Physics 202
Individual Quizbit | Thermodynamics

Work individually to produce a single handwritten solution to these questions. The first part of activity is a timed quiz, where you are graded on effort and completeness. Turn that into Gradescope under the associated timed assignment. Then you will have until the end of the week to submit to a separate Gradescope assignment a well organized and thorough solution. Start with fundamental principles and use multiple representations to communicate understanding of the physics.

For questions 1 through 2 **fill in the square** next to all correct answers. A given problem may have more than one correct answer. Each correctly bubbled answer will receive two points. There are **5** correct answers in this section and only the first **5** filled in answers will be graded. There is no partial credit.

1. Which of the following actions will *unquestionably* increase the temperature of an ideal gas in a closed container (constant N)?
   - □ (a) Increase the average speed of ideal gas particles, average mass remains the same.
   - □ (b) Increase the thermal energy of the ideal gas.
   - □ (c) Increase the average kinetic energy of each ideal gas particle.
   - □ (d) Increase the average mass of the ideal gas, average speed of ideal gas particles decreases.

2. A long bar of copper is placed vertically in a large boiling pot of water that maintains a boil. A block of ice is placed on top of the bar and allowed to melt. If you assume the only transfer of energy to the ice is through the bar, which of the following actions will melt the ice more quickly?
   - □ (a) Make the bar longer in length
   - □ (b) Using a bar that is identical in every way but that has a larger diameter.
   - □ (c) Create a more rigorous boil in the water.
   - □ (d) Use a bar that is identical in every way but is made from a different material that has a smaller thermal conductivity.
   - □ (e) Use a bar that is identical in every way but is made from a different material that has a larger thermal conductivity.

3. The Shepherds Flat Wind Farm near Arlington Oregon uses 338 wind turbines. The type of turbine used is the GE 2.5xl. The moment of inertia for a single rotating rotor of the GE 2.5xl is about 3.5 x 10^7 kg m^2. Each rotor spins at about 10 revolutions per minute. How much mass of liquid water (originally at 0°C) could be vaporized into gas at 100°C using one rotor's worth of rotational kinetic energy?

Constants
c_{water} = 4190 J/kg·K
c_{ice} = 2090 J/kg·K
$L_{f,water}$ = 3.33x10^5 J/kg
$L_{v,water}$ = 22.6x10^5 J/kg
ρ_{water} = 1000 kg/m^3

Sensemaking Follow-up (not due during timed quiz but should be part of final solution)

How much would it cost at 14 cents/kw·hr to vaporize this mass of water?