1. Test Bank, Question 18

A quantity of an ideal gas is compressed to half its initial volume. The process may be adiabatic, isothermal or isobaric. Rank those three processes in order of the work required of an external agent, least to greatest.

- adiabatic, isothermal, isobaric
- adiabatic, isobaric, isothermal
- isothermal, adiabatic, isobaric
- isobaric, adiabatic, isothermal
- isobaric, isothermal, adiabatic

2. Test Bank, Question 20

Over 1 cycle of a cyclic process in which a system does net work on its environment:

- the change in the pressure of the system cannot be zero
- the change in the volume of the system cannot be zero
- the change in the temperature of the system cannot be zero
- the change in the internal energy of the system cannot be zero
- none of the above

3. Chapter 19, Problem 13

A sample of an ideal gas is taken through the cyclic process abca shown in Fig. 19-20. The scale of the vertical axis is set by \( p_b = 5.99 \text{ kPa} \) and \( p_{ac} = 6.28 \text{ kPa} \). At point a, \( T = 203 \text{ K} \). (a) What is the temperature at point b? (b) What is the net energy added to the gas as heat during the cycle?

- (a) Number 518.917133757962 Units K
- (b) Number -426.3 Units J

4. Test Bank, Question 23

The force on the walls of a vessel of a contained gas is due to:

- repulsive force between gas molecules
- slight loss in average speed of a gas molecule after collision with wall
- change in momentum of a gas molecule due to collision with wall
- elastic collisions between gas molecules
- inelastic collisions between gas molecules

5. *Chapter 19, Problem 24

At 297 K and 1.17 x 10^{-2} atm, the density of a gas is 1.50 x 10^{-5} g/cm^3. (a) Find \( v_{\text{rms}} \) for the gas molecules. (b) Find the molar mass of the gas.

(a) Number \[ 486.869592396157 \] Units m/s
(b) Number \[ 0.031235856937 \] Units kg/mole

6. *Chapter 19, Problem 26

What is the average translational kinetic energy of nitrogen molecules at 2190 K?

Number \[ 4.5333 \times 10^{-20} \] Units J

*Significant digits are disabled; the tolerance is +/-2%*

7. Test Bank, Question 29

The internal energy of an ideal gas depends on:

- the temperature only
- the pressure only
- the volume only
- the temperature and pressure only
- temperature, pressure, and volume

8. Chapter 19, Problem 37

Figure 19-23 shows a hypothetical speed distribution for a sample of \( N \) gas particles (note that \( P(v) = 0 \) for speed \( v > 2v_0 \)). What are the values of (a) \( \frac{av}{v_0} \), (b) \( \frac{v_{avg}}{v_0} \), and (c) \( \frac{v_{rms}}{v_0} \)? (d) What fraction of the particles has a speed between \( 1.5v_0 \) and \( 2.0v_0 \)?

![Diagram](image)

(a) \( 0.67 \)  
(b) \( 1.2 \)  
(c) \( 1.3 \)  
(d) \( 0.33 \)

9. *Chapter 19, Problem 40*

Two containers are at the same temperature. The first contains gas with pressure \( p_1 \), molecular mass \( m_1 \), and root-mean-square speed \( v_{rms1} \). The second contains gas with pressure 5\( p_1 \), molecular mass \( m_2 \), and average speed \( v_{avg2} = 4v_{rms1} \). Find the mass ratio \( \frac{m_1}{m_2} \).

\[
18.849555921539 \quad \text{Significant digits are disabled; the tolerance is +/-2%}
\]

10. *Chapter 19, Problem 48*

When 25.0 J was added as heat to a particular ideal gas, the volume of the gas changed from 56 cm\(^3\) to 80 cm\(^3\) while the pressure remained constant at 1.2 atm. (a) By how much did the internal energy of the gas change? If the quantity of gas present is \( 3.9 \times 10^{-3} \) mol, find the molar specific heat of the gas at (b) constant pressure and (c) constant volume.

(a) Number \( 22.08256 \) Units J  
(b) Number \( 71.209690687726 \) Units J/mol·K  
(c) Number \( 62.899690687726 \) Units J/mol·K

11. Test Bank, Question 74

The "Principle of equipartition of energy" states that the internal energy of a gas is shared equally:

- among the molecules
- between kinetic and potential energy
- among the relevant degrees of freedom
12. *Chapter 19, Problem 53

Suppose 4.88 mol of an ideal diatomic gas, with molecular rotation but not oscillation, experienced a temperature increase of 34.7 K under constant-pressure conditions. What are (a) the energy transferred as heat \( Q \), (b) the change \( \Delta E_{\text{int}} \) in internal energy of the gas (c) the work done by the gas and (d) the change \( \Delta K \) in the total translational kinetic energy of the gas?

(a) Number 4925.13756 Units J
(b) Number 3517.9554 Units J
(c) Number 1407.18216 Units J
(d) Number 2110.77324 Units J

13. *Chapter 19, Problem 57

The volume of an ideal gas is adiabatically reduced from 239 L to 84.2 L. The initial pressure and temperature are 1.30 atm and 280 K. The final pressure is 5.60 atm. (a) Is the gas: 1 - monatomic, 2 - diatomic, or 3 - polyatomic? Give the number of the correct answer. (b) What is the final temperature, in kelvins? (c) How many moles are in the gas?

(a) 2
(b) Number 424.929514000644 Units K
(c) Number 13.486634003782 Units mol

14. *Chapter 19, Problem 61

A gas is to be expanded from initial state \( i \) to final state \( f \) along either path 1 or path 2 on a \( p-V \) diagram. Path 1 consists of three steps: an isothermal expansion (work is 44 J in magnitude), an adiabatic expansion (work is 21 J in magnitude), and another isothermal expansion (work is 32 J in magnitude). Path 2 consists of two steps: a pressure reduction at constant volume and an expansion at constant pressure. What is the change in the internal energy of the gas along path 2?

Number: -21 Unit: J

Significant digits not applicable; exact number, no tolerance

15. *Chapter 19, Problem 63

Figure 19-27 shows a cycle undergone by 1.96 mol of an ideal monatomic gas. For 1 to 2, what are (a) heat \( Q \), (b) the change in internal energy \( \Delta E_{\text{int}} \), and (c) the work done \( W \)? For 2 to 3, what are (d) \( Q \), (e) \( \Delta E_{\text{int}} \), and (f) \( W \)? For 3 to 1, what are (g) \( Q \), (h) \( \Delta E_{\text{int}} \), and (i) \( W \)? For the full cycle, what are (j) \( Q \), (k) \( \Delta E_{\text{int}} \), and (l) \( W \)? The initial pressure at point 1 is 1.52 atm (where 1 atm = 1.013 \times 10^5 \text{ Pa}). What are the (m) volume and (n) pressure at point 2 and the (o) volume and (p) pressure at point 3?

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