CHM 101 Sample Exam Questions

1. You are responsible for the information on this page. Please read it carefully.

2. Print and **code** both your name and **10-digit affiliate ID** on the scantron sheet. The affiliate ID is the second sequence of numbers on your University ID card.

3. Use only a #2 pencil.

4. Do all calculations on the exam pages. Do not make any unnecessary marks on the answer sheet.

5. This exam consists of 25 multiple choice questions worth 4 points each and a periodic table. Make sure you have them all.

6. Choose the best answer to each of the questions and answer it on the computer-graded answer sheet. Read all responses before making a selection.

7. When you are finished, turn in your scantron in the stack that corresponds to your version. Your scantron is color-coded in the upper right hand corner. You may keep your exam questions.

Potentially useful information:

1 inch = 2.54 cm
1 lb = 453.6 g
1 quart = 0.9464 L
4 quart = 1 gallon
32 fluid ounces = 1 quart

K = ºC + 273.15

Heat energy added	=	Specific heat	×	Mass in grams	×	Change in temperature in Cº

1 cal = 4.184 J
1000 cal = 1 kcal = 1 Cal

Solubility Info
All compounds containing any of the following are soluble:
Na^+, K^+, NH_4^+, NO_3^-

Activity Series

Li (Most Active)
K
Ba
Ca
Na
Mg
Al
Zn
Fe
Cd
Ni
Sn
Pb
H
Cu
Hg
Ag
Au (Least Active)

$$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$$

1atm = 760 torr =760 mmHg

$$\nu = \frac{c}{\lambda}$$

$c = 3.0\text{x}10^8$ m/s

$PV = nRT$ $(R = 0.08206\ \text{L}\cdot\text{atm/K}\cdot\text{mol})$

Chapter 1

1. Which of the following is considered a mixture?

   A. Cl_2 B. CO_2 C. Na D. Copper-zinc alloy E. Both A and B are mixtures

2. Which of the following best describes what happens when water evaporates?

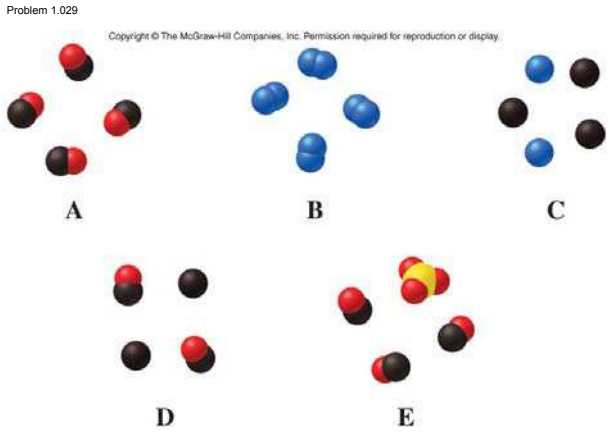
   A. Water molecules undergo a chemical change in which hydrogen and oxygen molecules form.
   B. Water molecules undergo a physical change in which hydrogen and oxygen molecules form.
   C. Water molecules undergo a chemical change in which gaseous water vapor molecules form.
   D. Water molecules undergo a physical change in which gaseous water vapor molecules form.
   E. Water boiling does not involve physical or chemical changes.

3. A pharmaceutical chemist measured the melting point of an unknown compound in four trials. Her data is listed below. Which of the following statements best describes her data?

Melting Point (°C)
95.29
95.30
95.31
92.99

   A. Three melting points are accurate and one is not accurate.
   B. Three melting points are precise.
   C. The data is accurate.
   D. All of the data is not accurate.
   E. The average should have only one significant figure.

4. Which of the following represents a pure compound?



5. If the mass of a dog is 65-lb, what is the mass in units of kilograms? (1 lb = 453 g)

   A. 29,000 kg
   B. 29 kg
   C. 0.290 kg
   D. 0.14 kg
   E. 140 kg

6. If the diameter of a cell is 9.0 x10^{-6} meter, its diameter can also be reported as _____.

A. 9.0 mm
B. 9.0 μm
C. 9.0 nm
D. 9.0 pm
E. 9.0 km

7. What is the **density** of a cubic solid that is 3.00 cm on each side and has a mass of 25.0 grams?

A. 0.926 g/cm^3 B. 1.08 g/cm^3 C. 2.78 g/cm^3 D. 8.33 g/cm^3 E. 27.0 g/cm^3

8. Why is the density of gaseous CO_2 less than that of solid CO_2?

A. In the gaseous state, the CO_2 molecules have a lower mass.
B. In the gaseous state, the CO_2 molecules have a greater mass.
C. In the gaseous state, there is more space between the CO_2 molecules.
D. In the gaseous state, there is less space between the CO_2 molecules.
E. In the gaseous state, the CO_2 molecules are bigger.

