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. KBS/JH

DATE: February 25, 2020

SUBJECT: Change to High School Maryland Integrated Science Assessment Structure

PURPOSE:

The purpose of this item is to provide background on the options considered prior to making a recommendation to transition from a 3-dimensional domain-integrated high school science assessment to a 3-dimensional single domain assessment.

HISTORICAL BACKGROUND:

The High School Maryland Integrated Science Assessment (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. At the January 28, 2020 meeting, the State Board requested information on the full scope of options explored by the agency.

National trends indicate that Maryland is one of two states that adopted the NGSS, are assessing science in an integrated manner, and require students to pass the assessment in order to graduate from high school. The majority of states that adopted the NGSS, or a framework aligned with NGSS, have an integrated assessment, and do not use the assessment as a graduation requirement. 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 maintains its recommendation 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 A: Sample HS MISA Life Science Item Set
Attachment B: Former High School Biology Assessment Items

High School Maryland Integrated Science Assessment (HS MISA)

MARYLAND STATE DEPARTMENT OF EDUCATION
EQUITY AND EXCELLENCE

STATE BOARD MEETING

February 25, 2020

HS MISA Operational Challenges

- Science teachers are trained and certified in single disciplines (Biology, Chemistry, Physics, etc.) and not in integrated science.
- Students take up to three courses, from three teachers, over three years before sitting for an assessment they must pass in order to graduate.
- 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.

National Overview of State Science Assessments and Standards

- Maryland is one of two states that has adopted the Next Generation Science Standards that assesses in an integrated fashion and requires students to pass the assessment as a graduation requirement.
- 11/13 states that require students to pass a science assessment as a graduation requirement use the assessment as an end-of-course exam rather than a stand alone graduation requirement, only test a single domain of science content, and 10/13 assess Biology.
- 21 states assess students in an integrated fashion but do not make passing the assessment a graduation requirement.

HS MISA Option 1

Maintain the current organization of MISA but eliminate the graduation assessment requirement and test only for the purposes of federal accountability.

- No change in cost.
- Maintains federal accountability reporting requirements.
- Maintains full fidelity to the Next Generation Science Standards.
- Sends a clear message that science is not as important as other tested areas.
- Millions of dollars will be spent on an assessment with little ability to impact instruction.
- Requires COMAR changes to eliminate science assessment as a graduation requirement.
- Does not address the issue of placement for students transferring between systems and from other states.

HS MISA Option 2

Mandate a course sequence for science and the placement of the assessed performance expectations (PEs) and administer three science assessments given at the end of each of three required science courses. Passing score would be the aggregation of all three assessments.

- Allows for the science assessment to be given at the end of a single course of instruction.
- Could use national assessments as alternatives (AP/IB).
- Addresses the challenge of placement for students transferring between systems.
- Requires COMAR changes to require courses and assessments.
- Would incur significant cost increases of approximately $10 million dollars.
- Finding one course sequencing model that all LSS would agree on would be difficult.
- Science would have three assessments when math, ELA, and SS only have one.
- Would add 200 minutes of assessment time which significantly impacts the ability of LSS to administer local assessments and stay under the state mandated 2% assessment cap.

Sequencing Models Used by Maryland School Districts

Integrated ESS Course Sequence (14 LSS currently use)

Biology with Earth Space Science → Chemistry with Earth Space Science → Physics with Earth Space Science

Domain Course Sequence (10 LSS currently use)

Earth and Space Science → Life Science → Physical Science

HS MISA Option 3

Develop a new single science domain assessment in Biology.

- Change can be done within the fiscal confines of the current contract .
- No interruption to federal reporting for accountability.
- Allows for the science assessment to be linked to a single course taught by a single teacher.
- All remaining science courses will still be aligned to the Next Generation Science Standards.
- Could use national assessments as alternatives (AP/IB).
- All LSS currently require students to take a Biology course.
- Addresses the lack of a prescribed sequencing of science courses eliminating potential preparation disparities across the state.
- Addresses the issue with student transfers between systems and from states that have not adopted Next Generation Science standards.
- Maintains a three dimensional assessment aligned to the Next Generation Science Standards.

Attachment A

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.

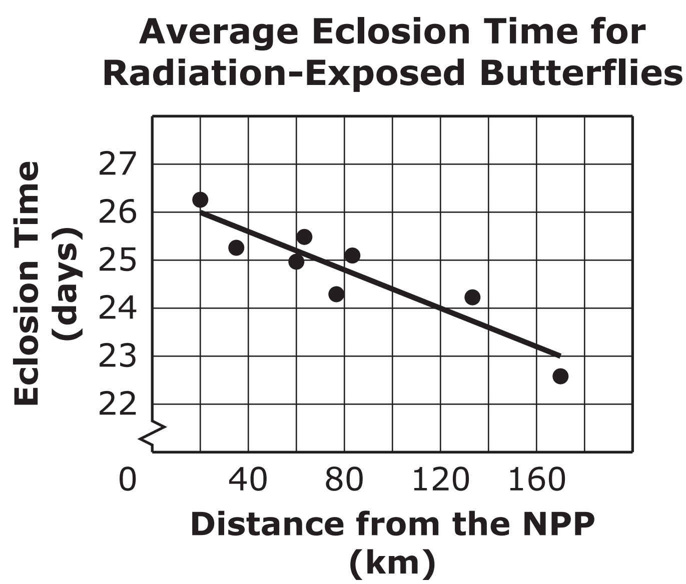
Read the information. Use the information to answer the questions.

