MICHIGAN
Science Content Standards and Working Draft Benchmarks
Middle School
Science Level Green © 2005

STANDARDS	PAGE REFERENCES
I. Construct New Scientific and Personal Knowledge	
Content Standard 1: All students will ask questions that help them learn about the world; design and conduct investigations using appropriate methodology and technology; learn from books and other sources of information; communicate their findings using appropriate technology; and reconstruct previously learned knowledge. (Constructing New Scientific Knowledge)	
1. Generate scientific questions about the world based on observation. (*Key concepts:* See Using Scientific Knowledge. *Real-world contexts:* See Using Scientific Knowledge.)	SE: 6-7, 13-14 *MiniLAB* 14 *National Geographic Visualizing* 15 *Section Review* 18 #2 TWE: LD 14
2. Design and conduct simple investigations. (*Key concepts:* The process of scientific investigations-test, fair test, hypothesis, data, conclusion. Forms for recording and reporting data-tables, graphs, journals. *Real-world contexts:* See Using Scientific Knowledge.)	SE: 16-18 *Section Review* 18 #6 *Chapter Review* 25 #23 *LAB Design Your Own* 354-355, 610-611 TWE: TFYI 13 DI 13, 15
3. Investigate toys/simple appliances and explain how they work, using instructions and appropriate safety precautions. (*Key concepts:* Safety precautions for using electrical appliances. Documentation for toys and appliances-diagrams, written instructions. *Real-world contexts:* Situations requiring assembly, use, or repair of toys, radios, or simple appliances, such as replacing batteries; connecting electrical appliances, such as stereos, videocassette recorders.)	SE: *Chapter Review* 25 #23 TWE: MM 9 TFYI 13 DI 13 IQL 16
4. Use measurement devices to provide consistency in an investigation. (*Key concepts:* Documentation-laboratory instructions. Measurement units-milliliters, liters, teaspoon, tablespoon, ounce, cup, millimeter, centimeter, meter, gram, nonstandard units. *Measurement tools:* Balancing devices, measuring cups and spoons, measuring tape. *Real-world contexts:* Cooking for groups of various sizes; following or altering laboratory instructions for mixing chemicals.)	SE: *Chapter Review* 25 #25, #26, #27, #28 *Model and Invent Lab* 202-203 *Section Review* 230 #6 *Applying Math* 686, 688 *MiniLAB* 687 *Section Review* 689 #2, #5, #6 *LAB* 488-489, 701 *LAB Design Your Own* 706-707 *Science Skill Handbook* 753-755 *Math Skill Handbook* 776-790 TWE: TFYI 685

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5. Use sources of information to help solve problems. (*Tools:* Forms for presenting scientific information, such as figures, tables, graphs. *Real-world contexts:* Libraries, projects where research is needed.)	SE: 13 *Technology Skill Handbook* 773, 775 TWE: A 8 CC 251
6. Write and follow procedures in the form of step-by-step instructions, recipes, formulas, flow diagrams, and sketches. (*Key concepts:* Purpose, procedure, observation, conclusion. *Real-world contexts:* Following a recipe; listing or creating the directions for completing a task.)	SE: *LAB Design Your Own* 108-109, 236-237, 324-325, 354-355, 390-391, 424-425, 458-459, 550-551, 610-611, 674-675, 706-707 TWE: DI 15 A 15
II. Reflect on the Nature, Adequacy and Connections Across Scientific Knowledge	
Content Standard 1: All students will analyze claims for their scientific merit and explain how scientists decide what constitutes scientific knowledge; how science is related to other ways of knowing; how science and technology affect our society; and how people of diverse cultures have contributed to and influenced developments in science. (Reflecting on Scientific Knowledge)	
1. Evaluate the strengths and weaknesses of claims, arguments, or data. (*Key concepts:* Aspects of arguments such as data, evidence, sampling, alternate explanation, conclusion. *Real-world contexts:* Deciding between alternate explanations or plans for solving problems; evaluating advertising claims or cases made by interest groups.)	SE: 18 *LAB* 19, 98 TWE: EA 109, 355, 391, 611, 675, 707
2. Describe limitations in personal knowledge. (*Key concepts:* Recognizing degrees of confidence in ideas or knowledge from different sources. *Real-world contexts:* See Using Scientific Knowledge.)	SE: 6-10, 18 TWE: QD 9
3. Show how common themes of science, mathematics, and technology apply in real-world contexts. (*Thematic ideas:* Systems-subsystems, feedback models, mathematical constancy, scale, conservation, structure, function, adaptation. *Real-world contexts:* See Using Scientific Knowledge.)	SE: 409, 415, 452, 455, 669, 672 *MiniLAB* 455, 669 TWE: DISC 672
4. Describe the advantages and risks of new technologies. (*Key concepts:* Risk, benefit, side effect, advantage, disadvantage. *Real-world contexts:* Technological systems for manufacturing, transportation, energy distribution, housing.)	SE: 321-323, 564, 576, 720, 731 TWE: SJ 250, 564 IM 250, 564 TPK 321 VL 322 CD 322
5. Recognize the contributions made in science by cultures and individuals of diverse backgrounds. (*Key concepts:* Scientific contributions made by people of diverse cultures and backgrounds. *Real-world contexts:* See Using Scientific Knowledge.)	SE: *TIME* 238 TWE: CD 226, 264, 348, 352, 517 DI 228

