

Name Key Date _____ Period _____

Fall Semester Final Review 2016

Conversions

Show ALL work and round answers appropriately.

- 1 How many grams are in 5.49 kg? 5490 g
- 2 Convert .76 miles to cm. Write your answer in scientific notation. (1 mile = 1.61 km) $1.2 \times 10^5\text{ cm}$
- 3 Convert 1.54 kg to mg. Write your answer in scientific notation. $1.54 \times 10^6\text{ mg}$
- 4 Convert 0.013 m^3 to L. (Hint: how many cm^3 are in 1 mL?) 13 L
- 5 How many cubic feet are in 8.9 cubic cm? ($1\text{ ft}^3 = 0.028\text{ m}^3$) $3.1 \times 10^{-4}\text{ ft}^3$
- 6 Convert 1257cL to L. 12.57 L
- 7 How many quarters will you need to have \$25.75? 103.0 quarters
- 8 Convert 55km to mm. Write your answer in scientific notation. $5.5 \times 10^7\text{ mm}$
- 9 Convert 2506g into kg. Write your answer in scientific notation. $2.5 \times 10^3\text{ kg}$
- 10 How many milliseconds are in a leap year? Write your answer in scientific notation. (Hint: A leap year has 366 days.) $3.16 \times 10^{10}\text{ msec}$

11 The speed of light is 3.0×10^8 m/s. Convert this value into miles per hour. Write your answer in scientific notation.

6.7×10^8 miles/hr

12 The lowest possible temperature is 0 Kelvin, also known as absolute zero. Express this temperature in °F. (Hint: this is a two step process)

-459.4°F

13 Calculate each of the following and round your answer appropriately.

a. $6.52 + 57.3 - 86.259$

-22.4

b. 0.00256×0.0810

2.07×10^{-7}

14 What is the difference between mass and weight?

mass = the amount of matter in an object
weight = the force of gravity exerted on an object

Period Table

15 What is an isotope? What are the isotopes of Hydrogen?

isotope: atoms of the same element that have different atomic masses (due to different # of neutrons)

16 Xenon is generally un-reactive. How is its low reactivity related to its position in the periodic table?

It is a noble gas that has enough valence electrons to satisfy the octet rule

Protium (^1_1H)
Deuterium (^2_1H)
Tritium (^3_1H)

17 Name an element that has similar chemical properties to that of Potassium.

Li, Na, Rb, Cs, Fr

18 Name 2 halogens.

F, Cl, Br, I, At

19 I am a good conductor of electricity. I am in group 11 on the periodic table. I have a grayish luster. What am I?

Silver ; Ag

20. Complete the following table:

Hyphen Notation	Symbol Notation	Atomic #	Mass #	# of protons	# of neutrons	# of electrons
Sodium-23	$^{23}_{11}\text{Na}$	11	23	11	12	11
Calcium-40	$^{40}_{20}\text{Ca}$	20	40	20	20	20
Silicon-28	$^{28}_{14}\text{Si}$	14	28	14	14	14
Iron-56	$^{56}_{26}\text{Fe}$	26	56	26	30	26
Barium-138	$^{138}_{56}\text{Ba}$	56	138	56	82	56

21. Complete the following table :

Scientist	Experiment	Contribution
John Dalton		5 Assumptions of Atomic Theory
JJ Thompson	cathode ray tube	Discovered the presence of (-) charged electron (Plum Pudding Model)
Ernest Rutherford	gold foil experiment	Presence of small, dense nucleus with (+) charge
Niels Bohr	H emission spectroscopy	Electrons are confined to quantized energy levels

Moles

22. How many moles of oxygen make up 2,500,000 atoms of oxygen?

$4.2 \times 10^{-18} \text{ mol}$

23. What is the mass, in grams, of 5.0×10^9 atoms of neon?

$1.68 \times 10^{-13} \text{ g}$

24. What mass of silver, Ag, contains the same number of atoms as 10.0 g of Boron, B?

99.8 g Ag

25. How many neutrons are present in 8.75 mol of Uranium-223?

$6.90 \times 10^{26} \text{ neutrons}$

Properties and Changes

For each of the following, choose whether it is a PHYSICAL (P) or CHEMICAL (C) property.

26. P Bromine exists as a liquid at room temperature.

27. C Zinc reacts with hydrochloric acid to produce zinc chloride and hydrogen gas.

28. C Iron will combine chemically with oxygen to produce rust.

29. P Nitrogen and oxygen are ~~clear~~, colorless, odorless gases.

30. P Water has a density that is exactly 1 g/mL.

NO NO WORD!

State whether each of the following changes is PHYSICAL (P) or CHEMICAL (C), and explain why.