9. When 222 seconds is converted to minutes, how should the result be properly reported with the correct number of **significant figures**?

A. 4 min B. 3.7 min C. 3.70 min D. 3.700 min E. 3.70x10^{-2} min

10. The density of gold is 19.3 g/mL. What is the **mass** of 0.0100 L of gold, in units of grams?

A. 1.93x10^{-6} g
B. 0.193 g
C. 1.93 g
D. 193 g
E. 1.93x10^{4} g

11. Which of the following is the lowest possible temperature?

A. –273.15 °C
B. –273.15 K
C. 273.15 K
D. 0 °C
E. The is no lowest possible temperature

12. What happens to the potential energy and kinetic energy of a ball as it rolls down a hill?

A. Potential energy increases and kinetic energy increases.
B. Potential energy increases and kinetic energy decreases.
C. Potential energy decreases and kinetic energy increases.
D. Potential energy decreases and kinetic energy decreases.
E. There is no change at all.

Chapter 2

13. Based in part on his experiments using a cathode ray tube, Thomson developed the "plum pudding" model for the atom. When Rutherford bombarded a thin metal sheet with alpha particles, most passed through but some were deflected or bounced back. Rutherford's model of the atom included what atomic structure to explain the deflection of alpha particles?

A. electron
B. neutron
C. nucleus
D. cathode Ray
E. plums

14. Which of the following best describes an electron?

A. same charge as the neutron
B. a positively charged particle
C. greater in mass than a proton
D. located in the nucleus of an atom
E. negatively charged particle

15. An atom with 25 protons and 30 neutrons has which of the following symbols?

A. ${}^{25}_{5}\mathrm{B}$ B. ${}^{30}_{25}\mathrm{Mn}$ C. ${}^{55}_{25}\mathrm{Mn}$ D. ${}^{25}_{30}\mathrm{Zn}$ E. ${}^{55}_{30}\mathrm{Zn}$

16. Calculate the **relative atomic mass** of Kelsium, a fictional element, if it has two *isotopes* with the following abundance and masses:

${}^{10}\mathrm{Ke}$	10.01 amu	20.00%
${}^{12}\mathrm{Ke}$	12.02 amu	80.00%

A. 5.81 amu
B. 5.21 amu
C. 10.41 amu
D. 11.00 amu
E. 11.62 amu

17. Naturally occurring magnesium is comprised of three isotopes: ${}^{24}\mathrm{Mg}$, ${}^{25}\mathrm{Mg}$, and ${}^{26}\mathrm{Mg}$. Which of the following statements can be said about their relative abundance? (Refer to the periodic table)

A. ${}^{24}\mathrm{Mg}$ is present is the largest percent abundance.
B. ${}^{25}\mathrm{Mg}$ is present is the largest percent abundance.
C. ${}^{26}\mathrm{Mg}$ is present is the largest percent abundance.
D. Each has a 33.334% abundance
E. Each has a 50.000% abundance

18. How many protons and electrons are in a S^{2-} anion?

A. 14 protons, 16 electrons
B. 16 protons, 18 electrons
C. 16 protons, 14 electrons
D. 18 protons, 16 electrons
E. 32 protons, 30 electrons

