3D Science Performance Assessment Tasks

HIGH SCHOOL

HOW ENVIRONMENT CAN IMPACT HOMEOSTASIS

These materials were developed under a grant awarded by the Michigan Department of Education

Task Title	How Environment Can Impact Homeostasis

Standards Bundle Information
Performance Expectations • HL-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. • HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
Science and Engineering Practices • Develop and use a model: Students will develop and refine a model of the integumentary system that shows the skin layers and accessory organs to demonstrate structure/function relationships. • Plan and conduct an investigation: Students will research the damage that occurs to the skin from an environmental impact.
Cross-Cutting Concepts • Structure and function: Students will demonstrate the relationship between structure and function of skin layers and accessory organs • Systems and System models: Students will represent (model) the hierarchical organization of the major organ of the system. • Stability and Change: Students will explore how the body maintains homeostasis by researching environmental impacts on the skin
Disciplinary Core Ideas • Multicellular organisms have a hierarchical structural organization in which any one system is made up of numerous parts and is itself a component of the next level. • Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage through positive feedback or discourage through negative feedback what is going on inside the living system.
CCSS ELA: • RI.1.1 Ask and answer questions about key details in a text. (1-LS1-2) • RI.1.2 Identify the main topic and retell key details of a text. (1-LS1-2) • RI.1.10 With prompting and support, read informational texts appropriately complex for grade. (1-LS1-2) • W.1.7 Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions). (1-LS1- 1)

CCSS Mathematics:

- 1.NBT.B.3 Compare two two-digit numbers based on the meanings of the tens and one digits, recording the results of comparisons with the symbols (1-LS1-2)
- 1.NBT.C.4 Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning uses. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten. (1- LS1-2)
- 1.NBT.C.5 Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used. (1-LS1-2)
- 1.NBT.C.6 Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. (1-LS1-2).

Overview / Introduction of the Assessment Task

In this task assessment, students are playing the role of a health care provider, who is asked to prepare some type of educational material about sunburn for parents of children. Students may work individually or in groups (teacher discretion). Educational material may be video, poster, bulletin board, or pamphlet.

Teacher Background

The integumentary system, contains the largest organ in the body--the skin. Functions of this system include protection from outside threats, including but not limited to UV and infectious agents, elimination of waste, sensation, endocrine function (vitamin D production), and temperature regulation. As a good introduction to the integumentary system, see: https://www.aad.org/public/kids/skin.

Skin has 3 main layers: epidermis, dermis, and subcutaneous. The epidermis (outer layer), has 5 of it's own layers: stratum basale, stratum spinosum, stratum granulosum, stratum lucidum, and stratum corneum (in order from deep to surface). Each layer has its specific cell structures as well as function. The dermis (middle layer) contains a majority of structures with which we are familiar: sudoriferous glands, sebaceous glands, hair roots and follicles, arrector pili muscles, and nerves (affective and effective). http://www.woundcarecenters.org/article/wound-basics/functions-of-the-skin and http://courses.washington.edu/bioen327/Labs/Lit_SkinStruct_Bensouillah_Ch01.pdf

A slightly detailed video introduction: https://www.youtube.com/watch?v=z5VnOS9Ke3g

The integumentary system provides some useful structures in feedback loops of temperature regulation. For example, when the body gets cold, we shiver, which generates heat production which brings the body temperature back to normal, homeostasis. Likewise, when we get too hot, our sweat glands release fluid that, as it evaporates, removes heat from the body until it again is brought back to a normal temperature range. More information regarding this can be found at: http://scienceaid.co.uk/biology/humans/homeostasis.html and background and additional lessons and examples are available at: http://outreach.mcb.harvard.edu/teachers/Summer09/KarynCoulon/TeacherNotes.pdf.

Sunburn is defined as a reddening of the skin due to the sun's UV exposure. Sunburn is a short-term effect of UV exposure; cancer, long-term effect of UV exposure. Short and long-term effects of sun exposure can happen to people of any skin color. (http://www.skincancer.org/prevention/sunburn).

Sunburn and cancer disrupt homeostasis by damaging the skin. The skin can lose its ability to protect from infectious pathogens and UV, lose its ability to help keep the body hydrated, lose its ability to create vitamin D (http://enhs.umn.edu/current/5103/uv/harmful.html).

Damage from UV exposure can be prevented by covering skin in the sun, using sunscreen, and limiting exposure (http://sciencenetlinks.com/lessons/sun-skin/) (http://kidshealth.org/en/parents/sunburn-sheet.html).

Information for Classroom Use

Connections to Instruction: Additional content that might be connected includes cells and cell parts, connections to other body systems, heat transfer, wavelength properties and energy, ethnic variations in skin coloration and evolution of skin color (see: HHMI interactive video at:http://www.hhmi.org/biointeractive/how-we-get-our-skin-color-interactive)

Approximate Duration for the Summative Task: (all components)

St. likely will need 1-2 class hours to research information and another 1-2 class hours to put together the final product. Depending on online access, students might get this as a homework assignment/assessment to be completed outside class time.

Class time might be used to allow students to share their final product, give inputs, or select the top three to pass to a local pediatrician's office for live audiences.

