MEA 2016–17

Science Grade 11

The table below shows the entire eleventh grade science test design. Scores are based on common items only, half 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	13	14	15	16	17	18	19	20	21	22
Practice Test Page Number	2	2	2	3	3	3	4	4	4	4	4	5	5	5	5	6	6	6	7	7	8	9
Content Strand (Maine 2007 *Learning Results*)	E.5.d	D.3.b	E.5.b	D.3.d	E.3.g	D.4.c	E.1.b	D.3.c	D.3.a	E.4.d	D.2.b	D.4.e	D.3.l	D.1.b	E.4.b	D.4.f	D.2.d	D.3.h	E.1.d	D.2.a	D.1.c	E.2.b
Depth of Knowledge Code	2	2	2	2	1	2	2	2	2	2	2	3	2	1	2	2	2	2	2	3	2	3
Item Type	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	CR	CR
Possible Points	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	4
Answer Key	D	C	A	C	D	D	D	A	B	B	C	C	A	C	D	C	B	B	B	B		
% Who Chose A or Earned 1 Point	4	23	60	8	8	4	3	56	16	23	23	21	43	13	27	15	15	24	23	16	25	24
% Who Chose B or Earned 2 Points	1	8	4	20	28	8	23	3	48	33	15	12	10	10	10	25	64	40	44	44	26	34
% Who Chose C or Earned 3 Points	4	52	25	46	34	28	6	31	15	28	48	36	27	68	19	46	7	24	23	26	28	25
% Who Chose D or Earned 4 Points	91	16	11	26	30	60	68	9	21	15	13	30	20	8	42	12	12	11	9	13	12	7
Statewide Average Student Score																					1.3	1.2

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

MEA Science Grade 11 Released Items – Student Work

Constructed-Response Item 21

21. The data table below shows the ages of five of the oldest materials found in our solar system.

Ages of Five Materials in Our Solar System

Name	Location Found	Sample Type	Age (billion years)
Northwest Africa 2364	Africa	Meteorite	4.57
Norite clast B	Moon	Lunar rock	4.46
Zircon	Australia	Mineral	4.37
Acasta Gneiss	Greenland	Metamorphic rock	4.0
Genesis Rock	Moon	Lunar rock	4.0

a. Describe how evidence from the data table can be used to support the claim that our solar system formed about 4.6 billion years ago.

b. Explain why Earth's oldest rock, Acasta Gneiss, is younger than the oldest meteorite, Northwest Africa 2364.

Scoring Guide for Constructed-Response Item 21

Score	Description
4	The response demonstrates a thorough understanding of the age, origin, and process of the formation of the universe as currently understood by science. The response uses two pieces of evidence from the data table to support the claim that Earth formed at about the same time as our solar system and explains why Earth's oldest rock, Acasta Gneiss, is younger than the oldest meteorite, Northwest Africa 2364. The response has no errors or omissions.
3	The response demonstrates a general understanding of the age, origin, and process of formation of the universe as currently understood by science. The response has an error/omission.
2	The response demonstrates a limited understanding of the age, origin, and process of formation of the universe as currently understood by science. The response has errors/omissions.
1	The response demonstrates a minimal understanding of the age, origin, and process of formation of the universe as currently understood by science. The response has one correct piece of information.
0	The response is incorrect or irrelevant to the skill or concept being measured.
Blank	No response.

Training Notes for Constructed-Response Item 21

a. The ages of materials in our solar system can be used to estimate how long ago it was formed. Because the oldest sample, a meteorite, is about 4.57 billion years old, this supports the idea that our solar system must be at least as old as the oldest material.

b. Earth's rocks (such as Acasta Gneiss) are constantly changing, and new rock forms as old rock is destroyed [metamorphism]. The meteorite has not changed since it was first formed so it is older than Earth's oldest rock.

a) According to the data table, the oldest known material found in our solar system, Northwest Africa 2364, a meteorite, is about 4.57 billion years old. Because Northwest Africa 2364 is part of our solar system now, and therefore was approximately 4.57 billion years ago, it can be concluded that our solar system formed about 4.6 billion years ago.

b) Earth's oldest rock, Acasta Gneiss, is younger than the oldest meteorite, Northwest Africa 2364, because Earth's environment more than 4 billion years ago was not stable enough to support minerals in rock form. As a result of change in temperature and pressure, meteorites and minerals were able to transform into rock and make Acasta Gneiss, 4 billion years ago, and Genesis Rock, 4 billion years ago.

