

Practice final exam questions

Section I----Atomic structure / Electron configuration /Periodic trends

- **Subatomic particles of an atom-A, Z & n**
- **Calculating isotope abundance**
- **Electron configurations for all elements upto atomic number 56**
- **Periodic trends for I.E, EN, atomic size/radius, ionic size across the PT & going down a group.**
- **Electromagnetic spectrum (order of waves) ,frequency ,wavelength relationship.**

1. A new element, Tyserium (Ty), has recently been discovered and consists of two isotopes. One isotope has a mass of 331 g/mol and is 35.0 % abundant. The other isotope is 337 g/mole and is 65.0 % abundant. What is the mass of Ty as it appears on the periodic table?

1] 332 g/mol 2] 333 g/mol 3] 334 g/mol 4]335 g/mol 5]336 g/mol

2. Copper has two isotopes, ^{63}Cu and ^{65}Cu . If the atomic mass of copper is 63.5 g/mol, what is the % of each isotope?

1] 25.0 % ^{63}Cu and 75.0 % ^{65}Cu 2] 33.0 % ^{63}Cu and 66.0 % ^{65}Cu

3] 50.0 % ^{63}Cu and 50.0 % ^{65}Cu 4] 66.0 % ^{63}Cu and 33.0 % ^{65}Cu

5] 75.0 % ^{63}Cu and 25.0 % ^{65}Cu

3. How many electrons are in a chromium (III) ion, $_{24}^{52}\text{Cr}^{+3}$?

1) 52 2) 49 3) 27 4) 24 5) 21

4. An atom has atomic number 13 and mass number 27. The number of valence e- is:

1) 5 2) 2 3) 3 4) 4 5) none of these.

5. Which is a set of iso-electronic species?

1) S^{-2} , Cl^{-} , Ar^0 2) Li^{+} , Ne^0 , Na^{+} 3) Cl^{-} , Ar^0 , Na^{+} 4) Ar^0 , K^{+} , Mg^{+2}

6. How many completely **filled** orbitals are indicated by the electronic configuration $1s^2, 2s^2 2p^6, 3s^2 3p^6, 4s^2, 3d^6$?

1) 6 2) 26 3) 11 4) 15 5) 10

7. The electron configuration $1s^2, 2s^2 2p^6, 3s^2 3p^6$ represents all of the following **except**

1) Ti^{+4} 2) Cr^{+6} 3) S^{-2} 4) V^{+3} 5) Ca^{+2}

8. Identify the element with a 4d configuration for its last electron.

- 1) ${}_{23}\text{V}$ 2) ${}_{42}\text{Mo}$ 3) ${}_{29}\text{Cu}$ 4) ${}_{24}\text{Cr}$ 5) none of these

9. Different forms of radiation arranged in the order of decreasing wavelength are

- 1) radio waves, gamma rays, visible light, ultraviolet rays.
2) radio waves, visible light, ultraviolet rays, X rays.
3) gamma rays, radio waves, X rays, ultraviolet rays.
4) radio waves, ultraviolet rays, visible light, gamma rays.
5) X rays, visible light, ultraviolet rays, radio waves.

10. Which ground state electronic configuration will most readily produce a plus two ion?

- 1) $1s^2 2s^2 2p^6 3s^2 3p^4$ 2) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$ 3) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s$
4) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^2$ 5) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6$

11. The frequency and wavelength of a wave are

- 1) equal 2) inversely proportional 3) directly proportional 4) unrelated

12. An ion has 13 electrons, 12 protons, and 14 neutrons. What is the mass of the ion?

- 1) 14 a.m.u. 2) 25 a.m.u. 3) 26 a.m.u. 4) 27 a.m.u. 5) 39 a.m.u.

13. A certain element has an $Z=7$ and an $A=14$. This means that there must be:

- 1) 14 electrons in the nucleus of the element
2) 14 protons in the nucleus of the element
3) 7 protons and 7 neutrons in the nucleus of the element
4) 7 protons, 7 electrons & 7 neutrons in the nucleus of the element

14. The size of an element's atomic radius _____ from left to right across the periodic table.

1. increases 2. decreases
3. remains constant 4. is randomly assigned

15. Arrange the following elements from lowest to highest IE: Be, Mg, Ca, Rb, Sr

- 1] Be, Mg, Ca, Rb, Sr 2] Rb, Sr, Ca, Be, Mg 3] Rb, Sr, Ca, Mg, Be 4] Be, Mg, Ca, Sr, Rb

16. Electronegativity _____ from left to right within a period and _____ from top to bottom within a group.

- 1] decreases, increases 2] increases, increases 3] increases, decreases
4] stays the same, increases 5] increases, stays the same

17. The IE of the elements _____ as you go from left to right across a period of the periodic table, and _____ as you go from the bottom to the top of a group in the table.

