher respects the various students' learning style.
- Learning experiences are based on student readiness, interest, or learning profile.
- Assessment is ongoing.
- Tasks are adjusted based on assessment data.

- Teacher is primarily a coordinator of time and activities.
- Students work in a variety of groups & configurations.
- Time is flexible and is based on student needs.
- Teacher uses a variety of instructional strategies to help target instruction to student needs.
- Clearly established criteria used to support student success.

Zone of Proximal Development…ZPD



Zone of Proximal Development, an idea developed by Lev Vygotsky over one hundred years ago, seeks to define the process through which students effectively learn in cooperation with a teacher.

A student's Zone of Proximal Development, or ZPD, is defined as the student's range of ability with and without assistance from a teacher or a more capable peer. On one end of the range is the student's ability level without assistance. On the other end of the range is the student's ability level with assistance.

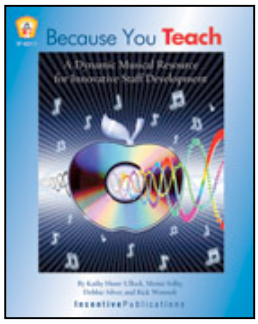
A classroom that makes the best use of all of its students' ZPDs should follow the following guidelines:

The teacher should act as a scaffold, providing the minimum support necessary for a student to succeed. The idea is to assist without denying the student's need to build his or her own foundation. The challenge for the teacher, then, is to find the optimal balance between supporting the student and pushing the student to act independently. To effectively scaffold the student, the teacher should stay one step ahead of the student, always challenging him or her to reach beyond his or her current ability level. However, if instruction falls outside of the zone (above or below a student's ZPD), no growth will occur.

Adapted from: <http://www.wcer.wisc.edu/step/ep301/Spr2000/Jenna-B/zpd.html

Differentiated Instruction – Step One

Start a 3” x 5” note card for each student in your room. Put a student's name at the top. On the card list the information such as:



Reading level-
English language proficiency level-
Level of adult supervision and involvement at home-
Strength areas-
Weak areas-
Preferred learning style-
Personal interests-
Least favorite things-
Fears-

Add or delete items as you see fit for your needs. Fill in as much of the information as you can. Begin working to find out the areas with which you are not familiar. Update and add to the information as you learn more about the student. Periodically review the information and use it to plan differentiated instruction, assignments, and assessments.

Activity from *Because You Teach: A Dynamic Musical Resource for Innovative Staff Development* (2006) by Kathy Hunt Ullock, Monte Selby Debbie Silver, Rick Wormeli. Nashville, TN: Incentive Publications.

Differentiating Instruction

DIFFERENTIATING CONTENT:

1. **Use reading materials at varying readability levels.**
2. **Make text materials available through means other than just reading.**
3. **Present ideas through both auditory and visual means.**
4. **Use reading buddies. (Yes, in high school!)**
5. **Meet with small groups to re-teach an idea or skill for struggling learners or to extend the thinking or skills of advanced learners.**

M. I. And Your Science Classroom

(adapted from J. Abruscato's *Teaching Children Science*, 2001)

Logical-mathematical (Number/Puzzle Smart)

- Emphasize the underlying patterns children observe in science activities.
- Have students think about the steps involved in all deductions and activities.
- Stress numbers, measuring, and other mathematical concepts whenever possible.

Linguistic (Word Smart)

- Begin concept studies with popular children's books.
- Emphasize writing down predictions, observations, and writing in science journals.
- Encourage students to keep personal science dictionaries.
- Connect creative writing activities to science concepts.

Musical (Music Smart)

- Use songs, raps, and music selections to accompany the introduction of new concepts and/or to practice vocabulary.
- Encourage students to make up their own songs using science concepts.

Visual/Spatial (Picture Smart)

- Encourage students to use models and pictures to demonstrate understanding.
- Present new material through videos and pictures.
- Connect graphs to information whenever possible.

Bodily/Kinesthetic (Body Smart)

- Provide ample opportunities for students to use science materials and equipment.
- Whenever possible, have students demonstrate new learning through movement and dance. (i.e. acting out the metamorphosis of a butterfly).

Interpersonal (People Smart)

- When doing a cooperative activity help students "de-brief" not only their findings but also how well they worked together.
- Provide opportunities for students to share their findings, discoveries, and questions with their classmates.

Intrapersonal Awareness (Self Smart)

- Encourage the use of personal journals and reflective activities.
- Allow students to choose solitary, independent work occasionally.

Naturalist (Nature Smart)

- Use activities from programs such as Project Learning Tree, Project WILD/Aquatic, and Project WET that link science to the natural world.
- Use natural objects or media using natural objects to illustrate points.

Cartesian Diver

Introduction:

The Cartesian Diver was made popular in the 1800's by the philosopher Rene Descartes. It is commonly found in science classrooms or perhaps you have seen the

Diving Tony toy distributed in boxes of Frosted Flakes. The Cartesian diver offers an eloquent demonstration of the most unique property of a gas, its compressibility.

Materials:

One 2-liter plastic bottle with cap
One glass eyedropper

Procedure:

1) Fill the bottle with water.
2) Fill a glass with water.
3) Draw water into the dropper until it is 2/3 full.
4) Place the dropper into the glass of water. If it sinks, adjust the water level until the dropper floats.
5) Place the dropper into the 2-liter bottle and screw the cap tightly in place.

Activity:

Hold the bottle in one hand and squeeze. What do you observe? Release the pressure with your hand and observe again.

Questions:

Why does the dropper sink when you apply pressure to the bottle?

As you squeeze the bottle the pressure inside increases. Liquids are not compressible but gases are. Therefore, the air in the dropper compresses and allows more water to flow into the dropper. This increases the weight of the dropper. As the weight increases, the density increases until it becomes greater than the density of water. Objects that have a density greater than water will sink.

Why are gases compressible and liquids not?

In gases the molecules are very far apart compared to their size. In other words, gases are mostly empty space. When put under increased pressure, the gas molecules can move closer together and the gas will occupy less volume.

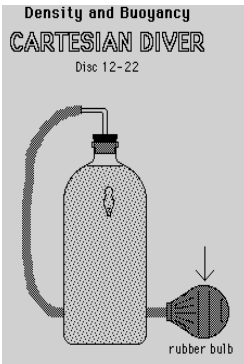
On the other hands, in liquids the molecules are already crowded very close together. Since there is no empty space between the molecules, an increase in pressure cannot cause a decrease in volume.