Assumptions:

The summative assessment (3DSPA) was designed to assess students' ability to perform the task, applying previous knowledge of the unit in the performance assessment **without** having been exposed to this specific phenomenon (sunburn) in advance.

The goal is that students demonstrate through this assessment their knowledge of all three dimensions with the unique example of sunburn the content of organization and feedback loops of a body system (integumentary) as well as using models and research to demonstrate stability and change toward homeostasis and hierarchical organization of systems in the body.

Materials Needed:

Research requires Online access and conversations with people regarding their experiences

For final product:

Paper based-colored paper, coloring tools (markers, colored pencils, crayons), scissors, glue sticks, printing capabilities

Media based-appropriate technology and programs for making and editing videos, photographs, PowerPoints

Supplementary Resources:
https://drive.google.com/drive/u/0/folders/0Bx3JwwSmcjHOV3ZRVkt5cmZhcDg

Learning Performances

- Student will develop a model of skin, depicting layers, components, interactions and accessory organs
- Student will model the relationship between tissues within an organ and the role (function they perform) toward the function of that organ.
- Student will revise a model to show the interaction between two systems.
- Student will research an example of a negative feedback loop that involves the integumentary system to demonstrate stabilization of a system
- Student will model a negative feedback loop to demonstrate stabilization of a system
- Student will analyze data to determine what impact changes of a system have on homeostasis.
- Student will gather and interpret data of how the body changes with changing internal or external conditions.
- Student will research and provide evidence of the effect of diet on a system.
- Student will gather data and graph the major causes of death (loss of homeostasis) for their age group.
- Student will investigate the signs and symptoms of a patient (simulated) to determine the change in homeostasis.
- Student will research treatments to return a patient to homeostasis.

Performance Assessments

<table>
<tr><th colspan="3">Student Performances</th></tr>
<tr><td rowspan="4">Formative Assessment Task 1

Layers of skin</td><td>Learning Performance: Students will develop a model of skin, depicting layers, components, interactions and accessory organs</td><td rowspan="4">Expected Duration:</td></tr>
<tr><td>Description (Phenomena, Scenario, Task

Task: Create a model out of paper. (Background: Students may need instruction on how to create a model.) Label structures.</td></tr>
<tr><td>Directions

Use different types/colors of paper to represent layers of skin. Include writing and/or drawing structures on appropriate layer.

When complete, students use peer review. Give time to revise models.</td></tr>
<tr><td>Scoring / Teacher Look-For’s:

Teacher observes models for correct labeling may include layers of skin, key accessory organs. Teacher discretion of depth and number based on teacher goals.</td></tr>
<tr><td rowspan="4">Formative Assessment Task 2

Functions of key parts</td><td>Learning Performance: Student will model the relationship between tissues within an organ and the role (function they perform) toward the function of that organ.</td><td rowspan="4">Expected Duration:</td></tr>
<tr><td>Description (Phenomena, Scenario, Task)

Students will research and explain function of the skin components as well as accessory organs.</td></tr>
<tr><td>Directions

Add functionality to previously created models.

Get into groups for peer review. Revise models as needed.</td></tr>
<tr><td></td></tr>
</table>

	Scoring / Teacher Look-For's: Observe additions to models of function to assess understanding. Teacher discretion as to the depth and number of key parts	
Formative Assessment Task 3 *Feedback loops*	Learning Performance: Student will research an example of a negative feedback loop that involves the integumentary system to demonstrate stabilization of a system. Student will model a negative feedback loop to demonstrate stabilization of a system	Expected Duration:
	Description (Phenomenon, Scenario, Task) Temperature regulation, feedback loops. Half of the students do cold, half of the students do hot. Once students have concept of **short-term** temperature. Regulation, consider walking through what would happen **long term** if the body were not returned to homeostasis through these efforts-ex. Shivering not warming body sufficiently, may lead to shivering stopping and ultimately **positive feedback** (in negative direction) to hypothermia	
	Directions research example given, model the feedback loop and present to opposite partner	
	Scoring / Teacher Look-For's: Students should include an example of negative feedback based on the integumentary system and explain the relationship between the key components (stimulus, receptor, effector, integrating center, response) http://outreach.mcb.harvard.edu/teachers/Summer09/KarynCoulon/TeacherNotes.pdf pg. 2) for their example	
Final Task: (Model, Design, Explain, Argue, Investigate) Produce product of research on effects of	Learning Performance: Student will develop a model of hierarchical organization and specific function. Student will analyze data to determine what impact changes of a system have on homeostasis.	Expected Duration:
	Phenomenon: Skin burning in the sun.	

sunburn on skin-short and long term	Goal- research the impacts of sun exposure on integumentary system (SEP), demonstrate knowledge of structure and function relationships within the system and their importance in homeostasis (CCC)	Role Medical assistant in a pediatric office	
	Audience: parents of patients in pediatrician's office	Situation Asked to create educational material for parents on the dangers of sunburn and prevention strategies	
	Product / Performance: Presentation for parents (may be hard copy, ex. poster, brochure, bulletin board, or media based, ex. video, powerpoint, PSA) demonstrating understanding of parts of integumentary system, function of parts, damage due to uv, and prevention strategies		

