# Brainiacs Biology Olympiad Preliminary Round Sample Exam Paper 2

## Category II – grades 9 and 10

**Easy Questions (5 Questions)**

**Q1.**

**DNA is a molecule that carries genetic information in living organisms.** It is composed of two strands that form a double helix, and its structure allows it to pass on hereditary traits.
Indicate if each of the following is true or false:
A. DNA is made up of nucleotides, which include a sugar, a phosphate group, and a nitrogen base.
B. DNA is found only in the nucleus of a cell.
C. Genes are specific segments of DNA that determine traits.
D. The sequence of nitrogen bases in DNA determines genetic information.

**Answers**:
A. True
B. False (DNA is also found in mitochondria and chloroplasts in eukaryotic cells.)
C. True
D. True

---

**Q2.**

**The circulatory system is responsible for transporting blood, nutrients, and gases throughout the body.** The heart, blood vessels, and blood are the primary components of this system.
Indicate if each of the following is true or false:
A. Arteries carry oxygen-rich blood away from the heart.
B. The heart pumps oxygen-poor blood to the lungs for oxygenation.
C. Platelets in the blood are responsible for carrying oxygen.
D. The circulatory system works with the respiratory system to deliver oxygen to body cells.

**Answers**:
A. True
B. True
C. False (Platelets are involved in blood clotting.)
D. True

---

**Q3.**

**Microorganisms like bacteria and fungi play both beneficial and harmful roles in our daily lives.** Some are essential for processes like food production, while others can cause diseases.
Indicate if each of the following is true or false:
A. Bacteria are used in the production of yogurt and cheese.
B. Viruses can reproduce independently without a host.
C. Fungi help decompose organic matter in the environment.
D. Proper hygiene can help prevent diseases caused by microorganisms.

**Answers**:
A. True

B. False (Viruses require a host to reproduce.)
C. True
D. True

---

**Q4.**

**The xylem and phloem are specialized tissues in plants responsible for transporting water, nutrients, and food.** These tissues help maintain plant growth and survival.
Indicate if each of the following is true or false:
A. Xylem transports water and minerals from roots to leaves.
B. Phloem transports food from leaves to other parts of the plant.
C. Transpiration helps pull water up through the xylem.
D. The phloem only transports nutrients to the roots.

**Answers**:
A. True
B. True
C. True
D. False

---

**Q5.**

**Ecosystems consist of producers, consumers, and decomposers.** Energy flows through ecosystems, starting with producers who capture energy from the sun.
Indicate if each of the following is true or false:
A. Energy flow in an ecosystem is unidirectional.
B. Consumers depend on producers or other consumers for energy.
C. Decomposers recycle nutrients back into the ecosystem.
D. Energy is lost at each trophic level in a food chain.

**Answers**:
A. True
B. True
C. True
D. True

---

**Normal Questions (10 Questions)**

**Q6.**

**DNA is the blueprint of life, storing genetic instructions for organisms.** It is found in the chromosomes within the nucleus of a cell.
Indicate if each of the following is true or false:
A. DNA is composed of two parallel strands forming a double helix.
B. Adenine pairs with cytosine in the DNA structure.
C. DNA is present in both prokaryotic and eukaryotic cells.
D. Chromosomes are structures made of tightly packed DNA.

**Answers**:
A. True
B. False (Adenine pairs with thymine.)
C. True
D. True

---

**Q7.**

**Gregor Mendel's experiments with pea plants established the basic principles of inheritance.** These include the concepts of dominant and recessive traits.
Indicate if each of the following is true or false:
A. Mendel used pea plants because they have easily observable traits.
B. Mendel's law of segregation states that two alleles for a trait separate during gamete formation.
C. Recessive traits are always expressed if an organism inherits one recessive allele.
D. Dominant traits mask the expression of recessive traits in heterozygous individuals.