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III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts	
Content Standard 1: All students will apply an understanding of cells to the functioning of multicellular organisms; and explain how cells grow, develop and reproduce. (Cells)	
1. Describe similarities/differences between single-celled and multicellular organisms. (*Key concepts:* Differences-single-celled, multicellular, cell specialization. Cell structures-nucleus, cytoplasm, cell wall, cell membrane. *Observation tools*: Hand lens, microscope. *Real-world contexts:* 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.)	SE: 221-230, 796-799 *LAB* 231 *Section Review* 230 #2, #3, #4, #5 *Chapter Review* 241 #25, #26, #29 A detailed discussion of each animal group can be found in Glencoe's *Science Level Red* © 2005.
2. Explain why specialized cells are needed by plants and animals. (*Key concepts:* Specialized functions of cells – reproduction, photosynthesis, transport. *Real-world contexts:* Specialized animal cells: red blood cells, white blood cells specialized plant cells – root cells, leaf cells, stem cells.)	SE: 214, 254-258, 401-404, 413-414, 420-421, 423, 434-437, 440, 444-445, 450, 453, 456, 470-471, 473-477, 479, 502-503, 512-515, 524 *MiniLAB* 255 *LAB Design Your Own* 458-459 TWE: CD 257 IQL 256
3. Explain how cells use food as a source of energy. (*Key concepts:* How cells use food-food, molecule, respiration, oxygen, carbon dioxide, water. *Real-world contexts:* Experiments/ demonstrations showing reactants/products of respiration and photosynthesis.)	SE: 216- 217, 262-265, 367-370, 378-379 *LAB Design Your Own* 390-391 *Chapter Review* 394-395 #9, #12, #16, #27
Content Standard 2: All students will use classification systems to describe groups of living things; compare and contrast differences in the life cycles of living things; investigate and explain how living things obtain and use energy; and analyze how parts of living things are adapted to carry out specific functions. (Organization of Living Things)	
1. Compare and classify organisms into major groups on the basis of their structure. (*Key concepts:* Characteristics used for classification- vertebrates/invertebrates, cold-blooded/warm-blooded, single-cell/multicellular, flowering/nonflowering. *Real-world contexts:* Representative organisms, such as dog, worm, snake, Amoeba, geranium, wheat.)	SE: 218-220, 505, 506-511, 512-520 *LAB* 521 *Reference Handbooks* 796-799 TWE: SCB 498E-498F
2. Describe the life cycle of a flowering plant. (*Key concepts:* Flowering plant parts and processes-roots, stems, leaves, flowers, fruits, seeds, embryo, pollen, ovary, egg cell, germination, fertilization. *Real-world contexts:* Common flowering plants, such as bean, tulip.)	SE: 517-520 TWE: IQL 519 Glencoe's *Life Science* © 2005 contains a detailed discussion of flowering plant life cycle. SE: 284-288

