Name:
Class:
Date:

Question #1

Which of these cell structures converts nutrients to energy for cell functions?

A cell membrane

B chloroplasts

C mitochondria

D endoplasmic reticulum

Question #2

Students want to gather evidence for the claim that *the number of atoms present before a chemical reaction is equal to the number of atoms present after the chemical reaction.* They decide to react vinegar and baking soda in a sealed plastic bag. *Which of the following would provide the evidence the students need for their claim?*

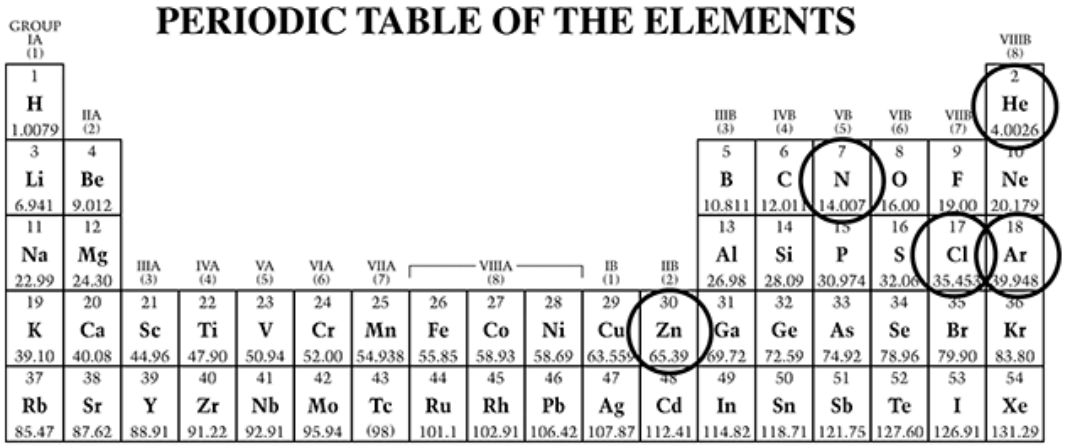
A The mass of the plastic bag, baking soda, and vinegar before the reaction was equal to the mass after the reaction.

B Bubbles were produced during the reaction which meant that a gas was being produced.

C The plastic bag did not change in any way, indicating that it was not involved in the reaction.

D The mass of the baking soda was equal to the mass of the vinegar used to create the chemical reaction.

Question #3



Element	Symbol
Argon	Ar
Chlorine	Cl
Helium	He
Nitrogen	N
Zinc	Zn

Based on its location on the partial periodic table shown above, which element would you predict has chemical properties that are most similar to argon (Ar)?

A Chlorine (Cl)

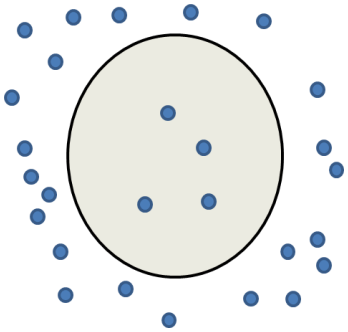
B Helium (He)

C Nitrogen (N)

D Zinc (Zn)

Question #4

Molecules move in and out of a cell by diffusion. The picture shows a cell and molecules both inside and outside the cell.



The blue dots represent molecules.

The gray circle outlined in black represents the cell.

How will the molecules in this illustration move as a result of diffusion?

A	out of the cell
B	into the cell
C	the molecules will disappear
D	none of the answer choices are correct

Coral Reproduction: A Range of Strategies to Ensure Long-Term Survival

1 **Most organisms reproduce either sexually or asexually. However, some organisms employ numerous reproductive strategies. Among these organisms are corals, tiny creatures that are the foundation of the ocean's coral reefs. Reefs are made up of many individuals called polyps. Large collections of polyps form what is known as a colony.**

Sexual Reproduction: Broadcast Spawning

2 **Roughly 75 percent of all stony coral species reproduce sexually through broadcast spawning. This method allows new colonies to be established that are genetically different from either parent colony. Male and female corals cannot move out of place to make reproductive contact as can fish, crabs, and other marine animals. Broadcast spawning allows them to overcome this hurdle to sexual reproduction.**

