# Physics 1301, Exam 4 Review

The following is a list of things you should *definitely* know for the exam, however, the list *is not* exhaustive. You are responsible for all the material covered in the assigned readings, lectures, and homework assignments. We did not discuss stress and strain or Young's modulus, so you are not responsible for those topics.

- Perform basic calculations about moving fluids using the continuity equation and Bernoulli's equation.
- Perform basic calculations regarding the linear, area, and volume expansion of materials.
- Perform basic calculations regarding heat flow and heat capacity and latent heat.
- Perform basic calculations using the ideal gas law.
- Perform basic calculations concerning the kinetic theory of gases.
- Solve basic problems using the first law of thermodynamics.
- Solve basic problems concerning the efficiency of engines.
- Explain what the second law of thermodynamics is, and answer basic questions about it.

# Exam 4 Multiple Choice Problems

**Sample** **Dr. Andersen**

On the scantron sheet provided, *write* and *bubble in* your name. In the *identification number* field, write and bubble in the 7 digits from your student id number from your black cougar 1 card, or from your fee bill (do not try to fill the first two characters, which are letters.) Each of the following multiple choice questions is worth seven points. Mark the correct answer on the scantron sheet provided.

1. A gas undergoes an expansion at constant pressure, starting with a volume of 2.13 L, at a temperature of 23.0° $C$, and ending at a temperature of 42.0° $C$. What is the final volume filled by the gas?

   (a) 2.13 L.

   (b) 3.89 L.

   (c) 1.17 L.

   (d) 2.00 L.

   (e) 2.27 L.

2. A copper rod has a length of 12.000 cm at a temperature of 22.000° $C$. If its temperature is decreased to −22.000° $C$, what will the length of the rod be? The coefficient of linear expansion for copper is $17 \times 10^{-6}$ $K^{-1}$.

   (a) 12.018 cm.

   (b) 11.982 cm.

   (c) 12.000 cm.

   (d) 12.009 cm.

   (e) 11.991 cm.

3. Two identical cans are filled with gas, one with helium and the other with argon. Each can contains the same number of atoms of its respective gas, and the average speed of the gas atoms in each can is the same. Based on this, what can you conclude about the temperatures in the cans?

   (a) The temperature of the helium is higher than that of the argon.

   (b) The temperature of the argon is higher than that of the helium.

   (c) Both gases will have the same temperature.

   (d) It is not possible to determine the relative temperature of the two gases from the information given.

4. A heat engine operates between a hot reservoir of temperature 353 K, and a cold reservoir of temperature 281 K. The maximum efficiency of this heat engine is:

   (a) 0.204.

   (b) 0.796.

   (c) 0.256.

   (d) 0.734.

   (e) 1.00.

5. The first law of thermodynamics can be stated as $\Delta U = Q - W$. What conservation law in physics is the fist law of thermodynamics an alternative statement of?

   (a) Conservation of mass.

   (b) Conservation of linear momentum.

   (c) Conservation of angular momentum.

   (d) Conservation of energy.

   (e) Conservation of charge.

6. A silver ring of mass 4.0 grams goes from a temperature of 0.0° $C$ to a temperature of 37° $C$. How much heat was absorbed by the ring? The specific heat of silver is 234 $J/(kg\ K)$.

   (a) 8.8 J.

   (b) 35 J.

   (c) 22 J.

   (d) 290 J.

   (e) 51 J.

7. When you freeze water in your freezer to make ice cubes, the amount of order in the molecules of the water increases. However, the second law of thermodynamics says that the amount of order in an isolated system can only stay constant or decrease with time. How come making ice cubes doesn't violate the second law of thermodynamics?

   (a) Water is essential to life, and the laws of thermodynamics don't apply to living organisms.

   (b) The second law of thermodynamics doesn't apply to systems that undergo phase changes.

   (c) Because the ice cubes don't constitute an isolated system.

   (d) The ice can always be melted, and so the amount of order in the system has not permanently increased.

8. What is the temperature in Kelvin of something that has a temperature of 56° $F$?

   (a) 13 K.

   (b) 217 K.

   (c) 260 K.

   (d) 286 K.

   (e) 329 K.

9. How much energy is required to vaporize 100. grams of water, if it starts at 100.° $C$? For water, $L_f = 33.5 \times 10^4\ J/kg$ and $L_V = 22.6 \times 10^5\ J/kg$.

   (a) $2.26 \times 10^5\ J$.

   (b) $3.35 \times 10^4\ J$.

   (c) $2.26 \times 10^8\ J$.

   (d) $3.35 \times 10^7\ J$.

   (e) $5.60 \times 10^5\ J$.

10. A closed can with a movable plunger at one end contains an ideal monatomic gas. The gas in the can undergoes an isothermal process. Which of the following *must* be true about this process?

    (a) No heat enters or leaves the can.

    (b) No work is done by or on the gas.

    (c) The volume of the gas does not change.

    (d) The internal energy of the gas does not change.

    (e) The pressure in the gas does not change.

# Exam 4 Worked Problems

## Sample Dr. Andersen



Both problems are worth 15 points, and will be graded in a manner similar to the assigned homework problems in the book; up to 6 points possible for the description of your solution method, up to 6 points for your algebra and other work *(available only if you receive the full 6 points for the description)*, and three points for the correct answer *(available only if you receive the full 6 points for your work)*, including units.

1.) A 625 g iron block is heated to 352° $C$ is placed in an insulated container (of negligible heat capacity) containing 40.0 g of water at 15.0° $C$. What is the equilibrium temperature of this system? If your answer is 100° $C$, determine the amount of water that has vaporized. The average specific heat of iron over this temperature range is 560 $J/(kg\ K)$, and the specific heat of liquid water is 4186 $J/(kg\ K)$.

2.) With the pressure held constant at 210 kPa, 49 mol of a monatomic gas ideal gas expands from an initial volume of 0.75 $m^3$ to a final volume of 1.9 $m^3$. a) How much work was done by the gas during the expansion? b) What was the change in the internal energy of the gas? c) How much heat was added to the gas?