

SUMMER LEARNING PACKET
FOR
JUNIORS (SUMMER -2012)

SCIENCE/ PHYSICS

- SCIENTIFIC METHOD
- CELL CYCLE AND MITOSIS
- PRACTICE ACT SCIENCE TEST
- PRACTICE EARTH SCIENCE TEST

Sample Questions from Earth Science, Life Science, Physics, Chemistry, and The Environment

Earth Science

1. The source of energy for the Earth's water cycle is the

- A. wind
- B. sun's radiation
- C. Earth's radiation
- D. sun's gravity

2. Which BEST describes the surface of the Earth over billions of years?

- A. A flat surface is gradually pushed up into higher and higher mountains until the Earth is covered with mountains.
- B. High mountains gradually wear down until most of the Earth is at sea level.
- C. High mountains gradually wear down as new mountains are continuously being formed.
- D. High mountains and flat plains stay side by side for billions of years with little change.

3. Fossil fuels were formed from

- A. uranium
- B. sea water
- C. sand and gravel
- D. dead plants and animals

4. Air is made up of many gases. Which gas is found in the greatest amount?

- A. Nitrogen
- B. Oxygen
- C. Carbon dioxide
- D. Hydrogen

5. The sun is bigger than the moon, but they appear to be about the same size when you look at them from the Earth. Why is this?

6. Jane and Mario were discussing what it might be like to live on other planets. Their science teacher gave those data about the Earth and an imaginary planet, Athena. The table shows these data.

	EARTH	ATHENA
Atmospheric Conditions	21% oxygen	10% oxygen
	0.03% carbon dioxide	80% carbon dioxide
	78% nitrogen	5% nitrogen
	ozone layer	no ozone layer
Distance from a star like the sun	148,640,000 km	103,600,000 km
Rotation on axis	1 day	200 days
Revolution around the sun	365 1/4 days	200 days

Write down one important reason why it would be difficult for humans to live on Athena if it existed.

7. Which statement explains why daylight and darkness occur on Earth?

- A. The Earth rotates on its axis.
- B. The sun rotates on its axis.
- C. The Earth's axis is tilted.
- D. The Earth revolves around the sun.

8. How long does it take light from the nearest star other than the sun to reach the Earth?

- A. Less than 1 second
- B. About 1 hour
- C. About 1 month
- D. About 4 years

9. Write down one reason why the ozone layer is important for all living things on Earth.

1. What is the BEST reason for including fruits and leafy vegetables in a healthy diet?

- A. They have high water content.
- B. They are the best source of protein.
- C. They are rich in minerals and vitamins.
- D. They are the best source of carbohydrates.

2. What features do all insects have?

	Number of Legs	Number of Body Parts
A.	2	4
B.	4	2
C.	6	3
D.	8	3

3. When you bend your arm at the elbow, the bones and muscles in your arm are acting as a system. What simple machine does this system represent?

- A. Inclined plane
- B. Pulley
- C. Wedge
- D. Lever

4. AMOUNT OF OXYGEN PRODUCED IN A POND

Location	Oxygen Produced
Top Meter	4 grams/cubic meter
Second Meter	3 grams/cubic meter
Third Meter	1 gram/cubic meter
Bottom Meter	0 grams/cubic meter

Which statement is consistent with the data in the table?

- A. More oxygen production occurs near the surface because there is more light there.
- B. More oxygen production occurs near the bottom because there are more plants there.

- C. The greater the water pressure, the more oxygen production occurs.
- D. The rate of oxygen productions not related to depth.

5. Which species have been on the Earth for the shortest amount of time?

- A. Humans
- B. Insects
- C. Fish
- D. Reptiles

6. How are warm-blooded animals different from cold-blooded animals?

- A. Warm-blooded animals have a higher metabolism in warm weather.
- B. Warm-blooded animals are more aggressive in captivity.
- C. Warm-blooded animals always have a higher blood temperature.
- D. Warm-blooded animals normally maintain a fairly constant internal temperature at all air temperatures.
- E. Warm-blooded animals are found only in warm climates.

7. How could you find out how old a tree is after it is cut?

8. The male insects in a population are treated to prevent sperm production. Would this reduce the insect population?

- A. No, because the insects would still mate.
- B. No, because it would not change the offspring mutation rate.
- C. Yes, because it would sharply decrease the reproduction rate.
- D. Yes, because the males would die.

