**5. Lexical Inferencing**

Inferencing is a great tool to use when encountering unfamiliar vocabulary. It involves guessing intelligently the meaning of new words by using the context.

When encountering unfamiliar words, clues from the text known as context clues can be used. These clues are words that come before or after the new word and help to get an idea of what the new word means. Context clues can be definitions, descriptions, examples, explanations, synonyms, and antonyms.

**Pre-Tasks**

**Ultra-thin layers of rust generate electricity from flowing water**

*Circle the letter that corresponds to the best option to complete each exercise in sections 1 – 5*

|  |  |
| --- | --- |
| 1. **Predicting (5)**   According to the cues provided, what is the text about?   1. Rust is a common problem on infrastructure 2. Iron oxide can convert kinetic energy of saltwater into electricity 3. The electrokinetic effect will replace solar power 4. A new discovery to be used in specific scenarios | Resultado de imagen para Ultra-thin layers of rust generate electricity from flowing water  July 30, 2019 |

There are many ways to generate electricity-batteries, for example solar panels, wind turbines, and hydroelectric dams; and now there is rust. A new research conducted by scientists at Caltech and Northwestern University (US) shows that thin films of rust - iron oxide - can generate electricity when saltwater flows over them. These films represent an entirely new way of generating electricity and could be used to develop new forms of sustainable power production.

Interactions between metal compounds and saltwater often generate electricity, but this is usually the result of a chemical reaction in which one or more compounds are converted to new compounds. Reactions like these are what is at work inside batteries. In contrast, the new phenomenon discovered by Tom Miller, Caltech professor of chemistry, and Franz Geiger, Dow Professor of Chemistry at Northwestern, does not involve chemical reactions, but rather converts the kinetic energy of flowing saltwater into electricity.

The phenomenon, the electrokinetic effect, has been observed before in thin films of graphene and it is remarkably efficient. The effect is around 30 percent efficient at converting kinetic energy into electricity. For reference, the best solar panels are only about 20 percent efficient. "It is basically just rust on iron, so it is pretty easy to make in large areas," says Miller.

Though rust will form on iron alloys on its own, the team needed to ensure it formed in a consistently thin layer. To do that, they used a process called physical vapor deposition (PVD), which turns normally solid materials, in this case iron oxide, into a vapor that condenses on a desired surface. PVD allowed them to create an iron oxide layer 10 nanometers thick. When they took that rust-coated iron and flowed saltwater solutions of varying concentrations over it, they found that it generated several tens of millivolts and several microamps per cm-2.

The mechanism behind the electricity generation is complex, involving ion adsorption and desorption. The ions present in saltwater attract electrons in the iron beneath the layer of rust. As the saltwater flows, so do those ions, and through that attractive force, they drag the electrons in the iron along with them, generating an electrical current.

Miller says this effect could be useful in specific scenarios where there are moving saline solutions, like in the ocean or the human body. "For example, tidal energy, or things bobbing in the ocean, like buoys, could be used for passive electrical energy conversion," he says. "You have saltwater flowing in your veins in periodic pulses. That could be used to generate electricity for powering implants”.

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**2.Skimming (30)**

Choose from the list **A-G** the main idea for paragraphs **1-6**. There is one extra letter that you do not need to use.

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| --- |
| 1. The phenomenon studied is 30 % efficient at turning power into electricity. 2. A new phenomenon has been discovered to convert electricity from rust. 3. According to scientists the electrokinetic effect could be practical in precise contexts with saline solutions. 4. Soon, this technology will be the most common way to generate electricity. 5. The study turns kinetic energy of flowing saltwater into electricity. 6. Electric current is not generated by chemical reaction but by an attraction force of ions and electrons. 7. The process of physical vapor deposition enabled the creation of an iron oxide layer to be used with saltwater to generate power.   Paragraph 1  Paragraph 2  Paragraph 3  Paragraph 4  Paragraph 5  Paragraph 6 |

