CHM 114, #71156
Exam #3, Group A
November 7, 2011
Instructor: O. Graudejus
Points: 100

Print Name _____

Sign Name _____

Student I.D. # _____

1. You are responsible for the information on this page. Please read it carefully.
2. **Code** your name and 10 digit affiliate identification number on the separate scantron answer sheet. Use only a #2 pencil
3. Do all calculations on the exam pages. Do not make any unnecessary marks on the answer sheet.
4. This exam consists of 25 multiple choice questions worth 4 points each and a periodic table. Make sure you have them all.
5. Choose the best answer to each of the questions and answer it on the computer-graded answer sheet. Read all responses before making a selection.
6. Read the directions carefully for each problem.
7. Avoid even casual glances at other students' exams.
8. Stop writing and hand in your scantron answer sheet and your test promptly when instructed. LATE EXAMS MAY HAVE POINTS DEDUCTED.
9. You will have 50 minutes to complete the exam.
10. If you leave early, please do so quietly.
11. Work the easiest problems first.
12. A periodic table is attached as the last page to this exam.
13. Answers will be posted online this afternoon.

Potentially useful information:

$K = ºC + 273.15$ $PV=nRT$

$R=8.314\ J\cdot K^{-1}\cdot mol^{-1}$ $\Delta E = q + w$

$c=3\cdot10^{8}$ m/s $E_{photon}=h\cdot\nu=h\cdot c/\lambda$

$h=6.626\cdot10^{-34}$ Js 760 torr = 1 atm = 101325 Pa = 1.013 bar

Avogadro's Number = 6.022×10^{23} particles/mole

$\Delta H°_{rxn} = \sum n\ \Delta H_f°$ (products) $- \sum n\ \Delta H_f°$ (reactants)

$q = (Sp.\ Heat) \times m \times \Delta T$ (Specific $Heat_{water}$ = 4.184 J/g°C)

$KE = \frac{1}{2} mv^2$

$KE = \frac{3}{2} RT$ (R is a constant)

$$u = \sqrt{\frac{3RT}{M}}$$

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1) PCl_5 has _____ electron domains and a _____ molecular arrangement.

A) 6, trigonal bipyramidal
B) 6, tetrahedral
C) 5, square pyramidal
D) 5, trigonal bipyramidal
E) 6, seesaw

2) Of the following species, _____ will have bond angles of 120°.

A) PH_3
B) ClF_3
C) NCl_3
D) BCl_3
E) All of these will have bond angles of 120°.

3) According to VSEPR theory, if there are three electron domains in the valence shell of an atom, they will be arranged in a(n) _____ geometry.

A) octahedral
B) linear
C) tetrahedral
D) trigonal planar
E) trigonal bipyramidal

4) There are _____ σ and _____ π bonds in the $H_2C{=}C{=}CH_2$ molecule.

A) 4, 2
B) 6, 4
C) 2, 2
D) 2, 6
E) 6, 2

5) Of the molecules below, only _____ is nonpolar.

A) BF_3
B) NF_3
C) IF_3
D) PBr_3
E) $BrCl_3$

6) The combination of two atomic orbitals results in the formation of _____ molecular orbitals.

A) 1
B) 2
C) 3
D) 4
E) 0

7) A sample of a gas (1.50 mol) is contained in a 15.0 L cylinder. The temperature is increased from 100 °C to 150 °C. The ratio of final pressure to initial pressure $[\frac{P_2}{P_1}]$ is _____.

A) 1.50
B) 0.667
C) 0.882
D) 1.13
E) 1.00

8) A gas mixture of Ne and Ar has a total pressure of 4.00 atm and contains 16.0 mol of gas. If the partial pressure of Ne is 2.75 atm, how many moles of Ar are in the mixture?

A) 11.0
B) 5.00
C) 6.75
D) 9.25
E) 12.0

9) Which one of the following gases would have the highest average molecular speed at 25 °C?

A) O_2
B) N_2
C) CO_2
D) CH_4
E) SF_6

10) A gas at a pressure of 10.0 Pa exerts a force of _____ N on an area of 5.5 m^2.

A) 55
B) 0.55
C) 5.5
D) 1.8
E) 18

11) The reaction of 50 mL of N_2 gas with 150 mL of H_2 gas to form ammonia via the equation:

$$N_2\ (g) + 3H_2\ (g) \rightarrow 2NH_3\ (g)$$

will produce _____ mL of ammonia if pressure and temperature are kept constant.

A) 250
B) 50
C) 200
D) 150
E) 100

12) The Mond process produces pure nickel metal via the thermal decomposition of nickel tetracarbonyl:

$$Ni(CO)_4\ (l) \rightarrow Ni\ (s) + 4CO\ (g)\ .$$

What volume (L) of CO is formed from the complete decomposition of 444 g of $Ni(CO)_4$ at 752 torr and 22.0 °C?

A) 0.356
B) 63.7
C) 255
D) 20.2
E) 11.0

13) Which noble gas is expected to show the largest deviations from the ideal gas behavior?

