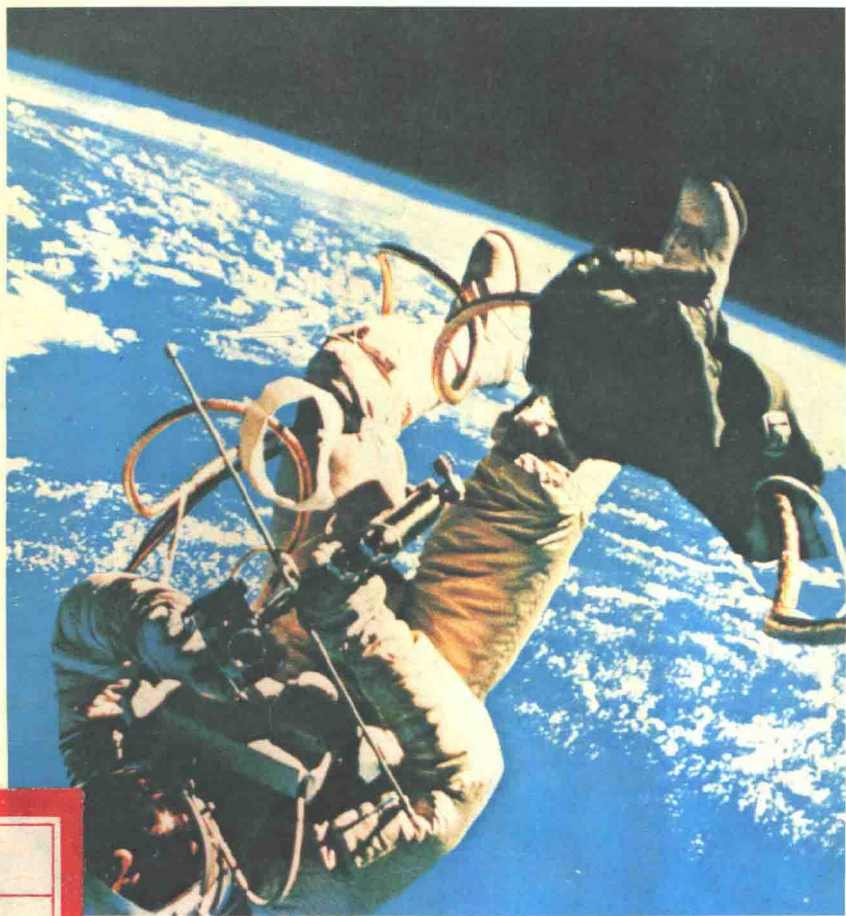


簡易英語科技叢書

# 太空與人



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## 出版說明

《簡易英語科技叢書》是爲初學英語的中國青年學生提供一套閱讀英語科技書籍資料的參考讀物。

本叢書包括十六個科學課題，分爲十六冊出版。每一課題構成一個完整的知識讀物。這十六個課題把目前國外學校教學中的基礎科學內容都包括進去了。

爲提高讀者科學知識和閱讀興趣，每一分冊均附有生動的彩色插圖，英語文字力求淺顯，使一般初學英語的中國青年學生都能接受。

## **CONTENTS**

	<i>Page</i>
Introduction .. .. .	5
What is space? .. .. .	6
What is the force of gravity? .. .. .	7
Entry into space .. .. .	8
Rockets .. .. .	8
Multi-stage rockets .. .. .	11
Return to earth .. .. .	13
Satellites .. .. .	14
The spacemen .. .. .	18
Events of the space age .. .. .	21
The first journey to the moon .. .. .	25
Space travel .. .. .	30

## INTRODUCTION

When you look up into the sky on a clear night, you will see the moon and the stars. Since ancient times men have been curious to know more about the moon, the stars and other bodies in the sky. They invented telescopes to get a closer look at them and discovered that there are many suns, moons and planets in the sky. They became eager to explore the mysterious sky.

