International University - VNUHCM
Department of Physics

Final Examination

Date: January 11, 2022; Duration: 120 minutes

Open book; **Online; Laptops/Cell-phones are allowed.**

SUBJECT: PHYSICS 2 (ID: PH014IU)	
Approval by Chair of Department of Physics Signature  Full name: Phan Bảo Ngọc	Lecturer: Signature  Full name: Phan Hiền Vũ
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 knowledge in CLO1
   - Examine your skill in analysis and design in CLO2 and CLO3
   - Evaluate your English skill in analyzed writing in CLO4
2. *Requirements:*
   - Choose carefully your exam CODE.
   - Read carefully each question and answer it following the requirements
   - Write the answers and draw models CLEAN and TIDY directly in the exam paper.
   - Take CLEAR photos of your exam paper, and convert them into ONE PDF FILE, named 'YOUR NAME'.PDF.
   - Submit your exam FILE in the Blackboard system as an assignment by DEADLINE

QUESTIONS (CODE: 1)

Q1. (20 marks) A gas consisting of 1 mole of a monatomic gas goes through the cyclic process ABCA. It starts off at point A of pressure p_0 and volume V_0. It firstly expands at constant pressure to double volume at point B. Then the pressure is reduced, with constant volume, to half pressure at point C. Finally, the gas is compressed with a constant temperature back to point A.

a) Sketch the cyclic process ABCA in the p - V plane.

b) If $p_0 = 6$ kPa and $V_0 = 2$ m^3, compute the energy transferred as heat through the whole cycle.

Q2. (20 marks) A balloon filled with 0.001 mol helium is at the temperature of 20^{o}C in the room. The molar mass of helium is 4.002602 g/mol and the diameter of helium is 140 pm.

a) Determine the root-mean-square speed of helium atoms moving around in the balloon.

b) If the volume of the balloon is 50 cm^3, compute the mean free path of helium.

Q3. (20 marks) The temperature of 2 moles of a diatomic gas is raised 15 K at constant volume.

a) Compute the energy transferred as heat.

b) Compute the change in the internal energy of the gas.

c) Compute the change in the average kinetic energy per molecule.

Q4. (20 marks) A monatomic gas is contained in a cylinder with a movable piston. Initially it has a volume V_0, pressure P_0 and temperature T_0. A weight is placed on the piston, and the gas is compressed adiabatically to a pressure $10P_0$. Hint: Express your answers in terms of V_0 and T_0 respectively.

a) What is the final volume of the gas?

b) What is the final temperature of the gas?

c) What is the internal energy change of the gas? Explain why it changes.

Q5. (20 marks) A 100 g aluminum box is at a temperature of 60^{o}C. The aluminum box is thrown into the lake, which has a temperature of 15^{o}C. After the aluminum box is finished transferring energy into the lake, how much did the entropy change of the box-lake system?

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QUESTIONS (CODE: 2)

Q1. (20 marks) A gas consisting of 1 mole of a monatomic gas goes through the cyclic process ABCA. It starts off at point A of pressure p_0 and volume V_0. Firstly, the pressure is reduced, with constant volume, to half pressure at point B. Then, the gas is compressed with a constant temperature to half volume at point C. Finally, it expands at constant pressure back to point A.

a) Sketch the cyclic process ABCA in the p - V plane.

b) If $p_0 = 6$ kPa and $V_0 = 4$ m^3, compute the energy transferred as heat through the whole cycle.

Q2. (20 marks) A balloon filled with 0.001 mol nitrogen is at the temperature of 20°C in the room. The molar mass of nitrogen is 28.014 g/mol and the diameter of nitrogen is 364 pm.

a) Determine the root-mean-square speed of nitrogen molecules moving around in the balloon.

b) If the volume of the balloon is 50 cm^3, compute the mean free path of nitrogen.

Q3. (20 marks) The temperature of 2 moles of a polyatomic gas is raised 20 K at constant volume.

a) Compute the energy transferred as heat.

b) Compute the change in the internal energy of the gas.

c) Compute the change in the average kinetic energy per molecule.

Q4. (20 marks) A diatomic gas is contained in a cylinder with a movable piston. Initially it has a volume V_0, pressure P_0 and temperature T_0. A weight is placed on the piston, and the gas is compressed adiabatically to a pressure $15P_0$. Hint: Express your answers in terms of V_0 and T_0 respectively.

a) What is the final volume of the gas?

b) What is the final temperature of the gas?

c) What is the internal energy change of the gas? Explain why it changes.

Q5. (20 marks) A 200 g copper cup is at a temperature of 75°C. The copper cup is thrown into the lake, which has a temperature of 17°C. After the copper cup is finished transferring energy into the lake, how much did the entropy change of the cup-lake system?

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QUESTIONS (CODE: 3)

Q1. (20 marks) A gas consisting of 1 mole of a monatomic gas goes through the cyclic process ABCA. It starts off at point A of pressure p_0 and volume V_0. Firstly, the gas is compressed with a constant temperature to half volume at point B. Then, it expands at constant pressure to double volume at point C. Finally, the pressure is reduced, with constant volume, back to point A.

a) Sketch the cyclic process ABCA in the p - V plane.

b) If $p_0 = 3$ kPa and $V_0 = 4$ m^3, compute the energy transferred as heat through the whole cycle.

Q2. (20 marks) A balloon filled with 0.001 mol hydrogen is at the temperature of 20^{o}C in the room. The molar mass of hydrogen is 1.00794 g/mol and the diameter of hydrogen is 120 pm.

a) Determine the root-mean-square speed of hydrogen molecules moving around in the balloon.

b) If the volume of the balloon is 50 cm^3, compute the mean free path of hydrogen.

Q3. (20 marks) The temperature of 2 moles of a monatomic gas is raised 25 K at constant volume.

a) Compute the energy transferred as heat.

b) Compute the change in the internal energy of the gas.

c) Compute the change in the average kinetic energy per atom.

Q4. (20 marks) A polyatomic gas is contained in a cylinder with a movable piston. Initially it has a volume V_0, pressure P_0 and temperature T_0. A weight is placed on the piston, and the gas is compressed adiabatically to a pressure $20P_0$. Hint: Express your answers in terms of V_0 and T_0 respectively.

a) What is the final volume of the gas?

b) What is the final temperature of the gas?

c) What is the internal energy change of the gas? Explain why it changes.

Q5. (20 marks) A 500 g steel can is at a temperature of 80^{o}C. The steel can is thrown into the lake, which has a temperature of 20^{o}C. After the steel can is finished transferring energy into the lake, how much did the entropy change of the can-lake system?

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