Grade 6 – Science Standards

Standard	E&S Activities	Billy B & Me CD Songs
I. Inquiry		
A. Abilities Necessary to do Scientific Inquiry		
1. Identify process skills that can be used in scientific investigations.		
a. Observe		
1. Observe patterns of objects and events.		
2. Distinguish between qualitative and quantitative observations.		
b. Classify		
1. Arrange data in sequential order.	**3 - Energy Chains**	
2. Use scientific (e.g., field guides, charts, periodic tables, etc.) and dichotomous keys for classification.		
c. Measure		
1. Select and use appropriate tools (e.g., metric ruler, graduated cylinder, thermometer, balances, spring scales, and stopwatches) and units (e.g., meter, liter, Celsius, gram, Newton, and second) to measure to the unit required in a particular situation.		
2. Select and use appropriate metric prefixes to include milli-, centi-, and kilo-.		
d. Infer		
1. Make inferences based on observations.	**4 - What Powers the Move?**	
e. Predict		
1. Predict the results of actions based on patterns in data and experiences.	**4 - What Powers the Move?**	
2. Design and conduct a scientific investigation.		
a. Recognize potential hazards within a scientific investigation and practice appropriate safety procedures.		
b. Pose questions and problems to be investigated.		
c. Obtain scientific information from a variety of sources (such as Internet, electronic encyclopedias, journals, community resources, etc.).	**5 - In the Driver's Seat**	
d. Distinguish and operationally define independent (manipulated) and dependent (responding) variables.		
e. Manipulate one variable over time with repeated trials and controlled conditions.		

Grade 6 – Science Standards

Standard	E&S Activities	Billy B & Me CD Songs
f. Collect and record data using appropriate metric measurements.		
g. Organize data in tables and graphs.		
h. Analyze data to construct explanations and draw conclusions.	**5 - In the Driver's Seat**	
3. Use appropriate tools and techniques to gather, analyze, and interpret data		
a. Select and use appropriate tools and technology (such as calculators, computers, probes, thermometers, balances, spring scales, microscopes, binoculars, and hand lenses) to perform tests, collect data, and display data.	**5 - In the Driver's Seat**	
b. Analyze and interpret data using computer hardware and software designed for these purposes.		
4. Develop descriptions, explanations, predictions, and models using evidence.		
a. Discriminate among observations, inferences, and predictions.		
b. Construct and/or use models to carry out/support scientific investigations.		
5. Think critically and logically to make relationships between evidence and explanations.		
a. Review and summarize data to show cause-effect relationships in experiments.		
b. State explanations in terms of independent (manipulated) and dependent (responding) variables.		
c. State hypotheses in ways that include the independent (manipulated) and dependent (responding) variables.		
6. Recognize and analyze alternative explanations and predictions.		
a. Analyze different ideas and explanations to consider alternative ideas.		
b. Accept the skepticism of others as part of the scientific process. **(N)**		
7. Communicate scientific procedures and explanations.		
a. Use drawings, written and oral expression to communicate information.	**2 - May the Source Be with You** **4 - What Powers the Move?**	

Grade 6 – Science Standards

Standard	E&S Activities	Billy B & Me CD Songs
b. Create drawings, diagrams, charts, tables and graphs to communicate data.	**2 - May the Source Be with You** **4 - What Powers the Move?** **5 - In the Driver's Seat**	
c. Interpret and describe patterns of data on drawings, diagrams, charts, tables, graphs, and maps.		
d. Create and/or use scientific models to communicate information.		
8. Use mathematics in all aspects of scientific inquiry.		
a. Use mathematics to gather, organize and present data.	**5 - In the Driver's Seat**	
b. Use mathematics to structure convincing explanations.	**5 - In the Driver's Seat**	
B. Abilities of Technological Design **1. Identify appropriate problems for technological design.**		
a. Identify a specific need for a product.	**4 - What Powers the Move?**	
b. Determine whether the product will meet the needs and be used.	**4 - What Powers the Move?**	
2. Design a solution or product.		
a. Compare and contrast different proposals using selected criteria (e.g., cost, time, trade-off, and materials needed).	**4 - What Powers the Move?**	
b. Communicate ideas with drawings and simple models.	**4 - What Powers the Move?**	
3. Implement a proposed design.		
a. Select suitable tools and techniques to ensure adequate accuracy.		
b. Organize materials, devise a plan and work collaboratively where appropriate.		
4. Evaluate completed technological designs or products.		
a. Measure the quality of the product based on the original purpose or need and the degree to which it meets the needs of the users.		
b. Suggest improvements and try proposed modifications to the design.		
5. Communicate the process of technological design.		
a. Identify the stages of problem design: (1) problem identification, (2) solution design, (3) implementation, and (4) evaluation.		
C. Understandings about Science and Technology **1. Scientific inquiry and technological design have similarities and differences.**		