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.

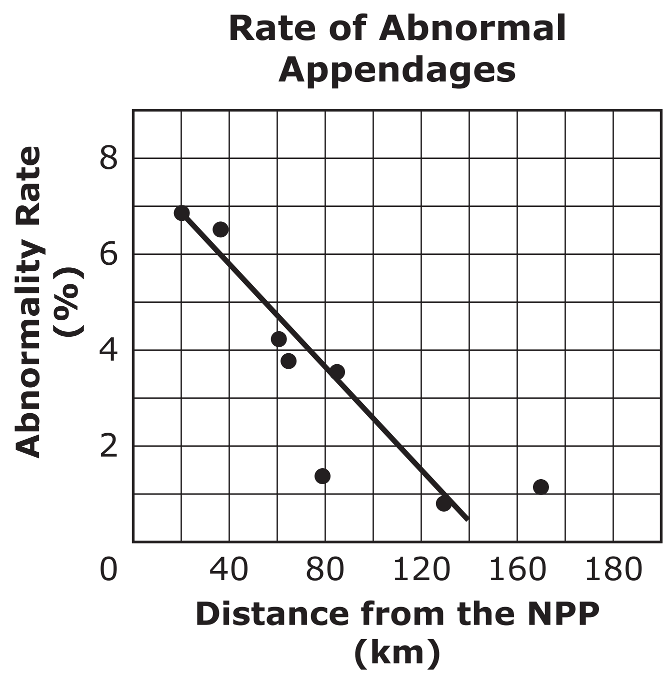
Pale grass blue butterflies are found throughout Japan. This includes areas near the Fukushima Nuclear Power Plant (NPP). An accident at the nuclear power plant on March 11, 2011, released a large amount of nuclear radiation into the surrounding area. Radiation exposure decreased as the distance from 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.

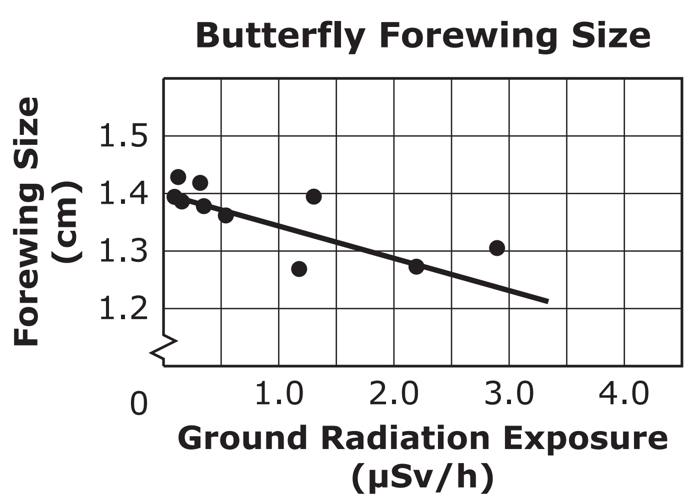


Abnormalities

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.

