

## CEM 141 Phase I Problem Set

### Units/Sig figs

Conversions you will never need to 'memorize'

$$2.54 \text{ cm} = 1 \text{ inch} \quad 16 \text{ oz} = 453.59 \text{ g}$$

- 1) If matter is uniform throughout and cannot be separated into other substances by physical processes, but can be decomposed into other substances by chemical processes, it is called a (an) \_\_\_\_\_.
- 2) The SI unit for mass is \_\_\_\_\_.
- 3) A common English set of units for expressing velocity is miles/hour. The SI unit for velocity is \_\_\_\_\_.
- 4) Momentum is defined as the product of mass and velocity. The SI unit for momentum is \_\_\_\_\_.
- 5) The SI unit of temperature is \_\_\_\_\_.
- 6) The number 0.00430 has \_\_\_\_\_ significant figures.
- 7) The number 1.00430 has \_\_\_\_\_ significant figures.
- 8) The correct answer (reported to the proper number of significant figures) to the following is \_\_\_\_\_.

$$6.3 \times 3.25 = \underline{\hspace{2cm}}$$

$$9) \frac{(0.002843)(12.80184)}{0.00032} = \underline{\hspace{2cm}}$$

### Definitional Stuff

- 11) What is the physical state(s) in which matter has no specific shape but does have a specific volume?
- 12) A combination of sand, salt, and water is an example of a \_\_\_\_\_.
- 13) A small amount of salt dissolved in water is an example of a \_\_\_\_\_.
- 14) Gases do not have a fixed \_\_\_\_\_ as they are able to be \_\_\_\_\_.
- 15) Which states of matter are significantly compressible?
- 16) In the following list, only \_\_\_\_\_ is not an example of a chemical reaction.  
A) dissolution of a penny in nitric acid    B) the condensation of water vapor  
C) a burning candle    D) the formation of polyethylene from ethylene  
E) the rusting of iron
- 17) Of the following, only \_\_\_\_\_ is a chemical reaction.  
A) melting of lead    B) dissolving sugar in water    C) tarnishing of silver  
D) crushing of stone    E) dropping a penny into a glass of water
- 18) Which one of the following is not an intensive property?  
A) density    B) temperature    C) melting point    D) mass    E) boiling point
- 19) Which one of the following is an intensive property?  
A) mass    B) temperature    C) heat content    D) volume    E) amount
21.    What are some of the differences between a solid, a liquid, and gas?
22.    What is the difference between homogeneous and heterogeneous matter? Classify each of the following as

homogeneous or heterogeneous:

- (a) soil (c) a carbonated soft drink (e) gold  
(b) 1 L sample of air (d) gasoline (f) a solution of ethanol and water

23. Classify each of the following as a mixture or a pure substance:

- (a) water (d) iron (g) wine  
(b) blood (e) cookie (h) leather  
(c) the oceans

24. Of the pure substances in the previous problem, which are elements, and which are compounds?

25. Distinguish between physical changes and chemical changes.

26) Round the number 0.08535 to two significant figures.

27) Round each of the following numbers to four significant figures, and express the results in standard exponential notation:

- (a) 102.53070 (b) 656,980 (c) 0.008543210 (d) 0.000257870 (e) -0.0357202

28) Perform the indicated mathematical operations and express each result to the correct number of significant figures.

- (a)  $3.894 \times 2.16$  (d)  $2.46 \times 2$   
(b)  $2.96 + 8.1 + 5.0214$  (e)  $9.146 - 9.137$   
(c) 485 divide 9.231

29) Chemists often give the composition of a mixture as mass per unit volume. For example, if 1.5 g of table sugar is dissolved in 5.0 mL of water, we say there is  $1.5 \text{ g}/5.0 \text{ mL} = 0.30 \text{ g/mL}$  of sugar in the solution. Express this concentration in each of the following units.

