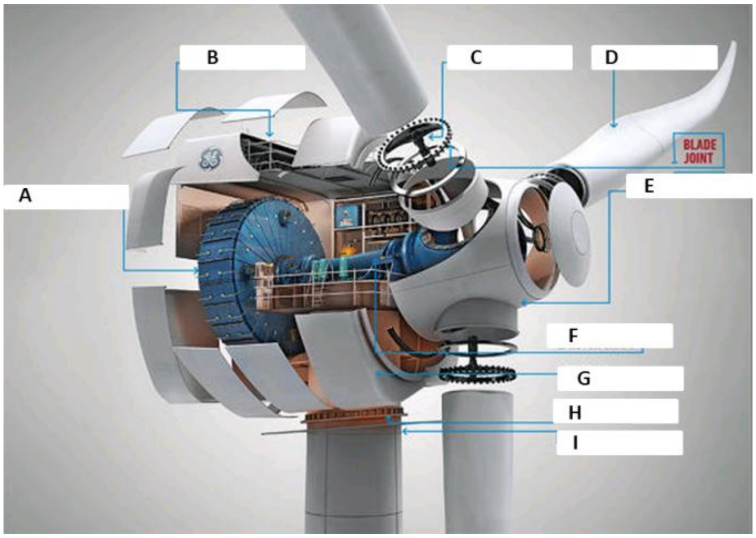
ANSWER ANSWER ANSWER

Round: 12B

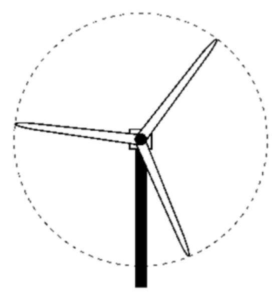


1. The diagram of an offshore wind turbine (above), shows different pieces of equipment on the turbine. Match the letters from the diagram with the parts below.

(1 pt each, 9 pts total)

Generator *A*	Pitch Controller *C*	Blade *D*
Electrical Circuitry *B*	Rotor *E*	Tower *I*
Yaw Drive *H*	Rotor Shaft *F*	Nacelle *G*

2. The largest offshore wind turbines (with power ratings of 5 megawatts or larger) now under development have a diameter that is about 120 meters.



a) Calculate (to the nearest integer) the swept area for the largest offshore wind turbines. Show your work.

(3 pts total) Swept Area = $((120m)/2)^2 \times \pi = 3600m^2 \times 3.14 = 11304\ m^2$

(accept 10800 to 11310)

b) The potential wind power a turbine produces can be calculated by the following equation:

Wind power = .5 x swept area x air density x velocity^3

Assuming the velocity for the 5 megawatt-rated wind turbine in Fig. 2 is 15 m/s and the air density at sea level is approximately 1.2 kg/m^3, calculate the wind power. Show your work.

(1 pt for work, 1 pt for correct value, 1 pt for correct units, 3 pts total)

*Wind power = .5 x 11304 m^2 x 1.2 kg/m^3 x (15m/s)^3 =22890600 kg*m^2/s^3*

*(Accept 21000000 to 23000000 kg*m^2/s^3 OR Watts OR 21 to 23 Megawatts)*

3. How many commercial offshore wind farms are currently in operation in U.S. waters?

   Zero (0) (2 pts)

4. Consider the wind power you calculated in Question 2. Compare your answer to the actual power rating of the turbine (5 megawatts of 5,000,000 watts). What law describes the theory for this inefficiency?

   Betz Limit OR Betz' Law (3 pts)