Chemistry 115 Name

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Exam 3b November 15, 2012

 Multiple Choice (30 points)

 Page 5 (14 points)

 Page 6 (20 points)

 Page 7 (19 points)

 Page 8 (17 points)

 Total (100 points)

 Percent

All work must be shown to receive credit. Give all answers to the correct number of significant figures

PV=nRT

Avogadros number = 6.022 x 1023 /mol

Ideal gas constant = 0.0821 L atm/mol K

 = 62.4 L torr/mol K

1 atm = 760 torr = 760 mm Hg = 101.3 kPa = 14.7 psi

Henry’s Law $\frac{solubility}{pressure}=constant $

Grossmont College

Periodic Table

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  IA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | VIIA | NOBLE GASES |
| 1**H**1.008 | IIA |  |  |  |  |  |  |  |  |  |  | IIIA | IVA | VA | VIA | 1**H**1.008 | 2**He**4.002 |
| 3**Li**6.941 | 4**Be**9.012 |  |  |  |  |  |  |  |  |  |  | 5**B**10.81 | 6**C**12.01 | 7**N**14.01 | 8**O**16.00 | 9**F**19.00 | 10**Ne**20.18 |
| 11**Na**23.00 | 12**Mg**24.30 | IIIB | IVB | VB | VIB | VIIB |  VIII VIII VIII | IB | IIB | 13**Al**27.00 | 14**Si**28.09 | 15**P**30.97 | 16**S**32.06 | 17**Cl**35.45 | 18**Ar**39.95 |
| 19**K**39.10 | 20**Ca**40.08 | 21**Sc**44.96 | 22**Ti**47.90 | 23**V**50.94 | 24**Cr**52.00 | 25**Mn**54.94 | 26**Fe**55.85 | 27**Co**58.93 | 28**Ni**58.70 | 29**Cu**63.55 | 30**Zn**65.38 | 31**Ga**69.72 | 32**Ge**72.59 | 33**As**74.92 | 34**Se**78.96 | 35**Br**79.90 | 36**Kr**83.80 |
| 37**Rb**85.47 | 38**Sr**87.62 | 39**Y**88.91 | 40**Zr**91.22 | 41**Nb**92.91 | 42**Mo**95.94 | 43**Tc**(99) | 44**Ru**101.1 | 45**Rh**102.9 | 46**Pd**106.4 | 47**Ag**107.9 | 48**Cd**112.4 | 49**In**114.8 | 50**Sn**118.7 | 51**Sb**121.8 | 52**Te**127.6 | 53**I**126.9 | 54**Xe**131.3 |
| 55**Cs**132.9 | 56**Ba**137.3 | 57**La**138.9 | 72**Hf**178.5 | 73**Ta**180.9 | 74**W**183.9 | 75**Re**186.2 | 76**Os**190.2 | 77**Ir**192.2 | 78**Pt**195.1 | 79**Au**197.0 | 80**Hg**200.6 | 81**Tl**204.4 | 82**Pb**207.2 | 83**Bi**209.0 | 84**Po**(209) | 85**At**(210) | 86**Rn**(222) |
| 87**Fr**(223) | 88**Ra**226.0 | 89**Ac**227.0 | 104**Rf**(261) | 105**Db**(262) | 106**Sg**(263) | 107**Bh**(262) | 108**Hs**(265) | 109**Mt**(266) | 110**??**(269) |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 58**Ce**140.1 | 59**Pr**140.9 | 60**Nd**144.2 | 61**Pm**(147) | 62**Sm**150.4 | 63**Eu**152.0 | 64**Gd**157.3 | 65**Tb**158.9 | 66**Dy**162.5 | 67**Ho**164.9 | 68**Er**167.3 | 69**Tm**168.9 | 70**Yb**173.0 | 71**Lu**175.0 |
| 90**Th**232.0 | 91**Pa**231.0 | 92**U**238.0 | 93**Np**(237) | 94**Pu**(244) | 95**Am**(243) | 96**Cm**(247) | 97**Bk**(247) | 98**Cf**(251) | 99**Es**(252) | 100**Fm**(257) | 101**Md**(258) | 102**No**(259) | 103**Lr**(260) |

