Reviewing for the Science MEAP

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Welcome

Thank you for joining the **Science Explosion** in reviewing for the Science MEAP. The MEAP test causes anxiety in many people. We hope we are able to relieve some of that anxiety as we share some new information, strategies and insights, which will lead your students to more success. The major key to success on the MEAP test is teaching to the state science objectives (Michigan Essential Goals and Objectives for Science Education - MEGOSE). This means that districts must have a science curriculum, which is aligned to MEGOSE. There is no short cut to an aligned curriculum. We want students to do their best on the MEAP, but it is one test given at one period of time. It is more important to assess students on the state science objectives regularly throughout the school year. The more often that students are assessed on the objectives, the more success they will have when evaluated on the state test.

This book focuses on MEGOSE, vocabulary, investigations, text critiques, and games. All of these are used to help students to review. Students may have mastered objectives a year or two prior to the state MEAP, but now they need to review the objectives. Students need to keep rehearsing knowledge in order to retain it in their long-term memory. Review and repetition are essentials in creating long-term memory. These strategies do not replace daily instruction. It is known that the main reason that students forget information is because they were not paying attention in the first place. Often we think students have forgotten information, but maybe they never learned it in the first place. It is our hope, that the model of instruction demonstrated by the **Science Explosion**, will help students want to pay attention and to be actively involved in their own learning.

We hope you enjoy this book and find it of value to both you and your students. If the **Science Explosion** can be of any help to you or you would like additional information about district science inservices, please feel free to contact us at:

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Your friends in science,
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The Writing of the MEAP Test

The "new MEAP test" appeared in the winter of 1995. This was the first time that all of the questions on the MEAP test were based on the Michigan Essential Goals and Objectives for Science Education (MEGOSE). Science educators throughout the State wrote the questions. In order to write a question for the test, the following steps needed to be followed:

- Read the objective
- Read the terms, tools, and concepts
- Read the real-world contexts
- Read the narrative section in MEGOSE

At this point, a question could be written. This is why it is very important for teachers to be familiar with MEGOSE. The test is written to this set of objectives. You will find the complete set of objectives, on the pages that follow.

The MEAP test, to be given in January 1999, incorporates a new set of test questions, in addition to those, which have appeared since 1995. Science educators in Michigan did not write these questions. They were written by, Measurement Incorporated, but were piloted and analyzed for bias and content by educators in our state.

There will be another "new MEAP test" in the year 2002. This "new test" will be based on the Michigan Curriculum Framework (MCF). Careful observation of MEGOSE and MCF show that they are really the same. Science educators can feel comfortable that the test in 2002 will look almost the same as the test in 1999. The MEAP test based on the MCF will last at least five years. That means that the MEAP test will be basically the same from 1995-2007. This should be comforting to science educators who are concerned that objectives change from year to year.

Changes in the MEAP for 1999

1999 brings changes in the MEAP test. For the past three years, Phase One of the MEAP test was in effect. Phase Two of the MEAP test takes effect this school year. The major difference between Phase One and Two is the number of topics that are being assessed. The table below shows the differences:

January/February -- 1998 Test	January/February -- 1999 Test
Constructing	Constructing
Reflecting	Reflecting
Organization of Living Things	Cells
Ecosystems	Organization of Living Things
Matter and Energy	Heredity
Changes in Matter	Evolution
Hydrosphere	Ecosystems
Atmosphere and Weather	Matter and Energy
	Changes in Matter
	Waves and Vibrations
	Motion of Objects
	Geosphere
	Hydrosphere
	Atmosphere and Weather
	Solar System, Galaxy and Universe

All of these topics have been included within the Michigan Essential Goals and Objectives for Science Education (MEGOSE). But Phase One was in effect in order to let school districts align their curriculum and better prepare for Phase Two.

The format of the Phase Two test will look the same as Phase One. The test will include approximately the same number of questions, a science investigation, text critique, and the area-specific. This will be the last year that the area-specific component of the test will be required for the MEAP test. The area-specific component selected, should be the same one that has been selected over the past two years.

Since the test is given in January and February, districts will be able to obtain their test results before summer vacation, so that the data can be used to design summer inservice programs.

MEGOSE

For

Grades K-5

Elementary Objections from the Michigan Essential Goals and Objectives for Science Education (MEGOSE)

Constructing Scientific Knowledge

Objectives--Elementary	Related concepts, terms, and tools	Real-world contexts
1) Generate reasonable questions about the world, based on observation.	Appropriate scientific concepts, terms, and tools: See Using Scientific Knowledge	Appropriate scientific contexts: See Using Scientific Knowledge
2) Develop solutions to unfamiliar problems through reasoning, observation, and/or experiment.	Appropriate scientific concepts, terms, and tools: See Using Scientific Knowledge	Appropriate scientific contexts: See Using Scientific Knowledge
3) Manipulate simple mechanical devices and explain how they work.	Names and uses for parts of machines, such as *levers, wheel and axles, pulleys, inclined planes, gears, screws, wedges*	Simple mechanical devices, such as *bicycles, bicycle pumps, pulleys, faucets, clothespins*
4) Use simple measurement devices to make metric measurements.	Measurement units: *milliliters, liters, teaspoon, tablespoon, ounce, cup, millimeter, centimeter, meter, gram* Measurement tools: *measuring cups and spoons, measuring tape, balance or scale*	Making simple mixtures, such as *food, play dough, paper mache* Measuring *height of a person, mass of a ball*
5) Develop strategies and skills for information gathering and problem solving.	Tools: Sources of information, such as reference books, trade books, periodicals	Seeking help from peers, adults, libraries, other resources
6) Construct charts, graphs, and prepare summaries of observations.	Terms: *increase, decrease, steady* Tools: *graph paper, rulers, crayons*	Examples of simple charts and graphs like those found in a newspaper

Reflecting Scientific Knowledge

Objectives--Elementary	Related concepts, terms, and tools	Real-world contexts
1) Develop an awareness of the need for evidence in making decisions scientifically.	*data, evidence, sample, guess, opinion*	Deciding whether an explanation is supported by evidence in simple experiments
2) Show how science concepts can be interpreted through creative expression such as language arts and fine arts.	*Poetry, expository work, painting, drawing, music, diagrams, graphs, charts*	Explaining simple experiments using paintings and drawings Describing natural phenomena scientifically and poetically
3) Develop an awareness of and sensitivity to the natural world.	Appreciation of the balance of nature and the effects organisms have on each other, including the effects humans have on the natural world	Appropriate scientific contexts: See Using Scientific Knowledge
4) Describe how technology is used in everyday life.	Provide faster and farther transportation and communication, organize information and solve problems, save time	Cars, other machines, radios, telephones, computer games, calculators, appliances
5) Develop an awareness of the contributions made to science by people of diverse backgrounds.	Scientific contributions made by people of diverse cultures and backgrounds. (See Appendix A)	Appropriate scientific content See Using Scientific Knowledge

Cells

Objectives--Elementary	Related concepts, terms, and tools	Real-world contexts
1) Describe cells as living systems.	Life functions: *growth, development, reproduction, response to environment, movement* *All parts of living things are made of cells*	Common plant, animal, or protist cells: *elodea leaf cells, onion skin cells, human cheek cells, Paramecium*

Organization of Living Things

Objectives--Elementary	**Related concepts, terms, and tools**	**Real-world contexts**
1) Compare and classify familiar organisms on the basis of observable physical characteristics.	Words describing plant and animal parts: *backbone, skin, shell, limbs, roots, leaves, stems, flowers*	Animals that look similar: *snakes, worms, millipedes* Flowering and non-flowering plants: *pine tree, oak tree, rose, algae*
2) Describe vertebrates in terms of observable body parts and characteristics.	Vertebrate characteristics: *fur, scales, feathers, horns, claws, eyes, quills, beaks, teeth, skeleton, muscles, cells*	Vertebrate and non-vertebrate animals, such as *humans, cow, sparrow, goldfish, spider, starfish, and* animals listed above
3) Describe life cycles of familiar organisms.	Life cycle stages: *Egg, young, adult, seed, flower, fruit*	Common plants and animals such as *beans, apples, butterflies, grasshoppers, frogs, birds*
4) Compare and contrast food, energy, and environmental needs of selected organisms.	Life requirements: *Food, air, water, minerals, sunlight, space, habitat*	Germinating seeds, such as *beans, corn* Aquarium or terrarium life, such as *guppy, goldfish, snail*
5) Describe functions of selected seed plant parts.	Plant parts: *Roots, stems, leaves, flowers, fruits, seeds*	Common edible plant parts, such as *bean, cauliflower, carrot, apple, tomato, spinach*

Heredity

Objectives--Elementary	**Related concepts, terms, and tools**	**Real-world contexts**
1) Give evidence that characteristics are passed from parents to young.	Participants: *parent, young* Characteristics: *hair color, eye color, skin color, leaf shape, leaf size*	Examples of mature and immature organisms, such as *dogs/puppies, cats/kittens, maple trees/saplings, beans/seedlings*

Evolution

Objectives--Elementary	Related concepts, terms, and tools	Real-world contexts
1) Explain how fossils provide evidence about the nature of ancient life.	Words describing types of evidence: *fossil, extinct, ancient, modern life forms*	Common contexts: *plant and animal fossils, museum dioramas and paintings/drawings of ancient life and/or habitats*
2) Explain how physical and or behavioral characteristics of organisms help them to survive in their environments.	Words describing characteristics: *adaptation, fitness, instinct, learning, habit* Words describing traits and their adaptive values: *sharp teeth or claws for catching and killing prey, color for camouflage*	Common vertebrate adaptations, such as *white polar bears, sharp claws and sharp canines for predators, changing colors of chameleon,* Behaviors, such as *migration, communication of danger, adaptation to changes in the environment*

Ecosystems

Objectives--Elementary	Related concepts, terms, and tools	Real-world context
1) Identify familiar organisms as part of a food chain or food web and describe their feeding relationships within the web.	Words describing parts of a food web: *producer, consumer, predator, prey, decomposer, habitat*	Food chains and food webs involving organisms, such as *rabbits, birds, snakes, grasshoppers, plants*
2) Explain common patterns of interdependence and interrelationships of living things.	See objective 1	Relationships among plants and animals in an ecosystem: *Symbiotic relationships, such as insects and flowering plants, birds eating fruit and spreading seeds* *Parasitic relationships, such as humans and mosquitoes, trees and mistletoe*
3) Describe the basic requirements for all living things to maintain their existence.	Needs of life: *food, habitat, water, shelter, air, light, minerals*	Selected ecosystems, such as an *aquarium, rotting log, terrarium, backyard, local pond or wetland, wood lot*
4) Design systems that encourage growing of particular plants or animals.	Words describing needs of life: see objective 3 above	Ecosystems managed by humans, including *farms, ranches, gardens, lawns, potted plants*
5) Describe positive and negative effects of humans on the environment.	Human effects on the environment: *garbage, habitat destruction, land management, resource management*	*Household wastes, school wastes, waste water treatment, habitat destruction due to community growth, reforestation projects, establishing parks or other green spaces*