Grade 6 – Science Standards

Standard	E&S Activities	Billy B & Me CD Songs
a. Compare and contrast scientific inquiry and technological design.		
2. Many different people in different cultures have made and continue to make contributions to science and technology.		
a. Describe examples of contributions people have made to science and technology. **(H, N)**	**4 - What Powers the Move?**	
3. Science and technology are reciprocal.		
a. Explain how science and technology are essential to each other. **(T)**		
4. Perfectly designed solutions do not exist.		
a. Discuss factors that affect product design and alter the original design. **(T)**		
b. Discuss risk versus benefit factors in product design. **(P)**	**4 - What Powers the Move?**	
5. Technological designs have constraints.		
a. Describe examples of constraints on technological designs. **(T)**		
b. Explain why constraints on technological design are unavoidable. **(T, N)**		
6. Technological solutions have intended benefits and unintended consequences.		
II. Life Science **Unit of Study: Fungi and Plants** **A. Structure and Function in Fungi and Plant Systems** **1. Important levels of organization for structure and function include cells and whole organisms. All organisms are composed of cells — the fundamental unit of life.**		
a. Identify and explain the function of plant cell parts (e.g., vacuoles, nucleus, cytoplasm, cell membrane, cell wall, and chloroplasts).		**The Rock and Roll of Photosynthesis** **Energy**
b. Distinguish between and illustrate plant and animal cells (e.g., cell wall, chloroplasts, and nucleus).		
c. Describe the basic characteristics of two of the kingdoms of organisms--fungi and plants.		
d. Compare and contrast three forms of fungi (mushrooms, yeasts and molds).		

Grade 6 – Science Standards

Standard	E&S Activities	Billy B & Me CD Songs
e. Compare and contrast vascular and nonvascular plants, flowering and non-flowering plants and deciduous and coniferous trees.		
2. Some diseases are the result of damage by infection by other organisms.		
a. Describe the helpful and harmful effects of some fungi on other organisms (e.g., athlete's foot and ringworm in humans, rust in plants and penicillin). **(P)**		
B. Plant Reproduction and Heredity **1. Reproduction is a characteristic of all living systems, because no individual organism lives forever, reproduction is essential to the continuation of every species. Some organisms reproduce asexually. Other organisms reproduce sexually.**		
a. Describe asexual reproduction processes in plants and fungi (e.g., vegetative propagation in stems, roots, and leaves of plants; budding in yeasts; fruiting bodies in fungi).		
b. Identify the process of cell division as asexual reproduction.		
c. Identify where sexual spores are produced on mushrooms and explain how the spores are dispersed.		
2. Plants also reproduce sexually — the egg and sperm are produced in the flowers of flowering plants.		
a. Observe, draw, and label the parts of a flower and examine their functions in sexual reproduction.		
b. Describe the importance of wind, water, or insects to the pollination process and the adaptations of flowering plants to ensure pollination.		
c. Discuss the negative impacts of pesticides on the pollination process. **(P)**		
3. An egg and sperm unite to begin the development of a new individual.		
a. Trace the path of the sperm cells to the egg cell in the ovary of a flower to produce a seed.		
b. Analyze the structures and functions of parts of a seed in the formation of a plant.		
c. Investigate and describe the conditions necessary for the germination of seeds.		
d. Analyze the structures and functions of fruits in the reproduction of seed plants.		