19. Which of the following symbols represents an **oxide ion**?

A. O^{-} B. O^{2-} C. O^{3-} D. O^{+} E. O^{2+}

20. About how much more massive is an average argon atom than an average helium atom?

A. 2 times
B. 9 times
C. 10 times
D. 40 times
E. They have the same mass

21. The element calcium can be classified as a(n) _____ .

A. alkali metal
B. transition metal
C. main-group element
D. actinide
E. nonmetal

22. Which of these elements is a noble gas?

A. lanthium B. oxygen C. hydrogen D. neon E. chlorine

23. Which of the following elements occurs naturally as diatomic molecules?

A. hydrogen B. nitrogen C. fluorine D. iodine E. All of the above

Chapter 3

24. Which of the following is an ionic compound?

A. CaF_2
B. N_2
C. CF_4
D. H_2O
E. all of these

25. What is the formula for a compound composed of Cr^{3+} ions and S^{2-} ions?

A. CrS
B. Cr_2S_3
C. Cr_3S_2
D. CrS_2
E. CrS_3

26. What is the formula for the compound chromium(III) oxide?

A. Cr_3O
B. Cr_2O_3
C. CrO_3
D. CrO
E. Cr_3O_2

27. Which of the following is the correct name for the compound with the formula, Na_2SO_4?

A. sodium sulfate
B. disodium sulfate
C. sodium sulfide
D. sodium sulfite
E. disodium sulfur tetroxide

28. Which of the following acids is named **incorrectly**?

A. HNO_3, nitric acid
B. HCl, hydrochloric acid
C. H_2CO_3, carbonic acid
D. H_3PO_4, hydrophosphoric acid
E. CH_3CO_2H, acetic acid

29. Which of the following substances is classified as a molecular compound?

A. $CaCO_3$
B. AgCl
C. NH_3
D. NO_3^-
E. none of the above

30. Solutions containing what type(s) of compounds do NOT conduct electricity?

A. Acids
B. Bases
C. Molecular compounds
D. Ionic compounds
E. All of these

Chapter 4

31. What is the *molar mass* of $C_6H_{12}O_6$?

A. 29.02 g/mol
B. 30.03 g/mol
C. 174.12 g/mol
D. 180.16 g/mol
E. More information is needed

32. What is the **mass** of 1.50 mole of **ammonia**?

A. 11.35 g
B. 0.0881 g
C. 25.5 g
D. 17.03 g
E. 1.50 g

33. When 1.00 mole of Na_2SO_4 is dissolved in water, how many **Na^+ ions** are in the water?

A. ½ Na^+ ion
B. 1 Na^+ ion
C. 6.02×10^{23} Na^+ ions
D. 1.20×10^{24} Na^+ ions
E. 3.32×10^{-24} Na^+ ions

34. Which of the following contains the **greatest number of moles** of molecules?

A. 1.0 gram of H_2
B. 1.0 gram of O_2
C. 1.0 gram of Cl_2
D. 1.0 gram of CO_2
E. All contain the same number of moles

35. Which of the following equations best describes the process of dissolving calcium nitrate in water?

A. $Ca(NO_3)_2(s) \rightarrow Ca(l) + 2NO_3(l)$
B. $Ca(NO_3)_2(s) \rightarrow Ca(aq) + 2N(aq) + 3O(aq)$
C. $Ca(NO_3)_2(s) \rightarrow Ca^{2+}(aq) + 2N^{3-}(aq) + 3O_3^{2-}(aq)$
D. $Ca(NO_3)_2(s) \rightarrow Ca^{2+}(aq) + (NO_3^-)_2(aq)$
E. $Ca(NO_3)_2(s) \rightarrow Ca^{2+}(aq) + 2NO_3^-(aq)$

36. Diamond is a form of pure carbon. How many **moles** of carbon are in a 2.0-gram diamond?

A. 24 mol
B. 12 mol
C. 0.50 mol
D. 0.083 mol
E. 0.17 mol

37. What is the *mass percentage* of **iron** in Fe_2O_3?

A. 69.94%
B. 66.67%
C. 34.97%
D. 77.73%
E. 40.00%

38. Which of the following is NOT an *empirical formula*?

A. $C_3H_9O_3$

B. $C_5H_9N_3$

C. C_5H_{12}

D. CH_4

E. CH

39. Analysis of a compound showed that it contained 21.9% sulfur and 78.1% fluorine by mass. What is the *empirical formula* for the compound?

A. SF_4
B. S_2F_7
C. SF_6
D. S_2F_3
E. SF_2

40. How many moles of HCl are in 35.0 mL of a 0.100 M HCl solution?

A. 3.50 mol
B. 0.350 mol
C. 2.86 mol
D. 2.86×10^{-3} mol
E. 3.50×10^{-3} mol

41. What is the percent by mass concentration of KCl in a solution prepared by adding 25.0 g KCl to 125.0 g of water?

A. 0.200% B. 20.0% C. 0.167% D. 16.7% E. 5.00%

42. A solution is prepared by adding enough water to 1.0 mL of a 2.0 M solution so that the total volume is 10.0 mL. What is the concentration of the diluted solution?