Matter and Energy

Objectives--Elementary	Related concepts, terms, and tools	Real-world contexts
1) Classify common objects and substances according to observable attributes: color, size, shape, smell, hardness, texture, flexibility, length, weight, buoyancy, states of matter, magnetic properties.	Words describing: Texture: *rough, smooth* Flexibility: *rigid, stiff, firm, flexible, strong* Smell: *pleasant, unpleasant* States of matter: *solid, liquid, gas* Magnetic properties: *attract, repel, push, pull* Size: *large, small, larger, smaller* Buoyancy: *sink, float* Color: *common color words* Shape: *circle, square, triangle, rectangle, oval* Weight: *heavy, light, heavier, lighter*	Common objects, such as *desks, coins, pencils, buildings, snowflakes, etc.* Common substances, including: Solids, such as *copper, iron, wood, plastic, Styrofoam, etc.* Liquids, such as *water, alcohol, milk, juice, gasoline, etc.* Gases, such as *air, helium, water vapor, etc.*
2) Measure weight, dimensions, and temperature of appropriate objects and materials.	Words describing linear dimensions: *length, width, height, long, short, wide, narrow, tall, short, taller, shorter, etc.* Units of measure (both standard and non-standard): *meters, centimeters, others* Measurement tools: *ruler, meter stick, balance or scale, thermometer*	Common objects such as those listed above
3) Identify properties of materials which make them useful.	Useful properties: *unbreakable, waterproof, light, conducts electricity, conducts heat, attracted to a magnet*	Appropriate selection of materials for a particular use, such as *waterproof raincoat, cotton or wool for clothing, glass for windows, metal pan to conduct heat, copper wire to conduct electricity*
4) Identify forms of energy associated with common phenomena.	*Energy, work, heat, sound, food energy, energy of motion, electrical*	Appropriate selection of energy and phenomena, such as *appliances like a toaster or iron that use electricity, sun's heat to melt chocolate, water wheels, wind-up toys, warmth of sun on skin, windmills, music from guitar*
5) Describe the interaction of magnetic materials with other magnetic and non-magnetic materials.	*Magnetic/non-magnetic, magnetic poles, magnetic attraction and repulsion* Tools: *magnetic compass*	Common magnets, using a magnetic compass to find direction

6) Describe the interaction of electrically charged material with other charged or uncharged material.	*Charging by rubbing or touching, electric attraction and repulsion*	Static cling, lightning, sparks
7) Describe possible electrical shock hazards to be avoided at home and at school.	*Shock, wall outlet, hazards*	Electric outlets, power lines, frayed electric cords, electric appliances, lightning

Changes in Matter

Objectives--Elementary School	Related concepts, terms, and tools	Real-world contexts
1) Describe common physical changes in matter (size, shape, melting, freezing, dissolving).	States of matter: *solid, liquid, gas* Changes in size and shape: *bending, tearing, breaking* Changes in state of matter: *melting, freezing* *Dissolving, invisible* *heat source*	Changes in size or shape of familiar objects, such as *making snowballs, breaking glass, crumbling cookies, making clay models, carving wood, breaking bones* Changes in state of water or other substances, such as *freezing of ice cream, or ponds, melting wax or steel*
2) Prepare mixtures and separate them into their component parts.	*Mixture, solution* Separation techniques: *filtration, using sieves, dissolving soluble substances, magnets, floating vs. sinking, distillation* Tools: *filter paper, funnels, magnets, sieves, beakers, solar stills*	Mixtures of various kinds: salt *and pepper, iron filings and sand, sand and sugar, rocks and wood chips, sand and gravel, etc.*
3) Construct simple objects that fulfill a technological purpose.	Materials: *rubber bands, paper, corks, scrap wood*	*Simple bridges, boats planes, ramps that can be made from common materials*

Motion of Objects

Objectives--Elementary	Relevant concepts, terms, and tools	Real-world contexts
1) Describe or compare motions of common objects in terms of speed and direction.	Direction words: *east, west, north, south, right, left* Speed words: *fast, slow, faster, slower*	Motions of familiar objects in two dimensions, including *rolling or thrown balls, wheeled vehicles, sliding objects*
2) Describe how forces (pushes or pulls) speed up, slow down, stop, or change the direction of a moving object.	Words describing changes in motion: *speeding up slowing down, turning* Words describing common forces: *push, pull, friction, gravity*	*Playing ball, moving chairs, sliding objects*
3) Use simple machines to make work easier.	*Inclined planes, levers, pulleys, gears, wheel and axles, screws, wedges*	*Block and tackles, ramps, screwdrivers, can openers*

Waves and Vibrations

Objectives--Elementary	Related concepts, terms, and tools	Real-world contexts
1) Describe sounds in terms of their properties (pitch, loudness).	Pitch: *high, low* Loudness: *loud, soft*	Sound from common sources, such as *musical instruments, radio, television, animal sounds, thunder, human voices*
2) Explain how sounds are made.	*Vibrations: fast, slow, large, small*	Sounds from common sources: see above
3) Describe light from a light source in terms of its properties.	Brightness: *bright, dim* Color of light: *red, orange, yellow, green, blue, violet*	Light from common sources, such as *sun, stars, light bulb, colored lights, firefly, candle, flashlight*
4) Explain how light illuminates objects.	*Light source, illumination, path of light*	Objects illuminated by light from common sources
5) Explain how shadows are made.	*Shadow, blocked path*	Shadows made by putting objects in the path of light from common sources, including *sunlight, light bulbs, projectors*

Geosphere

Objectives--Elementary	Related concepts, terms, and tools	Real-world contexts
1) Describe sounds in terms of their properties (pitch, loudness).	Pitch: *high, low* Loudness: *loud, soft*	Sound from common sources, such as *musical instruments, radio, television, animal sounds, thunder, human voices*
2) Explain how sounds are made.	*Vibrations: fast, slow, large, small*	Sounds from common sources: see above
3) Describe light from a light source in terms of its properties.	Brightness: *bright, dim* Color of light: *red, orange, yellow, green, blue, violet*	Light from common sources, such as *sun, stars, light bulb, colored lights, firefly, candle, flashlight*
4) Explain how light illuminates objects.	*Light source, illumination, path of light*	Objects illuminated by light from common sources
5) Explain how shadows are made.	*Shadow, blocked path*	Shadows made by putting objects in the path of light from common sources, including *sunlight, light bulbs, projectors*

Hydrosphere

Objectives--Elementary	Related concepts, terms, and tools	Real-world contexts
1) Describe sounds in terms of their properties (pitch, loudness).	Pitch: *high, low* Loudness: *loud, soft*	Sound from common sources, such as *musical instruments, radio, television, animal sounds, thunder, human voices*
2) Explain how sounds are made.	*Vibrations: fast, slow, large, small*	Sounds from common sources: see above
3) Describe light from a light source in terms of its properties.	Brightness: *bright, dim* Color of light: *red, orange, yellow, green, blue, violet*	Light from common sources, such as *sun, stars, light bulb, colored lights, firefly, candle, flashlight*
4) Explain how light illuminates objects.	*Light source, illumination, path of light*	Objects illuminated by light from common sources
5) Explain how shadows are made.	*Shadow, blocked path*	Shadows made by putting objects in the path of light from common sources, including *sunlight, light bulbs, projectors*

Atmosphere and Weather

Objectives--Elementary	Related concepts, terms, and tools	Real-world contexts
1) Describe the atmosphere.	*Air as a substance* *Clouds, dew* Also see Hydrosphere objective 1, Solar System objective 1	Daily atmospheric conditions Examples of using air to do work, including *balloons, fans*
2) Describe weather conditions and climates.	Temperature: *cold, hot, warm, cool* Cloud cover: *cloudy, fog, partly cloudy* Precipitation: *rain, snow, hail* Wind: *breezy, windy, calm* Severe weather: *thunderstorms, lightning, tornadoes, high winds, blizzards* Climates: *desert (hot & dry), continental (seasonal changes), tropical (hot and humid), polar* Tools: *thermometer, wind sock*	Daily changes in weather Examples of severe weather Examples of climates, including *desert, mountain, polar, temperate*
3) Describe seasonal changes in weather.	Seasons: *fall, winter, spring, summer*	Examples of visible seasonal changes in nature
4) Explain appropriate safety precautions during severe weather.	Safety precautions: *safe locations, sirens, radio broadcasts, severe weather watch and warning*	Examples of local severe weather, including *thunderstorms and tornadoes, that change with the seasons* Examples of local community safety precautions, including *weather bulletins and tornado sirens*

Solar System, Galaxy, and Universe

Objectives--Elementary School	Related concepts, terms, and tools	Real-world contexts
1) Compare and contrast the sun, moon, and earth.	*Planet, star, sphere, space, solar system, larger/smaller, closer/farther, heat, light*	Photos and videos from space of the sun, earth, moon, other planets
2) Describe the motions of the earth and moon around the sun.	*Perceived movement of the sun across the sky, orbit, month, year, day, night, spin, calendar*	Models or diagrams of the positions and relative distances between the sun, earth, moon Models showing the motions of the earth and moon Outdoor observing of the sun's motion

MEGOSE

For

Grades 5-8

Middle School Objections from the Michigan Essential Goals and Objectives for Science Education (MEGOSE)

Constructing Scientific Knowledge

Objectives--Middle School	Related concepts, terms, and tools	Real-world contexts
7) Generate scientific questions about the world, based on observation.	Appropriate scientific concepts, terms, and tools: See Using Scientific Knowledge	Appropriate scientific contexts: See Using Scientific Knowledge
8) Design and conduct simple investigations.	Words describing the process of scientific investigations: *test, fair test, hypothesis, data, conclusion* Forms for recording and reporting data: *tables, graphs, journals*	Appropriate scientific contexts: See Using Scientific Knowledge
9) Investigate toys/simple appliances and explain how they work using instructions and appropriate safety precautions.	Safety precautions for using electrical appliances. Documentation for toys and appliances: *diagrams, written instructions*	Situations requiring assembly, use, or repair of toys, radios, or simple appliances (such as replacing batteries) Connecting electrical appliances, such as stereos, videocassette recorders
10) Use measurement devices to provide consistency in an investigation.	Documentation: *laboratory instructions* Measurement units: *milliliters, liters, teaspoon, tablespoon, ounce, cup, millimeter, centimeter, meter, gram, non-standard units* Measurement tools: *balancing devices, measuring cups and spoons, measuring tape*	Cooking for groups of various sizes Following or altering laboratory instructions for mixing chemicals
11) Use sources of information to help solve problems.	Tools: Forms for presenting scientific information, such as *figures, tables, graphs*	Libraries, projects where research is needed
12) Write and follow procedures in the form of step-by-step instructions, recipes, formulas, flow diagrams, and sketches.	Terms: *purpose, procedure, observation, conclusion*	Following a recipe Listing or creating the directions for completing a task