- 1] increase, increase 2] increase, decrease 3] decrease, increase
4] decrease, decrease 5] are completely unpredictable

18. Of the choices below, which gives the order for first ionization energies?

- 1] Cl > S > Al > Ar > Si 2] Ar > Cl > S > Si > Al 3] Al > Si > S > Cl > Ar
4] Cl > S > Al > Si > Ar 5] S > Si > Cl > Al > Ar

19. What is the formula for tetra-phosphorus hex-oxide?

- 1] P_6O_4 2] P_4O_6 3] P_4O_7 4] None of these are correct 5] P_2O_3

20. Find the percent of hydrogen in ferric hydroxide $Fe(OH)_3$.

- 1] 2.2 % 2] 2.8 % 3] 4.0 % 4] 6.7 %

21. A compound is 40.0 % carbon, 6.66 % hydrogen and 53.3 % oxygen. What is its empirical formula?

- 1] $C_4H_7O_5$ 2] CH_3O_2 3] $C_2H_6O_4$ 4] CH_2O

Section II----Bonding- Lewis dot, shapes & intermolecular forces

- **Drawing Lewis dot structure (no resonance/ expanded octet/hybridization)**
- **Geometry names for all molecules from AX₂ AX₃ AX₄ (chart will be given no need to memorize names but you should recognize them)**
- **Hydrogen bonding, dipole-dipole force & London forces(Vander waal's force**
- **Blue sheet with properties of solids chart**

22. The bonding in the barium fluoride crystal is primarily:

- 1) ionic; 2) polar covalent; 3) metallic; 4) non-polar;

23. Which compound is the most ionic?

- 1) CCl₄(l) 2) SiO₂(s) 3) KCl(s) 4) NH₃(g) 5) Br₂(l)

24. The shape of NH₄⁺ is best described by:

- 1) Linear 2] Planar 3] Pyramidal 4] Tetrahedral 5] Octahedral

25. In which compound does the bond have the **least** degree of ionic character?

- 1) KBr 2) HF 3) MgO 4) BrCl 5) All have the same degree.

26. Which molecule has the most polar bonding characteristics?

- 1) H₂O 2) H₂S 3) H₂Se 4) H₂Te 5) NaBr

27. Which of the following is **not** a polar molecule?

- 1) hydrogen fluoride 2) hydrogen 3) water 4) ammonia (NH₃)

28. Which of the following kinds of bonds exists in a N₂ molecule?

- 1) ionic 2) polar 3) single 4) double 5) triple

29. Element X has an electron configuration of 1s² 2s²2p⁶ 3s². Element X will most likely form oxides with the formula 1) X₂O; 2) X₂O₃; 3) XO; 4)XO₂.

30. Which represents a polar molecule?

- 1) F₂ 2) O₂ 3) CH₄ 4) CO₂ 5) HCl

31. The geometry of the SO₃ molecule is best described as

- 1) trigonal planar 2) tetrahedral 3) trigonal pyramidal 4) bent

32. Pi (π) bonding occurs in each of the species **except**

- 1) CO₂; 2) C₂H₄; 3) CN⁻; 4) C₆H₆; 5) CH₄.

