AP Chemistry Intro & Reference Packet 2020-2021

Mrs. Cohen, WPHS *Student Name:* _____

This packet is both an introduction to and review prior to your AP course. The material in this packet will be necessary for you to succeed in your course. A pretest will be given on the first day of class covering the topics in this packet; This pretest will *not* be reflected on the marking period grade, however, it should provide a sense of the student's preparedness for the course.

If you have any questions, please email me: lynne.cohen@ocps.net

We need to use our class time effectively so the goal of this summer packet is that you will have reviewed much of the material from your first chemistry class. We will not just review material from before. **Please expect take-home work** including over academic year breaks (Thanksgiving, Winter, and Spring) to cover and review material without wasting class time.

What should I do with this packet?

- Print and keep a copy of it with you in your first month of AP Chem. Make flashcards for anything you need to memorize.
- Use the questions to review basic content covered in Honors Chemistry, which you should already know, but may need to refresh yourself with.
- **This packet is NOT due. It will NOT be collected. It is solely for your own practice, review, and reference.**

Welcome to AP chemistry!

The AP curriculum includes all topics and labs needed to complete before the **Chemistry AP test on Friday, May 7, 2021**. Please add this date to your calendar now! The AP Chemistry curriculum is purposefully challenging and builds upon the assumption that you have prior knowledge of chemistry through taking an introductory high-school level course (Regular or, preferably, Honors). If you have not taken such a course, I strongly recommend you adjust your schedule to take that PRIOR to this course.

Many of you will find this class to be one of the more difficult ones on your schedule. There is a lot to cover and while we can do it we will all need to work very hard. You should expect this class to be significantly more difficult than your first chemistry class. This means that we cannot slow down if you don't understand a topic. You need to make sure that you are staying up with

all assignments, and coming in if you need extra help. In the first week of school, I will post my availability for extra help and tutoring. However, you must be able to study on your own, come to help sessions prepared with questions, and to use independent and online resources to help support your learning without a teacher present. If you can do that, and you're willing to work hard, you're going to do great.

Part 1: Why are you taking AP Chemistry?

A hallmark of AP chemistry is the opportunity to perform experiments. You will have plenty of hands-on experience with chemicals, glassware, and instruments which allow you to experience the theoretical concepts of the discipline. Most students find that being in the lab and "doing" things is the most exciting part of the course. However, this can also lead to some confusion. Labs are done on the "macroscopic" scale, the scale of every-day life. However, much of what we explore exists on the "microscopic" (or, more accurately, nanoscopic) scale, the scale we cannot see with our eyes--the world of atoms. So one of the challenges of chemistry is explaining phenomena you can *see* through the interactions of atoms that you *cannot see*.

That said, one stereotype of chemists is that they lead uninteresting lives hidden in a laboratory. In reality, chemistry can lead to very interesting and exciting careers in research, medicine, engineering, law, etc. Here are a few examples of famous chemists who do not fit the stereotype:

- Chaim Wieizmann – First President of Israel
- Knute Rockne – legendary football coach of Notre Dame
- Mario Molina – co-discovered that fluorocarbons could destroy the earth's ozone layer
- Marye Anne Fox – former chancellor of UCSD
- Samuel Massie Jr. - the first African-American professor at the U.S. Naval Academy
- Linus Pauling – winner of the Nobel Prize in both Chemistry AND Peace.
- *Dream about the day when your name might be added to this kind of list!*

Why are *you* taking AP Chemistry? What are you hoping to get out of it? What are you willing to put into it? How will taking this class help you achieve your goals?

This course is fast-paced. It is natural to find yourself feeling overwhelmed at some point or another. What will you do when *you* start feeling overwhelmed in this course?