3 **Broadcast spawning events can occur one or several times each year. During broadcast spawning, corals found in many reefs and colonies release huge numbers of female and male gametes (eggs and sperm) into the water at precisely the same time, usually at sunset. Once the gametes are released, they float toward the surface of the water. If a male and a female gamete join together, a larva is produced called a planula. If a planula survives to settle and mature into a single coral polyp, it can start a new colony. Each polyp is genetically different from both its parents. Fifty percent of their genes come from one parent, while fifty percent of their genes come from the other parent.**

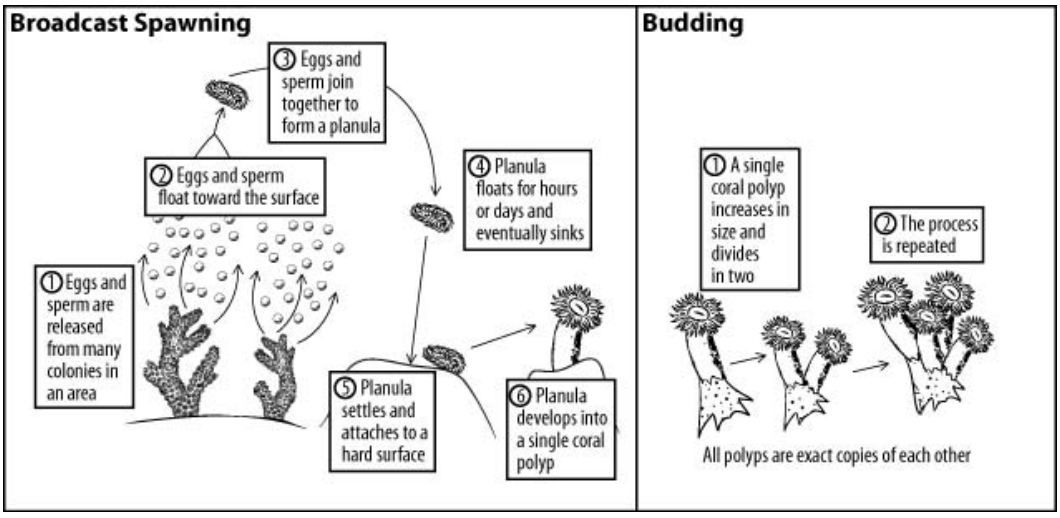
4 **Broadcast spawning has both disadvantages and advantages. Perhaps the biggest disadvantage is that the chances that an individual egg and sperm will eventually form an entirely new coral colony are very low. Many gametes never fuse together to form a planula. Ocean predators consume many of the larvae before they find a suitable place to settle, attach to a solid surface, and mature. Finally, there is no guarantee that a planula will find a suitable place to establish a new colony.**

5 **Producing gametes requires energy. This helps explain why broadcast spawning occurs in colonies that are well established. Such colonies can devote the energy required for broadcast spawning, which also has important advantages. The successful formation of a new colony that is meters or even kilometers away from the parent colonies enhances the genetic diversity of coral reefs and helps increase their numbers. The fact that corals in different colonies have different genes also increases the overall chances that corals as a species survive. One colony may not have a genetic makeup that allows them to adapt to an environmental change. However, another colony with different genes might.**

Asexual Reproduction: Budding

6 **As a result of broadcast spawning, there may be a solitary polyp attached to a hard surface. Coral reef colonies, however, consist of many polyps. Therefore, this single polyp must find a way to increase its numbers. A form of asexual reproduction known as budding is used to establish new colonies and increase the size of existing ones. Once a polyp reaches a certain size, it simply divides into two, producing a pair of identical polyps. This process is repeated many times. All of the polyps produced are exact genetic copies of the original polyp. Regardless of how many polyps eventually make up a colony, they all have the exact same genes. In other words, 100% of the genetic information is passed from each parent polyp to its offspring.**

