

Name: _____

Date: _____ Pd: _____

MCAS Review 1

Format of the Test

- 2 days
- 40 multiple choice questions
- 5 open-response questions

What's on the Test?

Biochemistry and Cell Biology – 25%

- *Prokaryotes vs. Eukaryotes*
- *Parts of a Cell*
- *Osmosis, Diffusion, Active Transport*
- *Organic Compounds: Carbohydrates, Lipids, Proteins, Nucleic Acids*
- *Enzymes*
- *Photosynthesis and Cellular Respiration*
- *Mitosis/Meiosis*

Genetics – 20%

- *Punnett squares*
- *Dominant vs. Recessive*
- *Incomplete Dominance and Codominance*
- *Sex-linked traits, polygenic traits, and multiple alleles*
- *DNA and RNA*
- *Transcription and Translation*

Anatomy and Physiology – 15%

- *Nervous, Circulatory, Muscular, Skeletal, Excretory, Digestive, Respiratory and Endocrine Systems*

Ecology – 20%

- *Populations*
- *Humans and how they affect biodiversity*
- *Food webs*
- *Water, Nitrogen, and Carbon Cycles*
- *Relationships: Predation, Parasitism, Competition, Commensalism, and Mutualism*

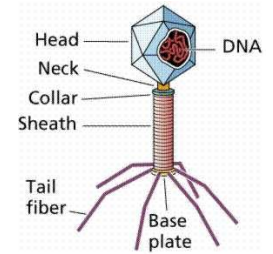
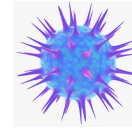
Evolution and Biodiversity – 20%

- *Evidence for evolution*
- *Levels of Taxonomy*
- *Reproductive isolation*
- *Natural selection*

BIOCHEMISTRY AND CELL BIOLOGY REVIEW

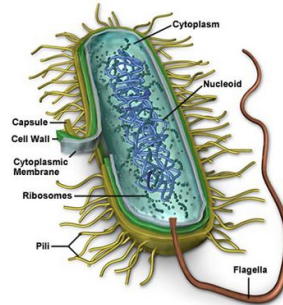
VIRUSES

- Have protein coat and genetic material (DNA or RNA)
- Cannot reproduce on their own – need a host cell
- NOT LIVING!

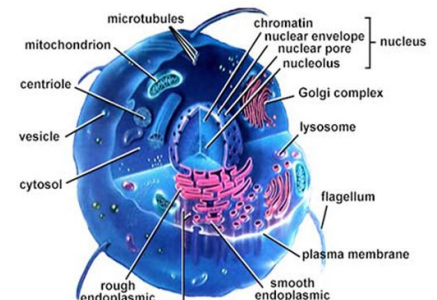


PROKARYOTES VS. EUKARYOTES

- **PROKARYOTES**
 - o Smaller, simpler
 - o **No nucleus**, No membrane-bound organelles
 - o DNA floats around in cytoplasm
 - o BACTERIA!
- **EUKARYOTES**
 - o Larger, more complex
 - o Plants, animals, fungi, protists
 - o Can be unicellular or multicellular



prokaryotic cell
(bacteria)



eukaryotic cell
(protists, fungi, animals, plants)

PARTS OF A CELL

In plant and animal cells

Plasma (cell) membrane	Selectively permeable (lets certain things in and out)
Nucleus	“Control center”, where the genetic material (DNA and RNA) is!
Cytoplasm	Fluid in cell
Mitochondrion	“Mighty mitochondria” – turns glucose into energy (<i>cellular respiration!</i>)
Endoplasmic reticulum	Rough (with ribosomes) or smooth, passageways for proteins
Golgi apparatus	Repackages proteins and sends them out in vesicles to other places
Lysosome	“Garbageman” – breaks down larger molecules into smaller ones (has enzymes!)
Ribosome	Makes proteins, where translation takes place!
Flagellum	Longer, whip-like structure that moves back and forth to move cell
Vacuole	Storage unit for water, food, etc...

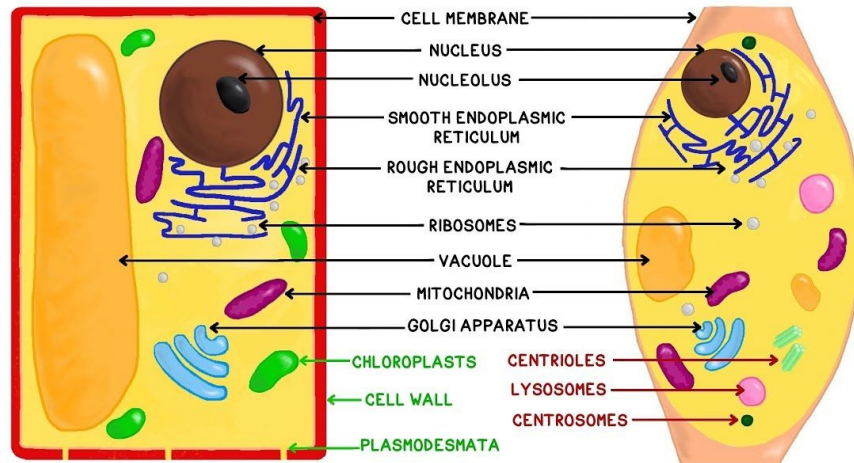
ONLY in animal cells

Centriole	Sets up spindle for cell division
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ONLY in plant cells

Central vacuole (large)	Storage unit for water, food, etc...
Cell wall	Rigid outer layer, provides structure
Chloroplast	Contains chlorophyll, where <i>photosynthesis</i> takes place!

