

### Practice Multiple Choice Questions:

- 1) Which of the following is NOT a laboratory safety rule?
  - a) You should never mix acids with bases
  - b) You should tie back your long hair
  - c) You should never add water to acid
  - d) All of the above are valid safety rules
  
- 2) What piece of laboratory equipment is best-suited for accurately measuring the volume of a liquid?
  - a) graduated cylinder
  - b) beaker
  - c) Erlenmeyer flask
  - d) more than one of the above
  
- 3) Which piece of laboratory equipment can be used to store chemicals for long periods of time?
  - a) buret
  - b) evaporating dish
  - c) beaker
  - d) more than one of the above
  
- 4) The independent variable in an experiment is:
  - a) The variable you hope to observe in an experiment.
  - b) The variable you change in an experiment.
  - c) The variable that isn't changed in an experiment.
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- 5) "Qualitative results" refer to:
  - a) Results that can be observed during an experiment.
  - b) Results that are difficult to observe during an experiment.
  - c) Results that require numerical data.
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- 6) When drawing a graph that measures family average income over a period of 50 years, the independent variable is:
  - a) Income
  - b) Average
  - c) Years
  - d) It is impossible to say
  
- 7) Accuracy is defined as:
  - a) A measure of how often an experimental value can be repeated.
  - b) The closeness of a measured value to the real value.
  - c) The number of significant figures used in a measurement.
  - d) None of these
  
- 8) How many significant figures are present in the number 10,450?
  - a) three
  - b) four
  - c) five
  - d) none of these

- 9) What is the appropriate SI unit for distance?
- centimeters
  - inches
  - meters
  - kilometers
- 10) How many decimeters are there in 15 centimeters?
- 150 dm
  - 1.5 dm
  - 0.15 dm
  - none of these
- 11) How many kilograms are there in 4.21 pounds? There are 2.2 pounds in 1 kilogram.
- 9.26 kg
  - 1.91 kg
  - 0.523 kg
  - none of these
- 12) A homogenous material is defined as being:
- An element
  - Any material with uniform composition
  - Synonymous with "solution"
  - More than one of these
- 13) An example of a chemical property is:
- density
  - mass
  - acidity
  - solubility
- 14) "Exothermic" processes:
- Absorb energy
  - Give off energy
  - Have no energy change
  - It is impossible to predict the energy change of an exothermic process.
- 15) Intrinsic properties are properties that:
- Don't depend on the amount of material present.
  - Depend on the amount of material present.
  - Cannot be measured without performing a chemical reaction.
  - None of the above is correct.
- 16) What is the density of an object with a volume of 15 mL and a mass of 42 grams?
- 0.352 g/mL
  - 2.80 g/mL
  - 630 g/mL
  - None of the above is correct.
- 17) Which of the following is not one of Dalton's laws?
- Atoms are indestructible.
  - Atoms of the same element have isotopes with different masses.
  - Atoms of different elements have different chemical and physical properties.
  - All of these are examples of Dalton's laws.

- 18) The "plum pudding" model of the atom was devised by:  
a) Dalton  
b) Democritus  
c) Rutherford  
d) none of the above answers is correct
- 19) Bohr's model of the atom was able to accurately explain:  
a) Why spectral lines appear when atoms are heated.  
b) The energies of the spectral lines for each element.  
c) Why electrons travel in circular orbits around the nucleus.  
d) none of the above answers is correct.
- 20) What subatomic particle has a mass of one atomic mass unit?  
a) proton  
b) neutron  
c) electron  
d) more than one of the above
- 21) How many electrons does iron have?  
a) 26  
b) 30  
c) 56  
d) It depends on the isotope of iron
- 22) True or false: All isotopes are radioactive.  
a) True  
b) False
- 23) Mass spectrometers separate isotopes of different elements based on their:  
a) mass  
b) electric charge  
c) mass divided by electric charge  
d) none of these
- 24) What percent of atoms of magnesium have a mass of exactly 24 amu?  
a) 100%  
b) 70%  
c) 30%  
d) 0%
- 25) The colors of light given off when a sample is heated corresponds to:  
a) The energy difference between the ground state and excited state of an element.  
b) The amount of energy added to the sample.  
c) The heat of the element.  
d) None of the above
- 26) "Line spectra" are caused primarily by:  
a) The existence of many ground states in an atom  
b) The existence of many excited states in an atom  
c) The existence of many atoms in a typical sample  
d) None of the above

- 27) A continuous spectrum is caused primarily by:
- The presence of so many excited states that the lines all blur together into a rainbow.
  - The presence of so many ground states that the lines all blur together into a rainbow.
  - The presence of many atoms in a typical sample.
  - None of the above
- 28) Which of the following is true of the distance of an electron from the nucleus of a  $^1\text{H}$  atom?
- It is 1 amu.
  - It remains constant over time.
  - its distance at any given time can only be predicted by looking at a "wavefunction".
  - It is impossible to say where an electron will be at any given time.
- 29) Orbitals hold:
- A maximum of one electron each
  - A maximum of two electrons each
  - A number of electrons that depends on the energy level.
  - A number of electrons that depends on the type of orbital.
- 30) Which type of orbital looks like a figure-8 when drawn?
- s-orbital
  - p-orbital
  - d-orbital
  - f-orbital
- 31) Which of the following is not an allowed value for the angular momentum quantum number of an atom?
- 1
  - 0
  - +1
  - more than one of the above is disallowed
- 32) The magnetic quantum number of an orbital defines:
- The energy level of the orbital
  - The shape of the orbital
  - The spatial orientation of the orbital
  - The spin of the electrons in the orbital
- 33) Which of the following typically has a low melting point?
- metals
  - nonmetals
  - metalloids
  - transition metals
- 34) The difference between a "family" and a "group" in the periodic table is that:
- Families are columns and groups are rows.
  - Families are rows and groups are columns.
  - Families determine the energy level of an element and groups determine their properties.
  - None of the above is true.

- 35) Which of the following elements has three valence electrons?
- lithium
  - boron
  - nitrogen
  - more than one of the above
- 36) The electron configuration for gallium is:
- $[\text{Ar}] 4s^2 4d^{10} 4p^1$
  - $[\text{Ar}] 4s^2 3d^{10} 3p^1$
  - $[\text{Ar}] 4s^2 3d^{10} 4p^1$
  - none of these answers is correct.
- 37) What section of the periodic table is a very strong oxidizer?
- alkali metals
  - lanthanides
  - halogens
  - none of these answers is correct.
- 38) Which element has the largest atomic radius?
- fluorine
  - carbon
  - tin
  - iodine
- 39) The shielding effect explains why:
- the electronegativity of fluorine is greater than that of bromine
  - the electronegativity of fluorine is greater than that of boron
  - the electronegativity of fluorine is smaller than that of gallium
  - none of these answers is correct
- 40) The octet rule explains why:
- the electronegativity of fluorine is greater than that of bromine
  - the electronegativity of fluorine is greater than that of boron
  - the electronegativity of fluorine is smaller than that of gallium
  - none of these answers is correct
- 41) Cations have:
- Positive charge
  - Negative charge
  - No charge
  - It is impossible to predict the charge on a cation.
- 42) Which pair of atoms would most likely form an ionic compound when bonded to each other?
- calcium and fluorine
  - silicon and nitrogen
  - two oxygen atoms
  - none of the above would probably form an ionic compound
- 43) Which of the following is NOT a property of a salt?
- They have ordered packing arrangements called "lattices"
  - They conduct electricity when dissolved in water or molten.
  - They have a low melting point but a high boiling point.
  - They are brittle.

- 44) The chemical name for  $\text{Fe}_2\text{O}_3$  is:
- iron oxide
  - iron (II) oxide
  - iron (III) oxide
  - iron (VI) oxide
- 45) The percent composition of aluminum in aluminum (III) hydroxide is:
- 50%
  - 25%
  - 14%
  - none of these answers is correct.
- 46) Hydrates are defined as:
- compounds with water molecules attached to them.
  - compounds that have had their water molecules removed
  - compounds that have been heated to high temperatures
  - none of these answers is correct.
- 47) Why do two nonmetals generally form covalent bonds with one another?
- They have similar sizes
  - They have similar electronegativities
  - Nonmetals prefer to share electrons rather than transfer them
  - None of the above
- 48) Why do covalent compounds usually have lower melting and boiling points than ionic compounds?
- No bonds need to be broken to melt a covalent compound.
  - The intermolecular forces in ionic compounds are weaker than those in covalent compounds.
  - Covalent molecules have higher electron affinities than ionic molecules.
  - None of the above is correct.
- 49) Why doesn't water conduct electricity well?
- Huh? Water is an excellent conductor of electricity!
  - Pure water contains very few ions.
  - The hydrogen bonding in water cause the molecules to move slowly from one place to another.
  - None of the above is correct.
- 50)  $\text{N}_2\text{S}_3$  is properly named:
- nitrogen sulfide
  - nitrogen (III) sulfide
  - nitrogen (II) sulfide
  - none of these
- 51) The difference between a molecular and structural formula is that:
- Molecular formulas give you the ratios of the elements in a compound, while structural formulas tell you how many atoms of each element are present.
  - Molecular formulas tell you where the atoms in a compound are, while structural formulas don't.
  - Molecular formulas don't tell you where the atoms in a compound are, while structural formulas do.
  - None of the above is correct.

