G. Chemistry Mid-exam 2009 E.C.

Part I: Multiple Choices (1 pts each)

D 1. Which one of the following is true about modern view of atomic structure?
(A) Atom of the same element has equal number of protons and electrons
(B) Every atom has equal number of protons
(C) Every atom is made up of molecules
(D) Proton and electron reside together in the nucleus of an atom

B 2. One of the following is true about isotopes
(A) Atom with different atomic and proton number
(B) Atom of a given element have the same atomic number
(C) Atom with different proton number
(D) Atom of a given element have the same mass number

C 3. Which one of the following elements normally occurs as a diatomic molecule?
(A) Ozone (C) Nitrogen
(B) Water (D) Ammonia

A 4. One of the following compounds is not build from a polyatomic ion?
(A) Ammonium bromide (C) Potassium sulfate
(B) Cobalt (II) nitrate (D) Iron (III) chloride

D 5. Which one of the following is true about polar covalent bond
(A) The bond is formed by equal sharing of pair of electrons
(B) The bond is formed by electron transfer within an organic compound
(C) The bond is formed due to unequal sharing of pair of electrons in the formed ionic compound
(D) The bond is formed due to the difference in electronegativity between individual atoms

C 6. Which of the following molecule has the strongest bond?
(A) Oxygen molecule (C) Nitrogen molecule
(B) Hydrogen molecule (D) Fluorine molecule

B 7. What is the possible geometry in sp^3d hybridization?
(A) Linear (C) Tetrahedral
(B) Trigonal bipyramidal (D) Octahedral

B 8. What kinds of hybrid orbitals are formed between sulfur and oxygen atoms in sulfur dioxide molecules?
(A) sp (C) sp^3
(B) sp^2 (D) sp^2d

D 9. Certain elements (Fe = 372.0 nm, K = 404.7 nm, Mg = 285.2 nm, and Na = 589.6 nm) emit light of a specific wavelength when they are burned. Determine which element emits photons of highest energy?

(A) Iron (C) Sodium

(B) Magnesium (D) Potassium

B 10. Which one is the possible chemical formula for ammonium tetra chlorocuprate (II)?

(A) $(NH_4)_2CuCl_4$ (C) $[Cu(NH_4)_4]Cl$

(B) NH_4CuCl_4 (D) $(NH_4)_2[CuCl_4]$

Part II: Short Answer

1. Magnesium has three isotopes, with mass number 26, 25, and 24. (3 pts)

   (a) Write the complete chemical symbol for each of them, respectively.

   Ans: $^{26}_{12}Mg$, $^{25}_{12}Mg$, and $^{24}_{12}Mg$. NB: M- capital, $^{A}_{Z}X$

   (b) How many neutrons are in an atom of each isotope, respectively?

   Ans: 14, 13, and 12.

2. What are the most probable Empirical, Molecular, and Structural formula for hydrogen peroxide molecule, respectively? Ans: HO, H_2O_2, and H–O–O–H (3 pts)

3. Write the balanced chemical equation for a reaction when sodium metal reacts with liquid water would yields for the formation of base and evolutions of gas? (1 pts)

   Ans: $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$

4. A 5.325 g sample of methyl benzoate, a compound used in the manufacture of perfumes, contains 3.758 g of carbon, 0.316 g of hydrogen, and 1.251 g of oxygen and the molecular mass of this compound is, M_r = 136 g/mol. (4 pts)

   (A) What is the empirical formula? *Ans:* C_4H_4O

   (B) What is the molecular formula? *Ans:* $C_8H_8O_2$

5. A strip of aluminum metal with a mass of 2.00 g is placed in an aqueous solution containing 2.50 g of copper nitrate, causing the following reaction to occur: (3 pts)

   $2Al(s) + 3Cu(NO_3)_2(aq) \rightarrow 3Cu(s) + 2Al(NO_3)_3$

   (A) Which reactant is limiting? *Ans:* $Cu(NO_3)_2$

   (B) How many grams of Cu will form? *Ans:* 0.825 g

   (C) How many grams of $Al(NO_3)_3$ will form? *Ans:* 1.888 g

6. From the given molecule NO, NO^+, and NO^-. (3 pts)

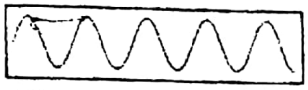
(A) Which molecule has the highest bond order? NO^+

(B) The most stable molecule is NO^+

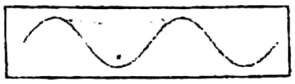
(C) Which one is diamagnetic? NO

7. From the two electromagnetic wave representations; (2 pts)

I



II



(A) Which wave has the higher frequency? I

(B) If one Wave represent Infrared light and the other represent Ultraviolet light, then,

Which wave is Ultraviolet and infrared, respectively? I and II.

