MARYLAND STATE DEPARTMENT OF
EDUCATION
EQUITY AND EXCELLENCE

Karen B. Salmon, Ph.D.
State Superintendent of Schools

TO: Members of the State Board of Education

FROM: Karen B. Salmon, Ph.D.

DATE: January 28, 2020

SUBJECT: Change to High School Maryland Integrated Science Assessment Structure

PURPOSE:

The purpose of this item is to recommend a transition from a 3-dimensional domain-integrated high school science assessment to a 3-dimensional single domain assessment.

HISTORICAL BACKGROUND:

The HS MISA, aligned to the Next Generation Science Standards (NGSS) adopted by Maryland in 2013, integrates all three dimensions of the standards including the disciplinary core ideas, science and engineering practices, and crosscutting concepts. The disciplinary core ideas include life science, physical science, Earth and space science content. The primary purpose of MISA is to provide high-quality science assessments to measure how well students understand grade band concepts in science. The assessment is one of several ways to help parents and teachers understand how well children are acquiring science concepts and practices. The High School MISA assesses content and practices contained in multiple high school courses, hence it is not an end-of-course examination.

The Board and Local School Systems expressed concerns regarding the current HS MISA. The concerns expressed include the expectation that students retain knowledge across two or three courses before testing and that the end-of-course sequence assessment rather than end-of-course assessment creates issues with teacher accountability, teacher training, and student transfers between systems.

MSDE has considered several options to address the recommendations of the High School Graduation Task Force as well as the concerns of the Board and Local School Systems. MSDE weighed several variables such as teacher certification, student performance, local school system course sequences, assessment time, and assessment development costs.

EXECUTIVE SUMMARY:

MSDE's recommendation is to transition from a 3-dimensional assessment of multiple domains to a 3-dimensional assessment of a single domain. This change would also help align the high school science assessment with the other high school content assessments if the High School Graduation Task Force recommendations are adopted at a later time.

ACTION:

Accept the recommendation of MSDE to transition the HS MISA to a 3-dimensional assessment of a single domain.

ATTACHEMENTS:

Attachment 1: Sample MCAP HS MISA Life Science Lab Set
Attachment 2: Sample High School Assessment Biology items

High School Maryland Integrated Science Assessment (HS MISA)

STATE BOARD MEETING

January 28, 2020

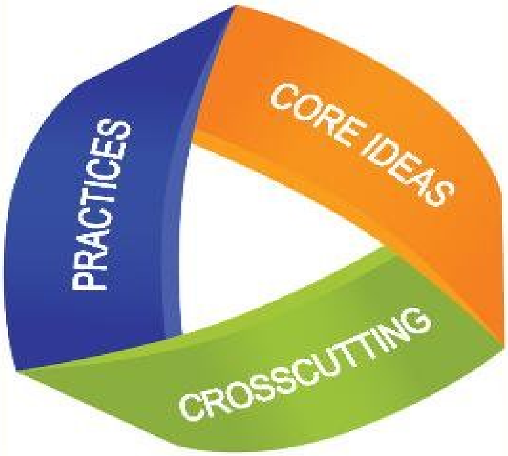
Next Generation Science Standards

Three Dimensions of Science Learning

A Framework of Standards for Exploring the Natural World and Human-Designed World

What Students Do:

- Ask questions
- Design investigations
- Collect, analyze, and interpret data
- Develop and use models
- Construct evidence-based arguments
- Define a design problem
- Apply knowledge to engineer solutions to a problem



What Students Know:
Disciplinary Core Ideas

Physical Science

- Matter and Its Interactions
- Motion and Stability; Forces and Interactions
- Energy
- Waves and Their Applications in Technologies for Information Transfer

Life Science

- From Molecules to Organisms: Structures and Processes
- Ecosystems: Interactions, Energy, and Dynamics
- Heredity: Inheritance and Variation of Traits
- Biological Evolution: Unity and Diversity

