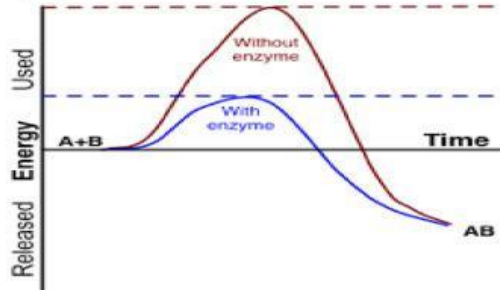


Howard High School Biology Mock Milestones Exam**Macromolecules: Questions 1 - 4**

1. The graphs shows how enzymes affect reactions in cells. Which statement best summarizes the information shown in the graph? (DOK 3)



- A. Enzymes reverse the direction of the reaction.
- B. Enzymes increase the activation energy which speeds up the chemical reaction.
- C. Enzymes decrease the energy level of the products.
- D. Enzymes decrease the activation energy which speeds up the chemical reaction.

2. A student removes carbohydrates from a cell's environment. Which cellular process would be most immediately affected? (DOK 3)

- A. Transmission of genetic information
- B. Formation of phospholipid membranes
- C. Short-term energy availability
- D. Synthesis of enzymes

3. A mutation alters the DNA sequence coding for an enzyme. Which outcomes are most likely to result? *Select all that apply.* (DOK 3)

- A. The enzyme may lose its specific shape
- B. The enzyme may no longer bind to its substrate
- C. The rate of chemical reactions may change
- D. The cell membrane will dissolve

4. Which statements correctly describe how macromolecules work together to maintain cellular function? *Select all that apply.* (DOK 3)

- A. DNA provides instructions for protein synthesis
- B. Proteins catalyze reactions involving carbohydrates and lipids
- C. Lipids encode genetic information
- D. RNA transfers information from DNA to ribosomes

Organelles: Questions 5 - 8

5. A student is studying cell structures and organelles. He wants to create an explanation of how the various organelles interact to meet the cell's need for proteins while preventing too many proteins from collecting inside the cell. Which of the following would be the BEST explanation for the student to use? (DOK 3)

- A. The ribosomes that cover the rough endoplasmic reticulum manufacture proteins. These proteins are sent to lysosomes where they are modified and sorted based on their destinations. Proteins no longer needed by the cell are broken down by the Golgi apparatus.
- B. The surface of the smooth endoplasmic reticulum manufactures proteins. These proteins are sent to the Golgi apparatus where they are modified and sorted based on their destinations. Proteins no longer needed by the cell are broken down by lysosomes.
- C. The ribosomes that cover the Golgi apparatus manufacture proteins. These proteins are sent to the smooth endoplasmic reticulum where they are modified and sorted based on their destinations. Proteins no longer needed by the cell are broken down by lysosomes.
- D. The ribosomes that cover the rough endoplasmic reticulum manufacture proteins. These proteins are sent to the Golgi apparatus where they are modified and sorted based on their destinations. Proteins no longer needed by the cell are broken down by lysosomes.

6. A toxin damages the rough endoplasmic reticulum of a cell. Which cellular process will be most immediately affected? (DOK 3)

- A. Lipid synthesis
- B. Protein modification and transport
- C. ATP production
- D. DNA replication

7. A student observes that a cell cannot remove damaged organelles or waste materials efficiently. Which organelle malfunction could explain this issue? *Select all that apply.* (DOK 3)

- A. Lysosome
- B. Vacuole
- C. Mitochondrion
- D. Golgi apparatus

8. Which statements correctly explain how organelles work together to maintain cellular homeostasis? *Select all that apply.* (DOK 4)

- A. The nucleus provides instructions for protein synthesis
- B. Ribosomes translate genetic information into proteins
- C. The Golgi apparatus packages and distributes proteins
- D. Mitochondria store genetic information

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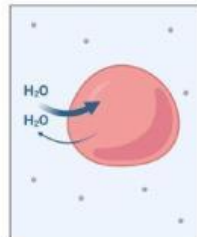
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Cellular Transport: Questions 9 - 12

9. A mutation prevents sodium-potassium pumps from functioning correctly. Which effects are most likely to occur? *Select all that apply.* (DOK 4)

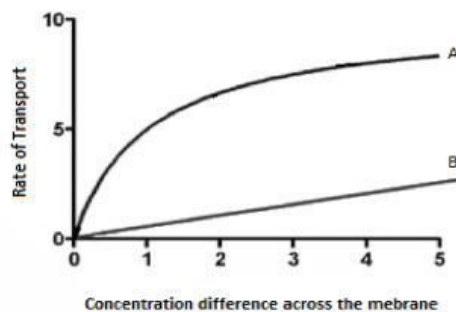
- A. Disrupted ion balance across the membrane
- B. Loss of membrane potential
- C. Decreased ATP production in mitochondria
- D. Impaired nerve signal transmission

