

Mock exam ENV-103

This mock exam has 25 questions, the full exam will have around 50 questions. Portion of these questions are directly from last year's exam.

1) DNA replication is semiconservative, that means:

- a. A brand-new dsDNA molecule is generated separated from the old double stranded DNA molecule.
- b. The resulting dsDNA molecules are made of one parental strand and a newly formed daughter strand.
- c. During replication, the 5' to 3' direction is only partially conserved .
- d. Replication is semiconservative because it always introduces a small but significant number of mutations during the process.

2) If a bacteria contained a mutant enzyme (aminoacyl-tRNA synthetase) that attaches a lysine amino acid instead of the normal phenylalanine to tRNAs with the anticodon AAA which of the following would occur?

- a. None of the proteins in the cell will contain phenylalanine.
- b. mRNAs with a UUU codon will add a lysine instead of phenylalanine to the polypeptide.
- c. The cell will compensate for the defect by attaching phenylalanine to tRNAs with lysine-specifying anticodons.
- d. The ribosome will skip a codon every time a UUU is encountered.

3) Which of the following statements correctly describe the roles of cohesion and adhesion in the movement of water through plants?

- A) Cohesion, due to hydrogen bonds, reduces surface tension and prevents water from moving up the xylem. Adhesion is the attraction between water molecules.
- B) Cohesion, caused by ionic bonds, allows water to evaporate quickly from plant leaves. Adhesion is the attraction between water molecules.
- C) Adhesion allows water molecules to stick together, forming droplets. Cohesion allows water to cling to other substances like plant cell walls.
- D) Adhesion helps water stick to plant cell walls, and cohesion keeps water molecules connected as they move upward through the xylem.
- E) Answers A and C are correct.

4) Which of the following best describes how replication bubbles form during DNA replication in a bacterial (prokaryotic) cell?

- A) Replication starts at a single origin on the circular DNA molecule, and a replication bubble forms as the DNA unwinds and replication proceeds in both directions.
- B) Replication begins at multiple origins across the circular DNA, forming several replication bubbles that move in one direction.
- C) Replication begins randomly along the DNA molecule and proceeds toward the center of the chromosome.
- D) Replication proceeds linearly from one end of the circular DNA to the other without forming any bubbles.

5) Which of the following statements accurately describes the role and characteristics of gametes in animals?

- A) Gametes are diploid cells produced by mitosis and undergo further cell division before fertilization.
- B) Gametes are the only haploid cells in animals, produced by meiosis, and they undergo no further cell division before fertilization.
- C) Gametes are haploid cells produced by mitosis and fuse to form a haploid zygote that divides by meiosis to develop into a multicellular organism.
- D) Gametes are diploid cells that undergo meiosis after fertilization to form a diploid zygote.

6) Which of the following statements correctly describes the role of water in polymer synthesis and breakdown?

- A) A dehydration reaction occurs when two monomers bond together through the gain of a water molecule.
- B) Hydrolysis is the process of forming polymers from monomers by adding water molecules.
- C) Polymers are disassembled back to monomers by hydrolysis, which involves the addition of a water molecule.
- D) Dehydration and hydrolysis are processes that assemble and disassemble polymers without involving water molecules.

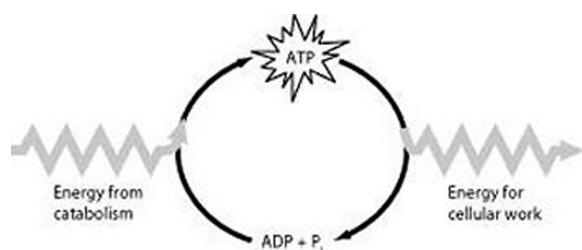
7) Which of the following is an example of potential rather than kinetic energy?

- A) water rushing over Niagara Falls
- B) light flashes emitted by a firefly
- C) a molecule of glucose
- D) a crawling beetle foraging for food

8) Which of the following statements best reflects the impact of the first law of thermodynamics on how organisms manage energy?

- A) The energy content of an organism remains unchanged regardless of its metabolic activity.
- B) Organisms create energy internally to support growth and reproduction.
- C) The entropy of an organism consistently decreases over time, defying the laws of thermodynamics.
- D) Organisms grow by transforming energy obtained from the environment into biologically useful forms such as organic matter.

