

## Lesson 2

### 15 Look at the adjective form of nouns.

A. *Noun (существительное) + ful = Adjective (прилагательное)*

e.g. use (польза) – useful (полезный), skill (умение, навык) – skillful (умелый, профессиональный)

#### Form adjectives from the following nouns.

success - \_\_\_\_\_ stress - \_\_\_\_\_  
wonder - \_\_\_\_\_ help - \_\_\_\_\_  
beauty - \_\_\_\_\_ care - \_\_\_\_\_

B. *Noun (существительное) + less = Adjective (прилагательное)*

e.g. use (польза) – useless (бесполезный)

#### Form adjectives from the following nouns.

weight - \_\_\_\_\_ harm - \_\_\_\_\_  
wire - \_\_\_\_\_ water- \_\_\_\_\_  
mind - \_\_\_\_\_ end - \_\_\_\_\_

C. *Adjective (прилагательное) + ness = Abstract noun (абстрактное существительное)*

e.g. weightless (невесомый) – weightlessness (невесомость)

#### Form nouns from the following adjectives.

useful - \_\_\_\_\_ thick - \_\_\_\_\_  
tired - \_\_\_\_\_ hard - \_\_\_\_\_  
busy - \_\_\_\_\_ dark - \_\_\_\_\_

### 16 Read and translate the following international words from the text “Creating Materials in a Weightless Environment”.

product |'prɒdʌkt|, experiment |ɪk'spɛrɪm(ə)nt|, defect |'di:fekt|, processing |'prəʊsesɪŋ|, theorize |'θiəraɪz|, temperature |'temp(ə)rətʃə|, ceramics |sɪ'ræmɪks|, component |kəm'pəʊnənt|, gallium |'galiəm|, zinc |zɪŋk|, oxide |'ɒksaɪd|, zirconium |zə:'kɒniəm|, barium |'be:riəm|, lanthanum |'lanθənəm|, aluminum |ə'lu:mɪnəm|, effect |ɪ'fekt|.

### 17 Read and learn pronunciation of the words from the text “Creating Materials in a Weightless Environment”.

alloy |'æloɪ|, although |ɔ:l'dəʊ|, advent |'adv(ə)nt|, variety |və'raɪəti|, mold |məʊld|, thoroughly |'θɔ:rəli|, partially |'pɑ:ʃ(ə)li|, certain |'sɜ:t(ə)n|, vital |'vaɪt(ə)l|, microsurgery

|mʌɪkrə(ʊ)'sə:dʒ(ə)rɪ|, impurity |ɪm'pjʊərɪtɪ|, Earth |ə:θ|, sample |'sɑ:mp(ə)l|, researcher |rɪ'sɜ:tʃə|, precisely |prɪ'saɪsli|.

## Vocabulary

<b>advent</b> <i>n</i>	появление	<b>mold</b> <i>n/v</i>	шаблон, литейная форма/формовать
<b>alloy</b> <i>n</i>	сплав	<b>movement</b> <i>n</i>	движение
<b>although</b> <i>adv</i>	хотя; несмотря на то, что	<b>precisely</b> <i>adv</i>	именно, точно
<b>application</b> <i>n</i>	применение	<b>process</b> <i>n/v</i>	процесс/обрабатывать
<b>certain</b> <i>adj</i>	определенный	<b>property</b> <i>n</i>	свойство, характеристика
<b>create</b> <i>v</i>	создавать	<b>research</b> <i>n/v</i>	исследование/исследовать
<b>data</b> <i>n</i>	данные	<b>raw</b>	сырье
<b>dedicate to smth</b> <i>v</i>	посвящать чему-либо (кому-либо)	<b>materials</b>	
<b>diminish</b> <i>v</i>	уменьшать, убавлять, сокращать	<b>separate</b> <i>v</i>	отделять, разделять
<b>eliminate</b> <i>v</i>	устранять, ликвидировать	<b>sustain</b> <i>v</i>	поддерживать
<b>improve</b> <i>v</i>	улучшать	<b>thus</b> <i>adv</i>	так, таким образом
<b>impurity</b> (мн.ч. <i>-ies</i> ) <i>n</i>	примесь (примеси)	<b>valuable</b> <i>adj</i>	ценный
<b>introduce</b> <i>v</i>	вводить, представлять, знакомить, применять, привносить	<b>vital</b> <i>adj</i>	очень важный (жизненно важный)
<b>melt</b> <i>n/v</i>	расплав, плавка/таять, плавить	<b>weight</b> <i>n</i>	вес

