

AP CHEMISTRY SUMMER ASSIGNMENT 2019

Welcome to A.P. Chemistry. The goal of this course is to present the equivalent of a one-year Freshman College Chemistry course. This course offers the opportunity to earn college credit (determined by AP score) as well as high school credit (by passing the class). Thus one of your goals is to prepare for the AP Chemistry test in May, which also gives a rigorous preparation in College Chemistry. The majority of class time will be spent in lab. Thus little time is spent on lecture — I believe that learning is active not passive. Students perform hands-on laboratory work throughout the course that accounts for at least 75% of class time, and additional class time, including a 0 (zero) Block, will be used to help students meet each of the learning goals in the AP Scientific Practices and Content Standards. The class emphasizes depth of understanding of a topic, rather than surface coverage or memorization of topics.

Textbook to buy AT THE LATEST before classes start in August: (you may also wish to purchase this as a resource for the summer assignment). I recommend buying a cheap used copy on Amazon.

Chemistry: the Central Science, AP Edition, by Brown and LeMay, Jr., 13th Edition, Pearson, 2015.

Unit 1: Review of Some Chemistry Fundamentals

Due: August 21-22, 2019

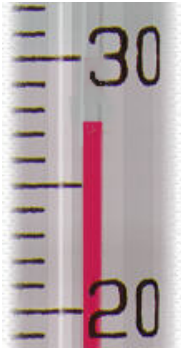
Please review Chapters 1, 2, 3, and 4, roughly pages 3-163 in the Brown and LeMay text book, and complete the Review Problems in Summer Assignments #1-5B. We will have approximately one-half class period to go over any questions and for you to get help on more challenging problems such as combustion analysis, net ionic equations, and redox. The test over the summer assignment will be given during the second week of classes, approximately August 26-30.

Topics Covered (approximate):

1. Scientific Method and Measurement
2. Classification of Matter/Atoms and Elements
3. Molecules and Compounds
4. Chemical Equations and Stoichiometry
5. Solutions and solution stoichiometry
6. Redox numbers, redox reactions/half reactions

Please message me on Schoology, or email me (wgibbons@kehillah.org) over the summer if you have questions.

Summer Practice #1 AP Chemistry 2019

1. How many significant digits are present in the temperature read from the thermometer illustrated to the right?
- 
- a) 1 b) 2 c) 3 d) 4
2. The dimensions of a rectangular solid are 8.00 cm long, 4.00 cm wide, and 2.00 cm high. If the density of the solid is 10.0 g/cm³, what is its mass?
- a) 10/64 grams d) 320 grams
b) 10.0 grams e) 640 grams
c) 64.0 grams
3. A metal sample weighing 30.9232 grams was added to a graduated cylinder containing 23.26 mL of water. The volume of water plus the sample was 24.85 mL. Which setup will result in the density of this metal?
- a) $30.9232 \times (24.85 - 23.26)$
b) $\frac{30.9232}{24.85 - 23.26}$
c) $\frac{24.85 - 23.26}{30.9232}$
d) $30.9232 \times \frac{24.85}{23.26}$
e) $\frac{30.9232}{24.85 + 23.26}$
4. The number of significant digits in 0.30500 is
- a) 1 d) 4
b) 2 e) 5
c) 3
5. A box measures 3.50 cm x 2.915 cm. The product of these numbers = 10.2025 cm². What is the proper way to report the area of the box?
- a) 10.20 cm² c) 10 cm²
b) 10.2 cm² d) 10. cm²
6. The result of $2.350 \times (4.0 + 6.311)$ is,
- a) 24 c) 24.21
b) 24.2 d) 24.205
7. A student does a calculation using her calculator and the number 280.27163 is shown on the display. If there are actually three significant figures, how should she show the final answer?
- a) 280 d) 2.80×10^{-2}
b) 280.3 e) 2.80×10^2
c) 280.27
8. The term that refers to the reproducibility of a laboratory measurement is
- a) precision c) accuracy
b) repeatability d) exactness
9. Which measurement below is NOT written with three significant digits?
- a) 2.00 cm c) 0.003 L
b) 550. grams d) 12.7 mm
10. The number 6.33×10^2 equals,
- a) 6.33 c) 633
b) 0.633 d) 0.0633