Reflecting Scientific Knowledge

Objectives--Middle School	Related concepts, terms, and tools	Real-world contexts
6) Evaluate the strengths and weaknesses of claims, arguments, or data.	Aspects of arguments such as *data, evidence, sampling, alternate explanation, conclusion*	Deciding between alternate explanations or plans for solving problems Evaluating advertising claims or cases made by interest groups
7) Describe limitations in personal knowledge.	Recognizing degrees of confidence in ideas or knowledge from different sources	Appropriate scientific contexts: See Using Scientific Knowledge
8) Show how common themes of science, mathematics, and technology apply in selected real world contexts.	Thematic ideas: *systems-subsystems, feedback models, mathematical constancy, scale, conservation, structure, function, adaptation* (Also see Appendix B)	Appropriate scientific contexts: See Using Scientific Knowledge
9) Describe the benefits and risks of new technologies or patterns of human activity.	*Risk, benefit, side effect, advantage, disadvantage*	Technological systems for manufacturing, transportation, energy distribution, housing
10) Recognize the contributions made in science by cultures and individuals of diverse backgrounds.	Scientific contributions made by people of diverse cultures and backgrounds. (See Appendix A)	Appropriate scientific content See Using Scientific Knowledge

Cells

Objectives--Middle School	Related concepts, terms, and tools	Real-world contexts
2) Describe similarities/differences between single-celled and multicellular organisms.	Words describing differences: *single-celled, multicellular, cell specialization* Cell structures: *nucleus, cytoplasm, cell wall, cell membrane* Observation tools: *hand lens, microscope*	Common examples of protists: *Amoeba*, *Paramecium* Common examples of specialized cells of multicellular organisms: *leaf cells, root cells, stem cells, blood cells, muscle cells, nerve cells*
3) Explain why specialized cells are needed by plants and animals.	Specialized functions of cells: r*eproduction, photosynthesis, transport*	Specialized animal cells: *red blood cells, white blood cells, muscle cells, nerve cells,* Specialized plant cells: *root cells, leaf cells, stem cells*
4) Explain how cells use food as a source of energy.	Words that describe how cells use food: *food, molecule, respiration, oxygen, carbon dioxide, water*	Experiments/demonstrations showing reactants/products of respiration and photosynthesis

Organization of Living Things

Objectives--Middle School	Related concepts, terms, and tools	Real-world contexts
6) Compare and classify organisms into major groups on the basis of their structure.	Characteristics used for classification: *vertebrates/ invertebrates, cold-blooded/ warm-blooded, single-cell/multicellular, flowering/ non-flowering*	Representative organisms, such as *dog, worm, snake, Amoeba, geranium, wheat*
7) Describe the life cycle of a flowering plant.	Flowering plant parts and processes: See objective 5 above, plus *embryo, pollen, ovary, egg cell, germination, fertilization*	Common flowering plant, such as *bean, tulip*
8) Describe evidence that plants make and store food.	Process and products of food production: *photosynthesis, starch, sugar, oxygen*	Plant food storage organs, such as *potato, onion* Starch storage in plants grown under different conditions Also see Cells objective 9
9) Explain how selected systems and processes work together in animals and plants.	Systems/Processes: *digestion, circulation, respiration, endocrine, reproduction, skeletal, muscular, nervous, excretion, transport, growth, repair*	Interrelations of body systems during selected activities, such as *between skeletal , muscular, circulatory, and respiratory systems during physical exercise*

Heredity

Objectives--Middle School	Related concepts, terms, and tools	Real-world contexts
2) Describe how the characteristics of living things are passed on through generations.	Words identifying reproductive cells: *egg, sperm* Cell parts: *nucleus, gene*	Common traits controlled by a single gene pair, such as *wrinkled or smooth seeds in a pea plant, color of horse hair*
3) Describe how heredity and environment may influence/determine characteristics of an organism.	Words describing traits: *inherited, acquired*	Data on heredity, such as *identical twin studies, effects of introduced toxins, effects of natural selection, effects of controlled selection and breeding*

Evolution

Objectives--Middle School	Related concepts, terms, and tools	Real-world contexts
3) Describe how biologists might trace possible evolutionary relationships among present and past life forms.	Terms related to selected evidence of common ancestry: *geologic time, fossil, bone, embryo, limb*	A-V media, models of fossils that show *evidence of common ancestry,* such as *similarity of vertebrate limb bones, similarity of early vertebrate embryos, similarity of fossil bones to those of contemporary animals (i.e. horse legs)*

Ecosystems

Objectives--Middle School	Related concepts, terms, and tools	Real-world context
6) Describe common patterns of relationships among populations.	Words describing participants and relationships: *predator, prey, parasitism, competition, symbiosis*	Examples of *predator-prey, symbiotic, and parasitic relationships:* See objectives 1 and 2 above Examples of *competitive relationships*, including *squirrels and seed-eating birds, cattle and bison*
7) Predict the effects of changes in one population in a food web on other populations.	*Natural balance, population, dependence, survival*	Plants and animals in an ecosystem dependent upon each other for survival in selected ecosystems: See objective 3 above Comparison of animals and plants found in polluted vs. non-polluted water, urban vs. rural settings, rural vs. forest settings
8) Describe how all organisms in an ecosystem acquire energy directly or indirectly from sunlight.	*Sunlight, plants, food, photosynthesis, heat*	Selected food chains, including humans Also see Cells objectives related to photosynthesis
9) Describe the likely succession of a given ecosystem over time.	*Succession, stages, climax community*	Process of gradual change in ecological systems, such as *in ponds or abandoned farm fields*
10) Identify some common materials that cycle through the environment.	*Carbon cycle and water cycle: Water, carbon dioxide , oxygen, sugar (food)* Also see appropriate Cells and Atmosphere and Weather objectives	Selected ecosystems Also see objective 3 above

11) Describe ways in which humans alter the environment.	*Agriculture, land use, resource development, resource use, solid waste, toxic waste*	Human activities, such as *farming, pollution from manufacturing and other sources, hunting, habitat destruction, land development*
12) Explain how humans use and benefit from plant and animal materials.	Materials from plants, including: *wood, paper, cotton, linen, starch, rubber, wax, and oils* Materials from animals, including: *leather, wool, fur, protein, oils, wax*	Human made objects that incorporate plant and animal materials, including *clothing, building materials, machines, and medicines* Also see objectives 1, 8 and 11 above Also see appropriate Geosphere objectives

Matter and Energy

Objectives--Middle School	Related concepts, terms, and tools	Real-world contexts
8) Measure physical properties of objects or substances (mass, weight, temperature, dimensions, area, volume).	Units of measure: *kilogram, gram, liter, degrees Fahrenheit, degrees Celsius* Measurement tools: *balances, spring scales, measuring cups or graduated cylinders, thermometers, metric ruler*	Common substances such as those listed in objective 1 above Hot and cold substances, such as *ice, snow, cold water, hot water, steam, cold air, hot air, etc.*
9) Describe when length, mass, weight, area, or volume are appropriate to describe the size of an object or the amount of substance.	*Length, mass, weight, area, volume* *Array of measuring devices, metric ruler, graduated cylinders, balances, spring scale*	Common objects: see objective 1 above
10) Classify substances as elements, compounds, or mixtures.	*Element, compound, mixture*	Common substances such as those listed above, including: Elements, such as *copper, aluminum, sulfur, helium,iron* Compounds, such as *water, salt, sugar, carbon dioxide* Mixtures, such as *soil, salt and pepper, salt water*
11) Describe matter as consisting of extremely small particles (atoms) which bond together to form molecules.	*Molecule, particle, matter, bond, atom*	Common substances, such as those listed above
12) Describe the arrangement and motion of molecules in solids, liquids, and gases.	Words describing arrangement: *regular pattern, random* Words describing distance between molecules: *closely packed, separated* Words describing molecular motion: *vibrating, bumping together, moving freely*	Common solids, liquids and gases, such as those listed above

13) Describe energy and the many common forms it takes (mechanical, heat, light, sound, electrical, magnetic, chemical, nuclear).	Forms of energy: *mechanical, heat, sound, light, electrical, magnetic, chemical, nuclear, food energy*	Body heat, heating a home, using light to see, using sound to hear, eating food, using electricity for appliances, gasoline for cars, nuclear power
14) Describe how common forms of energy can be converted, one to another.	Forms of energy: See objective 13 above Conservation of energy Energy transformation	Motors, generators, power plants, lightbulbs, appliances, cars, walking, playing a musical instrument, cooking food
15) Describe electron flow in simple electrical circuits.	*Complete circuit, open circuit, closed circuit*	Household wiring, electrical conductivity testing, flashlight, electric appliances
16) Use electric currents to create magnetic fields.	*Electric current, magnetic poles, magnetic fields* Tools: *magnetic compass, battery, wire*	Electromagnets, bells, speakers, motors, magnetic switches, Earth's magnetic field

Changes in Matter

Objectives--Middle School	Related concepts, terms, and tools	Real-world contexts
4) Describe common physical changes in materials: evaporation, condensation, thermal expansion and contraction.	States of matter: *solid, liquid, gas* Changes in states of matter: *evaporation, condensation* Thermal expansion and contraction	Changes in state, such as *water evaporating as clothes dry, condensation on cold window panes* Expansion of bridges in hot weather
5) Describe common chemical changes in terms of properties of reactants and products.	Common chemical changes: *burning paper, rusting iron, formation of sugars during photosynthesis*	Chemical changes: *burning, photosynthesis, digestion, corrosion*
6) Distinguish between physical and chemical changes in natural and technological systems.	Changes in matter: *physical changes and chemical changes*	Natural physical and chemical changes: *water cycle, chewing, erosion, corrosion, photosynthesis, respiration* Technological physical and chemical changes: *dehydrated foods, solid air fresheners, recycling glass, burning fuels, manufacturing plastics*
7) Describe how waste products accumulating from natural and technological activities create pollution.	*Manufacturing, distribution, refining, mining, landfill, water treatment*	Many sources of pollution, both natural and technological

8) Explain physical changes in terms of the arrangement and motion of atoms and molecules.	Molecular descriptions of states of matter: see Matter and Energy objectives 11 and 12 above Physical changes: see objective 1 and 4 above Speed of molecular motion: *moving faster, slower, vibrate, rotate, unrestricted motion, conservation of matter*	See examples of Physical Changes of Matter, objective 1 and objective 6 above

Motions of Objects

Objectives--Middle School	Related concepts, terms, and tools	Real-world contexts
4) Qualitatively describe and compare motions in three dimensions.	Words that describe three-dimensional motion: *up, down, curved path*	Objects moving in three dimensions, such as *thrown balls, roller coasters, cars on hills, airplanes*
5) Relate changes in speed or direction to unbalanced forces in two dimensions.	Words describing changes in motion and common forces: see above Words that describe additional forces: *attraction, repulsion, balanced, unbalanced*	Changing the direction: *changing the direction of a billiard ball, bus turning a corner* Changing the speed: *car speeding up, a rolling ball slowing down* *Magnets, other common objects that are and are not attracted to magnets*
6) Describe the forces exerted by magnets, electrically charged objects, and gravity.	Words that describe electrical charges and magnetic poles: *north pole, south pole, positive charge, negative charge, weight, gravitational pull*	Electrically charged or polarized objects, such as *balloons rubbed on clothing, bits of paper, salt grains, magnets, magnetic materials, Earth's gravitational pull on objects*
7) Design strategies for moving objects by means of the application of forces, including the use of simple machines.	Types of simple machines: *lever, pulley, screw, inclined plane, wedge, wheel and axle*	Objects being moved by using simple machines, such as *wagons on inclined planes, heavy objects moved by levers, seesaw, cutting with knives or axes*