Earth Science

- Earth's Place in the Universe
- Earth's Systems
- Earth and Human Activity

Engineering, Technology, and Applicationon of Science

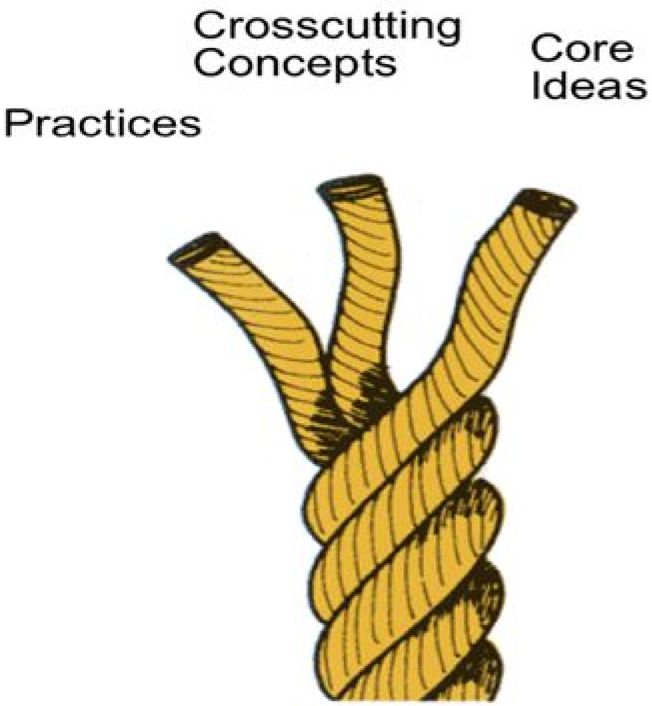
- *Engineering Design*

How Students Connect the Three Domains of Science:

- Patterns
- Cause and effect
- Scale, proportion, and quantity
- Systems and system models
- Energy and matter
- Structure and function
- Stability and change

Information is based on Next Generation Science Standards and the NJ Student Learning Standards for Science.

Next Generation Science Standards



NEXT GENERATION SCIENCE STANDARDS

Blending of Three Dimensions

- Science and engineering practices
- Crosscutting concepts
- Disciplinary core ideas