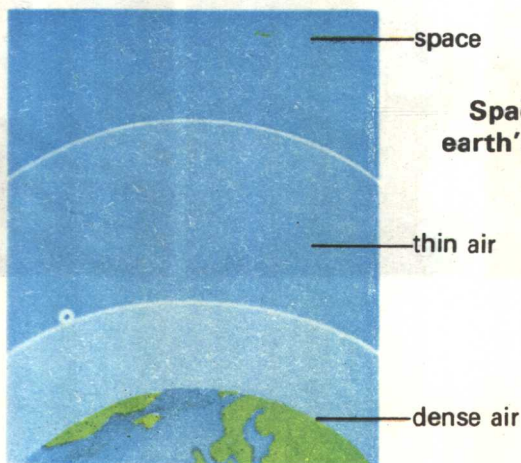
**Man has throughout the ages studied the skies.**



On October 4, 1957, the **Space Age** began when the first man-made **satellite** (you will learn about this later) was sent into space to circle round the Earth. Today, scientists are able to land men on the moon. More space explorations will be made in the future. In this book we shall learn about Man and his explorations in space.

### WHAT IS SPACE?

The Earth is surrounded by a layer of air, called the **atmosphere**. The atmosphere determines the weather on Earth. The atmosphere close to the Earth's surface is thick. It gradually becomes thinner, as we move further away from the Earth. The region beyond the Earth's atmosphere which contains the rest of the Universe is known as **space**.



**Space lies beyond  
earth's atmosphere.**

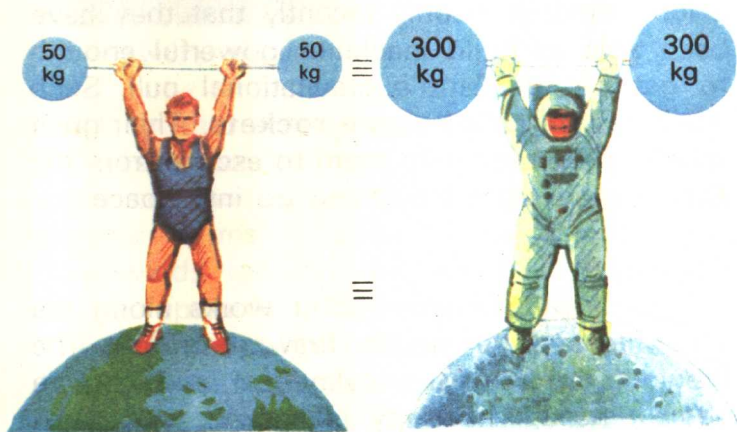


## WHAT IS THE FORCE OF GRAVITY?

If you throw a ball up, it will come down again. What makes it come down? The ball comes down because it is pulled or attracted towards the Earth. The Earth exerts a force of attraction on all objects. Objects that are nearer to the Earth are attracted to it with a greater force than those that are further away. This force of attraction is known as the **force of gravity**. The gravitational force acting on an object at the Earth's surface is called the **weight** of the object.

All the heavenly bodies in space like the moons, the planets and the stars also exert an attractive force on objects. The bigger and heavier a body is, the greater is its force of gravity. Thus, since the moon is a smaller body

**You can lift things six times heavier on the moon.**





than the Earth, the force it exerts on an object at its surface is less than that exerted by the Earth on the same object on the Earth's surface. In fact, the moon's gravitational force is only one-sixth that of the Earth's. This means that an object weighing 120 kilograms on Earth will only weigh 20 kilograms on the moon. Therefore on the moon you could lift weights which are six times heavier than the heaviest weight that you can lift on Earth.

The Earth's gravitational force or pull keeps us and everything else on Earth from floating away to space. To get out into space and travel to the moon or other planets we have to overcome the Earth's gravitational pull.

## ENTRY INTO SPACE

How can we overcome Earth's gravitational pull? Scientists have been working on this for a long time. It is only recently that they have been able to build machines powerful enough to get out of Earth's gravitational pull. Such machines are called **space rockets**. Their great speed and power help them to escape from the Earth's gravitational pull and go into space.

## ROCKETS

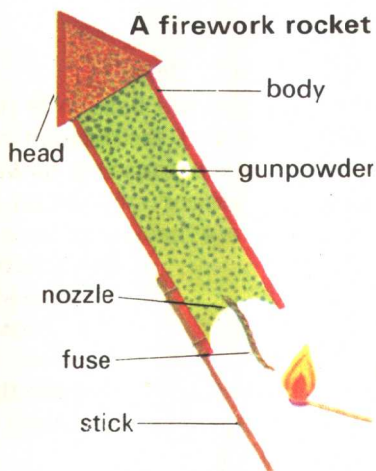
The powerful space rocket works along the same lines as a simple firework rocket. The firework rocket has a cylindrical body and a conical head. The body is packed with **gun-**

**powder** which is the fuel. It is a mixture of chemicals that will burn rapidly to form hot gases.

At the base or foot of the rocket there is an opening or **nozzle**. A fuse hangs out like a tail from the nozzle. A long stick attached along the body serves to direct the rocket before the fuse is lighted.



