Name: _____ Block: __ Date: _____
Microbiology Chapters 1 and 2 Review

Complete the following short answer questions.

1. Define *microbiology*.

The study of microorganisms.

2. What are the six major groups of organisms studied in microbiology?

1. Bacteriology: the study of bacteria
2. Mycology: the study of fungi
3. Parasitology: the study of protozoa and parasitic worms
4. Virology: the study of viruses
5. Immunology: the study of immunity
6. Phycology: the study of algae

3. Describe at least four practical applications of microbiology to everyday life.

Bioremediation, denitrification, decomposition, production of food and beverages, digestion, antimicrobials

4. Explain how microorganisms are involved in the flow of energy and nutrients through the Earth's ecosystem. Microorganisms are responsible for the breakdown and denitrification of substances, allowing simple compounds and nutrients to re-enter the food chain.

5. List at least four products the production of which involves the activity of microorganisms.

Yogurt, cheese, salami, beer, wine, bead, sauerkraut

6. What is *bioremediation*?

It is the use of bacteria to consume or break down waste products into simpler, more easily managed products.

7. What is a *pathogen*? List at least four groups of organisms among which pathogens can be found. A pathogen is any microorganism that can be linked to a disease process.

E.coli, S. aureus, Pseudomonas aeruginosa, Streptococci pneumoniae, Streptococci pyogenes

8. Describe the key differences between a *prokaryotic* cell and a *eukaryotic* cell.

Comparison of Prokaryotes and Eukaryotes

	Prokaryotes	Eukaryotes
Organisms	Bacteria	Protists, fungi, plants and animals
Cell size	Generally 1 to 10 µm measured lengthwise	Generally 10 to 100 µm, lengthwise
Metabolism	Anaerobic or aerobic	Anaerobic or aerobic
Organelles	None	Nucleus, mitochondria, chloroplasts, endoplasmic reticulum, Golgi apparatus, lysosomes, etc.
Cell support	External cell wall	Internal cytoskeleton
DNA	Circular DNA in single cellular compartment	Very long linear DNA contained within a membrane-bounded nucleus
RNA and protein	RNA and protein synthesized in the single compartment	RNA synthesized and processed in nucleus; proteins synthesized in cytoplasm
Transmembrane movement	No endocytosis or exocytosis	Endocytosis and exocytosis
Cell division	Chromosomes pulled apart by attachments to inner membrane	Chromosomes pulled apart by attachments to cytoskeletal components
Cellular organization	Mainly unicellular	Unicellular or multicellular, with many differentiated cell types

9. Is a virus a cell? Explain your answer.

No, a virus is made up of of a core of genetic material, either DNA or RNA, surrounded by a protective coat called a capsid which is made up of protein. It is not considered a living thing.

10. What unit of measure would most commonly be used to describe the size of a bacterial cell?

micrometers

11. Relate the invention of the microscope to the demise of the theory of spontaneous generation (a.k.a. abiognesis).

The invention and use of the microscope allowed individuals to see the eggs that were producing the maggots on food, or to visualize the microorganisms that were causing disease.

12. Describe (using a flow diagram) the sequence of events that takes place during the process known as the *scientific method*.

13. Name the three principle subatomic particles that make up atoms. What are their respective charges and locations in an atom? What are the atomic masses of these particles, respectively?

	Location	Mass	Charge
Proton	Nucleus	1 amu	1+
Neutron	Nucleus	1 amu	None
Electron	Electron Cloud	0 amu	1-

14. What is an isotope? What is a *radioactive* isotope? What are some uses for radioactive isotopes?

An isotope refers to an atom of an element with differing numbers of neutrons, therefore differing masses. Radioactive refers to any of several species of the same chemical element with different masses whose nuclei are unstable and dissipate excess energy by spontaneously emitting radiation in the form of alpha, beta, and gamma rays. Uses include the solar power, carbon dating, imaging and weapons.

15. What is a covalent bond? What are the conditions necessary for the formation of a covalent bond? Give an example.

A covalent bond happens when the two atoms involved in a bond have similar electronegativities and share the electrons. For example: Carbon to Hydrogen.

16. What is a *polar covalent* bond?

A polar covalent bond happens when the sharing in a covalent bond is unequal and a polarity arises leaving one end of the molecule partially positive and the other end partially negative.

