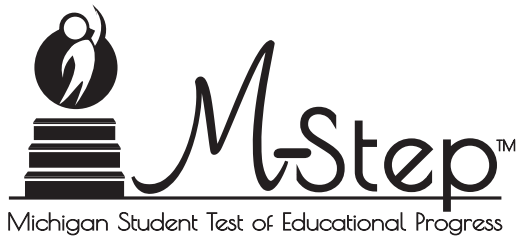


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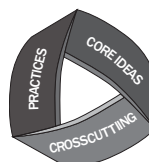
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# Grade 11 Science

# Sample Items



**MICHIGAN STATE BOARD OF EDUCATION  
STATEMENT OF ASSURANCE OF COMPLIANCE WITH FEDERAL LAW**

The Michigan State Board of Education complies with all Federal laws and regulations prohibiting discrimination and with all requirements and regulations of the U.S. Department of Education. It is the policy of the Michigan State Board of Education that no person on the basis of race, color, religion, national origin or ancestry, age, sex, marital status, or handicap shall be discriminated against, excluded from participation in, denied the benefits of, or otherwise be subjected to discrimination in any program or activity for which it is responsible or for which it receives financial assistance from the U.S. Department of Education.

The sample items included in this set can be used by students and teachers to become familiar with the kinds of items students will encounter on the paper/pencil summative assessments. The sample items demonstrate the rigor of Michigan’s academic content standards. They are not to be interpreted as indicative of the focus of the M-STEP assessments; they are simply a collection of item samples. Every standard is not included in this sample set.

**DIRECTIONS:**

You will be taking the Science M-STEP. This test includes passages and pictures that you will read and use to answer different types of questions. Some of the items give the student a model with the answer options provided in the answer document. For this reason, an answer document has been provided for practice.

Carefully read each passage and look at each picture before answering the questions that follow. Mark your answers in your Answer Document.

A Periodic Table of the Elements has been provided for your reference on the next page.