33. Which of the following molecules are non-polar?

- 1) CO and CO₂ 2) H₂O and CO 3) CO and CH₄ 4) CO₂ and CH₄ 5) CH₄ and H₂O

34. The molecular shape for carbon disulfide, CS₂ is

- 1) Linear 2) Angular 3) Pyramidal 4) Tetrahedral 5) Trigonal planar

35. Which of these statements about solid NaCl is **false**?
- 1) Within the crystal, each Na ion is surrounded by Cl ions.
 - 2) The bonding in NaCl crystals is strong.
 - 3) Each chloride ion is surrounded by Na ions in a crystal.
 - 4) Each Na ion is attracted to Cl ions because of their opposite charges.
 - 5) Each Na ion is bonded tightly to only one Cl ion, forming molecules of NaCl within the crystal.
36. Which has a trigonal planar configuration?
- 1) ClO_3^-
 - 2) NO_3^-
 - 3) PH_3
 - 4) CO_2
 - 5) NH_4^+
37. Which of the following molecules would be tetrahedral?
- 1) SO_2
 - 2) SiH_4
 - 3) SF_4
 - 4) BCl_3
 - 5) XeF_4
38. The **shapes** of BF_3 and NF_3 molecules are
- 1) trigonal planar.
 - 2) different
 - 3) pyramidal
 - 4) tetrahedral.
 - 5) hydrogen bonding.
39. A substance which is highly soluble in water is probably
- 1) ionic.
 - 2) either ionic or polar covalent.
 - 3) polar covalent.
 - 4) neither ionic nor polar covalent.
 - 5) non-polar covalent.
40. Iodine, I_2 , is very slightly soluble in water, a polar solvent, but quite soluble in toluene, a non-polar solvent. What can be inferred about the nature of the I_2 molecule?
- 1) It is ionic.
 - 2) It is non-polar.
 - 3) It is polar.
 - 4) It is hydrogen bonded.
 - 5) Nothing can be inferred.
41. Alcohol is very soluble in water because both compounds
- 1) are liquids;
 - 2) are ionic;
 - 3) possess molecules that can link by hydrogen bonds;
 - 4) are non-polar.
42. Which of the following statements is characteristic of an ionic compound?
- 1) reflects light
 - 2) melting point is low
 - 3) is soluble in non-polar solvents
 - 4) has a high vapor pressure
 - 5) conducts electric current in liquid phase
43. The boiling point of CH_4 is much lower than that of HF. This is because:
- 1) of ion-dipole interactions in CH_4 .
 - 2) of hydrogen bonding in HF.
 - 3) HF is more polarizable.
 - 4) CH_4 is polar.
44. The difference between an ionic compound and molecular compound is:
- 1) the transfer or sharing of electrons.
 - 2) the ionization energy of the nonmetal.
 - 3) the electronegativity of the metal.
 - 4) the electron affinity of the metal.
45. The concept of "like dissolves like" is illustrated by which of the following?
- 1) NaCl (s) is more soluble in CCl_4 than in water.
 - 2) $\text{I}_2(\text{s})$ is more soluble in CCl_4 than in water.
 - 3) $\text{CuSO}_4(\text{s})$ is more soluble in CCl_4 than in water.
 - 4) CCl_4 is soluble in water.
 - 5) $\text{I}_2(\text{s})$ is more soluble in water than in CCl_4 .

46. Which one of the following molecules would be most polar?

- 1) HF 2) HCl 3) HBr 4) H₂ 5) HI

47. Based on the following information:

CF₄, molar mass 87.99 & B.P is -182°C, CCl₄, molar mass 153.8, & B.P is -123°C

The reason that CCl₄ has a higher boiling point than CF₄ is that:

- 1) CF₄ molecule have a greater polarizability
2) CCl₄ molecules have a greater polarizability
3) CCl₄ molecules are more polar
4) CF₄ molecules are more polar

48. Solid iodine would be most soluble in which of the following solvents?

- 1) H₂O 2) CCl₄ 3) iodine would be equally soluble in H₂O and CCl₄
4) iodine would be insoluble in both H₂O and CCl₄

49. Which pure substance would have the largest molar heat of vaporization?

- 1) Ar 2) H₂ 3) N₂ 4) H₂O 5) CH₄

50. Which pure substance would have the smallest molar heat of vaporization (energy needed to change liquid to gas)?

- 1) C₄H₁₀ 2) C₅H₁₂ 3) C₃H₈ 4) CH₄ 5) C₂H₆

**Section III-----Equations/Types of Reactions/ Naming & Formula/ Moles/E.F
M.F/Stoichiometry/Molarity/Dilution**

- **Balancing equations & identifying types of reactions (no ionic eq)**
- **Writing names & formulas using a flow chart (will be given)**
- **Using moles map & completing unit cancellation problems for moles.**
- **Finding EF & MF using % composition of elements (no organic EF)**
- **Stoichiometry- limiting & excess reagent. & Molarity & Dilution problems.**

51. The percent composition of aluminum in aluminum hydroxide is:

- 1) 50% 2) 25% 3) 14% 4) none of these answers

52. There are 6.02×10^{23} water molecules in a mole of water. What is the mass of 3.01×10^{23} molecules of water?

- 1) 0.50 grams 2) 9.00 grams 3) 18.0 grams 4) 27.0 grams

53. What is the mass of 3.4 moles of aluminum hydroxide?

- 1) 156.4 g. 2) 207.4 g. 3) 265.2 g. 4) 294.1 g.