PLANT VS. ANIMAL CELLS



Important Elements: CHONPS

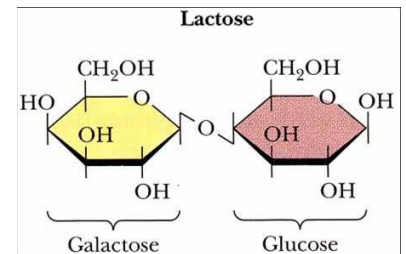
Carbon, Hydrogen, Oxygen, Nitrogen, Phosphorous, Sulfur

- **Carbon** is the basis of all **organic** matter (living things!)

Organic Compounds: *compounds of life!*

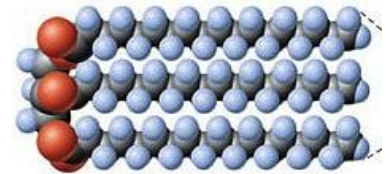
Carbohydrates

- o Ex: Sugars, starches
- o Made up of simple sugars (**monosaccharides**)
- o Main source of **energy** in living things



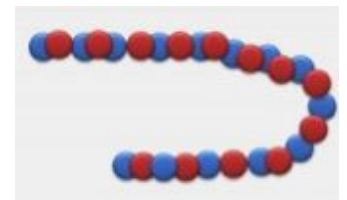
Lipids

- o Ex: Fats, oils, and waxes
- o Made up of **glycerol** and **fatty acids**
- o **Store energy**
- o Main part of cell membranes (phospholipids!)



Proteins

- o Ex: Enzymes, other structures...
- o Made up of **amino acids** put together in a chain
- o Many functions, growth, repair, communication, cell membrane
- o **ENZYMES:** end with -ASE
 - Speed up (increase the rate) of chemical reactions
 - Work best at certain pHs and temperatures



Nucleic Acids

- o Ex: DNA, RNA
- o Made up of **nucleotides**
- o Genetic material – tells your cells what to do!



PRACTICE QUESTIONS

- Which of the following matches a cell organelle with its function?
 - Chloroplast - Movement
 - Nucleus - Cell Regulation
 - vacuole—energy production
 - mitochondria—photosynthesis
- A researcher is studying a particular disease-causing agent. The agent has a protein coat, but it lacks a nucleus, contains no other organelles, and can reproduce only when it is inside an animal cell. The researcher should classify the agent as which of the following?
 - A bacterium
 - A fungus
 - A protist
 - A virus
- A lab technician needs to determine whether cells in a test tube are prokaryotic or eukaryotic. The technician has several dyes she could use to stain the cells. Four of the dyes are described in the table below.

Dye	Test
acridine orange	stains DNA and RNA
osmium tetroxide	stains lipids
eosin	stains cell cytoplasm
Nile blue	stains cell nuclei

- Which dye could the technician use to determine whether the cells are prokaryotic or eukaryotic?
- acridine orange
 - osmium tetroxide
 - eosin
 - Nile blue
- Several parts of an animal cell are involved in the processes of protein synthesis, packaging, and export. Which of the following correctly places the cell parts in the order in which they are involved?
 - nucleus → vacuole → cell membrane
 - mitochondria → vacuole → cell membrane
 - ribosome → endoplasmic reticulum → Golgi complex → cell membrane
 - lysosome → endoplasmic reticulum → Golgi complex → cell membrane
 - If a cell's lysosomes were damaged, which of the following would **most likely** occur?
 - The cell would produce more proteins than it needs.
 - The cell would have chloroplasts that appear yellow rather than green.
 - The cell would be less able to break down molecules in its cytoplasm.
 - The cell would be less able to regulate the amount of fluid in its cytoplasm.
 - In which of the following ways does a bacterial cell differ from an animal cell?
 - A bacterial cell is much larger than an animal cell.
 - A bacterial cell has more mitochondria than an animal cell.
 - A bacterial cell has RNA for its genetic material, whereas an animal cell does not.
 - A bacterial cell does not have membrane-bound organelles, whereas an animal cell does.

