Aii មជ្ឈមណ្ឌលភាសា អេ អាយ អាយ
Aii Language Center
A Mengly J. Quach Education School

Name_____ Date_____

QUIZ 2

Reading Explorer 5 Unit 10 Lesson A

DIRECTIONS: Choose the best answer for each question.

Cosmic Dawn

High in the Andes Mountains, an array[1] of telescopes larger than many cities reveals the secrets of the universe.

An Eye on the Heavens

[A] Telescopes have come a long way since the first ones were invented early in the 17th century. Traditional telescopes allow astronomers to view objects in space thanks to the visible light those objects emit or reflect. However, for modern telescopes, any electromagnetic radiation will suffice for the purpose of viewing objects in space. Extremely hot objects, such as stars, emit not only visible light but also high-energy gamma radiation. Specialized telescopes - such as NASA's space-based Chandra X-ray Observatory[2] - are built to detect such radiation. Cold objects - like comets and asteroids - emit low-energy radiation, which is invisible to the naked eye. Much of the universe is even colder than this. The clouds of dust and gas of which stars are made are only slightly warmer than absolute zero - the temperature at which atoms stop moving. To capture images of cold objects, astronomers use radio telescopes.

[B] A radio telescope is a device that typically uses a large dish antenna to collect the low-energy radiation emitted by objects in space. In the 1960s, astronomers started using them to view asteroids, planets, comets, and other objects. However, it was challenging to get a clear image of those objects using ground-based antennas because low-energy radiation is absorbed and distorted by water vapor in the Earth's atmosphere. The signal that a dish antenna on the ground finally receives is therefore weak.

ESL Teacher: Mr. Sean Patrick Magallano
Course Book: REX 5

Level: GEP 12
Unit:10

[C] The signal can be strengthened by positioning the antenna on a site with very dry air, and it can be made even stronger by arranging several antennas in an array, combining their signals so that they function together as a single, more powerful telescope. By the 1980s, several small arrays were operating in Japan, Europe, and the United States. Technological advances soon made much larger arrays possible, provided that a high, flat site could be found where the antennas could be set up. And if the antennas were portable, the distance between them could be adjusted to change the sensitivity of the telescope. Placed far apart, they could zoom in to focus on a small target, such as a planet. Grouping the antennas closer together would have the effect of zooming out, which would be useful for capturing images of an object as large as a galaxy. In the 1990s, astronomers began searching the world for the ideal place to set up a large array of antennas.

The Perfect Location

[D] One May morning, two small trucks passed through the quiet town of San Pedro in Chile's Atacama Desert and headed up a mountainside. It was 1994, and the men inside the trucks were trying to find the highest, driest, flattest place on Earth. They had already spent a week and a half checking other locations in this desert. Now, guided by a map and a Chilean astronomer named Hernan Quintana, they were searching for the Chajnantor plateau. At 5,000 meters, it is almost as high as the two base camps used by climbers on Mount Everest (Qomolangma).

[E] The Atacama Desert is one of the driest places on Earth, with less than 1.2 centimeters of rain a year on average. The desert's remoteness and thin, dry air make the area ideal for observing the night sky. Astronomers from several countries were very interested in setting up observatories there. For the most part, these were observatories to view the fraction of the universe visible using the portion of the light spectrum that the human eye can see. Quintana and his companions were looking for a location to set up an array of dish antennas for a large radio telescope. Quintana felt that the Atacama Desert was likely the best possible place - but it wasn't easy to get to.

[F] "The trip was slow and painful, because the tires kept getting stuck in the sand," remembers Riccardo Giovanelli of Cornell University, one of the researchers who accompanied Quintana. When they finally arrived, the group was

not disappointed. "The sky was beautiful - it was the deepest blue one can expect to see," remembered Giovanelli. "There was no doubt that somewhere nearby was the place." One of the astronomers brought along an instrument to measure water vapor. It was lower than any other place they had been.

[G] News of the discovery inspired a cooperative effort among astronomers in the United States, Europe, and Japan. Scientists in these countries began to realize that by working together, they could build a larger and more powerful array than any one of them could alone. In 1999, an agreement was signed to cooperate on a telescope project.

Assembling the Array

[H] It would take more than 10 years to transform one of the world's loneliest spots into a busy modern observatory. Land mines[3] planted decades before by the Chilean military had to be located and removed, and an oil company needed to be convinced to choose a different route for a planned pipeline that would have crossed the site. Prototype antennas were redesigned after testing in New Mexico, and new ones needed to be manufactured. The infrastructure for the installation had to be built from scratch, including many kilometers of service roads.

[I] The first of the dish antennas - 12 meters in diameter and weighing more than a hundred tons - arrived from the United States at the Chilean port of Antofagasta in April 2007. Escorted by police cars, a truck carried the massive dish up the mountain, its progress occasionally interrupted by herds of llamas crossing the road.

[J] Over the next five years the dishes continued to arrive. Two specially made 28-wheel transporters - nicknamed Otto and Lore - stood ready to move the antennas to new locations on the plateau as needed. Setting the dishes up to work together required astonishing precision: They would need to turn together on command and point at the same target in the sky within a second and a half of one another. A massive supercomputer had to be installed on-site to coordinate their movements and interpret the signals received.

