2024 Iowa Envirothon Current Issue Exam Team_____
"Renewable Energy for a Sustainable Future"
Each Question is worth three points – 75 points possible

Topic: Renewable Energy For a Sustainable Future

MATCHING: (3 Points Each)

A. Aequus
B. British thermal unit (BTU)
C. Carbon dioxide (CO_2)
D. Carbon monoxide (CO)
E. Earthly energy
F. Foot-newtons
G. Foot-pounds
H. Horsepower
I. Megawatt
J. Joule
K. Kenetic energy
L. Kilowatt-hour (kWh)
M. Mercury
N. Nitrogen
O. Non-renewable energy
P. Particulate matter
Q. Quantum energy
R. Renewable energy
S. Smart energy
T. Solar liter
U. Sulfur dioxide

Write the correct letter in each blank below for the term above that best matches each description below:

1. _____ emissions from combusting fossil fuels are the main driver of climate change. This emission is also the main byproduct of coal combustion which produces approximately one ton of CO_2 per megawatt hour (MWh) of energy generate from this power source.

2. _____ is the most commonly used unit for measuring heat energy.

3. A _____ represents the amount of energy required to light ten 100-watt light bulbs for one hour.

4. A _____ is the energy expended (or work done) to apply a force of one newton over a distance of one meter.

5. _____ is obtained from sources that are virtually inexhaustible and that replenish over small time scales relative to human life spans. Examples of this energy source include biomass, geothermal, hydroelectric, solar, and wind.

6. _____ is a toxic heavy metal that can damage the nervous, digestive, and immune systems, and is a serious threat to the healthy development of young children. Coal plants are responsible for 44 percent of U.S. emissions of this pollutant.

Multiple Choice: (Circle the letter for the one best answer for each of the following questions)

7. _____ energy surpassed coal as Iowa's primary source of electricity in 2019 and provided 64% of Iowa's electricity in 2022.
A. Natural gas
B. Nuclear
C. Solar
D. Wind

8. The Iowa Department of Natural Resources must report annual greenhouse gas inventories to the legislature and governor each year. What greenhouse gases (GHG) is/are included in this inventory?
A. Carbon dioxide (CO_2)
B. Methane (CH_4)
C. Nitrous oxide (N_2O),
D. Hydrofluorocarbons (HFC)
E. Sulfur hexafluoride (SF_6)
F. Perfluorocarbons (PFC)
G. All of the above
H. Carbon monoxide (CO)
I. "A", "B" and "H" above

9. What sector had the most Greenhouse gases (GHG) emissions in Iowa in 2021?
A. Agriculture sector
B. Emissions from fossil fuel used by the residential/commercial/industrial sector
C. Fossil fuel use by power plants
D. Transportation sector

10. _____ emissions significantly impact our health and are the largest source of air emissions in Iowa. These emissions were responsible for 85% of the sulfur dioxide, 58% of the nitrogen oxide, 58% of the carbon monoxide, 54% of the lead and 36% of the particulate matter in Iowa during 2021.
A. Automobile
B. Coal plant
C. Nuclear plant
D. Livestock confinement facility

11. Which of the following statement is "True"?
A. By 2030, MidAmerican and Alliant Energy are planning to discontinue the operation of their coal plants used in Iowa for burning fossil fuels.
B. A recent study found that counties in the U.S. that experienced a coal plant closure in their immediate vicinity not only reduced human mortality rates, but increased corn yields by 1.1%.
C. According to the "Iowa Electric Generation, Condition of the State, October 2020", shutting down Iowa's remaining coal plants and replacing them with wind when accounting for land that will be shifted into producing renewable energy would result in net decrease in Iowa corn production of between 21 million and 285 million bushels statewide annually.
D. All of the above are true.

12. Which of the following statement is “True”, regarding renewable energy vs. carbon-free energy?
A. All kinds of renewable energy are also “carbon-free” since they do not emit CO_2 or other greenhouse gases into the atmosphere.
B. Not all renewable energy is carbon-free and not all carbon-free energy is renewable.
C. Biofuels and bioenergy are both renewable as well as carbon-free.
D. Nuclear energy is both carbon-free and renewable.

