

NAME: _____ DATE: _____ SECTION: _____

MCAS PREP PACKET – CELL BIOLOGY AND BIOCHEMISTRY

1. Prokaryotes are structurally simple organisms that have existed for over two billion years. Which of the following are prokaryotes?
 - A. bacteria
 - B. fungi
 - C. plants
 - D. protists
2. The fungus *Penicillium* reproduces asexually and forms genetically identical spores. Which of the following processes does *Penicillium* use to form its spores?
 - A. fertilization
 - B. mitosis
 - C. osmosis
 - D. transcription
3. A variety of respiratory diseases in humans can be caused by adenoviruses. Which of the following describes the structure of an adenovirus?
 - A. a prokaryotic cell that is propelled by a flagellum
 - B. a nucleic acid core that is surrounded by a protein coat
 - C. a set of ribosomes that is held together by microtubules
 - D. a single cell that contains a plasma membrane and a circular chromosome
4. The table below provides information about nutrition and cellular structure for organisms in different kingdoms.

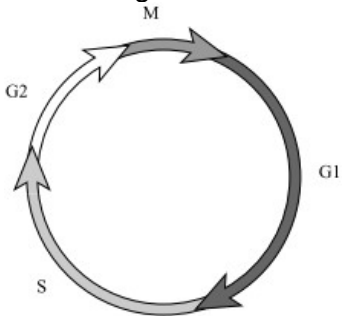
Kingdom	Nutrition	Nucleus	Unicellular or Multicellular
Fungi	heterotrophic	yes	unicellular and multicellular
Plantae	autotrophic	yes	multicellular
Animalia	?	?	?

What information **best** completes the table?

- A. autotrophic, no, unicellular
- B. autotrophic, yes, multicellular
- C. heterotrophic, no, unicellular
- D. heterotrophic, yes, multicellular

5. A student is looking at a picture of a cell taken through a microscope. The presence of which of the following would indicate that the cell is eukaryotic?
- cytoplasm
 - DNA
 - nucleus
 - plasma membrane
6. Amino acids, sugars, and ions move across the cell membrane. Their movement from a region of high concentration to a region of low concentration is accomplished by special proteins in the membrane. Which of the following terms applies to this type of cell transport?
- active transport
 - facilitated diffusion
 - osmosis
 - transcription
7. In periods of hot, dry weather, the pores on the leaf surfaces of most plants close in order to reduce water loss during the day. When these pores are closed, plants cannot take in carbon dioxide. As a direct result, the rate of which of the following processes decreases?
- cellular respiration
 - mitosis
 - nitrogen fixation
 - photosynthesis

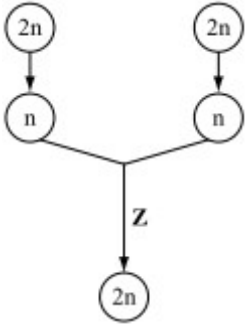
8. The diagram below shows the cell cycle.



- Which of the following activities occurs in the G1 phase?

- growth of the cell
 - replication of the DNA
 - formation of the mitotic spindle
 - breakdown of the nuclear membrane
9. 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

10. The diagram below represents steps in sexual reproduction.



Which of the following occurs in the step labeled **Z**?

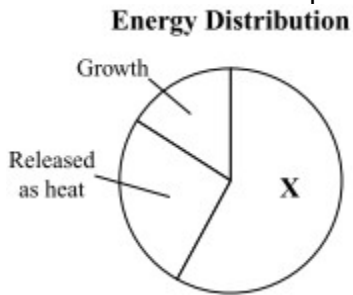
- A. fertilization
 - B. meiosis
 - C. mitosis
 - D. translocation
11. A lab technician needs to determine whether cells in a test tube are prokaryotic or eukaryotic. The technician has several dyes she could use to stain the cells. Four of the dyes are described in the table below.

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?