A firework display

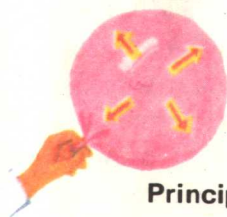


When the gunpowder burns, hot gases or **exhaust** gases rush out of the nozzle. The hot gases continue to rush out as long as the gunpowder burns. When these gases shoot downwards through the nozzle the rocket is pushed upwards. This is called **jet propulsion**. The simple experiment, shown in the picture, will help you to understand jet propulsion.

Space rockets work in the same way as the

firework rockets. However space rockets may weigh several thousand tonnes and stand more than ninety metres high. They are so big because they have to carry a large amount of fuel and the necessary amount of oxygen for burning the fuel.

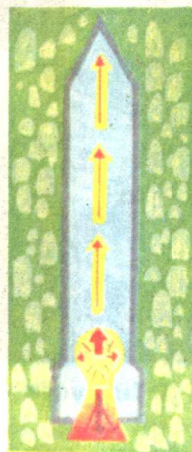
Inside an inflated balloon equal forces act in all directions against the wall of the balloon. When the mouth of the balloon is released, air rushes out and the balloon shoots forward. This is because the forward force of air on the balloon still acts on it. There is no longer any backward force acting on the balloon because of the escaping air. The forward force therefore pushes or propels the balloon forwards.



Principle of jet propulsion

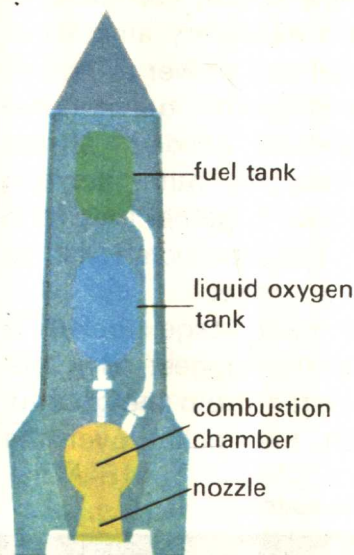


Rockets too work on this principle.

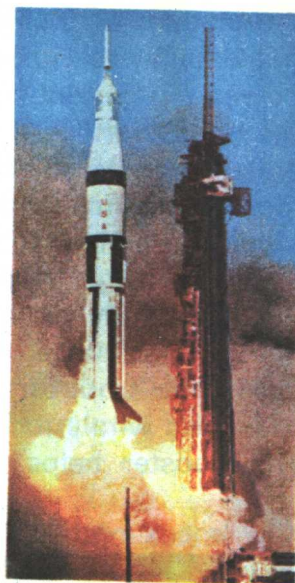


The oxygen contained in the rocket is either in the liquid or the solid form. The common fuels used by rockets are kerosene and alcohol.

When a rocket is fired or **launched** into space a lot of heat and hot gases are released through the nozzle. The flames and smoke from the nozzle rise up high above the ground and the sound is deafening.



A section of  
a space rocket



A rocket  
blast-off

Courtesy of United States Information Service, Singapore

We know that a rocket has to reach a great speed to escape from Earth's gravitational pull. The speed required is about 40,200 kilometres per hour (25,000 miles per hour). This speed is known as **escape speed** or **escape velocity**. To reach such a speed a lot of fuel must be burned.

The space rocket is used to launch a **spacecraft** into space. This spacecraft may be unmanned or manned.

