

Advanced Chemistry Final Review

1. What are the products of complete combustion of hydrocarbons?
Hydrocarbons are compounds made of carbon and oxygen. When they burn (combine with oxygen) they form carbon dioxide and water.
2. What is the total number of atoms represented in the formula $\text{Al}_2(\text{CO}_3)_3$?
14
3. How many significant figures are in .0040040 m?
Five. Zeros in front---never significant. Zeros in the middle--always significant. Zeros at the end--significant if there is a decimal point.
4. Balance an equation for the production of iron (III) carbonate from iron (III) oxide and carbon dioxide.
$$\text{Fe}_2\text{O}_3 + 3\text{CO}_2 \rightarrow \text{Fe}_2(\text{CO}_3)_3$$
5. What is the difference between accuracy and precision?
accuracy means correct. precision means that the results are the same, even if they are wrong.
6. Glass is made from silicon dioxide. (sand is made of mostly silicon dioxide and glass is made from liquefied sand)
Just know this one.
7. How does the number of molecules of Ar in a 2 liter container compare to the number of molecules of He in another 2 liter container, if the temperature and pressure are the same in both?
Equal volumes of gas contain equal numbers of molecules if T and P are equal.....so.....**they are the same**
8. What is the name of P_2O_5 ?
diphosphorus pentoxide
9. What is the formula for Density? $D = m/V$
10. How many moles of HCl are required to react completely with 4 moles of Zn?
Eight. The equation is
$$\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$$
11. What is the volume of one mole of gas at STP? 22.4 liters
12. In problem 10, if you were given 30 moles of each reactant, what quantity of what reactant would remain unreacted?

30 moles of HCl would require 15 moles of Zn given the 1:2 ratio. So, you would have 15 moles of Zn left over. (30 - 15)

13. What is the percentage of sodium in sodium oxide?

$$46 / 62 \times 100 = 74 \%$$

46 is the mass of two sodium atoms. 62 is the total mass of sodium oxide.

14. What is the volume of 88 grams of carbon dioxide at 25 C and 1.1 atm?

$$P \quad V = M/MW \quad R \quad T$$
$$(1.1 \text{ atm}) \quad V = (88\text{g}/44\text{g}) \quad (.08205 \text{ Latm/moleK}) \quad (298 \text{ K})$$

$$V = 44.5 \text{ liters}$$

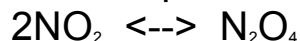
15. In an open manometer, the mercury level in the arm connected to a gas sample is lower than that of the arm open to the atmosphere by 15 mm. If the atmospheric pressure is 760, what is the pressure of the gas?

If the level of mercury is higher on the side that is open to the atmosphere, then the gas in the container must be pushing harder than the atmosphere. The difference would be the height of the mercury (15 mm), so the pressure of the gas would be 760 + 15, or 775

16. What effect does lowered atmospheric pressure have on the boiling point of water?

Since water boils when the vapor pressure = atmospheric pressure, lowering atmospheric pressure would mean the vapor pressure could be less when boiling begins. This means a lower temperature would be necessary to create the necessary pressure, so boiling point is lowered. In this situation, you could think of vapor pressure as the molecules pushing on each other inside the liquid.

17. What is the equilibrium constant expression for the following reaction?



$$K_{eq} = [\text{N}_2\text{O}_4] / [\text{NO}_2]^2$$

18. $2\text{A} + 2\text{B} \rightarrow \text{A}_2\text{B}_2 \quad \Delta H = -250 \text{ KJ}$.

If 4 moles of A react, what is the energy change?

$$4 \text{ moles A} \times -250 \text{ kJ} / 2\text{moles A} = -500 \text{ kJ}$$

19. How does a catalyst affect activation energy?

A catalyst lowers activation energy. (it creates a different way for the reaction to occur)

20. How are positive ions formed? losing electrons

21. Is SO₂ polar? Yes. When you draw the dot diagram the molecule is bent (trigonal planar electron geometry and bent molecular geometry, with one double bond), so the charge vectors do not cancel

22. What element has an electron configuration ending in 3p²? Si

23. What type(s) of bonding are in Na₂SO₄?

both ionic (between the sodium and the sulfate ions), and covalent (within the sulfate ion)

24. Which halogen has the highest ionization energy? Fluorine. It is the smallest and has the least shielding effect.

25. If Carbon was defined as having a mass of 20, what would be the relative mass of Mg?

$$\frac{12}{20} = \frac{24.3}{x}$$

$$x = 40.5$$

Use the proportion above. 12 is the normal weight of carbon, 24.3 is the normal weight of Mg. 20 is the newly defined mass of carbon, solve for the new mass of Mg.