- A. acridine orange
 - B. osmium tetroxide
 - C. eosin
 - D. Nile blue
12. Which of the following describes plant cells but **not** animal cells?
- A. The nucleus contains the chromosomes.
 - B. The ribosomes assist in protein synthesis.
 - C. Plastids store starch made during photosynthesis.
 - D. Mitochondria produce energy through respiration.

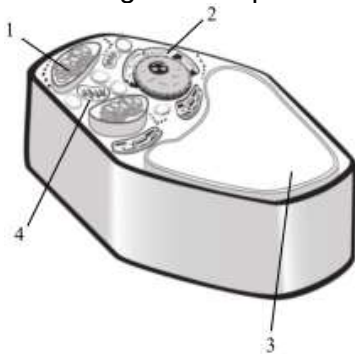
13. Plants absorb solar energy during photosynthesis. The graph below represents how this energy is distributed in some plants.



Which of the following statements describes what happens to the energy represented by the section labeled **X**?

- A. It is recycled to the Sun.
 - B. It is consumed by decomposers.
 - C. It is lost to the soil and the atmosphere.
 - D. It is used for cellular respiration and maintenance.
14. Energy for most chemical reactions in cells is supplied by which of the following molecules?
- A. ATP
 - B. DNA
 - C. adrenaline
 - D. hemoglobin
15. If a cell's lysosomes were damaged, which of the following would **most likely** occur?
- A. The cell would produce more proteins than it needs.
 - B. The cell would have chloroplasts that appear yellow rather than green.
 - C. The cell would be less able to break down molecules in its cytoplasm.
 - D. The cell would be less able to regulate the amount of fluid in its cytoplasm.

16. A diagram of a plant cell is shown below.



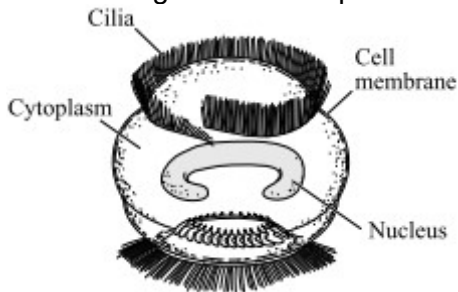
Which number identifies the organelle that functions to store water and dissolved salts?

- A. 1
- B. 2
- C. 3
- D. 4

17. Scientists have discovered a new type of organism. To assign the organism to a domain and kingdom, which of the following is **most** important for scientists to know?
- the organism's cell structure
 - the organism's population size
 - the organism's social behavior
 - the organism's reproductive rate

18. Which of the following statements correctly describes the processes of photosynthesis and cellular respiration?
- Photosynthesis and cellular respiration occur in the same organelle.
 - Photosynthesis and cellular respiration are performed by all organisms.
 - Photosynthesis produces carbon dioxide, and cellular respiration uses carbon dioxide.
 - Photosynthesis stores energy for cells, and cellular respiration releases energy for cells.

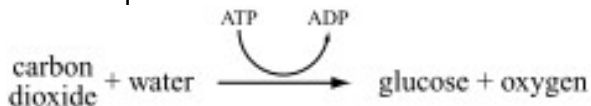
19. The diagram below represents *Trichodina*.



Trichodina is a eukaryotic organism that attaches itself to fish and eats bacteria. Which of the following distinguishes *Trichodina* from all prokaryotes?

- Trichodina* is unicellular.
 - Trichodina* has a nucleus.
 - Trichodina* has cytoplasm.
 - Trichodina* is heterotrophic.
20. In a cell, which of the following organelles **most likely** contains digestive enzymes?
- centriole
 - chloroplast
 - lysosome
 - ribosome

21. An equation for a biochemical reaction is shown below.



Which of the following happens during this reaction?

- Energy from ATP is used to make glucose.
- ADP adds a high-energy bond to its structure.
- ADP is metabolized to provide oxygen to a cell.
- Energy is stored in the molecule ATP for future use.

