CHE111 Review Test 3

NAME _____

1. A 51.2 g of O_2 gas (molecular weight 32 g/mole) occupies _____ L at 22 °C and 2.5 atm. Use the ideal gas law, PV = nRT

   P: pressure (atm)
   V: volume (L)
   n: # of moles
   R: 0.082 (atm·L)/(mole·K)
   T: temperature (K)

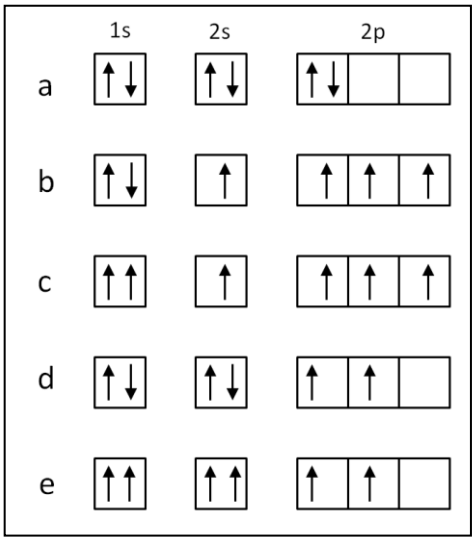
   a. 0.079 b. 3.2×10^{-2} c. 15.5 d. 1.2 e. 12.6

2. Arrange the following gases in order of increasing average molecular speed at 25 °C.

   He, O_2, CO_2, H_2

   a. $He < O_2 < H_2 < CO_2$ b. $CO_2 < O_2 < He < H_2$
   c. $He < H_2 < O_2 < CO_2$ d. $CO_2 < He < N_2 < O_2$
   e. $CO_2 < O_2 < H_2 < He$

3. Which one of the following is the correct electron configuration for a ground-state carbon atom? (d)



4. The lines in the absorption spectrum of hydrogen result from _____.

   a. electrons given off by hydrogen as it cools

b. energy given off in the form of visible light when an electron moves from a higher energy state to a lower energy state
c. electrons given off by hydrogen when hydrogen is illuminated by visible light
d. energy taken in the form of visible light when an electron moves from a lower energy state to a higher energy state
e. decomposing hydrogen atoms

5. The wavelength (λ) of light that has a frequency (ν) of $7.5 \times 10^{9}\ s^{-1}$ is _____ m.
c (speed of light) = 3×10^{8} m/s = ν·λ.

a. 0.0400 b. 12.0 c. 2.5 d. 2.50×10^{-5} e. 25.0

6. The quantum number which describes the shape of an orbital is:

a. n b. *l* c. m_l d. m_s
e. The shape of an atomic orbital is nothing to do with quantum number

7. There are _____ possible values for the magnetic quantum number (m_l) of an electron in a 3p subshell.

a. 0 b. 1 c. 2 d. 3 e. 4

8. For a *d* orbital,

a. The value of *n* must be 2.
b. The value of m_s must be ½
c. The value of *l* must be 3
d. The value of m_l must be 3
e. The value of *l* must be 2

9. Given the following sets of quantum numbers for *n*, *l*, m_l, and m_s, which one of these sets is not possible for an electron in an atom?

	n	*l*	m_l	m_s
a.	2	1	0	-½
b.	3	1	-1	½
c.	4	1	2	½
d.	4	3	-2	-½
e.	5	2	2	½

10. Which atom below is diamagnetic?

a. Be b. B c. C d. N e. O

Consider the following electron configurations to answer the questions 11 and 12 that follow:

(i) [Kr] $5s^1$
(ii) [Ne] $3s^2\ 3p^5$
(iii) [Ar] $4s^2\ 3d^{10}\ 4p^4$
(iv) [Ne] $3s^2\ 3p^6$

(v) [Ar] $4s^2$

11. The electron configuration of the atom that is expected to form a stable +2 ion is _____.

a. (i) b. (ii) c. (iii) d. (iv) e. (v)

12. The electron configurations of the two atoms that form isoelectronic ions are _____.

a. (i) and (iii) b. (ii) and (iii) c. (ii) and (v)
d. (iii) and (iv) e. (i) and (v)

13. The ion PCl_4^- has _____ valence electrons.

a. 34 b. 8 c. 28 d. 35 e. 36

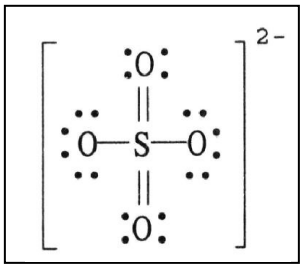
14. Of the following, which gives the correct order for atomic radius for Mg, Na, P, Si and Ar?