54. Which substance is limiting if 3.8 moles of Ca are reacted with 5.6 moles of hydrogen bromide?

- 1) calcium 2) calcium bromide 3) hydrogen bromide 4) hydrogen

55. If 500 grams of a gas contain 7.6×10^{23} molecules, what will be the volume of this gas at STP conditions?

- 1) 17.7 liters 2) 24.5 liters 3) 28.4 liters 4) 31.2 liters

56. Find the mass of 3.9×10^{23} molecules of carbon dioxide gas at STP conditions.

- 1) 19.1 grams 2) 28.6 grams 3) 67.7 grams 4) 76.4 grams

57. What volume of hydrogen sulfide gas, H_2S , has the same number of molecules as 10.0 liters of neon gas, Ne? Both gases are at the same temperature and pressure.

- 1) 3.33 liters 2) 10.0 liters 3) 22.4 liters 4) 30.0 liters

58. The number of moles of sodium chloride represented by 117 grams is

- 1) 1 2) 2 3) 3 4) 3.25 5) 22.4

59. A gas has a density of 0.717 gram/liter at STP. What is the molecular mass in grams/mole?

- 1) 4.0 g/m 2) 16.1 g/m 3) 28.0 g/m 4) 32.0 g/m 5) 35.5 g/m

60. Which set of coefficients correctly balances the reaction $K_3PO_4 + MgCl_2 \rightarrow$ _____?

- 1) 1, 3, 1, 6 2) 2, 3, 1, 6 3) 2, 3, 2, 1 4) 3, 2, 1, 6 5) none of these

61. How many moles of water are formed when one mole of butane, C_4H_{10} (g), is burned in oxygen?

- 1) 1 mole 2) 5 moles 3) 8 moles 4) 11.2 moles 5) 22.4 moles

62. The chemical reaction represented by the equation: $2 \text{NaOH} + \text{H}_2\text{SO}_4 \Rightarrow$,
is an example of:
1) double replacement 2) single replacement 3) decomposition; 4) combination.
63. The reaction between zinc and hydrogen chloride is: 1) combination;
2) single replacement; 3) neutralization; 4) double replacement.
64. The breaking down of a complex substance to form two or more simpler substances is:
1) decomposition; 2) composition; 3) replacement; 4) double replacement.
65. In the thermite reaction iron is produced from iron ore, Fe_3O_4 . What type of reaction is this?
1) double replacement 2) single replacement 3) decomposition; 4) combination.
66. In the reaction $\text{Al} + \text{O}_2 \rightarrow$ _____, how many moles of aluminum oxide are
produced from one mole of aluminum?
1) 0.5 mole 2) 2.0 moles 3) 3.0 moles 4) 4.0 moles 5) none of these
67. Which substance is in excess if 7.0 moles of Al are reacted with 10.0 moles of H_2SO_4
1) H_2SO_4 2) aluminum sulfate 3) hydrogen 4) aluminum
68. How many grams of AgBr will form when 45.0 mL of 0.842 M CaBr_2 combines with
excess AgNO_3 ? $\text{CaBr}_2(aq) + 2 \text{AgNO}_3(aq) \rightarrow 2 \text{AgBr}(s) + \text{Ca}(\text{NO}_3)_2(aq)$
1) 14.2 g 2) 2.31 g 3) 20.1 g 4) 7.12 g
69. What is the coefficient of chromic nitrate in the following chemical reaction
when it is balanced? calcium chloride + chromic nitrate _____ .
1) 1 2) 2 3) 3 4) 4 5) 5
70. When water and carbon dioxide are formed during an exothermic reaction, it is a-
a) synthesis reaction b) combustion reaction c) single displacement reaction d) double
displacement reaction
71. Which of the following compounds are insoluble in water?
A. Na_2CO_3 B. PbSO_4 C. AgBr D. K_2S
1] A & B only 2] C & D only 3] D & B only 4] C & B only
72. A 20.0 grams sample of NaOH is used to make a 250. mL NaOH solution. What is the
molarity of the NaOH solution?
1) 5.00 M 2) 8.00 M 3) 2.00 M 4) 1.00 M
73. How many grams of NaCl are needed to prepare 0.500 L of a 4.00 M NaCl solution?
1) 117 g 2) 4.00 g 3) 58.5 g 4) 2.00 g
74. Calculate the new concentration when 25.00 mL of a 5.0 M stock solutions of CuSO_4 is
diluted to 500.00 mL.
1] 0.025 M 2) 0.250 M 3) 0.25 M 4) 0.0250 M

Section IV----Gas Laws/Energy/ Chemical equilibrium/ Acids Bases

75. Hydrogen has a volume of 48 ml. at STP conditions. What pressure is needed to convert this gas to 60 ml. at 30°C conditions?

