Unit 3: States of Matter Practice Exam

Multiple Choice. *Identify the choice that best completes the statement or answers the question.*

____ 1. Two gases with unequal masses are injected into opposite ends of a long tube at the same time and allowed to diffuse toward the center. They should begin to mix
   a. in approximately five minutes.
   b. closer to the end that holds the heavier gas.
   c. closer to the end that holds the lighter gas.
   d. exactly in the middle.

____ 2. According to the kinetic-molecular theory, particles of matter
   a. are in constant motion.
   b. have different shapes.
   c. have different colors.
   d. are always fluid.

____ 3. Which process can be explained by the kinetic-molecular theory?
   a. combustion
   b. oxidation
   c. condensation
   d. displacement reactions

____ 4. According to the kinetic-molecular theory, which substances are made of particles?
   a. gases only
   b. liquids only
   c. all matter
   d. all matter except solids

____ 5. According to the kinetic-molecular theory, particles of matter are in motion in
   a. gases only.
   b. gases and liquids only.
   c. solids, liquids, and gases.
   d. solids only.

____ 6. An ideal gas is a hypothetical gas
   a. not made of particles.
   b. that conforms to all of the assumptions of the kinetic theory.
   c. whose particles have zero mass.
   d. made of motionless particles.

____ 7. A real gas
   a. does not obey all the assumptions of the kinetic-molecular theory.
   b. consists of particles that do not occupy space.
   c. cannot be condensed.
   d. cannot be produced in scientific laboratories.

____ 8. According to the kinetic-molecular theory, particles of an ideal gas
   a. attract each other but do not collide.
   b. repel each other and collide.
   c. neither attract nor repel each other but collide.
   d. neither attract nor repel each other and do not collide.

____ 9. Which is an example of gas diffusion?
   a. inflating a flat tire
   b. the odor of perfume spreading throughout a room
   c. a cylinder of oxygen stored under high pressure
   d. All of the above

____ 10. By which process do gases take the shape of their container?
   a. evaporation
   b. expansion
   c. adhesion
   d. diffusion

____ 11. According to the kinetic-molecular theory, how does a gas expand?
a. Its particles become larger.
b. Collisions between particles become elastic.
c. Its temperature rises.
d. Its particles move greater distances.

____ 12. Which is an example of effusion?
a. air slowly escaping from a pinhole in a tire
b. the aroma of a cooling pie spreading across a room
c. helium dispersing into a room after a balloon pops
d. oxygen and gasoline fumes mixing in an automobile carburetor

____ 13. The particles in a liquid are usually
a. closer together and lower in energy than those in a solid.
b. farther apart and higher in energy than those in a gas.
c. closer together and lower in energy than those in a gas.
d. farther apart and lower in energy than those in a solid.

____ 14. Which term best describes the process by which particles escape from the surface of a nonboiling liquid and enter the gas state?
a. sublimation
b. evaporation
c. surface tension
d. aeration

____ 15. A solid forms when the average energy of a substance's particles
a. increases.
b. decreases.
c. decreases then increases.
d. creates a random arrangement.

____ 16. Particles within a solid
a. do not move.
b. vibrate about fixed positions.
c. move about freely.
d. exchange positions easily.

____ 17. The compressibility of solids is generally
a. lower than the compressibility of liquids and gases.
b. higher than the compressibility of liquids only.
c. about equal to the compressibility of liquids and gases.
d. higher than the compressibility of gases only.

____ 18. Which causes the high density of solids?
a. The particles are more massive than those in liquids.
b. The intermolecular forces between particles are weak.
c. The particles are packed closely together.
d. The energy of the particles is very high.