Lanthanide series

Actinide series

Part I – Multiple Choice (30 points)

1. The ability of an atom to attract the shared electrons in a covalent bond is its \_\_\_\_\_\_\_\_.
	1. electronegativity
	2. bonding ability
	3. polarity
	4. ionic character
	5. nonpolarity
2. The bond in Cl2 is a(n) \_\_\_\_\_\_\_\_ bond.
	1. ionic
	2. metallic
	3. polar ionic
	4. nonpolar covalent
	5. polar covalent
3. The VSEPR theory allows us to determine the \_\_\_\_\_\_\_\_.
	1. charge on an ion
	2. color of a compound
	3. bond type for a molecule
	4. formula for a compound
	5. shape of a molecule
4. The HF molecule can be classified as \_\_\_\_\_\_\_\_.
	1. nonpolar
	2. ionic
	3. polar covalent
	4. bent
	5. planar
5. Hydrogen bonds are a major factor in the structure of \_\_\_\_\_\_\_\_.
	1. DNA
	2. hydrogen chloride
	3. dry ice
	4. air
	5. table salt
6. The main interactions between molecules of methane, CH4, are \_\_\_\_\_\_\_\_.
	1. hydrogen bonds
	2. ionic bonds
	3. dispersion forces
	4. dipole-dipole attractions
	5. none of the above
7. According to the kinetic molecular theory of gases, a gas can be compressed much more than a liquid or solid because
	1. a gas is composed of very small particles.
	2. the particles of a gas are very far apart.
	3. gas particles move rapidly.
	4. gas particles do not attract or repel one another.
	5. gas particles move faster when the temperature increases.
8. The force of gas particles against the walls of a container is called \_\_\_\_\_\_\_\_.
	1. volume
	2. quantity of gas
	3. temperature
	4. pressure
	5. density
9. Vapor pressure can be described as
	1. the pressure exerted by a gas above the surface of its liquid.
	2. the temperature at which bubbles of vapor appear in a liquid.
	3. the pressure exerted on the earth by the particles in the air.
	4. the temperature at which the vapor pressure of a liquid equals atmospheric pressure.
	5. the pressure within the lungs during inhalation.
10. What unit of temperature is used in gas law calculations?
	1. Fahrenheit
	2. Celsius
	3. Kelvin
	4. either Celsius or Fahrenheit
	5. either Celsius or Kelvin
11. In Gay-Lussac's law, the pressure of a gas increases due to an increase in temperature because
	1. the molecules strike the walls of the container less often.
	2. the molecules strike the walls of the container harder and more often.
	3. the molecules get bigger.
	4. there is a decrease in the volume of the container.
	5. there is an increase in the number of gas particles.
12. At which temperature would NH3 gas be most soluble?
	1. 283 K
	2. 293 K
	3. 303 K
	4. 313 K
	5. 333 K
13. At which pressure would carbon dioxide gas be most soluble?
	1. 500 torr
	2. 600 torr
	3. 700 torr
	4. 800 torr
	5. 900 torr
14. Which phase of matter can act as a solvent?
	1. Solid
	2. Liquid
	3. Gas
	4. All the above
15. Liquids which are capable of mixing and forming a solution are
	1. Miscible
	2. Immiscible
	3. Unsaturated
	4. Dilute
	5. Solubilizers

Part 2 – Problems and Short Answer (70 points)

1. (8 points) Draw Lewis Electron Dot Structures for the following molecules.
	1. OF2



* 1. C2H2 (Carbons bonded together with one H on each C.)



1. (6 points) Draw Lewis Electron Dot Structures for the carbonate ion (CO32−). Include reasonable resonance structures. (carbon is the central atom)



1. (8 points) Predict the orbital or molecular geometry of the numbered atoms:

Orbital geometry N1  trigonal planar

Molecular geometry C2 linear

Orbital geometry O3 tetrahedral

Molecular geometry C4 trigonal planar

1. (4 points) What are intermolecular forces and how are they different than covalent bonds?

Intermolecular forces and the forces that hold one molecule close to another. They are forces holding one atom close to another not covalent bonds which hold one atom close to another in a molecule.

1. (4 points)What is viscosity? How does it depend on intermolecular forces?

