

## MISSION X: MISSION HANDOUT



### YOUR MISSION: **Crew Strength Training**

You will perform body-weight squats and push-ups to develop upper and lower body strength in muscles and bones. You will also record observations about improvements in *strength training* during this physical experience in the Mission Journal.

Strong muscles and bones are important to your overall health. They are necessary so you can perform chores and tasks at home, at school, or while playing. When you lift an object off the floor, push yourself up out of bed, or bend to see under an object, you are using upper and lower body strength. Physical activities such as these will help keep your muscles and bones strong!

**MISSION QUESTION:** How could you perform a physical activity that would strengthen your muscles and bones in both your upper and lower body?



### MISSION ASSIGNMENT: **Strength Training**

#### ☐ **Body weight squats:**

Using only your body weight, perform a squat (each squat is a *repetition*).

- ⇒ Stand with your feet shoulder width apart, back straight, looking forward, arms at your side.
- ⇒ Lower your body, bending your knees while keeping your back straight (as if sitting). Raise your arms forward for balance as you squat. At the bottom of the motion, your upper legs should be close to parallel with the floor and your knees should not extend past your toes.
- ⇒ Raise your body back to a standing position.
- ⇒ Try to perform 10 to 25 squat *repetitions*, increasing over time as possible.

#### ☐ Rest for 60 seconds.

#### ☐ **Push-ups:**

Using your arms to lift your body, perform a push-up (each push-up movement is a *repetition*).

- ⇒ Lie down on the floor on your stomach.
- ⇒ Place your hands on the floor, under your shoulders, shoulder width apart.
- ⇒ Using only your arms to lift your body, lift up slightly until your lower body is off the floor and only your toes and hands are touching the floor. (If this is difficult, you may keep your knees on the floor.) This will be your starting position.
- ⇒ Straighten your arms to raise your body. Do not lock your elbows.
- ⇒ Lower your body back to the starting position.
- ⇒ Try to perform 10 to 25 push-up *repetitions*, increasing over time as possible.

#### ☐ Rest 60 more seconds.

#### ☐ This entire routine of *strength training* should be repeated two more times.

#### ☐ Record observations before and after this physical experience in your Mission Journal.

**Follow these instructions to train like an astronaut.**

**Strength Training:**

Physical activities which use resistance to increase muscle and bone strength, and help improve overall health and fitness.

**Crew****(crew members):**

People working together on a common activity or for a common purpose; a term for NASA astronauts who share their mission with each other.

**Repetition:**

A motion (such as a body-weight squat or a push-up) that is repeated and usually counted.

**Resistance:**

An opposing force (through gravity, weight, or equipment).

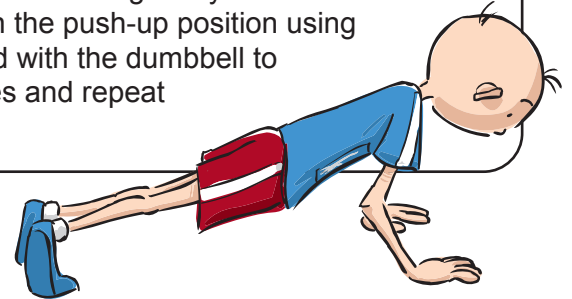
By doing exercises that use your own body weight, you can increase the strength of your muscles and bones. Lack of physical activity can increase the chances of injury because your muscles and bones may be weak. Even easy physical tasks might seem hard!

**It's a Space Fact:**

Astronauts must perform physical tasks in space that require strong muscles and bones. In a reduced gravity environment muscles and bones can become weak, so astronauts must prepare by *strength training*. They work with NASA strength and conditioning specialists on Earth and continue to work in space to keep their muscles and bones strong for exploration missions and discovery activities.

**Fitness Accelerations**

- Complete five squats, holding the last squat for 30 seconds. Complete five more squats, holding the last squat for 60 seconds. Rest for 60 seconds. Do this three times for a total of 30 squats.
- Complete 10-25 pushups on a balance ball. You will balance your body on the exercise ball and push off with your hands to complete one push-up.
- Grab two 1-3 lb dumbbells. Get into the push-up position and do five push-ups as your hands balance on the dumbbells. Now, lift the dumbbell with your right arm off the floor and bring it to your underarm. You will be balancing your body in the push-up position using one arm as you lift your right hand with the dumbbell to your underarm. Do these ten times and repeat with the opposite arm.

