

Test Instructions: **READ THIS CAREFULLY!**

- 1) Please sit so there is at least 1 empty seat between you and your neighbor if you are in the middle of the row.
- 2) **NO** talking except to instructor; if I see/hear any discussion with your neighbor(s) I will have to take your test. If I **see** a cell phone, it comes up to the front of the classroom with me for the duration of the exam.
- 3) If you need a bathroom break, come & ask me first (only 1 person at a time).
- 4) **SCANTRON** form **95677** is required. Be sure to make your marks so that they are dark and that they fill the boxes. Remember you need to use a **#2** pencil. If you need to erase, make sure you do it thoroughly.
- 5) Be sure to write your **Name** and **Test #** on the **front** side of the **SCANTRON** form. Also fill in the **Key ID** (= Version) **Letter** (top left bubble field).  
Your exam should have **9** pages. **Feel free to write anywhere on the Exam itself.**  
**\*\*Check where you are reading in the exam and marking on the Scantron Regularly!**
- 6) Turn in this Exam with the **SCANTRON** form.
- 7) If you want to stay in the lecture room, please remain quiet and do **NOT** open your books or notes until all exams have been collected.
- 8) **NO** discussion just outside the room; move far away from the room to do that. You will disturb the other students still working on the Exam.

General Test Advice:

Read each question carefully. Small words like "**NOT**" can change the meaning dramatically.

Take a little time to check your place on both this Exam and the **SCANTRON** form. It is easy to get out of register.

**!!Some of the questions may be divided by page breaks; be careful to read all the possible answers!!**



**GOOD LUCK!**



**Multiple Choice** Choose the **BEST** answer.

1. The basic structure of chromatin has sometimes been referred to as "beads on a string of DNA." Those beads are called
  - A. chromosomes.
  - B. chromatids.
  - C. supercoils.
  - D. interphases.
  - E. nucleosomes.

2. Water passes very quickly through cell membranes because:
- A. the bilayer is largely hydrophilic.
  - B. it moves through very hydrophobic channels.
  - C. water movement is tied to ATP hydrolysis.
  - D. it is a small charged molecule.
  - E. it moves through aquaporin channels in the membrane.
3. During bacterial cell division, the two DNA molecules are separated by:
- A. centrosomes.
  - B. spindle fibers.
  - C. nucleosomes.
  - D. cell elongation.
  - E. aneuploidy.
4. Sodium azide destroys the proton gradient across the inner mitochondrial membrane. What would you expect to be the effect of incubating isolated mitochondria in a solution of sodium azide?
- A. More Oxygen ( $O_2$ ) would be made from carbon dioxide ( $CO_2$ ).
  - B. **No** ATP would be made as transport of electrons down the respiratory chain ceased.
  - C. Mitochondria would show a burst of increased ATP synthesis.
  - D. Glycolysis would stop.
  - E. Mitochondria would switch from glycolysis to fermentation.
5. Substrate-level phosphorylation is used to refer to:
- A. transfer of a phosphate from ATP to a protein.
  - B. transfer of an ATP from a substrate to a  $NAD^+$ .
  - C. transfer of a phosphate from a substrate to an ADP.
  - D. transfer of an ATP from a substrate to a protein.
  - E. transfer of a phosphate from ATP to a substrate.
6. Whenever energy is transformed there is always an increase in the:
- A. free energy (G) of the system
  - B. free energy (G) of the universe
  - C. enthalpy (H) of the universe
  - D. entropy (S) of the universe
7. Yeast cells tend to create anaerobic conditions because they use oxygen ( $O_2$ ) faster than it can be replaced by diffusion through the cell membrane. For this reason, yeast cells:
- A. exhibit a red pigment.
  - B. exhibit a green pigment.
  - C. die.
  - D. produce ethanol.
  - E. None of the above
8. Which of the following is the most general term for the energy of position?
- A. actinic
  - B. electricity
  - C. kinetic
  - D. light
  - E. potential
9. An organism with a cell wall would have the most difficulty doing which process?
- A. diffusion
  - B. osmosis
  - C. active transport
  - D. phagocytosis
  - E. exocytosis

