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Michigan Educational Assessment Program

**High School
Science
Assessment**

SPRING 2005

Released Items

**MICHIGAN STATE BOARD OF EDUCATION
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DIRECTIONS

In this test you will demonstrate your understanding of science. You will have at least 90 minutes to complete the test.

This test includes both multiple-choice and constructed-response questions. For the multiple-choice questions, use only a number 2 pencil to mark your answers. Make a dark mark that completely fills the corresponding circle in your **Answer Folder**. If you are not sure of the answer to a multiple-choice question, mark your *best* choice and go on to the next question. If you change an answer, be sure to erase the first mark completely. Remember to mark only one answer for each question.

Mixed in with the multiple-choice items are constructed-response questions. Read each question carefully. Each question requires you to write words, sentences, or paragraphs that completely answer the question. Make sure you at least attempt to answer each constructed-response question. If you feel you cannot write a complete answer for a question, write as much of an answer as you can. You can earn partial credit for a correct but incomplete answer to a constructed-response question.

Write your answer for a constructed-response question only on the lines or in the space provided for that question in the **Answer Folder**. Anything written outside of the space provided will not be scored. You are not allowed to continue an answer for a constructed-response question using any additional paper.

You do not necessarily have to use all the space provided to write a response that completely answers the question.

Nothing written in the test booklet to answer a constructed-response question will be scored.

A periodic table of the elements has been provided for your reference inside the back cover of this test booklet.

If you do not understand any of these directions, please raise your hand.

- 4 Which of the following explains the high value of recycling aluminum?
- A It will quickly turn to copper if not recycled.
 - B It has an unstable nucleus, so it decomposes very easily.
 - C It is very reactive, so it is rarely found in a pure form in nature.
 - D It is not very reactive, so it is often found in a pure form in nature.

Use the following information to answer items 5 through 8.

The five Great Lakes make up 95% of the United States' fresh water supply. Chemicals, pesticides, and herbicides from the agriculture industry and toxic wastes from factories have polluted the Lakes. Higher temperatures and reduced precipitation have contributed to lower water levels, leading to costly efforts to dig out harbors and to open shipping lanes.

A hard freeze that affected Lakes Superior, Huron, and Erie during the winter of 2003 forced ships carrying industrial products to delay shipments or risk being trapped in the 2-foot-thick ice.

- 5 A scientist who believes that the dropping water levels in the Great Lakes are the result of global warming would be *most likely* to study ways to reduce
- A oil spills.
 - B acid rain.
 - C fossil fuel use.
 - D recycling of paper.
- 6 A student receives an assignment to research and write a report on a nonrenewable resource of the Great Lakes region. Which of the following resources would be an appropriate choice?
- A fish
 - B iron
 - C trees
 - D wind
- 7 Which process originally contributed *most* to the amount of water contained in the Great Lakes?
- A runoff from tributaries
 - B glacial melting
 - C plate tectonics
 - D rainfall

Use the following information to answer items 27 through 29.

The beaching of some 14 Cuvier's beaked whales in the Bahamas in March 2000 brought to critical mass a long-seething controversy. At least eight of the whales died, and the cause of death for many was cranial hemorrhaging, probably from exposure to intense sound waves. After investigating, the U.S. Navy took responsibility.

The incident couldn't have come at a worse time for the Navy, which is struggling to gain public acceptance of its new low-frequency active (LFA) sonar. For decades, the Navy has relied mainly on passive sonar, or simply listening with hydrophones, which could detect sound generated by a ship's boiler or even by pots and pans from the galley.

But by the 1980s the Soviet Union had built up a fleet of superquiet nuclear-powered submarines for which passive sonar proved inadequate. Midfrequency active sonar—the classic “pinging” of World War II submarine movies—wasn't an option, either, because it required targets to be close to the source: midfrequency sounds (between one and 10 kilohertz) attenuate quickly in water. But low-frequency sound (below about one kilohertz) travels more efficiently, enabling the LFA sonar, according to a Navy official, to detect targets “an order of magnitude”—at least 10 times—farther away.

The current version of LFA sonar consists of sound projectors placed 300 to 500 feet deep. Lasting from six to 100 seconds and interspersed with somewhat longer periods of silence, the tones are emitted in the 100- to 500-hertz band. The Navy wants to deploy LFA sonar arrays in both the Atlantic and Pacific oceans. No one doubts that marine mammals will hear the system; sonar arrays can generate sound-pressure levels of up to 230 decibels in water near the source. The argument is over the severity of the animals' response, if any. Some environmentalists claim that LFA sonar will interfere with whales that use the same frequency bands.

Whale biologist Kenneth C. Balcomb of the Center for Whale Research in Friday Harbor, Wash., who tried to rescue a few of the Bahamian whales, says that the pressure of the low-frequency waves will cause the organs of certain animals to resonate. Commenting on the Navy's environmental impact statement, Balcomb noted that there are several examples of “hemorrhagic injuries and death occurring in humans when they are inadvertently exposed to loud sound.”

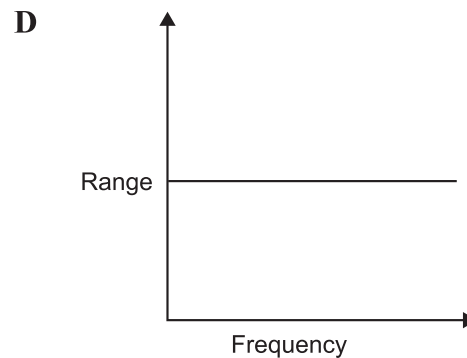
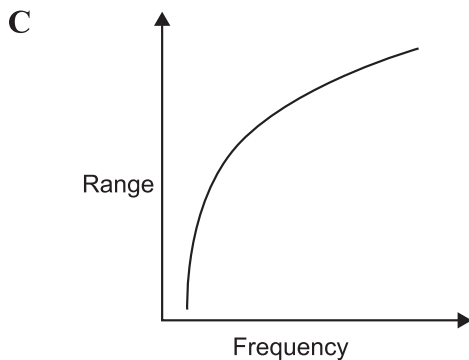
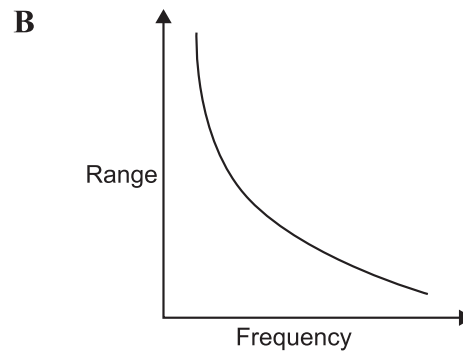
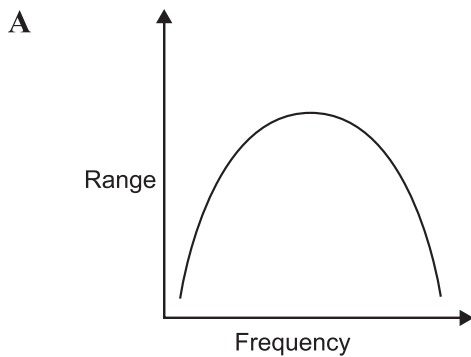
As for the beached beaked whales, their deaths may be more of an isolated incident than a portent of things to come. Harvard University biologist Darlen Ketten, who has studied the Bahamian incident, concludes that the animals appear to have been caught in a sound duct created by “physical parameters that were seasonal.” Moreover, the whales were swimming in a canyon, which helped to create “an unusually intense sound field” during the Naval exercises, Ketten says. “To say that a different sonar is going to impact other animals in the same way is going way off on a limb. Sonars have been around for decades.”

From SOUND JUDGMENTS by Wendy Williams. *Scientific American*, October 2001, p. 18.

