PLEASE READ THE FOLLOWING INSTRUCTIONS BEFORE BEGINNING THIS EXAMINATION:

1. Be sure to enter your name and student number correctly on the IBM sheet.

2. **Read the entire question before answering it. Choose the single best and most complete answer to each question.**

3. To complete the examination, you must answer all questions of which there are **25**. Obtaining 25 marks will constitute a perfect paper.

4. **Multiple choice questions for the examination will be based solely on your responses as indicated on the IBM sheet**. Be absolutely certain your answers on the IBM sheet accurately reflect your choice for each question.

5. There is no additional penalty for a wrong answer. Wrong answers, omitted answers, and multiple answers will score zero.

6. Hand calculators, cellphones, laptops, or any electronic devices are not to be used in the examination.

7. **Keep your bubble sheet protected** during the exam. You can be brought up of academic dishonesty charges if someone copies you, even if you were unaware.

8. Please return **both** your bubble sheet and exam booklet before leaving.

Question 1
A scientist performs a controlled experiment. This means that _____.

A. the experiment is repeated many times to ensure the results are accurate.
B. one experiment is performed, but the scientist controls the variables.
C. two versions of the experiment are conducted, one differing from the other by only a single variable.
D. the experiment proceeds at a slow pace to ensure the scientist can carefully observe all processes.

Question 2
Consider the following statement: "I always see nuclei in the cells I observe under my microscope. Therefore, all cells have nuclei.". This statement is an example of _____.

A. inductive reasoning.
B. deductive reasoning.
C. a theory.
D. an experiment.

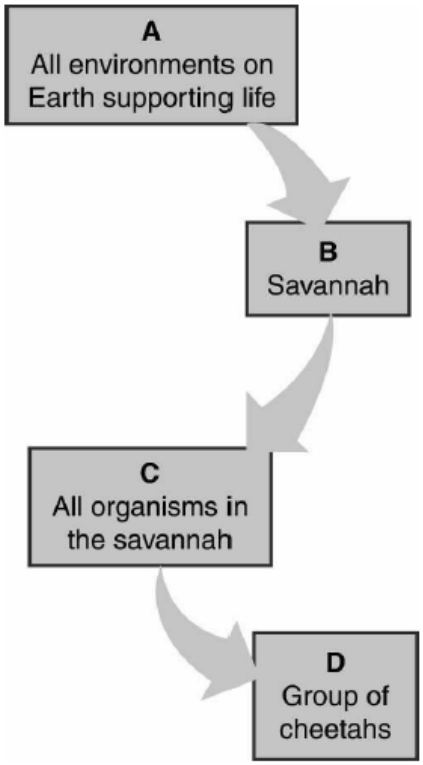
Question 3
The following graph shows the results of an experiment in which mice learned to run through a maze over a 6-day period. Which of the following conclusions can you draw from the graph?

A. Food rewards were necessary for mice to complete the maze.
B. The experimenter's predictions were correct.
C. The number of days of testing depended on the average time to complete the maze.
D. The average time to complete the maze depended on the number of days of testing.

Question 4
There are several properties that all organisms share. In humans, exposure to ultraviolet light can result in a darkening of the skin. Which property of life is this skin darkening an example of?

A. Energy processing.
B. Internal environment regulation.
C. Growth and development.
D. Response to the environment.

Question 5
Which level in the following hierarchy is an example of a population?



A. Level A
B. Level B
C. Level C
D. Level D

Question 6
What might happen if an ecosystem lost its decomposers?

A. The ecosystem would stop functioning.
B. The ecosystem would become more resilient.
C. There would be more nutrients available to animals.
D. There would be more energy available to plants.

Question 7
A single water molecule, H–O–H, is held together by _____.

A. two hydrogen bonds.
B. one polar covalent bond.
C. two polar covalent bonds.
D. one nonpolar covalent bond.

Question 8
Which of the following would be affected when a protein is denatured?

A. Primary structure.
B. Tertiary structure.
C. Carboxyl groups.
D. Amino groups.

Question 9
How are cohesion, adhesion, and surface tension related?

A. All are produced by covalent bonding.
B. All are results of the structure of carbon atoms.
C. All are properties related to ionic interactions.
D. All are properties related to hydrogen bonding.

Question 10
The Great Salt Lake in Utah, USA has an average salinity seven times higher than that of the oceans. Very few multicellular organisms live in this harsh environment. One multicellular organism that does live in the Great Salt Lake, the brine shrimp, must devote a large portion of its energy to osmoregulation because its body contains less solutes than the surrounding environment. The brine shrimp must _____.

A. Actively pump water into its cells to counter water loss due to osmosis.
B. Synthesize membranes impermeable to any substance that upsets its osmotic balance.
C. Actively pump water out of its cells to counter water inflow due to osmosis.
D. Actively pump salt out of its cells to counter water inflow due to osmosis.

Question 11
A mutant protist is found which lacks a mitochondrial membrane. Which metabolic process would likely be disrupted in these protists?