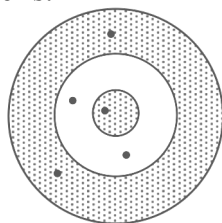
11. All the following are characteristic properties of phosphorus. Which one is a chemical property?
- Both red phosphorus and white phosphorus exist in solid allotropic forms.
 - The red form melts at about 600°C and the white form melts at 44°C .
 - The white form is soluble in liquid carbon disulfide, but is insoluble in water.
 - When exposed to air, white phosphorus will burn spontaneously, but red phosphorus will not.
12. Classify each observation as a physical or a chemical property and tally them.
- Observation 1: Bubbles form on a piece of metal when it is dropped into acid.
- Observation 2: The color of a crystalline substance is yellow.
- Observation 3: A shiny metal melts at 650°C .
- Observation 4: The density of a solution is 1.84 g/cm^3
- 2 chemical properties and 2 physical properties
 - 3 chemical properties and 1 physical properties.
 - 1 chemical properties and 3 physical properties
 - 4 chemical properties
 - 4 physical properties
13. Chromatography is a good way to separate the
- elements in a compound
 - the components in a mixture
 - the atoms in an element
 - the phases of a pure substance
14. When a pure solid substance was heated, a student obtained another solid and a gas, each of which was a pure substance. From this information which of the following statements is ALWAYS a correct conclusion?
- The original solid is not an element.
 - Both products are elements.
 - The original solid is a compound and the gas is an element.
 - The original solid is an element and the gas is a compound.
 - Both products are compounds.
15. The prefix “milli-” corresponds to what multiplication factor?
- 10^{-6}
 - 10^{-3}
 - 10^1
 - 10^3
 - 10^6
16. A solution of sugar water may be defined as a
- heterogeneous mixture
 - homogeneous mixture
 - heterogeneous compound
 - homogeneous compound
 - homogeneous element

17. "Wafting" is the proper technique for
- neutralizing a spilled acid.
 - putting out burning clothing.
 - washing chemicals from the eye.
 - smelling a chemical substance.
 - observing the color of a chemical.

18. You measure the density of a slab of lead as 11.10 g/mL. The accepted value is 11.34 g/mL. The percent error for your measurement is
- 2.1 %
 - 2.4 %
 - 3.7 %
 - 5.1 %

19. Which one of the following elements is correctly matched with its symbol?
- Ag, gold
 - Ni, nickel
 - Fl, fluorine
 - Mg, manganese
 - H, helium

20. The marks on the following target represent someone who is:



- accurate, but not precise.
- precise, but not accurate.
- both accurate and precise.
- neither accurate nor precise.

Answers: (Please use CAPITAL letters)

1.		11.	
2.		12.	
3.		13.	
4.		14.	
5.		15.	

6.		16.	
7.		17.	
8.		18.	
9.		19.	
10.		20.	

Summer Practice #2 AP Chemistry 2019

1. Certain properties are characteristic of metals.
Which property means that you can pound the substance into a foil?

a) ductility c) sectility
b) conductivity d) malleability

2. Which of the following is a metalloid?
a) As b) Ag c) S d) Pb e) He

3. Which of the following is a transition metal?
a) Cl b) Ni c) P d) Ca e) C

4. Which of the following is an alkali metal?
a) Mg b) Kr c) K d) Al e) H

5. Which of the following is a lanthanide?
a) Xe b) Eu c) Cd d) P e) W

6. Which element has the highest melting point?
a) Pb b) Au c) Os d) W e) Hg

7. Cathode rays start at the
a) negative electrode c) positive electrode
b) power source d) gas inside the tube

8. In a cathode ray tube, electrons are bent toward
a) a positively charged plate.
b) a negatively charged plate.

9. Listed below are the charges and masses of four particles. Which one will be deflected the **least** in a mass spectrometer?

a) +2, 2 amu c) +1, 1 amu
b) +4, 4 amu d) +1, 4 amu

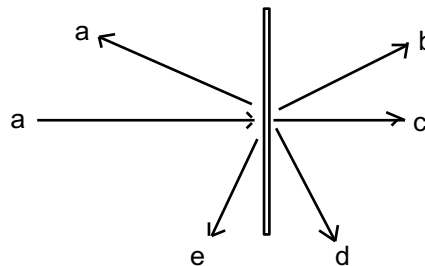
10. In a Millikan oil drop type experiment, the charge on four oil drops (in Coulombs) was found to be:

3.33 Coulombs
8.88 Coulombs
6.66 Coulombs
11.10 Coulombs

What is the charge on the electron according to this experiment?

a) 1.11 Coulomb c) 4.44 Coulomb
b) 2.22 Coulomb d) 11.10 Coulomb

11. Pictured below is a schematic of the Rutherford experiment. Which scattered α -particle gives the best evidence for the nuclear atom?



a) a b) b c) c d) d e) e

12. Which of the following is an isotope of the element with 20 protons ($p=20$) and 22 neutrons ($n=22$)?

a) titanium-22 c) calcium-40
b) zirconium-40 d) titanium-48

13. The imaginary element X has the following natural abundances and isotopic masses. What is the atomic mass of X?

${}^{24}_{12}\text{X}$	24.02 amu	40.0%
${}^{26}_{12}\text{X}$	26.10 amu	60.0%

Show your work:

For questions 14 - 17, use the following key:

(each answer may be used once, more than once,
or not at all)

- a) alpha
- b) beta
- c) gamma
- d) alpha and beta, but not gamma

14. A high energy form of light

15. Two protons & two neutrons

16. A high speed electron

17. Used by Ernest Rutherford as a “probe”

For questions 18 - 22, use the following key:

(each answer may be used once, more than once,
or not at all.)

