Biology Ch 1: Science of Biology – Answer Key

Class 9 Biology (FBISE pattern) | Al Amal Learning Center

Tip: the ***circled*** option is correct. Read why, then try the question again yourself.

SECTION A (MCQs)

Q	Question	A	B	C	D
1.	The study of fossils is called:	Anatomy	Morphology	Paleontology	Physiology

Why C? Paleontology = study of the history of life on Earth based on **fossils**. Anatomy = internal structure, morphology = size and shape, physiology = functions of organs.

2.	For a hypothesis to be considered scientific, it must be:	Subjective	Opinion based	Testable by experiments	Proven correct

Why C? A hypothesis is a **tentative** idea, so it must be **testable** and potentially **falsifiable**. It is not "proven correct" - experiments decide that.

3.	The study of inserting the human insulin gene in bacteria is related with:	Biochemistry	Molecular biology	Cell biology	Biotechnology

Why D? Biotechnology = use of living organisms (here bacteria) or their components to make **useful products** for mankind, e.g. insulin.

4.	Biology is the study of:	Living organisms	Non-living objects	Planet Earth	Chemical compounds

Why A? bios = life, logos = study. **Biology** studies **living organisms** and how they relate to each other and to their surroundings.

5.	The statement made on the basis of observations is called:	Hypothesis	Deduction	Theory	Law

Why A? A **hypothesis** is a tentative explanation of the observations. Deduction = logical consequence of the hypothesis ("if...then"), theory = broad and well supported, law = always true.

6.	Biology is considered a subset of natural sciences because it deals with:	Natural phenomena without observation or experimentation	Only the physical characteristics of living organisms	Living organisms and their interactions with nature	Living organisms only from a historical perspective

Why C? Natural sciences study nature through observation and experiments. Biology studies **living organisms and their interactions with nature**.

7.	Which statement best describes the teaching of the Quran regarding nature?	It encourages observation and study of nature	It presents nature mainly as resources for human use	It discusses nature only in relation to historical events	It encourages appreciation of nature but not its investigation

Why A? Many verses of the Quran talk about the ***origin of life*** (e.g. every living thing made from water) and invite people to ***study*** it.

8.	Pharmacology is related to:	Defense against germs	Study of drugs and their effect	Study of diseases	Study of form and function of body

Why B? *Pharmacology* = science of ***drugs*** and their effects (aspirin, morphine, insulin, penicillin). Defense against germs = immunology, diseases = pathology.

9.	A group of scientists from Biology and Chemistry work together to develop a new vaccine. Which other field can contribute to quick and accurate development of the vaccine?	Computer science	Physics	Mathematics	Geography

Why A? Computer skills help analyse ***complex biological data*** (***bioinformatics*** / computational biology). Maths could also help, but the chapter highlights computers.

10.	Scientists are investigating how a mutation in a gene is passed from one generation to the next. This research belongs to:	Pharmacology	Immunology	Genetics	Physiology

Why C? *Genetics* = study of ***genes and heredity*** (how traits pass from parents to offspring).

11.	A well-tested explanation supported by evidence but still open to revision is called:	Law	Observation	Hypothesis	Theory

Why D? A ***theory*** is broader than a hypothesis and has more evidence, but scientists may ***modify or reject*** it if new results do not fit.

12.	Climate change research involves biology, meteorology and geology mainly to:	Reduce efficiency	Avoid experiments	Integrate different expertise	Create conflict

Why C? Interdisciplinary research: scientists from different fields work together and combine knowledge to solve a problem (like the climate change STEAM activity).

13.	A team studying a new disease includes a biologist, a computer scientist and a statistician. Which outcome best shows scientific collaboration?	Biologist works alone	Data kept secret	Shared analysis and feedback	Single opinion accepted

Why C? Collaboration = ***sharing*** knowledge and ***critiquing*** ideas across fields, not working alone or hiding data.

14.	During a research project, scientists from different fields criticise each other's methods. This practice mainly helps to:	Delay results	Create conflict	Improve accuracy	Limit discussion

Why C? Critique helps find mistakes, so the research becomes more ***accurate***. Collaboration needs sharing ***and*** critiquing ideas.

SECTION B (Short Questions)

Branches of biology

Q1 [3 marks]

Question: What is meant by biology?

Asked in: 2025 2nd Exam

The word ***biology*** comes from two Greek words: ***bios*** = life and ***logos*** = thought, reasoning and study. Biology is the ***study of living organisms***. It helps us explain how living things ***relate to one another*** and to their ***surroundings***.

Main divisions: ***Botany*** (plants), ***Zoology*** (animals), ***Microbiology*** (micro-organisms such as viruses and bacteria).

Q2 [3 marks]

Question: Complete the table with the relevant branch of biology: Taxonomy, plants, insects.

