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PHYSICAL SCIENCE

物理科学

Matter, Matter Everywhere

物质无处不在

STEPHEN M. TOMECEK (美) 著

外语教学与研究出版社

FOREIGN LANGUAGE TEACHING AND RESEARCH PRESS

(京)新登字 155 号

京权图字: 01 - 2004 - 4816

图书在版编目(CIP)数据

物理科学 物质无处不在/(美)托梅切克(Tomecek, S. M.)著;李文平注. —北京:外语教学与研究出版社, 2004. 8

(国家地理科学探索丛书·自然科学系列:英文注释版)

ISBN 7 - 5600 - 4253 - 8

I. 物… II. ①托… ②李… III. 英语—语言读物, 物理学 IV. H319.4: O

中国版本图书馆 CIP 数据核字(2004)第 078784 号

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国家地理科学探索丛书(英文注释版主题合订版)由美国北极星传媒有限公司策划并授权出版。

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责任编辑: 余 军

执行编辑: 周 晶

出版发行: 外语教学与研究出版社

社 址: 北京市西三环北路 19 号 (100089)

网 址: <http://www.fltrp.com>

印 刷: 北京画中画印刷有限公司

开 本: 740×975 1/16

印 张: 2

版 次: 2004 年 8 月第 1 版 2004 年 8 月第 1 次印刷

书 号: ISBN 7 - 5600 - 4253 - 8/G·2185

全套定价: 29.50 元

* * *

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这套丛书以英文注释形式出版，注释由国内重点中学教学经验丰富的英语教师完成。特别值得推荐的是本套丛书在提高青少年读者英语阅读能力的同时，还注重培养他们的科学探索精神、动手能力、逻辑思维能力和沟通能力。

本丛书既适合学生自学，又可用于课堂教学。丛书各个系列均配有一本教师用书，内容包括背景知识介绍、技能训练提示、评估测试、多项选择题及答案等详尽的教学指导，是对课堂教学的极好补充。

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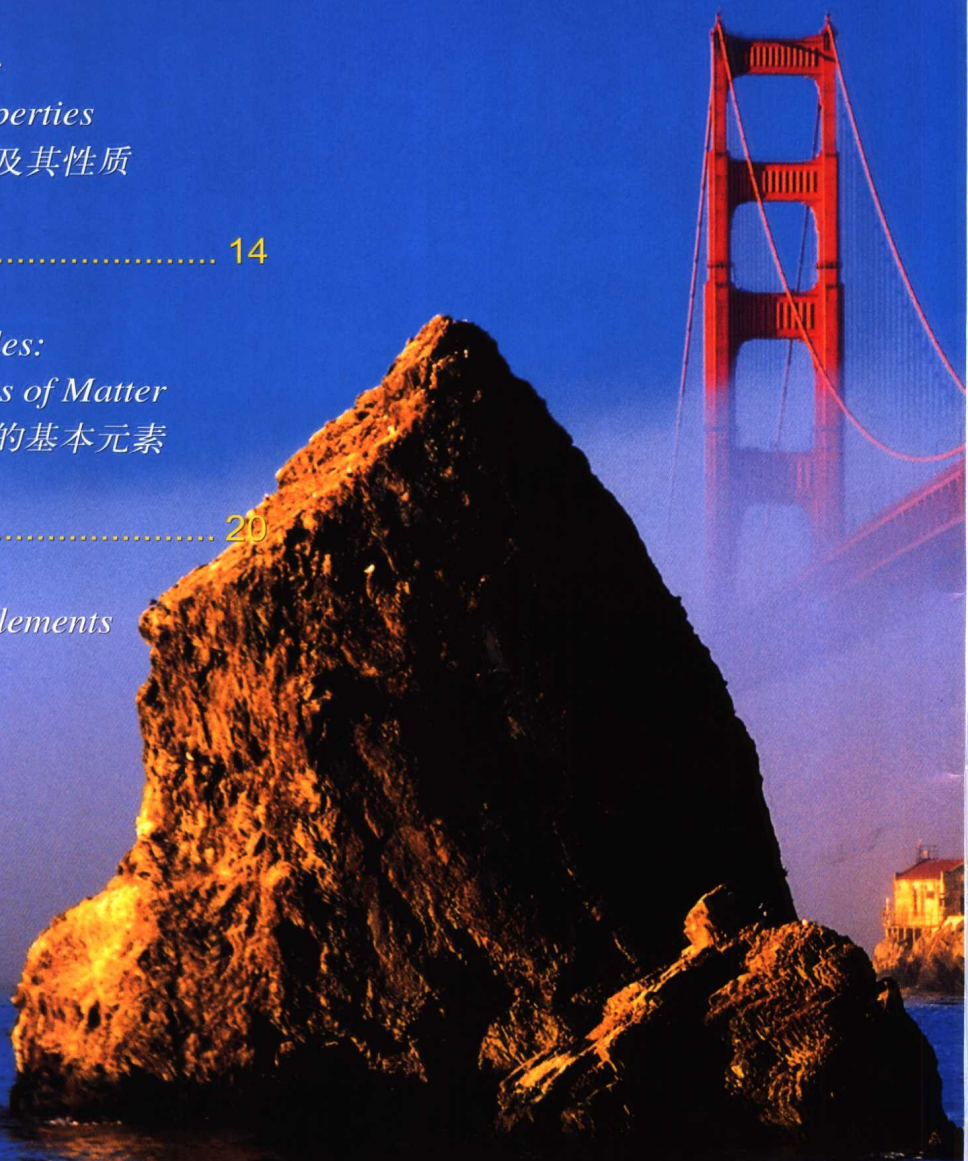
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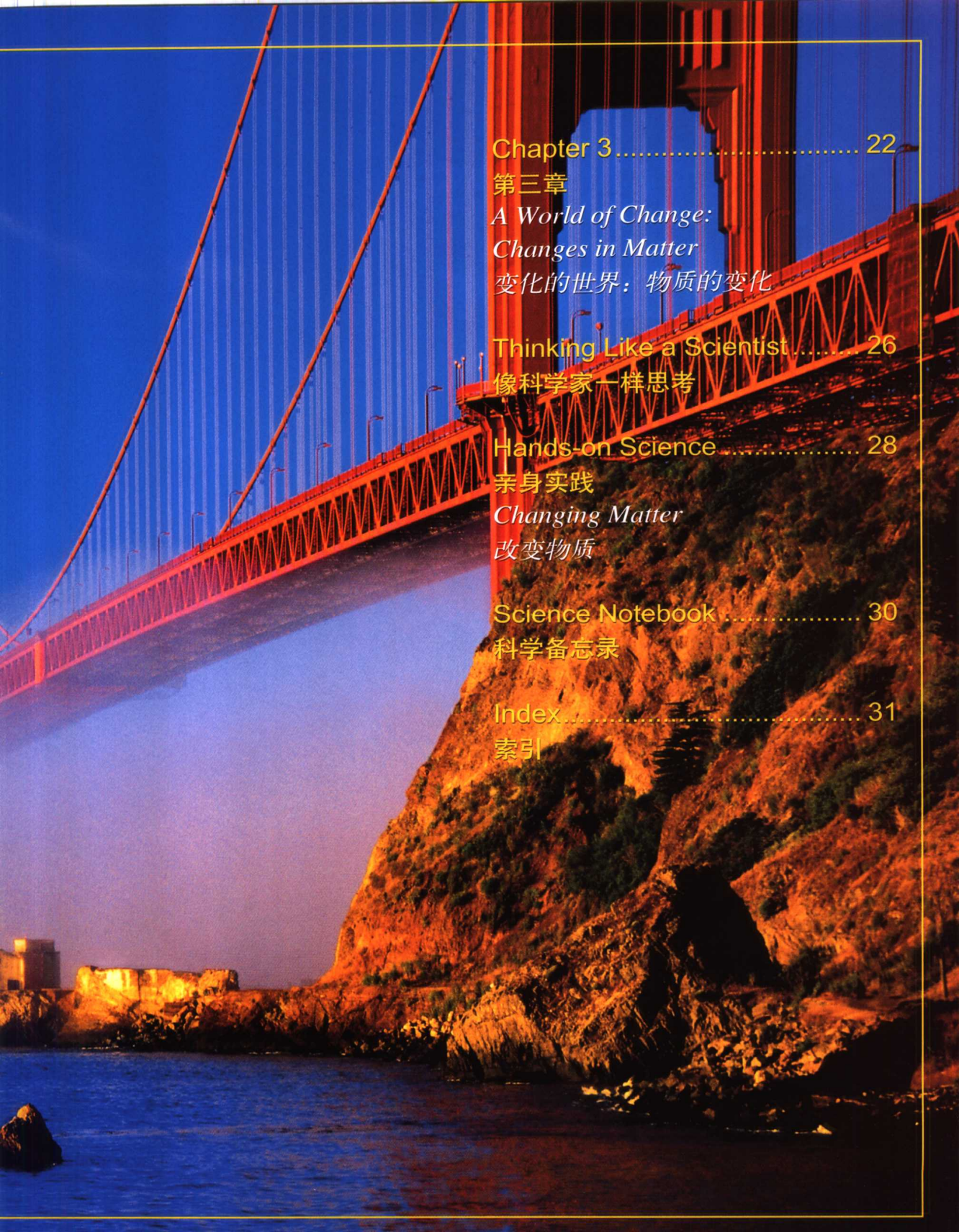
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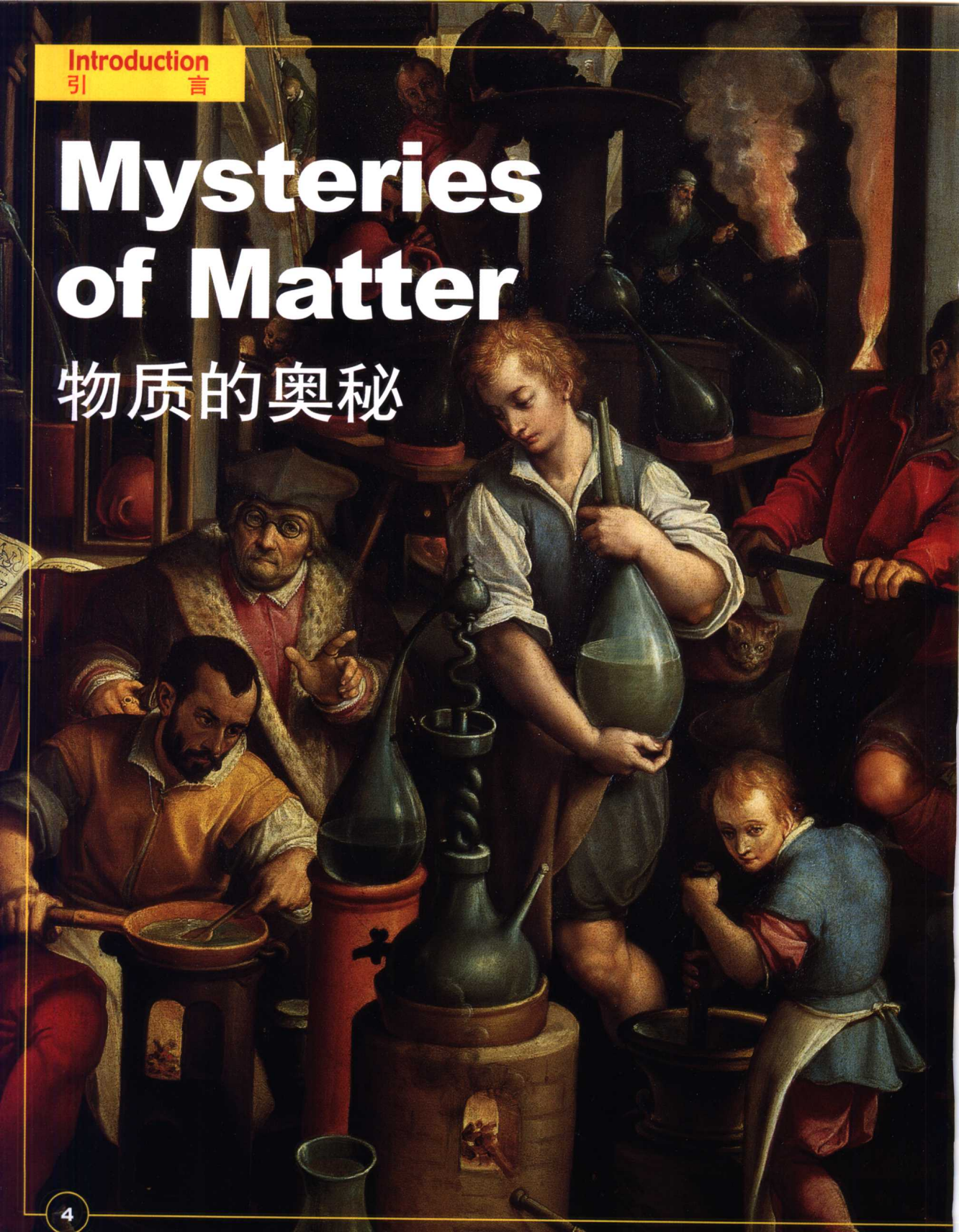
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引言

Mysteries of Matter

物质的奥秘



Peek¹ into the pot. You've frozen³, stirred, and boiled the mixture⁴ in hopes of creating⁵ gold. If it works this time, you'll be respected⁶ and rich. Take a look. Did it work? Oh no—it's still not gold! Back to the lab.

Long ago, this is how an alchemist⁷ might have experimented⁸ in his or her workshop⁹. In the Middle Ages¹⁰ (about a.d. 500–1500), alchemists spent countless hours experimenting with matter¹¹. Alchemists looked for ways to cure¹² diseases¹³, lengthen life, or change metals like iron and lead into precious¹⁴ metals like gold. For centuries alchemists tried to unlock¹⁵ the mysteries¹⁶ 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 methods¹⁷ that alchemists never imagined¹⁸.



Gold coins

1. peek	v.	窥视；看一眼
2. freeze	v.	冻结
3. stir	v.	搅动
4. mixture	n.	混合物
5. create	v.	产生；制造
6. respect	v.	尊敬
7. alchemist	n.	炼金术士
8. experiment	v.	做实验
9. workshop	n.	工场；作坊

10. Middle Ages		中世纪
11. matter	n.	物质
12. cure	v.	治愈
13. disease	n.	疾病
14. precious	adj.	珍贵的；宝贵的
15. unlock	v.	揭开
16. mystery	n.	神秘
17. method	n.	方法；方式
18. imagine	v.	想像

Painting showing alchemists in their lab

Classifying Matter:

Matter and Its Properties



物质的分类：物质及其性质

Butterflies¹, leaves, lizards², and even you are made of matter. What do you know about matter? Can you describe³ the matter around you?

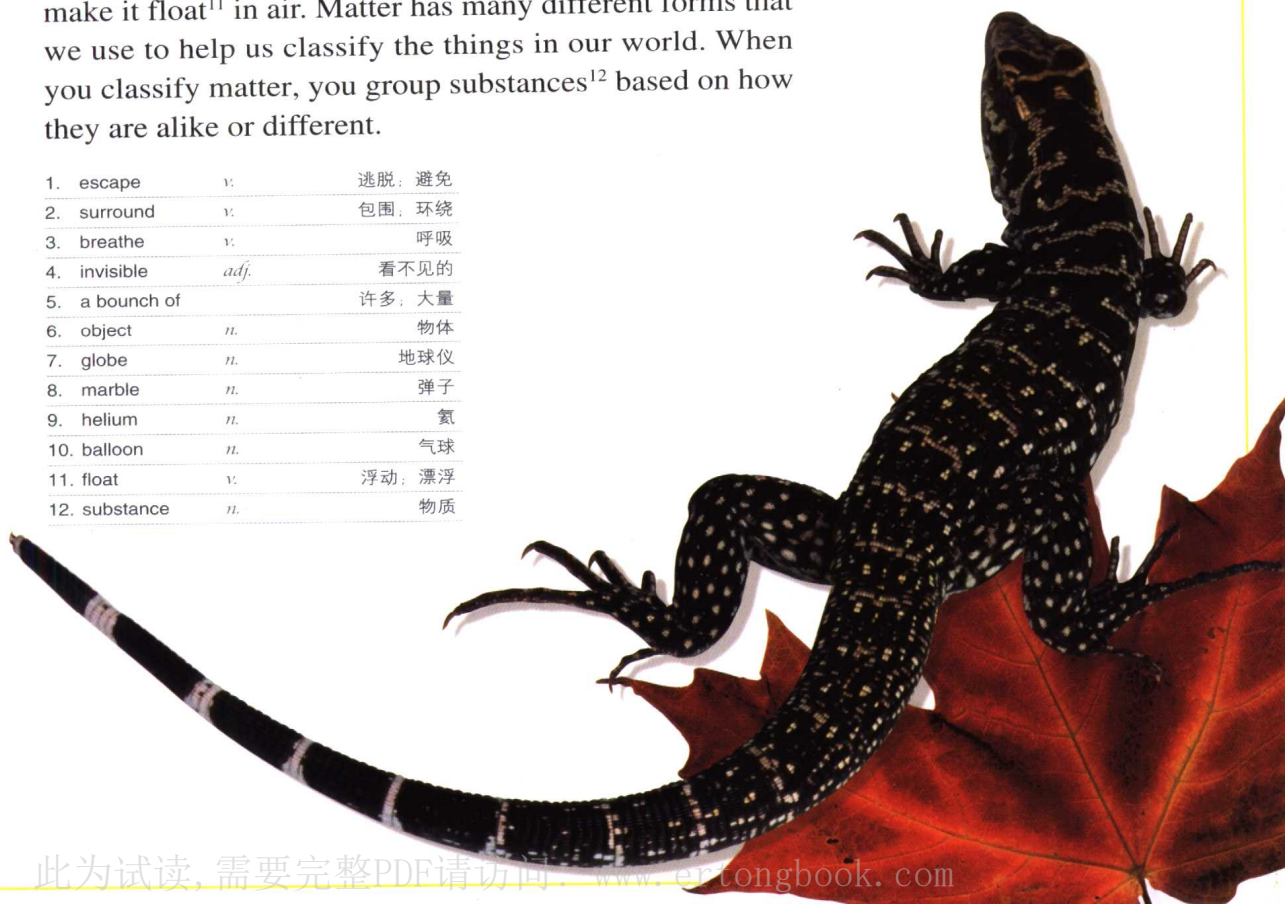
- | | | |
|--------------|-----------|--------|
| 1. butterfly | <i>n.</i> | 蝴蝶 |
| 2. lizard | <i>n.</i> | 蜥蜴 |
| 3. describe | <i>v.</i> | 描述, 形容 |

You can't escape¹ it! Everywhere you turn, you are surrounded² by matter. Some matter, such as the air we breathe³, is invisible⁴. The matter that makes up the sun lights up our lives. In fact, even your body is a big bunch of⁵ matter.

Look around you. What objects⁶ do you see? How would you describe the objects? You might describe some objects by their shape. A ball, a globe⁷, and a marble⁸ 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 helium⁹ can be put into a balloon¹⁰ to make it float¹¹ 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 substances¹² 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 bunch 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



States¹ of Matter

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

Solid² Matter in its most rigid³ state is a solid. A solid has a definite⁴ 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 up⁵ space. Can you think of other examples of solids?

Liquid⁶ 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 sidewalk⁷, it may form a puddle⁸. 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 container⁹ they are in.

1. state	<i>n.</i>	状态
2. solid	<i>n.</i>	固体
3. rigid	<i>adj.</i>	坚硬的, 刚硬的
4. definite	<i>adj.</i>	明确的
5. take up		占据
6. liquid	<i>n.</i>	液体
7. sidewalk	<i>n.</i>	人行道
8. puddle	<i>n.</i>	(一片)积水
9. container	<i>n.</i>	容器
10. canoe	<i>n.</i>	划独木舟
11. paddle	<i>n.</i>	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 canoed¹⁰ in a lake, the paddles¹¹ would change the shape of the water.

Gas¹ 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 particles² will spread out³ and fill the container. For example, if you put a small amount of the gas oxygen⁴ into a room, the particles of oxygen would spread across the entire room.

Plasma⁵ While most people are familiar with⁶ solids, liquids, and gases, there's another state of matter called plasma. Plasma rarely occurs⁷ naturally on Earth's surface⁸, but the sun and other stars are mostly made of plasma. Plasma is made of electrically charged⁹ particles of matter that glow¹⁰. When you see streaks¹¹ of lightning, you are seeing plasma.

Thinking Like a Scientist: Experimenting

When scientists want to test an idea, they conduct¹² an experiment. An experiment is a controlled scientific test. Suppose¹³ you wanted to find out the temperature¹⁴ at which water changes from a liquid to a solid. You could do an experiment to find out. You would start by making a hypothesis¹⁵ that tells the temperature at which you think water will freeze. Then you would list the materials¹⁶ and the steps of the experiment. Once you do your experiment, you can use the information you gathered¹⁷ to evaluate¹⁸ 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	<i>n.</i>	气体	10. glow	<i>v.</i>	发光
2. particle	<i>n.</i>	颗粒, 微粒	11. streak	<i>n.</i>	光束
3. spread out		蔓延	12. conduct	<i>v.</i>	实施, 进行
4. oxygen	<i>n.</i>	氧, 氧气	13. suppose	<i>v.</i>	假设
5. plasma	<i>n.</i>	等离子体	14. temperature	<i>n.</i>	温度
6. be familiar with		熟悉	15. hypothesis	<i>n.</i>	前提, 假设
7. occur	<i>v.</i>	发生, 出现	16. material	<i>n.</i>	材料
8. surface	<i>n.</i>	表面	17. gather	<i>v.</i>	收集
9. charge	<i>v.</i>	使充电	18. evaluate	<i>v.</i>	评估, 评价



Sea star

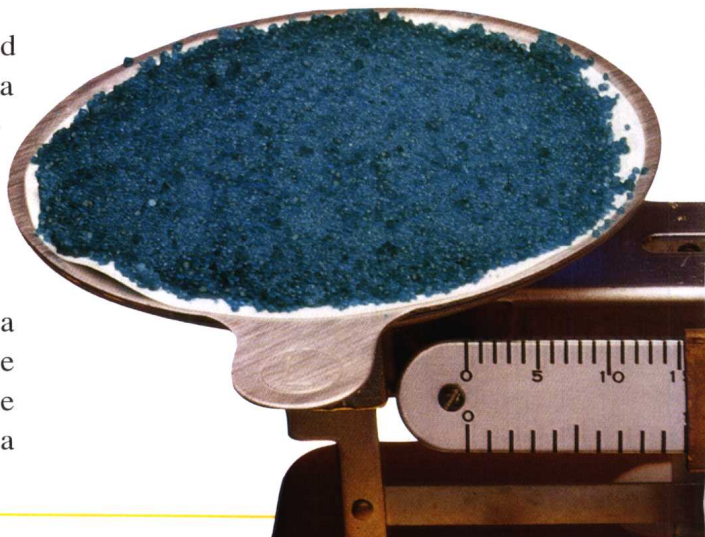
Measuring¹ Matter

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 probably² start by telling about its properties, such as its color, size, texture³, and shape. The characteristics⁴ of matter that you can observe⁵ are called properties.

All matter has the properties of mass⁶ and volume⁷. Mass is the amount of matter in a substance. You can find the mass of something by putting it on a balance⁸. 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 device⁹, 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

solid like a wooden block, you can take a ruler and measure its length, width, and height. Multiplying¹⁰ 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 oddly¹¹ shaped objects was solved¹² by a Greek¹³ scientist named Archimedes¹⁴.

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

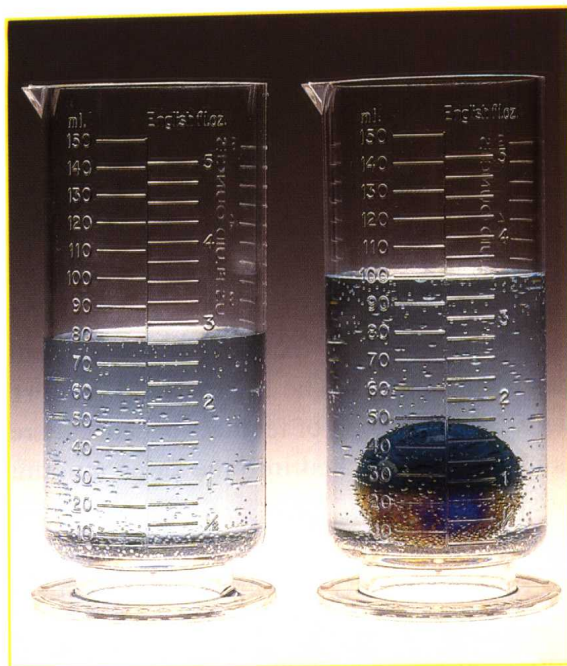


Archimedes' Discovery

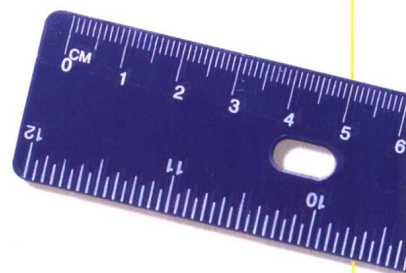
About 250 B.C., Archimedes had to solve a problem for the king. To solve the problem, he had to find the volume of the king's crown¹. Because the crown had an irregular² shape, Archimedes couldn't make the measurement. Then one day he noticed that when he got into the tub³, the water level in the tub rose. His body displaced⁴, or pushed away, water in the tub. He realized⁵ 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?

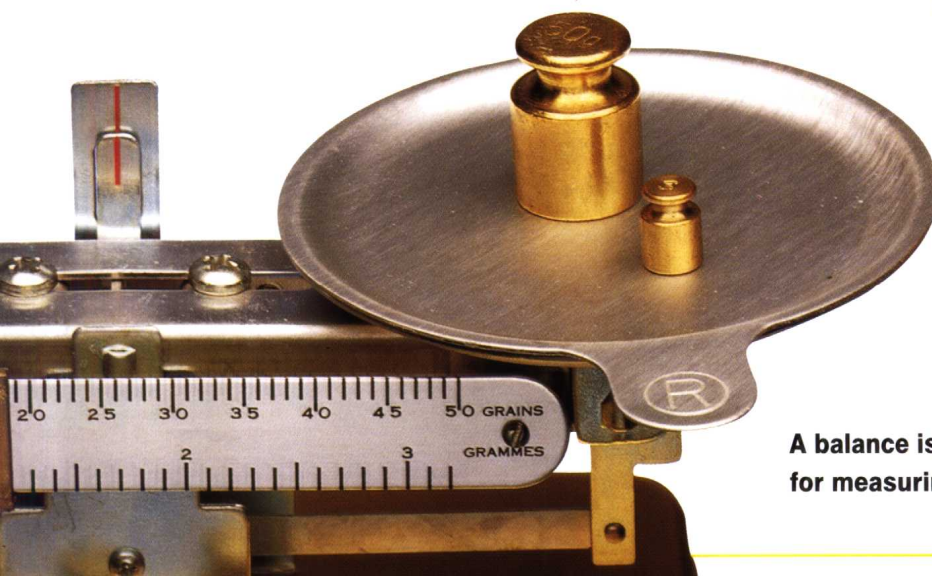
1. crown	<i>n.</i>	王冠
2. irregular	<i>adj.</i>	不规则的
3. tub	<i>n.</i>	浴盆; 浴缸
4. displace	<i>v.</i>	排(水)
5. realize	<i>v.</i>	认识到
6. tool	<i>n.</i>	工具



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



A ruler is a tool⁶ you can use to measure the length, width, and height of an object.



A balance is a tool used for measuring mass.

Discovering Density¹

In addition to² 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 tightly³ packed⁴ a substance is. For example, imagine that you have two boxes that are exactly⁵ 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 dense⁶ 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 of⁷ 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 iceberg⁸ and an ice cube⁹ are made of ice so the density is the same for both.

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

Density of Common¹⁰ Materials

Material	Density (g/cm ³)
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 compare¹ different types of materials. Look at the chart² on page 12. You can see that water has a density of about 1 gram³ per cubic centimeter⁴. 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 raft⁵ 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 sink⁶.

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. Organisms⁷, such as fish, survive⁸ the winter by living in the warmer water below the ice.

