

Test Instructions: **READ THIS CAREFULLY!**

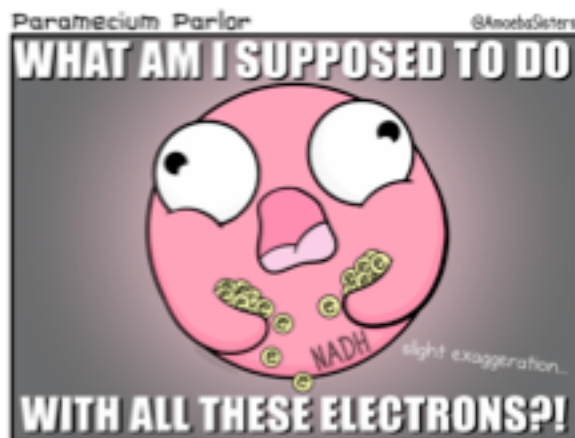
- 1) Please sit so there is at least 1 empty seat between you and your neighbor if you are in the middle of the row.
- 2) **NO** talking except to instructor; if I see/hear any discussion with your neighbor(s) I will have to take your test. If I see a cell phone, it comes up to the front of the classroom 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:

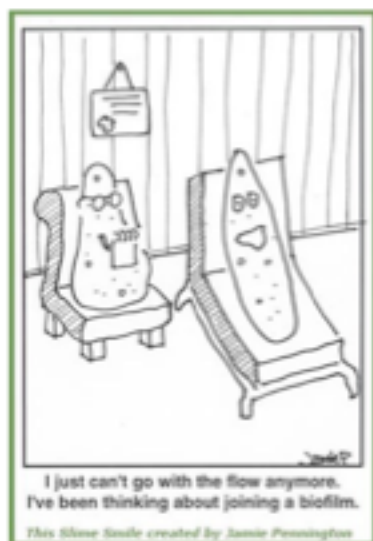
Read each question carefully. Small words like "**NOT**" can change the meaning dramatically.

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!



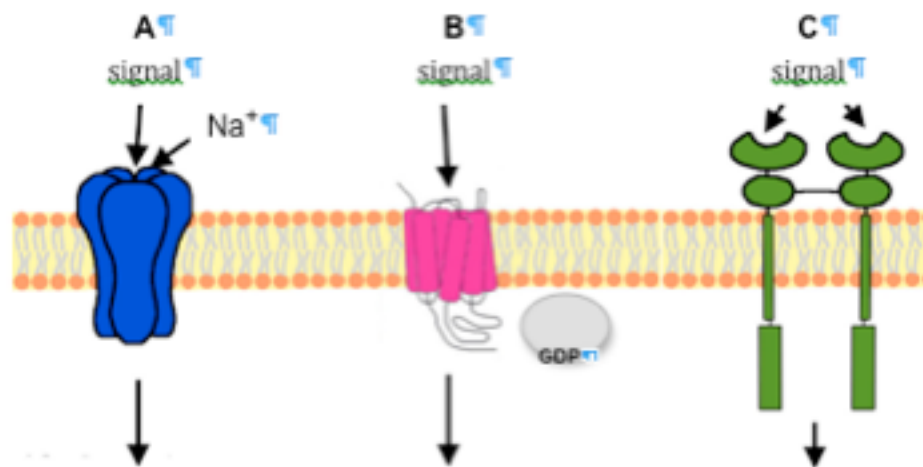
Matching (answer on the machine-graded part of the Scantron)

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

- | | |
|-------------|---|
| 1. citrate | A. product of energy payoff phase of glycolysis |
| 2. glucose | B. product of transition reaction |
| 3. pyruvate | C. substrate of energy investment phase of glycolysis |
| 4. acetyl | D. product of 1st step of Krebs cycle |
| 5. ATP | |

Match the chemical to how it is involved with photosynthesis:

- | | |
|--------------------------------|---|
| 6. O_2 | A. substrate for carbon fixation (1st reaction of Calvin cycle) |
| 7. CO_2 | B. product at the end of a set of reactions involving both photosystem I and II |
| 8. NADPH | C. product of a reaction only at photosystem II |
| 9. ribulose biphosphate (RuBP) | D. toxic product from Calvin cycle when O_2 is used instead of CO_2 |
| 10. glycolate | |



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

11. G protein-coupled receptor
12. receptor tyrosine kinase
13. ligand-gated ion channel

Multiple Choice Choose the **BEST** answer.

14. 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.
15. 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.
16. 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

17. 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
18. Which of the following is the most general term for the energy of position?
- A. actinic
 - B. electricity
 - C. kinetic
 - D. light
 - E. potential
19. 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
20. 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.
21. Specialized animal cell connections include:
- A. gap junctions.
 - B. tight junctions.
 - C. plasmodesmata.
 - D. A and B
 - E. A, B, and C
22. 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
23. How many carbon dioxide (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
24. 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 $NADP^+$

25. 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
26. 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
27. 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
28. 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
B. carbohydrate
C. steroid
D. nucleic acid
E. protein
29. In the thylakoid membranes, what is the main role of the antenna pigment molecules?
- A. split water and release oxygen to the reaction-center chlorophyll
B. harvest photons and transfer light energy to the reaction-center chlorophyll
C. synthesize ATP from ADP + P_i
D. transfer electrons to ferredoxin (in the electron transport chain) and then to NADPH
E. concentrate photons within the stroma
30. Succinate dehydrogenase is an enzyme of the Citric acid/Krebs cycle. Where in the cell is this enzyme located?
- A. In the thylakoids
B. In the cytoplasm
C. In the chloroplast
D. In the mitochondrial matrix
E. In the plasma membrane
31. An environment where one would expect to find a CAM plant would be usually:
- A. salty and wet
B. cold
C. abundant with plant-eaters
D. hot and dry
E. humid
32. Which of the following characterizes the sodium-potassium pump?
- A. Sodium ions are pumped out of a cell against their concentration gradient.
B. Potassium ions are pumped into a cell against their concentration gradient.
C. The pump protein undergoes a conformational change.
D. Only A and C are correct.
E. A, B, and C are correct.