**Think Safety!**

- Astronauts carefully practice proper *strength training* on Earth so they can safely *strength train* in space.
- ⇒ It is important to do these activities slowly and correctly to avoid injury.
- ⇒ Remember that drinking plenty of water is important before, during, and after physical activities.

**Mission Explorations:**

- ⇒ Climb across the monkey bars of the play equipment using only your hands.
- ⇒ Do walking lunges across the gym floor.
- ⇒ Walk up and down a set of stairs.
- ⇒ Compete in a game of rope tug-of-war. (Wear gloves to avoid rope burns.)

**Status Check:** Have you updated your Mission Journal?



# Train Like an Astronaut: Adapted Physical Activity Strategies

## Crew Strength Training

### YOUR MISSION

You will perform body-weight squats and push-ups to develop upper and lower body strength in muscles and bones. You will also record observations about improvements in strength training during this physical experience in the Mission Journal.

### LINK TO SKILLS AND STANDARDS

**APENS:** 2.01.08.01 Understand variance in “motor milestones” such as typical or average age of achievement for individuals with disabilities – Implement activities that strengthen postural muscles and extremities necessary for locomotion.

#### *Activity Specific Terms/Skills*

Squats, push-ups, bone and muscle strengths, cardiac vascular, repetition, endurance, team work, resistance, heart rate

### SPACE RELEVANCE

Astronauts must perform physical tasks in space that require strong muscles and bones. In a reduced gravity environment, muscles and bones can become weak, so astronauts must prepare by strength training. They work with NASA strength and conditioning specialists on Earth and continue to work in space to keep their muscles and bones strong for exploration missions and discovery activities.

### WARM-UP & PRACTICE

#### **Warm-up**

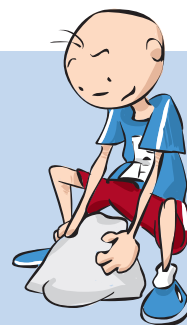
Assistance/Supported squat or activities that mimic a squat:

- 🚩 Shooting a basketball, Bowling, Dancing
- 🚩 Step-up, Wall push-ups, Walk stairs, Rowing

#### **Practice:**

- 🚩 Use hand or wrist weight
- 🚩 Tug-of-war
- 🚩 Resistance exercises (stand face-to-face, gently pushing against each other's palms)
- 🚩 On back, perform straight or bent leg lifts; the Dead Bug movement
- 🚩 Demonstrate animal poses: 'seal', 'bear crawl', or yoga poses: comic book 'Superman' position etc., have performer attempt and hold for desired count

[www.trainlikeanastronaut.org](http://www.trainlikeanastronaut.org)



#### SUGGESTED ADAPTED EQUIPMENT:

- 🚩 THERA-BANDS/RESISTANT BANDS OR CORDS
- 🚩 HAND WEIGHTS
- 🚩 WEIGHT BARS
- 🚩 CANNED GOODS WEIGHT LIFTING
- 🚩 MEDICINE BALLS



# Crew Strength Training

## LET'S "TRAIN LIKE AN ASTRONAUT!"

**Individual Play** (Adjust steps and procedures as appropriate for participants. After each activity, rest for 60 seconds)

### Body weight squats:

- ▲ Using only your body weight, perform a squat (each squat is a repetition).
- ▲ Stand with your feet shoulder width apart, back straight, looking forward, arms at your side.
- ▲ Lower your body, bending your knees while keeping your back straight (as if sitting). Raise your arms forward for balance as you squat. At the bottom of the motion, your upper legs should be close to parallel with the floor and your knees should not extend past your toes.
- ▲ Raise your body back to a standing position.
- ▲ Try to perform 10 to 25 squat repetitions, increasing over time as possible

### Push-ups:

- ▲ Using your arms to lift your body, perform a push-up (each push-up movement is a repetition).
- ▲ Lie down on the floor on your stomach.
- ▲ Place your hands on the floor, under your shoulders, shoulder width apart.
- ▲ Using only your arms to lift your body, lift up slightly until your lower body is off the floor and only your toes and hands are touching the floor. (If this is difficult, you may keep your knees on the floor.) This will be your starting position.
- ▲ Straighten your arms to raise your body. Do not lock your elbows.
- ▲ Lower your body back to the starting position.
- ▲ Try to perform 10 to 25 push-up repetitions, increasing over time as possible.