# Periodic Table of the Elements

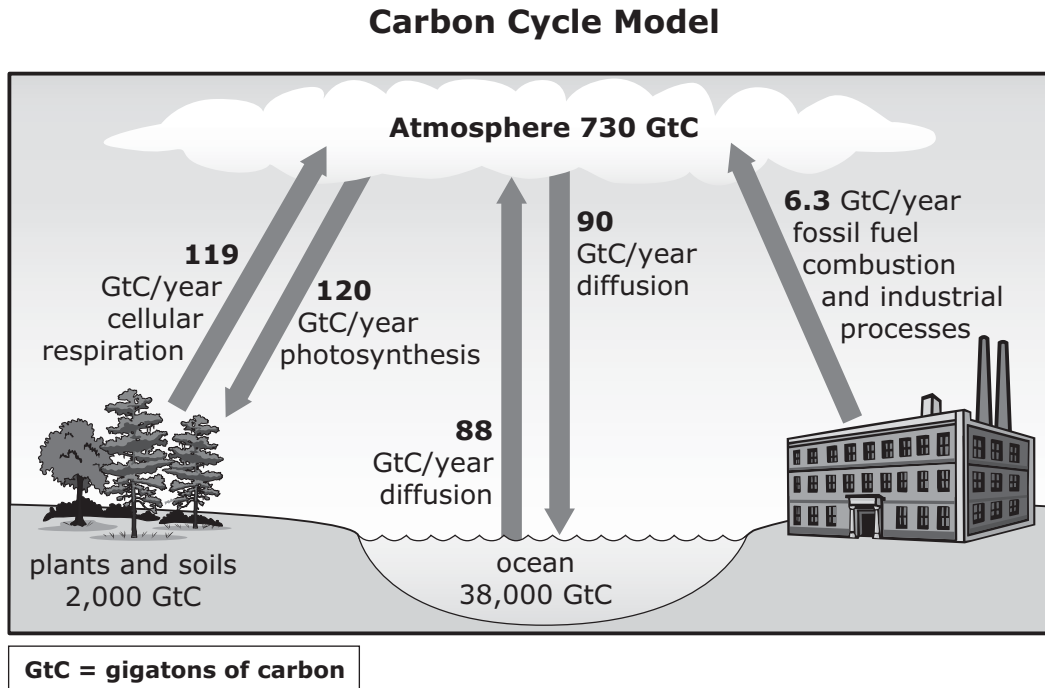
		KEY																																																	
		79 <b>Au</b> Gold 196.97		Atomic Number		Symbol		Atomic Name		Average atomic mass																																									
1	1 <b>H</b> Hydrogen 1.01	2	2 <b>He</b> Helium 4.00	3	3 <b>Li</b> Lithium 6.94	4	4 <b>Be</b> Beryllium 9.01	5	5 <b>B</b> Boron 10.81	6	6 <b>C</b> Carbon 12.01	7	7 <b>N</b> Nitrogen 14.01	8	8 <b>O</b> Oxygen 16.00	9	9 <b>F</b> Fluorine 19.00	10	10 <b>Ne</b> Neon 20.18																																
2	11 <b>Na</b> Sodium 22.99	12	12 <b>Mg</b> Magnesium 24.31	13	13 <b>Al</b> Aluminum 26.98	14	14 <b>Si</b> Silicon 28.09	15	15 <b>P</b> Phosphorus 30.97	16	16 <b>S</b> Sulfur 32.07	17	17 <b>Cl</b> Chlorine 35.45	18	18 <b>Ar</b> Argon 39.95	19	19 <b>K</b> Potassium 39.10	20	20 <b>Ca</b> Calcium 40.08	21	21 <b>Sc</b> Scandium 44.96	22	22 <b>Ti</b> Titanium 47.87	23	23 <b>V</b> Vanadium 50.94	24	24 <b>Cr</b> Chromium 52.00	25	25 <b>Mn</b> Manganese 54.94	26	26 <b>Fe</b> Iron 55.85	27	27 <b>Co</b> Cobalt 58.93	28	28 <b>Ni</b> Nickel 58.69	29	29 <b>Cu</b> Copper 63.55	30	30 <b>Zn</b> Zinc 65.41	31	31 <b>Ga</b> Gallium 69.72	32	32 <b>Ge</b> Germanium 72.64	33	33 <b>As</b> Arsenic 74.92	34	34 <b>Se</b> Selenium 78.96	35	35 <b>Br</b> Bromine 79.90	36	36 <b>Kr</b> Krypton 83.80
3	37 <b>Rb</b> Rubidium 85.47	38	38 <b>Sr</b> Strontium 87.62	39	39 <b>Y</b> Yttrium 88.91	40	40 <b>Zr</b> Zirconium 91.22	41	41 <b>Nb</b> Niobium 92.91	42	42 <b>Mo</b> Molybdenum 95.94	43	43 <b>Tc</b> Technetium (98)	44	44 <b>Ru</b> Ruthenium 101.07	45	45 <b>Rh</b> Rhodium 102.91	46	46 <b>Pd</b> Palladium 106.42	47	47 <b>Ag</b> Silver 107.87	48	48 <b>Cd</b> Cadmium 112.41	49	49 <b>In</b> Indium 114.82	50	50 <b>Sn</b> Tin 118.71	51	51 <b>Sb</b> Antimony 121.76	52	52 <b>Te</b> Tellurium 127.60	53	53 <b>I</b> Iodine 126.90	54	54 <b>Xe</b> Xenon 131.29																
4	55 <b>Cs</b> Cesium 132.91	56	56 <b>Ba</b> Barium 137.33	57	57 <b>La</b> Lanthanum 138.91	58	58 <b>Ce</b> Cerium 140.12	59	59 <b>Pr</b> Praseodymium 140.91	60	60 <b>Nd</b> Neodymium 144.24	61	61 <b>Pm</b> Promethium (145)	62	62 <b>Sm</b> Samarium 150.36	63	63 <b>Eu</b> Europium 151.96	64	64 <b>Gd</b> Gadolinium 157.25	65	65 <b>Tb</b> Terbium 158.93	66	66 <b>Dy</b> Dysprosium 162.50	67	67 <b>Ho</b> Holmium 164.93	68	68 <b>Er</b> Erbium 167.26	69	69 <b>Tm</b> Thulium 168.93	70	70 <b>Yb</b> Ytterbium 173.04	71	71 <b>Lu</b> Lutetium 174.97																		