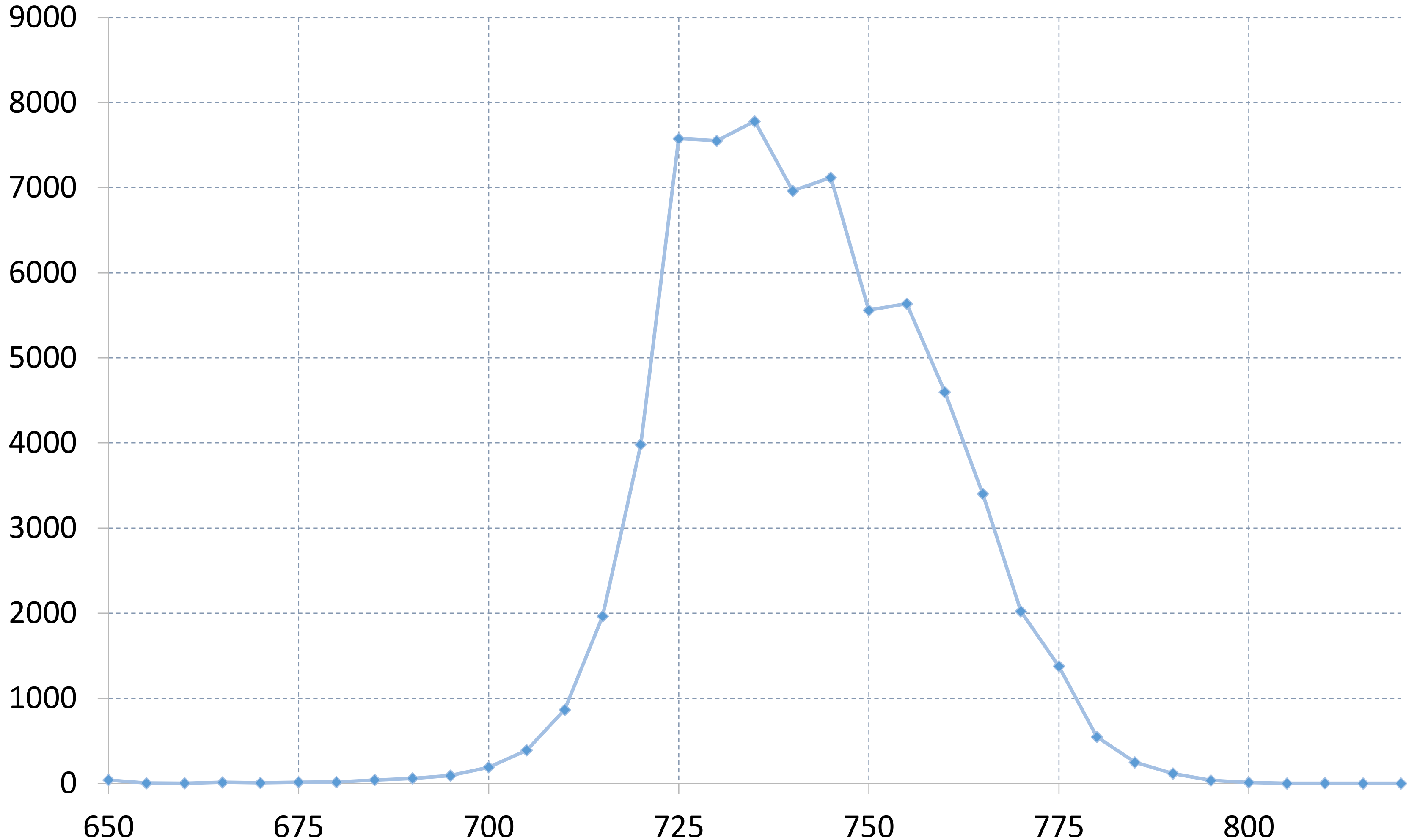
HS MISA Operational Challenges

- Science teachers are trained and certified in single disciplines (Biology, Chemistry, Physics, etc.) and not in integrated science.
- Lack of a prescribed sequencing of science courses leads to potential preparation disparities across the state.
- Student transfers between systems and from states that have not adopted Next Generation Science standards, makes student placement and test preparation difficult.

HS MISA Operational Challenges

- Assessment is offered at the end of multiple courses rather than at the end of one course;
    - Making it impossible to transition to an end-of-course exam scenario consistent with the Graduation Task Force recommendations.
    - Placing review responsibilities on one teacher rather than the two or three responsible for preparing the student.
    - Requiring students to retain disciplinary knowledge and practices taught by multiple teachers, over multiple courses, and multiple years.

January and May 2019
Combined HS MISA Score Distribution



Develop a new single subject 3D Science Assessment.

Potential Timeline for Transition to Single-Subject HS MISA Assessment

Event	Date
All field test slots occupied by only HS 3D-Life Science items. The rest of assessment will be integrated items.	January and May 2021
Operational Administration of 3D-Life Science Assessment (DOES NOT count for graduation).	January and May 2022
Develop and Release Practice Test for 3D-Life Science Assessment	Fall 2022
Revise ISRs and Reporting	Fall 2022
Standards Setting for HS 3D-Life Science Assessment	Summer 2022
Reports released for LSS to make adjustments to instruction	Fall 2022
Administration of HS 3D-Life Science Assessment counts for graduation	January and May 2023
First Summer Administration of HS 3D-Life Science Assessment	Summer 2023

MCAP Maryland Comprehensive Assessment Program

MISA

Maryland Integrated Science Assessment

January 2019 Released Items and Answer Key

Developed and published under contract with the Maryland State Department of Education by Cognia.

Read the information. Use the information to answer the questions.