A. 2.0 *M*
B. 1.0 *M*
C. 0.20 *M*
D. 10 *M*
E. 0.22 *M*

Chapter 5

43. When aqueous solutions of H_2SO_4 and NaOH are mixed, _____ will occur.

A. a combination reaction
B. a decomposition reaction
C. a single-displacement reaction
D. a double-displacement reaction
E. no reaction

44. Identify the spectator ions in the following reaction: $Zn(s) + 2HNO_3(aq) \rightarrow Zn(NO_3)_2(aq) + H_2(g)$

A. Zn^{2+} and NO_3^-
B. H^+ and NO_3^-
C. NO_3^- only
D. Zn^{2+} only
E. There are no spectator ions

45. When the equation below is balanced properly, what is the ***coefficient*** in front of $O_2(g)$?

$$C_6H_{14}(l) + O_2(g) \rightarrow CO_2(g) + H_2O(g)$$

A. 6 B. 7 C. 9 D. 12 E. 19

46. When aqueous solutions of hydrochloric acid and sodium carbonate are mixed,

A. H_2 gas is formed.
B. CO_2 gas is produced.
C. sodium metal is formed.
D. a precipitate is formed.
E. no reaction occurs.

47. Which of the metals (Al, Ca, Mg) will react in an aqueous solution of KNO_3 to produce potassium metal?

A. Mg B. Ca C. Al D. All of these E. None of these

48. When aqueous solutions of $AgNO_3$ and $MgCl_2$ are mixed, what is the *correct formula* for the **precipitate** that forms?

A. K_2Ag
B. $AgCl$
C. $AgCl_2$
D. $MgNO_3$
E. $Mg(NO_3)_2$

49. Which of the following equations best describes the reaction that occurs when potassium metal reacts with oxygen gas in a combination reaction?

A. $K(s) + O(g) \rightarrow KO(s)$

B. $K(s) + O_2(g) \rightarrow KO_2(s)$

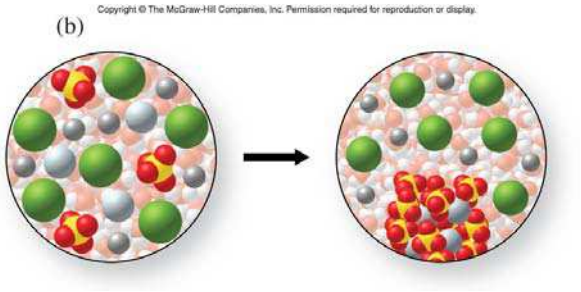
C. $4K(s) + O_2(g) \rightarrow 2K_2O(s)$

D. $2K(s) + O(g) \rightarrow K_2O(s)$

E. $K(s) + O_2(g) \rightarrow KO(s) + O(g)$

50. Which of the following classifications describes the molecular-level representation?

A. decomposition
B. combination
C. single-displacement
D. double-displacement
E. combustion



Chapter 6

51. In any chemical reaction, which of the following is NOT always *conserved*?

A. Number of atoms.
B. Mass
C. Moles of atoms
D. Number of molecules

52. The balanced equation for the decomposition of TNT is given. If 4.6 mole of TNT reacts, what is the theoretical yield of N_2 in moles?

$$2C_7H_5(NO_2)_3(s) \rightarrow 7C(s) + 7CO(g) + 3N_2(g) + 5H_2O(g)$$

A. 0.57 mol
B. 6.9 mol
C. 14 mol
D. 3.1 mol
E. 0.85 mol

53. The balanced equation for the combustion of acetylene, C_2H_2, is given. If 12 molecules of C_2H_2 reacts, how many molecules of O_2 should react with it?

$$2C_2H_2(g) + 5O_2(g) \rightarrow 4CO_2(aq) + 2H_2O(l)$$

A. 5
B. 10
C. 60
D. 30
E. 12

54. What **mass of Cl_2** will react with 5.00 grams of Al by the reaction represented by the following balanced equation?

$$2Al(s) + 3Cl_2(g) \rightarrow 2AlCl_3(g)$$

A. 1.27 grams Cl_2
B. 7.5 grams Cl_2
C. 13.1 grams Cl_2
D. 19.7 grams Cl_2
E. 8.76 grams Cl_2

55. When 2.4 mol C_2H_2 is mixed with 5.0 mol O_2, the following reaction occurs:

$$2C_2H_2(g) + 5O_2(g) \rightarrow 4CO_2(aq) + 2H_2O(l)$$

Which of the following best describes this particular reaction?

A. C_2H_2 is the limiting reactant and should be used up completely.
B. O_2 is the limiting reactant and should be used up completely.
C. C_2H_2 is the limiting reactant and some should be leftover after the reaction is complete.
D. O_2 is the limiting reactant and some should be leftover after the reaction is complete.
E. Both reactants will be used up completely.