**Answers**:
A. True
B. True
C. False (Recessive traits are expressed only if both alleles are recessive.)
D. True

---

**Q8.**

**The circulatory system ensures the transport of essential substances like oxygen and nutrients.** Blood composition includes plasma, red blood cells, white blood cells, and platelets.
Indicate if each of the following is true or false:
A. Plasma makes up the majority of blood volume.
B. Red blood cells are responsible for carrying oxygen using hemoglobin.
C. White blood cells are involved in transporting nutrients.
D. Platelets help in the clotting of blood.

**Answers**:
A. True
B. True
C. False (White blood cells are involved in immunity.)
D. True

---

**Q9.**

**Microorganisms, such as bacteria and viruses, play vital roles in human health and the environment.** They can be both beneficial and harmful.
Indicate if each of the following is true or false:
A. Bacteria can help in nitrogen fixation in the soil.
B. Viruses can reproduce independently outside a host.
C. Fungi are microorganisms that can cause diseases in plants.
D. Antibiotics are effective against viral infections.

**Answers**:
A. True
B. False (Viruses need a host to reproduce.)
C. True
D. False (Antibiotics work against bacteria, not viruses.)

---

**Q10.**

**The xylem and phloem are plant tissues that transport water, nutrients, and food.** These tissues are crucial for plant survival and growth.
Indicate if each of the following is true or false:
A. Xylem transports food to the leaves.
B. Phloem transports nutrients to growing parts of the plant.
C. Transpiration helps move water through the xylem.
D. Phloem moves food in only one direction.

**Answers**:
A. False (Xylem transports water, not food.)
B. True
C. True
D. False (Phloem moves food bidirectionally.)

---

**Q11.**

**The human digestive system breaks down food into nutrients that the body can absorb.** It involves processes like chemical digestion and nutrient absorption.
Indicate if each of the following is true or false:
A. The stomach is the primary site of nutrient absorption.
B. The small intestine absorbs nutrients into the bloodstream.
C. The liver produces bile to aid in fat digestion.
D. Enzymes play a key role in breaking down carbohydrates, proteins, and fats.

**Answers**:
A. False (The small intestine is the primary site of absorption.)
B. True
C. True
D. True

---

**Q12.**

**Energy flows through ecosystems in a unidirectional manner, starting with producers.** Trophic levels describe the feeding relationships among organisms.
Indicate if each of the following is true or false:
A. Producers are at the top of the food chain.
B. Energy is lost as heat at each trophic level.
C. Herbivores are primary consumers.
D. Decomposers recycle nutrients but do not contribute to energy flow.

**Answers**:
A. False (Producers are at the base.)
B. True
C. True
D. False (Decomposers contribute to nutrient cycling and energy flow.)

---

**Q13.**

**Transpiration is the loss of water vapor from plant leaves.** This process is influenced by environmental factors like temperature and humidity.
Indicate if each of the following is true or false:
A. High humidity increases the rate of transpiration.
B. Transpiration occurs through stomata on the leaf surface.
C. Transpiration helps cool the plant and transport nutrients.
D. The rate of transpiration decreases with higher temperatures.

**Answers**:
A. False (High humidity decreases transpiration.)
B. True
C. False (Transpiration helps cool the plant and transport water and minerals)
D. False (Higher temperatures increase transpiration.)

---

**Q14.**

**The nervous system allows the body to respond to stimuli and coordinate actions.** It includes the brain, spinal cord, and nerves.
Indicate if each of the following is true or false:
A. Sensory neurons carry signals from the brain to the muscles.
B. Reflex actions are automatic and do not involve the brain.
C. The spinal cord is responsible for transmitting signals between the brain and the body.
D. The brain is divided into regions that control specific functions.

**Answers**:
A. False (Sensory neurons carry signals from sensory organs to the brain.)
B. True
C. True
D. True

---

**Q15.**

**Population dynamics describe the changes in population size and composition over time.** Factors such as birth rate, death rate, and carrying capacity influence these changes.
Indicate if each of the following is true or false:
A. A high birth rate increases population size.
B. The carrying capacity is the maximum population size an ecosystem can support.
C. A population decreases when the death rate is lower than the birth rate.
D. Environmental factors can limit population growth.