10. In noncyclic photophosphorylation, water is used for
- A. the hydrolysis of ATP.
  - B. the excitation of chlorophyll.
  - C. the reduction of chlorophyll.
  - D. the oxidation of NADPH.
  - E. the synthesis of chlorophyll.
11. Specialized animal cell connections include:
- A. gap junctions.
  - B. tight junctions.
  - C. plasmodesmata.
  - D. A and B
  - E. A, B, and C
12. A cell whose cytoplasm has a concentration of 0.02 M glucose is placed in a test tube with a solution of 0.01 M glucose. Assuming that glucose is **not** actively transported into the cell, which of the following terms describes the tonicity of the external solution relative to the cytoplasm of the cell?
- A. isotonic
  - B. hypertonic
  - C. hypotonic
  - D. flaccid
  - E. turgid
13. How many carbon dioxide ( $\text{CO}_2$ ) molecules must be added to RuBPs in photosynthesis to eventually make a single molecule of glucose?
- A. 2
  - B. 4
  - C. 6
  - D. 8
  - E. 12
14. Assume a thylakoid is somehow punctured so that the interior of the thylakoid is **no** longer separated from the stroma. This damage will have the most direct effect on which of the following processes?
- A. the splitting of water
  - B. the absorption of light energy by chlorophyll
  - C. the flow of electrons from photosystem II to photosystem I
  - D. the synthesis of ATP
  - E. the reduction of  $\text{NADP}^+$
15. Which organelle is most important for initiating the process of apoptosis in most eukaryotic cells?
- A. nucleus
  - B. endoplasmic reticulum
  - C. mitochondrion
  - D. Golgi
  - E. lysosome
16. What would be true for the signaling system in an animal cell that lacks the ability to make GTP?
- A. It would **not** be able to activate and inactivate the G protein on the cytoplasmic side of the plasma membrane.
  - B. It could only activate the enzyme that makes cAMP.
  - C. It would still be able to carry out all types of signal transduction.
  - D. only A and B
  - E. none of the above
17. According to the First Law of Thermodynamics,
- A. the universe loses energy because of heat production.
  - B. systems rich in energy are intrinsically unstable and will give up energy with time.
  - C. energy can be neither created nor destroyed.
  - D. A and B only
  - E. A, B and C

18. A(n) \_\_\_\_\_ is an example of a signal molecule that can bind to an intracellular receptor and thereby cause a gene to be turned off or on.
- |                 |                 |
|-----------------|-----------------|
| A. ion          | D. nucleic acid |
| B. carbohydrate | E. protein      |
| C. steroid      |                 |
19. In the thylakoid membranes, what is the main role of the antenna pigment molecules?
- split water and release oxygen to the reaction-center chlorophyll
  - harvest photons and transfer light energy to the reaction-center chlorophyll
  - synthesize ATP from ADP + P<sub>i</sub>
  - transfer electrons to ferredoxin (in the electron transport chain) and then to NADPH
  - concentrate photons within the stroma
20. Succinate dehydrogenase is an enzyme of the Citric acid/Krebs cycle. Where in the cell is this enzyme located?
- |                       |                                |
|-----------------------|--------------------------------|
| A. In the thylakoids  | D. In the mitochondrial matrix |
| B. In the cytoplasm   | E. In the plasma membrane      |
| C. In the chloroplast |                                |
21. An environment where one would expect to find a CAM plant would be usually:
- |                               |                |
|-------------------------------|----------------|
| A. salty and wet              | D. hot and dry |
| B. cold                       | E. humid       |
| C. abundant with plant-eaters |                |
22. Which of the following characterizes the sodium-potassium pump?
- Sodium ions are pumped out of a cell against their concentration gradient.
  - Potassium ions are pumped into a cell against their concentration gradient.
  - The pump protein undergoes a conformational change.
  - Only A and C are correct.
  - A, B, and C are correct.
23. Where do the enzymatic reactions of the Calvin cycle take place?
- stroma of the chloroplast
  - thylakoid membranes
  - outer membrane of the chloroplast
  - electron transport chain
  - interior thylakoid space
24. The movement of a substance across a biological membrane against its concentration gradient with the help of energy input is:
- |                     |                          |
|---------------------|--------------------------|
| A. diffusion        | D. facilitated diffusion |
| B. active transport | E. exocytosis            |
| C. osmosis          |                          |
25. Zinc, an essential trace element for most organisms, is present in the active site of the enzyme carboxypeptidase. The zinc most likely functions as a(n):
- competitive inhibitor of the enzyme
  - noncompetitive inhibitor of the enzyme
  - allosteric activator of the enzyme
  - cofactor necessary for enzyme activity
  - coenzyme derived from a vitamin