9) How do cells use the ATP cycle illustrated in the figure?



- A) Cells use the cycle to recycle ADP and phosphate.
- B) Cells use the cycle to recycle energy released by ATP hydrolysis.
- C) Cells use the cycle to recycle ADP, phosphate, and the energy released by ATP hydrolysis.
- D) Cells use the cycle primarily to generate heat.

10) Approximately how many molecules of ATP are produced from the complete oxidation of one molecule of glucose ($C_6H_{12}O_6$) in aerobic cellular respiration?

- A) 2
- B) 4
- C) 18-24
- D) 30-32

11) What is the most logical sequence of steps for splicing foreign DNA into a plasmid and inserting the plasmid into a bacterium?

- I. Transform bacteria with a recombinant DNA molecule.
- II. Cut the plasmid DNA using restriction enzymes (endonucleases).
- III. Extract plasmid DNA from bacterial cells.
- IV. Hydrogen-bond the plasmid DNA to non-plasmid DNA fragments.
- V. Use ligase to seal plasmid DNA to non-plasmid DNA.

- A) II, III, V, IV, I
- B) III, II, IV, V, I
- C) III, IV, V, I, II
- D) IV, V, I, II, III

12) Which of the following characteristics of Taq polymerase make it useful in the PCR process?

- A) It is heat stable and can withstand the heating step of PCR.
- B) Only minute amounts are needed for each cycle of PCR.
- C) It binds more readily than other polymerases to the primers.
- D) It has regions that are complementary to the primers.

13) Darwin and Wallace's theory of evolution by natural selection was revolutionary because it _____.

- A) was the first theory to challenge the ideas of special creation.

B) proposed that individuals could adapt to their environment within their lifetime through natural selection.

C) refuted the idea that species are unchanging and highlighted the importance of variation and natural selection in populations.

14) Of the following anatomical structures, which is homologous to the bones in the wing of a bird?

- A) bones in the hind limb of a kangaroo
- B) chitinous struts in the wing of a butterfly
- C) bony rays in the tail fin of a flying fish
- D) bones in the flipper of a whale
- E) None of them

15) The predatory bacterium *Bdellovibrio bacteriophorus* drills into a prey bacterium and, once inside, digests it. In an attack upon a gram-negative bacterium that has a slimy cell covering, what is the correct sequence of structures penetrated by *B. bacteriophorus* on its way to the prey's cytoplasm?

- a) phospholipid membrane, capsule, peptidoglycan, lipopolysaccharide membrane
- b) lipopolysaccharide membrane, peptidoglycan, capsule, phospholipid membrane
- c) lipopolysaccharide membrane, capsule, peptidoglycan, phospholipid membrane
- d) capsule, lipopolysaccharide membrane, peptidoglycan, phospholipid membrane

16) Which of the following statements accurately describe carbon's bonding characteristics and molecular shapes?

- A) Carbon can form four covalent bonds.
- B) Carbon can only form linear molecules due to its tetrahedral shape.
- C) Carbon has four valence electrons.
- D) Both A and C are correct.
- E) Both A and B are correct.

17) Which of the following statements correctly describes macromolecules and their monomers?

- A) Carbohydrates are composed of amino acids, which are the building blocks of polypeptides.
- B) Monosaccharides are the simplest form of carbohydrates, known as simple sugars.
- C) Nucleotides are the building blocks of proteins, composed of a sugar, a phosphate group, and a nitrogenous base.
- D) Polypeptides are branched polymers built from nucleotides.
- E) Polypeptides are carbohydrate macromolecules formed by linking nucleic acids together.

18) Which of the following statements accurately describes ribosomes?

- A) Ribosomes are composed of DNA and proteins; they synthesize messenger RNA (mRNA).

- B) Ribosomes are composed of proteins only; they synthesize messenger RNA (mRNA).
- C) Ribosomes are composed of ribosomal RNA (rRNA) and proteins; they synthesize proteins.
- D) Ribosomes are composed of ribosomal RNA (rRNA) and proteins; they synthesize messenger RNA (mRNA).
- E) Ribosomes are composed of ribosomal RNA (rRNA) only; they synthesize proteins.

19) Which of the following statements accurately distinguishes gymnosperms from angiosperms?

