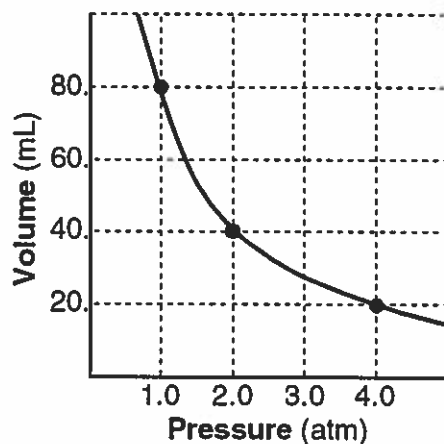


Name: _____

- 1) An assumption of the kinetic theory of gases is that the particles of a gas have
 - A) strong attraction for each other and an insignificant volume
 - B) strong attraction for each other and a significant volume
 - C) little attraction for each other and an insignificant volume
 - D) little attraction for each other and a significant volume
- 2) The average kinetic energy of the molecules of an ideal gas is directly proportional to the
 - A) number of moles present
 - B) temperature measured on the Kelvin scale
 - C) pressure at standard temperature
 - D) volume occupied by individual gas molecules
- 3) A flask containing molecules of gas *A* and a separate flask containing the molecules of gas *B* are both at the same temperature. Gases *A* and *B* must have equal
 - A) average kinetic energies
 - B) pressures
 - C) masses
 - D) volumes
- 4) Which change must result in an increase in the average kinetic energy of the molecules of a sample of $N_2(g)$?
 - A) The density changes from 2.0 g/l to 2.5 g/l.
 - B) The volume changes from 1 liter to 2 liters.
 - C) The pressure changes from 0.5 atmosphere to 1 atmosphere.
 - D) The temperature changes from 20°C to 30°C.
- 5) At what condition of temperature and pressure would the molecules of a gas have the *greatest* average kinetic energy?
 - A) 10°C and 2 atm
 - B) 50°C and 4 atm
 - C) 0°C and 3 atm
 - D) 100°C and 1 atm
- 6) At which temperature would the molecules in a one gram sample of water have the *lowest* average kinetic energy?
 - A) 100 K
 - B) 5°C
 - C) 5 K
 - D) -100°C
- 7) When a sample of a gas is heated at constant pressure, the average kinetic energy of its molecules
 - A) decreases, and the volume of the gas decreases
 - B) increases, and the volume of the gas increases
 - C) increases, and the volume of the gas decreases
 - D) decreases, and the volume of the gas increases
- 8) One reason that a real gas deviates from an ideal gas is that the molecules of the real gas have
 - A) forces of attraction for each other
 - B) no net loss of energy on collision
 - C) a negligible volume
 - D) a straight-line motion
- 9) As the space between molecules in a gas sample decreases, the tendency for the behavior of this gas to deviate from the ideal gas laws
 - A) decreases
 - B) remains the same
 - C) increases
- 10) A real gas would behave *most* like an ideal gas under conditions of
 - A) high pressure and low temperature
 - B) low pressure and high temperature
 - C) low pressure and low temperature
 - D) high pressure and high temperature

