



Модуль 6 Advances in Space Research

Topic: Advances in Space Research

Grammar: Modal Verbs

Essential Vocabulary: gravity, weightlessness, raw materials, advent, improve, sustain, dedicate, process, although, vital, impurity, eliminate, allow, precisely

1. Look at the pictures and match them to the words in the box



1



2



3



4



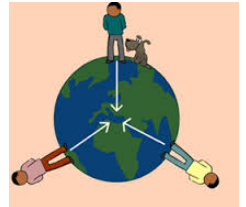
5



6



7



8

Earth, astronaut, Universe, gravity, planets, space, weightlessness, ISS

2. Answer the questions and discuss your answers in pairs:

- Have you ever dreamed to be an astronaut or a space researcher?
- Is space research important for mankind? Why?
- Can space technologies be beneficial for our life on Earth?
- What is the difference between Earth and space conditions?



3. Listening comprehension

Could you be an astronaut? ¹

Listen to a small talk. Before you start listening look at the following words and expressions to better understand the talk:

- claustrophobia - клаустрофобия
- to get on each other's nerves/annoy - раздражать
- to put up with - мириться, терпеть
- zero gravity - отсутствие силы тяжести
- somersaults - кувырки
- to float - всплывать, плавать
- to exert no force - не оказывать влияния
- wasting of the bones and muscles – атрофия костей и мышц
- to prevent - предотвращать
- weightlessness - невесомость
- buoyancy |'bɔɪənsi| - плавучесть; подъёмная сила; жизнерадостность; бодрость
- padded - оббитый, мягкий
- altitude |'æltɪtju:d| - высота
- nosedive - пикирование
- to conduct - проводить
- to get stranded - попасть в бедственное положение
- forage - добывать продовольствие
- keen to know - стремиться узнать
- to apply - подавать заявление
- to give up - отказаться
- to run out of time- испытывать дефицит времени

4. Are the statements true (T) or false (F)? Correct the wrong statements.

1. A few dozens of people have been into space so far.
2. Astronauts have to put up with extremely high gravity in space.
3. Wasting of bones and muscles is the result of zero gravity.
4. Astronauts can use a virtual reality headset and special gloves to prepare them for weightlessness and spacewalking.
5. Astronauts practise their spacewalk in pools with sand.
6. The European Space Agency sends astronauts to Russia for the survival training.
7. When the space capsule lands somewhere unexpected, astronauts have to find food for them.
8. According to Nasa's website, 18 000 people applied to join their 2017 astronaut class.

5. Fill in gaps with words from a box

Water, before, zero gravity, practise, exerting, weightlessness, out, spacewalk, prevent, float, conduct, exercise, swimming pool, planes, feels like, similar, sudden

Zero gravity – a condition where gravity is _____ no force – **can** lead to wasting of the bones and muscles. Astronauts take two and a half hours of _____ per day to help

¹ Could you be an astronaut? URL: <http://www.bbc.co.uk/learningenglish/english/features/6-minute-english/ep-160526>

_____ this. But what do astronauts **have to** do _____ they go into space, to prepare them for _____ and spacewalking? They **can** _____ using a virtual reality headset and special gloves. It's like playing a computer game that looks and _____ doing a spacewalk. And they also train in a _____! The way astronauts practise _____ is in water. _____ gives them the neutral buoyancy that they need. Buoyancy is the ability to _____. Floating in space is _____ to floating in water. Astronauts experience the feeling of weightlessness in _____ too. A large plane with padded walls flies to high altitude and then goes into a _____ fall which creates short periods of weightlessness. But it's not all fun and games. The main reasons for being _____ on the International Space Station is to _____ research. Major Tim Peake is doing scientific experiments, such as how to grow plants in space and what effect radiation and _____ have on this process.

Speaking

6. Summarize the information above. Use these questions to help you prepare your summary.

1. How many people have been in space so far?
2. What is the biggest challenge for Rob to become an astronaut?
3. What do astronauts have to put up with?
3. What is zero gravity or weightlessness?
4. Can astronauts walk in space? Why?
5. How do they move?
6. Where are scientific experiments on radiation and zero gravity effects conducted?