Teacher Directions for Final Performance Task

Task Component	**Teacher Does**	**Student Does**
Directions:	Teacher prints assignment form at: https://docs.google.com/document/d/1G6g7f-OaG0789-duEUxbhG9idhuGdXFfqEKYrFCpMWw/edit Decide if this is a group or individual project Go over directions with students Ask for questions and answer	Students follow handout of directions, making notes and formulating questions to ask
Component 1: Research-if done in class	Locate computer access for class Perhaps id useful sites for shared location Prepare for students working at different rates and have materials ready for next components	Locate key information Reword information in own terms Note key resources for citations Save work

Component 2: Develop Brochure Poster Bulletin board Video, PowerPoint, PSA	Provide computer access for student. Provide materials. Assist students in work by answering questions, posing questions to encourage progress	Determine the format of their project Develop materials needed and put together to create final product
Component 3: If desired: share projects	Establish procedure for sharing projects (ex. Pairs, small groups, whole class) If appropriate include rubric for students to provide feedback Extension-determine those projects to share with local physician office for live audience, invite community members to presentation	Share projects Be active listener while others present
Student Directions for Final Assessment Task	Skin Brochure Directions Skin Health Educational Material Scenario: You are a medical assistant at a pediatrician's office and it is mid-July. Patients are there for a number of the common ailments of children. However, you realize one afternoon that every child in the waiting room is pink, not the rosy pink of healthy laughing children but the ouch pink of sunburn. You think to yourself and later out loud to your supervisor, don't these parents realize what is happening? Your supervisor suggests that you create an educational presentation that could help parents know the risks of sun exposure and empower them to prevent this skin damage. Goal: You will need to: • research the impacts of sun exposure on the integumentary system • demonstrate your knowledge of structure function relationships within the system and -their importance in homeostasis You will produce: a presentation which may be in the form of a bulletin board, poster, or brochure or media presentation as a video, PSA, or PowerPoint You Need to include: • the functions of the system • labelled model of parts of the integumentary system • explanation in your own words of the function of the significant structures • short and long term effects of sun exposure on the tissues and organs • how varying skin colors are affected (similarities and differences)	

CheckBric

Student Name _____

Teacher Name _____

Learning Performance: Student will develop a model of hierarchical organization and specific function.	Exemplary (4)	Proficient (3)	Developing (2)	Not Yet (1)
Use model of skin structure to explain hierarchical organization. ● must include a personal model of the integumentary system ● labels of layers and accessory organs are clear and appropriate for model ● written explanation referring to the model of how the parts are organized and their function				
Analyze the data from the model to explain the organization of skin and its role in homeostasis. (cells->tissues-> organs) ● demonstrate organization of the skin ● connect organization of skin to the model ● demonstrate how structures of skin provide homeostasis for the body				
Learning Performance: Student will analyze data to determine what impact changes of a system have on homeostasis.	Exemplary (4)	Proficient (3)	Developing (2)	Not Yet (1)
Communicate the changes caused by sun exposure and how it impacts the skin and homeostasis. ● short term effects (at least 2) ● long term effects (at least 2) ● prevention (at least 2)				
Gather, interpret, and explain research data and describe changes of homeostasis in the educational material for parents. ● use words appropriate for teaching most parents (5th grade reading level). ● use 3 appropriate websites as sources. ● follow APA format.				

4 Exemplary	Work at this level is of exceptional quality. It is both thorough and accurate. It exceeds the standard. It shows a sophisticated application of knowledge and skills.
3 Proficient	Work at this level meets the standard. It is acceptable work that demonstrates application of essential knowledge and skills. Minor errors or omissions do not detract from the overall quality.
2 Developing	Work at this level does not meet the standard. It shows basic, but inconsistent application of knowledge and skills. Minor errors or omissions detract from the overall quality. Your work needs further development.
1 Emerging	Work at this level shows a partial application of knowledge and skills. It is superficial (lacks depth), fragmented or incomplete and needs considerable development. Your work contains errors or omissions.

Copyrighted Material and Sources

https://www.aad.org/public/kids/skin
http://www.woundcarecenters.org/article/wound-basics/functions-of-the-skin
http://courses.washington.edu/bioen327/Labs/Lit_SkinStruct_Bensouillah_Ch01.pdf
https://www.youtube.com/watch?v=z5VnOS9Ke3g
http://scienceaid.co.uk/biology/humans/homeostasis.html
http://outreach.mcb.harvard.edu/teachers/Summer09/KarynCoulon/TeacherNotes.pdf.
http://www.skincancer.org/prevention/sunburn http://enhs.umn.edu/current/5103/uv/harmful.html
http://sciencenetlinks.com/lessons/sun-skin/
http://kidshealth.org/en/parents/sunburn-sheet.html
http://www.hhmi.org/biointeractive/how-we-get-our-skin-color-interactive
http://outreach.mcb.harvard.edu/teachers/Summer09/KarynCoulon/TeacherNotes.pdf