A. Glycolysis.
B. Oxidative phosphorylation.
C. Alcohol fermentation.
D. Lactic acid fermentation.

Question 12
Glucose molecules provide energy to power the swimming motion of sperm. In this example, the sperm are changing _____.

A. chemical energy into potential energy.
B. kinetic energy into potential energy.
C. chemical energy into kinetic energy.
D. kinetic energy into thermal energy.

Question 13
In cellular respiration, which of the following outcomes is the *immediate* result of electrons moving through the electron transport chain?

A. Release of carbon dioxide.
B. Formation of a hydrogen proton gradient.
C. Release of oxygen gas.
D. Phosphorylation of ADP to ATP.

Question 14
Although the reactions of the Calvin cycle are not directly dependent on light, they usually do not occur at night. Why?

A. It is often too cold at night for reactions of the Calvin cycle to occur.
B. Plants usually open their stomata at night.
C. Carbon dioxide concentrations are lower at night.
D. The Calvin cycle depends on products produced in the light reactions.

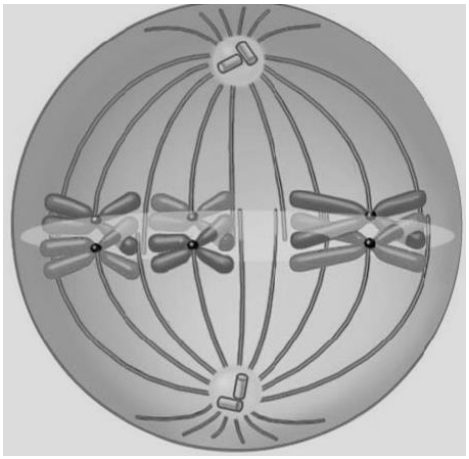
Question 15
A eukaryotic cell has a nuclear envelope that prevents mRNA molecules from leaving the nucleus. Which of the following will not happen in this cell?

A. DNA will not replicate.
B. RNA will not be transcribed from DNA.
C. tRNAs will not bind to codons.
D. Amino acids will not form.

Question 16
A geneticist found that a mutation had no effect on the polypeptide encoded by a gene. The mutation probably involved the _____.

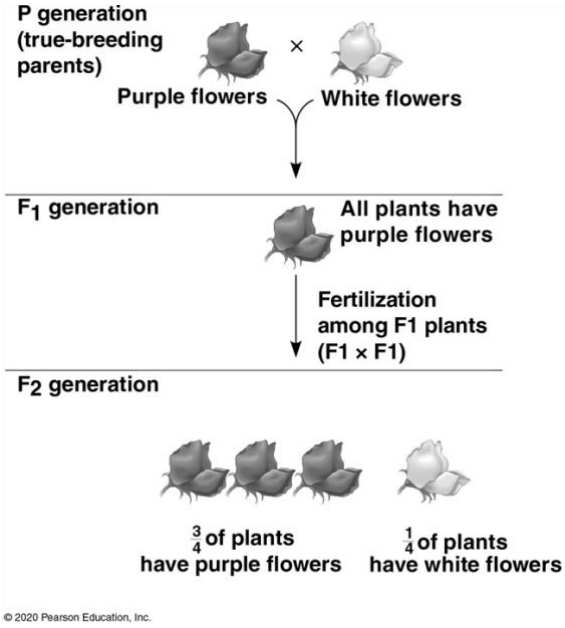
A. insertion of one nucleotide.
B. replacement of several codons.
C. deletion of one nucleotide.
D. substitution of one nucleotide.

Question 17
What event will immediately follow the event happening in this image?



A. The sister chromatids will separate and move to either end of the cell.
B. The homologous chromosomes will separate and move to either end of the cell.
C. The cell will enter prophase.
D. The cell will enter telophase.

Question 18
Which plants in the following figure must all be heterozygous?