31. P An orange liquid mixture of salt crystals dissolved in water is boiling. The water evaporates and leaves behind orange crystal. *change of state (aq) → (s)*
32. C Bread bakes in the oven. *Odor, color change*
33. P Steel is melted and then cooled into new shapes to use as parts for cars. *change of state (l) → (s)*
34. C Water is decomposed into its elements, oxygen and hydrogen, by running an electric current through water. *new products form*
35. C An antacid tablet fizzes and releases carbon dioxide gas when it comes in contact with hydrochloric acid in the stomach. *bubbling*
36. C A bottle of wine left open turns to vinegar. *new products form*
37. P Dry ice "evaporates" without melting. *change in state (s) → (g)*

States of Matter

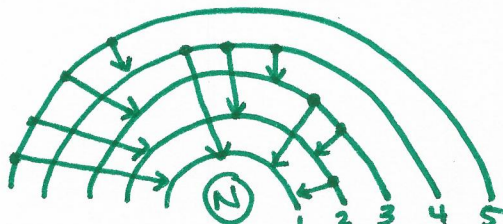
38. Which state of matter is most compressible? Why? *gas, the particles are far apart from one another, so they can be compressed*
39. Which state of matter is present in stars and fluorescent lights?
plasma
40. Consider three 25g samples of water: one is ice, one is liquid, and one exists as vapor.
- In which state of matter will water occupy the most volume? *gas (vapor)*
 - In which state of matter will water occupy the least volume? *liquid*
 - In which state of matter will the strength of the forces between the water molecules be the greatest? *solid (ice)*

Electromagnetic Spectrum

41. What is the frequency of light that has a $\lambda = 9.04 \times 10^{-4}$ cm? 3.32×10^{13} Hz
42. Determine the energy of a photon described in the previous problem. 2.20×10^{-20} J
43. How long will it take a radio wave with frequency of 7.25×10^5 Hz to travel from Mars to Earth, a distance of 8.00×10^7 km? 267 sec

44. Assume that an atom has a total of five possible energy levels and that an electron can "jump" up or down between any of these energy levels. Draw a model of these energy levels and use it to predict the maximum number of spectral lines in the emission spectrum.

10 lines



45. An emitted photon has an energy of 4.9695×10^{-19} J.

a. What is the frequency of this light?

7.5×10^{14} Hz

b. What is its wavelength?

4.0×10^{-7} m

c. What is the color of the emitted light? (Find it on an electromagnetic spectrum)

violet

Electron Configuration

46. What is the value of "x" for an alkali metal with the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^6 4s^x$. What is the identity of this element?

x = 1, potassium (K)

47. Write the noble gas notation for Barium.

$[Xe] 6s^2$

48. Write the electron configuration for Yttrium.

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

49. Write the orbital notation for Silver.

$\uparrow\downarrow | \uparrow\downarrow | \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow | \uparrow\downarrow | \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow | \uparrow\downarrow | \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow | \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow | \uparrow | \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow$

50. How many valence electrons does each of the following families of elements have?

a. Alkaline Earth Metals 2

c. Alkali Metals 1

b. Halogens 7

d. Noble Gases (except He) 8

Periodic Trends

51. Name the alkali metal with the greatest ionization energy. Li

52. Of the elements that have 4 valence electrons, which has the smallest atomic radius? C

53. Which has a larger radius, Al or Al^{3+} ?

54. Name the halogen with the greatest electronegativity. F

55. The electrons available to be gained, lost, or shared in the formation of chemical compounds are called valence electrons.

56. The energy required to remove an electron from an atom is called its ionization energy, and is measured in units of kJ/mol .

57. The measure of the ability of an atom in a chemical compound to attract electrons is called electronegativity.

58. An atom that has a + charge is called a(n) cation while an atom with a - charge is called a(n) anion.

59. One-half the distance between the nuclei of identical atoms that are bonded together is the atomic radius.

True or False - Mixed review

Mark each of the following statements true (T) or false (F). If the statement is false, correct the underlined portion of the statement to make it true.

60. F Energy and wavelength are directly proportional values. indirectly
61. F Hertz is a unit of measurement for wavelength. frequency
62. F Atoms in the ground state emit photons. excited
63. F UV rays travel at a greater speed than infrared waves. same
64. F White is the absence of color. Black
65. T Orange light has a greater frequency than red light.
66. T The d sublevel has 5 orbitals.
67. F Hund's rule states that no two electrons can have the same set of quantum numbers. Pauli Exclusion
68. T Two electrons that occupy the same orbital have opposite spins.
69. F Electrons will fill the 3d orbital before they occupy the 4s orbital. after
70. F It is possible to simultaneously determine both the position and the velocity of an electron. NOT
71. T All atoms of the same element have the same atomic number.
72. T Hydrogen has 3 isotopes.
73. F The electron is the subatomic particle with the greatest mass. neutron
74. T Avogadro's number describes the amount of particles in 1 mole.
75. T Rutherford's gold foil experiment proved the presence of a nucleus.
76. F The atomic mass is the mass of the most common isotope of a particular element.

