Grade = 100 − 3(#wrong) 3 points per question

Chem 1110 Rybolt Exam 4 FALL 2011 Name KEY

Numerical constants may be listed below. Other needed information is given in the problem or written on the board or found in the Periodic Tables you will use during exam. For numerical problems, be sure to **show your work**, include units and circle your final answer. If several choices are given, **circle the correct answer**. Your written answers should be brief and to the point. You can use your own calculator on the exam, but no notes, books, external information, or other electronic devices are to be used. No cell phone is to be used in Exam room.

1.000 g = 6.022×10^{23} amu 1mol = 6.022×10^{23} K = °C + 273 °C = (°F − 32)/1.8

c = 3.00×10^{8} m/s h = 6.63×10^{-34} Js R = 0.08206 (L atm/ mol K)

1atm = 760 torr = 760 mmHg = 1.01×10^{5} Pa = 14.7psi

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1) Which of the following molecules is polar?

a CO_2 b CH_4 c F_2 (d H_2O)

2) A gas initially has value of T=200K, P=2.0 atm, and V=4.0 L. If T is changed to 555 K and V is changed to 0.555 L, then the pressure P(atm) will be equal to

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$P_2 = P_1 \frac{V_1}{V_2} \frac{T_2}{T_1}$$

$$P_2 = 2.0\,atm \left(\frac{4.0\,L}{0.555\,L}\right)\left(\frac{555\,K}{200\,K}\right)$$

$P_2 = 6.5$ atm

$P_2 = 40$ atm

3) A metal cylinder was filled with 2.22 moles of gas at a temperature of 300 K. The pressure was found to be 100 atm. Therefore, the volume of the cylinder must be _____ L

$$PV = nRT$$

$$V = \frac{nRT}{P}$$

$$V = (2.22\,mol)\left(0.08206 \frac{L\,atm}{mol\,K}\right)(300\,K) / 100\,atm$$

$V = 0.55\,L$ or (0.547 L)

4) The air in a truck tire has an absolute pressure of 3.0 atmosphere when the truck is parked in Massachusetts on a cold morning (Temp = -1°C). The truck is shipped to Miami where the temperature is 28°C. What is the pressure inside the tire when it is in Miami?

$T_1 = -1\,°C + 273 = 272\,K$

$T_2 = 28\,°C + 273 = 301\,K$

$P_1 = 3.0$ atm

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$P_2 = P_1 \frac{T_2}{T_1} = 3.0\,atm \left(\frac{301\,K}{272\,K}\right)$$

$P_2 = 3.32$ atm

5) If 1.0 mole of argon gas is placed in a 2 liter container, the density of the gas will be __ (g/L)

$$d = \frac{1.0\,mol\,(40.0\,g/mol)}{2.0\,L} = 20\,g/L$$

6) According to the kinetic molecular theory, as the temperature is increased the speed of gas molecules should

increase decrease remain unchanged

7) A mixture of gases has a total pressure of 500 torr. The mixture is 2.0 mol of Ne, 4.0 mol of Ar, 3.0 mol of Kr, and 1.0 mol of Xe. The partial pressure of Xenon is _____ torr.

$$P_{Xe} = 500\,torr\left(\frac{1.0}{2.0+4.0+3.0+1.0}\right)$$

$$= 500\,torr\left(\frac{1}{10}\right)$$

$$= 50\,torr$$

8) Which of the following states of matter has the largest distance between molecules and is the most random

a gas b liquid c solid

9) Ethane C_2H_6 can be changed to a liquid when the temperature is lowered is because of what type of attraction between the molecules

a hydrogen bonding b dipole-dipole attraction c instantaneous induced dipole attraction

10) Vaporaization converts a liquid to a gas

11) Of the following molecules ____ would be expected to have the highest melting point and thus be a solid a room temperature

CH_4 C_4H_{10} C_8H_{18} $C_{20}H_{42}$

12) Butane C_4H_{10} is a gas at room temperature but methanol CH_3OH is a liquid What type of intermolecular force or attractions between molecules accounts for the fact that methanol has a high enough boiling point to be a liquid at room temperature even though it is smaller than butane.

hydrogen bonding
also has dipole interactions

13) Why is the boiling point of water in Miami greater than the boiling point of water in Denver?