7 **Budding has several advantages that make it an ideal strategy for increasing polyp numbers and establishing a new colony. The process is efficient, since successful reproduction does not require both male and female gametes. None of the energy used during reproduction is wasted; all of it is used to create additional colony members. Members of a newly formed colony may eventually reproduce sexually through either broadcast spawning or another method called brooding.**



Other Reproductive Strategies

8 **Stony corals that do not broadcast spawn reproduce sexually by brooding. In brooding, only male gametes are released into the water. If a male gamete encounters a female coral polyp with egg cells, the male gamete is taken in, and it fertilizes the egg inside the female coral. Later, an almost-fully mature planula is released into the water.**

9 **Fragmentation, like budding, is another way that corals can reproduce asexually. A portion of a coral colony may break off during a storm or boat-grounding. The individual corals that have broken off can start new colonies that are genetically identical to the parent colony.**

Question #5

Describe an advantage and a disadvantage of sexual reproduction. Then describe an advantage and a disadvantage of asexual reproduction. Cite evidence from the text to support each point included in your response.

Sickle Cell Disease

1 **Sickle cell disease is the most common inherited blood disorder in the United States. It affects about 80,000 Americans. In the United States, African Americans are most frequently affected by sickle cell disease. About one in 12 African Americans and about one in 100 Hispanic Americans carry the sickle cell trait.**

What Causes Sickle Cell Disease?

2 **Sickle cell disease is caused by a mutation in the hemoglobin-Beta gene. This gene is responsible for the creation of a protein called beta-globin. Beta-globin is part of a larger protein called hemoglobin that is found in red blood cells. Figure 1 shows how a single gene mutation causes a significant change to the beta-globin protein units that form the structure of hemoglobin.**

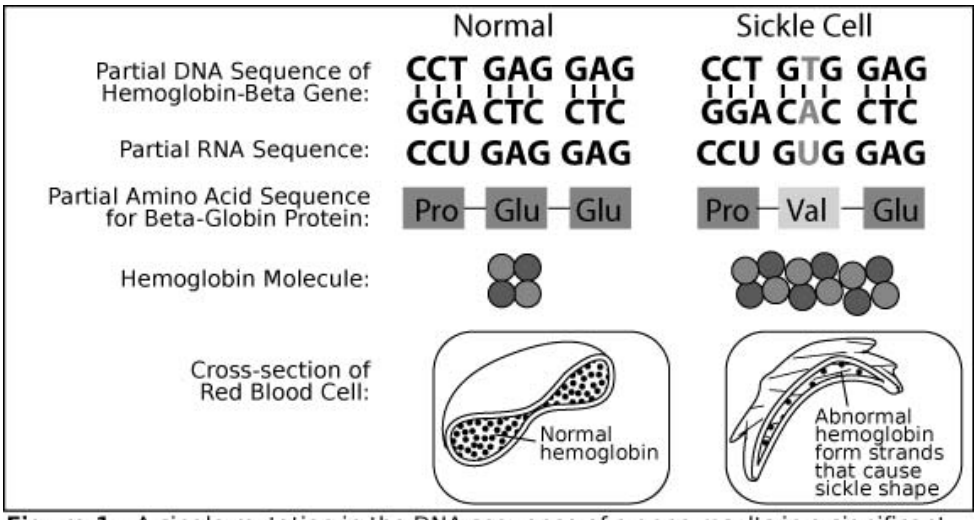


Figure 1 - A single mutation in the DNA sequence of a gene results in a significant change in the shape of the red blood cell.

3 **Normally, A is the fifth letter in the DNA sequence for this part of the hemoglobin-Beta gene. See the top line of letters in figure 1. This coding normally specifies the amino acid glutamic acid (Glu) in that place in the beta-globin protein. If the A changes to a T, the new amino acid specified in that place is valine (Val). This change in the beta-globin protein leads to an abnormally long hemoglobin molecule.**

4 **In people with sickle cell disease, abnormal hemoglobin molecules—hemoglobin S—stick to one another. They form long, rod-like structures. These structures cause red blood cells to become stiff. They assume a sickle shape. Red blood cells with normal hemoglobin (hemoglobin-A) are smooth and round. They easily glide through blood vessels. The sickle shape causes the red blood cells with abnormal hemoglobin to pile up.**