5	87 <b>Fr</b> Francium (223)	88	88 <b>Ra</b> Radium (226)	89	89 <b>Ac</b> Actinium (227)	90	90 <b>Th</b> Thorium 232.04	91	91 <b>Pa</b> Protactinium 231.04	92	92 <b>U</b> Uranium 238.03	93	93 <b>Np</b> Neptunium (237)	94	94 <b>Pu</b> Plutonium (244)	95	95 <b>Am</b> Americium (243)	96	96 <b>Cm</b> Curium (247)	97	97 <b>Bk</b> Berkelium (247)	98	98 <b>Cf</b> Californium (251)	99	99 <b>Es</b> Einsteinium (252)	100	100 <b>Fm</b> Fermium (257)	101	101 <b>Md</b> Mendelevium (258)	102	102 <b>No</b> Nobelium (259)	103	103 <b>Lr</b> Lawrencium (262)																		
6	83 <b>Bi</b> Bismuth 208.98	84	84 <b>Po</b> Polonium (209)	85	85 <b>At</b> Astatine (210)	86	86 <b>Rn</b> Radon (222)	87	87 <b>Fr</b> Francium (223)	88	88 <b>Ra</b> Radium (226)	89	89 <b>Ac</b> Actinium (227)	90	90 <b>Th</b> Thorium 232.04	91	91 <b>Pa</b> Protactinium 231.04	92	92 <b>U</b> Uranium 238.03	93	93 <b>Np</b> Neptunium (237)	94	94 <b>Pu</b> Plutonium (244)	95	95 <b>Am</b> Americium (243)	96	96 <b>Cm</b> Curium (247)	97	97 <b>Bk</b> Berkelium (247)	98	98 <b>Cf</b> Californium (251)	99	99 <b>Es</b> Einsteinium (252)	100	100 <b>Fm</b> Fermium (257)	101	101 <b>Md</b> Mendelevium (258)	102	102 <b>No</b> Nobelium (259)	103	103 <b>Lr</b> Lawrencium (262)										
7	81 <b>Tl</b> Thallium 204.38	82	82 <b>Pb</b> Lead 207.2	83	83 <b>Bi</b> Bismuth 208.98	84	84 <b>Po</b> Polonium (209)	85	85 <b>At</b> Astatine (210)	86	86 <b>Rn</b> Radon (222)	87	87 <b>Fr</b> Francium (223)	88	88 <b>Ra</b> Radium (226)	89	89 <b>Ac</b> Actinium (227)	90	90 <b>Th</b> Thorium 232.04	91	91 <b>Pa</b> Protactinium 231.04	92	92 <b>U</b> Uranium 238.03	93	93 <b>Np</b> Neptunium (237)	94	94 <b>Pu</b> Plutonium (244)	95	95 <b>Am</b> Americium (243)	96	96 <b>Cm</b> Curium (247)	97	97 <b>Bk</b> Berkelium (247)	98	98 <b>Cf</b> Californium (251)	99	99 <b>Es</b> Einsteinium (252)	100	100 <b>Fm</b> Fermium (257)	101	101 <b>Md</b> Mendelevium (258)	102	102 <b>No</b> Nobelium (259)	103	103 <b>Lr</b> Lawrencium (262)						