- (a) mg/mL (b) ng/mL (c)  $\text{kg/m}^3$  (d) mg/L (e) cg/L

31)  $3.337 \text{ g/cm}^3 = \text{_____} \text{ kg/m}^3$

32) 1.34 kilometer = \_\_\_\_\_ centimeters      8) 1 kilogram = \_\_\_\_\_ milligrams

33) The output of a plant is 4335 pounds of ball bearings per work week (five days). If each ball bearing weighs 0.0113 g, how many ball bearings does the plant make in 13 work days? (Indicate the number in proper scientific notation with the appropriate number of significant figures.) 1 lb = 453.6 g

34) A package of aluminum foil contains 50.  $\text{ft}^2$  of foil, which weighs approximately 8.0 oz. Aluminum has a density of  $2.70 \text{ g/cm}^3$ . What is the approximate thickness of the foil in millimeters?  $2.54 \text{ cm} = 1 \text{ inch}$ ,  $16 \text{ oz} = 453.59 \text{ g}$

35) An object will sink in a liquid if the density of the object is greater than that of the liquid. The mass of a sphere is 9.83 g. If the volume of this sphere is less than \_\_\_\_\_  $\text{cm}^3$ , then the sphere will sink in liquid mercury (density =  $13.6 \text{ g/cm}^3$ ).

36) The density of silver is  $10.5 \text{ g/cm}^3$ . A piece of silver with a mass of 61.3 g would occupy a volume of \_\_\_\_\_  $\text{cm}^3$ .

37) Osmium has a density of  $22.6 \text{ g/cm}^3$ . The mass of a block of osmium that measures  $1.01 \text{ cm} \times 0.233 \text{ cm} \times 0.648 \text{ cm}$  is \_\_\_\_\_ g.

### Thermo

38) The internal energy of a system is always increased by \_\_\_\_\_.  
A) adding heat to the system

- B) having the system do work on the surroundings
- C) withdrawing heat from the system
- D) adding heat to the system and having the system do work on the surroundings
- E) a volume compression

39) When a system \_\_\_\_\_,  $\Delta E$  is always negative.

- A) absorbs heat and does work
- B) gives off heat and does work
- C) absorbs heat and has work done on it
- D) gives off heat and has work done on it
- E) none of the above is always negative.

41) A \_\_\_\_\_  $\Delta H$  corresponds to an \_\_\_\_\_ process.

- A) negative, endothermic
- B) negative, exothermic
- C) positive, exothermic
- D) zero, exothermic
- E) zero, endothermic

42) Which one of the following statements is true?

- A) Enthalpy is an intensive property.
- B) The enthalpy change for a reaction is independent of the state of the reactants and products.
- C) Enthalpy is a state function.
- D)  $H$  is the value of  $q$  measured under conditions of constant volume.
- E) The enthalpy change of a reaction is the reciprocal of the  $\Delta H$  of the reverse reaction.

43. Suppose you toss a tennis ball upward.

- (a) Does the kinetic energy of the ball increase or decrease as it moves higher?
- (b) What happens to the potential energy of the ball as it moves higher?
- (c) If the same amount of energy were imparted to a ball the same size as a tennis ball, but of twice the mass, how high would it go in comparison to the tennis ball? Explain your answers.

44. (a) What is the kinetic energy in joules of a 950-lb. motor cycle moving at 68 mph?

(b) By what factor will the kinetic energy change if the speed of the motorcycle is decreased to 34 mph?

45. Calculate  $\Delta E$ , and determine whether the process is endothermic or exothermic for the following cases:

- (a) A system absorbs 85 kJ of heat from its surroundings while doing 29 kJ of work on the surroundings
- (b)  $q = 1.50$  kJ and  $w = -657$  J
- (c) the system releases 57.5 kJ of heat while doing 13.5 kJ of work on the surroundings.

46. For the following processes, calculate the change in internal energy of the system and determine whether the process is endothermic or exothermic:

- (a) A balloon is heated by adding 900 J of heat. It expands, doing 422 J of work on the atmosphere.
- (b) A 50-g sample of water is cooled from 30°C to 15°C, thereby losing approximately 3140 J of heat.
- (c) A chemical reaction releases 8.65 kJ of heat and does no work on the surroundings.