8. For the complex $[Co(NH_3)_4(H_2O)Cl]Cl_2$; (4 pts)

(A) Oxidation number of central metal ion +2

(B) The condensed state electron configuration of central metal ion $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$

(C) The coordination number of the metal 6

(D) Systematic name of the complex Tetraamine aqua chloro dichloride

Part III: Workout, Show the necessary steps

1. What is the momentum, wavelength, energy, and frequency, of an electron traveling at 1.25×10^{5}m/s if the mass of the electron is 9.11×10^{-31} kg? (4 pts)

Given $v_e = 1.25\times10^{5}$ m/s $h = 6.63\times10^{-34}$ J·s required: (a) p = ?

$m_e = 9.11\times10^{-31}$ kg $c = 3\times10^{8}$ m/s (b) λ = ?

(c) ΔE = ?

$\lambda = \frac{h}{mv}$ ⇒ $\lambda = \frac{h}{p}$, since $mv = p$

$p = \frac{h}{\lambda}$, $\Delta E = h\nu$, $\lambda = \frac{c}{F}$

(4 pts)

2. Discuss the splitting of d orbitals in $[Mn(CN)_6]^{4-}$ & $[Mn(H_2O)_6]^{2+}$ complex compound according to the crystal field theory (CFT). (3 pts)

General Chemistry mid-exam

Chemistry MID EXAM, 2007 for pre engineering students

1 Which of the following interactions between the components of solution favors solution formation?

A) Solute-solvent interaction less than solute-solute interaction

B) Solvent-solvent interaction less than solute-solute interaction

C) Solute-solute interaction less than solute-solvent interaction

D) Solvent-solvent interaction greater than solvent-solute interaction

E) None

2. Different samples of the same compound always contain its constituent elements in the same proportion by mass is stated by

A. law of multiple proportions

B. law of definite proportion

C. law of conservation of mass

D. none

3. Ammonia and carbon dioxide are reacted to give urea as follow:-

NH_3 (g) + CO_2 (g) ⟶ $(NH_2)_2CO$ (aq) + H_2O; 637.2 g of NH_3 are allowed to react with 1142 g of CO_2

A. find the limiting reactant

B. find the mass of urea produced

C. how much of excess reagent is left at the end the reaction

4. Daltons' atomic theory which states all atoms of a given element are identical, in both weight and chemical properties was discarded due to the discovery of:-

A. sub atomic particles

B. isotopes

C. allotropes

D. all of the above

5. The detonation of car tyre during the day time due to high temperature is the application of

A. Charles' law

B. Boyels' law

C. Gay-Lusac's law

D. None of the above

6. Which one of the following is not redox (oxidation-Reduction) reaction?

A. $2Na + Cl_2 \rightarrow 2NaCl$

B. $2HgO \rightarrow 2Hg + O_2$

C. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

D, $AgNO_3 + NaCl \rightarrow AgCl\downarrow + NaNO_3$

7. Which one of the following are the requirements that the wave function fulfill to be accepted

A, it should be finite

B, it should be single valued

C, it should be continuous

D, all are correct

8. The total number of ligand atoms bonded directly to the central metal ion is known as

A, valence number

B. group number

C, coordination number

D, none

9. The general types of bond formed between central metal ion and ligand in complex Compound is

A. covalent bond

B. ionic bond

C, dative bond

D, metallic bond

10. Which one of the following is found at the lower energy level when compare to the other

A, atomic orbital

B, bonding molecular orbital

C, anti-bonding molecular orbital

D, B and C

11. The rate of diffusion of hydrogen gas is _____

A. four times that of chlorine gas

B. two times that of oxygen gas

C. four times that of oxygen gas

D. four times that of chlorine gas

12. The pressure of a container of He is 650 torr at 25°C. the sealed container is cooled to 0°C. what will the pressure be?

