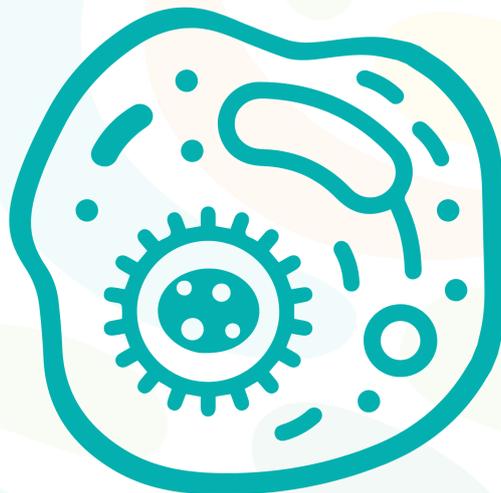




BRAINIACS OLYMPIAD

GRADES 11-12

BIOLOGY SAMPLE PAPER (PRACTICAL PART)



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Grades: 11–12

Time: 120 minutes

Total Points: 100

Equipment: *Not required*

TASK 1 [50 points]

PART 1. ENZYMES & BIOCHEMISTRY (INVESTIGATION + DATA) [28 points]

Effect of pH on Enzyme Activity (Protease)

Enzymes are affected by environmental conditions such as pH.

You are given results from an investigation in which a protease enzyme was used to digest protein at different pH values.

Given data:

pH	Time taken for protein to be digested (s)
4	200
6	120
8	70
10	150

(a)(i) Calculate the rate of enzyme activity for each pH value. [8]

(Rate = $1 \div \text{time}$)

(a)(ii) Plot a line graph of pH against rate of enzyme activity. [8]

(a)(iii) Identify the optimum pH for this enzyme and justify your answer. [4]

(a)(iv) Explain why enzyme activity decreases when pH becomes very acidic or very alkaline. [4]

(a)(v) State: [4]

- Independent variable
 - Dependent variable
-
-
-

PART 2. ADVANCED GENETICS & MOLECULAR BIOLOGY [10 points]

DNA Replication Error

During DNA replication, an error occurs in one strand.

Original DNA sequence:

TAC – CGA – AAC

Altered DNA sequence:

TAC – CCA – AAC

(a) Name the type of mutation shown. [2]

(b) Explain how this mutation could affect: [4]

- The mRNA sequence
 - The amino acid sequence of the protein
-
-

(c) State one possible effect of this mutation on the organism. [4]

PART 3. HUMAN PHYSIOLOGY & DATA INTERPRETATION [12 points]

Regulation of Body Temperature

Sweating helps to regulate body temperature.

A student measured body temperature after running.

Time after exercise (min)	Body temperature (°C)
0	37.0
10	38.5
20	37.8
40	37.1

(a) Plot a line graph of time after exercise against body temperature. [6]

(b) Explain how sweating helps to control body temperature. [4]

(c) State one way this response shows negative feedback. [2]

TASK 2 [50 points]

PART 1. BIOTECHNOLOGY & RESEARCH METHODS (PLANNING)

Investigating Factors Affecting Yeast Respiration

Yeast is widely used in biotechnology.

Plan an investigation to study:

The effect of sugar concentration on the rate of respiration in yeast

You may refer to:

- Yeast suspension
- Sugar solutions
- Test tubes
- Gas syringe or balloon
- Stopwatch

Your plan must include:

- Aim
- Hypothesis
- Independent variable
- Dependent variable
- Method (step-by-step)
- One safety precaution
- How results would be analyzed

Aim:

Hypothesis:

Independent variable:

Dependent variable:

Method:

Safety precaution:

Analysis of results:

PART 2. ENVIRONMENTAL SCIENCE (EVALUATION) [6 points]

Urban Development and Ecosystems

A new housing area is built near a forest.

(a) State two possible effects of this development on the forest ecosystem. [2]

(b) Suggest two actions that could reduce environmental damage. [2]

(c) Explain why maintaining species diversity is important for ecosystem balance. [2]

END OF PAPER