

A.P. CHEMISTRY SUMMER ASSIGNMENT

<https://sites.google.com/site/zumbochem/>

Welcome to Advanced Placement Chemistry. We are glad you have selected this course and wish you great success in your academic pursuits. The summer assignment is designed to prepare you for a rigorous course equivalent to a first year college chemistry class.

This assignment will help you successfully review the Regents Chemistry curriculum and diagnose your needs so that more time can be spent on topics that dominate the AP Chemistry exam. You are responsible for all material covered on the Regents Chemistry Examination.

Please be prepared for a TEST during the first week of class.

Directions:

- a. Review your Regents chemistry notes. Alternatively, the Barron's review book is recommended for a review of Regents concepts.
- b. Take the diagnostic exam (attached). An answer key can be found at my site (linked above) I will take any questions during the first week of class.
- c. **MEMORIZE THE FOLLOWING REFERENCE TABLES:
A, C, D, E, F, K, L, O, P, Q, and R.**

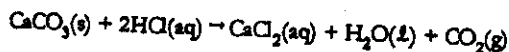
Copies of the Reference Table can be found online

- d. Create flashcards for a minimum of three of the Reference Tables listed above. I recommend you choose Tables E and F. The 3rd table is at your discretion.
- e. Complete the preview packet for Unit 1 (attached).
- f. Purchase a Carbonless lab notebook – a link to some suggestions can be found on my site.
- g. Bring all items with you to class on the first day of school. This will be checked and points assigned for completed work.
- h. Have a great summer and be ready to WORK come September! 😊

AP Chem - Summer Diagnostic Exam

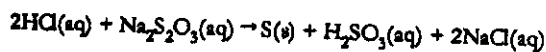
Name: _____

- 1) When sodium and fluorine combine to produce the compound NaF, the ions formed have the same electron configuration as atoms of
 A) neither argon nor neon
 B) neon, only
 C) argon, only
 D) both argon and neon
- 2) Which compound has hydrogen bonding between its molecules?
 A) KH
 B) CH₄
 C) NH₃
 D) CaH₂
- 3) Given the balanced equation:



What is the total number of moles of CO₂ formed when 20. moles of HCl is completely consumed?

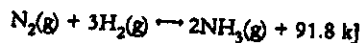
- A) 5.0 mol
 B) 20. mol
 C) 40. mol
 D) 10. mol
- 4) A compound has a molar mass of 90. grams per mole and the empirical formula CH₂O. What is the molecular formula of this compound?
 A) CH₂O
 B) C₄H₈O₄
 C) C₃H₆O₃
 D) C₂H₄O₂
- 5) The percent composition by mass of nitrogen in NH₄OH (gram-formula mass = 35 grams/mole) is equal to
 A) $\frac{14}{35} \times 100$
 B) $\frac{4}{35} \times 100$
 C) $\frac{35}{14} \times 100$
 D) $\frac{35}{4} \times 100$
- 6) Which aqueous solution of KI freezes at the *lowest* temperature?
 A) 1 mol of KI in 1,000. g of water
 B) 1 mol of KI in 500. g of water
 C) 2 mol of KI in 1,000. g of water
 D) 2 mol of KI in 500. g of water
- 7) A 3.0 M HCl(aq) solution contains a total of
 A) 3.0 moles of HCl per mole of water
 B) 3.0 grams of HCl per liter of water
 C) 3.0 moles of HCl per liter of solution
 D) 3.0 grams of HCl per mole of solution
- 8) Given the balanced equation representing a reaction:



Decreasing the concentration of Na₂S₂O₃(aq) decreases the rate of reaction because the

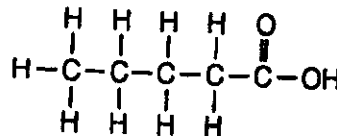
- A) frequency of effective collisions decreases
 B) activation energy decreases
 C) frequency of effective collisions increases
 D) activation energy increases
- 9) Why can an increase in temperature lead to more effective collisions between reactant particles and an increase in the rate of a chemical reaction?
 A) The activation energy of the reaction decreases.
 B) The activation energy of the reaction increases.
 C) The number of molecules with sufficient energy to react decreases.
 D) The number of molecules with sufficient energy to react increases.

- 10) In terms of energy and entropy, systems in nature tend to undergo changes toward
 A) lower energy and lower entropy
 B) higher energy and lower entropy
 C) lower energy and higher entropy
 D) higher energy and higher entropy
- 11) Which statement must be true when solution equilibrium occurs?
 A) The masses of the dissolved solute and the undissolved solute are equal.
 B) The concentration of the solution remains constant.
 C) The solution is supersaturated.
 D) The solution is at STP.
- 12) Given the reaction at equilibrium:



What occurs when the concentration of H₂(g) is increased?

- A) The rate of the forward reaction and the concentration of N₂(g) both increase.
 B) The rate of the forward reaction increases and the concentration of N₂(g) decreases.
 C) The rate of the forward reaction and the concentration of N₂(g) both decrease.
 D) The rate of the forward reaction decreases and the concentration of N₂(g) increases.
- 13) According to the Arrhenius theory, an acid is a substance that
 A) changes phenolphthalein from colorless to pink
 B) changes litmus from red to blue
 C) produces hydroxide ions as the only negative ions in an aqueous solution
 D) produces hydronium ions as the only positive ions in an aqueous solution
- 14) A molecule of a compound contains a total of 10 hydrogen atoms and has the general formula C_nH_{2n+2}. Which prefix is used in the name of this compound?
 A) pent-
 B) but-
 C) dec-
 D) oct-
- 15) Given the formula for an organic compound:

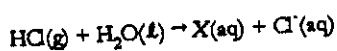


This compound is classified as an

- A) ester
 B) aldehyde
 C) amine
 D) organic acid
- 16) A sample of an element has a mass of 34.261 grams and a volume of 3.8 cubic centimeters. To which number of significant figures should the calculated density of the sample be expressed?
 A) 5
 B) 2
 C) 3
 D) 4
- 17) A student measures the mass and volume of a piece of aluminum. The measurements are 25.6 grams and 9.1 cubic centimeters. The student calculates the density of the aluminum. What is the percent error of the student's calculated density of aluminum?
 A) 4%
 B) 2%
 C) 1%
 D) 3%

- 18) Which one of the following compounds is insoluble in water?
 A) silver bromide
 B) sodium bromide
 C) potassium bromide
 D) calcium bromide

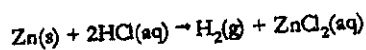
- 19) Given the equation:



What ion is represented by letter X?

- A) hypochlorite
 B) hydroxide
 C) perchlorate
 D) hydronium

- 20) Given the balanced equation representing a reaction:



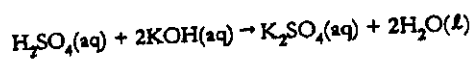
Which set of reaction conditions produces $\text{H}_2(g)$ at the *fastest* rate?

- A) 1.0 g of powdered Zn(s) in 50. mL of 1.0 M HCl(aq) at 20. °C
 B) 1.0 g of powdered Zn(s) in 50. mL of 1.0 M HCl(aq) at 30. °C
 C) a 1.0 g lump of Zn(s) in 50. mL of 0.5 M HCl(aq) at 30. °C
 D) a 1.0 g lump of Zn(s) in 50. mL of 0.5 M HCl(aq) at 20. °C

- 21) Which Lewis electron-dot diagram represents an atom in the ground state for a Group 13 element?



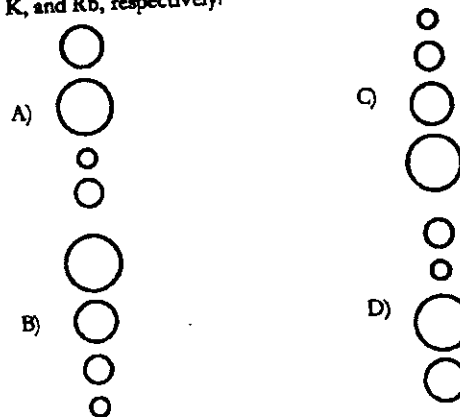
- 22) Given the balanced equation representing a reaction:



Which type of reaction is represented by this equation?

- A) decomposition
 B) synthesis
 C) neutralization
 D) single replacement
- 23) According to the wave-mechanical model of the atom, electrons in an atom
- A) travel in defined circles
 B) are located in orbitals outside the nucleus
 C) are most likely found in an excited state
 D) have a positive charge
- 24) Which one of the following elements is a brittle solid with low conductivity at STP?
- A) sulfur
 B) argon
 C) sodium
 D) aluminum
- 25) Which formula represents an ionic compound?
- A) CH_4
 B) CH_3OH
 C) H_2
 D) NH_4Cl

- 26) Which grouping of circles, when considered in order from the top to the bottom, *best* represents the relative size of the atoms of Li, Na, K, and Rb, respectively?



- 27) Half-reactions can be written to represent *all*
- A) neutralization reactions
 B) double-replacement reactions
 C) fission and fusion reactions
 D) oxidation and reduction reactions
- 28) What is the mass number of an atom that has six protons, six electrons, and eight neutrons?
 A) 12
 B) 14
 C) 20
 D) 6
- 29) Tetrachloromethane, CCl_4 , is classified as a
- A) compound because the atoms of the elements are combined in a fixed proportion
 B) mixture because the atoms of the elements are combined in a fixed proportion
 C) compound because the atoms of the elements are combined in a proportion that varies
 D) mixture because the atoms of the elements are combined in a proportion that varies
- 30) Which of the following statements explains why low temperature and high pressure are required to liquefy chlorine gas?
- A) Chlorine molecules have strong covalent bonds.
 B) Chlorine molecules have weak intermolecular forces of attraction.
 C) Chlorine molecules have weak covalent bonds.
 D) Chlorine molecules have strong intermolecular forces of attraction.
- 31) Which substance can *not* be decomposed by a chemical change?
 A) Cu
 B) HI
 C) AlCl_3
 D) H_2O
- 32) Which one of the following compounds has *both* ionic and covalent bonds?
 A) NaI
 B) CH_3OH
 C) Na_2CO_3
 D) CO_2
- 33) Which one of the following Group 15 elements exists as diatomic molecules at STP?
 A) bismuth
 B) phosphorus
 C) nitrogen
 D) arsenic

- 34) A student collects the materials and equipment below to construct a voltaic cell.

- two 250-mL beakers
- wire and a switch
- one strip of magnesium
- one strip of copper
- 125 mL of 0.20 M $\text{Mg}(\text{NO}_3)_2(\text{aq})$
- 125 mL of 0.20 M $\text{Cu}(\text{NO}_3)_2(\text{aq})$

Which additional item is required for the construction of the voltaic cell?

- A) a salt bridge C) an anode
B) a battery D) a cathode
- 35) Which statement describes a chemical property of the element magnesium?
- A) Magnesium has a high boiling point.
B) Magnesium conducts electricity.
C) Magnesium reacts with an acid.
D) Magnesium is malleable.
- 36) Which two characteristics are associated with metals?
- A) high first ionization energy and high electronegativity
B) high first ionization energy and low electronegativity
C) low first ionization energy and high electronegativity
D) low first ionization energy and low electronegativity
- 37) Which energy conversion occurs during the operation of a voltaic cell?
- A) Electrical energy is spontaneously converted to chemical energy.
B) Chemical energy is spontaneously converted to electrical energy.
C) Chemical energy is converted to electrical energy only when an external power source is provided.
D) Electrical energy is converted to chemical energy only when an external power source is provided.
- 38) A real gas behaves *least* like an ideal gas under the conditions of
- A) high temperature and high pressure
B) low temperature and low pressure
C) low temperature and high pressure
D) high temperature and low pressure
- 39) Chlorine-37 can be represented as
- A) $^{20}_{37}\text{Cl}$ C) $^{17}_{35}\text{Cl}$
B) $^{35}_{17}\text{Cl}$ D) $^{35}_{20}\text{Cl}$
- 40) Which value of an element is calculated using *both* the mass and the relative abundance of each of the naturally occurring isotopes of this element?
- A) half-life C) atomic number
B) molar volume D) atomic mass
- 41) Given the balanced equation representing a phase change:



Which statement describes this change?

- A) It is exothermic, and entropy increases.
B) It is exothermic, and entropy decreases.
C) It is endothermic, and entropy increases.
D) It is endothermic, and entropy decreases.

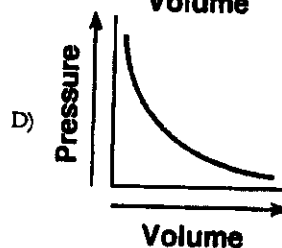
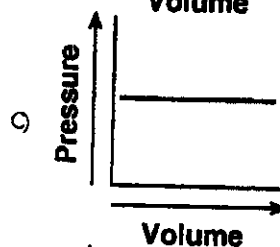
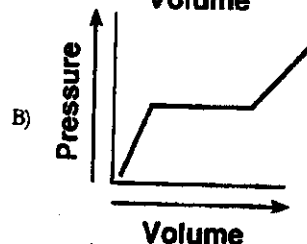
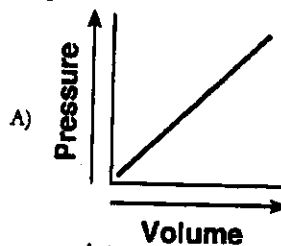
- 42) At which temperature would atoms of a $\text{He}(\text{g})$ sample have the *greatest* average kinetic energy?

- A) 298 K C) 273 K
B) 37°C D) 25°C

- 43) According to the kinetic molecular theory, which of the following statements describes the particles in a sample of an ideal gas?

- A) The separation between the gas particles is smaller than the size of the gas particles themselves.
B) The force of attraction between the gas particles is strong.
C) The collisions between the gas particles cannot result in a transfer of energy between the particles.
D) The motion of the gas particles is random and straight-line.

- 44) Which of the following graph represents the relationship between pressure and volume for a sample of an ideal gas at constant temperature?



- 45) A compound is made up of iron and oxygen, only. The ratio of iron ions to oxide ions is 2:3 in this compound. The IUPAC name for this compound is

- A) iron(III) oxide C) iron(II) oxide
B) triiron dioxide D) iron trioxide

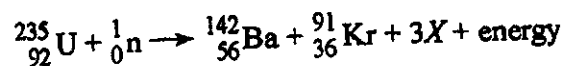
- 46) Which formula represents copper(I) oxide?

- A) CuO C) Cu_2O
B) Cu_2O_2 D) CuO_2

- 47) What is the name of the polyatomic ion in the compound Na_2O_2 ?

- A) oxalate C) oxide
B) peroxide D) hydroxide

- 48) Given the balanced equation representing a nuclear reaction:



Which particle is represented by X?

- A) ${}_0^1\text{n}$ C) ${}_2^4\text{He}$
 B) ${}_1^1\text{H}$ D) ${}_{-1}^0\text{e}$
- 49) The total number of protons, electrons, and neutrons in each of four different atoms are shown in the table below.

Subatomic Particles in Four Different Atoms

Atom	Total Number of Protons	Total Number of Electrons	Total Number of Neutrons
A	6	6	7
D	6	6	8
X	7	7	8
Z	8	8	9

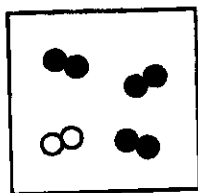
Which two atoms are isotopes of the same element?

- A) X and D B) A and D C) A and Z D) X and Z
- 50) Which two particle diagrams represent mixtures of diatomic elements?

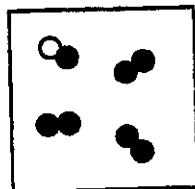
KEY:

○ = atom of one element

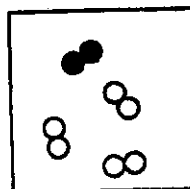
● = atom of another element



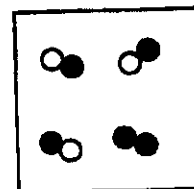
A



B



C



D

A) B and C

B) A and B

C) B and D

D) A and C

— Unit 1 Preview —

Complete the following list of chemistry problems. They cover concepts you learned in first year chemistry. If you get stuck, feel free to read through the appropriate section of your *Regents textbook*. Show all work on this copy. *renew book.*

1. Give an example of a homogeneous mixture and a heterogeneous mixture.
2. Do the following statements describe chemical or physical properties?
 - a. Oxygen gas supports combustion.
 - b. Fertilizers help to increase agricultural production.
 - c. Water boils below 100°C on top of a mountain.
 - d. Lead is denser than aluminum.
 - e. Uranium is a radioactive element.
3. Does each of the following describe a physical change or a chemical change?
 - a. The helium gas inside a balloon tends to leak out after a few hours.
 - b. A flashlight beam slowly gets dimmer and finally goes out.
 - c. Frozen orange juice is reconstituted by adding water to it.
 - d. The growth of plants depends on the sun's energy in a process called photosynthesis.
 - e. A spoonful of table salt dissolves in a bowl of soup.
4. Give the names of the elements represented by the chemical symbols:

a. Li	h. Pt
b. F	i. Mg
c. P	j. U
d. Cu	k. Al
e. As	l. Si
f. Zn	m. Ne
g. Cl	

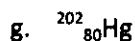
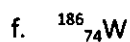
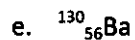
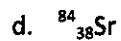
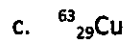
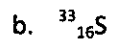
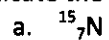
5. Give the chemical symbols for the following elements:
- potassium
 - tin
 - chromium
 - boron
 - barium
 - plutonium
 - sulfur
 - argon
 - mercury
6. Classify each of the following substances as an element or compound:
- hydrogen
 - water
 - gold
 - sugar
7. Classify each of the following as an element, compound, homogeneous mixture, or heterogeneous mixture:
- seawater
 - helium gas
 - sodium chloride (table salt)
 - a bottle of soft drink
 - milk shake
 - air in a bottle
 - concrete

Skip to #12..

12. a. Normally the human body can endure a temperature of 105°F for only short periods of time without permanent damage to the brain or other vital organs. What is this temperature in $^{\circ}\text{C}$?
- b. Ethylene glycol is a liquid organic compound that is used as an antifreeze in car radiators. It freezes at -11.5°C . Calculate the freezing point temperature in degrees Fahrenheit.
- c. The temperature on the surface of the sun is about 6300°C . What is this temperature in degrees Fahrenheit?
- d. The ignition temperature of paper is 451°F . What is the temperature in degrees Celsius?
13. Convert the following temperatures to Kelvin:
- a. 113°C , the melting point of sulfur
- b. 37°C , the normal body temperature
- c. 357°C , the boiling point of mercury
14. Convert the following temperature to degrees Celsius:
- a. 77 K , the boiling point of liquid nitrogen
- b. 4.2 K , the boiling point of liquid helium
- c. 601 K , the melting point of lead
15. What is the number of significant figures in each of the following measurements?
- a. 4867 mi
- b. 56 mL
- c. 60,104 ton
- d. 2900 g
- e. 40.2 g/cm^3

16. Carry out the following calculations as if they were calculations of experimental results, and express each answer in the correct units with the correct number of significant figures.
- $5.6792 \text{ m} + 0.6 \text{ m} + 4.33 \text{ m}$
 - $3.70 \text{ g} - 2.9133 \text{ g}$
 - $4.51 \text{ cm} \times 3.6666 \text{ cm}$
17. Carry out the following conversions (you must use conversion factors):
- 22.6 m to dm
 - 25.4 mg to kg
 - 556 mL to L
 - 10.6 kg/m^3 to g/cm^3
18. The average speed of helium at 25°C is 1255 m/s. Convert this speed to miles per hour (mph) using conversion factors.
19. Describe the contributions of the following scientists to our knowledge of atomic structure:
- JJ Thomson
 - RA Millikan
 - Ernest Rutherford
 - James Chadwick
20. Describe the experimental basis for believing that the nucleus occupies a very small fraction of the volume of the atom.

21. Indicate the number of protons, neutrons, and electrons in each of the following species:



22. Define, with two examples, the following terms:

a. alkali metals

b. alkaline earth metals

c. halogens

d. noble gases

23. Elements whose name ends with -ium are usually metals. Sodium is one example. Identify a nonmetal whose name ends with -ium.

24. Explain why the chemical formula HCl can represent two different chemical systems.

Skip to #32..

32. How many moles of cobalt (Co) atoms are there in 6.00×10^9 cobalt atoms?
33. How many moles of calcium (Ca) atoms are in 77.4 g of calcium?
34. How many atoms are present in 3.14 g of copper (Cu)?
35. Calculate the molar mass of each of the following substances:
- NO_2
 - SO_3
 - C_6H_6
 - NaI
 - K_2SO_4
 - $\text{Ca}_3(\text{PO}_4)_2$
36. How many molecules of ethane (C_2H_6) are present in 0.334 g of C_2H_6 ?
37. What are the empirical formulas of the compounds with the following compositions?
- 40.1% C, 6.6% H, 53.3% O

 - 18.4% C, 21.5% N, 60.1% K
38. The anticaking agent added to Morton salt is calcium silicate, CaSiO_3 . This compound can absorb up to 2.5 times its mass of water and still remain a free flowing powder. Calculate the percent composition of CaSiO_3