

Educator Guide: Amusement Park Physics With a NASA Twist

Aligned to Missouri Science GLE's
by Missouri NASA ERC
Spring 2006

CORRELATION TABLE WITH THE MISSOURI SCIENCE GLE'S Table Explanations and Legend

This table provides a correlation between the activities and content in the NASA Educator Guide, *Amusement Park Physics With a NASA Twist*, and the Missouri Grade Level Expectations (GLE's) in Science. All science Strands and Concepts are listed in the table. Activities and content in the Guide that address a specific concept are indicated under the appropriated grade level(s) shown across the top of the table. See examples of correlation entries below.

This Educator Guide is designed for grades 7-9. However, some content and activities may also be applicable to other grade levels as indicated in the table.

While the table addresses the Science GLE's, it should be noted that *Amusement Park Physics With a NASA Twist* also addresses Mathematics GLE's in ALL Activities.

LEGEND

X	An "X" alone indicates that the GLE concept is addressed in the Educator Guide's content material, but there is not a specific hands-on activity for that concept.
CA1-4, RW2, 4,5,7,8	This type of entry (with no "X") indicates the hands-on activities in the Guide (by activity number) that address the concept; however, the concept is not addressed in the Guide's content materials. "BS" = Basic Skills Activities; "CA" = Classroom Activities; "RW" = Ride Workbook Activities (SEE EDUCATOR GUIDE TABLE OF CONTENTS)
X, CA1-4, RW2, 4,5,7,8	This type of entry (with the "X") indicates the hands-on activities in the Guide (by activity number) that address the concept; and it denotes that the concept is also addressed by the Guide's content materials.
■	This type of entry (denoted with a geometric shape) indicates that there is a hands-on activity for all of one particular group. I.e., "■" = <u>ALL</u> Basic Skills Activities; "●" = <u>ALL</u> Classroom Activities; "◆" for <u>ALL</u> Ride Workbook Activities

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	K	1	2	3	4	5	6	7	8	9/10/11
STRAND 1 : MOTION AND ENERGY										
1. Changes in Property and Principles of Matter and Energy										
A. Objects, and the materials they are made of, have properties that can be used to describe and classify them	X, CA2	X, CA2	X	X	CA2		X, CA2			
B. Properties of mixtures depend on the concentrations, properties, and interactions of particles										
C. Properties of matter can be explained in terms of moving particles too small to be seen without tremendous magnification										
D. Physical changes in the state of matter that result from thermal changes can be explained by the Kinetic Theory of Matter										
E. The atomic model describes the electrically neutral atom										
F. The periodic table organizes the elements according to their atomic structure and chemical reactivity										
G. Properties of objects and states of matter can change chemically and/or physically										
H. Chemical bonding is the combining of different pure substances (elements, compounds) to form new substances with different properties										
I. Mass is conserved during any physical or chemical change						X		X		
2. Energy has a source, can be transferred, and can be transformed into various forms but is conserved between and within systems										
A. Forms of energy have a source, a means of transfer (work and heat), and a receiver										
B. Mechanical energy comes from the motion (kinetic energy) and/or relative position (potential energy) of an object										X, CA4-8, RW 1,3,8

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STRAND 1 : MOTION AND ENERGY (CONTINUED)										
C. Electromagnetic energy from the Sun (solar radiation) is a major source of energy on Earth										
D. Chemical reactions involve changes in the bonding of atoms with the release or absorption of energy										
E. Nuclear energy is a major source of energy throughout the universe										
F. Energy can change from one form to another within systems, but the total amount remains the same										X, CA4-8, RW 1,3,8
STRAND 2 : FORCE & MOTION										
1. The motion of an object is described by its change in position relative to another object or point										
A. The motion of an object is described as a change in position, direction, and speed relative to another object (frame of reference)	X, ●	X, ●			X, ●, RW5, 7,8			X, CA1-4, RW2, 4,5,7,8		X, CA1-4, RW2, 4,5,7,8
B. An object that is accelerating is speeding up, slowing down, or changing direction										X
C. Momentum depends on the mass of the object and the velocity with which it is traveling										X, CA4
2. Forces affect motion										
A. Forces are classified as either contact (pushes, pulls, friction, buoyancy) or non-contact forces (gravity, magnetism), that can be described in terms of direction and magnitude	X, ●	X, ●			X, CA5	X, BS12, RW 2,4, 6,8		X, CA 5-8		X, CA 5-8
B. Every object exerts a gravitation force on every other object			X, CA4		X, BS12, RW2,4, 6,8			X, RW 6,8		X, RW 6,8
C. Magnetic forces are related to electrical forces as different aspects of a single electromagnetic force										