9. Which is made with the help of bacteria?

- A. Yogurt
- B. Cream
- C. Soap
- D. Cooking oil

10. What is the main function of chloroplasts in a plant cell?

- A. To absorb light energy and manufacture food.
- B. To remove waste materials by active transport.
- C. To manufacture chemical energy from food.
- D. To control the shape of a cell.

11. Which BEST explains why green marine algae are most often restricted to the top 100 meters of the ocean?

- A. They have no roots to anchor them to the ocean floor.
- B. They can live only where there is light.
- C. The pressure is too great for them to survive below 100 meters.
- D. If the algae lived below 100 meters they would be eaten by animals.

12. A girl found the skull of an animal. She did not know what the animal was but she was sure that it preyed on other animals for its food. What clues led to this conclusion?

- A. The eye sockets faced sideways.
- B. The skull was much longer than it was wide.
- C. There was a projecting ridge along the top of the skull.
- D. Four of the teeth were long and pointed.
- E. The jaws could move sideways as well as up and down.

13. When a bird sings it is most likely singing in order to

- A. frighten away other types of birds
- B. mark the bird's territory against another type of bird
- C. attract insects
- D. wake up other animals

14. On cold days, snakes usually lie very still and eat very little or nothing, while birds usually move around and eat a lot of food. Which statement best explains this?

- A. Both animals are cold-blooded, but without feathers to keep warm, snakes get too cold to move.
- B. Unlike birds, snakes are warm-blooded; they must hibernate during cold weather.
- C. Unlike snakes, birds are cold-blooded; they are less affected by the cold than snakes.
- D. Unlike snakes, birds are warm-blooded; they must eat food to maintain a constant temperature.

15. Which of these meals would give you most of the nutrients that you need?

- A. Meat, milk, and a piece of chocolate
- B. Bread, vegetables, and fish
- C. Vegetables, fruit, and water
- D. Meat, fish, and bread

16. Years ago farmers found that corn plants grew better if decaying fish were buried near by. What did the decaying fish probably supply to the plants to improve their growth?

- A. energy
- B. minerals
- C. protein
- D. oxygen
- E. water

17. Which is the most basic unit of living things?

- A. Cells
- B. Bones
- C. Tissues
- D. Organs

18. Write down the reason why we get thirsty on a hot day and have to drink a lot.

19. Jose caught influenza. Write down one way he could have caught it.

20. What happens when an animal hibernates?

- A. There is no life in any of its parts.
- B. It stops breathing.
- C. Its temperature is higher than when it is active.
- D. It is absorbing energy for use when it is active.
- E. It is using less energy than when it is active.

21. What digestive substance is found in the mouth? What does it do?

22. What is the advantage of having two eyes to see with rather than one eye?

23. What could be the unwanted consequences of introducing a new species to a certain area? Give an example.

24. Suppose you want to investigate how the human heart rate changes with changes in activity. What materials would you use and what procedures would you follow?

Physics

1. A metal spoon, a wooden spoon, and a plastic spoon are placed in hot water. After 15 seconds, which spoon will feel the hottest?

- A. The metal spoon
- B. The wooden spoon
- C. The plastic spoon
- D. The three spoons will feel the same.

2. Which form of solar radiation causes sunburn?

- A. Visible
- B. Ultraviolet
- C. Infrared
- D. X-rays
- E. Radio waves

3. Air is colorless, odorless, and tasteless. Describe one way that air can be shown to exist.

4. Machine A and Machine B each used to clear a field. The table shows how large an area each cleared in 1 hour and how much gasoline each used.

	Area of field cleared in 1 hour	Gasoline used in 1 hour
Machine A	2 hectares	3/4 liter
Machine B	1 hectare	1/2 liter

Which machine is more efficient in converting the energy in gasoline to work? Explain your answer.

5. The crews of two boats at sea can communicate with each other by shouting. Why is it impossible for the crews of two space ships a similar distance apart in space to do this?

- A. The sound is reflected, ore in space.
- B. The pressure is too high inside the spaceships.
- C. The spaceships are traveling faster than sounds.
- D. There is no air in space for sound to travel through.

6. A flashlight close to a wall produces a small circle of light compared to the circle it makes when the flashlight is far from the wall. Does more light reach the wall when the flashlight is further away?