Effects of Sickle Cell Disease

5 **Sickle cells are destroyed rapidly in the bodies of people with the disease. This causes anemia, a shortage of healthy red blood cells. Anemia can produce symptoms such as pale skin, weakness, and headaches. Severe cases of anemia can lead to heart attacks. This anemia is what gives the disease its commonly known name—sickle cell anemia.**

6 **Sickle cells that pile up can cause blockages and damage vital organs and tissue. Sickle cells can result in lung tissue damage that causes a condition called acute chest syndrome. These abnormal cells also damage the spleen, kidneys, and liver. Damage to the spleen makes patients—especially young children—easily overwhelmed by bacterial infections.**

Inheritance of Sickle Cell Disease

7

A baby born with sickle cell disease inherits the mutated hemoglobin-Beta gene for the disorder from both parents. When both parents have the genetic defect, there is a 25 percent chance that each child will be born with sickle cell disease.

8 **If a child inherits only one copy of the defective gene (from either parent), there is a 50 percent chance that the child will carry the sickle cell trait. People who only carry the sickle cell trait typically don't get the disease. However, they can pass the defective gene on to their children.**

Diagnosing Sickle Cell Disease

9 **Doctors diagnose sickle cell disease through a blood test that checks for hemoglobin S—the defective form of hemoglobin. To confirm the diagnosis, a blood sample is examined under a microscope to check for large numbers of sickled red blood cells. In more than 40 states, testing for the defective protein that causes people to develop sickle cell disease is routinely performed on newborns.**

Gene Therapy: Hope for a Cure

10 **Researchers are experimenting with attempts to cure sickle cell disease using gene therapy. They correct the defective gene and then insert it into the bone marrow of those with sickle cell disease. This, they hope, will prompt the body to produce normal hemoglobin. Recent experiments show promise. In December 2001, scientists at Harvard Medical School and MIT announced that they had corrected sickle cell disease in mice using gene therapy.**

11 **Researchers bioengineered mice so that their genetic material contained the defective human hemoglobin-Beta gene that causes sickle cell disease. Bone marrow containing the gene was removed from some of the mice and genetically "corrected." This was done by adding a copy of the human hemoglobin-Beta gene that researchers altered. This altered gene inhibits the production of abnormal hemoglobin that causes cells to assume a sickle shape.**

12 **Then, researchers removed the bone marrow from some of the other bioengineered mice. The "corrected" marrow was transplanted into these mice. The mice with sickle cell disease began producing high levels of normal red blood cells. They also showed a large reduction in sickle cells. Scientists are hopeful that this technique could also be used to help people with sickle cell disease.**

Question #6

According to figure 1, what amino acid is found in this part of the beta-globin protein in hemoglobin-S but NOT in the same part of beta-globin protein in normal hemoglobin?

A Pro

B Val

C GAG

D GUG

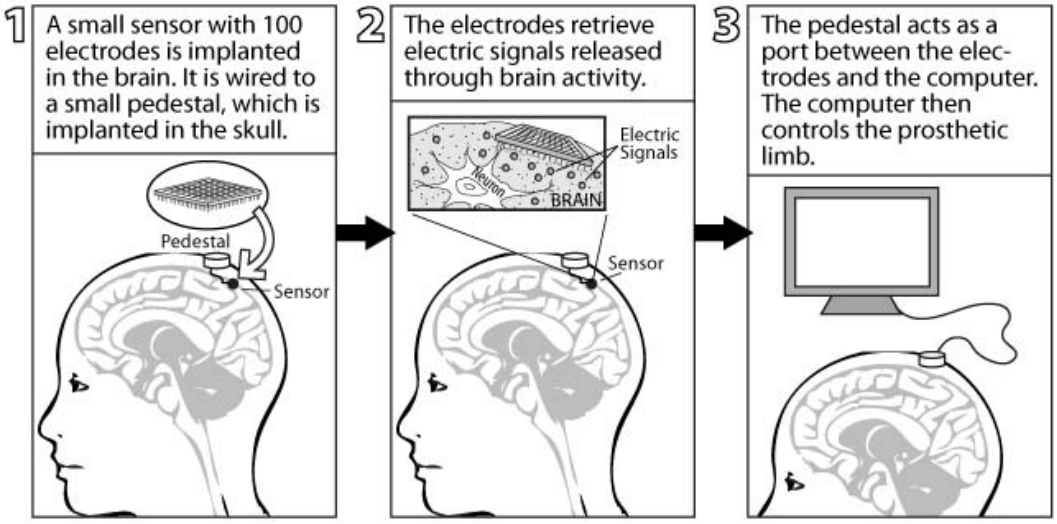
Prosthetics of Future Will Mesh Body, Mind, and Machine