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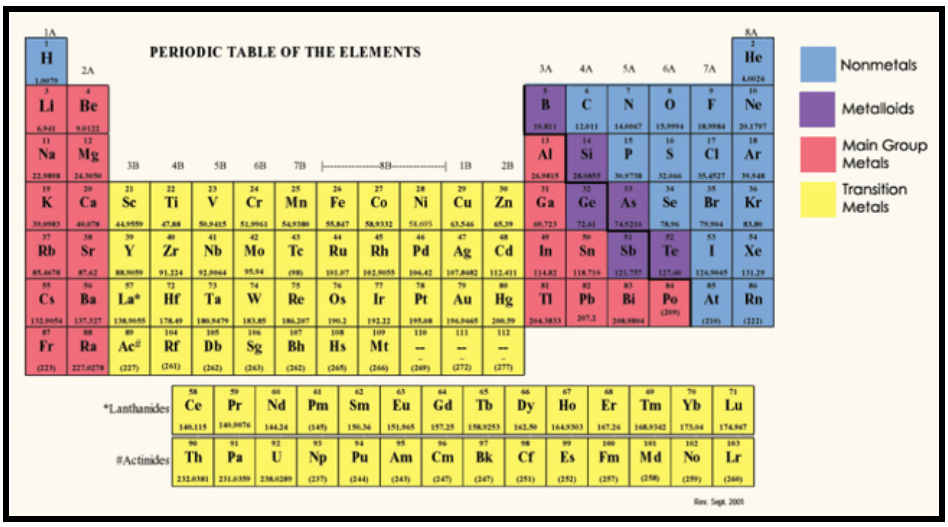
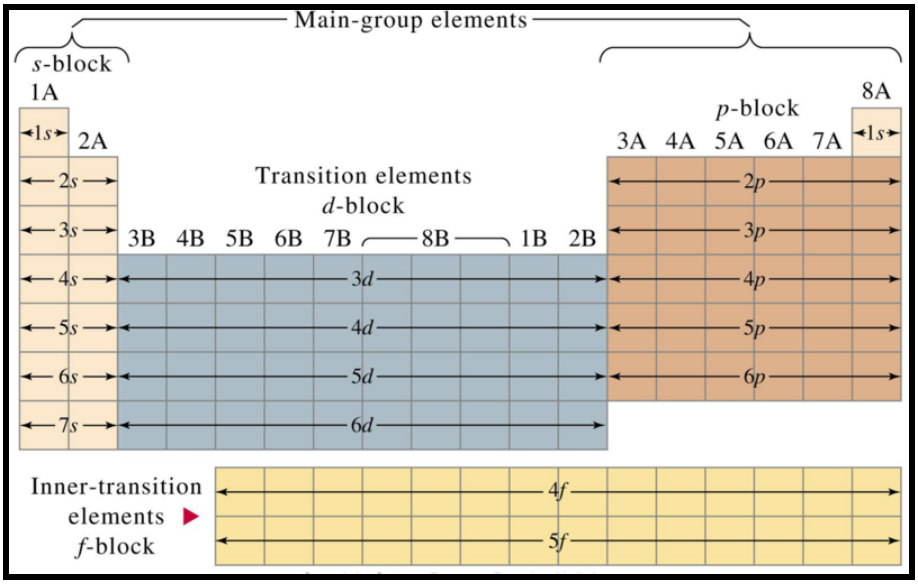
Part 2: Memorize Ion Charges & Naming Conventions

Quick Periodic Table Refresher





- "**Periods**" are Rows. "**Groups**" are columns.
- The **"block" (s, p, d or f)** represents the orbital shape of the *last added* electron.
- The "**Main groups**" are the s & p blocks.
- The "**Transition metals**" are in d block, which contain the majority of common "hard" metals.

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- The "**Inner Transition**" metals are in the f block (which is usually removed to the bottom of the table in order to conserve horizontal space). Several of these are radioactive.
- **Families** are sets of elements, often in a single column/group, that demonstrate similar properties and reactions. Note: There was an old style of labeling the groups (Main groups were 1A, 2A, then 3A-8A after the transition metals), but the new style of labeling groups is simply 1-18. Below are the most common "Families" of the periodic table:
  - **Alkali Metals**: Group 1 *(labeled 1A in the old style)*
  - **Alkaline Earth Metals**: Group 2 *(2A in the old style)*
  - **Transition Metals**: Groups 3-12 *(3B-2B in the old style)*
  - **Not in Families**: in Groups 13-16 *(3A-6A in the old style)* are **not** in families because there is much variation in their columns due to the metalloids.
  - **Halogens:** Group 17 *(7A in the old style)*
  - **Noble Gases:** Group 18 *(8A in the old style)*

Main Group Ions

Elements on the far left of the periodic table always make positive ions, while on the far right they are always negative. Towards the center, however, some elements can make differently charged ions or can go either positive or negative depending on surrounding elements.

All-Positive Groups		**Groups with Both**			**All-Negative Groups**	
+1	**+2**	**+3**	**+4 / -4**	**+5 / -3**	**-2**	**-1**
Group 1 (1A) **	**Group 2 (2A)**	**Group 13 (3A)**	**Group 14 (4A)**	**Group 15 (5A)**	**Group 16 (6A)**	**Group 17 (7A)**
Alkali Metals	**Alkaline Earth**	**Boron Group**	**Carbon Group**	**Nitrogen Group**	**Oxygen Group**	**Halogens**
Lithium **Li^{+1}** Sodium **Na^{+1}** Potassium **K^{+1}** Rubidium **Rb^{+1}** Cesium **Cs^{+1}** Francium **Fr^{+1}**	Beryllium **Be^{+2}** Magnesium **Mg^{+2}** Calcium **Ca^{+2}** Strontium **Sr^{+2}** Barium **Ba^{+2}** Radium **Ra^{+2}**	*NEGATIVE* Boride **B^{-3}** *POSITIVE* Boron **B^{+3}** Aluminum **Al^{+3}** Gallium **Ga^{+3}**	*NEGATIVE* Carbide **C^{-4}** *POSITIVE* Carbon **C^{+4}** Silicon(IV) **Si^{+4}** Germanium(IV) **Ge^{+4}**	*NEGATIVE* Nitride **N^{-3}** Phosphide **P^{-3}** *POSITIVE* Bismuth(V) **Bi^{+5}**	Oxide **O^{-2}** Sulfide **S^{-2}** Selenide **Se^{-2}**	Fluoride **F^{-1}** Chloride **Cl^{-1}** Bromide **Br^{-1}** Iodide **I^{-1}**