Numbers within parentheses refer to the atomic mass of the most stable isotope.

Read the passage, look at the pictures, and answer the questions.

### Atmospheric Changes over Time

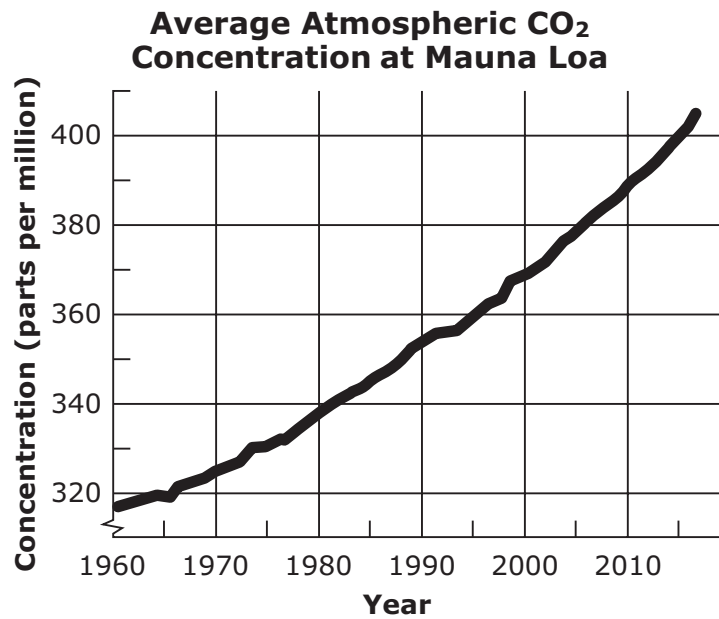
The gases that make up Earth's atmosphere have changed over time. Scientists measure the levels of carbon dioxide (CO<sub>2</sub>) in Earth's atmosphere. The simplified Carbon Cycle Model shows locations where carbon is stored and processes that move carbon from one location to another.



- 1** Scientists can use carbon cycle models to help make predictions about the amounts of carbon in different locations. Use this Carbon Cycle Model to identify **all** the processes that would decrease CO<sub>2</sub> in the atmosphere if the rates of these processes were to increase.
- A** photosynthesis
  - B** cellular respiration
  - C** fossil fuel combustion
  - D** diffusion into the ocean
  - E** diffusion into the atmosphere

- 2 This question has **two** parts.

The graph shows data about atmospheric CO<sub>2</sub> concentrations collected in Mauna Loa, Hawaii, since 1960.



Use the data and the Carbon Cycle Model to explain the pattern of atmospheric CO<sub>2</sub> concentrations over time.

**Part A**

The data show that atmospheric CO<sub>2</sub> concentrations have \_\_\_\_\_ over time.

- A increased
- B decreased
- C stayed the same

**Part B**

This pattern is most likely due to the process of \_\_\_\_\_ .

- A photosynthesis
- B cellular respiration
- C fossil fuel combustion
- D diffusion into the ocean
- E diffusion into the atmosphere

**3** This question has **two** parts.

Scientists think that Earth's early atmosphere was different from Earth's current atmosphere due to a large amount of volcanic activity. Scientists analyze oxygen ( $O_2$ ), carbon dioxide ( $CO_2$ ), and water ( $H_2O$ ) from recent volcanic activity to make inferences about the presence of these gases in Earth's early atmosphere.

### Data from Scientific Analysis

Gases	Recent Volcanic Activity used to estimate Earth's early atmosphere	Current Atmosphere
$O_2$	0.0%	21.0%
$CO_2$	2.0%	Trace amounts
$H_2O$	96.0%	Trace amounts
Other gases	2.0%	79.0%

Scientists estimate that the first land plants developed on Earth about 450 million years ago and changed Earth's atmosphere drastically.

Complete the statements below to describe the role of plants in changing Earth's atmosphere.

#### Part A

The amount of \_\_\_\_\_ in the atmosphere \_\_\_\_\_ over time.

- |                         |                    |
|-------------------------|--------------------|
| <b>A</b> water          | <b>D</b> increased |
| <b>B</b> oxygen         | <b>E</b> decreased |
| <b>C</b> carbon dioxide |                    |

#### Part B

This is because of the process of \_\_\_\_\_ .

