

Intermediate-Level Science Review

This workbook is aligned with the Next Generation Science Standards Framework. The primary goal of this workbook is to provide students with the essential content information, the vocabulary, and the applicable skills needed to ensure success on the 8th grade cumulative exam.

This workbook consists of the following:

- 20-unit essays covering the required disciplinary core content
- Each unit is designed to be interactive with the student
- Many explanatory caption diagrams for each unit
- Test Your Knowledge – Three multiply choice exams are inserted after specific topics to check student’s progress and understanding of these topics.
- Contains two full length exams built on “cluster test questions” that parallel the expected format of the 8th grade cumulative exam.

Special Thanks To:

William Docekal – Earth Science Teacher – Retired

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P. O. Box 328
Onsted, MI. 49265-0328
www.topicalrbc.com

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Structure, Function of Cells and Systems

A cell or organism must exhibit some specific characteristics to be considered alive such as: be able to _____, respond to _____, maintain homeostasis (regulate itself), and have the ability to grow, develop and adapt. In 1665, using the newly invented microscope, the cell was first observed. A cell is the smallest basic unit of life considered to be alive and is the building block of all living organisms. Today, the mystery continues on how the first cell appeared on Earth, but it is widely accepted that it formed from _____ matter floating in the primitive oceans billions of years ago. Eventually unicellular organisms join together forming _____ clusters that organized and ultimately became plants and animals. Multicellular organisms became more efficient than unicellular organisms in their ability to obtain _____, protect themselves through increased size, work cooperatively, reproduce and adapt. Multicellular organisms developed _____ cells that perform specific functions that are required by the organism for survival. For example, a _____ is a single, self-functioning cell. On the other hand, a _____ cell, is a specialized cell that performs a specific function for the multicellular organism allowing both to survive.

All cells have _____, or small cell parts, that perform specific necessary activities or functions. Many organelles are common to both animal and plant cells. The organelle called the _____, stores the hereditary material, genes, on chromosomes and coordinates the cell's activity. The cell _____ separates the inside content of the cell from the outside environment, protecting the cell. The cell membrane allows the passage of materials, such as nutrients, _____, water, and waste products, into or out of the cell. The _____ is the "powerhouse" of the cell. Its function is to generate _____ necessary to power the cell. Cytoplasm is the fluid within the cell where the organelles are suspended. Organelles that are found only in _____ are the cell wall and _____. The plant cell wall is the rigid outer layer of the cell. This gives support, strength, structure and protection to the plant. Chloroplasts capture light energy and carries out the process of _____, which makes sugar that is the plant's food and energy source. All organelle structures coordinate and work together to maintain the cell's internal balance known as _____. If this is out of balance, serious consequences can affect cells and possibly the whole organism. Many diseases, such as diabetes, will disrupt normal homeostasis.

multicellular
stimuli
reproduce
specialized
nutrients
blood
bacterium
organic

nucleus
membrane
organelles
gases
energy
plants
mitochondrion
photosynthesis
homeostasis
chloroplasts

Cells are the basis for organization in organisms. Cells that are grouped together by function are known as tissues. Tissues with similar functions form an _____. For example, the heart is an organ composed of different types of muscle and nerve _____. When organs are arranged to interact together, they make up a _____. Each plays an important role that is needed for a particular life function. The human body consists of different systems. The musculoskeletal system consists of the muscles, _____ and connective tissues that give structure and support to the body. The digestive system breaks down nutrients into usable form. The _____ system involves all parts of the breathing mechanism (e.g., nose, mouth, windpipe and lungs) accomplishing the exchange of the gases _____ and carbon dioxide. The circulatory system includes the muscular heart that pumps blood throughout the body, carrying oxygen, nutrients and _____ to all cells, while removing carbon dioxide. The excretory system collects and removes harmful wastes. The regulatory system involves the nervous and endocrine systems that coordinate internal activities throughout the body. The immune system defends the body from infection. The _____ system acts to form new individuals.

All systems have different parts that interact for the good of the whole system. For example, the sensory system is part of the _____ system, responsible for processing stimuli (signals) from cells or from the outside environment and then relaying them via nerves to be processed or acted on. This starts with _____ receptors that are located throughout our body, such as the eyes, ears, nose, mouth and skin. When a _____ is detected by a sensory receptor, an electrochemical signal is rapidly relayed by nerves to the _____ nervous system (spinal cord and brain) where it is processed. This might cause a motor (muscle) response to the stimulus area. Your brain is constantly receiving information through many ongoing chemical signals from sensory receptors that assist you in functioning or help you react to the environment around you. Even _____ detect and respond to stimuli in their _____. If a light source is from only one direction, plant hormones will direct it to grow in that direction. The leaves of certain plants open and close as they respond to the daily cycle of light and darkness. Leaves become drawn inward and _____ close up to save water during a drought. All organisms detect and respond to stimuli; this enables the organism to survive.

