TEST NAME: Final Exam Practice
TEST ID: 179902
GRADE: 09 – 12
SUBJECT: Life and Physical Sciences
TEST CATEGORY: My Classroom

Note: All of the answers to the 91 questions are included on this document. However, I have only had a chance to type out explanations for the first few. Stay tuned! It should be finished by the weekend.

Answers

1. B – A substance's temperature decreases when put into a freezer. A decrease in temperature is a decrease in average kinetic energy.

2. C – When temperature increases, molecular motion increases. When temperature decreases, molecular motion decreases. When ice is added to warm water, the ice (at $0^{o}C$) will absorb heat and begin to melt. At the same time, the warm water will decrease in temperature.

3. B – A change in heat without a change in temperature on a heating curve graph means that the substance is changing from one phase/state to another. The explanation at the top of the graph mentions that the water starts as ice and eventually changes to steam. Leg 4 would represent the heat of vaporization – how much heat it takes to boil the water.

4. B – The tea is presumably warmer than the ice cubes. The tea will lose heat and lower temperature while the ice gains heat and melts.

5. C – Heat of fusion is the amount of heat it takes to change a solid substance to a liquid.

6. C – The first horizontal part of the graph (where melting occurs; solid → liquid) occurs at about $70^{o}C$. The second horizontal part of the graph (where boiling occurs; liquid → gas) occurs at about $140^{o}C$.

7. B – $\frac{4.18\ J}{g\ ^{o}C} \cdot 500\ g \cdot 27\ ^{o}C = 56340\ J$ $\frac{56340\ J}{1\ mole} = 56340\ J/mole$ $5.64 \times 10^{4}\ J/mole$

8. D – q = heat; see Reference Tables p. 3

9. C – $1.2\ atm \cdot 50.0\ L = n \cdot 0.0821\ L\,atm/mole\,K \cdot 650\ K$ $60 = 53.365\ n$ $n = 1.1$ moles

10. C – I don't love this question because you need to focus on the fact that the question asks about what causes the balloon to burst, and not the relationship between temperature and volume. The fact of the matter is that both the temperature and pressure decrease as you rise through the atmosphere. Only the decrease in pressure would increase the volume causing the balloon to burst. (The decrease in temperature would cause the balloon to shrink.)

11. B – I, again, do not love this question. More collisions with the container walls (tire's inner surface) will cause the pressure to increase. However, the wording of the answer implies (at least to me) that there are more gas molecules in the tire when the pressure goes up – which is just not true.

12. B – Indicators of a chemical change include: 1) formation of a gas/bubbling, 2) formation of a precipitate (solid formed from two aqueous solutions), 3) temperature change, and 4) color change. Reaction would be

endothermic because the temperature went down because heat is absorbed. Because heat is absorbed, we feel the lack of heat.

13. C – One of the other indicators of a chemical change is the emission of an odor – in addition to the others mentioned in #12.

14. A – Gas bubbles forming are an indicator of a chemical change, as mentioned in #12.

15. C – Mass of hydrogen divided by the mass of the entire molecule, then multiply by 100.

C = 12.01 x 6 = 72.06
H = 1.00 x 12 = 12.00
O = 15.99 x 6 = 95.94
= 180 when added together

$\frac{12.00}{180} \times 100 = 6.67\%$

16. C – Exothermic means that heat is released or given off. The reactants have more energy than the products. Melting involves absorbing heat. Falling rocks and breaking glass are not chemical changes. Leaves burning of paper by process of elimination.

17. D – If the ice melts, then the reaction must be exothermic. Exothermic reactions release heat.

18. B – Burning is a chemical change. Melting, dissolving, and steam rising are physical changes.

19. B – Production of a gas is an indicator of a chemical change taking place.

20. C – Stoichiometry problem

1) Find moles. $\frac{36.0\text{ g}}{18.0\text{ g}} \left| \frac{1\text{ mole}}{} \right. = 2\text{ moles } H_2O$

2) Mole ratio! $\frac{2\text{ moles } H_2O}{2} = \frac{x\text{ moles } O_2}{1}$ cross multiply to get x = 1 mole O_2

