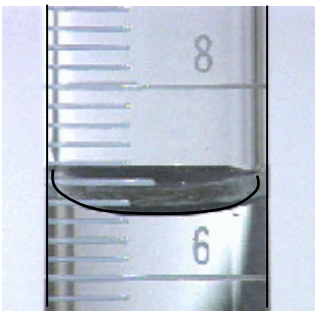
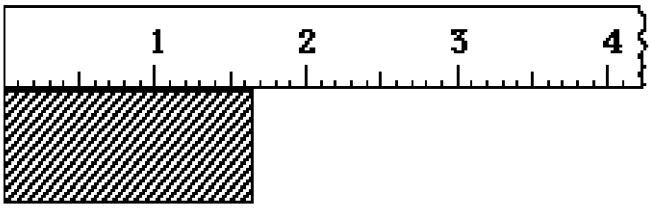
Chem-is-try 1st Semester Study Guide 2016

I. Measurement and Matter

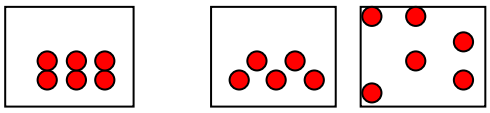


1. Measure the liquid shown to the appropriate (significant) level. → 6.60 mL
2. Name the piece of equipment shown→ graduated cylinder
3. What is the unit for measuring a liquid (volume) and a solid (mass)?
   Volume = liter, mass = gram

4. What is the measurement to the right?
   1.65 cm



5. Calculate the volume of a container that is 6.5 cm x 8 cm x 5 cm. 260cm^3
6. Convert the following metric units using proportions (or ratios):
   (a) 0.23 mL = .00023 L (b) 7 kg = 7000 g
   (c) 9.5 cm = .095 m (d) 1.4 cm^3 = 1.4 mL
7. What quantity is represented by the following:
   (a) kilo = 1000 (b) centi = 100 (c) milli = 1000
8. Draw a particle diagram of each state of matter (solid, liquid, gas).



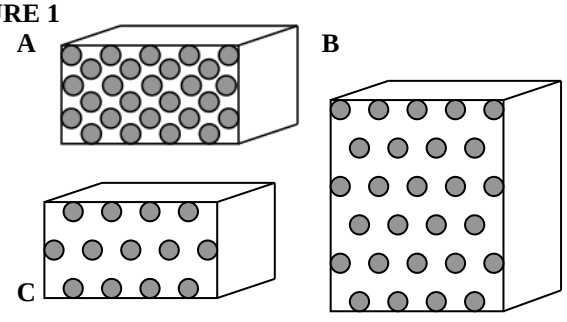
9. Describe the "law of conservation of matter".
   Matter cannot be created or destroyed, it must always be conserved.
10. If a chemical reaction occurs between 4.1 g copper and 5.2 g oxygen, how much Copper (I) oxide would be formed (assuming all reactants are completely used up)?
    9.3g
11. Define density.
    The mass of a substance per unit of volume.

Use the diagram and description below to answer questions 12-15. (Assume mass is represented by the grey dots)

Fill in the blanks using the following key:
a) = "greater than" (>) b) = "less than" (<) c) = "equal to" (=)

12. Volume A __b____ Volume B
13. Mass A __c____ Mass B
14. Density A __a____ Density B
15. Density B ___c___ Density C (technically there should be one more dot in C)

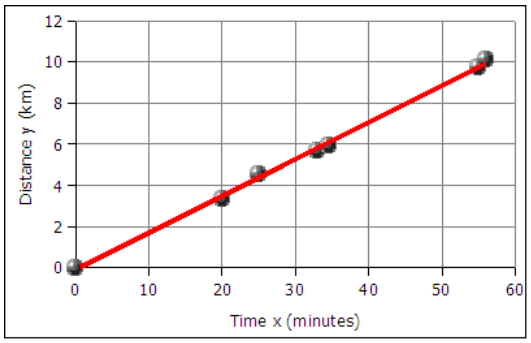
FIGURE 1



16. Ethanol has a density of 0.789 g/cm^3.
    a. What is the mass of 225 cm^3 of ethanol?
    m = 177.53g
    b. What is the volume of 75.0 g of ethanol?
    v = 95.06 cm^3

17. You have a 5.78 g sample of an unknown metal. You fill a graduated cylinder to 6.78 mL of water. After you took your initial reading from the graduated cylinder you submerge your metal sample and the volume rises to 8.92 mL. Calculate the density of the unknown metal.
    d = 2.70 g/mL

