HOMEWORK PROBLEMS Chapter 19: TEMPERATURE

Hand in your solutions in class, on:

**Show the equations and calculations, and box your answer. Be sure to include the units.**

NOTE: Any **four questions** from this HW will be graded, and the marks for this HW will be based on these only. (1, 5, 7, 9, 15, 19, 23, 24, 29, 35, 40, 62)

**1.** Convert the following temperatures to their values on the Fahrenheit and Kelvin scales:

(a) the sublimation point of dry ice, –78.5°C; (b) human body temperature, 37.0°C.



**5.** Liquid nitrogen has a boiling point of –195.81°C at atmospheric pressure. Express this temperature (a) in degrees Fahrenheit and (b) in kelvins.



**7.** A copper telephone wire has essentially no sag between poles 35.0 m apart on a winter day when the temperature is –20.0°C. How much longer is the wire on a summer day when the temperature is 35.0°C?



**9.** The active element of a certain laser is made of a glass rod 30.0 cm long and 1.50 cm in diameter. Assume the average coefficient of linear expansion of the glass is equal to 9.00 × 10–6 (°C)–1. If the temperature of the rod increases by 65.0°C, what is the increase in (a) its length, (b) its diameter, and (c) its volume?



**15.** A hollow aluminum cylinder 20.0 cm deep has an internal capacity of 2.000 L at 20.0°C. It is completely filled with turpentine at 20.0°C. The turpentine and the aluminum cylinder are then slowly warmed together to 80.0°C. (a) How much turpentine overflows? (b) What is the volume of turpentine remaining in the cylinder at 80.0°C? (c) If the combination with this amount of turpentine is then cooled back to 20.0°C, how far below the cylinder’s rim does the turpentine’s surface recede?



**19.** Gas is confined in a tank at a pressure of 11.0 atm and a temperature of 25.0°C. If two-thirds of the gas is withdrawn and the temperature is raised to 75.0°C, what is the pressure of the gas remaining in the tank?



**23.** ****An auditorium has dimensions 10.0 m × 20.0 m × 30.0 m. How many molecules of air fill the auditorium at 20.0°C and a pressure of 101 kPa (1.00 atm)?



**24. Q|C** A container in the shape of a cube 10.0 cm on each edge contains air (with equivalent molar mass 28.9 g/mol) at atmospheric pressure and temperature 300 K. Find (a) the mass of the gas, (b) the gravitational force exerted on it, and (c) the force it exerts on each face of the cube. (d) Why does such a small sample exert such a great force?



**29.** An automobile tire is inflated with air originally at 10.0°C and normal atmospheric pressure. During the process, the air is compressed to 28.0% of its original volume and the temperature is increased to 40.0°C. (a) What is the tire pressure? (b) After the car is driven at high speed, the tire’s air temperature rises to 85.0°C and the tire’s interior volume increases by 2.00%. What is the new tire pressure (absolute)?



**35.** A spherical steel ball bearing has a diameter of 2.540 cm at 25.00°C. (a) What is its diameter when its temperature is raised to 100.0°C? (b) What temperature change is required to increase its volume by 1.000%?



**40.** The density of gasoline is 730 kg/m3 at 0°C. Its average coefficient of volume expansion is 9.60 × 10–4 (°C)−1. Assume 1.00 gal of gasoline occupies 0.003 80 m3. How many extra kilograms of gasoline would you receive if you bought 10.0 gal of gasoline at 0°C rather than at 20.0°C from a pump that is not temperature compensated?



**62.** A cylinder that has a 40.0-cm radius and is 50.0 cm deep is filled with air at 20.0°C and 1.00 atm (Fig. P19.62a). A 20.0-kg piston is now lowered into the cylinder, compressing the air trapped inside as it takes equilibrium height *hi* (Fig. P19.62b). Finally, a 25.0-kg dog stands on the piston, further compressing the air, which remains at 20°C (Fig. P19.62c). (a) How far down (Δ*h*) does the piston move when the dog steps onto it? (b) To what temperature should the gas be warmed to raise the piston and dog back to *hi*?

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**Figure P19.62**

