National Aeronautics and Space Administration

Train Like an Astronaut

NASA SUMMER OF INNOVATION

UNIT
Life Science – The Body

GRADE LEVELS
4^{th} – 6^{th} and 7^{th} – 9^{th}

CONNECTION TO CURRICULUM
Science, mathematics, physical science

TEACHER PREPARATION TIME
1 hour. Downloading of videos will vary based on connection speeds.

LESSON TIME NEEDED
4 hours *Complexity: Moderate*

DESCRIPTION
This lesson is a physical and inquiry-based approach to human health and fitness on Earth and in space. Students can participate in physical activities modeled after the real-life physical requirements of humans traveling in space.
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OBJECTIVES
Students will:

- Set goals and challenge themselves, as well as other students in the Fit Explorer Challenge.
- Practice physical activities as they train like an astronaut with Mission Handouts.
- Make observations on physical improvements, research fitness and exploration topics, and log their goals in a Mission Journal.
- Engage in hands-on activities to learn about the Science of Physical Activity and the Science of Nutrition.

NATIONAL STANDARDS

National Science Education Standards (NSTA)
Science as Inquiry
- Skills necessary to become independent inquirers about the natural world

Life Science Standards
- Characteristics of organisms
- Organisms and environments

Science in Personal and Social Perspectives
- Personal health

Principles and Standards for School Mathematics (NCTM)
Operations and Algebraic Thinking
- Generate and analyze patterns
- Analyze patterns and relationships

Measurement and Data
- Represent and interpret data

Statistics and Probability
- Develop understanding of statistical variability
- Summarize and describe distributions

National Physical Education Standards:

Standard 1: Demonstrates competency in motor skills and movement patterns needed to perform a variety of physical activities.

Standard 2: Demonstrates understanding of movement concepts, principles, strategies, and tactics as they apply to the learning and performance of physical activities.
Standard 3: Participates regularly in physical activity.

Standard 4: Achieves and maintains a health-enhancing level of physical fitness.

Standard 5: Exhibits responsible personal and social behavior that respects self and others in physical activity settings

Standard 6: Values physical activity for health, enjoyment, challenge, self-expression, and/or social interaction.

National Health Education Standards (NHES) Second Edition (2006):

Standard 1: Students will comprehend concepts related to health promotion and disease prevention to enhance health.
o 1.5.1 Describe the relationship between healthy behaviors and personal health.

Standard 4: Students will demonstrate the ability to use interpersonal communication skills to enhance health and avoid or reduce health risks.
o 4.5.1. demonstrate effective verbal and non-verbal communication skills to enhance health.

Standard 5: Students will demonstrate the ability to use decision-making skills to enhance health.
o 5.5.4 Predict the potential outcomes of each option when making a health-related decision.
o 5.5.6 Describe the outcomes of a health-related decision.

Standard 6: Students will demonstrate the ability to use goal-setting skills to enhance health.
o 6.5.1 Set a personal health goal and track progress toward its achievement.

Standard 7: Students will demonstrate the ability to practice health-enhancing behaviors and avoid or reduce health risks.
o 7.5.2 Demonstrate a variety of healthy practices and behaviors to maintain or improve personal health.

MANAGEMENT

The activities in this lesson should be done with cooperative groups of two to three students. Safety practices should be reviewed and observed during the activities. *Important! Students should have proper medical clearance on record before participating in any kind of physical activity program.* Hint: If any of the data collection devices listed is new to the students, consider familiarizing the students with that instrument a few days before the physical activity begins. For physical activities, students should wear loose-fitting clothing that permits freedom of movement.

CONTENT RESEARCH

Review the background information included with each activity. Review and discuss information with students to ensure understanding to allow students to explore the data results and explain their answers and outcomes.

Key Terms:

- **aerobic activities** – activities designed to increase the amount of oxygen in the blood
- **cardiac muscles** – a special kind of involuntary muscle found in the heart (which works without a person's thinking about it)
- **exercise** – any physical activity that raises your heart rate or makes you work hard to lift or pull an object, including your own body
- **joint** – a place where two or more bones meet
- **muscles** – soft, but strong tissue made of long fibers that contract or become shorter to move bones; muscles can only pull in one direction so they must work in pairs resistive exercise – an activity that strengthens bone and muscle by generating force against resistance
- **skeletal muscles** – a group of voluntary muscles (muscles that you can control), which are attached to bones or other muscles to help you move
- **smooth muscles** – a group of involuntary muscles (muscles that work without conscious thought), which make up most of the body organs such as the stomach, insides of blood vessels, intestines, and others
- **stress –** emotional tension or physical force; physical stress is created when bones and muscles work against a force

MATERIALS

Links to resources are listed under each lesson activity.