Remote Control Cartesian Diver

By Dr. Bill Deese, Louisiana Tech University

You can amaze your students by operating your Cartesian Diver by "remote control." Start with the standard Cartesian Diver set-up. Drill a hole in the bottle top just large enough to accommodate a piece of aquarium tubing. Use another bottle (any size, but smaller is usually more convenient). Drill a hole in its cap also large enough to

accommodate the aquarium tubing. Fill the second bottle with water and insert a piece of aquarium tubing 3 or more feet long inside each bottle.



By squeezing the small bottle, you will increase the pressure in it. The increased pressure in the small bottle will result in an identical increase in pressure in the large bottle, thus sending the Cartesian Diver to the bottom of the large bottle by a "remote control" device.

Some sneaky teachers we know even hide the "remote control" so that they can seemingly command the Cartesian Diver to dive by voice control alone. We highly recommend this procedure! It really causes the students to think about what is happening.

This activity demonstrates the principle that pressure is the same throughout a fluid.

Creative Candle Demonstration

After you have discussed "going outside the lines" thinking with your students, tell them you want them to observe a common phenomena and write down the most accurate description of what they actually see happening. Stress that they are not to tell you what they expect the "right" answers to be. Pull out a "candle" made of potato, apple, pear, or whatever you choose; its wick is made of some kind of nut sliver (the oil in it will burn just like a string wick). Light it, turn out the classroom lights, and let it burn for about 4 minutes. Have the children write down their observations, and then share them aloud with the class. (I always use cooperative groups for this.) Accept all observations enthusiastically. Some will probably report seeing the wax melting, the sparks shooting out of the string, etc. Nod your head very attentively, thank them for their responses, then remind them that sometimes they need to think OUTSIDE the lines! Begin eating the "candle" as you explain. Leave as the bell rings.

Critical Thinking and the Magic Tube

By William Deese
Louisiana Tech University

Description: A large cylinder with cords protruding from four holes is shown to the audience. When each cord is pulled, sometimes surprising results are obtained. The audience is challenged to explain how the magic tube is constructed.

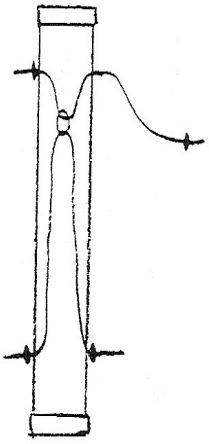
Materials: 2-foot section of 2-inch PVC pipe
(2) 2-inch caps for the PVC pipe
7-foot section of 1/4-inch cord
(1) 1-inch metal ring

Construction:

1) Drill a 1/4 inch hole in the tube 3 inches from one end. Rotate the tube 180 degrees and drill another hole exactly opposite to the first one.
2) Drill two holes at the other end in analogous positions.
3) Cut the cord into 4-foot and 3-foot lengths.
4) Thread the 4-foot cord through a hole, through the metal ring, and out the hole on the opposite side.
5) Tie knots near each end of the cord.
6) Position the ring in line with the holes at the other end of the tube and thread the 3-foot cord through both holes and the ring.
7) Tie knots about 3 inches from each end of the second cord.
8) Pull one end of the long cord out and cut about 12 inches off. Tie knots about 3 inches from each end.

Procedure:

1) Display the magic tube to your audience and pull one of the Cords. Then pull the end exactly opposite the first one you pulled.
2) Now pull one of the cords at the other end and observe.
3) Continue to pull various ends of the cords while your audience tries to figure out how the magic tube works.
4) If your audience is a class, ask them to design their own tubes. There may be more than one design that works.



Hazards: Be careful when drilling the holes in the PVC pipe.

Reference: A hand-out by Bruce Hogue, Dustan Middle School

Name- _____

I CAN DO SOMETHING!

The purpose of this "get acquainted" activity is to start thinking about the different areas of intelligence. Participants are to mix freely and try to get seven different people to sign the blanks (each participant may sign her/his own sheet once). In order to record a name in the blank, the person signing must actually perform the task (not just say that she/he can do it). The object is to be one of the first people to collect different signatures for every task.

Find Someone Who Can:

_____	**tell a joke or make a pun.**
_____	**finish this numerical sequence: 81,196,100, 169, 121, ___, and explain the logic behind it.**
_____	**within 20 seconds name 6 traits scientists use to sort plants into categories.**
_____	**hop on one foot 3 times in a row without losing balance.**
_____	**can tell you how tall you are within 1/2 an inch.**
_____	**can sing the "do-re-mi-fa-so-la-ti-do" sequence backwards and on key.**
_____	**can name 5 clubs or organizations in which s/he held an office.**
_____	**tell you 5 times s/he "went against the crowd" because of a personal conviction.**

Checklists for Assessing "How Students Are Smart"

Adapted by Debbie Silver from *Multiple Intelligences in the Classroom* by Thomas Armstrong

Name of Student- _____

Check all the items that apply:

Linguistic Intelligence (Word Smart)

__1. Is a good reader.
__2. Enjoys word games.
__3. Is a good joke teller/ storyteller.
__4. Has a good vocabulary for age.
__5. Enjoys listening activities.
__6. Likes to write stories and/or poems.
__7. Communicates with others in a highly verbal way.
__8. Appreciates rhymes, puns, and/or nonsense words.
__9. Has a good memory for words, stories, details.

Other linguistic strengths:

Logical-Mathematical Intelligence (Number Smart)

__1. Asks a lot of questions about how things work.
__2. Has a good sense of cause and effect.
__3. Finds math games interesting.
__4. Can see and repeat patterns easily.
__5. Enjoys working puzzles and brain teasers.
__6. Understands computer programming.
__7. Is a logical thinker.
__8. Can estimate things involving numbers with relative ease.
__9. Can work math concepts in head.

Other logical-mathematical strengths:

Visual-Spatial Intelligence (Picture Smart)

__1. Reports clear, visual images (or dreams).
__2. Can envision objects from more than one perspective.
__3. Daydreams more than peers.
__4. Likes to draw and/or create art projects.
__5. Has a good eye for detail and color.
__6. Is good at spatial games like chess and Tetris.
__7. Likes movies, slides, or other visual presentations.
__8. Can move between 2-dimensional and 3-dimensional representations with ease.
__9. Can read and/or create maps.

Other visual-spatial strengths:

Bodily-Kinesthetic Intelligence (Body Smart)

__1. Is very coordinated.
__2. Exceptionally mobile: moves, twitches, fidgets, taps when seated for long.
__3. Enjoys working with clay, fingerpaint, and other tactile media.
__4. Can mimic others' gestures, posture, and movements.
__5. Must touch anything new or interesting.
__6. Loves to take things apart and put them back together.
__7. Uses dramatic body movements for self-expression.
__8. Enjoys running, hopping, climbing, wrestling, or similar activities.
__9. Exhibits fine motor control (crafts, painting, etc.).

