Student Name: _____ Date: ____ / ____ / _2022__ Score:_____
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QUIZ 2

DIRECTIONS: Choose the best answer for each question.

Plugging into the Sun

[A] *Early on a clear November morning in the Mojave Desert, a full moon is sinking over the gigawatt glare of Las Vegas. Nevada Solar One is sleeping. But the day's work is about to begin.*

[B] It is hard to imagine that a power plant could be so beautiful: 400 hectares of gently curved mirrors lined up like canals of light. Parked facing the ground overnight, they are starting to awaken - more than 182,000 of them - and follow the sun.

[C] "Looks like this will be a 700-degree day," says one of the operators in the control room. His job is to monitor the rows of mirrors as they concentrate sunlight on long steel pipes filled with circulating oil, heating it as high as 400 degrees Celsius. The heat produces steam, driving a turbine and dynamo, pushing as much as 64 megawatts onto the grid - enough to electrify 14,000 households, or a few Las Vegas casinos.

[D] When Nevada Solar One came online in 2007, it was the first large solar plant to be built in the United States in more than 17 years. During that time, solar technology blossomed elsewhere. The owner of Nevada Solar One, Acciona, is a Spanish company, and the mirrors were made in Germany. Putting on hard hats and dark glasses, plant manager Robert Cable and I drive out to take a closer look at the mirrors. Men with a water truck are hosing some down. "Any kind of dust affects them," Cable says. On a clear summer day with the sun directly overhead, Nevada Solar One can convert about 20 percent of the sun's rays into electricity. Gas plants are more efficient, but this fuel is free.

[E] "If we talk about geothermal or wind, all these other sources of renewable energy are limited in their quantity," said Eicke Weber, director of the Fraunhofer Institute for Solar Energy Systems, in Freiburg, Germany. "The total power needs of the humans on Earth is approximately 16 terawatts," he adds. (A terawatt is a trillion - 1,000,000,000,000 - watts.) In a few years, the number is expected to grow to 20 terawatts. "The sunshine on the solid part of the Earth is 120,000 terawatts," says Weber. "From this perspective, energy from the sun is virtually unlimited."

Tapping the Sun

[F] Solar energy may be unlimited, but its potential is barely tapped. Today, solar power accounts for such a tiny fraction of U.S. electricity production - just over 2 percent. "But," said Robert Hawsey, an associate director of the National Renewable Energy Laboratory (NREL) in Golden, Colorado, "that's expected to grow. Ten to 20 percent of the nation's peak electricity demand could be provided by solar energy by 2030."

[G] Achieving that level will require government help. Nevada Solar One was built because the state had set a deadline requiring utilities to generate 20 percent of their power from renewable sources by

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2015. During peak demand, the solar plant's electricity is almost as cheap as that of its gas-fired neighbor - but that's only because a 30-percent federal tax credit helped offset its construction costs.

[H] The aim now is to bring down costs and reduce the need for subsidies and incentives. To achieve this, NREL's engineers are studying mirrors made from lightweight polymers instead of glass, and tubes that will absorb more sunlight and lose less heat. They're also working on solar power's biggest problem: how to store some of the heat produced during daylight hours for release later on.

[I] Nevada Solar One uses solar thermal energy (STE) technology, which collects the sun's rays via mirrors to produce thermal energy (heat). Another method is to convert sunlight directly into electricity with photovoltaic (PV) panels made of semiconductors such as silicon. Back in the 1980s, an engineer named Roland Hulstrom calculated that if PV panels covered just three-tenths of a percent of the United States, they could electrify the entire country.

[J] Years later, PV panels still contribute a small - but growing - amount to the nation's electricity supply. On rooftops in California, Nevada, and other states with good sunshine and tax incentives, they are increasingly common - almost as familiar as air conditioners.

[K] For years, PV power was not as developed as solar thermal, but today it is the dominant solar power technology. Massive investment, government incentives, and technological breakthroughs have caused prices for PV panels to fall dramatically. In 2009, the U.S company First Solar because the first to manufacture thin-film solar cells at a cost of under a dollar to watt - close to what's needed to compete with fossil fuels.

Germany's Solar Solution

[L] On a cold December morning west of Frankfurt, Germany, fog hangs frozen in the trees, and clouds block the sun. In the town of Morbach, the blades of a 100-meter-high wind turbine appear and disappear in the gloom,[2] while down below, a field of photovoltaic panels struggle for light. Considering its unpredictable weather, who would have thought that Germany would transform itself into the largest producer of photovoltaic power in the world?