Summary Annotation Statement:

Each part of this answer includes a key factor with sufficient detail required to receive full credit. Part A refers to the 'oldest known material,' which is creditable. Part B states the 'Earth's environment was not stable enough,' which is creditable.

a. The information that the oldest material in our solar system, Northwest Africa 2364, supports the claim that our solar system was formed about 4.6 billion years ago. If a material is this old the solar system couldn't be any younger. It's also unlikely to be older because older materials would be found.
b. Earth's oldest rock, Acasta Gneiss is younger than the oldest meteorite, Northwest Africa 2364 because the Earth was formed after the solar system.
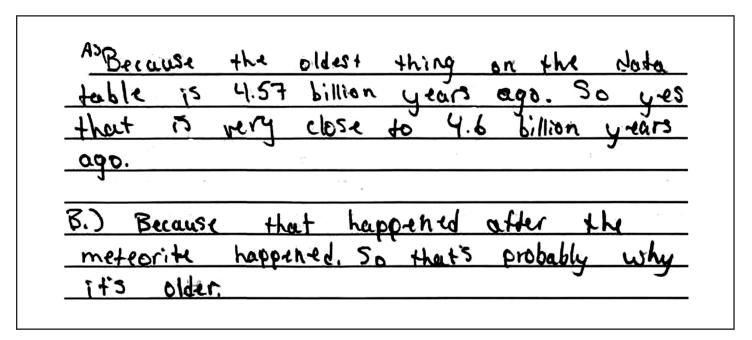
Summary Annotation Statement:

Part A is fully creditable. Response appropriately uses evidence from the table to support the claim. Part B lacks a thorough explanation of why Acasta Gneiss is younger than NW Africa 2364, missing a discussion about metamorphosis of rocks.

The evidence from the table shows that the oldest material we have discovered is about 4.6 billion years old. Although we may not have found the oldest material yet, the evidence we do have at this moment shows that our earth is at least 4.6 billion years old

B) The oldest rock is younger than the oldest meteorite because Acasta Gneiss was formed on earth, however, the meteorite was not.

Summary Annotation Statement:

This answer in Part A is insufficient; it displays a creditable discussion, but does not provide examples of the evidence required for full credit. Part B is also insufficient. The answer correctly states that the oldest rock formed on earth, Acasta Gneiss, is younger than the oldest meteorite, but it does not explain why this is significant.

A.) Because the oldest thing on the data table is 4.57 billion years ago. So yes that is very close to 4.6 billion years ago.

B.) Because that happened after the meteorite happened. So that's probably why it's older.

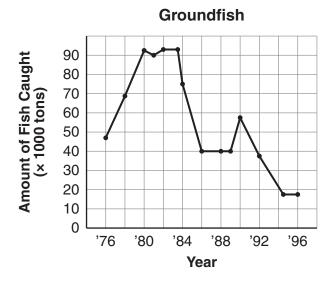**Summary Annotation Statement:**

Part A states and applies data from the table, but the explanation of this data is insufficient. Part B is not creditable, as the explanation is too vague.
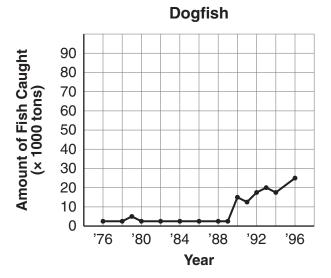
A) According to the table, northwest Africa 2364 is a 4.57 billion year-old meteorite.

B) Acasta Gneiss is 4 billion years old, according to the data table, which was found in Greenland and is a metamorphic rock. Referring to the table again, Northwest Africa 2364 was found in Africa and is a meteorite, is 4.57 billion years old. Greenland is not part of Africa, so it would make sense that Northwest Africa is older than the Earth's largest rock.

Summary Annotation Statement:

Part A is not creditable; it includes a creditable piece of evidence, but does not provide any explanation. Part B is an insufficient response, and therefore is not creditable.

22. The graphs below display the amount of groundfish and dogfish caught in New England over a 20-year period. (Assume the number of fish caught correlates with the population size of the fish species.) The groundfish and dogfish adults prey on each other's young.

Groundfish

Dogfish

a. Write a conclusion about what the populations of groundfish and dogfish will be in another 20 years if the trends in the graphs stay the same. Use evidence from both graphs to support your conclusion.

b. Identify whether these fish populations are in dynamic equilibrium for the period shown in the graphs. Explain the reasoning for your answer by relating it to the data in the graphs.

