BIOL-8 Practice Test 02 — Answer Key

Modules 5-6: Membranes & Metabolism

Part A: Multiple Choice Answers

Q	Answer	Explanation
1	B	Proteins float within a flexible phospholipid bilayer — the "fluid mosaic"
2	C	Hydrophobic tails face inward, away from water, toward each other
3	B	Cholesterol buffers membrane fluidity — prevents too rigid in cold or too fluid in heat
4	B	Integral (transmembrane) proteins span the entire bilayer from one side to the other
5	B	Glycoproteins serve as identification markers for cell recognition and signaling
6	C	Selectively permeable = allows some substances through but not others based on size, charge, polarity
7	B	Simple diffusion moves molecules down their gradient, no energy, no proteins needed
8	C	Facilitated diffusion is passive but uses channel or carrier proteins to assist transport
9	B	Osmosis = water movement across a selectively permeable membrane toward higher solute concentration
10	C	Hypotonic = less solute outside → water enters the cell → swelling → possible lysis
11	B	Hypertonic = more solute outside → water leaves → plasma membrane pulls from cell wall (plasmolysis)
12	C	Na^+ /K^+ pump uses ATP to move ions against their concentration gradient = active transport
13	C	

Q	Answer	Explanation
		Phagocytosis = "cell eating" — the membrane wraps around and engulfs large solid particles
14	B	Pure water is hypotonic to blood cells; water would rush in by osmosis, causing cells to lyse
15	C	Aquaporins are specialized channel proteins for rapid water transport across membranes
16	B	Catabolism = breaking down complex molecules, releasing energy (e.g., glucose → CO_2 + ATP)
17	B	Anabolism = building complex molecules from simple ones, requiring energy input
18	C	ATP (adenosine triphosphate) is the cell's energy currency
19	C	Energy is stored in the phosphoanhydride bonds between the phosphate groups
20	B	Enzymes lower activation energy, allowing reactions to proceed faster at body temperature
21	B	Induced fit = the active site adjusts its shape slightly to bind the substrate more tightly
22	B	Competitive inhibitors mimic the substrate and bind directly to the active site, blocking it
23	B	Noncompetitive inhibitors bind elsewhere on the enzyme, distorting the active site shape
24	B	Feedback inhibition = the end product shuts down an earlier enzyme in its own production pathway

Q	Answer	Explanation
25	B	Glucose + $6O_2$ → $6CO_2$ + $6H_2O$ + ATP (the overall equation for cellular respiration)
26	C	Glycolysis occurs in the cytoplasm (does not require mitochondria)
27	B	The citric acid cycle occurs in the mitochondrial matrix
28	B	The ETC is embedded in the inner mitochondrial membrane (cristae)
29	C	Fermentation produces ATP without oxygen (anaerobic pathway)
30	D	Aerobic respiration yields approximately 36-38 ATP per glucose molecule

Part B: Fill in the Blank Answers

Q	Answer
31	proteins
32	passive
33	hypertonic
34	exocytosis
35	pinocytosis
36	metabolism
37	catalysts
38	electron transport chain
39	lactic acid
40	electron

Part C: Short Answer Key

41. Passive vs. Active Transport:

Feature	Passive Transport	Active Transport
Energy	No ATP required	Requires ATP
Direction	Down (with) the concentration gradient	Against the concentration gradient
Examples	Diffusion, osmosis, facilitated diffusion	Sodium-potassium pump, endocytosis, exocytosis

Key distinction: Passive transport is driven by the natural kinetic energy of molecules moving from high to low concentration. Active transport requires the cell to spend ATP to move substances where they would not naturally go.

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42. Tonicity and Animal Cells:

Solution	What Happens	Result
Isotonic	Water moves in and out equally	Cell maintains normal shape
Hypertonic	Water leaves the cell (toward higher external solute)	Cell shrinks — **crenation**
Hypotonic	Water enters the cell (toward higher internal solute)	Cell swells and may burst — **lysis** (cytolysis)

The direction of water movement always follows the solute concentration — water moves toward the side with MORE solute (less water).

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43. Enzyme Function and Denaturation:

- Enzymes are biological catalysts (proteins) with a specific **active site** that binds a particular substrate
- The **induced fit model** states that the active site slightly changes shape upon substrate binding for a tighter fit, like a handshake
- Enzymes lower the **activation energy** needed for a reaction, dramatically increasing reaction rate without being consumed
- **Denaturation** occurs when extreme temperature or pH disrupts the hydrogen bonds and other interactions that maintain the enzyme's 3D shape — the active site is distorted and can no longer bind the substrate, so the enzyme loses its function

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44. Three Stages of Cellular Respiration:

Stage	Location	Inputs	Outputs
Glycolysis	Cytoplasm	1 glucose	2 pyruvate, 2 ATP (net), 2 NADH
Citric Acid Cycle	Mitochondrial matrix	2 acetyl-CoA	2 ATP, 6 NADH, 2 $FADH_2$, CO_2
Electron Transport Chain	Inner mitochondrial membrane	NADH, $FADH_2$, O_2	~32-34 ATP, H_2O

Total yield: approximately **36-38 ATP** per glucose molecule. Oxygen serves as the final electron acceptor in the ETC, combining with electrons and H^+ to form water.

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45. Fermentation Comparison:

Feature	Lactic Acid Fermentation	Alcoholic Fermentation
End products	Lactic acid	Ethanol + CO_2
Occurs in	Animal muscle cells, some bacteria	Yeast, some bacteria
Example	Muscle soreness during intense exercise	Bread rising, beer/wine production

Both types produce only **2 ATP per glucose** (from glycolysis only). Fermentation is far less efficient than aerobic respiration (~36-38 ATP) because: 1. Without oxygen, the electron transport chain cannot run — this is where the vast majority of ATP is generated 2. Most of the energy from glucose remains trapped in the waste products (lactic acid or ethanol) rather than being extracted

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End of Answer Key