Grade 6 – Science Standards

Standard	E&S Activities	Billy B & Me CD Songs
C. Regulation and Behavior		
1. All organisms must be able to obtain and use resources, grow, reproduce, and maintain stable internal conditions while living in a constantly changing external environment.		
a. Describe the most effective conditions for the growth of fungi and their adaptations to those conditions.		
b. Describe how green plants produce energy from the sun using the terms photosynthesis, chlorophyll, water, carbon dioxide, oxygen and sugar.	**1 - Energy Detectives** **3 - Energy Chains** **6 - Energy Challenge Game**	**It is the Energy, It is the Sun** **The Rock and Roll of Photosynthesis** **Yummy, Yummy**
c. Describe how plants use sugar to produce energy (respiration).		**It is the Energy, It is the Sun** **The Rock and Roll of Photosynthesis**
d. Explain the importance of green plants to the survival of other organisms in the environment.		
e. Relate the structures of roots, stems and leaves to their functions in plants.		**Yummy, Yummy**
f. Observe, draw, and analyze the structure and function of xylem and phloem tissues in roots and stems of vascular plants.		
g. Identify guard cells and explain their function in the operation of stomata (transpiration).		
h. Examine why stomata in most plants are closed at night and open during the day.		
2. Behavior is one kind of response an organism can make to an internal or environmental stimulus.		
a. Define tropisms in plants.		
b. Apply tropisms in plants in response to specific stimuli (e.g., light, gravity, touch, and water) to real world situations.		
3. An organism's behavior evolves through adaptation to its environment.		
a. Explain the importance of fungi as decomposers and their adaptations to that role.		
b. Compare and contrast the major characteristics of land biomes (e.g., Tropical rainforests, Temperate rainforests, deserts, tundra, coniferous forests/taiga, and deciduous forests).		
c. Distinguish adaptations of various plants to survive and reproduce in different biomes.		

Grade 6 – Science Standards

Standard	E&S Activities	Billy B & Me CD Songs
Unit of Study: Muscular and Skeletal Systems		
D. Structure and Function in Muscular and Skeletal Systems		
1. The human organism has muscular and skeletal systems for movement.		
a. Illustrate the parts and describe the functions of the skeletal and muscular systems including bones, muscles, ligaments, joints, and tendons.		
2. Disease is a breakdown in structures or functions of an organism. Some diseases are the result of intrinsic failures of the system.		
a. Identify the diseases of the muscular and skeletal systems that are the result of intrinsic factors (e.g., muscular dystrophy and arthritis).		
III. Earth Science		
Unit of Study: Energy Transfer in the Atmosphere		
A. Structure of the Earth System		
1. Water, which covers the majority of the Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from the Earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow and falls to the surface where it collects in lakes, oceans, soil, and rocks underground.		
a. Identify, investigate and explain the processes of condensation, evaporation, precipitation, and runoff using a model or diagram.		**Water Cycle**
b. Relate the occurrence of water in the Earth's crust, oceans, and atmosphere to the water cycle processes.		
c. Analyze why precipitation occurs in the form of rain, sleet, hail, or snow.		
2. Water is a solvent. As it passes through the water cycle, it dissolves minerals and gases and carries them to the oceans.		
a. Classify different substances based on their solubility in water.		
b. Infer the effects of water on the weathering of the Earth's surface in terms of solubility.		
c. Describe how minerals (and salts) accumulate in lakes and oceans.		
d. Explain how acid rain forms from dissolved gases (carbon dioxide, sulfur and nitrogen oxides from burning fossil fuels) in the water in the atmosphere.		**Our Changing World**
3. The atmosphere is a mixture of nitrogen, oxygen, and trace gases that include water vapor.		
a. Identify the gas composition of the atmosphere.		