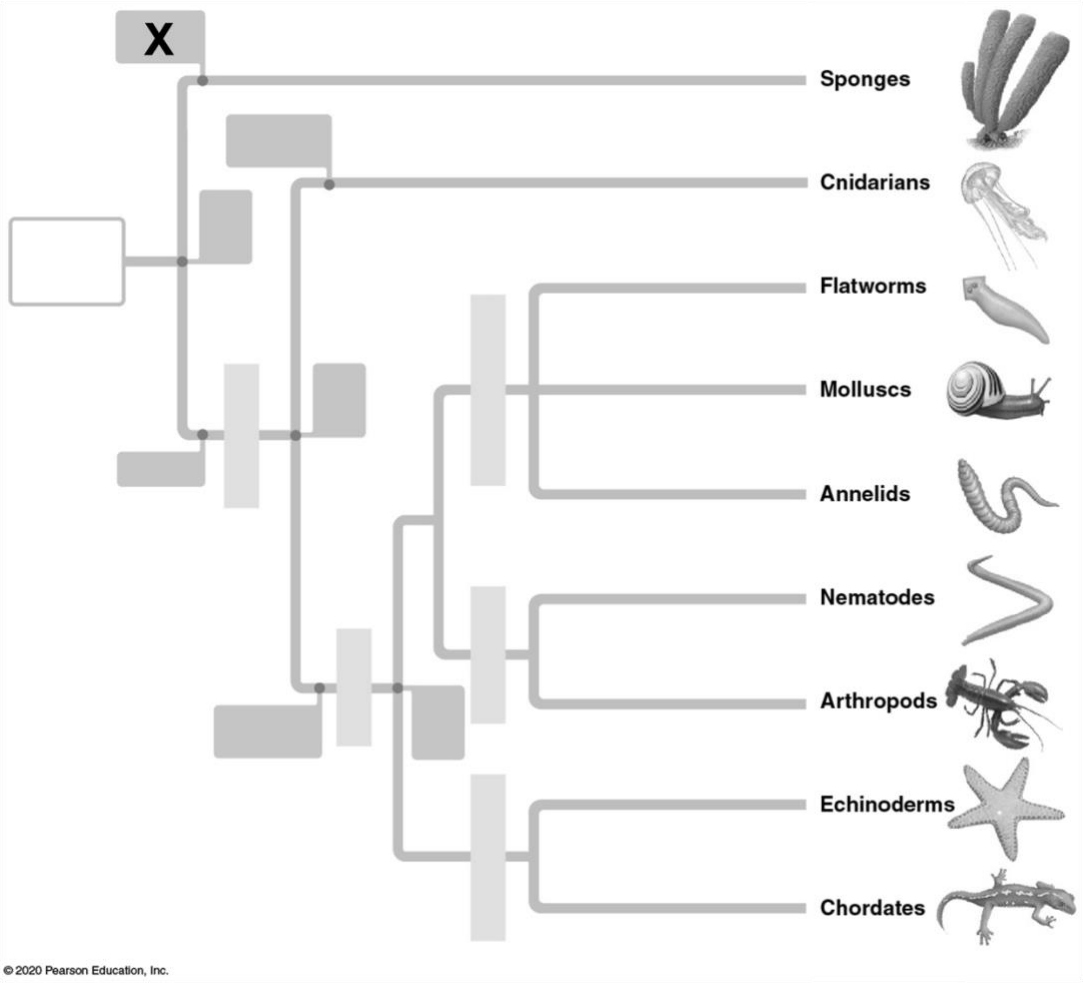
A. Purple flowered plants in the P generation.
B. White flowered plants in the P generation.
C. Purple flowered plants in the F_1 generation.
D. Purple flowered plants in the F_2 generation.

Question 19
Two characteristics assort independently in a species of insect. In this species of insect, red eyes (R) are dominant to black eyes (r) and long wings (L) are dominant to short wings (l). You are asked to determine the genotype of an insect whose phenotype is red eyes and long wings. Which of the following insects would you cross with your unknown insect to determine its genotype?

A. An insect having black eyes and short wings.
B. An insect having black eyes and long wings.
C. An insect having red eyes and long wings.
D. An insect having red eyes and short wings.

Question 20

In the following phylogenetic tree of invertebrate species, the homologous character labeled with an "X" is shared by _____.



A. All species in the tree.
B. Flatworms, cnidarians, and sponges.
C. Cnidarians and sponges.
D. Sponges only.

Question 21
Which of the following scenarios would most likely result in the evolution of a population of humans?

A. A colony of 12 humans is established on mars and remains isolated from the rest of the human population.
B. A plane crashes, randomly killing 121 Canadians out of 38.25 individuals in the country's population.
C. Harmful ultraviolet radiation causes a major increase in mutation rates of skin cells in Canadian adults.
D. A new pandemic reduces interprovincial travel over the next 15 years.

Question 22
A group of ants escaped from a picnic basket carried to the top of a mountain and thrived in this area where there were no other ants. Many years later descendants of these ants crawled into a picnic basket on the mountain and traveled back to the valley from which their ancestors had come. According to the biological species concept, which of these observations would cause you to conclude that the ants on top of the mountain had become a different species from those in the valley?

A. The mountain and valley ants were different colours.
B. The mountain and valley ants were different sizes.
C. The mountain and valley ants ate different foods.
D. The mountain ants could not mate with the valley ants.

Question 23
In a hybrid zone, _____ can occur if the reproductive barrier between two species is weak, as is happening among cichlid fish in murky Lake Victoria.

A. reproductive isolation
B. allopatric speciation
C. a bottleneck
D. fusion

Question 24
Methanogens, extreme halophiles, and extreme thermophiles are all examples of _____.

A. protists.
B. archaea.
C. bacteria.
D. algae.

Question 25

An organism in the lab is classified as a photoautotroph. Later you observe it acquiring nutrients from dead plant material at the bottom of a fish tank. You conclude the photoautotroph is actually a _____.

A. mixotroph.
B. chemoautotroph.
C. photoheterotroph.
D. chemoheterotroph.