CHM 1001 General Chemistry

Assignment 1

- 20 multiple-choice questions + 5 short answer questions.
- There is only one correct answer for each multiple-choice question.
- Please write your answers in the Assignment Answers Template, which was uploaded on the blackboard before.
- Upload your answer into Blackboard before the deadline, only word and PDF format are allowed.
- No late submission is allowed.

Deadline: 23:59 pm, October 25th (UTC+8)

Part 1: Multiple-choice questions

1. As a gaseous element condenses, the atoms become _____ and they have _____ attraction for one another.
A) more separated, more
B) more separated, less
C) closer together, more
D) closer together, less
E) larger, greater

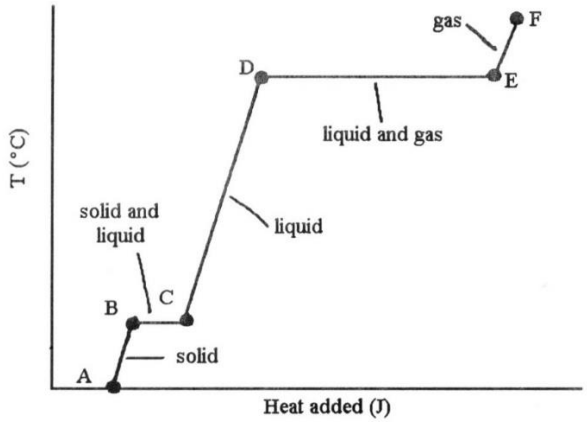
2. Which statement is true about liquids but not true about solids?
A) They flow and are highly ordered.
B) They are highly ordered and not compressible.
C) They flow and are compressible.
D) They assume both the volume and the shape of their containers.
E) They flow and are not compressible.

3. The intermolecular force(s) responsible for the fact that CH_4 has the lowest boiling point in the set CH_4, SiH_4, GeH_4, SnH_4 is/are _____.
A) hydrogen bonding
B) dipole-dipole interactions
C) London dispersion forces
D) mainly hydrogen bonding but also dipole-dipole interactions
E) mainly London-dispersion forces but also dipole-dipole interactions

4. Of the following substances, only _____ has London dispersion forces as the only intermolecular force.
A) CH_3OH
B) NH_3
C) H_2S
D) Kr
E) HCl

5. The shape of a liquid's meniscus is determined by _____.
A) the viscosity of the liquid
B) the type of material the container is made of
C) the relative magnitudes of cohesive forces in the liquid and adhesive forces between the liquid and its container
D) the amount of hydrogen bonding in the liquid
E) the volume of the liquid

6. The phase changes B → C and D → E are not associated with temperature increases because the heat energy is used up to _____.



A) increase distances between molecules
B) break intramolecular bonds
C) rearrange atoms within molecules
D) increase the velocity of molecules
E) increase the density of the sample

7. Calculate the enthalpy change (in kJ) associated with the conversion of 25.0 grams of ice at -4.00 °C to water vapor at 109.0 °C. The specific heats of ice, water, and steam are 2.09 J/g-K, 4.18 J/g-K, and
1.84 J/g-K, respectively. For H2O, ΔHfus = 6.01 kJ/mol and ΔHvap = 40.67 kJ/mol.
A) 64.8
B) 75.9
C) 11100
D) 12000
E) 112

8. The unit cell with all sides the same length and all angles equal to 90° that has lattice points only at the corners is called _____.
A) monoclinic
B) body-centered cubic
C) primitive cubic
D) face-centered cubic
E) spherical cubic

9. Which statement about steel is false?
A) It is a polymer.
B) It is an alloy of iron.
C) It can have different percentages of carbon.
D) It can be made so it resists rust.
E) none of the above

10. Metallic solids do not exhibit _____.
A) excellent thermal conductivity
B) excellent electrical conductivity
C) variable hardness
D) extreme brittleness
E) variable melting point

11. NaCl crystallizes in a face-centered cubic cell. What is the total number of ions (Na+ ions and Cl- ions) that lie within a unit cell of NaCl?
A) 2
B) 4
C) 8
D) 6
E) 5

12. Potassium metal crystallizes in a body-centered cubic structure with a unit cell edge length of 5.31 Å. The radius of a potassium atom is _____ Å.
A) 1.33
B) 1.88
C) 2.30
D) 2.66
E) 5.31

13. When the size of a semiconductor particle or crystal _____, the band gap energy _____.
A) decreases, decreases
B) decreases, remains the same
C) increases, increases
D) decreases, increases
E) decreases, goes to zero

14. The first person to investigate the relationship between the pressure of a gas and its volume was _____.
A) Amadeo Avogadro
B) Lord Kelvin
C) Jacques Charles
D) Robert Boyle
E) Joseph Louis Gay-Lussac

15. Of the following, _____ is a correct statement of Boyle's law.

A) $PV = \text{constant}$

B) $\frac{P}{V} = \text{constant}$

C) $\frac{V}{P}$ = constant

D) $\frac{V}{T}$ = constant

E) $\frac{n}{P}$ = constant

16. The volume of an ideal gas is zero at _____.
A) 0 °C
B) -45 °F
C) -273 K
D) -363 K
E) -273 °C

17. The density of NO2 in a 4.50 L tank at 760.0 torr and 25.0°C is _____ g/L.
A) 1.64
B) 9.30
C) 1.68
D) 1.88
E) 3.27

18. 30.0 grams of argon and 15.0 grams of xenon are placed in a 120.0 ml container at 22.0°C. The partial pressure of xenon is _____ atm.
A) 8.70
B) 22.9
C) 0.700
D) 174
E) 5.60

19. According to kinetic-molecular theory, in which of the following gases will the root-mean-square speed of the molecules be the highest at 200°C?
A) HCl
B) Cl2
C) H2O
D) SF6
E) None. The molecules of all gases have the same root-mean-square speed at any given temperature.

20. A tank containing both HF and HBr gases developed a leak. The ratio of the rate of effusion of HF to the rate of effusion of HBr is _____.

A) 4.04
B) 0.247
C) 2.01
D) 0.497
E) 16.3

Part 2: Short answer questions

1. An inflated balloon has a volume of 6.0 L at sea level (1.0 atm) and is allowed to ascend until the pressure is 0.45 atm. During ascent, the temperature of the gas falls from 22 °C to -21 °C. Calculate the volume of the balloon at its final altitude.

2. An empty 49.0 L methane storage tank has an empty mass of 55.85 kg and when filled, has a mass of 62.07 kg. Calculate the pressure of CH_4 in the tank at 21˚C using both the ideal gas equation and the van der Waals equation. CH_4: a = 2.253 L^2 atm mol^{-2}, b = 0.04278 L mol^{-1}

3. Which type(s) of intermolecular forces need to be overcome to convert each of the following liquids to gases? (a) CH_4, （b）CH_3F, (c) CH_3OH

4. Which kind of material (n- or p-type) would result if pure germanium were doped with （a）gallium and (b) arsenic?

5. Which of the following compounds would be expected to form intermolecular hydrogen bonds in the liquid state? (a) CH_3OCH_3 (dimethyl ether), (b) CH_4, (c) HF, (d) CH_3CO_2H (acetic acid), (e) Br_2, (f) CH_3OH (methanol)