**Answers**:
A. True
B. True
C. False (The population increases when the death rate is lower than the birth rate.)
D. True

---

**Hard Questions (5 Questions)**

**Q16.**

**Experiment**:
Students studied the effect of temperature on the rate of transpiration in plants. They placed a potted plant in three different environments: a cool room (15°C), a warm room (30°C), and a hot room (45°C). They measured the weight loss of the plant due to water loss over 6 hours. Results showed the most weight loss at 45°C, moderate loss at 30°C, and the least at 15°C.

Indicate if each of the following is true or false:
A. Transpiration occurs faster at higher temperatures because water evaporates more quickly.
B. The weight loss in the plants was caused only by water loss from the soil, not the leaves.
C. Lower transpiration rates at cooler temperatures help conserve water.
D. The results suggest that temperature directly affects the rate of transpiration.

**Answers**:
A. True
B. False
C. True
D. True

---

**Q17.**

**Scenario**:
A group of students performed an experiment to observe how light intensity affects photosynthesis. They placed aquatic plants under different light intensities (low, medium, and high) and measured the number of oxygen bubbles released in 5 minutes. They observed that the rate of oxygen production increased with light intensity up to a point, after which it remained constant.

Indicate if each of the following is true or false:
A. Light intensity is the only factor that affects the rate of photosynthesis.
B. The constant rate of oxygen production at high light intensity indicates a saturation point.
C. Oxygen bubbles are a direct measure of the rate of photosynthesis in the plants.
D. Photosynthesis can continue indefinitely without limitations if light intensity is high enough.

**Answers**:
A. False (Other factors like $CO_2$ concentration and temperature also affect photosynthesis.)
B. True
C. True
D. False (Other limitations like enzyme activity or $CO_2$ availability come into play.)

---

**Q18.**

**Experiment**:
Students investigated how microorganisms respond to different types of surfaces. They exposed a bacterial culture to plastic, glass, and metal surfaces for 24 hours. Afterward, they measured bacterial growth. They found the most growth on plastic, moderate growth on glass, and the least growth on metal.

Indicate if each of the following is true or false:
A. The results suggest that plastic provides the best surface for bacterial growth.
B. Metal surfaces are less conducive to bacterial growth due to their antimicrobial properties.
C. The bacterial growth rate depends solely on the type of surface.
D. Hygiene practices should consider the surface material to reduce bacterial contamination.

**Answers**:
A. True
B. True
C. False (Other factors like moisture and temperature also influence growth.)
D. True

---

**Q19.**

**Scenario**:
A student monitored a freshwater ecosystem and observed the population dynamics of fish and algae over time. Initially, algae growth increased due to an excess of nutrients, but the fish population declined. Later, algae populations also decreased, and the water became murky.

Indicate if each of the following is true or false:
A. The initial algae growth was likely caused by nutrient pollution (eutrophication).
B. The decline in the fish population was unrelated to the algae bloom.
C. The murky water could result from the decomposition of dead algae.
D. Eutrophication can disrupt the balance of ecosystems and reduce biodiversity.

**Answers**:
A. True
B. False (The algae bloom can deplete oxygen, affecting fish survival.)
C. True
D. True

---

**Q20.**

**Experiment**:
Students studied how enzymes are affected by pH. They added the enzyme amylase to starch solutions at three different pH levels: acidic (pH 4), neutral (pH 7), and alkaline (pH 9). They measured the amount of sugar produced after 10 minutes. The highest sugar production occurred at pH 7, with significantly lower production at pH 4 and pH 9.

Indicate if each of the following is true or false:
A. Amylase works best in neutral conditions, as shown by the highest sugar production at pH 7.
B. The enzyme is denatured at both pH 4 and pH 9, which reduces its activity.

C. pH levels do not affect enzyme activity.
D. Enzyme activity is optimal in a specific pH range and decreases outside that range.

**Answers**:
A. True
B. True
C. False
D. True