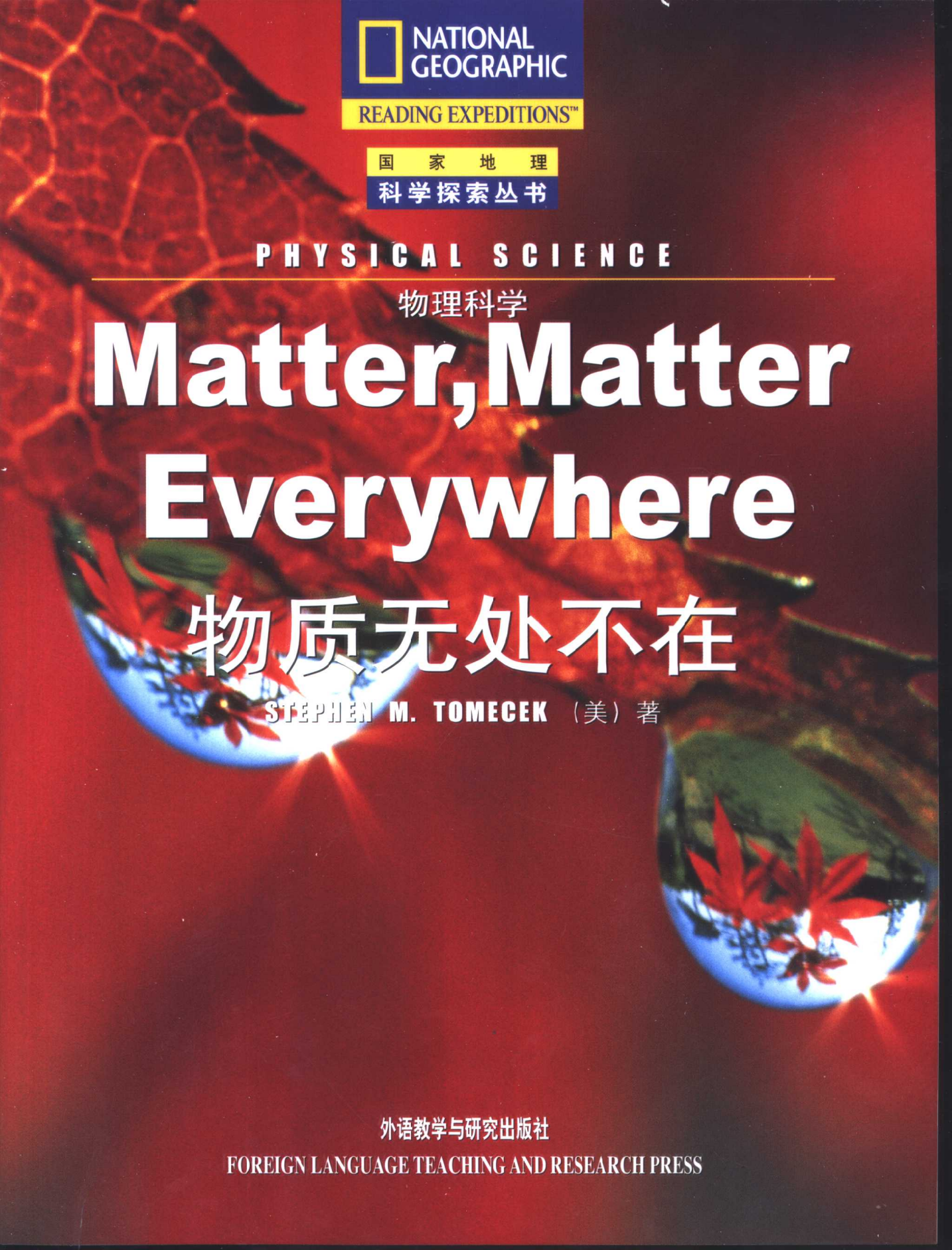
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