Biology

Leaving Certificate

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ONLINE GRINDS

Ordinary Level Course Content:

- Bacteria, Viruses, Fungi & Yeast
- Biochemical reactions & Enzymes
- Blood & Circulatory System
- Breathing System
- Cell Division
- Cell Metabolism & Osmosis
- Digestive System
- Ecology & Ecosystems
- Excretion
- Experiment Questions
- Eye/Ear & Nervous system
- Food and Food Tests
- Genetics, DNA & Evolution
- Hormonal System
- Human Reproduction
- Immunity
- Musculoskeletal System
- Photosynthesis
- Plant Reproduction
- Plant Responses
- Plant Responses & Seed Growth
- Plant Structure
- Respiration
- Transport in Plants

Your Textbook will indicate what parts of individual topics are specifically for Higher Level Students and you do not have to study these

Contents: **Lessons 1 to 30**

Subject: Biology Leaving Certificate

Lesson 1: Introduction/Scientific Method

Title: The Scientific Method

Introduction: The scientific method is a systematic approach used by scientists to investigate and understand natural phenomena. It provides a structured framework for conducting experiments, making observations, and drawing reliable conclusions. In the field of biology, the scientific method plays a crucial role in the discovery and understanding of living organisms and their interactions with the environment. This set of notes will outline the key steps of the scientific method and their significance in the context of biology.

Observation:

The scientific process begins with careful observation of a specific phenomenon or problem.

Observations should be objective and based on real-world evidence.

Biologists often use their senses, instruments, or existing data to make observations.

Research:

After making initial observations, researchers gather relevant information from reliable sources, such as scientific journals, books, and databases.

Research helps scientists understand the background of the topic under investigation and identify existing theories or hypotheses related to the observed phenomenon.

Hypothesis:

A hypothesis is a tentative explanation or prediction based on observations and research.

It should be testable and capable of being supported or refuted through experimentation.

Hypotheses are often expressed in an "if-then" format, outlining the expected cause-and-effect relationship.

Experimental Design:

Scientists design experiments to test the hypothesis and gather data.

A well-designed experiment includes an independent variable (the variable being manipulated), a dependent variable (the variable being measured), a control group (provides a baseline for comparison), and an experimental group(s) (subjected to the independent variable).

The experimental design should also include appropriate controls to account for confounding factors and ensure the validity of the results.

Double Blind Testing- neither the researcher or the people in the study know who is the placebo group or who is the real test group

Data Collection:

During the experiment, researchers collect quantitative or qualitative data, depending on the nature of the investigation.

Accurate and detailed data recording is essential to ensure the reliability and reproducibility of the study.

Techniques such as measurements, observations, surveys, or laboratory tests may be employed to gather data.

Data Analysis:

Scientists analyse the collected data using statistical methods and visualization techniques.

Analysis helps identify patterns, trends, and relationships in the data.

Statistical tests are often applied to determine if the results are statistically significant or due to chance.

Conclusion:

Based on the analysis of the data, scientists draw conclusions regarding the hypothesis.

Conclusions may either support or refute the initial hypothesis.

It is important to consider the limitations and uncertainties associated with the study and acknowledge potential sources of error.

Communication:

Scientists communicate their findings through scientific papers, presentations, conferences, or discussions.

They publish their data in a scientific journal

Peer review allows other experts to evaluate the study's validity and contribute to scientific knowledge.

Conclusion: The scientific method is a rigorous and logical approach that guides scientists in exploring and understanding the natural world. In biology, it helps researchers formulate hypotheses, design experiments, collect data, analyse results, and draw meaningful conclusions.

By following this systematic process, scientists can continually refine our understanding of the living world and contribute to the advancement of biological knowledge.

Limitations of the scientific method:

- The extent of our knowledge. (Forming a hypothesis and designing an experiment depends on the amount we know relating to our observations.)
- Our ability to understand the results (If the results of an experiment are interpreted wrongly, then faulty conclusions and hypotheses will be drawn.)
- Accidental discoveries (New insights are often discovered accidentally which have contributed to the development of scientific thinking.)
- Changes in the environment (Scientific methods may only apply to living things at one particular time. As living things are constantly evolving, hypotheses must constantly be changed. For example, global warming over the last several decades has impacted plant and animal behaviour patterns.)
- The basis of investigation (If an investigation is badly designed or improperly carried out it will not yield results that are as valid as they should be)

Ethical Issues:

Ethics refers to the concept of whether something is right or wrong. There are sometimes arguments as to whether the application of a scientific method is good or bad, such as cloning animals or using a placebo where it is likely that the active compound could make a difference to survival.

Question 1: Why is it important to include a control group in an experiment? Give an example to illustrate your answer. (Leaving Cert Biology)

Answer: Including a control group in an experiment is important to provide a baseline for comparison and ensure the validity of the results. The control group remains unchanged and is not subjected to the independent variable, allowing researchers to compare the effects of the independent variable accurately.

2. What is a hypothesis? An educated guess based on an observation
3. What might a hypothesis develop into?- A scientific investigation
4. Explain the purpose of a control in a scientific experiment.- Something to compare results to
5. Explain each of the following terms in relation to the scientific method:

data – information gathered as a result of experimentation

replicate- repeating the steps of an investigation to obtain multiple data points

theory- an investigation that has been found to be accurate after many replications by different scientists over time.