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GED® Science: 5 Es for Effective Instruction

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Welcome!

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Science Resources for the Classroom

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ABE Adult Basic Education | GED® & AHS GED® Preparation & Adult High School | ESOL English as a Second Language of Other Languages | FCAPS Florida Council on Academic Preparation System

ipdae WELCOMES EDUCATORS

FEATURED EVENTS

DID YOU KNOW...

GED® & AHS Make a selection to view the available resources or View All

- Webinars
- Handbooks
- Workshops
- Lessons
- Videos
- Books
- Links

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Science Resources for the Classroom

Sci Experimental Design

Science Webinars

Strategies for Science (Florida's Instructor Handbook for GED® Preparation)

Workshop Materials – Scientific Minds Want to Know; The Wonderful World of Science


Lesson Plans for GED® Science

Videos – Grab and Gos

More exciting resources to come . . .

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Objectives of Workshop



- Identify content for inclusion into the science classroom
- Explore the 5 Es as a research-based lesson planning process
- Apply the 5 Es to hands-on lessons

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What Should I Teach?

Science Content
(GEDTS Assessment Guide for Educators pp. 78-80)

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    graph TD
      A[Science Content] --> B[Science Focusing Themes]
      A --> C[Science Practices (Hills)]
      B --> D[Students apply skills of science to develop an understanding of the scientific concepts.]
      C --> D
    
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What Should I Teach?

Focusing Themes

	Science Content Topics		
	Life Science (40%)	Physical Science (40%)	Earth & Space Science (20%)
Focusing Themes Human Health and Living Systems	<ul style="list-style-type: none"> • Human body and health • Organization of life • Molecular basis for heredity • Evolution 	<ul style="list-style-type: none"> • Chemical properties and reactions related to human systems 	<ul style="list-style-type: none"> • Interactions between Earth's systems and living things
Focusing Themes Energy and Related Systems	<ul style="list-style-type: none"> • Relationships between life functions and energy intake • Energy flows in ecologic networks (ecosystems) 	<ul style="list-style-type: none"> • Conservation, transformation, and flow of energy • Work, motion, and forces 	<ul style="list-style-type: none"> • Earth and its system components • Structure and organization of the cosmos

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What Should I Teach?

Science High Impact Indicators (Practices)

- SP.2.b:** Identify and refine hypotheses for scientific investigations.
- SP.2.e:** Identify and interpret independent and dependent variables in scientific investigations.
- SP.4.a:** Evaluate whether a conclusion or theory is supported or challenged by particular data or evidence.
- SP.6.a:** Express scientific information or findings visually.
- SP.7:** Apply formulas from scientific theories.

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Science is a way of thinking much more than it is a body of knowledge

—Carl Sagan

9

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How should I teach the Big Ideas of Science?

Guide – p. 5

5 Es

10

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Guide – pp. 5-8 Engage

Engage: Activity which will focus student's attention, stimulate their think, access prior knowledge.

Sample Activities	What the teacher does	What the student does
<ul style="list-style-type: none"> Demonstration/ experiment Reading Brainstorming KWL Analyzing picture of graphic 	<ul style="list-style-type: none"> Creates interest Generates curiosity Raises questions Elicits responses that uncover what the students know or think about the concept/topic 	<ul style="list-style-type: none"> Asks questions such as: <ul style="list-style-type: none"> Why did this happen? What do I already know about this? What have I found out about this? Shows interest in the topic

10

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Guide – pp. 5-8 Explore

Explore: Activity which gives students time to think and investigate/test/make decisions/problem solve, and collect information.

Sample Activities	What the teacher does	What the student does
<ul style="list-style-type: none"> Perform an investigation Read authentic resources to collect information Solve a problem Construct a model 	<ul style="list-style-type: none"> Encourages students to work together without direct instruction Observes and listens to the students as they interact Asks probing questions to redirect the students' investigations when necessary Provides time for students to puzzle through problems 	<ul style="list-style-type: none"> Thinks freely but within the limits of the activity Tests predictions and hypotheses Forms new predictions and hypotheses Tries alternatives and discusses them with others Records observations and ideas Suspends judgement

10

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Explain: Activity which allows students to analyze their exploration - understanding is clarified and modified through a reflective activity.

Sample Activities	What the teacher does	What the student does
<ul style="list-style-type: none"> Student analysis & explanation Supporting ideas with evidence Structured questioning Reading and discussion Teacher explanation 	<ul style="list-style-type: none"> Encourages the students to explain concepts and definitions in their own words. Asks for justification (evidence) and clarification from students. Formally provides definitions, explanations, and new labels. Uses students' previous experiences as basis for explaining concepts. 	<ul style="list-style-type: none"> Explains possible solutions or answers to others. Listens carefully to others' explanations. Questions others' explanations. Listens to and tries to comprehend explanations the teacher offers. Refers to previous activities. Uses recorded observations in explanations.

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Elaborate (extend): Activity which expands and solidifies student thinking and/or applies it to a real-world situation.

Sample Activities	What the teacher does	What the student does
<ul style="list-style-type: none"> Problem solving Decision making Experimental inquiry Thinking skill activities: compare, classify, apply 	<ul style="list-style-type: none"> Expects the students to use formal labels, definitions, and explanations provided previously. Encourages the students to apply or extend the concepts and skills in new situations. Reminds the students of alternative explanations. Refers the students to existing data and evidence and asks, What do you already know? Why do you think . . . ? Strategies from <i>Explore</i> apply here also. 	<ul style="list-style-type: none"> Applies new labels, definitions, explanations, and skills in new, but similar situations. Uses previous information to ask questions, propose solutions, make decisions, and design experiments. Draws reasonable conclusions from evidence. Records observations and explanations. Checks for understandings among peers.

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Evaluate: Activity which allows the teacher to assess student performance and/or understandings of concepts, skills, processes, and applications.

Sample Activities	What the teacher does	What the student does
<ul style="list-style-type: none"> Any of the previous activities Develop a scoring tool or rubric Test (SR, BCR, ECR) Performance assessment Produce a product Journal entry Portfolio 	<ul style="list-style-type: none"> Observes the students as they apply new concepts and skills Assesses students' knowledge and/or skills Looks for evidence that the students have changed their thinking or behaviors Allows students to assess their own learning and group-process skills Asks open-ended questions, such as: Why do you think . . . ? What evidence do you have? What do you know about x? How would you explain x? 	<ul style="list-style-type: none"> Answers open-ended questions by using observations, evidence, and previously accepted explanations Demonstrates an understanding or knowledge of the concept or skill Evaluates his or her own progress and knowledge Asks related questions that would encourage future investigations

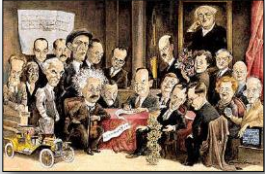
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ipdae BY EDUCATORS FOR EDUCATORS **5 Es Lesson Planner**

HOW TO APPLY IT

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Physical Science

ENERGY AND RELATED SYSTEMS


17

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Using the 5 Es

Apply Learning Integrating the 5 Es – Use Experiments




18

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Engage

Engage - All Objects Fall at the Same Rate



- Stand on a chair. Hold 2 oranges in each hand. Extend your arms straight out in front of your body so that each orange is the same height from the floor.
- Hypothesize which will hit the floor first.
- Let go of both oranges at the same time. What happened?
- Now stand in the same position but this time hold an orange in one hand and a grape in the other hand.
- Hypothesize which will hit the floor first? What happened? Why?

http://www.floridaipdae.org/dfiles/resources/lessons/GED2014/SCI_ScientificInquiry.pdf

19

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Explore

Explore - Gravity and Air Resistance

Analyzing Data

- How does air resistance affect the acceleration of falling objects?

Effects of Air Resistance	
Paper Type	Time
Flat paper	
Loosely crumpled paper	
Tightly crumpled paper	
Your paper design	

Guide – pp. 10-12


20

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Explain - 1666 Newton's Three Laws of Motion

- Every object in a state of uniform motion tends to remain in that state of motion unless an external force is applied to it.
- The relationship between an object's mass m , its acceleration a , and the applied force F is $F = ma$.
- For every action there is an equal and opposite reaction.



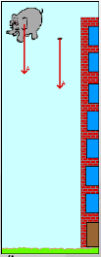
Best Idea Ever! <https://youtu.be/jwPc0kK9VHU>

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Explain - Newton's Second Law of Motion

- Suppose that an elephant and a feather are dropped off a very tall building from the same height at the same time. Suppose that air resistance could somehow be eliminated (no air drag).
- Which object will hit the ground first?



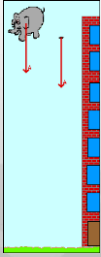
The Physics Classroom:
<http://www.physicsclassroom.com/class/newtlaws/Lesson-3/Free-Fall-and-Air-Resistance>

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Explain - Newton's Second Law of Motion

- Suppose that an elephant and a feather are dropped off a very tall building from the same height at the same time. Assume the realistic situation that both feather and elephant encounter air resistance.
- Which object will hit the ground first?



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Don't Forget the Vocabulary

- Force
- Object
- Mass
- Acceleration
- $F = ma$ (Force = mass x acceleration)

Forces are Balanced

$a = 0 \text{ m/s}^2$

Objects at Rest ($v = 0 \text{ m/s}$)

↓

Stay at Rest

Forces are Unbalanced

There is an acceleration

↓

The acceleration depends directly upon the "net force"

↓



The acceleration depends inversely upon the object's mass.

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ipdae BY EDUCATORS FOR EDUCATORS Elaborate/Extend

Elaborate (extend)

Would a tennis ball or bowling ball require more force to throw? Remember $F = ma$

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Evaluate

- Provide an example of Newton's 2nd Law of Motion. Explain why it's a good example of the law. You may wish to draw a picture, develop a summary, or demonstrate it to the class.
- How does the 2nd law of motion apply to everyday objects?

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Chemistry

ENERGY AND RELATED SYSTEMS

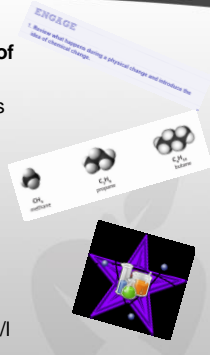
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Resources for Teaching the Basics of Chemistry Using the 5 Es


- Matter – Solids, Liquids, and Gasses
- Changes of State
- Density
- Periodic Table and Bonding,
- Water Molecules and Dissolving
- Chemical Change

Access Lesson Plans from ACS Chemistry for Life at:
<http://www.middle-school-chemistry.com/lessonplans/>



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Life Science
HUMAN HEALTH AND LIVING SYSTEMS

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ipdae BY EDUCATORS FOR EDUCATORS **Engage**

Watch a TED-Ed video on antibiotic resistance

Engage




- Ask for real-life experiences
- State the who, what, when, where, and why of the video

<http://ed.ted.com/lessons/how-antibiotics-become-resistant-over-time-kevin-wu>

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Explore




- Read an article that has the pros and cons of using antibiotics for health issues such as colds and respiratory infections. Example: Antibiotics: Understanding the Pros and Cons http://www.huffingtonpost.com/dr-cara-natterson/antibiotic-drugs_b_784324.html
- Compare the two sides. Construct an argument for or against prescribing antibiotics using evidence from the article.

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Explain




- Identify and summarize the major ideas in a narrative
- Define vocabulary terms such as synthesis, natural selection, mutations
- Identify the cause and effect of overuse of antibiotics
- Predict what you think will happen if a person takes the same antibiotic six times in one year

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Elaborate/Extend

Elaborate (extend)




Imagine that you have a farm and raise livestock. Using information that you learned from the video, as well as additional resources, decide whether you would give all of your livestock antibiotics as preventative measure. Why or why not?

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Evaluate

Evaluate



Design an experiment that will measure when people begin to feel better after taking antibiotics. Conduct the experiment and report your results in narrative and graphic form.

http://www.floridaipdae.org/dfiles/resources/lessons/GED/Science_Lesson_Plans/SCI_Antibiotic_Resistance.pdf

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Earth and Space Science
HUMAN HEALTH AND LIVING SYSTEMS

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Using the 5 Es in Earth Science

Sample Lesson Plan

Objective: Students will observe and describe the processes of erosion, transportation, and deposition by creating a physical model.

Materials

- paint tray (the kind used for a paint roller)
- pieces of sod (enough for each group)
- potting soil
- heavy clay like soil
- rainmaker (paper cup with about ten tiny holes poked in the bottom)
- water

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Engage

Take students on a walk outside of the school building and note where the soil is worn away or seems to have collected. Have students make a list of the sites.

Ask students:

- Do you notice anything different about these areas?
- What do you think caused these changes?




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Explore

Have students construct a model to investigate how these changes may have occurred. Provide students with materials so that they can construct their own model of a landscape. Have them use a paint roller tray as the base of their model. Share with students that they should not put any landscape materials in the bottom well. Have students put a full glass of water into their rainmaker and slowly move the rainmaker over their model. Have students observe what happens to their landscape when rain occurs.



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Explain

Ask students:

- What were your predictions before it rained on your landscape?
- What happened to your landscape when it rained?
- How is your landscape different after the rain than before the rain?
- What happened to the soil? Where did it go? Why did this happen?

Explain erosion, transportation, and deposition




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ipdae BY EDUCATORS FOR EDUCATORS Elaborate/Extend

Elaborate (extend)

Have groups of students plan a method to decrease or eliminate erosion. Have them design another landscape using the roller pan and resources. Have students write an explanation for why they think their plan will work to curb erosion. Have students experiment with their new landscape and describe whether or not their plan worked.


Have students identify a real-world situation of erosion, what occurred, and what is being done to restore the environment.



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Evaluate

Provide students with photographs representing different landscapes. Have students evaluate whether or not each landscape would be effective in preventing erosion. Have students define the terms erosion, transportation, and deposition and provide real-world examples of each.



41

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Resources


Resources for Earth and Space Science

Environmental Protection Agency

- <http://www.epa.gov/students/lesson-plans-teacher-guides-and-online-resources-educators>

Discovery Education

- <http://www.discoveryeducation.com/search/page/-/lesson-plan/earth%20science/index.cfm>



42



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Summing It Up

Final Thoughts

To increase science reading and writing skills...

“Each student needs to read like a detective... And write like an investigative reporter.”


David Coleman
Co-author of ELA Common Core State Standards



43

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Access IPDAE Resources

Remember, to access additional GED® materials . . .

- Go to www.floridaipdae.org
- Click on 
- Have fun exploring – webinars, lesson plans, Grab and Gos, workshops, tips of the week, and much, much more!

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QUESTIONS?

COMMENTS?



45

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“The best professional development is ongoing, experiential, collaborative, and connected to and derived from working with students.”

Edutopia 2014

Always here to assist!

Stay Connected

The IPDAE Team

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