

FINAL VERSION 9/17/07 (Pages 10 & 11 updated 11/26/07)

#### STRAND 2: REFLECTING ON SCIENTIFIC KNOWLEDGE

**Background Information:** The science benchmarks in this document are taken from the Michigan Curriculum Framework Science Content Benchmarks, 2000 version (MCF v.2000). These benchmarks have been extended for the MI-Access Functional Independence, Supported Independence, and Participation populations, and are presented in this document. The coding keys below explain abbreviations found throughout the document, including the benchmark and extended benchmark codes. If a cell contains **N/A**, the MCF v.2000 Benchmark was determined to be inappropriate to extend for the population and/or grade span by the MI-Access Science Assessment Plan Writing Team.

MCF v.2000 Science Elementary, Middle School, and High School (Grades K-12) Benchmark Organization					
STRAND 1 Constructing New Scientific Knowledge (C)	STRAND 2 Reflecting on Scientific Knowledge (R)	STRAND 3 Using Life Science Knowledge (L)	STRAND 4 Using Physical Science Knowledge (P)	STRAND 5 Using Earth Science Knowledge (E)	
Standards					
CN: Constructing New Scientific Knowledge	RO: Reflecting on Scientific Knowledge	CE: Cells OR: Organization of Living Things HE: Heredity EV: Evolution EC: Ecosystems	<ul><li>ME: Matter and Energy</li><li>CM: Changes in Matter</li><li>MO: Motion of Objects</li><li>WV: Waves and Vibrations</li></ul>	<ul> <li>GE: Geosphere</li> <li>HY: Hydrosphere</li> <li>AW: Atmosphere and Weather</li> <li>SS: Solar System, Galaxy, and Universe</li> </ul>	

Extended Benchmark Coding Examples				
Extended Benchmark: R.RO.FI.EB.II.1.e.1a Extended Benchmark: R.RO.FI.EB.II.1.m.2ADDh			Extended Benchmark: R.RO.FI.EB.II.1.m.2ADDh	
R	Reflecting on Scientific Knowledge	R	Reflecting on Scientific Knowledge	
RO	Reflecting on Scientific Knowledge	RO	Reflecting on Scientific Knowledge	
FI	Functional Independence	FI	Functional Independence	
EB	Extended Benchmark	EB	Extended Benchmark	
II.1.e.1	MCF v.2000 Benchmark	II.1.m.2	MCF v.2000 Benchmark	
а	First Extended Benchmark in this document linked to MCF v.2000 Benchmark II.1.e.1	ADDh	This Extended Benchmark is linked to a middle school MCF v.2000 Benchmark (II.1.m.2) but has been added to high school.	



## SCIENCE

## STRAND: REFLECTING ON SCIENTIFIC KNOWLEDGE (R)

STANDARD: REFLECTING ON SCIENTIFIC KNOWLEDGE (RO)

All students will analyze claims for their scientific merit and explain how scientists decide what constitutes scientific knowledge.