**18 Before reading the text about production of materials on space stations answer the following questions.**

1. How interested are you in space?
2. What advances in space research do you know?
3. What have you read or seen about production in space?
4. What physical phenomena govern the process onboard the spaceship?
5. What influence does gravity have on the final product ?
6. How can we use the acquired knowledge and data to improve industrial processes on Earth ?

**19 Read the text paying attention to the words in bold. Make sure you know what they mean.**

### Creating Materials in a Weightless Environment

The **weightless** environment on space stations was of as much interest to materials scientists as to any others. Scientists are interested in a variety of physical properties of materials, such as **melting** points, **molding properties**, and the combining or **separating** of **raw materials** into useful products. Before the first space stations, materials scientists *could* perform simple experiments of very short duration aboard plummeting airplanes<sup>1</sup> and from tall drop towers.

Through these studies, scientists discovered that gravity plays a role in **introducing** defects in crystals, in the combination of materials, and in other processing activities requiring the **application** of heat. Until the **advent** of space stations, however, they *were not able to sustain* a weightless environment long enough to thoroughly study these phenomena.

The advent of space stations allowed the study of new **alloys**, protein crystals for drug **research**, and silicon crystals for use in electronics and semiconductors. Materials scientists theorized that improvements in processing in weightlessness *could* lead to the development of **valuable** drugs, high-strength, temperature-resistant ceramics and alloys, and faster computer chips.



*Using the ISS's Microgravity Science Glovebox, an astronaut studies the effects of weightlessness on various materials. In a weightless environment, scientists are able to remove impurities from most materials.*

One of the Mir components, the Kristall module, was **partially dedicated** to experiments in materials processing. One objective was to use a sophisticated electrical furnace in a weightless environment for producing perfect crystals of gallium arsenide and zinc oxide<sup>3</sup> to **create** absolutely pure computer chips capable of faster speeds and fewer errors. **Although** they failed to create absolutely pure chips, they were purer than those they *could* create within Earth's gravitational field.

More recently, fiber-optic cables are also being **improved** in weightlessness. Fiber-optic cables, **vital** for high-speed **data** transmission, microsurgery, certain lasers, optical power transmission, and fiber-optic gyroscopes<sup>4</sup>, are made of a complex blend of zirconium, barium, lanthanum, aluminum, and sodium<sup>5</sup>. When this blend is performed in a weightless environment, materials scientists are finding them to be more than one hundred times more efficient than fibers created on Earth.

In 2002 the ISS began the most complex studies of **impurities** in materials and ways to **eliminate** them in a microgravity environment. One of the most interesting causes of impurities, for example, is bubbles. On Earth, when metals are melted and blended, bubbles form. According to materials scientist Dr. Richard Grugel, "When bubbles are trapped in solid samples<sup>6</sup>, they show up as internal cracks<sup>7</sup> that **diminish** a material's strength and usefulness." In a weightless situation, however, although bubbles still form, they move very slightly **thus** reducing internal cracks. Secondly, their slow **movement** allows researchers to study the effect of bubbles on alloys more easily and **precisely**.