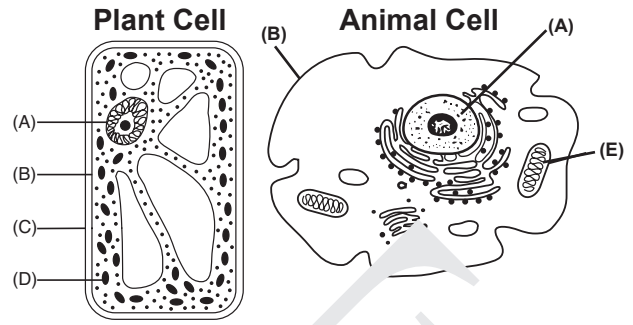
system
tissues
hormones
organ
reproductive
oxygen
bones
respiratory

stimulus
central
nervous
sensory
pores
environment
plants

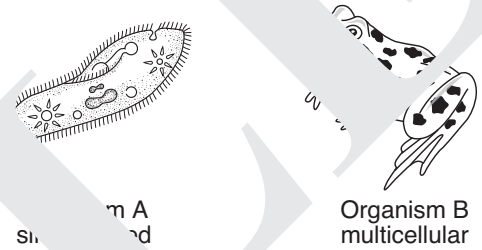
Diagrams:

1. **Plant and Animal Cell** – All cells contain organelles that perform specific functions. Both the of these cells have a cell membrane that is a barrier between the inside and outside environment. The plant has an outer cell wall that provides support and protection.

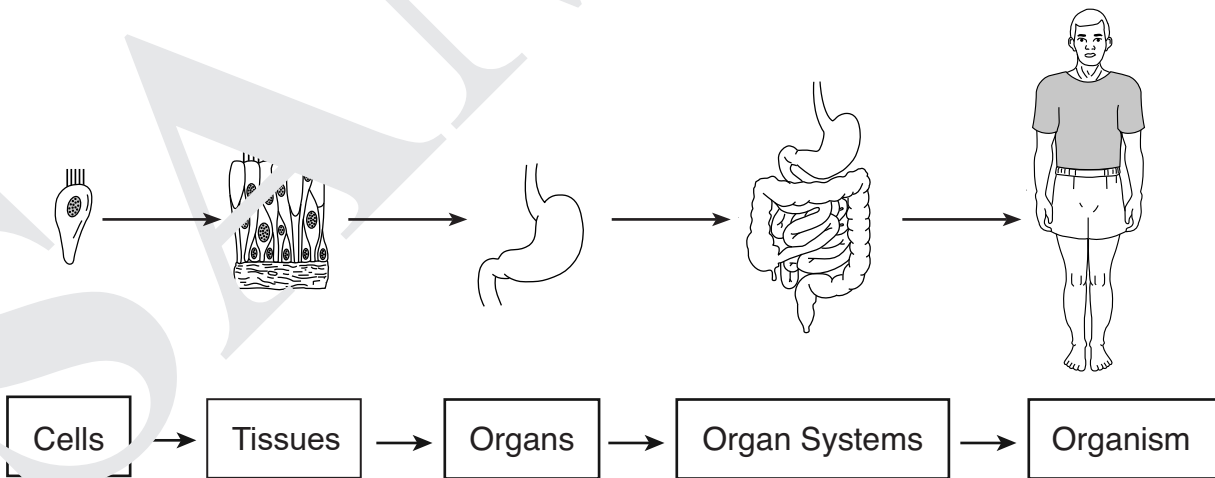
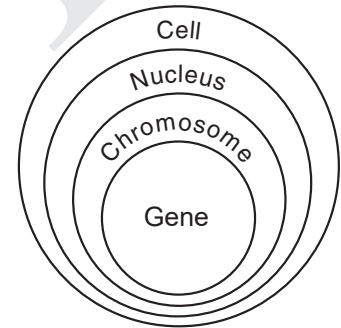
A is the nucleus C is the plant cell wall
 B is the membrane D is the chloroplast E is the mitochondrion



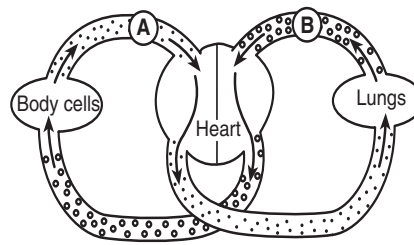
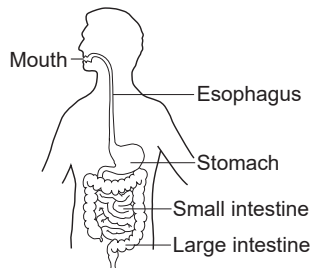
2. **Unicellular vs. Multicellular Organisms** – Organism A is a unicellular organism (e.g., bacteria). It is a single-celled animal containing organelles that carry out its life functions. Organism B is a frog, a multicellular organism that is highly developed, involving systems (e.g., circulatory system) to support its functions.