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3. Describe evidence that plants make and store food. (*Key concepts:* Process and products of food production-photosynthesis, starch, sugar, oxygen. *Real-world contexts:* Plant food storage organs, such as potato, onion; starch storage in plants grown under different conditions.)	SE: 216, 262-265, 501, 512- 515, 519-520 *Section Review* 265 TWE: A 262 UA 262 IM 262 DI 262 SJ 262 USW 263 VL 265
4. Explain how selected systems and processes work together in plants and animals. (*Key concepts:* Systems/Processes-digestion, circulation, respiration, endocrine, reproduction, skeletal, muscular, nervous, excretion, transport, growth, repair. *Real-world contexts:* Interrelations of body systems during selected activities, such as among skeletal, muscular, circulatory, and respiratory systems during physical exercise.)	SE: 214-217, 366, 371, 377-378, 400, 412, 414, 419-421, 435-437, 439, 443, 444, 447, 449-450, 452, 455-457, 468, 472, 476-477, 512-513 TWE: SJ 368 CD 414 TFYI 415, 421, 469 MM 446
Content Standard 3: All students will investigate and explain how characteristics of living things are passed on through generations; explain why organisms within a species are different from one another; and explain how new traits can be established by changing or manipulating genes. (Heredity)	
1. Describe how the characteristics of living things are passed on through generations. (*Key concepts:* Reproductive cells-egg, sperm. Cell parts-nucleus, gene. *Real-world contexts:* Common traits controlled by a single gene pair, such as wrinkled or smooth seeds in a pea plant, color of horse hair.)	SE: 284-289, 290-295, 306-312, 314-319 *National Geographic Visualizing* 309 *Applying Math* 311 *LAB* 313 *LAB Design Your Own* 324-325 TWE: DI 310 DISC 310 QD 311
2. Describe how heredity and environment may influence/determine characteristics of an organism. (*Key concepts:* Traits-inherited, acquired. *Real-world contexts:* Data on heredity, such as identical twin studies, effects of introduced toxins, effects of natural selection, effects of controlled selection and breeding.)	SE: 287, 316, 335, 336, 480 TWE: IM 335 DI 336 A 336 QD 336

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Content Standard 4: All students will explain how scientists construct and scientifically test theories concerning the origin of life and evolution of species; compare ways that living organisms are adapted (suited) to survive and reproduce in their environments; and analyze how species change through time. (Evolution)	
1. Describe how scientific theory traces possible evolutionary relationships among present and past life forms. (*Key concepts:* Selected evidence of common ancestry-geologic time, fossil, bone, embryo, limb. *Real-world contexts:* 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.)	SE: 338-339, 340-341, 343-349, 350-353 TWE: A 344 FF 344 QD 345 TFYI 347 VL 348, 350
Content Standard 5: All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact. (Ecosystems)	
1. Describe common patterns of relationships among populations. (*Key concepts:* Participants and relationships-predator, prey, parasitism, competition, symbiosis. *Real-world contexts:* Examples of predator-prey, symbiotic, and parasitic relationships-see elementary benchmarks 1 and 2; examples of competitive relationships, including squirrels and seed-eating birds, cattle and bison.)	SE: 539-543 *Science OnLine* 540 *MiniLAB* 542 *Section Review* 543 #4, #6 TWE: VL 540 MM 540 DI 541, 542 A 541 QD 541 USW 542 SJ 542 UA 543
2. Predict the effects of changes in one population in a food web on other populations. (*Key concepts:* Natural balance, population, dependence, survival. *Real-world contexts:* Plants and animals in an ecosystem dependent upon each other for survival in selected ecosystems-see elementary benchmark 3; comparison of animals and plants found in polluted vs. nonpolluted water, urban vs. rural settings, rural vs. forest settings.)	SE: 502, 546 *Applying Science* 546 TWE: LD 546
3. Describe how all organisms in an ecosystem acquire energy directly or indirectly from sunlight. (*Key concepts:* Sunlight, plants, food, photosynthesis, heat. *Real-world contexts:* Selected food chains, including humans; also see Cells benchmarks related to photosynthesis.)	SE: 226, 261-265, 544-547 *LAB* 231 TWE: IM 262 SJ 262 IQL 546 QD 547

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4. Describe the likely succession of a given ecosystem over time. (*Key concepts:* Succession, stages, climax community. *Real-world contexts:* Process of gradual change in ecological systems, such as in ponds or abandoned farm fields.)	See Glencoe's *Science Level Blue* © 2005 SE: 150-153, 154 Primary and secondary succession in ecosystems are discussed in Glencoe's *Life Science* © 2005 SE: 740-743
5. Identify some common materials that cycle through the environment. (*Key concepts:* Carbon cycle and water cycle-water, carbon dioxide, oxygen, sugar (food). Also see appropriate Cells and Atmosphere and Weather benchmarks. *Real-world contexts:* Selected ecosystems-also see elementary benchmark 3.)	SE: 59-61, 99-101, 548-549 *Section Review* 61 #3, #4, #6 *Section Review* 549 #3, #6 *MiniLAB* 548 *LAB* 665 TWE: VL 59 TFYI 61 SJ 101 IM 101, 548 IQL 546 QD 547
6. Describe ways in which humans alter the environment. (*Key concepts:* Agriculture, land use, resource development, resource use, solid waste, toxic waste. *Real-world contexts:* Human activities, such as farming, pollution from manufacturing and other sources, hunting, habitat destruction, land development.)	SE: 568-576 *LAB* 577 *Section Review* 576 #3, #4 TWE: TFYI 571, 572 IM 572 QD 573, 575 IQL 547 SJ 547 A 575
7. Explain how humans use and benefit from plant and animal materials. (*Key concepts:* Materials from plants, including-wood, paper, cotton, linen, starch, rubber, wax, and oils. Materials from animals, including leather, wool, fur, protein, oils, wax. *Real-world contexts:* Human-made objects that incorporate plant and animal materials, including clothing, building materials, machines, and medicines-also see elementary benchmark 1, and middle school benchmarks 3 and 6-also see appropriate Geosphere benchmarks.)	SE: 323, 388, 520, 524, 560-561 *Launch LAB* 499 *LAB Use the Internet* 522-523 TWE: SJ 517 CD 322 UA 561