10. A cell is placed in a hypertonic solution. Which observation best describes what will happen to the cell? (DOK 3)



- A. The cell will swell as water enters
- B. The cell will shrink as water leaves
- C. The cell will burst due to pressure
- D. There will be no net movement of water

11. The graph shows the rate of transport across a cell membrane as the concentration difference across the membrane increases for two processes, labeled A and B.



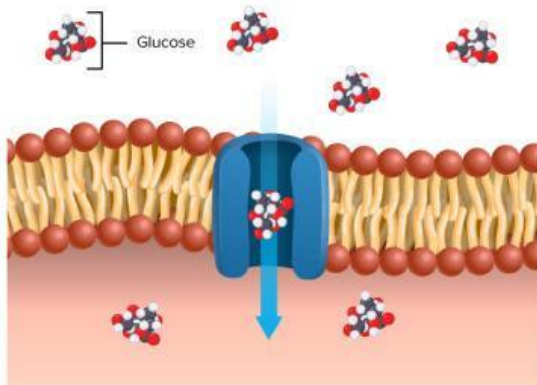
Based on the patterns shown in the graph, which statement best explains the difference between process A and process B?

- A. Process A represents facilitated diffusion because the rate increases steadily without reaching a maximum, while process B represents simple diffusion.
- B. Process A represents active transport because energy is required to move substances down their concentration gradient, while process B does not require energy.
- C. Process A represents facilitated diffusion because the transport rate levels off as carrier proteins become saturated, while process B represents simple diffusion.
- D. Process A represents osmosis because water moves faster at high concentrations, while process B represents diffusion of ions.

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12. A diagram shows glucose molecules entering a cell through a membrane protein without ATP use.

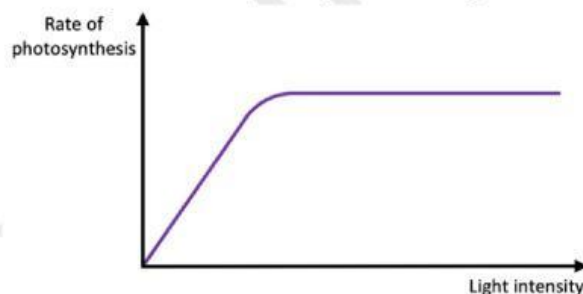


Which conclusions are supported by this diagram? *Select all that apply.* (DOK 4)

- A. The process requires a transport protein
- B. The process moves molecules down a concentration gradient
- C. The process is active transport
- D. The process is a form of facilitated diffusion

Cellular Energy – Photosynthesis: Questions 13 - 16

13. The graph below shows the rate of photosynthesis as light intensity increases.



Why does the rate eventually level off even though light intensity continues to increase? (DOK 3)

- A. Chlorophyll stops absorbing light
- B. Carbon dioxide becomes a limiting factor
- C. Oxygen production stops completely
- D. The Calvin cycle shuts down

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14. Use the table below to answer the following question.

Process	Function	Location	Reactants	Products
Photosynthesis	Energy capture	X	Carbon dioxide and water	Z
Respiration	W	Mitochondria	Y	Carbon dioxide and water

Match the letters above with the correct answers. (DOK 2)

- A. W = energy storage, X = chloroplast, Y = glucose and water, Z = glucose and oxygen
- B. W = energy release, X = chlorophyll, Y = glucose and oxygen, Z = glucose and water
- C. W = energy release, X = chloroplast, Y = glucose and oxygen, Z = glucose and oxygen
- D. W = energy storage, X = chloroplast, Y = glucose and water, Z = glucose and oxygen

15. A plant is placed in an environment with low carbon dioxide levels but high light intensity. Which outcomes are most likely? *Select all that apply.* (DOK 4)

- A. Reduced glucose production
- B. Reduced rate of the Calvin cycle
- C. Increased oxygen production indefinitely
- D. Energy flow through the ecosystem may decrease

16. Which statements correctly explain how photosynthesis supports energy flow in ecosystems? *Select all that apply.* (DOK 3)

