MEA 2017–18

Science Grade 11

The table below shows the entire eleventh grade science test design. Scores are based on common items only, 12 of which are released and can be found in this document.

Test Design

Content Area	Common		Field Test Items		Total Items per Student		Base Testing Time	Points
	MC	CR	MC	CR	MC	CR		
Science	40	4	8	1	48	5	120 min.	56

Each item on the MEA measures a content standard of Maine's 2007 *Learning Results*.

Science Content Standards Assessed on the MEA

D. The Physical Setting
1. Universe and Solar System
2. Earth
3. Matter and Energy
4. Force and Motion

E. The Living Environment
1. Biodiversity
2. Ecosystems
3. Cells
4. Heredity and Reproduction
5. Evolution

Item Information Chart

Please refer to the item information chart on the next page for in-depth information on each science released item. The released item numbers in the chart correspond to item numbers in the practice test and on the MEA Item Analysis Report.

Constructed-Response Scoring Guides

A constructed-response scoring guide includes score point descriptions used to determine the score. Training notes that follow the scoring guide provide in-depth descriptions or particular information also used to determine the score.

Student Work

At least one sample student response is provided for each score point with annotations that explain the reasoning behind the assigned score.

Grade 11 Science Released Item Information

Released Item Number	1	2	3	4	5	6	7	8	9	10	11	12
Practice Test Page Number	2	2	2	3	3	3	4	4	5	5	6	7
Content Strand (Maine 2007 *Learning Results*)	D.4.a	E.4.c	E.4.a	D.2.a	E.5.c	D.4.c	D.3.c	D.3.b	D.2.d	E.2.d	D.4.f	E.1.a
Depth of Knowledge Code	2	2	3	2	2	3	2	2	2	3	2	3
Item Type	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	CR	CR
Possible Points	1	1	1	1	1	1	1	1	1	1	4	4
Answer Key	B	C	A	D	C	B	C	D	C	C		
% Who Chose A or Earned 1 Point	12	18	49	27	11	14	15	27	10	13	24	18
% Who Chose B or Earned 2 Points	79	23	7	16	23	73	14	18	8	22	22	25
% Who Chose C or Earned 3 Points	8	43	23	23	51	8	55	24	67	41	15	23
% Who Chose D or Earned 4 Points	0	15	20	34	15	3	15	31	14	24	7	18
Statewide Average Student Score												

Content Strands: See "MDOE Regulation 132–*Learning Results: Parameters for Essential Instruction*" at http://www.maine.gov/education/lres/pei/index.html.

Item Type: MC = multiple choice, CR = constructed response

Answer Key: the letter of the correct answer choice

Constructed-Response Item 11

11. The diagram below shows a heavy box just before a student gently pushes it and makes it move down the slide.

a. Define kinetic and potential energy.

b. Explain how potential energy and kinetic energy change as the box goes from the top of the slide to the bottom of the slide.

When the box reaches the bottom of the slide, its kinetic energy is only 45 J. The predicted kinetic energy is 90 J.

c. Describe <u>one</u> reason for the difference between actual and predicted kinetic energy.

Scoring Guide for Constructed-Response Item 11

Score	Description
4	The response demonstrates a thorough understanding of the relationship between kinetic and potential energy and how to apply that understanding to solve problems. The response correctly defines potential and kinetic energy, explains how these two types of energy change as the box slides, and describes the reason for the difference between the actual and predicted kinetic energy. The response has no errors or omissions.
3	The response demonstrates a general understanding of the relationship between kinetic and potential energy and how to apply that understanding to solve problems. The response has an error/omission.
2	The response demonstrates a limited understanding of the relationship between kinetic and potential energy and how to apply that understanding to solve problems. The response has errors/omissions.
1	The response demonstrates a minimal understanding of the relationship between kinetic and potential energy and how to apply that understanding to solve problems. The response has one piece of correct information.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Training Notes for Constructed-Response Item 11

a. The potential energy of the box is the energy stored as a result of the position (height) of the box in Earth's gravitational field. The kinetic energy of the box is the energy the box has due to its motion.

b. At the top of the slide, the box has all potential energy. As the box moves down the slide, this potential energy is converted to kinetic energy.

c. Responses may include the following:

- friction between the bottom of the box and surface of the slide
- air resistance with the box
- some of the kinetic energy is converted to heat energy

a.) Potential energy is Stored energy
Kinetic energy is energy in motion.

b.) As The box goes from The Top of
The Slide To The bottom, The Potential
energy decreases while The kinetic energy
increases.

c.) Human error, The Variable of
friction may have not been
Considered when Predicting The kinetic energy.

