Name KEY Date:_____Block:

MCAS Practice: Biochemistry and Cells

1. Ovalbumin is a protein found in eggs. Which of the following best describes the molecular structure of ovalbumin?

   A. a group of six carbon atoms joined in a ring - CARBS
   B. a chain of amino acids folded and twisted into a molecule PROTEIN
   C. a set of three fatty acids attached to a molecule of glycerol LIPID
   D. a sequence of nitrogenous bases attached to a sugar-phosphate backbone

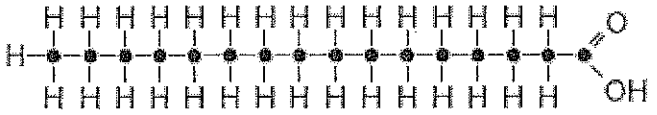
2. A tomato plant in a greenhouse was found to be infected with tobacco mosaic virus. A few weeks later, nearby plants were also found to be infected with the virus.

   Which of the following best describes how the virus reproduced?

   A. The virus made its own spores.
   B. The virus produced seeds in the tomatoes.
   C. The virus used the host plant's resources and machinery to reproduce.
   D. The virus immediately killed the host plant and was free to reproduce.

   * Virus uses the host cell to reproduce

3. A diagram of an organic molecule is below.



long lines of C, H, O

Which element is found at the positions marked by the dots (•) in the molecule? Lipids

   a. Phosphorus
   b. sulfur
   c. Carbon
   d. Nitrogen

4. Look at the above molecule. Which of the following would this molecule fall under?

   a. Carbohydrates - RINGS
   b. Lipids
   c. Proteins (C, H, N, O)
   d. Nucleic acids (C, H, N, O, P)

5. Students in a biology laboratory are monitoring the rate at which hydrogen peroxide breaks down to produce water and oxygen gas. They begin monitoring a sample of hydrogen peroxide and then add catalase, an enzyme that speeds up its breakdown. Their data are shown in the table below.

Time (min)	Rate of Hydrogen Peroxide Breakdown

	(molecules per min)
0.0	0.000
0.5	0.030
1.0	0.032
1.5	4,970,000.000
2.0	5,001,000.000
2.5	4,985,300.000
3.0	5,021,700.000

enzyme

Based on the data in this table, during which of the following time periods did the students add the catalase to the hydrogen peroxide?

A. between 0.0 and 0.5 min

B. between 1.0 and 1.5 min rate increased

C. between 2.0 and 2.5 min

D. between 2.5 and 3.0 min

6. When gametes are produced from a parent cell during normal meiosis, which of the following describes the number of chromosomes in each resulting cell? haploid gametes

A. Each resulting cell has the same number of chromosomes as the parent cell. Mitosis

B. Each resulting cell has twice the number of chromosomes as the parent cell.

C. Each resulting cell has one-half the number of chromosomes as the parent cell. (23) + (23) = Zygote

D. Each resulting cell has one-fourth the number of chromosomes as the parent cell.

7. Which of the following most likely happens in the cells of a person running in the Boston Marathon? More E Req. w/ Exercise ATP is Cell Energy

A. The respiration rate increases to produce more ATP.

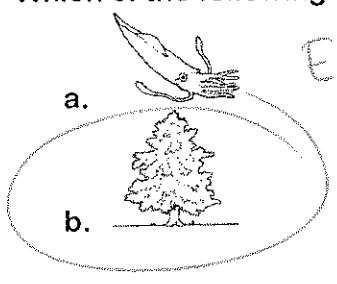
B. The replication rate increases to produce more DNA.

C. The photosynthesis rate increases to produce more sugars.

D. The cell division rate increases to produce more muscle fibers.

8. Which of the following organisms is eukaryotic, multicellular, and autotrophic? Euk / Mult / Heterotrophic

a.



b.

c. 

Euk / Unicellular / Hetero

d. 

Euk / Multicellular / Hetero

9. Which of the above organisms conducts photosynthesis?

Mushrooms are not plants

   a. Squid and tree
   b. Tree and mushroom
   c. Tree
   d. Tree, protozoa and mushroom

10. Some bacteria live in hot springs. Their cells contain enzymes that function best at temperatures of 70°C or higher.

At a temperature of 50°C, how will the enzymes in these bacterial cells **most likely** be affected?

A. The enzymes will be destroyed by lysosomes.

B. The enzymes will lose their bond structure and fall apart.

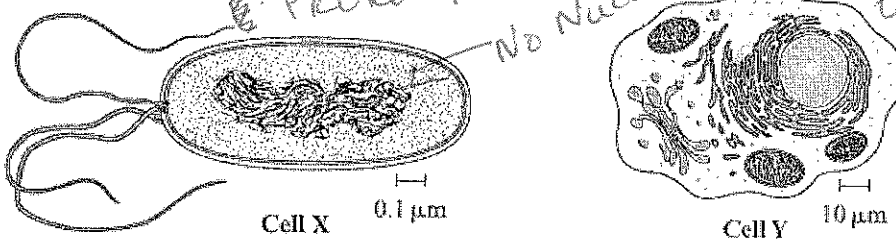
Enzymes speed up RXNS

C. The enzymes will require less energy to function than at 70°C.

D. The enzymes will not increase the rate of reactions as much as they would at 70°C.

11. The illustrations below represent two different cells.

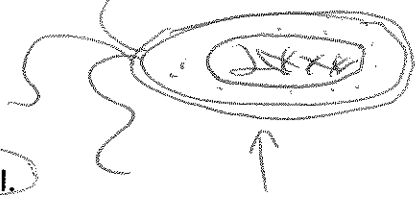
E. Prokaryote — No Nucleus just DNA — Eukaryote



Which of the following statements best identifies these two cells?

A. Cell X is a prokaryotic cell and cell Y is a eukaryotic cell.
B. Cell X is an archae cell and cell Y is a eubacterial cell.
C. Cell X is a red blood cell and cell Y is a muscle cell.
D. Cell X is a plant cell and cell Y is an animal cell.

Note:



this would be a Eukaryote

12. What is the major difference between the above cells DNA?
   a. Cell X doesn't have DNA
   b. Cell X has DNA that is not enclosed in a nucleus
   c. Only Cell X has chromosomes
   d. Only Cell Y undergoes DNA replication

13. If scientists search other planets for possible life, they are likely to focus on the presence of molecules containing which of the following elements?

A. carbon all living things contain C
B. iron
C. potassium
D. sodium

14. Many land plants store energy in starch. When energy is needed, the starch molecules can be broken down quickly. This chemical reaction produces which of the following?

COMPLEX CARB ↓ BROKEN INTO A SIMPLE CARB = SUGAR

A. amino acids PROTEIN
B. lipids FAT
C. monosaccharides Simple sugars
D. RNA chains

15. Which of the following best describes the formation of a zygote?

A. A sperm cell nucleus and an egg cell nucleus fuse.
B. A cell's DNA replication and mitosis are accelerated.
C. A succession of cell divisions produces a solid mass of cells.
D. A cell with 46 chromosomes divides to form cells with 23 Chromosomes each.

16. Which of the following functions does active transport perform in a cell?

A. packaging proteins for export from the cell
B. distributing enzymes throughout the cytoplasm
C. moving substances against a concentration gradient
D. equalizing the concentration of water inside and outside the cell

17. Which of the following is a main function of the cell wall?

↑ MADE OF cellulose

A. to store carbohydrates for later use
B. to give the cell a rigid structure
C. to package proteins for export
D. to carry out photosynthesis

18. Which of the following statements correctly matches a cell part with its function?

A. The ~~cell membrane~~ (Golgi) packages lipids for export.
B. ~~The mitochondria perform photosynthesis.~~ X Cell. resp.
C. The lysosome digests molecules. ✓
D. The nucleus ~~produces energy.~~ holds DNA

19. In red blood cells, the compound carbonic anhydrase increases the rate at which carbon dioxide is converted to bicarbonate ions for transport in the blood. In red blood cells, carbonic anhydrase acts as which of the following?

