Sample Chemistry 118 Final Exam Questions

Part I- Multiple Choice

1. If we should "run out of aluminum" someday, it would be because we had
    a) destroyed too much Al   b) drunk too much beer
    c) scattered Al too widely   d) converted too much Al to another metal

2. Of the following, who is **least** likely to develop a case of spongiform encephalopathy?
    a) an English cow   b) a cannibal
    c) an IV drug user   d) a human growth hormone recipient

3. All of the following might form +3 ions **except**
    a) Se   b) Co   c) Al   d) Cr

4. The three-dimensional structures of DNA is the result of
    a) covalent bonds between chains   b) hydrogen bonds between chains
    c) ionic bonds between chains   d) interactions that are not well understood

5. Which of the following is **not** true of DNA profiling?
    a) RFLP's are the result of differences in non-coding DNA between individuals.
    b) Sufficient DNA can be isolated from an envelope flap to conduct DNA profiling.
    c) It is useless to distinguish between identical twins.
    d) Sequencing of DNA from human remains found in Siberia conclusively proved that "Anna Anderson" could not have been the Princess Anastasia Romanov.

6. The specificity of enzyme catalysis is often described as the
    a) ball and chain mechanism   b) lock and key mechanism
    c) roller coaster mechanism   d) kinetic energy mechanism

7. The element with the ground state electron configuration $1s^2 2s^2 2p^4$ is
    a) nitrogen   b) carbon   c) oxygen   d) sulfur

8. When calcium reacts with chlorine, the reaction involves
    a) transfer of electrons from Ca to Cl   b) transfer of electrons from Cl to Ca
    c) formation of new hydrogen bonds   d) equal sharing of electrons

9. The molar mass of magnesium fluoride is
    a) 43.3 g/mole   b) 86.6 g/mole   c) 67.6 g/mole   d) 62.3 g/mole

10. Which of the following is **not** true?
    a) Atoms of the same element can have different numbers of neutrons
    b) Atoms of the same element can have different numbers of protons
    c) Atoms of the same element can have different atomic masses
    d) Atoms of two different elements can have the same number of neutrons

11. All of the following sets of elements would exhibit similar chemistry within the set **except**
   a) Fe, Ru, Os   b) Na, K, Cs   c) Pd, Ag, Cd   d) I, Br, F

12. The burning of butane, C_4H_{10}, in a cigarette lighter yields only carbon dioxide and water. How many moles of O_2 are required to burn 1 mole of butane?
   a) 13   b) 10   c) 9   d) 13/2

13. The inertness of the noble gases is due to the
   a) unique structure of their nuclei   b) special number of protons and neutrons
   c) number and arrangement of their electrons   d) bonds they form with other elements

14. Which of the following solutions would be the **least** acidic?
   a) pH = 6   b) turns litmus blue
   c) tap water   d) H^+ concentration= 1×10^{-1} moles/liter

15. The compound CH_3NH_2 reacts with water to form $CH_3NH_3^+$ and OH^-. In this reaction CH_3NH_2 acts as a(n)
   a) acid   b) base   c) salt   d) catalyst

16. Set point theory involves
   a) the prediction of optimum muscle composition based on diet
   b) the determination of optimum percent body fat for your age and height
   c) the manner in which muscle is built in response to hormone levels
   d) the manner in which the hunger sensation is controlled by the brain

17. During the last stages of a marathon (26.2 miles) the body's principal source of energy is
   a) glycogen   b) fat   c) protein   d) water

18. Burning wood is
   a) thermodynamically favorable but kinetically unfavorable
   b) thermodynamically unfavorable and kinetically unfavorable
   c) thermodynamically favorable and kinetically favorable
   d) thermodynamically unfavorable but kinetically favorable

19. Complex carbohydrates are polymers of
   a) amino acids   b) nucleic acids   c) fatty acids   d) glucose

20. The decomposition of 2 moles of water to hydrogen and oxygen requires 137 kcal of energy. The reaction of hydrogen and oxygen to form **4 moles** of water
   a) requires 137 kcal   b) releases 137 kcal
   c) requires 274 kcal   d) releases 274 kcal

21. Which of the following would be a poor choice for a biological weapon?
   a) *Bacillus anthracis*   b) prions   c) *Yersinia pestis*   d) Hantavirus

22. ATP releases energy to power cellular processes
    a) through reaction with creatine
    b) through hydrolysis to ADP
    c) through oxidation
    d) through neutralization

23. Which of the following is *not* true of aerobic exercise?
    a) The maximum amount of ATP is produced during aerobic exercise.
    b) Examples of aerobic exercise include bowling and golf.
    c) Aerobic metabolism cannot be sustained for more than a few minutes.
    d) Both fats and carbohydrates can fuel aerobic exercise.