Base Station Walk Back Educational Resources

- Base Station Walk-Back Mission Handout
- Base Station Walk-Back Mission Log
- Base Station Walk-Back Educator Guide
- Base Station Walk-Back Video
- Mission Journal and pencil
- Optional equipment:
  - watch or stopwatch
  - heart rate monitor
  - pedometer
  - walking wheel

Crew Strength Training Educational Resources

- Crew Strength Training Mission Handout
- Crew Strength Training Mission Log
- Crew Strength Training Educator Guide
- Crew Strength Video
- Mission Journal and pencil
- Optional equipment:
  - watch or stopwatch
  - wall access
  - metronome

Do a Spacewalk Educational Resources

- Do a Spacewalk! Mission Handout
- Do a Spacewalk! Mission Log
- Do a Spacewalk! Educator Guide
- Do a Spacewalk! Video
- Mission Journal and pencil
- Tape measure or meter stick

Optional equipment:

- Watch or stopwatch

LESSON ACTIVITIES

Base Station Walk-Back

Students will train to improve lung, heart, and other muscle endurance as they walk a progressive, measured distance.

http://www.nasa.gov/audience/foreducators/fitexplorer/train/N_Walkback_detail.html

Mission Handout:
http://www.nasa.gov/pdf/182810main_MH_Walkback_v2.pdf
Mission Log: http://www.nasa.gov/pdf/182814main_MJ_Log_WalkBack.pdf
Educator Guide:
http://www.nasa.gov/pdf/182806main_MH_WalkBack_EdGuide.pdf
Video:
Windows Media (WMV) closed captions
http://www.nasa.gov/wmv/344741main_Base%20Station%20Walk-Back-Closed.wmv
QuickTime (MOV) closed captions
http://www.nasa.gov/mov/344740main_Base%20Station%20Walk-Back-Closed.mov
Windows Media (WMV) open captions
http://www.nasa.gov/wmv/344743main_Base%20Station%20Walk-Back-Open.wmv
QuickTime (MOV) open captions
http://www.nasa.gov/mov/344742main_Base%20Station%20Walk-Back-Open.mov
Note: Choose the video format that best fits your class and technology.

MATERIALS (continued)
Links to resources are listed under each lesson activity.

Jump for the Moon Educational Resources
- Jump for the Moon Mission Handout
- Jump for the Moon Mission Log
- Jump for the Moon Educator Guide
- Jump for the Moon Video
- Mission Journal and pencil
- jump rope (one per student)
- watch or stopwatch
- Optional equipment:
  - heart rate monitor

Mission: Control! Educational Resources
- Mission: Control! Mission Handout
- Mission: Control! Mission Log
- Mission: Control! Educator Guide
- Mission Control! Video
- Mission Journal and pencil
- Practice
  - tennis ball (one per student)
  - watch or stopwatch (one per student)
- Game: gym ball or similar sized/weighted ball (at least

Crew Strength Training
Students will train to develop upper and lower body strength in their muscles and bones by performing body-weight squats and push-ups.
http://www.nasa.gov/audience/foreducators/fitexplorer/train/N_CrewStrength_detail.html
Mission Handout:
http://www.nasa.gov/pdf/182807main_MH_CrewStrength_v2.pdf
Mission Log:
http://www.nasa.gov/pdf/182812main_MJ_Log_CrewStrength.pdf
Educator Guide:
http://www.nasa.gov/pdf/182803main_MH_CrewStrength_EdGuide.pdf
Video:
Windows Media (WMV) closed captions
http://www.nasa.gov/wmv/344745main_Crew%20Strength%20Training-Closed.wmv
QuickTime (MOV) closed captions
http://www.nasa.gov/mov/344744main_Crew%20Strength%20Training-Closed.mov
Windows Media (WMV) open captions
http://www.nasa.gov/wmv/344747main_Crew%20Strength%20Training-Open.wmv
QuickTime (MOV) open captions
http://www.nasa.gov/mov/344744main_Crew%20Strength%20Training-Closed.mov
Note: Choose the video format that best fits your class and technology.

Do a Spacewalk!
Students will train to increase muscular strength and improve upper and lower body coordination by performing the “bear crawl” and the ‘’crab walk”.
http://www.nasa.gov/audience/foreducators/fitexplorer/train/N_Spacewalk_detail.html

Mission Handout: http://www.nasa.gov/pdf/182809main_MH_Spacewalk_v2.pdf
Mission Log: http://www.nasa.gov/pdf/182813main_MJ_Log_Spacewalk.pdf
Educator Guide: http://www.nasa.gov/pdf/182805main_MH_Spacewalk_EdGuide.pdf
Video:
Windows Media (WMV) closed captions
http://www.nasa.gov/wmv/344752main_Do%20A%20Spacewalk-Closed.wmv
QuickTime (MOV) closed captions
http://www.nasa.gov/mov/344748main_Do%20A%20Spacewalk-Closed.mov
Windows Media (WMV) open captions
http://www.nasa.gov/wmv/344754main_Do%20A%20Spacewalk-Open.wmv
QuickTime (MOV) open captions
http://www.nasa.gov/mov/344753main_Do%20A%20Spacewalk-Open.mov

Note: Choose the video format that best fits your class and technology.