47. (a) why is the change in enthalpy usually easier to measure than in internal energy?

(b) For a given process at constant pressure,  $\Delta H$  is negative. Is the process endothermic or exothermic?

### Atoms, Periodic Table Basics

48. Which statement below correctly describes the responses of alpha, beta, and gamma radiation to an

electric field?

- A) Both beta and gamma are deflected in the same direction, while alpha shows no response.
- B) Both alpha and gamma are deflected in the same direction, while beta shows no response.
- C) Both alpha and beta are deflected in the same direction, while gamma shows no response.
- D) Alpha and beta are deflected in opposite directions, while gamma shows no response.
- E) Only alpha is deflected, while beta and gamma show no response.

49. The nucleus of an atom contains \_\_\_\_\_.

51. Which atom has the largest number of neutrons?

- A) phosphorous-30
- B) chlorine-37
- C) potassium-39
- D) argon-40
- E) calcium-40

52) Of the following, the smallest and lightest subatomic particle is the \_\_\_\_\_.

- A) neutron
- B) proton
- C) electron
- D) nucleus
- E) alpha particle

53) Which atom has the smallest number of neutrons?

- A) carbon-14
- B) nitrogen-14
- C) oxygen-16
- D) fluorine-19
- E) neon-20

54) Which atom has the largest number of neutrons?

- A) phosphorous-30
- B) chlorine-37
- C) potassium-39
- D) argon-40
- E) calcium-40

55) There are \_\_\_\_\_ electrons, \_\_\_\_\_ protons, and \_\_\_\_\_ neutrons in an atom of  $^{132}_{54}\text{Xe}$ .

56. For each of the following, Give complete chemical symbol, # n, #e- in each

- a. neutral germanium 73
- b. selenium 78 w/ -2 charge
- c. osmium 192 w/ +1 charge

57) An atom of the most common isotope of gold,  $^{197}\text{Au}$ , has \_\_\_\_\_ protons, \_\_\_\_\_ neutrons, and \_\_\_\_\_ electrons.

58) Different isotopes of a particular element contain the same number of \_\_\_\_\_.

59) Different isotopes of a particular element contain different numbers of \_\_\_\_\_.

61. List the 4 tenets of Dalton's Atomic Theory.

62. An ion has 12 protons, 13 neutrons, and 10 electrons. The symbol for the ion is \_\_\_\_\_.

63) Which statement below correctly describes the responses of alpha, beta, and gamma radiation to an electric field?

- A) Both beta and gamma are deflected in the same direction, while alpha shows no response.
- B) Both alpha and gamma are deflected in the same direction, while beta shows no response.
- C) Both alpha and beta are deflected in the same direction, while gamma shows no response.
- D) Alpha and beta are deflected in opposite directions, while gamma shows no response.
- E) Only alpha is deflected, while beta and gamma show no response.

64) Which pair of atoms constitutes a pair of isotopes of the same element?

- A)  $^{14}_6\text{X}$      $^{14}_7\text{X}$     B)  $^{14}_6\text{X}$      $^{12}_6\text{X}$     C)  $^{17}_9\text{X}$      $^{17}_8\text{X}$
- D)  $^{19}_{10}\text{X}$      $^{19}_9\text{X}$     E)  $^{20}_{10}\text{X}$      $^{21}_{11}\text{X}$

65. Name the following atoms, then predict the charge of the most common ion of that species and name said ion.

- a. Cl
- b. Ca
- c. N
- d. Na
- e. Zn

## EM spectrum, Light everywhere

66) Determine which of the following statements are false, and correct them.

- Electromagnetic radiation travels through a vacuum at a constant speed, regardless of wave length.
- Electromagnetic radiation is incapable of passing through water.
- Infrared light has higher frequencies than visible light.
- The glow from a fireplace, the energy within a microwave oven, and a foghorn blast are all forms of electromagnetic radiation.