3. **Cell Structure** – This model represents levels of organization within a cell. Inside the cell is the nucleus; within the nucleus are chromosomes. Located on the chromosomes are genes that store genetic information.



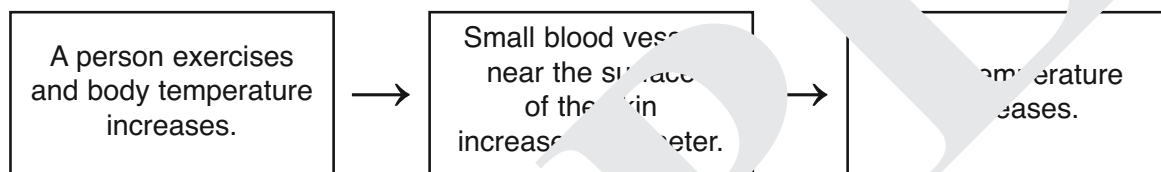
4. **Human Body Systems** – All body systems begin with cells that form tissues. Tissues that work together form an organ. When organs interact together, they form a system. The stomach is part of the digestive system. The human body consists of eleven organ systems.



Key	
	Oxygen-rich blood
	Carbon dioxide-rich blood

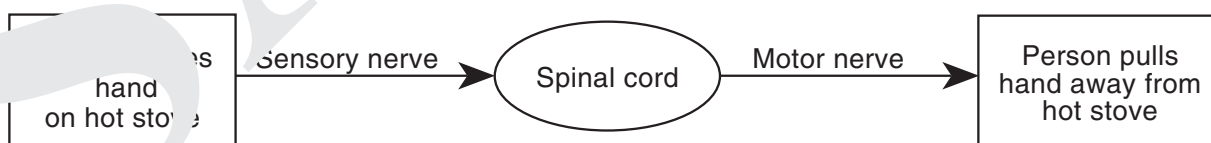
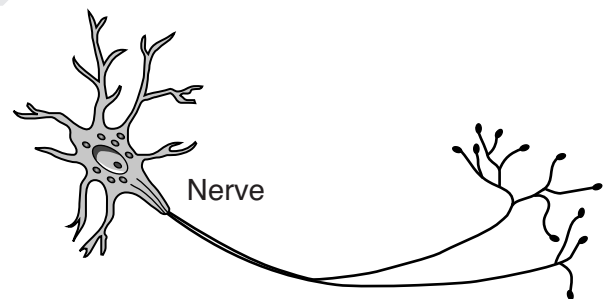
5. **The Digestive System** – The digestive system breaks down food into smaller pieces so that nutrients are able to be absorbed into the body. Digestive enzymes play a key role in this process.

The Circulatory System – This system moves oxygenated blood and nutrients to all body cells, while removing cellular respiration waste—carbon dioxide. The heart is a powerful muscle that pumps blood through a vast network of blood vessels.



6. **Homeostasis** – Homeostasis is an ongoing process to maintain a stable and healthy environment within an organism. To compensate for a person overheating, the surface blood vessels expand, releasing more heat, which will lower the body temperature.

7. **Nervous System** – The nervous system coordinates everything we do. The nervous system includes the brain, spinal cord (the central nervous system), and a complex network of nerves. Nerve cells generate electrochemical signals that transmit information.



8. **Sensory and Motor Nerves** – When a sensory nerve receives a sensation, as when a finger touches a hot stove, an electrical impulse is transmitted to the central nervous system. The motor nerve will activate a muscle response by pulling the finger away.

Weather - Climate and Global Warming

If weather is what occurs daily, climate is what one can expect from year to year. It's a known fact that the climate of _____ regions is milder compared to the climate of interior regions. So, what factors determine a region's climate? A major factor is _____. Regions that are located near the equator (the tropics) will have more intense (stronger) sunlight compared to higher latitude regions, producing great differences in their _____ temperatures. This unequal heating produces large _____ wind belts located around our planet that affect the climate of wide regions. These belts are large _____ currents formed by warm rising air that eventually cools and sinks back to the Earth's surface. Rain forests are located in zones of rising air, while in zones of sinking air, arid or _____ conditions exist. Within each wind belt, the wind at the surface tends to blow in one direction and is termed _____ wind. Across the United States, our prevailing winds come from the southwest. These wind belts move _____ masses along with them, causing a change of weather to the regions they pass over. The climate on the opposite sides of a mountain range is different due to the _____ amounts and temperature differences. The elevation of an area affects its climate. Oceans and their currents—cold or warm—impact the weather and climate of coastal areas.

