7.3 Metabolic Reactions

Content Area: **Science**
Course(s):
Time Period: **Marking Period 2**
Length: **6 weeks**
Status: **Published**

Course Pacing Guide

Unit	Marking Period	Length
Chemical Reactions and Matter Transformation	1	6 weeks
Cells and Systems (2019 only)	1	6 weeks
Metabolic Reactions	2	6 weeks
Genetics (2019 only)	2,3	4 weeks
Evolution (2019 only)	3	4 weeks
Photosynthesis and Matter Cycling	4	8 weeks
Ecosystems	4	6 weeks

Unit Overview

This unit on metabolic reactions in the human body starts out with students exploring a real case study of a middle-school girl who reported some alarming symptoms to her doctor. Her symptoms included an inability to concentrate, headaches, stomach issues when she eats, and a lack of energy for everyday activities and sports regularly. She also reported noticeable weight loss over the past few months, in spite of consuming what appeared to be a healthy diet. Her case sparks questions and investigations around trying to figure out which pathways and processes in the student's body might be functioning differently than a healthy system and why.

Enduring Understandings

- Develop and use a model to explain how food is rearranged through chemical reactions, forming new molecules that support growth and/or release energy this matter moves through the human body
- Develop and use a model to explain how different subsystems of the body work together to provide cells what they need to function
- Construct and defend a scientific explanation of how the student's condition (celiac disease) leads to weight loss and lack of energy
- Construct a scientific explanation based on evidence for how environmental factors, such as food intake, influence the growth of animals
- In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions
- The growth of an animal is controlled by factors including food intake
- Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules to support growth or to release energy

- Cellular respiration in animals involves chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon with oxygen to produce carbon dioxide and other materials

Essential Questions

- What is going on inside the student's body that is making her feel the way she does?
- Can we see anything inside the student that looks different?
- Why do molecules in the small intestine seem like they are disappearing?
- What happens to food molecules as they move through the small intestine and large intestine?
- Why do large food molecules, like some complex carbohydrates, seem to disappear in the digestive system?
- What happens to the different substances in food as it travels through the digestive system?
- What is the function of the digestive system and how is this student's digestive system different?
- What does the surface of her small intestine look like up close compared with a healthy one?
- How can a problem in one body system cause problems in other systems?
- Why is this student losing so much weight?
- What happens to matter when it is burned?
- Does this chemical reaction to burn food happen inside our bodies?
- How does a healthy body uses food for energy and growth, and how is this student's body functioning differently?
- Do all animals do chemical reactions to get energy from food like humans?

New Jersey Student Learning Standards (No CCS)

SCI.MS-LS1-5	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
SCI.MS-LS1-3	Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
SCI.MS-LS1-7	Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.
SCI.MS-PS1-1	Develop models to describe the atomic composition of simple molecules and extended structures.
SCI.MS-PS1-2	Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

Interdisciplinary Connections

MA.6.RP.A.3	Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
LA.RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

Technology Standards

TECH.8.1.8.A.2	Create a document (e.g., newsletter, reports, personalized learning plan, business letters or flyers) using one or more digital applications to be critiqued by professionals for usability.

21st Century Themes/Careers

CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.

Instructional Strategies & Learning Activities

Throughout this unit, students will:

- investigate data specific to this student's case in the form of doctor's notes, endoscopy images and reports, growth charts and micrographs
- plan and carry out investigations to test their ideas

Learning activities include:

- Exploring an anchoring phenomenon
- Creating an initial model
- Creating a Driving Question Board and an Ideas for Investigation chart
- Examining data (endoscopy report)
- Planning and conducting an investigation (dialysis tubing)
- Investigate food/waste data
- Map student's system to human body system
- Analyze weight data trends

- Conduct investigations to understand chemical reactions
- Develop models to explain metabolic reactions

