Unit 1-1

Language Focus: Classifying Topic Focus: The Composition of Matter 科学的な研究をするときには私たちのまわりにあ るさまざまな物質を収集し,観察して分類するこ とが大切です。その分類の仕方を学びましょう。

INFroduction 音声を聞いて()を埋めてから下の問いに日本語で答えなさい。

The early stages of scientific research involve making observations and gathering information. (¹), merely collecting facts is not enough. The scientist needs to arrange and classify the facts and to find (²) among them. The word *classification* comes from the word *class* — meaning a group of things that all have one important element in (³). Scientists group related information into an array. Chemists, for example, cannot study every (⁴), but can make generalizations by

arranging all the elements into groups with related (⁵). (⁶), if iodine is identified as belonging to the same group as chlorine and bromine, its properties can be predicted. Similarly, since there are several million kinds of plants and animals on earth, it is clearly (⁷) to study each one. However, by classifying an animal as a member of a particular group, or species, a biologist can (⁸) its characteristics. Classification is thus very basic to scientific (⁹) and (¹⁰).

1. classification の語源は何ですか。

- 2. なぜ分類することが科学にとって大切なのですか。
- 3. 分類することによって、例えば生物学者は何をすることができると言っていますか。

□ パートナーと答えを話し合いなさい。

Sentence Patterns

分類を表現するには次の要素が必要です。

- 1. a general class (一般的な部類:上位区分)
- 2. a specific item or items (具体的な項目:下位区分)
- 3. a basis for classification (分類の根拠)
 - 【例】All matter may be classified as either solid, liquid, or gas. general class = matter specific items = solid, liquid, gas

上記の例では、「物質」が上位区分にあたる一般的な部類、「固体」「液体」「気体」がその下位区分にあたります。次の表で英語の表現をまとめてみましょう。

	Classifying from General to Specific					Classifying from Specific to General			
Matter	is/are may be can be could be	classified grouped divided arranged categorized	into I	divisions. groups. types. classes. categories. classifications.	Oxygen	may be can be could be is/are	classified classed categorized	as a gas. 1	
		classified categorized classed grouped	as	solid, liquid, or gas.		an exan a type o	an example of a a type of		
There are three		types kinds classes categories		er.	Oxygen is	a form	of ga	gas.	

O Identifying General and Specific Ideas: general class には下線を, specific item(s) には波線を引きなさい。

【例】 Copper, lead, mercury, and silver are nonferrous substances.

- 1. Steel is an alloy.
- 2. Five important classes of compounds are acids, bases, salts, metallic oxides, and nonmetallic oxides.
- 3. A deer is a mammal.
- 4. Carbon exists in three forms: graphite, diamond, and amorphous.
- 5. Rocks are grouped into three categories: igneous, metamorphic, and sedimentary.

○ Changing Active Voice to Passive Voice: 科学的な文章を書くときや分類するときには、受動態がしばしば用いられます。なぜなら科学では重点が通常動きにあって、それを行う人にはありません。また現在形の単文が科学的な文章を書くときには最もよく用いられます。例にならって、能動態を受動態に書き換えなさい。

【例】We extract sulfur from volcanic rock. → Sulfur is extracted from volcanic rock.

- 1. Luigi Galvani invented the electric battery in 1786.
- 2. The authorities temporarily suspended the American space shuttle program after the accident in 1986.
- 3. Workers completed the Panama Canal in 1914.

4. The 1986 earthquake in Mexico City killed many people.

5. Chemists can extract nitrogen from the air by liquefaction.

Short Reading

空欄にあてはまる語を下から選び入れなさい。

The Nature of Matter

Everything around us consists of matter: this book, your body, the air you breathe, and the water you (¹). Matter is anything that has weight or mass and takes up space.

All matter may be classified as either $(^2$), liquid, or gas. Solids are firm and have a definite form. Rubber, wood, glass, iron, cotton, and sand are all classified as solids. A considerable force would be needed to change the shape or volume of an iron bar, for example, because the atoms or molecules of a solid are densely packed and have very little $(^3$) of movement.

Solids may be further divided into two (⁴): crystalline and amorphous. Ice, diamonds, sodium chloride, and quartz are crystalline solids. Crystalline solids are made up of atoms arranged in a definite pattern. When these solids are heated, the change to a liquid, known as melting, is sharp and clear. Amorphous substances include rubber, glass, and plastic. In these substances, the pattern of the atoms is not orderly, and when heated, they gradually soften.

Liquids, on the other (⁵), are not rigid. If water, milk, or oil is poured on a table, it will flow all over the surface. The atoms or molecules of liquids attract each other and thereby enable liquids to flow. But these atoms are loosely structured and do not keep their shape. Therefore a liquid will take the shape of any (⁶) in which it is poured. However, liquids have a definite volume; a quart of milk cannot fit in a pint container.

Gases, such as air, oxygen, and carbon (⁷), have no fixed shape or volume of their own. They diffuse or spread out to fill any container. If water is put into a tire, it will run to the bottom; if air is put into a (⁸), it fills the whole space inside the tire. The atoms or molecules of gases are widely spaced and move very rapidly. They either compress or expand to adapt to any area.

Everything we know is made of matter in solid, liquid or gaseous form.

dioxide	drink	freedom	container
classes	hand	solid	tire

空欄に入る語句をテープを聞いて確認した後,文章をもう一度読み,受 動態に下線を引きなさい。また,分類を表している文をできるだけたく さん見つけなさい。



Unit 1-2

Main Reading: The Infinitesimal Atom

Vocabulary Buffeling 平均的な人の語彙はだいたい 20 代半ばでとまってしまいます。従ってそれ以後も語彙 を増やすためには意図的に努力する必要があります。英語の語源を, 語根 (word root), 接頭辞 (prefix), 接尾辞 (suffix) に分解して覚えることもひとつの方法ですし, また同意語 (synonym) や 反意語 (antonym) を知ることも大切です。次の例を見てください。

subdivision < sub = 「下」 + divide「分ける」 + ion 名詞語尾 indestructible < in- = not + destruct「破壊する」 + able = 「できる」形容詞を作る。 positive electric charge = 「陽電荷」 positive の反対が negative reaction = re「再び」 + action「反応,反動」

化学記号は英語とラテン語、ギリシア語からできています。

Hg: mercury「水銀」<ラテン語の*h*ydrar*g*yrum Cl: chlorine「塩素」<ギリシア語の khloros = pale green その色から英国の科学者が命名。

この教科書では、長文を読む前に Vocabulary Building セクションを設けて上記のような例を系統立てて紹介し、 科学的な文章に頻繁に使用される語を中心に語彙力の増強をはかります。さらに、知らない単語の意味を文脈から推 測する練習問題も用意されていますので、すぐに辞書に頼るのではなく、自分が持っている知識を活用して、文脈か ら意味を推測することを日頃から心がけましょう。

Vocabulary in Context

長文を読む前に単語の意味を文脈から推測する練習をしてみましょう。斜字体の 単語の意味に近いほうを○で囲みなさい。

- Atoms are *infinitesimal* in size.
 (a) tiny
 (b) huge
- The whale suddenly *emerged* from the water.
 (a) arose
 (b) disappeared
- 3. All matter is either liquid, solid, or gas, and solids may be *subdivided* into crystalline and amorphous.
 - (a) built up (b) broken down
- 4. Plastic products are hard to dispose of because they are almost *indestructible*.(a) unable to be destroyed(b) unable to be constructed
- 5. At one time the atom was thought to be *indivisible*.(a) unable to be divided(b) unable to be seen
- 6. Einstein's ideas are too *abstract* for many people to understand.(a) practical(b) theoretical
- 7. The airplane had to rely on radar in the *dense* fog.(a) thick(b) thin
- 8. The moon *revolves* around the earth.(a) stretches(b) circles

- 9. The mosquitoes showed their *attraction to* the light.(a) dislike for(b) liking for
- 10. Some scientists suspect that the planet Uranus once *collided* with another object in space.(a) crashed(b) orbited

fincling Math Deeps 科学的文章は主に概念とその概念を裏付ける資料からなっ ています。その概念は通常,主題文 (topic sentence) で 述べられ、しかも主題文はそのパラグラフの中のすべての情報を覆う傘のようなもので す。パラグラフのそれ以外の部分は主題文を裏付ける情報です。次の文を読んで、各パ ラグラフの主題文を見つけて下線を引き、設問に答えなさい。(最初のパラグラフはすで に書かれています。)

electron proton neutron

helium atom

The Infinitesimal Atom

There are over four million substances known to man. Yet it is one of the amazing facts of science that all these substances are made up of only about 100 different varieties of matter, which are called elements. Oxygen, hydrogen, gold, aluminum, sulfur, carbon, and chlorine are all examples of elements that combine in different ways to make the more than four million substances. Elements are made of particles called molecules, too tiny to be seen even with a powerful optical microscope. Molecules are made of even smaller particles called atoms. All the world is made of atoms.

The concept of atoms first emerged in ancient Greece. In 400 B.C. the philosopher Democritus theorized that matter could be divided into smaller and smaller particles until a point was reached beyond which no further subdivision was possible. These indestructible particles were called *atomos*, a Greek word meaning indivisible. We know today that atoms are so small that it would take more than a million of them to equal the thickness of this sheet of paper. Democritus' theory, however, was not universally accepted in the ancient world, for many believed in Aristotle's theory that matter is composed of four elements: earth, fire, air, and water.

During the Middle Ages in Europe, the concept of atoms was considered too abstract and was accordingly rejected. Finally, in 1804 the Englishman John Dalton formulated an atomic theory based on his experimentation. He claimed that all matter is made of atoms; that all atoms of a single element have the same shape, size, weight, and behavior; and that atoms of each element are different from those of any other element. He said that atoms are not created or destroyed but rather form new combinations in chemical reactions.

Dalton thought that atoms were solid, but today atoms are believed to consist mainly of space, with a dense nucleus at the center. The size of the nucleus inside an atom is comparable to the size of an ant on a football field. Each nucleus contains protons, which have a positive electric charge, and neutrons, which have no charge. The nucleus is surrounded by electrons, which have a negative electric charge. The number of protons equals the number of electrons in each atom, and therefore the entire atom has no charge. In 1913, the Danish physicist Niels Bohr proposed a model of the atom in which the electrons revolved around the nucleus like the planets revolve around the sun. Today the movement of electrons is thought to be more like bees hovering around a hive. The force of attraction between the positive protons in the nucleus and the negative

electrons whirling around keeps the electrons in their paths.

What is it that makes iron hard, oxygen a gas, and mercury a liquid? The properties of an element are determined by the number of electrons in an atom, which is called the atomic number. All atoms of the same element are alike. If you've seen one atom of oxygen, you've seen them all. Hydrogen, the lightest element, has one electron and one proton. In fact, the hydrogen atom, the most common atom in the universe, is the basis on which our entire universe was formed. Oxygen has eight protons and eight electrons. Uranium, one of the heaviest elements, has 92 protons and 92 electrons.

All the world is made of atoms: Everything we see and know of is made of the billions and billions of these infinitesimal specks of matter. All life exists because atoms are continually moving, combining, separating, colliding, giving off energy, and absorbing energy.

Understanding the Reading 次の各文は本文の内容と異なります。例にならって、本文の内容と一致するように文を書き直しなさい。

- 【例】Molecules are even smaller than atoms. → Atoms are even smaller than molecules.
- 1. The concept of the atom did not exist before 1804.
- 2. In ancient Greece, a lot of people believed Democritus' theory that matter is composed of four elements.

3. During the Middle Ages, the atomic theory was widely accepted.

4. John Dalton theorized that atoms are composed of electrons, protons, and neutrons.

- 5. The size of a nucleus inside an atom is equal to the size of an ant.
- 6. Atoms are densely packed with protons, neutrons, and electrons.

Comprehension Check テープを聞いて、その質問の答えとして最もふさわしいものを選びなさい。

(c) John Dalton

1. (a) Democritus

2. (a) element (b)

- 3. (a) 1
- (b) proton (b) 8

(b) Aristotle

(c) nucleus (c) 11 (d) Niels Bohr

(d) neutron (d) 9