

ACTIVITY 0.1 ASTRONAUT WORKOUT

From the Pre-launch Chapter of the
Principia Space Diary
[http://principiaspacediary.org/
activities/astronaut-workout](http://principiaspacediary.org/activities/astronaut-workout)

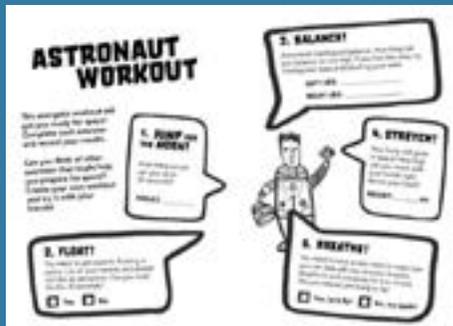
LEARNING LEVEL

KS1, KS2, P1-5

CURRICULUM LINKS & DIFFERENTIATION IDEAS

View detailed curriculum links for England, Scotland, Northern Ireland and Wales, plus differentiation ideas for your region and year level.

[principiaspacediary.org/
curriculum-planner/](http://principiaspacediary.org/curriculum-planner/)



Resources Required

- Classroom with clear floor space or outdoor space. You will need an area large enough for all students to lie down with their arms outstretched.
- Stopwatches or class timer (available online)
- Metre sticks or rulers

Background to this Activity

ESA Astronaut Tim Peake trained for four years before flying into space. He needed to be fit and healthy and he also needed to understand what might happen to his body in space.

Running the Activity

During this activity students will do a range of exercises: aerobic, anaerobic, co-ordination, weight bearing, balance, core strength and mindfulness. This is designed to be physically energetic and students will also need to work together to count, measure and document their results in their Space Diary.

1. Jump: On Earth, humans experience the effects of gravity as a constant force pulling on the human body. By jumping you are trying to defy gravity. Jumping activities are weight bearing activities that help build strong bones. They also get the heart rate up to improve cardiovascular fitness.

2. Float: Students can imagine they are floating around inside the ISS while stretching their arms out wide and strengthening their core.

3. Balance: Develop core muscles and posture. This is important for astronauts like Tim because the Soyuz capsule that will take Tim from Earth to the ISS is very small and the journey is gruelling. Tim needs strong core muscles.

4. Stretch: Astronauts can grow up to two inches taller in space as there is no gravity to keep the bones compressed. After returning to earth, they will return to their normal height. Students can work in pairs or teams to measure each other.

5. Breathe: Lots of things can go wrong in space, so it is critical that astronauts have strong, healthy minds. They need to be able to deal with problems in a calm and efficient way. This mindfulness exercise gets the kids to focus their minds so they, too, can tackle any problem. Ask students to sit in a comfortable position, eyes closed. As they breathe in and out have them visualise that their breath is a ball of heat moving through their body, all the way down and out their legs.

Questions for the Class

- Why do astronauts need to be healthy?
- Why do astronauts need to have a healthy mind?
- What parts of the body are you using as you exercise?
- Can you research the exercises Tim did during training?

ACTIVITY 0.2 YOUR BODY IN SPACE

From the Pre-launch Chapter of the Principia Space Diary
<http://principiaspacediary.org/activities/your-body-in-space>

LEARNING LEVEL

KS1, KS2, P1-5

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Resources Required

- Add-on: Post-its to encourage questions from the class. Could these be added to a 'Space Diary' wonderwall?
- Computer/s if you wish to complete the Code Club extension activity

Background to this Activity

There are many changes that the human body goes through in space and the International Space Station is the perfect environment to monitor these changes. Many of Tim's activities on the ISS were tests on his body.

Pre-flight, astronauts need to be sure that they do not have any colds or infections that they could take into the ISS. They also see flight surgeons who make sure they do not have any medical conditions that would require treatment so far away from home. There is some medical equipment on board but astronauts would need to be flown home if they had a major health issue.

In microgravity, astronauts float around and therefore there is no load on their body. Their bones and muscles decondition and they need to exercise daily on the space station to counteract the effects of space. Tim trained for two hours per day on the ISS to counter the effects of gravity and he even completed the London Marathon up there.

Astronauts are also prone to motion sickness and kidney stones. Sleep is often disturbed on the ISS as the circadian rhythms are disrupted.

Fluid shifts mean that astronauts may feel as if they have a head cold and this also affects their sense of smell and taste. They can get a puffy face, and sometimes their eyesight may be effected. In fact, the shape of the eyeball can change ever so slightly. This would not be noticeable to the human eye.

Astronauts can grow by up to two inches while in space because the lack of gravity means the spine will expand and relax more easily.

Running the Activity

Ask the questions to your class or have them test each other. For older children, ask them to research the effects of space on the human body and come up with their own questions. Could they make a presentation or give a talk on their research?

Students can use the Zappar app on the iphone or tablet to access the answers. See instructions overleaf.