One can see that climate is caused by many natural factors. But now there is an abundance of scientific data revealing that man's actions are a major contributor to _____ warming. Coal, gasoline, and natural gas are referred to as _____ fuels. When these are burned for our energy needs, they release _____ dioxide and water vapor. These gases, along with methane, are classified as _____ gases because they have the capacity to absorb radiation, increasing the temperature of the atmosphere. A changing climate puts adverse stress on all organisms and resources within _____. Coral reef ecosystems are being severely threatened by _____ ocean waters. Polar ice caps are melting at alarming rates, raising the sea level of the oceans. This will be very costly for coastal cities to mitigate. Yearly, record breaking temperatures are being recorded by many cities. Drought conditions are more frequent, fueling more _____. You probably have experienced the smoke from distant wildfires—an unhealthy situation. Natural events also add greenhouse gases. Volcanic eruptions and forest fires from lightning strikes release much carbon dioxide. The scientific community has voiced serious concern if global warming continues. Action is being demanded to reduce greenhouse gases. Eliminating _____ burning power plants, making cars more fuel efficient, producing more _____ cars, and investing in wind and solar energy will reduce carbon dioxide emission. As with all decisions, there are positive and negative impacts to consider, but with a better understanding of climate science and an agreement that all of us can be part of the solution, we can slow global warming or even make our world “carbon _____.”

latitude
planetary
annual
coastal
air
desert
rainfall
prevailing
convection

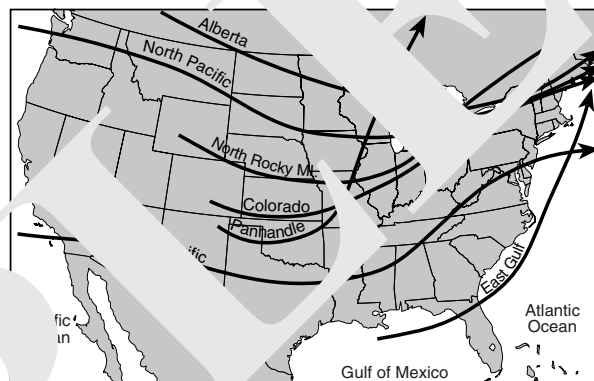
fossil
warmer
carbon
greenhouse
global
coal
neutral
ecosystems
electric
wildfires

Diagrams:

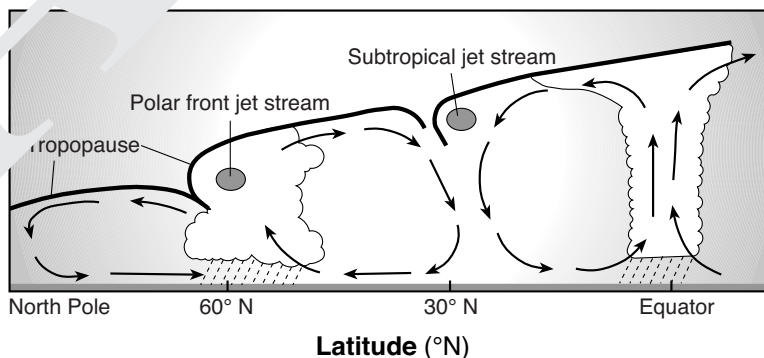
1. **Elevation and Temperature** – As elevation increases, temperature decreases. Mountains located in tropical regions, at times, will have snow near the peak.



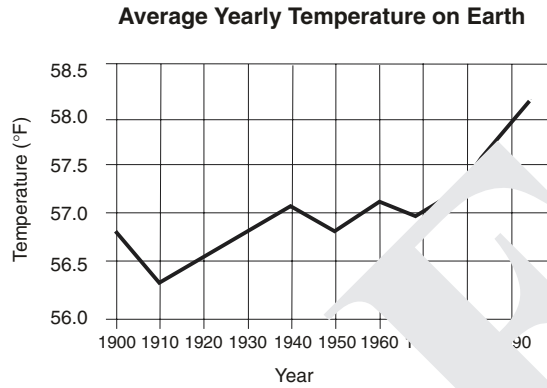
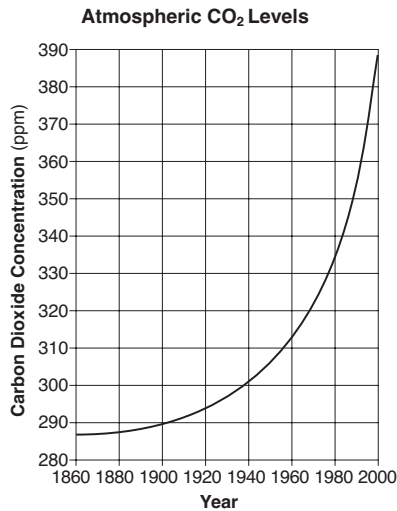
2. **Paths of Air Masses** – The diagram shows the major paths that air masses travel. Our prevailing winds generally blow from the west toward the northeast. These winds move air masses and their associated weather with them.