1. **Scanning (10)**
2. ***What are some examples of electricity generation sources?***
3. Solar Energy
4. Wind Power
5. Hydro Power
6. All of the above
7. ***Why does iron oxide represent a new way to generate electricity?***
8. It is 100% efficient
9. It only needs batteries
10. It can be produced in South America
11. It has potential for sustainable power production
12. ***Which organizations of leading research are involved in the study?***
13. British
14. Spanish
15. American
16. Ukranian
17. ***What happens inside a battery?***
18. Metal compound interaction
19. Chemical reactions
20. Compound conversion
21. All of the above
22. ***Why is this new phenomenon discovered by Miller and Geiger particular?***
23. It does not use salt water
24. There is no chemical reaction
25. It uses graphenes
26. It is NOT mentioned
27. ***How efficient is the electrokinetic effect?***
28. Remarkably efficient
29. 30% efficient
30. More efficient than solar panels
31. All of the above
32. ***What does PVD stand for?***
33. Power Vapor Deposition
34. Physical Vapor Deposition
35. Phenomenon Vapor Desorption
36. It is NOT mentioned
37. ***What does the PVD process do to solid materials?***
38. It freezes solid materials
39. It carries solid materials from one place to another
40. It turns solid materials into vapor
41. It conserves solid materials
42. ***What important processes are mentioned to generate electricity in paragraph 5?***
43. Physical Vapor Deposition
44. Adsorption and Desorption
45. Kinetic and Potential energy
46. Alloying and Conversion
47. ***The text does NOT mention:***
48. What the electrokinetic effect is
49. How efficient the electrokinetic effect is to generate electricity
50. Where the electrokinetic effect can be used
51. When the electrokinetic effect to generate electricity will be used
52. **Inferencing (25)**
53. ***What does kinetic energy refer to?***
54. Energy from fossil fuels
55. Energy due to motion
56. Energy due to a rise in temperature
57. None of the above
58. ***What is “Caltech”?***
59. California Institute of Technology
60. California state
61. California cities
62. California map
63. ***What are instances of sustainable power production?***
64. Solar power
65. Wind energy
66. Kinetic energy
67. All of the above
68. ***What are ions?***
69. Particles of matter that uniquely define chemical elements
70. A[tom](https://www.chemicool.com/definition/atom.html)s or [molecule](https://www.chemicool.com/definition/molecule.html)s that carry an [electric charge](https://www.chemicool.com/definition/charge.html)
71. A group of atoms bonded together
72. Subatomic particles without an electric charge
73. ***What are electrons?***
74. Atoms
75. Iron alloys
76. Negatively charged subatomic particles
77. None of the above
78. ***What causes iron to rust?***
79. Hot weather
80. Films of graphene
81. Iron, oxygen and moisture combination
82. All of the above
83. ***What is rust?***
84. Iron oxide
85. Carbon monoxide
86. Nitrous oxide
87. Acid oxide
88. ***What does tidal power harness to produce energy?***
89. Sunlight
90. Forces from tides
91. Wind
92. Heat from the earth
93. ***What makes an ideal location for tidal power plants in Argentina?***
94. Córdoba
95. Santa Fe
96. Santa Cruz
97. Misiones
98. ***What is the message of the text?***
99. Scientists are using saline solutions to generate electricity
100. The electrokinetic effect is more efficient than solar power
101. Ultra-thin layers of rust will replace solar panels
102. Kinetic energy from saltwater and iron oxide can generate electricity
103. **Vocabulary (10)**
104. ***The noun “films” in line 3 can be explained as a:***
105. movies
106. plastic-like materials
107. thin layers of something
108. sheets of metal
109. ***The noun “compounds” in line 7 can be understood as:***
110. areas
111. systems
112. layers
113. combinations
114. ***The noun “graphene” in line 13 can be explained as a:***
115. drawing
116. small unit
117. form of carbon
118. system
119. ***The adverb “remarkably” in line 14 can be replaced by:***
120. commonly
121. significantly
122. ordinary
123. meaningless

1. ***The adverb “pretty” in line 16 can be explained as:***
2. quite
3. pleasant
4. elegant
5. enough
6. ***The verb “ensure” in line 17 can be replaced by:***
7. save
8. expect
9. assure
10. trust
11. ***The verb “drag” in line 25 can be understood as:***
12. pull
13. continue
14. force
15. access
16. ***The noun “scenarios” in line 27 can be understood as:***
17. plots
18. books
19. summaries
20. situations
21. ***The verb “bobbing” in line 28 can be explained as:***
22. vibrating
23. rolling
24. flowing
25. moving up and down
26. ***The verb “powering” in line 31 can be understood as:***
27. working
28. having strength
29. providing energy
30. having the control of something