Test II

Name______________________________________

1) A car starts out when the air temperature is 288 K. The air pressure in the tires is 500 kPa. After driving a while, the temperature of the air in the tires increases to 298 K. What is the pressure in the tires at that point, assuming the volume remains constant?
   A) 483 kPa
   B) 507 kPa
   C) 517 kPa
   D) 532 kPa
   Answer: C

2) What is the temperature of 3.0 moles of gas at a pressure of 250 kPa held in a volume of 15 L?
   A) 150 K
   B) 200 K
   C) 250 K
   D) 300 K
   Answer: A

3) Your lungs hold 4.2 L of air at a temperature of 27°C and a pressure of 101.3 kPa. How many moles of air do your lungs hold?
   A) 0.15 moles
   B) 0.17 moles
   C) 0.19 moles
   D) 0.21 moles
   Answer: B

4) The coefficient of volume expansion of olive oil is $0.68 \times 10^{-3} \text{ K}^{-1}$. A 1-liter glass beaker is filled to the brim with olive oil at room temperature. The beaker is placed on a range and the temperature of the oil and beaker increases by 25°C. As a result, 0.0167 liters of olive oil spill over the top of the beaker. What is the coefficient of linear expansion of glass?
   A) $1 \times 10^{-6} \text{ K}^{-1}$
   B) $4 \times 10^{-6} \text{ K}^{-1}$
   C) $1 \times 10^{-6} \text{ K}^{-1}$
   D) $3 \times 10^{-6} \text{ K}^{-1}$
   Answer: B

5) Two metal rods are made of the same material and have the same cross-sectional area. The two rods differ only in their lengths which we call $L$ and $3L$, respectively. You heat the two rods from the same initial temperature to the same final temperature. You observe that the short rod expands its length by an amount $\Delta L$. The amount by which the length of the long rod will expand must be
   A) $\Delta L$
   B) $\frac{3}{2} \Delta L$
   C) $2 \Delta L$
   D) $3 \Delta L$
   Answer: D

6) When you walk barefoot in a room, the floor feels cooler walking on a tile floor as compared to a wooden floor because
   A) tile has a smaller specific heat than wood.
   B) tile has a larger specific heat than wood.
   C) tile has a smaller thermal conductivity than wood.
D) tile has a larger thermal conductivity than wood.  
Answer: D

7) An aluminum electric tea kettle has a mass of 500 g. It has a 500-W heating coil. How long will it take to heat up 1.0 kg of water from 18°C to 98°C in the tea kettle? The specific heat of aluminum is 900 J/(kgK).
A) 5 minutes  
B) 7 minutes  
C) 12 minutes  
D) 15 minutes  
Answer: C

8) A block of metal is 2 cm × 3 cm × 5 cm. When one of the 2 cm × 3 cm faces is held at a temperature $T_1$ and the other at a temperature $T_2$, the heat flow through the block is $P$. In terms of $P$, what is the heat flow when one of the 2 cm × 5 cm faces is held at a temperature $T_1$ and the other at a temperature $T_2$?
A) $(9/4)P$  
B) $(9/25)P$  
C) $(75/12)P$  
D) $(25/9)P$  
Answer: D

9) The type of heat transfer that occurs between a stove and a pot placed on it is
A) convective.  
B) conductive.  
C) radiative.  
D) countercurrent.  
Answer: B

10) Two metal rods are to be used to conduct heat from a region at 100ºC to a region at 0ºC. The rods can be placed in parallel, as shown on the left, or in series, as on the right. The heat conducted in the series arrangement is
A) greater than the heat conducted with the rods in parallel.  
B) the same as the heat conducted with the rods in parallel.  
C) less than the heat conducted with the rods in parallel.  
D) impossible to compare with the heat conducted with the rods in parallel.  
Answer: C

11) The molecular weight of carbon dioxide is 44.0 g/mol. What is the internal energy in 3.00 kg of carbon dioxide at 300 K? As an approximation, treat the carbon dioxide gas as if it was monatomic.
A) $2.55 \times 10^5$ J  
B) $1.70 \times 10^5$ J  
C) $2.55 \times 10^4$ J  
D) $1.70 \times 10^4$ J  
Answer: A

12) A 46-g block of ice at -15ºC is dropped into a calorimeter containing 100 g of water at 5ºC. When equilibrium is reached, how much of the ice will have melted? The specific heat of ice is 2090 J/(kg K) and the latent heat of fusion of water is $33.5 \times 10^4$ J/kg.
13) On a cold winter day, you turn up the thermostat in your house. Assume that your house is well sealed and that no air enters or leaves the house. When the air temperature in your house rises a short while later, what statement is correct regarding the air pressure?
A) The air pressure is higher at the higher temperature.
B) The air pressure is lower at the higher temperature.
C) The air pressure does not change at the higher temperature.
D) The air pressure increases at first but then decreases again as the temperature approaches its higher value.
Answer: A