Jump for the Moon
Students will train to increase bone strength and to improve heart and other muscle endurance by performing jump training with a rope, both while stationary and moving.
http://www.nasa.gov/audience/foreducators/fitexplorer/train/N_JumpMoon_detail.html

Mission Handout: http://www.nasa.gov/pdf/182760main_MH_JumpMoon_v2.pdf
Mission Log: http://www.nasa.gov/pdf/182762main_MJ_Log_JumpMoon.pdf
Educator Guide: http://www.nasa.gov/pdf/182761main_MH_JumpMoon_EdGuide.pdf
Video:
- Windows Media (WMV) closed captions
  http://www.nasa.gov/wmv/344756main_Jump%20For%20The%20Moon-Closed.wmv
- QuickTime (MOV) closed captions
  http://www.nasa.gov/mov/344755main_Jump%20For%20The%20Moon-Closed.mov
- Windows Media (WMV) open captions
  http://www.nasa.gov/wmv/344758main_Jump%20For%20The%20Moon-Open.wmv
- QuickTime (MOV) open captions
  http://www.nasa.gov/mov/344755main_Jump%20For%20The%20Moon-Closed.mov

Note: Choose the video format that best fits your class and technology.

Mission: Control!
Students will train to improve balance and spatial awareness by performing throwing and catching techniques on one foot.
http://www.nasa.gov/audience/foreducators/fitexplorer/train/N_MissionControl_detail.html

Mission Handout: http://www.nasa.gov/pdf/182808main_MH_MissionControl_v2.pdf
Mission Log: http://www.nasa.gov/pdf/182811main_MJ_Log_MissionControl.pdf
Educator Guide: http://www.nasa.gov/pdf/182804main_MH_MissionControl_EdGuide.pdf
Video:
- Windows Media (WMV) closed captions
  http://www.nasa.gov/wmv/344760main_Mission%20Control-Closed.wmv
- QuickTime (MOV) closed captions
  http://www.nasa.gov/mov/344759main_Mission%20Control-Closed.mov
- Windows Media (WMV) open captions
  http://www.nasa.gov/wmv/344762main_Mission%20Control-Open.wmv
- QuickTime (MOV) open captions
  http://www.nasa.gov/mov/344761main_Mission%20Control-Open.mov

Note: Choose the video format that best fits your class and technology.

ADDITIONAL RESOURCES
To learn about exercise used during past and future space flight missions, visit
http://hacd.jsc.nasa.gov/projects/ecp.cfm

Access fitness-related information and resources at http://www.fitness.gov

View programs on health and fitness:
Scifiles™ The Case of the Physical Fitness Challenge
http://www.knowitall.org/nasa/scifiles/index.html
- Educator Guide: http://www.knowitall.org/nasa/pdf/scifiles/fitness.pdf
- Video: http://www.knowitall.org/nasa/asx/physical.fitness.challenge.asx

NASA Connect™ Good Stress: Building Better Bones and Muscles
http://www.knowitall.org/nasa/connect/index.html
Educator Guide: http://www.knowitall.org/nasa/pdf/connect/Good_Stress_Guide.pdf
Video: http://www.knowitall.org/nasa/asx/goodstress.asx

For more information on the neurovestibular system, visit:
NASA's Web of Life
The Effects of Space Flight on the Human Vestibular System
http://weboflife.nasa.gov/learningResources/vestibularbrief.htm

DISCUSSION QUESTIONS
Note: This is a sample of the questions available for each activity in the educator guide.
Use the following open-ended questions before, during, and after practicing the physical activity to help students make observations about their own physical fitness level and their progress in the physical activity:

- How do you feel? *Answers will vary*
- How far did you get? *Answers will vary*
- What happened to your heart rate? - *Answers will vary depending on when question is asked. Increase for during physical activity or decrease for after physical activity.*
- Where is the energy you are using coming from? *Food, combined with oxygen, is the source of the bodies energy.*
- What do your legs feel like now compared to when we first tried this physical activity? *Answers will vary*
- Can you describe how your breathing changed during the physical activity? *Answers will vary*
- How did your body cool itself during the physical activity? *Perspiration or Sweating*
- How well would your body cool itself if you were wearing a thick coat? *Answers will vary*
- What are some challenges astronauts might face in completing a walk-back to their base station? *Answers will vary*
- How might these challenges affect their ability to perform the walk-back? *Answers will vary*

ASSESSMENT ACTIVITIES
The *Mission Journal* is the major assessment item for these activities. Student observations about their physical activity and answering the discussion questions from each activity will provide teachers with important feedback about student understanding. However, the opportunities for individual podcasts, oral reports, etc. on their experience are viable alternatives or additions.

ENRICHMENT

THE SCIENCE OF PHYSICAL ACTIVITY
Living Bones, Strong Bones
Engineering, nutrition, and physical activity collide when students design and build a healthy bone model of a space explorer which is strong enough to withstand increasing amounts of weight. Learn more at http://www.nasa.gov/audience/foreducators/fitexplorer/education/N_LBSB_detail.html