Waves and Vibrations

Objectives--Middle School	**Related concepts, terms, and tools**	**Real-world contexts**
6) Explain how sound travels through different media.	Media: *solids, liquids, gases*	Sounds traveling through solids, such as *glass windows, strings, the earth* Sound traveling through liquids, such as *dolphin and whale communication* Sound traveling through gases, such as *human hearing, sonic booms*
7) Explain how echoes occur and how they are used.	*Echo, sonar*	Echoes in rooms (acoustics) and outdoors Practical uses of echoes, such as *navigation by bats and dolphins, ultrasound imaging, sonar*
8) Explain how light helps us to see.	*Light source, illumination, path of light, reflection, absorption* Parts of eye: *retina, vitreous humor, lens, cornea, pupil, iris, optic nerve*	Seeing common objects in our environment Seeing "through" transparent media, such as *windows, water*
9) Explain how objects or media reflect, refract, transmit, or absorb light.	*Reflection, refraction, absorption, transmission, scattering (or diffusion), medium* Transmission of light: *transparent, translucent, opaque* Refraction of light: *lenses, prisms*	Objects that reflect or absorb light, with and without scattering, such as *ordinary light and dark colored metals, mirrors* Media that transmit light with and without scattering, such as *clear and frosted glass, clear and cloudy water, clear and smoky air* Uses of lenses, such as *eye, cameras, telescope, microscope, magnifying lens*
10) Describe the motion of pendulums or vibrating objects (frequency, amplitude).	*Period, frequency, amplitude*	Vibrating or oscillating objects, such as *pendulums, weights on springs, vocal cords, tuning forks, guitar strings*
11) Explain how waves transmit energy.	*Types and forms of energy, longitudinal, transverse, emission, absorption, transmission, reflection*	Reflecting and non-reflecting objects such as *mirrors, black cloth, waves in slinkies and long springs, water waves*

Geosphere

Objectives--Middle School	Related concepts, terms and tools	Real-world contexts
7) Describe and identify surface features using maps.	Types of maps: *relief, topographic, elevation* Landforms: *plains, deserts, plateaus, basin, Great Lakes, rivers, continental divide, mountains, mountain range, or mountain chain*	Maps showing regional surface features, such as *the Great Lakes or local topography*
8) Explain how rocks and minerals are formed.	Processes of forming rocks: *melting, cooling, heat, pressure, sediments* *Heat source is interior of earth* See Solar System Objective 6 Materials: *soil, sand, rock, lava, shells, dead organisms*	Physical environments where rocks are being formed, such as *volcanoes (by cooling), ocean floor (by deposition), deltas, beaches, swamps*
9) Explain how rocks and fossils are used to determine the age and geological history of the earth.	*Time lines, rock layers, fossils, relative dating* See Waves and Vibrations objective 15	Places where rock layers are visible Fossils, such as *Petosky stones*
10) Explain how rocks are broken down, how soil is formed, and how surface features change.	Forces: *gravity, pressure* Erosion by: *glaciers, waves, wind, streams, weathering, plant roots* Decomposition by: *bacteria, fungi, worms, rodents, other animals* See Ecosystems objective 10	Local areas where erosion by wind, water, or glaciers may have occurred, such as *along the shoulder of roads, under downspouts* Chemical weathering from road salt; formation of caverns Physical weathering, such as *potholes and cracks in sidewalks from frozen water*
11) Explain how technology changes the surface of the earth.	Types of human activities: *surface mining, construction and urban development, farming, dams, landfills restoring marsh lands, reclaiming spoiled land*	Local examples of surface changes due to human activities listed in column 2 Local examples of negative consequences of these changes, such as *groundwater pollution, destruction of habitat and scenic land, reduction of arable land*

Hydrosphere

Objectives--Middle School	Related concepts, terms, and tools	Real-world contexts
5) Describe various forms that water takes on the earth's surface and conditions under which they exist.	Liquid water forms: *lakes, rivers, oceans, springs* Frozen water forms: *continental glacier, valley glacier, snow on mountains, polar cap* Gaseous water in atmosphere *Climate changes, ice ages* Also see Atmosphere and Weather objectives 5 and 7	Local lakes, rivers, streams, ponds, springs Examples of frozen water, including *snow, glaciers, ice bergs, polar regions, frozen Great Lakes shorelines*
6) Describe how rainwater in Michigan reaches the oceans.	Water path: *run-off, creeks, streams, wetlands, rivers, Great Lakes* See objectives 2 and 3 above, and Atmosphere and Weather objective 7 Motion of water: *currents, waves, tides* *Temperature, thermal layering* Ocean composition: *saltiness*	Maps showing streams, lakes, rivers, oceans Examples of motions of rivers and lakes Investigations of rivers and lake temperatures
7) Describe the origins of pollution in the hydrosphere.	Sources of pollution: *sewage, household dumping, industrial wastes* *Limits to natural resources* Also see Geosphere objective 6 and Atmosphere and Weather objective 8	Examples of polluted water Examples of occasions when water supply is restricted, such as during droughts

Atmosphere and Weather

Objectives--Middle School	Related concepts, terms, and tools	Real-world contexts
5) Describe the composition and characteristics of the atmosphere.	Atmosphere: *air, molecules, gas, water vapor, humidity, dust particles, air pressure* *Temperature changes with altitude* Also see Hydrosphere objective 5	Examples of characteristics of the atmosphere, including *steam, pressurized cabins in airplanes, demonstrations of air pressure* Examples of air-borne particulates, such as *smoke, dust, pollen, bacteria*
6) Describe patterns of changing weather and how they are measured.	Weather patterns: *cold front, warm front, air mass* Tools: *thermometer, rain gauge, wind direction indicator, weather maps, satellite weather images*	Sudden temperature and cloud formation changes Records, charts, and graphs of weather changes over periods of days

7) Explain the water cycle and its relationship to weather patterns.	Water cycle: *evaporation, condensation, cooling, clouds, run-off* Precipitation: *rain, snow, hail, fog, humidity, droughts* Also see Changes in Matter objectives 1 and 2, Ecosystems objective 10	Aspects of the water cycle in weather, including *clouds, precipitation, evaporating puddles*
8) Describe health effects of polluted air.	Effects: *breathing difficulties, irritated eyes* Sources: *car exhaust, industrial emissions* See Reflecting on Scientific Knowledge objective 6	Locations and times where air quality is poor Local sources of potential air pollution

Solar System, Galaxy, and Universe

Objectives--Middle School	Related concepts, terms, and tools	Real-world contexts
3) Compare the earth to other planets in terms of supporting life.	Comparisons: *relative distances, relative sizes, atmospheres, heat, temperature of planets* Compositions: *rocky, solid, gases, frozen gases* Sun produces the light and heat that falls on each planet Molecules necessary to support life: see Cells and Living Things objectives	Examples of local and extreme outdoor conditions on earth vs. conditions on other planets Situations where a heat source warms an object at varying distances from it
4) Describe, compare, and explain the motions of planets, moons, and comets in the solar system.	*Orbit, year, spin, axis, gravity, moons, rings, comets* Also see Motion of Objects objectives	Maps showing the motions of the planets, comets, moon and its phases
5) Describe and explain common observations of the day and night skies.	*Perceived and actual movement of the moon across sky, moon phases, stars and constellations, planets, Milky Way, comet tail*	Outdoor observing of the skies, using telescopes and binoculars, as well as "naked-eye" viewing Telescopic and spacecraft-based photos of planets, moons, and comets News reports of planetary and lunar exploration
6) Explain how the solar system formed.	*Clouds of gases and dust, gravity, spinning, heavy and light elements, hot interiors of earth-like planets* Relative ages of the universe and solar system Tools: *telescopes, binoculars* Also see Geosphere objective 13	Telescope observing and photos of star-forming regions Drawings and narratives about star explosions and star formation Accounts of searches for other planets around neighboring stars

Importance of Vocabulary Words

Building a strong vocabulary takes time and effort. Vocabulary is developed through a variety of experiences including reading and writing in all the different curricular areas. Students need many different opportunities for meaningful practice of both technical and specialized vocabulary that they encounter in each of the disciplines taught in school. In order to help expand vocabulary skills, different methods should be applied. True understanding of words should be more than just memorizing definitions. The students must also acquire the ability to use words in meaningful, well-constructed sentences.

The following pages include the MEAP vocabulary for grades K-8. The words are grouped by grade level, as well as by content area. Following the vocabulary words are a series of activities that can be used for instructional purposes in the classroom.

MEAP

Vocabulary for

Grades K-5

MEAP VOCABULARY K-5

Constructing Scientific Knowledge

levers	wheel and axles
pulleys	inclined plane
gears	screws
wedges	milliliters
teaspoon	tablespoon
ounce	cup
millimeter	centimeter
meter	measuring cups and spoons
measuring tape	balance and scale
increase	decrease
steady	graph paper

Reflecting on Scientific Knowledge

data	evidence
sample	guess
opinion	use of poetry
expository work	use of painting
drawing	use of music
diagrams	graphs
charts	balance of nature
effects	

Cells

life functions	growth
development	reproduction
response to environment	movement
all things made of cells	elodea cells
onion skin cells	cheek cells
paramecium	

Living Things

backbone	skin
shell	limbs
roots	leaves
stems	flowers
fur	scales
feathers	horns
claws	beaks
teeth	skeleton
muscles	cells
egg	young
adult	seed
food	air
water	minerals
sunlight	space
habitat	fruits

Heredity

parent	young
hair color	eye color
skin color	leaf shape
leaf shape	characteristics
traits	

Evolution

evidence	fossil
extinct	ancient
modern life forms	characteristics
physical characteristics	behavioral characteristics
adaptation to changes in habitat	fitness
instinct	learning
habit	traits
camouflage	migration

Ecosystems

food chain	food web
interdependence	symbiosis
parasitism	ecosystems
producer	consumer
habitat	food
light	predator
prey	decomposer
requirements of living things	green space
minerals	shelter
air	water
land management	reforestation
waste water treatment	

Changes in Matter

physical change	changes of states of matter
states of matter	solid
liquid	gas
bending	tearing
breaking	melting
freezing	dissolving
invisible	heat source
mixture	solution
filtration	using sieves
magnets	dissolving soluble substances
floating and sinking	distillation
filter paper	funnels
solar still	beakers

Matter and Energy

attributes	texture
rough	smooth
flexibility	rigid
stiff	firm
flexible	strong
smell	pleasant
unpleasant	solid
liquid	gas
magnetic properties	attract
repel	push
pull	size
large	small
larger	smaller
buoyancy	sink
float	color
shape	weight
linear dimensions	length
width	height
long	narrow
tall	short
units of measure	meters
centimeter	ruler
thermometer	meter stick
balance	scale
property	unbreakable
waterproof	conducts electricity
conducts heat	attracts magnet
energy	food energy
magnetic poles	work
energy of motion	magnetic/non magnetic
heat energy	electrical energy
sound energy	magnetic attraction
magnetic repulsion	

Motions of Objects

speed	direction
east	west
north	south
up	down
right	left
fast	slow
faster	slower
forces	push
pull	speeding up
slowing down	turning
friction	gravity
simple machines and work	inclined plane
lever	pulleys
gears	wheel and axle
screws	wedges
block and tackle	ramps