24. Which of the following is *not* true of anaerobic exercise?
    a) Anaerobic exercise involves short bursts of intense muscle activity.
    b) Anaerobic training increases the capacity for buffering lactic acid.
    c) Anaerobic exercise is performed by fast-twitch muscles.
    d) Individuals with lots of body fat have an advantage when performing anaerobic exercise.

25. Who would be expected to have the lowest VO_2 max?
    a) Lance Armstrong   b) a Pronghorn antelope   c) a Sherpa   d) Stephen Colbert

26. Which would have the highest glycemic index?
    a) Gatorade   b) Exceed   c) water   d) pizza

27. What is the greatest challenge facing high-altitude mountaineers?
    a) cold weather   b) thermogenesis   c) low O_2 d) Abominable Snowmen

28. Which of the following would be *least* likely to improve performance in an endurance athlete on a hot day?
    a) ERG   b) EPO   c) carnitine   d) sleeping in a hyperbaric chamber

29. To what class of performance-enhancing drugs would the molecule shown here belong?
    a) O_2 carrier
    b) stimulant
    c) fuel carrier
    d) anabolic steroid
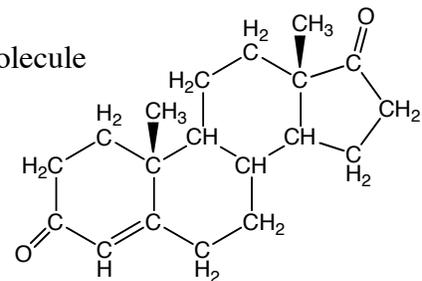
30. Which of the following factors has *not* contributed to increases in life expectancy in the United States over the last century?
    a) Understanding that germs cause disease
    b) Improved hygiene and sanitation
    c) Childhood vaccination programs
    d) Increased food availability

Part II- Short Answer

1. Glucose ($C_6H_{12}O_6$) is metabolized aerobically in the body to produce CO_2 and H_2O.
   a) Write a balanced equation for this process.

   b) Draw an energy diagram showing the relative energies of the reactants and products of this reaction.

   c) What is the product when glucose is metabolized **anaerobically** in the muscles?

2. Forensic biochemists analyze blood and other bodily fluids to identify unknown crime stains.
   a) A,B,O blood typing and protein polymorphism are "exclusionary only". What does this mean?

   b) Briefly, what are the steps in obtaining a "DNA profile"?

   c) Which is more definitive, DNA evidence or an eyewitness? Explain.

3. For each of the following problems, briefly describe a rational chemical solution.
   a) You have just been exposed to smallpox.

   b) The Olympic Trials in the marathon are being held in Denver (with the finish line at Mile High Stadium) and you hope to win.

   c) You are Oprah Winfrey and "Jenny Craig" will pay you $1,000,000.00 if you lose 50 pounds as their spokesperson.

4. a) Draw an electron dot structure for N_2H_4.

    b) What type of bonds are the N-H bonds (i.e., ionic, nonpolar covalent, polar covalent)?

    c) Would you expect this compound to dissolve in water? Explain.

5. You are working late in the lab and realize that the labels have fallen off four bottles of chemicals that you need to finish your experiment. All four are white crystals with similar appearances, but you know that they are **citric acid**, **sodium hydroxide**, **calcium chloride, and potassium chloride**. Fortunately, you have a conductivity device and can test whether a small amount of each compound in water causes a light bulb to light up. Your results are as follows:

Bottle	Light?
A	brightest
B	bright
C	faint
D	bright

a) You immediately realize that you can identify two of the bottles right away. Which two bottles, what do they contain, and how do you know?

b) To identify the other two bottles, you can perform one more simple test. What test would you do and why?

