**Chemistry 3A – Fall 2025 Version A**Sections 43957-43958  
Midterm Examination #2

Select the **BEST** response for the question. Point values: multiple choice 3 pt; true/false 1 pt

1. Of the following intermolecular forces dipole-dipole (D-D), hydrogen bonding (H-B), London Dispersion Forces (LDF), which choice shows the order of strength of interaction?  
   (LDF > H-B means LDF is stronger than H-B)

a) LDF > H-B > D-D b) H-B > D-D > LDF c) H-B > LDF > D-D d) D-D > H-B > LDF

1. A lab report had just had a number “10.0” with no units written for this quantity. It was supposed to be the **mass** of sulfur used in the experiment. What units should the number have had?

a) g b) mol c) g/mol d) (number of) molecules e) mol/g

1. Which of the following represents a change in enthalpy in a substance that is being is being boiled?

a) D*Hv*ap b) D*H*sub c) D*H*fus d) D*H*melt

1. Which of these types of matter will have a definite volume and a definite shape?

a) gas b) liquid c) solid d) London Dispersion Force e) choices (a) and (b))

1. Assume specific heat capacity of cadmium (Cd) is 0.250 J/(g °C). A 10.0 g piece of cadmium metal is heated from 20°C to 50°C. How many joules of heat energy were transferred to the metal?

a) 400 J b) 225 J c) 75.0 J d) 0.635 J

1. What is the best choice for what is TRUE about the characteristics of a Type II ion?

a) it is a positively charged metal cation

b) it is an element that can ionize to more than one charge state (for example, it can be +1, +2, +3, and even -1, -2, etc)

c) the element's name in a compound requires the use of a roman numeral (the Stock system)

d) all the above

1. In drawing a Lewis structure for the carbonate (NO3)- ion, you have placed the octet around the three oxygen (O) atoms, but you see the central carbon (N) atom has only six electrons (3 bonding pairs) to the oxygen atoms. You have no electrons remaining to add in your inventory. What step do you need to do?

a) Nothing: your Lewis structure is ready and complete

b) Add a hydrogen atom to the molecule

c) A lone pair from one of the oxygen (O) atoms will have to be used to create a double bond with the central nitrogen (N)

d) Use Avogadro's Number at an earlier step

e) The noble gas argon (Ar) must provide a single electron to complete this structure

1. What is the molar mass of MgSO4·7 H2O?
2. 120.38 g/mol b) 126.112 g/mol c) 246.5 g/mol d) 18.016 g/mol
3. What is the mass percentage of water in the hydrate MgSO4·7 H2O?
4. 0% b) 49.84% c) 51.16% d) 100%

The Lewis structure is shown for NO2- ion . **Next three questions** relate to it.

1. What are the total number of valence electrons for the molecule?
2. 6 b) 10 c) 12 d) 18 e) 24
3. Each atom in the molecule should have an octet of electrons. How many electrons is that?
4. 2 b) 4 e) 8 d) 10 e) 12
5. Which of the following statements is FALSE about the Lewis structure
6. There are a total of 3 bonding pairs of electrons in the molecule
7. The molecule has a net charge of -1
8. The central atom nitrogen has no nonbonding (lone) pairs of electrons
9. One of the oxygen atoms has three nonbonding (lone) pairs of electrons

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1. Ammonia (:NH3) is a molecule with three terminal H atoms and a nonbonding (lone) pair of electrons on the central N atom. What is its molecular geometry?

a) bent b) trigonal planar c) trigonal pyramidal d) tetrahedral

1. Carbon and hydrogen have very little difference in their electronegativity values. What kind of chemical bond are they likely to form in any molecule?

a) ionic b) metallic c) (nonpolar) covalent d) polar covalent

1. What class of (crystalline) solid does extensively hydrogen-bonded H2O as ice as well as carbon dioxide (CO2) as dry ice, and also diatomic element molecule iodine (I2) form?

a) ionic b) covalent network c) metallic d) molecular

1. Water is at 1°C. What is its temperature on the Kelvin scale?
2. 0 K b) 100 K c) 274 K d) 298 K
3. When atoms like cesium and fluorine have the largest differences in electronegativity, what kind of bond will they form?

a) ionic b) metallic c) covalent d) polar covalent e) covalent-ionic

1. How many moles of a compound is there if the number of molecules or atoms or particles of that compound is two (2) times Avogadro’s Number?
2. 1 mol b) 2 mol c) 10 mol d) 20 mol e) 100 mol
3. What procedure is done in a laboratory if the goal is to get the **empirical formula** of an unknown compound?
4. checking viscosity b) elemental analysis c) boiling point determination

d) heating curve analysis e) cooling curve analysis

1. What kind of **intermolecular force** is an electrostatic interaction in which the molecules have a structure giving them a permanent partial positive charge (d+) on one end or side and a partial negative charge (d-) on another end or side?
2. hydrogen bonding b) London dispersion forces c) covalent-ionic
3. dipole-dipole interaction e) enthalpy of covalency
4. What is the correct name for **Fe2O3**, noting that Fe is a Type II metal cation?
5. tin(IV) sulfide b) iron(I) oxide c) iron(III) oxide d) iron oxide
6. Which molecular formula correctly shows the compound **dinitrogen tetrachloride**?
7. NCl b) N2Cl2 c) N4Cl2 d) N2Cl4
8. There are 6.022 × 1023 atoms of element calcium (Ca). How many grams of calcium are there?
9. 6.022 × 1023 g b) 6.65 g c) 40.08 g d) 241.3 g
10. Which of these elements is a Group 2 element?
11. Na b) Ca c) Mg d) both (b) and (c) e) all elements (a), (b), (c) are Group 2
12. What characteristics are true about the H2O molecule?
13. Its central oxygen atom has three nonbonding (lone) pairs of electrons
14. The difference in electronegativity between O and H atoms enables hydrogen bonding
15. Its molecular geometry is described as trigonal planar
16. It has no molecular polarity (no dipole moment)

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1 mol of sodium and 1 mole of potassium are equal numbers of Na and K atoms

1. true b) false
2. Kinetic energy is an energy determined by motion or velocity of a mass
3. true b) false
4. Nonbonding (lone) pairs of electrons affecting molecular geometry is explained by Valence Shell Electron Pair Repulsion (VSEPR) theory
5. true b) false
6. The burning of gasoline is an endothermic process
7. true b) false
8. 2.0 moles of H2 molecules is 6.022 x 1023 molecules of H2
9. true b) false
10. Beryllium has a molar mass of 9.012 g/mol
11. true b) false
12. There are more molecules in 0.50 mol of CO2 than in 0.50 mol of SO2
13. true b) false
14. A **formula unit** is a dimension of **mass** and its units are in grams (g)
15. true b) false
16. London Dispersion Forces describe a temporary, instantaneous induced dipole as intermolecular force
17. true b) false
18. Cesium chloride is an ionic compound with the formula Cs2Cl
19. true b) false