COMPETIFY HUB

FUELING AMBITION, FORGING PATHS

# BIOLOGY

## GRADES 9-12

PROVIDING FREE RESOURCES FOR ALL

Q1: Which of the following are major triggers for apoptosis?

a. Natural formation of certain regions of the body
b. Excessive damage due to DNA
c. Excessive protein misfolding
d. All of the above

Q2: Where do chromosomes line up during metaphase in a cell undergoing cell division?

a. At the Poles
b. Metaphase plate
c. Nuclear region
d. Near the ribosomes

S1: D - All of the Above

Explanation:
Answer – D. All of the above-mentioned criteria are some of the main triggers that cause apoptosis.

S2: B - During metaphase plate

Explanation:
Answer – b. During metaphase, chromosomes line up at the metaphase plate and then proceed to go towards the opposite poles due to the pull of the kinetochore fibers towards that pole in Anaphase.

Q3: Which of the following is NOT a key protein receptor in cell transduction pathways?

a. G-protein Coupled Receptors
b. Receptor Tyrosine Kinases
c. Ligand-gated Ion channels
d. Aquaporins

Q4: Which of the following enzymes is responsible for reducing the activity of gene expression caused by activation of cAMP?

a. Phospholipase C
b. Protein Phosphatases
c. Phosphodiesterase
d. Aconitase

## S3: D - Aquaporins

Explanation: Answer – D. Out of all the above options, Aquaporins do not play any function in transducing signals across signal pathways.

## S4: C - Phosphodiesterase

Explanation: Answer – C. The enzyme Phosphodiesterase is responsible for deactivating cAMP to AMP, a molecule that does not retain its signal transduction function as its predecessor.

## Q5: Which of the following most accurately explains why signal transduction pathways are exponential in nature?

a. A messenger can activate more than 1 relay molecule in the next stage
b. The hormone-receptor complex activates the largest amount of relay molecules, while the rest remain constant
c. Secondary messengers can increase the amplitude of the response, often more than tenfold
d. Both A and C

## Q6: What is the key difference between cytokinesis in an animal cell and in a plant cell?

a. Cytokinesis in an animal cell involves contractile motion of actin filaments, whereas vacuoles deposit cell wall material between two daughter plant cells.
b. Cytokinesis in an animal cell involves contractile motion of microtubules, whereas plant cells require actin filaments for separation.
c. Cytokinesis in an animal cell involves a cleavage furrow, but plant cells create a cell plate
d. All of the Above
e. Only A and C
f. Only A and B

S5: D - Both A and C

Explanation: Answer: D. It is known that relay molecules can phosphorylate more than one protein in the next stage of the signal transduction pathway, and secondary messengers can significantly amplify a signal due to their small, diffusible, and fast-moving nature.

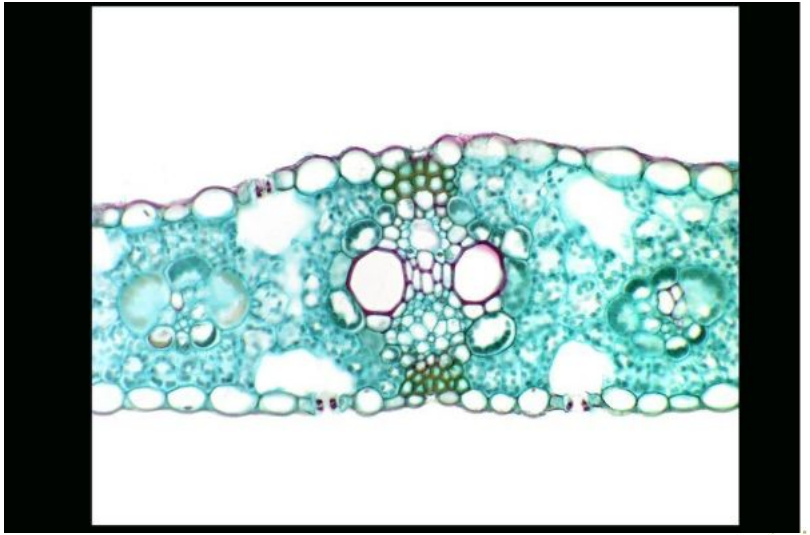
S6: E - Both A and C

Explanation: Answer – E. Cytokinesis in animal cells requires the action of actin filaments that contract to create a cleavage furrow to pinch the cell in 2. The very same process in plant cells requires the deposition of cell wall materials by vacuoles, creating a cell wall in the process.