This text is adapted from an October 26, 2005, article from the Veterans Health Administration's Research Development website.

1 **In the 1970's, a television show called *The Six Million Dollar Man* featured a test pilot who suffered horrific injuries in a crash. He was then "rebuilt" with bionic parts. He became a superman who could lift cars and leap 40 feet in the air.**

2 **The science of prosthetics actually hopes to restore independence and mobility to those who have lost their limbs. Prosthetic devices[1] enable them to do everyday things most of us take for granted such as walking, running, enjoying hobbies, using a pen or fork, or holding a child. But the technology emerging in labs today is no less dramatic than that of a television show.**

3 **For example, Dr. John Donoghue has developed a system called BrainGate. BrainGate decodes brain waves and translates them into computer commands. Early results show that a quadriplegic can switch on lights and open email using only his mind. The system uses a tiny sensor implanted in the part of the brain that controls movement. A person can simply think about moving his computerized artificial arm, and the thought triggers the device to act.**



4 **The system still relies on wires hooked to the brain. However, scientists are working to eventually have a wireless system. Dr. Richard Normann designed the chip that Dr. Donoghue uses for BrainGate. He is working to refine the chip and explore further uses for it. "To go from a bundle of wires sticking out of somebody's head to a system that is invisible will be a major advance in this technology," he says.**

Biohybrid Limbs

5 **Dr. Hugh Herr, director of the "Leg Lab" at MIT, is working closely with other researchers. Herr was a champion rock climber who lost both feet due to frostbite and went on to become a top prosthetics engineer. His lab studies how humans walk. From these observations, they design "smart" knees and ankles that mimic real joints.**

6 **"These systems have to know how to walk," says Herr. His latest knee-ankle prototype has sensors that measure force, position, and movement and feed the data to an onboard microprocessor. The knee has an electromagnet and a fluid that changes in milliseconds from an oil to a near-solid. The ankle may use materials that turn electrical energy into mechanical force. These materials can act as an artificial muscle.**

7 **Herr envisions that in the future, "Artificial joints will be able to move like biological joints."**

Two-Way Talk Between Brain and Artificial Limb

8 **Herr's model also uses BIONS™, short for bionic neurons. These microchips will be injected into the leg muscles that remain. These chips will pick up movement signals from the brain and send them to the artificial limb. Says Herr, "We need to have the amputee's brain control the artificial knee, to tell the knee that they intend to turn left or right, or that there are stairs up ahead."**

9 **BION technology also figures in an artificial hand invented in the lab of Dr. Richard Weir. Sensors placed in existing arm muscles will pick up brain signals. An external controller will use "fuzzy logic" to translate the signals into commands for the hand. Fuzzy logic is the algebraic decision-making of artificial intelligence.**

10 **"We expect that for the first time in prosthetics history we will have enough control sites to be able to control a wrist, a thumb, and possibly even individual fingers on a hand," said Weir.**

[1]*prosthetic devices*: artificial devices that replace missing body parts

Question #7

The following question has two parts. First, answer Part A. Then, answer Part B.

Part A:

What is a required function of an artificial muscle, according to the text?

A to conduct signals to the brain from the different body parts

B to translate signals from the brain into commands for the body

C to change electrical energy into a mechanical force

D to transmit electrical energy from neurons to the brain

Question #8

Part B:

Which paragraph from the text BEST supports this basic characteristic?