3. **The Gulf Stream Current** – The Gulf Stream is a warm ocean current flowing out of the Gulf of Mexico traveling along the east coast of North America. This current moves warm tropical water northward, affecting the climate of the coastal areas it flows by.

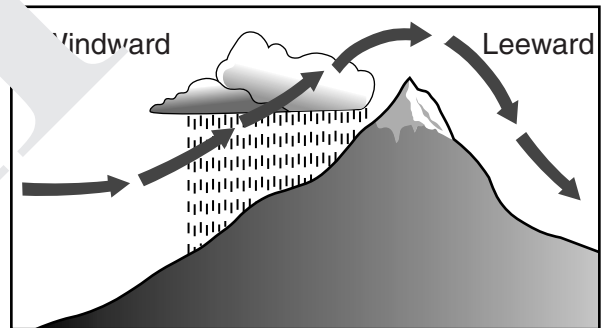


4. **Global Convection Currents** – The unequal heating of our planet produces major convection currents within the atmosphere. These currents form when warm air rises and cools, producing precipitation. Eventually the cooler, drier air sinks back to the Earth.



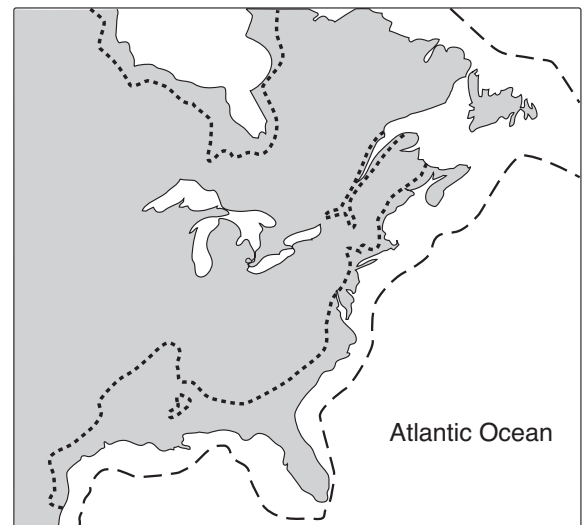
5. **Global Warming** – The Earth’s average temperature has increased constantly since 1910. This global warming has been attributed to the increase of greenhouse gases, especially CO₂. These rising temperatures have put much stress on certain species. At the same time polar ice sheets are melting at alarming rates, and our summers are much hotter.

6. **Mountains and Climate** – Mountains force prevailing winds to rise. As the air rises it cools, forming clouds and precipitation. Once over the mountains, the descending drier air warms up, producing an arid or desert climate.



7. **Rise in Sea-level** – Sea levels around the world are rising because of climate change. As fossil fuels are burned, carbon dioxide and other greenhouse gases that warm the Earth’s atmosphere are released. Polar ice sheets and glaciers are melting at alarming rates, adding water to the oceans. The rising sea levels pose a significant threat to coastal cities.

Key	
---	Coastline 18,000 years ago
.....	Future coastline if global warming continues



Chemical Reactions

Elements and compounds can undergo a chemical reaction, making a new substance. For example, carbon reacts with _____, forming carbon dioxide ($C + 2O \rightarrow CO_2$), and iron reacts with oxygen, forming rust ($2Fe + 3O \rightarrow Fe_2O_3$). In chemical reactions, the atoms or _____ that make up the original substances are rearranged, producing different substances. There are a number of signs that a chemical reaction is taking place: a _____ change occurs, a release of a _____, an odor is given off, or the substances undergo a change in color. Many of these chemical reactions are slow, causing _____ that weakens the material. Coating metal with paint is an effective way to stop or reduce a chemical reaction acting on a metal. Other chemical reactions are occurring when a firecracker is lit or when milk turns sour or when you cook food, and even in your stomach when digestive _____ chemically break down food. A rapid chemical reaction is usually associated with _____ (burning), where a substance reacts with oxygen. Sometimes the combustion is so fast it produces an _____. The molecules/atoms in many reactions seem, at times, to be destroyed, especially in a combustion reaction, but are they? Scientists have determined that, in all reactions, the total number of _____ does not change; they are simply rearranged, combining to form new products. This is the Law of Conservation of _____, which states: Matter is neither created nor destroyed in chemical or in physical reactions. Simply stated, the mass before the reaction _____ the mass after the reaction.