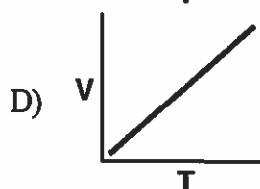
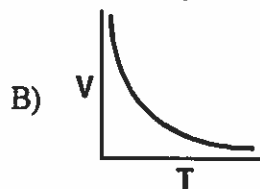
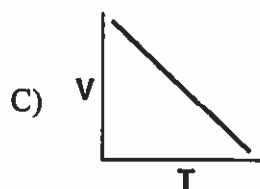
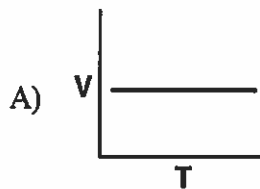
- 18) The pressure on 30. milliliters of an ideal gas increases from 101.3 kPa to 202.6 kPa at constant temperature. The new volume is equal to
- A) $\frac{101.3 \text{ kPa}}{30. \text{ mL}} \times 202.6 \text{ kPa}$ C) $30. \text{ mL} \times \frac{202.6 \text{ kPa}}{101.3 \text{ kPa}}$
 B) $30. \text{ mL} \times \frac{101.3 \text{ kPa}}{202.6 \text{ kPa}}$ D) $\frac{202.6 \text{ kPa}}{30. \text{ mL}} \times 101.3 \text{ kPa}$
- 19) What pressure, in atmospheres, is equal to 152 kPa?
 A) 1.50 B) 1.00 C) 0.670 D) 2.00
- 20) A sample of gas has a volume of 2.0 liters at a pressure of 1.0 atmosphere. When the volume increases to 4.0 liters, at constant temperature, the pressure will be
 A) 0.50 atm B) 1.0 atm C) 0.25 atm D) 2.0 atm
- 21) The graph below represents the relationship between pressure and volume of a given mass of a gas at constant temperature. The product of pressure and volume is constant.



According to the graph, what is the product in atm • mL?

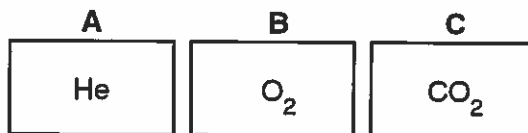
- A) 20. B) 60. C) 40. D) 80.
- 22) The volume of a given mass of an ideal gas at constant pressure is
- A) directly proportional to the Kelvin temperature
 B) directly proportional to the Celsius temperature
 C) inversely proportional to the Kelvin temperature
 D) inversely proportional to the Celsius temperature

- 23) At constant pressure, which graph shows the correct relationship between the volume of a gas (V) and its absolute temperature (T)?



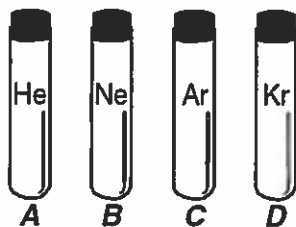
- 24) A sample of a gas occupies 6.00 liters at a temperature of 200. K. If the pressure remains constant and the temperature is raised to 600. K, the volume of the gas sample would be
 A) 12.0 L B) 18.0 L C) 2.00 L D) 3.00 L
- 25) At constant pressure, 50. milliliters (mL) of a gas at 20. °C is heated to 30. °C. The new volume of the gas in milliliters (mL) is equal to
 A) $50. \times \frac{30.}{20.}$ B) $50. \times \frac{293}{303}$ C) $50. \times \frac{303}{293}$ D) $50. \times \frac{20.}{30.}$
- 26) A 0.500-mole sample of a gas has a volume of 11.2 liters at 273 K. What is the pressure of the gas?
 A) 11.2 atm B) 1.00 atm C) 273 atm D) 0.500 atm
- 27) A gas has a volume of 1,400 milliliters at a temperature of 20.0 K and a pressure of 101.3 kPa. What will be the volume when the temperature is changed to 40.0 K and the pressure is changed to 50.65 kPa?
 A) 350 mL B) 1,400 mL C) 5,600 mL D) 750 mL
- 28) When 7.00 moles of gas *A* and 3.00 moles of gas *B* are combined, the total pressure exerted by the gas mixture is 1.0 atm. What is the partial pressure exerted by gas *A* in this mixture?
 A) 0.70 atm B) 0.30 atm C) 1.0 atm D) 0.10 atm
- 29) A gas volume that contains an equal number of hydrogen and oxygen molecules has a pressure of 0.6 atmosphere. The partial pressure due to the oxygen molecules is
 A) 0.1 atm B) 0.2 atm C) 0.6 atm D) 0.3 atm
- 30) A cylinder is filled with 2.0 moles of nitrogen, 3.0 moles of argon, and 5.0 moles of helium. If the gas mixture is at STP, what is the partial pressure of the argon?
 A) 101.3 kPa B) 20.3 kPa C) 50.7 kPa D) 30.4 kPa
- 31) At STP, 44.8 liters of CO_2 contains the same number of particles as
 A) 0.500 mole of H_2 C) 2.00 moles of Ne
 B) 4.00 moles of N_2 D) 1.00 mole of He
- 32) Equal volumes of all gases at the same temperature and pressure contain an equal number of
 A) molecules B) protons C) atoms D) electrons

- 33) The diagrams below represent three 1-liter containers of gas, *A*, *B*, and *C*. Each container is at STP.