26. Which is saturated? alkanes, alkenes or alkynes? Saturated means all single bonds. The answer is alkanes. (like methane, ethane, propane, etc.....)

alkenes have a double bond, and alkynes have a triple bond. These bonds could be broken and more hydrogens could be added, so they are said to be unsaturated.

27. CO₂ has polar bonds. Why is the molecule non-polar?

When you draw the dot diagram you will find that there are no unshared electrons around the center atom. This means the molecule will be linear, and the charge vectors will cancel each other.

28. Cs is an alkali metal. What is the likely formula for cesium nitride? Alkali metals have an oxidation of state of +1..... Nitrogen has 5 valence electrons, so -3. Cs_3N

29. What volume of .2 M NaCl would contain 3 moles of NaCl?

.2 M means .2 moles per liter or 1 liter per .2 moles.

3 moles \times 1 liter/.2 moles = 15 liters

30. What is produced when Zn reacts with sulfuric acid?

A single replacement reaction..... zinc sulfate and hydrogen.

31. If silver chloride makes a saturated solution so that the concentration of silver ion in the solution is .000015, what is the chloride ion concentration?



since there is a 1:1 ratio, the chloride ion concentration will be .000015 M

32. How many grams of NaOH are needed to make 2 liters of 4 M solution of NaOH?

2 liters \times 4 moles/liter \times 40 grams/mole = 320 grams

33. If 50 ml of 2 M HCl are diluted to 4 liters, what is the new concentration?

.05 liters \times 2 moles per liter = .1 moles of HCl

.1 moles of HCl / 4 liters = .025 moles/liter or .025 M

34. What is the oxidation state of sulfur in the sulfate ion?

SO_4^{-2} the sum of the charge on the elements must equal the charge on the ion. so since the oxygen is -2, the sulfur must be +6.

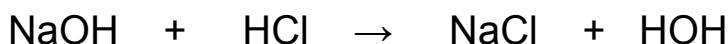
35. What is the hydrogen ion concentration in .2 M HCl? Is this more, or less than it would be in .2 M $\text{HC}_2\text{H}_3\text{O}_2$?

.2 M HCl is a strong acid, so there is no equilibrium. The H⁺ (or H₃O⁺) would be much less concentrated in the acetic acid since it is a weak acid and establishes equilibrium.

36. Which metallic halides are insoluble?

Know this one.....Silver, Mercury (I) and Lead.

37. If 40 ml of .2 M NaOH are needed to neutralize 30 ml of HCl, what was the concentration of the HCl?



.04 liters x .2 moles/liter = .008 moles of sodium hydroxide.

since there is a 1:1 ratio in the reaction of HCl and NaOH, the moles of HCl will equal the moles of NaOH, so there were .008 moles of HCl in the 30 ml.

Molarity is moles/liter, so

$$.008 \text{ mole} / .03 \text{ liters} = .27 \text{ M HCl}$$

38. What is the normal oxidation state of the alkaline earth metals?

+2. two valence electrons, so they lose them.

39. The density of vegetable oil is .920 g/ml. How many ml do you need to have a mass of 75 grams?

$$75 \text{ grams} \times 1 \text{ ml} / .920 \text{ grams} = 81.5 \text{ ml}$$

40. What is the oxidation state of the hydroxide ion? -1

41. Which is correct? Add water to acid, or add acid to water?

do what you "oughter," add acid to water.

42. What is the mass of 1.204×10^{24} molecules of water?

1.204×10^{24} molecules x 1 mole / 6.02×10^{23} molecules x 18 grams/ mole

$$= 36 \text{ grams}$$

43. What is the name of FeO? Iron(II) oxide. Iron may have multiple oxidation states, so you must write the oxidation state.

44. What gas is primarily involved in the formation of acid rain? The gas is a nonmetal oxide.

SO₂ Sulfur dioxide. Nonmetal oxides + water → acids

45. If a gas is collected over water and the total pressure is 750 mmHg at 25 C, what would you need to consider to find the pressure of the dry gas?

You would need to subtract the water vapor pressure. You will be given the value.

46. The empirical formula of a compound is HO. The molecular weight is 34. What is the molecular formula?

HO = 17. Since 17 goes into 34 two times, the molecular formula is H₂O₂

47. When pressure goes up, what happens to volume? It goes down.

48. When temperature goes up, what happens to volume? It goes up

49. Draw a graph of energy vs. time for an endothermic reaction.

I am having trouble importing an image into Google Docs, so know that products will have more energy than the reactants.