Because the pressure is greater in Miami.

14) When ice skating, the large pressure applied to ice under the blades of ice skates, causes a change of

s → g s → l l → g l → g

15) Of the following _____ can form an ionic solid

a NaCl b HCl c C d Cu e H_2O

16) The best conduction of electricity in a solid is found in _____ solid

a ionic b molecular c network d metallic

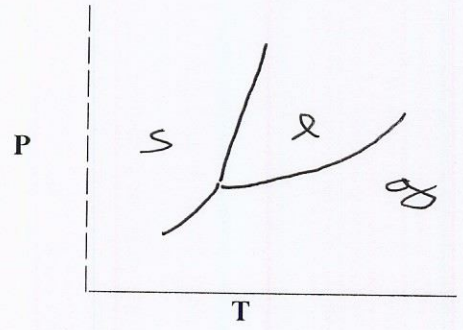
17) The allotrope of pure carbon that exist as long cylinders is

graphene graphite diamond bucky balls carbon nanotubes

18) In a metal the most nearest neighbor metal atoms around one atom is .

a 2 b 6 c 8 d 10 e 12

19) Draw a phase diagram for water and identify regions of solid liquid and gas



20) Evaporation converts a _____ to a _____

a liquid, solid b gas, liquid c liquid, gas d solid, liquid e solid, gas

21) Which of the following would be the best conductor of heat?

a NH_3 b C_2H_6 c O_2 d Fe

22) The conversion of a gas to a liquid is

a sublimation b melting c deposition d condensation e freezing

23) _____ in glass has a meniscus curved down because of the weak _____ forces between the liquid and the glass

a Water, cohesive b Water, adhesive c Mercury, cohesive d Mercury, adhesive

24) Of the following molecules ____ would be expected to have the strongest van der Waals forces between the molecules:

(a SnH_4) b GeH_4 c SiH_4 d CH_4

largest molecule strongest vdW

25) A gas initially has value of T=200K, P=2atm, and V=4L. If T is changed to 800 K and V is changed to 16 L, then P(atm) will be equal to

a 8 b 6 c 4 (d 2) e 1

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \qquad \frac{2\,atm \;\; 4\,L}{200K} = \frac{P_2 \;\; 16\,L}{800K}$$

$$0.040 = P_2 \; 0.020$$

$2\,atm = P_2$ no change in P

26) The type of force responsible for the fact that water has a higher boiling point than hydrogen sulfide

a London forces b dipole- dipole c metallic bond (d hydrogen bond)

27) Considering the size of the Cs^+ and Na^+ cations which should have a larger coordination number (number of nearest neighbors)

(a CsCl) b NaCl

Cs^+ bigger than Na^+

28) Recall that the average velocity of a gas is $u = [3RT/M]^{1/2}$ where R= 8.31 J/mol K. Therefore Ar with a molar mass of 0.040 kg/mol at a temp of 300K should have what velocity.

$$u = \left(\frac{3\left(8.31 \frac{J}{mol\,K}\right)(300K)}{0.040\,kg/mol} \right)^{1/2}$$

Units

$$\left(\frac{\frac{kg\,m^2}{s^2}\,K}{mol\,K \;\; kg/mol} \right)^{1/2}$$

$$\left(\frac{m^2}{s^2}\right)^{1/2} = \frac{m}{s}$$

$u = 434\ m\,s^{-1}$

29) In the van der Waals equation of state $P = (nRT)/(V - nb) - a^2n^2/V^2$ the parameter b accounts for what property of real gases

hydrogen bonding van der Waals forces (molecular size) dipole moment

30) Circle all the molecular forces that causes attractions between CO_2 molecules

hydrogen bonding dipole-dipole attraction (instantaneous induced dipole attraction(VDW))

31) Van der Waals(VDW) also known as instantaneous induced dipole attraction interactions between molecules would cause which of the following to have the highest boiling point

He Ne Ar Kr (Xe)

largest size