- 1) 0.68 atm. 2) 0.95 atm. 3) 1.48 atm. 4) 1.06 atm. 5) none of these

76. At 400°C and 0.878 atm., 4.55 liters of NO₂ (g) are converted completely to N₂O₄ (g) at 0°C and 0.945 atm. The reaction is $2 \text{NO}_2 (\text{g}) \rightarrow \text{N}_2\text{O}_4 (\text{g})$. Calculate V.

- 1) 0.00 liter 2) 3.42 liters 3) 2.44 liters 4) 0.86 liter 5) 1.71 liters

76. If the density for the gas neon is 0.3 gram/liter, what volume will one mole of this gas occupy?

- 1) 9.7 liters 2) 67.3 liters 3) 84.1 liters 4) 89.3 5) 101 liters

77. A substance which is easily changed to a gas is said to be: 1) flammable;
2) non-flammable; 3) diffusable; 4) volatile; 5) deliquescent.

78. Four grams of magnesium react with an excess of dilute hydrochloric acid. Calculate the volume in liters of hydrogen gas collected over water at 300 K, if the vapor pressure of water at that temperature is 26.7 mm and the barometric pressure is 730 mm.

- 1) 3.14 liters 2) 3.69 liters 3) 3.81 liters 4) 4.39 liters 5) 5.20 liters

79. A sample of air is heated from 10°C to 40°C. P= 30 lbs/sq. in, what will be the new pressure?

- 1) 14.6 lbs/sq. in. 2) 27.1 lbs/sq. in. 3) 21.7 lbs/sq. in. 4) 33.2 lbs/sq. in. 5) 41.9 p.s.i.

80. If 1.60 grams of a gas occupy 230 ml. at 30°C and 3 atm., what is the density of the gas at standard pressure and temperature?

- 1) 2.17 g/l 2) 18.8 g/l 3) 2.58 g/l 4) 23.2 g/l 5) none of these

81. In a reaction HCl, 72 mg. of Mg metal produced 91 ml. of a gas collected over water at 22°C and 630 mm. of Hg pressure. How many mg of aluminum metal would be needed to produce the same volume of the same gas under the same conditions?

- 1) 36 mg. 2) 48 mg. 3) 56 mg. 4) 71 mg. 5) 81 mg.

82. A sealed bottle, which can stand an internal pressure of 4.0 atmospheres, is filled with air at 16°C and 760 mm pressure. At what temperature would the bottle break?

- 1) 65 K 2) 73 K 3) 724 K 4) 1,157 K 5) 1,214 K

83. $\text{HF} + \text{HCO}_3^- \rightleftharpoons \text{F}^- + \text{H}_2\text{CO}_3$ Identify the bases in the reaction.

- 1) HF and HCO₃⁻ 2) F⁻ and H₂CO₃ 3) HF and H₂CO₃ 4) F⁻ and HCO₃⁻

84. If the density of a certain gas at 273 K and 760 mm of Hg is 1.4 grams per liter, its molar weight may be found by the expression

- 1) $1.4 \text{ g.} \times 4 \times 22.4 \text{ l}$ 3) $1.4 \text{ g.} \times 2 \times 22.4 \text{ l}$ 5) $\frac{760 \times 1.4 \text{ g}}{273 \text{ K}}$
2) $1.4 \text{ g.} \times 22.4 \text{ l}$ 4) $\frac{2 \times 22.4 \text{ l}}{1.4 \text{ g}}$

85. A gas occupies a volume of 1.25 liters at 800 mm of Hg and 50.0°C. Which mathematical expression determines its volume at S.T.P.?

- 1) $\frac{1.25 \times 800 \times 273}{760 \times 323}$ 3) $\frac{1.25 \times 760 \times 323}{800 \times 273}$ 5) $\frac{1.25 \times 760 \times 273}{800 \times 50.0}$
2) $\frac{1.25 \times 760 \times 273}{800 \times 323}$ 4) $\frac{1.25 \times 800 \times 50.0}{760 \times 273}$

86. Calculate the partial pressures of gases A and B. They are mixed in a ratio of 2.0 moles:3.0 moles. The total pressure of the system is 600 mm of Hg.