Other bodily-kinesthetic strengths:

Musical Intelligence (Music Smart)

__1. Can detect music that is off-key, off-beat, or disturbing in some way.
__2. Remembers melodies of songs.
__3. Taps rhythmically as he/she works or plays.
__4. Sensitive to environmental noise (rain on the windows, etc.).
__5. Plays a musical instrument and/or sings in a choir.
__6. Has a good singing voice.
__7. Responds favorably when music is played.
__8. Sings songs that he/she has learned.
__9. Unconsciously hums much of the time.

Other musical strengths:

Interpersonal Communications Intelligence (People Smart)

__1. Establishes meaningful peer relationships.
__2. Seems to be a natural leader.
__3. Empathizes with others.
__4. Likes to play with others.
__5. Shows good teamwork skills.
__6. Others seek this student's company.
__7. Has two or more close friends.
__8. Frequently acts as a mediator and/or peace maker.
__9. Enjoys teaching others.

Other interpersonal communication strengths:

Intra-personal Awareness Intelligence (Self Smart)

__1. Displays a sense of strong will.
__2. Enjoys playing or working alone.
__3. Has high self-esteem.
__4. Has a good sense of self-direction.
__5. Does not mind being different from others.
__6. Has a realistic view of his/her strengths and weaknesses.
__7. Is able to deal effectively with successes and failures.
__8. Has an interest or talent that is not readily shared with others.
__9. Seems to "march to the beat of a different drummer."

Other intra-personal awareness strengths:

Naturalistic Intelligence (Nature Smart)

__1. Likes to identify and classify living and nonliving things in nature.
__2. Cares for pets or animals.
__3. Understands repeating patterns in nature and the universe.
__4. Seems more "in tune with nature" than peers.
__5. Would rather be outside than inside.
__6. Has a demonstrated appreciation for a part of the natural world (i.e. dinosaurs, clouds, rocks, etc.).
__7. Likes to garden and/or appreciates plants.
__8. Understands and appreciates the environment.
__9. Loves to collect things from nature.

Other naturalistic strengths:

Using Technology To Differentiate Instruction

Verbal/Linguistic (Word Smart)

- CD-ROM interactive books, e-books, text to voice software
- **Create podcasts**
- Reading and interpreting web information
- **http://bubbl.us/**
- **http://voicethread.com**
- **http://www.wordle.net/**

Logical Analytical/Math (Number Smart)

- Spreadsheets
- Graphing calculators
- Online data collection
- Science and math websites and software
- Problem solving websites and software
- The Futures Channel **http://www.thefutureschannel.com**

Naturalist (Nature Smart)

- **http://www.plt.org**
- **http://www.projectwild.org**
- **http://www.projectwet.org**

Bodily Kinesthetic (Body Smart)

- Video productions of skits, dances, etc.
- Claymation -- sequence of movement
- Lego Logo and Robotics
- Joysticks, keyboards, and other devices for fine motor control

Visual Spatial (Picture Smart)

- Multimedia presentations
- **www.googlelittrips.com**
- Tom Synder's Timeliner
- Photoshop
- 3D and morphing software
- Scrapbooking, slideshows, clipart, charts, graphs, and tables
- Digital cameras

- Concept mapping tools and diagrams **http://www.text2mind**
- **www.inspiration.com**

Musical (Music Smart)
- Video and audio recording devices (digitalize music)
- Music clips
- **Music composition software (Garage Band)**
- **www.songsforteaching.com**

Interpersonal Communication Skills (People Smart)
- Blogs
- Listservs
- Peer tutoring
- Social networking
- Collaborative computer software or games
- **Group presentations (PowerPoint/Keynote)**
- Tom Synder's Group Decision software
- Video conferencing

Intrapersonal Awareness (Self Smart)
- **Blogs**
- **Computer-based journaling**
- Computer-based editing
- Multi-media portfolios
- Internet research (self-paced)
- Problem-solving software
- Individual video projects
- Virtual Worlds

Differentiating Instruction

PROCESS:

Use tiered activities through which all learners work with the same important understandings and skills but proceed with different levels of support.

Provide interest centers that encourage students to explore subsets of the class topic of particular interest to them.

Develop personal agendas to be completed either during a specified agenda time or as students complete work early.

Offer manipulatives or other hands-on supports for students who need them.

Vary the length of time a student may take to complete a task in order to provide additional support for a struggling learner or to encourage an advanced learner to pursue a topic in greater depth.

Logical Analytical/Linguistic

Science Fact Sense
Cells

____ = Number of _____

a. 1 = N O N in a P C
b. 0 = N O C W in an A C
c. 5 = N O K: M, P, F, P, and A
d. 3 = N O D: A, B, E
e. 5 = N O P in C M
f. 1 = N O C in an E
g. 46 = N O C in most H C
h. 2 = N O D C produced by C M
i. 1665 = Y R H D a C

Science Fact Sense
General Science

a. 9 = N O P in S S
b. 3 = N O B in the M E
c. 4 = N O C in the HH
d. 8 = N O P of the M
e. 93= N O M M from E to S
f. 7 = N O C in the R
g. 206 = N O B in the A S
h. 1,100 = N O F P S that S R
i. 21 = P of O in the A
j. 5 = N O C a C has in its S
k. 40 = N O F in the L of a GWS
l. 32 = N O T in most A H
m. 6 = N O P in M
n. 3 = N O N of A in a W M
o. 1 = N O of C in P
p. 3 = N O N of B P on an I
q. 2 = N O S P in a D
r. 8 = N O L on an O
s. 0 = N O B in a S
t. 0 = N O D C at which W F
u. 46 = N O C in most H C
v. 8 = N O L on a S
w. 1 = N O Q in a B
x. 70 = P of E C by W
y. 2 = N O P on a M
z. **6 = N O S on a S**

Debbie Silver, 2005

Naturalist

Project Learning Tree (PLT) is an award-winning environmental education program designed for teachers and other educators, parents, and community leaders working with youth from grades PK-12. PLT uses the forest as a "window" on the world to increase students' understanding of our environment; stimulate students' critical and creative thinking; develop students' ability to make informed decisions on environmental issues; and instill in students the commitment to take responsible action on behalf of the environment. http://www.plt.org/