Differentiated Instruction

Examples may include:
Inquiry/Problem-Based Learning
Learning preferences integration (visual, auditory, kinesthetic)
Sentence & Discussion Stems
Tiered Learning Targets
Meaningful Student Voice & Choice
Relationship-Building & Team-Building
Self-Directed Learning
LMS use
Student Data Inventories
Mastery Learning (feedback toward goal)
Grouping
Rubrics
Jigsaws
Assessment Design & Backwards Planning
Student Interest & Inventory Data

Formative Assessments

Include, but are not limited to:

- Initial models
- Driving Question Board
- Notebook checks
- Progress Trackers
- Scientists Circle discussions
- Peer Feedback rubrics

Summative Assessment

Scientific Explanation (Midpoint assessment)

Transfer task (final unit assessment): Students will apply understanding of phenomenon to a related phenomenon (investigating other animals).

Benchmark Assessments

Fall/Winter LinkIt Assessments

Alternate Assessments

Modifications to assessments based on IEP/504; alternate assessments may include oral explanations, scaffolded templates, digital choice for final model representations

Resources & Technology

Adapted from OpenSciEd unit: Metabolic Reactions

BOE Approved Texts

N/A

Closure

Individual classes and lessons will end with a closure activity that reinforces what students figured out during class, and helps navigate toward next steps.

Closure activities may include:

- Scientists' Circle
- Post-it reflection
- Google form exit ticket

- Group performance reflection
- Science notebook jot

ELL

- Alternate Responses
- Extended Time
- Teacher Modeling
- Simplified Written and Verbal Instructions
- Frequent Breaks
- Google Translate

Special Education

Accommodations will be made in accordance with students' IEPs. The following list provides examples:

- Shorten assignments to focus on mastery of key concepts.
- Substitute alternatives for written assignments (clay models, posters, panoramas, collections, etc.)
- Keep workspaces clear of unrelated materials.
- Provide a computer for written work.
- Seat the student close to the teacher or a positive role model.
- Provide an unobstructed view of the chalkboard, teacher, movie screen, etc.
- Keep extra supplies of classroom materials (pencils, books) on hand.
- Maintain adequate space between desks.
- Give directions in small steps and in as few words as possible.
- Number and sequence the steps in a task.
- Have student repeat the directions for a task.
- Provide visual aids.

- Go over directions orally.
- Allow the student to complete an independent project as an alternative test.
- Show a model of the end product of directions (e.g., a completed math problem or finished quiz).
- Stand near the student when giving directions or presenting a lesson.
- Mark the correct answers rather than the incorrect ones.
- Use a pass-fail or an alternative grading system when the student is assessed on his or her own growth.

504

Examples of accommodations in 504 plans include but are not limited to:

- preferential seating
- extended time on tests and assignments
- reduced homework or classwork
- verbal, visual, or technology aids
- modified textbooks or audio-video materials
- behavior management support
- verbal testing
- excused lateness, absence, or missed classwork
- pre-approved nurse's office visits and accompaniment to visits

At Risk

Examples may include:

- Have student restate information
- Provision of notes or outlines
- Concrete examples
- Assistance in maintaining uncluttered space

- Weekly home-school communication tools (notebook, daily log, phone calls or email messages)
- Peer or scribe note-taking
- Use of manipulatives
- No penalty for spelling errors or sloppy handwriting
- Follow a routine/schedule
- Teach time management skills
- Verbal and visual cues regarding directions and staying on task
- Adjusted assignment timelines
- Visual daily schedule
- Immediate feedback
- Work-in-progress check
- Pace long-term projects
- Preview test procedures
- Film or video supplements in place of reading text
- Pass/no pass option
- Cue/model expected behavior
- Use de-escalation strategies
- Use peer supports and mentoring
- Have parent sign homework/behavior chart

Gifted and Talented

Examples may include:

- Offer choice
- Speak to Student Interests
- Allow G/T students to work together
- Tiered learning

- Focus on effort and practice
- Encourage risk taking