

Thermodynamics: Homework A – Set 1
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Problem 1

Start here. Read the Following, then Answer the Question below.

The relation between resistance R and temperature T for a thermistor (a device that measures temperature) closely follows this equation, where R_0 is the resistance, in ohms, measured at temperature T_0 , in Kelvin, and Beta is a material constant.

$$R = R_0 \exp[\beta(1/T - 1/T_0)]$$

Question 1:

What are the dimensional units of R_0 ?

- A. Ohm
- B. Ohm per Kelvin
- C. Kelvin per Ohm
- D. Kelvin
- E. None of the above

Question 2:

What are the dimensional units of Beta?

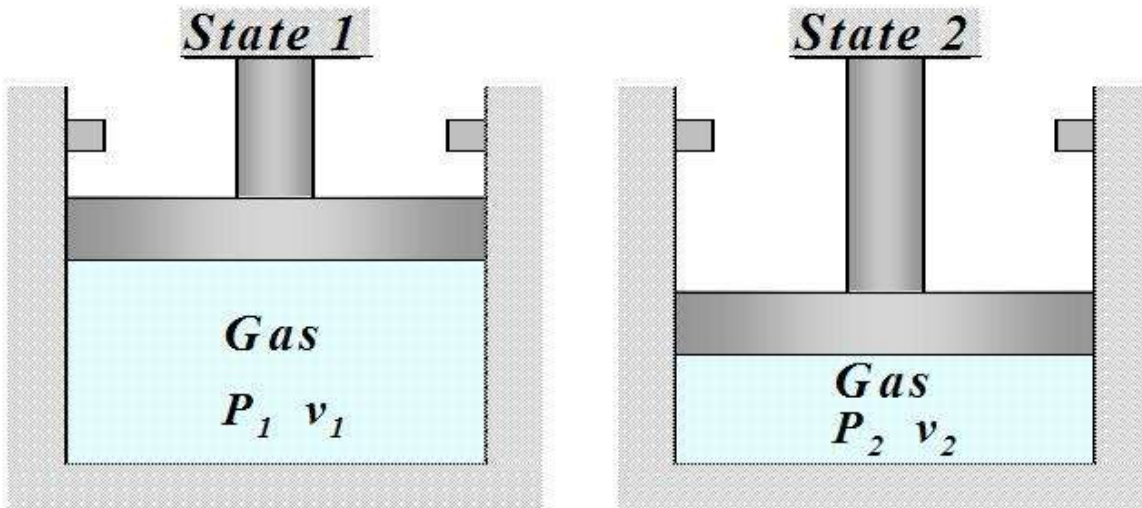
- A. Ohm
- B. Ohm per Kelvin
- C. Kelvin per Ohm
- D. Kelvin
- E. None of the Above

Problem 2

Start here. Read the Following, then click "Get Values."

One kilogram of a refrigerant is contained in a piston cylinder arrangement. The refrigerant is compressed from State 1, where $P_1 = 2$ bars, $v_1 = 83.54 \text{ cm}^3 / \text{gm}$, to State 2, where the pressure is P_2 and $v_2 = 21.34 \text{ cm}^3 / \text{gm}$. During this process, the relationship between the pressure and specific volume is of the form $Pv^n = C$, where C is a constant.

$P_2 = 10.442$ bars



Question 1 of 3:

Which of these relationships between P , v , v , and C are true?

- A. $Pv^n = C$
- B. $P_1 * v_1^n = P_2 * v_2^n$
- C. $(v_1/v_2)^n = P_2/P_1$
- D. None of the above

Question 2 of 3:

What is the value of n ?

Question 3 of 3:

What are the units of n ?

- A. g/cm^3
- B. kg
- C. cm^3/g
- D. None; it is a dimensionless quantity.