27 In paragraph 4, LFA sonar is described as having a *minimum*

- A wavelength of 500 cm.
- B wavelength of 100 cm.
- C number of 500 pulses per second.
- D number of 100 pulses per second.

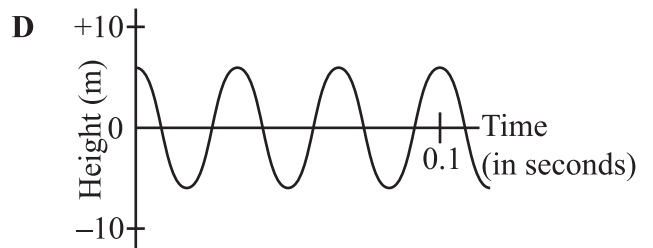
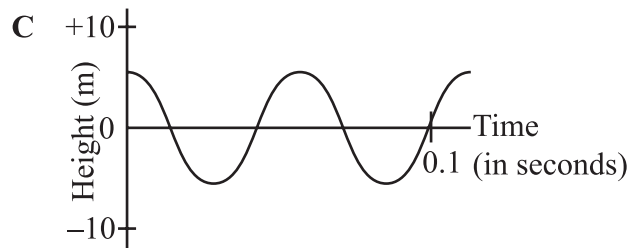
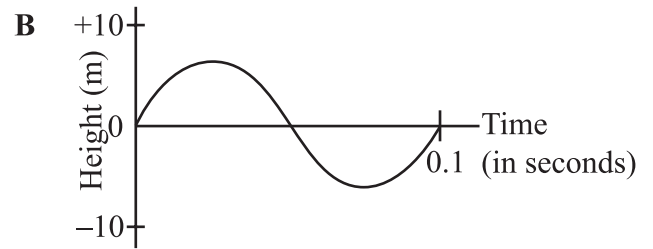
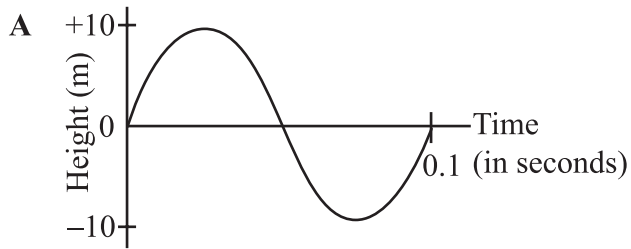
28 Which of the following graphs *best* illustrates the relationship between frequency and the effective range of the sound wave described in paragraph 3?



29 Which of the following correctly describes how energy from sound projectors reaches whales?

- A Kinetic energy produced in the speakers travels as mechanical waves to the whales.
- B Kinetic energy is transformed by the speakers into potential energy, which becomes kinetic in the whales.
- C The energy transfers by radiation until it touches the whales and conducts into their tissues.
- D Excess kinetic energy produced by sound in the water is transformed into chemical energy in whale tissues.

