

Fifth Grade Companion Document

5-Unit 2: Animal Systems

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Introduction to the K-7 Companion Document An Instructional Framework

Overview

The Michigan K-7 Grade Level Content Expectations for Science establish what every student is expected to know and be able to do by the end of Grade Seven as mandated by the legislation in the State of Michigan. The Science Content Expectations Documents have raised the bar for our students, teachers and educational systems.

In an effort to support these standards and help our elementary and middle school teachers develop rigorous and relevant curricula to assist students in mastery, the Michigan Science Leadership Academy, in collaboration with the Michigan Mathematics and Science Center Network and the Michigan Science Teachers Association, worked in partnership with Michigan Department of Education to develop these companion documents. Our goal is for each student to master the science content expectations as outlined in each grade level of the K-7 Grade Level Content Expectations.

This instructional framework is an effort to clarify possible units within the K-7 Science Grade Level Content Expectations. The Instructional Framework provides descriptions of instructional activities that are appropriate for inquiry science in the classroom and meet the instructional goals. Included are brief descriptions of multiple activities that provide the learner with opportunities for exploration and observation, planning and conducting investigations, presenting findings and expanding thinking beyond the classroom.

These companion documents are an effort to clarify and support the K-7 Science Content Expectations. Each grade level has been organized into four teachable units- organized around the big ideas and conceptual themes in earth, life and physical science. . The document is similar in format to the Science Assessment and Item Specifications for the 2009 National Assessment for Education Progress (NAEP). The companion documents are intended to provide boundaries to the content expectations. These boundaries are presented as “notes to teachers”, not comprehensive descriptions of the full range of science content; they do not stand alone, but rather, work in conjunction with the content expectations. The boundaries use seven categories of parameters:

- a. **Clarifications** refer to the restatement of the “key idea” or specific intent or elaboration of the content statements. They are not intended to denote a sense of content priority. The clarifications guide assessment.
- b. **Vocabulary** refers to the vocabulary for use and application of the science topics and principles that appear in the content statements and expectations. The terms in this section along with those presented

within the standard, content statement and content expectation comprise the assessable vocabulary.

- c. **Instruments, Measurements and Representations** refer to the instruments students are expected to use and the level of precision expected to measure, classify and interpret phenomena or measurement. This section contains assessable information.
- d. **Inquiry Instructional Examples** presented to assist the student in becoming engaged in the study of science through their natural curiosity in the subject matter that is of high interest. Students explore and begin to form ideas and try to make sense of the world around them. Students are guided in the process of scientific inquiry through purposeful observations, investigations and demonstrating understanding through a variety of experiences. Students observe, classify, predict, measure and identify and control variables while doing "hands-on" activities.
- e. **Assessment Examples** are presented to help clarify how the teacher can conduct formative assessments in the classroom to assess student progress and understanding
- f. **Enrichment and Intervention** is instructional examples the stretch the thinking beyond the instructional examples and provides ideas for reinforcement of challenging concepts.
- g. **Examples, Observations, Phenomena** are included as exemplars of different modes of instruction appropriate to the unit in which they are listed. These examples include reflection, a link to real world application, and elaboration beyond the classroom. These examples are intended for instructional guidance only and are not assessable.
- h. **Curricular Connections and Integrations** are offered to assist the teacher and curriculum administrator in aligning the science curriculum with other areas of the school curriculum. Ideas are presented that will assist the classroom instructor in making appropriate connections of science with other aspects of the total curriculum.

This Instructional Framework is NOT a step-by-step instructional manual but a guide developed to help teachers and curriculum developers design their own lesson plans, select useful portions of text, and create assessments that are aligned with the grade level science curriculum for the State of Michigan. It is not intended to be a curriculum, but ideas and suggestions for generating and implementing high quality K-7 instruction and inquiry activities to assist the classroom teacher in implementing these science content expectations in the classroom.