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IV. Use Scientific Knowledge from the Physical Sciences in Real-World Contexts	
Content Standard 1: All students will measure and describe the things around us; explain what the world around us is made of; identify and describe forms of energy; and explain how electricity and magnetism interact with matter. (Matter and Energy)	
1. Measure physical properties of objects or substances (mass, weight, area, temperature, dimensions, volume). (*Key concepts:* Units of measure-kilogram, gram, liter, degrees Fahrenheit, degrees Celsius. *Measurement tools:* Balances, spring scales, measuring cups or graduated cylinders, thermometers, metric ruler. *Real-world contexts:* Common substances such as those listed in elementary benchmark 1; hot and cold substances, such as ice, snow, cold water, hot water, steam, cold air, hot air.)	SE: *Launch LAB* 531, 651 *MiniLAB* 95, 596, 704 *LAB* 48-49, 260, 538, 599, 665, 701 *LAB Design Your Own* 390-391, 458-459 *LAB Model and Invent* 138-139 *Applying Math* 606
2. Describe when length, mass, weight, area, or volume are appropriate to describe the size of an object or the amount of a substance. (*Key concepts:* Length, mass, weight, area, volume. Array of measuring devices, metric ruler, graduated cylinders, balances, spring scale. *Real-world contexts:* Common objects-see elementary benchmark 1.)	SE: 19, 753-755 *National Geographic Visualizing* 15 *Chapter Review* 25 #26, #27, #28 *Launch LAB* 531, 651 *MiniLAB* 95, 596, 704 *LAB* 48-49, 260, 438, 538, 599, 665, 701 *LAB Design Your Own* 390-391, 458-459 *LAB Model and Invent* 138-139
3. Classify substances as elements, compounds, or mixtures. (*Key concepts:* Element, compound, mixture. *Real-world contexts:* 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.)	SE: 196, 247-251, 602, 620-622, 622-625, 626-628 TWE: TFYI 247 IM 621 MM 621 VL 621 QD 249, 622
4. Describe matter as consisting of extremely small particles (atoms) which bond together to form molecules. (*Key concepts:* Molecule, particle, matter, bond, atom. *Real-world contexts:* Common substances such as those listed above.)	SE: 246-249, 625, 626-632 TWE: TFYI 247