A. 595 torr B. 959 torr C. 656 torr D. 300 torr

13. During the addition of solute into the solvent to form solution. which one of the following happens?

A. freezing point depression

B. boiling point elevation

C. No change in state

D. A & B

14. The total electron arrangement in square planar shaped molecules (complex):-

A. Octahedral B. square planar C. tetrahedral D. pyramidal

Exercecies

1. The compound Terephthalic Acid is used in the manufacture of plastics. The compound contains only the elements C, H, and O. Elemental Analysis shows that it is 57.8% C and 3.6% H by mass. If the MW of this compound is 166 g/mol, then what is the molecular formula for Terephthalic Acid?
2. Combustion analysis of 12.01g of a compound containing C, H, and O produced 14.08 g of CO_2 and 4.32g of H_2O. Find the empirical formula for this compound.
3. The thermite reaction is used to generate small quantities of molten iron through the reaction below. If 15.0 g of $Fe_2O_{3\,(s)}$ is reacted with 9.0 g of Al (s) generating 8.87g of molten Fe, then:

   a) What is the limiting reactant?

   b) What reactants left in excesses?

   c) The percent yield of this reaction?

$$Fe_2O_{3\,(s)} + 2\ Al(s) \rightarrow Al_2O_{3\,(s)} + 2\ Fe\ (l)$$

4. Silver has two naturally occurring isotopes: one is ^{107}Ag with a mass of 106.91amu and the second ^{109}Ag with a mass of 108.90 amu. If the atomic weight of silver is 107.87amu, then what is the percent abundance's of each of the two isotopes?
5. Give the name, atomic symbol, and group number of the element with the following Z value, and classify it as a metal, metalloid, or nonmetal:

   (a) Z = 32 (b) Z= 1 6 (c) Z= 2 (d) Z = 3 (e) Z = 42
6. Write an empirical formula for each of the following:

   (a) Hydrazine, a rocket fuel, molecular formula N_2H_4

   (b) Glucose, a sugar, molecular formula $C_6H_{12}O_6$

7. Give the systematic names for the formulas or the formulas for the names: (a) tin (IV) chloride: (b) $FeBr_3$: (c) cuprous bromide: (d) Mn_2O_3
8. What is the molecular formula of each compound?

   (a) Empirical formula CH_2 (M = 42.08 g/mol)

   (b) Empirical formula NH_2 (M = 32.05 g/mol)

   (c) Empirical formula NO_2 (M = 92.02 g/mol)

   (d) Empirical formula CHN(M = 135.14 g/mol)

II. Matching (1 point each)

A	B
6. Democritus	a. α- scattering experiment
7. Dalton	b. plum pudding model
9. Ernest Rutherford	d. gave the name "atomos"
10. James Chadwick	e. explain the mystery of mass ratio

Gr. Chemistry Exam

ADAMA SCIENCE AND TECHNOLOGY UNIVERSITY

SCHOOL OF NATURAL SCIENCE

DEPARTMENT OF CHEMISTRY, GENEERAL CHEMISTRY (Chem.101)

EXAM FOR PRE - ENGINEERING REGULAR STUDENTS

*NAME*_____ *Date*: July. 30, 2012

ID.NO _____ *Time allowed*: 2:30 hrs

*GROUP*_____

GENERAL INSTRUCTION

1. This exam booklet contains **30** multiple choice and **5** workout questions.
2. No rough paper should be used; backside of the question paper can be used instead for rough work.
3. Calculator is allowed, but it has to be used individually.
4. Attempt all questions.

Answer sheet for Part I

1 _____	11 _____	21 _____
2 _____	12 _____	22 _____
3 _____	13 _____	23 _____
4 _____	14 _____	24 _____
5 _____	15 _____	25 _____
6 _____	16 _____	26 _____
7 _____	17 _____	27 _____
8 _____	18 _____	28 _____
9 _____	19 _____	29 _____
10 _____	20 _____	30 _____

For Instructor's Use Only

Part I 30%	Part 20 %	Total 50%

1 -

T I: *Multiple Choice*
RUCTION *Write the letter of your choice on the Answer sheet (1pt each).*

1. An alloy is a homogeneous mixture of

   A. two solids B. two liquids C. two metals D. two non-metals E. None of these

2. In one molal solution that contains 0.5 mole of a solute there is

   A.1000 g of solvent B. 1000 ml of solvent C. 500 ml of solvent
   D. 500 g of solvent E. None of these

3. What is the normality of a solution containing 28.0 g of KOH dissolved in sufficient water to make 400 ml of solution?

