

MIDTERM EXAM-4 – v1

PHYS 201 (Spring 2015), 05/01/15

Name:

Lab-Sect. no.:

Signature:

In taking this exam you confirm to adhere to the Aggie Honor Code:
“An Aggie does not lie, cheat, steal or tolerate those who do.”

Duration: 50 minutes

Show all your work for full/partial credit!

Include the correct units in your final answers for full credit!

Unless otherwise stated, quote your results in SI units!

1.) *Multiple Choice*

(18 pts.)

For each statement below, circle the correct answer (TRUE or FALSE, no reasoning required).

- (a) If a police car is moving away from you, you will hear its siren with a higher frequency than when the police car is at rest.
TRUE FALSE
- (b) The frequency of standing waves on a string depends on the tension in the string.
TRUE FALSE
- (c) Just like sound propagation, heat transfer via radiation requires a medium.
TRUE FALSE
- (d) At constant volume the pressure of an ideal gas is proportional to the average kinetic energy of the gas particles.
TRUE FALSE
- (e) When an ideal gas does expansion work without heat being added to it, its temperature increases.
TRUE FALSE
- (e) The heat capacity of a gas is larger when it is kept at constant pressure compared to constant volume.
TRUE FALSE

No.	Points
1	
2	
3	
4	
5	
Sum	

2.) *Standing Wave and Sound Intensity*

(24 pts.)

A wire of mass 25 g and length 1.2 m with both ends fixed vibrates in its second harmonic frequency of 300 Hz .

- (a) What is the propagational speed on the wire?
- (b) What is the tension in the wire?
- (c) If the intensity level of the emitted sound is 40 dB at 1 m distance, at which distance has the intensity level dropped to 0 dB (assume spherical propagation)?

3.) *Heat Capacity*

(12+6 pts.)

Consider 1 kg ice at 0 degrees Fahrenheit (specific heat capacities: $c_{\text{ice}}=2010 \text{ J}/(\text{kg} \cdot \text{K})$,
 $c_{\text{water}}=4190 \text{ J}/(\text{kg} \cdot \text{K})$, $c_{\text{steam}}=1890 \text{ J}/(\text{kg} \cdot \text{K})$; latent heats: $L_f=3.34 \cdot 10^5 \text{ J/K}$,
 $L_v=2.256 \cdot 10^6 \text{ J/K}$).

- (a) Calculate the energy needed to convert the ice into steam at 250°F .
- (b) Equate the energy calculated in part (a) to gravitational potential energy, to calculate the height (in *miles*) to which the ice would have to be lifted. (1 *mi* = 1.6 *km*)

4.) *Kinetic Theory of Gases*

(16 pts.)

In the following assume ideal monatomic gases.

- (a) What is the root-mean-square speed of helium atoms (mass $4u$) at a temperature of $T = -200^\circ\text{C}$?
- (b) At which temperature do argon atoms (mass $40u$) have the same root-mean-square speed than helium atoms at $T = -200^\circ\text{C}$?

5.) *Ideal Gas Equation*

(24 pts.)

In an isothermal process an ideal gas expands to a final volume of 0.2 m^3 at a final pressure of $5 \cdot 10^4\text{ Pa}$ at $T = 120^\circ\text{C}$. The initial pressure was 5 times larger than the final one.

- (a) How many moles of gas are used?
- (b) What is the initial volume of the gas?
- (c) Sketch the p - V diagram of the process and calculate the work that has been done by or on the gas (include the correct sign)?