

Chemistry-4311
September 18, 2009

Quiz #2

Name Key

1. Matching (Use a letter only once)

According to the ideal gas law equation, for constant number of moles and temperature, pressure is g to volume.

The energy levels for a particle in a box are given by c.

PV is a unit of a.

According to the ideal gas law equation, the density is b.

Tunneling is important for e particles.

- a. energy
- b. MP/RT
- c. $n^2h^2/8mL^2$
- d. proportional
- e. light
- f. force
- g. inversely proportional
- h. heavy
- i. RT/MP
- j. nhv

2. This question is for a particle in a box.

a. Derive an expression for $(E_{n+1} - E_n)$, the spacing between two energy levels.

$$E = \frac{n^2 h^2}{8mL^2}$$
$$\Delta E = E_{n+1} - E_n = \frac{(n+1)^2 h^2}{8mL^2} - \frac{n^2 h^2}{8mL^2}$$
$$= \frac{(n^2 + 2n + 1) h^2}{8mL^2} - \frac{n^2 h^2}{8mL^2} = \frac{(2n+1) h^2}{8mL^2}$$

b. Show that the spacing between levels decreases as either the mass of the particle or the size of the box increases.

$$\Delta E = \frac{(2n+1) h^2}{8mL^2}$$

becomes smaller as either m or L is increased

3. A sample of air occupies 5.00 liters (L) at 25 °C and 1.00 atm. What pressure is needed to compress the gas to 0.250 L at this temperature?

$$PV = nRT = \text{constant}$$

$$P_1 V_1 = P_2 V_2$$

$$1.00 \times 5.00 = P_2 \times 0.250$$

$$P_2 = \frac{1.00 \times 5.00}{0.250} = 20.0 \text{ atm}$$