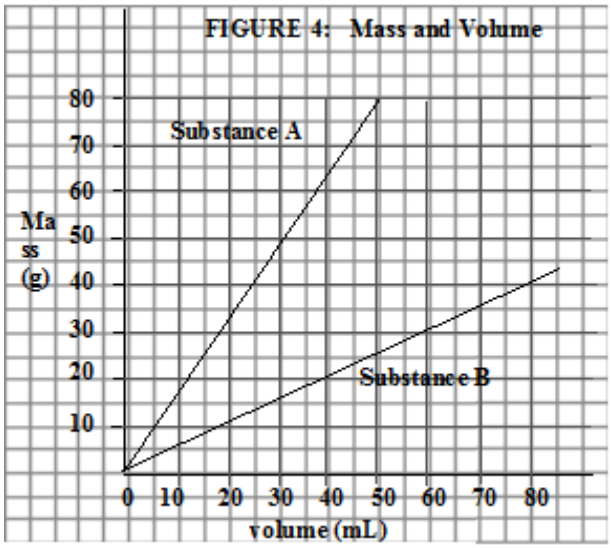
18. Use the graph on the right for the following:



    a. Calculate the slope of the line (be sure to include units):
    (10-6)/(55-35) = .2 km/min

    b. Write a "for every" statement describing the meaning of the slope.
    For every .2 km travelled it will take 1 minute

19. Use the graph on the right to compare the density of substances.

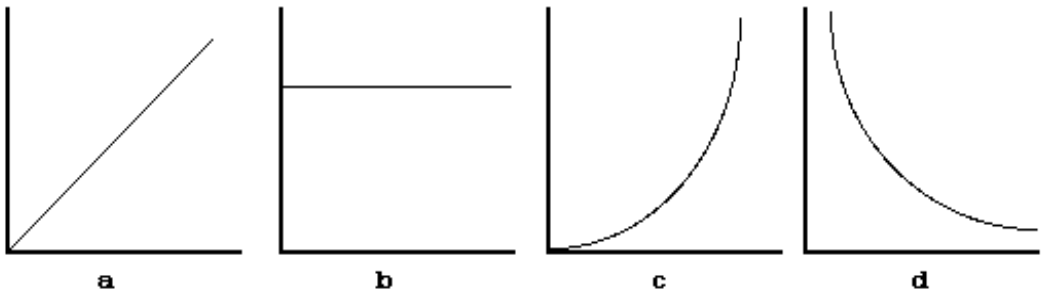


    a. Which substance has the greatest density?
    Substance A

    b. If there is 50 grams of each substance, which substance would have the greatest volume?
    Substance B

II. Behavior of Gases

Demonstrate knowledge of the relationships that exist among the pressure, volume, temperature and number of molecules of a gas.



20. a) Which graph describes the relationship between gas pressure and volume? Is this an inverse or direct relationship? Graph D, inverse
    b) Which graph describes the relationship between gas pressure and temperature? Is this an inverse or direct relationship? Graph A, direct

21. Explain what causes pressure in a container. Collisions of the particles with the sides of the container.

22. a) At the big track meet you bring balloons to give to your friend. A large storm comes through and the temperature drops. Draw a particle picture of the balloon before and after the storm.
b) Explain what happens to the pressure inside the balloons as the temperature drops.
As the temperature drops, the particles slow down and therefore collide less with the sides of the container so the pressure inside the balloon drops.

23. Explain why it would be very dangerous to put a can of hairspray in a hot oven.
The particles inside the can would start to move much faster, colliding more with the sides of the can, creating more pressure. If the can cannot withstand the increased pressure, it will explode.

24. What happens to the volume of a latex balloon when it increases to high altitudes (assuming temperature is somewhat constant)?
As the outside air pressure pushing on the balloon decreases, the volume of the balloon will expand.

25. Draw the before and after pictures for a closed, fixed-volume container of gas that was originally at 1.0 atm and 35 °C and at some later time has a temperature of 100 °C.

26. A sample of gas occupies a volume of 3.0 L at 700 mmHg, what would happen to the volume at 375mmHg?
The volume increases to almost double.

27. Due to the friction between a tire and the road surface, the temperature of the air inside a tire increases as one drives. If the tire pressure is 26 psi when the car is in the driveway at 25˚C, what would happen to the temperature of the air inside the tire when the pressure increases to 29 psi? Assume tire volume is constant.
Temperature will increase

III. Nuclear Chemistry

28. Describe the 3 types of radiation commonly emitted from a nucleus.
Alpha, beta, gamma

29. Describe the strength of each of the 3 types of radiation, and how they can be stopped.
Alpha, largest radiation, weakest strength, can be stopped by skin and paper.
Beta, extremely small particle, medium strength, can be stopped by foil, bone.
Gamma, not a particle, high level radiation, can be stopped by concrete or steel.

30. What happens to the mass number of an atom that undergoes beta decay? What happens to the atomic number?
Mass number does not change. Atomic number increases by one.