Asked in: 2025 1st Paper 1 (old pages)

Branch	To study
Botany	Plants
Taxonomy	**Classification and naming** of organisms
Entomology	Insects

Q3 [3 marks]

Question: Complete the table: Pathology, microscopic study of tissues, Paleontology.

Asked in: 2025 1st Paper 1

Branch of Biology	Area of study
Pathology	**Study and diagnosis of diseases**
Histology	Microscopic study of tissues
Paleontology	**Study of the history of life on Earth** based on fossils

Q4 [3 marks]

Question: Complete the table: Pharmacology, study of cells, Cytology.

Asked in: 2025 1st Paper 2

Branch of Biology	Area of study
Pharmacology	**Study of drugs** and their effects
Cytology	Study of cells
Cytology	**Structure and functions of the cell** (also called cell biology)

Q5 [0.5 x 6 = 3 marks]

Question: Match the branch of biology with the aspect it describes: Pharmacology, Physiology, Pathology, defense against pathogens, classification and naming, relations between organisms and environment.

Asked in: Model Paper 2025

Branch of biology	Aspect of living things described
Pharmacology	**Study of drugs**
Physiology	**Functions of organs** (digestion, respiration, excretion, photosynthesis)
Pathology	**Study and diagnosis of diseases**
Immunology	Defense against pathogens
Taxonomy	Classification and naming
Ecology	Relations between organisms and environment

Q6 [1 x 3 = 3 marks]

Question: Briefly describe Histology, Genetics and Pharmacology.

Asked in: 2026 Paper B

Branch	Description	Example
Histology	Microscopic study of tissues of organisms	Epithelial tissue forms a continuous layer covering the body surface
Genetics	Study of genes and heredity in organisms	Red-flowered plants produce red flowers; white cats produce white kittens
Pharmacology	Study of drugs (chemical substances)	Aspirin treats pain, fever and inflammation; also morphine, insulin, penicillin

Q7 [1 x 3 = 3 marks]

Question: Briefly describe Taxonomy, Immunology and Morphology with one example of each.

Asked in: 2026 Paper M

Branch	Description	Example
Taxonomy	**Classification and naming** of organisms	Humans are mammals; scientific name is Homo sapiens
Immunology	Study of **immunity**: the ability of the body to protect itself from foreign substances and microbes	Vaccination protects against diseases like polio, corona, dengue
Morphology	Study of the **size, shape and structure** of organisms	Roots, stem, leaves, flowers and fruits of a flowering plant; human dental structure

Biology and other sciences

Q8 [0.5 x 6 = 3 marks]

Question: Complete the table for the union of biology with other sciences: Biochemistry, Computational biology, Biophysics and their aspects.

Asked in: Model Paper 2025

Interdisciplinary science	**Aspect of living organisms**
Biostatistics (biometry)	Analysis of data related to organisms
Biochemistry	**Chemical constituents and chemical reactions** in living organisms
Bio-economics	Cost and benefit analysis of organisms (biology from an economic point of view)
Computational biology	**Data analysis, mathematical modeling and computer simulations** of biological systems
Biogeography	Distribution of organisms in geographic regions
Biophysics	Biological phenomena studied by the **principles and laws of physics**

Q9 [1.5 + 1.5 = 3 marks]

Question: Briefly explain Biotechnology and Biophysics. Give one example of each.

Asked in: 2026 Paper B

Branch	**Explanation**	**Example**
Biotechnology	Use of different techniques to **manipulate living organisms** for the benefit of mankind	Inserting the human insulin gene into bacteria to make insulin
Biophysics	Study of biological phenomena according to the **principles and laws of physics**	Movement of muscles and bones (limbs work like levers)

Q10 [1.5 + 1.5 = 3 marks]

Question: Briefly describe Biometry and Biogeography with one example of each.

Asked in: 2026 Paper D

Branch	**Description**	**Example**
Biometry (biostatistics)	Collecting biological data by observations and experiments and **analysing it with statistical rules**	Comparing blood of 100 malaria patients with 100 healthy persons and analysing the data

Branch	Description	Example
Biogeography	Study of the **distribution of plants and animals** in different geographical regions of the world	Cacti in deserts, polar bears in cold polar regions

Q11 [1.5 + 1.5 = 3 marks]

Question: Briefly describe Computational Biology and Biochemistry. Give one example of each.

Asked in: 2026 Paper M

Branch	Description	Example
Computational biology	Use of **data analysis, mathematical modeling and computer simulations** to understand biological systems	Locating fragments of DNA on chromosomes; sequencing the human genome
Biochemistry	Study of the **chemical constituents** of organisms and the **chemical reactions** in them	Digestion of food, respiration, photosynthesis

Careers

Q12 [1.5 + 1.5 = 3 marks]

Question: Briefly explain horticulture and animal husbandry with examples.

