

PRACTICE EXAM

Difficulty: MEDIUM

Questions: 10

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## Thermodynamics & Fluids - Chapter 3 & 4 Exam

Instructions: Answer all questions to the best of your ability. Show your work for problem-solving questions.

### # Multiple Choice Questions (4 points each, 40 points total)

Instructions: Choose the best answer for each question.

**Question 1:** What assumption is made regarding specific volume in the incompressible substance model?

- A) Specific volume is assumed to vary linearly with temperature.
- B) Specific volume is assumed to be constant.
- C) Specific volume is assumed to vary exponentially with pressure.
- D) Specific volume is assumed to be negligible.

**Question 2:** Under what conditions is the ideal gas model most accurate?

- A) High pressure and low temperature
- B) Low pressure and high temperature
- C) High pressure and high temperature
- D) Low pressure and low temperature

**Question 3:** What is the process called when  $n=0$  in a polytropic process?

- A) Isothermal
- B) Isometric
- C) Isobaric
- D) Isentropic

**Question 4:** In a control volume analysis, what does  $\dot{W}$  represent in the energy rate balance equation?

- A) Flow work
- B) Heat transfer rate
- C) All work effects excluding flow work
- D) Kinetic energy

**Question 5:** What type of device develops power as a gas or liquid passes through a set of blades attached to a rotating shaft?

- A) Nozzle
- B) Diffuser
- C) Turbine
- D) Compressor

## # Short Answer Questions (6 points each, 30 points total)

Instructions: Answer each question in 2-3 sentences.

**Question 6:** Explain why specific volume and internal energy change very little with pressure at a fixed temperature for liquids.

**Question 7:** Describe the key difference between a nozzle and a diffuser in terms of their effect on fluid velocity.

**Question 8:** Explain the concept of flow work and why it is important in control volume analysis.

## # Problem-Solving Questions (10 points each, 30 points total)

Instructions: Show all work for full credit.

**Question 9:** Air is compressed steadily by a compressor from 100 kPa and 20°C to 600 kPa and 177°C at a rate of 1.6 kg/s. Assuming constant specific heats, determine the power required to drive the compressor in kW. (Assume  $c_p = 1.005 \text{ kJ/kg.K}$ ).

**Question 10:** A well-insulated rigid tank of volume 5 m<sup>3</sup> contains 4 kg of air at 27°C. A paddle wheel inside the tank is rotated by an external power source until the temperature inside rises to 77°C. If the air is considered an ideal gas with constant specific heats ( $c_v = 0.718 \text{ kJ/kg.K}$ ), determine the work done by the paddle wheel in kJ.

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