**Study Guide: Unit 1; Matter, Measurements, and Problem Solving**

Vocabulary and Relevant Equations

Atom - Basic unit of matter, consists of protons, neutrons, and electrons

Molecule - A unit of matter consisting of covalently bonded atoms

Solid - The state of matter in which particles are in a fixed and definite shape and volume

Liquid - The state of matter in which particles are in a fixed volume and indefinite shape

Gas - The state of matter in which particles are in an indefinite shape and volume

Plasma - The state of matter in which particles have so much energy that they become ions

Standard Laboratory equipment - beaker, Erlenmeyer Flask, graduated cylinder, etc.

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Liter - standard unit of volume (L)

Gram - standard unit of mass (g)

Joule - standard unit of energy (J)

Mole - standard unit of chemical processes (mol)

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Terra - *n* x 1012

Giga - *n* x 109

Mega - *n* x 106

Kilo - *n* x 103

Centi - *n* x 10-2

Milli - *n* x 10-3

Nano - *n* x 10-9

Pico - *n* x 10-12

Femto- *n* x 10-15

Atto- *n* x 10-18

1 mole of particles = 6.02 x 1023 particles

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Multiple Choice (5 questions)

1. For which of the following are the intermolecular forces greatest:
   1. H2O(s)
   2. H2O(**l** )
   3. H2O(g)
2. A 20.0mL sample of H2SO4 and a 0.535L sample of H2O are combined. Assuming that there is no loss of volume, what is the final volume. Round your answer to the correct number of significant figures.
   1. 5.0 L
   2. 5.55 x 10-1 L
   3. 20.5 mL
   4. 0.5 L
3. Identify the respective transitions in correct order: Liquid->Gas, Solid->Gas, Gas->Liquid
   1. Deposition, Freezing, Melting
   2. Vaporization, Sublimation, Melting
   3. Vaporization, Sublimation, Condensation
   4. Vaporization, Deposition, Condensation
4. A student uses needs to transfer 10.0 mL of a 0.1M solution into a 50 mL beaker. Which article of glassware would be best for this transfer?
   1. A 20 mL beaker
   2. A 20 mL graduated cylinder
   3. A 100 mL volumetric flask
   4. A 1 mL graduated pipette
5. Which state of matter is the substance below currently in?



* 1. Liquid
  2. Plasma
  3. Solid
  4. Gas

Free Response

\*\*Report all answers to the correct number of sigfigs\*\*

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1. You have 6.66x1024 atoms of solid boron in a container
   1. Calculate the number of grams of boron present. Report the answer in correct scientific notation

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* 1. The boron is heated so that it is in the liquid phase when heating is done
     1. Draw particle view pictures of the boron as a solid and as a liquid; include at least 10 particles of boron in each picture and indicate which picture is which state of matter





* + 1. Describe the movement of particles in each picture

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* 1. Inside the container, the Boron occupies a volume of 0.000001783 ML
     1. What is the Boron’s volume in kL and L? Report all answers in correct scientific notation.

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* + 1. Calculate the density of Boron

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* 1. The actual density of solid Boron is 2460 kg/m3 at 298 K
     1. Calculate the percent difference between the actual density and the experimental density

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* + 1. If there is a significant percent difference, provide an explanation to why results differ. If there is no significant percent difference, write “no significant difference”

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1. A solution of exactly 105.37 mL HCl needs to be created
   1. What type of glassware should be used from the following list to measure 105.37 mL of water? Why?
      1. 100 mL Graduated Cylinder
      2. 150 mL Graduated Cylinder
      3. P-1000 Micropipette
      4. 150 mL Volumetric Flask
      5. 150 mL Volumetric Pipet

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* 1. A student creating the HCl solution measures 50.00 mL of 18M HCl and puts it in an Erlenmeyer Flask. The student then adds 55.37 mL of water to the flask. The student’s lab partner then decides that it would be fun to get a high percent error and adds 70 mL of water and 20 mL of 18M HCl to the flask.
     1. What procedural error did the student perform in making the original solution

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* + 1. Is the final solution more or less concentrated than the original solution? Show your work.

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KEY

MC:

1- A

2- B

3- C

4- B

5- C

to FRQ

\*\* Points forfeited for sigfig errors\*\*

1)

a) 1.20x102 grams of Boron (+1)

b) i) 



For Solid Phase, there must be particles rigidly next to each other. For liquid phase, there must be particles close together, but without any structure(+1 solid phase) (+1 liquid phase)

ii)Solid Boron vibrates (+1), Liquid Boron particles flow over each other (+1)

c) i) 1.783x100 L, 1.783x10-3 kL (+1 total for both calculations)

ii) 67.1 g/L (+1)

d) i)Converted either density so that units are the same in both

Percent diff = |Actual-Exp|/Actual \*100 (+1 for formula and unit consistency)

Percent diff = 97.27% (+1)

ii) Liquids take up more volume than solids, therefore, the liquid boron should have a lower density than the solid boron (+1)

2) a) 150 mL Graduated Cylinder because it is most accurate and can measure efficiently (+1)

b) i) They added water to acid, not acid to water (+1)

ii) Correct Calculations documenting the Final Solution as having more [HCl] than original solution. There will be more than one correct methodology to show this. (+1)

Stating that the final HCl solution is more concentrated than the original (+1)