Asked in: 2025 1st Paper 1

Field	Explanation	Examples
Horticulture	**The art of gardening** (growing fruits, vegetables and flowers)	Careers: plant breeding, horticulturist, nursery work
Animal husbandry	**Care and breeding of domestic animals**	Careers: veterinary science, animal breeding, animal training

Q13 & 14 [3 marks]

Question: Briefly describe / identify and explain any two careers based on the study of biology.

Asked in: 2025 1st Paper 1 (old pages), 2025 2nd Exam

Career	Explanation
Medicine and surgery	MBBS = bachelor of medicine and bachelor of surgery. **Medicine** = diagnosis and treatment of diseases. **Surgery** = treating diseases by removing or replacing defective parts or organs.
Fisheries	Contributes to the economy of Pakistan. Careers: **fish farming, fishery management** and related research.

Other options: farming and agriculture, animal husbandry, biotechnology, horticulture, forestry.

Q15 [1 x 3 = 3 marks]

Question: Enlist any three careers related to biology and briefly state what each deals with.

Asked in: 2026 Paper D

Career	What it deals with
Medicine and surgery	Diagnosis and treatment of diseases; removal or replacement of defective parts
Farming and agriculture	Growing crops and animals for food, wool and other products; agriculture is the science of improving farming methods
Forestry	Science of **planting, managing and caring for forests**; careers in forest ecology, environmental engineering
(Biotechnology)	Use of living organisms or their components to make useful products; bacteriology, virology, molecular genetics

Scientific method, hypothesis, theory and law

Q16 [3 marks]

Question: Enlist any four steps of the biological method in their correct order.

Asked in: 2025 1st Paper 1 (old pages)

1. **Recognition** of a biological problem
2. **Observation** and identification
3. Building up (formulating) a **hypothesis**
4. Drawing **deductions**

The remaining steps are: 5. devising an **experiment** and 6. inferring the **result**.

Q17 [3 marks]

Question: Write three characteristics of a good hypothesis.

Asked in: 2026 Model Paper

1. It should be a **general statement**.
2. It should be a **tentative idea**.
3. It should **agree with the available observations**.
4. It should be **testable and potentially falsifiable**.

Write any three of these.

Q18 [1 + 1 + 1 = 3 marks]

Question: Write any three important observations carried out by A. F. A. King about the spread of malaria.

Asked in: 2026 Model Paper

King (an American scientist) listed **20 observations in 1883**. Important ones:

1. People who **slept outdoors** were more likely to get malaria than those who slept indoors.
2. People who slept **under fine nets** were less likely to get malaria than those who did not use nets.
3. People who slept **near smoky fire** usually did not get malaria.

Q19 [1.5 + 1.5 = 3 marks]

Question: Briefly explain theory and law with examples.

Asked in: 2025 1st Paper 2

	Theory	*Law*
Meaning	An **explanation of some aspect of the natural world**, based on facts repeatedly confirmed by observation and experiments	A statement that **describes an observable occurrence** in nature that **appears to always be true**
Scope	**Broader than a hypothesis**, supported by more evidence	A verified theory with wide application may become a law
Can it change?	Yes, it may be **modified or rejected** if new results do not fit	Considered always true

	Theory	*Law*
Example	Darwin's theory of evolution	***Mendel's law of inheritance***

SECTION C (Long Questions)

Q1 [6 marks]

Question: How is the scientific method used to solve a biological problem? Explain all steps in correct sequence with a brief explanation of each.

Asked in: 2026 Paper B, D and M

Scientists, including biologists, solve problems with the ***scientific (biological) method***, a series of steps:

Step	Explanation
1. Recognition of the problem	A biological problem is a ***question related to living organisms***. It is asked by someone or comes to the mind of a researcher.
2. Observation	Made with the ***five senses*** (vision, hearing, smell, taste, touch). ***Qualitative*** = based on quality or characteristic. ***Quantitative*** = based on measurable value (numbers), so more accurate.
3. Formulation of hypothesis	A ***tentative explanation*** of the observations that may be the answer to the problem. It should be general, tentative, agree with the available observations and be ***testable and falsifiable***.
4. Deductions	***Logical consequences*** of the hypothesis, taking the hypothesis as true. They use ***"if...then"*** logic.
5. Experimentation	The ***most important step***. Deductions are tested rigorously, using a ***control group*** and an ***experimental group***, to find out whether the hypothesis is correct.
6. Summarization of results	The ***quantitative data*** collected from experiments is arranged to draw results. If the hypothesis is supported, it may lead to a theory; if not, a new hypothesis is made.

Flow: ***Problem -> Observation -> Hypothesis -> Deduction -> Experiment -> Result***. If the hypothesis is ***not supported***, a new hypothesis is made. If it is ***supported***, further research may lead to a ***theory*** and then a ***principle***.

