

Food, Exercise and Sleep on the ISS

Subject/Grade Level:	Space and the Solar System / Middle School (Grades 6-8)
Lesson Objective(s):	Students understand what it takes to maintain a healthy lifestyle on the International Space Station.
Materials:	<ul style="list-style-type: none"> • 4 stations with tables (details are provided under station setup). • 2 plastic tablecloths for Stations 1 and 2. • Poster with food groups (available for purchase at https://www.learningzonexpress.com/food-groups-poster-set.html or similar) • 6-7 dried foods: for example: http://amzn.to/2luHUHa • Dehydrator (optional). Sliced mushrooms. • Sticky tape or push pins. • Vacuum sealer. • Jug of warm water (potable). • Paper towels. • Plastic spoons. • Small ketchup cups or drinking cups for rehydrating dried food. • Blow up astronaut / large doll plus air pump. • Sleeping bag (or trash bag). • Sticky hooks and tethers (e.g. string). • 2 large safety pins.
Health Standards:	<p>CA Health Standards:</p> <p>1.1.N Describe the short-term and long-term impact of nutritional choices on health.</p> <p>1.8.N Identify ways to prepare food that are consistent with current research-based guidelines for a nutritionally balanced diet.</p> <p>1.15.N Explain that incorporating daily moderate or vigorous physical activity into one's life does not require a structured exercise plan or special equipment.</p>
Differentiation strategies to meet diverse learner needs:	<ul style="list-style-type: none"> • <u>Think-pair-share</u>, for students that learn best when engaging with classmates. • <u>Multisensory learning</u>, to accommodate students that are auditory learners and visual learners, as well as encourage students to engage their senses in the learning process. • <u>Awareness of social and cultural backgrounds</u> of students to reinforce the real-life application of what they are learning.
Student Worksheet	Each of the four stations has its own worksheet/instructions. There is a separate worksheet for the start and end of the lesson (engagement/evaluation).
Skills Needed	Time management, collaboration, critical thinking and analysis/interpretation.

ENGAGEMENT

The lesson starts by examining the components of a healthy lifestyle and comparing what it's like to stay healthy on Earth compared with what it's like for an astronaut on board the ISS.

Questions/discussion for students.

On Earth:

1. What does it mean to be healthy?
2. What happens to your body when it is healthy and when it is not?
3. Where does healthy food come from?
4. How much of different types of food should you be eating to be healthy?
5. Does a healthy life include exercise?
6. How often should you be exercising? For how long?
7. How much should you be sleeping to be healthy? How do you sleep/ where?

Compare this with the Space Station. There are many limitations in the microgravity environment of the International Space Station that make the everyday activities of eating healthy food, exercising and sleeping more challenging.

In pairs, students will now try to answer these same questions from an astronaut's perspective.

Hand out the first Worksheet.

TASK: Using your worksheet, with your partner, imagine that you're both astronauts. Brainstorm and note your answers to the health questions on your worksheet.

EXPLORATION

Students are going to visit between **2 and 4 stations in turn** (dependent on time) to examine how being in space impacts everyday living for astronauts on the ISS. The 4 workstations are:

Workstation 1: Space Food Design and Preparation

Workstation 2: Vacuum Food Packaging and Rehydration

Workstation 3: Exercise in Space

Workstation 4: Sleeping in Space

Assign 2 students to each station to be the guides/experts. Give them the workstation setup sheets. They should pick up their materials/equipment and go to their stations to complete the setup, become familiar with the workstation and how to reset it between groups.

Divide the remaining students into 4 groups (even numbers) and into pairs within the groups. Dependent on numbers and time, students group can be direct to 1 or 2 workstations, or to tour all four.

Student should take pens/pencils to make notes on their Worksheets (which are available at each station).

Allow 6-8 minutes per workstation. Once done, reassemble the class.

ELABORATION/EVALUATION

Let's see what eating, exercising and sleeping is really like on the space station. Watch the videos:

Strange foods (and drinks) in space:

<https://youtu.be/zOmOadxxEbs> (2mins)

Astronauts exercise in space

<https://youtu.be/87YxeKTv8Y8> (3:50min, but suggest stopping at 2:43min)

OR

Chris Hadfield exercises in space:

<https://youtu.be/MQ0PxT7wnuU> (2:40min)

Sunny Williams talk about sleeping on the ISS (first 2 minutes only)

<https://youtu.be/SGP6Y0Pnhe4>

Discussion

What do students think it means to say that the ISS is a closed system (regarding food, water, climate, bathroom, air, oxygen etc.) Have students consider alternate solutions to food, exercise and sleeping on the ISS.

Other resources:

For more resources, activities etc. check the following link:

<https://www.nasa.gov/audience/foreducators/fitexplorer/home/index.html>

There are 2 activities from the NASA website:

1. Hand/eye co-ordination exercise (assembling a jigsaw while wearing 2 pairs of gloves).
2. Creating an eating plan (using the food pyramid to plan individual eating plans for healthy living).