Level of Independence (Full, FI, SI, P) Assessable at: (Classroom/LEA/ISD, State)	Elementary School	Middle School	High School
	<b>II.1.e.1</b> Develop an awareness of the need for evidence in making decisions scientifically.	<b>II.1.m.1</b> Evaluate the strengths and weaknesses of claims, arguments, or data.	<b>II.1.h.1</b> Justify plans or explanations on a theoretical or empirical basis.
MCF v.2000 Science Benchmark	<i>Key concepts:</i> (K-2) observations; (3-5) data, evidence, sample, fact, opinion. <i>Real-world contexts:</i> Deciding whether an explanation is supported by evidence in	<i>Key concepts:</i> Aspects of arguments such as data, evidence, sampling, alternate explanation, conclusion; inference, observation.	<i>Key concepts:</i> Aspects of logical argument, including evidence, fact, opinion, assumptions, claims, conclusions, observations.
	simple experiments, or relies on personal opinion.	<i>Real-world contexts:</i> Deciding between alternate explanations or plans for solving problems; evaluating advertising claims or cases made by interest groups; evaluating sources of references.	<i>Real-world contexts:</i> Any in the sections on Using Scientific Knowledge.
	<b>R.RO.FI.EB.II.1.e.1a</b> Distinguish between observations and inferences in science.	<b>R.RO.FI.EB.II.1.m.1a</b> Evaluate the quality of evidence in making decisions scientifically.	R.RO.FI.EB.II.1.h.1a Evaluate a plan based on the strengths and weaknesses of claims, arguments, o data.
Functional Independence Extended Benchmark Classroom/LEA/ISD and State	Key concepts: Fact and opinion, observation, evidence, sample. Real-world contexts: Printed advertisements, television commercials,	Key concepts: Fact and opinion, observation, evidence, sample, data, conclusions. Real-world contexts: Health/body systems, tobacco/alcohol abuse, food decisions, exercise decisions.	Key concepts: Fact and opinion, observation, evidence, sample, data, draw conclusions.
	radio. R.RO.SI.EB.II.1.e.1a	R.RO.SI.EB.II.1.m.1a	Real-world contexts: Health/body systems, tobacco/alcohol abuse, food decisions, exercise decisions. R.RO.SI.EB.II.1.h.1a
Supported Independence Extended Benchmark	Distinguish between true and false. <i>Key concepts:</i> Observation, true/false, common science misconceptions.	Distinguish between fact and opinion. <i>Key concepts:</i> Fact/opinion, observation, collect data.	Identify data or observations that suppo an explanation. <i>Key concepts:</i> Fact/opinion, observation collect data, draw conclusions.
Classroom/LEA/ISD	<i>Real-world contexts:</i> Observable facts, such as the sky is blue, the sun is hot.	<i>Real-world contexts:</i> Preferences and favorites of soda pop amongst classmates.	<i>Real-world contexts:</i> General scams (such as Internet, phone), rules vs. desires, safety—stranger danger.
Participation Extended Benchmark	N/A	N/A	N/A



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All students will analyze claims for their scientific merit and explain how scientists decide what constitutes scientific knowledge:

Level of Independence (Full, FI, SI, P) Assessable at: (Classroom/LEA/ISD, State)	Elementary School	Middle School	High School
MCF v.2000 Science Benchmark	None	<b>II.1.m.2</b> Describe limitations in personal knowledge. <i>Key concepts:</i> Recognizing degrees of confidence in ideas or knowledge from different sources, evaluating dates and sources of references. <i>Real-world contexts:</i> Any in the sections on Using Scientific Knowledge.	<b>II.1.h.2</b> Describe some general limitations of scientific knowledge. <i>Key concepts:</i> Understanding of the general limits of science and scientific knowledge as constantly developing human enterprises; recognizing that arguments can have emotive, economic, and political dimensions as well as scientific.
Functional Independence Extended Benchmark Classroom/LEA/ISD and State	N/A	<b>R.RO.FI.EB.II.1.m.2a</b> Recognize limitations in personal knowledge. <i>Key concepts:</i> Fact vs. opinion, when to ask for help, who to ask for help, where to get information. <i>Real-world contexts:</i> Career choices/interests, safety issues, social interactions, news.	Real-world contexts: Any in the sections on Using Scientific Knowledge. <b>R.RO.FI.EB.II.1.m.2ADDh</b> Describe limitations in personal knowledge. <i>Key concepts:</i> Fact vs. opinion, when to ask for help, who to ask for help, where to get information. <i>Real-world contexts:</i> Career choices/interests, safety issues, social interactions, news.
Supported Independence Extended Benchmark Classroom/LEA/ISD and State	N/A	R.RO.SI.EB.II.1.m.2a Recognize limitations in personal knowledge/abilities. <i>Key concepts:</i> Fact/opinion, when to ask for help, who to ask for help, where to get information. <i>Real-world contexts:</i> Class selection, team sports, games, safety issues, social interactions.	R.RO.SI.EB.II.1.m.2ADDh Recognize limitations in personal knowledge/abilities. <i>Key concepts:</i> Fact/opinion, when to ask for help, who to ask for help, where to get information. <i>Real-world contexts:</i> Class selection, team sports, games, nutrition choices, career choices, safety issues, social interaction, news.