22. Lung cancer cells do not respond to the signals that regulate the growth of normal lung cells. Which of the following processes is **not** appropriately regulated in the cancerous cells?

- A. fertilization
- B. meiosis
- C. mitosis
- D. transpiration

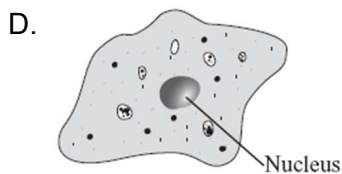
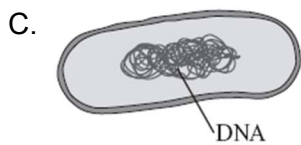
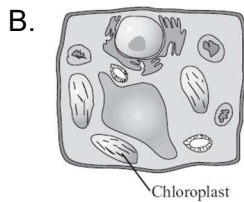
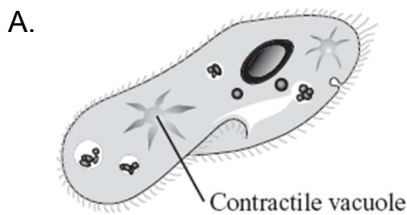
23. If an animal cell is placed in distilled water, it will swell and burst. The bursting of the cell is a result of which biological process?

- A. active transport
- B. enzyme activity
- C. osmosis
- D. respiration

24. In which of the following ways does a bacterial cell differ from an animal cell?

- A. A bacterial cell is much larger than an animal cell.
- B. A bacterial cell has more mitochondria than an animal cell.
- C. A bacterial cell has RNA for its genetic material, whereas an animal cell does not.
- D. A bacterial cell does not have membrane-bound organelles, whereas an animal cell does.

25. Scientists believe that the first organisms that appeared on Earth were prokaryotic. Which of the following **best** represents what the cell structure of these organisms may have looked like?



26. Mallory has four aquatic plants of the same size and species. She submerges each plant in a separate beaker filled with 200 mL of water. She then sets each beaker under a different intensity of light. Mallory observes that, of the four plants, the plant in the beaker under the most intense light gives off the most gas bubbles in a 20 min period.
27. Which of the following statements best explains Mallory's observations?
- A. Cells decompose most quickly under the most intense light.
 - B. Water evaporates from plants fastest under the most intense light.
 - C. Photosynthesis occurs at the highest rate under the most intense light.
 - D. Gases in the leaves of plants expand most under the most intense light.
28. All organisms have ways to produce ATP. Which of the following statements describes why ATP is a critical compound for all cells?
- A. It causes mitosis to begin.
 - B. It is an energy-transfer molecule.
 - C. It is a major component of cell membranes.
 - D. It carries information from DNA to the ribosomes.
29. Which of the following statements explains why viruses are able to reproduce only inside host cells instead of being able to reproduce on their own?
- A. Viruses cannot function at temperatures other than 98.6°F.
 - B. Viruses lack spindle fibers that correctly align chromosomes for division.
 - C. Viruses are too small to effectively make copies of themselves on their own.
 - D. Viruses lack the cellular machinery needed to make copies of their genetic material.
30. 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?

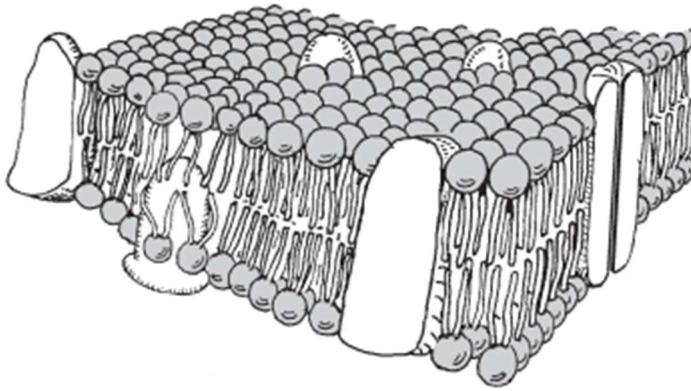
- A. The virus made its own spores.
- B. The virus produced seeds in the tomatoes.
- C. The virus used the host plant's resources and machinery to reproduce.
- D. The virus immediately killed the host plant and was free to reproduce.

SCORE POINT 4

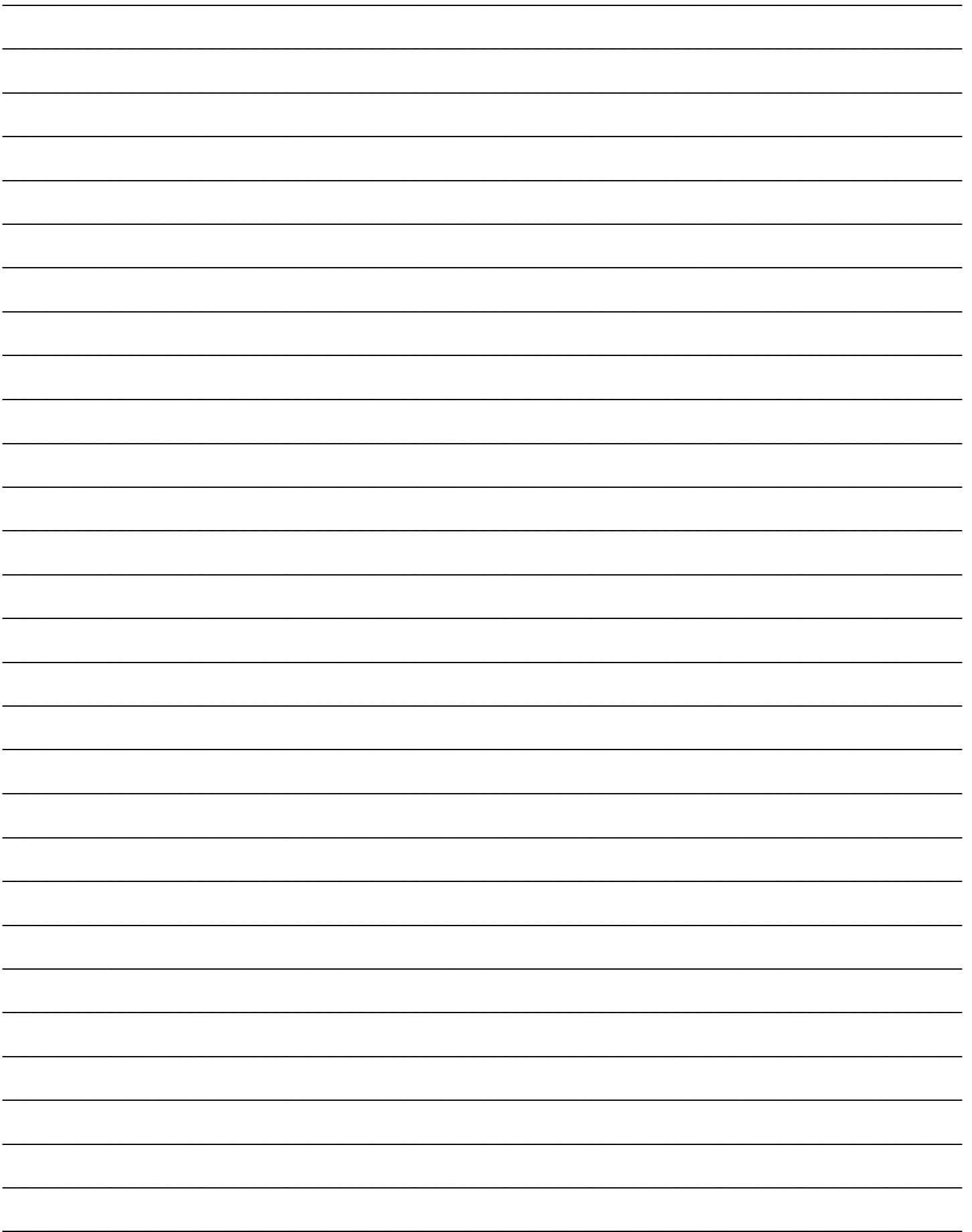
a) No, the student is incorrect. It can be seen from the diagram that the cell has membrane bound organelles such as a nucleus. Only eukaryotic, not prokaryotic cells have these. Therefore the cell is not eukaryotic, but prokaryotic.

- b) 1. Both store genetic information in DNA. (rather than RNA)
- 2. Both grow and reproduce.
- 3. Both have cell membranes

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



- a. Describe the basic structure of the cell membrane.
- b. Describe **two** primary functions of the cell membrane.
- c. Explain how the structure of the cell membrane allows it to perform the functions described in part (b).



SCORE POINT 4

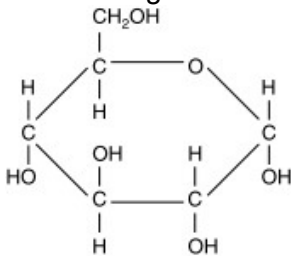
a) The lipid bilayer consists of two layers of lipids, whose hydrophilic ends face outwards because the cytoplasm and outside fluid contain water, so the hydrophobic sides lie inside. Among the lipids reside glycoproteins, each of which have certain functions. For example, some facilitate diffusion, and some serve as identification tags.

b) The primary function of the cell membrane is to retain cytoplasm and organelles within itself. The lipid bilayer with its hydrophilic outside maintains a constant boundary.

Another primary function is to selectively be permeable to certain molecules. It is necessary to allow some molecules out and some in, so the membrane allows diffusion, simple or facilitated, and active transport

c) The lipid bilayer, since it has a hydrophobic core, is a constant boundary. This is because a break in the hydrophilic wall would allow water into the hydrophobic core, so breaking apart is naturally undesirable. Since the membrane has glycoprotein woven into it, it can diffuse larger molecules through the larger canals of the transport protein. Also, if molecules must be moved against a concentration gradient, certain proteins have the means of supplying both the energy and aperture required for active transport. Also, the unique formations of certain proteins allow for identification by other cells. The plasma membrane supplies the cell with a strong yet fluid layer of protection.

32. The diagram below shows the molecular structure of glucose.



Glucose is a simple carbohydrate that is important to living organisms.

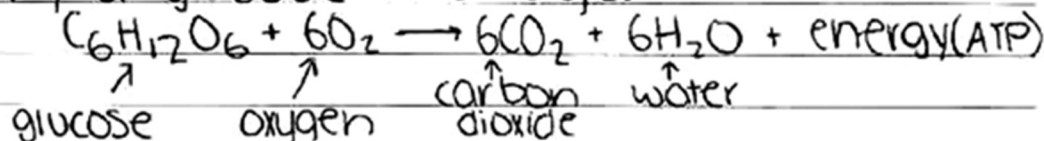
- Describe the primary function of glucose in cells.
- Simple sugars like glucose can be used to make larger organic molecules.
- Identify **two** larger molecules made from simple sugars.
- Identify a specific cellular process that would be affected by a glucose shortage, and discuss the effects of the shortage on the process you identified.

SCORE POINT 4

a. The primary function of glucose in cells is to give off energy to the organism.

b. Two larger molecules made from simple sugars are polysaccharides and starches.

c. Cellular respiration would be affected by a glucose shortage.



With a shortage of glucose, organisms can not produce as much energy(ATP).

SCORE POINT 4

a. The primary function of glucose is to provide energy in cells.

b. One larger organic molecule that can be made from a simple sugar is a disaccharide, which is two sugars instead of one. Another larger organic molecule is a polysaccharide, which is more than two simple sugars.

c. A cellular process that would be affected by a glucose shortage is active transport. If there is less sugar than there will be less ATP to help move a substance across the concentration gradient.