### *MULTI-STAGE ROCKETS*

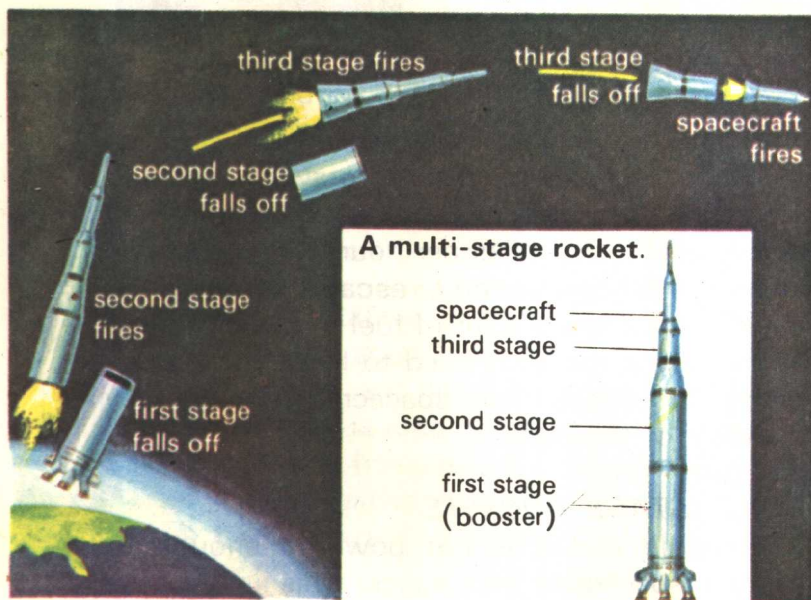
A single rocket is not powerful enough to send a spacecraft into space. This is because



the amount of fuel a single rocket can carry, is not enough to supply the necessary amount of power. To get enough fuel and power to last till the spacecraft gets out of Earth's gravitational pull, a number of rockets are needed. These rockets are linked one atop the other, looking much like a giant lighthouse. Together they form a **multi-stage rocket**. The spacecraft lies at the top of the multi-stage rocket.

The first stage of a multi-stage rocket is called the **booster**. It is the biggest as it has to lift the whole rocket system from the ground. The booster helps to lift the rocket over the

### Entry into space.

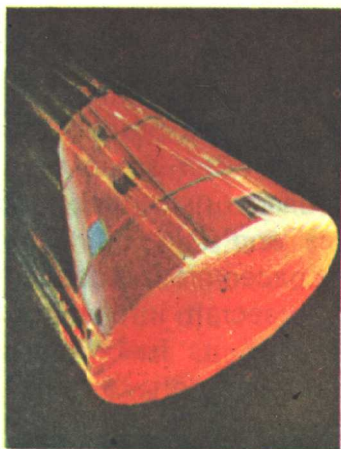


thick region of the atmosphere. When the fuel of the booster is used up it separates from the rest of the rocket and drops to Earth. When this happens the second stage fires and propels the rocket further towards space. After some time the second stage, having used up its fuel, just like the booster, separates and falls off. The third stage, to which the spacecraft is attached then fires. It carries the spacecraft into space. When the third stage uses up its fuel, it too falls off. The spacecraft is then left to travel to its destination on its own power.

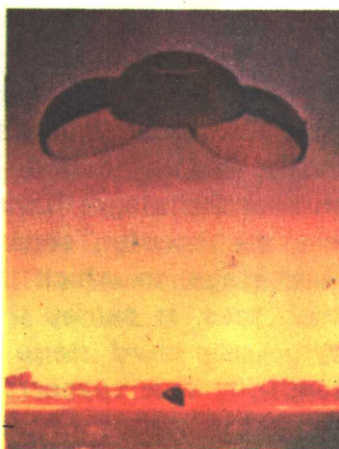
## RETURN TO EARTH

Spacecraft can be launched into space with the help of multi-stage rockets. But before manned spacecraft could be sent to space, the problem of getting the spacecraft safely back to Earth had to be solved.

There are many dangers to overcome when a spacecraft returns to earth. The main one is speed. When a spacecraft returns to Earth it will be travelling at a great speed. In order to land on Earth, the returning spacecraft must be slowed down. This is done by firing special rockets called **retro-rockets**. The **capsule** or the part of the spacecraft which contains the spacemen separates from the rest of the spacecraft. The capsule re-enters the Earth's atmosphere and may fire several retro-rockets in order to slow down.



The heat shield protects the spacecraft.



The parachutes of a spacecraft

Courtesy of United States Information Service, Singapore

The atmosphere also acts as a kind of brake and slows down the capsule. However a lot of heat is given out because of the great speed at which the capsule pushes through the atmosphere. To prevent the capsule from burning up, it is protected by a **heat shield**. Parachutes are also used to slow down the capsule further so that it can land safely.

Scientists have been able to send men into space, and bring them back to Earth. They could only do this after studying about space and the bodies in it.