A. an enzyme
B. a hormone
C. a lipid
D. a sugar

20. Which of the following best describes how CO2 is transported in and out of the blood?

a. Diffusion
b. Osmosis
c. Active transport
d. Cellular respiration

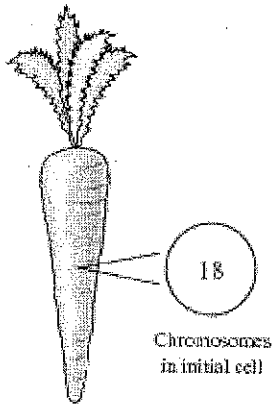
→ high to low concentration

21. Many plants have waxy coatings on some surfaces. This coating reduces water loss because it is not water-permeable. This waxy coating is which of the following types of organic molecule?

A. carbohydrate
B. lipid FATS/OILS/WAX/BUTTER
C. nucleic acid
D. protein

22. The diagram below provides information about a carrot cell.

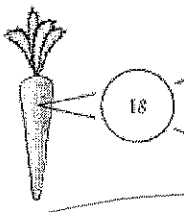
A carrot cell contains 18 chromosomes. Which of the following diagrams illustrates the correct number of chromosomes in new cells produced by mitosis?



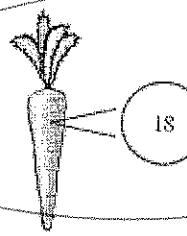
Meiosis But 4 cells

12 → 9, 9, 9, 9

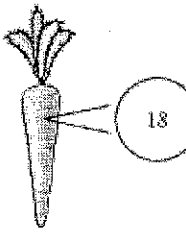
a.



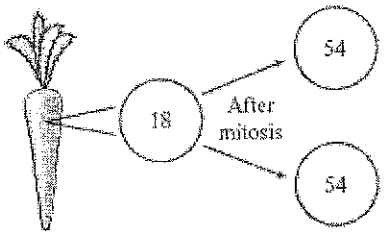
b.



c.



d.



23. A horse has 32 chromosomes in each of its gametes. How many chromosomes do horses have?

a. 32
b. 64
c. 128
d. 12

32 (eggs) + 32 (sperm) = 64

24. How many chromosomes are in a diploid cell of a horse?

a. 32
b. 64
c. 128
d. 12

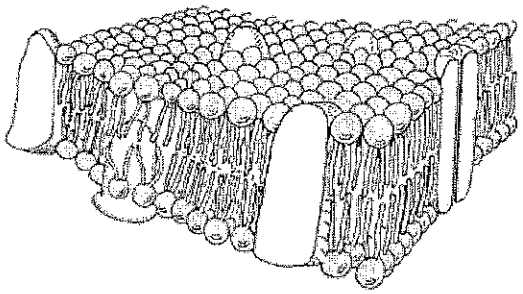
same

DIPLOID is the full CHROMOSOME #

25. When would a horse undergo meiosis?

a. to produce new skin cells mitosis
b. to make cells needed for reproduction Sexual reproduction
c. to make cells needed for growth mitosis
d. for repair MITOSIS

26. The diagram below shows a cross section of part of a cell membrane.



a. Describe the basic structure of the cell membrane.

The cell membrane is a phospholipid bilayer that is embedded with proteins.

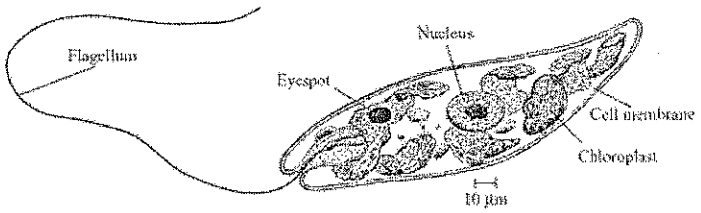
b. Describe two primary functions of the cell membrane.

Cell transport: Semi permeable membrane regulates what goes in and out of the cell
ACTS AS BARRIER

c. Explain how the structure of the cell membrane allows it to perform the functions described in part (b).

lipid structure allows the cell membrane to be fluid-like; expanding/contracting which is important b/c of osmosis, Proteins can act as channels of transport.

27. The drawing below represents an organism that a student observed when examining a sample of pond water with a light microscope. The student identified this organism as a prokaryote.



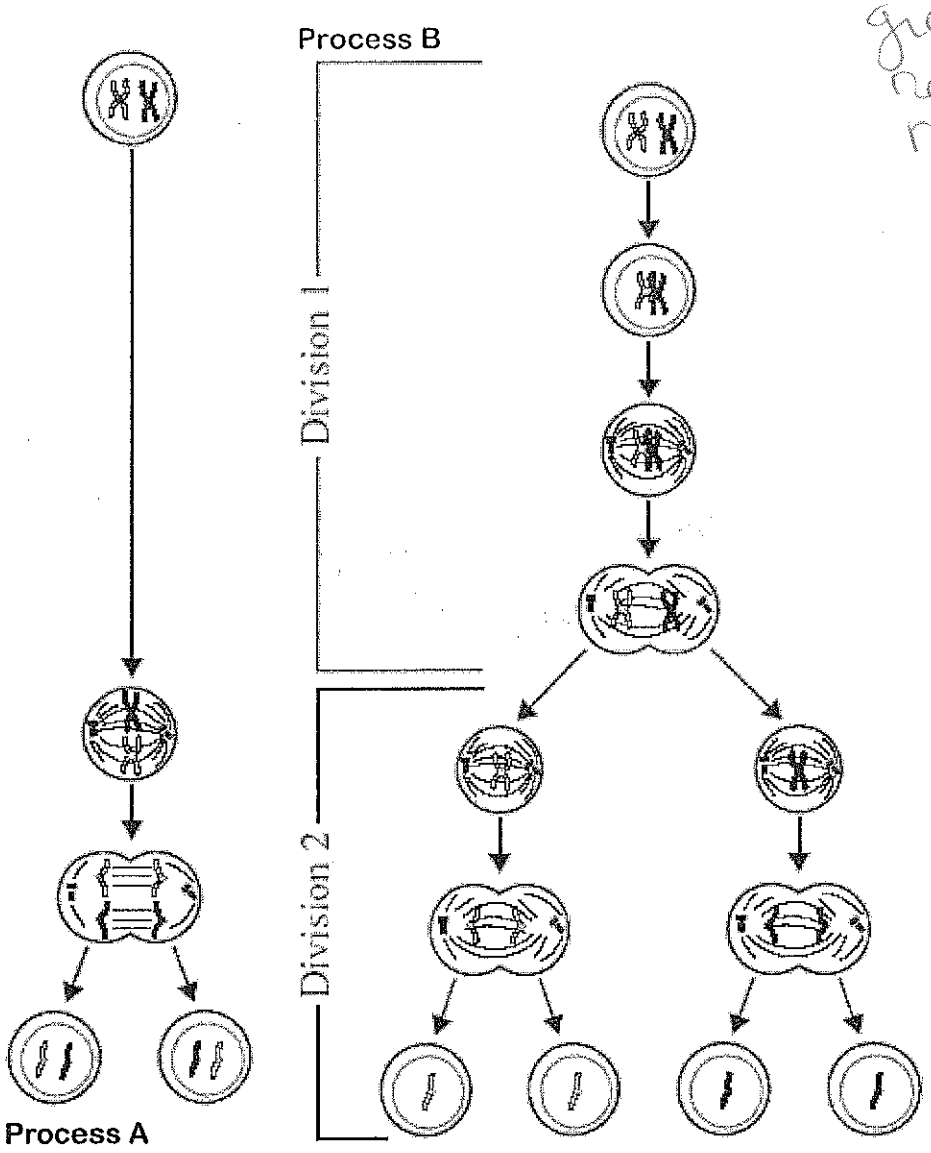
a. Is the student's identification accurate? Explain your answer using information from the diagram.