13. Currently 28% of the world’s electricity comes from renewable sources. Which of the following represents the highest portion of the world’s electricity generated from a renewable source?
A. Bioenergy
B. Geothermal
C. Hydropower
D. Solar
E. Wind

14. Which of the following is a renewable energy source that comes from the fall and movement of water, it is influenced by gravity as well as energy from the sun, and utilizes a water reservoir as an energy storage system?
A. Biomass
B. Geothermal
C. Hydropower
D. Solar
E. Wind

15. Which of the following is a renewable energy source that comes from the heat within the earth and this source is most commonly used for bathing and to heat buildings?
A. Biomass
B. Geothermal
C. Hydropower
D. Solar
E. Wind

16. Which of the following is a renewable energy source that comes from the organic matter found in plants which have converted radiant energy from the sun into chemical energy. This chemical energy is stored in the form of carbohydrates and is captured from the sun through the process of photosynthesis?
A. Biomass
B. Geothermal
C. Hydropower
D. Solar
E. Wind

17. A grouping of wind turbines generating electricity is called a wind _____.
A. acreage
B. cluster
C. community
D. factory
E. farm

18. _____ is any liquid fuel made from "biomass" which may include plants and other biological matter like animal waste and leftover cooking fat. This liquid can be used as a replacement for petroleum-based fuels like gasoline and diesel. In theory, these liquids can be a "carbon neutral" or even "carbon negative" way to power cars, trucks and planes, which means they take at least as much CO_2 out of the atmosphere as they put back in.
A. Biofuels
B. Biogenetic juice
C. Bio-powerade
D. Neutral-carbonated flowables
E. All of the above

19. Which statement(s) regarding Solar energy is/are "True"?
A. The production of solar energy is rapidly growing because of tax subsidies, improved conversion efficiency of newer solar panels and the lower up-front costs per kilowatt of energy generated by utilizing them.
B. Solar energy is more economical because of global warming trends have resulted in more sunny days and more consistent weather patterns.
C. Benefits of solar electric systems include the low operating and maintenance costs, production of virtually no emissions or waste while functioning, raising the value of homes and no fuel operating costs.
D. Outdated solar system equipment is easy to disassemble, recycle and replace.
E. All of the above
F. Only "A" and "C" are True

20. Which of the following is/are identified as a challenge for the Wind power industry?
A. Less windy locations may not be able to compete economically with other energy sources.
B. There are significant costs associated with upgrading the nation's transmission network to connect areas with abundant wind resources to high population centers.
C. Noise produced by the turbine blades as well as the visual impacts that wind turbines have on the landscape are concerns for some landowners.
D. Wind turbines may negatively impact local wildlife.
E. All of the above

