Physics: Principles and Applications, 6e Giancoli
Chapter 13 Temperature and Kinetic Theory

Conceptual Questions

1) State the zeroth law of thermodynamics.
Answer: If two systems are in thermal equilibrium with a third system, then they are in thermal equilibrium with each other.
Diff: 1 Type: ES Var: 1 Page Ref: Sec. 13.3

2) A bimetallic strip, consisting of metal G on the top and metal H on the bottom, is rigidly attached to a wall at the left. (See Fig. 13-1.) The coefficient of linear thermal expansion for metal G is greater than that of metal H. If the strip is uniformly heated, it will

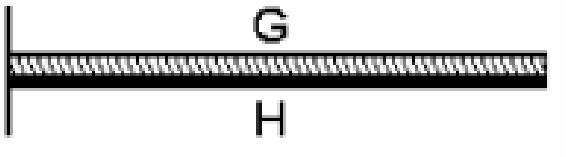

FIGURE 13-1

A) curve upward.
B) curve downward.
C) remain horizontal, but get longer.
D) bend in the middle.
Answer: B
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.4

3) When the engine of your car heats up, the spark plug gap will
A) increase.
B) decrease.
C) remain unchanged.
D) decrease at first and then increase later, so that the two effects cancel once the engine reaches operating temperature.
Answer: A
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.4

4) Consider a flat steel plate with a hole through its center as shown in Fig. 13-2. When the plate's temperature is increased, the hole will

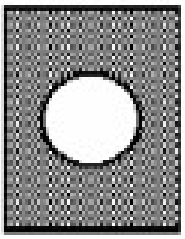

FIGURE 13-2

A) expand only if it takes up more than half the plate's surface area.
B) contract if it takes up less than half the plate's surface area.
C) always contract.
D) always expand.
Answer: D
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.4

5) The coefficient of linear expansion for aluminum is $1.8 \times 10^{-6}\ (C°)^{-1}$. What is its coefficient of volume expansion?
A) $9.0 \times 10^{-6}\ (C°)^{-1}$
B) $5.8 \times 10^{-18}\ (C°)^{-1}$
C) $5.4 \times 10^{-6}\ (C°)^{-1}$
D) $3.6 \times 10^{-6}\ (C°)^{-1}$
Answer: C
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.4

6) The surface water temperature on a large, deep lake is 3°C. A sensitive temperature probe is lowered several meters into the lake. What temperature will the probe record?
A) a temperature warmer than 3°C
B) a temperature less than 3°C
C) a temperature equal to 3°C
D) There is not enough information to determine.
Answer: A
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.4

7) Which temperature scale never gives negative temperatures?
A) Kelvin
B) Fahrenheit
C) Celsius
D) all of the above
Answer: A
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.6

8) Which two temperature changes are equivalent?
A) 1 K = 1 F°
B) 1 F° = 1 C°
C) 1 C° = 1 K
D) none of the above
Answer: C
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.6

9) The temperature in your classroom is approximately
A) 68 K.
B) 68°C.
C) 50°C.
D) 295 K.
Answer: D
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.6

10) State Boyle's law.
Answer: The volume of a gas is inversely proportional to the absolute pressure applied to it when the temperature is kept constant.
Diff: 1 Type: ES Var: 1 Page Ref: Sec. 13.6

11) State Charles's law.
Answer: The volume of a given amount of gas is directly proportional to the absolute temperature when the pressure is kept constant.
Diff: 1 Type: ES Var: 1 Page Ref: Sec. 13.6

12) State Gay-Lassac's law.
Answer: At constant volume, the absolute pressure of a gas is directly proportional to the absolute temperature.
Diff: 1 Type: ES Var: 1 Page Ref: Sec. 13.6

13) A container of an ideal gas at 1 atm is compressed to one-third its volume, with the temperature held constant. What is its final pressure?
A) 1/3 atm
B) 1 atm
C) 3 atm
D) 9 atm
Answer: C
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.6

