From the Headlines! Big Ideas in Science

Information, Resources, and Strategies for the Classroom

A Webinar from GED Testing Service®

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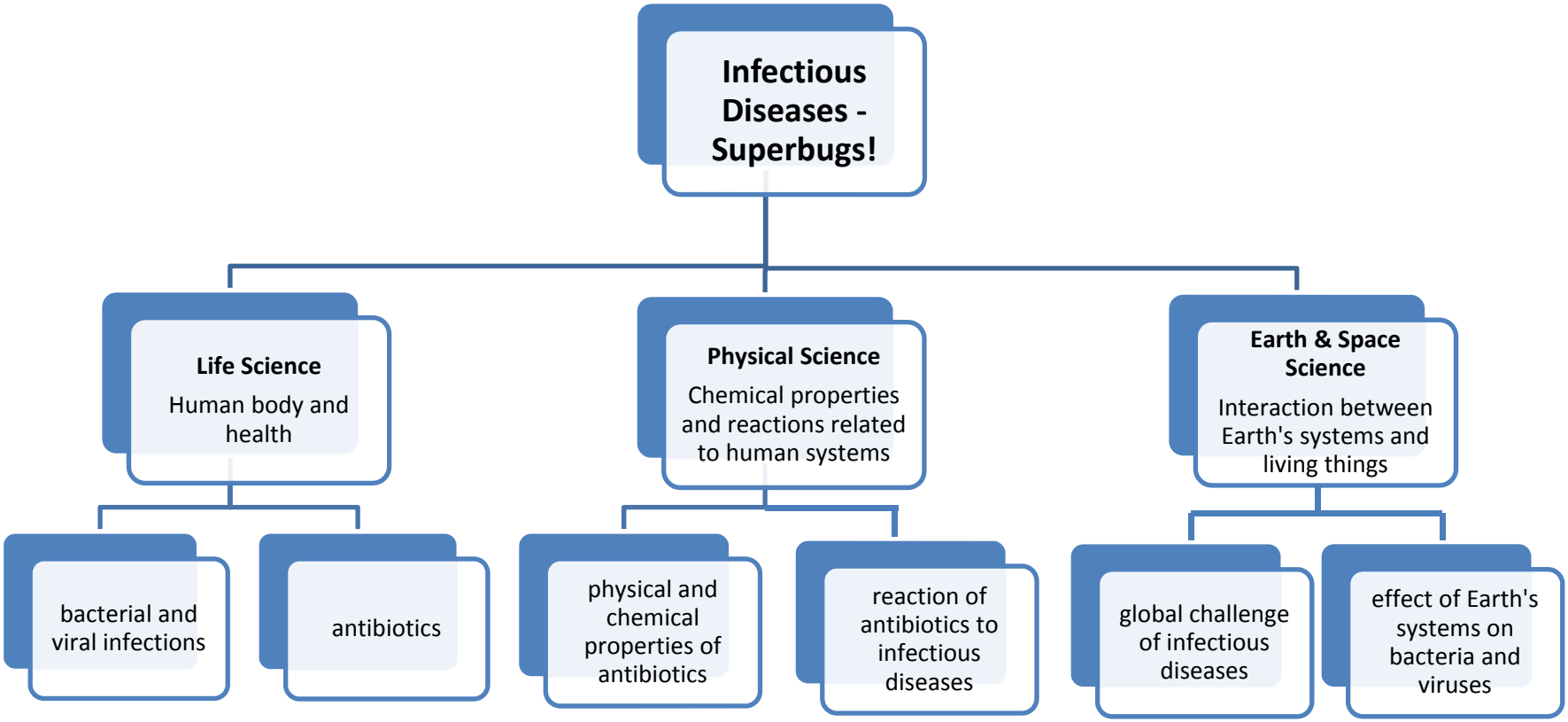
Circle of Inquiry