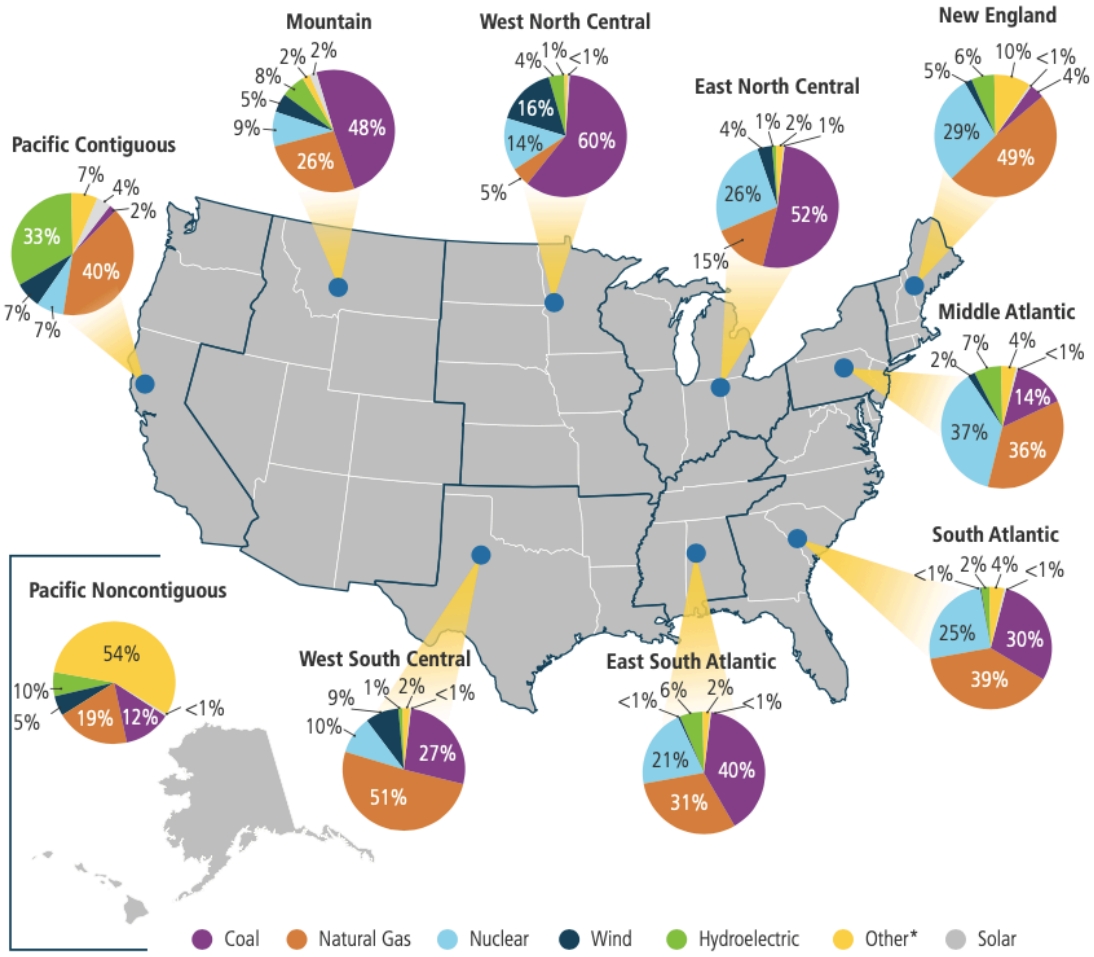
21. What is the reason that Iowa has emerged as a frontrunner in the United States when it comes to the generation of wind energy?
A. The vast areas of flat land and constant wind patterns that characterize the state make it an excellent place for harnessing the force of the wind.
B. The state of Iowa is mandating the closure of all coal processing plants by the year 2030.
C. The coal reserves being mines in Iowa and other mid-western states are expected to be deleted within the next 20 years.
D. The United State Department of Agriculture (USDA) are providing incentives to Iowa farmers and landowners for the construction and operation of wind turbines.
E. The state of Iowa has mandated that at least 75% of Iowa's electricity come from renewable recourses by the year 2030.
F. All of the above

22. In the United States, _____ are currently the fastest growing renewable energy sources, but combined, these two sources provide only 5% of total energy used in the United States.
A. wind and solar
B. wind and biomass
C. solar and geothermal
D. biomass and solar

23. Which of the following is NOT one of the steps recommended for planning for a home renewable energy system?
A. analyzing your existing electricity use
B. deciding if you want to operate your system on or off of the electric grid
C. obtain Dept of Energy permits allowing for the installation of a renewable energy systems
D. reviewing local electical codes and requirements
E. understanding technology options you have for your site.

Use Figure A-2, "Electric Power Regional Fuel Mixes, 2015" for Question #24
(See attached)
24. According to Figure A-2, "Electric Power Regional Fuel Mixes, 2015", which of the following regional area of the continental U.S. was utilizing the highest proportion of renewable energy for the electrical generation in 2015?
*(Do not consider "Other" which includes a mix of renewable/non-renewable used in small amounts)
A. East North Central – 6%
B. East South Atlantic – 2%
C. Middle Atlantic – 9%
D. Mountain - 16%
E. New England – 11%
F. Pacific Contiguous - 44%
G. South Atlantic – 6%
H. West North Central – 20%
I. West South Central – 10%

