Excerpt from District 131 in Illinois based on Next Generation Science Standards
Science Overarching Transfer Goals,
Understandings, and Essential Questions

Transfer Goal	Essential Questions (STUDENT)	Understandings (TEACHER)
Design an investigation based on a problem, question or hypothesis using appropriate scientific tools, resources, and representations	● Based on the information I have, how do I use science skills to develop a question, hypothesis, and/or solve a problem? ● How do I design an investigation to test my idea (K-5) /hypothesis/ assumption? (6-12)	● Scientists do research to formulate insightful questions and solve problems. ● Good experimental design and laboratory techniques lead to precise and accurate data.
Collect and/or analyze data in relation to an idea, question, or hypothesis to look for patterns or relationships	● How do I use my senses to help me learn about the world? (K-8) ● How do I collect quality data? ● Can I trust my data? (K-5) How do I know if my evidence is scientifically valid? (6-12) ● What patterns (K-12) or trends (2-12) do I see in my data?	● Quality of evidence is dependent upon a variety of factors (controlling variables, attention to precision and accuracy, replication, selection of reliable resources). ● Scientists examine evidence to look for relationships (patterns, trends) which enable the development of conclusions.
Develop a valid scientific conclusion, assess its validity and limitations in order to suggest future questions or course of action	● What conclusions can I draw from the patterns/trends in my data? (K-12) AND How do I know my conclusion is valid? (6-12) ● What next steps or new questions does this conclusion inspire?	● Conclusions can only be as strong as the quality and quantity of the evidence and analyses on which they are based. ● Conclusions drawn from scientific evidence are not always applicable to all situations. ● Outcomes of experiments often lead to new questions for further investigation.
Define a problem and develop a solution through creation of a model with regular testing and redesign	● (K-12) What's the problem I am trying to solve? ● (K-12) What design/model can I create to address the problem (3-12) given the constraints and criteria? ● (3-12) How can I evaluate and improve my model? ● (K-12) Does the design/model solve the original problem? AND (3-12) What is the best model based on criteria and constraints?	● (K-12) Engineers begin developing solutions to problems by asking questions, making observations and gathering background information to clearly understand/define the problem. ● (3-12) Possible solutions to a problem are limited by various constraints and criteria, such as available resources, materials, and societal considerations. ● (K-12) Comparing multiple ideas from possible solutions can lead to a new/more effective design.

		● (K-12) Designs (e.g., sketches, computer simulations, physical models) communicate possible solutions to be tested/shared for peer/expert/customer review, critique, and redesign. ● (3-12) Building and testing with physical models reveals unexpected failure points in a proposed solution. ● (K-12) There is always more than one solution to a given design problem, but some are more effective than others given the criteria and constraints.
Critically examine text to determine main ideas and conclusions OR assess validity and limitations	● What information is important here (within and across sources)? ● What evidence is being used to support the author's/scientist's statements? (3-12) Is it valid? ● How do I develop and support a statement/conclusion?	● A credible statement/conclusion on a scientific issue is supported using valid evidence.
Communicate results through writing, speaking, and illustrations for a target audience using appropriate vocabulary	● Who is my audience? How will I communicate my evidence and ideas to them? ● What can I learn by sharing my work with others? (K-2) What can I learn from other people examining my work? (3-12) ● How does what I write/read/experience influence future questions and ideas?	● A credible statement/conclusion on a scientific issue is supported using valid evidence. ● Data displays (e.g. charts, tables, graphs) support and clarify explanations of evidence to increase accessibility for the intended audience. ● Peer review helps ensure the credibility of scientific findings. ● Disseminating scientific knowledge inspires future inquiry and ideas.

GROWTH AND DEVELOPMENT/INHERITANCE

Essential Questions (Student)	Understandings (Teacher)
(1-5) How does an organism change over time? (1-8) How does this organism reproduce? How does it compare to other/similar organisms? AND (6-8) How can organisms enhance their reproductive success? (3-12) How can human interaction and	(1-5) Plants and animals have unique and diverse lifecycles. (1-5) Adult living organisms (plants and animals) reproduce and pass along traits to help ensure species survival. (6-12) Organisms transfer genetic information to their offspring.

environmental factors influence the inheritance of (genetic) traits? (6-12) How do genetic and environmental factors affect the growth of an organism? (6-12) How do variations in genes determine the traits in an individual and their offspring? (6-12) How are inherited genes expressed in DNA determine physical traits and processes? (9-12) How do cells reproduce and differentiate to form and maintain a complex organism? (9-12) Where do new traits in organisms come from?	(1-8) Plants and animals have specialized characteristics and behaviors that can increase their chances for reproductive success. (3-12) Inherited traits/genetic information and its expression is subject to change based on environmental factors and their influences on gene mutation. (6-12) All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. (6-12) Mutations may help, hurt, or have no effect on an organism. (9-12) Cellular division (mitosis) and differentiation produce and maintain a complex organism. (9-12) Chromosomes can swap sections in meiosis during sexual reproduction, creating new genetic combinations and genetic variation.

MATTER AND ENERGY IN ECOSYSTEMS

Essential Questions (Student)	Understandings (Teacher)
(K) What do plants and animals need to survive? (2-5) How do plants and animals depend on their environment (sun and water) to survive and grow? (5-12) How does matter cycle throughout an ecosystem? (5-12) How does energy flow through the ecosystem?	(K-8) Living things need energy and other resources from their environment to live and grow. All energy comes from the sun. (5-12) Matter cycles and energy flows through ecosystem(s). (6-12 i.e. water, nitrogen, and carbon cycles) (5-12) Energy flows in the ecosystem, changing from one form to another. (6-12) Transfer of energy is the result of chemical processes between organisms to all levels of an ecosystem. (6-12) Transfers of matter into and out of the

	physical environment occur at every level. (9-12) The molecules produced through photosynthesis are used to construct a variety of larger molecules of life (i.e. proteins, DNA) (9-12) Cellular respiration releases stored energy from molecules to perform functions of life.

WEATHER AND CLIMATE

Essential Questions (Student)	Understandings (Teacher)
(K-5) What's the weather today? How do I explain it? What will the weather be like tomorrow/this week? Why can't my predictions be more accurate? (K-5) How does looking at patterns of weather tell me about the climate of a region? (K-5) How does looking at the weather help me make decisions? (6-12) What factors interact and influence weather and climate? (6-12) How does the level of greenhouse gases influence climate and weather patterns? (6-12) How do <u>all</u> living things impact Earth's climate?	(K-5) Climate describes the range of an area's typical weather conditions and the extent to which those conditions vary over years. (K-12) Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and/or living things. (6-12) From the beginning of time, our climate is dependent on a balance of carbon dioxide producers and consumers. (6-12) Light and radiation from the sun drives all climate changes on Earth including wind patterns, ocean currents, and general climate zones. (K-5) Some kinds of severe weather are more likely than others in a given region. (6-12) Because weather patterns are so complex, it is difficult to predict weather accurately. (6-12) Changes in the atmosphere due to human activity have impacted climate. (9-12)The outcomes predicted by global climate models strongly depend on the amount of human-generated greenhouse gases added to the atmosphere each year and the ability of the Earth to absorb them.