17. What is a *nonpolar covalent* bond? Give an example.

In a non-polar covalent bond the electrons are shared “equally”, so there are no polar regions formed. A diatomic molecule like oxygen gas. O_2 (g)

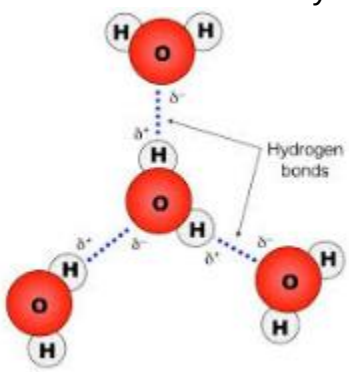
18. What is an ionic bond? What are the conditions necessary for the formation of an ionic bond? Give an example.

An ionic bond forms when the electronegativity differences between to atoms are so different that the electrons are actually transferred creating ions. Sodium and chlorine.

19. What is a hydrogen bond? What are the conditions necessary for the formation of a hydrogen bond? Give an example.

Hydrogen bonds form between polar molecules that contain hydrogen and Nitrogen, Oxygen and Fluorine. It is the attraction between the exposed hydrogen nucleus and the negative region around N, O, or F. Ammonia molecules will form hydrogen bonds with each other.

20. Explain why water has a polar molecule. What is the relationship between the polarity of the molecule and the hydrogen bonding between water molecules?



The partial negative area that occurs around the oxygen will attract the partial positive area that occurs around the hydrogen. Because this is a strong attraction it creates a need for more energy to change phases for water.

21. Name a few properties of water, and relate them to the structure of water, including its polarity and hydrogen bonding between molecules.

Universal solvent, high specific heat capacity, polar molecule (capable of hydrogen bonds), it can dissociate, has a high surface tension, water moderates climate temperature

22. Define and acid and a base. On the pH scale, which numbers indicate a solution is acidic? Basic? Neutral?

An acid is a proton donor and a base is a proton acceptor. 1-6.9 = acidic 7 = neutral 7.1 -14= basic

23. What are buffers, and why are they important to life?

Buffers are solutions that can maintain the pH of a solution even when acids or bases are added, thus keeping the pH of the solution stable (or homeostasis in a body).

24. Draw structural formulas for the seven functional groups presented in chapter 2 of the textbook. Beside each functional group briefly describe its significance.

25. List the four major *groups of organic macromolecules* described in the textbook. Which three of the groups are *polymers*? What are the *monomers* making up each of the polymeric groups, respectively?

Carbohydrates – monosaccharides
Lipids – fatty acids
Proteins – amino acids
Nucleic acids - nucleotides

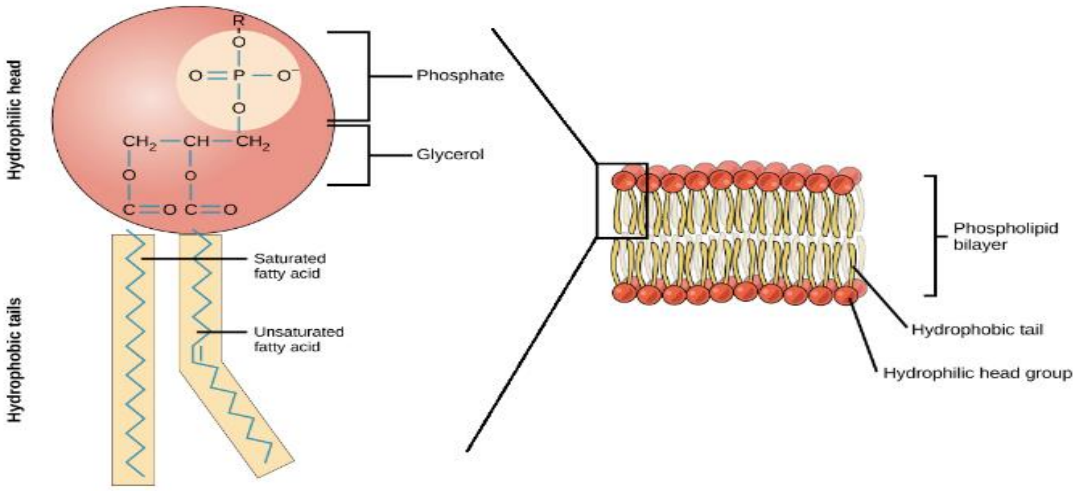
26. What is the general chemical process (reaction) that joins monomers together to make polymers? What is the general chemical process (reaction) that breaks down polymers into monomers?