Yes

No

(Check one)

Explain your answer

7. A tight metal lid on a jar of pickles may loosen when it has been held in hot water. This is because the hot water causes the

A. glass jar to contract

B. metal lid to contract

C. glass jar to expand more than the metal lid expands

D. metal lid to expand more than the glass jar expands

8. A glass of water with ice cubes in it has a mass of 300 grams. What will the mass be immediately after the ice has melted? Explain your answer.

9. When white light strikes on Peter's shirt, the shirt looks blue. Why does the shirt look blue?

A. It absorbs all the white light and turns most of it into blue light.

B. It reflects the blue part of the light and absorbs most of the rest.

C. It absorbs only the blue part of the light.

D. It gives off its own blue light.

10. Electric energy is used to power a lamp.

Is the amount of light energy produced more than, or less than, or the same as the amount of electrical energy used?

The amount of light energy produced is

more than

less than

the same as the amount of electrical energy used

(check one)

Give a reason to support your answer.

11. One day when the temperature was just below 0 degrees C, Peter and Ann made snowballs. They put a thermometer into one of the snowballs and it showed 0 degrees C. They try to make the snowball warmer by holding it in their hands. What do you think the thermometer showed after two minutes? Explain your answer.

Chemistry

1. The words *cloth*, *thread*, and *fiber* can be used in the following sentence: *cloth* consists of *threads* which are made of *fiber*. Use the words *molecules*, *atoms*, and *cells* to complete the following sentence:

_____ consists of _____ which are made of _____.

2. Which is an example of a chemical reaction?

- A. The melting of ice
 - B. The grinding of salt crystals to powder.
 - C. The burning of wood.
 - D. The evaporation of water from a puddle.
-

3. Animals are made up of many atoms. What happens to the atoms after an animal has died?

- A. The atoms stop moving.
 - B. The atoms recycle back into the environment.
 - C. The atoms split into simpler parts and then combine to form other atoms.
 - D. The atoms no longer exist once the animal has decomposed.
-

4. Which gas could cause a glowing splint to burst into flame?

- A. Neon
 - B. Oxygen
 - C. Nitrogen
 - D. Carbon dioxide
-

5. Which of the following is NOT a mixture?

- A. Air
- B. Blood
- C. Orange juice
- D. Salt

6. When oil is burning, the reaction will

- A. only release energy
- B. only absorb energy
- C. neither absorb nor release energy
- D. sometimes release and sometimes absorb energy depending on the oil

7. Which is a chemical change?

- A. Element 1 is hammered into a thin sheet.
- B. Element 2 is heated and turns to a liquid.
- C. Element 3 turns a greenish color as it sits in air.
- D. Element 4 is ground up into a fine, slippery powder.

8. If a neutral atom loses an electron, what is formed?

- A. A gas
- B. An ion
- C. An acid
- D. A molecule

9. A mixture of powdered iron and sulfur is heated. What will be formed?

- A. a single element
- B. two other elements
- C. a solution
- D. an alloy
- E. a compound

10. Which is NOT an example of a chemical change?

- A. Boiling water
- B. Rusting iron
- C. Burning wood
- D. Baking bread

11. Carbon dioxide is the active material in some fire extinguishers. How does carbon dioxide extinguish a fire?

12. It takes 10 painters 2 years to paint a steel bridge from one end to the other. The

paint that is used lasts about 2 years, so when the painters have finished painting at one end of the bridge, they go back to the other end and start painting again.

a. Why MUST steel bridges be painted?

b. A new paint that lasts 4 years has been developed and costs the same as the old paint. Describe 2 consequences of using the new paint.

Environment

1. Maria collected the gas given off by a glowing piece of charcoal. The gas was then bubbled through a small amount of colorless limewater. Part of Maria's report stated, "After the gas was put into the jar, the limewater gradually changed to a milky white color." This statement is

- A. an observation
- B. a conclusion
- C. a generalization
- D. an assumption of the investigation
- E. a hypothesis

2. Juanita did several experiments to germinate corn. She summed up her results as follows:

- 1. Moist grains of corn germinate in the light.
- 2. Moist grains of corn germinate in the dark.

What can you conclude from her results?

3. Write down one example of how computers help people do their work.

4. A cupful of water and a similar cupful of gasoline were placed on a table near a window on a hot sunny day. A few hours later it was observed that both the cups had less liquid in them but that there was less gasoline left than water. What does this experiment show?