- A** photosynthesis  
**B** cellular respiration

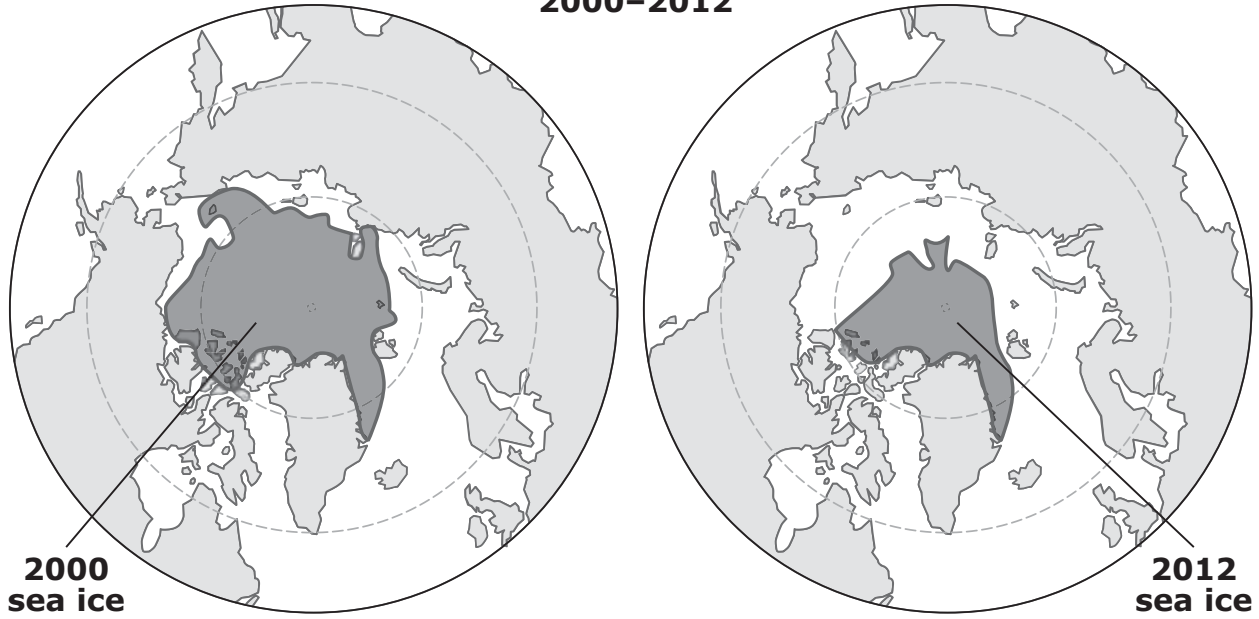


Read the passage, look at the pictures, and answer the questions.

### Atmospheric Changes over Time (continued)

Students study how changes in Earth’s atmosphere affect Arctic sea ice.

**Changes in Arctic Sea Ice Boundaries  
2000–2012**



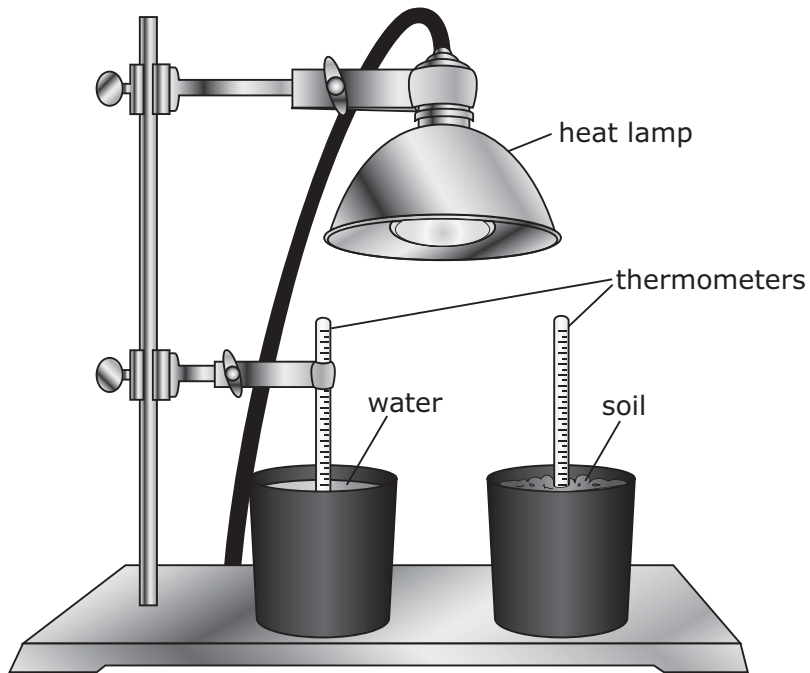
The students notice that the maps show liquid water and land in addition to sea ice. They perform an investigation to determine if solar radiation affects water and land differently.