[M] A fraction of Germany's five-gigawatt photovoltaic power comes from centralized plants like the one at Morbach. With land at a premium in Germany, solar panels can be found mounted on rooftops, farmhouses, even on soccer stadiums and along the autobahn.[4] The panels, dispersed across the German countryside, are all connected to the national grid.

[N] The solar boom has completely transformed towns like "sunny Freiburg," as the tourist brochures call it. The town sits at the edge of the Black Forest in the southern part of the country. Towering walls of photovoltaics greet visitors as they arrive at Freiburg's train station. Across the street from a school covered with photovoltaic panels is Solarsiedlung ("solar settlement"), one of the town's condominium complexes.[5]

[O] "We are being paid for living in this house," said Wolfgang Schnürer, one of Solarsiedlung's residents. The day before, when snow covered the roof, Schnürer's system produced only 5.8 kilowatt-hours, not enough power for a German household. But on a sunny day in May, it yielded more than seven times that much.

[P] In Germany, regulations require utility companies to pay even the smallest PV producers a premium of about 50 euro cents a kilowatt-hour. In 2008, Schnürer's personal power plant yielded over 6,000 kilowatt-hours, more than double the amount the family consumed. When they subtracted

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their usage from the amount they produced, the family found they were more than 2,500 euros (nearly $3,000) in profit.

[Q] Anybody who installs a PV system is guaranteed above-market rates for 20 years - the equivalent of an 8 percent annual return on the initial investment. "It is an ingenious mechanism," Eicke Weber said. "I always say the United States addresses the idealists, those who want to save the planet. In Germany, the law addresses anyone who wants to get 8 percent return on his investment for 20 years."

[R] In total, Germany now generates over 6.5 percent of its electricity annually from solar energy, whereas the United States generates less than half this amount. The largest photovoltaic installation in the United States - the Solar Star in California - is only the 11th largest in the world. Nearly all the bigger ones are located in either China or India. But in the United States, too, there is a gathering sense that the time for solar energy has arrived - if there is a commitment to jump-start[6] the technology. "Originally it seemed like a pie-in-the-sky idea," said Michelle Price, the energy manager at the Nellis Air Force base outside Las Vegas. "It didn't seem possible." Many things seem possible now.

[1] One **gigawatt** is a billion (10^9) watts.
[2] If something has **blossomed**, it has grown and developed well.
[3] Something that is in the **gloom** is in partial or total darkness.
[4] **Autobahn** is a word used to describe expressways in Austria, Germany, and Switzerland on which vehicles travel very fast.
[5] **Condominium complexes** are apartment compounds, or living areas.
[6] To **jump-start** something means to give it added energy so that it will develop faster.

1. What does the phrase *canals of light* refer to in paragraph B?
   a. canals filled with shining water
   b. moonlight glowing on curved pipes
   c. rows of mirrors reflecting the sun
   d. bright lights from Las Vegas

2. Which of these is the final step in the process of power production at Nevada Solar One?
   a. The heat powers a turbine and dynamo.
   b. Electricity enters the power grid.
   c. Pipes absorb heat from the sun.
   d. Oil in the pipes becomes extremely hot.

3. What is the purpose of paragraph E?
   a. to demonstrate that solar power is more than adequate for human needs
   b. to point out that geothermal and wind power have inadequate capacity
   c. to emphasize Germany's pioneering role in solar energy
   d. to argue for installing solar collectors at sea as well as on land

4. Why is electricity from Nevada Solar One competitive in price?
   a. The installation received a federal tax benefit.
   b. The plant met a deadline for renewable power.
   c. The Nevada state legislature pays for it.
   d. Gas and other fossil fuels have become too expensive.

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5. What is the main idea in paragraphs I and J?
    a. Solar was not popular in the 1980s.
    b. Photovoltaic panels can provide energy for the whole country.
    c. The use of solar mirrors is decreasing.
    d. There are two main methods of harnessing solar energy.

6. Which of the following sentences is true?
    a. Solar thermal energy (STE) technology uses semiconductors such as silicon.
    b. Photovoltaic (PV) panels are the most widely-used technology in the solar power industry.
    c. Photovoltaic (PV) panels use mirrors to produce thermal energy.
    d. Solar thermal energy (STE) technology converts sunlight directly into electricity.