56. When 0.40 mol Al is mixed with 0.80 mol Cl_2, the following reaction occurs:

$$2Al(s) + 3Cl_2(g) \rightarrow 2AlCl_3(s)$$

Which of the following best describes what remains after the reaction is complete?

A. 0.40 mol Cl_2 and 0.40 mol $AlCl_3$
B. 0.20 mol Cl_2 and 0.40 mol $AlCl_3$
C. 0.13 mol Al and 0.53 mol $AlCl_3$
D. 0.20 mol Al and 0.20 mol $AlCl_3$
E. 0.60 mol Cl_2 and 0.20 mol $AlCl_3$

57. How many moles of NaCl should be produced when 0.50 mol Na is added to 0.50 mol Cl_2? The balanced equation for the reaction is:

$$2Na(s) + Cl_2(g) \rightarrow 2NaCl(s)$$

A. 0.50 mol NaCl
B. 0.25 mol NaCl
C. 0.75 mol NaCl
D. 1.00 mol NaCl
E. 1.50 mol NaCl

58. A 5.00-gram sample of mercury(II) oxide is decomposed completely to mercury metal and oxygen gas. What is the total mass of the products?

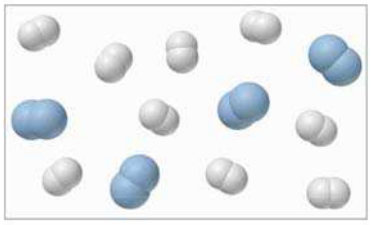
A. 3.33 g
B. 1.67 g
C. 5.39 g
D. 4.63 g
E. 5.00 g

59. A student calculated that 20.0 g of product should be obtained in a reaction. However, after doing the reaction, the student obtained only a 65.0% yield. What mass of product did the student actually recover?

A. 13.0 g B. 6.50 g C. 65.0 g D. 30.8 g E. 35.0 g

60. The diagram below shows a mixture of O_2 (larger and darker molecules) and H_2 just at an instantaneous moment just before reaction. Assuming that the reaction goes to completion by the equation shown below, which of the following statements best describes the resulting mixture?

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$



A. H_2 is the limiting reactant and one O_2 molecule will be leftover.
B. O_2 is the limiting reactant and one H_2 molecule will be leftover.
C. H_2 is the limiting reactant and five H_2 molecules will be leftover.
D. O_2 is the limiting reactant and five O_2 molecules will be leftover.
E. There is no limiting reactant and no reactant molecules will be left over amounts.

Chapter 7

61. The wavelength of light that has a frequency of 1.2×10^{13} s^{-1} is _____ m.

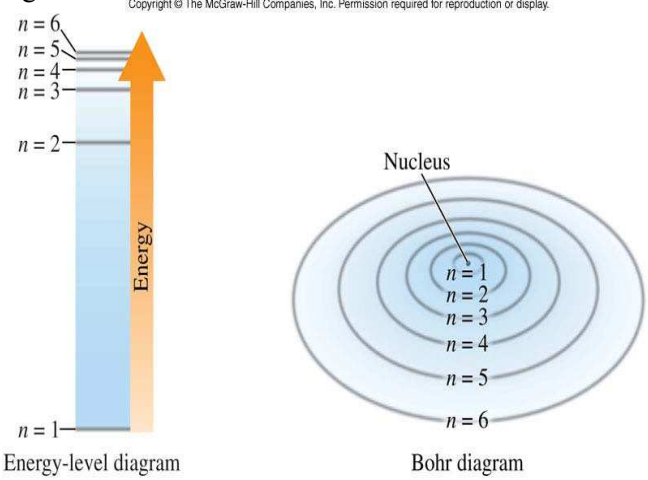
A. 25
B. 2.5×10^{21}
C. 0.0400
D. 12.0
E. 2.5×10^{-5}