- 52) What is the total number of lone pairs in carbon disulfide?  
a) two  
b) four  
c) eight  
d) twelve
- 53) What is the bond angle in nitrogen trichloride?  
a)  $120^{\circ}$   
b)  $109.5^{\circ}$   
c)  $107.5^{\circ}$   
d)  $90^{\circ}$
- 54) What is the shape of nitrogen trichloride?  
a) trigonal planar  
b) trigonal pyramidal  
c) tetrahedral  
d) none of these
- 55) VSEPR basically states that:  
a) The repulsion of atomic nuclei help determine the shapes of covalent molecules.  
b) The repulsion between electrons helps determine the shapes of covalent molecules.  
c) The repulsion between bonds helps determine the shapes of covalent molecules.  
d) None of these statements is correct.
- 56) What is the molar mass of iron (III) hydroxide?  
a) 73 grams/mol  
b) 90 grams/mol  
c) 107 grams/mol  
d) none of these
- 57) How many grams are there in 2.1 moles of sodium?  
a) 48.3 grams  
b) 0.0913 grams  
c) 11.0 grams  
d) none of these is correct
- 58) How many molecules are there in 45 grams of aluminum trifluoride?  
a)  $2.28 \times 10^{27}$  molecules  
b)  $3.23 \times 10^{23}$  molecules  
c)  $1.12 \times 10^{24}$  molecules  
d) none of these is correct
- 59) Lead (III) chloride reacts with calcium hydroxide to form calcium chloride and lead (III) hydroxide. What are the coefficients for this reaction?  
a) 3, 2, 2, 3  
b) 2, 3, 2, 3  
c) 2, 3, 3, 2  
d) none of these
- 60) The symbol (s) after a chemical compound lets you know that it is:  
a) soluble in water  
b) insoluble in water  
c) a solid  
d) more than one of the above

- 61) When water and carbon dioxide are formed during an exothermic reaction, it's probably  
a:  
a) synthesis reaction  
b) combustion reaction  
c) single displacement reaction  
d) double displacement reaction
- 62) If we want to make 150 grams of sodium sulfate by reacting ammonia with sulfuric acid, how much ammonia will be needed?  
a) 19.3 grams  
b) 38.6 grams  
c) 77.2 grams  
d) none of these
- 63) How many grams of carbon dioxide will be formed when 100 grams of  $\text{CH}_4$  is burned in oxygen?  
a) 122 grams  
b) 244 grams  
c) 488 grams  
d) none of these
- 64) If the theoretical yield for a reaction was 156 grams and I actually made 122 grams of the product, what is my percent yield?  
a) 78.2%  
b) 128%  
c) 19.0%  
d) none of these
- 65) Carbon disulfide undergoes a single displacement reaction with oxygen to form carbon dioxide. If 100 grams of carbon dioxide are reacted with 50 grams of oxygen, what will the limiting reagent be?  
a) carbon disulfide  
b) carbon dioxide  
c) oxygen  
d) sulfur
- 66) Hydrochloric acid reacts with calcium to form hydrogen and calcium chloride. If 100 grams of hydrochloric acid reacts with 100 grams of calcium chloride, what is the limiting reagent?  
a) hydrochloric acid  
b) hydrogen  
c) calcium chloride  
d) calcium
- 67) For the reaction in problem 66, how much of the nonlimiting reagent will be left over after the reaction is complete?  
a) 54.8 grams  
b) 45.2 grams  
c) 2.74 grams  
d) none of these
- 68) Which are stronger, intramolecular forces or intermolecular forces?  
a) Intramolecular forces  
b) Intermolecular forces



- 69) Which compound is probably most polar of the following?
- boron trichloride
  - oxygen difluoride
  - silicon tetrafluoride
  - selenium difluoride
- 70) Which of the following compounds is NOT polar?
- ammonia
  - nitric acid
  - methane
  - none of these
- 71) Why are organic molecules usually not very polar?
- They contain carbon, which is nonpolar.
  - They have a high degree of symmetry.
  - The electronegativities of carbon and hydrogen are similar.
  - More than one of the above.
- 72) What compound will most likely have the lowest melting and boiling point?
- aluminum trifluoride
  - nitrogen trichloride
  - fluorine
  - hydrogen sulfide
- 73) Which of the compounds from problem 72 above would be most likely to dissolve in water?
- aluminum trifluoride
  - nitrogen trichloride
  - fluorine
  - hydrogen sulfide
- 74) Chromatography is used to:
- Separate two or more compounds based on their polarities.
  - Separate two or more compounds based on their masses.
  - Separate two or more compounds based on how strongly they interact with other compounds.
  - More than one of the above.
- 75) If you were a piece of chromatography paper and your  $R_f$  value of your chin was a solute after an experiment, the  $R_f$  value of your chin would be approximately:
- 0.15
  - 0.50
  - 0.85
  - It's impossible to guess, because you're not sitting in a solvent.
- 76) The difference between dipole-dipole forces and hydrogen bonds are that:
- dipole-dipole forces only exist between nonpolar molecules
  - dipole-dipole forces occur between polar molecules
  - dipole-dipole forces are caused by the interaction of partial charges on both molecules.
  - None of the above are able to distinguish between dipole-dipole forces and hydrogen bonds.

- 77) The electron sea theory is used to describe bonding in:
- network atomic solids
  - ionic solids
  - molecular solids
  - none of these
- 77) The main difference between a suspension and a colloid is that:
- In suspensions the particles eventually settle to the bottom.
  - In colloids the particles eventually settle to the bottom.
  - In colloids, the solute is permanently dissolved in the solvent.
  - None of these
- 78) If I have 30 grams of lithium hydroxide dissolved to make 3L of a solution, the molarity of this solution is:
- 0.42 M
  - 1.26 M
  - 10.0 M
  - none of these
- 79) An unsaturated solution:
- Hasn't dissolved as much solute as is theoretically possible
  - Has dissolved exactly as much solute as is theoretically possible
  - Is unstable because it has dissolved more solute than would be expected.
  - none of these
- 80) Which would you expect to be more soluble in water at 0<sup>0</sup> C, sodium acetate or fluorine?
- sodium acetate
  - fluorine
  - it is impossible to tell
- 81) If I dilute 5 mL of 0.15 M NaCl to a final volume of 5 L, what's the final concentration of NaCl?
- 0.00015 M
  - 0.0015 M
  - 15000 M
  - none of these
- 82) What's the molality if I have 5 L of a solution that contains 1.5 moles of lithium acetate?
- 1.5 m
  - 3.33 m
  - 0.30 m
  - none of these
- 83) Why does the vapor pressure of a solution decrease when an ionic compound is added to it?
- The mole fraction of solvent is higher, causing a lower vapor pressure.
  - There are fewer solvent molecules at the surface, so fewer can vaporize and leave the solution.
  - Most solutes have a positive heat of solvation, causing the temperature of the solution to decrease.
  - none of these

- 84) Which of the following is not an acid?
- $\text{HNO}_3$
  - $\text{CH}_3\text{COOH}$
  - $\text{H}_2\text{SO}_4$
  - All of these are acids
- 85) If a solution conducts electricity, it is probably:
- an acid
  - a base
  - neutral
  - it is impossible to guess.
- 86) If a compound has a pH of 6.5, it has a pOH of:
- 6.5
  - 7.5
  - $3.16 \times 10^{-7}$
  - $3.16 \times 10^{-8}$
- 87) What is the difference between the endpoint and equivalence point in a titration?
- The endpoint is when the pH is exactly 7
  - The equivalence point is when the pH is exactly 7
  - The endpoint and the equivalence point are the same thing.
  - None of these answers is correct.
- 88) If it takes 5 mL of 1.4 M NaOH to neutralize 150 mL of HCl with an unknown concentration, what was the original concentration of the acid?
- 0.47 M
  - 0.047 M
  - 0.014 M
  - none of these
- 89) What is the pH of a 0.001 M formic acid solution?  $K_a = 1.8 \times 10^{-4}$ .
- 3.74
  - 10.3
  - 3.37
  - 10.6
- 90) Which of the following could be the conjugate base of nitric acid?
- sodium nitrate
  - strontium nitrate
  - nitrogen trioxide
  - more than one of the above
- 91) Buffers keep the pH of a solution from changing by:
- converting strong acids to weak ones
  - converting weak acids to strong ones
  - converting weak bases to strong ones
  - more than one of the above answers is correct.
- 92) What's the concentration of  $\text{Ag}^+$  ion in a saturated silver chloride solution?  $K_{sp} = 1.56 \times 10^{-10}$ .
- $1.25 \times 10^{-5}$  M
  - 4.90 M
  - $3.39 \times 10^{-4}$  M
  - none of these

- 93) Why do we assume that gas particles experience no intermolecular forces?
- Because it's true.
  - Because gas particles move too quickly to experience intermolecular forces for very long.
  - Because gas particles are usually a long distance from one another.
  - More than one of the above.
- 94) The kinetic energy of gas molecules is directly proportional to:
- degrees Celsius
  - Kelvins
  - the identity of the gas being studied
  - more than one of the above
- 95) Standard temperature and pressure refers to:
- 0 atm and 273 K
  - 1 atm and 273 K
  - 101.325 kPa and 0 K
  - more than one of the above
- 96) If 10 mL of a gas is at a pressure of 1 atm and we double the pressure, the new volume of the gas will be:
- 5 mL
  - 10 mL
  - 15 mL
  - 20 mL
- 97) If you heat a 5 L balloon from a temperature of  $25^{\circ}\text{C}$  to  $50^{\circ}\text{C}$ , its new volume will be:
- 10 L
  - 2.5 L
  - 5.42 L
  - 4.61 L
- 98) If I have 25 mL of a gas at a pressure of 2.1 atm and a temperature of 300 K, what will the pressure be if I increase the temperature to 400 K and compress the gas to a volume of 10 mL?
- 14 atm
  - 8.6 atm
  - 0.028 atm
  - none of these
- 99) Avogadro's law states that:
- The volume of a gas is directly proportional to its temperature in Kelvins.
  - The volume of a gas is directly proportional to the number of moles present.
  - The volume of a gas is directly proportional to the ideal gas constant.
  - none of these
- 100) If I have a 200 L container filled with nitrogen at a pressure of 1.0 atm, how many moles of nitrogen are present at  $25^{\circ}\text{C}$ ?
- 0.085 moles
  - 8.18 moles
  - 19.3 moles
  - none of these