According to Dr. Donald Gillies, NASA's leader for materials science, the studies of bubbles and other mysteries of materials production hold promise for new materials:

*We can thank advances in materials science for everything from cell phones to airplanes to computers to the next space ship in the making<sup>8</sup>. To improve materials needed in our high-tech economy and help industry create the hot new products of the future, scientists are using low*

*gravity to examine and understand the role processing plays in creating materials. (533 words, about 3400 signs)* <sup>1</sup>

**Notes to the text:**

<sup>1</sup> plummeting airplanes – падающие самолеты

<sup>2</sup> drop towers - вышки для ударных испытаний (сбрасывания высоты)

<sup>3</sup> gallium arsenide and zinc oxide – арсенид галлия и оксид цинка

<sup>4</sup> optical power transmission, fiber-optic gyroscopes – передача оптической энергии, волоконно-оптические гироскопы

<sup>5</sup> zirconium, barium, lanthanum, aluminum, and sodium – цирконий, барий, лантан, алюминий и натрий

<sup>6</sup> when bubbles are trapped in solid samples – когда пузырьки застревают в твердом образце

<sup>7</sup> they show up as internal cracks – они выглядят как внутренние трещины

<sup>8</sup> in the making – в процессе становления, в процессе развития

**20 Match the synonyms to the words. Give Russian equivalents to all these words.**

advent	exactly
able	to permit
application	to fulfill
to eliminate	mix
precisely	usage
to improve	to remove
to allow	material
to create	capable
blend	to make
product	appearance
to perform	to make better

**21 After reading mark TRUE or FALSE statements. Correct the false ones.**

1. Scientists discovered that weightlessness plays an important role in introducing defects in crystals. **T/F**
2. It became possible to sustain weightlessness on Earth long time ago. **T/F**
3. The advantages of the zero-gravity state may result in the development of different materials with improved qualities. **T/F**
4. The Kristall module was partially aimed at performing experiments in materials processing. **T/F**
5. One objective was to use an electrical cooker in a weightless environment for producing perfect crystals of gallium arsenide and zinc oxide. **T/F**

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<sup>1</sup> По материалам <http://www.scienceclarified.com/scitech/Space-Stations/Research-and-Experiments.html#ixzz40M3Pi5Z7>

6. The computer chips were purer than those they could create within Earth's gravitational field. **T/F**
7. Materials scientists are finding fiber-optic cables to be more than one million times more efficient than fibers created on Earth. **T/F**
8. In a weightless situation bubbles move very slightly thus reducing internal cracks. **T/F**

**22 Put the correct words from the table below in the above article.**

The weightless environment on space stations (1)\_\_\_\_\_ of as much interest to materials scientists. Scientists are (2) \_\_\_\_\_ in a variety of physical properties of materials, such as melting points, molding characteristics, and the combining or separating of raw materials into useful products. (3)\_\_\_\_\_ the first space stations, materials scientists performed simple experiments of very short duration aboard plummeting airplanes and from tall drop towers. Scientists discovered that gravity plays a role in introducing (4)\_\_\_\_\_ in crystals, in the combination of materials, and in other processing activities requiring the application of heat. Until the advent of space stations, however, they were incapable of sustaining a weightless environment long enough to (5)\_\_\_\_\_ these phenomena.

The advent of space stations allowed the study of new alloys, protein crystals for drug research, and silicon crystals (6) \_\_\_\_\_ use in electronics and semiconductors. Materials scientists theorized that improvements in processing in weightlessness could lead to the (7)\_\_\_\_\_ of valuable drugs, high-strength, temperature-resistant ceramics and alloys, and faster computer chips.

The Kristall module, was (8)\_\_\_\_\_ dedicated to experiments in materials processing. One objective was to use a sophisticated electrical furnace in a weightless environment for producing perfect crystals of gallium arsenide and zinc oxide<sup>1</sup> to create absolutely pure computer chips capable of (9)\_\_\_\_\_ speeds and fewer errors.

(10)\_\_\_\_\_ recently, fiber-optic cables are also being improved in weightlessness. Fiber-optic cables, vital for high-speed data transmission, microsurgery, certain lasers, optical power transmission, and fiber-optic gyroscopes, are made of a complex blend of zirconium, barium, lanthanum, aluminum, and sodium. When this blend is performed in a weightless environment, materials (11) \_\_\_\_\_ are finding them to be more than one hundred times more efficient than fibers created on Earth.

- |     |                    |                 |                |                |
|-----|--------------------|-----------------|----------------|----------------|
| 1.  | (a) was            | (b) as          | (c) will       | (d) has        |
| 2.  | (a) interesting    | (b) interest    | (c) interested | (d) interests  |
| 3.  | (a) before         | (b) after       | (c) as soon as | (d) when       |
| 4.  | (a) errors         | (b) defects     | (c) mistakes   | (d) bugs       |
| 5.  | (a) steady         | (b) studio      | (c) student    | (d) study      |
| 6.  | (a) for            | (b) to          | (c) by         | (d) at         |
| 7.  | (a) develop        | (b) development | (c) developing | (d) developed  |
| 8.  | (a) totally        | (b) wholly      | (c) completely | (d) partially  |
| 9.  | (a) faster         | (b) higher      | (c) lower      | (d) slower     |
| 10. | (a) Many           | (b) Much        | (c) More       | (d) Multi      |
| 11. | (a) lab assistants | (b) astronauts  | (c) workers    | (d) scientists |

**23 Work in pairs: take turns to ask and answer the questions to the text “Creating Materials in a Weightless Environment“**

1. What natural phenomenon were scientists interested in?
2. What kind of experiments did material scientists perform before the first space stations?
3. What did they discover through these studies?

4. When did it become possible to sustain weightlessness long enough?
5. What did the advent of space stations allow to study?
6. In which spheres of our life can improved materials be applied?

**24 Test each other: Look at the words and word combinations below. With your partner, try to recall the context they were used in.**

<ul style="list-style-type: none"> <li>• space stations</li> <li>• semiconductors</li> <li>• an electrical furnace</li> <li>• pure chips</li> </ul>	<ul style="list-style-type: none"> <li>• fiber-optic cables</li> <li>• a complex blend</li> <li>• impurities</li> <li>• bubbles</li> </ul>
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**25 Complete the Table (column “Application on Earth”) using the information from the text “Creating Materials in a Weightless Environment“**

Conditions on board the spaceship/equipment on board the space ship	Objects of study (materials/products)	Made of/composed of	Application on Earth
weightlessness (gravity)	new alloys protein crystals	-	
	silicon crystals	-	
electrical furnace in a weightless environment	perfect crystals	gallium arsenide and zinc oxide	
weightlessness	fiber-optic cable	a complex blend of zirconium, barium, lanthanum, aluminum, and sodium	
microgravity environment	impurities in materials (bubbles)	-	



**26. Summarize the information on materials research in space using the following plan.**

1. The effects of weightlessness on various materials
2. The role of space stations in the production of new materials and products
3. The results of the experiments performed on board the space station



**27. Translate into English using modal verbs *can, must, need, may* or their equivalents if possible.**

1. Изменение физических свойств материалов можно изучать на борту космической станции.
2. В результате экспериментов в условиях невесомости ученые должны найти способы устранения примесей в материалах
3. Громоздкие (bulky) конструкции не нужно доставлять с Земли, так как их следует изготавливать на борту станции.
4. Компания “Made in Space” смогла создать технологию 3Д печати, которая может быть использована для замены поврежденных деталей непосредственно на МКС
5. Иногда космонавты вынуждены изготавливать деталь вне МКС в вакууме космоса.
6. Новая технология позволила производить инструменты на борту, что необходимо для длительных (long term) космических полетов.
7. Несмотря на то, что А.Энштейн предсказал (predicted) гравитационные волны столетие назад, их существование было доказано совсем недавно.

#### Homework after Lesson 2

- 1) Ex. 26
- 2) Ex. 27