

Chemistry 106: General Chemistry
Syracuse University Project Advance
Exam #3, Fall 2014

Name _____ Period _____ Date _____

(1) Which of the following statements about resonance is/are **incorrect**?

- I. When resonance exists, a single Lewis structure does not adequately represent the bonding.
- II. Resonance describes the vibration of nuclei within the molecule.
- III. Resonance describes a bonding situation that is in between(a blend) the contributing structures.

- a) I
- b) II
- c) III
- d) I and III
- e) none are incorrect

(2) A bond in which an electron is unequally shared by two atoms is

- a) coordinate covalent
- b) dipolar
- c) polar covalent
- d) nonpolar covalent
- e) ionic

(3) In the Lewis structure of ClF_3 , the number of lone pairs of electrons around the central atom is

- a) 0
- b) 1
- c) 2
- d) 3
- e) 4

(4) The molecular geometry of SF₂ is

- a) linear
- b) bent (or angular)
- c) trigonal planar
- d) trigonal pyramidal
- e) tetrahedral

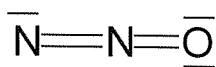
(5) A double bond is

- a) stronger and shorter than a triple bond
- b) weaker and longer than a single bond
- c) weaker and shorter than a triple bond
- d) stronger and longer than a single bond
- e) stronger and shorter than a single bond

(6) Which atom would be expected to be the most electronegative?

- a) B
- b) Na
- c) N
- d) Cs
- e) Al

(7) For the Lewis structure, the formal charges on N, N, and O, respectively (from left to right in the structure) are



- a) -1, +2, -1
- b) -1, +1, 0
- c) 0, 0, 0
- d) 0, +1, -1
- e) -2, +2, 0

(8) Which pair of elements would form the most ionic bond?

- a) H and O
- b) O and F
- c) Cs and S
- d) Li and S
- e) Al and N

- (9) The bonding in water is best characterized as
- hydrogen bonding
 - ionic
 - coordinate covalent
 - polar covalent
 - nonpolar covalent
- (10) Which of the following does **not** describe a **covalent bond**?
- sharing of valence electrons.
 - electrons are attracted simultaneously to both positive nuclei forming the bond.
 - involves overlapping orbitals of the atoms that compose it.
 - sharing of core electrons.
 - all describe covalent bonds.
- (11) In the ICl_4^- ion, the electron pairs are arranged around the central iodine in the shape of
- an octahedron
 - a tetrahedron
 - a trigonal bipyramid
 - a trigonal pyramid
 - a square plane
- (12) A π (pi) bond is the result of:
- overlap of two sp^2 hybrid orbitals
 - overlap of two p orbitals along their axes
 - sidewise overlap of two parallel p orbitals
 - overlap of two s orbitals
 - overlap of an s and a p orbital
- (13) A bond in which an electron pair is unequally shared by two atoms is
- ionic.
 - coordinate covalent.
 - nonpolar covalent.
 - polar covalent.
 - dipolar.

(14) Which of the following molecules has/have sp^3 hybrid orbitals on the central atoms(s)?

- I. CH_4
- II. BF_3
- III. H_2O
- IV. $H_2C=CH_2$
- V. NH_3

- a) II and IV
- b) I and III
- c) I, II and V
- d) I, II, and III
- e) I, III, and V

(15) The approximate adjacent F-Xe-F bond angle in XeF_4 is

- a) 90°
- b) 109°
- c) 120°
- d) 180°
- e) 104.5°

(16) The TOTAL bonding in acetylene (C_2H_2) consists of

- a) one σ and one π bond
- b) two σ and one π bond
- c) two σ and two π bond
- d) three σ and two π bond
- e) three σ and no π bond

(17) Using molecular Orbital Theory, determine the bond order of the O_2 molecule

- a) 0
- b) 1
- c) 1.5
- d) 2
- e) 2.5

- (18) Generally, a molecule in which the central atom is sp^3d^2 hybridized will have _____
_____ electron-pair geometry
- octahedral
 - linear
 - trigonal planar
 - trigonal bipyramidal
 - tetrahedral
- (19) A molecular orbital that is symmetrical for rotation about the internuclear axis is called
- a bonding orbital
 - an anti-bonding orbital
 - a pi orbital
 - a sigma orbital
 - a nonbonding orbital
- (20) Molecular Orbital Theory describes the bonding in H_2 as having
- both the σ_{1s} and σ^*_{1s} orbitals filled
 - the σ_{1s} orbital filled and σ^*_{1s} orbital empty
 - the σ_{1s} orbital filled and σ^*_{1s} orbital half-filled
 - the σ_{1s} orbital half-filled and σ^*_{1s} orbital filled
 - the σ_{1s} orbital empty and σ^*_{1s} orbital filled
- (21) A typical triple bond consists of
- three sigma bonds
 - three pi bonds
 - one sigma and two pi bonds
 - two sigma and one pi bond
 - none of the above
- (22) Suppose 3.15 L of neon at $21^\circ C$ and $P = 0.951$ atm is compressed to 1.292 atm, with the temperature held constant. The new volume is
- 2.32 L
 - 3.00 L
 - 3.15 L
 - 4.10 L
 - 4.44 L

(23) Which response contains all the characteristics listed that should apply to PF_3 ?