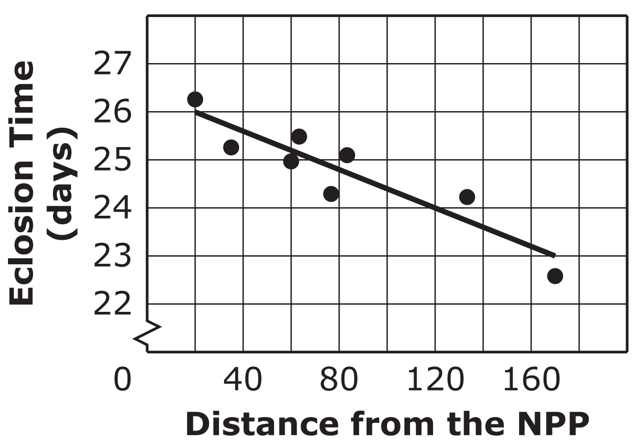
Butterflies Near the Power Plant

The pale grass blue butterfly (*Zizeeria maha*) has small, blue-colored wings. The distance the butterfly can fly is limited by the size of its wings. The butterfly begins its life cycle as an egg. The egg hatches into a larva, or caterpillar. Next, the pupa forms a chrysalis and eventually the adult emerges as a butterfly. The typical life cycle is about twenty-two days.

Pale grass blue butterflies are found throughout Japan. This includes areas near the Fukushima Nuclear Power Plant (NPP). An accident at the nuclear power plant on March 11, 2011, released a large amount of nuclear radiation into the surrounding area. Radiation exposure decreased as the distance from the nuclear plant increased. A group of scientists claimed that the pale grass blue butterflies were a model organism to evaluate the environmental and biological effects of the radiation. Two months after the accident, the scientists captured adult pale grass blue butterflies at different distances from the nuclear power plant. This was the first generation of butterflies exposed to the radiation from the accident.

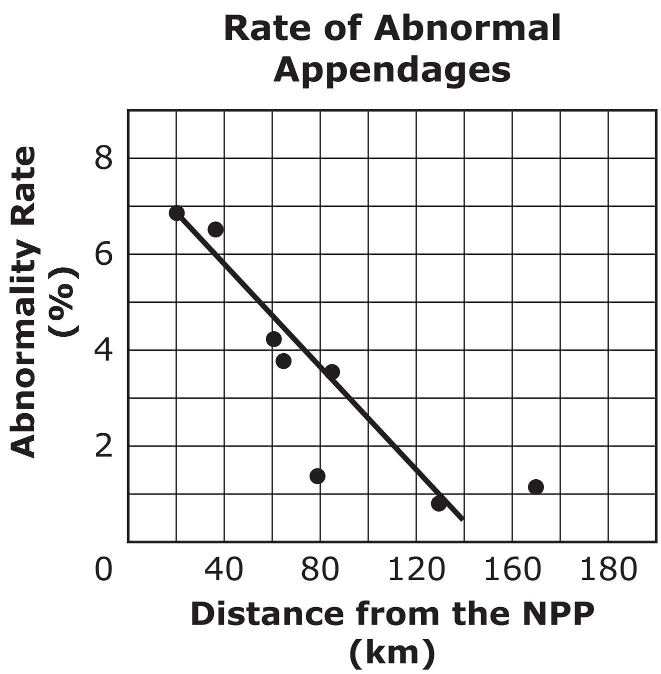
In a laboratory, the scientists bred the collected adult butterflies to create two generations. The eclosion time is the time it takes the butterfly to go from egg to adult. The eclosion time of each generation was recorded by the scientists. The graph shows the data collected.

Average Eclosion Time for Radiation-Exposed Butterflies

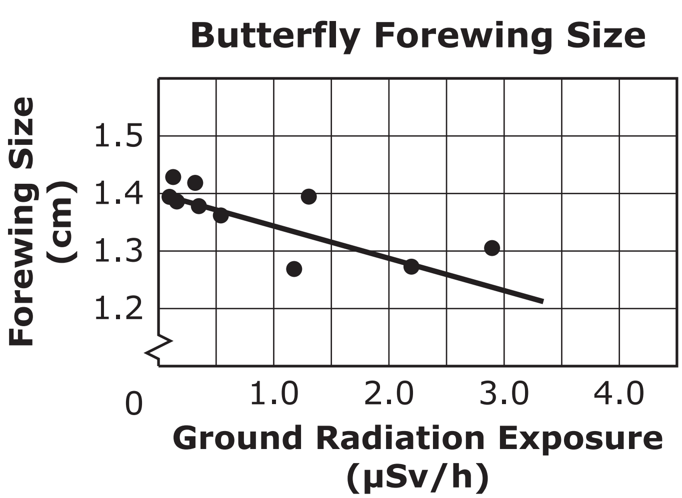


Abnormalities

The scientists observed the new generations of butterfly for abnormalities in their wings, eyes, and appendages. The graph shows some of the data the scientists collected during their observations.