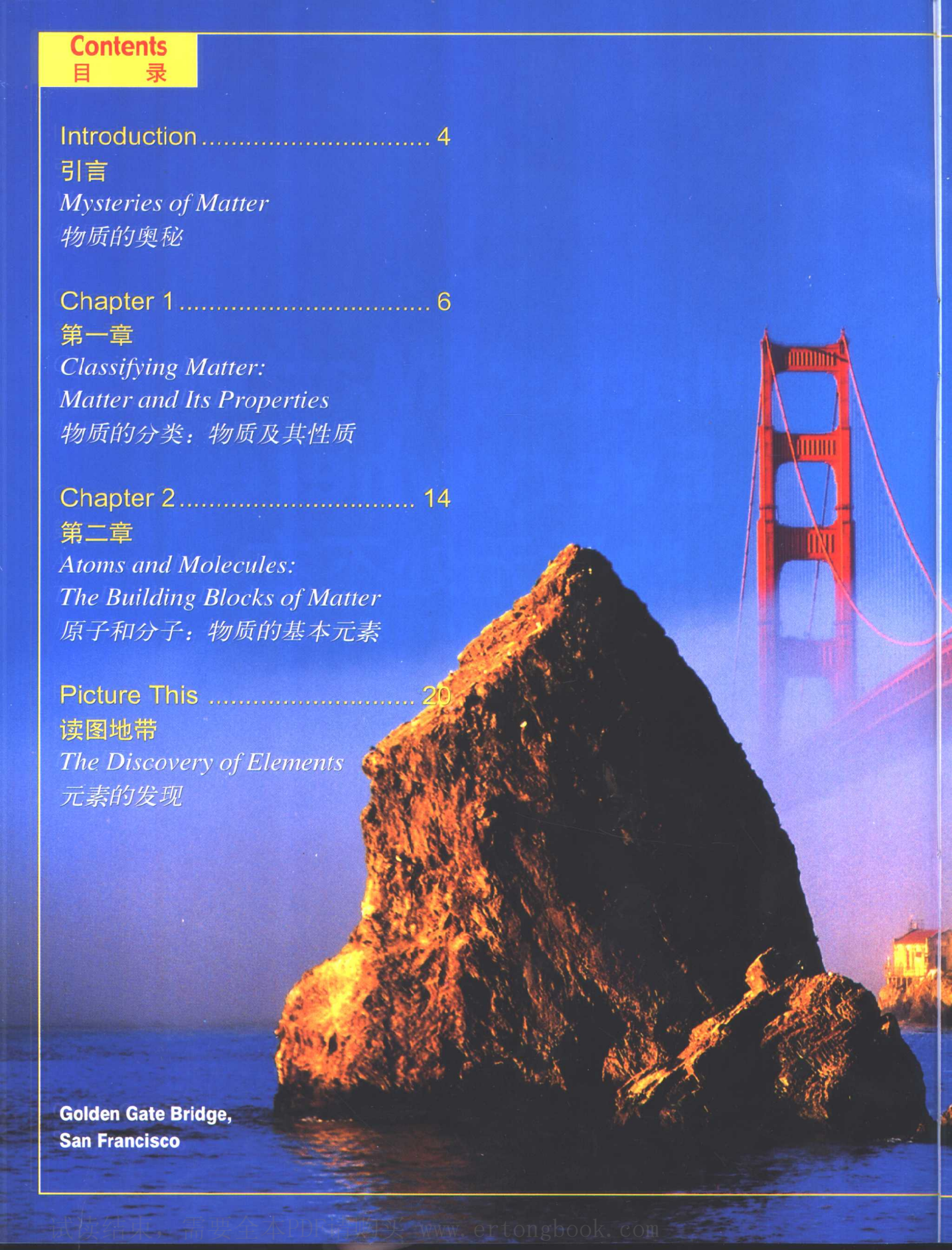
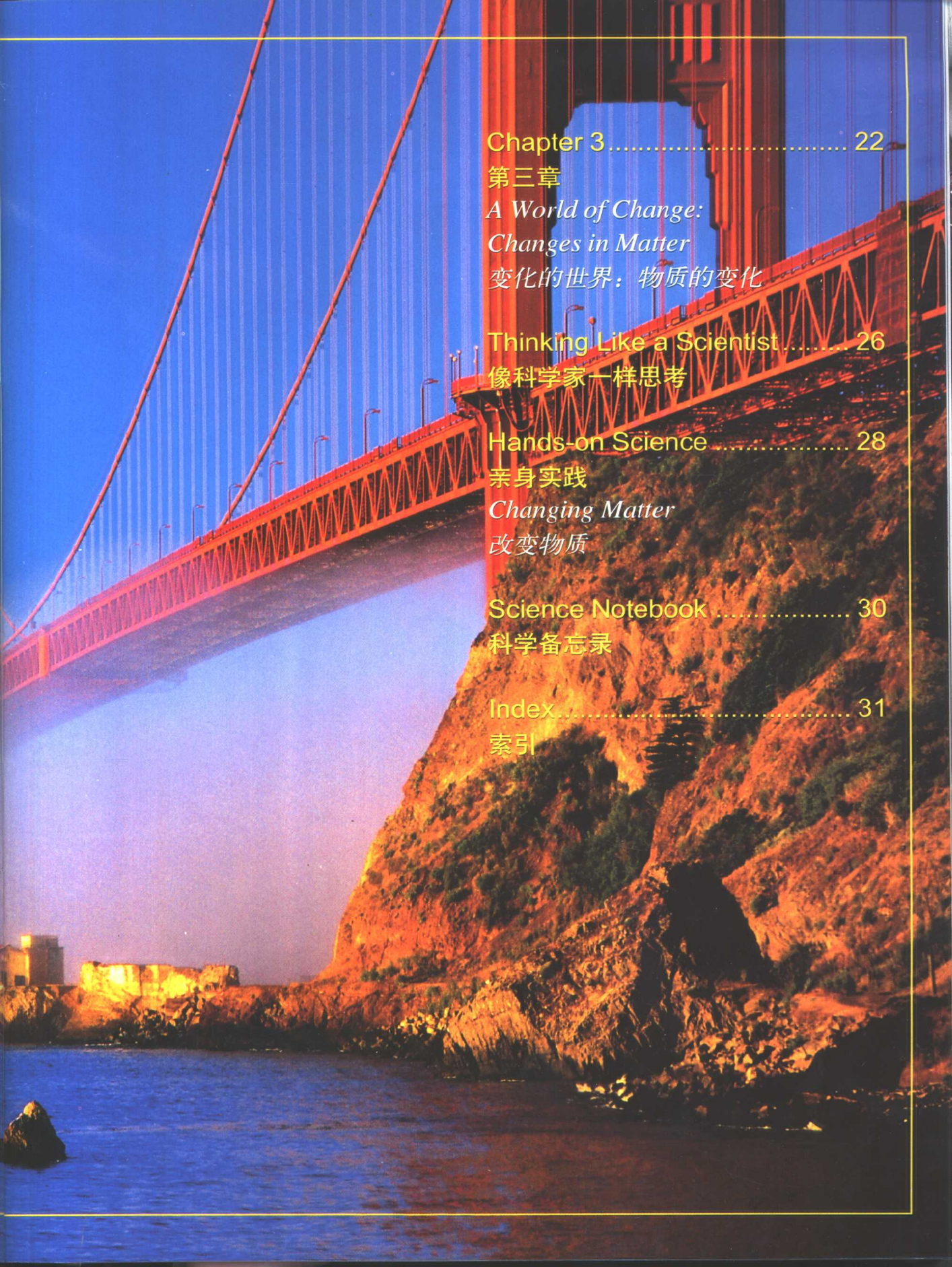
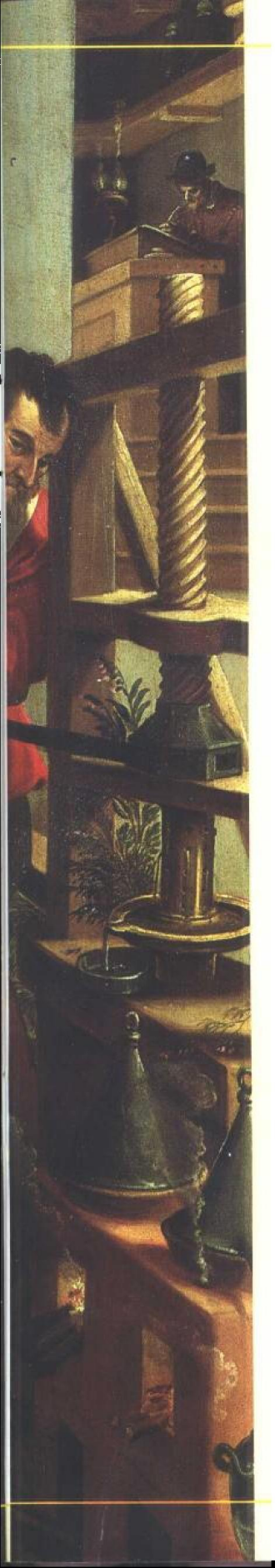