14) If the pressure acting on an ideal gas at constant temperature is tripled, its volume is
A) reduced to one-third.
B) increased by a factor of three.
C) increased by a factor of two.
D) reduced to one-half.
Answer: A

Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.6

15) According to the ideal gas Law, PV = constant for a given temperature. As a result, an increase in volume corresponds to a decrease in pressure. This happens because the molecules
A) collide with each other more frequently.
B) move slower on the average.
C) strike the container wall less often.
D) transfer less energy to the walls of the container each time they strike it.
Answer: C
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

16) The number of molecules in one mole of a substance
A) depends on the molecular weight of the substance.
B) depends on the atomic weight of the substance.
C) depends on the density of the substance.
D) is the same for all substances.
Answer: D
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

17) A container holds N molecules of an ideal gas at a given temperature. If the number of molecules in the container is increased to 2N with no change in temperature or volume, the pressure in the container
A) doubles.
B) remains constant.
C) is cut in half.
D) none of the above
Answer: A
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

18) Both the pressure and volume of a given sample of an ideal gas double. This means that its temperature in Kelvin must
A) double.
B) quadruple.
C) reduce to one-fourth its original value.
D) remain unchanged.
Answer: B
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

19) The temperature of an ideal gas increases from 2°C to 4°C while remaining at constant pressure. What happens to the volume of the gas?
A) It decreases slightly.
B) It decreases to one-half its original volume.
C) It increases slightly.
D) It increases to twice as much.
Answer: C
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

20) A mole of diatomic oxygen molecules and a mole of diatomic nitrogen molecules at STP have
A) the same average molecular speeds.

B) the same number of molecules.
C) the same diffusion rates.
D) all of the above
Answer: B
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

21) Consider two equal volumes of gas at a given temperature and pressure. One gas, oxygen, has a molecular mass of 32. The other gas, nitrogen, has a molecular mass of 28. What is the ratio of the number of oxygen molecules to the number of nitrogen molecules?
A) 32:28
B) 28:32
C) 1:1
D) none of the above
Answer: C
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

22) The average molecular kinetic energy of a gas can be determined by knowing only
A) the number of molecules in the gas.
B) the volume of the gas.
C) the pressure of the gas.
D) the temperature of the gas.
Answer: D
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.10

23) A sample of an ideal gas is slowly compressed to one-half its original volume with no change in temperature. What happens to the average speed of the molecules in the sample?
A) It does not change.
B) It doubles.
C) It halves.
D) none of the above
Answer: A
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.10

24) A sample of an ideal gas is heated and its Kelvin temperature doubles. What happens to the average speed of the molecules in the sample?
A) It does not change.
B) It doubles.
C) It halves.
D) none of the above
Answer: D
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.10

25) The absolute temperature of an ideal gas is directly proportional to which of the following?
A) speed
B) momentum
C) kinetic energy
D) mass
Answer: C
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.10

26) In order to double the average speed of the molecules in a given sample of gas, the temperature (measured in Kelvin) must

A) quadruple.
B) double.
C) increase by a factor of square root two of its original value.
D) increase by a factor of square root three of its original value.
Answer: C
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.10

27) Oxygen molecules are 16 times more massive than hydrogen molecules. At a given temperature, the average molecular kinetic energy of oxygen, compared to hydrogen
A) is greater.
B) is less.
C) is the same.
D) cannot be determined since pressure and volume are not given
Answer: C
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.10

28) Oxygen molecules are 16 times more massive than hydrogen molecules. At a given temperature, how do their average molecular speeds compare? The oxygen molecules are moving
A) 4 times faster.
B) at 1/4 the speed.
C) 16 times faster.
D) at 1/16 the speed.
Answer: B
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.10

29) A fixed container holds oxygen and helium gases at the same temperature. Which one of the following statements is correct?
A) The oxygen molecules have the greater kinetic energy.
B) The helium molecules have the greater kinetic energy.
C) The oxygen molecules have the greater speed.
D) The helium molecules have the greater speed.
Answer: D
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.10