Participation       Develop awareness of personal information.       Develop awareness of personal information.         Extended Benchmark       N/A       Key concepts: Name, address, phone number.       Develop awareness of personal information.         Classroom/LEA/ISD       Real-world contexts: Safety, advocacy.       Real-world contexts: Safety, advocacy.       Develop awareness of personal information.
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SCIENCE

## STRAND: REFLECTING ON SCIENTIFIC KNOWLEDGE (R)

## STANDARD: REFLECTING ON SCIENTIFIC KNOWLEDGE (RO)

All students will show how science is related to other ways of knowing.

Level of Independence (Full, FI, SI, P) Assessable at: (Classroom/LEA/ISD, State)	Elementary School	Middle School	High School
	<b>II.1.e.2</b> Show how science concepts can be illustrated through creative expression such as language arts and fine arts.	<b>II.1.m.3</b> Show how common themes of science, mathematics, and technology apply in real- world contexts.	<b>II.1.h.3</b> Show how common themes of science, mathematics, and technology apply in real-world contexts.
MCF v.2000 Science Benchmark	<i>Key concepts:</i> Poetry, expository work, painting, drawing, music, diagrams, graphs, charts.	<i>Key concepts:</i> Systems subsystems, feedback models, mathematical constancy, scale, conservation, structure, function, adaptation.	<i>Key concepts:</i> Systems subsystems, feedback models, mathematical constancy, scale, conservation, structure,
	<i>Real-world contexts:</i> Explaining simple experiments using paintings and drawings; describing natural phenomena scientifically and poetically.	<i>Real-world contexts:</i> Any in the sections on Using Scientific Knowledge.	function, adaptation. <i>Real-world contexts:</i> Any in the sections on Using Scientific Knowledge.
Functional Independence Extended Benchmark Classroom/LEA/ISD at all levels and State at middle and high school	<ul> <li><b>R.RO.FI.EB.II.1.e.2a</b></li> <li>Identify and/or show how simple science concepts can be illustrated through creative expression.</li> <li><i>Key concepts:</i> Drawing, painting, music, poetry.</li> <li><i>Real-world contexts:</i> Representing natural phenomena artistically, representing labs through art.</li> </ul>	R.RO.FI.EB.II.1.m.3a Identify how science relates to the world around them. <i>Key concepts:</i> Recycling, hygiene, measurement, seasons, population, transportation, conservation, weather. <i>Real-world contexts:</i> Hand washing, using a microwave oven, choosing appropriate clothes for the weather, sorting paper/plastic.	R.RO.FI.EB.II.1.h.3a Identify how science relates to the world around them. <i>Key concepts:</i> Technology, recycling, hygiene, measurement, seasons, population, transportation, conservation, weather, historical development of major scientific advancements. <i>Real-world contexts:</i> Hand washing, using a microwave oven, choosing appropriate clothes for the weather, sorting paper/plastic, driving an automobile.
Supported Independence Extended Benchmark Classroom/LEA/ISD at all levels and State at middle and high school	<b>R.RO.SI.EB.II.1.e.2a</b> Identify and/or explore how simple scienceconcepts can be illustrated throughcreative expression.Key concepts: Drawing, painting, music,creative movements.Real-world contexts: Representing naturalphenomena artistically, representing labsthrough art.	<b>R.RO.SI.EB.II.1.m.3a</b> Identify the science concepts in common activities. <i>Key concepts:</i> Hygiene, cooking, seasons, weather, recycling. <i>Real-world contexts:</i> Hand washing, using a microwave oven, choosing appropriate clothes for the weather, sorting paper/plastic.	<b>R.RO.SI.EB.II.1.h.3a</b> Identify the science concepts in common activities. <i>Key concepts:</i> Hygiene, cooking, seasons, weather, transportation. <i>Real-world contexts:</i> Hand washing, using a microwave oven, choosing appropriate clothes for the weather.