3) Find answer. $\frac{1\text{ mole}}{1\text{ mole}} \left| \frac{32.0\text{ g}}{} \right. = 32.0\text{ g } O_2$

21. A – "limiting reagent" = limiting reactant; Note: there will be no limiting reactant calculations on your NC Final Exam

1) Find moles. $\frac{2.00\text{ g } NH_3}{17.0\text{ g}} \left| \frac{1\text{ mole}}{} \right. = 0.1176\text{ moles } NH_3$ $\frac{4.00\text{ moles } O_2}{32.0\text{ g}} \left| \frac{1\text{ mole}}{} \right. = 0.125\text{ moles } O_2$

2) Divide each by its coefficient from the balanced equation. The lower # is the limiting reactant.

$\frac{0.1176}{4} = 0.00294$ $\frac{0.125}{5} = 0.025$

22. A – Find moles of each element. Divide all moles by the smallest # of moles to get subscripts.

$\frac{48.62\text{ g Mg}}{24.31\text{ g}} \left| \frac{1\text{ mole}}{} \right. = 2\text{ moles Mg}$ $\frac{32.00\text{ g O}}{16.00\text{ g}} \left| \frac{1\text{ mole}}{} \right. = 2\text{ moles O}$

$\frac{2}{2} = 1$ $\frac{2}{2} = 1$ MgO

23. D – Stoichiometry problem to determine the theoretical yield. Then find percent yield.

1) $\frac{84.0\text{ g}}{84.0\text{ g}} \left| \frac{1\text{ mole}}{} \right. = 1\text{ mole } NaHCO_3$

2) $\frac{1\text{ mole } NaHCO_3}{1} = \frac{x\text{ moles NaCl}}{1}$ x = 1 mole NaCl

3) $\frac{1 \text{ mole}}{1 \text{ mole}} \left| \frac{58.44 \text{ g}}{} \right. = 58.4 \text{ g NaCl}$ % yield = $\frac{56.0}{58.4} \times 100 = 95.9\%$

24. B – Catalysts are used to speed up the rate of a chemical reaction.

25. A – Because NH_3 is on the right side, an increase in NH_3 causes the reaction to shift to the left, which favors the reactants.

26. A – The graph plots temperature vs. reaction rate and it is a directly proportional graph.

27. D – Increase in pressure will shift the equilibrium to the side with the lower number of moles of gas. There are 4 moles of gas on the left side and 2 moles of gas on the right side. When the equilibrium shifts right, more product is formed.

28. A – Strange question, but remember that things are EQUAL at EQUILibrium.

29. A – To increase production of NO, the equilibrium will need to shift to the right. Removing water (on the right) causes the equilibrium to shift to the right.

30. C – The answer explains the reasoning.

31. C – Reducing the pH means to make the solution more acidic. Sodium bicarbonate forms a slightly basic solution, so it would not likely reduce the pH to 7.

32. D – The solvent is the substance that the solute is dissolved in.

33. A – The solute is dissolved in the solvent.

34. D – In one mole of Na_3PO_4, there are 3 moles of Na^{+1} ions ($Na_3PO_4 \leftrightarrow 3\ Na^{+1} + PO_4^{-3}$). In three moles of Na_3PO_4, there are a total of nine moles of Na^{+1} ions. $6.022 \times 10^{23} \cdot 9 = 5.420 \times 10^{24}$

35. B – The equation for dilutions is: $M_1V_1 = M_2V_2$
$1.0\ M \cdot 25\ \cancel{mL} = x \cdot 75\ \cancel{mL}$ $x = 0.33\ M$

36. C – Hydroxide concentration = $[OH^{-1}] = 1.00 \times 10^{-5}\ M$ $pOH = -\log[OH^{-1}]$ pH + pOH
$-\log[1.00 \times 10^{-5}] = 5$ $14 - 5 = 9$
Note: There should not be a unit with pH.

37. D – Strong acids and bases are strong electrolytes (bright light). Weak acids and bases are weak electrolytes (more dim light).