### Investigation Materials

- water to model the ocean
- soil to model the land
- heat lamp to model the Sun
- equal volumes of water and soil

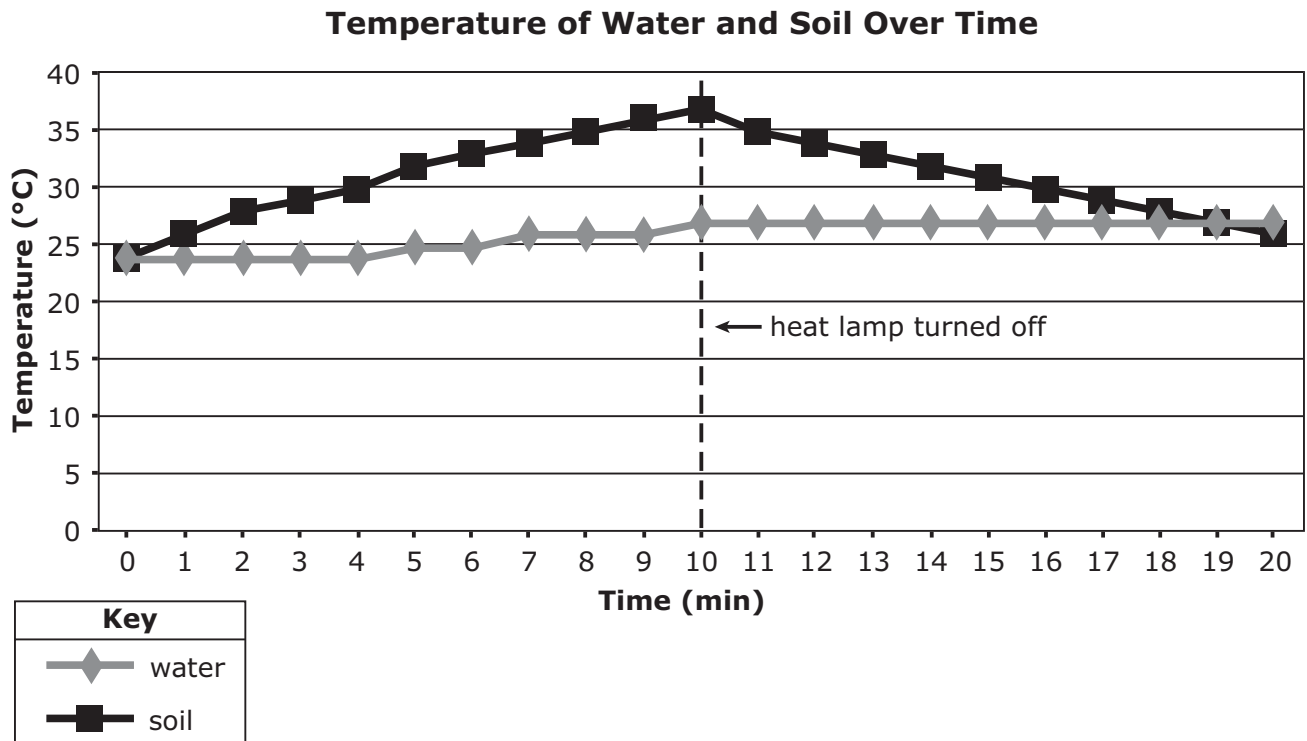
The heat lamp was turned on for 10 minutes and then turned off.

### Investigation Setup



- 4 This question has **three** parts.

The graph shows the data collected during the investigation.



**Part A**

Based on the graph, which statement **best** explains the difference in the temperature pattern between the substances?

- A Water absorbs and stores more energy than soil.
- B Soil absorbs and stores more energy than water.
- C The same amount of energy changes the temperature of soil less than it changes the temperature of water.
- D The same amount of energy changes the temperature of soil more than it changes the temperature of water.

Complete the statements that **best** uses evidence from the investigation to support the explanation chosen in Part A.

**Part B**

The water had \_\_\_\_\_ increase in temperature when the heat lamp was on.

- A** a large
- B** a small
- C** no

**Part C**

The water had \_\_\_\_\_ decrease in temperature when the heat lamp was turned off.

- A** a large
- B** a small
- C** no

- 5 This question has **two** parts.

The students decided to modify the original investigation to answer a new question.

**New Question:** Does reflection of solar radiation have a role in the changing amount of sea ice?

**Part A**

Choose **one** modification that would **best** help to answer the new question.