   A. 1.25 N B.0.63 N C. 2.5 N D. 5.0 N E. None of these

4. What is the vapor pressure of 1000 g of a water solution at 25^{0}C that contains 124.0 g of the nonvolatile solute ethylene glycol, $C_2H_6O_2$? The vapor pressure of pure water at this temperature is 23.76 torr. Assume an ideal solution.(M.wt of $C_2H_6O_2$)=62g/mol)

   A.0.94 torr B. 22.8 torr C.3.7 torr D. 24.6 torr E. None of these

5. How many moles of sugar must be added to 100 g of water to lower the freezing point of the solution by 1°C? The value of K_f for water is 1.86°C/m.(M.wt sucrose = 342g/mol)

   A.0.54 mol B. 0.27 mol C. 0.054 mol D. 0.027 mol E. None of these

6. Which of the following statements is true regarding osmotic pressure?
   A. Osmotic pressures are always extremely small.
   B. The osmotic pressure does not depend on the concentration of the solute.
   C. Measurement of osmotic pressure cannot be used to determine small molar masses.
   D. Measurement of osmotic pressure can be used to determine very large molar masses.
   E. None of these

7. In which of the following molecules the central atom exceptional to the octet rule?

   A. NH_3 B. CH_4 C. BF_3 D. H_2O E. none

8. How many electron pair(s) are there around the central atom (I) in the ion I_3^-?

   A. 6 B. 5 C. 4 D. 3 E. 2

2 A

9. Water has a vapor pressure of 23.76 mmHg at 250C. What is the vapor pressure of a solution of sucrose if the mole fraction of sucrose is 0.25?
A. 5.9 mmHg B. 17.8 mmHg C. 29.8 mmHg D. 15.2 mmHg

10. To determine the molecular weight of a polymer with an approximate molecular weight of 10,000, one would probably measure the
A. Osmotic pressure of a solution
B. Boiling point elevation of a solution
C. Freezing point of a solution
D. Vapor pressure of a solution

11. Which of the following best describes the VSEPR structure of SF_4?
A. T-shaped B. distorted tetranedral C. Trigonal bipyamidal D. Octahedral

12. What would be the bond order of a diatomic H_2^- system?
A. 0 B. ½ C. 3/4 D. 1

13. Elemental oxygen, O_2, has _____ unpaired electrons and therefore is _____
A. no, diamagnetic B. 1, paramagnetic C. 2, paramagnetic D. 3, paramagnetic

14. The hybridization of the oxygen atom in water is
A. sp B. sp2 C. sp3 D. sp3d

15. All of the following are a result of the pi-bonding that occurs in H_2CCH_2 EXCEPT
A. The carbon-carbon bond is shortened.
B. The H-C-H angle is 109^0
C. The carbon-carbon bond is strengthened.
D. Rotation around the carbon-carbon bond is easier. E B and D

16. A 6.90 M solution of KOH in water contains 30% by weight of KOH. the density of the solution in g/ml is:
A. 1.288 B. 2.576 C. 0.644 D. 0.322

17. What is the maximum number of electrons in an atom that can have, n=4, $m_l = +2$ quantum numbers
A. 2 B. 4 C. 6 D. 8 E. 10

18. The equivalent weight of $KMnO_4$ in the following balanced chemical equation is:-
$2MnO_4^- + 3CN^- + H_2O \leftrightarrows 2MnO_2 + 3CNO^- + 2OH^-$
(At wts: K = 39.0; Mn = 55.0; and O = 16.0).
A. 26.3 B. 31.6 C. 39.5 D. 52.67 E. 79.0

3 -2

19. How many grams of the solute are required to prepare 2 molal glucose solution from 800g of water. (Mwt of glucose = 180 g/mol)

A. 144 B. 288 C. 72 D. 36 E. 18

20. Which of the following is true about the bonding in ethene (C_2H_4) molecule?

A. all the sigma bonds are formed by overlap of 1s orbital of H with sp^2 hybrid orbital of carbon
B. the pi bond is formed by overlap of sp^2 hybrid orbital of each carbon atom
C. the pi bond is stronger than the sigma bond
D. the molecule have five sigma bonds and one pi bond E. none of these