30) A container is filled with a mixture of helium and oxygen gases. A thermometer in the container indicates that the temperature is 22°C. Which gas molecules have the greater average kinetic energy?
A) It is the same for both because the temperatures are the same.
B) The oxygen molecules do because they are diatomic.
C) The helium molecules do because they are less massive.
D) The helium molecules do because they are monatomic.
Answer: A
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.10

31) A container is filled with a mixture of helium and oxygen gases. A thermometer in the container indicates that the temperature is 22°C. Which gas molecules have the greater average speed?
A) The helium molecules do because they are monatomic.
B) It is the same for both because the temperatures are the same.
C) The oxygen molecules do because they are more massive.
D) The helium molecules do because they are less massive.
Answer: D
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.10

32) The three phases of matter can exist together in equilibrium at the

A) critical point.
B) triple point.
C) melting point.
D) evaporation point.
Answer: B
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.12

33) Supersaturation occurs in air when the
A) relative humidity is 100% and the temperature increases.
B) relative humidity is less than 100% and the temperature increases.
C) relative humidity is less 100% and the temperature decreases.
D) relative humidity is 100% and the temperature decreases.
Answer: D
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.13

Quantitative Problems

1) Express your body temperature (98.6°F) in Celsius degrees.
A) 37.0°C
B) 45.5°C
C) 66.6°C
D) 72.6°C
Answer: A
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.2

2) Express 68°F in °C.
A) 7.0°C
B) 20°C
C) 36°C
D) 181°C
Answer: B
Diff: 1 Type: BI Var: 2 Page Ref: Sec. 13.2

3) Express -40°C in °F.
A) -72°F
B) -54°F
C) 40°F
D) 4.4°F
Answer: C
Diff: 1 Type: BI Var: 4 Page Ref: Sec. 13.2

4) The temperature changes from 35°F during the night to 75°F during the day. What is the temperature change on the Celsius scale?
A) 72 C°
B) 40 C°
C) 32 C°
D) 22 C°
Answer: D
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.2

5) A temperature change of 20 °C corresponds to a temperature change of
A) 68°F.
B) 11°F.

C) 36°F.
D) none of the above
Answer: C
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.2

6) At what temperature are the numerical readings on the Fahrenheit and Celsius scales the same?
A) -30°
B) -40°
C) -50°
D) -60°
Answer: B
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.2

7) A steel bridge is 1000 m long at -20°C in winter. What is the change in length when the temperature rises to 40°C in summer? (The average coefficient of linear expansion of steel is 11×10^{-6}/C°.)
A) 0.33 m
B) 0.44 m
C) 0.55 m
D) 0.66 m
Answer: D
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.4

8) An aluminum rod 17.4 cm long at 20°C is heated to 100°C. What is its new length? Aluminum has a linear expansion coefficient of 25×10^{-6}/C°.
A) 17.435 cm
B) 17.365 cm
C) 0.348 cm
D) 0.0348 cm
Answer: A
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.4

9) By how much will a slab of concrete 18 m long contract when the temperature drops from 24°C to -16°C? (The coefficient of linear thermal expansion for concrete is 10^{-5}/C°.)
A) 0.50 cm
B) 0.72 cm
C) 1.2 cm
D) 1.5 cm
Answer: B
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.4

10) A bolt hole in a brass plate has a diameter of 1.200 cm at 20°C. What is the diameter of the hole when the plate is heated to 220°C? (The coefficient of linear thermal expansion for brass is 19×10^{-6}/C°.)
A) 1.205 cm
B) 1.195 cm
C) 1.200 cm
D) 1.210 cm
Answer: A
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.4

11) 20.00 cm of space is available. How long a piece of brass at 20°C can be put there and still fit at 200°C? Brass has a linear expansion coefficient of 19×10^{-6}/C°.