Source URL: <http://thermodynamics.eng.usf.edu/indexA.html>

Saylor URL: <http://www.saylor.org/courses/ME103/#1.3>

Problem 3



A new absolute temperature scale is proposed. On this scale the ice point of water is $150\text{ }^{\circ}\text{S}$ and the steam point is $300\text{ }^{\circ}\text{S}$. Use the temperatures given below to determine the required values for the questions.

$$T_1=50^{\circ}\text{S} \quad T_2=400^{\circ}\text{S}$$

Question 1 of 4:

- A. 0°C
- B. 0°F
- C. -273.15K
- D. 0K
- E. None of the above

Question 2 of 4:

What is the temperature in $^{\circ}\text{C}$ that corresponds to T_1 ?

Question 3 of 4:

What is the temperature in $^{\circ}\text{C}$ that corresponds to T_2 ?

Question 4 of 4:

What is the ratio of the size of $^{\circ}\text{S}$ to the Size of the $^{\circ}\text{C}$ (i.e. $^{\circ}\text{S}/^{\circ}\text{C}$)?

Problem 4



Oil flows through a 6 inch diameter pipe at a rate of "G" barrels per day (BPD) (42 gallons per barrel) and has a density of 35 lbm/ft³. Convert this flow rate as indicated in the questions below.

G= 50,000 BPD

Question 1 of 6:

Which of the Following are correct? Check all that apply

- 1 psia = 144 lb/ft²
- 1kW = 1.341 hp
- 1 m = 39.370 in
- 1 slug = 14.5939 kg
- None of the above

Question 2 of 6:

What is the oil flow rate in pounds per minute (lbm/min)?

Question 3 of 6:

What is the oil flow in litres per second (L/s)?

Question 4 of 6:

What is the oil flow in gallons per minute?

Question 5 of 6:

What is the oil flow in cubic feet per minute (cfm or ft³/min)?

Question 6 of 6:

What is the oil flow velocity in feet per second (ft/s)?

Problem 5



A vacuum gauge connected to a tank reads P_1 at a location where the barometric reading is 28.5 in Hg. The density of mercury is 848.4 lb/ft³.

$$P_1 = 5.4 \text{ PSI}$$

Question 1 of 2:

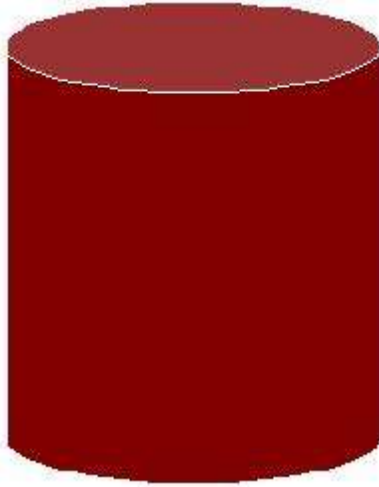
Which of the following are given in the problem statement? Check all that apply.

- P absolute
- P guage
- P vacuum
- P atm

Question 2 of 2:

What is the absolute pressure in the tank (psi)?

Problem 6



A gas of molecular weight M is contained in a cylindrical vessel 10 m in diameter and 20 m in height. Pressure is 325 psia and temperature is 465 °F.

$$M = 50$$

Question 1 of 5:

What is the volume occupied by the gas, in m^3 ?

- A. 15 m^3
- B. 1571 m^3
- C. 146 m^3
- D. 3002 m^3
- E. 45789 m^3

Question 2 of 5:

How many lbmoles of gas are contained within the cylinder?

Question 3 of 5:

How many pounds of gas are contained within the cylinder?

Question 4 of 5:

What is the mass density of gas, in lbm/ft^3 , within the cylinder?

Question 5 of 5:

What is the molar density, in $lbmol/ft^3$, of the gas within the container?

Problem 7



A automobile weighs W . The acceleration due to gravity is 32.2 ft/s^2 . The driver wishes to find how to achieve a constant rate of acceleration.

$$W = 2,200 \text{ lb force}$$

Question 1 of 3:

Which of Newton's Laws apply to this problem? Check all that apply.

First Law

Second Law

Second Law

Third Law

Fourth Law

None of the above; Newton's Laws do not apply here.

Question 2 of 3:

What is the mass of the car in lbm?

Question 3 of 3:

What is the magnitude of the net force, in lb-force, required to accelerate the automobile at a constant rate of 5 ft/s^2 ?