31. Write a nuclear reaction for the alpha decay of francium-208
$^{208}_{87}Fr \rightarrow {}^{4}_{2}He + {}^{204}_{85}At$

32. Write a nuclear reaction for beta emission by argon-37
$^{37}_{18}Ar \rightarrow {}^{0}_{-1}e + {}^{37}_{19}K$

33. Complete the equations for these reactions:

a. $^{6}_{3}Li + {}^{1}_{0}n \rightarrow {}^{4}_{2}He + {}^{3}_{1}H$

b. $^{27}_{13}Al + {}^{4}_{2}He \rightarrow {}^{30}_{15}P + {}^{1}_{0}n$

c. $^{235}_{92}U \rightarrow {}^{90}_{38}Sr + {}^{144}_{58}Ce + {}^{1}_{0}n + 4\,{}^{0}_{-1}e$

34. Polonium-214 has a relatively short half-life of 164 seconds. How many seconds would it take for 8.0 g for this isotope to decay to 0.25g?

8 ÷ 2 = 4 4 ÷2 = 2 2÷2 = 1 1÷2 = .5 .5 ÷ 2 = .25g **5 ½ lives**

(5 ½ lives x 164 seconds) = 820 seconds

35. In 5.49 seconds, 1.20 g of argon-35 decay to leave only 0.15 g. What is the half-life of argon 35?

1.2÷2 = .6 .6÷2 = .3 .3÷2 = .15g 3 ½ lives

5.49 sec/3 ½ lives = 1.83 seconds

36. Describe the difference between fission and fusion reactions.

Fission is the splitting of a large unstable nucleus into two or more smaller nuclei, which releases massive amounts of energy.

Fusion is the combining of two smaller nuclei to form a larger nucleus. Releases more energy than fission.

37. List some beneficial applications of radiation.

X-rays, cancer treatment, energy (nuclear power), medical diagnostic tests.

IV. Atomic Theory and the Periodic Table

38. What are rows on the periodic table called? What about columns?

Rows = periods

Columns = groups or families

39. What do groups on the periodic table have in common?

Same number of valence electrons. They will share chemical properties and will bond in similar manners.

40. How many valence electrons do the following elements have?

a. Mg = 2
b. I = 7
c. O = 6
d. Ne = 8

41. What is group 8A on the periodic table called? What is unique about this group of elements?

Noble gases. They have a full stable octet and do not react or bond easily.

42. Draw an atom as it would look according to the current model. Label nucleus, and identify where the protons, neutron and electrons are located.

Nucleus = small and in the middle. Contains the protons and the neutrons.

Electrons = located in “cloud” regions outside the nucleus.

In between the nucleus and electrons is empty space.

43. Summarize the main ideas from the sticky tape lab.

Matter is made up of positive and negative particles.

Only the negative particles are able to move.

The negative particles are electrons, and the positive charge is in the core of the atom.

44. Review the six scientists and their experiments and models.

Dalton, Thomson, Rutherford, Bohr, Schrodinger

Mendeleev

45. Review how neutral atoms form ions. (Periodic Table Activity)
If electrons are lost – form a cation (positive ion)
If electrons are gained – form an anion (negative ion)

V. Naming and Bonding

46. How does a Sulfur atom (S) become a Sulfur ion (S^{-2})?
Gains 2 electrons

47. Which ions are formed from the following elements? K, Mg, N, O and Br
K^+, Mg^{2+}, N^{3-}, O^{2-}, Br^-

48. Give 3 common properties of ionic compounds.
High melting and boiling points
Conduct when melted or dissolved
Crystal structures
Brittle

49. What type of bonds share electrons between atoms?
Covalent

50. Describe what type of elements form covalent bonds, and give examples of these.
Two nonmetals. H_2O, CO_2, NO_2

51. What are the proper names for the following compounds and indicate whether ionic or covalent.

a.	K_2S	ionic	potassium sulfide
b.	CaO	ionic	calcium oxide
c.	Fe_3N_2	ionic	iron(II) nitride
d.	CF_4	covalent	carbon tetrafluoride

52. What are the proper chemical formulas for the following compounds?

a.	Aluminum Sulfate	$Al_2(SO_4)_3$
b.	Carbon Dioxide	CO_2
c.	Beryllium Nitrate	$Be(NO_3)_2$
d.	Tin (IV) Bromide	$SnBr_4$

53. What does a roman numeral indicate in an ionic compound?
The charge on the cation (metal)

54. Write the formula or name the following:
(a) Iron (III) chloride ___$FeCl_3$_____
(b) Sodium sulfate_____Na_2SO_4_____
(c) Barium hydroxide___$Ba(OH)_2$_____
(d) Cobalt (II) carbonate__$CoCO_3$_____
(e) LiCl _____lithium chloride_____
(f) Al_2O_3____aluminum oxide____
(g) NaF ____sodium fluoride_____
(h) Aluminum chromate__$Al_2(CrO_4)_3$__

55. Name the following: (a) C_3Cl_5 – tricarbon pentachloride (b) N_6O_4 – hexanitrogen tetroxide (c) Se_9O_8 - nonaselenium octoxide (d) NF_2 - nitrogen difluoride (e) C_2O – dicarbon monoxide

56. Draw a Lewis dot diagram for sodium, and chlorine.
Sodium – one dot
Chlorine – seven dots

57. (a) $CaCl_2$ ***Stronger forces between + and – charges in ionic compounds
(b) $CaCl_2$