Q2 [5 marks]

Question: Describe the first five steps of the scientific method used in biological investigations.

Asked in: 2025 2nd Exam

Step	Explanation
1. Recognition of the problem	A biological problem is a ***question related to living organisms***. It is asked by someone or comes to the mind of a researcher.

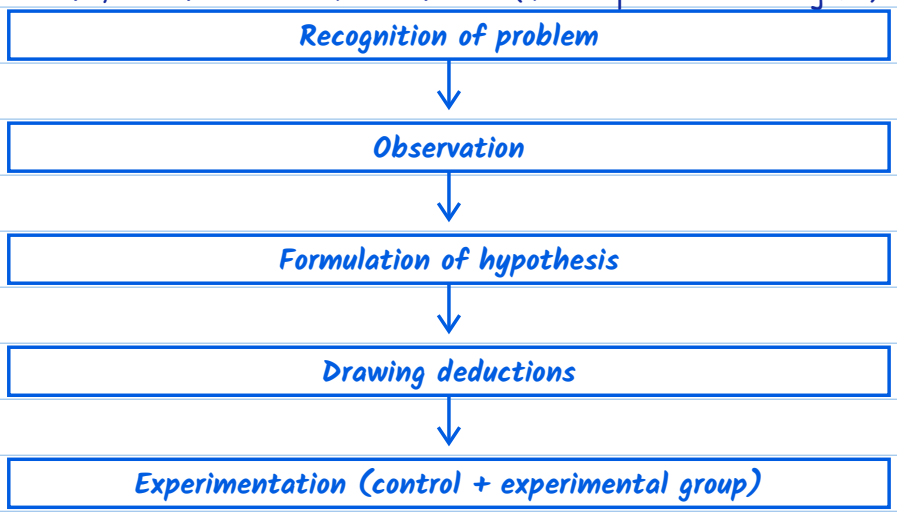
Step	Explanation
2. Observation	Made with the **five senses** (vision, hearing, smell, taste, touch). **Qualitative** = based on quality or characteristic. **Quantitative** = based on measurable value (numbers), so more accurate.
3. Formulation of hypothesis	A **tentative explanation** of the observations that may be the answer to the problem. It should be general, tentative, agree with the available observations and be **testable and falsifiable**.
4. Deductions	**Logical consequences** of the hypothesis, taking the hypothesis as true. They use **"if...then"** logic.
5. Experimentation	The **most important step**. Deductions are tested rigorously, using a **control group** and an **experimental group**, to find out whether the hypothesis is correct.

Q3 [5 marks]

Question: Illustrate the first five steps of the scientific method used in solving a biological problem.

Asked in: 2025 1st Paper 1

Draw this flow chart, then add one line under each box (use the points from Long Q2):



Q4 [6 marks]

Question: How may the biological method help to find the cause of an infectious disease, using its different steps?

Asked in: Model Paper 2025

Example: **malaria**, found to be caused by **Plasmodium**.

Step	Malaria example
1. Recognition of problem	Malaria was a problem since ancient times, but its **cause was not known**.

Step	Malaria example
2. Observations	In the 19th century: (a) malaria and **marshy areas** are related; (b) **quinine** is an effective drug; (c) **drinking marsh water** does not cause malaria; (d) **Plasmodium** is seen in the blood of a malarial patient.
3. Hypothesis	Laveran (French physician, 1882): **"Plasmodium is the cause of malaria."**
4. Deduction	**If** Plasmodium is the cause of malaria, **then** all persons ill with malaria should have Plasmodium in their blood.
5. Experiment	Blood of **100 patients** examined under a microscope; blood of **100 healthy persons** examined as the **control group**.
6. Results	Almost all patients had Plasmodium. Only **7 of 100** healthy persons had it (in the **incubation period**; they later became ill). The other 93 had none. The hypothesis was proved.
Reporting	Results were announced worldwide, which helped to control malaria.

Q5 [5 marks]

Question: Discuss the connection of biology with Physics, Chemistry, Computer, Geography and Economics.

Asked in: 2025 1st Paper 2

Biology is **not an isolated science**; it is integrated with other disciplines.

Science	Field	Connection with biology
Physics	Biophysics	Organisms work on principles of physics, e.g. **muscles and bones** work like levers. The behaviour of atoms and molecules explains the living cell.
Chemistry	Biochemistry	Study of the chemical constituents (carbon, hydrogen, oxygen, nitrogen) and chemical reactions such as **digestion, respiration and photosynthesis**.
Computer	Computational biology (bioinformatics)	Data analysis, mathematical modeling and computer simulations; e.g. **locating DNA fragments** and **sequencing the human genome**.
Geography	Biogeography	Study of the **distribution of plants and animals** in different geographical regions of the world.
Economics	Bio-economics	Biology from an **economic point of view**; production of **wheat, fish, rice** and studying their export value.