5th Grade Unit 2: Animal Systems

Content Statements and Expectations

Code	Statements & Expectations	Page
L.OL.M.4	Animal Systems – Multicellular organisms may have specialized systems that perform functions that serve the needs of the organism.	1
L.OL.05.41	Identify the general purpose of selected animal systems (digestive, circulatory, respiratory, skeletal, muscular, nervous, excretory, and reproductive.)	1
L.OL.05.42	Explain how animal systems (digestive, circulatory, respiratory, skeletal, muscular, nervous, excretory, and reproductive) work together to perform selected activities.	2

5-Unit 2: Animal Systems

Big Ideas (Key Concepts)

- Animals' bodies are made up of various body systems that perform specific functions.
- These body systems function together and contribute to the animal's survival and well being.

Clarification of Content Expectations

Standard: Organization of Living Things

Content Statement – L.OL.M.4

Animal Systems – Multicellular organisms may have specialized systems that perform functions that serve the needs of the organism.

Content Expectations

L.OL.05.41 Identify the general purpose of selected animal systems (digestive, circulatory, respiratory, skeletal, muscular, nervous, excretory, and reproductive).

Instructional Clarifications

1. Identify means to recognize the general purpose of selected animal systems.
2. A description of what "system" refers to is logical as introduction to this expectation.
3. Human systems are used as representative of all vertebrate systems. This is particularly important if human systems are not taught in other parts of a district's K-7 curriculum.
4. Comparing animal systems of organisms from different animal Phyla is not the purpose or intent of this expectation.
5. Identification of the general purpose of each animal system is the focus of instruction, not a detailed understanding of the anatomy and physiology of all parts of each system.
6. Identify those organs in selected systems that relate to the general purpose of each system.
7. The purpose of the circulatory system is to carry food and oxygen to all parts of the body and to remove waste products from all parts of the body.

8. The purpose of the digestive system is to break down food into small particles that can be carried in the blood to all parts. A common misconception is that we eat because our stomachs need food.
9. The purpose of the respiratory system is to bring into the blood and to remove waste products (or carbon dioxide) from the blood.
10. The purpose of the skeletal system is to provide support and structure for the animal.
11. The purpose of the muscular system is to provide movement and form for the animal.
12. The purpose of the nervous system is an internal communication system between the brain and all other parts of the body.
13. The purpose of the excretory system is to remove wastes from the body.
14. The purpose of the reproductive system is to create offspring for the continuation of species.

Assessment Clarification

1. Identification of the general purpose of each animal system is the focus of instruction, not a detailed understanding of the anatomy and physiology of all parts of each system.

L.OL.05.42 Explain how animal systems (digestive, circulatory, respiratory, skeletal, muscular, nervous, excretory, and reproductive) work together to perform selected activities.

Instructional Clarifications

1. Two or more systems can be linked in performing selected activities.
2. Example of systems working together: As muscles work, the circulatory system carries oxygen from the respiratory system and food from the digestive system to muscles to provide energy. Then the circulatory system carries away waste from the muscles to the urinary system and respiratory system.
3. A common misconception is that not all systems are working all the time.

Assessment Clarifications

1. Students explain how two or more systems are linked in performing selected sports activities.
2. Students explain how all animal systems are functioning all the time, even when the animal is at rest.

**Inquiry Process, Inquiry Analysis and Communication,
Reflections and Social Implications**

Inquiry Process
S.IP.05.11 Generate scientific questions about animal systems (digestive, circulatory, respiratory, skeletal, muscular, nervous, excretory and reproductive) based on observations, investigations, and research.
S.IP.05.12 Design and conduct scientific investigations that demonstrate how selected systems work together (for example: how changes in muscular activity cause changes in circulatory and respiratory activity).
S.IP.05.13 Use tools and equipment appropriate to scientific investigations of systems working together (stop watches, meter sticks).
S.IP.05.14 Use metric measuring devices in investigations of how animal systems work together.
S.IP.05.15 Construct charts and graphs comparing changes in muscular activity with changes in pulse rate and breathing rate.
S.IP.05.16 Identify patterns in data from investigations of changes in muscular activity, pulse rate and breathing rate.
Inquiry Analysis and Communication
S.IA.05.11 Analyze information from data tables and graphs comparing changes in muscular activity with changes in pulse rate and breathing rate to answer scientific questions.
S.IA.05.12 Evaluate data, claims, and personal knowledge through collaborative discourse about animal systems working together.
S.IA.05.13 Communicate and defend findings of observations and investigations using evidence about muscular activity, heart rate and breathing rate.
S.IA.05.14 Draw conclusions from sets of data from multiple trials (data from all student groups) of a scientific investigation.
S.IA.05.15 Use multiple sources of information to evaluate strengths and weaknesses about the claims, arguments, or data regarding the relationship between muscular activity and breathing rate and pulse rate.
Reflection and Social Implication
S.RS.05.21 Evaluate the strengths and weaknesses of claims, arguments, and data about the work performed by selected animal systems.
S.RS.05.22 Describe limitations in personal and scientific knowledge about the ways in which animal systems work together.
S.RS.05.24 Demonstrate scientific concepts through various illustrations, performances, models, exhibits or activities of how animal systems work together.
S.RS.05.27 Describe how science and technology related to animal systems have advanced because of the contributions of Ibn Nafis, Daniel Hale Williams and other people throughout history and across cultures.