An Overview of the 5Es		
Phase	**Purpose**	**Role of Teacher**
Engage	Create interest and stimulate curiosity. Set learning within a meaningful context. Raise questions for inquiry. Reveal students' ideas and beliefs, compare students' ideas.	Activity or multi-modal text used to set context and establish topicality and relevance. Motivating/discrepant experience to create interest and raise questions. Open questions, individual student writing, drawing, acting out understandings, and discussion to reveal students' existing ideas and beliefs so that teachers are aware of current conceptions and can plan to extend and challenge as appropriate – a form of diagnostic assessment.
Explore	Provide experience of the phenomenon or concept. Explore and inquire into students' questions and test their ideas. Investigate and solve problems.	Open investigations to experience the phenomenon, collect evidence through observation and measurement, test ideas and try to answer questions. Investigation of text-based materials (e.g. newspaper articles, web-based articles) with consideration given to aspects of critical literacy, including making judgments about the reliability of the sources or the scientific claims made in the texts.
Explain	Introduce conceptual tools that can be used to interpret the evidence and construct explanations of the phenomenon. Construct multi-modal explanations and justify claims in terms of the evidence gathered. Compare explanations generated by different students/groups.	Student reading or teacher explanation to access concepts and terms that will be useful in interpreting evidence and explaining the phenomenon. Small group discussion to generate explanations, compare ideas and relate evidence to explanations. Individual writing, drawing and mapping to clarify ideas and explanations. Formative assessment to provide feedback to teacher and students about development of investigation skills and conceptual understandings. Small group writing/design to generate a communication product (e.g. poster, oral report, formal written report or PowerPoint presentation, cartoon strip, drama presentation, letter) with attention to form of argumentation, genre form/function and audience, and with integration of different modes for representing science ideas and findings.
Elaborate (extend)	Use and apply concepts and explanations in new contexts to test their general applicability. Reconstruct and extend explanations and understandings using and integrating different modes, such as written language, diagrammatic and graphic modes, and mathematics.	Further investigations, exercises, problems or design tasks to provide an opportunity to apply, clarify, extend and consolidate new conceptual understandings and skills. Further reading, individual and group writing may be used to introduce additional concepts and clarify meanings through writing. A communication product may be produced to re-represent ideas using and integrating diverse representational modes and genres consolidating and extending science understandings and literacy practices.
Evaluate	Provide an opportunity for students to review and reflect on their own learning and new understandings and skills. Provide evidence for changes to students' understandings, beliefs and skills.	Discussion of open questions or writing and diagrammatic responses to open questions – may use same/similar questions to those used in Engage phase to generate additional evidence of the extent to which the learning outcomes have been achieved. Reflections on changes to explanations generated in Engage and Evaluation phases to help students be more metacognitively aware of their learning.

Overview of Science Themes and Example Content

		Science Example Content Topics		
		Life Science (40%)	**Physical Science (40%)**	**Earth & Space Science (20%)**
Focusing Themes	***Human Health and Living Systems***	• Human body and health • Organization of life • Molecular basis for heredity • Evolution	• Chemical properties and reactions related to human systems	• Interactions between Earth's systems and living things
	Energy and Related Systems	• Relationships between life functions and energy intake • Energy flows in ecologic networks (ecosystems)	• Conservation, transformation, and flow of energy • Work, motion, and forces	• Earth and its system components • Structure and organization of the cosmos

Building on a Science Theme



Thematic Plan: Superbugs Are Here!

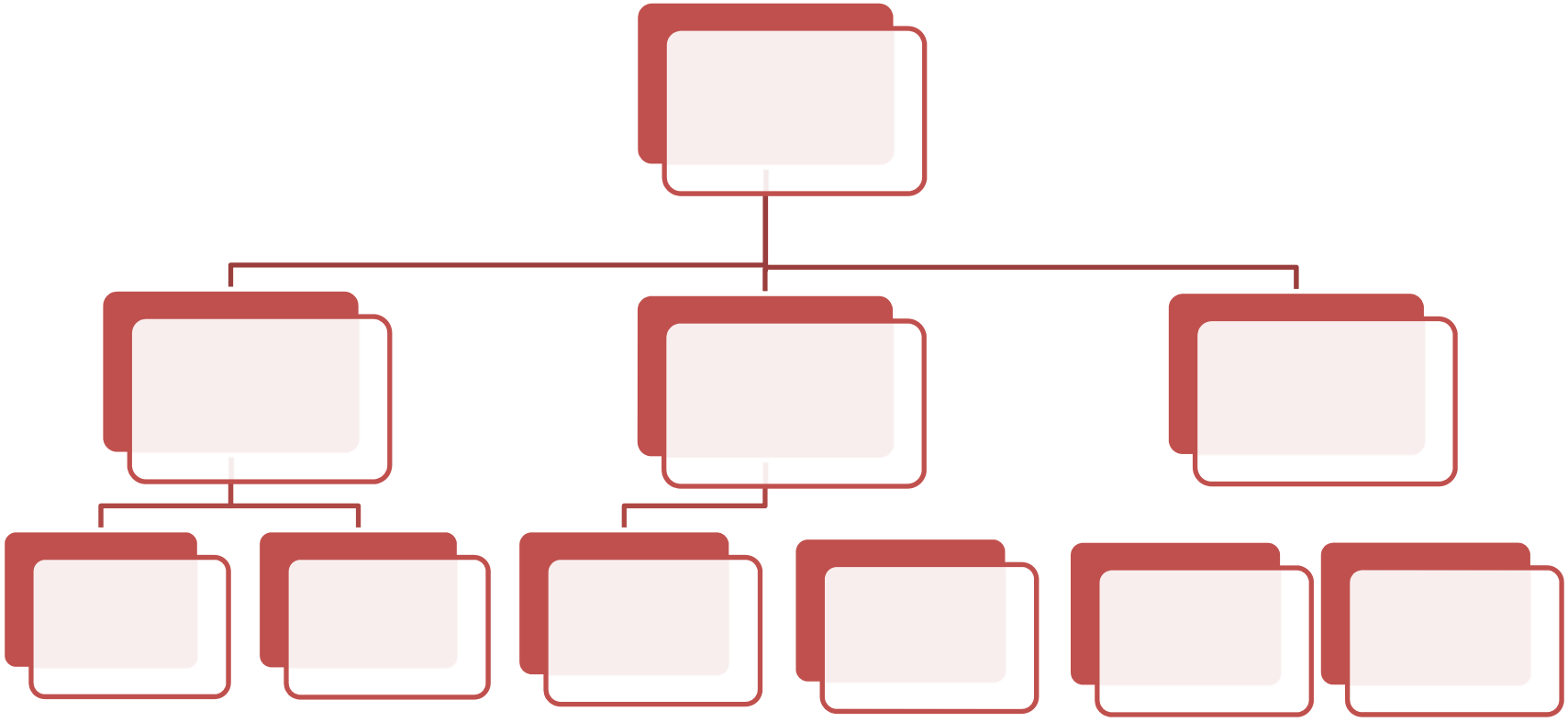
Objectives

- Understand the similarities and differences between bacteria and viruses
- Understand antibiotic resistance and the increases in superbugs in today's world
- Understand the interaction between Earth's systems and infectious diseases
- Understand chemical properties and reactions related to bacterial and viral infections and antibiotics

Engagement	Show students a video on superbugs or a current article or real-world example of antibiotic resistance, such as: https://www.youtube.com/watch?v=_Qa7sSnG6yI Ask students: • Have you ever taken an antibiotic? • How and when should antibiotics be used? • Who was Alexander Fleming? • What are bacteria? • What have you heard about super-bugs?
Exploration	Have students explore how bacteria and viruses are different. The purpose of this stage is for students to frame questions regarding the differences between bacteria and viruses, as well as the effectiveness of antibiotics. You may wish to have students watch videos or read articles and then have them answer questions or complete a Venn diagram where they identify the similarities and differences between bacteria and viruses, such as Bacteria and Viruses - http://ed.ted.com/on/q41jt6vp#finally Questions to Explore • What are bacteria? • What are viruses? Is there a difference? • What can we do to fight bacteria? • How come sometimes medicine we take for infections don't work? • What is a superbug?
Explain	Have students explain basic concepts of antibiotics and bacterial and viral infections as part of today's world. Provide students with non-fiction texts in order to build knowledge, as well as discussions and hands-on activities. **Sample Resources** • Biographies of Alexander Fleming http://www.nobelprize.org/nobel_prizes/medicine/laureates/1945/fleming-bio.html http://www.bbc.co.uk/history/historic_figures/fleming_alexander.shtml • Superbugs: A Silent Health Emergency

	https://www.sciencenewsforstudents.org/article/superbugs-silent-health-emergency • The War on Superbugs https://www.sciencenewsforstudents.org/article/war-superbugs • Hands-on Activities through Interacting with Diseases http://sciencenetlinks.com/interactives/antibiotic.html http://www.pbs.org/wgbh/nova/body/disease-detective.html
Extend (Elaborate)	Show students how the topic of infectious diseases crosses the different areas of science. The following are beginning resources to extend learning. *Earth Science* RX for Survival http://www.pbs.org/wgbh/rxforsurvival/index.html http://www.pbs.org/wgbh/rxforsurvival/series/teachers/index.html Windows to the Universe - Changing Planet: Infectious Diseases http://www.windows2universe.org/earth/changing_planet/infectious_disease.html *Physical Science (Chemistry)* Discuss that the world of chemistry is also a part of infectious diseases as scientists learn more about the chemical and physical properties of viruses vs. bacteria and the reaction of antibiotics in today's changing world. Access photos of different types of viruses and bacteria and show how antibiotics are or are not effective and why. You may also wish to integrate graphics and games in order to provide extension of the topic, such as: Superbugs (a downloadable game) - https://longitudeprize.org/superbugs Debrief by having students share the importance that infectious diseases and antibiotics have on their daily lives.
Evaluate	Provide students with questions to evaluate their learning, such as: ▪ What are the differences between viruses and bacteria? ▪ Are all bacteria harmful? Explain. ▪ How does the overuse of antibiotics lead to resistant strains of bacteria? ▪ When you get a cold, should you take an antibiotic to help you get better? Why? ▪ What can you do in your life to reduce antibiotic resistance? Have students research solutions to antibiotic resistance. Have them identify a solution and cite their sources for each piece of information. Discuss the need to use reputable sources based on scientific facts. The following is an example: Example: Overuse of antibiotics increases the chance of bacteria developing antibiotic resistance. Source: http://emerald.tufts.edu/med/apua/about_issue/about_antibioticres.shtml