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5. Describe the arrangement and motion of molecules in solids, liquids, and gases. (*Key concepts:* Arrangement-regular pattern, random. Distance between molecules-closely packed, separated. Molecular motion-vibrating, bumping together, moving freely. *Real-world contexts:* Common solids, liquids, and gases, such as those listed above.)	SE: 652-656, 658, 659-664 *Launch LAB* 651 *Section Review* 656 #2, #3, #4, #5, #6 *National Geographic Visualizing* 660 *MiniLAB* 662 TWE: DI 653 TFYI 653 MM 653 A 654 UA 654 VL 655 QD 656
6. Describe energy and the many common forms it takes (mechanical, heat, light, sound, electrical, magnetic, chemical, nuclear). (*Key concepts:* Forms of energy-mechanical, heat, sound, light, electrical, magnetic, chemical, nuclear, food energy. *Real-world contexts:* Body heat, heating a home, using light to see, using sound to hear, eating food, using electricity for appliances, gasoline for cars, nuclear power.)	SE: 99-102, 257, 405, 657-664, 716-720 *LAB* 728 *Section Review* 720 #3, #4, #5, #6 TWE: SJ 658, 719 TPK 716 IQL 717 USW 718 A 718, 726 DI 719 DISC 719 RT 720
7. Describe how common forms of energy can be converted, one to another. (*Key concepts:* Forms of energy-mechanical, heat, sound, light, electrical, magnetic, chemical, nuclear, food energy. Conservation of energy. Energy transformation. *Real-world contexts:* Motors, generators, power plants, lightbulbs, appliances, cars, walking, playing a musical instrument, cooking food.)	SE: 721-727 *MiniLAB* 723 *National Geographic Visualizing* 724 *Section Review* 720 #2 *Section Review* 727 #1, #3, #4, #5 TWE: IM 722, 725 LD 722 VL 723 QD 723 TFYI 725 A 726
8. Describe electron flow in simple electrical circuits. (*Key concepts:* Complete circuit, open circuit, closed circuit. *Real-world contexts:* Household wiring, electrical conductivity testing, flashlight, electric appliances.)	Generation and use of electricity as a resource is discussed in this book. Specifics of electricity, circuits, and current are discussed in Glencoe's *Science Level Blue* © 2005. SE: 643-647, 650-651
9. Use electric currents to create magnetic fields. (*Key concepts:* Electric current, magnetic poles, magnetic fields. *Tools:* Magnetic compass, battery, wire. *Real-world contexts:* Electromagnets, bells, speakers, motors, magnetic switches, Earth's magnetic field.)	Specifics of electricity, circuits, and current are discussed in Glencoe's *Science Level Blue* © 2005. SE: 673-674

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Content Standard 2: All students will investigate, describe and analyze ways in which matter changes; describe how living things and human technology change matter and transform energy; explain how visible changes in matter are related to atoms and molecules; and how changes in matter are related to changes in energy. (Changes in Matter)	
1. Describe common physical changes in materials: evaporation, condensation, thermal expansion, and contraction. (*Key concepts:* States of matter-solid, liquid, gas. Changes in states of matter-evaporation, condensation. Thermal expansion and contraction. *Real-world contexts:* States of matter-solid, liquid, gas. Changes in state, such as water evaporating as clothes dry, condensation on cold window panes; expansion of bridges in hot weather.)	SE: 600-601, 650-675 *Section Review* 656 #1 *Applying Science* 661 *MiniLAB* 662 *Science OnLine* 663 TWE: QD 601, 663 MM 601 A 654 VL 655 UA 655 LD 655
2. Describe common chemical changes in terms of properties of reactants and products. (*Key concepts:* Common chemical changes-burning paper, rusting iron, formation of sugars during photosynthesis. *Real-world contexts:* Chemical changes-burning, photosynthesis, digestion, corrosion.)	SE: 602-607 *MiniLAB* 603 TWE: DI 603 IQL 604 SJ 604 IM 605, 607 UA 607
3. Distinguish between physical and chemical changes in natural and technological systems. (*Key concepts:* Changes in matter-physical changes and chemical changes. *Real-world contexts:* 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.)	SE: 261-265, 400-404, 548, 579-581, 602, 606, 607 *National Geographic Visualizing* 608 TWE: UA 262 IM 262 SJ 262 QD 264 CD 264
4. Describe how waste products accumulating from natural and technological activity create pollution. (*Key concepts:* Manufacturing, distribution, refining, mining, landfill, water treatment. *Real-world contexts:* Many sources of pollution, both natural and technological.)	SE: 564, 573-576 *Section Review* 576 #4 TWE: QD 573, 575 A 573, 575 VL 574 IQL 574 SJ 574 DI 574, 575