A butterfly's forewings are its two front wings. The graph shows the changes in forewing size as the butterflies' exposure to radiation increased. The risk of health effects from exposure to radiation are measured in microsievert units (μSv) in the graph.



Radiation Impact

In butterflies, the genes that control the development of wings, eyes, and appendages are located on the same chromosome. The scientists performed another experiment to determine the impact of the radiation on the butterflies. The scientists collected a second sample of adult butterflies two months and six months after the nuclear accident. In a laboratory, the scientists grew two new generations of the butterflies from the adult butterflies they had collected.

The data table shows a comparison of the butterflies collected two months and six months after the accident and their offspring.

Abnormalities in Several Generations of Butterflies

Generation	2 Months after Nuclear Accident (%)	6 Months after Nuclear Accident (%)
Parent population (P)	13.2	28.1
1st generation produced (F1)	18.3	51.9
2nd generation produced (F2)	33.5	Data not collected

1 How did the wings of the pale grass blue butterfly help explain the increased rate of abnormalities seen in the butterfly population six months after the nuclear accident at the nuclear power plant?

A The pale color of the wings made it easier to detect abnormalities the radiation caused in the wing DNA.

B The small size of the wings made detecting abnormalities in the wing proteins of the butterfly easier after the nuclear accident.

C The small size of the wings made flying far from the nuclear accident difficult so the butterfly DNA was exposed to radiation that caused abnormalities in the proteins formed.

D The wings provided additional areas for the butterfly to capture nuclear radiation after the accident and led to increased levels of abnormalities seen in butterfly proteins.

2 Based on the data shown in the Rate of Abnormal Appendages and Butterfly Forewing Size graphs, which conclusion can **most likely** be made?

A The development of the appendages and forewings in butterflies is controlled by the same cell.

B The development of the appendages and forewings in butterflies is controlled by different groups of specialized cells.

C The DNA and the proteins involved in the development of butterfly appendages and forewings were affected by radiation.

D The DNA in the cells of butterfly appendages and forewings was affected by the radiation, but it had no effect on the proteins formed.

3 Which evidence supports the claim that genes that control the life cycle and development of pale grass blue butterflies were affected similarly by the accident at the nuclear power plant? Select the two that apply.

A The abnormalities seen in offspring generations of butterflies were greater than in the parent generation.

B The abnormality rate in appendages for the butterflies increased closer to the site of the nuclear accident.

C The abnormalities caused by the radiation were only seen in the eyes and wings of pale grass blue butterflies.

D The average eclosion time was longer for radiation-exposed butterflies that were closer to the site of the nuclear accident.

E The pale grass blue butterflies fed on plants that grew near the nuclear power plant, which caused mutations in the butterfly DNA.

F The abnormalities seen in the butterfly population six months after the nuclear accident were greater than the abnormalities seen two months after the accident.

4 Which claim is supported by the data in the Abnormalities in Several Generations of Butterflies table?

A Exposure to radiation only resulted in abnormalities in butterfly wings.

B Exposure to radiation affected the DNA in butterfly cells and was passed on to the offspring.

C Pale grass blue butterflies were more affected by radiation exposure than other butterfly species.

D Larger doses of radiation led to more butterfly deaths in the parent (P) generation.

5 Which claims explain the increased abnormality rate seen in the F1 generation of butterflies that were caught two months and six months after the nuclear accident? Select the two that apply.

A Each generation of offspring produced by adults that were exposed to nuclear radiation randomly mutated.

B The scientists collected adult butterflies for the study from areas with the highest levels of nuclear radiation.

C The parent populations of butterflies that produced offspring were those with the largest number of genetic abnormalities.

D Nuclear radiation caused genetic damage in the adult butterflies that was inherited by the offspring generation.

E Mutations that occurred during meiosis led to offspring generations with more mutations than the parent generation.

F The offspring that survived the nuclear accident were those that inherited the most mutations from the parent butterflies.