a. Si > P > Ar > Na > Mg
b. Na > Mg > Si > P > Ar
c. Ar > P > Si > Mg > Na
d. Ar > Si > P > Na > Mg
e. Mg > Na > P > Si > Ar

15. Which isoelectronic series is correctly arranged in order of increasing radius?

a. $Ca^{2+} < K^+ < Ar < Cl^-$
b. $Cl^- < Ar < K^+ < Ca^{2+}$
c. $Ca^{2+} < Ar < K^+ < Cl^-$
d. $Ca^{2+} < K^+ < Cl^- < Ar$
e. $K^+ < Ca^{2+} < Ar < Cl^-$

16. The formal charge on **sulfur** of SO_4^{2-} ion in figure is _____.



a. +4 b. -2 c. +2 d. +0 e. -4

17. Given the electronegativities below, which covalent single bond is least polar?

Element:	H	C	N	O
Electronegativity:	2.1	2.5	3.0	3.5

b. O-C b. O-N c. N-H d. C-H e. O-H

18. According to valence bond theory, which orbitals overlap in the formation of the bond in F_2?

a. 1s on F and 1s on F
b. 1s on F and 2s on F
c. 2s on F and 2s on F
d. 2s on F and 2p on F
e. 2p on F and 2p on F

19. The basis of the valence shell electron pair repulsion (VSEPR) model of molecular bonding is _____.

a. regions of electron density in the valence shell of an atom will arrange themselves so as to maximize overlap
b. atomic orbitals of the bonding atoms must overlap for a bond to form
c. electron domains in the valence shell of an atom will arrange themselves so as to minimize repulsions
d. hybrid orbitals will form as necessary to, as closely as possible, achieve spherical symmetry
e. regions of electron density on an atom will organize themselves so as to maximize s-character

20. What is the orbital hybridization of the central atom P in PF_5?

a. *sp*
b. sp^2
c. sp^3
d. sp^3d
e. sp^3d^2

21. An energy level scheme for the orbitals of second row diatomic molecules O_2 through Ne_2, lists the molecular orbitals in the following order of increasing energy

$\sigma_{1s} < \sigma^*_{1s} < \sigma_{2s} < \sigma^*_{2s} < \sigma_{2p(z)} < \pi_{2p(y)}, \pi_{2p(x)} < \pi^*_{2p(y)}, \pi^*_{2p(x)} < \sigma^*_{2p(z)}$

Based on this energy level scheme, the bond order for the bond in the O_2^- ion in its ground state is

a. 0.5
b. 1.0
c. 1.5
d. 2.0
e. 2.5

Part II (70 points)

22. Find partial pressures of He (P_{He}) and O_2 (P_{O2}) in a 12.5 L tank with 12.5 g He and 8.6 g O_2 at 298 K (10 points). Ideal gas law, PV = nRT

P: pressure (atm)
V: volume (L)
N: # of moles

R: 0.082 (atm·L)/(mole·K)
T: temperature (K)

$P_{He} = nRT/V = (12.5g/4g/mole)\times(0.082\ atm\cdot L/mol\cdot K)\times(298K)/12.5L = 6.11\ atm$
$P_{O2} = nRT/V = (8.6g/32g/mole)\times(0.082\ atm\cdot L/mol\cdot K)\times(298K)/12.5L = 0.53\ atm$

23. For Cu (atomic number 29), (15 pts)

a. Write the electron configuration of **Cu** (atomic number 29) (5 pts)
(energy level of atomic orbitals: 1s, 2s, 2p, 3s, 3p, 4s, 3d, 4p ……)

b. How many valence electrons? (5 pts)

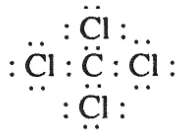
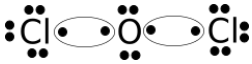
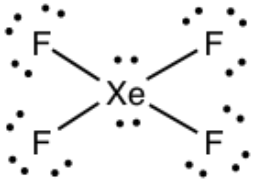
c. Diamagnetic or paramagnetic? (5 pts)

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^{10}$
11 valence electrons
paramagnetic

. Draw the Lewis dot structures of the following compounds in the column (1), using VSEPR model, predict the molecular geometry of the compound in the column (2), and decide whether the molecule is polar or nonpolar. You can use a line to represent a pair of bonding electrons between atoms. **Missing lone-pair electrons of peripheral atoms in the Lewis dot diagram will result in a deduction of 2 points each occurrence.** (45 pts)

CHE111 Review Test 3

Put the keys in the box directly

	Lewis structure (5 pts)	Molecular geometry (5 pts)	Polar or Nonpolar (5 pts)
CCl_4		Tetrahedral	Nonpolar
OCl_2		Bent	Polar
XeF_4		Square planar	Polar