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5. Explain physical changes in terms of the arrangement and motion of atoms and molecules. (*Key concepts:* Molecular descriptions of states of matter-also see Matter and Energy benchmarks. Physical changes-States of matter (solid, liquid, gas). Changes in size and shape-bending, tearing, breaking. Changes in state of matter-melting, freezing, evaporation, condensation. Thermal expansion and contraction. Speed of molecular motion-moving faster, slower, vibrate, rotate, unrestricted motion, conservation of matter. *Real-world contexts:* See examples of Physical Changes of Matter, elementary benchmark 1 and middle school benchmark 3.)	SE: 600-601, 650-675 *Section Review* 656 #1 *Applying Science* 661 *MiniLAB* 662 *Science OnLine* 663 *Section Review* 673 #1, #5 *Chapter Review* 679 #21, #25, #26, #27 TWE: QD 601, 663 MM 601 A 654 VL 655 UA 655 LD 655
Content Standard 3: All students will describe how things around us move and explain why things move as they do; demonstrate and explain how we control the motions of objects; and relate motion to energy and energy conversions. (Motion of Objects)	
1. Qualitatively describe and compare motions in three dimensions. (*Key concepts:* Three-dimensional motion-up, down, curved path. *Real-world contexts:* Objects moving in three dimensions, such as thrown balls, roller coasters, cars on hills, airplanes.)	SE: 684-689, 690-693 *Launch LAB* 683 *MiniLAB* 687 *TIME* 708 TWE: VL 685 DISC 686
2. Relate changes in speed or direction to unbalanced forces in two dimensions. (*Key concepts:* Changes in motion and common forces-speeding up, slowing down, turning, push, pull, friction, gravity. Additional forces-attraction, repulsion, balanced, unbalanced. *Real-world contexts:* 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.)	SE: 687-689, 690-693 *Applying Math* 688 *Section Review* 689, #1 #3 #5 #6 *Science OnLine* 692 TWE: DI 686, 688 LD 687 QD 688, 692
3. Describe the forces exerted by magnets, electrically charged objects, and gravity. (*Key concepts:* Electrical charges and magnetic poles-north pole, south pole, positive charge, negative charge, weight, gravitational pull. *Real-world contexts:* 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.)	SE: 597 Electrical charges and magnetism are discussed in Glencoe's *Science Level Blue* © 2005. SE: 187-188, 307-308, 636-641, 666-671

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4. Design strategies for moving objects by application of forces, including the use of simple machines. (*Key concepts:* Types of simple machines-lever, pulley, screw, inclined plane, wedge, wheel, and axle. *Real-world contexts:* Objects being moved by using simple machines, such as wagons on inclined planes, heavy objects moved by levers, seesaw, cutting with knives or axes.)	SE: 440, 690-693 *National Geographic Visualizing* 441 TWE: A 441 A 693
Content Standard 4: All students will describe sounds and sound waves; explain shadows, color, and other light phenomena; measure and describe vibrations and waves; and explain how waves and vibrations transfer energy. (Waves and Vibrations)	
1. Explain how sound travels through different media. (*Key concepts:* Media-solids, liquids, gases. *Real-world contexts:* 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.)	SE: 454 TWE: VL 454 DISC 454 Also see Glencoe's *Science Level Blue* © 2005 SE: 694, 701-705
2. Explain how echoes occur and how they are used. (*Key concepts:* Echo, sonar. *Real-world contexts:* Echoes in rooms-acoustics-and outdoors; practical uses of echoes, such as navigation by bats and dolphins, ultrasound imaging, sonar.)	See Glencoe's *Science Level Blue* © 2005 SE: 705
3. Explain how light helps us to see. (*Key concepts:* Light source, illumination, path of light, reflection, absorption. Parts of eye-retina, vitreous humor, lens, cornea, pupil, iris, optic nerve. *Real-world contexts:* Seeing common objects in our environment; seeing "through" transparent media, such as windows, water.)	SE: 453-454 TWE: IQL 453 Also see Glencoe's *Science Level Blue* © 2005 SE: 709-713
4. Explain how objects or media reflect, refract, transmit, or absorb light. (*Key concepts:* Reflection, refraction, absorption, transmission, scattering (or diffusion), medium. Transmission of light-transparent, translucent, opaque. Refraction of light-lenses, prisms. *Real-world contexts:* 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.)	See Glencoe's *Science Level Blue* © 2005 SE: 699, 709