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STRAND 2 : FORCE AND MOTION (CONTINUED)										
D. Newton's Laws of Motion explain the interaction of mass and forces, and are used to predict changes in motion		X, ●	X, CA 2-8		X, ●			X, CA 2-8		X, CA 2-8
E. Perpendicular forces act independently of each other										X, CA 4-6
F. Simple machines (levers, inclined planes, wheel and axle, pulleys) affect the force applied to an object and/or direction of movement as work is done			X			X		X		
STRAND 3 : LIVING ORGANISMS										
1. There is a fundamental unity underlying the diversity of all living organisms										
A. Organisms have basic needs for survival										
B. Organisms progress through life cycles unique to different types of organisms										
C. Cells are the fundamental units of structure and function of all living things										
D. Plants and animals have different structures that serve similar functions necessary for the survival of the organism										
E. Biological classifications are based on how organisms are related										
2. Living organisms carry out life processes in order to survive										
A. The cell contains a set of structures called organelles that interact to carry out life processes through physical and chemical means										
B. Photosynthesis and cellular respiration are complementary processes necessary to the survival of most organisms on Earth										
C. Complex multicellular organisms have systems that interact to carry out life processes through physical and chemical means										

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STRAND 3 : LIVING ORGANISMS (CONTINUED)										
D. Cells carry out chemical transformations that use energy for the synthesis or breakdown of organic compounds										
E. Protein structure and function are coded by the DNA (Deoxyribonucleic acid) molecule										
F. Cellular activities and responses can maintain stability internally while external conditions are changing (homeostasis)										
G. Life processes can be disrupted by disease (intrinsic failures of the organ systems or by infection due to other organisms)										
3. There is a genetic basis for the transfer of biological characteristics from one generation to the next through reproductive processes										
A. Reproduction can occur asexually or sexually										
B. All living organisms have genetic material (DNA) that carries hereditary information										
C. Chromosomes are components of cells that occur in pairs and carry hereditary information from one cell to daughter cells and from parent to offspring during reproduction										
D. There is a heritable variation within every species of organism										
E. The pattern of inheritance for many traits can be predicted by using the principles of Mendelian genetics										
STRAND 4 : ECOLOGY										
1. Organisms are independent of one another and with their environment										
A. All populations living together within a community interact with one another and with their environment in order to survive and maintain a balanced ecosystem										
STRAND 4 : ECOLOGY (CONTINUED)										

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B. Living organisms have the capacity to produce populations of infinite size, but environments are resources are finite										
C. All organisms, including humans, and their activities cause changes in their environment that affect the ecosystem										
D. The diversity of species within an ecosystem is affected by changes in the environment, which can be caused by other organisms or outside processes										
2. Matter and energy flow through an ecosystem										
A. As energy flows through the ecosystem, all organisms capture a portion of that energy and transform it to a form they can use										
B. Matter is recycled through an ecosystem										
3. Genetic variation sorted by the natural selection process explains evidence of biological evolution										
A. Evidence for the nature and rates of evolution can be found in anatomical and molecular characteristics of organisms and in the fossil record										
B. Reproduction is essential to the continuation of every species										
C. Natural selection is the process of sorting individuals based on their ability to survive and reproduce within their ecosystem										
STRAND 5 : EARTH SYSTEMS : (Geosphere, Atmosphere, Hydrosphere)										
1. Earth's systems (geosphere, atmosphere and hydrosphere) have common components and unique structures										
A. The Earth's crust is composed of various materials, including soil, minerals and rocks, within characteristic properties										
STRAND 5 : EARTH SYSTEMS : (Geosphere, Atmosphere, Hydrosphere) (CONTINUED)										

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B. The hydrosphere is composed of water (a material with unique properties) and other materials										
C. The atmosphere (air) is composed of a mixture of gases, including water vapor, and minute particles										
D. Climate is a description of average weather conditions in a given area of time										
2. Earth's systems (geosphere, atmosphere and hydrosphere) interact with one another as they undergo change by common processes										
A. The Earth's materials and surface features are changed through a variety of external processes										
B. There are internal processes and sources of energy within the geosphere that cause changes in Earth's crustal plates										
C. Continual changes in the Earth's materials and surface that result from internal and external processes is described by the rock cycle										
D. Changes in the Earth over time can be inferred through rock and fossil evidence										
E. Changes in the form of water as it moves through Earth's systems are described as the water cycle										
F. Constantly changing properties of the atmosphere occur in patterns which are described as weather										
G. The geosphere, hydrosphere and atmosphere are continually interacting through processes that transfer energy and Earth's materials										
3. Human activity is dependent upon and affects Earth's resources and systems										
A. Earth's materials are limited natural resources affected by human activity										
STRAND 6 : UNIVERSE										
1. The universe has observable properties and structure										