7. The following sentence would be best placed at the end of which paragraph?

    Investors believe that as fossil fuels become scarcer and hence more expensive, PV solar panels will become more economical.

    a. Paragraph H
    b. Paragraph K
    c. Paragraph N
    d. Paragraph P

8. If you visited Morbach, Germany, what would you see all over the town?
    a. high wind turbines
    b. the Black Forest
    c. photovoltaic panels on roofs
    d. gas-fired power plants

9. In paragraph R, what does *the bigger ones* refer to?
    a. Spanish technology parks
    b. German power plants
    c. photovoltaic installations
    d. air force bases

10. Which of the following is true for both Germany and the United States?
    a. It is one of the top producers of photovoltaic power in the world.
    b. Anybody who installs a PV system is guaranteed above-market rates for 20 years.
    c. Less than 10% of the country's electricity is generated from solar energy every year.
    d. Regulations require utility companies to pay all PV producers a premium.

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DIRECTIONS: Choose the best answer for each question.

How Solar Lanterns Are Giving Power to the People

[A] Prashant Mandal flips on a compact LED light in the hut he shares with his wife and four children. Instantly hues of canary yellow and ocean blue - reflecting off the plastic tarps that serve as the family's roof and walls - fill the cramped space where they sleep. Mandal, a wiry 42-year-old with a thick black beard and a lazy eye, gestures with a long finger across his possessions: a torn page from a dated Hindu calendar, a set of tin plates, a wooden box used as a chair. He shuts down the solar unit that powers the light and unplugs it piece by piece, then carries it to a tent some 20 yards away, where he works as a chai wallah, selling sweet, milky tea to travelers on the desolate road in Madhotanda, a forested town near the northern border of India.

[B] "My life is sad, but I have my mind to help me through it," Mandal says, tapping the fraying cloth of his orange turban. "And this solar light helps me to keep my business open at night."

[C] Roughly 1.1 billion people in the world live without access to electricity, and close to a quarter of them are in India, where people like Mandal have been forced to rely on noxious kerosene and bulky, acid-leaking batteries. Mandal's solar unit, which powers two LED lights and a fan, is energized by a 40-watt solar panel. Sun beats down on the panel, charging a small, orange power station for roughly ten hours at a time. Mandal leases the ingenious kit from SimpaNetworks. A for-profit company with a name derived from the notion of "simple payments," Simpa offers subscription plans structured to fit the budgets of low-income consumers. Even so, the equivalent of roughly 35 cents a day is a massive expenditure for Mandal, who supports his family on a razor-thin budget of less than two dollars a day. Food costs money, as do schoolbooks, medicine, and tea.

[D] Nevertheless Mandal says that spending 20 percent of his earnings on Simpa's services is better than living so much of his life in total darkness. "I was spending that much to recharge a battery before," he says. "I would walk about one kilometer back and forth up the road to recharge it. Sometimes battery acid would spill and burn me. One time it spilled and burned right through the fabric of my pants - all for power."

[E] Mandal's struggle is replayed in villages in Myanmar and in Africa, where private companies are selling people solar units and panels and building solar farms. The International Energy Agency estimates that 621 million people in sub-Saharan Africa have no electricity. Because of insufficient power lines in India, only 37 percent of the nearly 200 million people in Mandal's home state of Uttar Pradesh use electricity as their primary source of lighting, according to 2011 census data. Simpa calculates that 20 million households there rely mainly on government-subsidized kerosene. Throughout the small farm towns, mobile phones are charged using tractor batteries; hundreds die of heatstroke each summer, when temperatures can soar to 115 degrees Fahrenheit; and the grimy black soot released by kerosene scars human lungs. Mandal's neighbors who have electricity say that it stays on only two to three hours each day, with no alerts from the government utility about when the blackouts will start or end. Mandal, however, would have no viable source of power without solar because of the improvised nature of his home.

[F] Simpa CEO Paul Needham, who used to work in Microsoft's advertising department in Washington State, lives a far more privileged life in India than Mandal could ever dream of. He has running water in his home and a near-steady flow of electricity and Wi-Fi. Originally from Vancouver, Canada, Needham moved to India in 2012 hoping to help bridge the gap between people like himself and Mandal. "In many ways India is a divided society, because after decades of rapid

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development, rural areas like these still lag behind major cities," he says. "Our customers can't wait for a better power grid to be built. They need power now."

[G] Needham explains that he got the idea for his company while visiting with members of a women's rights organization in Tanzania in 2010. He saw people paying a neighbor to recharge their cellphones using a solar panel she owned. "It dawned on me that this could really be viable as a business model," he says. "Solar could be sold."

