BSEK • 10TH CLASS • KARACHI BOARD

10th Class Biology Notes

Full-Book Notes, MCQs and Solved Questions
Board of Secondary Education Karachi (BSEK) — English

Chapter-wise revision notes, solved multiple-choice questions,
short questions and long questions — written in original words for these notes.

These notes follow the Sindh Textbook Board book
The Textbook of Biology for Grade 10 (Test Edition, SELD/STBB-18/2021),
Chapters 1 to 9. Check the chapter titles against your own issued book,
because boards may revise them.

Prepared for students of 10th Class Biology (BSEK Karachi). All practice questions in this book are original and written for these notes.

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- **MCQ Answer Key**

How to Use This Book

- Read the revision notes of one chapter first and underline the key terms.
- Then attempt the 10 MCQs of that chapter without looking at the answer key, and check your answers at the end of the book.
- Write the short and long questions in your own words after reading the given answers.
- Practise the labelled diagrams described at the end of each chapter's notes — draw them from memory and label every part.
- Revise the key terms of every chapter before the examination.

A Note on the Examination Paper

The Class 10 Biology paper in Sindh is a theory paper of 60 marks, with a practical-based assessment (PBA) of 15 marks — 75 marks in total — as in the BSEK model papers. Students should check the current model paper on the official BSEK website, bsek.edu.pk, before the examination.

Labelled Diagrams

Each chapter ends with a 'Diagram to Practise' note describing the diagram to draw and label. The diagrams in these notes are described, never copied from the book — draw them yourself from the descriptions and the notes.

All practice questions in this book are original and written for these notes. They are not copied from any past paper or guidebook.

Chapter 1: Gaseous Exchange

Breathing and Respiration

Breathing is the physical process of taking air into the lungs and giving it out, so that oxygen enters the body and carbon dioxide leaves it. Respiration is the chemical process inside the cells in which glucose and oxygen release energy, carbon dioxide and water: glucose + oxygen → carbon dioxide + water + energy. Breathing supplies the oxygen for respiration and removes the carbon dioxide it produces.

The Air Passage

Air enters through the nose, where hairs and mucus trap dust and the air is warmed and moistened. It then passes through the pharynx and the larynx (the voice box) into the trachea, the windpipe. The trachea is kept open by C-shaped rings of cartilage, and its lining has mucus and tiny hair-like cilia that move dust upwards. The trachea divides into two bronchi, one to each lung; the bronchi divide into smaller bronchioles, which end in the alveoli.

How We Breathe

During inhalation the diaphragm contracts and flattens, and the intercostal muscles lift the ribs up and out. The chest volume increases, the air pressure inside the lungs falls, and air rushes in. During exhalation the diaphragm relaxes and domes upwards, the ribs move down and in, the chest volume decreases, and air is pushed out. The breathing rate is about 12 to 16 times a minute at rest and increases during exercise; it is controlled by the medulla of the brain.

Gas Exchange in the Alveoli

The alveoli are tiny air sacs at the ends of the bronchioles, about 300 million in number. Their walls are only one cell thick, they are kept moist, and they are surrounded by a network of capillaries. Oxygen in the inhaled air diffuses across the thin, moist walls into the blood, where haemoglobin in the red blood cells carries it to the tissues. At the same time carbon dioxide, the waste product of respiration, diffuses from the blood into the alveoli and is breathed out. The large surface area of the alveoli and the rich blood supply make this exchange fast and efficient.

Disorders of the Breathing System

- Asthma: the airways narrow and swell, causing wheezing and shortness of breath.
- Bronchitis: inflammation of the bronchi, causing a cough with mucus.
- Emphysema: the walls of the alveoli break down, most often because of smoking, so less surface is left for gas exchange.
- Pneumonia: an infection of the lungs in which the alveoli fill with fluid.
- Lung cancer: uncontrolled growth of cells in the lung, strongly linked to smoking.

Smoking and Health

Cigarette smoke contains tar, which damages the lungs; nicotine, which is addictive and narrows the blood vessels; and carbon monoxide, which binds to haemoglobin about 200 times more readily than oxygen and so reduces the oxygen carried by the blood. Smoking is a major cause of lung cancer, bronchitis and emphysema.

Diagram to Practise

Draw the human breathing system — nose, trachea, bronchi, bronchioles and lungs — and label each part. Then draw one alveolus with the capillary around it and mark with arrows the movement of oxygen into the blood and carbon dioxide out of the blood.