All chemical reactions need to absorb thermal energy to start the reaction. In a laboratory setting, a _____ burner is often used to initiate a reaction. Sometimes just mixing two chemicals will generate _____, proving a chemical reaction is occurring. A heat pack, used as a hand warmer, is a good example. When pressure is applied to the heat pack, the chemicals inside mix, starting the reaction. This chemical reaction generates _____ that you feel as heat. The opposite is an instant cold pack. Once the cold pack is activated, the chemical inside absorbs energy from the surrounding liquid in the cold pack, lowering the temperature of the ice pack. The combustion of _____ and gasoline release sulfur (S) and nitrogen (N) into the air. These _____ join with atmospheric water, producing acid rain. Acid rain can cause health problems, harm ecosystems, and react with minerals in buildings, monuments and statues. When you snap a glow stick, chemistry is at work producing the light within. In time, the reaction slows down, and the glowing light fades out. Chemical reactions are constantly occurring, either _____ or absorbing thermal energy.

acids
molecules
combustion
corrosion
temperature
oxygen
atoms
gas
equals
explosion
Mass

heat
energy
chemically
Bunsen
releasing
coal

The science of chemistry is complex, especially since atoms and _____ are too small to be seen. Early experimenters, known as alchemists, tried to change common metal and other chemicals into gold. They failed in this quest, but by trial and error they realized that pure _____ existed, and that matter must be made of very small indivisible particles, given the term atoms. By observing different chemical changes, along with careful measurements, a _____ (educated guess) was proposed on how matter behaved. Eventually the atomic _____ was better understood, leading to the atomic theory. This theory, over time, has been modified as new evidence is presented. _____, physicists, engineers, technicians and other professionals are still working on major scientific research projects involving the subunits of the atom. In the future, will you be on one of these teams? I hope so.

hypothesis
elements
model
molecules
chemists

Diagrams:



1. **Chemical Reaction Model** – In this chemical reaction, hydrogen atoms are bonding (attaching) chemically to the oxygen atoms. The end product is two molecules of water that have different properties than the atoms that produced water.

2. **Elements** – All elements differ from each other by the number of protons they have within their nucleus. The atomic number gives the element's proton number. Hydrogen has one proton, while lead has 82. The atomic mass is the number of protons and neutrons the element contains in its nucleus.

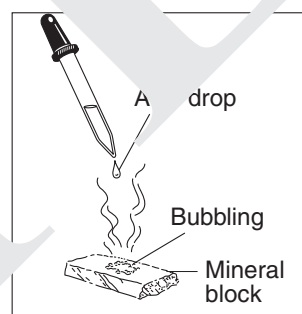
Key	
1 H Hydrogen 1.01	Atomic number Element symbol Element name Atomic mass
82 Pb Lead 207.2	

3. **Metals and Non-metals** – On the Periodic Chart, elements are arranged by increasing atomic number. The elements in Group 18 are the noble gases, and these gases tend not to react with other elements. The “step-like” black line separates the non-metals (located on the right side of that line) from the metals (located on the left side of that line).

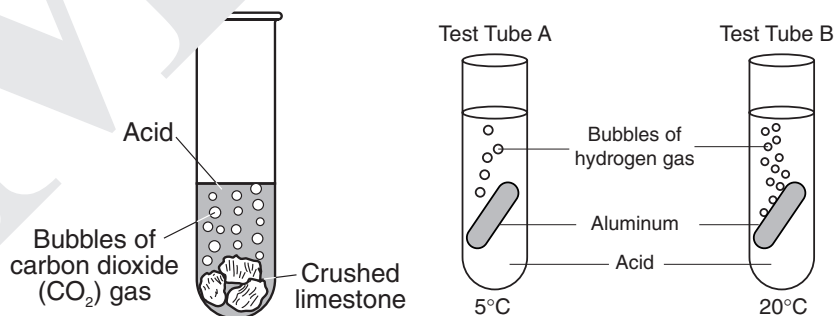
Portion of the Periodic Table of the Elements 18

		Groups					
		13	14	15	16	17	18
		11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
		27 Al Aluminum 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35 Cl Chlorine 17	40 Ar Argon 18
11 64 Cu Copper 29	12 65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	76 Se Selenium 34	79 Br Bromine 35	84 Kr Krypton 36
108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Tl Thallium 81	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54

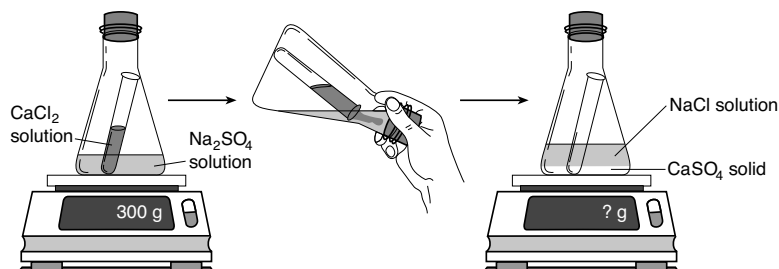
4. **Signs of a Chemical Reaction** – Signs that a chemical reaction is possibly occurring are: the release of a gas (bubbles form); temperature change; light is given off; precipitation (release) of a solid; a color change or odor is detected.