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5. Describe the motion of pendulums or vibrating objects (frequency, amplitude). (*Key concepts:* Period, frequency, amplitude. *Real-world contexts:* Vibrating or oscillating objects, such as pendulums, weights on springs, vocal cords, tuning forks, guitar strings.)	See Glencoe's *Science Level Blue* © 2005 SE: 696-698, 702-703
6. Explain how waves transmit energy. (*Key concepts:* Types and forms of energy, longitudinal, transverse, emission, absorption, transmission, reflection. *Real-world contexts:* Reflecting and nonreflecting objects such as mirrors, black cloth, waves in slinkies and long springs, water waves.)	See Glencoe's *Science Level Blue* © 2005 SE: 694-698
V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts	
Content Standard 1: All students will describe the earth's surface; describe and explain how the earth's features change over time; and analyze effects of technology on the earth's surface and resources. (Geosphere)	
1. Describe and identify surface features using maps. (*Key concepts:* Types of maps-relief, topographic, elevation. Landforms-plains, deserts, plateaus, basin, Great Lakes, rivers, continental divide, mountains, mountain range, or mountain chain. *Real-world contexts:* Maps showing regional surface features, such as the Great Lakes or local topography.)	See Glencoe's *Science Level Blue* © 2005 SE: 324-325, 527, 767
2. Explain how rocks and minerals are formed. (*Key concepts:* Processes of forming rocks-melting, cooling, heat, pressure, sediments. Heat source is interior of earth-see Solar System benchmarks. Materials-soil, sand, rock, lava, shells, dead organisms. *Real-world contexts:* Physical environments where rocks are being formed, such as volcanoes-by cooling, ocean floor-by deposition, deltas, beaches, swamps.)	SE: 29-34, 58-61, 62-65, 67-70, 71-77 *MiniLAB* 31, 72 *National Geographic Visualizing* 32, 60 *Section Review* 35 #2, #3, #5 *Chapter Review* 53 #18, #20, #21 *LAB* 35 TWE: IP 33 DI 59, 64 QD 63 UA 68 TFYI 69 SJ 73 DISC 73
3. Explain how rocks and fossils are used to determine the age and geological history of the earth. (*Key concepts:* Time lines, rock layers, fossils, relative dating. See Waves and Vibrations benchmarks. *Real-world contexts:* Places where rock layers are visible; fossils, such as Petoskey stones.)	SE: 71-77, 343-347 *National Geographic Visualizing* 346 TWE: A 344 TFYI 344 SJ 344 QD 345 MM 345 UA 347

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4. Explain how rocks are broken down, how soil is formed and how surface features change. (*Key concepts:* Forces-gravity, pressure. Erosion by-glaciers, waves, wind, streams, weathering, plant roots. Decomposition by-bacteria, fungi, worms, rodents, other animals. See Ecosystems benchmarks. *Real-world contexts:* 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.)	SE: 72-74, 623 *MiniLAB* 72 TWE: DI 72 VL 73 DISC 73 SJ 73 A 74
5. Explain how technology changes the surface of the earth. (*Key concepts:* Types of human activities-surface mining, construction and urban development, farming, dams, landfills, restoring marsh lands, reclaiming spoiled land. *Real-world contexts:* Local example of surface changes due to human activities listed in the Key concepts above; local examples of negative consequences of these changes, such as groundwater pollution, destruction of habitat and scenic land, reduction of arable land.)	SE: 562, 573-576 *MiniLAB* 562 TWE: DI 563, 574 DISC 563 VL 574 SJ 574 A 575 TFYI 575
Content Standard 2: All students will demonstrate where water is found on earth; describe the characteristics of water and how water moves; and analyze the interaction of human activities with the hydrosphere. (Hydrosphere)	
1. Describe various forms that water takes on the earth's surface and conditions under which they exist. (*Key concepts:* 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 benchmarks. *Real-world contexts:* Local lakes, rivers, streams, ponds, springs; examples of frozen water, including snow, glaciers, icebergs, polar regions, frozen Great Lakes shorelines.)	SE: 90-91, 101, 149-151, 160, 164, 253, 573-574, 601, 656, 664 *National Geographic Visualizing* 660 TWE: TFYI 252 LD 596 SJ 160 CC 162 CD 573

STANDARDS	PAGE REFERENCES
2. Describe how rain water in Michigan reaches the oceans. (*Key concepts:* Water path-run-off, creeks, streams, wetlands, rivers, Great Lakes. See elementary benchmark 2 and Atmosphere and Weather benchmarks. Motion of water-currents, waves, tides. Temperature, thermal layering. Ocean composition-saltiness. *Real-world contexts:* Maps showing streams, lakes, rivers, oceans; examples of motions of rivers and lakes; investigations of rivers and lake temperatures.)	SE: 101, 157, 548, 627, 736 *MiniLAB* 157, 548 *National Geographic Visualizing* 158 *Science Stats* 644 *LAB* 665 TWE: SJ 101 IM 101 TFYI 548 MM 736
3. Describe the origins of pollution in the hydrosphere. (*Key concepts:* Sources of pollution-sewage, household dumping, industrial wastes. Limits to natural resources. Also see Geosphere benchmarks and Atmosphere and Weather benchmarks. *Real-world contexts:* Examples of polluted water; examples of occasions when water supply is restricted, such as during droughts.)	SE: 560-561, 573-574, 644 TWE: VL 574 IQL 574 SJ 574 DI 574
Content Standard 3: All students will investigate and describe what makes up weather and how it changes from day to day, from season to season and over long periods of time; explain what causes different kinds of weather; and analyze the relationships between human activities and the atmosphere. (Atmosphere and Weather)	
1. Describe the composition and characteristics of the atmosphere. (*Key concepts:* Atmosphere-air, molecules, gas, water vapor, humidity, dust particles, air pressure. Temperature changes with altitude. Also see Hydrosphere benchmarks. *Real-world contexts:* 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.)	SE: 90-97, 103-107, 161, 165 *Launch LAB* 89 *Applying Science* 94 *MiniLAB* 95 *Integrate Career* 161 TWE: FF 92 VLAB 92 DISC 163
2. Describe patterns of changing weather and how they are measured. (*Key concepts:* Weather patterns-cold front, warm front, air mass. *Tools:* Thermometer, rain gauge, wind direction indicator, weather maps, satellite weather images. *Real-world contexts:* Sudden temperature and cloud formation changes; records, charts, and graphs of weather changes over periods of days.)	SE: 118-125, 126-133, 134-136, 160-166 *LAB Model and Invent* 138-139 *LAB* 137, 167 TWE: QD 119 VL 122

STANDARDS	PAGE REFERENCES
3. Explain the water cycle and its relationship to weather patterns. (*Key concepts:* Water cycle-evaporation, condensation, cooling, clouds, run-off. Precipitation-rain, snow, hail, fog, humidity, droughts. Also see Changes in Matter benchmarks, Ecosystems benchmarks. *Real-world contexts:* Aspects of the water cycle in weather, including clouds, precipitation, evaporating puddles.)	SE: 101, 118-125 *Launch LAB* 117 *MiniLAB* 120 *Applying Math* 121 TWE: QD 119 LD 120 DI 121 TFYI 122 DISC 123, 124
4. Describe health effects of polluted air. (*Key concepts:* Effects-breathing difficulties, irritated eyes. Sources-car exhaust, industrial emissions. See Reflecting on Scientific Knowledge benchmarks. *Real-world contexts:* Locations and times where air quality is poor; local sources of potential air pollution.)	SE: 91, 170, 417-418, 568-572 *LAB* 98 *Section Review* 418 #7 TWE: DISC 91 TFYI 91, 417 MM 96 DISC 96 IQL 417 CD 571 CC 572
Content Standard 4: All students will compare and contrast our planet and sun to other planets and star systems; describe and explain how objects in the solar system move; explain scientific theories as to the origin of the solar system; and explain how we learn about the universe. (Solar System, Galaxy and Universe)	
1. Compare the earth to other planets in terms of supporting life. (*Key concepts:* 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 benchmarks. *Real-world contexts:* 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.)	SE: 103, 163, 187, 194-201 *LAB* 167 *Applying Science* 197 *LAB Model and Invent* 202-203 TWE: CC 196 MM 195 TFYI 163, 195, 197 VL 196 SJ 196 DI 197
2. Describe, compare, and explain the motions of planets, moons, and comets in the solar system. (*Key concepts:* Orbit, year, spin, axis, gravity, moons, rings, comets. Also see Motion of Objects benchmarks. *Real-world contexts:* Maps showing the motions of the planets, comets, moon and its phases.)	SE: 180-183, 185-190, 194-200 *MiniLAB* 186 TWE: LD 180 DISC 181, 188 CD 182 TFYI 186, 189 QD 187, 189 A 187, 197 UA 200 DI 200

STANDARDS	PAGE REFERENCES
3. Describe and explain common observations of the day and night skies. (*Key concepts:* Perceived and actual movement of the moon across sky, moon phases, stars and constellations, planets, Milky Way, comet tail. *Real-world contexts:* 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.)	SE: 156-157, 182-183, 186-187 *Section Review* 183 #4, #6 TWE: IM 157 A 187 QD 187
4. Explain current scientific thinking about how the solar system formed. (*Key concepts:* Clouds of gasses 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 benchmarks. *Real-world contexts:* 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.)	SE: 201 Also see Glencoe's *Science Level Blue* © 2005 SE: 338, 388-391

Codes Used for TWE Pages

A	Activity
CC	Curriculum Connection
CD	Cultural Diversity
DI	Differentiated Instruction
DISC	Discussion
EA	Error Analysis
FF	Fun Fact
IM	Identifying Misconceptions
IP	Integrate Physics
IQL	Inquiry Lab
LD	Laboratory Demonstration
MM	Make a Model
QD	Quick Demo
RT	Reteach
SCB	Science Content Background
SJ	Science Journal
TFYI	Teacher FYI
TPK	Tie to Prior Knowledge
UA	Use an Analogy
USW	Using Science Words
VL	Visual Learning
VLAB	Virtual Labs