- 1) 200 mm and 400 mm. 3) 300 mm and 300 mm.
2) 240 mm and 360 mm. 4) 400 mm and 200 mm. 5) 500 mm & 100 mm.

87. At the same temperature which gas has the fastest average molecular speed?

- 1) H₂ 2) N₂ 3) CO₂ 4) CH₄ 5) C₈H₁₈

88. If there is no change in temperature, what pressure is necessary to change 750 ml. of carbon dioxide at 1.20 atm. to 520 ml?

- 1) 0.99 atm. 2) 10.73 atm. 3) 22.22 atm. 4) 509.9 atm. 5) none of these

89. One mole of nitrogen, two moles of neon, and four moles of argon are sealed in a cylinder. The combined pressure of the gases is 1400 mm of Hg. What is the partial pressure of the nitrogen, in mm of Hg?

- 1) 100 mm. 2) 200 mm. 3) 400 mm. 4) 500 mm. 5) 1,400 mm.

90. If 3.00 moles of neon in a flask has a pressure of 1.50 atm. The pressure rises to 4.50 atm. when 1.00 mole of hydrogen and some oxygen are added. How many moles of oxygen are added?

- 1) 1.50 moles 2) 3.00 moles 3) 5.00 moles 4) 2.50 moles 5) 4.50 moles

91. The density of a gas at 273 K and 760 mm of Hg is 4.00 g/l.

What is its molecular mass in g/mol?

- 1) 0.0112 2) 0.176 3) 5.60 4) 32.2 5) 89.6

92. If the density of a gas is 1.87 grams/liter at 34°C and 745 mm Hg, what will be its **density** at 84°C and 721 mm Hg?

- 1) 0.64 g/l. 2) 0.73 g/l. 3) 1.11 g/l. 4) 1.56 g/l. 5) 2.10 g/l.

93. The mercury level inside a eudiometer tube is 8 mm higher than the mercury level outside. The gas pressure **outside** the tube is 13 mm less than standard pressure. What is the gas pressure **inside** the tube?

- 1) 739 mm. 2) 747 mm. 3) 755 mm. 4) 781 mm. 5) none of these

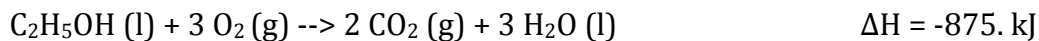
94. When a bottle of perfume is opened, its fragrance spreads quickly all over a room.

- This is an example of: 1) molarity; 2) compressibility; 3) diffusion;
4) expansibility.

95. A rubber balloon containing hydrogen has a volume of 3.0 liters. It is being used to study the acceleration behavior of hydrogen upon its release into the atmosphere. The temperature here is 20°C and the pressure exerted by the hydrogen is 9.0 cm above that of standard conditions. The balloon rises to the top of the tower where it expands to 3200 ml. and the pressure changes to 840 mm. Calculate the **temperature** at the top of the tower.
 1) 21.1°C. 2) 35.9°C. 3) 271.5 K. 4) 316.3 K. 5) 326.7 K.
96. Given the reaction: $2 \text{Al}(s) + 3/2 \text{O}_2(g) \rightarrow \text{Al}_2\text{O}_3(s)$; $\Delta H = -400 \text{ kcal/mol}$. How much heat will be given off by the reaction of 27 grams of aluminum?
 1) 100 kcal 2) 200 kcal 3) 300 kcal 4) 400 kcal
97. When 100 calories of heat energy are added to 10 grams of water at 20°C, the **final** temperature of the water will be
 1) 10°C; 2) 30°C; 3) 40°C; 4) 100°C.
98. The equation $\text{MgCO}_3(s) + \text{energy} \rightarrow \text{MgO}(s) + \text{CO}_2(g)$ is a(n)
 1) combustion reaction; 2) exothermic decomposition reaction;
 3) endothermic synthesis reaction; 4) endothermic decomposition reaction.
99. Fifty grams of water are heated from 22.0°C to 36.0°C. How much heat is absorbed?
 1) 360cal 2) 1,080cal 3) 700cal 4) 1,100cal 5) 1,800cal
100. Use the "heat of formation" of each substance to determine the ΔH for the overall reaction: $\text{C}_6\text{H}_{14}(g) + \text{O}_2(g) \rightarrow 6 \text{CO}_2(g) + 7 \text{H}_2\text{O}(g)$.
 1) -40.0 kcal 2) -111.8 kcal 3) -928.6 kcal 4) -1,008.6 kcal
 5) none of these
101. Use the "heat of formation" of each substance to determine the ΔH for the overall reaction: $2 \text{Al}(s) + \text{Fe}_2\text{O}_3(s) \rightarrow \text{Al}_2\text{O}_3(s) + 2 \text{Fe}(s)$.
 1) +595.0 kcal 2) -203.0 kcal 3) -196.0 kcal 4) -399.0 kcal
 5) -595.0 kcal
102. When $\text{C}_2\text{H}_5\text{OH}(l)$ reacts with $\text{O}_2(g)$, $\text{CO}_2(g)$ and $\text{H}_2\text{O}(g)$ are produced. With the help of a "heats of formation" table, calculate the H of this reaction.
 1) -85.4 kcal 2) +295.0 kcal 3) -66.4 kcal 4) -427.8 kcal 5) none of these
103. Calculate ΔH for the reaction $4 \text{NH}_3(g) + 5 \text{O}_2(g) \rightarrow 4 \text{NO}(g) + 6 \text{H}_2\text{O}(g)$, from the following Data.