5. **Chemical Reaction** – The limestone is chemically reacting with the acid releasing $\text{CO}_2(\text{g})$. Many reactions involving an acid release a gas. The other two test tubes show a temperature change occurring in a chemical reaction. Some reactions release thermal energy (heat) increasing the substance temperature; others absorb thermal energy causing a lower temperature.

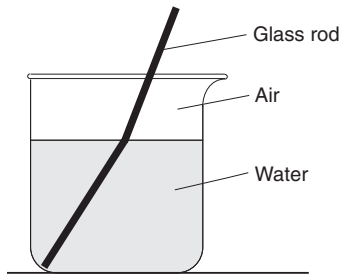


6. **Conservation of Mass** – When the corked flask is tipped, the substance within the test tube spills out, producing a chemical reaction. Because the flask is corked, nothing could escape. The final mass of the reacted flask will still be 300 grams. In all chemical reactions, mass is always conserved.



Test Your Knowledge

1. A straight glass rod appears to bend when placed in a beaker of water, as shown in the model.



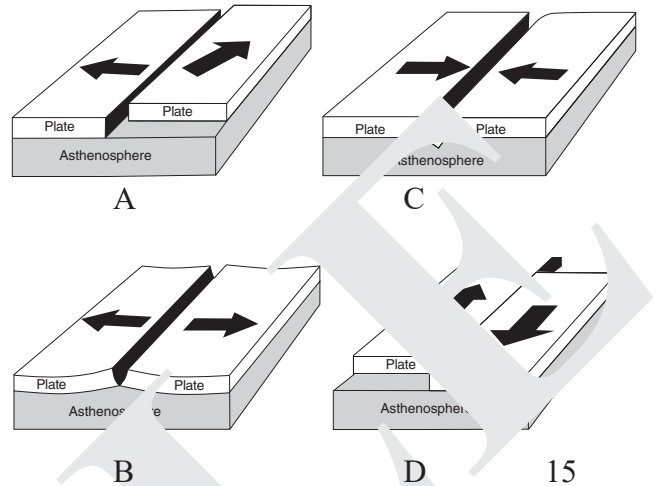
What is the best explanation for this phenomenon?

- A The water is warmer than the air.
B Light is absorbed faster in water than in air.
C Light is reflected at the air-water interface.
D Light is refracted as it crosses the air-water boundary. 1 _____
2. Which object is closest to Earth?
A the Sun C the Moon
B Venus D Mars 2 _____
3. Which sequence correctly lists the relative sizes from smallest to largest?
A our solar system, universe, Milky Way Galaxy
B our solar system, Milky Way Galaxy, universe
C Milky Way Galaxy, our solar system, universe
D Milky Way Galaxy, universe, our solar system 3 _____
4. Which type of electromagnetic energy has the shortest wavelength? (See page 57)
A infrared radiation
B radio wave radiation
C ultraviolet radiation
D x-ray radiation 4 _____

5. Scientists can plan to photograph a solar eclipse because most astronomical events are
A cyclic and predictable
B cyclic and unpredictable
C random and predictable
D random and unpredictable 5 _____
6. As viewed from Earth, most stars appear to move across the sky each night because
A Earth revolves around the Sun
B Earth rotates on its axis
C stars orbit around Earth
D stars revolve around the center of the galaxy 6 _____
7. Which event is caused by Earth's revolution?
A day and night
B prevailing winds
C seasons
D change of the Earth's tilt 7 _____
8. Why is evidence of asteroids striking Earth so difficult to find?
A Asteroids are made mostly of frozen water and gases and are vaporized on impact.
B Asteroids are not large enough to leave impact craters.
C Asteroids do not travel fast enough to create impact craters.
D Weathering, erosion, and deposition on Earth have destroyed or buried most impact craters. 8 _____

9. Which object forms by the contraction of a large sphere of gases causing a nuclear reaction?
 A comet C star
 B planet D moon 9 _____
10. Most sunlight striking a smooth, light-colored, solid surface is
 A refracted C reflected
 B transmitted D absorbed 10 _____
11. Which process requires water to gain thermal energy from the environment?
 A evaporation C runoff
 B condensation D precipitation 11 _____
12. Active volcanoes are most abundant along the
 A edges of tectonic plates
 B eastern coastline of the United States
 C 23.5° N and 23.5° S parallels of latitude
 D equatorial ocean floor 12 _____
13. Which two factors cause the direct rays of the Sun to move between 23.5° N and 23.5° S?
 A tilt of Earth's axis and Earth's revolution
 B tilt of Earth's axis and Earth's rotation
 C eccentricity of Earth's orbit and Earth's revolution
 D eccentricity of Earth's orbit and Earth's rotation 13 _____
14. Where has the process of nuclear fusion been occurring for over four billion years?
 A in Earth's inner core
 B on the surface of the Moon
 C at crustal plate boundaries
 D in the Sun's interior 14 _____