Project W.I.L.D./Aquatic Project WILD is an interdisciplinary, supplementary environmental and conservation education program for educators of grades K-12. The program emphasizes wildlife because of its intrinsic and ecological values, as well as its importance as a basis for teaching how ecosystems function. http://www.projectwild.org/

Project W.E.T. Project WET (Water Education for Teachers) is a nonprofit water education program and publisher for educators and young people ages 5-18. The program facilitates and promotes awareness, appreciation, knowledge, and stewardship of water resources through the dissemination of classroom-ready teaching aids and establishment of internationally sponsored Project WET programs. http://www.projectwet.org/

Differentiating Instruction

PRODUCT:

Different Ways to Find Out What Students Understand

Make a chart or diagram	**Do a demonstration**	**Create a dance**
Write a letter to the editor	**Make a scrapbook**	**Design a Web Quest**
Conduct a discussion	**Participate in a debate**	**Create a puppet show**
Create an advertisement	**Make an editorial video**	**Keep a journal log**
Write an essay	**Design a structure**	**Create a report**
Participate in a simulation	**Develop a collection**	**Make a plan**
Create a poem	**Write and do a rap**	**Make a mural**
Do a photo essay	**Design a game**	**Create a new product**
Create an invention	**Present a news report**	**Do an experiment**
Teach someone else	**Judge an event**	**Make a model**
Write an analogy	**Conduct an interview**	**Develop a rubric**
Participate in a mock trial	**Create cartoons**	**Write a book**
Design and teach a class	**Create a flow chart**	**Make a learning center**
Devise a new recipe	**Give a performance**	**Draw a blueprint**
Write a monologue	**Defend a theory**	**Do a self-assessment**
Illustrate a math concept	**Create a brochure**	**Solve a mystery**
Do a multimedia presentation	**Develop an exhibit**	**Critique a book**
Write a diary from the perspective of someone else	**Set up a system of checks and balances**	**Do a Gallery Walk (Carousel Walk)**

Mitosis Assessment Activity

Assessment Goals:

- Describe what happens to a cell during **interphase.**
- Name each of the **four phases of mitosis** and present them in the correct order.
- Correctly identify each of the organelles present in each phase. Include these organelles: **centrioles**, **chromosomes**, **chromatids**, **spindle fibers**, **nuclei**,
- Explain the **actions of the organelles** in each phase.
- Show the actions of the **nuclear membrane** and **cell membrane** at each phase.

Date- _____ Title- _____

Group Members Present: _____

PRESENTATION OR MODEL (25 points)- _____

- Describes the events of interphase.
  5 4 3 2 1
- Demonstrates each stage accurately.
  5 4 3 2 1
- Correctly identifies the major organelles present in each phase.
  5 4 3 2 1
- Correctly explains the actions of the major organelles in each phase.
  5 4 3 2 1
- Correctly explains the actions of the nuclear and cell membranes in each phase.
  5 4 3 2 1

TEACHING METHOD: (15) - _____

- Activity taught concept correctly.
  5 4 3 2 1
- All students *could* participate.
  5 4 3 2 1
- Activity promoted learning.
  5 4 3 2 1

ORAL PRESENTATION: (20) - _____

- Everyone has a part.
  5 4 3 2 1
- Part stated (not read).
  5 4 3 2 1
- Given accurately and clearly.
  5 4 3 2 1
- Definitions are explained correctly
  5 4 3 2 1

TOTAL SCORE - _____

COMMENTS: -

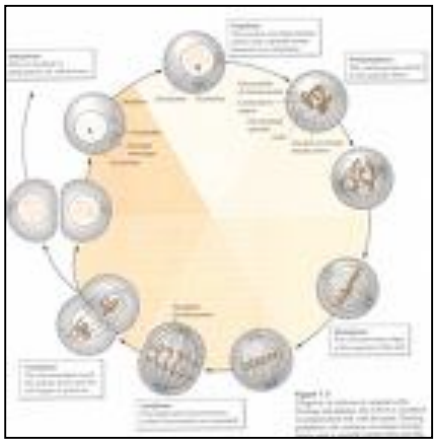
Mitosis Square Dance

Background/Review Questions:

1. Name, in order, the 3 major steps in the Cell Cycle.
2. Describe the similarity between G1 and G2 phases. What does the G stand for?
3. In what phase does DNA replicate?
4. Arrange the following in order from 1-6:
   _____ a. chromosomes align in the middle of the cell
   _____ b. cytokinesis
   _____ c. organelles multiply
   _____ d. chromosomes form from chromatin
   _____ e. chromosomes unravel to return to chromatin
   _____ f. spindle fibers pull sister chromatids to opposite sides of the cell
5. In what phase of mitosis does the nuclear membrane disappear? Reappear?

Directions:

Your lab group is to write the words for, and create the steps to, the "Mitosis Square Dance." This will be a verbal and visual representation of what goes on in the cell during Mitosis. You must include the following words:



- **Anaphase**
- **chromosomes**
- **interphase**
- **metaphase**
- **mitosis**
- **nuclear envelope**
- **prophase**
- **sister chromatids**
- **spindle fibers**
- **telophase**

A grading rubric will be provided for your. This will be a lab grade based on the:

1. scientific accuracy of the written words of the square dance lyrics
2. creativity of lyrics
3. performance
4. participation

Each group will turn in a copy of the words on loose leaf that is written neatly, mandatory words are <u>underlined</u>, and lab group members are listed at the top with their respective numbers. There must be at least 2 chromosomes (4 sister chromatids) participating in the square dance. When performed, each chromosome will be represented by wearing different colored bandanas provided by your teachers.

Mitosis Square Dance
From Conroe ISD teacher, Tamara Lee

“Music Smart” Definition

Students who are “music smart”:

- **The “Music Smart” student has the capacity to think in music, to be able to hear patterns, recognize them, remember them, and perhaps manipulate them.**
- **These students can “play music” inside their heads even in a quiet room. People who have a strong musical intelligence don’t just remember music easily -- they can’t get it out of their minds because it’s so ever present.**
- **“Music Smart” students can often remember large quantities of narrative when they learn it through music.**
- **Certain music and rhythms trigger their memory of facts and experiences.**

Rubric Template

(Describe here the task or performance that this rubric is designed to evaluate.)

	Beginning **1**	**Developing** **2**	**Accomplished** **3**	**Exemplary** **4**	**Score**
Stated Objective or Performance	Description of identifiable performance characteristics reflecting a beginning level of performance.	Description of identifiable performance characteristics reflecting development and movement toward mastery of performance.	Description of identifiable performance characteristics reflecting mastery of performance.	Description of identifiable performance characteristics reflecting the highest level of performance.	