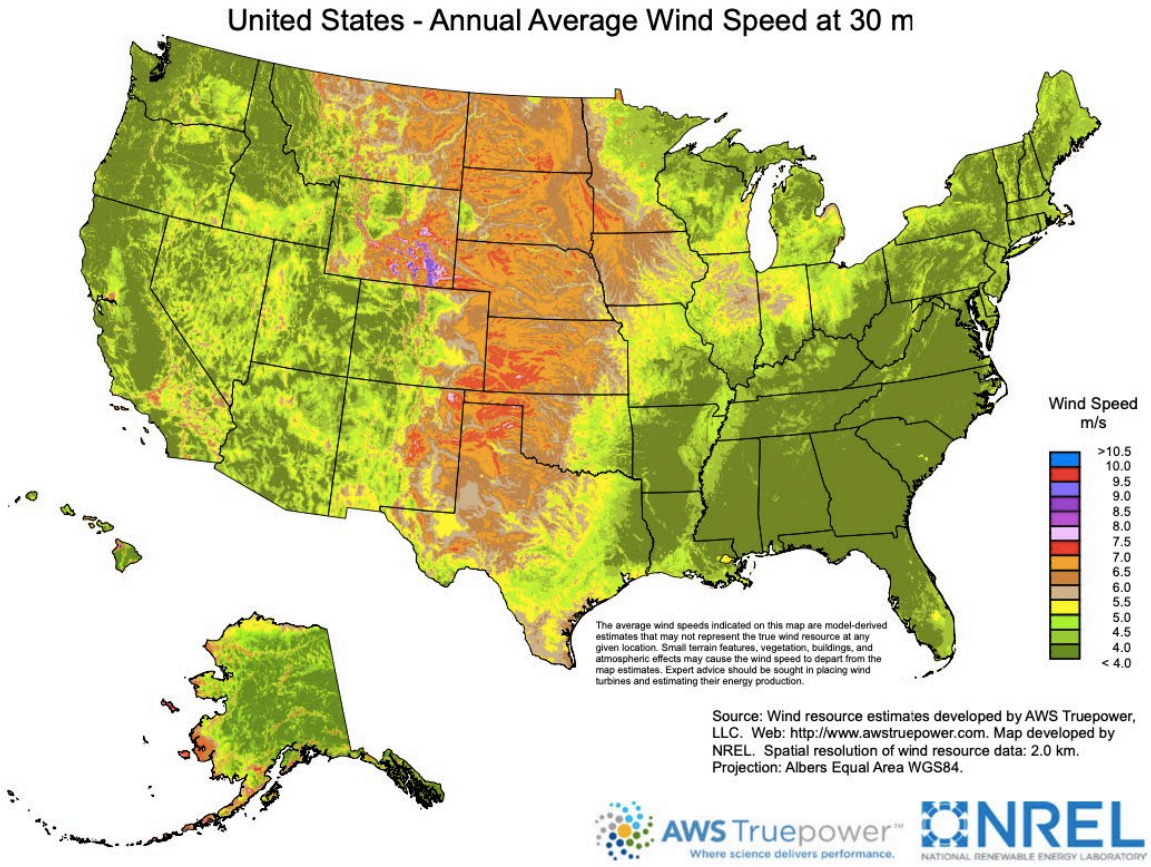
Figure A-2. Electric Power Regional Fuel Mixes, 2015[11, 12]



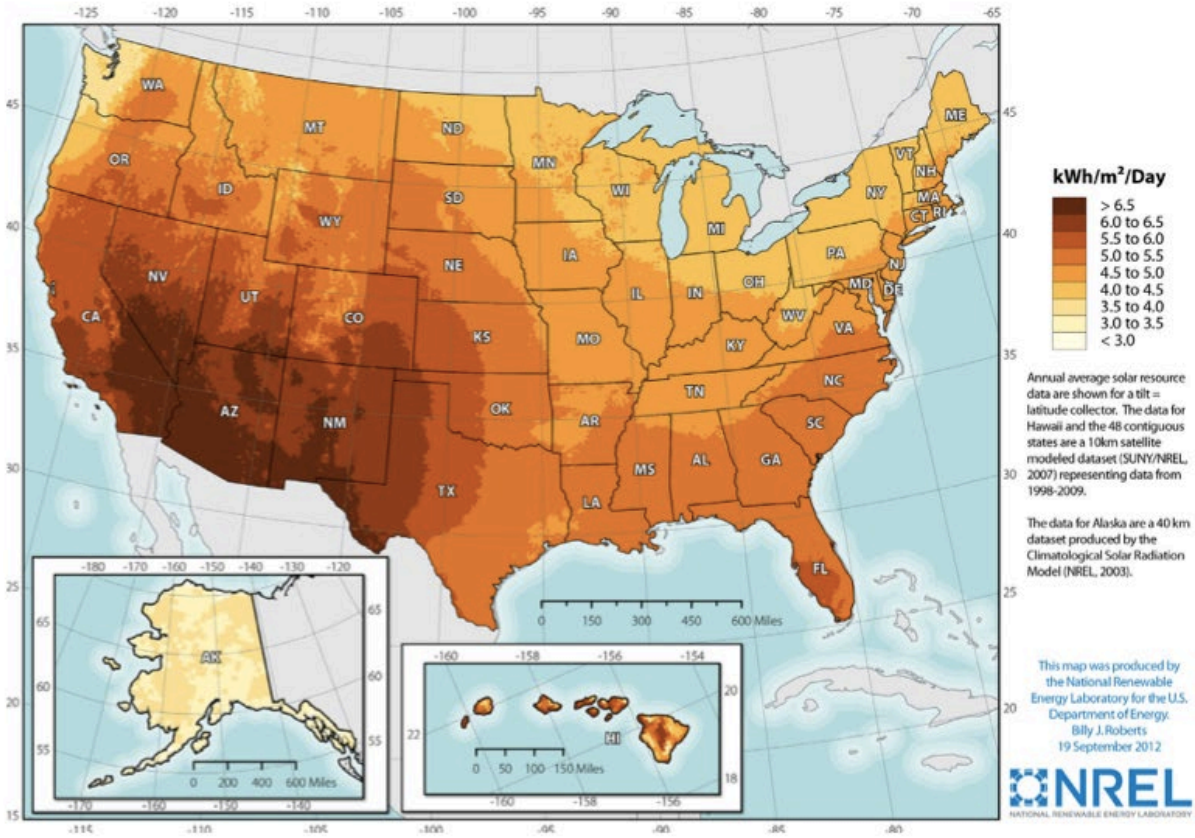
<u>Use Figure A-3. "Wind and Solar Energy Resource Maps for the United States" for Question #25</u> (See attached…. Please note A-3 is on page 7 AND 8)