A) 19.93 cm
B) 19.69 cm
C) 19.50 cm
D) 19.09 cm
Answer: A
Diff: 3 Type: BI Var: 1 Page Ref: Sec. 13.4

12) A 5.0-cm diameter steel shaft has 0.10 mm clearance all around its bushing at 20°C. If the bushing temperature remains constant, at what temperature will the shaft begin to bind? Steel has a linear expansion coefficient of 12×10^{-6}/C°.
A) 353°C
B) 333°C
C) 53°C
D) 680°C
Answer: A
Diff: 3 Type: BI Var: 1 Page Ref: Sec. 13.4

13) 400 cm^3 of mercury at 0°C will expand to what volume at 50°C? Mercury has a volume expansion coefficient of 180×10^{-6}/C°.
A) 450 cm^3
B) 409.7 cm^3
C) 403.6 cm^3
D) 401.8 cm^3
Answer: C
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.4

14) 1 L of water at 20°C will occupy what volume at 80°C? Water has a volume expansion coefficient of 210×10^{-6}/C°.
A) 1.6 L
B) 1.013 L
C) 0.987 L
D) 0.9987 L
Answer: B
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.4

15) The volume coefficient of thermal expansion for gasoline is 950×10^{-6} /C°. By how much does the volume of 1.0 L of gasoline change when the temperature rises from 20°C to 40°C?
A) 6.0 cm^3
B) 12 cm^3
C) 19 cm^3
D) 37 cm^3
Answer: C
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.4

16) A 500-mL glass beaker of water is filled to the rim at a temperature of 0°C. How much water will overflow if the water is heated to a temperature of 95°C? (Ignore the expansion of the glass and the coefficient of volume expansion of water is 2.1×10^{-4} /C°.)

A) 3.3 mL
B) 10 mL
C) 33 mL
D) 100 mL
Answer: B
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.4

17) For mercury to expand from 4.0 cm^3 to 4.1 cm^3, what change in temperature is necessary? Mercury has a volume expansion coefficient of $180 \times 10^{-6}/C°$.
A) 400°C
B) 139°C
C) 14°C
D) 8.2°C
Answer: B
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.4

18) A mercury thermometer has a bulb of volume 0.100 cm^3 at 10°C. The capillary tube above the bulb has a cross-sectional area of 0.012 mm^2. The volume thermal expansion coefficient of mercury is 1.8×10^{-4} $(C°)^{-1}$. How much will the mercury rise when the temperature rises by 30°C?
A) 0.45 mm
B) 4.5 mm
C) 45 mm
D) 45 cm
Answer: C
Diff: 3 Type: BI Var: 1 Page Ref: Sec. 13.4

19) Convert 14°C to K.
A) 46 K
B) 100 K
C) 287 K
D) 474 K
Answer: C
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.6

20) Convert 14°F to K.
A) 263 K
B) 287 K
C) -10 K
D) 474 K
Answer: A
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.6

21) Convert 14 K to °C.
A) 46°C
B) 287°C
C) 25°C
D) -259°C
Answer: D
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.6

22) Convert 14 K to °F.
A) 287°F

B) -434°F
C) -259°F
D) 474°F
Answer: B
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.6

23) Oxygen condenses into a liquid at approximately 90 K. What temperature, in degrees Fahrenheit, does this correspond to?
A) -193°F
B) -217°F
C) -265°F
D) -297°F
Answer: D
Diff: 2 Type: BI Var: 2 Page Ref: Sec. 13.6

24) An ideal gas occupies 300 L at an absolute pressure of 400 kPa. Find the absolute pressure if the volume changes to 850 L and the temperature remains constant.
A) 140 kPa
B) 640 kPa
C) 850 kPa
D) 1140 kPa
Answer: A
Diff: 1 Type: BI Var: 3 Page Ref: Sec. 13.6