7. Which of the following statements best describes the reproduction of both viruses and cells?
- Viruses and cells use mitosis to reproduce.
 - Viruses and cells must have a host to reproduce.
 - Viruses and cells must activate polar bodies to reproduce.
 - Viruses and cells need copies of their genetic material to reproduce
8. What do disaccharides, such as sucrose, and polysaccharides, such as starch, have in common?
- They are lipids made of fatty acids.
 - They are nucleic acids made of nucleotides.
 - They are nucleic acids made of nucleotides.
 - They are carbohydrates made of simple sugars.
9. Which of the following is a main function of the cell wall?
- to store carbohydrates for later use
 - to give the cell a rigid structure
 - to package proteins for export
 - to carry out photosynthesis
10. Which of the following lists of elements contains the **most common** elements in organic compounds?
- carbon, hydrogen, and oxygen
 - chlorine, phosphorus, and sodium
 - copper, magnesium, and sulfur
 - calcium, iron, and potassium
11. Which of the following categories of organic molecules is **correctly** paired with one of its functions?
- nucleic acids—digest dead cells
 - proteins—provide structure in skin, hair, and nails
 - lipids—give quick energy to cells
 - carbohydrates—store genetic information
12. Ovalbumin is a protein found in eggs. Which of the following best describes the molecular structure of ovalbumin?
- a chain of amino acids folded and twisted into a molecule
 - a group of six carbon atoms joined in a ring
 - a set of three fatty acids attached to a molecule of glycerol
 - a sequence of nitrogenous bases attached to a sugar-phosphate backbone
13. Baby food manufacturers sometimes use protease in their products. Proteases catalyze the breakdown of the proteins in these foods, making digestion easier and faster for infants. Protease is which of the following types of molecules?
- Hormones
 - fatty acids
 - Monosaccharides
 - Enzymes

14. The role of an enzyme in a chemical reaction is to increase which of the following?

- a. the structure of reaction
- b. The pH of the chemical reaction
- c. the rate of reaction
- d. the temperature at which the reaction occurs

15. What is synthesized by a ribosome?

- a. Nucleic Acids
- b. Proteins
- c. Lipids
- d. Carbohydrates

16. A cell from an organism has the structures listed: **nucleus, mitochondria, cell wall, chloroplasts**
What type of cell is described?

- a. Animal
- b. Bacterium
- c. Plant
- d. Fungus

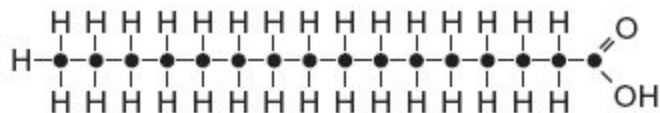
17. Which group of organic compounds contains **fatty acids**?

- a. Carbohydrates
- b. Nucleic Acids
- c. Proteins
- d. Lipids

18. Which of the following units are repeatedly joined together to form a strand of **DNA**?

- a. Polysaccharides
- b. Fatty acids
- c. Amino Acids
- d. Nucleotides

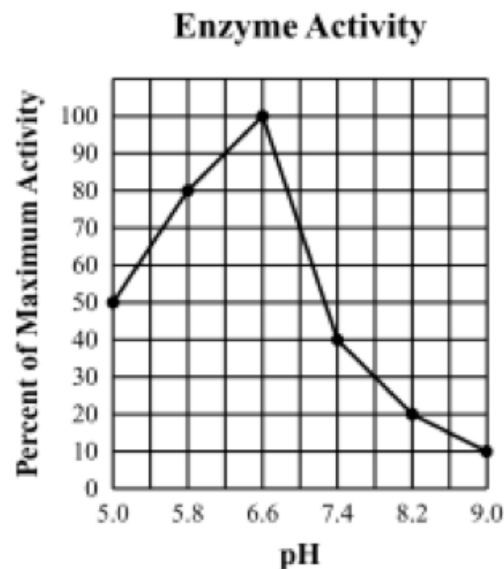
19. A diagram of an **organic** molecule is below. Which element is found at the positions marked by the dots (•) in the molecule?



- a. Nitrogen
- b. Carbon
- c. Phosphorus
- d. Sulfur

20. The figure to the right shows enzyme activity through a pH range of 5.0 to 9.0. At which pH is the enzyme activity the **greatest**?

- a. 5.0
- b. 9.0
- c. 6.6
- d. 8.3



22. **Catalase** is an enzyme that protects cells from damage by helping convert the toxin hydrogen peroxide (H_2O_2) into water (H_2O) and oxygen (O_2). A student is investigating how different pH values and different temperatures affect catalase activity. The table below shows the student's data.

Catalase Experiment Data

Test Tube	Amount of Catalase (drops)	Amount of Hydrogen Peroxide (mL)	pH of Solution	Temperature of Solution ($^{\circ}C$)	Relative Rate of Reaction
1	10	3	1	5	no reaction
2	10	3	1	30	no reaction
3	10	3	1	60	no reaction
4	10	3	3	5	very slow reaction
5	10	3	3	30	slow reaction
6	10	3	3	60	no reaction
7	10	3	7	5	slow reaction
8	10	3	7	30	rapid reaction
9	10	3	7	60	no reaction

a. Identify the test tube that **most likely** has physical conditions similar to the conditions in human cells. Explain your answer.

b. Describe how catalase activity changes as pH decreases. Use data from the table to support your answer.

c. Describe how catalase activity changes as temperature increases. Use data from the table to support your answer.

d. Explain why temperature affects catalase activity in the way you described in part (c).