Vocabulary

Critically Important–State Assessable	Instructionally Useful
digestive system circulatory system skeletal system muscular system nervous system excretory system reproductive system respiratory system	energy movement & support breathe digestion absorption elimination transport stimulus response sperm egg urine feces mouth esophagus stomach small intestine large intestine (colon) liver pancreas heart arteries veins skeletal: (bones, tendons, ligaments, skull, ribs, sternum) muscles tendons brain spinal cord sensory nerves motor nerves kidneys urinary bladder urethra ovaries oviducts uterus vagina testes vas deferens penis

Instruments, Measurements, Representations

stop watches	use to determine pulse rate
representations	create and utilize data tables
representations	graphic results of pulse rate investigation
model	symbolic representation of linking sports and body systems

Instructional Framework

*The following Instructional Framework is an effort to clarify possible units within the K-7 Science Grade Level Content Expectations. The Instructional Framework provides descriptions of instructional activities that are appropriate for inquiry science in the classroom and meet the instructional goals. Included are brief descriptions of multiple activities that provide the learner with opportunities for exploration and observation, planning and conducting investigations, presenting findings, and expanding thinking beyond the classroom. The Instructional Framework is **NOT** a step-by-step instructional manual, but a guide intended to help teachers and curriculum developers design their own lesson plans, select useful and appropriate resources and create assessments that are aligned with the grade level science curriculum for the State of Michigan.*

Instructional Examples

Animal Systems: L.OL.05.41, L.OL.05.42

Objective

- Animal body systems work together in order for activities to be performed.

Engage and Explore

- Engage students in an activity that supplies each student with a card containing one of the following 1) a body system 2) a major organ or part 3) general purpose/function. Students work collaboratively to match a body system with the appropriate organ/part and function. Each group will explain to the class the reasons for their choices. (L.OL.05.41, S.RS.05.21, S.RS.05.24)
- Pairs of students measure changes in pulse rate and breathing rate before and after mild exercise such as jumping jacks. One student exercises, the other student monitors the pre and post exercise pulse rate. Each pair of students list the systems they feel were most important in this activity and explain how these systems worked together. (L.OL.05.42, S.IP.05.12, S.IP.05.13, S.IP.05.15)

Explain and Define

- Students investigate individual organ systems separately and report on each of their functions as a means of communicating the specific job of each system. It is important to understand that no organ systems are independent and the work of each system is related to the work of one or more other systems. (L.OL.05.42)

Elaborate and Apply

- Elaborate on the student questions generated during the activities and class discussion. (L.OL.05.41, L.OL.05.42, S.IA.05.12)
- Students pool class data on pulse-rate activity and create a graph to represent class results. Determine mean and mode for class results and compare their individual results to class results. (L.OL.05.42, S.IP.05.15, S.IP.05.16, S.IA.05.11, S.IA.05.12, S.IA.05.13, S.IA.05.14, S.RS.05.11, S.RS.05.12)
- Students choose a sports or leisure activity to describe the body systems used and how these body systems are used together to perform the activity of the chosen sport or leisure activity. Students design symbolic representation from the sport of their choice upon which they will write each system and how it is used in that activity. (L.OL.05.42, S.RS.05.22, S.RS.05.24)
- Elaborate on the health of the human body and maintenance of body systems through discussion and research of a healthy diet and exercise. (L.OL.05.42, S.IA.05.12, S.RS.05.11)
- Pose *what would happen if... questions* regarding the consequences of one body system shutting down or becoming injured. (L.OL.05.42, S.RS.05.11, S.RS.05.12)