Early Discoveries

[K] The installation was officially opened in March 2013 and named the Atacama Large Millimeter/submillimeter[4] Array, or ALMA for short. Even before it was completely set up, it had already produced results. The year before, with only 16 antennas in operation, researchers led by Caltech's[5] Joaquin Vieira had used ALMA to view 26 distant galaxies. From the images they gathered, they were able to deduce that many stars in those galaxies were a billion years younger than astronomers had previously thought.

[L] Since the official opening of ALMA, there has been a steady stream of other discoveries of great interest to astronomers. In July 2013, the telescope's high-resolution[6] images provided clues that may help answer a question that has long puzzled astronomers: Why are massive galaxies so rare in the universe? ALMA is also helping researchers understand how planets are born, by providing the first-ever images of the planet-forming process.

[M] One of the ALMA's most notable achievements is the role it played in creating the first image of a black hole. ALMA collaborated with six other observatories to form an array that functions as one Earth-sized telescope. This network collected and processed more than a petabyte of data while staring at a black hole in the distant Messier 87 galaxy. The image - a circular void surrounded by a ring of orange light - made headline news in April 2019.

[N] These achievements are just the beginning. In the future, ALMA will show us even finer details of galaxies and star systems. On a dry plateau a few kilometers from where shepherds[7] once slept, our eyes will open upon an unseen universe.

[1] An **array** of instruments, such as antennas, is a number of them that are connected together to form a single unit.
[2] An **observatory** is a building with a large telescope from which scientists study objects in space.
[3] A **land mine** is an explosive device that is placed on or under the ground and explodes when a person or vehicle touches it.
[4] 1 **millimeter** = 0.001 m; 1 **submillimeter** = 0.0001 m; the array's name refers to the range of radiation wavelengths that it can detect.

[5] **Caltech** is the abbreviation for the California Institute of Technology, located in California, USA.
[6] **High-resolution** images or photographs are extremely clear, down to the smallest details.
[7] A **shepherd** is a person whose job is to look after herds of sheep.

1. Why is the passage entitled *Cosmic Dawn*?
   a. The greatest number of planets and galaxies are visible at dawn.
   b. Astronomers are interested in seeing dark areas of the universe.
   c. Daylight and nighttime occur at different rates in the solar system.
   d. The ALMA telescopes are a start of a new era of space exploration.

2. What is NOT mentioned as a way to improve the signal received by a radio telescope?
   a. placing the antenna in a dry area
   b. using multiple antenna dishes
   c. placing the antenna high up
   d. using a larger antenna dish

3. How do astronomers change the focus of the array of the antennas?
   a. They can adjust the distance between the antennas.
   b. A computer adjusts the size of the telescope opening.
   c. Some antennas are equipped with zoom lenses.
   d. The largest telescope has a wide-angle lens for seeing galaxies.

4. Which statement best expresses Quintana's feelings?
   a. He was concerned that the water vapor would be excessive.
   b. He argued that the other desert locations were more appropriate.
   c. He believed that the dry, high atmosphere of the Atacama was ideal.
   d. He thought that the flat place was not as beautiful as the Andes.

5. Why was ALMA an international project?

a. Chile had the best physical conditions, but few astronomers to do research.
b. Collaboration meant ALMA would be superior to what any one country could afford.
c. Astronomers couldn't agree on sites in Japan and New Mexico.
d. The desert was uninhabited except for llamas and shepherds, so land was cheap.

6. Which of these is NOT mentioned as a challenge in setting up the ALMA project?
   a. the worker's adjustment to high altitude
   b. removing land mines
   c. relocating plans for an oil pipeline
   d. building service roads

7. What does *They* refer to in paragraph J?
   a. Otto and Lore
   b. transporter drivers
   c. massive super computers
   d. the antenna dishes

8. What does the header *Early Discoveries* refer to?
   a. 17th century reflecting telescopes by Isaac Newton
   b. NASA telescopes like the Hubble Space Telescope
   c. scientific results from the first months of ALMA
   d. discoveries by early astronomers such as Galileo

9. What is another way of saying *a steady stream* in paragraph L?
   a. a small river that has water in it
   b. a continuous flow of results
   c. water that suddenly flows downstream
   d. a sudden surge or flood of information

10. Which of the following happened first?

a. The first image of a black hole was published.
b. Caltech researchers used ALMA to view 26 distant galaxies.
c. The ALMA installation was officially opened.
d. ALMA images provide clues as to why massive galaxies are so rare.

DIRECTIONS: Complete the sentences using the words in the box.

companion	coordinate	deduce	distort	emit
in operation	interpret	position	precision	prototype

11.Diesel engines _____ high levels of pollutants into the air.

12.It is ethically wrong to _____ the data from your experiments.

13.You have to _____ the microscope lens correctly in order to be able to view the specimen.

14.For many years, her only _____ had been her dog, Max.

15.It took eighty people to _____ the event at the national level.

16.Students will need to _____ the results and provide logical explanations for their observations.

17.That factory has not been _____ for almost a year now.

18.From the evidence they collected, the police were able to _____ that the thief had to be an employee of the company.

19.The company has managed to build a working _____ of a driverless car.

20.With modern equipment, scientists can measure vast distances with amazing _____.