

# MHSA 2007–2008

## Science and Technology

The table below shows the entire MHSA science and technology 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			EMBEDDED FIELD TEST			TOTAL ITEMS PER STUDENT			TESTING TIME	POINTS
	MC	CR	SA	MC	CR	SA	MC	CR	SA		
SCIENCE AND TECHNOLOGY	40	4	0	8	1	0	48	5	0	120 MIN.	56

Each item on the MHSA measures a grade span expectation based on Maine’s 1997 *Learning Results*. Score points for items are accumulated and reported in clusters. Each content standard is included in a cluster as indicated below.

#### Science and Technology Clusters

##### 1. Life Sciences

- Classifying Life Forms (A)
- Ecology (B)
- Cells (C)

##### 2. Physical Sciences

- Structure of Matter (E)
- Energy (H)
- Motion (I)

##### 3. Earth and Space Sciences

- Continuity and Change (D)
- The Earth (F)
- The Universe (G)

##### 4. Nature and Implications of Science

- Inquiry and Problem Solving (J)
- Scientific Reasoning (K)
- Communication (L)
- Implications of Science and Technology (M)

### Item Information Chart

Please refer to the item information chart on the next page for in-depth information on each science and technology released item. The released item numbers in the chart correspond to item numbers in the practice test and on the MHSA Class 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. At least one sample student response is provided for each score point with annotations that explain the reasoning behind the assigned score.

### Student Work

Student work samples to supplement these scoring guides are found in the file labeled “Student Work.”

# MHSA Science and Technology 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	3	4	4	4	5	5	5	5	6	6	6	6	7	7	8	9
Learning Results	C5	E3	H5	M4	F1	I4	G2	K5	B1	J3	A2	M4	J4	K1	D1	F1	D7	G1	K1	D2	C2	H7
Cluster	1	2	2	4	3	2	3	4	1	4	1	4	4	4	3	3	3	3	4	3	1	2
Item Type	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	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
Key	C	D	A	B	B	D	D	A	B	C	B	C	B	B	A	C	A	B	D	B		
% Who Chose A or Earned 1 Point	16	8	60	5	22	19	8	67	6	17	6	6	7	6	47	6	57	14	1	8	52	14
% Who Chose B or Earned 2 Points	13	8	3	77	46	5	3	13	72	30	67	25	82	74	3	6	8	33	9	67	13	15
% Who Chose C or Earned 3 Points	34	22	27	4	9	6	13	10	13	42	14	53	4	17	3	64	15	29	11	19	4	10
% Who Chose D or Earned 4 Points	26	57	8	12	21	68	73	6	5	8	11	11	6	2	45	21	14	16	79	2	1	27
Statewide Average Student Score																					0.95	1.83

**Learning Results:** See “State of Maine 1997 Learning Results” document available at the Maine Department of Education’s Web site at <http://www.maine.gov/education/lres/lres.htm>.

**Cluster:** A group of content standards. (See previous page for the groups.)

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

**Answer Key:** the letter of the correct answer choice

## Constructed-Response Item 21

21. Describe how DNA and RNA produce the physical characteristics found in organisms. Your answer should describe
- the role of DNA,
  - the sequence of processes involved (including the role of RNA), and
  - how the processes produce the observed physical characteristics.

### Scoring Guide for Constructed-Response Item 21

Score	Description
4	Student demonstrates thorough understanding of how cells transmit information through DNA and RNA. Response completely describes the roles of DNA and RNA in producing the physical characteristics observed in organisms. Response contains no errors.
3	Student demonstrates broad understanding of how cells transmit information through DNA and RNA. Response generally describes the roles of DNA and RNA in producing the physical characteristics observed in organisms. Response contains an error or an omission.
2	Student demonstrates limited understanding of how cells transmit information through DNA and RNA. Response partially describes the roles of DNA and/or RNA in producing the physical characteristics observed in organisms. Response contains errors and/or omissions.
1	Student demonstrates little understanding of how cells transmit information through DNA and RNA. Response minimally describes the role of DNA OR RNA.
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 21

Although this item will likely be scored holistically, there are four major links in the sequence:

1. DNA in the nucleus contains genes, the codes for the physical traits.
2. The coding in the DNA is transferred to RNA.
3. The RNA molecules move from the nucleus to the cytoplasm to construct protein molecules.
4. Proteins make up the structure of the observed physical characteristics or catalyze the chemical reactions (enzymes) that result in the observed physical characteristics.

**Note:**

A 4-point answer does not need to include specific details such as:

- codes occur in triplets
- A (adenine) combines with T (thymine) and C (cytosine) combines with G (guanine)
- there are three kinds of RNA

## Constructed-Response Item 22

22. Use the information below to answer this question.

<p><b>Formulas</b></p> <p>voltage = current × resistance</p> <p>power = voltage × current</p> <p><b>Units of Measure</b></p> <p>current: ampere</p> <p>resistance: ohm</p> <p>power: watt</p> <p>voltage: volt</p>
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Wires connect a lightbulb to the terminals of a 12-volt battery. The total resistance of the circuit is 4 ohms.

- a. Calculate the amount of current flowing through the circuit. Show your work.
- b. Calculate the circuit's power. Show your work.
- c. If the total resistance of the circuit were greater than 4 ohms, what would happen to the power? Explain your reasoning.

### Scoring Guide for Constructed-Response Item 22

Score	Description
4	Student demonstrates thorough ability to use mathematics to describe and predict electrical activity. Response correctly answers all four parts of the item (a, b, and both parts of c)—how much current flows in the circuit, the power of the circuit, how the power would be affected by a greater resistance, and why the power would be affected in that way.
3	Student demonstrates general ability to use mathematics to describe and predict electrical activity. Response correctly answers at least three parts of the item. Response contains an error or omission.
2	Student demonstrates limited ability to use mathematics to describe and predict electrical activity. Response correctly answers at least two parts of the item. Response contains errors or omissions.
1	Student demonstrates little ability to use mathematics to describe and predict electrical activity. Response minimally answers one part of the item.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
<b>Blank</b>	No response.

## Training Notes for Constructed-Response Item 22

a. Worth up to 1 point: current = voltage/resistance = 12 volts/4 ohms = 3 amperes

**Note:** No units or incorrect units receive only  $\frac{1}{2}$  point.

b. Worth up to 1 point: power = voltage  $\times$  current = 12 volts  $\times$  3 amperes = 36 watts

**Note 1:** Students should receive full credit for part b if they use the correct formula but an erroneous current based on an incorrect calculation in part a.

**Note 2:** No units or incorrect units receive only  $\frac{1}{2}$  point.

c. Worth up to 2 points: The power would decrease. It would decrease because the greater resistance means less current flows through the circuit.

**Note:** The unit is part of the answer,  $-\frac{1}{2}$  point for parts a and b if the unit is missing. Convert half points back to the original whole number rubric as shown below.

4 = 4 points

3 = 3 or  $3\frac{1}{2}$  points

2 = 2 or  $2\frac{1}{2}$  points

1 =  $\frac{1}{2}$ , 1, or  $1\frac{1}{2}$  points