** **Hydrogen (H) in Group 1 is an exception to the rule. It can be +1 or -1.**

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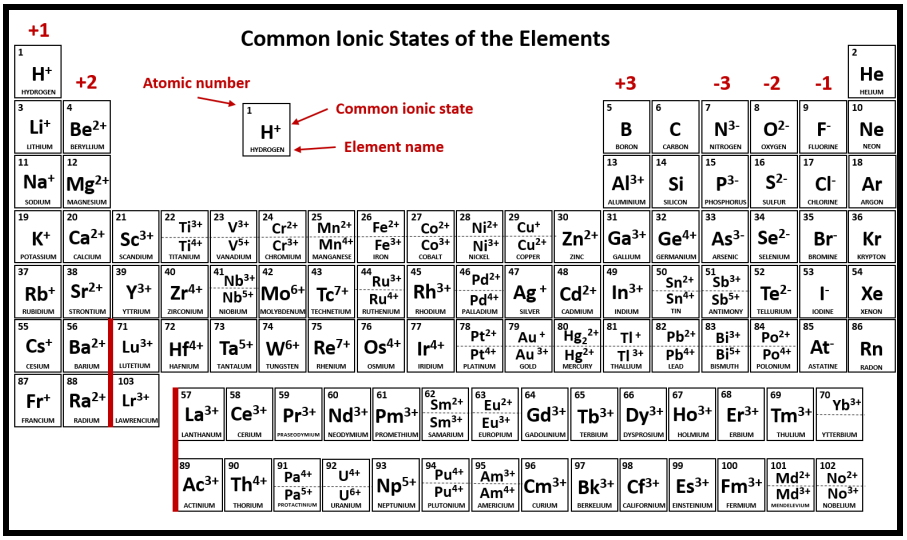
Hydrogen

- **H, Hydrogen: +1 or -1**
  - *Hydrogen is the first element on the periodic table, and the only nonmetal on the left side of the periodic table. It is the most basic and most abundant element in the universe. It can have a charge +1 or -1, though it is more often positive.*

Transition Metal Ions

Transition metals (all in the "d" block and, arguably, some of the metals in the lower left corner of the "p" block) are metals that all make only positive ions, but may form different charges depending on the circumstance. Roman numerals after the name indicate the charge.

- Fe, Iron (II) or (III): +2 or +3
- Cu, Copper (I) or (II): +1 or +2
- Hg, Mercury (I) or (II): +1 or +2
- Sn, Tin (II) or (IV): +2 or +4
- Pb, Lead (II) or (IV): +2 or +4
- Co, Cobalt (II) or (IV): +2 or +4
- Mn, Manganese (II) or (IV): +2 or +4
- Cr, Chromium (II) or (III): +2 or +3
- NO ROMAN NUMERALS:
  - Ag, Silver +1
  - Zn, Zinc +2
  - Cd, Cadmium +2
  - Ni, Nickel +2



https://wou.edu/chemistry/files/2017/04/Common-ionic-states-of-the-elements.png

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Polyatomic Ions

Polyatomic ions are made of several atoms covalently bonded together that then act as a single, unbreakable unit. Their names, formulas and charges are memorized. Most of the work on memorization occurs with these ions. **Helpful Tip:** Learn the hypochlorite -> chlorite -> chlorate -> perchlorate series and that will help you untangle some of the naming.

1. The prefix **"hypo-"** means "under" or "too little" (think "hypodermic", "hypothermic" or "hypoglycemia"). a. *Hypochlorite is "under" chlorite, meaning it has the least oxygen.* 2. The suffix **"-ite"** means it has an oxygen, but not too much. a. ("I just took a little *bite*...") 3. The suffix **"-ate"** means it has more oxygen than ite. a. ("I *ate* the whole thing!...") 4. The prefix **"per-"** is derived from "hyper", which means "too much". So perchlorate *(hyperchlorate) has one more oxygen than "ate".*	**ClO^{-1}** **ClO_2^{-1}** **ClO_3^{-1}** **ClO_4^{-1}**

Memorize the following polyatomic ions. Suggestion: Make flash cards with the 'name' on one side & the 'ion' on the other side (Do not forget the charge!)