Scoring Guide for Constructed-Response Item 22

Score	Description
4	The student demonstrates a thorough understanding of dynamic equilibrium and the ability to apply that understanding to an actual situation. The response makes a conclusion about the populations in 20 years and uses evidence from the graphs to support the conclusion. The response also indicates this is not a dynamic equilibrium and explains why. The response has no errors or omissions.
3	The student demonstrates a general understanding of dynamic equilibrium and the ability to apply that understanding to an actual situation. The response has one error/omission overall.
2	The student demonstrates a limited understanding of dynamic equilibrium and the ability to apply that understanding to an actual situation. The response has two errors/omissions overall.
1	The student demonstrates a minimal understanding of dynamic equilibrium and the ability to apply that understanding to an actual situation. The response has one piece of correct information.
0	The response is incorrect or irrelevant to the skill or concept being measured.
Blank	No response.

Training Notes for Constructed-Response Item 22

Possible responses include but are not limited to:

a. By observing the data from the two graphs, it can be determined that the population of groundfish over the next 20 years will continue to decrease and the population of dogfish will continue to increase. The trend between the two graphs shows a negative correlation between the groundfish and dogfish OR reference data points/trends from both graphs.

Possible responses include but are not limited to:

b. The populations of groundfish and dogfish are not in dynamic equilibrium. As the groundfish population is reduced, the dogfish population shows a steady increase. Thus, there is no equilibrium point around which each of the populations tend to remain in size OR there is no cyclic pattern shown.

a. If the trends represented continue (namely, an increasing dogfish and decreasing groundfish population) the next twenty years will likely see a very low number of groundfish, perhaps even an extinction in the area, and a very high number of dogfish. As we see by the low number of dogfish and the high number of ground fish of the last twenty years, the two species have something of an inverse population relationship. When one thrives, one fails. The new trends seem to show that inverse relationship causing the dogfish to thrive.

b. The two species have not been in dynamic equilibrium. Dynamic equilibrium can occur with fluctuations in population size, but only if these are in a cyclical state. For example, DE would occur if dogfish had high pops in the summer, and groundfish in the winter. The graph show no cycling, merely a falling population in one, and an increasing in the other. An event likely happened in '85, when groundfish population decreased dramatically, an environmental shift that caused these trends.

Summary Annotation Statement:

This response demonstrates a thorough understanding. All parts are correct, well explained, and appropriately supported.

A. I believe that in another 20 years, the amount of Groundfish will decrease and Dogfish will increase. Looking at the Groundfish graph, It started out very high. By the time twenty years came, the number decreased by about 28,000. Since it would start out low the number most likely will keep decreasing over time. However, I think the Dogfish number will increase. When looking at the graph, it started out very low. As time went on it only increased by about 25,000. This shows within another 20 years, the number will increase.

B. I dont believe these fish populations are in dynamic equilibrium. The groundfish started off very high, stayed the same, and then decreased greatly. The Dogfish started very low and increased by a little. This shows they are not an equal population.

Summary Annotation Statement:

This response is generally correct, overall. The answer displays some misunderstanding about dynamic equilibrium, as the term is not related to having "an equal population."

ⓐ If the trends in the graphs stay the same the Dogfish population will rise while the Groundfish will slowly deplete. The reasoning for this is based on the trends. The Dogfish population looks to be heading up. The Ground fish on the other hand is going down.

ⓑ These graphs show that these fish are in a dynamic equalibrium. They are in direct correlation. The Dogfish elders have started to take control of the territory by consuming the ground fishes young.

Summary Annotation Statement:

Part A is the only complete and correct part of this answer. There is no specific data cited in the response, but the student does talk about "trends."

A. I believe that by what the chart is showing, that there will be a decrease in Groundfish and an increase in Dogfish.

B.

Summary Annotation Statement:

The response for Part A is correct, but offers no support.

a. The dogfish population tends to stay very low but both seem to increase and decrease at the same time. So where they somewhat fluctuate and decrease at a similar rate, in 20 years, the groundfish will increase as the dogfish decrease, then they will both increase, decrease, and both will flatline again. (b.) I don't know/remember what a dynamic equilibrium is, but I would say yes because for the most part they go at the same up and down, unless they go opposite.

Summary Annotation Statement:

This answer is too vague, unfocused, and contradictory to receive any credit.