Waves and Vibrations

sound	pitch
high pitch	low pitch
loudness	vibrations
fast vibrations	slow vibrations
large vibrations	small vibrations
light	brightness
color of light	light source
illumination	path of light
shadow	blocked path

Geosphere

rivers	mountains
deserts	plains
valleys	oceans
hills	earth materials
sand	clay
silt	soil
rocks	minerals
molten rock	river beds
ores	fossils
extinct animals	dinosaurs
age of fossils	rock layers
volcanoes	earthquakes
erosion	rivers
cracks	results of erosion
uses of materials	oil to gasoline
sand into glass	ores into metal
gravel to concrete	coal to electricity
uranium to nuclear power	recycling of paper
recycling of glass	recycling of plastic
reduce, reuse, recycle	

Hydrosphere

three states of water	liquid
visible	flowing
melting	dew
steam	solid
hard	ice
freezing	gas
invisible	evaporation
water vapor	clouds
path of rainwater	precipitation
rain	fog
run-off	flow downhill
flow to oceans	underground water
bodies of water	streams
rivers	lakes

oceans	sources of drinking water
wells	springs
Great Lakes	uses of water
food preparation	generation of electricity
recreation	irrigation

Atmosphere and Weather

atmosphere	air as a substance
clouds	dew
weather conditions	climate
temperature	cold
hot	cool
cloud cover	cloudy
fog	partly cloudy
precipitation	rain
snow	hail
sleet	winds
breezy	windy
calm	severe weather
thunderstorm	lightning
tornadoes	high winds
blizzard	desert climate
continental climate	tropical climate
polar climate	thermometer
wind sock	wind vane
seasons: summer, fall, winter, spring	safety precautions in severe weather
severe weather watch	severe weather warning

Solar System, Galaxy, and Universe

sun	moon
earth	planet
star	sphere
space	solar system
heat	light
closer/farther	motion
larger/smaller	perceived motion of sun
orbit	month
year	day
night	spin
calendar	

MEAP

Vocabulary for

Grades 5-8

Science MEAP Vocabulary Grades 5-8

Constructing and Reflecting

test	fair test
hypothesis	data
conclusion	tables
graphs	journals
diagrams	written instructions
laboratory instructions	milliliters
liters	teaspoon
tablespoon	ounce
cup	millimeter
centimeter	meter
gram	non-standard units
balancing devices	measuring cups
measuring spoons	measuring tape
figures	tables
graphs	purpose
procedure	conclusion
observation	evidence
sampling	alternate explanation
system-subsystem	feedback models
mathematical constancy	scale
conservation	structure
function	adaptation
risk	benefit
side effect	advantage/disadvantage

Cells

single-celled	multi-celled
cell specialization	cytoplasm
cell wall	cell membrane
hand lens	microscope
reproduction	photosynthesis
transport	food
molecule	respiration
oxygen	carbon dioxide
water	

Living Things

vertebrates	invertebrates
cold-blooded	warm-blooded
single-celled	multi-celled
flowering	non-flowering
embryo	pollen
ovary	egg cell
germination	fertilization
digestion	circulation
respiration	endocrine
skeletal	muscular
nervous	excretion
transport	growth
repair	

Heredity

egg cell	sperm
nucleus	gene
inherited	acquired

Evolution

geological time	fossil
bone	embryo
limb	

Ecosystems

predator	prey
parasitism	competition
symbiosis	natural balance
population	dependence
survival	sunlight
plants	toxic waste
heat	succession
stages	climax community
carbon cycle	water cycle
carbon dioxide	sugar (food)
land use	resource development
resource use	solid waste

Using Scientific Knowledge to Understand Physical Science

Matter and Energy

kilogram	gram
degrees Fahrenheit	degrees Celsius
spring scales	graduated cylinder
thermometers	length
mass	weight
area	volume
element	compound
mixture	particle
matter	bond
atom	energy
complete circuit	open circuit
closed circuit	electric current
magnetic poles	magnetic fields
magnetic compass	battery
wire	

Changes in Matter

solid	liquid
gas	evaporation
condensation	thermal expansion
contraction	chemical changes
burning paper	rusting iron
sugar formation – photosynthesis	physical changes
regular pattern	manufacturing
distribution	refining
landfill	water treatment
closely packed	separated
speed of molecular motion	vibrate
rotate	bumping together
moving freely	mechanical
heat	sound
light	electrical
magnetic	nuclear
food	chemical energy

Motion of Objects

up, down, curved path	attraction
repulsion	balanced
unbalanced	north pole
south pole	positive charge
negative charge	gravitational pull
lever	pulley
screw	inclined plane
wedge	wheel
axle	

Waves and Motion

echo	sonar
light source	illumination
path of light	reflection
absorption	retina
vitreous humor	lens
cornea	pupil
iris	optic nerve
reflection	refraction
transmission	scattering or diffusion
transparent	translucent
opaque	refraction of light
lenses	prisms
period	frequency
amplitude	longitudinal
transverse	emission

Understanding Scientific Knowledge to Understand Earth and Space Science

Geosphere

types of maps	relief
topographic	elevation
landforms	plains
deserts	plateaus
basins	Great Lakes
rivers	continental divide
mountains	mountain range
mountain chain	process of forming rocks
melting cooling	heat
pressure	sediments
soil	sand
rock	lava
shells	dead organism
time lines	rock layers
fossils	relative dating
gravity	erosion
glaciers	waves
streams	weathering
plant roots	decomposition
bacteria	fungi
worms	rodents
human activities	surface mining
construction	urban development
farming	dams
landfills	restoring marsh lands
reclaiming spoiled land	

Hydrosphere

water	lakes
rivers	oceans
springs	continental glacier
valley glacier	snow on mountains
polar cap	climate changes
ice ages	creeks
wetlands	currents
waves and tides	temperature
thermal layering	ocean composition
saltiness	sewage
household dumping	industrial wastes
limits to natural resources	

Atmosphere and Weather

air	molecules
gas	water vapor
humidity	dust
particles	air pressure
temperature changes with altitude	weather patterns
cold front	warm front
air mass	thermometer
rain gauge	wind direction indicator
weather maps	satellite weather images
clouds	run-off
precipitation	raining
hail	fog
humidity	drought
effects on human health	breathing difficulties
irritated eyes	car exhaust
industrial emissions	

Solar system and the Universe

relative distances	relative sizes
atmosphere	heat
temperature of planets	composition of planets
rocky	solid
gases	frozen
orbit	year
spin	axis
gravity	moons
rings	comets
phases of the moon	stars
constellations	planets
milky way	comet tail
clouds of gases and dust	heavy interiors of planets
age of universe	age of solar system
formation of solar system	telescope
binoculars	

Flash Cards

Incorporating flash cards into a lesson can be very beneficial as reference for class discussions, for spelling, meanings of words, and writing sentences that are contextually meaningful. Many different types of word games can be developed with the use of these cards and they can be used in a variety of ways throughout the entire school year. Create a “word wall” for displaying the flash cards to be used as reinforcement and reference during class assignments or alphabetically file them in a 3 X 5 box for future use.

Flash card games are an excellent way to learn vocabulary and have fun at the same time. As students have the opportunity to work with their cards they will begin to enjoy memory work. Whether the games are as simple as Tic Tac Toe, Bingo, Charades, or Pictionary, they create a positive and exciting learning environment for all students.

These suggestions should be helpful in placing memorization into long-term memory. Teachers often have difficulty teaching at this "low knowledge" level because they see themselves as working with students at "higher levels." Besides gaming, another simple way to promote the learning of simple facts is through a series of enjoyable memory work. For example:

- Give students a pretest on terms.
- Have each student make a flash card, for each term missed.
- Student's pair up with another student to practice and help each other to learn their flash cards. It is recommended that they pair up with three other students.
- Another practice test is given.
- Scores are recorded to show improvement.
- Students now work with the words that they have missed.
- Student's pair up with another student to practice and help each other to learn their flash cards. It is recommended that they pair up with three other students.
- The final test is given.
- Students are then encouraged to write a short reflective piece on how they worked together, improved and how they can improve in the future.

Living Things backbone	Living Things skin
Living Things shell	Living Things limbs
Living Things roots	Living Things leaves
Living Things stems	Living Things flower

Living Things outer body covering of animal	Living Things vertebral column
Living Things body part of animal used for support, locomotion, grasping like arm, leg, or wing	Living Things hard outer covering of some animals like turtles, snails, and lobsters
Living Things food making part of plant	Living Things anchor plant, absorb water and nutrients, and store food
Living Things reproductive part of plant	Living Things support for plant and conducting water and minerals

Changes in Matter solid	Changes in Matter liquid
Changes in Matter gas	Changes in Matter evaporation
Changes in Matter condensation	Changes in Matter thermal expansion
Changes in Matter burning paper	Changes in Matter rusting iron

Changes in Matter form of matter that has a definite volume but takes the shape of its container	Changes in Matter form of matter with a definite shape and volume
Changes in Matter changes in state from liquid to gas	Changes in Matter form of matter with no definite shape or volume
Changes in Matter enlarge due to presence of heat	Changes in Matter change in state from gas to liquid
Changes in Matter reddish-brown coating on iron caused by exposure to moisture and oxygen; a chemical change	Changes in Matter new properties formed during burning; a chemical change

Rhythm Poetry - Water

A **quatrain** is a 4-line poem. Its rhyme scheme may be *aabb, abab, abcb, or abba*. If your rhyme scheme is *aabb*, this simply means that the last word in the first line and the last word in the second line will rhyme with each other (aa). The last word in the third line and the last word in the fourth line will also rhyme with each other (bb). Therefore, the lines that rhyme are always labeled with the same letters. Also, remember to begin the first word of each line with an upper case letter.

Example: ***Water, water, water, we use it everyday***
In the water cycle it is found in different ways
Maybe as a solid, or a liquid, or a gas
If we use it wisely, then the longer it will last!

You and your partner will write two quatrain poems. To help you write your poetry we will **"brainstorm"** (share) some **"water words"** (any words about water you already know or you learned today) as a group. Everyone will write down the "water words" we brainstormed in column 1 on their Brainstorming Data Sheet. Then you will use the "Riddle, Rhythm, and Rhyme" dictionary to find words that rhyme with your "water words" and list those in Column 2. With your partner, you will **compose** (write) a rhythm poem using the "water words" and rhyming words on the Brainstorming Data Sheet. You can use any rhyme scheme. Have fun, work together, and be creative!

Poem #1 Title: _____

Line 1 _____
Line 2 _____
Line 3 _____
Line 4 _____

Poem #2 Title: _____
Line 1 _____
Line 2 _____
Line 3 _____
Line 4 _____

Water Words

Clean
Dirty
Ice
Waste
Water cycle
Cooking
Bathing
Drink
Solid
Liquid
Gas
Water Vapor
Rivers
Oceans
Lakes
Polluted
Pollution
Pollute
Leaky Faucets
Use Wisely
Conserve
Hot
Cold
Sewer
Ground Water
Well Water
Solvent
Clean
Wash
Clear
Murky
Green
Pure
Distilled
Rain
Hard Water
Soft Water
Runoff
Swampy
H2O
Fish
Wildlife
Contaminate
Evaporate
Condensate
Precipitate

Brainstorming Data Sheet For "Water Words"

Column 1: Water Words	Column 2: Rhyming Words

Names_____ Hour_____
_____ Group #_____
_____
_____

Rhythm Poetry

Topic: _____

Poem #1 Rhyme Scheme _____
Title:_____
_____
_____
_____
_____

Poem #2 Rhyme Scheme _____
Title: _____
_____
_____
_____
_____

If you have time to write some more quatrains, do so on the backside of this paper. Circle the correct response for the question below.