## SATELLITES

The body that is nearest to the Earth is the moon. It circles the Earth and is therefore known

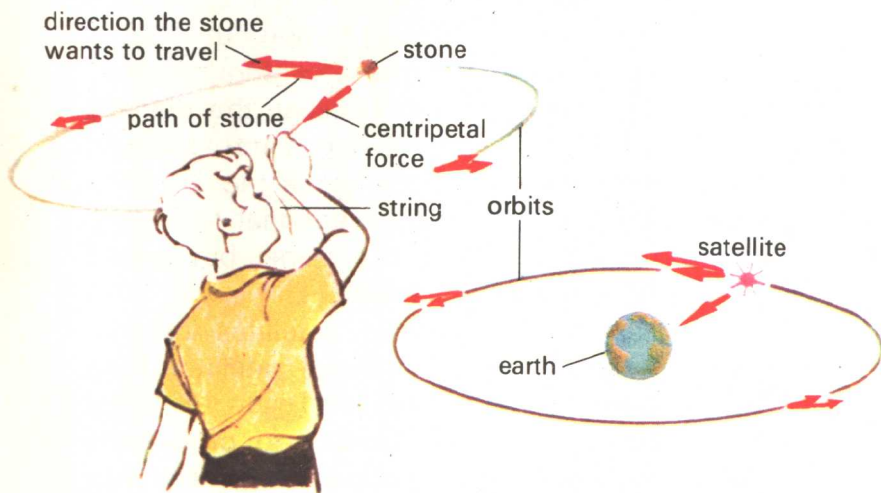


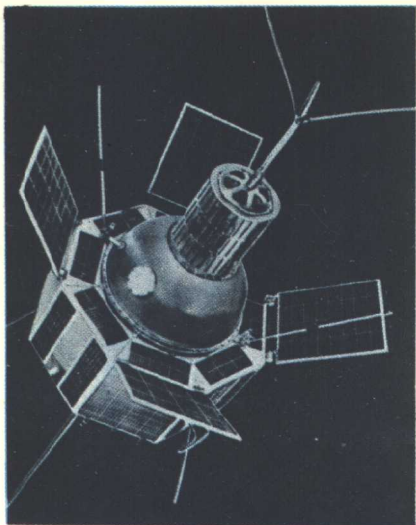
as a satellite of the Earth. Earth has one such satellite while some of the other planets have more. These satellites are called **natural satellites**. Man-made spacecraft which circle the Earth are called **artificial satellites**.

Natural as well as artificial satellites circle the planets in a definite path or **orbit**. Why do satellites stay in orbit? Why don't they shoot off into outer space?

This behaviour of satellites can be explained by doing a simple experiment. Tie a stone to a piece of string and whirl it around your head. If you let your end of the string go, the stone will not keep moving in a circle. It will fly away in a straight line.

**An experiment to show why satellites stay in orbit.**

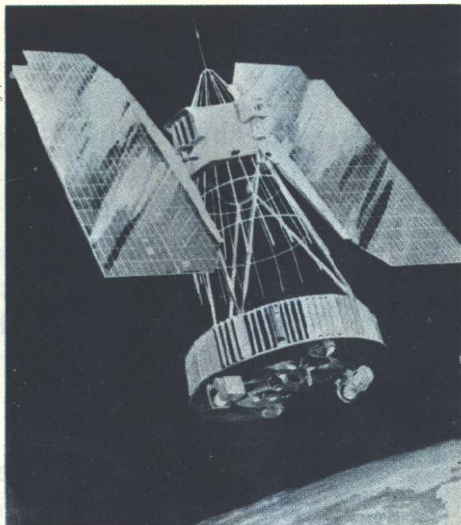




A scientific satellite.

Courtesy of USS, Singapore

Courtesy of Sovfoto



A weather satellite.

Moving things always travel in straight lines at the same speed unless they are acted on by force. When the stone is whirling around your head, the string keeps pulling the stone inward so that it travels in a circle rather than in a straight line. This force keeping the stone moving in a circle is called the centripetal force.

A satellite stays in orbit because the planet's gravitational force keeps pulling it into a circle, just as the string keeps the stone moving in a circle. If there were no gravitational force, the satellite would not circle the planet but would move off into outer space.

There are many artificial satellites orbiting around the Earth. Some artificial satellites have been sent up to orbit the moon and even the planet Mars. The first artificial satellite to orbit Earth was the Russian satellite, **Sputnik I**. The first