- a) John Dalton
- b) Ernest Rutherford
- c) J.J. Thomson
- d) Democritus

18. His model of the atom has been called the “plum
pudding” Model.

19. His model of the atom has been called the “billiard
ball” model.

20. He studied matter in cathode ray tubes.

21. His philosophical idea included the term “atomos”.

22. He added to the atomic theory the idea that atoms
had positive and negative parts.

23. Consider the following notation: ${}_{86}^{220}\text{Rn}$

Which statement below is correct?

- a) This particle contains 86 protons
- b) This particle has a mass number of 86
- c) This particle has an atomic number of 220
- d) This particle contains 220 neutrons

24. Which elements did Mendeleev leave spaces for in
his periodic table?

25. If copper metal is a mixture two isotopes, Cu-63,
mass = 62.9298 u and Cu-65, mass = 64.9278 u.

The molar mass of copper is 64.546 g/mole.

Calculate the % abundances of the two isotopes of
copper. Show your work.

Just For Fun:

Element names finish these sentences.

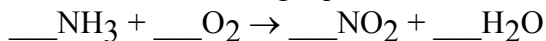
- A ridiculous inmate is a _____.
- I bumped my _____ the car door.
- I am sad when all the flowers _____.
- What the police officer does to the crook. _____
- What the doctor does to the patient. _____
- What the undertaker does if the doctor doesn't
succeed. _____
- If your cattle get away, _____.
- A famous London theatre is the _____.
- Demonstrations help keep the lectures from
getting _____.
- Linoleum, tile, and hardwood are three types of
_____.

Summer Practice #3 AP Chemistry 2019

- What is the formula of the ionic compound formed between Mg and Br?
 - MgBr
 - Mg₂Br
 - MgBr₂
 - Mg₂Br₂
 - Mg₂Br₃
- What is the formula of the ionic compound formed between Ca and P?
 - Ca₂P₃
 - CaP
 - Ca₅P₁₀
 - Ca₂P
 - Ca₃P₂
- What is the name of the SO₃²⁻ ion?
 - sulfate
 - nitrate
 - sulfite
 - sulfur trioxide
 - hydrogen sulfate
- What is the correct formula and charge for the chromate ion?
 - CrO₄²⁻
 - CrO₄⁻
 - Cr₂O₇²⁻
 - Cr₂O₇⁻
 - Cr³⁺
- Which one of the following elements forms ions with two different valences?
 - calcium
 - arsenic
 - iron
 - fluorine
- The correct name for CCl₄ is
 - carbon(I) chloride
 - carbon chloride
 - carbon tetrachloride
 - monocarbon chloride(IV)
 - carbochlorinate
- The correct formula for hydrogen telluride is
 - HTe
 - H₂Te
 - H₃Te
 - HTe₂
- The correct formula for dinitrogen tetroxide is
 - NO₂
 - N₂O₄
 - N₂O₅
 - NO₃⁻
 - (N₂O)₄
- The correct name for S₂Cl₂ is
 - sulfur dichloride
 - sulfur(I) chloride
 - sulfur(II) chloride
 - disulfur dichloride
 - sulfur chloride
- The correct name for NO₂ is
 - nitrogen dioxide
 - nitrite
 - nitrogen oxide
 - nitrogen(II) oxide
 - nitrate
- The molar mass of (NH₄)₂S is closest to:
 - 50 g/mol
 - 82 g/mol
 - 68 g/mol
 - 100 g/mol
- How many atoms are in 12 molecules of glucose, C₆H₁₂O₆?
 - 24
 - 288
 - 2160
 - 7.22 x 10²⁴
- Calculate the number of atoms in 4.0 x 10⁻⁵ g of aluminum.
 - 8.9 x 10¹⁷
 - 4.6 x 10¹⁹
 - 6.5 x 10²⁰
 - 3.8 x 10²³

Summer Practice #4 AP Chemistry 2019

1. Balance the following equation:



The balanced equation shows that 1.00 mole of NH_3 requires mole(s) of O_2 .