62. Which of the following is composed of the **highest frequency** light?

A. Green light
B. Violet light
C. Orange light
D. Yellow light
E. Red light

63. Which of the following electron transitions in the H atom will result in the longest wavelength of light emitted?

A. $n = 6$ to $n = 2$
B. $n = 6$ to $n = 3$
C. $n = 6$ to $n = 4$
D. $n = 6$ to $n = 5$
E. $n = 5$ to $n = 6$



64. Which of the following is NOT a type of **electromagnetic radiation**?

A. X-Rays
B. gamma rays
C. visible light
D. infrared radiation
E. sound waves

65. Which of the following best describes a ***p* orbital**?

A. spherical
B. an orbit
C. two lobes, 2-dimensional
D. two lobes, 3-dimensional
E. four lobes, 3-dimensional

66. Which type(s) of **orbitals** are allowed in the $n = 2$ principle energy level?

A. *s* orbitals only
B. *s* and *p* orbitals only
C. *p* orbitals only
D. *s*, *p*, and *d* orbitals only
E. *s*, *p*, *d* and *f* orbitals only

67. How many ***orbitals*** are in the 4*d* sublevel?

A. 2 B. 4 C. 5 D. 8 E. 10

68. How many ***unpaired*** electrons are in the ground state electron configuration of a nitrogen atom?

A. 1 B. 2 C. 3 D. 5 E. 6

69. Which of the following is the **abbreviated electron configuration** for a titanium atom, Ti?

A. [Ar] $3d^2$
B. [Ar] $4s^2\ 3d^2$
C. [Ar] $4d^2$
D. [Ar] $4s^2\ 4d^2$
E. [Ar] $4s^2\ 3d^4$

70. Which of the following has the electron configuration, $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$?

A. S^{2-}
B. Cl^-
C. Ar
D. K^+
E. All of the above

71. A lead atom has ____ **valence electrons**.

A. 28 B. 2 C. 4 D. 14 E. 84

72. Which of the following atoms has the largest **radius**?

A. Li B. C C. O D. F E. Ne

73. Which of the following atoms has the largest **first ionization energy, I_1**?

A. Li
B. Be
C. B
D. C
E. N

74. Why is the second ionization energy for potassium significantly greater than its first ionization energy?

A. The second electron is a nonvalence (core) electron, therefore easier to remove.
B. The second electron is a nonvalence (core) electron, and therefore harder to remove.
C. The second proton is held more tightly, and therefore harder to remove.
D. The second proton is held more tightly, and easier to remove.
E. Formation of an anion requires more energy

75. Which of the following has the largest radius?

A. S^{2-}
B. Cl^{-}
C. Ar
D. K^{+}
E. All have the equal radii.

Chapter 8

76. Which of the following substances has both **ionic** and **covalent bonding**?

A. NaCl
B. Cl_2
C. MgO
D. $MgCO_3$
E. Ne

77. Which of the following elements is the most **electronegative**?

A. H
B. Li
C. N
D. O
E. S

78. In which of the following molecules does **oxygen** have a **partial positive charge (δ+)?**

A. O_2
B. OF_2
C. H_2O
D. MgO
E. None of the above

79. Which of the following contains a **triple bond**?

A. C_2H_6 B. HCN C. NO_3^- D. NH_3 E. O_2

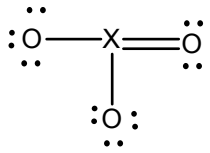
80. Which of the following is best represented by **two equivalent resonance structures**?

A. CO_2 B. NO_2^- C. NO_3^- D. N_2 E. None of these

81. In which of the following does the central atom disobey the **octet rule**?

A. BH_3 B. NH_3 C. PH_3 D. H_2S E. None of the these

82. An unknown molecular compound has the following Lewis structure. Which of the following elements could be the identity of **X**?



A. Si B. P C. S D. Cl E. Ne

83. Which of the following has bond angles closest to 120°?

A. CO_2
B. H_2O
C. SO_2
D. CH_4
E. NH_3

84. Draw the Lewis structure for H_2S and determine its approximate **bond angles** and **molecular shape**.

A. 90 degrees, tetrahedral
B. 120 degrees, linear
C. 120 degrees, bent
D. 109.5 degrees, trigonal planar
E. 109.5 decrees, bent

85. Which of the following molecules is a **nonpolar molecule** with **polar bonds**?

A. NF_3
B. CH_2Cl_2
C. CF_4
D. O_3
E. CO

Chapter 9

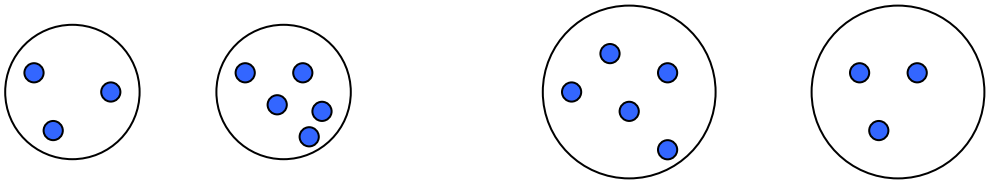
86. Which of the following best explains what happens to a balloon that rises to a higher altitude at constant temperature? (Note: Atmospheric pressure decreases as altitude increases)