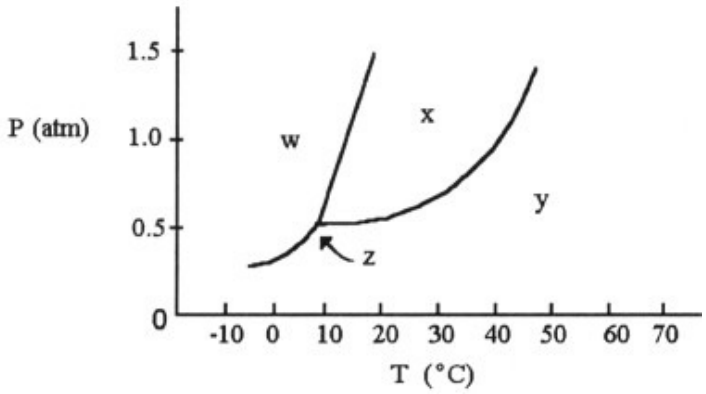
A) helium
B) neon
C) argon
D) krypton
E) xenon

14) Which one of the following should have the lowest boiling point?

A) CH_3OH
B) H_2S
C) NH_3
D) HCl
E) CH_4

15) Why is propane (C_3H_8) a gas at room temperature whereas pentane (C_5H_{12}) is a liquid?

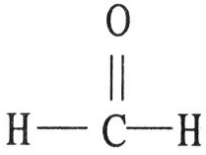
A) pentane has stronger hydrogen bonds
B) propane has stronger hydrogen bonds
C) London Dispersion forces are stronger in pentane
D) London Dispersion forces are stronger in propane
E) pentane is a strong dipole

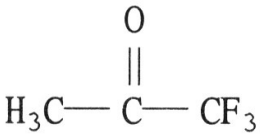


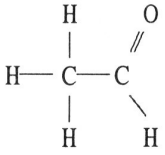
16) The normal boiling point (at atmospheric pressure) of the substance with the phase diagram shown above is _____ °C.

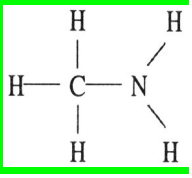
A) 10
B) 20
C) 30
D) 40
E) 60

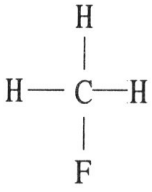
17) Which one of the following substances will have hydrogen bonding as one of its intermolecular forces?

A) 

B) 

C) 

D) 

E) 

18) The heat of fusion of water is 6.01 kJ/mol. The heat capacity of liquid water is 75.3 J/mol · K. The conversion of 50.0 g of ice at 0.00°C to liquid water at 10.0°C requires _____ kJ of heat.

A) 2110
B) 18.8
C) 2.11
D) 16.7
E) Insufficient data are given.

19) Some food takes longer to cook at high altitudes than at low altitudes because _____.

A) water boils at a lower temperature at high altitude than at low altitude
B) water boils at a higher temperature at high altitude than at low altitude
C) heat isn't conducted as well in low density air
D) natural gas flames don't burn as hot at high altitudes
E) there is a higher moisture content in the air at high altitude

20) What is the typical effect of the addition of an interstitial element on the properties of a metal?

A) increase in malleability and ductility
B) increase in hardness and melting point, decrease in ductility
C) decrease in melting point and increase in ductility
D) decrease in conductivity and increase in brittleness
E) increased surface luster

21) Which of the following compounds forms a molecular solid?

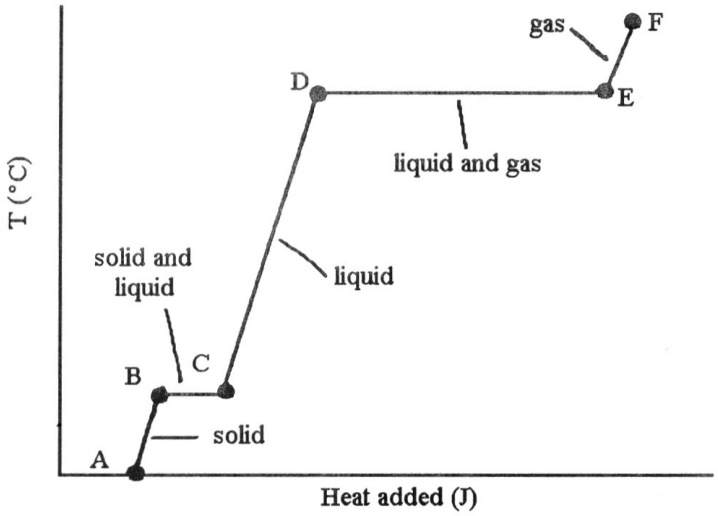
A) NaCl
B) SiO_2
C) Au
D) Cl_2
E) Ni_3Al

22) _____ solids consist of atoms or molecules held together by dipole-dipole forces, London dispersion forces, and/or hydrogen bonds.

A) Ionic
B) Molecular
C) Metallic
D) Covalent-network
E) Metallic and covalent-network

23) Which one of the following substances is more likely to dissolve in benzene (C_6H_6)?

A) CH_3CH_2OH
B) NH_3
C) NaCl
D) CCl_4
E) HBr



24) The heating curve shown above was generated by measuring the heat flow and temperature of a solid as it was heated. The heat flow into the sample in the segment _____ will yield the value of the ΔH_{vap} of this substance.

A) AB
B) BC
C) CD
D) DE
E) EF

25) Ammonium nitrate (NH_4NO_3) dissolves readily in water even though the dissolution is endothermic by 26.4 kJ/mol. The solution process is spontaneous because _____.

A) the vapor pressure of the water decreases upon addition of the solute
B) osmotic properties predict this behavior
C) of the decrease in enthalpy upon addition of the solute
D) of the increase in enthalpy upon dissolution of this strong electrolyte
E) of the increase in disorder upon dissolution of this strong electrolyte