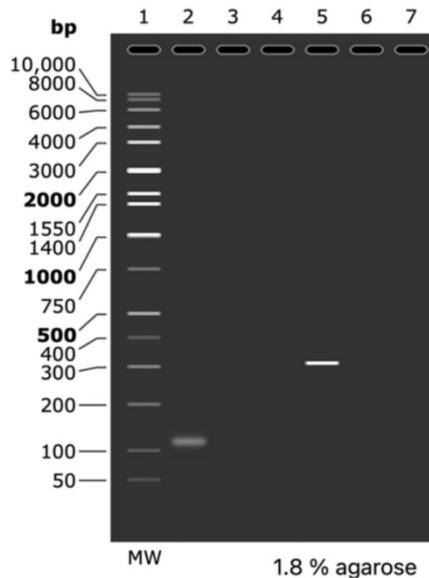
- A) Gymnosperms have seeds enclosed in an ovary and bear fruits, while angiosperms have seeds exposed on leaflike structures.
- B) Gymnosperms are flowering plants that bear flowers and fruits, while angiosperms are plants with “naked seeds.”
- C) Both gymnosperms and angiosperms bear flowers, but only angiosperms have seeds exposed on leaflike structures.
- D) Gymnosperms have seeds that are not enclosed in an ovary and lie exposed on megasporophylls, while angiosperms bear flowers and fruits.
- E) None of them

20) Indicate which of the following statements is false.

- A) Prokaryotic transcription and translation are coupled processes tightly regulated together.
- B) DNA replication is semiconservative, each of the two resulting double helices has one new strand and one parental (template) strand.
- C) The DNA polymerase transfers information from DNA to RNA.
- D) The genome of an organism includes their plasmids and organelle genomes, if they have any.
- E) A and C are both false.
- F) A and B are both false.

21) You are conducting an experiment to determine the presence of a specific gene in different bacterial samples. The specific gene you are studying is called alkB, this gene gives bacteria the ability to degrade hydrocarbon contaminants in the environment. You have three bacteria that you isolated from a contaminated soil (A, B, and C). You want to know which of these bacteria have the alkB gene. You decide to use PCR to amplify the alkB gene. You also included a positive control and a negative control.

You run your PCR and gel and have the following result:



Lane 1: Molecular weight (MW) ladder
 Lane 2: Bacteria A
 Lane 3: Bacteria B
 Lane 4: Bacteria C
 Lane 5: +ve control
 Lane 6: -ve control

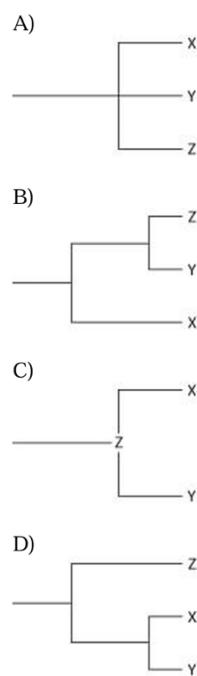
Based on the PCR gel which of your isolated bacteria have the alkB gene?

- A) Bacteria A
- B) Bacteria B
- C) Bacteria D
- D) All of them
- E) None of them

22) A silent mutation would constitute a change in:

- A) Protein primary structure
- B) Protein secondary structure
- C) Protein tertiary structure
- D) Protein quaternary structure
- E) Protein primary and secondary structures
- F) None of the above
- G) All of the protein structure levels

23) Let's say that three of the living anteater species (X, Y, and Z) are placed in the genus *Placeholder*. If we know that these three species are closely related to each other, but we cannot tell which of the two are more closely related to each other. Which of the following is the most accurate phylogenetic tree?



24) Which statement best describes how diatoms influence atmospheric carbon dioxide levels?

- A) Diatoms release large amounts of carbon dioxide during photosynthesis
- B) Diatoms contribute to lowering atmospheric CO₂ by storing carbon in their bodies
- C) Diatoms increase atmospheric CO₂ by decomposing rapidly at the ocean surface
- D) Diatoms protect themselves from CO₂ by forming thick glass-like walls

25) What is a primary benefit that mycorrhizae provide to plants in their symbiotic relationship?

- A) They increase the absorption of phosphorus and essential minerals
- B) They produce flowers for the plant to attract pollinators
- C) They enable plants to perform photosynthesis more efficiently
- D) They provide plants with protection from herbivores