Stated Objective or Performance	Description of identifiable performance characteristics reflecting a beginning level of performance.	Description of identifiable performance characteristics reflecting development and movement toward mastery of performance.	Description of identifiable performance characteristics reflecting mastery of performance.	Description of identifiable performance characteristics reflecting the highest level of performance.	

Using the New Bloom's Taxonomy to Design Meaningful Learning Assessments Kevin Smythe & Jane Halonen

Based on: Clark, B. (2002). Growing up gifted: Developing the potential of children at home and at school. Upper Saddle River, NJ: Merrill Prentice Hall.

Retrieved from: http://www.apa.org/ed/new_blooms.html

	Challenged	Average	Gifted
CONTENT What	Three crucial points Three concepts	All aspects of the topic	In-depth study
PROCESS How	Direct instruction of each step in the research process	Modeling Independent work Review and practice	Minimal instruction with probing questions for independent study
PRODUCT Evaluation	Group paper of one page	Five page paper	Power point presentation with computer generated graphics and tables

Criteria for evaluating differentiated activities

1. Did every student do it?
2. Should every student do it?
3. Would every student *want* to do it?
4. Could every student do it?
5. Did the student do it willingly and zestfully?
6. Did the student use authentic resources and methodology?
7. Was it done for an audience other than (or in addition to) the teacher?

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BARFS/NOT BARFS

These Are Barfs:	These Are NOT Barfs:
Mass	Respiration
Archimedes' Principle	Magnetism
Floating/Sinking	Adhesion
Weight	Surface Tension

A Barf is - _____

Which of These Are Barfs?

Volume Amphs Compressibility

Buoyancy Electricity

Specific Gravity g/cm³ Immune System

Solutions to General Science Word Sense:

a.	9 = N O P in S S	(number of planets in the solar system)
b.	3 = N O B in the M E	(number of bones in the middle ear)
c.	4 = N O C in the HH	(number of chambers in the human heart)
d.	8 = N O P of the M	(number of phases of the moon)
e.	93= N O M M from E to S	(number of million miles from earth to sun)
f.	7 = N O C in the R	(number of colors in the rainbow)
g.	206 = N O B in the A S	(number of bones in the adult skeleton
h.	1,100 = N O F P S that S T	(number of feet per second that sound travels)
i.	21 = P of O in the A	(Per cent of oxygen in the atmosphere)
j.	5 = N O C a C has in its S	(number of chambers a cow has in its stomach)
k.	40 = N O F in the L of a GWS	(number of feet in the length of a Great White Shark)
l.	32 = N O T in most A H	(number of teeth in most adult humans)
m.	6 = N O P in M	(number of phases in mitosis)
n.	3 = N O N of A in a W M	(number of atoms in a water molecule)
o.	1 = N O of C in P	(number of continents in Pangea)
p.	3 = N O N of B P on an I	(number of body parts on an insect)
q.	2 = N O S P in a D	(number of seed parts in a dicot)
r.	8 = N O L on an O	(number of legs on an octopus)
s.	0 = N O B in a S	(number of bones in a shark)
t.	0 = N O D C at which W F	(number of degrees Celsius at which water freezes)
u.	46 = N O C in most H C	(number of chromosomes in most human cells)
v.	8 = N O L on a S	(number of legs on a spider)
w.	1 = N O Q in a B	(number of queens in a beehive)
x.	70 = P of E C by W	(percent of earth covered by water)
y.	2 = N O P on a M	(number of poles on a magnet)
z.	6 = N O S on a S	(number of sides on a snowflake)

Cooperative Learning For Secondary Learners

In working with secondary school learners it is important to remember that:

- Group members are responsible for the performance of each individual learner.
- Group members are individually accountable and must be able to report on or explain the team's results.
- The groups are to be assigned by the teacher. Their make-up should be heterogeneous with respect to sex, race, socioeconomic status, ability/learning styles, cliques, and other important factors.
- Leadership is shared on a rotating basis. Each team member has a job and responsibilities.
- The teacher is a resource; students are in charge of their own learning.
- Time must be allowed for group processing and self-evaluation.

The job assignments I use for traditional grouping are these:

Group Leader

1. Reads all directions to group
2. Leads the discussions
3. Checks the data sheet
4. Helps with clean-up
5. Is the only one who can ask a question of the teacher

Materials Manager

1. Is responsible for collecting and returning all materials & supplies to the appropriate place(s)
2. Is the only one who can get up for materials and supplies
3. Makes sure the everyone in the group has equal access to the materials and supplies
4. Checks the data sheet
5. Helps with clean-up

Time Keeper

1. Holds the team stopwatch (or watches the clock)
2. Keeps group on task and reminds them about time
3. Is responsible for getting the group to finish on time
4. Checks the data sheet
5. Helps with clean-up

Data Collector

1. Collects the data for the activity
2. Records data on the appropriate form or sheet
3. Returns data sheet to teacher and/or records group data on class data sheet
4. Makes sure all other team members check the data sheet
5. Helps with clean-up

Since this is not a perfect world, and all class populations are not divisible by four, I have a fifth job that can be assigned in a group:

Encourager

1. Monitors other team members to make sure they do their own jobs
2. Takes responsibility for praising and affirming jobs that are well done
3. Records comments and actions that show positive interpersonal communication
4. Reports recorded data to group at de-briefing session
5. Helps with clean-up

If a group of four has one member absent, two of the jobs can be combined for that day.

Part of the group's participation grade is based on how well each team member performs her/his job. Points are deducted if one team member does another team member's assigned responsibility.

Group Participation Number Line

Date: _____

Group Number: _____

Group Members Present: _____

_____

_____

100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0

Participation Points Earned: _____

There is nothing chaotic about cooperative learning that is well-planned and well-managed. Teachers should plan activities that are challenging and yet doable if the group members work together. Tasks should require the concentrated efforts of all

team members doing their jobs and working with in the allotted time. Materials and supplies should be out and sorted before students arrive. During the cooperative learning activity it is the responsibility of the teacher to monitor the students and:

- Give immediate feedback and reinforcement for learning
- Re-teach certain concepts if necessary
- Clarify directions
- Encourage oral elaboration
- Affirm positive interactions and efforts
- Informally assess student learning and collaboration

Another way to ensure that the cooperative learning activity is organized and has a smooth closure is to allow time after clean up and whole group information sharing to ask the groups to evaluate how they interacted with one another. Either verbally or in their journals students can answer questions like these:

- Tell how involved each of your team members was in the decisions your group made.
- How do you feel about the work your group did today? Why?
- What would you would like to tell your teammates about how you felt during today's activity or the way you feel now?
- What could your team do to improve the way you get along and/or work together?
- What is your favorite thing about being on this team?