6 Use evidence to support the claim that the nuclear accident at the nuclear power plant caused changes that resulted in the abnormalities seen in the pale grass blue butterfly population for the next several generations.

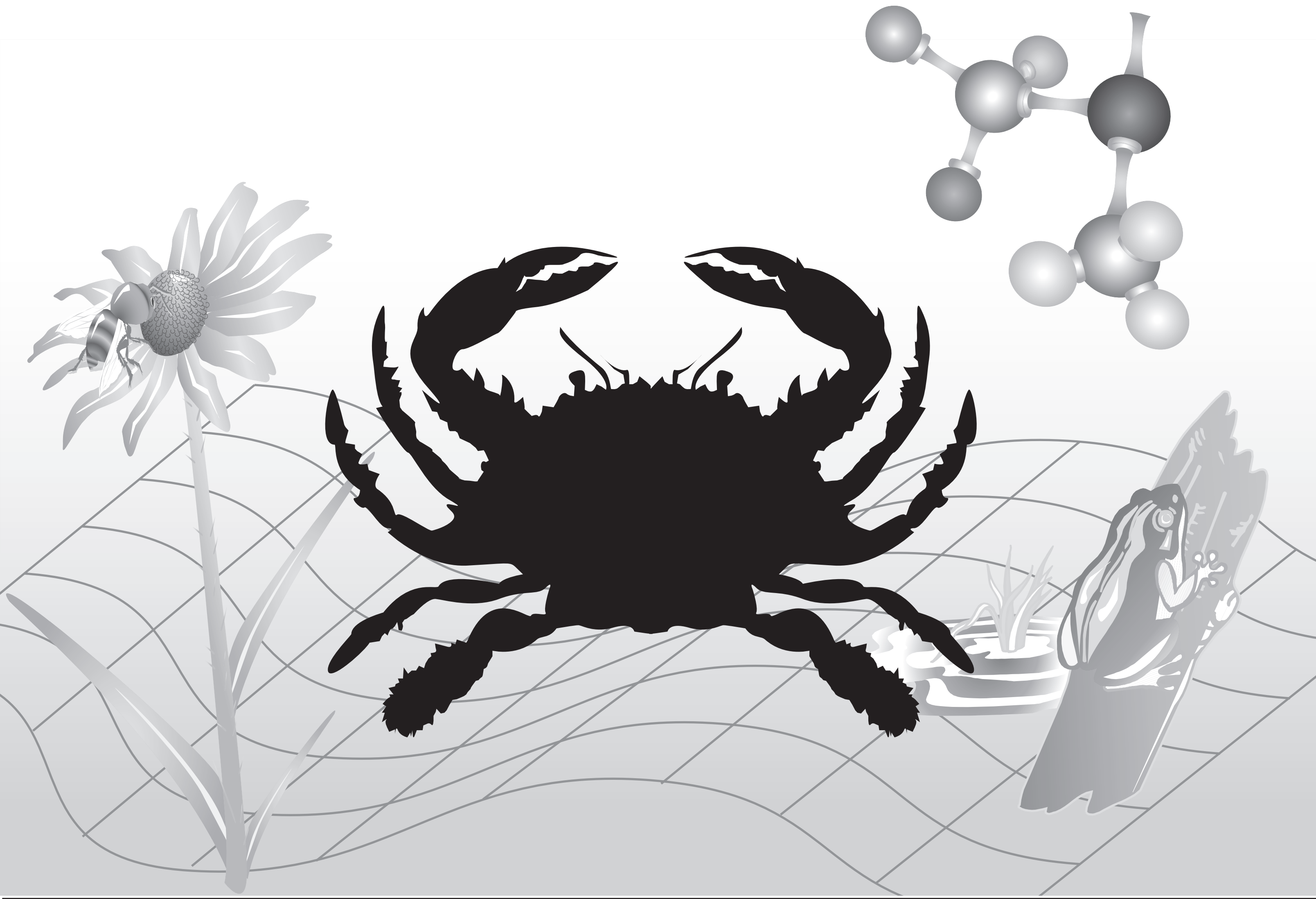
Write your answer on the lines on your Answer Sheet.