Evaluate Student Understanding

Formative assessment

- Evaluate the appropriateness of student's selection of body system and related leisure activity. (L.OL.05.42)
- Evaluate the accuracy of students' matching of body systems with appropriate organ/part and function. (L.OL.05.41)
- Explain which body systems, during exercise, are most involved and they work together. (L.OL.05.42)

Summative assessment

- Complete a fill in the blank chart with three columns: body system, parts (organs), and general purpose. One column for each system will contain clue information. Clue examples for the organ column could be heart, or stomach; for function, transports nutrients throughout organism, for body system, digestive or reproductive, etc. Students will add to that column and complete other blank columns with appropriate information. (L.OL.05.41)
- Explain what body systems work together as you do your homework. (L.OL.05.42)

Enrichment

- After conducting independent research about a selected system or organ, students create an artifact that represents their deepened knowledge. Possible artifacts could be a poster, digital presentation, model, song, diorama, or other appropriate possibilities.
- Dissection of chicken wings, fish or specific organs such as beef heart, kidneys.
- After conducting independent research about a specific disease that affects organs or organ systems, students create an artifact that represents their deepened knowledge. Possible artifacts could be a poster, digital presentation, model, song, diorama, or other appropriate possibilities.
- Museums or science centers with appropriate displays.

Intervention

- Provide students with a short video relevant to the above content expectations, from United Streaming, Annenberg or other sources.
- Provide alternative print material that may be more appropriate to the student's literacy level.

Examples, Observations, and Phenomena (Real World Context)

Students are generally aware that breathing rate and pulse rate increase during exercise. The activities in this unit build an understanding of the quantitative proportionality between amount of exercise and rate of breathing and pulse.

Digestive, muscular and circulatory systems are interdependent in the act of eating, digesting and distributing nutrients.

Skeletal, muscular and nervous systems are interdependent in physical activity.

Poor diet and lack of exercise has affected the health of the nation. The rate of obesity, obesity and other health issues are on the rise in the United States.

Organic foods are becoming a more popular choice for the health conscious population. Additives, preservatives, and other artificial ingredients are becoming a health risk to consumers. Some consumers are concerned that food additives, such as preservatives and dyes may pose health risks.

Smoking affects the respiratory system and can lead to cancer and respiratory and heart diseases.

Literacy Integration

Reading

R.CM.05.01 Students will connect personal knowledge, experiences, and understanding of the world to themes and perspectives in text through oral and written responses.

R.CM.05.02 Students will retell through concise summarization grade-level narrative and informational text.

R.CM.05.04 Students will apply significant knowledge from grade-level science, social studies, and mathematics texts.

Writing

W.PR.05.02 apply a variety of pre-writing strategies for both narrative and informational writing (e.g., graphic organizers such as maps, webs, Venn diagrams) in order to generate, sequence, and structure ideas (e.g., role and relationships of characters, settings, ideas, relationship of theory/evidence, or compare/contrast).

- Students work in teams to perform investigations, including the recording of observations, discussion of results and presentation of results and conclusions.

Speaking

S.CN.05.02 adjust their use of language to communicate effectively with a variety of audiences and for different purposes including research, explanation, and persuasion.

S.DS.05.01 engage in interactive, extended discourse to socially construct meaning in book clubs, literature circles, partnerships, or other conversation protocols.

S.DS.02.01 engage in substantive conversations, remaining focused on subject matter, with interchanges building on prior responses in book discussions, peer conferencing, or other interactions.

Mathematics Integration

D.RE.05.02 Construct line graphs from tables of data; include axis labels and scale.

D.AN.05.03 Given a set of data, find and interpret the mean (using the concept of fair share) and mode.

D.AN.05.04 Solve multi-step problems involving means.

- Students determine individual pulse rates by counting pulse rate for 15 or 30 seconds and multiplying to determine the pulse per minute. Students then calculate their mean pulse rate based on three trial measurements. Students will pool class data on pulse-rate activity and create a graph to represent class results. Determine mean and mode for class results and compare their individual results to class results.