15. Which block model best represents the relative direction of plate motion at a divergent plate boundary?



16. The spinning of Earth on its axis causes the apparent rising and setting of the
 A Sun, only
 B Sun and the Moon, only
 C Moon and some stars, only
 D Sun, the Moon, and some stars 16 _____
17. Which factor has the greatest influence on the number of daylight hours that a particular Earth surface location receives?
 A longitude
 B latitude
 C diameter of Earth
 D distance from the Sun 17 _____
18. Energy is transferred by our Sun to Earth mainly by
 A convection
 B density currents
 C conduction
 D electromagnetic waves 18 _____

Test Your Knowledge exams consist of over 40 questions.

TEST 1

Base your answers to questions 1 through 6 on the information below and on your knowledge of science.

The Extinction of the Passenger Pigeon

In the early 1800s, the passenger pigeon was the most abundant bird species in North America. These pigeons traveled in flocks sometimes larger than a billion birds. The enormous flock sizes helped protect them from predation by foxes, lynx, owls, and falcons. It also helped them outcompete other animals (squirrels, chipmunks) for chestnuts and acorns, their main food source. Unfortunately, this flocking behavior made the passenger pigeons easy targets for the people who killed them for food. The invention of the telegraph to broadcast flock locations to hunters had devastating results. By the 1890s, their numbers had dwindled dramatically, with flocks only numbering in the hundreds. In 1914, the passenger pigeon became extinct when the last member of the species died at the Cincinnati Zoo.

1. In a predator-prey relationship, the predator usually wins by consuming a meal. The passenger pigeon was the prey for foxes, lynx, owls, and falcons. Explain how the size of their flock was a beneficial factor protecting them from these predators.

2. Competition for resources is always ongoing in nature. As the size of the flock diminished, they were outcompeted for resources. Identify two resources that the passenger pigeon and squirrels competed for.
1) _____ 2) _____
3. Which factor contributed least to the extinction of the passenger pigeon species?
A improved firearms that extended their shooting range
B laws that banned the hunting of passenger pigeons to sell
C expansion of the railroads, which opened up new markets for selling pigeons
D the invention of the telegraph 3 _____
4. A direct result of the rapid decline of the passenger pigeon population was most likely
A an increase in resources for chipmunks C a decrease in the squirrel population
B a decrease in resources for chipmunks D an increase in the owl and falcon populations 4 _____
5. The extinction of the passenger pigeon illustrates that
A humans are the only cause of species extinctions
B human activities can irreversibly affect ecosystems
C new and better adapted species always evolves from extinction
D it takes hundreds of years for a species extinction 5 _____
6. The transmission of a message via telegraph on the location of the passenger pigeon was sent by analog signals. Today most transmission are done by digital signals. Give one evidence why digital signals are now preferred over analog signals.

Base your answers to questions 7 through 12 on the information below and on your knowledge of science.

Plants Clean Up Mining Wastes

The mining of certain metal ores, such as copper and lead, can result in the contamination of soils. Wastes from the mining process can be toxic to plants and animals in the area. It has been discovered that some non-native species of grass are able to grow in these contaminated areas. These grass plants can actually remove some of the toxic wastes from the soil by accumulate them in their tissues. Growing these resistant grass plants in contaminated soil, then harvesting them to remove the toxic wastes from the environment, has been suggested as a possible way to clean up these areas.

7. Identify one positive and one negative outcome of mining metal ores.

Positive outcome - _____

Negative outcome - _____

8. Explain why importing the non-native grass to clean up mining toxic wastes in areas where that grass does not normally grow could lead to unexpected environmental problems.

9. The extraction of an ore and the separating process to obtain the metal takes much energy. To reduce the amount of fossil fuel used to produce this energy it has been suggested to use alternative renewable energy sources. Identify two such energy sources. 1) _____ 2) _____

10. Humans are able to positively or negatively affect the environment where they operate mines. Which statement accurately describes one possible positive effect.

- A the burning of fossil fuels to generate the needed energy
- B the draining of a swamp to mine the ore below it
- C the mining industry providing many jobs that helps the economy to grow
- D the control release of slightly toxic substance into a wetland

10 _____

11. After five years of operation, the mine has petitioned the local government to double its operational size. If approved, environmentalists are concern that it will affect the biodiversity of the existing ecosystem in this area. A serious threat to biodiversity is

- A maintenance of food chains
- B habitat destruction
- C competition of a species population in different ecosystems
- D a stable population size

11 _____

12. Explain why ore is considered to be a nonrenewable resource.

_____ *Test 1 and Test 2 consist of over 50 questions each.* _____