*I wrote some more water rhythm poetry on the backside. Yes No

Water Poems

Help conserve our water supply, don't fill your bathtub very high
Repair your faucets if they leak, turn off the water when brushing your teeth

Septic leakage, pesticides, factory wastes, man-o-live
Protect our water in the ground or soon clean water won't be found

Dispose of chemicals properly, not down the sewer or out at sea
This is a problem we all must face to help preserve the human race

We find our water all around, it's on the surface and underground
Collects in oceans, rivers, and lakes the water cycle keeps it in place

Water, water we use it everyday, in the water cycle it is found in different ways
Maybe as a solid, a liquid, or a gas, if we use it wisely the longer it will last

Think about the ways that you use water everyday
You cook, you drink, you wash your clothes and then you bathe

Water, water, we use it everyday
Water, water, it is found in different ways
Water, water, solid, liquid, and a gas
Water, water, use it wisely it will last

Water, water, it keeps us all alive
Water, water, yes we need it to survive
Water, water, there's enough for you and me
Water, water, let's keep it pollution free

Water Rhythm Rap

(Chorus): Water,Water we use it everyday
Water, Water it is found in different ways
Water, Water solid, liquid, and a gas
Water, Water use it wisely it will last

Help conserve our precious water supply
Don't fill your bathtubs too very high
Repair your faucets if you find that they all leak
And always turn the water off when brushing your teeth

Septic leakage and toxic pesticides,
Dirty factory wastes, man-o-live
Protect our water when it's down in the ground
Or soon clean water just won't be found

(Repeat Chorus)

Dispose of all chemicals properly
Not just down the sewer or out at sea
This is a problem that we all must face
To help preserve the whole human race

Water collects in oceans, rivers, and in lakes
Helping keep the water cycle in its place
Think about the way that you use water everyday
You cook, you drink, you wash your clothes, and then you
bathe

(Repeat Chorus)

The Science MEAP Investigation

Each year, there is a science investigation that precedes the MEAP test. The purpose of the investigation is to encourage good "hands-on" science. Each year the investigation is different. The fifth grade investigation is a "cookbook" investigation and the eighth grade investigation is more "inquiry-based." The State of Michigan provides a teleconference in order to demonstrate the investigation and answer any questions that might exist.

Many good science teachers say that the investigation is not necessary because they are doing lots of investigations in the classroom. That is probably true, but it is still known that students throughout the State of Michigan are not doing enough "hands-on," so the investigation helps to promote this approach. If you are doing lots of investigations in your classroom then congratulations. If not, then try to do more.

The MEAP science materials arrive a month or so before the MEAP test. After completing the investigation, teachers keep the booklets that the students use and return them for use on the MEAP test. The MEAP test has one cluster pertaining to the investigation. It is composed of 4-5 multiple choice questions and one constructed response.

The fifth grade MEAP investigation uses the following format:

- *Our Question*--The question we are going to investigate is……
- *What I Already Know*--Here are some things I already know about the question……..
- *What I Think Will Happen*-My Hypothesis--I think……..
- *Materials That We Will Use*--This is provided for students
- *Procedures*--This is provided for students
- *My Observations*--This is a "sloppy copy" area
- *Data*--Students are to put their observations into tables, charts, and graphs
- *Summary of My Results*--The summary of my results……
- *My Answer to the Question*--My answer to the question is……
- *My Reasons for My Answer*--I think this is the answer because I observed…….
- *Some Possible Errors*--These are the things that might have caused errors in my investigation…….

The format for the eighth grade MEAP is as follows:

- *Question*--Provided by the teacher
- *Hypothesis*--Written by students either individually or in small groups
- *Materials*--Provided by the teacher
- *Procedure*--Designed by the students with some guidance by the teacher
- *Observations*--This data is done by the student in note form
- *Evidence*--Student puts the data into a graph, table or chart format
- *Conclusion*--Classroom discussion takes place and all data is considered before students write their conclusion
- *Reasons for Error*--Students analyze their work to see if any errors occurred or how errors could have impacted their results

Correlating the MEAP Investigation with the Science Explosion Investigations

We encourage you to use the Science Explosion Investigations with your students. The Science Explosion investigations emphasize a constructivist approach. They encourage questioning, researching, concluding, and application to real world situations. We would like you to do the investigations with students in your classroom.

If you do these investigations with fifth graders, please supply the directions for the materials and procedure, which are found on the teacher page. If you are doing them with eighth graders, they should be able to figure out the materials with a little help from you, but should be able to design the procedure on their own.

Text Critiques and Constructed Response Questions

When the "new MEAP test" was introduced in 1995, one of the "new" features was the text critique. The purpose of the text critique is to determine whether students can transfer knowledge from their classwork to a "real-world" selection of text. Text critique questions should take students beyond just reading comprehension. Students must be able to read the material, comprehend it, and apply it to a higher level of critical thinking.

In this book, we have provided you with examples of text and two constructed response style questions. We have also organized them to be used with a cooperative learning strategy called, "Working Together." To be successful, students should do the following steps:

- Read the text.
- Find the four or five most important pieces of information.
- Share their list with members of a cooperative group.
- As a group, agree on the most important pieces of information.
- Answer a constructed response style question, which is written to take students to higher levels of critical thinking.

As a teacher, a fundamental tool to use is Bloom's Taxonomy of Critical Thinking. In this model, there are six levels of critical thinking: knowledge, comprehension, application, analysis, synthesis and evaluation. The highest level of critical thinking is evaluation and the lowest is knowledge. It is important that students go through the lower levels as they move to the higher levels.

As teachers, it is important that we write questions that are more complex, not more difficult. Complexity deals with the thought processes of students. Difficulty deals with the amount of effort that needs to be used in order to demonstrate knowledge of the objective. For instance, it is more important for students to be able to assess the quality of their drinking water, rather than list all of the steps that are in involved in a water quality purification plant.

Here are some steps that students can use in order to write better answers to constructed response style questions. They should:

- Reread the question.
- Reread the text
- Restate the question in their answer
- Reflect back on their prior knowledge on the topic
- Clarify the task that needs to be done
- Answer the question

WHAT MAKES IT RAIN?

Strange as it may seem, the sun makes it rain. Water must first go up into the air before it can come down. It is warmth from the sun that lifts water.

The sun shines on the oceans, on lakes, and on rivers. Water vapor forms and spreads through the air.

Warm air can hold a great deal of water vapor. But cold air cannot hold so much. When warm, moist air cools, some of its water vapor turns to liquid. Little droplets form and make clouds. If the clouds are chilled, then rain may fall from them.

On a warm day, air often rises. While rising, it cools. Its water vapor turns into droplets. Puffy little clouds form. More and more air rises and cools. The clouds grow. Soon they cover the sky.

The drops of water in the clouds grow bigger, too. When they are too big to float in the air, down they come as rain. The big drops splatter against the ground.

The rain cools the air, and the air stops rising. No more water vapor comes into the clouds. So they stop growing. Soon the storm is over.

Constructed Response Questions

- Draw a picture to show what happens when it rains.

- Pretend you work for a newspaper. Interview a drop of water that has just fallen from the sky.

TINY TREES

Tall trees are a problem for electric utilities, which spend an estimated $1.5 billion annually to trim and spray plants near power lines. To save money and reduce herbicide use, utilities want to plant small trees along rights-of-way. The problem: many miniature varieties are vulnerable to insects, disease, and drought.

To breed trees that can withstand these stresses, utilities are sponsoring research at the Center for the Development of Hardy Landscape in Minneapolis. Top candidates include an ornamental pear and a maple that are attractive enough for residential areas.

Constructed Response Questions:

- Using the information in this article, compare and contrast miniature varieties of trees with tall varieties of trees.

- Imagine three ways that living things in the forest would be affected if all of the trees were miniature in size.

HOW DOES A CAST HELP BROKEN BONES?

A cast is a hard case or support that is put over a part of the body where a bone has been broken or joint dislocated, which means it was pushed out of position.

The cast keeps the broken or damaged body parts from moving around., so that they'll heal in exactly the right position. That speeds up healing and also lessens pain.

Before the cast is put in place, a soft material like a bandage is put on the spot to protect the skin form irritation.

Then the bandages are soaked with a wet material called plaster of paris—which people often use for craft projects. The plaster soaked bandages dry hard.

Newer casts are made of fiberglass. But sometimes they are hard to get on just right and they cost more.

Constructed Response Questions:

- Construct a list of three questions that a patient, with a broken bone, would ask a doctor before getting their cast.

- Defend a doctor's choice to use a plaster cast instead of a fiberglass cast.

OWLS – HUNTERS OF THE NIGHT

An owl has eyes in the front of its face, just like a person does. It is able to see more clearly than other birds that have eyes on the side of their heads. But, unlike a person, an owl cannot move its eyes. Instead, it has to move its head to track a moving object. That's not a problem though, because the owl's neck is so flexible that it can turn its head almost completely around!

An owl is able to fly silently as it hunts. Most birds have stiff feathers that make noise when they fly. An owl's feathers have soft, fringed edges, allowing it to fly silently as it flaps it wings through the air.

An owl has such a keen sense of hearing that it can hear a mouse 25 meters away. It can hear so well that it can hunt in total darkness just using the sense of sound. Other birds have small openings, but an owl has very large ear holes on the sides of its head.

An owl also has two facial discs – feathers that are arranged in a circle around its eyes. These discs direct sound towards the ears, allowing it to hear better.

Constructed Response Questions:

- Distinguish the traits that allow owls to be better hunters than other birds during the night.

- Imagine how your life would be different if your eyes could not move.

FEEDING TIME

Wild animals do not eat three meals a day. Birds and many small furry animals, such as squirrels, feed nearly all day long. Other animals, such as mountain lions and coyotes, eat only once in a while.

Some animals, such as snakes, do not get hungry often. They eat about once a week in warm weather and in cold weather even less. They feed on insects, worms, frogs, and mice.

No animal eats as many kinds of food as you do. Few like to eat both plant and animal food.

Some, such as the mountain lion, eat only meat. They have sharp teeth and claws for tearing their food.

Others eat only plants. Deer and sheep could not eat raw meat if they tried. They have hoofs and flat teeth. Flat teeth are good for grinding leaves.

Birds have no teeth at all. They swallow their food whole. Insects, too, get along without teeth.

Every animal must eat. Every animal has some way of getting food.

Constructed Response Questions:

- Draw three food chains included within this article.

- Draw a picture of your favorite animal. What does it eat? Draw a close-up picture of its mouth.

TASTE AND SMELL

Can you remember the last time you had a bad cold? Perhaps someone gave you a bowl of hot soup so you would feel better? You probably couldn't smell it very good with your nose all stopped up. What about its taste? It probably had very little flavor as well.