- 101) The Van der Waals equation is used when:
- We want to know how real gases behave.
  - We want to assume that gases behave ideally.
  - We work with a real gas, rather than an ideal gas.
  - none of these
- 102) If I place 2 moles of helium and 3 moles of oxygen in a 20 liter container at a temperature of 310 K, what is the pressure in the container?
- 2.54 atm
  - 3.82 atm
  - 6.36 atm
  - none of these
- 103) The vapor pressure of a liquid increases when:
- The temperature is raised
  - The temperature is lowered
  - The pressure is lowered
  - none of these
- 104) What's the velocity of hydrogen at 298 K?
- 1930 m/sec
  - 2730 m/sec
  - 61.0 m/sec
  - none of these
- 105) Why don't hydrogen molecules really move as fast as the calculation in problem 104 would suggest?
- hydrogen molecules experience intermolecular forces
  - hydrogen molecules bump into other hydrogen molecules, slowing them down.
  - hydrogen molecules are a liquid at 298 K
  - none of these
- 106) The opposite of sublimation is called:
- melting
  - condensing
  - freezing
  - none of these
- 107) For which process would the heat be negative?
- Changing the temperature of ice water to 50<sup>0</sup> C
  - Condensing steam.
  - Boiling water.
  - more than one of the above.
- 108) A calorimeter is used to:
- Determine the heat of a reaction
  - Determine the heat given off/absorbed during some process
  - Store the heat from a chemical reaction.
  - none of these

- 109) When 2.0 grams of methane are burned in a bomb calorimeter containing 2000 grams of water, it causes the temperature of the water to rise by  $13.3^{\circ}\text{C}$ . What is the molar heat of combustion of methane?  $C_p(\text{H}_2\text{O}) = 4.18 \text{ J/g}^{\circ}\text{C}$ .
- a) 111 kJ
  - b) 888 kJ
  - c) 13.9 kJ
  - d) none of these

That's all.

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  - b) You should tie back your long hair
  - c) You should never add water to acid
  - d) All of the above are valid safety rules
  
- 2) What piece of laboratory equipment is best-suited for accurately measuring the volume of a liquid?
  - a) **graduated cylinder**
  - b) beaker
  - c) Erlenmeyer flask
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c) 30%  
d) 0%
- 25) The colors of light given off when a sample is heated corresponds to:  
a) The energy difference between the ground state and excited state of an element.  
b) The amount of energy added to the sample.  
c) The heat of the element.  
d) None of the above
- 26) “Line spectra” are caused primarily by:  
a) The existence of many ground states in an atom  
b) The existence of many excited states in an atom  
c) The existence of many atoms in a typical sample  
d) None of the above

- 27) A continuous spectrum is caused primarily by:
- The presence of so many excited states that the lines all blur together into a rainbow.
  - The presence of so many ground states that the lines all blur together into a rainbow.
  - The presence of many atoms in a typical sample.**
  - None of the above
- 28) Which of the following is true of the distance of an electron from the nucleus of a  $^1\text{H}$  atom?
- It is 1 amu.
  - It remains constant over time.
  - It's distance at any given time can only be predicted by looking at a "wavefunction".
  - It is impossible to say where an electron will be at any given time.**
- 29) Orbitals hold:
- A maximum of one electron each
  - A maximum of two electrons each**
  - A number of electrons that depends on the energy level.
  - A number of electrons that depends on the type of orbital.
- 30) Which type of orbital looks like a figure-8 when drawn?
- s-orbital
  - p-orbital**
  - d-orbital
  - f-orbital
- 31) Which of the following is not an allowed value for the angular momentum quantum number of an atom?
- 1**
  - 0
  - +1
  - more than one of the above is disallowed
- 32) The magnetic quantum number of an orbital defines:
- The energy level of the orbital
  - The shape of the orbital
  - The spatial orientation of the orbital**
  - The spin of the electrons in the orbital
- 33) Which of the following typically has a low melting point?
- metals
  - nonmetals**
  - metalloids
  - transition metals
- 34) The difference between a "family" and a "group" in the periodic table is that:
- Families are columns and groups are rows.
  - Families are rows and groups are columns.
  - Families determine the energy level of an element and groups determine their properties.
  - None of the above is true.**

- 35) Which of the following elements has three valence electrons?
- lithium
  - boron
  - nitrogen
  - more than one of the above
- 36) The electron configuration for gallium is:
- $[\text{Ar}] 4s^2 4d^{10} 4p^1$
  - $[\text{Ar}] 4s^2 3d^{10} 3p^1$
  - $[\text{Ar}] 4s^2 3d^{10} 4p^1$
  - none of these answers is correct.
- 37) What section of the periodic table is a very strong oxidizer?
- alkali metals
  - lanthanides
  - halogens
  - none of these answers is correct.
- 38) Which element has the largest atomic radius?
- fluorine
  - carbon
  - tin
  - iodine
- 39) The shielding effect explains why:
- the electronegativity of fluorine is greater than that of bromine
  - the electronegativity of fluorine is greater than that of boron
  - the electronegativity of fluorine is smaller than that of gallium
  - none of these answers is correct
- 40) The octet rule explains why:
- the electronegativity of fluorine is greater than that of bromine
  - the electronegativity of fluorine is greater than that of boron
  - the electronegativity of fluorine is smaller than that of gallium
  - none of these answers is correct
- 41) Cations have:
- Positive charge
  - Negative charge
  - No charge
  - It is impossible to predict the charge on a cation.
- 42) Which pair of atoms would most likely form an ionic compound when bonded to each other?
- calcium and fluorine
  - silicon and nitrogen
  - two oxygen atoms
  - none of the above would probably form an ionic compound
- 43) Which of the following is NOT a property of a salt?
- They have ordered packing arrangements called "lattices"
  - They conduct electricity when dissolved in water or molten.
  - They have a low melting point but a high boiling point.
  - They are brittle.