33. Where do the enzymatic reactions of the Calvin cycle take place?
- A. stroma of the chloroplast
 B. thylakoid membranes
 C. outer membrane of the chloroplast
 D. electron transport chain
 E. interior thylakoid space
34. The movement of a substance across a biological membrane against its concentration gradient with the help of energy input is:
- A. diffusion
 B. active transport
 C. osmosis
 D. facilitated diffusion
 E. exocytosis
35. 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):
- A. competitive inhibitor of the enzyme
 B. noncompetitive inhibitor of the enzyme
 C. allosteric activator of the enzyme
 D. cofactor necessary for enzyme activity
 E. coenzyme derived from a vitamin

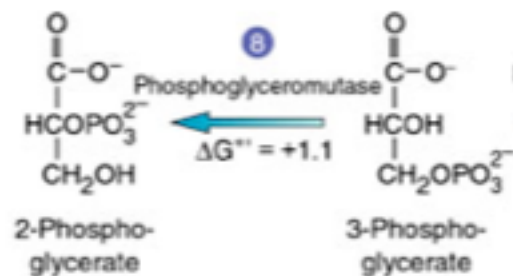
Momentary Cartoon Break



(Back to the Exam)

36. 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.
37. 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
38. A chemical reaction that has a positive ΔG is correctly described as:
- A. endergonic
 B. exergonic
 C. enthalpic
 D. spontaneous
 E. exothermic

39. ATP can be used to drive nonspontaneous reactions because:
- nonspontaneous reactions are exergonic.
 - the breakdown of ATP to ADP is exergonic.
 - the breakdown of ATP to ADP is endergonic.
 - when ATP is broken down to ADP, P_i is released.
 - ADP possesses more free energy than ATP.
40. What does cyclic electron flow in the chloroplast produce?
- ATP
 - NADPH
 - glucose
 - A & B
 - A, B, & C
41. Receptor tyrosine kinases need how many signal molecules to activate them?
- 1
 - 2
 - 3
 - 4
 - 5
42. What is a genome?
- an ordered display of chromosomes arranged from largest to smallest
 - a specific sequence of polypeptides within each cell
 - a specialized polymer of 4 different kinds of monomers.
 - a specific segment of DNA that is found within a prokaryotic chromosome
 - the complete set of DNA from an organism
43. Photorespiration is prevented physically from occurring in:
- CAM plants.
 - all chloroplasts.
 - C_4 plants.
 - microbodies.
 - C_3 plants.
44. G proteins bind to a/an _____ to cause a cellular response.
- phosphatase
 - enzyme
 - kinase
 - ligand
 - gated channel



45. What kind of chemical reaction occurs during glycolysis when 3-Phosphoglycerate becomes 2-Phosphoglycerate?
- redox
 - rearrangement
 - dehydration synthesis
 - functional group transfer
 - hydrolysis

46. Which of the following statements correctly describe(s) anabolic biological pathways?
- A. They do **not** depend on enzymes.
 - B. They release energy as they degrade polymers to monomers.
 - C. They consume energy to build up polymers from monomers.
 - D. They lead to the breakdown of catabolic compounds.
 - E. Both A and C
47. Certain areas of eukaryotic cell membranes are called "coated pits." Which of the following cell activities is associated with those areas?
- A. phagocytosis
 - B. reception of a molecule for signal transduction
 - C. receptor-mediated endocytosis
 - D. exocytosis
 - E. secretion
48. Many species use fermentation to aid in usable energy production. A function of fermentation is to:
- A. reduce NAD^+ to $\text{NADH} + \text{H}^+$ and thus pass electrons to oxygen (O_2).
 - B. oxidize carbon dioxide (CO_2) to produce oxygen (O_2).
 - C. produce acetyl CoA.
 - D. oxidize $\text{NADH} + \text{H}^+$ to NAD^+ , ensuring a continuing production of ATP.
 - E. None of the above
49. Which of the following molecules stimulates glycolysis?
- A. AMP
 - B. ATP
 - C. carbon dioxide (CO_2)
 - D. citrate
 - E. oxygen (O_2)
50. 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
51. Calcium ions (Ca^{2+}) and inositol triphosphate (IP_3) function inside cells as:
- A. receptors
 - B. kinases
 - C. scaffolding proteins
 - D. second messengers
 - E. phosphatases
52. 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
53. 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

54. 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
55. Anaerobic respiration uses all but:
- A. glycolysis
 - B. chemiosmosis
 - C. Citric acid/Kreb's cycle
 - D. electron transport chain
 - E. reduction of oxygen (O₂)
56. What is the change in free energy (ΔG) of a system at chemical equilibrium?
- A. slightly increasing
 - B. greatly increasing
 - C. slightly decreasing
 - D. greatly decreasing
 - E. **no** net change
57. 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
58. 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.
59. 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.
60. During bacterial cell division, the two DNA molecules are separated by:
- A. centrosomes.
 - B. spindle fibers.
 - C. nucleosomes.
 - D. cell elongation.
 - E. aneuploidy.