67) List the following types of electromagnetic radiation in order of increasing wavelength:

- the gamma rays produced by a radioactive nuclide used in medical imaging
- radiation from an FM radio station at 93.1 MHz on the dial
- a radio signal from an AM radio station @ 950 kHz

68) What is the frequency of radiation whose wavelength is 100 nm?

- What is the wavelength of radiation that has a frequency of  $7.6 \times 10^{10} \text{ s}^{-1}$ ?
- Would the radiation in part (a) or part (b) be detected by an X-ray detector?
- What distance does electromagnetic radiation travel in 25.5 fs? (f is a metric prefix (femto) which means  $10^{-15}$ )

69) The wavelength of light that has a frequency of  $1.20 \times 10^{13} \text{ s}^{-1}$  is \_\_\_\_\_ m.

71) The energy of a photon of light is \_\_\_\_\_ proportional to its frequency and \_\_\_\_\_ proportional to its wavelength.

- A) directly, directly    B) inversely, inversely    C) inversely, directly  
D) directly, inversely    E) indirectly, not

72) The frequency of a photon that has an energy of  $3.7 \times 10^{-18} \text{ J}$  is \_\_\_\_\_  $\text{s}^{-1}$ .

73) The energy of a photon that has a wavelength of 12.3 nm is \_\_\_\_\_ J.

74) A mole of yellow photons of wavelength 527 nm has \_\_\_\_\_ kJ of energy.

75) a. Calculate the smallest increment of energy (a quantum) that can be emitted or absorbed at a wavelength of 438 nm.

b. Calculate the energy of a photon of frequency  $6.75 \times 10^{14} \text{ Hz}$ .

c. What wavelength of radiation has photons of energy  $2.87 \times 10^{-18} \text{ J}$ ? In what portion of the electromagnetic spectrum would this radiation be found?

76) An AM radio station broadcasts at 1010 kHz, and its FM partner broadcasts at 98.3 MHz. Calculate and compare the energy of the photons emitted by these two radio stations.

77) A diode laser emits at a wavelength of 987 nm.

(a) In what portion of the electromagnetic spectrum is this radiation found?

(b) All of its output energy is absorbed in a detector that measures a total energy of 0.52 J over a period of 32 s. How many photons per second are being emitted by the laser?

78. Fireworks have different elements being 'burned' in them. Why do different fireworks all have different colors?

## Bohr H Atom

79) Of the following transitions in the Bohr hydrogen atom, the \_\_\_\_\_ transition results in the emission of the highest-energy photon.

- A)  $n = 1 \rightarrow n = 6$     B)  $n = 6 \rightarrow n = 1$     C)  $n = 6 \rightarrow n = 3$     D)  $n = 3 \rightarrow n = 6$     E)  $n = 1 \rightarrow n = 4$

81) The energy (J) required for an electronic transition in a Bohr hydrogen atom from  $n = 2$  to  $n = 3$  is \_\_\_\_\_ J.

81) When the  $e^-$  in a hydrogen atom moves from  $n = 6$  to  $n = 2$ , light with a wavelength of \_\_\_\_\_ nm is emitted.

- 82) Is energy emitted or absorbed when the following electronic transitions occur in hydrogen?  
 (a) from  $n = 4$  to  $n = 2$ , (b) from an orbit of radius 2.12 Å to one of radius 8.46 Å, (c) an electron adds to the  $H^+$  ion and ends up in the  $n = 3$  shell.
- 83) Indicate whether energy is emitted or absorbed when the following electronic transitions occur in hydrogen:  
 (a) From  $n = 2$  to  $n = 6$ , (b) from an orbit of radius 4.76 Å to one of radius 0.529 Å, (c) from the  $n = 6$  to the  $n = 9$  state.
- 84) For each of the following electronic transitions in the hydrogen atom, calculate the energy, frequency, and wavelength of the associated radiation, and determine whether the radiation is emitted or absorbed during the transition: (a) from  $n = 4$  to  $n = 1$ , (b) from  $n = 5$  to  $n = 2$ , (c) from  $n = 3$  to  $n = 6$ . Does any of these transitions emit or absorb visible light?

