

Wind Power Prelim Test

Written by ABRHS

Name _____

Grade (circle one): 9 10 11 12

Score: _____ / 90 \Rightarrow _____ / 50

Notes:

- If a question has an answer line, please write your final answer on it. This goes for computations as well; do work in the space provided, but write your final answer on the provided line.
- Appropriate significant figures and units should be used.

1) What are the two main types of wind turbines?

2) Classify the following types of turbines and turbine designs into the two categories you listed above.

a) Panemone _____

b) Savonius _____

c) Darrieus _____

d) Postmill _____

e) MOD-2 _____

3) Which notable wind turbine was built in 1957, and by whom? _____

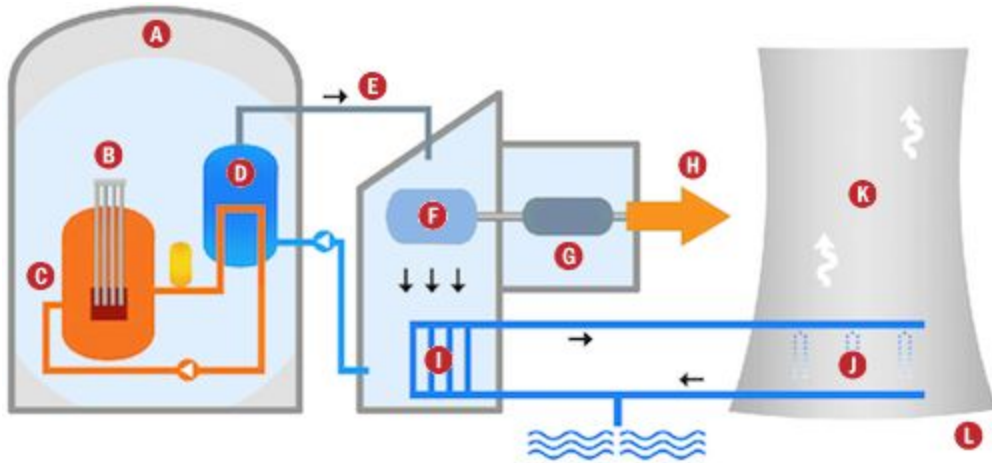
4) What is the theoretical maximum amount of power that the CD-mounted blade assembly could generate in a 10.0 m/s wind, if the air density is 1.225 kg/m³? Give your answer in W.

5) When was solar power first used in space? _____

6) Why do wind turbines rotate clockwise?

7) What is the optimal tip-speed ratio for a three-bladed wind turbine?

8) Label the following parts of a nuclear reactor:



- | | |
|----------|----------|
| a) _____ | g) _____ |
| b) _____ | h) _____ |
| c) _____ | i) _____ |
| d) _____ | j) _____ |
| e) _____ | k) _____ |
| f) _____ | l) _____ |

9) Which is more commonly used for power transmission, HVAC or HVDC, and why?

10) Electricity travels through a power transmission line at 450. MV and 60.0 A. If 5.00% of the power is lost in transmission, what is the resistance of the line?

11) What is the largest-capacity wind turbine, and what is its capacity?

12) Which of the following batteries are primary batteries? (There may be more than one.)

- Lead Acid Lithium Lithium Ion Poggendorff Silver Oxide

- 13) Pumped-storage hydroelectricity has an energy efficiency of _____%.
- 14) What do wind, nuclear, coal, gas, and hydroelectric power generators have in common?
- 15) A flywheel has an angular velocity of 40 rad/s and stores 100 kJ of energy. If the velocity is increased to 80 rad/s, how much energy is the flywheel storing?

- 16) The energy from the flywheel (after the increase in velocity) is transferred to hydrogen energy storage at a 97% efficiency rate. The hydrogen is to be held in a cubic storage container. If the density of hydrogen is 0.08988 g/L, how long is the side of the container?

- 17) According to Wikipedia, how many major power outages has the USA had from the beginning of 2005 to the end of August 2016?
- A) less than 10
 - B) 10 - 19
 - C) 20 - 29
 - D) 30 or more
- 18) Explain why wind turbines cannot extract 100% of the wind's energy.

19) Name and describe two reasons for power loss in transmission lines.

20) A lead-acid battery has a rated discharge time of 7.00 hours at a rate of 10.0 A. If instead the battery were discharged in 8.50 hours, by how much would the capacity increase or decrease? Assume the Peukert constant is 1.2.

21) A transformer has a turn ratio of 1.70. If a 450 kV signal is inputted into the transformer, what voltage is the output?

22) Which of the two voltages in the previous problem is commonly used in US transmission lines?

23) How much energy is estimated to be harvestable by tidal power worldwide?

24) Where were the first windmills developed?

25) Which continent had the most installed wind power capacity in 2015?