+1 Charges:

- Ammonium **NH_4^{+1}**
- Hydronium **H_3O^{+1}**

-1 Charges:

- Acetate **CH_3COO^{-1}** *(or $C_2H_3O_2^{-1}$)*
- Azide **N_3^{-1}**
- Bromate **$BrO3^{-1}$**
- Cyanide **CN^{-1}**
- Hydroxide **OH^{-1}**
- Nitrate **NO_3^{-1}**
- Nitrite **NO_2^{-1}**
- Perchlorate **ClO_4^{-1}**
- Chlorate **ClO_3^{-1}**
- Chlorite **ClO_2^{-1}**
- Hypochlorite **ClO^{-1}**
- Iodate **IO_3^{-1}**
- Permanganate **MnO_4^{-1}**
- Thiocyanate **SCN^{-1}**
- Dihydrogen phosphate **$H_2PO_4^{-1}$**
- Bicarbonate/Hydrogen carbonate **HCO_3^{-1}**
- Bisulfate / Hydrogen sulfate **HSO_4^{-1}**

-2 Charges:

- Carbonate **CO_3^{-2}**
- Chromate **CrO_4^{-2}**
- Dichromate **$Cr_2O_7^{-2}$**
- Hydrogen phosphate **HPO_4^{-2}**
- Sulfate **SO_4^{-2}**
- Sulfite **SO_3^{-2}**
- Thiosulfate **$S_2O_3^{-2}$**
- Oxalate **$C_2O_4^{-2}$**
- Silicate **SiO_3^{-2}**
- Tetraborate **$B_4O_7^{-2}$**

-3 Charges:

- Phosphate **PO_4^{-3}**
- Phosphite **PO_3^{-3}**
- Arsenate **AsO_4^{-3}**
- Borate **BO_3^{-3}**

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Common Binary Compounds

These covalent compounds are extremely common in AP questions. Some use conventional naming prefixes (like carbon dioxide) while others have what we call "common names" (like water or ammonia) and others use names from older naming systems (like hydrazine), which carry over simply because their use was so widespread. Please memorize these as well:

- Water: **H_2O**
- Carbon Dioxide: **CO_2**
- Carbon Monoxide: **CO**
- Hydrogen peroxide: **H_2O_2**
- Ammonia: **NH_3**
- Hydrazine: **N_2H_4**
- Acetylene: **C_2H_2**
- Phosphine: **PH_3**
- Arsine: **AsH_3**
- Nitric Oxide: **NO**
- Nitrous Oxide: **N_2O**
- Methane: **CH**

Greek Prefixes for Naming Molecular (Covalent) Compounds

1 = mono-	2 = di-	3 = tri-	4 = tetra-	5 = penta-
6 = hexa-	7 = hepta-	8 = octa-	9 = nona-	10 = deca-

Diatomic Molecules

These elements, when found alone in nature (not bonded with other elements), exist in pairs of two instead of singly:

BrINClHOF: Br_2 I_2 N_2 Cl_2 H_2 O_2 F_2
Other weirdos: P_4 and S_8
All other elements will either exist in a compound or, if alone, without a subscript (single)

Naming Acids

- **Binary acids** – H and one other entity; does NOT include oxygen. Naming convention is **Hydro-(element)-ic acid:**
  - HCl hydrochloric acid, HF hydrofluoric acid, HBr hydrobromic acid, HI hydroiodic acid, HCN hydrocyanic acid, H2S hydrosulfuric acid
- **"-Ic" Acids from "ate" compounds** – the acid form of a polyatomic ending in "-ate". There is **no hydro prefix, and "-ate" becomes "–ic acid":**
  - H_2CO_3 carbonic acid, HNO_3 nitric acid, H_2SO_4 sulfuric acid, $HClO_3$ chloric acid, H_3PO_4 phosphoric acid, HIO_3 iodic acid
- **"-Ous" Acids (One less oxygen) -** the acid of an "-ite" polyatomic, or that has *one less oxygen* than its "-ic" counterpart**.** There is **no prefix, and it ends in "–ous acid":**
  - H_2SO_3 sulfurous acid, H_2CO_2 carbonous acid, HNO_2 nitrous acid, $HClO_2$ chlorous acid, H_3PO_3 phosphorous acid
- **"Hypo-" Acids (Two less oxygens) -** An acid that has two less oxygens than its "-ic" counterpart. There is **a hypo- prefix, and it ends in "–ous acid":**

- H_2CO hypocarbonous acid, HNO hyponitrous acid, H_2SO_2 hyposulfurous acid, HClO hypochlorous acid

Strong vs Weak Acids

- **Strong acids**: "Strong" means that that are dissociated in aqueous solution. You should immediately be able to distinguish an acid as weak or strong. There are 8 common strong acids to memorize:
  - HCl - hydrochloric acid
  - HBr - hydrobromic acid
  - HI - hydriodic acid
  - $HClO_4$ – perchloric acid
  - HNO_3 – nitric acid
  - HIO_4 – periodic acid
  - H_2SO_4 – sulfuric acid
  - $HClO_3$ – chloric acid
- **Weak Acids** are ALL acids that are not on the preceding list. Two *very* common weak acids that come up on tests are:
  - CH_3COOH - acetic acid
  - HF - hydrofluoric acid

Part 3: Access Resources

Here are some **Chrome extensions** you may find useful.