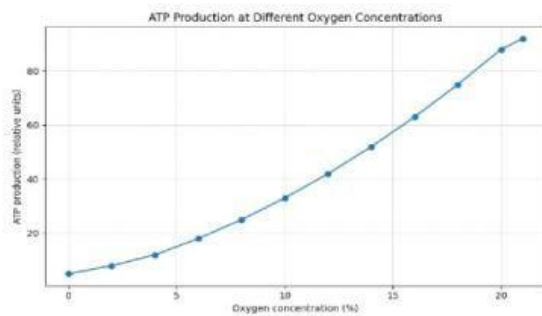
- A. Photosynthesis converts light energy into chemical energy
- B. Glucose produced can be transferred through food webs
- C. Photosynthesis recycles energy within the ecosystem
- D. Oxygen released supports aerobic respiration

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Cellular Energy – Cellular Respiration: Questions 17 - 20

17. The graph below shows ATP production at different oxygen concentrations.



Why does ATP production decrease sharply when oxygen levels are low? (DOK 3)

- A. Glycolysis stops without oxygen
- B. The electron transport chain cannot function properly
- C. Glucose is no longer available
- D. Carbon dioxide accumulates too quickly

18. A muscle cell switches to anaerobic respiration during intense exercise. Which outcome is most likely? (DOK 4)

- A. Increased ATP production compared to aerobic respiration
- B. Accumulation of lactic acid
- C. Complete breakdown of glucose into carbon dioxide
- D. Increased oxygen consumption

19. A cell experiences damage to the inner mitochondrial membrane. Which effects are most likely to occur? *Select all that apply.* (DOK 4)

- | | |
|---------------------------------------|---|
| A. Reduced ATP production | B. Disrupted electron transport chain |
| C. Increased efficiency of glycolysis | D. Reduced ability to maintain cellular homeostasis |

20. Which statements correctly explain how cellular respiration supports energy flow in living systems? *Select all that apply.* (DOK 3)

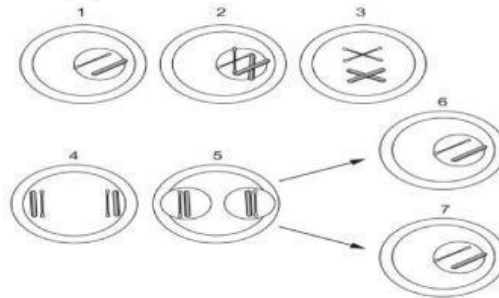
- A. Energy stored in glucose is converted into ATP
- B. ATP provides energy for cellular processes
- C. Cellular respiration recycles energy within ecosystems
- D. Carbon dioxide is released as a byproduct

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Genetic Continuity – Questions 21 - 24

21. Students modeled the changes in cells during mitosis, using paper plates, flat wooden sticks, cotton swabs, and construction paper.



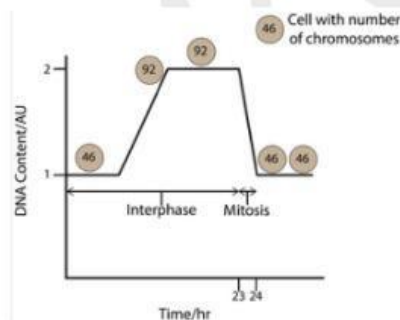
Which statement correctly uses the model to explain how mitosis maintains genetic continuity?

- A. The chromosomes in cell 1 are the same as in cells 6 and 7.
- B. Crossing-over occurs in cell 3, which increases the genetic diversity in cells 6 and 7.
- C. When the nuclear membrane reforms in cell 5, each nucleus becomes diploid in number.
- D. The independent assortment that is represented in cell 2 ensures that cell 3 has the correct number of chromosomes.

22. Which events occur during meiosis but NOT during mitosis? *Select all that apply.* (DOK 2)

- A. Reduction of chromosome number
- B. Crossing over of homologous chromosomes
- C. Production of genetically identical cells
- D. Independent assortment

23. The graph below shows chromosome number before and after cell division.



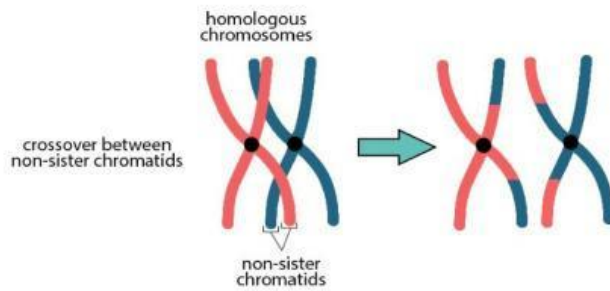
Which conclusion is best supported if chromosome number remains constant after division? (DOK 3)

- A. The cell underwent meiosis I
- B. The cell underwent mitosis
- C. Fertilization occurred
- D. Nondisjunction happened

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24. A diagram shows homologous chromosomes exchanging segments during prophase I.