No - prokaryotes have DNA but no true nucleus. The above cell has a nucleus & other membrane bound organelles.

b. Identify three similarities between the cells of prokaryotes and eukaryotes.

cell membrane
DNA (genetic material)
- both carry out life functions
ie. respond to stimuli
grow
repair
reproduce

28. Look at the following two processes:



a. Explain what occurs in process A:

Mitosis - Prophase - chromosomes appear
- nuclear envelope disappears
1 division
Metaphase - sister chromatids line up
centrioles / spindle fibers
Anaphase - sister chromatids pull apart
Telophase - nuclear envelope reappears
Cytokinesis → produces 2 new identical diploid (2N) cells.

b. Explain what occurs in process B:

Meiosis - Prophase - crossing over
2 divisions
Metaphase - homologous chromosomes line up
Anaphase
Telophase
P
M
A
T

c. Identify All the similarities between the two processes:

both involve the division of the Nucleus
both have P, M, A, T

d. Explain three differences between the two processes:

mitosis	meiosis
1 division	2
identical	non identical

e. Which of the above is used for asexual reproduction?

mitosis

f. Which of the above is used for sexual reproduction?

meiosis

g. Fill in the following chart:

	Pros	Cons	Cell Process
Asexual Reproduction	Fast / easy no mate needed	All identical	~~Growth~~ F
Sexual Reproduction	Time & Energy Expended Finding a mate genetically unique gives a advantage to survive		

genetically unique cells gives a species more diversity, more diversity gives a better chance for survival

29. The illustration below represents a cell that is entering mitosis.

a. Identify one function of mitosis.

Growth / Repair / Asexual Rep

b. Which phase of the cell cycle is the above cell in?

prophase

c. Label the homologous chromosomes and sister chromatids on the above diagram.

d. Explain what happened in order to create sister chromatids.

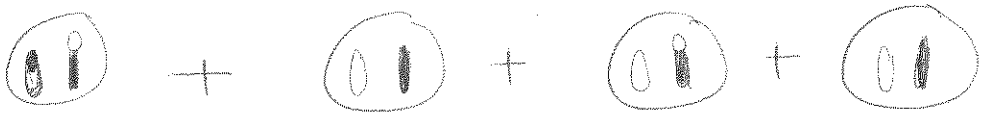
dna replication during s phase of interphase

e. What is the diploid number of the above cell?

2n = 4

f. Draw the end products that will be formed when this cell completes mitosis.

g. Draw the end products that will be formed when this cell completes meiosis.



Cell Biology

1. Define each of the following:
   a. plasma membrane → Phospholipid bilayer ← Semi permeable → regulates transport
   b. nuclear envelope
   - Membrane that encloses genetic info (DNA)
   c. nucleus
   - DNA / site of transcription + DNA replication
   d. nucleolus
   - where Ribosomes are made
   e. cytoplasm
   - contents of cell
   f. mitochondrion
   - cellular respiration (where ATP (cell energy) is made)
   g. endoplasmic reticulum
   - transports proteins
   h. Golgi apparatus
   - packages proteins
   i. Lysosome
   - contains digestive enzymes
   j. ribosome, vacuole
   ↑ protein factory — stores water
   k. cell wall
   ↑ protects + provides rigidity / structure
   l. chloroplast
   - photosynthesis / makes glucose (food for cell)
   m. cytoskeleton
   - gives cell structure (animal cells)
   n. centriole
   - needed for mitosis / meiosis
   o. cilium
   - hair like projections - movement (paramecium)
   p. flagellum
   - whip like tail - movement (euglena)
   q. pseudopod
   - cytoplasmic projection / how amoeba moves
   r. diffusion
   - movement from high to low concentration until equilibrium
   s. osmosis
   - movement of H_2O " "
   t. facilitate diffusion
   - w/ help of proteins
   u. active transport
   - requires Energy / low to high concentration

2. Explain the role of cell membranes as a highly selective barrier.

lets small molecules in/out passively
(H_2 + O_2 + CO_2 + H_2O)

3. Compare and contrast, at the cellular level, the general structures and degrees of complexity of prokaryotes and eukaryotes.

No Nucleus or organelles | Both carry out life functions + have Genetic Material | Nucleus + membrane bound organelles

4. Describe each of the six kingdoms (Archaebacteria, Eubacteria, Protista, Fungi, Plantae, Animalia).

	Prokaryote	Eukaryote	Autotroph	Heterotroph	Unicellular
Archaebacteria	✓		✓		✓
Eubacteria	✓		✓		✓
Protists (ex. Amoeba)		✓	✓	✓	✓
Fungi		✓		✓	
Plants		✓	✓		
Animals		✓		✓	

5. Identify the reactants, products, and basic purposes of photosynthesis and cellular respiration.

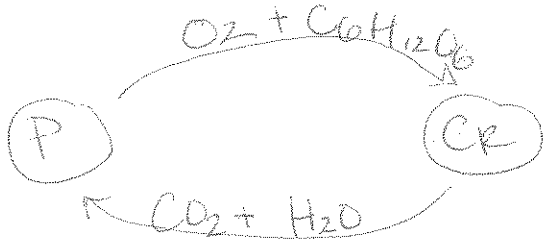
$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 36\ ATP$ (Products)

Cellular respiration

36 ATP in Product Goal

6. Explain the interrelated nature of photosynthesis and cellular respiration in the cells of photosynthetic organisms.

- rely on eachother
- recycle products
- helps ecosystem maintain homeostasis



7. Explain the important role that ATP serves in metabolism.

ATP provides cellular energy for all the chemical reactions in the body

8. Describe the cell cycle and the process of mitosis.

M phase

G_1 (Growth + PS) + S phase (DNA Rep) + G_2 → PMAT → Cytokinesis

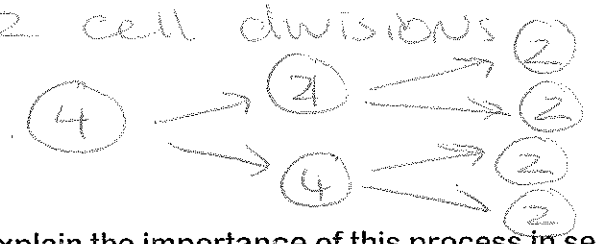
Interphase

9. Explain the role of mitosis in the formation of new cells, and its importance in maintaining chromosome number during asexual reproduction.

Needs to make identical cells to the parent cell for instances like repair (want new cells to look like the old)

10. Describe how the process of meiosis results in the formation of haploid cells.

2 cell divisions



Meiosis also produces genetically unique cells important to provide diversity in offspring

11. Explain the importance of this process in sexual reproduction.

Meiosis is producing sex cells; Sex cells recombine w/ other sex cells to make a complete zygote $\frac{1}{2} + \frac{1}{2}$ = full set

12. How do gametes form diploid zygotes in the process of fertilization?

egg + sperm → full set of chromosomes

$\frac{1}{2}$ $\frac{1}{2}$

13. Compare and contrast a virus and a cell in terms of genetic material and reproduction.

- Virus relies on a host cell to reproduce
- Currently a virus is not considered living