- Guillotined Chemist's Handbook: https://chrome.google.com/webstore/detail/guillotined-chemists-hand/mmoofdchnhgamecafaceoidojbdoikof?hl=en-US
- Periodic Table Extension: https://chrome.google.com/webstore/detail/periodic-table-of-element/dpdhegjlajgbiiceamhfgdgpogbfbppc?hl=en-US

Mobile Apps - There are many that could be useful. I recommend you choosing one that helps you gamify and memorize naming or ion charges in your spare time; that makes the task much easier. One I recommend is:

- "Inorganic Acids, Ions and Salts - Chemistry Quiz" by Andrey Solovyev (iOS and Google Play).

While your AP Chemistry textbook is not currently available to you, there are many free online **Textbook replacements** which, arguably, may even be preferable for some of you to use even during the school year.

- Open Stax Free Textbook: https://openstax.org/books/chemistry-atoms-first-2e/pages/1-introduction

- AP Chemistry on Khan Academy: https://www.khanacademy.org/science/ap-chemistry-beta (As of summer 2020, in beta, but the first three units are available, which is more than what you need right now)

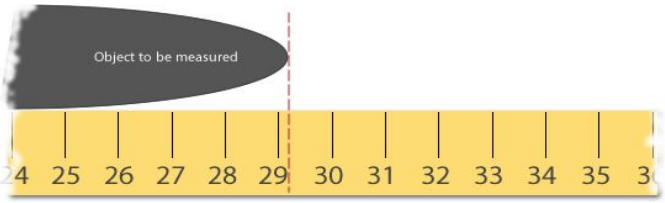
Part 4: Significant Figures in Measurement and Calculations

A successful chemistry student habitually labels all numbers, because the unit is important. Also of great importance is the number itself. Any number used in a calculation should contain only figures that are considered reliable, which are called "significant figures". Chemical calculations involve numbers representing actual measurements. In a measurement, significant figures in a number consist of: ***Figures (digits) definitely known + One estimated figure.***

There are rules for 1) performing measurements & gathering data in significant figures and 2) doing calculations in significant figures.

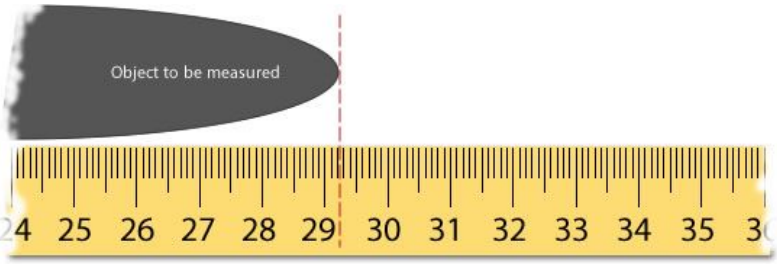
Measuring with Sig Figs

Find the nearest marked number for the item you're measuring. That is your only "definitely known" number. Then estimate on more digit of precision. **A correct reading of this measurement would be "29.1" or "29.2"**



Just "29" would not be correct because it's missing the estimated digit. "29.15" would not be correct because that's estimating too many digits; the ruler does not give that much precision.

However, if we **get a better rule with more precise markings, we can read to an extra "sig fig".** Here, the markings show us the object reaches, for sure, the 29.2 mark. Then we estimate how far between the .2 and .3 mark it falls**. A correct reading of this measurement would be "29.24" or "29.25".**



Note: If the above landed *directly* on the line, we would still report an extra digit; we would simply report it as a "0", If you forget to do that, you're reporting that you used a less precise tool than you actually used.

Calculating with Sig Figs

- **When doing addition or subtraction**, the answer should have the same precision as the least precise measurement (value) used in the calculation.
    - *Since the level of precision is related to the number of decimal places in the measured value, you then round to the least number of decimal places.*
    - *1.586 + 2.31 = 3.896 = 3.90 since 2.31 has only two decimal places.*
- **When doing multiplication or division**, the answer should have the same number of significant figures as the measured value with the least number of significant figures.
    - *You must count the number of sig figs in each original value and then round the answer to the lowest number.*
    - *16.156 / 2.72 = 5.93970588 = rounds to 5.94 since 2.72 has three sig figs.*
- **How to round:**
    - If the figure to be dropped is less than 5, simply eliminate it. (2.42 => 2.4)
    - If the figure to be dropped is 5 or greater, eliminate it and raise the preceding figure by 1. (2.47 => 2.5)
    - *In the case that the preceding figure is a 9 and is rounded up to a 10, be sure to keep that last 0.*
        - *Ex: 0.598 needs to be rounded to 2 sig figs. 8 is dropped and rounds the 0.59 to a 0.60. Report it as 0.60, NOT as 0.6.*

