

Topic 3: Energy Systems

Content Area: **Science**

Course(s): **IB Sports, Exercise & Health Science**

Time Period: **2nd Marking Period**

Length: 5 weeks

Unit Overview

Nutrition: Students will learn the building blocks of macronutrients, their molecular structure, how they are metabolized and what their function is in the body. They will also learn to distinguish between macronutrients and micronutrients. With this understanding students will be able to describe the various metabolic pathways.

Carbohydrate & Fat Metabolism: Students will be able to distinguish between and give examples of all components of metabolism. This includes how macromolecules are not only used for energy how they are stored for future use and how that power is unleashed. Students will be able to describe the intricate relationship between insulin, glycogen, and body fat during fasting and exercise, especially in relation to its role in muscle contraction.

Nutrition & Energy Systems: Students will be able to identify key structures of a cell that are essential in cellular respiration. This will help to describe the role of phosphate and ATP in the production of energy as well as the production of ATP from various macromolecules. Students will be able to discuss the characteristics of the three energy pathways and their contributions during rest and various modes of exercise.

STAGE 1- DESIRED RESULTS

2020 New Jersey Student Learning Standards- Science

DCI: HS-LS1-2, HS-LS1-3, HS-LS1-6

CCC: Cause & Effect, Systems and System Models, Energy and Matter, Structure and Function, Stability and Change

S&EP: Asking questions/defining problems, developing and using models, planning and carrying out investigations, analyzing and interpreting data, using mathematics and computational thinking, constructing explanations, engaging in argument from evidence, obtaining, evaluating & communicating information

Essential Questions

How does the body obtain and process essential nutrients and energy?

Enduring Understanding

Students will not only understand the essential macronutrients in the body but will be able to describe various methods for metabolizing them in order to provide the body with energy it needs, especially in athletes.

Students will know...

Vocabulary: macronutrient, micronutrient, protein, carbohydrate, lipid, glucose, disaccharide, polysaccharide, triacylglycerol, saturated fatty acid, unsaturated fatty acid, protein, essential amino acid, non-essential amino acid, metabolism, anabolism, aerobic catabolism, anaerobic catabolism, glycogen, triglyceride, insulin, lipolysis, glycogenolysis, glucagon, adrenaline, fasting, mitochondrion, cristae, inner matrix, outer smooth membrane, ribosomes, rough endoplasmic reticulum, lysosomes, golgi apparatus, nucleus, cellular respiration, adenosine triphosphate (ATP), adenosine diphosphate (ADP), creatine phosphate (CP), lactic acid system, pyruvate, oxygen deficit/oxygen debt, excess post-exercise oxygen consumption (EPOC), fatty acids, Krebs cycle, liberate, energy continuum,

Students will be able to...

- 3.1.1 list the macronutrients and micronutrients
- 3.1.2 outline the functions of macronutrients and micronutrients
- 3.1.3 state the chemical composition of a glucose molecule
- 3.1.4 identify a diagram representing the basic structure of a glucose molecule
- 3.1.5 explain how glucose molecules can combine to form disaccharides and polysaccharides
- 3.1.6 state the composition of a molecule of triacylglycerol
- 3.1.7 distinguish between saturated and unsaturated fatty acids
- 3.1.8 state the chemical composition of a protein molecule
- 3.1.9 distinguish between an essential and a non-essential amino acid
- 3.1.10 describe current recommendations for a healthy balanced diet
- 3.1.11 state the approximate energy content per 100g of carbohydrate, lipid and protein
- 3.1.12 discuss how the recommended energy distribution of the dietary macronutrients different between endurance athletes and non-athletes
- 3.2.1 outline metabolism, anabolism, aerobic catabolism and anaerobic catabolism

STAGE 2 - EVIDENCE OF LEARNING

Formative Assessment

- 3- Minute Pause
- A-B-C Summaries
- Analogy Prompt
- Choral Response
- Debriefing
- Exit Card / Ticket
- Hand Signals
- Idea Spinner
- Index Card Summaries
- Inside-Outside Circle Discussion (Fishbowl)
- Journal Entry
- Misconception Check
- Observation
- One Minute Essay
- One Word Summary
- Portfolio Check
- Questions & Answers
- Quiz
- Self-Assessment
- Student Conference
- Think-Pair-Share
- Web or Concept Map

Authentic Assessments

Identify/describe – macro & micronutrients, their functions in the body and in which foods they can be found, identifying essential fatty acids and essential amino acids

Draw – glucose molecule (in addition to writing the chemical formula)

Describe – how glucose molecules combine and separate

Describe – how fatty acid molecules combine and separate

Identify – the chemical composition of a protein molecule

Investigation – PhET “Eating & Exercise” students manipulate variables to explore the relationship between energy needs and activity level, students should be able to apply this information to different types of athletes as well (strength vs endurance)

Draw/label – flow chart detailing the relationships among anabolism, aerobic catabolism & anaerobic catabolism in terms of flow of energy and molecules needed/produced/stored (include glycogenolysis & lipolysis) in order to explain energy needs/expenditures during activity and fasting

Create – a meal plan for different types of athletes based on their needs

Label – structures of a cell, and the mitochondrion within and describe the functions of each organelle/structure

Describe – how ATP loses/gains a phosphate molecule and the role of ATP in muscle contractions