- 44) The chemical name for  $\text{Fe}_2\text{O}_3$  is:
- iron oxide
  - iron (II) oxide
  - iron (III) oxide**
  - iron (VI) oxide
- 45) The percent composition of aluminum in aluminum (III) hydroxide is:
- 50%
  - 25%
  - 14%
  - none of these answers is correct.
- 46) Hydrates are defined as:
- compounds with water molecules attached to them.**
  - compounds that have had their water molecules removed
  - compounds that have been heated to high temperatures
  - none of these answers is correct.
- 47) Why do two nonmetals generally form covalent bonds with one another?
- They have similar sizes
  - They have similar electronegativities**
  - Nonmetals prefer to share electrons rather than transfer them
  - None of the above
- 48) Why do covalent compounds usually have lower melting and boiling points than ionic compounds?
- No bonds need to be broken to melt a covalent compound.**
  - The intermolecular forces in ionic compounds are weaker than those in covalent compounds.
  - Covalent molecules have higher electron affinities than ionic molecules.
  - None of the above is correct.
- 49) Why doesn't water conduct electricity well?
- Huh? Water is an excellent conductor of electricity!
  - Pure water contains very few ions.**
  - The hydrogen bonding in water cause the molecules to move slowly from one place to another.
  - None of the above is correct.
- 50)  $\text{N}_2\text{S}_3$  is properly named:
- nitrogen sulfide
  - nitrogen (III) sulfide
  - nitrogen (II) sulfide
  - none of these**
- 51) The difference between a molecular and structural formula is that:
- Molecular formulas give you the ratios of the elements in a compound, while structural formulas tell you how many atoms of each element are present.
  - Molecular formulas tell you where the atoms in a compound are, while structural formulas don't.
  - Molecular formulas don't tell you where the atoms in a compound are, while structural formulas do.**
  - None of the above is correct.

- 52) What is the total number of lone pairs in carbon disulfide?  
a) two  
b) **four**  
c) eight  
d) twelve
- 53) What is the bond angle in nitrogen trichloride?  
a)  $120^{\circ}$   
b)  $109.5^{\circ}$   
c)  **$107.5^{\circ}$**   
d)  $90^{\circ}$
- 54) What is the shape of nitrogen trichloride?  
a) trigonal planar  
b) trigonal pyramidal  
c) tetrahedral  
d) none of these
- 55) VSEPR basically states that:  
a) The repulsion of atomic nuclei help determine the shapes of covalent molecules.  
b) **The repulsion between electrons helps determine the shapes of covalent molecules.**  
c) The repulsion between bonds helps determine the shapes of covalent molecules.  
d) None of these statements is correct.
- 56) What is the molar mass of iron (III) hydroxide?  
a) 73 grams/mol  
b) 90 grams/mol  
c) **107 grams/mol**  
d) none of these
- 57) How many grams are there in 2.1 moles of sodium?  
a) **48.3 grams**  
b) 0.0913 grams  
c) 11.0 grams  
d) none of these is correct
- 58) How many molecules are there in 45 grams of aluminum trifluoride?  
a)  $2.28 \times 10^{27}$  molecules  
b)  **$3.23 \times 10^{23}$  molecules**  
c)  $1.12 \times 10^{24}$  molecules  
d) none of these is correct
- 59) Lead (III) chloride reacts with calcium hydroxide to form calcium chloride and lead (III) hydroxide. What are the coefficients for this reaction?  
a) 3, 2, 2, 3  
b) **2, 3, 2, 3**  
c) 2, 3, 3, 2  
d) none of these
- 60) The symbol (s) after a chemical compound lets you know that it is:  
a) soluble in water  
b) insoluble in water  
c) **a solid**  
d) more than one of the above