25) Two liters of a perfect gas are at 0°C and 1 atm. If the gas is nitrogen, N_2, determine the number of moles.
A) 0.37
B) 0.73
C) 0.089
D) 0.098
Answer: C
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.7-14.9

26) Two liters of a perfect gas are at 0°C and 1 atm. If the gas is nitrogen, N_2, determine the number of molecules.
A) 3.5×10^{22}
B) 5.3×10^{22}
C) 4.7×10^{22}
D) 7.4×10^{22}
Answer: B
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

27) Two liters of a perfect gas are at 0°C and 1 atm. If the gas is nitrogen, N_2, determine the mass of the gas.
A) 2.5 g
B) 2.7 g
C) 2.9 g
D) 3.1 g
Answer: A
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

28) How many water molecules are there in 36 g of water? Express your answer as a multiple of Avogadro's number N_A. (The molecular structure of a water molecule is H_2O.)

A) $36N_A$

B) $2N_A$

C) $18N_A$

D) none of the above

Answer: B

Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

29) How many mol are there in 2.00 kg of copper? (The atomic weight of copper is 63.5 and its specific gravity is 8.90.)

A) 15.3

B) 31.5

C) 51.3

D) 53.1

Answer: B

Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

30) A sample of a diatomic ideal gas occupies 33.6 L under standard conditions. How many mol of gas are in the sample?

A) 0.75

B) 3.0

C) 1.5

D) 3.25

Answer: C

Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

31) An ideal gas has a pressure of 2.5 atm, a volume of 1.0 L at a temperature of 30°C. How many molecules are there in the gas?

A) 6.1×10^{23}

B) 6.0×10^{22}

C) 2.4×10^{22}

D) 2.3×10^{23}

Answer: B

Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

32) An ideal gas in a container of volume 100 cm^3 at 20°C has a pressure of 100 N/m^2. Determine the number of gas molecules in the container.

A) 4.2×10^6

B) 6.0×10^{23}

C) 2.5×10^{18}

D) 5.2×10^{18}

Answer: C

Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

33) A sample of helium (He) occupies 44.8 L at STP. What is the mass of the sample?
A) 2 g
B) 4 g
C) 6 g
D) 8 g
Answer: D
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

34) A 25-L container holds hydrogen gas at a gauge pressure of 0.25 atm and a temperature of 0°C. What mass of hydrogen is in this container?
A) 1.4 g
B) 2.8 g
C) 4.2 g
D) 5.6 g
Answer: B
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

35) A 100-cm^3 container has 4 g of ideal gas in it at 250 kPa. If the volume is changed to 50 cm^3 and the temperature remains constant, what is its new density?
A) 400 kg/m^3
B) 250 kg/m^3
C) 80 kg/m^3
D) 50 kg/m^3
Answer: C
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

36) An ideal gas occupies 600 cm^3 at 20°C. At what temperature will it occupy 1200 cm^3 if the pressure remains constant?
A) 10°C
B) 40°C
C) 100°C
D) 313°C
Answer: D
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

37) A constant pressure gas thermometer is initially at 28°C. If the volume of gas increases by 10%, what is the final Celsius temperature?
A) 31°C
B) 43°C
C) 58°C
D) 64°C
Answer: C
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

38) An ideal gas occupies 4.0 L at 20°C. What volume will it occupy at 40°C if the pressure remains constant?
A) 43 cm^3

B) 4.3 L
C) 8.0 L
D) 2.0 L
Answer: B
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

39) A balloon has a volume of 1.0 m^3. As it rises in the Earth's atmosphere, its volume expands. What will be its new volume if its original temperature and pressure are 20°C and 1.0 atm, and its final temperature and pressure are -40°C and 0.10 atm?
A) 2.0 m^3
B) 4.0 m^3
C) 6.0 m^3
D) 8.0 m^3
Answer: D
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