Explain – the phenomenon of oxygen deficit and oxygen debt

Describe & Evaluate – the three metabolic pathways for creating energy in terms of their fuel source, duration, intensity and ATP production and identify which are used during different stages and types of exercise

Benchmark Assessments

3.1 Quiz

3.2 Quiz

3.3 Quiz

UNIT 3 TEST (comprised of Paper 1 & Paper 2 type questions)

STAGE 3- LEARNING PLAN

Instructional Map

Preview “I can” statements to identify learning objectives

Learn fundamentals of nutrition

Learn fundamentals of carbohydrate and fat metabolism

Learn fundamentals of energy systems

Apply nutrition & metabolism knowledge to energy systems

Practice assessing which types of nutrients and energy systems are at work during various stages of exercise, training, and different types of sports, propose special diets for different types of athletes

Review "I can" statements to self-assess knowledge

Modification/Differentiation of Instruction

Differentiation Strategies for Special Education Students

- Remove unnecessary material, words, etc., that can distract from the content
- Use of off-grade level materials
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Time allowed
- Level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in "chunks"
- Varied texts and supplementary materials
- Use technology, if available and appropriate
- Varied homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language.
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Ability to work at their own pace
- Present ideas using auditory, visual, kinesthetic, & tactile means
- Provide graphic organizers and/or highlighted materials
- Strategy and flexible groups based on formative assessment
- Differentiated checklists and rubrics, if available and appropriate

Differentiation Strategies for Gifted and Talented Students

- Increase the level of complexity
- Decrease scaffolding
- Variety of finished products
- Allow for greater independence

- Learning stations, interest groups
- Varied texts and supplementary materials
- Use of technology
- Flexibility in assignments
- Varied questioning strategies
- Encourage research
- Strategy and flexible groups based on formative assessment or student choice
- Acceleration within a unit of study
- Exposure to more advanced or complex concepts, abstractions, and materials
- Encourage students to move through content areas at their own pace
- After mastery of a unit, provide students with more advanced learning activities, not more of the same activity
- Present information using a thematic, broad-based, and integrative content, rather than just single-subject areas

Differentiated Strategies for ELL Students

- Remove unnecessary materials, words, etc., that can distract from the content
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Gradually increase the level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in “chunks”
- Varied texts and supplementary materials, including visuals
- Use technology, if available and appropriate
- Differentiate homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language.
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Allow students to work at their own pace
- Presenting ideas through auditory, visual, kinesthetic, & tactile means
- Role play
- Provide graphic organizers, highlighted materials
- Strategy and flexible groups based on formative assessment

Differentiation Strategies for At Risk Students

- Remove unnecessary materials, words, etc., that can distract from the content

- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Gradually increase the level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in “chunks”
- Varied texts and supplementary materials
- Use technology, if available and appropriate
- Differentiate homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Presenting ideas through auditory, visual, kinesthetic, & tactile means
- Provide graphic organizers and/or highlighted materials
- Strategy and flexible groups based on formative assessment

504 Plans

Students can qualify for 504 plans if they have physical or mental impairments that affect or limit any of their abilities to:

- walk, breathe, eat, or sleep
- communicate, see, hear, or speak
- read, concentrate, think, or learn
- stand, bend, lift, or work

Examples of accommodations in 504 plans include:

- 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
- adjusted class schedules or grading
- verbal testing
- excused lateness, absence, or missed classwork

- pre-approved nurse's office visits and accompaniment to visits
- occupational or physical therapy

Peer Tutoring

Repeated Drill and Practice

Cooperative Grouping

Teacher notes

Use of additional reference materials

Modification Strategies

- Cooperative Grouping
- Extended Time
- Frequent Breaks
- Highlighted Text
- Interactive Notebook
- Modified Test
- Oral Directions
- Peer Tutoring
- Preferential Seating
- Re-direct
- Repeated Drill and Practice
- Shortened Assignment
- Teacher Notes
- Tutorials
- Use of Additional Reference Materials
- Use of Audio Resources

Differentiation Strategies

High Preparation

- Alternative Assessments
- Choice Boards
- Games and Tournaments
- Group Investigations
- Guided Reading
- Independent Research / Project
- Interest Groups
- Learning Contracts
- Leveled Rubrics
- Literature Circles
- Multiple Intelligence Options
- Multiple Texts
- Personal Agendas
- Project Based Learning (PBL)
- Stations / Centers
- Think-Tac-Toe
- Tiered Activities / Assignments
- Varying Graphic Organizers

Low Preparation

- Choice of Book / Activity
- Cubing Activities
- Exploration by Interest (using interest inventories)
- Flexible Grouping
- Goal Setting With Student
- Homework Options
- Jigsaw
- Mini Workshops to Re-teach or Extend Skills
- Open-ended Activities
- Think-Pair-Share by Readiness, Interest, or Learning Style
- Use of Collaboration
- Use of Reading Buddies
- Varied Journal Prompts
- Varied Product Choice
- Varied Supplemental Materials
- Work Alone / Together

Horizontal Integration- Interdisciplinary Connections

See Appendix

Vertical Integration- Discipline Mapping

9th grade – Biology
10th grade – Chemistry
11th grade – Anatomy & Physiology
12th grade – Physics

Additional Materials

Sports, Exercise and Health Science by Oxford University Press (classroom set & PDF in Canvas)