- a) 0.57 c) 1.33
b) 1.25 d) 1.75

2. Write a balanced equation for the combustion of acetaldehyde, CH_3CHO .

When properly balanced, the equation indicates that mole(s) of O_2 are required for each mole of CH_3CHO .

- a) 1 c) 2.5
b) 2 d) 3

3. Balance the following equation with the SMALLEST WHOLE NUMBER COEFFICIENTS possible. Select the number that is the sum of the coefficients in the balanced equation:



- a) 5 b) 6 c) 7 d) 8

4. Write a balanced equation for the combustion of propane, C_3H_8 .

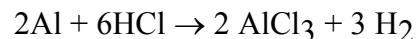
When properly balanced, the equation indicates that moles of O_2 are required for each mole of C_3H_8 .

- a) 3 b) 3.5 c) 5 d) 8

5. What is the **total** mass of products formed when 16 grams of CH_4 is burned with excess oxygen?

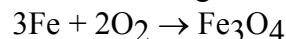
- a) 80 g c) 36 g
b) 44 g d) 32 g

6. Calculate the mass of hydrogen formed when 25 g of aluminum reacts with excess hydrochloric acid.



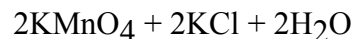
- a) 0.41 g c) 1.2 g
b) 0.92 g d) 2.8 g

7. How many grams of the mixed oxide, Fe_3O_4 , are formed when 6.00 g of O_2 react with Fe according to



- a) 43.4 c) 174
b) 86.8 d) 21.7

8. For the reaction:



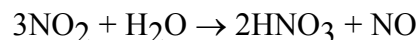
there is 100. g of each reactant available.

Which reagent is the limiting reagent?

[Molar Masses: $\text{MnO}_2=86.9$; $\text{KOH}=56.1$; $\text{O}_2=32.0$; $\text{Cl}_2=70.9$]

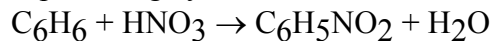
- a) MnO_2 c) O_2
b) KOH d) Cl_2

9. How many grams of nitric acid, HNO_3 , can be prepared from the reaction of 92.0 g of NO_2 with 36.0 g H_2O ?



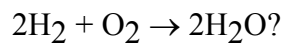
- a) 64 c) 84
b) 76 d) 116

10. The reaction of 25.0 g benzene, C_6H_6 , with excess HNO_3 resulted in 21.4 g $C_6H_5NO_2$. What is the percentage yield?



- a) 100% c) 54.3%
b) 27.4% d) 85.6%

11. How many grams of H_2O will be formed when 16.0 g H_2 is allowed to react with 16.0 g O_2 according to

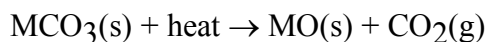


- a) 18.0 g c) 9.00 g
b) 144 g d) 32.0 g

12. When 8.00 g of H_2 reacts with 32.0 g of O_2 in an explosion, $2H_2 + O_2 \rightarrow 2H_2O$, the final gas mixture will contain:

- a) H_2 , H_2O , and O_2 c) O_2 and H_2O only
b) H_2 and H_2O only d) H_2 and O_2 only

13. 1.056 g of metal carbonate, containing an unknown metal, M, were heated to give the metal oxide and 0.376 g CO_2 .



What is the identity of the metal M?

- a) Mg c) Zn
b) Cu d) Ba

14. Styrene, the building block of polystyrene, is a hydrocarbon, a compound containing only C and H. A given sample is burned completely and it produces 1.481 g of CO_2 and 0.303 g of H_2O . Determine the empirical formula of the compound.

- a) CH c) C_2H_3
b) CH_2 d) C_2H_5

Summer Practice #5B AP Chemistry 2019

Overview:

There are two kinds of reactions in the world, Oxidation-Reduction Reactions and Acid-Base Reactions. In a redox reaction, electrons are gained and electrons are lost.

Double Replacement Reactions are _____ (redox/non-redox/either)
Single Replacement Reactions are _____ (redox/non-redox/either)
Synthesis Reactions are _____ (redox/non-redox/either)
Decomposition Reactions are _____ (redox/non-redox/either)
Combustion Reactions are _____ (redox/non-redox/either)

An important idea to help recognize oxidation-reduction reactions is to identify the oxidation number (or oxidation state) of an atom. The oxidation number is also called the "apparent charge." Atoms in ionic compounds have charges and these are also the oxidation numbers. Atoms in molecular compounds can also have oxidation numbers, although they do not have charges.