Student Worksheet – Food, exercise and sleep

Answer the questions below as if you were an astronaut on the ISS:

Why is it important for me to stay healthy?	
What happens if I have a health issue?	
How do I know my food is good for me?	
How much food should I be eating?	
Do I need to exercise? Why?	
How often should I be exercising? For how long?	
How much should I be sleeping to be healthy?	

Later, you will find out how accurate your answers are.

Setup for Station 1 (1 copy needed)

Meal Planning / Dehydration station

Materials

(on the wall)

1. Poster with food groups.

(on the table)

2. Tablecloth.
3. 3-5 dried food package samples (set out on the table).
4. Dehydrator (if available). Set the dehydrator on the table and set it going with the sliced mushrooms.
5. Worksheets for Workstation 1 (on the table).

Directions for students

When a group comes to the workstation, give them a Worksheet for Workstation 1. These are their tasks. Help them where needed.

1. In pairs, students create a healthy meal (breakfast, lunch, dinner and snack) from the poster and/or from the dried food on the table. They should consider which foods can be dehydrated or powdered. Is there anything on the poster that they think can't be prepared for the space station.
2. Do students think that fresh foods are available on the Space Station?
3. Review how the dehydrator works and what dried fruit looks like.



Between groups:

Check and reset the table. Make sure any used worksheets are set aside.

At the end:

Pack up and return all materials to the pick-up point.

Setup for Station 2 (1 copy needed)

Vacuum sealing / Food tasting

Materials

(on the table)

1. 2 types of dried food in plastic containers. Please a spoon in each.
2. Bags for vacuum sealing.
3. Vacuum sealing units (on the table).
4. 20 small plastic containers with spoons (add a couple of spoonfuls of the dried food to each).
5. Warm water in a jug (gradually add water to the first few plastic containers to rehydrate the food).
6. Paper towels (in case of spillage/mess).
7. Worksheets for Workstation 2.

Directions for students

When a group comes to the workstation, give them a Worksheet for Workstation 2. These are their tasks. Help them where needed.

1. In pairs, students spoon a small amount of dehydrated food into a bag. They vacuum seal their bag using the vacuum sealing unit(s).
2. Students sample the rehydrated food and record their impressions.



Between groups:

Check and tidy the table. Make sure any sealed bags and used worksheets are set aside. Add water to a few more cups of dried food.

At the end:

Pack up and return all materials to the pick-up point.

Setup for Station 3 (1 copy needed)

Exercise in Space

Materials (on the table)

1. Worksheets for Workstation 3.

Equipment

2. Four chairs

Directions for students

When a group comes to the workstation, give them a Worksheet for Workstation 3. These are their tasks. Help them where needed.

1. Start by reading Peggy Whitson's journal about exercising in space:
https://www.nasa.gov/mission_pages/station/expeditions/expedition16/journal_peggy_whits_on_6.html (see student materials)
2. Students should do 2 out of 3 exercises.
 - (a) Sitting on a chair, raise your legs and 'run' for 2 mins as if you were on a treadmill.
 - (b) Sitting on a chair, raise your legs and 'pedal' for 2 mins as if you were on an exercise cycle.
 - (c) Standing facing a wall, with your feet a little more than arms-length away, place your hands flat on the wall at shoulder height. Push outwards from the wall until you are upright, then release. Repeat for 2 mins.
3. On their Worksheets, students note what you think it would be like to do an hour of bike or treadmill and an hour of resistance exercises. How is Peggy's experience different from how students might exercise on Earth.

Between groups:

Check and tidy the table. Make sure used worksheets are set aside.

At the end:

Return all materials to the pick-up point. Put the chairs back.

Setup for Station 4 (1 copy needed)

Sleep

Materials

(on the table)

1. Worksheets for Workstation 4.
2. 2 sticky-backed hooks attached to the wall at shoulder height.
3. 2 tethers or string.
4. 2 large safety pins.
5. A sleeping bag or large trash bag.
6. A large astronaut doll and air pump if provided (blow it the doll with the air pump).

Directions for students

When a group comes to the workstation, give them a Worksheet for Workstation 4. These are their tasks. Help them where needed.

1. Start by tethering the 'sleeping bag' to the hooks on the wall.
2. Float your astronaut doll into the sleeping bag. Remember that he/she is weightless.
3. If the sleeping bag moves (starts floating away from the wall) what keeps it from floating off down along one of the ISS 'corridors'?
4. Remove the doll from the sleeping bag.
5. How hard would it be for a person to climb into a sleeping bag attached to the wall? (Don't try it).
6. In space, what difference would it make if the sleeping bag was tethered to the ceiling or to the floor?



Between groups:

Untether the sleeping bag. Remove the astronaut from the sleeping bag.