## TRY THIS! *Some ideas for Adapted Activity*

### Push-ups and/or related exercises:

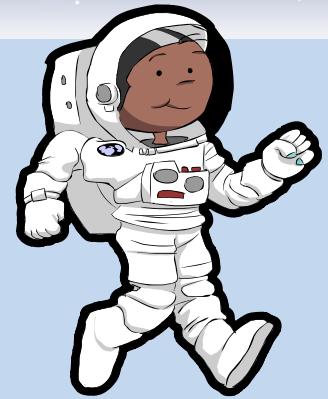
- ▲ Perform at various levels: table, stool, bench, wall or wall bar, steps, etc.
- ▲ Wheelchair push up: Seated in chair with arms, place hands on arm rests and lift body. Hold position In push up position, alternate right and left hand crossing midline to touch opposite shoulder, keeping plank; attempt in wall push up position

### Plank and/or related exercises:

- ▲ Perform at various levels: table, stool, bench, wall or wall bar, steps, etc.
- ▲ While in plank, place ball between body and floor and use hands, walk out and back

### Seated isometric exercises:

- ▲ In a chair or at bench edge, hold, breathe, and squeeze abdominal muscles Wall sit with back against wall, knees @ 90 degrees; hold, breathe, and squeeze abdominal muscles
- ▲ On a core ball, knees @ 90 degrees; squeeze abdominal muscles







# CREW STRENGTH TRAINING

## Learning Objectives

Students will

- perform body-weight squats and push-ups to develop upper and lower body strength in muscles and bones.
- record observations about improvements in strength training during this physical experience in the Mission Journal.

## Introduction

NASA researchers are working to lessen muscle atrophy and loss of bone density in astronauts involved in prolonged space flights. Both of these physical changes can be hazardous to astronauts on an extended exploration mission. Injured or weak crew members may not be able to perform their assigned tasks, causing safety concerns for themselves, as well as fellow astronauts. All crew members need to be in top physical condition to ensure the completion of the mission.

Astronauts also need strong muscles and bones to perform tasks while exploring a lunar or Martian surface. They must be able to lift, bend, build, maneuver and even exercise during a mission. Both the moon and Mars have enough gravitational force to require strong muscles and bones to do these tasks. If a crew member happens to trip and fall, the strength of their muscles and bones can mean the difference between getting up and returning to work, or having to end the mission and return back to Earth.

On Earth, the strength of muscles and bones is important to being physically fit and healthy. Severe muscle atrophy or bone loss in space could mean a crew member might fail to recover his or her pre-flight physical condition back on Earth. Therefore, astronauts do regular exercise and strength training before, during, and after a mission to keep their muscles and bones strong.

Performing multi-joint weight-bearing exercises, such as the push-up for upper body strength and the squat for lower body strength, can help develop stronger muscles and bones. Use the information below to help administer the Fit Explorer Mission Handout and help your students **train like an astronaut**.

## Administration

Follow the outlined procedure in the Crew Strength Training Mission Handout. The duration of this physical activity can vary, but will average **15 minutes**. In order for students to perform at their maximum potential, positive reinforcement should be used throughout the activity.

## Location

This physical activity should be conducted on a flat, dry surface.

*The use of a closely placed metronome may assist small groups in keeping cadence in the repetitions.*

## Set-up

Students should be at least an arms length apart from each other.

## Equipment

- Mission Journal and pencil

Optional equipment:

- watch or stopwatch
- wall access
- metronome

*For physical activity, students should wear loose-fitting clothing that permits freedom of movement.*

## Safety

- Push-ups should be done with arms extended (but not locked), and level with chest. If the student is unable to do a standard push-up, have him/her begin with bent-knee push-ups (knees on the ground).
- Always stress proper technique while performing exercises. Improper technique can lead to injury.
- Proper hydration is important before, during and after any physical activity.
- Be aware of the signs of overheating.
- A warm-up/stretching and cool-down period is always recommended.