- A. All liquids evaporate
- B. Gasoline gets hotter than water
- C. Some liquids evaporate faster than others.
- D. Liquids will only evaporate in sunshine.
- E. Water gets hotter than gasoline.

5. One of the principal causes of acid rain is

- A. waste acid from chemical factories being pumped into rivers
- B. acid from chemical laboratories being pumped into rivers
- C. gases from burning coal and oil dissolving in water in the atmosphere
- D. gases from air conditioners and refrigerators escaping into the atmosphere

6. Whenever scientists carefully measure any quantity many times, they expect that

- A. all of the measurements will be exactly the same
- B. only two of the measurements will be exactly the same
- C. all but one of the measurements will be exactly the same
- D. most of the measurements will be close, but not exactly the same

7. Since water is a renewable resource and so much of it falls each year, theoretically there should be enough water for everyone on Earth. Write down TWO reasons why not everyone has enough water.

SECTION 1 The Nature of Science *continued***Why Study Science?**

Scientific thinking is not just for people who make a living **working as scientists**. You can use the same **critical-thinking** process that scientists use as a tool in your everyday life.

An understanding of science can help you take better care of your health. For example, suppose you read an advertisement for a pill. The advertisement states that the pill can make you grow taller. Should you take the pill?

To think scientifically, you should be skeptical of the claim in the advertisement. You should learn more about the ingredients in the pill. You may learn that some of the ingredients in the pill can be harmful. By thinking scientifically, you can reduce the chances that you will take a pill that could make you sick.



Scientific thinking can help you decide whether the claims of a product are accurate.

Thinking like a scientist can also help you make good decisions about how to spend your money. For example, suppose you are looking for an acne medication. One type claims to be more effective than another, less expensive type. Before buying the more expensive medication, you should look for evidence that it is more effective than the less expensive type. By learning more about each product, you can decide which one will be best for you to purchase.

You can also use scientific thinking to improve the world around you. You may see a problem in your town, such as dangerous crosswalks or litter being left in parks. You can investigate these problems with skepticism and creativity to discover helpful solutions. By applying scientific thinking to these problems, you can help your whole community.

LOOKING CLOSER

5. Identify The student in the figure wants to decide whether or not to use the product in the bottle. What are two questions he could ask to help decide?

Critical Thinking

6. Infer It is especially important to be skeptical of claims made by people who are trying to sell you something. What do you think is the reason for this?

SECTION 1 The Nature of Science *continued*

Why Are Ethics Important in Science?

Science has many important effects on our everyday lives. For example, health scientists work to develop medicines, vaccines, and surgery methods. Agricultural scientists produce fertilizers and pesticides for our food crops. Scientists also work to provide people with better electrical power, computers, and automobiles. Because people depend so heavily on science, it is important for scientists to practice ethical behavior. ✓

READING CHECK

2. Explain Why is it important for scientists to behave ethically?

READING CHECK

3. Identify Relationships If one scientist reports false data, what may happen to other scientists?

Ethics are a system of moral principles and values. Scientists must behave ethically when they carry out investigations. This means they must allow other scientists to review their work. They must also report only correct and accurate data. All scientists depend upon the work of other scientists. If one scientist reports false data, other scientists may waste resources conducting investigations based on that unethical and incorrect work. ✓

Scientists must also obey laws and behave ethically when people or other organisms are involved in scientific investigations. For example, scientists may test new medications on people. A scientist carrying out such a study must follow ethical rules, such as those given below.

- The scientist must get a person's permission before involving the person in an investigation.
- The scientist must tell the person about all the risks of being involved in the investigation.
- The scientist must not try to force the person to participate in the investigation if the person does not want to. ✓

READING CHECK

4. Describe What must an ethical scientist do before involving a person in a scientific investigation?



When scientists carry out investigations, they must behave ethically.

Section 1 Review

SECTION VOCABULARY

skepticism a habit of mind in which a person questions the validity of accepted ideas

1. **Explain** Why is skepticism important in science?

2. **List** Describe four ways to practice scientific thought.

3. **Define** What is a universal law?

4. **List** Identify two universal laws.

5. **Identify** Give three examples of ethical scientific behavior.