A. The volume of the balloon increases because the pressure inside and outside the balloon decreases.
B. The volume of the balloon increases because the number of gas molecules in the balloon increases.
C. The volume of the balloon decreases because the pressure inside and outside the balloon decreases.
D. The volume of the balloon decreases because the number of gas molecules in the balloon decreases.
E. The volume of the balloon will remain constant because temperature is held constant.

87. Which of the following should be most soluble in benzene, C_6H_6?

A. CH_3OH B. H_2O C. Br_2 D. $H_2C{=}O$ E. $CH_3\text{-}O\text{-}CH_3$

88. Consider the following diagrams representing the same gas under different conditions of temperature and pressure. Which has the lowest density?



A B C D

A. A
B. B
C. C
D. D
E. Both B and C

89. A 2.00-L sample of gas at 1.00 atm pressure is cooled from 30.00°C to –100.00°C in an elastic container such as a balloon. What is the **final volume** of the gas? Because the container is elastic, the pressure remains constant.

A. 3.50 L
B. 6.67 L
C. 1.14 L
D. –6.67 L
E. 0.030 L

90. Which of the following occurs when an ideal gas sample is **increased in temperature**? (volume and moles are held constant.)

A. Pressure increases
B. Average kinetic energy increases
C. Average molecular speed increases
D. All of the above
E. None of the above

91. What is the mass of argon (Ar) gas in a 20.0-liter container given that the pressure in the container is 815 mmHg and the temperature is 298 K?

A. 35.0 g
B. 667 g
C. 45.6 g
D. 40.0
E. 0.0247 g

92. A mixture of gases contains helium, neon, nitrogen, and carbon dioxide at 298 K. Which gas has the greatest average velocity?

A. N_2
B. CO_2
C. He
D. Ne
E. All have the same average velocity.

Chapter 10

93. In which of the following liquids is **London-dispersion forces** present?

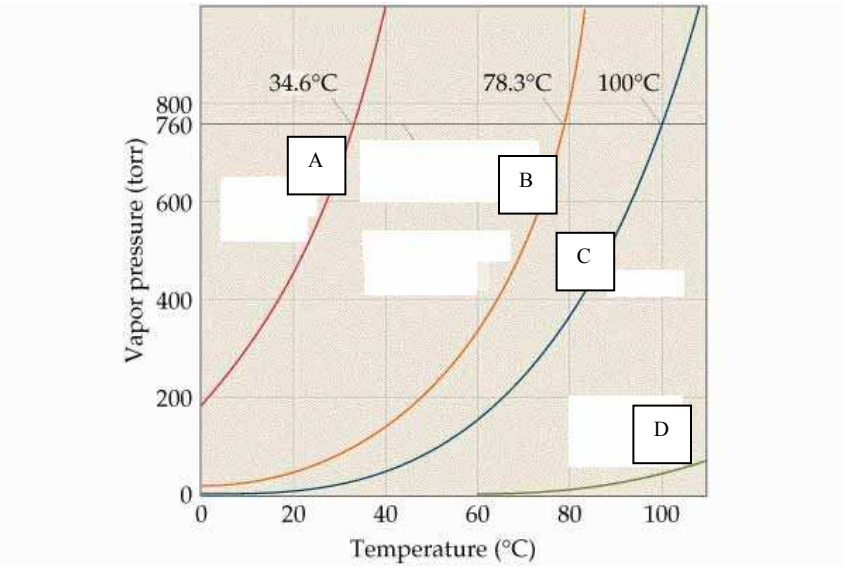
A. CH_3OH
B. CH_3NH_2
C. H_2O
D. CCl_4
E. All of the above

94. Which of the following liquids is expected to have the **highest boiling point**? (Note types of intermolecular forces in each substance.)

A. CH_4
B. CH_3OH
C. CH_3Cl
D. CH_3CH_3
E. $CH_3CH_2CH_3$

95. The graph below shows the vapor pressure of each liquid as a function of temperature. Which liquid has the **strongest** intermolecular forces?