HSA

Maryland High School Assessment

MARYLAND STATE DEPARTMENT OF EDUCATION

Achievement Matters Most



BIOLOGY

Public Release 2007

15 **A scientist believes that a factory has been dumping acid into a local river. To test this hypothesis, which property of water should the scientist monitor?**

A pH

B density

C polarity

D temperature

16 **A cellular process uses a strand of genetic material to produce a new strand. Parts of the strands are shown below.**

Original strand	**ATT CAG**
New strand	**UAA GUC**

This new strand will most likely be used for

F gene splicing

G DNA synthesis

H crossing-over

J protein synthesis

17 **Students conducted an experiment to test the effect of antibiotics on bacteria. They placed bacteria in a petri dish that contained agar treated with an antibiotic. Only one of the bacterial colonies survived.**

Which of these statements best explains why only one colony survived?

A The bacteria in the colonies competed for survival.

B There was only enough food in the dish for some of the bacteria to survive.

C There was not enough antibiotic in the dish to kill all the bacteria.

D The bacteria in the surviving colony had genetic variations that allowed them to survive.

18
BCR

In an experiment, a group of students placed ten raisins in a container with 100 milliliters of water. They covered the container and let the raisins sit overnight. The students removed the raisins from the container and observed that they were larger. They also observed that the volume of water in the container had decreased.

What happened to the raisins to cause them to become larger? In your response, be sure to

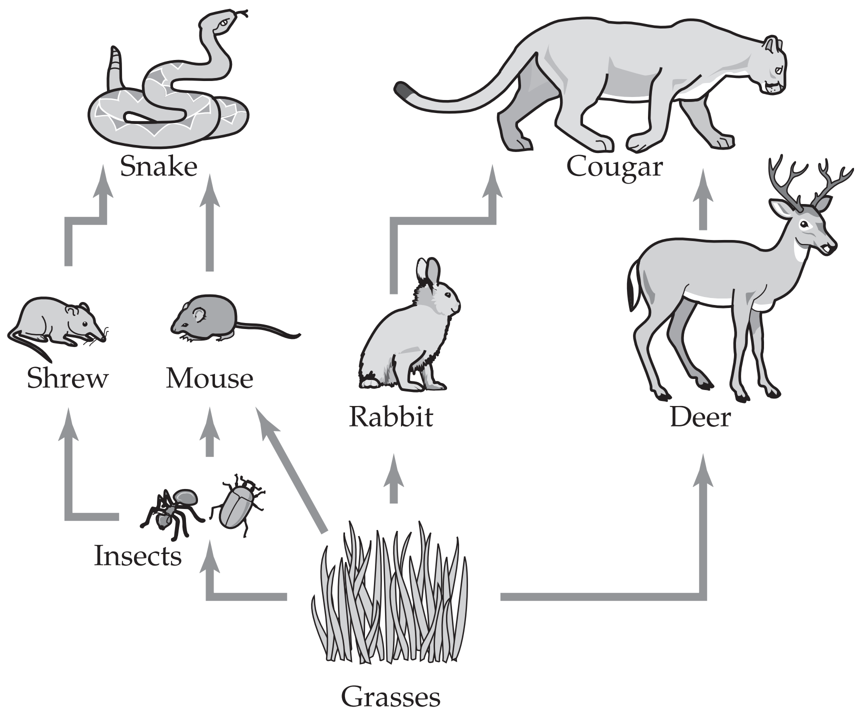
- **name the process that caused the raisins to become larger**
- **describe how this process caused the raisins to become larger**
- **explain the role of this process in living systems**

Write your answer in your Answer Book.

Directions

Use the relationships in the food web below to answer Numbers 19 through 21.

TERRESTRIAL FOOD WEB



19 **Which of these lists all of the predators shown in the food web?**

A cougars only

B cougars and snakes

C cougars, snakes, and shrews

D cougars, snakes, shrews, and mice

GO ON

20 **The relationship between the mice and the insects is an example of**

F commensalism

G mutualism

H parasite–host

J predator–prey

21 **According to the food web, which of these supply energy for all the other organisms?**

A snakes

B insects

C grasses

D cougars