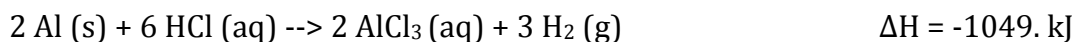
104. Find ΔH° for the reaction producing 1 mole of ethyl alcohol from its elements. Use the following thermochemical data.



105. Calculate ΔH for the reaction $\text{CH}_4(\text{g}) + \text{NH}_3(\text{g}) \rightarrow \text{HCN}(\text{g}) + 3 \text{H}_2(\text{g})$, given:



106. Calculate ΔH for the reaction for formation of solid AlCl_3 from the data:



107. For any chemical reaction at equilibrium, which of the following will change the value of the equilibrium constant?

- 1) adding a catalyst
- 2) increasing the pressure
- 3) increasing concentration of the reactants
- 4) increasing temperature
- 5) increasing concentration of the products

108. Increasing the initial concentrations of reactants

- 1) has no effect on a reaction.
- 2) increases the energy produced.
- 3) has no effect on the reverse reaction.
- 4) increases the number of collisions per sec.
- 5) none of these possibilities occur.

109. If a bottle 1/2 full of H_2O is tightly corked, equilibrium will be reached between $\text{H}_2\text{O}(\text{g})$ and $\text{H}_2\text{O}(\text{l})$ in the bottle. Which of the following is **wrong**?

- 1) Raising temperature favors formation of more $\text{H}_2\text{O}(\text{g})$.
- 2) Lowering temperature will decrease pressure on inside walls.
- 3) Water vapor pressure will increase as temperature increases.
- 4) Decreasing volume by pushing the cork farther in favors formation of more $\text{H}_2\text{O}(\text{g})$.
- 5) Raising temperature will decrease the amount of $\text{H}_2\text{O}(\text{l})$ present in the bottle.

110. Consider the equilibrium reaction: $\frac{1}{2} \text{Br}_2(\text{g}) + \frac{1}{2} \text{H}_2(\text{g}) \rightleftharpoons \text{HBr}(\text{g}) + 52 \text{ kcal}$.

Which statement is **false**?

- 1) The rate of HBr formation equals its rate of decomposition.
- 2) A temperature increase would cause less HBr to be present.
- 3) A catalyst would not change the equilibrium concentrations.
- 4) A pressure increase would shift the equilibrium so that more HBr would be present.
- 5) The $[\text{H}_2(\text{g})]$ at equilibrium would decrease if the $[\text{Br}_2(\text{g})]$ were increased.

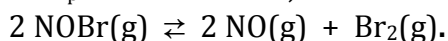
111. In the reaction $2 \text{A} + \text{B} \rightleftharpoons \text{C} + 3 \text{D}$, the molar concentrations at equilibrium are: $\text{A} = 1$; $\text{B} = 4$; $\text{C} = 8$; and $\text{D} = 2$. What is the value of the equilibrium constant?

- 1) 1/16
- 2) 1/6
- 3) 16
- 4) 64
- 5) none of these

112. Into a system which contained only A, a limited amount of B is injected. The equilibrium, $\text{A} + \text{B} \rightleftharpoons \text{C}$ is established. Which of the following statements applies?