Grammar

(See Grammar Reference to the Module pp21-26)

Part 1. Modal verbs. Ability, obligation, necessity, permission, prohibition, giving advice.

7. Which of the meanings of modal verbs (ability, obligation, necessity, permission, prohibition, giving advice) do these sentences refer to?

e.g. The astronauts need tools and parts on board the spaceship. (necessity)

1. The astronauts mustn't stay in space for too long.
2. Any type of space exploration should be postponed.
3. Trainee astronauts have to do a whole range of activities.
4. We can literally hear the Universe speaking to us.
5. You ought to help your friend. He is in trouble.
6. The doctor said, "You can take long walks every morning."

8. Complete the sentences with the modal verbs in the box (some modal verbs can be used more than once)

can/cannot	could	may	might	must	should	ought to	need	be able
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1. Astronauts _____ use a virtual reality headset and special gloves to prepare them for weightlessness and spacewalking.
2. You _____ touch these samples made in space.
3. Complexity in the Universe _____ be explained by Gravity.

4. He _____ arrive at the party on time, even after missing the train, so he was very pleased.
5. You _____ see the gravitational waves with your eyes.
6. You _____ keep this in a cool place.
7. Improvements in properties of materials in weightlessness _____ lead to the development of valuable drugs, high-strength, temperature-resistant ceramics and alloys and faster computer chips.
8. One _____ know that we'll _____ a lot of specialists who will _____ to work and live in space for a long time.
9. He asked me if he _____ rest for an hour.
10. Astronauts _____ learn skills such as spacewalking, teamwork and operating spacecraft systems.

9. Work in pairs. Make up dialogues according to the model using *can* or its equivalent *be able to* in the correct form. Use the suggested word combinations.

to go to the library to consult a doctor to go to the swimming pool
 to pass a driving test to have your hair cut to book some tickets to the cinema

Student 1: **Were** you **able** to visit your sick friend yesterday? (Last week...).

Student 2: I **couldn't** (**wasn't able**), I was very busy.

Student 1: **Can** you visit him tonight?

Student 2: No, I'm afraid I **can't**. I'll be preparing for my exam.

Student 1: And when **will** you **be able** to go there?

Student 2: I hope I'll **be able** to do it tomorrow (on Tuesday...) after my exam.

Additional suggestion



Before doing ex.10 you may wish to watch the video2 (file 2). "What is the best way to ask for permission?"

10. Paraphrase the following sentences using the modal verb *may/might* in the meaning of permission.

e.g. Astronauts are allowed to eat a brand of sweetener, but they cannot eat regular sugar, due to not being able to completely dehydrate. – Astronauts may eat a brand of sweetener, but they cannot eat regular sugar...

1. It's very cold here. You are shivering all over. You are permitted to put on your coat. 2.

Certainly you are allowed to take the book. Now it's yours. 3. I told her she was permitted to

have a holiday with us. And now she is looking forward to our trip. 4. The mother says that she

² <http://learningenglish.voanews.com/media/video/everyday-grammar-tv/3137097.html?z=0&zp=1> (file 2)

allows me to join my friends who will go to the Crimea for the summer holiday. 5. Candidates are allowed to take a dictionary into the exam, but they can't take in a grammar book.

11. Work in pairs. Make up short dialogues using the modal verb *must* to express obligation, necessity.

Student 1	Student 2
- Would you like to come to a party tonight?	- I can't, I'm afraid I must revise for my exams.
- Oh, come on. I'd really appreciate it.	- No, I'm sorry I really must revise for this exam.

1. Would you like to go to a holiday camp? 2. Would you like to visit the picture gallery? 3. Would you like to go for a drive into the country? 3. Would you like to go hiking? 4. Would you like to go fishing? 5. Would you like to go to the rock concert?

