

### Answer on Question #64077, Chemistry / General Chemistry

Students at the University of North Texas and the University of Washington built a car propelled by compressed nitrogen gas. The gas was obtained by boiling liquid nitrogen stored in a 180.0 L tank. What volume of N<sub>2</sub> is released at 0.970 atm of pressure and 25 degrees C from a tank full of liquid N<sub>2</sub> (d= 0.808 g/mL)?

#### Solution:

Use the ideal gas equation of state

$$PV = nRT$$

Where,  $n = m/M$

We find the mass of N<sub>2</sub>

$$m = \rho V = 808 \text{ kg/m}^3 \times 0.18 \text{ m}^3 = 145.44 \text{ kg}$$

$$M (\text{N}_2) = 28 \text{ g/mol} = 0.028 \text{ kg/mol}$$

We find the n

$$n = 145.44 \text{ kg} / 0.028 \text{ kg/mol} = 5194 \text{ mol}$$

Find the amount of nitrogen that would release

$$V = nRT / P$$

$$\text{Where, } R = 8.31 \text{ J/molK; } T = 273 + 25 = 298 \text{ K; } P = 98285.25 \text{ Pa}$$

Finally,

$$V = 5194 \text{ mol} \times 8.31 \text{ J/molK} \times 298 \text{ K} / 98285.25 \text{ Pa} = 130.87 \text{ m}^3 = 130870 \text{ L} = 131 \text{ kL}$$

**Answer: 130.87 m<sup>3</sup>**