Grade 6 – Science Standards

Standard	E&S Activities	Billy B & Me CD Songs
b. Operationally define humidity and relative humidity and relate these to weather conditions.		
4. The atmosphere has different properties at different elevations.		
a. Compare and contrast the physical characteristics of the different layers of the atmosphere (e.g., troposphere, stratosphere, mesosphere, thermosphere, and exosphere).		
b. Relate the characteristics of the layers of the atmosphere (e.g., temperature, pressure, and composition of gases) to different altitudes.		
c. Explain the effect of air pressure at different elevations (e.g., cooking and ears popping).		
5. Clouds, formed by the condensation of water vapor, affect weather and climate.		
a. Demonstrate and explain the formation of clouds.		
b. Classify shapes and types of clouds according to elevations.		
c. Relate cloud types to weather events and patterns.		
d. Use weather maps, Internet sites with satellite images, and other weather data to identify and predict weather conditions.		
6. Global patterns of atmospheric movement influence local weather.		
a. Relate heat transfer to the movement of air masses, high and low pressure areas, and fronts in the atmosphere.		
b. Compare characteristics and locations of global wind patterns (e.g., trade winds and the jet stream), and give examples of how these global patterns can affect local weather.		
c. Describe how satellites and computers provide information on local and worldwide weather patterns. (T)		
7. Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.		
a. Relate heat transfer to ocean current circulation.		
b. Compare the characteristics of the Gulf Stream with other large ocean currents and their effects on climate in Eastern North America and Western Europe.		
c. Infer why air temperatures are more moderate in areas near large bodies of water.		
d. Describe where hurricanes form and their movement across the oceans.		
e. Describe what happens when hurricanes move over land.		

Grade 6 – Science Standards

Standard	E&S Activities	Billy B & Me CD Songs
IV. Physical Science **Unit of Study: Physical Properties and Changes of Matter** **A. Properties and Changes of Properties in Matter**		
1. A substance has characteristic properties, such as density, boiling point, and solubility, all of which are independent of the amount of the sample.		
a. Investigate the direct relationship between the amount of water an object displaces and the object's volume.		
b. Relate the properties of sinking and floating to different densities of substances (hydrometer).		
c. Determine mass and volume of various substances and calculate their densities as mass/volume.		
d. Define and give examples of the three states of matter. Introduce plasma (e.g., lightning and material in neon lights) as a fourth state of matter.		
e. Apply properties of different densities to oil spill pollution problems and life in frozen lakes and to other real world situations.		
f. Classify substances based on melting points, boiling points, and solubility data.		
g. Investigate and describe how solubility differences can be used to identify components of a mixture (e.g., chromatography).		
2. Substances often are placed in categories or groups if they react in similar ways; metals is an example of such a group.		
a. Distinguish among elements, compounds, and mixtures.		
b. Use the periodic table to identify common elements in their groups.		
c. Distinguish metals from non-metals based on observed characteristics.		
d. Create models of atoms representing common elements by identifying the location and charges of the protons, neutrons, and electrons in the models.		
e. Distinguish between acids and bases using indicators.		
f. Relate the pH scale to the colors of indicators and relative strengths of acids and bases.		
3. There are more than 100 known elements that combine in a multitude of ways to produce compounds, which account for the living and nonliving substances that we encounter.		
a. List the most common elements and compounds found in living organisms.		