Golden Gate Bridge,
San Francisco



Mysteries of Matter

物质的奥秘



Peek[1] into the pot. You've frozen[3], stirred, and boiled the mixture[4] in hopes of creating[5] gold. If it works this time, you'll be respected[6] and rich. Take a look. Did it work? Oh no—it's still not gold! Back to the lab.

Gold coins

Long ago, this is how an alchemist[7] might have experimented[8] in his or her workshop[9]. In the Middle Ages[10] (about a.d. 500–1500), alchemists spent countless hours experimenting with matter[11]. Alchemists looked for ways to cure[12] diseases[13], lengthen life, or change metals like iron and lead into precious[14] metals like gold. For centuries alchemists tried to unlock[15] the mysteries[16] of matter. The alchemists never did turn lead into gold. However, their work helped to create the modern-day science of chemistry—the study of matter and its changes.

In this book we'll take a close-up look at matter. We'll see what makes up matter and how matter can be changed. We'll also look at how scientists continue to unlock the mysteries of matter. You'll discover that scientists can change matter using methods[17] that alchemists never imagined[18].

1.	peek	*v.*	窥视 看一眼	10.	Middle Ages		中世纪
2.	freeze	*v.*	冻结	11.	matter	*n.*	物质
3.	stir	*v.*	搅动	12.	cure	*v.*	治愈
4.	mixture	*n.*	混合物	13.	disease	*n.*	疾病
5.	create	*v.*	产生；制造	14.	precious	*adj.*	珍贵的；宝贵的
6.	respect	*v.*	尊敬	15.	unlock	*v.*	揭开
7.	alchemist	*n.*	炼金术士	16.	mystery	*n.*	神秘
8.	experiment	*v.*	做实验	17.	method	*n.*	方法，方式
9.	workshop	*n.*	工场；作坊	18.	imagine	*v.*	想像

Painting showing alchemists in their lab

Chapter 第一章 1

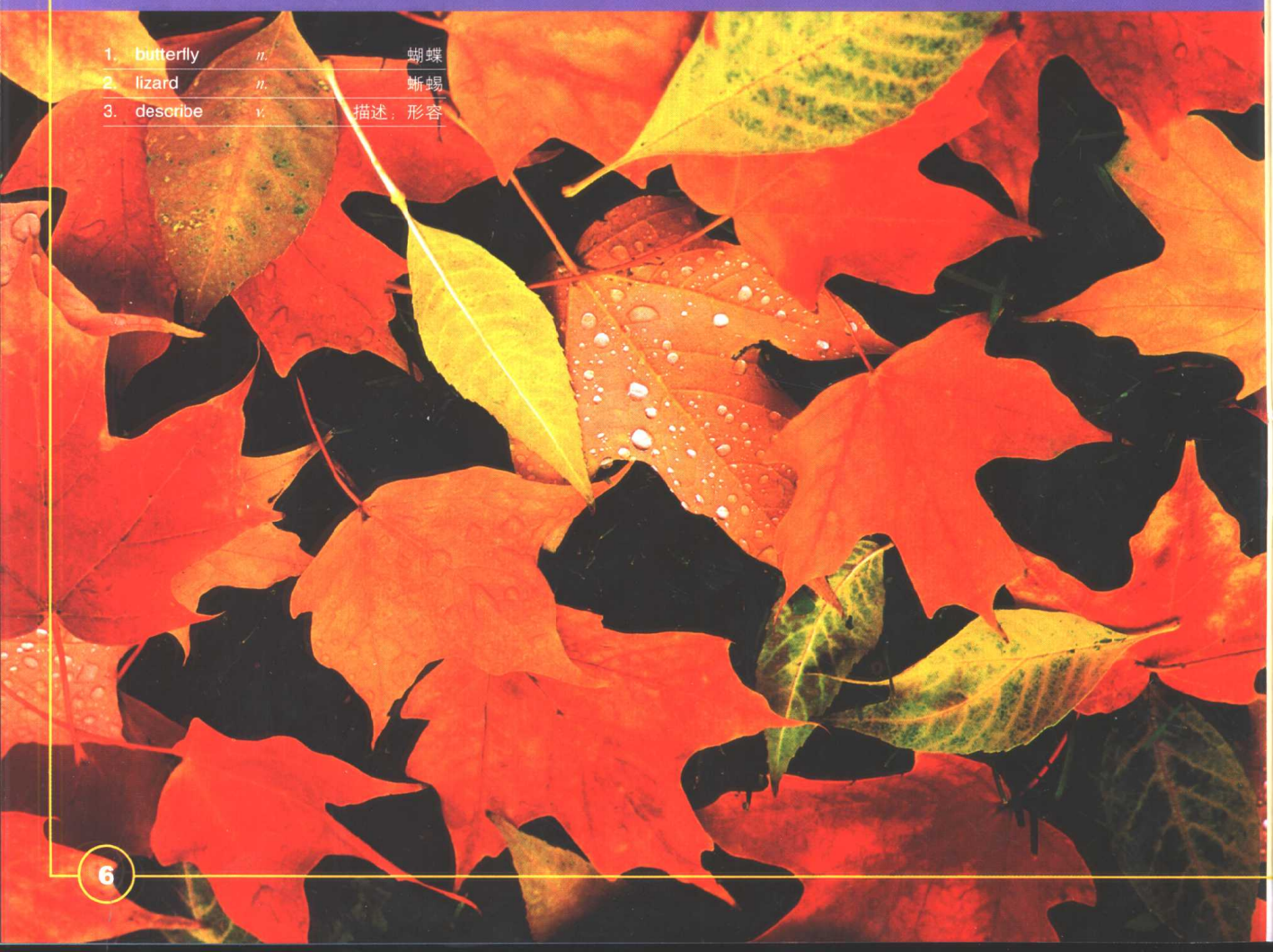
Classifying Matter:

Matter and Its Properties

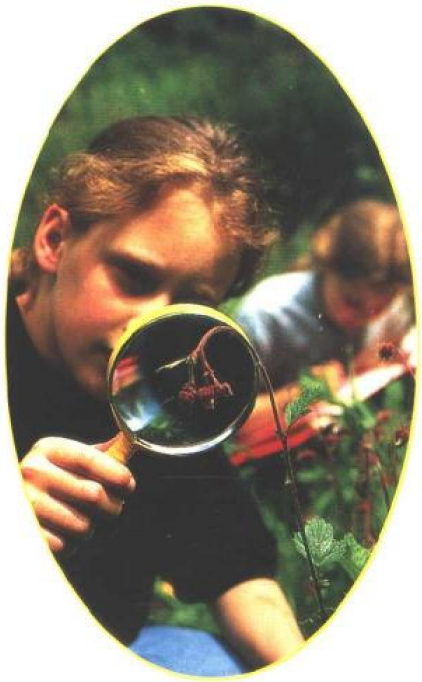
物质的分类：物质及其性质

Butterflies[1], leaves, lizards[2], and even you are made of matter. What do you know about matter? Can you describe[3] the matter around you?

1. butterfly *n.* 蝴蝶
2. lizard *n.* 蜥蜴
3. describe *v.* 描述，形容

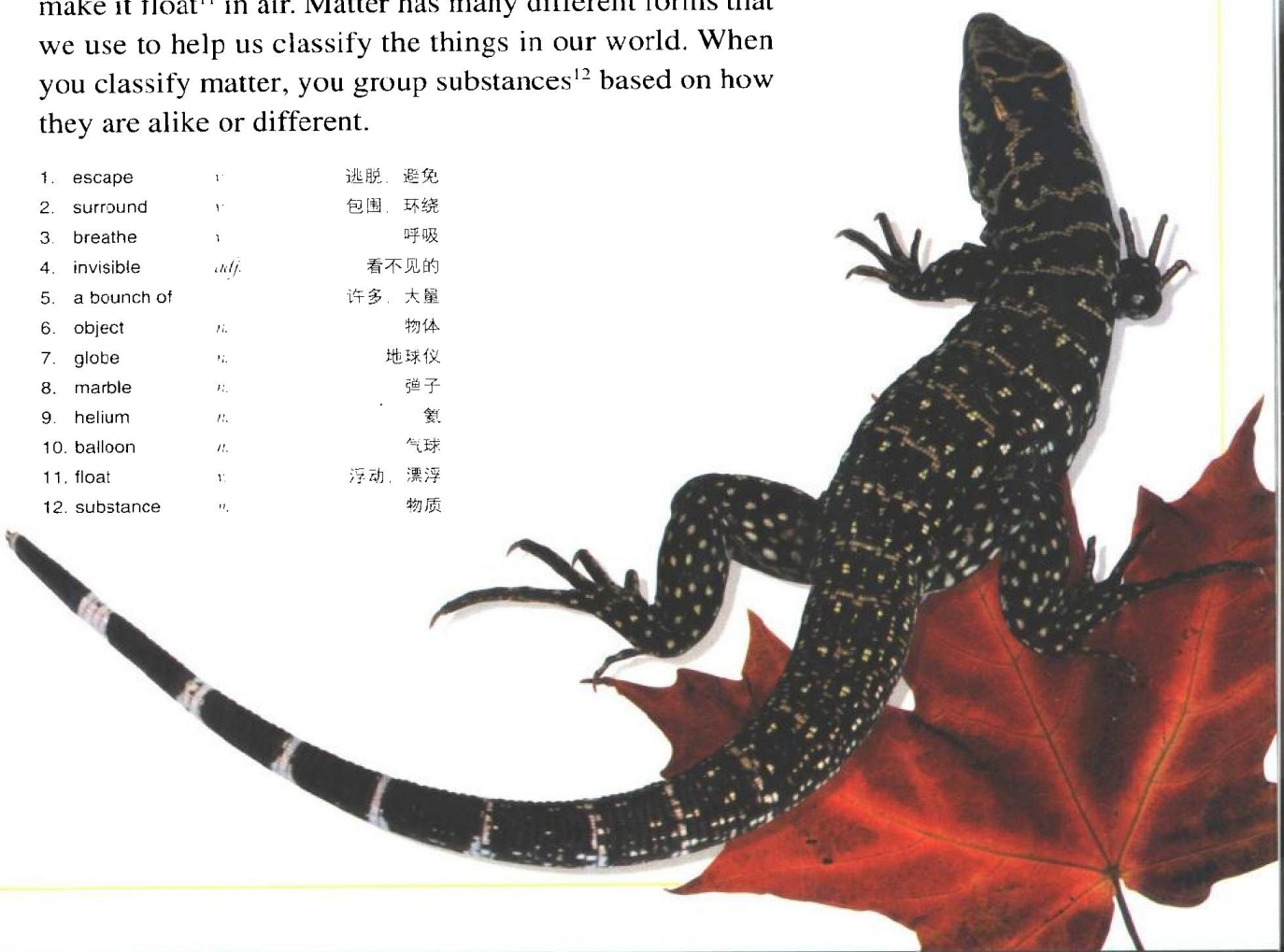


You can't escape[1] it! Everywhere you turn, you are surrounded[2] by matter. Some matter, such as the air we breathe[3], is invisible[4]. The matter that makes up the sun lights up our lives. In fact, even your body is a big bunch of[5] matter.



Look around you. What objects[6] do you see? How would you describe the objects? You might describe some objects by their shape. A ball, a globe[7], and a marble[8] are all round. You could describe some objects based on their color. For example, many pencils and school buses are yellow. How else could you describe matter? Some things, like rocks, are hard. Other things, like water, can be poured into a glass. Matter in the form of helium[9] can be put into a balloon[10] to make it float[11] in air. Matter has many different forms that we use to help us classify the things in our world. When you classify matter, you group substances[12] based on how they are alike or different.

1. escape	v.	逃脱，避免
2. surround	v.	包围，环绕
3. breathe	v.	呼吸
4. invisible	adj.	看不见的
5. a bounch of		许多，大量
6. object	n.	物体
7. globe	n.	地球仪
8. marble	n.	弹子
9. helium	n.	氦
10. balloon	n.	气球
11. float	v.	浮动，漂浮
12. substance	n.	物质



States[1] of Matter

Because of the differences in matter, scientists have come up with a way of classifying matter based on its form, or state.

Solid[2] Matter in its most rigid[3] state is a solid. A solid has a definite[4] shape. It also takes up a definite amount of space. Think about a rock. When you look at a rock, you can see that it has a set shape and takes up[5] space. Can you think of other examples of solids?

Liquid[6] Another form of matter is a liquid. Like a solid, a liquid takes up a definite amount of space. However, a liquid doesn't have a definite shape. Think about rain. What happens when rain hits the ground? If the rain hits soil, it may go into the ground. If rain falls on a sidewalk[7], it may form a puddle[8]. If it falls into a glass, it will take the shape of the glass. Liquids are different from solids because liquids change their shape to fit whatever container[9] they are in.

1.	state	*n.*	状态
2.	solid	*n.*	固体
3.	rigid	*adj.*	坚硬的，刚硬的
4.	definite	*adj.*	明确的
5.	take up		占据
6.	liquid	*n.*	液体
7.	sidewalk	*n.*	人行道
8.	puddle	*n.*	(一片)积水
9.	container	*n.*	容器
10.	canoe	*v.*	划独木舟
11.	paddle	*n.*	桨

The mountain is a solid. You can see its shape and the amount of space it takes up.

The water in a lake is a liquid. It takes up a definite amount of space, but it doesn't have a definite shape. If you canoed[10] in a lake, the paddles[11] would change the shape of the water.

Gas[1] A gas doesn't have a definite shape and doesn't take up a definite amount of space. This means that when a gas enters a container, the gas particles[2] will spread out[3] and fill the container. For example, if you put a small amount of the gas oxygen[4] into a room, the particles of oxygen would spread across the entire room.

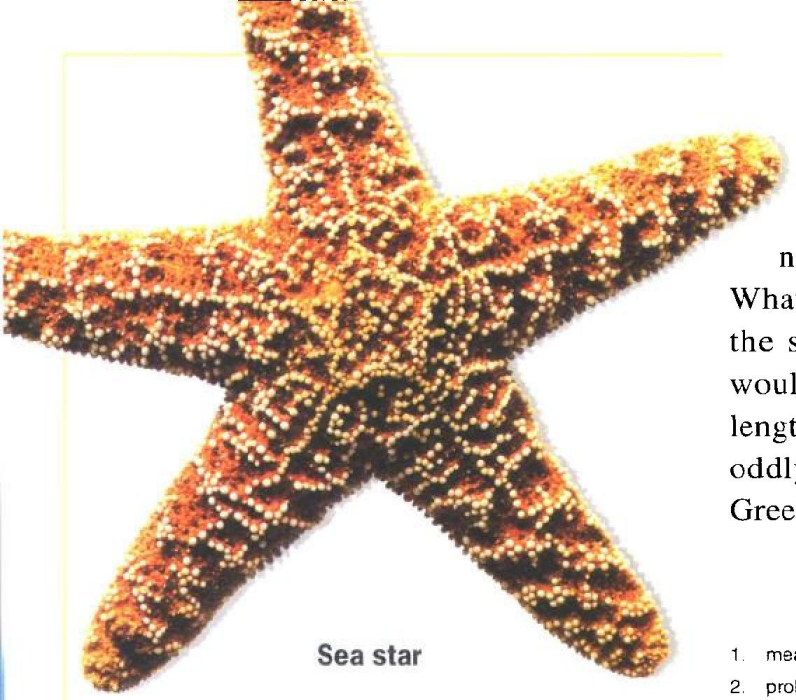
Plasma[5] While most people are familiar with[6] solids, liquids, and gases, there's another state of matter called plasma. Plasma rarely occurs[7] naturally on Earth's surface[8], but the sun and other stars are mostly made of plasma. Plasma is made of electrically charged[9] particles of matter that glow[10]. When you see streaks[11] of lightning, you are seeing plasma.

Thinking Like a Scientist: Experimenting

When scientists want to test an idea, they conduct[12] an experiment. An experiment is a controlled scientific test. Suppose[13] you wanted to find out the temperature[14] at which water changes from a liquid to a solid. You could do an experiment to find out. You would start by making a hypothesis[15] that tells the temperature at which you think water will freeze. Then you would list the materials[16] and the steps of the experiment. Once you do your experiment, you can use the information you gathered[17] to evaluate[18] your hypothesis.

Air is a gas. It doesn't have a definite shape and doesn't take up a definite amount of space.

1. gas	*n.*	气体	10. glow	*v.*	发光
2. particle	*n.*	颗粒，微粒	11. streak	*n.*	光束
3. spread out		蔓延	12. conduct	*v.*	实施，进行
4. oxygen	*n.*	氧，氧气	13. suppose	*v.*	假设
5. plasma	*n.*	等离子体	14. temperature	*n.*	温度
6. be familiar with		熟悉	15. hypothesis	*n.*	前提，假设
7. occur	*v.*	发生，出现	16. material	*n.*	材料
8. surface	*n.*	表面	17. gather	*v.*	收集
9. charge	*v.*	使充电	18. evaluate	*v.*	评估，评价



Sea star

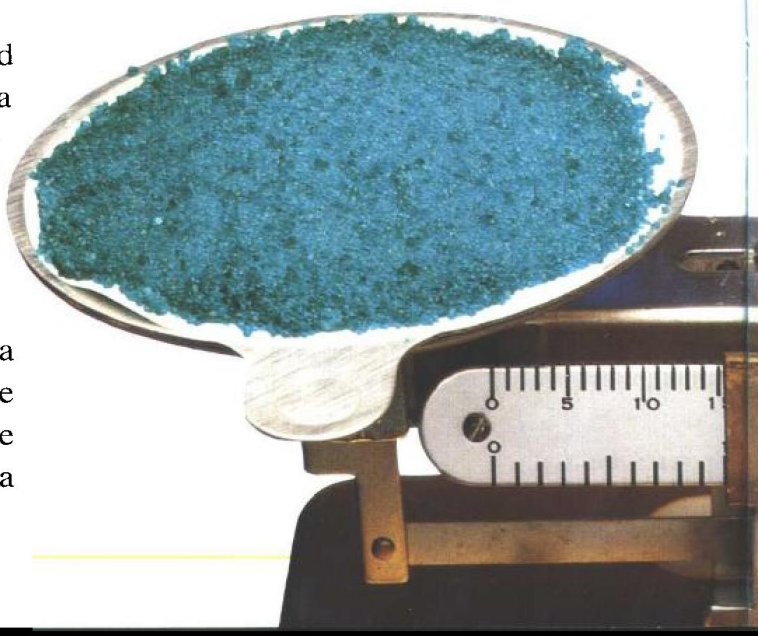
solid like a wooden block, you can take a ruler and measure its length, width, and height. Multiplying[10] these three numbers gives you the block's volume. What if you wanted to find the volume of the sea star? Because of its shape, you wouldn't be able to measure the sea star's length or width. The problem of measuring oddly[11] shaped objects was solved[12] by a Greek[13] scientist named Archimedes[14].

1.	measure	*v.*	量，测量
2.	probably	*adv.*	大概，也许
3.	texture	*n.*	质地
4.	characteristic	*n.*	特征
5.	observe	*v.*	观察
6.	mass	*n.*	质量
7.	volume	*n.*	体积
8.	balance	*n.*	天平
9.	device	*n.*	装置，仪器
10.	multiply	*v.*	相乘，乘
11.	oddly	*adv.*	奇怪地
12.	solve	*v.*	解决
13.	Greek	*adj.*	希腊的
14.	Archimedes		阿基米德(古希腊数学家，物理学家和发明家)

Measuring[1] Matter

The different forms of matter help us to classify and describe matter. What are other ways you can describe matter? Look at the sea star. How would you describe it to a friend? You would probably[2] start by telling about its properties, such as its color, size, texture[3], and shape. The characteristics[4] of matter that you can observe[5] are called properties.

All matter has the properties of mass[6] and volume[7]. Mass is the amount of matter in a substance. You can find the mass of something by putting it on a balance[8]. Volume is the amount of space an object takes up. If you want to find the volume of a liquid such as water, all you need to do is pour the water into a measuring device[9], such as a measuring cup. The mark at the top of the water level will tell you the volume of the water. If you want to find the volume of a

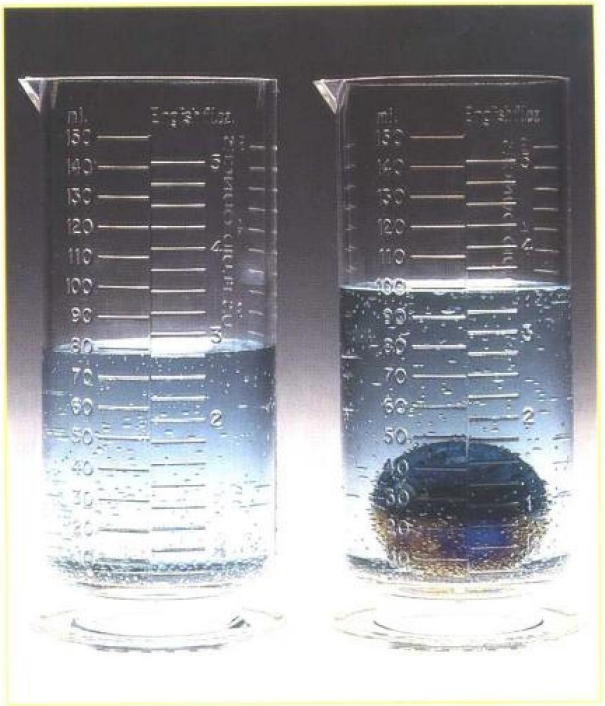


Archimedes' Discovery

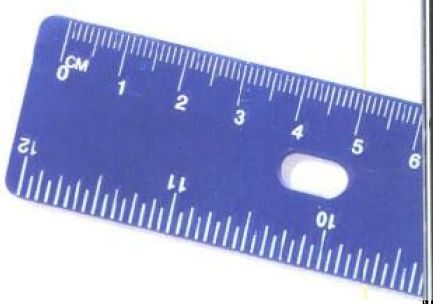
About 250 B.C., Archimedes had to solve a problem for the king. To solve the problem, he had to find the volume of the king's crown[1]. Because the crown had an irregular[2] shape, Archimedes couldn't make the measurement. Then one day he noticed that when he got into the tub[3], the water level in the tub rose. His body displaced[4], or pushed away, water in the tub. He realized[5] how to find the volume of the crown. He could put it into a container of water and measure how much water it displaced. He could solve the problem for the king!

What tools can be used to measure the properties of matter?

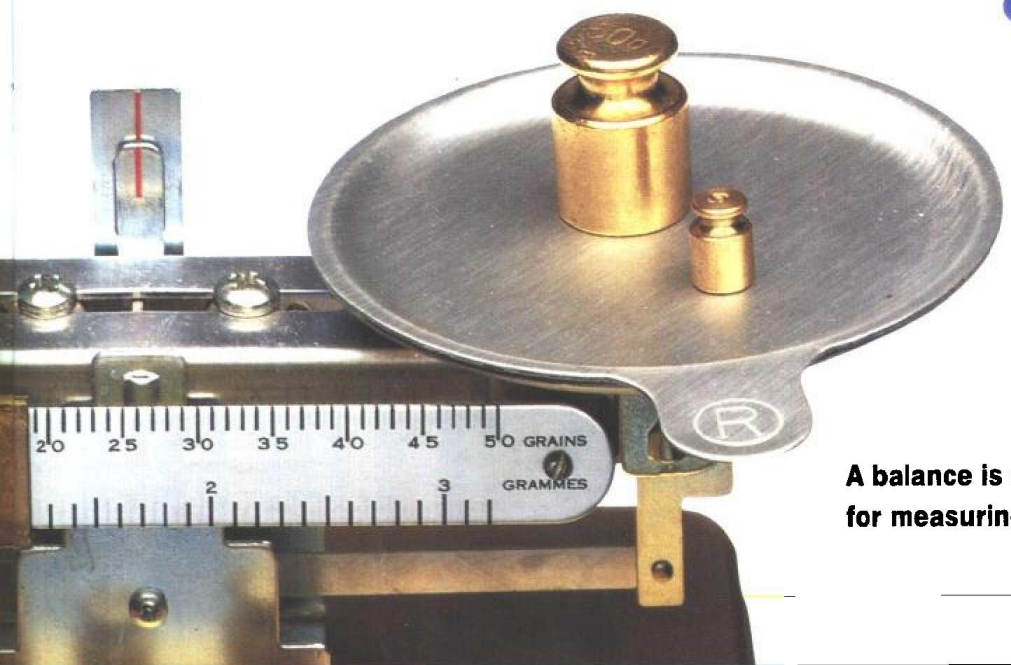
1.	crown	*n.*	王冠
2.	irregular	*adj.*	不规则的
3.	tub	*n.*	浴盆　浴缸
4.	displace	*v.*	排(水)
5.	realize	*v.*	认识到
6.	tool	*n.*	工具



When you put an object in water, the object displaces the water and makes the water level rise.



A ruler is a tool[6] you can use to measure the length, width, and height of an object.



A balance is a tool used for measuring mass.

Discovering Density[1]

In addition to[2] volume and mass, all matter has another property—density. Density is the amount of matter in a certain amount of space. In other words, density tells how tightly[3] packed[4] a substance is. For example, imagine that you have two boxes that are exactly[5] the same size. One box is full of sand. It is heavy and has a large mass. The other box is full of feathers. It is light and has a small mass. The box of sand is more dense[6] than the box of feathers because there is more mass packed into the same amount of space.

To find the density of something, you measure both its mass and its volume. First measure it on a balance to get its mass. Then find its volume with a ruler or measuring cup. By dividing the mass by the volume, you'll get the density.

Density is a property of matter that stays the same regardless of[7] how much of a substance you have. It doesn't make a difference if you have a large amount or a small amount of matter. If it's the same kind of matter, the density will be the same for both. For example, both an iceberg[8] and an ice cube[9] are made of ice so the density is the same for both.

1. density	*n.*	密度
2. in addition to		除……之外
3. tightly	*adv.*	紧紧地
4. pack	*v.*	压紧
5. exactly	*adv.*	完全地
6. dense	*adj.*	密集的
7. regardless of		不管
8. iceberg	*n.*	冰山
9. ice cube		小冰块
10. common	*adj.*	常见的，普通的
11. pine wood		松木
12. ebony wood		乌木

Density of Common[10] Materials

Material	Density (g/cm³)
Pine Wood[11]	0.5
Ice	0.9
Water	1.0
Ebony Wood[12]	1.1
Iron	7.9
Gold	19.3

Using densities, we can compare[1] different types of materials. Look at the chart[2] on page 12. You can see that water has a density of about 1 gram[3] per cubic centimeter[4]. Materials that have a density lower than this will naturally float in water.

Based on the chart, why would it be better to build a raft[5] out of pine wood rather than ebony wood? The pine raft is less dense than water, so it will float. An ebony raft is more dense than water and more likely to sink[6].

1	compare	v.	比较
2	chart	n.	图表
3	gram	n.	克
4	cubic centimeter		立方厘米
5	raft	n.	木排；木筏
6	sink	v.	沉没
7	organism	n.	生物
8	survive	v.	活下来

Did you ever wonder...

... why fish in most lakes don't die when the lakes freeze in the winter?

In some areas, the temperature of winter air gets low enough for the water in lakes to freeze. Most lakes, however, don't freeze all the way through. Just the surface of the water freezes solid. Unlike other substances, water is more dense in a liquid state than in a solid state. As a result, solid water (ice) floats on liquid water. Organisms[7], such as fish, survive[8] the winter by living in the warmer water below the ice.

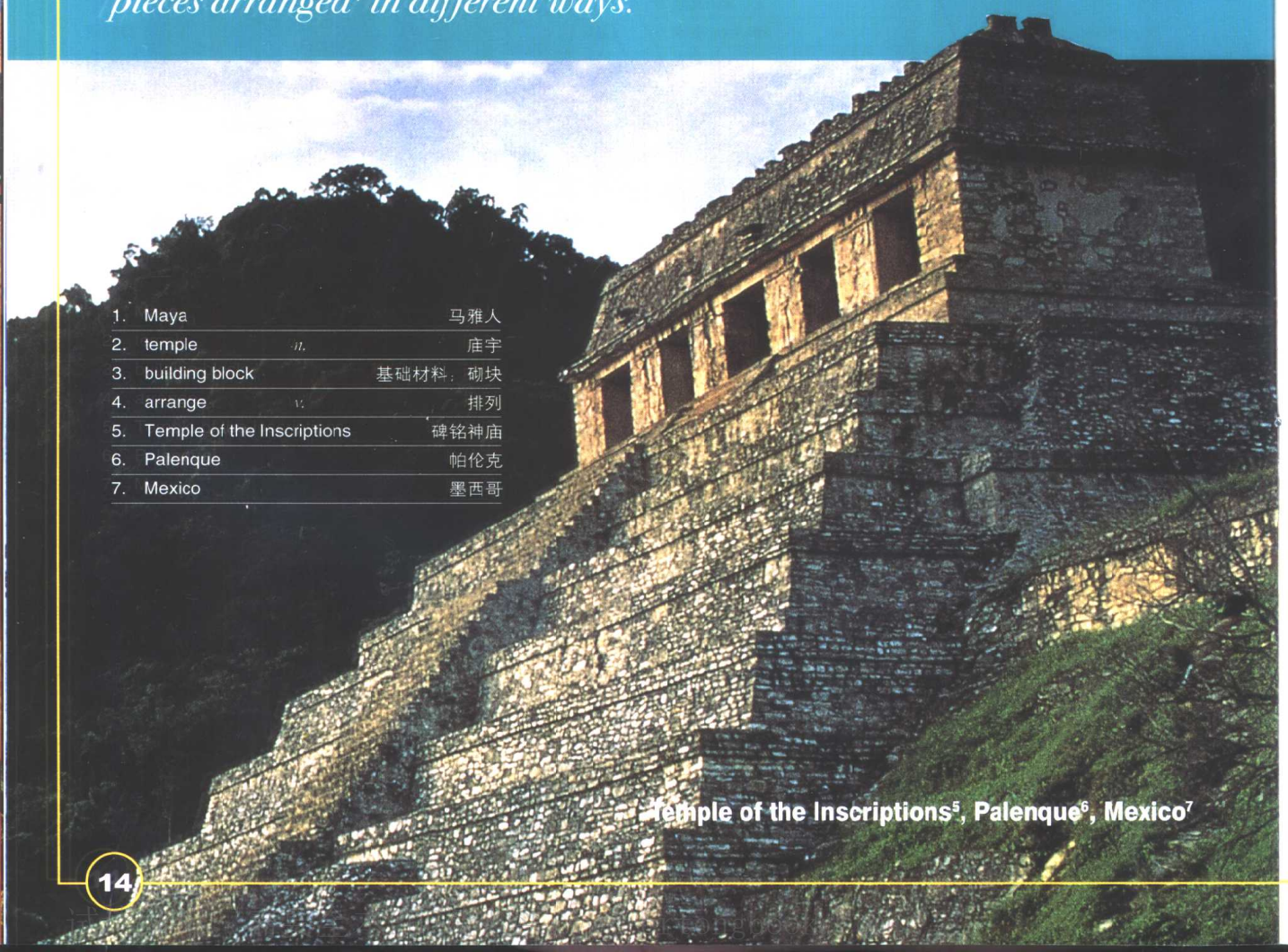
Chapter 2
第 二 章

Atoms and Molecules:

The Building Blocks of Matter

原子和分子：物质的基本元素

Many centuries ago, the Maya[1] built stone temples[2] by cutting and moving large blocks of rock. Like those building blocks[3] used for making the temples, all matter is made of smaller pieces arranged[4] in different ways.



Temple of the Inscriptions[5], Palenque[6], Mexico[7]

1.	Maya		马雅人
2.	temple	*n.*	庙宇
3.	building block		基础材料；砌块
4.	arrange	*v.*	排列
5.	Temple of the Inscriptions		碑铭神庙
6.	Palenque		帕伦克
7.	Mexico		墨西哥