38. A – acid + base → salt + water

39. B – another dilution $2.0\ \cancel{M} \cdot 500\ mL = 4.0\ \cancel{M} \cdot x$ $x = 250\ mL$

40. D – Molarity is equal to the number of moles of solute divided by the liters of solution.
NOTE: The mass given for F is incorrect. It should be 19.00.
$\frac{10.00 \text{ g}}{58.09 \text{ g}} \left| \frac{1 \text{ mole}}{} \right. = 0.1721 \text{ moles}$ $\frac{0.1721 \text{ moles}}{2.0 \text{ L}} = 0.086\ M$ (which = mol/L)

41. D – same equation as #40 - $\frac{2.0 \text{ moles}}{0.50 \text{ L}} = 4.0 \text{ M}$

42. A – same equation as #40 - $2.80 \text{ g} \left| \frac{1 \text{ mole}}{148.33 \text{ g}} \right. = 0.01888 \text{ moles}$ $\frac{0.01888 \text{ moles}}{0.075 \text{ L}} = 0.25 \text{ M}$

43. B – When a mixture can no longer hold any more solute at that temperature, it is considered saturated.

44. A – When more solute comes into contact with the solvent, dissolving occurs faster.

45. D – neutral implies that there are equal numbers of positive (protons) and negative (electrons) charges.

46. C – Half-life periods are the amount of time it takes for half of the atoms to decay.
Start with 1 → after 1 half-life, there is ½ present → after 2 half-lives, there is ¼ present → after 3 half-lives, there is $^1/_8$ present → after 4 half-lives, there is $^1/_{16}$ present → after 5 half-lives, there is $^1/_{32}$ present

47. A – I can only tell you what the test bank says is the correct answer. There is simply not enough information to solve this problem. Potassium-40 is not the stable decay product of uranium-238. Don't know what to tell you on this one.

48. C – mass of an atom = number of protons + number of neutrons 9 + 10 = 19

49. C – protons and neutrons make up the mass of an atom. Both are also found in the nucleus.

50. C – seriously?!? Don't you wish every exam question could be like this one?

51. A – Because both are atoms of the same element (uranium), they must have the same number of protons. Because they have different masses, it means that there has to be a different number of neutrons.

52. D – A 1:2 ratio of K-40 to Ar-40 means that two half-lives have elapsed. A 1:3 ratio means that 2 half-lives have elapsed. If one half-life is 1.25 billion years, then two half-lives is 2.5 billion years.

53. C – must have more negatives (electrons) than positives (protons)

54. B – more electrons than protons means that the overall charge would be negative

55. C – differing numbers of protons will mean that there are different elements

56. D – (A) protons and electrons are NOT the same mass, (B) what?, (C) – no they're opposite charges. However, the **amount of charge** they have must be equal in order to cancel the other out.

57. C – more protons than electrons means that the substance is positively charged

58. C – another really easy one!

59. B – again with an easy atomic structure question

60. D – The location of an electron within the electron cloud (where it is in relation to the nucleus) depends on the energy of the electron and the attraction of the electron

61. A – neutrons have no charge and are located in the nucleus along with the protons

62. C - Chlorine has seven valence electrons. Gaining one electron would make it have 8 valence electrons – which is what noble gases have

63. D – The element that ends its configuration with $4p^5$ is bromine. Bromine has **high** ionization energy, a **-1** charge, and is a poor conductor of electricity. Only answer left is (D).

64. D – Electromagnetic radiation (light is a form of) is released when an electron in an atom falls from the excited state (higher energy level) to the ground state (lower energy level)

65. C – If there is a 1:1 ratio of uranium to lead (there is the same amount of each – half of the sample has decayed), that means that one half-life has passed. One half-life is 704,000,000 years.

66. B – Sodium would lose its one ($3s^1$) valence electron, so we would want to find the electron configuration of an element that wanted to gain electrons (nonmetal/more than 4 valence electrons). $1s^2\ 2s^2\ 2p^5$ is fluorine, a nonmetal with seven valence electrons.

67. A – $Na_2C_2O_4$ – there are two atoms of sodium (Na), two atoms of carbon (C), and four atoms of oxygen (O).

68. A – The fact that water is a polar molecule (with slightly positive and slightly negative ends of the molecule) allows it to dissolve many different substances.

69. B – Metallic bonds describe how the valence electrons of metals (particularly transition metals) do not belong to any one particular atom; the electrons are described as a "sea" of delocalized (not belonging to a particular atom) electrons.