### Quantum Numbers and Electronic Configuration

- 85) The \_\_\_\_\_ quantum number defines the shape of an orbital.
- 86) There are \_\_\_\_\_ orbitals in the  $n=3$  shell.
- 87) How many p-orbitals are occupied in a Ne atom \_\_\_\_\_?
- 88) The 4d subshell in the ground state of atomic xenon contains \_\_\_\_\_ electrons.
89. Give the numerical values of  $n$  and  $l$  corresponding to each of the following designations: (a)  $3p$ , (b)  $2s$ , (c)  $4f$ , (d)  $5d$ .
- 91) Which of the following represent impossible combinations of  $n$  and  $l$ : (a)  $1p$ , (b)  $4s$ , (c)  $5f$ , (d)  $2d$ ?
- 92) Elements in group \_\_\_\_\_ have a  $np^5$  electron configuration in the outer shell.
- 93) True/false :If a hydrogen atom electron jumps from the  $n=6$  orbit to the  $n=2$  orbit, energy is released.
- 94) Which of the following are permissible sets of quantum numbers for an electron in a hydrogen atom:  
 (a)  $n = 2, l = 1, m_l = 1$ ; (b)  $n = 1, l = 0, m_l = -1$ ; (c)  $n = 4, l = 2, m_l = -2$ ; (d)  $n = 3, l = 3, m_l = 0$ ? For those combinations that are permissible, write the appropriate designation for the subshell to which the orbital belongs (that is,  $1s$ , and so on).
- 95)  $[Ar]4s^2 3d^{10} 4p^3$  is the electron configuration of a(n) \_\_\_\_\_ atom.
- 96) In a ground-state manganese atoms, the \_\_\_\_\_ subshell is partially filled.
- 97) The largest principal quantum number in the ground state electron configuration of cobalt is \_\_\_\_\_.
- 98) The ground-state electron configuration of the element \_\_\_\_\_ is  $[Kr]5s^1 4d^5$ .
- 99) The ground-state electron configuration of \_\_\_\_\_ is  $[Ar]4s^1 3d^5$ .
101. Give electronic configurations for the following species:  
 a. Sulfur in its common oxidation state  
 b. Tungsten +1 ion  
 c. Aluminum in its common oxidation state  
 d. neutral silver  
 e. silver in its common oxidation state
102. The electron configuration of a ground-state Ag atom is \_\_\_\_\_.
103. There are \_\_\_\_\_ unpaired electrons in a ground state phosphorus atom.
104. There are \_\_\_\_\_ unpaired electrons in a ground state fluorine atom.

105. In which set of elements would all members be expected to have very similar chemical properties? **Why?**

A) O, S, Se B) N, O, F C) Na, Mg, K D) S, Se, Si E) Ne, Na, Mg

106. Which element would be expected to have chemical and physical properties closest to those of fluorine? **Why?**

A) S B) Fe C) Ne D) O E) Cl

107. Electrons in the 1s subshell are much closer to the nucleus in Ar than in He due to the larger \_\_\_\_\_ in Ar.

A) nuclear charge B) paramagnetism C) diamagnetism D) Hund's rule E) azimuthal quantum number

108. Which one of the following configurations depicts an excited oxygen atom?

A)  $1s^2 2s^2 2p^2$  B)  $1s^2 2s^2 2p^2 3s^2$  C)  $1s^2 2s^2 2p^1$  D)  $1s^2 2s^2 2p^4$  E)  $[\text{He}] 2s^2 2p^4$

109. Which of the following elements has a ground-state electron configuration different from the predicted one?

A) Cu B) Ca C) Xe D) Cl E) Ti

111. Why do we emphasize the valence electrons in an atom when discussing atomic properties?

112. Write the condensed electron configurations for the following atoms, using the appropriate noble-gas core abbreviations: (a) Cs, (b) Ni, (c) Se, (d) Cd, (e) Pb.

113. Write the condensed electron configurations for the following atoms, and indicate how many unpaired electrons each has: (a) Ga, (b) Ca, (c) V, (d) I, (e) Y, (f) Pt, (g) Lu.