When you eat, odors from the food float up through a passage that connects the back of your mouth to your nose. Your brain combines information from your taste buds and from the smell receptors of your nose to identify the flavors of the food. The smell receptors in your nose identify the flavors of the food. They are more sensitive than your taste buds. Without your sense of smell, your sense of taste doesn't work very well. When you have a cold the smell receptors in your nose don't work very well. That is why you may not be able to tell the difference between the taste of a hot dog and some spinach.

Constructed Response Questions:

- What special qualifications would be necessary for a taste tester at an ice cream factory?

- How do animals in the forest use their sense of taste and smell to help them survive?

THE OZONE LAYER

Many products that used to be sold in aerosol spray cans are now sold in pump sprays. The reason for this is that many of the gases used in aerosols harm the environment. These gases are called chloroflourocarbons (CFCs). CFCs escape into the air when products containing them are used. Once in the atmosphere, CFCs can damage the ozone layer.

Ozone is a form of oxygen. A layer of ozone is found ten to fifty miles above the earth's surface. The ozone layer absorbs ultraviolet rays from the sun. Ultraviolet rays cause sunburn and skin cancer. The ozone layer protects plants and animals from the effects of these harmful ultraviolet rays.

The ozone layer has become thinner in the last 25 years. There is now a hole in the ozone layer. It is over Antarctica and seems to be getting larger each year. Many people are concerned about the damage that has been done to the ozone layer. Without a protective layer of ozone, ultraviolet rays may cause increases in the cases of skin cancer throughout the world. Many environmental groups are working to get CFCs banned worldwide.

Constructed Response Questions:

- You are the spokesperson for an environmental protection group. Present your case for banning aerosol spray cans.

- You are the spokesperson for an aerosol spray company. Present your case for lifting the ban on aerosol spray cans.

SMOG

Smog is a solution of gases we would be happy to live without. The term "smog" was first used to indicate a combination of smoke and fog found in large cities. Today the term also refers to conditions caused by various pollutants, other than smoke, that react with sunlight.

Most of the pollutants that cause smog come from the exhaust of automobiles and trucks and from factory emissions. However, many other things also contribute to smog. Among them are gasoline powered mowers, starter fluids for barbecue grills, household cleaning solvents, oil-based paints, and spray cans that contain hairspray or deodorant.

Smog is a worldwide problem. European cities, such as Rome and Budapest, are so troubled with smog they have banned cars from their city centers. In the spring of 1997, the schools of Mexico were closed for several days to keep the children from having to be out in the smog-filled air. Although smog is worse in large cities, it is also found in areas far from cities. Wind patterns, for example, can carry pollutants far from their source to inconvenience or even harm plant and animal life in other areas.

Countries all over the world are developing laws and regulations to help reduce air pollution. Some of these regulations deal with the automobile industry, requiring carmakers to produce cars that give better gas mileage or use a different kind of gasoline and give off less pollutants. Other laws regulate the use of charcoal lighter fluids, oil-based paints, and aerosol cans.

Constructed Response Questions:

- You are a building in a smog filled city. Describe what has happened to you over the past ten years.

- What technological advancements do you think will have to take place to reverse the pollution of our atmosphere?

BETTER WAYS TO BATTLE BUGS

Insects have always taken their share of crops meant for humans. To destroy these pests, farmers use chemicals known as pesticides. However, pesticides kill not only unwanted insects, but beneficial insects as well.

Over the years, pesticides have been seeping into the groundwater. Groundwater pollution from agriculture can contaminate our drinking water. The link between pesticides and their toxic effect on our bodies is not totally clear. Some pesticides have been linked to cancer, immune system disorders, behavior problems, and allergies.

Pesticides increase farmers' profits by reducing insect damage to crops. Therefore, farmers whose crops suffer effects of insects might not want to stop using pesticides. But many farmers have found alternatives.

Some farmers raise crops that insects dislike or rotate their crops to keep down pest populations in the area. Others use biological control. This involves killing pests with other insects or with bacteria. For example, farmers have found that the praying mantis eats asparagus beetles.

A recent invention for getting rid of bugs uses heat. A house or building is wrapped with large vinyl blankets and the air is heated to 60° C. All types of insects are killed by heat. Another recent discovery is a strong smelling mint oil that naturally repels most insects. Garlic and the oil from citrus fruits also help to repel fleas. Scientists continue to find new ways to combat pests.

Constructed Response Questions:

- Imagine that your drinking water came totally from groundwater and you are a farmer. What farming methods would you use to ensure your families safety?

- Analyze the advantages and disadvantages of using pesticides.

DECORATED WEBS ATTRACT MORE BUGS

For more than 100 years, scientists have wondered why many spiders add zigzags to their webs. Now a Taiwanese biologist working at the Museum of Zoology at the University of Michigan says he's found the answer.

I-Min Tso studied the webs of 53 banded garden spiders over a 6 week period. Each day he recorded the size and shape of *stabilmenta,* ribbonlike structures of silk that crisscross many spiders' webs. Tso also added up the number of bugs caught in each web. He found that webs decorated with stabilimenta caught 72 per cent more flying insects than did undecorated webs.

Tso believes that webs with stabilimenta catch more bugs because the webs are more attractive to flying insects. Previous studies have shown that flying insects orient themselves toward ultraviolet (UV) light. So the greater amount of UV light reflected by stabilimenta may be what is luring more bugs to their doom.

Tso says a spider spends up to an hour spinning a web. A single stabilimentum, however, can be built in less than five minutes. Spiders may optimize their insect-trapping success, Tso concludes, by building stabilimenta rather than creating larger webs.

Constructed Response Questions:

- Using the information in this article, think of a device that you could invent that may eliminate flying insects in your house.

- Draw what you think a spider web would look like with and without stabilmenta.

PURE SUBSTANCES AND MIXTURES

Much of the matter around us is made up of different kinds of molecules. Water, table salt, and sugar are each composed of one kind of molecule. Matter composed of only one kind of molecule (or atom) is called a pure substance. Elements and compounds are pure substances.

Matter which is made up of more than one pure substance is called a mixture. Mixtures are composed of more than one kind of molecule.

A solution of sugar in water is a mixture of two pure substances—sugar molecules and water molecules. The air we breathe is a mixture of several pure substances—mostly the gases nitrogen and oxygen.

Some mixtures are very complex. Wood, milk, and gasoline, for example, are complicated mixtures of many pure substances. It is usually not easy to tell a pure substance from a mixture.

A handful of dirt is a mixture. By looking closely at it we see tiny bits of matter with different colors, hardnesses, and textures. Pure substances like water, often look the same throughout. Dirt looks different throughout and dirt is not a pure substance.

Many mixtures, like milk and air, also look the same throughout. In such cases it is often a difficult task for a chemist to tell the difference between a mixture and a pure substance.

Constructed Response Questions:

- Imagine that you are looking through a glass with super-powered vision. Draw the molecules you would observe in a glass of pure water and a glass of pure air.

- Design an experiment in which you would be able to separate a mixture of salt and water.

SAND AND SOIL

Where does all the sand on a beach come from? The sand grains are little pieces of rock. They are pieces that were chipped off larger pieces.

Bit by bit, the rocks wear away. A little sand forms. Winds pick it up and hurl it against the rocks. Chips are knocked off the rocks. These chips are sand grains. They help make more sand as winds blow them about.

Hardly anything can grow in plain beach or desert sand. The water runs right through it when there is rain. The spaces between the grains are too large to store water. Also, pure sand does not contain any food for plants.

Soil is different. It contains materials that plants can use to help them grow. It holds water like a sponge. If you pick up a handful of soil you can feel how soft it is.

Soil is mostly a mixture of tiny bits of rock. Some sand is in it. But most of the particles are smaller than sand grains. Spaces between them are tiny. After a rain, water is trapped in the little spaces.

When seeds fall into soil, they sprout and grow. When plants die, their dead leaves and stems drop into the soil. They rot and make a material called humus. Humus, which gives the soil its dark color, is useful for plants.

Constructed Response Questions:

- Along the east coast of Lake Michigan are miles of sandy beaches. On the west side of Lake Michigan are miles of rocky cliffs. What processes could cause this to happen?

- Write the script for the TV show -- "My Life Story--From Rock to Soil."

Working Together

Name of the "Working Together" article:

_____

Read the above article. List at least 5 important points that were being made in the article in the space below.

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

List the important points, not listed above, made by others in your group on the other side of this sheet.

Working Together

Name of the "Working Together" article:

_____

These are the 5 most important points agreed upon by our group.

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

Group Members Signatures

_____ _____

_____ _____

_____ _____

Why Games for Review?

Learning is a self-activity. Learning advocates that the participant be actively involved in the process and not a passive observer. When using games as a method of instruction/review, participation must be an integral part of the structure and design.

Games require interaction, decision making, and immediate feedback. Everyone is able to get into the act, and the learning process operates at a much higher level of efficiency. Involvement has always been the best method of learning. Receptivity is at its greatest when the learner has a high degree of personal involvement in the learning process. Participants are able to see the consequences of their actions at once and to modify their behavior accordingly. Because they are involved, their attention is focused on what they are learning.

Many students come into the learning environment with elevated anxiety levels. In order for learning to occur, anxiety must be decreased so that retention can be increased. When reviewing with a game, you can cover content in a fun and interesting way. This fun review of material can lower tension and make people comfortable in the learning environment.

Sketch n' Fetch

How to Use
This game is similar to Pictionary. It can be used to review and reinforce terminology.

How Long
The introduction of this game takes approximately five minutes. Each round of the game takes up to 4-5 minutes. There are 5-10 rounds per game.

Equipment
- Packet of word cards
- Stopwatch or classroom clock with a second hand
- Dry erase board or paper (large sheets preferred)
- Markers

Directions
A group of 4-10 students are divided into two equal teams. Teams are placed across from each other. Each team numbers off its players accordingly. Player one on Team A is the first person selected to sketch. Player one on Team B is the first person selected to keep time.

Round one begins when the first player on Team A is given a word from the word packet. They have 30 seconds to think about how they can illustrate the word. After 30 seconds, drawing begins on a dry erase board. Members of Team A, try to guess the word, which is being illustrated. The team is given one point if the answer is guessed correctly. The time limit is 60 seconds.

Bonus: If Team A does not guess the word, the word is passed to a player on Team B and the same procedure is followed. If the word is guessed correctly by Team B, they gain a point. If not, the word is discarded. The purpose of the bonus point is to make all participants on both teams more acute in listening and observing.

The second half of round one begins with the first player on Team B being given a new word and play continues as above including the bonus opportunity. The maximum amount of points per round is two.

The most points determine the winning team.

Rules

- No talking is allowed by the person who is given the card to sketch.
- No written words or letters may be used within the sketch.
- Charade type gestures are allowed.
- All cards must be face down on the pile until selected.
- No cards can be shown to any other participants.
- One round consists of Team A selecting one card and then Team B selecting one card. The bonus card is not considered a selected card.

Example One: Team A selects a card. They get the word right and they receive one point. Team B draws a new card, but does not answer it correctly. Team A gets the word right and receives a bonus point. Score at the end of Round One is Team A-2, Team B-0. Team A begins round two.

Example Two: Team A selects a card. They cannot get the word correct within 60 seconds. Team B tries the word and gets is correct. They obtain one bonus point. Team B selects a new card and gets it correct. Score at the end of the round is Team A-0, Team B-2. Team A begins round two.