- 61) When water and carbon dioxide are formed during an exothermic reaction, it's probably  
a:  
a) synthesis reaction  
b) **combustion reaction**  
c) single displacement reaction  
d) double displacement reaction
- 62) If we want to make 150 grams of sodium sulfate by reacting ammonia with sulfuric acid, how much ammonia will be needed?  
a) 19.3 grams  
b) **38.6 grams**  
c) 77.2 grams  
d) none of these
- 63) How many grams of carbon dioxide will be formed when 100 grams of  $\text{CH}_4$  is burned in oxygen?  
a) 122 grams  
b) **244 grams**  
c) 488 grams  
d) none of these
- 64) If the theoretical yield for a reaction was 156 grams and I actually made 122 grams of the product, what is my percent yield?  
a) **78.2%**  
b) 128%  
c) 19.0%  
d) none of these
- 65) Carbon disulfide undergoes a single displacement reaction with oxygen to form carbon dioxide. If 100 grams of carbon dioxide are reacted with 50 grams of oxygen, what will the limiting reagent be?  
a) carbon disulfide  
b) carbon dioxide  
c) **oxygen**  
d) sulfur
- 66) Hydrochloric acid reacts with calcium to form hydrogen and calcium chloride. If 100 grams of hydrochloric acid reacts with 100 grams of calcium chloride, what is the limiting reagent?  
a) hydrochloric acid  
b) **hydrogen**  
c) calcium chloride  
d) calcium
- 67) For the reaction in problem 66, how much of the nonlimiting reagent will be left over after the reaction is complete?  
a) 54.8 grams  
b) **45.2 grams**  
c) 2.74 grams  
d) none of these
- 68) Which are stronger, intramolecular forces or intermolecular forces?  
a) Intramolecular forces  
b) **Intermolecular forces**

- 69) Which compound is probably most polar of the following?
- a) boron trichloride
  - b) oxygen difluoride
  - c) silicon tetrafluoride
  - d) **selenium difluoride**
- 70) Which of the following compounds is NOT polar?
- a) ammonia
  - b) nitric acid
  - c) **methane**
  - d) none of these
- 71) Why are organic molecules usually not very polar?
- a) They contain carbon, which is nonpolar.
  - b) They have a high degree of symmetry.
  - c) **The electronegativities of carbon and hydrogen are similar.**
  - d) More than one of the above.
- 72) What compound will most likely have the lowest melting and boiling point?
- a) aluminum trifluoride
  - b) nitrogen trichloride
  - c) **fluorine**
  - d) hydrogen sulfide
- 73) Which of the compounds from problem 72 above would be most likely to dissolve in water?
- a) aluminum trifluoride
  - b) nitrogen trichloride
  - c) fluorine
  - d) **hydrogen sulfide**
- 74) Chromatography is used to: bas
- a) Separate two or more compounds ed on their polarities.
  - b) Separate two or more compounds based on their masses.
  - c) Separate two or more compounds based on how strongly they interact with other compounds.
  - d) **More than one of the above.**
- 75) If you were a piece of chromatography paper and your chin was a solute after an experiment, the  $R_f$  value of your chin would be approximately:
- a) 0.15
  - b) 0.50
  - c) **0.85**
  - d) It's impossible to guess, because you're not sitting in a solvent.
- 76) The difference between dipole-dipole forces and hydrogen bonds are that:
- a) dipole-dipole forces only exist between nonpolar molecules
  - b) dipole-dipole forces occur between polar molecules
  - c) dipole-dipole forces are caused by the interaction of partial charges on both molecules.
  - d) **None of the above are able to distinguish between dipole-dipole forces and hydrogen bonds.**

- 77) The electron sea theory is used to describe bonding in:
- network atomic solids
  - ionic solids
  - molecular solids
  - none of these
- 77) The main difference between a suspension and a colloid is that:
- In suspensions the particles eventually settle to the bottom.
  - In colloids the particles eventually settle to the bottom.
  - In colloids, the solute is permanently dissolved in the solvent.
  - None of these
- 78) If I have 30 grams of lithium hydroxide dissolved to make 3L of a solution, the molarity of this solution is:
- 0.42 M
  - 1.26 M
  - 10.0 M
  - none of these
- 79) An unsaturated solution:
- Hasn't dissolved as much solute as is theoretically possible
  - Has dissolved exactly as much solute as is theoretically possible
  - Is unstable because it has dissolved more solute than would be expected.
  - none of these
- 80) Which would you expect to be more soluble in water at 0° C, sodium acetate or fluorine?
- sodium acetate
  - fluorine
  - it is impossible to tell
- 81) If I dilute 5 mL of 0.15 M NaCl to a final volume of 5 L, what's the final concentration of NaCl?
- 0.00015 M
  - 0.0015 M
  - 15000 M
  - none of these
- 82) What's the molality if I have 5 L of a solution that contains 1.5 moles of lithium acetate.
- 1.5 m
  - 3.33 m
  - 0.30 m
  - none of these
- 83) Why does the vapor pressure of a solution decrease when an ionic compound is added to it?
- The mole fraction of solvent is higher, causing a lower vapor pressure.
  - There are fewer solvent molecules at the surface, so fewer can vaporize and leave the solution.
  - Most solutes have a positive heat of solvation, causing the temperature of the solution to decrease.
  - none of these