26. The molecules that make up a eukaryotic chromosome are:
- A. DNA and RNA.
  - B. DNA and proteins.
  - C. proteins and lipids.
  - D. nucleotides and nucleosides.
  - E. proteins and phospholipids.
27. All of the following are functions found in a cell membrane **except**:
- A. transmitting signals
  - B. participating in energy transfer
  - C. participating in chemical reactions
  - D. regulating the passage of materials
  - E. being freely permeable
28. A chemical reaction that has a positive  $\Delta G$  is correctly described as:
- A. endergonic
  - B. exergonic
  - C. enthalpic
  - D. spontaneous
  - E. exothermic
29. ATP can be used to drive nonspontaneous reactions because:
- A. nonspontaneous reactions are exergonic.
  - B. the breakdown of ATP to ADP is exergonic.
  - C. the breakdown of ATP to ADP is endergonic.
  - D. when ATP is broken down to ADP,  $P_i$  is released.
  - E. ADP possesses more free energy than ATP.
30. What does cyclic electron flow in the chloroplast produce?
- A. ATP
  - B. NADPH
  - C. glucose
  - D. A & B
  - E. A, B, & C
31. Receptor tyrosine kinases need how many signal molecules to activate them?
- A. 1
  - B. 2
  - C. 3
  - D. 4
  - E. 5
32. What is a genome?
- A. an ordered display of chromosomes arranged from largest to smallest
  - B. a specific sequence of polypeptides within each cell
  - C. a specialized polymer of 4 different kinds of monomers.
  - D. a specific segment of DNA that is found within a prokaryotic chromosome
  - E. the complete set of DNA from an organism
33. Photorespiration is prevented physically from occurring in:
- A. CAM plants.
  - B. all chloroplasts.
  - C.  $C_4$  plants.
  - D. microbodies.
  - E.  $C_3$  plants.
34. G proteins bind to a/an \_\_\_\_\_ to cause a cellular response.
- A. phosphatase
  - B. enzyme
  - C. kinase
  - D. ligand
  - E. gated channel

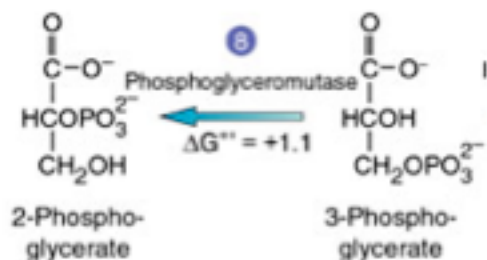
35. Which of the following statements correctly describe(s) anabolic biological pathways?
- They do **not** depend on enzymes.
  - They release energy as they degrade polymers to monomers.
  - They consume energy to build up polymers from monomers.
  - They lead to the breakdown of catabolic compounds.
  - Both A and C

### Momentary Cartoon Break

Paramecium Parlor



(Back to the Exam)



36. What kind of chemical reaction occurs during glycolysis when 3-Phosphoglycerate becomes 2-Phosphoglycerate?
- redox
  - rearrangement
  - dehydration synthesis
  - functional group transfer
  - hydrolysis
37. Certain areas of eukaryotic cell membranes are called "coated pits." Which of the following cell activities is associated with those areas?
- phagocytosis
  - reception of a molecule for signal transduction
  - receptor-mediated endocytosis
  - exocytosis
  - secretion
38. Many species use fermentation to aid in usable energy production. A function of fermentation is to:
- reduce  $\text{NAD}^+$  to  $\text{NADH} + \text{H}^+$  and thus pass electrons to oxygen ( $\text{O}_2$ ).
  - oxidize carbon dioxide ( $\text{CO}_2$ ) to produce oxygen ( $\text{O}_2$ ).
  - produce acetyl CoA.
  - oxidize  $\text{NADH} + \text{H}^+$  to  $\text{NAD}^+$ , ensuring a continuing production of ATP.
  - None of the above