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	K	1	2	3	4	5	6	7	8	9/10/11
A. The Earth, Sun and moon are part of a larger system that includes other planets and smaller celestial bodies						X				X
B. The Earth has a composition and location suitable to sustain life						X				
C. Most of the information we know about the universe comes from the electromagnetic spectrum										
2. Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces										
A. The apparent position of the Sun and other stars, as seen from Earth, changes in observable patterns										
B. The apparent position of the moon, as seen from Earth, and its actual position relative to Earth change in observable patterns										
C. The regular and predictable motions of the Earth and moon relative to the Sun explain natural phenomena of Earth, such as day, month, year, shadows, moon phases, eclipses, tides and seasons										
D. Gravity is a force of attraction between objects in the solar system that governs their motion								X		X
STRAND 7 : SCIENTIFIC INQUIRY										
1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning and critical thinking										
A. Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation	●	●	●	●	●	●	●	●	●	●
B. Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations	■, ●, ◆	■, ●, ◆	■, ●, ◆	■, ●, ◆	■, ●, ◆	■, ●, ◆	■, ●, ◆	■, ●, ◆	■, ●, ◆	■, ●, ◆
STRAND 7 : SCIENTIFIC INQUIRY (CONTINUED)										
C. Evidence is used to formulate explanations	BS10, ●	BS10, ●	BS10, ●	BS10, ●	BS10, ●	BS10, ●	BS10,13, ●	BS10,13, ●	BS10,13, ●	BS10,13, ●

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D. Scientific inquiry includes evaluation of explanations (hypotheses, laws, theories) in light of scientific principles (understandings)	●	●	●	●	●	●	BS10, ●	BS10, ●	BS10, ●	BS10, ●
E. The nature of science relies upon communication of results and justification of explanations	●	●	●	●	●	●	●	●	●	●
STRAND 8 : SCIENCE, TECHNOLOGY & HUMAN ACTIVITY										
1. The nature of technology can advance, and is advanced by, science as it seeks to apply scientific knowledge in ways that meet human needs										
A. Designed objects are used to do things better or more easily and to do some things that could not otherwise be done at all							X	X	X	
B. Advances in technology often result in improved data collection and an increase in scientific information	X, ■, ●, ◆	X, ■, ●, ◆	X, ■, ●, ◆	X, ■, ●, ◆	X, ■, ●, ◆	X, ■, ●, ◆	X	X	X	X
C. Technological solutions to problems often have drawbacks as well as benefits										
2. Historical and cultural perspectives of scientific explanations help to improve understanding of the nature of science and how science knowledge and technology evolve over time										
A. People of different gender and ethnicity have contributed to scientific discoveries and the invention of technological innovations										
B. Scientific theories are developed based on the body of knowledge that exists at any particular time and must be rigorously questioned and tested for validity							X	X	X	X
3. Science and technology affect, and are affected by, society										
A. People, alone or in groups, are always making discoveries about nature and inventing new ways to solve problems and get work done	X, CA 5-8	X, CA 5-8	X, CA 5-8	X, CA 5-8	X, CA 5-8	X, CA 5-8				
STRAND 8 : SCIENCE, TECHNOLOGY & HUMAN ACTIVITY (CONTINUED)										
B. Social, political, economic, ethical and environmental factors strongly influence, and are influenced by, the direction of progress of science and technology										

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C. Scientific ethics require that scientists must not knowingly subject people or the community to health or property risks without their knowledge or consent										
D. Scientific information is presented through a number of credible sources, but is at times influenced in such a way to become non-credible										

	Kinder.	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	9, 10, 11
Strand 1: Matter & Energy	Properties of Matter Investigating Sound	Properties of Matter: Mass and Temperature	Properties of Rocks and Soil Forms of Energy: Sound	Investigating States of Matter Earth, Sun and Moon	Mixtures and Solutions Forms of Energy: Electrical Circuits		Properties of and Changes in Matter Forms of Energy: Light and Sound	Forms of Energy: Heat, Electricity, and Magnetism Energy Transformations	Physical and Chemical Properties and Changes of Matter	Atomic Theory and Changes in Matter Energy Forms and Transfer
Strand 2: Force & Motion	Change in Position	Investigating Motion	Forces and Motion		Laws of Motion	Work and Simple Machines		Force, Motion, and Work		Interactions between Energy, Force, and Motion
Strand 3: Living Organisms	Plants and Animals Parent-Offspring Relationships	Characteristics of Plants and Animals	Life Cycles of Animals	Plants		Classification of Plants and Animals	Characteristics of Living Organisms		Cells and Body Systems Disease Reproduction and Heredity	Diversity and Unity Among Organisms Cellular Processes Genetics and Heredity
Strand 4: Ecology	Weather and Seasons			Food Chains	Interactions among Organisms and their Environments		Ecosystems and Populations			Interdependence of Organisms and their Environment Matter and Energy in the Ecosystem Biological Evolution
Strand 5: Earth Systems	Weather and Seasons	Observing Water and Weather	Earth Materials: Rocks and Soil	Investigating States of Matter	Changes in the Earth's Surface	Water Cycle and Weather	Internal Processes and External Events Earth's Resources	Weather and Climate	Rock Cycle and Plate Tectonics	Components and Structure of Earth's Systems Interactions among Earth's Systems and Processes of Change Effect of Human Activity on Earth's Resources
Strand 6: Universe	Objects in the Sky			Earth, Sun, and Moon		Solar System		Objects and Their Motion in the Solar System		Objects in the Universe and Their Motion
Strand 7: Scientific Inquiry	Inquiry	Inquiry	Inquiry	Inquiry	Inquiry	Inquiry	Inquiry	Inquiry	Inquiry	Inquiry
Strand 8: Science, Technology, & Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity