4 Space travel

UNIT AIMS

READING SKILLS
- Predicting main ideas from textual clues
- Finding vocabulary for expressing opinions and ideas
- Distinguishing between fact and opinion

EXAM PRACTICE
- Matching headings
- Multiple-choice
- Yes/No/Not Given

Background knowledge of the topic

1 **a** What can you see in images A and B?

b What do you know about them?

Read the following headings and summarize each of them in two or three words. Try to predict what the main points of a paragraph with these headings might be.

1 Limited room for lift-off
2 Wealthy tourists rocket into space
3 Space – thrills or spills?
4 Fit for space?

2 Scan the following paragraphs and match them with headings 1–4 in Exercise 1.

A Spectacular views of planet Earth and its extraordinary oceans are one of the first attractions of space tourism. But do the dangers of space outstrip the risks of everyday air travel? While the majority of today's tourists accept that air travel is relatively safe, only a few specialist space travellers have, so far, needed to consider the greater hazards of journeying into the stratosphere.

B It is not difficult to imagine the physical demands a trip into space can make on the human body. During the ascent, the spaceship will travel at 3,500 miles an hour, producing powerful gravitational forces that affect the circulation of the blood. Aspiring space tourists will have to undergo rigorous medical examinations to ensure they are healthy enough to survive the voyage.

C Recent developments in space technology have quite literally widened horizons in the tourist market. But, the experience of voyaging further into space is likely to be limited to only the very prosperous. Reservations for flights into the stratosphere currently cost $200 000. After two days' training, the novice astronauts will embark on a journey that lasts less than an hour.

D The amount of fuel required to propel a spacecraft high into the stratosphere contributes significantly to the cost of travelling 100 kilometres up to the Karman line that marks the divide between Earth's atmosphere and space. One of the ways to reduce this is to impose strict controls on the weight of the space vehicle and restrict cabin space to an absolute minimum.

Skills

Predicting main ideas from textual clues

Written texts in English often (but not always) follow a predictable structure. For example, a text or paragraph may start with a general comment or background information on a topic, followed by more specific detail. The more general statement will outline the main idea of the text and the details will provide supporting information. This might take the form of a definition, an example or an explanation of the main topic. A typical paragraph may be organized in the following way: *general statement, example, explanation*; or *problem, example(s), cause(s), solution(s).*

3 Number sentences a–d in the order you might expect to find them in a paragraph.

a The aspiring space tourist will have to meet a number of criteria before being able to travel.
b However, while the prospect of space tourism has become a fact, booking a ticket is not simple.
c During the 21st century, space technology has developed to such an extent that space tourism has now become a reality.
d First of all, as the price of a trip to the stratosphere is extraordinarily high, space tourists will have to be wealthy.

4 Match each sentence in Exercise 3 with a function i–v from the list below.

i example **ii** problem **iii** solution **iv** general statement **v** explanation

5 Read the following passage about manned space travel. Look at paragraph C and compare the order of the sentences with your answers in Exercise 4. Were any of them different? If so, explain how you decided.

A In 1961, when the Russian astronaut, Yuri Gagarin, piloted the first manned space flight, space travel was still no more than a fantasy. All the same, long before space flight became a reality, Jules Verne and H. G. Wells had proposed creative solutions to some of its more obvious challenges, such as defying the force of gravity. In Verne's 1865 science fiction novel, *From the Earth to the Moon*, a group of Americans invented a huge cannon from which they planned to fire three men up to the Moon. In his 1901 novel, *First Men in the Moon*, Wells described a spaceship made of an imaginary gravity-defying material that would float up to the moon with its passengers inside.

B In the light of modern scientific knowledge, these early fictional scenarios seem absurd. But, it is important to recognize that during the late-19th and early-20th centuries the scientific study of space was more concerned with theoretical physics than the potential of manned space flight. Since the early 1960s, developments in space programmes and manned space flight have allowed over 500 people to travel into space. In fact, nowadays space travel has become such an everyday occurrence that the presence of a permanent, manned international space station in orbit round the Earth is no longer regarded as newsworthy.

C During the 21st century, space technology has developed to such an extent that space tourism has now become a reality. However, while the prospect of space tourism has become a fact, booking a ticket is not simple. The aspiring space tourist will have to meet a number of criteria before being able to travel. First of all, as the price of a trip to the stratosphere is extraordinarily high, space tourists will have to be wealthy. Secondly, the potential astronaut will have to be healthy. For example, because of the effect of the G-forces generated during lift-off, anyone suffering from a heart condition will not be eligible to fly. Space tourism will also be limited by ecological concerns, as the quantities of fuel required for each lift-off raise serious questions about environmental pollution.

D Despite these restrictions, as science progresses, space tourism is likely to become more popular in the future. For example, while developments in spacesuit design are expected to improve safety, technological advances in rocket design will probably reduce fuel consumption and, consequently, costs, making space travel accessible to a much larger proportion of the population.

Exam skills

Matching headings questions

In an exam question where you have to match headings with paragraphs, recognizing the structure of a reading passage can help you predict the possible order of the headings and identify them more easily.

6 Match paragraphs A–D with the functions on the list in Exercise 4.

7 Look at the reading passage again and match paragraphs A–D with headings i–vi. There are more headings than paragraphs.

i manned space flight over the years
ii astronauts in fiction
iii the future of space travel
iv the profile of a space tourist
v future developments in space tourism
vi the international space station

Exam skills

Multiple-choice questions

In one type of multiple-choice question you will have to select the correct answer from a list of possible options. Use the following technique to answer this type of question.

a Identify the topic by finding the key words in the question stem.
b Scan the text quickly to locate the key words.
c Read the section around the key words carefully and compare the meaning with the possible answers on the list.

8 Read the following passage and answer questions 1–5.

1 When did humans begin to study the universe?
A During the 20th century.
B When Copernicus was born.
C A very long time ago.
D When Newton discovered the law of gravity.

2 Why were large rockets important for radio communications?
A They travelled long distances into outer space.
B They could take direct measurements from the ionosphere.
C They facilitated radio transmissions.
D They helped scientists guess more about the ionosphere.

3 What did sounding rockets do?
A They made a loud noise.
B They carried astronauts into space.
C They crashed on lift-off.
D They gathered information at high altitudes.

4 Which of the following could rockets not do?
A Launch a space capsule into orbit around the Earth.
B Return a space probe from another planet.
C Send a capsule into deep space.
D Send a space probe to another planet.

5 When did the expression 'space science' become official?
A When the Space Science Board was created.
B When the media made it popular.
C When rockets were invented.
D Early in the history of space exploration.

Interest in the phenomena of space is not recent, its origins being lost in the shadows of antiquity. Impelled by curiosity and a desire to understand, man has long studied, charted and debated the mysteries of the celestial spheres. Out of this interest eventually came the revolution in thought and outlook initiated by Copernicus, supported by the remarkably precise measurements of Tycho Brahe, illuminated by the observations of Galileo and the insights of Kepler, and given a theoretical basis by Newton in his proposed law of gravitation. The Copernican revolution continues to unfold today in human thought and lies at the heart of modern astronomy and cosmology.

Yet, until recently, outer space was inaccessible to man, and whatever was learnt about the sun, planets and stars was obtained by often elaborate deductions from observations of the radiations that reached the surface of the Earth. Nor were all the inaccessible reaches of space far away. The ionosphere, important because of its role in radio communications, was not as far away from the man on the ground below as Baltimore is from Washington. Nevertheless, until the advent of the large rocket, the ionosphere remained inaccessible not only to man himself but even to his instruments. As a result many of the conclusions about the upper atmosphere and the space environment of the Earth were quite tentative, being based on highly indirect evidence and long chains of theoretical reasoning. Time and again the theorist found himself struggling with a plethora of possibilities that could be reduced in number only if it were possible to make in situ measurements. Lacking the measurements, the researcher was forced into guesswork and speculation.

Small wonder, then, that when large rockets appeared they were soon put to work carrying scientific instruments into the upper atmosphere for making the long-needed in situ measurements. From the very start it was clear that the large rocket brought with it numerous possibilities for aiding the investigation and exploration of the atmosphere and space. It could be instrumented to make measurements at high altitude and fired along a vertical or nearly vertical trajectory for the purpose, falling back to Earth after reaching a peak altitude. When so used the rocket became known as a sounding rocket or rocket sonde, and the operation was referred to as sounding the upper atmosphere.

A rocket could also be used to place an instrumented capsule into orbit around the Earth, where the instruments could make extended-duration measurements of the outer reaches of the Earth's atmosphere or observations of the sun and other celestial objects. Or the rocket might launch an instrumented capsule on a trajectory that would take it far from the Earth into what was referred to as deep space, perhaps to visit and make observations of the moon or another planet. The orbiting capsules were called artificial satellites of the Earth; those sent farther out came to be known as space probes or deep space probes. Finally, the ultimate possibility of carrying men away from the Earth to travel through deep space and someday to visit other planets emphasized dramatically the new power that men had acquired in the creation of the large rocket.

A language of rocketry emerged, which the news media popularized. Familiar words took on new meanings, and new terms were encountered: artificial satellite, spacecraft, space launch vehicle, rocket stages, countdown, lift-off, trajectory, orbit, tracking, telemetering, guidance and control, retrorockets, re-entry and space science.

Through all the centuries of scientific interest in space phenomena, the phrase space science had not gained common use. That the terminology did not come into use until after rockets and satellites brought it forth gives force to the definition of space science given at the start of this section. That definition sets forth the meaning in mind when in June 1957 the US National Academy of Sciences combined the functions of the IGY Technical Panel on Rocketry and the IGY Technical Panel on the Earth Satellite Program into a single board, naming it the Space Science Board.

Exam skills

Yes/No/Not Given questions

You may need to distinguish between two similar question types in the IELTS test.

- TRUE/FALSE/NOT GIVEN questions ask you decide whether the statements in the questions are correct, incorrect or not mentioned according to the information in the text.
- YES/NO/NOT GIVEN questions ask you to decide whether the statements in the questions agree or disagree with the author's opinion in the text.

In this type of question you will need to:

- distinguish between fact and opinion
- identify the writer's opinion

Skills

Identifying facts

Facts are often expressed with the verb *to be* and/or in the present or past simple.

For example, the following statements are usually accepted as facts: *Everest is the highest mountain in the world. The sun sets at 20.20 this evening. Light travels at 186 000 miles a second. Gravity was discovered by Isaac Newton.*

Identifying opinions

Opinions are expressed in a number of ways, for example in the use of:

- main verbs such as *claim, think, believe, argue.*
- modal verbs, such as *could, might, may.*
- adjectives, adverbs.
- words with negative connotations (*too, miss, impediment, trauma*).
- conditionals.

9 Read the following statements and decide whether they are facts or opinions.

i Neil Armstrong made his 'one small step' on the Moon in 1969, only 12 years after Sputnik. _____

ii Had the pace set by John F. Kennedy's Apollo programme been sustained there would already be footprints on Mars. _____

iii Scientific exploration has burgeoned too. _____

iv In coming decades, the entire solar system will be explored by flotillas of miniaturized unmanned craft. _____

v The space shuttle failed twice in 135 launches. _____

Reading Passage 4

You should spend 20 minutes on questions 1–13, which are based on Reading Passage 4.

People who are alive today will walk on Mars

A Charles Bolden, NASA's administrator, averred that the robotic vehicle *Curiosity* will 'blaze a trail for human footprints on Mars'. He could be right. But there is a gulf between what is technically feasible and what is actually achieved.

B Neil Armstrong made his 'one small step' on the Moon in 1969, only 12 years after Sputnik. Had the pace set by John F. Kennedy's Apollo programme been sustained there would already be footprints on Mars. But that was driven by the urge to beat the Russians; there was no motive to sustain such huge expenditure.

C Scientific exploration has burgeoned too. In coming decades, the entire solar system will be explored by flotillas of miniaturized unmanned craft. Robots will mine raw materials from asteroids* and fabricate large structures. The Hubble Telescope's successors will further expand our cosmic vision of galaxies and nebulae*.

D But what role will humans play? There is no denying that *Curiosity* may miss startling discoveries no human geologist could overlook. But robotic techniques are advancing fast – whereas the cost gap between manned and unmanned missions remains huge.

E The main impediment to a manned NASA programme has always been that public and political opinion constrains it into being too risk-averse. The space shuttle failed twice in 135 launches. Although astronauts or test pilots would willingly accept this risk level, the shuttle had been promoted as safe for civilians. So each failure caused a national trauma and was followed by a hiatus in the programme while costly efforts were made – with very limited effect – to reduce the risk still further.

F Unless motivated by pure prestige, ambitious manned missions will be viable only if they are cut-price ventures, accepting high risks – perhaps even 'one-way tickets'. These may have to be privately funded; no Western government agency would expose civilians to such hazards.

G The SpaceX company, led by the entrepreneur Elon Musk, has successfully sent a payload* into orbit and docked with the Space Station. The involvement in space projects of Mr Musk and others in the high-tech community with credibility and resources is surely a positive step.

H Richard Branson will soon be lobbing people into space to experience a few minutes of weightlessness. Within a few years private companies will offer orbital flights. Maybe after another decade the really wealthy will be able to take a week-long trip around the far side of the Moon – voyaging farther from Earth than anyone has been before but avoiding the greater risks of a Moon landing and blast-off.

I The phrase 'space tourism' should, however, be avoided. It lulls people into believing that such ventures are routine and low-risk. If that becomes the perception, the inevitable accidents will be as traumatic as those of the space shuttle. Remember that nowhere in our solar system offers an environment as clement even as the Antarctic or the top of Everest. It is foolish to claim, as some do, that mass emigration into space offers escape from Earth's problems.

J But I believe, and hope, that some people living now will walk on Mars. Moreover, a century or two from now, small groups of intrepid adventurers may be living there or perhaps on asteroids quite independently from Earth. Whatever ethical constraints we impose here on the ground, we should surely wish such pioneers good luck in genetically modifying their progeny to adapt to alien environments.

K This might be the first step towards divergence into a new species: the beginning of the post-human era. And machines of human intelligence could spread still farther. Whether the long-range future lies with organic post-humans or intelligent machines is a matter for debate. Either way, dramatic cultural and technological evolution will continue not only here on Earth but far beyond.

* **asteroids** – tiny planets that orbit the Sun
* **nebulae** – clouds of gas between the stars
* **payload** – cargo of equipment

Questions 1–6

The reading passage has eleven paragraphs (A–K). Choose the correct headings for paragraphs ***C–H****.*

List of headings

i Space travel for leisure
ii Potential and reality
iii Life after humans
iv Transporting goods into space
v Mechanized investigation
vi Future colonies in outer space
vii Commercial funding for dangerous ventures
viii High-risk travel
ix Avoiding disasters
x Man versus machine
xi The end of the race for space

Example: Paragraph A ___ii___

1 Paragraph C .....

2 Paragraph D .....

3 Paragraph E .....

4 Paragraph F .....

5 Paragraph G .....

6 Paragraph H .....

Questions 7–10

Do the following statements agree with the claims of the writer in the passage?

Write

YES	*if the statement agrees with the writer's claims.*
NO	*if the statement contradicts the writer's claims.*
NOT GIVEN	*if it is impossible to say what the writer thinks about this.*

7 The Americans had no reason to continue spending large amounts of money on their space programme once they had won the race to the Moon.

8 One of the advantages of robots is that they notice unusual objects which human scientists might not see.

9 It would be wrong for future space explorers to alter their children's genes to make it possible for them to live on other planets.

10 Whatever the evolution of the species in the future, it should remain human.

Questions 11–13

*Choose the correct letter (**A**, **B**, **C** or **D**) from the options in the list.*

11 What will future unmanned spacecraft be able to do?

A Damage asteroids.

B Exploit new sources of materials.

C Travel beyond the solar system.

D Discover geological features that humans would not notice.

12 Why was the shuttle programme suspended?

A Because it was restricted to astronauts.

B Because it was safe for civilians.

C Because it was considered too dangerous.

D Because astronauts refused to take any more risks.

13 What is wrong with the expression 'space tourism'?

A It claims that it is dangerous to visit the Antarctic.

B It suggests that travelling into space is cheap.

C It should be avoided.

D It gives the impression that travelling into space is safe.