50. What is the definition of equilibrium? Two processes going in opposite directions at EQUAL RATES.

51. A compound is 70% iron, and 30% oxygen. What is its simplest formula?

assume a 100 gram sample.

70 grams Fe x 1 mole/56 grams = 1.25 moles Fe

30 grams O x 1 mole / 16 grams = 1.88 moles O (O is in a compound, so not diatomic)

Now divide both by the smallest

$$1.25 / 1.25 = 1$$

$$1.88/1.25 = 1.5$$

since 1.5 : 1 in whole numbers is 3 : 2, the formula is Fe₂O₃

52. Which is most soluble in water: a polar compound, or a nonpolar compound?

How do you determine polarity?

Since water is polar, polar compounds are attracted to it and they dissolve better.

To determine polarity you must draw the dot diagrams and consider the charge vectors.

53. What is the electronic structure (electron configuration) for ³⁵Cl?

17

1s², 2s², 2p⁶, 3s², 3p⁵

54. Which of the following particles emitted from a radioactive source is highest energy: alpha, beta, gamma or protons?

alpha particle are helium nuclei and are low energy.

beta particles are electrons, and are higher in energy.

gamma particles are the highest energy of these four particles. They are a form of light.

55. Why are the masses on the periodic table expressed as decimals?

the masses on the table are averages of the isotopes.

56. How many electrons, protons, and neutrons are in the chlorine atom listed in number 53?

17 protons, 17 electrons and 18 neutrons.

57. What elements are in the alkali metal family? all those in group I

58. What elements are in the halogen family? all those in group 17

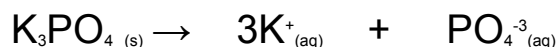
59. What is the functional group in a molecule of alcohol? alcohols always contain OH

60. How many bonds must be on carbon atoms in organic chemistry? 4

61. When chlorine becomes an ion, does it lose electrons and get smaller, or gain electrons and get bigger? gains electrons and gets bigger.

62. In a solution of .01 M HCl, what is the concentration of the OH⁻ ion?
(remember that the hydronium x hydroxide concentrations must equal 1 x 10⁻¹⁴)
1 x 10⁻¹²

63. What is the potassium ion concentration in .2 M potassium phosphate?



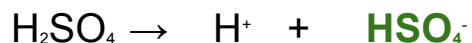
so, the potassium ion concentration is .6 M

64. What is the relationship between Ka and acid strength?

Higher Ka means there are more products in the ratio of products to reactants, so acids with higher Ka have more hydronium ions and are stronger.

65. Indicators like phenolphthalein are weak acids or weak bases. What particle is gained or lost when indicators change colors? Protons. Acids are proton donors, and bases are proton acceptors

66. Polyprotic acids lose one proton at a time when they ionize. What is the anion product of the first ionization of sulfuric acid?

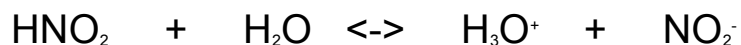


67. In a titration of hydrochloric acid with .1 M sodium hydroxide, the buret containing HCl dropped from 30 to 20 ml and the base buret dropped from 30 to 25. What was the molarity of the HCl?

10 ml of .1 M NaOH were consumed, or .001 moles. So, there were .001 moles of HCl in the 5 ml. Divide the .001 moles of HCl by .005 liters and you find a molarity of .2

68. If potassium nitrite is added to a solution of nitrous acid, how will the pH change?

Since potassium nitrite is a soluble salt, you are really adding NO₂⁻ to the following equilibrium:



The equilibrium will shift left, causing there to be less hydronium and the pH will go up.

69. Are precipitates soluble, or insoluble? Which of the following would form a precipitate if it were the product of a chemical reaction?

Lead(II) sulfide, sodium nitrate, barium sulfate, silver chloride, nitric acid, sodium chloride

Precipitates are insoluble. The solubility rules say that sulfides are insoluble, barium sulfate is listed as an insoluble sulfate, and silver halides are insoluble

You can find the rules here:

<http://howechem.net/CHEM/Equations/equationhelpsheet.pdf>

70. What is the net reaction when aqueous barium nitrate is combined with potassium sulfate?

The products are barium sulfate and potassium nitrate. Since barium sulfate is insoluble, the net reaction is:

