Thermodynamics

Course Number: ME-02-101

PDH: 12

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TERMINAL OBJECTIVE

1.0 Given operating conditions of a system, **EVALUATE** the thermodynamic state of the system.

ENABLING OBJECTIVES

1.1 **DEFINE** the following properties:
- a. Specific volume
- b. Density
- c. Specific gravity
- d. Humidity

1.2 **DESCRIBE** the following classifications of thermodynamic properties:
- a. Intensive properties
- b. Extensive properties

1.3 **DEFINE** the thermodynamic properties temperature and pressure.

1.4 **DESCRIBE** the Fahrenheit, Celsius, Kelvin, and Rankine temperature scales including:
- a. Absolute zero temperature
- b. The freezing point of water at atmospheric pressure
- c. The boiling point of water at atmospheric pressure

1.5 **CONVERT** temperatures between the Fahrenheit, Celsius, Kelvin, and Rankine scales.

1.6 **DESCRIBE** the relationship between absolute pressure, gauge pressure, and vacuum.

1.7 **CONVERT** pressures between the following units:
- a. Pounds per square inch
- b. Inches of water
- c. Inches of mercury
- d. Millimeters of mercury
- e. Microns of mercury

1.8 **DEFINE** the following:
- a. Heat
- b. Latent heat
- c. Sensible heat
- d. Unit used to measure heat

ENABLING OBJECTIVES (Cont.)

1.9 **DEFINE** the following thermodynamic properties:
- a. Specific enthalpy
- b. Entropy

1.10 **DESCRIBE** the following types of thermodynamic systems:
- a. Isolated system
- b. Closed system
- c. Open system

1.11 **DEFINE** the following terms concerning thermodynamic systems:
- a. Thermodynamic surroundings
- b. Thermodynamic equilibrium
- c. Control volume
- d. Steady-state

1.12 **DESCRIBE** the following terms concerning thermodynamic processes:
- a. Thermodynamic process
- b. Cyclic process
- c. Reversible process
- d. Irreversible process
- e. Adiabatic process
- f. Isentropic process
- g. Throttling process
- h. Polytropic process

1.13 **DISTINGUISH** between intensive and extensive properties.

1.14 **DEFINE** the following terms:
- a. Saturation
- b. Subcooled liquid
- c. Superheated vapor
- d. Critical Point
- e. Triple Point
- f. Vapor pressure curve
- g. Quality
- h. Moisture content

1.15 **DESCRIBE** the processes of sublimation, vaporization, condensation, and fusion.

ENABLING OBJECTIVES (Cont.)

1.16 Given a Mollier diagram and sufficient information to indicate the state of the fluid, **DETERMINE** any unknown properties for the fluid.

1.17 Given a set of steam tables and sufficient information to indicate the state of the fluid, **DETERMINE** any unknown properties for the fluid.

1.18 **DETERMINE** the change in the enthalpy of a fluid as it passes through a system component, given the state of the fluid at the inlet and outlet of the component and either steam tables or a Mollier diagram.

1.19 **STATE** the First Law of Thermodynamics.

1.20 Using the First Law of Thermodynamics, **ANALYZE** an open system including all energy transfer processes crossing the boundaries.

1.21 Using the First Law of Thermodynamics, **ANALYZE** cyclic processes for a thermodynamic system.

1.22 Given a defined system, **PERFORM** energy balances on all major components in the system.

1.23 Given a heat exchanger, **PERFORM** an energy balance across the two sides of the heat exchanger.

1.24 **IDENTIFY** the path(s) on a T-s diagram that represents the thermodynamic processes occurring in a fluid system.

1.25 **STATE** the Second Law of Thermodynamics.

1.26 Using the Second Law of Thermodynamics, **DETERMINE** the maximum possible efficiency of a system.

1.27 Given a thermodynamic system, **CONDUCT** an analysis using the Second Law of Thermodynamics.

1.28 Given a thermodynamic system, **DESCRIBE** the method used to determine:
- a. The maximum efficiency of the system
- b. The efficiency of the components within the system

ENABLING OBJECTIVES (Cont.)

1.29 **DIFFERENTIATE** between the path for an ideal process and that for a real process on a T-s or h-s diagram.

1.30 Given a T-s or h-s diagram for a system **EVALUATE**:
- a. System efficiencies
- b. Component efficiencies

1.31 **DESCRIBE** how individual factors affect system or component efficiency.

1.32 Apply the ideal gas laws to **SOLVE** for the unknown pressure, temperature, or volume.

1.33 **DESCRIBE** when a fluid may be considered to be incompressible.

1.34 **CALCULATE** the work done in constant pressure and constant volume processes.

1.35 **DESCRIBE** the effects of pressure changes on confined fluids.

1.36 **DESCRIBE** the effects of temperature changes on confined fluids.

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