At the end:

Deflate your astronaut. Return all materials to the pick-up point.

Workstation for Station 1 (class set needed)

Meal Planning / Dehydration station

Pick up a Worksheet for Workstation 1.

These are your tasks.

In pairs, choose a different meal to design (breakfast, lunch, dinner or snack). Note the meal you are creating below.

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From the poster and/or from the dried food on the table, choose items which would make a balanced, healthy meal.

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Which foods on the poster can be dehydrated or powdered? Is there anything on the poster that you think can't be prepared for the space station? Note those below:

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Do you think that fresh foods are available on the Space Station?

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If there's a dehydrator, figure out how it works. What does food look like when it's dehydrated? What would you have to do before you could eat it?

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Worksheet for Station 2 (class set needed)

Vacuum sealing / Food tasting

Pick up a Worksheet for Workstation 2.

Work in pairs. These are your tasks.

Spoon a small amount of dehydrated food into a bag. Then vacuum seal the bag using the vacuum sealing unit(s). How good is the air removal from the bag? How long do you think the food will keep?

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There should be some rehydrated food in small containers for you to try. Can you tell by looking if the food is rehydrated? Try a little. How does it taste? Does it need more water?

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How would you feel about eating dehydrated food every day?

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Worksheet for Station 3 (class set needed)

Exercise in Space



Exercising in Space

Pick up a Worksheet for Workstation 3 and a copy of Peggy Whitson's journal entry.

Here are your tasks:

Start by reading Peggy Whitson's journal about exercising in space.

Now, there are 2 exercises to do. Try and do at least 2 of them.

1. Sitting on a chair, raise your legs and 'run' for 2 mins as if you were on a treadmill.
2. Sitting on a chair, raise your legs and 'pedal' for 2 mins as if you were on an exercise cycle.
3. Standing facing a wall, with your feet a little more than arms-length away, place your hands flat on the wall at shoulder height. Push outwards from the wall until you are upright, then release. Repeat for 2 mins.

Below, record, what you think it would be like to do an hour of bike or treadmill and an hour of resistance exercises every day.

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How is Peggy's experience different from how you exercise on Earth?

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Station 3 – Exercise in Space (class set needed)

Read Peggy Whitson's Journal Entry

Each Station crew member is scheduled **for an hour of cardio** (either treadmill or cycle ergometer) and **an hour of resistive exercise** (the equivalent of weightlifting) each day while we are on orbit. With these exercises, we are trying to minimize the negative physiological effects of living in a microgravity environment, where the lack of gravity for just the normal “walking or sitting around,” means that our muscles and bone are deteriorating at faster than normal rates as compared to on Earth.



Image at right: Commander Peggy Whitson exercises in the Destiny laboratory on the International Space Station. Image Credit: NASA

I like to exercise, but the additional incentive to reduce these negative physiological impacts of living in space drive me to work out regularly. Returning to a normal gravity environment after a 6-month mission was challenging last time, in spite of the fact that I worked out routinely on my last mission as well. So, the desire to be able to walk and function normally when I return is a good motivator. A more real time motivator while I am up here is the need to be ready for a space-walk. For this mission I have been lucky enough to be

able to participate in 3 space walks (EVAs). Being in the pressurized space suit for 7 hours, while trying to accomplish hand-intensive assembly or repair tasks, is another huge motivator for me (don't want to look weak while everyone is watching!). My motto when it comes to EVAs is that “you can never be too strong.”

Successful long duration expeditions, whether to the poles of our Earth, the peak of a mountain, below the ocean, or up here in space, require a positive outlook. I advise rookie crew members that the self-knowledge of what things can keep you happy and help maintain a positive outlook is a critical aspect of preparation for long duration space flight. There is a psychological aspect of exercise that I value, both personally, as well as, for the overall mission goals. Both here on orbit or (even more so) on the ground, I use exercise as a stress reliever (Peggy gets cranky without exercise). I always feel more relaxed after working out. While I have never been a big believer in that whole endorphin thing, I do get a sense of satisfaction from working out that positively lifts my attitude. So, for me, exercise is not only a critical physical component to life up here, it has an important psychological component too.

Worksheet for Station 4 (class set needed)

Sleep

Pickup a Worksheet for Station 4.

These are your tasks.

1. Start by tethering the 'sleeping bag' to the hooks on the wall.
2. Float your astronaut doll into the sleeping bag. Remember that he/she is weightless.
3. If the sleeping bag moves (starts floating away from the wall) what keeps it from floating off down along one of the ISS 'corridors'?
4. Remove the doll from the sleeping bag.



How hard would it be for a person to climb into a sleeping bag attached to the wall (a) on Earth and (b) on the Space Station? (Don't try it. Just note your answer below):

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In space, what difference would it make if the sleeping bag was tethered to the ceiling or to the floor?

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