Summary Annotation Statement:

Part a—Succinct (correct) definitions. Part b—Wording that potential energy decreases while kinetic energy increases is very good. Part c—Human error/friction both acceptable with explanation.

(a) Kinetic Energy is energy used when an object is in motion. Potential Energy is energy used before the object goes into motion.

(b) While the box is resting at the top of the slide the potential energy is high and the kinetic energy is low. As it begins to slide downward, the potential energy decreases and the kinetic energy increases.

(c) One reason for the difference between the predicted and actual kinetic energies is that, while they were calculating the predicted energy, they forgot to calculate the energy lost from friction between the slide and the box.

Summary Annotation Statement:

Part a correctly defines kinetic energy. No credit for potential energy definition. Parts b and c are correct.

A. Kinetic energy is the energy of an object that is in motion. Potential energy is the energy of an object that has not yet been acted upon, but has the potential for motion and kinetic energy.
B. At the top of the slide, the box has potential energy. As it moves down the slide, it is in motion and therefore has kinetic energy.
C. One thing that could change the kinetic energy would be the wind.

Summary Annotation Statement:

Part a—Kinetic energy explanation is fine. Potential energy explanation is common, not creditable. Part b implies that potential energy only exists at the top, and then is all kinetic energy, instead of gradual increase in kinetic energy and decrease in potential energy. Therefore, partial credit. Part c offers no explanation of wind, and receives no credit.

a) Kinetic energy is energy in motion but potential energy is not. potential energy is what the kinetic energy is supposed to be.
b) the kinetic energy & potential energy change as the box goes from the top of the slide to the bottom because if the amount of kinetic changes & if different things effect the amount of kinetic energy than it could change.
c) actual kinetic energy ~~is~~ changes based on circumstances predicted kinetic energy changes before hand but doesnt change even if some thing happens.

Summary Annotation Statement:

Part a—kinetic energy explanation is good, but potential energy explanation is not creditable. Part b—No discussion of how kinetic energy and potential energy change over time. No credit. Part c does not address potential reasons for the difference.

A. Kinetic and potetional energy is the energy that happens during stuff such as throwing a baseball

B. As the box is going down the slide its potential energy and as the box is at the end of the slide its kinetic energy.

C. The predicted kinetic energy is just a thought of how much energy there will be. Actual kinetic energy is the actual amount of kinetic energy that is happening.

Summary Annotation Statement:

The response does not demonstrate any clear understanding of kinetic and potential energy.

Constructed-Response Item 12

12. All the members of a population of adult fruit flies are equally exposed one time to a chemical that kills over 70% of the population.

    a. Explain why the entire population of fruit flies is not killed by the chemical.

    The remaining fruit flies breed and have offspring. Several generations later, the population is exposed to the same amount of the same chemical.

    b. Predict what will happen when this generation of fruit flies is exposed to the same chemical. Explain your answer.

    c. Describe what will happen if the future generation of fruit flies is exposed to a different poisonous chemical.

