Wind Power Test

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Rules:

1. You may use one non-programmable calculator.
2. Notes secured in 3-ring binder may be used.
3. Choose the best answer.
4. Show All Work.
5. Use 3.14159 for Pi.
6. Have Fun!

These are the ANSWERS!!!

1.Which energy generation method is the most efficient? (1 pt)
A
A) Hydroelectricity
B)Nuclear
C)Solar
D)Tidal

2. List 3 factors against the use of hydroelectricity. (3 pts)
Can harm ecosystem due to dam; can destroy some organisms' source of food; can interrupt migration of fish; very expensive to make power plant; drought can affect energy output; limited space for reservoirs

3. True or False: Flywheels are a method of storing energy. (1 pt) True

4. If a turbine has a 7.5 ohm resistor and the voltage measured across the resistor is 100 mV what is the power generated by the motor? (2 pts)
100mV*13.3mA=1330 mW=1.33 W

5. A power plant in Chicago is generating 900 MW on a 700 KV line. Assuming the line is 100 kilometers long, with a resistance along the line of 0.2 ohms: (5 pts)

A: What is the current flowing along the line?
900 MW= 90000000 watts 700 KV= 700000 volts

90000000 watts / 700000 volts= 1286 amps

B: How much power is lost in the lines?
1) Find Voltage drop- (amps)(ohms)
2) Substitute- (1286 amps)(0.2 ohms)
3) Calculate- 257.2 kV
4) Find power lost- (amps)(kV)
5) Substitute- (1286 amps)(257.2 kV)
6) Calculate- **330.76 MW**

C: What is the percentage of the power lost?
1) Find percentage- (power lost) / (total power)
2) Substitute- (330.76 MW) / (900 MW) = **36.7%**

6. Circle which of the following are methods of energy storage:(1 pt) (Circled)
A C D

A. Molten Salt
B. Tidal
C. Flywheel
D. Liquid Nitrogen
E. Uranium

7. What does HAWT stand for?(1 pt) Horizontal Axis Wind Turbine

8. What does VAWT stand for?(1 pt) Vertical Axis Wind Turbine

9. DC energy is released at a constant rate, while AC energy can be released at fluctuating/changing/varying rates. (2 pts)

10. Why is AC energy commonly used for energy transportation? (1 pt)AC energy can change the amounts of voltage being transported and easily changes direction

11. What is Betz' law, and what is the percent associated with it? (2 pts)
Betz' law says that only a certain amount of energy can be harnessed from the wind.
59.3%

12. List 2 things that turbines have been used for. (2 pts)
Crushing grain, making gunpowder, generating electricity, pumping water, draining lakes, cutting wood at sawmill.

13. The first electricity producing wind turbine was created in Glasgow, Scotland. (1 pt)

14. After moving through a turbine, the energy generated from a hydroelectric dam goes into a transformer. (1 pt)

15. An airfoil is a wing or blade design designed to maximize lift and minimize drag. (2 pts)

16. What is the circumference of a turbine that has a blade length of 5 meters? (3 pts)
$2\pi R$ = 2(3.14159)(5 meters)= 31.41 meters

17. The yaw of the turbine is where the turbine faces to be in the wind. (2 pts)

18. The pitch of a turbine is: (1 pt) B
   A. The height of the turbine
   B. Angle of attack of the blades
   C. Type of blade
   D. None of the above

19. Given the following the dimensions, calculate the following.(4 pts)
Air Density- 1.23 kg/m³
Wind Speed- 6 m/s
Turbine Radius- 1 meters

A. How much power is being produced by this turbine?
0.5(area)(air density)(wind speed³)= 0.5(3.14159 x 1²)(6³)= 56.55 W

B. How much of this energy can actually be harnessed, and what law or principle governs this generation?
1.) (watts)*(Betz's Law)
2.) (56.55)*(59.3%)
3.) (56.55)*(0.593)
4.) **33.53 watts**
Betz's Law

20. The aerodynamic force that pushes up on a turbine is lift, and its' opposing force is drag. (2 pts)

21. If a power plant is generating 100 MW, running on a 20 KV line (20 kilometers long), loses 10 MW of power after running along the line, how much resistance does the line have? (2 pts) V=IR P=VR

1) Find Amps: 100MW / 20KV= 5000A

2) Find Ohms: V/I= 20KV / 5MA= **4 ohms**

22. In what year was the first electricity producing wind turbine created?(1 pt) 1887

23. How does the pitch of a turbine affect its efficiency? (1 pt)

The pitch can affect how effective the turbine is at catching wind

24. List 3 types of power plants that boil water into steam as a method of generating electricity. (3 pts)

Coal, Nuclear, and Geothermal

25. Identify the parts of this coal power plant, using the following terms: Generator, turbine, transformer, and boiler. (2 pts)

1- Boiler 2- Turbines 3- Generator 4- Transformer

1._____

2._____

3._____

4._____