A. A
B. B
C. C
D. D



Chapter 11

96. Many ionic compounds dissolve in water because

A. there are attractive forces between ions and water molecules
B. there are no attractive forces between ions and water molecules.
C. the entropy of the solution is greater than the entropy of pure NaCl and pure H_2O.
D. the entropy of the solution is less than the entropy of pure NaCl and pure H_2O.
E. Both A and C

97. Which of the following increases the **solubility** of a gas in solution?

A. Increasing gas pressure and increasing temperature
B. Increasing gas pressure and decreasing temperature
C. Decreasing gas pressure and increasing temperature
D. Decreasing gas pressure and decreasing temperature
E. Adding more water

98. If the solubility of a solid substance is 18.2 g/100 g water, which of the following best describes what is eventually formed after10.0 grams of the substance is mixed with 50.0 grams of water?

A. Saturated solution with some undissolved solid
B. Unsaturated solution with some undissolved solid
C. Saturated solution with no undissolved solid
D. Unsaturated solution with no undissolved solid
E. Supersaturated solution

99. What **volume** of a 0.500 M HCl solution contains 2.00 mol HCl?

A. 1.00 L B. 2.00 L C. 4.00 L D. 0.250 L E. None of these

Chapter 12

100. Consider the following system at equilibrium: $FeO(s) + H_2(g) \rightleftharpoons Fe(s) + H_2O(g)$

Given that the reaction in the forward direction is endothermic, which of the following will cause an increase in the moles of iron metal at equilibrium?

A. Removing H_2O vapor
B. Removing Fe solid
C. Removing H_2 gas
D. Decreasing the reaction temperature
E. None of these

101. Which of the following is always true when a system is in a state of equilibrium?

A. The moles of reactants is equal to the moles of products.
B. The mass of reactants is equal to the mass of products.
C. The rate of the forward process is equal to the rate of the reverse process.
D. The forward process and the reverse process both stop (rates of both are zero).
E. The pH is equal to 7.

Chapter 13

102. Which of the following is the conjugate acid of HSO_4^-?

A. H_2SO_4
B. SO_4^{2-}
C. $H_2SO_4^-$
D. H_3O^+
E. HSO_3^-

103. Identify the acid reactant in the following reaction.

$$NH_3(aq) + H_2O(aq) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$$

A. $NH_3(aq)$
B. $H_2O(l)$
C. $NH_4^+(aq)$
D. $OH^-(aq)$
E. $H_3O^+(aq)$

104. Which one of the following is an **acid that will ionize completely** when dissolved in water?

A. NaOH

B. HBr

C. HF

D. NaCl

E. NH_3

105. Which of the following is considered a *basic* solution?

A. A solution with a pH of 5
B. A 0.10 *M* solution of HCl
C. A solution with $[H_3O^+] = 1.0 \times 10^{-4}$ *M*
D. A solution with $[H_3O^+] = 1.0 \times 10^{-7}$ *M*
E. A solution with $[H_3O^+] = 1.0 \times 10^{-10}$ *M*

106. What is the pH of a 0.010 *M* NaOH solution?

A. 1.00 B. 2.00 C. 7.00 D. 12.00 E. 13.00

107. When extra water is added to 10.0 mL of an unknown solution, the pH increases by 1.00 pH unit. Does the solution contain an acid or a base, and how much water was added to the solution?

A. Acid; 10.0 mL water added
B. Acid; 90.0 mL water added
C. Base; 10.0 mL water added
D. Base; 90.0 mL water added

Answer Key

1. D	27. A	53. D	79. B
2. D	28. D	54. D	80. B
3. B	29. C	55. B	81. A
4. A	30. C	56. B	82. C
5. B	31. D	57. A	83. C
6. B	32. C	58. E	84. E
7. A	33. D	59. A	85. C
8. C	34. A	60. B	86. A
9. C	35. E	61. E	87. C
10. D	36. E	62. B	88. D
11. A	37. A	63. D	89. C
12. C	38. A	64. E	90. D
13. C	39. C	65. D	91. A
14. E	40. E	66. B	92. C
15. C	41. D	67. C	93. E
16. E	42. C	68. C	94. B
17. A	43. D	69. B	95. D
18. B	44. C	70. E	96. E
19. B	45. E	71. C	97. B
20. C	46. B	72. A	98. A
21. C	47. E	73. E	99. C
22. D	48. B	74. B	100. A
23. E	49. C	75. A	101. C
24. A	50. D	76. D	102. A
25. B	51. D	77. D	103. B
26. B	52. B	78. B	104. B
			105. E
			106. D
			107. B