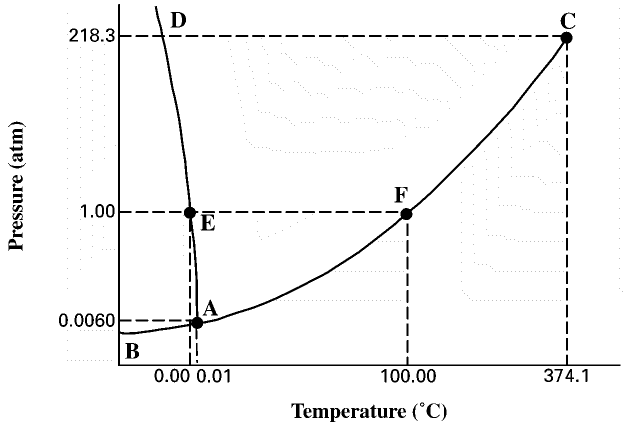
____ 19. If the rate of evaporation from the surface of a liquid exceeds the rate of condensation,
a. the system is in equilibrium.
b. the liquid is boiling.
c. energy as heat is no longer available.
d. the concentration of the vapor is increasing.

____ 20. When energy as heat is applied to a liquid-vapor system at equilibrium, a new equilibrium state will have
a. a higher percentage of liquid.
b. a higher percentage of vapor.
c. equal amounts of liquid and vapor.
d. all liquid.

____ 21. At pressures greater than 1 atm, water will boil at
a. a temperature higher than 100°C.
b. a temperature lower than 100°C.
c. 100°C.
d. 4°C.

____ 22. During the process of freezing, a liquid
a. loses kinetic energy.
b. loses potential energy.
c. gains potential energy.
d. gains kinetic energy.

Use the phase diagram for water to answer the questions 23 thorugh 27.



23. What does point C represent in the figure above?

24. What state exists above the curve AB and to the left of the curve AD?

25. What does point A represent in the figure above?

26. What state exists below the curve BC?

27. What state exists between the AC and AD curves?

Math Problems. *Show all work including the correct units and sig figs with your answer.*

28. Water has a heat of fusion of ± 333.4 J/g. Calculate the energy required or released when 10.9 g of water freezes.

29. Water has a heat of vaporization of ± 2266 J/g. How many grams of water can be condensed by releasing 2023 J of energy?

30. How much energy is required or released to cool 28.3 g of steam (water vapor) at 100.0°C to liquid water at 25.5°C? Water has a heat of vaporization of ± 2266 J/g and a specific heat of 4.184 J/g°C.

Essay. *Use complete sentences to answer the question below.*

31. Use Kinetic Molecular Theory to compare and contrast a substance's particles in the gas and liquid states. Be sure to discuss the particles thermal energy, interaction energy, attractive forces, speed of motion, range of motion and temperature.

Unit 3: States of Matter Practice Exam - Answer Section

MULTIPLE CHOICE

1. ANS: B
2. ANS: A
3. ANS: C
4. ANS: C
5. ANS: C
6. ANS: B
7. ANS: A
8. ANS: C
9. ANS: B
10. ANS: B
11. ANS: D
12. ANS: A
13. ANS: C
14. ANS: B
15. ANS: B
16. ANS: B
17. ANS: A
18. ANS: C
19. ANS: D
20. ANS: B
21. ANS: A
22. ANS: B

SHORT ANSWER

23. ANS:
    C is the critical point.

24. ANS:
    The solid phase.

25. ANS:
    A is the triple point.

26. ANS:
    The gas state.

27. ANS:
The liquid state.

NUMERIC RESPONSE

28. ANS: $Q = (10.9\ g) \times (-333.4\ J/g) = -3630\ J$ (3 s.f.)

29. ANS: $Q = (-2023\ J) \div (-2266\ J/g) = 0.8928\ g$ (4 s.f.)

30. ANS:
Phase Change $Q = (28.3\ g) \times (-2266\ J/g) = -64128\ J$ (3 s.f.)
Temp Change $Q = (28.3\ g) \times (4.184\ J/g°C) \times (25.5°C - 100.0°C) = -8821\ J$ (3 s.f.)
Total Energy = - 64126 J + (- 8821 J) = - 72900 J (s.f. to the hundreds digit)

ESSAY

31. ANS: The particles in both gas and liquid states have random motion and the particles can move past each other. Gas particles have a higher temperature than liquid particles and therefore more thermal energy and a faster speed of motion than liquid particles. Gas particles have more interaction energy than liquid particles and therefore a greater rand of motion than liquid particles.