6. Circle all the chemical changes below.

   • Food is metabolized to release energy.

   • A red substance is decomposed by heat to mercury and oxygen.

   • Sodium dropped in water forms sodium hydroxide and hydrogen gas.

   • Water boils on the stove.

   • A hydrogen balloon ignites in the presence of oxygen to form water.

   • Salt dissolves in water.

7. Fill in the missing information (as indicated by "?") in the following table.

Atom	He-4	An isotope of He-4 with 2 more neutrons	?
# protons	?	?	?
#neutrons	?	?	?
#electrons	?	?	16
mass number	?	?	34

8. Circle any of the questions that microscopy could be useful to address.

Whose fingerprints were on the weapon?   Is the white powder cocaine?

Did the suspect's gun fire the bullet?   What type of fibers were on the body?

Are the metal fragments pure gold?   Was gasoline used to start the fire?

9. Classify each of the following as an element, compound, or mixture (circle).

Blood   **element**   **compound**   **mixture**

Salt   **element**   **compound**   **mixture**

Gold   **element**   **compound**   **mixture**

Glass   **element**   **compound**   **mixture**

Hydrogen peroxide   **element**   **compound**   **mixture**

10. Circle any of the following that could be an acid. A solution that:

tastes bitter   turns litmus red

reacts with sodium hydroxide to produce salt water   dissolves in water to produce OH^-

reacts with sodium to produce H_2 has a pH = 7.0

11. For each of the following molecules of life, fill in the letter(s) of the appropriate function(s). (A molecule may have more than one function, and a function may be used more than once.)

_____Lipid   A) Molecule of heredity

_____Carbohydrate   B) Energy storage

                                    C) Cellular catalyst

_____Protein   D) Structural basis of membranes

_____Nucleic Acid   E) Codes for polypeptides

12. Molecules themselves are generally neither "good" nor "bad." For each of the following molecules, state both a good use of the molecule and a bad use of the molecule.

   a) cholesterol

   b) androstenedione

   c) DDT

13. This question is about muscles.

   a) Describe the metabolic differences between fast- and slow- twitch muscles.

   b) Name an activity that would use fast-twitch muscles.

   c) Name an activity that would use slow-twitch muscles.

   d) Describe a perform enhancer specific for fast-twitch activities.

   e) Describe a perform enhancer specific for slow-twitch activities.

14. a) What are two ways to increase the rate of any reaction?

   b) In our bodies we utilize the following reaction involving glucose, $C_6H_{12}O_6$, to generate energy.

$$C_6H_{12}O_6 + 6\ O_2 \longrightarrow 6\ CO_2 + 6\ H_2O + energy$$

   If we are planning to exercise extensively, which, if either, of the strategies in a) can we exploit to produce more energy?

   c) Although fats have a higher energy content per gram (9 kcal/g) than carbohydrates (4 kcal/g), we are better advised to eat a high carbohydrate diet than a high fat diet. Why?

Part III- Problems

1. A Big Mac provides 600 kcal of energy.
   a) For how long would you have to walk to burn one off? [Walking expends 0.073 kcal/min-kg; 1 kg = 2.2 lb.)

   b) For how long would you have to study to burn one off? [Studying expends 0.025 kcal/min-kg.]

2. A purple liquid is thought to be a pure compound. Analyses of three samples of the material yield the following results:

	Mass of sample	Mass of carbon	Mass of hydrogen
Sample 1	1.000 g	0.862 g	0.164 g
Sample 2	1.549 g	1.111 g	0.438 g
Sample 3	0.244 g	0.229 g	0.0153 g

   Could the material be a pure compound? Explain.

3. Nitric acid (HNO_3) can be made from ammonia (NH_3) and oxygen (O_2). The other product is water.
   a) Write a balanced equation for this reaction.

   b) What mass of nitric acid can be made from 971 grams of ammonia?

4. a) Write the equation for the reaction of 1 mole of calcium hydroxide with 2 moles of hydrochloric acid.

   b) What is the pH of the solution following completion of this reaction?

5. The combustion of one mole of CH_4 releases 803 kJ of energy.
   a) Write an appropriate balanced equation for this reaction, including the energy term.

   b) How much energy would be released during the combustion of 32 moles of CH_4?