21. Which of the following statements is correct?

A. Bond dissociation energy of O_2 is greater than that of O_2^+
B. The last two electrons in N_2 are placed in antibonding molecular orbitals
C. Bond dissociation energy of N_2 is less than that of N_2^+
D. Both N_2 and O_2 are paramagnetic
E. Bond dissociation energy of NO less than that of N_2

22. As one proceeds from fluorine to astatine in Group VIIA the electronegativity

A. Decreases and the atomic radius increases.
B. Decreases and the atomic radius decreases.
C. Increases and the atomic radius decrease.
D. Increases and the atomic radius increases.

23. Compared to the covalent atomic radius of a sodium atom, the covalent atomic radius of a magnesium atom is smaller. The smaller radius is primarily a result of the magnesium atom having.

A larger nuclear charge. C. smaller nuclear charge.

B.More principal energy levels. D. Fewer principal energy levels. E. None

24. Which orbitals cannot exist?

A. 2p B. 3p B. 4d C. 3f D. 6s E. none

25. An unknown element has the electron configuration [Rn] $7s^2\ 5f^{14}\ 6d^{10}\ 7p^6$, which of the following is true about this element.

A. This element is belonging to d-block elements

B. It is belonging to P-block elements C. It is noble gas

D. It is a diamagnetic element E.B, C and D F.A, C and D

4 -3

26. Which element could have the following set of quantum numbers, n, l, m and s respectively? 3, 2, -1, + ½

A. H B. Be C. P D. Ne

27. The Alkali Metals Li, Na, and K were tested in an experiment, but the researcher did not know which element was which. Element A was discovered to have the largest atomic radius while Element B was discovered to have the highest ionization energy. Element C had an atomic radius and ionization energy in between that of Elements A and B. Which element was Li, which was Na, and which was K?

A. A, B and C are Na, K and Li respectively.

B. A, B and C are K, Li and Na respectively.

C. A, B and C are Na, Li and K respectively.. D None of the above

28. Which of the following is true?

A. Elements in the groups 2A and 8A are always diamagnetic because every electron is spin-paired.

B. Electronegativity generally increases as you move up and to the right of the periodic table; however the Noble Gases are exceptions to this rule. Therefore, Fluorine is the most electronegative element.

C. The "*l*" quantum number can only be as high as n-1.

D. According to Aufbau Principle, you must fill the lowest energy orbital first.

E. All of the above.

29. The second ionization energy of sodium is much higher than the first ionization energy because…

A. The second electron is removed from an already-stable noble gas core.

B. The second electron is a valence electron.

C. The atom has a larger radius after the first electron is removed.

D. It's not higher than the first ionization energy. E. none of these

3. The electron affinity of chlorine is 349 kJ/mol. What is the correct equation for the formation of chloride?

A. $Cl\ (g) + e^- \rightarrow Cl^-\ (g) + 349\ kJ$

B. $Cl\ (s) + e^- \rightarrow Cl^-\ (s) + 349\ kJ$

C. $Cl\ (s) + 349\ kJ + e^- \rightarrow Cl^-\ (s)$

D. $Cl\ (g) + 349\ kJ + e^- \rightarrow Cl^-\ (g)$ E. All are correct

t II ***Workout Questions***

struction: ***Workout the following questions by showing the necessary steps required. Points will be given for those brief and precise answers.***