- A** Move the heat lamp farther away from the cup of water and the cup of soil.
- B** Place a thin sheet of metal on top of a second cup of water, and put it under the heat lamp for ten minutes. Then compare the water temperature of the two cups.
- C** Place a sheet of dark colored paper on top of a second cup of water, and put it under the heat lamp for ten minutes. Then, compare the water temperature of the two cups.

**Part B**

Choose **one** reasoning that supports the modification.

- A** Covering the cup of water represents snow and would reflect light from the heat lamp.
- B** The position of the heat lamp would affect how much energy reaches substances in the cups before the energy is reflected by each of the substances.
- C** The material used to cover the cup would absorb energy that would be reflected by the substance in the other cup.
- D** The heat lamp represents the energy from the Sun during winter when there is less solar radiation being absorbed and reflected by surfaces on Earth.

6 This question has **four** parts.

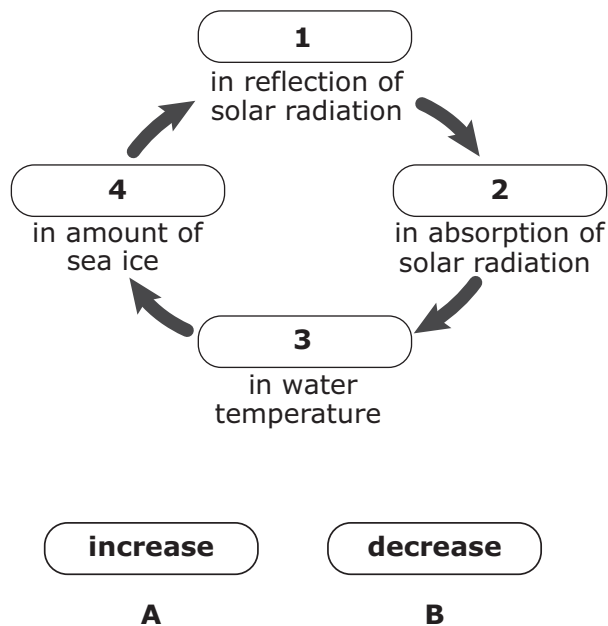
Read the excerpt below.

In 2007, the U.S. Geological Survey estimated that the global polar bear population will shrink to a third of its current size by 2050, due to loss of habitat and less access to prey. "Polar bears are declining because they use sea ice as hunting platforms to catch their primary prey, seals. But when that ice is there, it's really jumbled up due to freezing and refreezing events. The seals may be there, but the polar bears can't get to them. The observed loss of sea ice in the Arctic has been greater than earlier climate models. We're losing ice faster than forecasted."

—Jeff Bromaghin, U.S. Geological Survey statistician

**Part A**

Based on the excerpt and your knowledge of atmospheric changes, complete the model by choosing the correct label to show the relationship between solar radiation absorption and the available amount of sea ice that affects the polar bears' access to prey in the Arctic.



You may use this model as a workspace. Be sure to mark your answers in your answer document.

Use the model in Part A to explain how atmospheric changes are affecting polar bears' access to prey in the Arctic.

**Part B**

The model shows a cycle of \_\_\_\_\_ sea ice due to \_\_\_\_\_ in the atmosphere.

- |                     |                                    |
|---------------------|------------------------------------|
| <b>A</b> increasing | <b>C</b> increased O <sub>2</sub>  |
| <b>B</b> decreasing | <b>D</b> increased CO <sub>2</sub> |
|                     | <b>E</b> decreased O <sub>2</sub>  |
|                     | <b>F</b> decreased CO <sub>2</sub> |

**Part C**

The \_\_\_\_\_ in sea ice prevents \_\_\_\_\_ from accessing their prey

- |                   |                      |
|-------------------|----------------------|
| <b>A</b> increase | <b>C</b> seals       |
| <b>B</b> decrease | <b>D</b> polar bears |

**Part D**

Therefore, the \_\_\_\_\_ will die off.

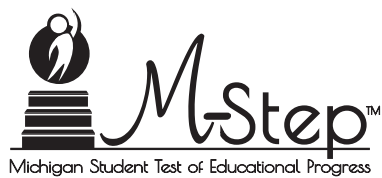
- A** seals
- B** polar bears







## Grade 11 Science Sample Items



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