Teachers need to keep a close watch on the personal interactions going on within groups. Happy well-functioning groups matched with appropriate tasks and given adequate time constraints run smoothly.

Alternative Ways to Use Cooperative Learning

1. **Within a lecture or presentation:**
   The teacher is discussing, modeling, or explaining something. S/he pauses to ask small groups to summarize, categorize, debate, describe, or otherwise react to the presented material.

2. **With higher level questioning:**
   The teacher asks small groups to come up with a team consensus on something to do with analysis, synthesis, or evaluation of the concept being discussed.

3. **As practice reinforcement:**
   The teacher asks students to get with their groups to practice, memorize, or review the given concepts.

4. **Decision-making/problem solving:**
   The group is to reach a decision or solve a problem presented by the teacher. The teacher is leading a class discussion on the separation of church and state in the United States Constitution. She asks small

groups to meet and decide whether or not to include the words, “Under God” in the Pledge of Allegiance. Groups are to figure out a
way for students to say the Pledge without violating the spirit of the law.

5. **As a review:**
The teacher asks a question. Team members put their heads together to discuss the answer. The teacher calls out a color, and the person who has that color dot will answer the question as the teacher whips through the groups.

6. **In a tournament or game format:**
There are several models for using cooperative learning in a tournament or game format. Student Teams-Achievement Divisions (STAD) and Teams-Games-Tournament (TGT) are two of the more popular ones.

7. **With peer editing:**
Team members proofread each other’s work and offer suggestions for improvement. This practice helps both the “corrector” and the “correctee.”

8. **As an assessment:**
A Gallery Walk (sometimes called Carousel Walk) is a way to assess students in groups. The teacher puts large pieces of newsprint around the room. On the top of each is a question for which there are several answers. Student groups are given different colored markers and asked to write one correct answer to each question. Answers cannot be repeated on a page. The teacher can informally assess student learning by listening to them as they “think out loud” in their groups (Slavin calls this *oral elaboration*). Or teachers can more formally assess the answers by noting the flow of answers used by each colored group.

9. **Research projects or group investigations:**
Group work on projects can promote sharing of the load and commitment to a time line. Often times students who are procrastinators when it comes to doing their own work will get motivated by their peers to finish their part of the assignment.

10. **Checking homework:**
Even though homework is for independent practice, many teachers
Have limited time for checking and correcting it during a rushed day.
Group members can check each other’s work for accuracy.

Fashion A Fish

(adapted from Project Aquatic by Debbie Silver)

Description

In this activity students will work in small groups to design habitats for their mystery fish. After selecting random structural traits from cards provided by the teacher, students will create a fish that combines all the characteristics they chose. They will name their creation as well as design its habitat.

Materials

Fish Trait Cards
Poster paper
Markers, colors, colored pencils, etc.
Printed materials and web resources about fish

Procedure

1. The teacher introduces the activity with a discussion about adaptive structures used by plants and animals to ensure their survival.
2. The teacher asks one member from each group to select one face-down card from each color group (each trait is a different color).
3. Group members create a fish that encompasses each characteristic on their cards. They name it and put its name on their poster along with the picture.
4. Group members decide the kind of habitat that would best suit their particular fish and draw it. (Discussion should include what it eats, what eats it, and how the adaptive structures help the fish survive.)
5. One member of each group (selected randomly by the teacher) presents their poster to the class and answers questions about their decisions.

Activity Resources: Monterey Bay Aquarium Web Site www.montereybayaquarium.org

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Fish Trait Cards (different colors for each trait)

Bodies	Eyes	Teeth
Streamlined	Large	Small
Torpedo-like	Small	Large
Flat side to side	Looking upward	Sharp
Flat top to bottom	Looking downward	Triangular

Tails	Mouth	Movement
Squared	Beaklike	Fast
Forked	Long jaws	Slow
Pointed	Lower jaw extends beyond upper	
Rounded	Upper jaw extends beyond lower	**Fins**
		Student choice

Colors

Dark on top and light on bottom	Light on top and dark on bottom
Brightly colored	Spotted

Invent an Animal

Adaptation and Camouflage

Objectives: To invent an imaginary animal that is camouflaged for hunting and or hiding in its habitat. Students will gain an appreciation of how animals "fit" their environment.

Concepts: All life forms show adaptations to the environments in which they live. Many species over time have evolved coloration, form, and patterns to help them blend with their natural surroundings.

Materials: Potatoes, paint, brushes, toothpicks, tongue depressors, pipe cleaners, clay, tape, sticks, glue, and other materials used for constructing animals.

Procedure: Discuss with students about general concepts of protective coloration and camouflage. Challenge students to invent an animal that can best be adapted to its habitat and niche.

Divide the students into two groups. Ask each group to examine a different habitat previously selected by the teacher. (Try to use areas as diverse as possible). Allow them to collect natural objects to use in disguising their animals. Give students time to construct their animals (20 -30 minutes) then hide them in their designated habitat.

Ask one group to try to find the other group's animals. Time how long it takes to locate all the creatures. Reverse the process, and let the hiding team try to find the recovering team's animals. Note time and compare teams' results.

Discussion:

1. Why were some animals easier to find than others?
2. In what other habitats would your animal be well camouflaged? Not at all camouflaged?
3. What special adaptations to you include on your animal to help it adapt to its environment?
4. Name some animals not protected by camouflage. How do they protect themselves from predators? How are they able to capture prey?

Extensions:

- Invent a plant that might be adapted in one or more of these ways:
  - lawnmower-proof
  - able to catch insects
  - able to compete for sunlight
  - able to store water
  - inedible to animals
  - other _____

GUIDELINES FOR SCIENCE JOURNALS (for students)

Debbie Silver, Louisiana Tech University Project LIFE

1. **Who should write in your journal?**
   YOU should. Your teacher will also write in your journal to answer your questions and make comments.

2. **What should you write in your journal?**
   - Thoughts you have had on the science topic of the day, what you have learned, or how you learned it.
   - Thoughts you have about your group, this class, the teacher, or yourself.
   - Questions you have – both answerable and unanswerable.
   - Further explorations you would like to try.
   - Suggestions you have for improving our classroom climate.

3. **Where should you do your journal writing?**
   In the notebook or folder you have specifically designated for it.

4. **When should you write in your journal?**
   - Before or after class each day.
   - As you are preparing, reading, or studying for class
   - Anytime you have insights, questions, of thoughts you would like to get down on paper.
   - During assigned journal-writing time.