70. A – A molecule that has 2 shared pairs of electrons around the central atom and 2 unshared electron pairs around the central atom is the class AB_2E_2, which is a bent shape.

71. D – Fluorine is a nonmetal in Group 17. That means that it will either gain one electron to form an ionic bond or share one electron in a covalent bond. (There is only one bonding site in an atom of fluorine.)

72. C – Note: Hydrogen "bonding" is NOT a type of bond! Hydrogen bonding is a strong intermolecular force. The presence of these hydrogen "bonds" account for water's unique properties: high melting and boiling point, adhesion, cohesion, high heat capacity (lots of energy required to change the temperature), requires a lot of energy to change into the gas state as well.

73. A – Do not let the "IUPAC" part of this question intimidate you! It is simply asking for the name of the compound! Ammonium is NH_4^{+1} and phosphate is PO_4^{-3}. No Greek prefixes used unless it is a binary compound (only two elements) that contains only nonmetals.

74. C – sodium sulfate Use p. 7 of reference tables for formulas of polyatomic ions.

75. D – Fe_2O_3 – binary compound (2 elements) with transition metal other than Al, Zn, Cd, Ag at beginning. Needs Roman numeral. Let x = oxidation number of Fe.

$(2 \cdot x) + (3 \cdot -2) = 0$

How many of the element Element's oxidation #

$2x - 6 = 0$ $\therefore x = 3$ (Roman numeral in name)

76. B – iron (III) hydroxide – Fe's oxidation number is 3 because of the Roman numeral. Use p. 7 of reference tables for hydroxide.

77. C – (A) is wrong because the number of valence electrons increases as atomic number *increases* and that is only true one period at a time. (B) is wrong because the number of protons in the nucleus is the same as the atomic number, so the number of protons in the nucleus increases with increasing atomic number. (D) is wrong because from the end of one period to the next, there is an increase in the number of protons.

78. A – Because the element does not react with lithium or calcium (both metals), X is likely going to be a metal. The formula for the compound when X reacts with oxygen is X_2O. Because O's oxidation number in a compound is -2, that means that X's oxidation number needs to be +1. If the formula of X with Cl is XCl, this further confirms that X's oxidation number would be +1. Elements with a +1 oxidation number are in Group 1.

79. D – Elements on the right side of the periodic table are nonmetals. Nonmetals are usually gases or liquids, or amorphous solids, but most are NOT solids. Nonmetals are NOT good conductors- metals are. Gases and liquids are usually less dense than solids, so nonmetals are generally LESS dense than metals. Nonmetals also have at least 4 valence electrons, so they are more likely to gain electrons when they form ions.

80. B – For an element to have similar properties, the elements should have the same number of valence electrons. Fe's configuration is: [Ar] $4s^2\ 3d^6$, for a total of 2 valence electrons and an incomplete "d" sublevel. K = [Ar] $4s^1$, for a total of one valence electron. Ni = [Ar] $4s^2\ 3d^8$, for a total of 2 valence electrons and an incomplete "d" sublevel. Br = [Ar] $4s^2\ 3d^{10}\ 4p^5$, for a total of 7 valence electrons. Kr = [Ar] $4s^2\ 3d^{10}\ 4p^6$, for a total of 8 valence electrons.

81. B – similar electron structure usually means the elements are in the same group. X is in the same group (column) as 2.

82. C – another easy one! Elements are arranged in order of increasing atomic number!

83. A – Most similar bonding properties = same group, so Cl, Br, and F

84. C – Similar properties = same group. So, a group 17 element would have 7 valence electrons.

85. D – Similar properties = same group. So similar arrangement of valence electrons. Si = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$, Li = $1s^2\ 2s^1$, O = $1s^2\ 2s^2\ 2p^4$, Cl = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$

86. D – easy one! Group is a vertical column!

87. C – Atomic radius is largest at the bottom left of the periodic table.

88. D – least electrically conductive = nonmetal; sodium, tungsten, and zinc are all metals. Argon is a noble gas/not a metal.

89. B – The attraction between the nucleus and electrons decreases because they are further away from each other.

90. A – Calcium is in the same group.

91. B – All group 17 nonmetals are extremely reactive because they only need to gain one more electron.