Chapter 1: Gaseous Exchange — Practice Questions

Multiple Choice Questions

1. Breathing is the process of

(a) taking in air and giving out air (b) pumping blood around the body (c) digesting food (d) releasing energy from glucose

2. The chemical process that releases energy in cells is

(a) photosynthesis (b) respiration (c) digestion (d) breathing

3. The windpipe is called the

(a) larynx (b) pharynx (c) trachea (d) bronchus

4. The trachea is kept open by

(a) bones (b) blood vessels (c) muscles (d) C-shaped rings of cartilage

5. Gas exchange in the lungs takes place in the

(a) alveoli (b) larynx (c) bronchi (d) bronchioles

6. During inhalation the diaphragm

(a) relaxes and domes up (b) contracts and flattens (c) stops moving (d) moves upwards

7. Oxygen is carried in the blood by

(a) white blood cells (b) platelets (c) haemoglobin (d) plasma

8. Carbon monoxide is dangerous because it

(a) cleans the lungs (b) kills germs (c) increases the oxygen in blood (d) binds haemoglobin more readily than oxygen

9. Asthma is a disorder in which

(a) the airways narrow (b) the trachea closes (c) the ribs break (d) the alveoli fill with fluid

10. Emphysema is mainly caused by

(a) exercise (b) smoking (c) cold drinks (d) dust alone

Short Questions

1. Define breathing.

Answer: Breathing is the physical process of taking air into the lungs and giving it out, so that oxygen enters the body and carbon dioxide leaves it.

2. How does respiration differ from breathing?

Answer: Breathing is the physical movement of air in and out of the lungs, while respiration is the chemical process inside cells in which glucose and oxygen release energy, carbon dioxide and water.

3. Why are the walls of the alveoli only one cell thick?

Answer: The walls of the alveoli are only one cell thick so that gases can diffuse quickly between the air in the alveoli and the blood in the capillaries around them.

4. What is the function of the mucus and cilia in the trachea?

Answer: Mucus traps dust and germs from the air, and the tiny hair-like cilia move the mucus upwards so that it can be swallowed or coughed out.

5. Name two disorders of the breathing system and one cause of each.

Answer: Asthma — the airways narrow, often triggered by dust or cold air. Emphysema — the walls of the alveoli break down, most often because of smoking.

Long Questions

1. Describe the mechanism of breathing in humans.

Answer: Breathing has two parts. During inhalation the diaphragm contracts and flattens, and the intercostal muscles lift the ribs up and out; the chest volume increases, the air pressure inside the lungs falls, and air rushes in through the nose, trachea and bronchi to the alveoli. During exhalation the diaphragm relaxes and domes upwards, the ribs move down and in, the chest volume decreases, and air is pushed out. The medulla of the brain controls the rate of breathing, which rises during exercise when the body needs more oxygen.

2. Explain how gaseous exchange takes place in the alveoli.

Answer: The alveoli are tiny air sacs at the ends of the bronchioles, about 300 million in number, with walls one cell thick, kept moist and surrounded by a network of capillaries. Oxygen in the inhaled air diffuses across the thin, moist walls into the blood, where haemoglobin in the red blood cells carries it to the tissues. At the same time carbon dioxide, the waste product of respiration, diffuses from the blood into the alveoli and is breathed out. The large surface area of the alveoli and the rich blood supply make this exchange fast and efficient.

Chapter 2: Homeostasis

What Is Homeostasis?

Homeostasis is the maintenance of a stable internal environment in the body — constant temperature, water, salts, glucose and pH — despite changes outside the body. It is controlled by negative feedback: a change is detected and the body acts to reverse it, bringing the condition back to normal.

The Kidney

The body has two bean-shaped kidneys. Each kidney has an outer cortex and an inner medulla, and the nephron is its functional unit. Blood enters the kidney through the renal artery, filtered blood leaves through the renal vein, and urine leaves through the ureter to the bladder.

The Nephron

Each kidney contains about one million nephrons. A nephron begins with the glomerulus, a knot of capillaries inside Bowman's capsule, followed by the proximal convoluted tubule, the loop of Henle, the distal convoluted tubule and the collecting duct.

Formation of Urine

Urine is formed in three steps. First, ultrafiltration: high blood pressure in the glomerulus forces water, salts, glucose and urea out of the blood into Bowman's capsule, while blood cells and proteins stay in the blood. Second, selective reabsorption: as the filtrate flows through the tubules, all the glucose and most of the water and salts are reabsorbed back into the blood. Third, secretion: extra salts and drugs are passed from the blood into the tubule. The hormone ADH (antidiuretic hormone) from the pituitary gland controls water reabsorption — when more ADH is released, more water is reabsorbed and less urine is produced.

Kidney Failure and Dialysis

If the kidneys fail, urea and salts build up in the blood. A dialysis machine, an artificial kidney, filters the blood outside the body; a kidney transplant is the permanent treatment. Kidney stones are hard deposits that can form in the kidney and block the flow of urine.