5. **Why should you write in your journal?**
   - To record ideas that you might otherwise forget.
   - To provide a record for you to read later on so that you can see growth in your learning.
   - To facilitate your learning, problem solving, writing, reading, discussions, and relationships in this class.

6. **Who will read your journal?**
   Only your teacher or whoever you give permission to read it. Unless it involves your safety or the safety of others. **ALL information will be kept in confidence by your teacher.**

7. **How should you write in your journal?**
   In wonderful, long flowing sentences with perfect punctuation, spelling, and handwriting . . .
   OR
   In single words that express your ideas, in short phrases, in sketches, in numbers, in maps, in diagrams, in sentences, in poetry, or in whatever style best fits the ideas you are trying to express.

Some possible divisions include:

LEARNING LOG

a. **CLASS NOTES** (vocabulary words, lists, clarifications given by the teacher, or discoveries made by groups/individuals).
b. **SPONGE ACTIVITIES** (lead-in questions, "mind bogglers," puzzles, problems solving questions, etc. related to the topic).
c. **LEARNING ASSESSMENTS** (concept maps, drawings, or student explanations assigned by teacher to determine the depth of understanding)
d. **QUESTIONS AND COMMENTS TO THE TEACHER** (students pose or answer questions about the science topic in a written dialog with the teacher).
e. **EXPERIMENTAL DESIGN AND DATA** (record set ups and data from experimental designs in cases where a specific data sheet is not provided).
f. **LONG TERM OBSERVATIONS** (descriptions of plant growth, animal behavior, charts, graphs, etc.)

JOURNALS

a. **FREE WRITING** (students may write on any feelings they have about their groups, the class, the teacher or themselves)).
b. **SCIENCE EXPERIENCES** (descriptions of the day's experiences with feelings about what was learned and how it affects them).
c. **WOULD LIKE TO KNOW MORE ABOUT** (students write questions they would like to have answered or explorations they would like to do).
d. **SUGGESTION BOX** (students write suggestions for improving the lesson, interpersonal relationships, or any other aspects of the classroom climate).

Solutions for Cell Word Sense:

a. 1 = Number of Nuclei in a Prokaryotic Cell
b. 0 = Number of Cell Walls in an Animal Cell
c. 5 = Number of Kingdoms: Moneran, Protist, Fungi, Plant and Animal
d. 3 = Number of Domains: Archaea, Bacteria, Eukarya
e. 5 = Number of Phases in Cell Mitosis
f. 1 = Number of Cells in an Egg
g. 46 = Number of Chromosomes in Most Human Cells
h. 2 = Number of Daughter Cells Produced by Cell Mitosis
i. 1665 = Year Robert Hook Discovered a Cell

What constitutes a Tiered Assignment?
- A focus on a key concept
- Adjustment of the task to the students' ability level
- Adjustment of the number of steps to the students' productivity level
- Students working with appropriately challenging tasks
- Result = Respectable work for everyone

To used Tiered Assignments you must:
~ Know the expected outcomes
~ Know the ability range of your students

Tiering by learning style, interest, or readiness

Sample Tiered Lesson
Introductory activity: The teacher asks the question, "What do we know about the issue of global warming?" Student answers are recorded. The teacher then asks, "As scientists, what criteria might we use to judge the validity of the information regarding global warming?" The criteria are posted for future reference. Students are then asked to develop a concept map representing what they know about the issue.

Using the two pre-assessment techniques, the teacher determines that there are three distinct levels of readiness to accomplish the task. All students will use the posted criteria to judge the information they will use for the activity.

Tier I: Students will use reading material that pictorially represents required information and conduct a pre-developed survey of science teachers and students to determine their awareness of the issue and what they believe and why they hold that belief. Students will apply the validity criteria to the information gathered. Findings will be presented.

Tier II: Students will use grade-level reading material to gather secondary information and develop and conduct a survey of a least two scientists currently investigating the issue. Students will apply the validity criteria to the information gathered. Findings will be presented.

Tier III: Students will compare their knowledge of global warming with at least one other environmental issue and note the similarities and differences in the evidence that is presented by each side of the issue. Each issue being addressed must meet the established criteria. Findings will be presented.

Culminating activity: Students present their findings on global warming and explain how this issue is an example of conflict as being a catalyst for change. After all presentations are completed, the teacher asks," What can we generally say about the issue of global warming? What predictions can we make based on our current knowledge of this issue? What value, if any, do the validity criteria have in drawing defensible conclusions?"

Performance Assessment

Performance tasks are often used in science to assess a student's ability to manipulate materials or apparatus as well as apply knowledge to solving real life problems. For example, a student might be asked to measure the volume of an irregular object with the use of an overflow can, a graduated cylinder, and water. Students can demonstrate successful performance by applying their knowledge and skills to a new situation or in a new way.

The assessment developer should have in mind a clear picture of what a successful performance would "look like." Development of the criteria (rubric) by which the performance will be assessed can involve both the assessor and the assessees. Clear standards must be communicated to the assessees beforehand so that they fully understand what is expected of them. The best assessments are woven into the instructional strategies and serve to reinforce the concepts expected to be mastered.

Demonstration Assessment

Because performance assessments are sometimes limited by the amount of time and supplies a teacher is able to devote to them, a satisfactory alternative is that of a demonstration assessment. For this assessment students watch their teacher or another performer make a presentation that incorporates their prior knowledge but forces them to apply it in a new way or to a new situation. After observing the occurrence, the student is required to bring together understanding of processes, procedures, and concepts in order to explain the phenomena. Generally students are asked to describe observations, use appropriate vocabulary, make appropriate inferences. A demonstration assessment requires a pre-determined general rubric and should be clearly communicated to students before the actual assessment.

GENERAL SCORING RUBRIC
FOR STUDENT RESPONSES

(Students may also choose to illustrate their explanations)

0 Makes no accurate observations and no accurate inferences.

1 Makes accurate observations, but no accurate inferences.

2 Makes accurate observations, uses some appropriate vocabulary to draw some accurate inferences.

3 Makes accurate observations, accurate inferences, cites evidence, uses appropriate vocabulary.

Floating and Sinking Ping Pong Balls

Materials:
2 different colored ping pong balls
Glass or plastic container (1500 ml or larger)
Large bag of unpopped popcorn kernels
1 pack BB's
Hot glue gun, clear tape, or SuperGlue™

Procedure:
Prior to the demonstration-

- Poke a small hole in one of the ping pong balls large enough to put in a BB. Put in as many BB's as the ping pong ball will hold. Then seal the hole with hot glue, tape, or SuperGlue™.