- 1) The concentration of A is unchanged.
- 2) The concentration of B is zero at equilibrium.
- 3) The concentration of C increases until either A or B is exhausted.
- 4) The concentration of A decreases initially, then becomes constant.
- 5) The concentrations of A and B become equal.

113. K_p is 0.16 at 25°C , and $H = -82 \text{ kcal}$ for the following reaction:



Which one of the following statements is **false**?

- 1) K_p for the reaction at 100°C will be less than 0.16.
- 2) If the equilibrium mixture is compressed, the number of moles of Br_2 will decrease.
- 3) Addition of Br_2 to the equilibrium mixture will result in an increase in NO .
- 4) Addition of NOBr to the equilibrium mixture will cause no change in K_p .
- 5) If the temperature is decreased, more Br_2 is produced.

114. Consider the reaction $\text{NO}(\text{g}) + \text{O}_3(\text{g}) \rightleftharpoons \text{NO}_2(\text{g}) + \text{O}_2(\text{g}) + 43.5 \text{ kcal}$. If the reaction is in a closed vessel at a given temperature, consider the following possible changes:

- A. Decrease temperature B. Add a catalyst C. Add O_3 D. Reduce the pressure

Which changes would **increase** the amount of NO_2 present at the new equilibrium?

- 1) A and B only
- 2) B and D only
- 3) B and C only
- 4) C and D only
- 5) A and C only

115. Consider the all-gas equilibrium $\text{H}_2\text{O} + \text{CO} \rightleftharpoons \text{H}_2 + \text{CO}_2$ for which $K_{\text{eq}} = 4.0$ at a certain temperature. If you were to **begin** with 1.5 moles of H_2O and 1.5 moles of CO in a 1.0 liter vessel, what would be the **equilibrium** concentration of CO_2 ?

- 1) 0.5 M
- 2) 0.8 M
- 3) 1.0 M
- 4) 1.2 M
- 5) 2.0 M

116. Consider the reaction: $2 \text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2 \text{SO}_3(\text{g})$. The equilibrium constant is 8.6×10^{-2} . If the equilibrium concentrations of SO_2 and SO_3 are $4.2 \times 10^{-1} \text{ M}$ and $6.4 \times 10^{-3} \text{ M}$ respectively, what is the molarity of O_2 ?

- 1) $4.1 \times 10^{-5} \text{ M}$
- 2) $1.3 \times 10^{-2} \text{ M}$
- 3) $2.7 \times 10^{-3} \text{ M}$
- 4) $1.8 \times 10^{-1} \text{ M}$
- 5) $3.6 \times 10^1 \text{ M}$

117. The substance that acts as both a Bronsted acid and a Bronsted base is:
1) HClO; 2) H₂SO₄; 3) PO₄⁻³; 4) HSO₃⁻; 5) ClO₄⁻.
118. The pH of a 1.25 x 10⁻³ M NaOH solution is:
1] 2.90 2] 11.10 3] 3.10 4] 7.00 5] 10.90
119. A ____ M solution of Ba(OH)₂ has a pH of 12.7.
1] 2.0 x 10⁻¹³ M 2] 5.0 x 10⁻² M 3] 1.0 x 10⁻¹³ M 4] 1.27 x 10¹ M 5] 2.5 x 10⁻² M
120. What is the hydronium ion concentration, [H₃O⁺], of a solution that has a pH of 8?
1) 10⁻⁴ M 2) 10⁻⁶ M 3) 10⁻⁸ M 4) 10⁷ M 5) none of these
121. What is the pH of a 0.01 M solution of sodium hydroxide, NaOH?
1) 12 2) 2 3) 10⁻² 4) 10⁻¹²
122. Which hydroxide ion concentration indicates the solution is the most acid in content?
1) 1 x 10⁻¹⁰ M 2) 1 x 10⁻⁸ M 3) 1 x 10⁻⁶ M 4) 1 x 10⁻⁴ M
123. The conjugate acid of HSO₄⁻ is
1) HSO₃⁺ 2) SO₄²⁻ 3) HSO₄⁺ 4) H₂SO₄ 5) H⁺

What not to study

Nuclear reactions & half-life

Scientist names from history of atomic structure & gas laws

Exceptions for electron configurations,

E.C for f-elements & box diagrams

Explanation for periodic trends

Organic Chemistry & functional groups

Shapes of molecules besides the basic shapes: linear, bent, trigonal planar (flat triangle), tetrahedral and trigonal pyramidal