A paragraph 3

B paragraph 6

C paragraph 8

D paragraph 9

Question #9

What is one way that meiosis is different from mitosis?

A In meiosis there is variation in the cells produced, in mitosis an exact copy of the cell is created.

B In meiosis there is variation in the cells produced, in mitosis an exact copy of the cell is created.

C Meiosis occurs in all cells, mitosis occurs only in sex cells.

D Meiosis produces 46 chromosomes, mitosis produces 23 chromosomes.

Question #10

A mutation changes the function of cells that produce sweat and mucous. The mutation causes the sweat and mucous to be thicker than normal. How can this change in cell function affect the whole organism?

A Organisms work together to form a cell, so a change in cell function is evidence of a change in the whole organism's function.

B Organisms contain tissues that are made of organs that are made of cells, so a change in the function of a cell can change how the organism functions.

C Cells and organs work together to carry out the organism's function, so a change in cell function affects the function of the entire organism.

D Organs are made of tissues that are made of cells, so a change in how cells function affects how organs function.

Question #11

Which of the following describes meiosis?

A Makes new sex cells, creates 2 daughter cells each with 23 chromosomes

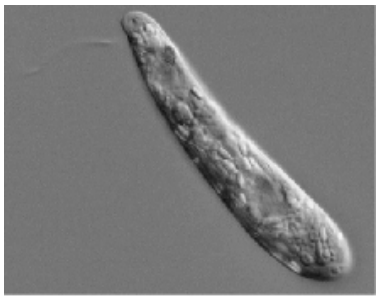
B Makes new sex cells, creates 4 daughter cells each with 23 chromosomes

C Makes new body cells, creates 2 daughter cells each with 46 chromosomes

D Makes new body cells, creates 4 daughter cells each with 46 chromosomes

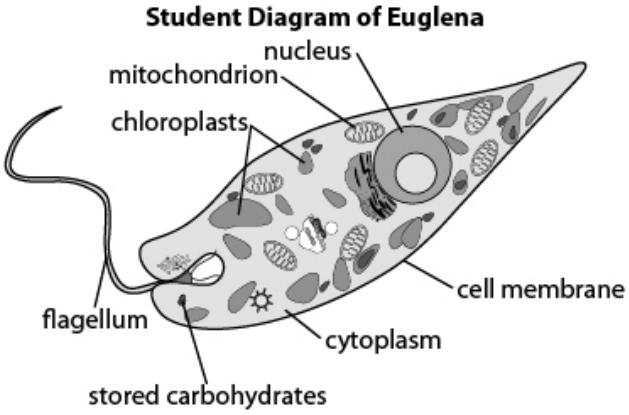
Observing Euglena in the Classroom

In science class, students used a microscope to observe objects in water. These objects were identified as "euglena." Their observations through the microscope appeared as follows:



The students switched on a bright light aimed at the euglena, and saw that the euglena moved toward the light.

The students made a large number of observations and, with the help of their teacher, interpreted what they saw. They used this information to make a model of the euglena in the form of a diagram. This is the diagram the students produced:



Question #12

The students are planning to write labels for their diagram, explaining how each part contributes to the function of the euglena. Which label would be most appropriate for the chloroplast?

A "This structure helps the euglena obtain minerals from its environment so that it can perform life functions."

B "This structure helps the euglena remove food wastes from the cell after their nutrition has been used for life processes."

C "This structure helps the euglena use up energy it has stored in the process of building new cell parts and growing."

D "This structure helps the euglena obtain energy from its environment so that it can perform life functions."

Question #13

Which plant cell structures capture sunlight to produce sugars?

A vacuoles

B ribosomes

C mitochondria

D chloroplasts

Question #14

The basic units of structure and function for both plants and animals are

A cells.

B organs.

C systems.

D tissues.

Question #15

Which of the following is found in a eukaryotic cell but *not* in a prokaryotic cell?

A DNA

B cytoplasm

C a nucleus

D a cell membrane

Question #16

Elements in the periodic table of the elements are organized into columns and rows.

Periodic Table of the Elements (partial section)

13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
					2 He
5 B	6 C	7 N	8 O	9 F	10 Ne
13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr

The columns are organized to show the

A similarities of the reactivity in groups.