- Place the popcorn kernels in a large clear glass container (I use a small fishbowl; a large Pyrex™ measuring bowl works well, too). Hide a different colored regular ping pong ball under the surface of the kernels.

In class-
- Put the ping pong ball weighted with BB's on top of the popcorn kernels.

- Gently shake the bowl. The weighted ping pong ball will "sink" and the unweighted ping pong ball will pop out of the kernels!

Explanation:
Because the weighted ball is much more dense than the unpopped popcorn kernels, it will sink. The gentle shaking motion of the kernels causes them to act like a liquid. Since the kernels are less dense than the ball, the shaking causes the ball to fall to the bottom of the container.

The unweighted ball, however, is less dense than the unpopped kernels. It is held in place temporarily by stacking a large number of kernels on top of it, but once the bowl is shaken and the kernels begin flowing as a liquid, the less dense ball rises to the top.

Tips:
This demonstration is a real motivator for students. It makes an excellent introduction to a unit on density and/or buoyancy. My favorite way to use, however, is an assessment at the end of the unit (see rubric).

Floating and Sinking Ping Pong Balls

Scoring rubric for student responses
(students may also choose to illustrate their explanations)

0 No observation. No explanation.

1 My teacher put a white ping pong ball in a fish bowl that had popcorn in it. When she took the bowl it sunk, but then it came back up, and it was yellow and black. I think the ball was really yellow and black, but my teacher covered the ball with some white stuff. When she shook the bowl, it got rubbed by the popcorn, and the white stuff came off.

2 My teacher put a white ping pong ball in a fishbowl that had unpopped popcorn kernels in it. When she shook the bowl the white ball sank into the kernels. She kept shaking, and a yellow and black ball popped up. I think she already had the yellow and black ball in the kernels, and it popped up when she shook the bowl. I think the white ball weighs more than the yellow and black ball.

3 (All of the above plus) We learned that objects less dense than the liquid they are in will float, and objects more dense than the liquid they are in will sink. I think the popcorn kernels acted kind of like a liquid when they were swirled, so the white ball is more dense than the popcorn kernels, and the yellow and black ball is less dense than the popcorn kernels.

Teacher Demonstration Checklist

In deciding whether a particular activity or demonstration is consistent with good science teaching, the following checklist (adapted from J. Abruscato's *Teaching Children Science,* 2001, p. 83) may prove helpful:

____ 1. Did the teacher have all the necessary materials ready? Did the demonstration take place without unnecessary delay?

____ 2. Was the demonstration straightforward and free from confusing complexities or details?

____ 3. Could all the students observe the demonstration without problem?

____ 4. Was the teacher prepared and confident? Was it obvious the teacher had practiced and was knowledgeable about all aspects of the concepts being conveyed?

____ 5. Was the teacher able to build suspense with the demonstration? Were the students surprised by an unexpected or dramatic result?

____ 6. Was the demonstration made with attention to the safety of all involved? Did the teacher model correct safety procedures? (i.e. wearing safety glasses, using a mitt, etc.)

____ 7. Did the demonstration directly relate to the topic of study and/or essential science understandings?

____ 8. Was the appropriate amount of time allocated for this demonstration? Was time given for drawing conclusions?

____ 9. Did the students have an opportunity to give reactions, ask questions, make statements?

____ 10. Did the demonstration provide an important learning experience for the students?

Helpful Internet Sites for Secondary

Activities for Secondary Science Students
http://www.asta.edu.au/st2003/audience/secondary.html
Excellent resource. Science & Technology Directory for 2003-2004.

Classroom Activities for Secondary Science
http://www.greece.k12.ny.us/task/activities/secondscience.htm
More resources and activities for secondary science teachers

KCK Secondary Science Assessment Prompts
http://kancrn.kckps.k12.ks.us/science/assessment/prompts.cfm
Great downloadable resources for alternative secondary science assessments

ICT Teaching and Assessing Science
http://ecs.lewisham.gov.uk/talent/secsci/TaLENT_SC5.htm
Ideas for teaching and assessing secondary science through ICT

New Teacher Resources
http://www.teachersfirst.com/unitlist.htm
Articles by and for new teachers. Suggested lesson plans with attention to the planning and management issues concerning new teachers

Sensational Science Activities
http://www.tufts.edu/as/wright_center/fellows/jbm_info/jbm6.html
Home page created for secondary science educators by John Banister-Marx. Good stuff!

Science Lesson Plans
http://www.col-ed.org/cur/science.html#sci1
This site, sponsored by the Columbia Education Center in Oregon provides a tremendous collection of elementary/middle level science lessons.

Teachernet Science Resources
http://www.teachernet.gov.uk/teachingandlearning/subjects/science/primaryscience/
One of the best sites on the internet for all kinds of activities, ideas, and integrated lesson plans for primary school science.

Using Lower Secondary Science Activities to Engage Below Level Students
www.eddept.wa.edu.au/outcomes/**science**/suppLsec.pdf
This downloadable PDF file has excellent ideas for differentiating secondary science activities for below level students.

Compiled by Debbie Silver, 2005

More Differentiating Instruction Resources:

http://www.learnerslink.com/curriculum.htm
Comprehensive compilation of effective D.I. strategies to Improve student -performance

http://www.adaptivecurriculum.com/us/lessons-library/hs-biology.html
Adaptive activities for high school biology students.

http://www.adaptivecurriculum.com/us/lessons-library/hs-chemistry.html
Adaptive activities for high school chemistry students.

http://www.adaptivecurriculum.com/us/lessons-library/hs-physics.html
Adaptive activities for high school physics students.

http://www.doe.in.gov/exceptional/gt/tiered_curriculum/
Ideas for tiered assignments in secondary science complied by the Indiana Department of Education.

http://www.manhattan.k12.ca.us/staff/pware/diff/
Tiered lesson plans for secondary school science offered by the Manhattan Beach Unified School District

http://www.cteresource.org/featured/differentiated_instruction.html
Learning Styles, Multiple Intelligences, and Differentiated Instruction from Virginia's CTE Resource Center

http://school.discoveryeducation.com/lessonplans/earthsci.html
Discovery Education science activities for secondary Earth science

http://www.hssd.k12.wi.us/forestglen/pathfinders/tier.htm
Tiered activities on rocks and minerals

http://www.teach-nology.com/teachers/lesson_plans/science/earth_sciences/
Earth science lesson plans

Compiled by Debbie Silver, 2010

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PRESENTED BY DR. DEBBIE SILVER for
Staff Development for Educators (SDE)

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