Which of the following statements correctly compares the number of molecules in the containers?

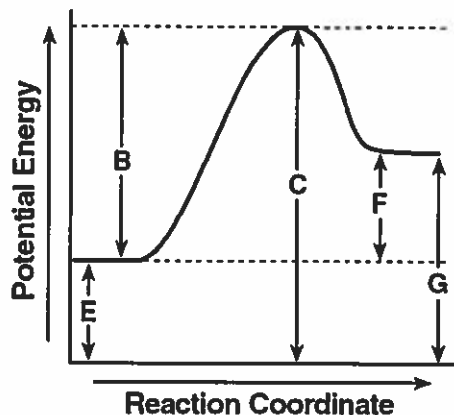
- A) Container *A* has the greatest number of molecules.
 B) All three containers have the same number of molecules.
 C) Container *C* has the greatest number of molecules.
 D) Container *B* has the greatest number of molecules.
- 34) How many moles of gas occupy 22.4 liters at 27°C and 0.50 atm of pressure? [$R = .082 \text{ L} \cdot \text{atm}/\text{mol} \cdot \text{k}$]
 A) 0.25 B) 10.0 C) 2.2 D) 0.45
- 35) Which gas will diffuse at the *fastest* rate under the same conditions of temperature and pressure?
 A) N₂ B) O₂ C) H₂ D) F₂
- 36) The stoppered tubes below, labeled *A* through *D*, each contain a different gas.



When the tubes are unstoppered at the same time and are under the same conditions of temperature and pressure, from which tube will gas diffuse at the *fastest* rate?

- A) *A* B) *B* C) *C* D) *D*
- 37) The density of NO gas in grams per liter at STP is approximately
 A) 30.0 B) 1.34 C) 15.0 D) 0.747
- 38) A 15-gram sample of a gas has a volume of 30. liters at STP. What is the density of the gas?
 A) 30. g/L B) 0.50 g/L C) 15. g/L D) 2.0 g/L
- 39) What is the volume occupied by 11.0 grams of a gas at STP if the molecular mass of the gas is 44.0?
 A) 5.60 L B) 89.6 L C) 11.2 L D) 22.4 L
- 40) In a chemical reaction, the difference between the potential energy of the products and the potential energy of the reactants is the
 A) heat of reaction C) activation energy
 B) heat of fusion D) free energy
- 41) For a chemical reaction, ΔH is equal to
 A) $\frac{H_{\text{products}}}{H_{\text{reactants}}}$ C) $H_{\text{products}} + H_{\text{reactants}}$
 B) $H_{\text{products}} \times H_{\text{reactants}}$ D) $H_{\text{products}} - H_{\text{reactants}}$

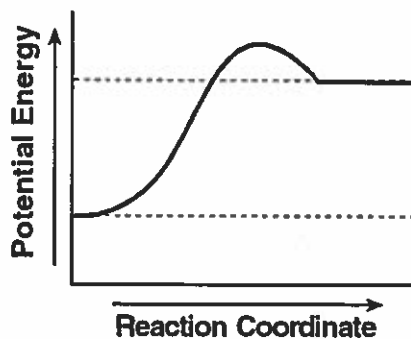
- 49) The diagram below represents a potential energy diagram of a chemical reaction.



What interval represents the heat of reaction (ΔH)?