40) A given sample of carbon dioxide (CO_2) contains 3.01×10^{23} molecules at STP. What volume does this sample occupy?
A) 11.2 L
B) 22.4 L
C) 44.8 L
D) 32.7 L
Answer: A
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

41) 500 cm^3 of ideal gas at 40°C and 200 kPa (absolute) is compressed to 250 cm^3 and cooled to 20°C. What is the final absolute pressure?
A) 748 kPa
B) 374 kPa
C) 200 kPa
D) 100 kPa
Answer: B
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

42) 1500 cm^3 of ideal gas at STP is cooled to -20°C and put into a 1000 cm^3 container. What is the final gauge pressure?
A) 11 kPa
B) 40 kPa
C) 113 kPa
D) 141 kPa
Answer: B
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

43) An ideal gas has a density of 1.75 kg/m^3 at a gauge pressure of 160 kPa. What must be the gauge pressure if a density of 1.0 kg/m^3 is desired at the same temperature?
A) 356 kPa
B) 280 kPa
C) 91 kPa
D) 48 kPa
Answer: D
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

44) An ideal gas has a volume of 0.20 m^3, a temperature of 30°C, and a pressure of 1.0 atm. It is heated to 60°C and compressed to a volume of 0.15 m^3. What is the new pressure?
A) 1.0 atm
B) 1.2 atm
C) 1.5 atm
D) 2.7 atm
Answer: C
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

45) A mixture of gases contains 15 g of H_2, 14 g of N_2, and 44 g of CO_2. The mixture is in a 40 L sealed container which is at 20°C. What is the pressure in the container?
A) 3.3×10^5 N/m^2
B) 4.4×10^5 N/m^2
C) 5.5×10^5 N/m^2
D) 6.6×10^5 N/m^2
Answer: C
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

46) What is the average separation between air molecules at STP?
A) 3.34×10^{-7} cm
B) 4.33×10^{-7} cm
C) 5.32×10^{-7} cm
D) 5.23×10^{-7} cm
Answer: A
Diff: 3 Type: BI Var: 1 Page Ref: Sec. 13.7-13.9

47) At what temperature is the average kinetic energy of an atom in helium gas equal to 6.21×10^{-21} J?
A) 200 K
B) 250 K
C) 300 K
D) 350 K
Answer: C
Diff: 1 Type: BI Var: 1 Page Ref: Sec. 13.10

48) At what temperature would the rms speed of H_2 molecules equal 11,200 m/s (the Earth's escape speed)?
A) 10^2 K
B) 10^4 K
C) 10^6 K
D) 10^8 K
Answer: B
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.10

49) A cylinder contains 16 g of helium gas at STP. How much energy is needed to raise the temperature of this gas to 20°C?

A) 789 J
B) 798 J
C) 879 J
D) 998 J
Answer: D
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.10

50) If the temperature of a gas is increased from 20°C to 40°C, by what factor does the speed of the molecules increase?
A) 3%
B) 30%
C) 70%
D) 100%
Answer: A
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.10

51) A molecule has a speed of 500 m/s at 20°C. What is its speed at 80°C?
A) 500 m/s
B) 550 m/s
C) 1000 m/s
D) 2000 m/s
Answer: B
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.10

52) The molecular mass of oxygen molecules is 32, and the molecular mass of nitrogen molecules is 28. If these two gases are at the same temperature, the ratio of nitrogen's rms speed to that of oxygen is _____.
A) $(8)^{1/2}$:$(7)^{1/2}$
B) 8:7
C) $(7)^{1/2}$:$(8)^{1/2}$
D) 7:8
Answer: A
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.10

53) The molecular mass of nitrogen is 14 times greater than that of hydrogen. If the molecules in these two gases have the same rms speed, the ratio of hydrogen's absolute temperature to that of nitrogen is _____.
A) $(14)^{1/2}$:1
B) 1:$(14)^{1/2}$
C) 1:14
D) 14:1
Answer: C
Diff: 2 Type: BI Var: 1 Page Ref: Sec. 13.10