25. Which of the following statements is "True"?
A. Solar energy resource availability varies widely across the United States.
B. Wind and solar energy resources are more concentrated in the Midwest and Southwest regions of the United States.
C. Solar energy resources are less as you are located further away from the equator.
D. All of the above

Figure A-3. Wind and Solar Energy Resource Maps for the United States[13,14]



Photovoltaic Solar Resource of the United States



Annual average solar resource data are shown for a tilt = latitude collector. The data for Hawaii and the 48 contiguous states are a 10km satellite modeled dataset (SUNY/NREL, 2007) representing data from 1998-2009.

The data for Alaska are a 40 km dataset produced by the Climatological Solar Radiation Model (NREL, 2003).

This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy.
Billy J. Roberts
19 September 2012

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Current Issue Resources

Current Issue Topic is "Renewable Energy For a Sustainable Future"

References for the State level Current Issue Exam

▪ Iowa Electric Generation: Condition of the State 2023

https://www.iaenvironment.org/webres/File/Program%20Publications/iowa_electric_generation_2023_final.pdf

▪ RENEWABLE ENERGY FOR A SUSTAINABLE FUTURE: Part A 2024 Current Environmental Issue STUDY RESOURCES

(Note that the sections listed below, will be used in preparing the written exam)

https://envirothon.org/wp-content/uploads/2023/09/2024-Current-Issue-Part-A.pdf

Introduction to Energy, *Paleontological Research Institution, 2022,* Pages 4 – 20

Electricity System Overview, *US Department of Energy, 2017,* Pages 22 – 34

Renewable Energy, *Jennifer Morris – MIT Climate Portal – February 2, 2022,* Pages 55 -56.

Solar at a Glance, *National Energy Education Development, 2023,* Page 57

Wind at a Glance, *National Energy Education Development, 2023,* Page 58

Hydropower at a Glance, *National Energy Education Development, 2023,* Page 59

Geothermal at a Glance, *National Energy Education Development, 2023,* Page 60

Biomass at a Glance, *National Energy Education Development, 2023,* Page 61

Biofuel, *Kristala Jones Prather – MIT Climate, 2020*, Pages 62-63

Facts About Solar Energy: Solar Electricity, *WI Center for Environmental Education, 2020,* Pages 64-68

The Dark Side of Solar Power, *Harvard Business Review, 2021,* Pages 69-73

Advantages and Challenges of Wind Energy, *Wind Energy Technologies Office, 2023,* Pages 74-75

Do We Have the Technology to Go Carbon-Neutral Today? *By Kathryn Tso – Ask MIT Climate – September 28, 2020,* Pages 95-96

US Renewable Energy, *University of Michigan – Center for Sustainable Systems, 2022,* Pages 173-17

Planning for Home Renewable Energy Systems, *US Department of Energy – Office of Energy Efficiency and Renewable Energy – 2023,* Pages 178-181

▪ Sustainable Wind Energy Revolution in Iowa (The Daily Iowan)

https://dailyiowan.com/2024/01/16/sustainable-wind-energy-revolution-in-iowa/#:~:text=Community%20Wind%20Energy%20Projects,small%2Dscale%20wind%20turbines%20jointly.