B number of neutrons in a column.

C sum of atomic weights per column.

D amount of radioactivity in each group.

Question #17

The majority of the elements found on the periodic table of the elements are

A gases.

B metals.

C liquids.

D nonmetals.

Question #18

Which set of chemical symbols correctly represents the elements listed?

A

Element	Symbol
Chlorine	C
Cobalt	Cl
Chromium	Co
Carbon	Cr

B

Element	Symbol
Chlorine	Co
Cobalt	Cl
Chromium	C
Carbon	Ca

C

Element	Symbol
Chlorine	Cl
Cobalt	Co
Chromium	Cr
Carbon	C

D

Element	Symbol
Chlorine	Cr
Cobalt	Ca
Chromium	Co
Carbon	Cs

Question #19

Organisms that reproduce asexually generally have offspring that are

A unicellular.

B multicellular.

C genetically varied.

D genetically identical.

Question #20

Which form of energy do plants need to capture in order to perform photosynthesis?

A heat

B solar

C chemical

D electrical

Question #21

In the nitrogen cycle, where is nitrogen found as an element?

A in plants

B in rocks

C in the air

D in animals

Question #22

What should students use to identify the percent chance of a trait being passed down from a parent to its offspring?

A a graph

B a flow chart

C a data table

D a Punnett square

Question #23

Select the answer from the menu.

The order of the elements in the periodic table is determined by their

[ ] .

- abundance in nature
- number of protons
- number of isotopes
- atomic mass

Question #24

Animals give off carbon dioxide that plants take in through leaves. What do plants give off as a result of photosynthesis that animals need to breathe?

A heat

B oxygen

C protein

D water

Question #25

Miranda learned how the human body carries out life functions. Which is the *most* basic level of organization in the human body?

A an organ

B a system

C a tissue

D a cell

Question #26

An atom with a +1 charge has

A lost a proton.

B lost an electron.

C gained a proton.

D gained an electron.

Question #27

Which of these is the fundamental unit of life?

A system

B organ

C tissue

D cell

Question #28

Which of these is the chemical symbol for magnesium?

A Ma

B Mg

C Mn

D Mu

Question #29

Which of the following structures enables fish to remain at a certain depth without expending energy through swimming?

A swim bladder

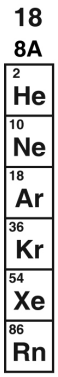
B lateral line

C dorsal fin

D gill slits

Question #30

The elements from group 18 (8A) on the periodic table are shown.



What do the elements in group 18 (8A) have in common?

A All form ions.

B All are nonreactive.

C All have two valence electrons.

D All are solids at room temperature.

Answer	Standard	Type
C	7.LS1.1	Multiple Choice
A	7.PS1.4	Multiple Choice
B	7.PS1.5	Multiple Choice
B	7.LS1.2	Multiple Choice
N/A	7.LS1.7	Essay
B	7.LS3.1	Multiple Choice
C	7.LS1.5	Multiple Choice
B	7.LS1.5	Multiple Choice
A	7.LS3.2	Multiple Choice
D	7.LS1.4	Multiple Choice
B	7.LS3.2	Multiple Choice
D	7.LS1.1	Multiple Choice
D	7.LS1.1	Multiple Choice
A	7.LS1.3	Multiple Choice
C	7.LS1.3	Multiple Choice
A	7.PS1.5	Multiple Choice
B	7.PS1.5	Multiple Choice
C	7.PS1.5	Multiple Choice
D	7.LS1.7	Multiple Choice
B	7.LS1.9	Multiple Choice
C	7.ESS3.1	Multiple Choice
D	7.LS3.3	Multiple Choice
N/A	7.PS1.1	TEI
B	7.LS1.9	Multiple Choice
D	7.LS1.4	Multiple Choice
B	7.PS1.1	Multiple Choice
D	7.LS1.3	Multiple Choice
B	7.PS1.5	Multiple Choice
A	7.LS1.6	Multiple Choice
B	7.PS1.5	Multiple Choice