14) A refrigerator has an interior volume of 0.500 m$^3$. The temperature inside the refrigerator in 282 K, and the pressure is 101 kPa. If the molecular weight of air is 29 g/mol, what is the mass of air inside the refrigerator?
A) 625 g
B) 513 g
C) 447 g
D) 329 g
Answer: A

15) A vertical cylindrical cylinder, closed at the bottom end, contains 0.0100 moles of gas. It is fitted at the top with a piston, which can move freely. The mass of the piston is 11.0 kg and the initial height of the piston above the bottom of the cylinder is 25 cm. What is the temperature of the gas?
A) 290 K
B) 325 K
C) 3620 K
D) 405 K
Answer: B

16) What is the root mean square value of the following velocity components: 2.0 m/s, -3.0 m/s, and 4.0 m/s?
A) 5.4 m/s
B) 1.9 m/s
C) 3.1 m/s
D) 3.3 m/s
Answer: C

17) The molecular weight of nitrogen is 28 g/mol. What is the rms speed of nitrogen molecules at 8.0°C?
A) 450 m/s
B) 500 m/s
C) 550 m/s
D) 600 m/s
Answer: B

18) A 30-cm steel rod, 1.0 cm in diameter, supports a 300-kg mass. What is the change in length of the rod? Young's modulus for steel is 20 × 10$^{10}$ N/m$^2$.
A) 5.6 × 10$^{-5}$ m
B) 6.5 × 10$^{-5}$ m
C) 5.6 × 10$^{-6}$ m
D) 6.5 × 10$^{-6}$ m
Answer: A
19) If you add 1.73 MJ of heat to 700 g of water at 70°C, what is the final temperature of the steam? The latent heat of vaporization of water is $22.6 \times 10^5$ J/kg. The specific heat of steam is 2010 J/(kg K).
A) 100°C
B) 123°C
C) 147°C
D) 143°C
Answer: D

20) On a hot summer day, you turn the thermostat in your house way down. Assume that your house is well sealed and that no air enters or leaves the house. When the air temperature in your house falls a short while later, what statement is correct regarding the air pressure?
A) The air pressure is higher at the lower temperature.
B) The air pressure is lower at the lower temperature.
C) The air pressure does not change at the lower temperature.
D) The air pressure decreases at first but then increases again as the temperature approaches its lower value.
Answer: B

21) For an ideal gas the internal energy depends on
A) volume
B) the amount of heat added to it
C) temperature
E) pressure
Answer C

22) An adiabatic process is performed on 15 moles of an ideal gas. The initial temperature is 320 K and the initial volume is 0.80 m$^3$. The final volume is 0.40 m$^3$. The adiabatic constant for the gas is 1.44 and universal gas constant $R=8.214472$ J/mol K. What is the final temperature of the gas
A) 435 K
B) 450 K
C) 465 K
D) 495 K
E) 480 K
Answer A

23) When the ideal gas is expanded in volume at constant pressure, the average kinetic energy of the gas molecules
A) increases
B) decreases
C) doesn’t change
D) may increase or decrease, depending on whether or not the process is carried out adiabatically.
E) may or not change, but insufficient information is given to make such estimation
Answer A

24) An adiabatic process is performed on 15 moles of an ideal gas. The initial temperature is 320 K and the initial volume is 0.80 m$^3$. The final volume is 0.40 m$^3$. The adiabatic constant for the gas is 1.44 and adiabatic constant for the gas is 1.44 and universal gas constant $R=8.214472$ J/mol K. The heat capacity is closest to
A) 27 J/mol K
B) 35 J/mol K
C) 72 J/mol K
D) 29 J/mol K
E) 42 J/mol K
Answer A
25) An adiabatic process is performed on 15 moles of an ideal gas. The initial temperature is 320 K and the initial volume is 0.80 m³. The final volume is 0.40 m³. The adiabatic constant for the gas is 1.44 and universal gas constant $R=8.214472$ J/mol K. The work done by the gas is closest to
A) zero kJ
B) 25 kJ
C) 32 kJ
D) -24 kJ
E) -32 K
Answer: E

26) An adiabatic process is performed on 15 moles of an ideal gas. The initial temperature is 320 K and the initial volume is 0.80 m³. The final volume is 0.40 m³. The adiabatic constant for the gas is 1.44 and universal gas constant $R=8.214472$ J/mol K. The heat absorbed by the gas (in kJ) is closest to
A) zero kJ
B) 25 kJ
C) 32 kJ
D) -24 kJ
E) -32 kJ
Answer: A

27) If you add 800 kJ of heat to 800 g of water at 80.0°C, how much water is left in the container? The latent heat of vaporization of water is $22.6 \times 10^5$ J/kg.
A) 476 g
B) 258 g
C) 600 g
D) none
Answer: A