Which statements are supported by this diagram? *Select all that apply.* (DOK 3)

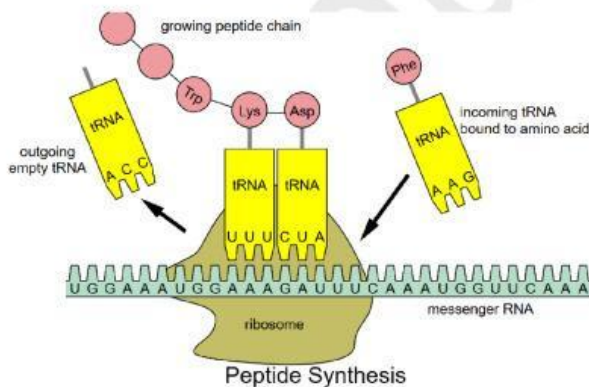
- A. Genetic variation is increased
- B. Alleles can be recombined
- C. Chromosome number is doubled
- D. Crossing over occurs during meiosis

Protein Synthesis: Questions 25 – 28

25. Which molecules are directly involved in translating mRNA into a protein? *Select all that apply.* (DOK 2)

- A. mRNA
- B. tRNA
- C. Ribosome
- D. DNA

26. A diagram shows a ribosome moving along an mRNA strand while tRNA molecules deliver amino acids.



What is the best conclusion supported by this diagram? (DOK 3)

- A. DNA is copied during translation
- B. Amino acids are assembled in a specific order
- C. Proteins are produced in the nucleus
- D. ATP is not required for translation

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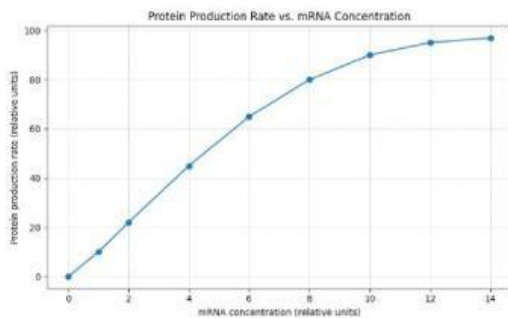
27. A cell is exposed to a toxin that damages ribosomes. Which outcomes are most likely?

Select all that apply. (DOK 4)

- A. Translation rate decreases
C. DNA replication is prevented

- B. Proteins may be incomplete or absent
D. Cellular homeostasis may be disrupted

28. The graph below shows protein production rate as mRNA concentration increases.



Why does protein production eventually level off? (DOK 3)

- A. DNA is no longer available
C. Transcription stops
B. Ribosomes become saturated
D. Amino acids disappear

Mutations: Questions 29 – 32

29. Mutations have various effects on the amino acid sequence that determines protein structure and function. A silent mutation has no effect on the protein's function. Which mutation would result in a silent mutation?

Codon Chart

		Second Base				
		U	C	A	G	
First Base	U	UUU } Phenylalanine (Phe/F) UUC } UUA } Leucine (Leu/L) UUG }	CUU } Serine (Ser/S) CCU } CAU } CGU }	AUU } Tyrosine (Tyr/Y) ACU } AAU – STOP AGU – STOP	GUU } Cysteine (Cys/C) GCU } GAU – STOP GGU } Tryptophan (Trp/W)	U C A G
	C	CUU } Leucine (Leu/L) CUC } CUA } CUG }	CUC } Proline (Pro/P) CCC } CAC } CGC }	AUC } Histidine (His/H) ACC } AAC } Glutamine (Gln/Q) AGC }	GUC } Arginine (Arg/R) GCC } GAC } GGC }	U C A G
	A	AUU } Isoleucine (Ile/I) AUC } AUA } AUG – Methionine (Met/M)	CUA } Threonine (Thr/T) CCA } CAA } CGA }	AUA } Asparagine (Asn/N) ACA } AAA } Lysine (Lys/K) AGA }	GUA } Serine (Ser/S) GCA } GAA } Arginine (Arg/R) GGA }	U C A G
	G	GUU } Valine (Val/V) GUC } GUA } GUG }	CUG } Alanine (Ala/A) CCG } CAG } CGG }	AUG } Aspartic acid (Asp/D) ACG } AAG } Glutamic acid (Glu/E) AGG }	GUG } Glycine (Gly/G) GCG } GAG } GGG }	U C A G