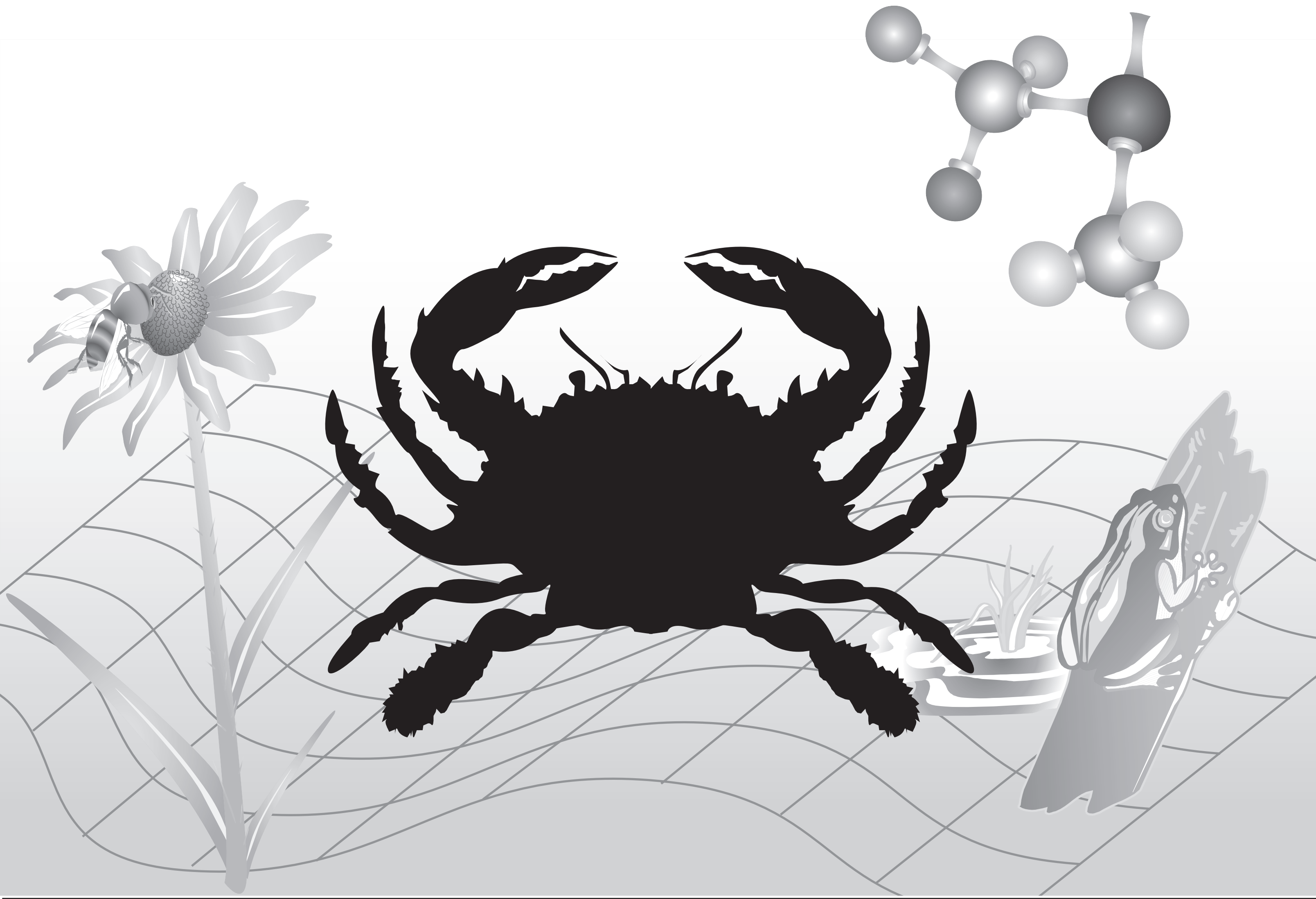
Attachement B

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.

GO ON

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

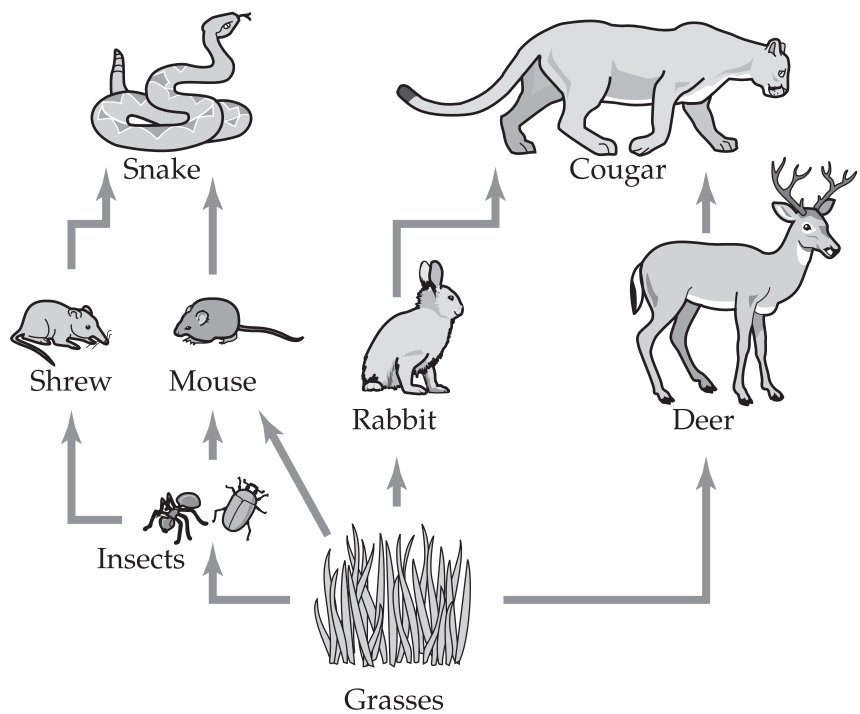
- **name the process that caused the raisins to become larger**
- **describe how this process caused the raisins to become larger**
- **explain the role of this process in living systems**

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