6. **Apply Concepts** Think about some decisions you make every day. Give two examples of how you can use scientific thought to help you make good decisions.



Cell Cycle and Mitosis

THE CELL CYCLE

The **cell cycle**, or **cell-division cycle**, is the series of events that take place in a **eukaryotic cell** between its formation and the moment it replicates itself. These events can be divided in **two** main parts: **interphase** (*in between divisions* phase grouping **G₁ phase**, **S phase**, **G₂ phase**), during which the cell is forming and carries on with its normal metabolic functions; the **mitotic phase** (M mitosis), during which the cell is replicating itself. Thus, cell-division cycle is an essential process by which a single-cell fertilized egg develops into a mature organism and the process by which hair, skin, blood cells, and some internal organs are formed.

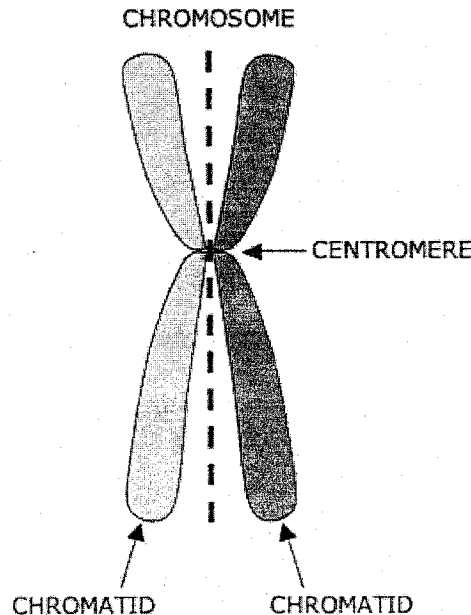
1. What is meant by the cell cycle or cell division cycle?
2. In what type of cells --- prokaryotes or eukaryotes --- does the cell cycle occur?
3. Name the 2 main PHASES of the cell cycle.
4. _____ is in between the times when a cell is dividing.
5. What is occurring in a cell during interphase?
6. What is occurring during the mitosis phase?
7. A fertilized cell develops into a _____ organism during the cell cycle.
8. Name three things that form during the cycle.

INTERPHASE

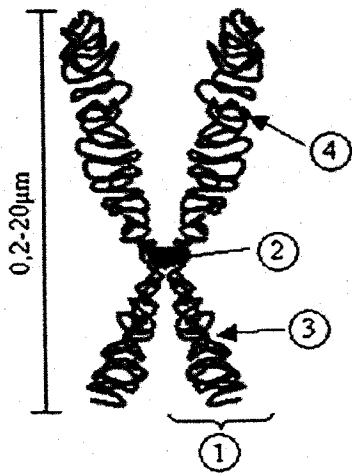
Interphase is a phase of the cell cycle, defined only by the absence of cell division. During interphase, the cell **obtains nutrients**, and **duplicates (copies) its chromatids** (genetic material). The genetic material or chromatids are located in **the nucleus** of the cell and are made of the **molecule DNA**.

9. What process **NEVER** occurs in interphase?
10. Cells obtain _____ and duplicate or copy their _____ or genetic material during interphase.
11. Where are chromatids found in a cell?
12. Chromatids are made of a molecule called _____.

Chromatids are connected by the **centromere** and have a **LONG AND SHORT ARM**.



Label the parts of the chromosome including the long and short arms.



1. _____
2. _____
3. _____
4. _____

Most eukaryotic cells spend most of their time in interphase. For example, human skin cells, which divide about once a day, spend roughly 22 hours in interphase. About 90 percent of cells are in interphase. Some cells, such as nerve cells, can stay in interphase for decades. There are 3 parts of interphase: **G₁** (growth 1 in which the cell creates organelles and begins metabolism), **S phase** (DNA synthesis in which the chromosomes of the cell are copied) and **G₂** (growth 2 in which the cell grows in preparation for cell division). **Find the cell cycle drawing** on this worksheet and **draw an additional line in red** around those parts of the cell cycle diagram that are included in interphase.

13. In what PHASE do most cells spend the majority of their lifetime?
14. How often do human skin cells divide each day?
15. How many hours per day is a human skin cell in interphase?
16. What type of cell may spend decades in interphase instead of dividing?
17. Name the 3 stages in interphase.
18. What does **G₁** stand for and what occurs in this stage?