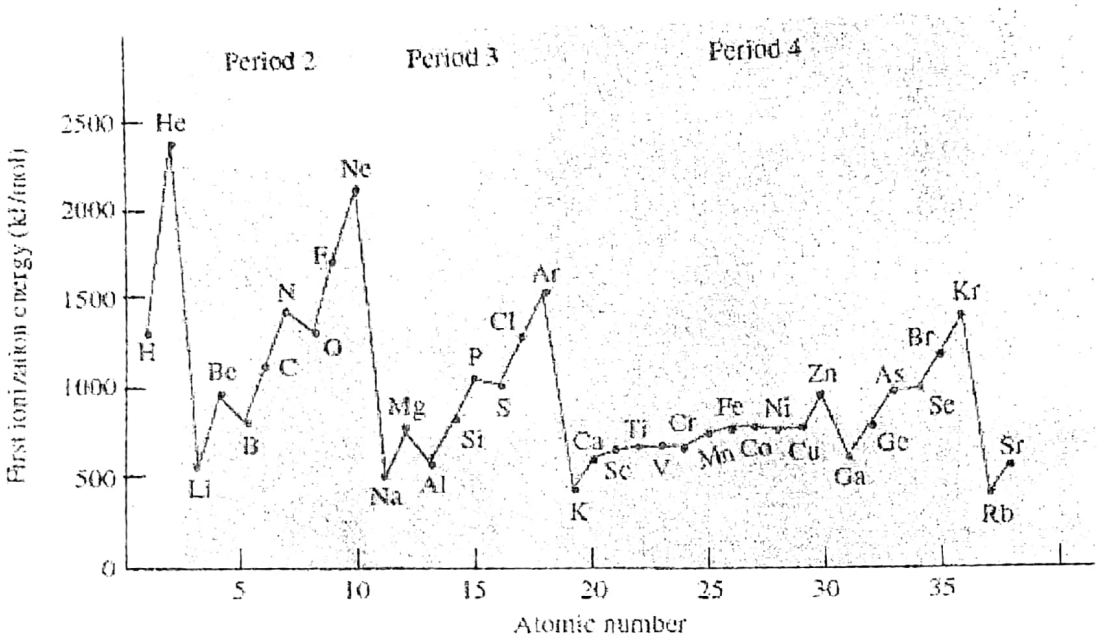
1. Write Lewis formulas for NO_2 and NO_2^-. On the basis of VSEPR theory, which one should have the largest bond angle? *(3 pts)*

2. Arrange the following ions in order of decreasing ionic radius: F^-, Na^+, N^{3-} and justify your answer. *(3 pts)*

3. Write a set of quantum numbers for a 4f orbital. *(4 pts)*

4. Explain the variation in ionization energy across a period and discuss the irregularity observed across a period of Group IIA Vs Group IIIA and Group VA Vs Group VIA

(5 Pts)



5. For each of the following molecules, predict the molecular structure, bond angles, give the hybridization of the central atom, and predict the overall polarity.

	Molecular structure	bond angles	hybridization	bond polarity
	$XeOF_4$			
b)	BeH_2			
c)				
d)	N			
e)	SF_6			

7-6

ADAMA UNIVERSITY

SCHOOL OF HUMANITIES AND NATURAL SCIENCES

GENERAL CHEMISTRY (CHEM. 101) L EXAM FOR PRE-ENGINEERING STUDENTS

NAME _____ *Date:* *July 08, 2011*

ID.NO _____ *Time allowed:* *2:30*

Group No: _____

GENERAL INSTRUCTION

1. This exam booklet contains 30 multiple choice, and 2 short answer questions.
2. No rough paper should be used; backside of the question paper can be used instead for rough work.
3. Calculator is allowed, but it has to be used individually
4. Use the following information whenever necessary.

i) ***Physical Constants:*** $C=3.00x10^{8}m/s$, $R_H = 109,680\ cm^{-1} = 2.18x10^{-18}J$, $h=6.626x10^{-34}Js$, $A=2.18X10^{-18}J$, $N_A=6.022x10^{23}$

ii) Atomic numbers and Atomic weights.

Element:	H	He	Li	Be	B	C	N	O	F	Mg	Al	Si	P	S	Cl	Kr	I	Ti	Pd
At.No:	1	2	3	4	5	6	7	8	9	12	13	14	15	16	17	36	53	22	46
At.Wt:	1	4	7	9	11	12	14	16	19	24	27	28	31	32	35.5	84	127	48	106

ANSWER SHEET FOR PART I

	A	B	C	D	E		A	B	C	D	E		A	B	C	D	E
1	O	O	O	O	O	11	O	O	O	O	O	21	O	O	O	O	O
2	O	O	O	O	O	12	O	O	O	O	O	22	O	O	O	O	O
3	O	O	O	O	O	13	O	O	O	O	O	23	O	O	O	O	O
4	O	O	O	O	O	14	O	O	O	O	O	24	O	O	O	O	O
5	O	O	O	O	O	15	O	O	O	O	O	25	O	O	O	O	O
6	O	O	O	O	O	16	O	O	O	O	O	26	O	O	O	O	O
7	O	O	O	O	O	17	O	O	O	O	O	27	O	O	O	O	O
8	O	O	O	O	O	18	O	O	O	O	O	28	O	O	O	O	O
9	O	O	O	O	O	19	O	O	O	O	O	29	O	O	O	O	O
10	O	O	O	O	O	20	O	O	O	O	O	30	O	O	O	O	O

For instructor's Use Only

Part I (45%)	Part II (10%)	Total (55%)	Remark

12

PART I: *Blacken the circle that corresponds to your best choice on the Answer sheet (1.5 pts pt each).*

1. Which of the following atoms has the largest number of unpaired spins (electrons) according to Hund's rule?

   A. C B. P C. F D. K E. All have the same number of unpaired spins

2. Which of the following has the most energy per photon?

   A. Visible light B. Ultraviolet rays C. X-rays D. Infrared radiation E. Radio wave

3. What is the minimum uncertainty in the speed of a particle if its mass is 1.0×10^{-27} kg and its position is known with an uncertainty of 1.0×10^{-7} m?

   A. 0.16 m/s B. 0.53 m/s C. 54 m/s D. 1.52×10^{-34} m/s E. None of these

4. Which of the following molecules should have the longest bond?

   A. Cl_2 B. I_2 C. Br_2 D. F_2 E. None of these

5. Which of the following has the smallest ionic radius?

   A. N^{3-} B. O^{2-} C. S^{2-} D. F^- E. None of these

6. The formal charge on N in HNO_3 is (Note that the O atoms in HNO_3 are not bonded together and H is bonded to single O bond)

   A. +1 B. +2 C. -1 D. -2 E. 0

7. Which one of the following species does not exist according to MOT?

   A. C_2^+ B. F_2^- C. Li_2^+ D. B_2^{2+} E. none of these

8. What is the shape of the I_3^- molecular ion?

   A. trigonal planar B. T-shaped C. trigonal pyramidal D. linear E. bent

9. Which of the following molecule is polar?

   A. BF_3 B. CO_2 C. PCl_3 D. SF_6 E. CCl_4

10. When O_2, N_2, and F_2 are arranged in order of increasing bond dissociation energy:

    A. $F_2 < N_2 < O_2$ B. $F_2 < O_2 < N_2$ C. $N_2 < O_2 < F_2$ D. $O_2 < N_2 < F_2$ E. None of these

11. Which of the following is true from the molecular configuration of O_2?

    A. has no unpaired electrons and diamagnetic

    B. has two unpaired electrons and paramagnetic

    C. has one unpaired electron and paramagnetic

    D. has a bond order of 1.5 and paramagnetic

    E. None of these

13

12. The work function for copper is 7.17×10^{-19}J. What is the kinetic energy of electrons expelled from a copper surface by radiation with a wavelength of 250 nm?

A. 7.8×10^{-20}J B. 2.5×10^{-18}J C. 7.2×10^{-19}J D. 7.9×10^{-19}J E. None of these

13. A beam of light with a wavelength of 450 nm is expelling electrons from a lithium surface. What will be the effect of doubling the intensity of this light that is, employing two lamps instead of one?

A. No effect

B. Increase in the kinetic energy of expelled electrons

C. Increase in intensity of expelled electron beam (more electrons expelled per unit time)

D. Increase of kinetic energy and intensity of expelled electron beam

E. None of the above

14. Which of the following transitions in the hydrogen spectrum will radiate the highest frequency?

A. From n=3 to n=2 B. From n=3 to n=1

C. From n=2 to n=1 D. From n=4 to n=2 E. None of the above

15. Why is the Bohr model of the atom forbidden by the Heisenberg uncertainty principle?

A. the Bohr model fails to predict the fine structure in the hydrogen spectrum.

B. the Bohr model is useful only for one-electron systems.

C. The direction of the orbiting electron is not known.

D. the Bohr electron is moving in a fixed orbit at a fixed speed.

E. None of these

16. All of the following are correctly stated underlying principles used to build up the configuration of a many electron atom, EXCEPT

