

Study Guide to Midterm 1

Disclaimer: Not ALL of the questions on the midterm will necessarily be found on this document. The Study Questions you have been answering for each chapter are the basis for the midterm questions, but in order to phrase a logical multiple choice question, i.e. how the question is asked, it may be worded differently – the answer will remain the same.

This is intended to help focus your revision for the upcoming midterm- it is NOT a substitute for answering the chapter by chapter Study Questions.

Chapter 1 Microbial World

What makes sourdough sour? What is name the organism that is responsible for making sourdough sour. Which type of microbe is it? Which metabolic process is responsible for the sour taste and what chemical end product is detected by the taste buds as 'sour'?

Who was the first person to observe microorganisms with a microscope?

Explain why viruses are not classified in any of the same categories as any of the other groups of microbes. Are viruses living or non-living?

Briefly explain how Louis Pasteur's experiments disproved the prevailing theory of spontaneous generation. Illustrate your answer with a diagram of his experimental setup.

Describe Koch's four postulates and their purpose in modern medicine.

Discuss the hypothesis developed by Ignaz Semmelweis following observations made while working in an obstetrics ward in 19th century Austria. Describe how he tested his hypothesis and how these insights are still in use today.

Name the three domains of life identified by Carl Woese in 1978. What features did he use to differentiate between the three domains?

Describe the observation made by Edward Jenner in 1796 regarding immunity of milkmaids to smallpox and describe how he applied this knowledge in the first successful vaccination trial.

Compare the theory of spontaneous generation, and the theory of biogenesis. Describe the series of early experiments that both supported and refuted the theory of Spontaneous Generation. (up until but not including 1858)

Discuss how Joseph Lister applied germ theory to medical procedures and how his insights are still used in medicine today.

Briefly describe how Alexander Fleming ‘discovered’ Penicillin, and how did he recognize it as an antibiotic.

Provide an example of a correctly written scientific name for a bacterium of your choice. Indicate the Genus name and the species name.

Chapter 2 Chemistry for Microbiology

What are ions?, and describe how ionic bonds form between atoms in a compound.

Explain how and why covalent bonds are formed between atoms.

How many protons, neutrons and electrons does Carbon have? Describe how the electrons are arranged, and how this enables carbon to form so many different molecules.

Without using the terms “acid” or “basic” what is the difference between a solution of pH 3 and a solution of pH 5?

Explain the difference between dehydration synthesis and hydrolysis.

Glucose is a monosaccharide. Diagram how two glucose monomers can be combined for form the disaccharide maltose. What is the name for this type of reaction? Then diagram your understanding how this disaccharide molecule can be split into two glucose units. What is the name for this type of reaction

Which type of molecule contains the alcohol glycerol?

Which type of molecule is composed of (CH₂O) units?

Water is a polar molecule. Explain what this means in terms of water's ability to act as a solvent

What are hydrogen bonds? Provide an example of a biological macromolecule that possesses hydrogen bonds and describe the structural role of hydrogen bonds in that molecule. Describe two changes in the chemical environment by which hydrogen bonds can be disrupted and describe what would happen to the structure of the molecule.

Starch, cellulose, and glycogen are all polysaccharides, how are they similar, and how are they different?

Draw and describe the four different levels of protein structure. For each level of structure name the type or types of chemical bonding responsible for the structure.

What are the four nitrogen containing bases of DNA? Name the double ring bases and what name is given to these? Name the single ring bases and what name is given to these. What are the complementary base pairings of DNA?

Describe how the properties of phospholipids make these molecules well suited for plasma membranes.

Chapter 3 Microscopy

Which units are used to measure the wavelength of light. What is the range of wavelengths of visible light? How does color relate to wavelength? Describe the relationship between the wavelength of light and resolution.

Provide a definition of the terms resolution and refraction.

What is refraction of light? How does refraction affect image quality in a compound light microscope? Explain why it is necessary to use oil to see specimens magnified by the 100x objective using a compound light microscope?

What structure does light pass through after leaving the condenser in a compound light microscope?

Which microscope achieves the highest magnification and greatest resolution?

The Gram stain is a differential stain, Describe the sequence of steps that need to be followed to perform a Gram stain. At which stage in the procedure are Gram positive and Gram negative organisms differentiated?