Participation Extended BenchmarkR.RO.P.EB.II.1.e.2a Identify and/or explore science activities that relate to the world around them through creative expression.Classroom/LEA/ISDKey concepts: Senses (five traditional senses—sight, hearing, smell, taste, touch—plus vestibular sense and proprioceptive sense); seasons.Real-world contexts: Cooking, eating, sensory exploration, weather.	R.RO.P.EB.II.1.m.3aIdentify and/or explore science activities that relate to the world around them.Key concepts: Senses (five traditional senses—sight, hearing, smell, taste, touch— plus vestibular sense and proprioceptive sense); seasons.Real-world contexts: Cooking, eating, sensory exploration, weather, functional tools.	<b>R.RO.P.EB.II.1.h.3a</b> Identify and/or explore science activities that relate to the world around them. <i>Key concepts:</i> Senses (five traditional senses—sight, hearing, smell, taste, touch—plus vestibular sense and proprioceptive sense); seasons. <i>Real-world contexts:</i> Cooking, eating, sensory exploration, weather, functional tools.
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### SCIENCE

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#### STANDARD: REFLECTING ON SCIENTIFIC KNOWLEDGE (RO)

All students will show how science is related to other ways of knowing.

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Level of Independence (Full, FI, SI, P) Assessable at: (Classroom/LEA/ISD, State)	Elementary School	Middle School	High School
			<b>II.1.h.4</b> Discuss the historical development of key scientific concepts and principles.
MCF v.2000 Science Benchmark	None	None	<i>Key concepts:</i> Historical, political, social, and economic factors influencing the development of science. See <i>Benchmarks</i> <i>for Science Literacy</i> , AAAS, Chapter 10.
			<i>Real-world contexts:</i> Historical development of key scientific theories.
Functional Independence Extended Benchmark	N/A	N/A	N/A
Supported Independence Extended Benchmark	N/A	N/A	N/A
Participation Extended Benchmark	N/A	N/A	N/A



SCIENCE

## STRAND: REFLECTING ON SCIENTIFIC KNOWLEDGE (R)

#### STANDARD: REFLECTING ON SCIENTIFIC KNOWLEDGE (RO)

All students will show how science and technology affect our society.

All students will show how science and technology affect our society.			
Level of Independence (Full, FI, SI, P) Assessable at: (Classroom/LEA/ISD, State)	Elementary School	Middle School	High School
	II.1.e.3	II.1.m.4	II.1.h.5
	Describe ways in which technology is used in everyday life.	Describe the advantages and risks of new technologies.	Explain the social and economic advantages and risks of new technology.
	Key concepts: Provide faster and farther transportation and communication,	Key concepts: Risk, benefit, side effect, advantage, disadvantage.	Key concepts: Cost-benefit analysis; See LO h.5 (health technology), PME-IV.1 h.1
	organize information and solves problems, save time.	Real-world contexts: Technological systems	(household and agricultural materials, EG-V.1 h.4 (resource use), LEC-III.5 h.6
MCF v.2000 Science Benchmark	<i>Real-world contexts:</i> Cars, other machines, radios, telephones, computer games, calculators, appliances, e-mail, the World Wide Web.	for manufacturing, transportation, energy distribution, housing, medicine (such as cloning, genetic engineering).	(effects of urban development and agriculture on ecosystems), EAW-V.3 h.4 (air pollution), EH-V.2 h.2 (water pollution.)
			<i>Real-world contexts:</i> Issues related to new technologies, including ones in health-care, transportation, communications, manufacturing, information and media.
	R.RO.FI.EB.II.1.e.3a	R.RO.FI.EB.II.1.e.3ADDm	R.RO.FI.EB.II.1.m.4ADDh
	Identify ways in which technology is used in everyday life.	Identify and/or describe ways in which technology is used in everyday life.	Identify the advantages and risks of technology in everyday life.
Functional Independence Extended Benchmark	Key concepts: Transportation, communication, household appliances.	Key concepts: Transportation, communication, household appliances.	<i>Key concepts:</i> Risk, benefit, advantage, disadvantage, side effects.
Classroom/LEA/ISD and State	<i>Real-world contexts:</i> Computer, Internet, calculator, television, appliances, automobile, plane.	<i>Real-world contexts:</i> Computer, Internet, calculator, television, appliances, automobile, plane.	<i>Real-world contexts:</i> Computer, Internet, appliances, telephone, driving an automobile, cooking, cleaning solvent.
	<b>R.RO.SI.EB.II.1.e.3a</b> Identify ways in which technology is used in everyday life.	<b>R.RO.SI.EB.II.1e.3ADDm</b> Identify ways in which technology is used in everyday life.	<b>R.RO.SI.EB.II.1.m.4ADDh</b> Identify the advantages and risks of everyday technology.
Supported Independence Extended Benchmark	Key concepts: How technology changes our lives.	<i>Key concepts:</i> Transportation, communication, household appliances.	Key concepts: Transportation, communication, household appliances;
Classroom/LEA/ISD and State	<i>Real-world contexts:</i> Computer, calculator, television, appliances, telephone, hand-washing dishes/dishwasher, hand-sewing/sewing machine, handwriting/word processing.	<i>Real-world contexts:</i> Computer, Internet, calculator, television, appliances, telephone, automobile.	risks, benefits, safety. <i>Real-world contexts:</i> Computer, Internet, calculator, television, appliances, telephone, automobile.