Counting Sig Figs

- **All non-zero numbers** are significant (4.53 has three sig figs).
- **Zeros in the middle of a number** are significant (4.503 has four sig figs).
- **Trailing zeros** (Zeros at the end of a number) are significant (4.50 has three sig figs) because the 0's are holding the place of a level of precision.
    - *Exception: If there is no decimal place, this becomes untrue. 100 has only 1 sig fig, while 100.0 has 4 sig figs. Always report values with the appropriate decimal.*
- **Leading zeros** are NOT significant. In 0.070, there are only two sig figs; the others are placeholders.
- **When in doubt, transform your number into scientific notation form.** The number of digits in the coefficient is the number of sig figs. 0.070 becomes 7.0×10^{-2} ; 7.0 has two sig figs, so 0.070 has two sig figs.

http://chemistry.bd.psu.edu/jircitano/sigfigs.html

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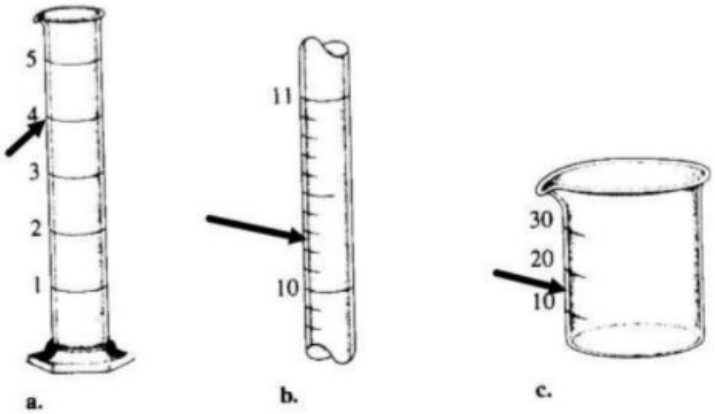
Part 5: Review Concepts from Chem 1 / Chem 1 Honors

Using Openstax (https://openstax.org/books/chemistry-atoms-first-2e/pages/1-introduction), Khan Academy, or any other online reference, look up the answers to any questions you can't already answer on your own.

1. For each of the following pieces of glassware, provide a sample measurement at arrow and discuss the number of significant figures and uncertainty:



2. A student performed an analysis of a sample for its calcium content and got the following results: 14.92%, 14.91%, 14.88%, and 14.91% The actual amount of calcium in the sample is 15.70%. What conclusion can you draw about the **accuracy** and **precision** of these results?

3. Calculate the percent error for the following measurements:
   a. The density of an aluminum block determined in an experiment was 2.64 g/cm^3. (Accepted value = 2.70 g/cm^3)
   b. The experimental determination of iron in ore was 16.48%. (Accepted value was 16.12%)

4. How many significant figures are in each of the following?
   a. 12
   b. 1098
   c. 2001
   d. 2.001 x 10^3
   e. 100
   f. 0.0000101
   g. 1000.
   h. 22.04030
   i. 1.00 x 10^3

5. Round of each of the following numbers to two significant figures, and write the answers in scientific notation.

a. 0.00031254
b. 31,254,000
c. 35,900
d. 0.00000399

6. Use scientific notation to express the number 48.987 to:
    a. One significant figure,
    b. Two significant figures
    c. Three significant figures

7. Perform the following mathematical operations, and express each result to the correct number of significant figures.
    a. 97.381 + 4.2502 + 0.99195
    b. 171.5 + 72.915 – 8.23
    c. (0.102 x 0.0821 x 273.5) / 1.2
    d. (9.04 – 8.23 + 21.954 + 81.0) / 3.1416

8. You need to be able to convert between units, both familiar and unfamiliar. Try these conversions:

24 grains = 1 pennyweight
20 pennyweights = 1 troy ounce
12 troy ounces = 1 troy pound
1 grain = 0.0648 gram 1 carat = 0.200 gram

    a. Diamonds are measured in carats. If a lucky girl receives a 5 carat diamond how many pennyweights is it?
    b. What is the mass of 2.3 troy ounces of gold in grams?
    c. The density of gold is 19.3 g/cm3. What is the volume of a troy pound of gold?

9. Pharmacists use the following set of measures: 20 grains ap = 1 scruple, 3 scruples = 1 dram ap, and 8 dram ap = 1 oz. ap, 1 dram ap = 3.888 g

    a. An aspirin tablet contains 5.00×10^2 mg of active ingredient. How many grains ap of active ingredient does it contain?
    b. From (a) how many scruples?
    c. What is the mass of 1.00 scruple in grams?