weighted average of all naturally occurring isotopes

77. Mendeleev created his periodic table by grouping elements with similar _____ together.
- a. Properties
 - b. Atomic mass
 - c. Atomic numbers
 - d. Densities
78. Within the p-block element group, the elements at the top _____ than those at the bottom.
- a. Have a greater atomic mass
 - b. Are more metallic
 - c. Have lower ionization energies
 - d. Have smaller radii
79. Within a period of elements, as the atomic number increases, the atomic radius _____.
- a. Generally increases
 - b. Generally decreases
 - c. Remains constant
 - d. ~~Spiter~~ is a nerd
Nielsen
80. The most characteristic property of the noble gases is that they are _____.
- a. Metallic
 - b. Radioactive
 - c. Largely unreactive
 - d. Unhappy
81. The first ionization energy for an atom is _____ the second ionization energy.
- a. Greater than
 - b. Less than
 - c. Equal to
 - d. I like ice cream
82. The current periodic table arranges elements by increasing _____.
- a. Atomic mass
 - b. Atomic number
 - c. Atomic radius
 - d. Ionization Energy

Compounds

83. The explosive TNT has the molecular formula $C_7H_5(NO_2)_3$.

- a. How many different elements make up this compound? 4
- b. How many oxygen atoms are present in one molecule of TNT? 6
- c. How many atoms total are present in one molecule of TNT? 21

84. Write the names for the following ions

Zn^{+2} Zinc

N^{-3} nitride

Na^{+} sodium

O^{-2} oxide

NO_2^{-} nitrite

Cu^{+1} Copper (I)

Fe^{+3} Iron (III)

SO_4^{-2} sulfate

Nuclear Chemistry

77. Write the nuclear symbol charge for each of the following:

Particle	Symbol	Charge
Alpha Particle	α ; ${}^4_2\text{He}$	+2
Beta Particle	${}^0_{-1}\beta$	-1
Positron	${}^0_{+1}\beta$	+1
Electron	${}^0_{-1}e$	-1

78. In the reaction ${}^9_4\text{Be} + X \rightarrow {}^{12}_6\text{C} + {}^1_0n$, the X represents _____.

- a. an alpha particle
- b. a beta particle
- c. an electron
- d. a positron

79. Control rods in nuclear reactors are commonly made of boron and cadmium because these two elements have the ability to _____.

- a. absorb neutrons
- b. emit neutrons
- c. decrease the speed of neutrons
- d. increase the speed of neutrons

80. Write the nuclear symbol for a neon isotope that has 12 neutrons. ${}^{22}_{10}\text{Ne}$ or Neon-22

81. Which type of particle has the most penetrating ability: alpha, beta, or gamma particles?

82. Explain how nuclear fusion is one of our sources of energy on Earth. How is nuclear fission a source of energy? The energy from the sun is a product of a nuclear fusion reaction. Nuclear fission is the type of reaction that generates energy from a nuclear power plant.

83. How many neutrons are contained in each of the following isotopes?

Isotope	# of neutrons
Carbon - 14	8
Tin-134	84
Hydrogen - 3	2

84. Complete the following nuclear equations by filling the blank with the missing particle. Then classify each type of nuclear reaction.

Equation	Type of Reaction
a. ${}_{86}\text{Rn}^{210} \rightarrow {}_2\text{He}^4 + \underline{{}_{84}\text{Po}^{206}}$	<u>alpha decay (emission)</u>
b. ${}_{53}\text{I}^{131} \rightarrow {}_{54}\text{Xe}^{131} + \underline{{}_{-1}\beta^0}$	<u>beta decay (emission)</u>
c. ${}_{57}\text{La}^{137} + {}_{-1}\text{e}^0 \rightarrow \underline{{}_{56}\text{Ba}^{137}}$	<u>electron capture</u>
d. ${}_{19}\text{K}^{38} \rightarrow {}_{18}\text{Ar}^{38} + \underline{{}_{+1}\beta^0}$	<u>positron emission</u>

85. Which of the following is the most stable isotope Carbon-12, Carbon-13, or Carbon-14? Explain why.

$6p^+ : 6n^0 \rightarrow$ most stable when p^+ and n^0 are in a 1:1 ratio

86. Silicon-31 has a half-life of approximately 2.5 hours. If we begin with a sample containing 1000 mg of Silicon-31, what is the approximate amount remaining after 10 hours?

62.5 mg

87. Technetium-99 is used as a radiographic agent in bone scans. A patient must wait until 15/16 of the radioactive isotope decays before he/she is allowed to leave the doctor's office. If ${}_{43}\text{Tc}^{99}$ has a half-life of 6.0 hours, how many days must a patient wait before leaving the doctor's office after a bone scan?

1 day

88. You are an endocrinologist (a doctor that studies human hormones), and a patient comes into your office who is overweight and lethargic. You predict that an underactive thyroid gland is the source of the problem. You decide to use a radioactive isotope to help determine whether your prediction is correct. Which radioactive element should you choose to help you diagnose the problem and why?

Iodine. Iodine is utilized by the thyroid gland to produce thyroid hormone.