	<b>R.RO.P.EB.III.1.e.3a</b> Identify and/or explore activities in which technology is used in everyday life.	<b>R.RO.P.EB.II.1.e.3ADDm</b> Identify and/or explore ways in which technology is used in everyday life.	<b>R.RO.P.EB.II.1.e.3ADDh</b> Identify and/or explore ways in which technology is used in everyday life.
Participation Extended Benchmark Classroom/LEA/ISD	<i>Key concepts:</i> Computer, television, appliances, assistive technology devices, toys.	<i>Key concepts:</i> Computer, television, appliances, assistive technology devices, video games.	<i>Key concepts:</i> Computer, television, appliances, assistive technology devices, video games, MP3 players.
	<i>Real-world contexts:</i> Technology can enhance daily living.	<i>Real-world contexts:</i> Technology can enhance daily living and leisure activities.	<i>Real-world contexts:</i> Technology can enhance daily living, leisure, and vocational activities.



SCIENCE

## STRAND: REFLECTING ON SCIENTIFIC KNOWLEDGE (R)

## STANDARD: REFLECTING ON SCIENTIFIC KNOWLEDGE (RO)

All students will show how science and technology affect our society.

Level of Independence (Full, FI, SI, P) Assessable at: (Classroom/LEA/ISD, State)	Elementary School	Middle School	High School
	<b>II.1.e.4</b> Develop an awareness of and sensitivity to the natural world.	<b>II.1.m.5</b> Develop an awareness of and sensitivity to the natural world.	<b>II.1.h.6</b> Develop an awareness of and sensitivity to the natural world.
MCF v.2000 Science Benchmark	<i>Key concepts:</i> Appreciation of the balance of nature and the effects organisms have on each other, including the effects humans have on the natural world.	<i>Key concepts:</i> Appreciation of the balance of nature and the effects organisms have on each other, including the effects humans have on the natural world.	Key concepts: Appreciation of the balance of nature and the effects organisms have on each other, including the effects humans have on the natural world.
	<i>Real-world contexts:</i> Any in the sections on Using Scientific Knowledge appropriate to elementary school.	<i>Real-world contexts:</i> Any in the sections on Using Scientific Knowledge appropriate to middle school.	<i>Real-world contexts:</i> Any in the sections on Using Scientific Knowledge appropriate to high school.
Functional Independence Extended Benchmark	<b>R.RO.FI.EB.II.1.e.4a</b> Develop an awareness of and sensitivity to the natural world.	<b>R.RO.FI.EB.III.1.m.5a</b> Develop an awareness of and sensitivity to the natural world.	<b>R.RO.FI.EB.II.1.h.6a</b> Develop an awareness of and sensitivity to the natural world.
Classroom/LEA/ISD/State	<i>Key concepts:</i> Pollution, environment. <i>Real-world contexts:</i> Pollution, environment, recycling.	<i>Key concepts:</i> Pollution, environment. <i>Real-world contexts:</i> Recycling, wetlands, ground water, forest fires.	Key concepts: Pollution, environment. Real-world contexts: Recycling, wetland ground water, epidemics.
	<b>R.RO.SI.EB.II.1.e.4a</b> Develop an awareness of the natural world.	<b>R.RO.SI.EB.II.1.m.5a</b> Develop an awareness of the natural world. <i>Key concepts:</i> Nature, observation,	<b>R.RO.SI.EB.II.1.h.6a</b> Develop an awareness of the natural world.
Supported Independence Extended Benchmark	Key concepts: Nature, observation, personal safety. Real-world contexts: Caring for	environment, personal safety. <i>Real-world contexts:</i> Caring for environment, pollution, recycling, habitats; water safety,	<i>Key concepts:</i> Preserving nature, community service, concept of conservation, personal safety.
Classroom/LEA/ISD/ <mark>State</mark>	environment, pollution, recycling; water safety.	weather safety.	<i>Real-world contexts:</i> Caring for environment, pollution, recycling, habitats; water safety, weather safety, yard maintenance.