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- A. AUA to AUG B. CCA to CCG C. GCU to GGU D. UAA to CAA

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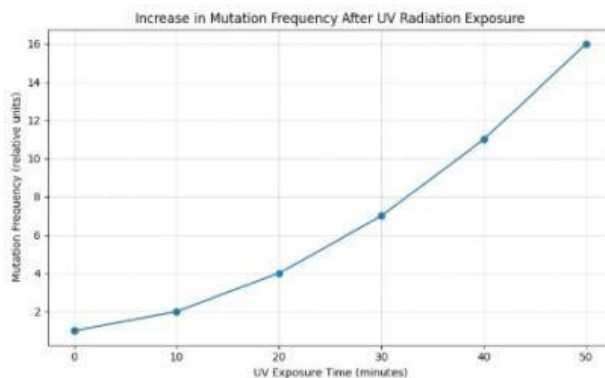
30. A mutation occurs in a skin cell but not in reproductive cells. Which outcome is most likely? (DOK 4)

- A. The mutation will be passed to offspring
- B. The mutation will affect meiosis
- C. The mutation may affect only the individual
- D. The mutation will change chromosome number

31. Which statements correctly explain the role of mutations in living systems? Select all that apply. (DOK 4)

- A. Mutations introduce genetic variation
- B. Some mutations can be beneficial, harmful, or neutral
- C. Mutations are required for evolution to occur
- D. All mutations result in genetic disorders

32. A graph shows an increase in mutation frequency after exposure to ultraviolet (UV) radiation.



Which conclusions are supported by the data? Select all that apply. (DOK 3)

- A. Environmental factors can increase mutation rates
- B. Mutations always cause genetic disorders
- C. Radiation can damage DNA
- D. Mutations occur only during meiosis

Karyotypes: Questions 33 – 36

33. Which characteristics can be identified using a karyotype? Select all that apply. (DOK 2)

- A. Sex of the individual
- B. Presence of extra or missing chromosomes
- C. Specific nucleotide changes
- D. Large chromosomal rearrangements

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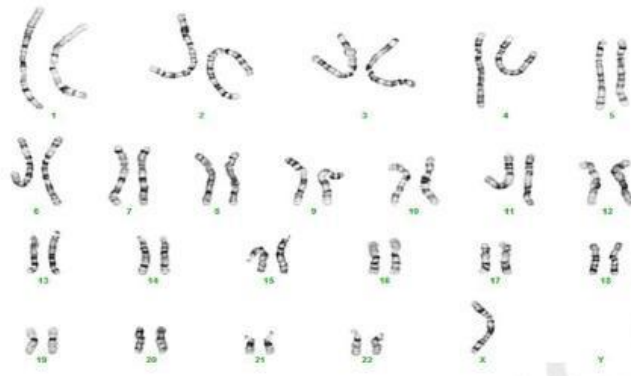
34. Which statements correctly explain the role of karyotypes in genetic analysis?

Select all that apply. (DOK 4)

- A. Karyotypes help identify chromosomal abnormalities
- B. Karyotypes can reveal nondisjunction events
- C. Karyotypes detect single-gene mutations
- D. Karyotypes support diagnosis of genetic disorders

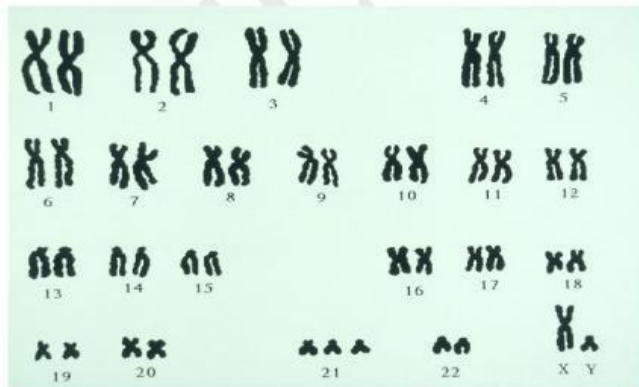
35. A karyotype shows an individual with 45 chromosomes. Which explanations are most likely?

Select all that apply. (DOK 4)



- A. A chromosome was lost due to nondisjunction
- B. Monosomy occurred
- C. Crossing over failed
- D. The individual may have developmental abnormalities

36. A diagram shows homologous chromosomes failing to separate during meiosis I. Which outcomes are supported by this diagram? Select all that apply. (DOK 3)



- A. Gametes with abnormal chromosome numbers
- B. Increased chance of chromosomal disorders
- C. Genetically identical daughter cells
- D. Possible trisomy or monosomy