39. Which of the following molecules stimulates glycolysis?
- A. AMP  
B. ATP  
C. carbon dioxide (CO<sub>2</sub>)  
D. citrate  
E. oxygen (O<sub>2</sub>)
40. In eukaryotic cells, the enzymes of glycolysis are found in the:
- A. the mitochondrial membrane.  
B. the cytoplasm.  
C. the nucleus.  
D. the mitochondrial matrix.  
E. None of the others
41. Calcium ions (Ca<sup>2+</sup>) and inositol triphosphate (IP<sub>3</sub>) function inside cells as:
- A. receptors  
B. kinases  
C. scaffolding proteins  
D. second messengers  
E. phosphatases
42. An alien plant has a unique photosynthetic pigment. The leaves of this plant appear to be reddish and yellow. What wavelengths of visible light are **not** being absorbed by this pigment?
- A. red & yellow  
B. blue & violet  
C. green & yellow  
D. blue, green, & red  
E. green, blue, & violet
43. All of the following are functions of integral membrane proteins except:
- A. protein synthesis  
B. transport  
C. small molecule reception  
D. enzyme activity  
E. cytoskeleton attachment
44. Reactants capable of interacting to form products in a chemical reaction must first overcome a thermodynamic barrier known as the reaction's:
- A. entropy  
B. activation energy  
C. endothermic level  
D. heat content  
E. free-energy content
45. Anaerobic respiration uses all but:
- A. glycolysis  
B. chemiosmosis  
C. Citric acid/Kreb's cycle  
D. electron transport chain  
E. reduction of oxygen (O<sub>2</sub>)
46. What is the change in free energy ( $\Delta G$ ) of a system at chemical equilibrium?
- A. slightly increasing  
B. greatly increasing  
C. slightly decreasing  
D. greatly decreasing  
E. **no** net change
47. What membrane-surface molecules are thought to be most important as cells recognize each other?
- A. phospholipids  
B. integral proteins  
C. peripheral proteins  
D. cholesterol  
E. glycoproteins

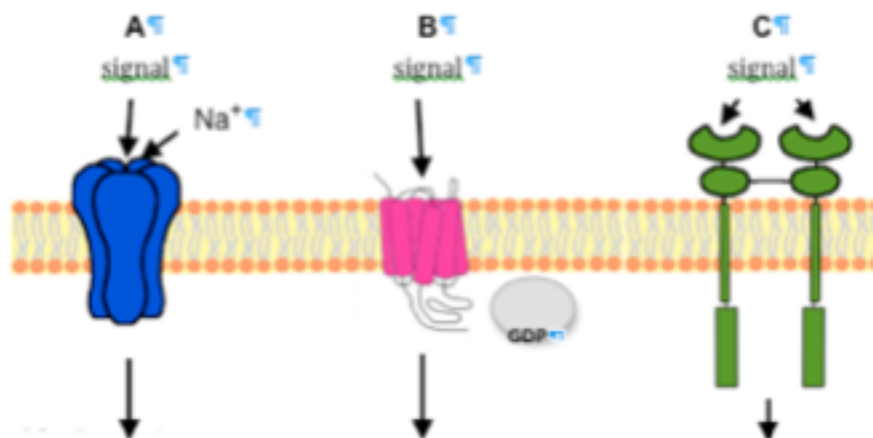
**Matching** (answer on the machine-graded part of the Scantron)

Match the chemical to how it is involved with glycolysis or respiration:

- |              |                                                       |
|--------------|-------------------------------------------------------|
| 48. citrate  | A. product of energy payoff phase of glycolysis       |
| 49. glucose  | B. product of transition reaction                     |
| 50. pyruvate | C. substrate of energy investment phase of glycolysis |
| 51. acetyl   | D. product of 1st step of Krebs cycle                 |
| 52. ATP      |                                                       |

Match the chemical to how it is involved with photosynthesis:

- |                                 |                                                                                           |
|---------------------------------|-------------------------------------------------------------------------------------------|
| 53. O <sub>2</sub>              | A. substrate for carbon fixation (1st reaction of Calvin cycle)                           |
| 54. CO <sub>2</sub>             | B. product at the end of a set of reactions involving both photosystem I and II           |
| 55. NADPH                       | C. product of a reaction only at photosystem II                                           |
| 56. ribulose biphosphate (RuBP) | D. toxic product from Calvin cycle when O <sub>2</sub> is used instead of CO <sub>2</sub> |
| 57. glycolate                   |                                                                                           |



Match the kinds of receptor (lettered examples shown above) to their names:

- |                                |
|--------------------------------|
| 58. G protein-coupled receptor |
| 59. receptor tyrosine kinase   |
| 60. ligand-gated ion channel   |