A biologist collected a sample of a leaf from a plant species found in a hot, semi-arid region. After examining the leaf through a cross-section, he finds that the leaf appears most similar to the given picture to the right:

Q7: Which of the following types of photosynthesis most likely occurs in this plant?

a. C3
b. C4
c. CAM
d. Photorespiration



(Credit: Photo by Micheal W. Clayton, Plant Structure and Function via University of Wisconsin-Madison)

S7: B - C4

Explanation: Answer: B. C4 plants demonstrate Kranz anatomy, such as the picture shown above, due to their unique method of photosynthesis that carries Malate from Bundle-sheath cells to Vascular cells for later inclusion into Calvin Cycle.

Q8: In a C4 plant, which enzyme is responsible for fixing Carbon Dioxide ($CO_2$) absorbed from the atmosphere into an organic compound found in the plant cell?

a. NADP+ reductase
b. PEP Carboxylase
c. Phosphoglycerate Kinase
d. None of the above

Q9: How many ATP and NADPH are required to make 7 glucose molecules?

a. 9 ATP + 6 NADPH
b. 18 ATP + 12 NADPH
c. 42 ATP + 93 NADPH
d. 126 ATP + 84 NADPH

## S8: B - PEP carboxylase

Explanation:  Answer: B. The enzyme PEP Carboxylase is responsible for fixing Carbon Dioxide from the atmosphere into Phosphoenolpyruvate (PEP) to create Oxaloacetate, beginning the initial stage of the Calvin Cycle in the Mesophyll cell.

## S9: D - 126 ATP + 84 NADPH

Explanation: Answer: D. The Calvin Cycle fixes 3 Carbon Dioxide atoms at a time from the atmosphere to generate ATP and regenerate Ribulose Biphosphate, consuming 9 ATP + 6 NADPH to generate 1 Glyceraldehyde-3-Phosphate (G3P). It requires 2 G3P to generate one hexose (glucose), yielding 18 ATP + 12 NADPH per hexose. Multiply this quantity by 7 to generate 7 glucose molecules.

Q10: A scientist injects a Substance X into a cell as it undergoes mitosis. After scientific analysis, it was discovered that Substance X increases the rate of depolymerization of microtubules towards the creation of the spindle fiber. Which of the following could be a consequence of the drug?

a. Increased fragility of the cell than without the drug
b. Deformation of the shape of the cell in certain areas
c. Cell observes improper motility
d. All of the above

Q11: A cell extracted from species X is observed to be haploid. A karyotype shows that the species X has 100 chromosomes. How many chromosomes does a diploid cell of species X have?

a. 50
b. 75
c. 150
d. 200

S10: D -All of the above

Explanation: Answer – D. If Substance X increases the rate of depolymerization of microtubules towards the creation of the spindle fiber, the strength and resistance to forces of the cell's cytoskeleton is compromised. An understanding of the functioning of the cytoskeleton is crucial to answering this question.

S11: D - 200

Explanation: Answer – D. A diploid cell contains 2n chromosomes, whereas a haploid cell has only n chromosomes. This is because diploid cells receive homologous chromosomes from both parents, whereas the dual-stage of meiosis halves this number into n chromosomes.

Q12: Which of the following is most likely the reason why plants conduct the wasteful process of photorespiration?

a. An adaptation to generate heat in cold/frigid regions
b. An adaptation to ward predators away
c. An evolutionary relic to recycle photosynthesis enzymes
d. An evolutionary relic that originated in the CO2-saturated primordial atmosphere

Q13: What of the following is true about Cyclic Electron flow?

a. Cyclic Electron flow does not use Photosystem II
b. Cyclic Electron flow generates ATP but not NADPH or O2
c. Cyclic Electron flow is hypothesized to be an evolutionary relic found in photosynthetic bacteria
d. All of the above

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## S12: D - CO2-saturated primordial atmosphere

Explanation: Answer: D. Evolutionary biologists theorize that photorespiration is a relic of photosynthesis that developed in the primordial ages since the atmosphere was highly concentrated with Carbon Dioxide and barely any Oxygen. In this situation, photorespiration had no net effect.

## S13: D - All of the above

Explanation: Answer: D. Cyclic Electron Flow is seen as primordial photosynthesis in photosynthetic bacteria that do not contain two photosystems. Its purpose is to pump H+ ions into the thylakoid space and generate ATP only.

Q14: A scientist injects a cell undergoing mitosis with a drug that prevents the function of cohesins. Which of the following is the most direct effect of the drug on the cell?

a. Spindle Fibers will not be able to pull sister chromatids to opposite poles
b. Sister Chromatids will not fuse along arms, disrupting Metaphase entirely
c. Kinetochores will not latch onto chromosomes correctly
d. Mitosis will fail to occur properly

S14: B - Sister Chromatids will not fuse along arms, disrupting Metaphase entirely

Explanation: Answer: B. The key function of the protein complexes known as cohesins is to connect sister chromatids along their arms to form a unified chromosome that will be disassembled and pulled apart to opposite poles on Metaphase and Anaphase.