Building on a Theme Lesson Planner



Science Resources from the World Wide Web

ABC Science. News, video clips, games, and lots of activities for the science classroom from the American Broadcasting Company. http://www.abc.net.au/science/

Annenberg Foundation. Great science materials and courses from *The Habitable Planet* to *Force and Motion*. Courses, lesson plans, and interactives will keep students engage in science. http://www.learner.org/resources/discipline-science.html

BBC Science. From space to the human body to, this interactive site allows learners to discover many different facets of science. http://www.bbc.co.uk/sn/

Cells Alive. This site can be used by teachers and students. Lots of great interactivity and resources on the basics of cells. http://www.cellsalive.com/toc.htm

Classroom Aid. Resources for teaching science content. http://classroom-aid.com/educational-resources/science/

Discovery Education. The website provides lesson plans on earth and space science. http://www.discoveryeducation.com/search/page/-/-/lesson-plan/earth%20science/index.cfm

eSkeletons. A great website that provides information and activities. http://www.eskeletons.org/

Earth Exploration Toolkit. Developed by teams of scientists and educators, the *Earth Exploration Toolbook* (EET) is a collection of online Earth system science activities. http://serc.carleton.edu/eet/index.html

Environmental Protection Agency. http://www.epa.gov/students/lesson-plans-teacher-guides-and-online-resources-educators

Exploratorium Online. The site contains over 15,000 articles and displays including interactivity regarding science. http://www.exploratorium.edu/

How Science Work. An app that provides lots of science information from the California Acadeym of Science. https://itunes.apple.com/us/course/how-science-works/id689052881

How Stuff Works. Ever wondered why a cd works? How about the ten myths about the brain? An interesting science site filled with real-world information. http://www.howstuffworks.com/

Interactive Websites for Teaching Science. Just click on one of the topics and explore the myriad of resources on the World Wide Web. http://interactivesites.weebly.com/science.html

Khan Academy. Lots of videos on graphics, as well as science content. https://www.khanacademy.org/

Mythbusters. From the Discovery Channel comes great videos that use the scientific method to explore different questions in science. http://www.discovery.com/tv-shows/mythbusters/

National Science Teachers Association. Freebies for Teachers. All kinds of curriculum guides, lesson plans, experiments, and resources. http://www.nsta.org/publications/freebies.aspx

NEWSELA. This website is an innovative way to build reading comprehension with nonfiction through daily news articles. https://newsela.com/

PBS: Science & Nature. Highlights and background information on every Science-based PBS program on the air; check out the Science for the Classroom link. http://www.pbs.org/science/

PhETSimulations. University of Colorado. Dozens of simulations, as well as activities and lab experiences. https://phet.colorado.edu/

Science Net Links. Advancing Science Serving Society provides lessons and tools for K-12 that are usable in the adult education classroom as well. http://sciencenetlinks.com/

Science News for Student. The latest in science news, written for everyone. Shorter news pieces (typically 350 to 800 words), written at about 6.0 – 9.0. https://www.sciencenewsforstudents.org/

Share My Lesson. Lesson plans and resources in all different areas of science plus more. https://sharemylesson.com/

Study Jams. Short videos on such things as the scientific method and scientific theory, as well as content areas in science. http://studyjams.scholastic.com/studyjams/jams/science/scientific-inquiry/scientific-methods.htm

Teachers Try Science. This site provides free and engaging **lessons**, along with **teaching strategies and resources**. http://www.tryscience.org/

Ted Ed Lessons. This website has great videos and lesson plans in all areas of science**.** http://ed.ted.com/lessons

The Physics Classroom. Information and activities in different areas of physics. http://www.physicsclassroom.com/

Understanding Science. A fun, free resource that aims to accurately communicate what science is and how it really works. http://undsci.berkeley.edu/

Virtual Microscope. Don't have a microscope in the classroom. Try this virtual one! http://www1.udel.edu/biology/ketcham/microscope/scope.html

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