A. Hund's rule: electrons in degenerate orbitals are arranged to minimize the number of unpaired spins.

B. Pauli principle: no two electrons in the same atom can have an identical set of four quantum numbers.

B. Aufbau principle: atomic orbitals are filled with electrons from lowest energy to higher energies.

D. All of the above statements are correct.

E. None of these

14

17. Which of the following is the correct electron configuration of $^{106}_{46}Pd$?

A. [Kr] $5s^2 4d^{10}$ B. [Kr] $5s^1 4d^9$ C. [Kr] $5s^0 4d^{10}$ D. [Kr]$5s^2 4d^8$ E. None of these

18. An atom has a velocity of 75 m/sec and a de Broglie wavelength of $2.199X10^{-10}$m. Which of the following is the atom?

A. H B.C C. Ti D. Mg E. None of the above

19. In one of the following species the electron geometry around the central atom and the molecular geometry are the same:

A. NH_4^+ B. NH_3 C. PCl_4^- D. H_2O E. None

20. The dative (coordinate covalent) bond is expected to be found in all species except in

A.H_3O^+ B. CO C. NH_4^+ D. NH_3 E. C and D

21. In which of the following molecules the central atom exceptional to the octet rules?

A. NH_3 B. BF_3 C. CH_4 D. H_2O E. none of these

22. How many electrons are there around the central atom (I) in the ion IF_4^- ?

A. 8 B. 6 C. 12 D. 10 E. 14

23. Which of the following statements is false?

A. The H-O-H bond angle in H_3O^+ is greater than in H_2O

B. The O-S-O bond angle in SO_2 is greater than in SO_3

C. Sigma bond is formed by head-on overlap of orbitals

D. Bonding in the N_2 molecules consists of a sigma and two pi bonds

E. The resonance forms required to describe the bonds in CO_3^{2-} are three

24. One of the following species does not show resonance structure

A. SO_2 B. SO_3 C. NO_2^- D. NO_3^- E. None

25. What is the energy of one mole of photons with a wavelength of 750mm?

A. $4.00X10^5$J B. 160KJ C. $4.00X10^{-5}$J D. 265KJ E. None of these

26. What will be the likely combination of ionization energy and electron affinity for an element that has a very low electronegativity?

A. High ionization energy, low electron affinity

B. High ionization energy, high electron affinity

C. Low ionization energy, low electron affinity

D. Low ionization energy, high electron affinity

E. None of these

27. Which of the following is not a property of ionic compounds?

A. Conduct heat and electricity because they have free electrons

B. Soluble in polar solvents

C. The bond is non directional

D. Have high melting and boiling points

E. Most of them are solids and crystalline

28. Central atom of one of the following species has tetrahedral electron geometry

A. H_2O B. BF_3 C. CO_2 D. PCl_5 E. None

29. If an ionic compound has a general formula of M_2X_3, the ions found in the compound are:

A. M^{2+}, X^{3-} B. M^{2+}, X^{2-} C. M^{2-}, X^{3-} D. M^{3+}, X^{2-} E. None

30. Which of the following is not true?

A. Bonding molecular orbital increases electron density b/n nuclei

B. Bonding molecular orbital stabilizes molecule

C. Hybrid atomic orbital forms effective overlap than simple atomic orbital

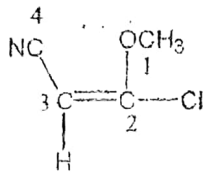
D. Anti-bonding molecular orbital has less energy than atomic orbital

E Anti bonding orbital is formed by in-phase (constructive) overlap of atomic orbitals

PART II: *Short Answer Questions*

Instruction: *Write the possible answer for the following questions by inserting the appropriate numbers or words.*

1. Given the structure of molecules



Based on the above structure of the molecule, answer the following questions? *(7pts)*

A) The number of π – bonds are _____

B) The number of σ – bonds are _____

C) The N – atom is _____ hybridized

D) The C(2) – atom is _____ hybridized

E) The C(4) atom is _____ hybridized

F) The O atom is _____ hybridized

G) Write all the possible overlap in the molecule

2. Give the maximum number of electron specified by the following quantum number. *(4 pts)*

A) n = 4 _____

B) n = 5 $\ell = 2$ _____

C) n = 3 $\ell = 2$ ml = +2 _____

D) n= 2 $\ell = 1$ ml = -1 $m_s = +1/2$ _____