Quiz Answers

1. True 2. True 3. False 4. True 5. True 6. False 7. False 8. True 9. False

Extensions & Digital Resources

Code your own quiz with our Scratch coding activity developed with Code Club:
<https://codeclubprojects.org/en-GB/space-mission/space-body-quiz/>

ZAP! Students can access the quiz answers themselves using the Zappar mobile/tablet app. See Zappar instructions at the link below and note that the mobile/tablet will need to be connected to the internet: <http://principiaspacediary.org/using-zap-codes-to-strengthen-digital-literacy/>

ACTIVITY 0.3 SPACE DINNER

From the Pre-launch Chapter of the Principia Space Diary
<http://principiaspacediary.org/activities/space-dinner>

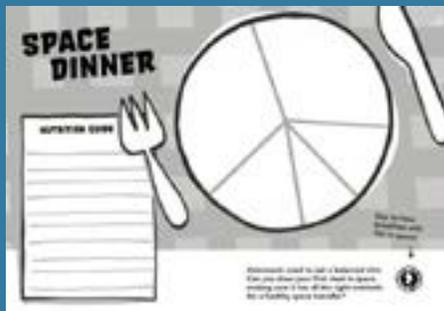
LEARNING LEVEL

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Resources Required

- Coloured pens
- Eatwell Plates via NHS website
- For younger children: Shopping basket and food
- For older children: Fact sheet on food types

Background to this Activity

Astronauts need to consume sufficient energy (calories) in space to work effectively and maintain good health. Calcium and vitamin D are vital with their beneficial effect on bones, as a low-gravity environment can lead to poor bone health. Many astronauts simply do not consume enough calories because of lack of time and their demanding work schedules.

Fluid shifts mean that astronauts get a 'stuffy head' and they feel like they have a cold. This means that food tastes blander in space than on Earth.

Meals are usually dehydrated and fresh fruit is a luxury.

The foods need to be easily and safely stored and must not create crumbs that could get into the special equipment on board the ISS. Dried strawberries from breakfast cereals, coffee granules, coated chocolate, foil carton drinks are all examples of foods that have been in space. NASA's fact sheet Food For Space covers food preparation in space and space-friendly foods: <https://www.nasa.gov/audience/formedia/presskits/spacefood/factsheets.html>

Check out the Great British Space Dinner competition by the UK Space Agency (<https://principia.org.uk/activity/the-great-british-space-dinner/>), which invited children from across the UK to help Tim choose some special menus that were prepared by celebrity chef Heston Blumenthal.

Running the Activity

Download the Eatwell Plate from the NHS website:

<http://www.nhs.uk/Livewell/Goodfood/Documents/The-Eatwell-Guide-2016.pdf>

Use one of the methods below to set up the exercise:

Set up the classroom as a shop with different food (for each group) in different parts of the room. Students can "shop" for items to include in their space dinner and draw what they choose.

Use the Eatwell Plate to choose and design a meal incorporating each food group.

As above, plus ask them to link their meal to each of the seven food groups. Use the resources provided with the Extension exercise for this activity (available on the website).

Extensions & Digital Resources

To challenge students further download Extension activities for this lesson from <http://principiaspacediary.org/activities/space-dinner>. These have been developed by teacher Claire Loizos.

ZAP! In this activity, students can use the Zappar app on a mobile or tablet device to watch a video of Tim Peake making scrambled eggs on the ISS by. See Zappar instructions at the link below and note that the mobile/tablet will need to be connected to the internet: <http://principiaspacediary.org/using-zap-codes-to-strengthen-digital-literacy/>

ACTIVITY 0.4 DESIGN YOUR SPACESUIT!

From the Pre-launch Chapter of the Principia Space Diary
<http://principiaspacediary.org/activities/design-your-spacesuit>

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KS1, KS2, P1-5

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Resources Required

- Coloured pens or pencils
- Optional: Fact sheets on spacesuit materials – tin foil for reflection, cotton wool for insulation

Background to the Activity

A spacesuit isn't just a uniform, it's like a personalised, human-shaped spacecraft designed to keep astronauts alive in space. There are two types of space suits: one for travelling to and from space, and one for doing spacewalks (EVAs).

The EVA suits for space walks have lots of different jobs to do. They provide the astronaut with air to breathe, keep them warm or cool, protect from debris flying through space, allow the astronaut to move fairly freely and even have rocket boosters in case the astronaut gets into trouble! The suits are heavy on Earth but zero gravity in space makes them feel light.

When travelling to the ISS and back to Earth, Tim Peake wore a Sokol spacesuit, which is different to the one he used on his space walks. 'Sokol' means 'falcon' in Russian, and it is a rescue suit. This is the same design as the one that Helen Sharman wore when she went to the Mir Space Station. The main features of this type of space suit are:

- Two layers: the inner one is rubberised and the outer one is made of white nylon.
- Boots that are built into the suit and space gloves attached at the wrists by special aluminium fastenings.
- A helmet that is also part of the suit. To put the suit on you have to squeeze your head through a neck seal into the helmet, which has a visor on a hinge (so you can open it). The seal at the neck means you can float in water on landing and open your visor without

your whole suit flooding!

- An air valve. An oxygen supply connected to the suit is activated in times of de-pressurisation.
- A radio and microphone to communicate

Running the Activity

Encourage older pupils to use a range of material samples to design the suit. This works well fastened on as a 'swatch' using a treasury tag. Ideas:

Tin foil: to reflect radiation

Cotton wool: for insulation – to trap air

Black inside: to absorb heat

White outside: to reflect heat radiation

Questions for the Class

- What are the different parts of the spacesuit?
- Why is the spacesuit made like a onesie?
- How heavy will the spacesuit feel in space?
- How do you go to the toilet when you are in the spacesuit?

Extensions & Digital Resources

ZAP! Students can access use the Zappar app to find out more about Tim Peake's spacesuit and to see a video with Lucy Hawking and Dallas Campbell discussing spacesuits at the Science Museum. See Zappar instructions at the link below and note that the mobile/tablet will need to be connected to the internet: <http://principiaspacediary.org/using-zap-codes-to-strengthen-digital-literacy/>