- 84) Which of the following is not an acid?
- $\text{HNO}_3$
  - $\text{CH}_3\text{COOH}$
  - $\text{H}_2\text{SO}_4$
  - All of these are acids
- 85) If a solution conducts electricity, it is probably:
- an acid
  - a base
  - neutral
  - it is impossible to guess.
- 86) If a compound has a pH of 6.5, it has a pOH of:
- 6.5
  - 7.5
  - $3.16 \times 10^{-7}$
  - $3.16 \times 10^{-8}$
- 87) What is the difference between the endpoint and equivalence point in a titration?
- The endpoint is when the pH is exactly 7
  - The equivalence point is when the pH is exactly 7
  - The endpoint and the equivalence point are the same thing.
  - None of these answers is correct.
- 88) If it takes 5 mL of 1.4 M NaOH to neutralize 150 mL of HCl with an unknown concentration, what was the original concentration of the acid?
- 0.47 M
  - 0.047 M
  - 0.014 M
  - none of these
- 89) What is the pH of a 0.001 M formic acid solution?  $K_a = 1.8 \times 10^{-4}$ .
- 3.74
  - 10.3
  - 3.37
  - 10.6
- 90) Which of the following could be the conjugate base of nitric acid?
- sodium nitrate
  - strontium nitrate
  - nitrogen trioxide
  - more than one of the above
- 91) Buffers keep the pH of a solution from changing by:
- converting strong acids to weak ones
  - converting weak acids to strong ones
  - converting weak bases to strong ones
  - more than one of the above answers is correct.
- 92) What's the concentration of  $\text{Ag}^+$  ion in a saturated silver chloride solution?  $K_{sp} = 1.56 \times 10^{-10}$ .
- $1.25 \times 10^{-5}$  M
  - 4.90 M
  - $3.39 \times 10^{-4}$  M
  - none of these

- 93) Why do we assume that gas particles experience no intermolecular forces?
- Because it's true.
  - Because gas particles move too quickly to experience intermolecular forces for very long.
  - Because gas particles are usually a long distance from one another.
  - More than one of the above.**
- 94) The kinetic energy of gas molecules is directly proportional to:
- degrees Celsius
  - Kelvins**
  - the identity of the gas being studied
  - more than one of the above
- 95) Standard temperature and pressure refers to:
- 0 atm and 273 K**
  - 1 atm and 273 K
  - 101.325 kPa and 0 K
  - more than one of the above
- 96) If 10 mL of a gas is at a pressure of 1 atm and we double the pressure, the new volume of the gas will be:
- 5 mL**
  - 10 mL
  - 15 mL
  - 20 mL
- 97) If you heat a 5 L balloon from a temperature of  $25^{\circ}\text{C}$  to  $50^{\circ}\text{C}$ , its new volume will be:
- 10 L
  - 2.5 L
  - 5.42 L**
  - 4.61 L
- 98) If I have 25 mL of a gas at a pressure of 2.1 atm and a temperature of 300 K, what will the pressure be if I increase the temperature to 400 K and compress the gas to a volume of 10 mL?
- 14 atm
  - 8.6 atm
  - 0.028 atm
  - none of these**
- 99) Avogadro's law states that:
- The volume of a gas is directly proportional to its temperature in Kelvins.
  - The volume of a gas is directly proportional to the number of moles present.**
  - The volume of a gas is directly proportional to the ideal gas constant.
  - none of these
- 100) If I have a 200 L container filled with nitrogen at a pressure of 1.0 atm, how many moles of nitrogen are present at  $25^{\circ}\text{C}$ ?
- 0.085 moles
  - 8.18 moles**
  - 19.3 moles
  - none of these

- 101) The Van der Waals equation is used when:
- a) **We want to know how real gases behave.**
  - b) We want to assume that gases behave ideally.
  - c) We work with a real gas, rather than an ideal gas.
  - d) none of these
- 102) If I place 2 moles of helium and 3 moles of oxygen in a 20 liter container at a temperature of 310 K, what is the pressure in the container?
- a) 2.54 atm
  - b) 3.82 atm
  - c) **6.36 atm**
  - d) none of these
- 103) The vapor pressure of a liquid increases when:
- a) **The temperature is raised**
  - b) The temperature is lowered
  - c) The pressure is lowered
  - d) none of these
- 104) What's the velocity of hydrogen at 298 K?
- a) **1930 m/sec**
  - b) 2730 m/sec
  - c) 61.0 m/sec
  - d) none of these
- 105) Why don't hydrogen molecules really move as fast as the calculation in problem 104 would suggest?
- a) **hydrogen molecules experience intermolecular forces**
  - b) hydrogen molecules bump into other hydrogen molecules, slowing them down.
  - c) hydrogen molecules are a liquid at 298 K
  - d) none of these
- 106) The opposite of sublimation is called:
- a) melting
  - b) condensing
  - c) freezing
  - d) **none of these**
- 107) For which process would the heat be negative?
- a) Changing the temperature of ice water to 50<sup>0</sup> C
  - b) **Condensing steam.**
  - c) Boiling water.
  - d) more than one of the above.
- 108) A calorimeter is used to:
- a) Determine the heat of a reaction
  - b) **Determine the heat given off/absorbed during some process**
  - c) Store the heat from a chemical reaction.
  - d) none of these

- 109) When 2.0 grams of methane are burned in a bomb calorimeter containing 2000 grams of water, it causes the temperature of the water to rise by  $13.3^{\circ}\text{C}$ . What is the molar heat of combustion of methane?  $C_p(\text{H}_2\text{O}) = 4.18 \text{ J/g}^{\circ}\text{C}$ .
- a) 111 kJ
  - b) **888 kJ**
  - c) 13.9 kJ
  - d) none of these

That's all.