Viscosity is a measure of a substances resistance to flow. A molecule with stronger intermolecular forces will have a higher viscosity.

1. (4 points) Ether has a higher vapor pressure than water. Which of these two liquids has the stronger intermolecular forces? Which liquid would you expect to have the higher boiling point?

Water must have the stronger intermolecular forces which means that it will also have the higher boiling point.

1. (5 points) The pressure of Freon gas in an aerosol can is 3.87 atm at 25oC. What is the new pressure of the gas if the temperature is increased to 85oC?

$$PV=nRT$$

$$\frac{P\_{1}}{T\_{1}}=\frac{P\_{2}}{T\_{2}} \rightarrow \rightarrow P\_{2}=P\_{1}\left(\frac{T\_{2}}{T\_{1}}\right)=3.87 atm\left(\frac{358 K}{298 K}\right)=4.65 atm$$

1. (5 points) If a package of pretzels contains 0.132 L of air on the ground where the temperature is 27oC and the atmospheric pressure is 760 torr, if the temperature decreases to 18oC and the pressure decreases to 635 torr when the plane reaches its cruising altitude, what volume of air will be in the bag of pretzels?

$$PV=nRT$$

$$\frac{P\_{1}V\_{1}}{T\_{1}}=\frac{P\_{2}V\_{2}}{T\_{2}}\rightarrow \rightarrow V\_{2}=V\_{1}\left(\frac{P\_{1}}{P\_{2}}\right)\left(\frac{T\_{2}}{T\_{1}}\right)=0.132 L\left(\frac{760 torr}{635 torr}\right)\left(\frac{291 K}{300 K}\right)=0.153 L$$

1. (5 points) A 10.0 L stainless steel tank is filled with 749 grams of CO2 at 45oC. What is the pressure of the gas in the tank in atmospheres?

$$?mol CO\_{2}=749 g CO\_{2}×\frac{1 mol CO\_{2}}{44.01 g CO\_{2}}=17.0 mol CO\_{2}$$

$$PV=nRT\rightarrow \rightarrow P=\frac{nRT}{V}=\frac{\left(17.0 mol\right)\left(0.0821 L atm\right)\left(318 K\right)}{\left(10.0 L\right) mol K}=44.4 atm$$

1. (4 points) Calculate the density of a sample of neon gas at standard temperature and pressure (STP).

$$density=\frac{g}{L}=\frac{20.18 g}{mol}×\frac{1 mol}{22.414 L}=\frac{0.900 g}{L}$$

1. (5 points) Butane gas (C4H10) burns in oxygen to produce carbon dioxide and oxygen.

2 C4H10 (g) + 13 O2(g) 🡪 8 CO2(g) + 10 H2O(g)

How many liters of oxygen gas are required to react with 6.27 L of C4H10 with if the pressure and temperature are held constant?

$$?L O\_{2}=6.27 L C\_{4}H\_{10}×\frac{13 L O\_{2}}{2 L C\_{4}H\_{10}}=40.8 L O\_{2}$$

1. (4 points) A gas mixture contains each of the following gases at the indicated partial pressure. N2 (837 torr), O2 (176 torr), and H2(677 torr). What is the total pressure of the mixture in atm?

$$total pressure=837 torr N\_{2}+176 torr O\_{2}+ 677 torr H\_{2}=1690. torr$$

$$?atm=1690. torr×\frac{1 atm}{760 torr}=2.224 atm$$

1. (4 points) A solution is made by mixing 59.2 grams of barium sulfate with 49.2 grams of water. Identify the solvent and solute in this solution.

Solvent is barium sulfate and the solute is water.

1. (4 points) Chlorine gas is a good oxidizing agent which is often used to purify municipal water supplies and ensure that it is safe to drink. If Cl2 has a solubility of 8.0 g/kg at 1.23 atm, what will the solubility of the gas be at a pressure of 0.052 atm?

$$\frac{S\_{1}}{P\_{1}}=\frac{S\_{2}}{P\_{2}}\rightarrow \rightarrow \rightarrow S\_{2}=S\_{1}\left(\frac{P\_{2}}{P\_{1}}\right)=8.0 {g}/{kg}\left(\frac{0.052 atm}{1.23 atm}\right)=0.34 g/kg$$