1. trigonal planar
2. one unshared pair of electrons on P
3. sp^3 -hybridized phosphorus atom
4. polar molecule
5. nonpolar molecule

- a) 1, 3, and 5
- b) 2, 3, and 4
- c) 1, 2, and 4
- d) 2, 3, and 5
- e) 1, 2, and 5

(24) A tank of volume 40 L contains a gas at 1.0 atm pressure, and a temperature of 20°C . Another tank, of volume 60 L, contains the same gas, also at 20°C , but at 2.0 atm pressure. The tanks are connected so gas can flow between them, with the temperature maintained at 20°C . At equilibrium, the pressure is the same everywhere in the total volume of 100 L. What is the final pressure?

- a) 1.4 atm
- b) 1.5 atm
- c) 1.6 atm
- d) 2.0 atm
- e) 3.0 atm

(25) Which of the following is/are characteristic of gases?

- a) High compressibility
- b) Relatively large distance between molecules.
- c) Formation of homogeneous mixtures regardless of the natures of non-reacting gas components.
- d) All of the above.
- e) None of the above.

(26) The average kinetic energy of molecules of a gas depends on

- a) the temperature of the gas.
- b) the total mass of the molecules of the gas.
- c) the density of the gas.
- d) all of these.
- e) none of these.

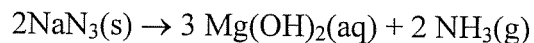
(27) A sample of oxygen gas occupies a volume of 900 mL at a pressure of 100 mmHg. What is the pressure of the gas if the volume is reduced to 300 mL and the temperature is doubled?

- a) 66.7 mmHg
- b) 33.3 mmHg
- c) 300 mmHg
- d) 150 mmHg
- e) 600 mmHg

(28) How many moles of gas occupy 60.82 L at 31°C and 367 mm Hg?

- a) 1.18
- b) 0.850
- c) 894
- d) 11.6
- e) 0.120

(29) Automobile air bags use the decomposition of sodium azide as their source of gas for rapid inflation:



How many grams of NaN_3 are required to provide 40.0 L of N_2 at 25°C and 763 mm Hg?

- a) 1.64
- b) 1.09
- c) 160
- d) 71.1
- e) 107

(30) What mass of nitrogen dioxide would be contained in a 4.32 L vessel at 48° C and 1062 torr?

- a) 5.35×10^4 g
- b) 53.5 g
- c) 10.5 g
- d) 105.0 g
- e) none of the above

- (31) A flask contains a mixture of two gases, A and B, at a total pressure of 2.6 atm. There are 2.0 moles of gas A and 5.0 moles gas B in the flask. What is the partial pressure (in atm) of gas A?
- a) 9.1
 - b) 6.5
 - c) 1.04
 - d) 0.74
 - e) 2.6
- (32) What is the molecular weight of a gas which has a density of 5.75 g/L at STP?
- a) 3.90
 - b) 129
 - c) 141
 - d) 578
 - e) 65.5
- (33) When a gas mixture effuses through a pinhole, the lighter components effuse faster because
- a) the heavier molecules tend to stay in the bottom of the container, away from the pinhole.
 - b) the lighter molecules move more rapidly.
 - c) the lighter molecules are also smaller and fit through the pinhole more easily.
 - d) the heavier molecules are more likely to be aggregated.
 - e) the lighter molecules have more kinetic energy.
- (34) An empty 2.0 L soda bottle is tightly capped with 2g of N₂ inside. If the bottle is placed in water at 95°C, what is the pressure in the bottle?
- a) 520 mmHg
 - b) 780 mmHg
 - c) 820 mmHg
 - d) 930 mmHg
 - e) 2800 mmHg

- EC. A gas from a certain volcano was a mixture of CO_2 (mole fraction 0.650), H_2 (mole fraction 0.250), HCl (mole fraction 0.054), HF (mole fraction 0.028), and “other gases.” The total pressure is 760 mm Hg. What is the *sum of the partial pressures* of the “other gases?”
- a) 13.7 mm Hg
 - b) 18.0 mm Hg
 - c) 21.3 mm Hg
 - d) 137 mm Hg
 - e) 152 mm Hg