33 Which graph shows the wave with the *greatest* amplitude?

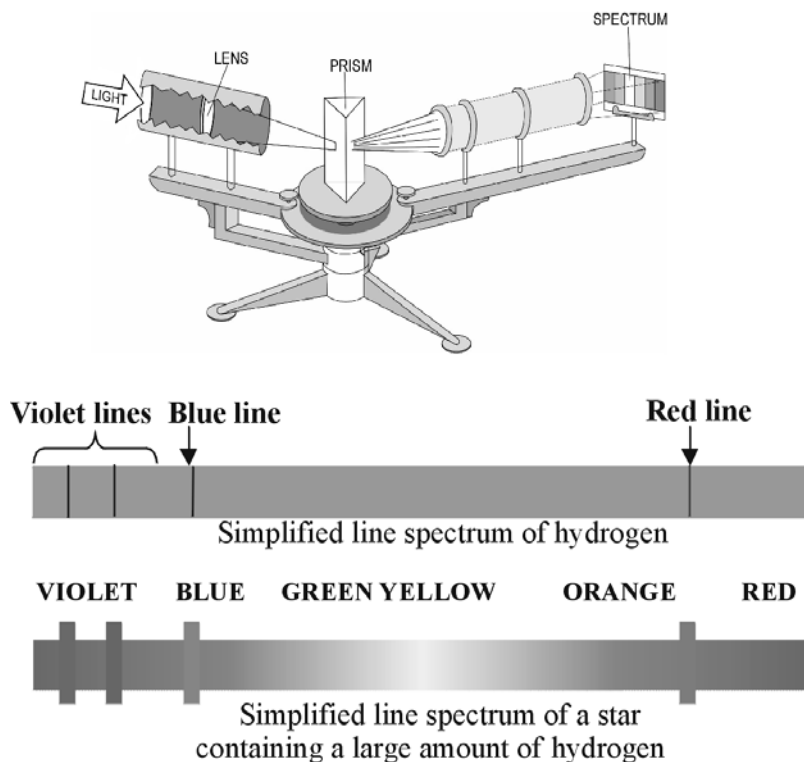


34 Genes are located on the

- A cell membrane.
- B cell wall.
- C chromosome.
- D lipids.

Use the following information to answer items 35 through 38.

SPECTROSCOPE



Spectroscopes convert light into spectra. Astronomers know that a particular element, such as hydrogen, emits specific colors when burned. When light from burning hydrogen passes through a spectroscope, these colors appear as colored lines on the spectrum. This is known as a line spectrum, and each element has its own particular line spectrum. Stars also produce line spectra with bright lines similar to those produced by specific elements. This is how astronomers know what stars are made of. As stars move away from Earth, these lines shift toward the color red. When stars move toward Earth, they shift toward blue-violet.

- 35 When light from a star produces a line spectrum similar to that produced by a particular element, what should we conclude about that element?
- A The element is present in the star.
 - B The element is not present in the star.
 - C The element reflects those same lines on the spectrum.
 - D The element transmits those same lines on the spectrum.

- 36 If the bright lines on the line spectrum of a star closely resemble the line spectrum produced by helium, what can we conclude about that star?
- A The star is an extremely young star.
 - B The star has never undergone fusion.
 - C The star has undergone fusion for millions of years.
 - D The star has not yet converted helium into hydrogen.
- 37 A particular star's line spectrum shifts in one direction, then in the other. If the star has **NOT** changed its direction, which of the following can explain this phenomenon?
- A fusion
 - B Earth's revolution
 - C the "big bang" theory
 - D the star's coalescence

ANSWER THE FOLLOWING CONSTRUCTED-RESPONSE ITEM IN YOUR ANSWER FOLDER.

- 38 **Constructed-Response**
(3 points)
- Suppose an astronomer locates a star 2 million light years away from Earth whose line spectrum is almost identical to that of our sun.
- Identify a way in which this star and our sun are similar.
 - How long did it take the light from this star to reach the astronomer's spectroscope?
 - According to this information, how might this star and our sun **NOT** be similar?

NOTHING WRITTEN IN THIS TEST BOOKLET WILL BE SCORED.

Use the following information to answer items 43 through 46.

Solubility of Common Compounds in Water

Compound	Melting Point (°C)	Boiling Point (°C)	Solubility in g/100g cold water	Solubility in g/100g hot water
barium chloride	963	1560	37.5	59
calcium chloride	782	1600	74.5	159
potassium chloride	770	1500	34.7	56.7
sodium chloride	801	1413	35.7	39.12
barium hydroxide	78	780	5.6	94.7
potassium hydroxide	360	1320	107	178
sodium hydroxide	318.4	1390	42	347
barium oxide	1923	2000	3.48	90.8
calcium oxide	2580	2850	0.131	0.07
potassium iodide	681	1330	127.5	208
sodium iodide	661	1304	184	302

Data from *Handbook of Chemistry and Physics 56th Ed.*, pp. B-67 through B-142.