Example Three: Team A selects a card. They cannot get the word correct within 60 seconds. Team B tries the words and cannot get it correctly. The word is now discarded and Team B selects a new card. They cannot get the word correct within 60 seconds. Team A tries the word and gets it correct. The score at the end of the round is Team A-1, Team B-0. Team A begins round two.

- Team play must rotate from player one, to the next successive player on the team.
- Team A must be quiet when Team B is guessing the sketch and vice versa.

Scorecard Example:

Round	Team A	Team B
1		
2		
3		
4		
5		
Total		

Scienceagories

(a takeoff on the game--Scattegories)

For 2-60 Players

Object: Quickly fill out a category list with answers that begin with the same letter. Score points if no other player matches your answers. Score the most points to win the game.

Game Play: The game is played in 2-3 rounds. To play a round, do the following steps in order:

1. All players take a category sheet and pencil.
2. Setting the Timer: Use either a game timer or a stopwatch. Each round should last 3-4 minutes.
3. Toss a letter die and call out the rolled letter or select a letter from a container (do not use the letters Q, V, X or Z). The selected letter is the *key letter* that will be used in this round of play.
4. Start the timer.
5. All players quickly fill in the first column of their answer sheets. Answers must fit the category and must begin with the key letter rolled.

Example:

List 1	One
1. ANIMAL	COUGAR
2. WATER	CLOUD
3. THINGS THAT ARE COLD	COLD CUTS
4. SPACE	CAPTAIN
5. MEASUREMENT	CENTIMETER
6. INSECTS	CRICKET
ETC.....	

6. When the timer stops, players must immediately stop writing.
7. Scoring a Round: Players, in turn read their answers aloud for number 1. Players correct their own answer sheets by circling an acceptable answer that DOES NOT match any other player's answer. Continue reading answers until all of the categories have been scored. Then, score 1 point for each of your circled answers. Record your score at the top of the column of your answer sheet.

Starting a New Round: Set the timer again, select a new letter and continue playing using the same category list as you did in the previous round. Fill in the next column with your new answers. NOTE: If the same letter is selected twice in a game, select a different letter.

WINNING THE GAME

After 3 rounds have been played, all players total the 3 scores on their answer sheets. The player with the highest score is the winner.
In case of a tie: The players who tie play one more round with a new letter. The player who has the highest score in that round is the winner.

Rules for Acceptable Answers

1. The first word of your answer must begin with the key letter.
2. The articles "A", "An", and "The" cannot be used for their key letters.
3. The exact same answer CANNOT be given twice in one round. Example: You cannot answer *Daisy* for a flower and also for a girl's name.
4. When answering with a proper name, the first or last name may be used as long as the key letter is the first letter of your answer. For example, if the key letter is "A" and the category is person, the "A" could be used to start their last name or begin their first name.
5. Creative answers can be acceptable. For example, you could answer Knuckle as a kind of Sandwich. But if one player challenges the answer, the group must vote on its acceptability.

Challenging Answers: While answers are being read, other players may challenge their acceptability. When an answer is challenged, all players (even the challenged player) vote on whether the answer is acceptable. Players who accept the answer give a thumbs-up sign. Players who do not accept the answer give a thumbs-down sign. Majority rules. In the case of a tie, the challenged player's vote does not count.

Extra Points: When answering with proper names or titles, score an extra point for using the key letter more than once as a fist letter in your answer. For example: Ronald Reagan, Carson City, Simon and Schuster, and the Rouge River for 2 points; Hubert Horatio Humphrey for 3 points.

List One	One	Two	Three
1. Metric Measurements	1	1	1
2. Sources of Science Information	2.	2.	2.
3. Technology	3.	3.	3.
4. Living Things	4.	4.	4.
5. Human Effects on the Environment	5.	5.	5.
6. Forms of Energy	6.	6.	6.
7. Mixtures	7.	7.	7.
8. Uses of Water	8.	8.	8.
9. Atmosphere	9.	9.	9.
10. Physical Characteristics	10.	10.	10.
11. Types of Producers	11.	11.	11.
12. Useful Properties of Materials	12.	12.	12.
Score			

List Two	One	Two	Three
1. Physical Changes	1	1	1
2. Sources of Drinking Water	2.	2.	2.
3. Weather Conditions	3.	3.	3.
4. Mechanical Devices	4.	4.	4.
5. Famous Scientists	5.	5.	5.
6. Plant Parts	6.	6.	6.
7. Predators	7.	7.	7.
8. Electricity	8.	8.	8.
9. Science Tools	9.	9.	9.
10. Forms of Water	10.	10.	10.
11. Seasonal Changes	11.	11.	11.
12. Observations	12.	12.	12.
Score			

List	One	Two	Three
1.	1	1	1
2.	2.	2.	2.
3.	3.	3.	3.
4.	4.	4.	4.
5.	5.	5.	5.
6.	6.	6.	6.
7.	7.	7.	7.
8.	8.	8.	8.
9.	9.	9.	9.
10.	10.	10.	10.
11.	11.	11.	11.
12.	12.	12.	12.
Score			

Take A Chance

(This game is similar to the television show Jeopardy)

How To Use

A round of this game can highlight the major learning points that need to be reinforced. The game can also be used to teach new content.

How Long

The introduction and explanation of the game requires 5 minutes. Allow one minute for each answer/question presented to the audience. Therefore, if you have five categories and 5 answer/questions under each category, it would take 25 minutes for this part of the game. This added to the introduction, requires 30 minutes.

Directions

Before the game begins, it is necessary to have the students be familiar with the method chosen for recognition. Will they stand up, ring a bell, use a party blower, etc.?

Divide the class into teams that will discuss the possible answers. Each team will select a spokesperson for the group. This game can be played as a reverse question and answer format or as a direct question and answer format. The teacher (game show host) reads the question, and the contestant/group must state the correct answer. If the answer is stated incorrectly, the other participants can compete to be recognized. As an alternative you can rotate from group to group or have a spinner or other device to choose which group is next to participate.

To start the game each group selects a number from a hat or by using a spinner. This will determine which group goes first. The question is asked and each group gets one minute to discuss the answer. At the end of one minute, the spokesperson from the starting group must give the answer.

If the person chosen responds with the correct answer, that team is rewarded with the appropriate number of points for that response. They then select the category for the teacher/game show host to use next. (An alternative is to re-draw to see which team goes next.) If the incorrect answer is given, the appropriate number of points are subtracted from that team's score. The teacher/host allows the other groups to compete to give the correct response. This continues until the correct response is given. The group who gives the correct response gets the appropriate number of points awarded to them and selects the next category.

The game continues until all the categories and levels are used up.

Materials

Make the game board from wood, foam core board, or display boards. Paste envelopes on to the board and label the envelopes with the appropriate number of points. Place question cards into envelopes.

TOPIC	TOPIC	TOPIC	TOPIC	TOPIC
100	100	100	100	100
200	200	200	200	200
300	300	300	300	300
400	400	400	400	400
500	500	500	500	500

SHOOT THE WORKS

This game uses a "Nerf" basketball, and a waste paper basket to add fun to a review session.

How To Use

Use this game as a review of terms.

How Long

The introduction of the game requires about 5 minutes. The game can take anywhere from 20 minutes to 45 minutes.

Directions

Before the game begins divide the class into teams of between 4 and 10 people each. Each player on the team will take a turn at answering a question. Each team will select the person to go first. The teams will pick a number from a hat to decide which team starts the competition.

To begin, the teacher/game show host will give the definition of a word. The first person from the selected team will give the word that matches the definition. If they give a correct response they receive 5 points. If they can spell the word correctly they receive an additional 3 points. They then will have an opportunity to shoot a basket for additional points. There are three free throw lines to choose from. They are at different distances from the basket. Making a basket from the closest line earns 1 point. The next two distances earn 2 and 3 points respectively.

If an incorrect response to the question is given, the next team gets a chance. The turn rotates from team to team after each question.

More Games

Tic Tac Toe

This is a simple game that everyone loves to play. All you need is a chalkboard or white board and a list of vocabulary words. Draw nine squares and fill in each square with a vocabulary word. Divide the class in half or in smaller groups. The teacher calls out a word and taking turns the team/group has to use the word in a grammatically correct sentence. Three in a row wins.

Go

A simple vocabulary game that makes words fun to learn. Each student needs a piece of paper with five columns. Assign each column a letter. The students have to write a vocabulary word that begins with that letter. The first one done yells "stop!" This student has to spell each of the words correctly.

Charades

A game that gets your bodily/kinesthetic students really involved. The class needs to be divided into two teams. The teacher has a pile of cards with the week's vocabulary words on them. One student at a time picks a card and has to act out the word that is on the card. The student's team needs to figure out what the student is acting out.

Baseball

Divide the students into two teams. Half of the class is in the field. The teacher is the pitcher. She or he says a word and the student that is at-bat has to define it, spell it, or both. If it is defined/spelled correctly, the student moves to first base. If it is defined/spelled incorrectly, it is an out. The team that is in the outfield listens to the batter to make sure the word is defined/spelled correctly.

Catch

A game to test a student's memory. The teacher starts by holding a small ball. She says a word from the week's vocabulary list and tosses the ball to another student. It is best to encourage students to toss the ball using an underhand throw, which creates an arch. That student has to say the previous item and one of his or her own. This format continues to the next students, etc. This game is very similar to the electronic version of "Simon." It may also be played with spelling. The teacher starts off by saying a word and throwing the ball to a student. That student starts spelling the first letter and throws the ball to another student. It continues until the whole word is spelled. After the whole word is spelled, it is thrown one more time to a student who has to spell the word and starts the next word.

Bingo (MEAPO)

This is a favorite with all students. Write 25 to 50 words on the chalkboard or overhead. Give the students a piece of paper with 25 squares in a 5X5 format.

The students write each of the words on any square they choose. The teacher selects words at random and reads definitions. The students put an X in the square with the appropriate word. When a row is filled, the student yells "Bingo"! As an alternative the teacher may just say the word and have student's place an "X" on the appropriate word.

	M	E	A	P	O
M					
E					
A			Free Space		
P					
O					

Conclusion and "Putting it into Practice"

As we come to the end of this book, it is time to implement the strategies that have been discussed throughout. Planning and preparation is one of the major domains of effective teaching. It is now your role to design an instructional model that will help students to be successful. Blank calendars have been provided in this section to help with the planning process. You determine the length of time. Review for the MEAP generally extends between two to six weeks. It is important that you consider the Science MEAP Investigation, which usually takes between two to three class periods. The following is an example of what a review might look like for a typical week:

- Each day begins with a "start-up," which can be found in the appendix.
- Monday--Vocabulary activity
- Tuesday--Text Critique activity
- Wednesday and Thursday--Investigation
- Friday--Review game

Design your review to meet the needs of your students. Explain why it is important to review. Encourage students to do their best. Make the review process "special." But most importantly, make the review fun, enjoyable and relevant for students. Encourage them to firmly place their knowledge into long-term memory in order to not only be successful on the MEAP, but to demonstrate that they can do well in school because they are utilizing their "talents" to the best of their ability.

MEAP Review Planning Calendar

Monday	Tuesday	Wednesday	Thursday

MEAP Review Planning Calendar

Monday	Tuesday	Wednesday	Thursday