- A) F B) C C) G D) E

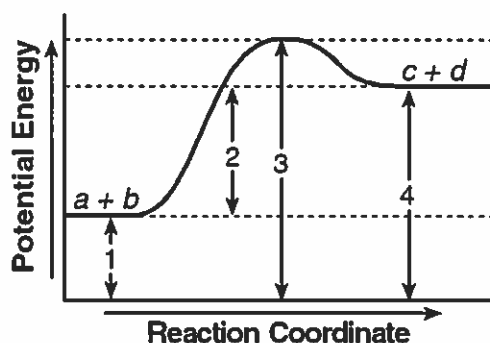
50)



According to the potential energy diagram shown above, the chemical reaction in the forward direction is

- A) endothermic because it absorbs energy C) endothermic because it releases energy
 B) exothermic because it releases energy D) exothermic because it absorbs energy
- 51) As the number of effective collisions of reacting particles increases, the rate of reaction
 A) decreases B) increases C) remains the same
- 52) Which series of physical change represents an entropy increase during each change?
 A) solid \rightarrow gas \rightarrow solid C) solid \rightarrow liquid \rightarrow gas
 B) gas \rightarrow liquid \rightarrow solid D) liquid \rightarrow gas \rightarrow solid
- 53) As the randomness of a system increases, the entropy of the system
 A) decreases B) increases C) remains the same
- 54) Which change represents an increase of entropy?
 A) $I_2(g) \rightarrow I_2(s)$ C) $I_2(g) \rightarrow I_2(l)$
 B) $H_2O(l) \rightarrow H_2O(g)$ D) $H_2O(g) \rightarrow H_2O(l)$
- 55) As products are formed in the following reaction, $NH_4^+(aq) + Cl^-(aq) \xrightarrow{H_2O} NH_4Cl(s) + 14.6 \text{ kJ}$, the entropy of the system
 A) increases and heat is absorbed C) decreases and heat is released
 B) decreases and heat is absorbed D) increases and heat is released

- 56) A reaction must be spontaneous if its occurrence is
- A) endothermic with a decrease in entropy
 B) exothermic with a decrease in entropy
 C) endothermic with an increase in entropy
 D) exothermic with an increase in entropy
- 57) The change in free energy of a chemical reaction is represented by
- A) ΔH
 B) ΔT
 C) ΔG
 D) ΔS
- 58) Which equation correctly represents the free energy change in a chemical reaction?
- A) $\Delta G = \Delta H - T\Delta S$
 B) $\Delta G = \Delta H + T\Delta S$
 C) $\Delta G = \Delta S - T\Delta H$
 D) $\Delta G = \Delta T - \Delta H\Delta S$
- 59) When a reaction has a negative ΔG , it must be
- A) endothermic
 B) nonspontaneous
 C) exothermic
 D) spontaneous
- 60) Which pair of changes would indicate that a reaction is endothermic but occurs spontaneously?
- A) a positive ΔH and a positive ΔG
 B) a positive ΔH and a negative ΔG
 C) a negative ΔH and a positive ΔG
 D) a negative ΔH and a negative ΔG
- 61) According to the *Standard Energies of Formation of Compounds at 1 atm and 298 K** chemistry reference table, what is the heat of formation of $\text{H}_2\text{O}(\ell)$ (in kilojoules per mole)?
- A) -285.5
 B) -241.6
 C) -237.0
 D) -228.2
- 62) Based on the *Standard Energies of Formation of Compounds at 1 atm and 298 K** chemistry reference table, a compound which forms spontaneously from its elements is
- A) nitrogen (IV) oxide
 B) ethene
 C) nitrogen (II) oxide
 D) ethane
- 63) The potential energy diagram shown below represents the reaction $a + b + 50 \text{ kJ} \longrightarrow c + d$.



- (a) Does this potential energy diagram represent an exothermic or an endothermic reaction? [Explain why.]
- (b) Which numbered interval represents the heat of the reaction?
- (c) What effect would the addition of a catalyst have on the rate of this chemical reaction?
- (d) What effect would the addition of a catalyst have on the heat of the reaction? [Explain your answer.]