*For information regarding warm-up/stretching and cool-down activities, reference the Get Fit and Be Active Handbook (ages 6-17) from the President's Council on Physical Fitness and Sports at <http://www.presidentschallenge.org/pdf/getfit.pdf>.*

## Monitoring/Assessment

Ask the Mission Question before students begin the physical activity. Have students use descriptors to verbally communicate their answers.

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 this physical activity:

- How do you feel?
- How many repetitions did you do?
- How did your upper body/lower body feel during the repetitions?
- What do your arms and legs feel like now compared to when we first tried this physical activity together?
- On the moon or Mars, do you think you would feel the same way?
- Where is the energy you are using coming from?
- What muscles do you feel you are working?

The most appropriate answers would include:

- Body weight squat
  - lower back
  - buttocks
  - front/back of upper legs
  - lower legs
- Push-up
  - chest

- shoulders
- back of upper arms
- lower arms

Some quantitative data for this physical activity may include:

- rate of perceived exertion (on a scale of 1-10)
- how many correct repetitions were performed
- length of rest period
- respirations (breaths per minute)

Some qualitative data for this physical activity may include:

- technique performance
- identifying soreness in body parts
- identifying shakiness or muscle cramping

## Collecting and Recording Data

Students should make observations about their physical experience training for stronger muscles and bones in their Mission Journal before and after the physical activity. They should also record their physical activity goals and enter qualitative data for drawing conclusions.

- Monitor student progress throughout the physical activity by asking open-ended questions.
- Time should be allotted for the students to record observations about their experience in their Mission Journal before and after the physical activity.
- Graph the data collected in the Mission Journal on the graph paper provided, letting students interpret the data individually. Share graphs with the group.

## Fitness Accelerations

- Complete five squats, holding the last squat for 30 seconds. Complete five more squats, holding the last squat for 60 seconds. Rest for 60 seconds. Do this three times for a total of 30 squats.
- Complete 10-25 pushups on a balance ball. You will balance your body on the exercise ball and push off with your hands to complete the pushups.
- Grab two 1-3 lb dumb bells. Get into the push up position and do five push ups as your hands balance on the dumb bells. Now, lift the dumb bell with your right arm off the floor and bring it to your underarm. You will be balancing your body in the push up position using one arm at this point as you lift your right hand with the dumb bell to your underarm. Do these ten times, now do the same exercise with the opposite arm. *Have the students do this exercise on a padded mat.*

## National Standards

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.
  - 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.
  - 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.
  - 5.5.4 Predict the potential outcomes of each option when making a health-related decision.
  - 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.
  - 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.
  - 7.5.2 Demonstrate a variety of healthy practices and behaviors to maintain or improve personal health.
- Standard 8: Students will demonstrate the ability to advocate for personal, family and community health.
  - 8.5.1 Express opinions and give accurate information about health issues.

### National Initiatives and Other Policies

Supports the *Local Wellness Policy*, Section 204 of the Child Nutrition and WIC Reauthorization Act of 2004 and may be a valuable resource for your Student Health Advisory Council in implementing nutrition education and physical activity.

### Resources

For more information about space exploration, visit [www.nasa.gov](http://www.nasa.gov).

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 [www.fitness.gov](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>.

NASA Connect™ Good Stress: Building Better Bones and Muscles

<http://www.knowitall.org/nasa/connect/index.html>.



For guidelines for fluid replacement and exercise:

National Athletic Trainer's Association (NATA)

- Fluid Replacement for Athletes (Position Statement)  
<http://www.nata.org/statements/position/fluidreplacement.pdf>

For information on warm-up and cool-down stretches, visit:

American Heart Association (AHA)

- Warm-up and Cool-down Stretches  
<http://americanheart.org/presenter.jhtml?identifier=3039236>

For information about rate of perceived exertion (RPE), visit:

Centers for Disease Control and Prevention (CDC)

- Perceived Exertion  
[http://www.cdc.gov/nccdphp/dnpa/physical/measuring/perceived\\_exertion.htm](http://www.cdc.gov/nccdphp/dnpa/physical/measuring/perceived_exertion.htm)

## Credits and Career Links

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