- 43 Based upon the information in the table, what is the general relationship between solubility and the heat required for a change of state?
- A As the melting point increases, solubility decreases.
 - B As the melting point increases, solubility increases.
 - C As the boiling point increases, solubility increases.
 - D As the boiling point decreases, solubility decreases.

- 44 What is the freezing point of sodium chloride?
- A 0°C
 - B 32°C
 - C 801°C
 - D 1413°C
- 45 Which compound would melt before the water begins to boil?
- A barium oxide
 - B calcium oxide
 - C barium chloride
 - D barium hydroxide

ANSWER THE FOLLOWING CONSTRUCTED-RESPONSE ITEM IN YOUR ANSWER FOLDER.

- 46 **Constructed-Response**
(3 points)
- Construct a bar graph comparing the solubility of sodium chloride and potassium iodide. Indicate on the horizontal axis whether the water is hot or cold, and put the solubility, in increments of 20 grams per 100 grams of water, on the vertical axis. Be sure to label which bar represents which compound.
 - Based on the information presented in your graph, which compound has a solubility that is *less* affected by temperature?

NOTHING WRITTEN IN THIS TEST BOOKLET WILL BE SCORED.

- 57** The light bulb in the brake light of a car is white. The light transmitted through the red plastic cover appears red because the cover
- A** refracts the red wavelengths of visible light.
 - B** reflects the red wavelengths of visible light.
 - C** absorbs all visible wavelengths except for red.
 - D** transmits all visible wavelengths except for red.

High School Key

Item #	Key	Benchmark
4	C	V.1.h.3
5	C	I.1.h.2
6	B	V.1.h.3
7	B	V.1.h.1
8	C-R	V.3.h.1
15	A	III.5.h.5
17	D	III.2.h.4
27	D	IV.4.h.3
28	B	I.1.h.4
29	A	IV.2.h.4
33	A	IV.4.h.3
34	C	III.3.h.2
35	A	I.1.h.3
36	C	IV.2.h.3
37	B	V.4.h.2
38	C-R	V.4.h.1
43	A	I.1.h.4
44	C	I.1.h.4
45	D	I.1.h.4
46	C-R	I.1.h.4
57	C	IV.4.h.1

Periodic Table of the Elements

IA																		VIII A
1																	2	
H																	He	
1.0080																	4.0026	
IIA												IIIA	IVA	VA	VIA	VIIA		
3	4											5	6	7	8	9	10	
Li	Be											B	C	N	O	F	Ne	
6.94	9.012											10.811	12.0115	14.0067	15.9994	18.9984	20.18	
11	12											13	14	15	16	17	18	
Na	Mg	IIIB	IVB	VB	VIB	VII B	VIII B			IB	IIB	Al	Si	P	S	Cl	Ar	
22.9898	24.31											26.9815	28.086	30.974	32.06	35.453	39.948	
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
39.102	40.08	44.96	47.90	50.94	51.996	54.938	55.847	58.933	58.71	63.546	65.37	69.72	72.59	74.9216	78.96	79.909	83.80	
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
85.47	87.62	88.91	91.22	92.91	95.94	(97.9)	101.07	102.91	106.4	107.868	112.40	114.82	118.69	121.75	127.60	126.904	131.30	
55	56	* 57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
132.91	137.34	138.91	178.49	180.95	183.85	186.2	190.2	192.22	195.09	196.97	200.59	204.37	207.2	208.98	(209)	(210)	(222)	
87	88	♦ 89	104	105	106													
Fr	Ra	Ac	Rf	Db	Sg													
(223)	226.0	227.0	(261)	(262)	(263)													

*Lanthanoid series

58	59	60	61	62	63	64	65	66	67	68	69	70	71
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
140.12	140.91	144.24	(145)	150.4	151.96	157.25	158.9	162.50	164.93	167.26	168.93	173.04	174.97

♦Actinoid series

90	91	92	93	94	95	96	97	98	99	100	101	102	103
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr
232.0	231.0	238.03	237.0	(244)	(243)	(247)	(247)	(251)	(252)	(257)	(258)	(259)	(262)



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