114. Identify the specific element that corresponds to each of the following electron configurations:

(a)  $1s^2 2s^2 2p^6 3s^2$ , (b)  $[\text{Ne}] 3s^2 3p^1$ , (c)  $[\text{Ar}] 4s^1 3d^5$ , (d)  $[\text{Kr}] 5s^2 4d^{10} 5p^4$ .

115. Give 3 species that are isoelectronic with argon.

116. Identify the group of elements that corresponds to each of the following generalized electron configurations:

(a) [noble gas]  $ns^2 np^5$

(b) [noble gas]  $ns^2 (n-1)d^2$

(c) [noble gas]  $ns^2 (n-1)d^{10} np^1$

(d) [noble gas]  $ns^2 (n-2)f^6$

117. What is wrong with the following electron configurations for atoms in their ground states? (a)  $1s^2 2s^2 3s^1$ , (b)

$[\text{Ne}] 2s^2 2p^3$ , (c)  $[\text{Ne}] 3s^2 3d^5$ .

118. The following electron configurations represent excited states. Identify the element, and write its ground-state condensed electron configuration.

(a)  $1s^2 2s^2 3p^2 4p^1$ , (b)  $[\text{Ar}] 3d^{10} 4s^1 4p^4 5s^1$ ,  $[\text{Kr}] 4d^6 5s^2 5p^1$ .

119. Write the electron configurations for the following ions: (a)  $\text{Si}^{2+}$ , (b)  $\text{Bi}^{3+}$ , (c)  $\text{Te}^{2-}$ , (d)  $\text{V}^{3+}$ , (e)  $\text{Hg}^{2+}$ , (f)  $\text{Ni}^{2+}$ .

121. Identify the element whose ions have the following electron configurations: (a) a  $2+$  ion with  $[\text{Ar}] 3d^9$ , (b) a  $1+$  ion with  $[\text{Xe}] 4f^{14} 5d^{10} 6s^2$ . How many unpaired electrons does each ion contain?

### Effective Nuclear Charge/ Atomic Radii

122. True/False: The effective nuclear charge acting on an electron is larger than the actual nuclear charge.

123. (a) What is meant by the term *effective nuclear charge*? (b) How does the effective nuclear charge experienced by the valence electrons of an atom vary going from left to right across a period of the periodic table?

124. Arrange the following atoms in order of increasing effective nuclear charge experienced by the electrons in the  $n = 3$  electron shell: K, Mg, P, Rh, and Ti. Explain the basis for your order.

125. How do the sizes of atoms change as we move (a) from left to right across a row in the periodic table, (b) from top to bottom in a group in a periodic table? (c) Arrange the following atoms in order of increasing atomic radius: F, P, S, As.

126. Using only the periodic table, arrange each set of atoms in order of increasing radius: (a) Ca, Mg, Be; (b) Ga, Br, Ge; (c) Al, Tl, Si.

127. Using only the periodic table, arrange each set of atoms in order of increasing radius: (a) Cs, K, Rb; (b) In, Te, Sn; (c) P, Cl, Sr.

128. The most common sulfur ion has a charge of \_\_\_\_\_. **Why?**

129. Of the following, which gives the correct order for atomic radius for Mg, Na, P, Si and Ar?

- A) Mg > Na > P > Si > Ar    B) Ar > Si > P > Na > Mg    C) Si > P > Ar > Na > Mg  
D) Na > Mg > Si > P > Ar    E) Ar > P > Si > Mg > Na

131. Which one of the following atoms has the largest radius? **Why?**

- A) O    B) F    C) S    D) Cl    E) Ne

132. Of the following species, \_\_\_\_\_ has the largest radius. **Why?**

- A) Rb<sup>+</sup>    B) Sr<sup>2+</sup>    C) Br<sup>-</sup>    D) Kr    E) Ar

133. Listed here are the atomic and ionic (2+) radii (in angstroms) for calcium and zinc:

Ca 1.74	Ca <sup>2+</sup> 0.99
Zn 1.31	Zn <sup>2+</sup> 0.74

a. Explain why the ionic radius in each case is smaller than the atomic radius.

b. Why is the atomic radius of calcium larger than that of zinc?

c. Suggest a reason why the difference in the ionic radii is much less than the difference in the atomic radii.