10. The world record for the hundred meter dash is 9.79 s. What is the corresponding speed in units of m/s, km/hr, ft/s, and mi/hr?
    a. At this speed how long would it take to run a mile (5,820 ft)?

11. You're planning to buy a new car. One model that you're considering gets 32 miles per gallon of gasoline in highway travel. The one that your spouse likes gets 14 kilometers to the liter. Which car has the better gas mileage? (1 gal = 4 qt., 1.057 qt = 1 L)

12. You pass a road sign saying "New York – 112 km." If you drive at a constant speed of 65 mi/hr., how long should it take you to reach New York?
    a. If your car gets 28 miles to the gallon, how many liters of gasoline are necessary to travel 112 km?

13. You have a 1.0 cm^3 sample of lead and a 1.0 cm^3 sample of glass. You drop each in separate beakers of water. How do the volumes of water displaced by each sample compare? Explain. Density of lead = 11.35 g/cm^3, Density of glass = 3.00 g/cm^3

14. A person has a temperature of 102.5 F. What is this temperature on the Celsius scale?
    a. On the Kelvin scale?

15. Convert the following Celsius temperatures to Kelvin and to Fahrenheit degrees.
    a. The boiling-point temperature of ethyl alcohol, 78.1 C
    b. A cold winter day, -25 C
    c. The lowest possible temperature, -273 C
    d. The melting-point temperature of sodium chloride, 801 C

16. The density of diamond is 3.51 g/cm3. What is the volume of a 4.5 carat diamond? 1 carat = 0.200 g

17. The volume of a diamond is found to be 2.8 mL. What is the mass of the diamond in carats? (See question #16)

18. A sample containing 33.42 g of metal pellets is poured into a graduated cylinder initially containing 12.7 mL of water, causing the water level in the cylinder to rise to 21.6 mL. Calculate the density of the metal.

19. Two spherical objects have the same mass. One floats on water; the other sinks. Which object has the greater diameter? Explain your answer.

20. What are some of the differences between a solid, a liquid, and a gas?

21. What is the difference between homogeneous and heterogeneous matter?

22. Classify each of the following as homogeneous or heterogeneous.

    a. Soil
    b. the Atmosphere
    c. Cola (Soda)
    d. Gasoline
    e. Gold
    f. a Solution of oil and water

23. Classify each of the following as a mixture or a pure substance. Of the pure substances, which are elements and which are compounds?
    a. Water
    b. Blood
    c. The oceans
    d. Iron
    e. Brass
    f. Uranium
    g. Wine
    h. Leather
    i. Table salt (NaCl

24. Distinguish between physical and chemical changes.

25. List four indications that a chemical change (reaction) has occurred.

26. If you place a glass rod over a burning candle, the glass appears to turn black. What is happening to each of the following (physical change, chemical change, both, or neither) as the candle burns? Explain each answer: a. the wax b. the wick c. the glass rod

27. The properties of a mixture are typically averages of the properties of its components. The properties of a compound may differ dramatically from the properties of the elements that combine to produce the compound. For each process described below, state whether the material being discussed is most likely a mixture or a compound, and state whether the process is a chemical change or a physical change.
    a. An orange liquid is distilled, resulting in the collection of a yellow liquid and a red solid.
    b. A colorless, crystalline solid is decomposed, yielding a pale yellow-green gas and a soft, shiny metal.
    c. A cup of tea becomes sweeter as sugar is added to it.

28. Describe Dalton's atomic theory.

29. What discoveries were made by J.J. Thomson, Henri Becquerel, and Lord Rutherford? How did Dalton's model of the atom have to be modified to account for these discoveries?

30. What is the distinction between atomic number and mass number?

31. What is the difference between atomic mass and average atomic mass?

32. What is an isotope?

33. How many protons and neutrons are contained in the nucleus of each of the following atoms? 22Ti42 b. 30Zn64 c. 32Ge76 d. 36Kr86 e. 33As75 f. 19K41

34. Write the isotopic symbol for each of the isotopes below.
    a. Atomic number = 8, number of neutrons = 9
    b. The isotope of chlorine in which mass = 37

c. Atomic number = 27, mass = 60
d. Number of protons = 26, number of neutrons = 31
e. The isotope of I with a mass number of 131
f. Atomic number = 3, number of neutrons = 4

35. The element copper has naturally occurring isotopes with mass number of 63 and 65. The relative abundance of the isotopes are 69.2% for mass = 62.93 amu, and 30.8% for mass = 64.93 amu. Calculate the average atomic mass of copper.

36. An element consists of 1.40% of an isotope with mass 203.973 amu, 24.10% of an isotope with mass 205.9745 amu, 22.10% of an isotope with mass 206.9759 amu, and 52.40% of an isotope with mass 207.9766 amu. Calculate the average atomic mass and identify the element.

37. Distinguish between the terms family and period in connection to the periodic table. For which of these terms is the term group also used?