Describe the pathway that a beam of light follows from the source of illumination that would allow you to see an object on a microscope slide.

Explain why an electron microscope can achieve greater resolution than a compound light microscope. State the limits of resolution for both types of microscopes.

What is the difference between a transmission electron microscope and a scanning electron microscope?

Chapter 4 Cells

Describe and draw 5 EXTRA cellular structures of bacteria, and explain their function in the organism.

List and describe 5 differences that distinguish between Prokaryotic and Eukaryotic cells.

Compare the structures and general properties of the gram positive and gram negative cell walls. How does the Gram stain distinguish between the two?

Provide named examples (Genus and species) for each of the following types of bacteria: a bacillus, a streptococcus, a spirillum, a vibrio and a spirochete

In terms of cellular arrangement, how do Streptococci differ from Staphylococci?

Compare and contrast a bacterial glycocalyx and a bacterial capsule in terms of their structure and function. Provide named examples of bacteria with slime layers and a capsule.

What type of molecule is peptidoglycan? Describe how the peptidoglycan layer of the bacterial cell wall is constructed.

Describe the structure and functions of the prokaryotic plasma membrane.

Name an endospore forming bacterium. Under which circumstances is it likely to form an endospore?

Explain the differences between passive diffusion, facilitated diffusion and active transport. Provide examples of molecules that would cross the plasma membrane of a cell via each of the three processes.

Provide definitions for the following terms; isotonic solution, hypotonic solution, and hypertonic solution.

Explain the difference between diffusion and osmosis.

What would happen to cells placed in hypotonic (< 0.9%) and hypertonic (>1.0%) environments?

Describe the structure and the function of mitochondria in eukaryotic cells.

Contrast the location and the structural organization of the genetic information of eukaryotic and prokaryotic cells.

Describe the composition, structure, and location of eukaryotic ribosomes. What is the function of ribosomes? Why is it medically significant that bacteria have structurally different ribosomes than eukaryotes like humans?

Draw and describe the structure and location of the smooth and rough endoplasmic reticulum in eukaryotic cells. Then compare the roles of the smooth and rough endoplasmic reticulum in eukaryotic cells.

Chapter 5 Microbial Metabolism

Using your own words provide definitions for the following terms; metabolism, anabolism, catabolism, reduction, and, oxidation.

Draw and describe how competitive and noncompetitive inhibitors inhibit enzyme function, and provide examples of each.

Diagram and describe how enzymes affect the rate of biochemical reaction. How do enzymes affect the energy required for a reaction to occur? Describe 3 different physical and chemical factors that can influence enzyme activity.

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What is the chemical formula for glucose? Provide balanced chemical equations for the following catabolic reactions: glycolysis , the fermentation of glucose to lactic acid, the fermentation of glucose to ethanol, and the complete aerobic oxidation of glucose.

Where does glycolysis take place in (a) prokaryotic cells, and (b) eukaryotic cells? What is the substrate for glycolysis? How many molecules of ATP are produced in glycolysis, and which method of phosphorylation is used?

Where does the Electron Transport Chain take place in (a) prokaryotic cells, and (b) eukaryotic cells? Which molecules act as electron donor, and which molecule is the terminal electron acceptor in aerobic respiration? How many molecules of ATP are produced in the Electron Transport Chain?

Draw and describe how ATP is generated via chemiosmosis in the Electron Transport Chain in aerobic organisms. Where do the electrons that enter the ETC come from? Describe the role of protons in ATP synthesis.

How many molecules of ATP can be generated by (a) prokaryotes, and (b) eukaryotes from the complete oxidation of glucose to CO_2 and H_2O ? What accounts for the difference?

Believe it or not the purpose of fermentation is not to make alcohol. During fermentation ATP energy is produced during the glycolysis. What is the purpose of the subsequent steps that lead to the production of ethanol?

Explain the differences between: photoheterotrophs and photoautotrophs , and provide named (Genus and species) examples of each.

Explain the differences between chemoautotrophs and chemoheterotrophs, and provide named (Genus and species) examples of each.

Draw and label the structure of a chloroplast. Identify the locations of (a) ATP and (b) carbohydrate synthesis.