To create a polymer most chemicals undergo dehydration synthesis and to break down a polymer generally requires hydrolysis.

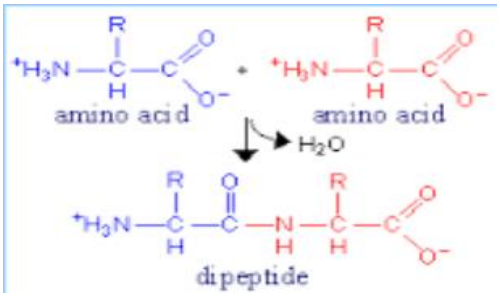
27. List several examples of monosaccharides, disaccharides, and polysaccharides.

Glucose → sucrose → starches

28. How does the structure of a *phospholipid* differ from that of a *fat*? Explain how/why phospholipids form a *bilayer* in the presence of water. Use labeled diagrams to illustrate your explanation.



29. Draw the structure of an amino acid. Draw the structure of a dipeptide, and label the peptide bond.



30. Describe the four possible levels of a protein structure, and note the chemical bonding patterns associated with each level of structure.

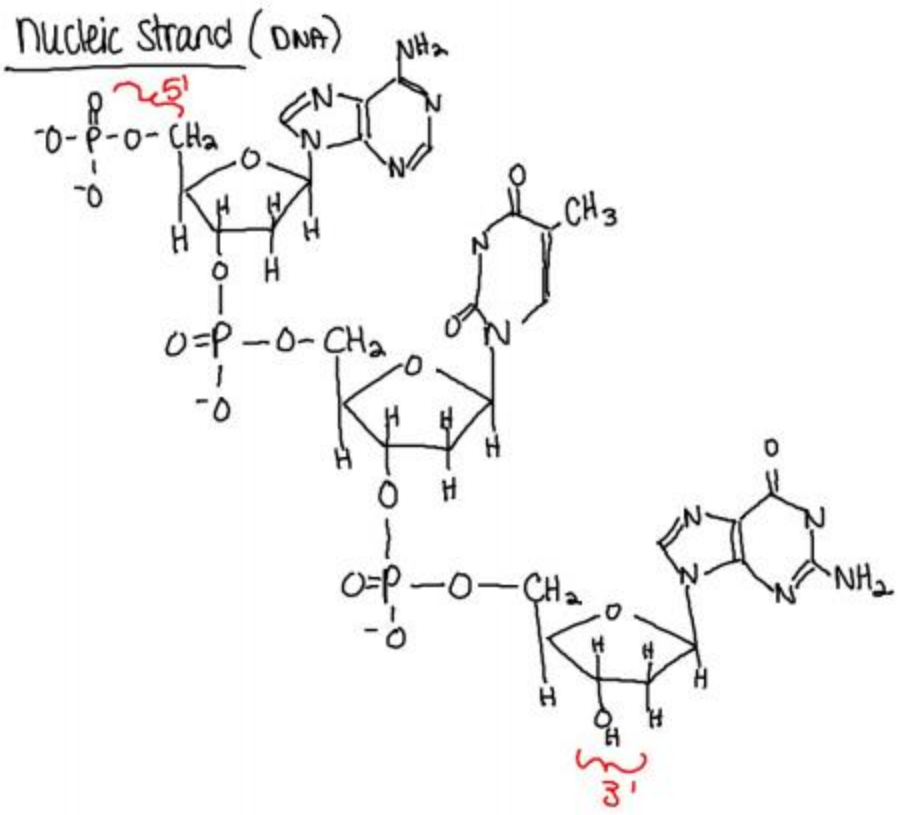
1° Structure - linear sequence of amino acids

2° Structure - initial patterns
- α helix
- β pleated sheets
- Random coils

3° Structure - overall structure due to covalent bonds (Polar bonds), hydrogen bonds, salt bridges & hydrophobic regions

4° Structure (quaternary) - smaller protein or polypeptides join together to form one large molecule.

31. How do nucleotides bond to form nucleic acids (polynucleotides, e.g. DNA and RNA)? Describe at least three differences between the structures of RNA and DNA.



RNA:

1. Ribose
2. Uracil (not Thymine)
3. Single stranded

DNA

1. Deoxyribose
2. Thymine (not Uracil)
3. Double stranded

32. Draw and label a simple diagram of a molecule of ATP (adenosine triphosphate). What is the *function* of ATP? ATP can be used as an energy source. Energy is released as the phosphate groups are broken off.