Grade 6 – Science Standards

Standard	E&S Activities	Billy B & Me CD Songs
b. Interpret labels on foods, household chemicals, and over-the-counter medicines to identify common elements and compounds present.		
Unit of Study: **Machines and Work** **B. Motion and Forces** **1. Motion can be measured and represented on a graph.**		
a. Measure force required to move an object using appropriate devices (e.g., spring scale, rubber band and ruler).		
b. Manipulate and graph force vs. distance required to move an object using a lever, pulley, or inclined plane without changing the total work involved.		
2. If more than one force acts on an object along a straight line, then the forces will reinforce or cancel one another, depending on their direction and magnitude. Unbalanced forces will cause changes in the speed or direction of an object's motion.		
a. Measure force required to move an object using appropriate devices (e.g., spring scale, rubber band and ruler).		
b. Manipulate and graph force vs. distance required to move an object using a lever, pulley, or inclined plane without changing the total work involved.		
3. If more than one force acts on an object along a straight line, then the forces will reinforce or cancel one another, depending on their direction and magnitude. Unbalanced forces will cause changes in the speed or direction of an object's motion.		
a. Construct and analyze simple machines (e.g., levers, pulleys, and inclined planes) to analyze forces and distances (i.e., work).		
b. Investigate how using simple machines can reduce the force (effort) required to do the same amount of work done without a machine by increasing the distance required to move the object.		
c. Demonstrate the change in direction of an object's motion using a machine or by interpreting diagrams or descriptions.		
d. Describe the effect of friction on an object by using different surfaces on an inclined plane or by interpreting diagrams or descriptions.		
e. Investigate how machines can reduce the effect of the forces of friction and gravity.		

Grade 6 – Science Standards

Standard	E&S Activities	Billy B & Me CD Songs
Unit of Study: Forms and Transfer of Energy		
C. Energy is transferred in many ways.		
1. Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, and the nature of a chemical.		
a. Identify sources of heat, light, sound, electrical and chemical energy, and mechanical motion.	**1 - Energy Detectives** **2 - May the Source Be with You** **3 - Energy Chains** **6 - Energy Challenge Game**	
b. Recognize and identify heat, light, sound, electrical and chemical energy, and mechanical motion as forms of energy.	**1 - Energy Detectives** **2 - May the Source Be with You** **3 - Energy Chains** **6 - Energy Challenge Game**	**It is the Energy, It is the Sun** **The Rock and Roll of Photosynthesis** **Energy** **Energy & Me**
2. Energy is transferred in many ways.		
a. Demonstrate how mechanical energy is transformed to another form of energy (e.g., vibrations, heat through friction).	**1 - Energy Detectives** **3 - Energy Chains** **6 - Energy Challenge Game**	**Energy & Me**
b. Demonstrate how chemical energy is transformed to another form of energy (e.g., light wands, lightning bugs, batteries, and bulbs	**1 - Energy Detectives** **3 - Energy Chains** **6 - Energy Challenge Game**	**Energy** **On the Move**
3. Heat moves in predictable ways, flowing from warmer to cooler objects, until both reach the same temperature.		
a. Predict and demonstrate the effect of the flow of heat in solids, liquids, and gases.		
b. Investigate the effects of temperature differences on the movement of water.		
c. Design an experiment that reduces the rate at which a substance melts.		
d. Observe and compare the melting time of a substance in an insulated container vs. an open container.		
e. Analyze how insulating factors affect the flow of heat.		
f. Relate insulating factors to real life applications (e.g., building construction, clothing, animal covering).		
g. Analyze and use examples to show how conduction, convection, or radiation factors enhance the flow of heat.		
4. Electrical circuits provide a means of transferring electrical energy when heat, light, sound, and chemical changes are produced. Heat, light, mechanical motion, or electricity might be involved in such transfers.		
a. Design and diagram, using common pictures and symbols, an electrical circuit to demonstrate energy transfer.		
b. Relate electricity to magnetism (e.g., electromagnets and simple electric motors) using descriptions and diagrams.		

Grade 6 – Science Standards

Standard	E&S Activities	Billy B & Me CD Songs
c. Analyze how an electric motor demonstrates energy transfers (e.g., chemical to electrical to mechanical motion).	**3 - Energy Chains**	
d. Explain how generators produce electricity from mechanical motion.	**3 - Energy Chains**	
5. The sun is a major source of energy for changes on the Earth's surface.		
a. Measure temperature differences as the sun or a model of the sun warms different surfaces.		
b. Graph time vs. temperature of different surfaces exposed to the sun and analyze the graphs to infer factors that affect heat absorption.		
c. Investigate and describe practical uses of solar energy (e.g., solar ovens, water heaters, calculators, etc.).		