12. Choose the suitable equivalent for the modal verb *must* – *to have to* or *to be to*?

1. If you don't care of yourself, you'll _____ consult a doctor.
2. Do you _____ pay for your education?
3. Today I _____ go to the post office. When _____ you _____ go there?
4. There were only two people in front of me in the lane so I didn't _____ wait long.
5. When _____ our delegation _____ arrive in London?
6. When _____ I _____ get off the tram?
7. Yesterday they _____ _____ come back home to a big dinner.
8. I missed my train and I _____ _____ wait half an hour for the next one.



13. Rewrite the sentences using the correct verb in brackets in the correct form.

1. Are kids allowed to stay on board the space station? (can/must)
2. Originally, astronauts were not required to wear space suits. (must/have to)
3. It is important that astronauts conduct materials-science experiments on the space station. (may/must)
4. Weightlessness causes medical problems in astronauts, so astronauts are advised to train regularly in order to avoid these problems.(must/should)
5. It was necessary to tell the crew what to do because they didn't know. (can/need)
6. Wearing a uniform is obligatory for officers. (need/have to).
7. Are we permitted to eat or drink at our computers? (should/may)

8. Military experience is not required to become an astronaut. (should/have to)
9. It's not necessary for you to have advanced degree like PhD to be an astronaut. (must/need)
10. Is it necessary for us to create a prolonged weightlessness to be able to carry out experiments?
(need/can)
11. After returning to Earth cosmonauts are not allowed to walk until intensive medical checks are conducted. (may/can)
12. They are advised to exercise for two hours a day during their stays in orbit to maintain their fitness. (must/should)

Home assignment after Lesson 1:

1. Ex-ce 13
2. Ex-ce 14



14. a) Read the text and headline its parts. b) Underline the modals verbs in the text and translate the sentences where they are used.

1) _____ —	2) _____ —	3) _____ —	4) _____ —	5) _____ —
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What is microgravity?³

1) It's easy to assume that astronauts float in space because they are far away from the Earth's gravitational force. But look at the moon. It is much further away than the International Space Station, yet it orbits around the Earth because it is perpetually attracted by its gravitational pull. So if the Earth's gravity can affect the moon, the astronauts cannot be floating because there is no gravity where they are. Gravity is an attractive force, which is always present between two objects that have a mass. It's such a weedy force, however, that we need huge objects such as planets or moons to realize it's there at all.

2) However, we can create environments in which we don't experience the effects of gravity. Usually people refer to such "microgravity" environments as "zero-g", because they make objects appear weightless. But what does it actually mean to be "weightless"? The thing about forces is that you only notice them when there is another force counteracting them. Since you have a mass, the Earth's gravitational pull is always accelerating you towards its centre. Luckily, the ground is in the way. But if there was nothing to stop you from falling, you wouldn't feel the ground "push back" and you would feel weightless.

3) This is the first way to "get rid" of gravity: free fall! Some people think of skydiving, but in fact a skydiver is never really in free fall – air drag can slow objects down. For scientific experiments, however, researchers can overcome the air resistance issue by pumping out air from a huge tower, some 150m high. Then they shoot experiments up to the top of the tower – and drop them – yep it's called a "drop tower". The experiment, and everything inside it, is in "microgravity" as it falls – for about four seconds. Another way to

³ April 27, 2016 by Sabrina Gaertner, The Open University, The Conversation
<https://phys.org/news/2016-04-microgravity.html>

achieve "free fall" is to put things into orbit (such as the International Space Station). A force, called the centrifugal force, "pushes" an object travelling in a circle away from the centre of the motion. Go around a corner fast on your bike and if you don't lean into the "bend" you'll find it difficult to stay on the bike and steer at the same time – lean too far and the wheels will get "pushed out" from underneath you. It's all a matter of balancing forces.

4) So, an object in "free fall" orbiting the Earth at just the right speed and altitude can appear weightless. This is the case with the ISS. Here, astronauts and everything else in it all travel in free fall, making it an amazing microgravity science laboratory. But why do scientists need microgravity? The majority of processes on Earth are influenced in some way by gravity, which means exploiting microgravity environments for research is a clever way to learn more about the way in which the world around us works. (2 300 characters)