### Ionization Energy

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

- A) Cl > S > Al > Ar > Si    B) Ar > Cl > S > Si > Al    C) Al > Si > S > Cl > Ar  
D) Cl > S > Al > Si > Ar    E) S > Si > Cl > Al > Ar

135. Which of the following has the largest second ionization energy? **Why?**

- A) Si    B) Mg    C) Al    D) Na    E) P

136. Give the equation corresponding to the second ionization energy of Aluminum.

137. Write equations that show the processes that describe the first, second, and third ionization energies of a boron atom.

138. (a) Why does Li have a larger first ionization energy than Na? (b) The difference between the third and fourth ionization energies of scandium is much larger than the difference between the third and fourth ionization energies of titanium. Why? (c) Why does Li have a much larger second ionization energy than Be?

141. (a) What is the trend in first ionization energies as one proceeds down the group 7A elements? Explain how this trend relates to the variation in atomic radii. (b) What is the trend in first ionization energies as one moves across the fourth period from K to Kr? How does this trend compare with the trend in atomic sizes?

142. Based on their positions in the periodic table, predict which atom of the following pairs will have the larger first ionization energy: (a) Cl, Ar; (b) Be, Ca; (c) K, Co; (d) S, Ge; (e) Sn, Te.

### e- Affinity

143. Give the equation that correctly represents the electron affinity of bromine.

*Consider the following electron configurations to answer the questions that follow:*

- (i)  $1s^2 2s^2 2p^6 3s^1$       (ii)  $1s^2 2s^2 2p^6 3s^2$       (iii)  $1s^2 2s^2 2p^6 3s^2 3p^1$   
(iv)  $1s^2 2s^2 2p^6 3s^2 3p^4$       (v)  $1s^2 2s^2 2p^6 3s^2 3p^5$

144. The electron configuration belonging to the atom with the highest second ionization energy is \_\_\_\_\_.
145. The electron configuration that belongs to the atom with the lowest second ionization energy is \_\_\_\_\_.
146. The electron configuration of the atom with the most negative electron affinity is \_\_\_\_\_.
147. The electron configuration of the atom that is expected to have a positive electron affinity is \_\_\_\_\_.
148. Which of the following traits characterizes the alkali metals?  
A) very high melting point    B) existence as diatomic molecules    C) formation of dianions  
D) the lowest first ionization energies in a period    E) the smallest atomic radius in a period
149. Which of the following statements about the general valence electron configuration of  $ns^2 np^5$  are true?  
(i) Elements with this electron configuration are expected to form -1 anions.  
(ii) Elements with this electron configuration are expected to have large positive electron affinities.  
(iii) Elements with this electron configuration are nonmetals.  
(iv) Elements with this electron configuration form acidic oxides.
151. True/False: Electron affinity measures how easy an atom gains an electron.

**Assorted**

152. Compare the elements sodium and magnesium with respect to the following properties: (a) electron configuration, (b) most common ionic charge, (c) first ionization energy, (d) reactivity toward water, (e) atomic radius. Account for the differences between the two elements.
153. Compare the elements fluorine and chlorine with respect to the following properties: (a) electron configuration, (b) most common ionic charge, (c) first ionization energy, (d) reactivity toward water, (e) electron affinity, (f) atomic radius. Account for the differences between the two elements.
154. Review all the properties and names of the 'atomic body elements'
155. Review properties of periodic table groups as discussed in class.