38. In the periodic table, what is the name of the following groups
    a. Group (2)
    b. Group (18)

39. An ion contains 50 protons, 68 neutrons, and 48 electrons. What is its symbol and charge?

40. Which of the following sets of elements are all in the same group in the periodic table?
    a. N, P, O
    b. C, Si, Ge
    c. Rb, Sn
    d. Mg, Ca

41. Identify each of the following elements:
    a. A member of the same family as oxygen whose most stable ion contains 54 electrons
    b. A member of the alkali metal family whose most stable ion contains 36 electrons
    c. A noble gas with 18 protons in the nucleus
    d. A halogen with 85 protons and 85 electrons

42. Would you expect each of the following atoms to gain or lose electrons when forming ions? What ion is the most likely in each case?
    a. Na
    b. Sr
    c. P
    d. Ba
    e. I
    f. O
    g. Al
    h. S
    i. Al
    j. S

43. For each of the following ions, indicate the total number of protons and electrons in the ion. For the positive ions, predict the formula of the simplest compound formed between itself and oxide. For the negative ions predict the simplest compound formed between itself and aluminum.
    a. Fe^{+2}
    b. Fe^{+3}
    c. Ba^{+2}
    d. Cs^{+1}
    e. S^{-2}
    f. P^{-3}
    g. Br^{-1}
    h. N^{-3}
    i. Br^{-1}
    j. N^{-3}

44. An element's most stable ion forms an ionic compound with bromine, having the formula XBr2. If the ion of element X has a mass number of 230 and 86 electrons, what is the identity of the element, and how many neutrons does it have?

Writing Formulas and Naming Compounds

1. Name each of the following compounds:
    a. **NaCl**
    b. **Rb_2O**
    c. **$FeBr_3$**
    d. **Cr_2O_3**
    e. **$CaBr_2$**
    f. **CsF**
    g. **CaS**
    h. **AlI_3**
    i. **Al_2O_3**
    j. **$ZnCl_2$**
    k. **Li_3N**
    l. **Ag_2S**
    m. **$KClO_4$**
    n. **$Al_2(SO_4)_3$**
    o. **$BaSO_3$**
    p. **$KMnO_4$**
    q. **Sr_3P_2**
    r. **$Ca_3(PO_4)_2$**
    s. **$Pb(NO_3)_2$**
    t. **$NaNO_2$**
    u. **$K_2Cr_2O_7$**

2. Name each of the following compounds:
    a. **NI_3**
    b. **PCl_3**
    c. **SO_2**
    d. **ICl_3**
    e. **SF_2**
    f. **N_2F_4**
    g. **P_2S_5**
    h. **N_2O_4**
    i. **P_2S_5**
    j. **N_2O_4**

3. Name each of the following compounds:
    a. **HCl**
    b. **H_3PO_4**
    c. **HIO_3**
    d. **HNO_2**
    e. **HI**
    f. **H_2SO_3**

4. Name each of the following compounds:
    a. **HgO**
    b. **CuI**
    c. **CuI_2**
    d. **CoI_2**
    e. **Na_2CO_3**
    f. **$NaHCO_3$**
    g. **$HC_2H_3O_2$**
    h. **NH_4NO_2**
    i. **Co_2S_3**
    j. **ICl**
    k. **$Pb_3(PO_4)_2$**
    l. **KIO_3**

m. $Ca(OH)_2$
n. CoS
o. S_3N_4
p. SF_6
q. $NaClO$
r. $BaCrO_4$
s. NH_4NO_3
t. H_2SO_4
u. Sr_3N_2
v. $Al_2(SO_3)_3$
w. SnO_2
x. Na_2CrO_4
y. $HClO$
z. NO

5. Write the formula for each of the following compounds:

a. Cesium bromide
b. Barium sulfate
c. Chlorine trifluoride
d. Ammonium chloride
e. Beryllium oxide
f. Chlorine monoxide
g. Magnesium fluoride
h. Sulfur difluoride
i. Sulfur hexafluoride
j. Sodium dihydrogen phosphate
k. Silicon tetrachloride
l. Lithium nitride
m. Chromium (III) carbonate
n. Tin (II) fluoride
o. Ammonium acetate
p. Ammonium hydrogen sulfate
q. Cobalt (III) nitrate
r. Copper (I) sulfide
s. Potassium chlorate
t. **Lithium t**artrate

6. Write the formula for each of the following compounds:

a. Sodium oxide
b. Sodium peroxide
c. Potassium cyanide
d. Copper (II) nitrate
e. Silicon tetrafluoride
f. Lead (II) sulfide
g. Lead (IV) sulfide
h. Copper (I) chloride
i. Cadmium selenide
j. Zinc sulfide
k. Ammonium hydrogen phosphate
l. Hydrobromic acid
m. Bromous acid
n. Perchloric acid
o. Silicon dioxide
p. Sodium sulfate
q. Aluminum hydrogen sulfate