Participation Extended Benchmark Classroom/LEA/ISD/ <mark>State</mark>	R.RO.P.EB.II.1.e.4a Develop an awareness of the natural world. <i>Key concepts:</i> Indoors/outdoors, cold/hot, wet/dry. <i>Real-world contexts:</i> Outdoor/pedestrian safety, outdoor games, water safety.	R.RO.P.EB.II.1.m.5a Develop an awareness of the natural world. <i>Key concepts:</i> Indoors/outdoors, cold/hot, wet/dry. <i>Real-world contexts:</i> Outdoor/pedestrian safety, outdoor games, water safety, plant care.	R.RO.P.EB.II.1.h.6a Develop an awareness of the natural world. <i>Key concepts:</i> Indoors/outdoors, cold/hot, wet/dry. <i>Real-world contexts:</i> Outdoor/pedestrian safety, outdoor games, water safety, plant/lawn care.
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## SCIENCE

## STRAND: REFLECTING ON SCIENTIFIC KNOWLEDGE (R)

**STANDARD: REFLECTING ON SCIENTIFIC KNOWLEDGE (RO)** All students will show how people of diverse cultures have contributed to and influenced developments in science.

Level of Independence (Full, FI, SI, P) Assessable at: (Classroom/LEA/ISD, State)	Elementary School	Middle School	High School
MCF v.2000 Science Benchmark	<b>II.1.e.5</b> Develop an awareness of contributions made to science by people of diverse backgrounds and cultures. <i>Key concepts:</i> Scientific contributions made by people of diverse cultures and backgrounds.	<b>II.1.m.6</b> Recognize the contributions made in science by cultures and individuals of diverse backgrounds. <i>Key concepts:</i> Cultural contributions to science, contributions made by people of diverse backgrounds.	<b>II.1.h.7</b> Describe the historical, political, and social factors affecting developments in science. <i>Key concepts:</i> Historical, political, social, and economic factors influencing the development of science.
	<i>Real-world contexts:</i> Any in the sections on Using Scientific Knowledge appropriate to this benchmark.	<i>Real-world contexts:</i> Biographies of minority and female scientists; histories of cultural contributions to science.	<i>Real-world contexts:</i> The development of the sun-centered model of the solar system and political pressures on Galileo; the development of Darwin's theory of evolution by natural selection.
Functional Independence Extended Benchmark Classroom/LEA/ISD	R.RO.FI.EB.II.1.e.5aDevelop an awareness of contributionsmade to science by people of diversebackgrounds and cultures.Key concepts:Scientific contributionsmade by people of diverse cultures andbackgrounds.Real-world contexts:Teacher providingexamples—people with disabilities(Stephen Hawking, Einstein, ChristopherReeve),Special Olympics.	<ul> <li><b>R.RO.FI.EB.II.1.m.6a</b></li> <li>Explore the contributions made in science by cultures and individuals of diverse backgrounds.</li> <li><i>Key concepts:</i> Cultural contributions to science, contributions made by people of diverse backgrounds.</li> <li><i>Real-world contexts:</i> Students using various resources, such as the Internet, biographies, periodicals.</li> </ul>	<b>R.RO.FI.EB.II.1.h.7a</b> Identify key developments in science. <i>Key concepts:</i> Key discoveries in science. <i>Real-world contexts:</i> Students using various resources, such as the Internet, biographies, periodicals.
Supported Independence Extended Benchmark	N/A	N/A	N/A
Participation Extended Benchmark	N/A	N/A	N/A