# The Periodic Table of the Elements

1 <b>H</b> 1.008																	2 <b>He</b> 4.003
3 <b>Li</b> 6.941	4 <b>Be</b> 9.012											5 <b>B</b> 10.81	6 <b>C</b> 12.01	7 <b>N</b> 14.01	8 <b>O</b> 16.00	9 <b>F</b> 19.00	10 <b>Ne</b> 20.18
11 <b>Na</b> 22.99	12 <b>Mg</b> 24.31											13 <b>Al</b> 26.98	14 <b>Si</b> 28.09	15 <b>P</b> 30.97	16 <b>S</b> 32.07	17 <b>Cl</b> 35.45	18 <b>Ar</b> 39.95
19 <b>K</b> 39.10	20 <b>Ca</b> 40.08	21 <b>Sc</b> 44.96	22 <b>Ti</b> 47.87	23 <b>V</b> 50.94	24 <b>Cr</b> 52.00	25 <b>Mn</b> 54.94	26 <b>Fe</b> 55.85	27 <b>Co</b> 58.93	28 <b>Ni</b> 58.69	29 <b>Cu</b> 63.55	30 <b>Zn</b> 65.39	31 <b>Ga</b> 69.72	32 <b>Ge</b> 72.61	33 <b>As</b> 74.92	34 <b>Se</b> 78.96	35 <b>Br</b> 79.90	36 <b>Kr</b> 83.80
37 <b>Rb</b> 85.47	38 <b>Sr</b> 87.62	39 <b>Y</b> 88.91	40 <b>Zr</b> 91.22	41 <b>Nb</b> 92.91	42 <b>Mo</b> 95.94	43 <b>Tc</b> (98)	44 <b>Ru</b> 101.1	45 <b>Rh</b> 102.9	46 <b>Pd</b> 106.4	47 <b>Ag</b> 107.9	48 <b>Cd</b> 112.4	49 <b>In</b> 114.8	50 <b>Sn</b> 118.7	51 <b>Sb</b> 121.8	52 <b>Te</b> 127.6	53 <b>I</b> 126.9	54 <b>Xe</b> 131.3
55 <b>Cs</b> 132.9	56 <b>Ba</b> 137.3	57 <b>La</b> 138.9	72 <b>Hf</b> 178.5	73 <b>Ta</b> 180.9	74 <b>W</b> 183.8	75 <b>Re</b> 186.2	76 <b>Os</b> 190.2	77 <b>Ir</b> 192.2	78 <b>Pt</b> 195.1	79 <b>Au</b> 197.0	80 <b>Hg</b> 200.6	81 <b>Tl</b> 204.4	82 <b>Pb</b> 207.2	83 <b>Bi</b> 209.0	84 <b>Po</b> (209)	85 <b>At</b> (210)	86 <b>Rn</b> (222)
87 <b>Fr</b> (223)	88 <b>Ra</b> (226)	89 <b>Ac</b> (227)	104 <b>Rf</b> (261)	105 <b>Db</b> (262)	106 <b>Sg</b> (266)	107 <b>Bh</b> (264)	108 <b>Hs</b> (269)	109 <b>Mt</b> (268)	110 <b>Uun</b> (271)	111 <b>Uuu</b> (272)	112 <b>Uub</b> (277)						
58 <b>Ce</b> 140.1	59 <b>Pr</b> 140.9	60 <b>Nd</b> 144.2	61 <b>Pm</b> (145)	62 <b>Sm</b> 150.4	63 <b>Eu</b> 152.0	64 <b>Gd</b> 157.3	65 <b>Tb</b> 158.9	66 <b>Dy</b> 162.5	67 <b>Ho</b> 164.9	68 <b>Er</b> 167.3	69 <b>Tm</b> 168.9	70 <b>Yb</b> 173.0	71 <b>Lu</b> 175.0				
90 <b>Th</b> 232.0	91 <b>Pa</b> (231)	92 <b>U</b> 238.0	93 <b>Np</b> (237)	94 <b>Pu</b> (244)	95 <b>Am</b> (243)	96 <b>Cm</b> (247)	97 <b>Bk</b> (247)	98 <b>Cf</b> (251)	99 <b>Es</b> (252)	100 <b>Fm</b> (257)	101 <b>Md</b> (258)	102 <b>No</b> (259)	103 <b>Lr</b> (262)				