Scoring Guide for Constructed-Response Item 12

Score	Description
4	The student demonstrates a thorough understanding of ways that the variation in structure and behavior in a population may influence the likelihood that some members of the species will have adaptations that will allow them to survive in a changing environment. The response describes why not all of the fruit flies die, predicts the effect on future generations of fruit flies, and describes the effect of a new chemical. The response has no errors or omissions.
3	The response demonstrates a general understanding of ways that the variation in structure and behavior in a population may influence the likelihood that some members of the species will have adaptations that will allow them to survive in a changing environment. The response has one error/omission overall.
2	The response demonstrates a limited understanding of ways that the variation in structure and behavior in a population may influence the likelihood that some members of the species will have adaptations that will allow them to survive in a changing environment. The response has two errors/omissions overall.
1	The response demonstrates a minimal understanding of ways that the variation in structure and behavior in a population may influence the likelihood that some members of the species will have adaptations that will allow them to survive in a changing environment. The response has one piece of correct information.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Training Notes for Constructed-Response Item 12

a. There is a gene that gives resistance to the chemical.

b. Most of the fruit flies in the future should survive because the gene for resistance was passed on to the offspring.

c. Plausible student responses include:

- Some fruit flies will possibly die from the new chemical compared to the first chemical if the flies do not have a natural resistance to the chemical.
- The surviving flies will produce offspring with resistance to two chemicals.

Note: The word immune was accepted if it meant resistance or tolerance to the poisonous chemicals.

a) All organisms are genetically different, & thus react to different things different ways. In the case of the fruit flies, some may have had a genetic alteration that allowed them to survive while others died. This is relatively rare, which would account for the relatively small percentage of flies that survived.

b) While some of the future generation may die, the majority will most likely survive when exposed to the chemical. The genes their predecessors had that allowed them to survive the chemical will have been passed through the generations to the new batch, giving most of them the ability to survive.

c) Introducing the new generation of flies to a new chemical will start the process all over again; most will die, & those that survived due to a genetic alteration will pass that alteration to future generations.

Summary Annotation Statement:

Strong 4-point score.

Sample 3-Point Response with Annotations for Constructed-Response Item 12

a.) The entire population of fruit flies wasn't killed by the chemical because of survival of the fittest. Over 70% may have died but a little under 30% didn't because the chemical may not have been strong enough to be completely deadly.

b.) I predict that a fewer number of the population will die from the chemical this time. Since the population that survived had the superior genes to resist the chemical it will be passed down through offspring. This is basically evolution and again survival of the fittest.

c.) If the future generation of fruit flies is exposed to a different type of poisonous chemical the results will be much the same as the first generations with the first chemical. This is because some may have genes that can resist it and some may not. Those who do not will die, those who do will live to pass on the genes to their offspring.

Summary Annotation Statement:

Part a incorrectly argues that the dose [amount] of chemicals the flies were exposed to was the cause of the 70% mortality, rather than the lack of a gene that conveys resistance to the chemical. Part b correctly addresses survival in the offspring. Part c correctly addresses what will happen to future generations. Overall, general understanding.

The whole population would not be killed by the chemical because some of them would - adapt to the exposure. It would be survival of the fittest. Further down the road, when a new generation was exposed, more than 30% of them would survive, since they all would have been born of parents who also survived. If the chemical exposure were to change, then more of the new fruit flies would be dead, as opposed to if it stayed the same. The process, though, would stay the same. Some fruit flies would live on and have babies who would likely be immune to both chemicals.

Summary Annotation Statement:

Part a—No, flies will not adapt at the point of exposure; Part b—correct prediction no passing of genes; Part c—some understanding.

Sample 1-Point Response with Annotations for Constructed-Response Item 12

a) because the remaning 30% have adapted and aren't as affected by the chemical

b) the percentage of flies that die will go down due to the immuniter passed on by the parents

c) they would have to adapt and the generation after will have a higher chance of surviving

Summary Annotation Statement:

Part a—not adapting; Part b—correct understanding; no prediction in C, not enough explanation for credit.

A) The entire population of the fruit flies are not killed because, they have more then the amount that's trying to kill them

B. When the generation of fruitflies is exposed, I think they're going to survive. Because, if they didnt die the first time, I dont see why they would the second time around, just years later w/ the same chemical

C. Depending on what the chemical is, they will either survive it or die from it. If they die from it, its a stronger chemical then the other chemicals or the fruitflies are getting weaker, and they cant hold in the chemicals, and pass it on to other animals/people

Summary Annotation Statement:

Part a—implies chemical dose issue; Part b—ignores “several generations later” and implies tolerance; Part c—comparing chemical properties.