International University - VNUHCM
Department of Physics

Final Exam

Date: 22/02/2022 Duration: 120 minutes

Open Book and Online

SUBJECT: PHYSICS 2 (FLUID MECHANICS AND THERMAL PHYSICS)

(ID: PH014IU)

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Proctor 1 Signature Full name:	Proctor 2 Signature Full name:

STUDENT INFO

Student name:

Student ID:

INSTRUCTIONS: the total of point is 100 (equivalent to 30% of the course)

1. *Purpose:*
   - Test your understanding of basic knowledge of The Kinetic Energy of Ideal Gas and the Second Law of Thermal Dynamics (CLO3).
   - Examine your skill in analysis and design a problem in science and engineering (CLO2).
   - Test your ability in applying knowledge of physics (CLO1).
   - Evaluate your English skills in writing communication manner (CLO4).
2. *Requirement:*
   - Read carefully each question and answer it following the requirements.
   - Write the answers and draw models CLEAN and TIDY directly in the exam paper.
   - Submit your exam including this cover page and the solutions of the following problems.

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Q1 (20 marks):

a. The variation of the specific heat of a substance is given by the expression $C = A + BT^2$, where A and B are constants and T is Celsius temperature. Show that the difference between the mean specific heat and the specific heat at midpoint $T/2$ is $\overline{C} - C(T/2) = BT^2/12$. Here, we define $\overline{C} = \frac{\int_0^T C dT}{\int_0^T dT}$.

b. In an ideal monatomic gas adiabatic expansion, if the volume of the gas increases from V_0 to $2V_0$ then what happens to the temperature?

Q2 (20 marks):

a. Three moles of an ideal diatomic gas occupy a volume of 20 dm^3 at 200 K. If the gas expands adiabatically to 40 dm^3, then find the final pressure.

b. A gas at temperature T is composed of molecules of mass m. Calculate the average time between intermolecular collisions varies with m?

Q3 (20 marks): A 3.0 g bullet moving at 120 m/s on striking a 50 g block of wood is arrested within the block. Given the specific heat of lead is 0.031 cal/g^0C. Calculate the rise of temperature of the bullet if:

a. the block is fixed;

b. the block is free to move.

Q4 (20 marks): A gaseous mixture consists of a diatomic gas and a monatomic gas. Let the degree of disassociation be $\delta = \frac{m_1}{m}$, where m_1 is the mass of the monatomic portion and m is the mixture mass. The monatomic gas has a mass of A g/mole. Assuming the total pressure of system is the additional pressures from the diatomic gas and a monatomic gas.

a. Show that the equation of state of the gas is $PV = [m_1 + \frac{1}{2}(m - m_1)]\frac{RT}{A}$.

b. Rewrite the equation of state of the gas above in term of m, δ, R, T and A. ($PV = \frac{m(1+\delta)}{2A}RT$.)

Q5: (20 marks)

a. Consider the quasi-static adiabatic expansion of an ideal gas from an initial state i to a final state f. Can the gas maintain its temperature as a constant? Explain your answer!

b. A mixture of Oxygen (molecular mass 32 u) and Nitrogen (molecular mass 28 u) molecules is maintain at a constant temperature. Find the root-mean-square speed ratio of $\frac{v_{rms}(Oxygen)}{v_{rms}(Nitrogen)}$

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