[H] The chance to escape India's blistering heat is perhaps the strongest incentive for leasing a solar system. Shiv Kumar, a 20-year-old laborer in Madhotanda, makes his living gathering hay for farmers, earning less than $2.50 on the days he works. When food is scarce, he sometimes works for grain rations. The home he shares with his father and brother is concrete, with two tiny rooms that offer little ventilation. So when a sales associate from Simpa demonstrated the solar kit, it was the fan that sold him. "The kerosene lamp was dim and yellow and made me feel depressed," Kumar says, standing in the fan's breeze. "But this is the best fan I've seen."

[I] Neel Shah, a Simpa product management leader, can attest that the challenges of bringing solar services to rural areas often stretch beyond whether people can afford them. "The solar business can be frustrating, but customers like Mandal make it worth it," says Shah, who met Mandal earlier this year after Mandal called Simpa to express his admiration. "We want to see a million people like him with light."

[J] Back in Madhotanda, inside the tent where he sells tea, Mandal reassembles his solar unit and hangs up the lamp. The space is empty in the punishing heat of the afternoon as he stirs the tea in a metal cauldron lit by a wood fire. A few passersby will arrive by sundown, when the air cools. Mandal wishes he could lease a second solar unit so that his children could have a more secluded place to study. But for now his priority is growing his business, a goal he believes solar power can help him achieve.

[K] "When customers see the lights," he says, "they will come."

11. What is the main idea of the passage?
    a. Solar energy is a viable energy alternative for poor people who are off the electrical grid.
    b. Solar energy has many uses, like charging a cellphone battery using a solar panel.
    c. Solar energy is a great business model in some developing countries.
    d. Solar energy is a nice luxury that is finally becoming available for most people.

12. In paragraph B, what is the meaning of the word *turban*?
    a. a part of a solar unit
    b. a piece of clothing worn like a shirt
    c. a tea towel used by people who sell tea in India
    d. a piece of cloth wound around one's head

13. The following sentence would be best placed at the end of which paragraph?
    Many others like Mandal also have to ration their budget carefully.
    a. Paragraph A
    b. Paragraph B
    c. Paragraph C
    d. Paragraph D

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14. According to data from 2011, how many people in Uttar Pradesh use electricity as their primary source of lighting?
    a. 200 million
    b. 100 million
    c. less than 100 million
    d. more than 100 million

15. People in Uttar Pradesh whose homes are connected to electricity have to face which problem?
    a. heatstroke
    b. no viable source of power
    c. having their lungs scarred with black soot
    d. frequent blackouts

16. What is meant in paragraph F by the words *India is a divided society*?
    a. The cities and rural areas of India are effectively at war with each other.
    b. Though many areas of India are now wealthy and have modern conveniences, many others are poor and lack modern conveniences.
    c. Some people in India have electricity, while others do not.
    d. Indian society is separated between foreigners like Needham and locals like Mandal.

17. How can the following sentence from paragraph G be paraphrased?

    Solar can be sold.

    a. People in developing countries need solar power because they lack electricity.
    b. There is a good market in developing countries for solar energy and devices.
    c. Solar energy can be sold by a person who has a solar device.
    d. Solar energy is not really free.

18. What was the main reason Kumar wanted a solar kit?
    a. He liked the fan.
    b. It would help him get more grain rations.
    c. He wanted to have a better light in his house.
    d. He wanted to earn more money.

19. In paragraph I, what does the phrase *make it worth it* mean?
    a. Solar services are becoming cheaper.
    b. Customers like Mandal are able to afford solar services.
    c. It is rewarding to work in the solar business, despite the challenges faced.
    d. People living in rural areas can't afford solar services.

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20. In paragraph J, what does the word *cauldron* mean?
    a. a pot
    b. a knife
    c. a cup
    d. a fan

DIRECTIONS: Complete the sentences. Choose the correct word.

a. circulate
b. deadline
c. ingenious
d. offset
e. panel
f. premium
g. renewable
h. subsidy
i. subtract
j. yielded

21. It helps to keep the room cool if you use a fan to ____ the air around.

22. Environmentalists favor ____ sources of energy such as wind, water, and solar.

23. If you want to enter the contest, you have to submit your entry before the ____.

24. Our electric car was expensive, but the purchase price was ____ by savings in fuel.

25. The solar ____ on the roof helps to heat the old farmhouse and its water supply.

26. To promote higher education, the government provides a(n) ____ for undergraduate housing.

27. Although it costs more, this car gets better mileage from ____-grade gasoline.

28. His farm ____ enough crops this year to make a huge profit.

29. When you compare your new job offer in the city to your existing salary, don't forget to ____ the cost of commuting from your pay.

30. The new design for the hotel is ____ because it uses special glass to control the temperature all year round.

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