Rules:

The oxidation number of:

Example:

- an element in the uncombined state is 0.
- a monatomic ion equals the charge on the ion.
- hydrogen is generally +1; in hydrides, -1.
- oxygen is generally -2; in peroxides, -1.
- elements other than oxygen and hydrogen in a neutral compound is such that the sum of the oxidation numbers for all atoms in the compound is 0.
- elements other than oxygen and hydrogen in a polyatomic ion is such that the sum of the oxidation numbers for all atoms in the ion equals the charge on the ion.

Practice:

Determine the oxidation number of the underlined element. Answers are given below:

1. <u>Ba</u> ²⁺	2. <u>N</u> ₂	3. <u>H</u> I	4. <u>O</u> ₂ ²⁻
5. Ag <u>Br</u>	6. <u>Cu</u> Cl ₂	7. H <u>N</u> O ₃	8. <u>Cl</u> O ₃ ⁻
9. <u>S</u> O ₃	10. Na ₂ <u>S</u> O ₃	11. Ba <u>Cr</u> O ₄	12. Ca <u>S</u> O ₄
1. +2	2. 0	3. +1	4. -1
5. -1	6. +2	7. +5	8. +5
9. +6	10. +4	11. +6	12. +6

Practice Problems

13. Determine the oxidation number of each element in the following ions or compounds:

- | | |
|--------------------------------|-----------------------------|
| a) BrO_3^- | d) CaH_2 |
| b) $\text{C}_2\text{O}_4^{2-}$ | e) H_4SiO_4 |
| c) F_2 | f) SO_4^{2-} |

14. Determine the oxidation number of each element in the following ions or compounds:

- | | |
|-------------------------------|---------------------------|
| a) SF_6 | d) N_2O_4 |
| b) H_2AsO_4^- | e) PCl_4^+ |
| c) UO_2^+ | f) XeO_4^{2-} |

15. Which of the following reactions is (are) oxidation-reduction reactions? Explain your answer briefly. classify the remaining reactions.

- $\text{Zn(s)} + 2 \text{NO}_3^-(\text{aq}) + 4 \text{H}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2 \text{NO}_2(\text{g}) + 2 \text{H}_2\text{O(l)}$
- $\text{Zn(OH)}_2(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + 2 \text{H}_2\text{O(l)}$
- $\text{Ca(s)} + 2 \text{H}_2\text{O(l)} \rightarrow \text{Ca(OH)}_2(\text{s}) + \text{H}_2(\text{g})$

57. Which of the following reactions is (are) oxidation-reduction reactions? Explain your answer briefly. classify the remaining reactions.

- $\text{CdCl}_2(\text{aq}) + \text{Na}_2\text{S}(\text{aq}) \rightarrow \text{CdS(s)} + 2 \text{NaCl(aq)}$
- $2 \text{Ca(s)} + \text{O}_2(\text{g}) \rightarrow 2 \text{CaO(s)}$
- $\text{Ca(OH)}_2(\text{s}) + 2 \text{HCl(aq)} \rightarrow \text{CaCl}_2(\text{aq}) + 2 \text{H}_2\text{O(l)}$

16. In each of the following reactions, decide which reactant is oxidized and which is reduced. Designate the oxidizing agent and reducing agent.

- $2 \text{Mg(s)} + \text{O}_2(\text{g}) \rightarrow 2 \text{MgO(s)}$
- $\text{C}_2\text{H}_4(\text{g}) + 3 \text{O}_2(\text{g}) \rightarrow 2 \text{CO}_2(\text{g}) + 2 \text{H}_2\text{O(g)}$
- $\text{Si(s)} + 2 \text{Cl}_2(\text{g}) \rightarrow \text{SiCl}_4(\text{l})$

17. In each of the following reactions, decide which reactant is oxidized and which is reduced. Designate the oxidizing agent and reducing agent.

- $\text{Ca(s)} + 2 \text{HCl(aq)} \rightarrow \text{CaCl}_2(\text{aq}) + \text{H}_2(\text{g})$
- $\text{Cr}_2\text{O}_7^{2-}(\text{aq}) + 3 \text{Sn}^{2+}(\text{aq}) + 14 \text{H}^+(\text{aq}) \rightarrow 2 \text{Cr}^{3+}(\text{aq}) + 3 \text{Sn}^{4+}(\text{aq}) + 7 \text{H}_2\text{O(l)}$
- $\text{FeS(s)} + 3 \text{NO}_3^-(\text{aq}) + 4 \text{H}^+(\text{aq}) \rightarrow 3 \text{NO(g)} + \text{SO}_4^{2-}(\text{aq}) + \text{Fe}^{3+}(\text{aq}) + 2 \text{H}_2\text{O(l)}$