Physics 2305 24 April, 2000

Quiz 15—Form A

One mole of an ideal monatomic gas initially at 300.0 K absorbs 500.0 J of heat, but since it is in an enclosed container, it cannot expand.

1. What is the mean kinetic energy of an atom *before* the heat is absorbed?

A) 4.14×10^{-21} J C) 7.04×10^{-21} J
B) 6.21×10^{-21} J D) Not enough information.

2. By what factor does the pressure change during the process?

A) 0.88 C) 1.06
B) 1.00 D) 1.13

Some useful equations:

$$\Delta E_{int} = Q - W \quad Q = nc\Delta T = mc\Delta T \quad W = \int p\, dV$$
$$\Delta E_{int} = nC_V\Delta T \quad pV = nRT = NkT$$
$$C_V = (3/2)\, R \quad \langle K \rangle = (3/2)\, kT$$

$$v_{rms} = (3RT/M)^{1/2} = (3kT/m)^{1/2}$$

$$R = 8.31 \text{ J mol}^{-1}\text{ K}^{-1} \quad k = 1.38 \times 10^{-23} \text{ J/K}$$

Physics 2305 24 April, 2000
Quiz 15—Form B

One mole of an ideal monatomic gas initially at 300.0 K absorbs 500.0 J of heat, but since it is in an enclosed container, it cannot expand.

1. How much has the internal energy changed in the process?

A) 0 J	C) 500 J
B) 250 J	D) Not enough information.

2. If the atoms are helium (molar mass 4.0026 g/mol, actual mass 6.65×10^{-27} kg/atom), what is the *final* root-mean square velocity?

A) 43.2 m/s	C) 1.37 km/s
B) 46.0 m/s	D) 1.46 km/s

Some useful equations:

$$\Delta E_{int} = Q - W \quad Q = nc\Delta T = mc\Delta T \quad W = \int p\, dV$$
$$\Delta E_{int} = nC_V\Delta T \quad pV = nRT = NkT$$
$$C_V = (3/2)\, R \quad \langle K \rangle = (3/2)\, kT$$

$$v_{rms} = (3RT/M)^{1/2} = (3kT/m)^{1/2}$$

$$R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1} \quad k = 1.38 \times 10^{-23} \text{ J/K}$$

Physics 2305 24 April, 2000
Quiz 15—Form C

One mole of a monatomic ideal gas initially at 12°C (285 K) expands when it absorbs 420.0 J of heat. The pressure throughout remains at 2 atm (202 kPa).

1. What volume does the gas initially occupy?

A) 7.9×10^{-16} m^3	C) 1.2×10^{-2} m^3
B) 4.9×10^{-4} m^3	D) 0.82 m^3

2. If the temperature changes by 20 C° (or K), how much work is done by the expanding gas?

A) 0 J	C) 250 J
B) 170 J	D) 420 J

Some useful equations:

$$\Delta E_{int} = Q - W \qquad Q = nc\Delta T = mc\Delta T \qquad W = \int p\, dV$$
$$\Delta E_{int} = nC_V\Delta T \qquad pV = nRT = NkT$$
$$C_V = (3/2)\, R \qquad \langle K \rangle = (3/2)\, kT$$

$$v_{rms} = (3RT/M)^{1/2} = (3kT/m)^{1/2}$$

$$R = 8.31 \text{ J mol}^{-1}\text{ K}^{-1} \qquad k = 1.38 \times 10^{-23} \text{ J/K}$$