The Skin and Temperature Control

The skin controls body temperature. When the body is hot, sweat glands release sweat, which cools the body as it evaporates, and blood vessels in the skin dilate so that more blood flows near the surface and more heat is lost. When the body is cold, the vessels constrict so less heat is lost, sweating stops, shivering produces heat from muscle activity, and the hairs stand up. The hypothalamus in the brain controls body temperature.

The Liver in Homeostasis

The liver regulates blood glucose: after a meal it stores excess glucose as glycogen, and when blood glucose falls it changes glycogen back into glucose. It also removes nitrogen from excess amino acids, forming urea, and it detoxifies harmful substances.

Diagram to Practise

Draw a nephron — glomerulus, Bowman's capsule, proximal tubule, loop of Henle, distal tubule and collecting duct — and label each part, marking where ultrafiltration and reabsorption take place.

Chapter 2: Homeostasis — Practice Questions

Multiple Choice Questions

1. Homeostasis is

(a) the digestion of food (b) a change in body shape (c) keeping the internal environment constant (d) the growth of the body

2. The functional unit of the kidney is the

(a) cortex (b) glomerulus (c) ureter (d) nephron

3. Ultrafiltration takes place in the

(a) Bowman's capsule (b) collecting duct (c) bladder (d) loop of Henle

4. In ultrafiltration, which of these stays in the blood?

(a) urea (b) proteins (c) water (d) glucose

5. All of the filtered glucose is reabsorbed in the

(a) ureter (b) glomerulus (c) proximal tubule (d) bladder

6. ADH controls the reabsorption of

(a) urea (b) salts only (c) glucose (d) water

7. When the body is hot, blood vessels in the skin

(a) dilate (b) close completely (c) burst (d) constrict

8. Shivering helps the body by

(a) cooling it (b) producing heat (c) making it sweat (d) stopping blood flow

9. The liver stores excess glucose as

(a) urea (b) starch (c) glycogen (d) fat only

10. Urine is carried from the kidney to the bladder by the

(a) nephron (b) renal artery (c) renal vein (d) ureter

Short Questions

1. Define homeostasis.

Answer: Homeostasis is the maintenance of a stable internal environment in the body, such as constant temperature, water, salts and glucose levels, despite changes outside the body.

2. What is a nephron?

Answer: A nephron is the functional unit of the kidney; it filters the blood and forms urine, and consists of the glomerulus, Bowman's capsule, tubules and collecting duct.

3. What is ultrafiltration?

Answer: Ultrafiltration is the filtering of blood under high pressure in the glomerulus, which forces water, salts, glucose and urea into Bowman's capsule while blood cells and proteins stay in the blood.

4. What does ADH do?

Answer: ADH (antidiuretic hormone) controls the reabsorption of water in the kidney tubules; when more ADH is released, more water is reabsorbed and less urine is produced.

5. How does the skin help when the body is cold?

Answer: When the body is cold, blood vessels in the skin constrict so less heat is lost, sweating stops, and shivering produces heat from muscle activity.

Long Questions

1. Describe the structure of the nephron and the formation of urine.

Answer: Each kidney contains about one million nephrons. A nephron begins with the glomerulus, a knot of capillaries inside Bowman's capsule, followed by the proximal tubule, the loop of Henle, the distal tubule and the collecting duct. Urine is formed in three steps. First, ultrafiltration: high blood pressure in the glomerulus forces water, salts, glucose and urea into Bowman's capsule. Second, selective reabsorption: as the filtrate flows through the tubules, all the glucose and most of the water and salts are reabsorbed into the blood. Third, secretion: extra salts and waste are passed into the tubule. The remaining fluid, urine, flows through the collecting duct to the ureter and the bladder.

2. Explain how the skin and liver help in homeostasis.

Answer: The skin controls body temperature. When the body is hot, sweat glands release sweat, which cools the body as it evaporates, and blood vessels dilate so more heat is lost from the surface. When the body is cold, vessels constrict, sweating stops and shivering produces heat. The liver controls blood glucose: after a meal it converts excess glucose into glycogen for storage, and when blood glucose falls it changes glycogen back into glucose. The liver also removes nitrogen from excess amino acids, forming urea, and detoxifies harmful substances.

Chapter 3: Coordination and Control

The Nervous System

The nervous system is made of the central nervous system — the brain and spinal cord — and the peripheral nervous system — the nerves. It detects changes (stimuli) through receptors and produces responses through effectors, the muscles and glands.

The Neuron

The neuron is the nerve cell. Its dendrites receive messages, its cell body contains the nucleus, and its axon carries the impulse away from the cell body. Many axons are covered by a myelin sheath, which insulates the axon and speeds up the impulse. Between two neurons there is a small gap called the synapse, across which the message passes by chemicals. There are three types of neuron: sensory neurons carry messages from receptors to the central nervous system, motor neurons carry messages from the central nervous system to effectors, and interneurons connect them inside the brain and spinal cord.

Reflex Action

A reflex action is a fast, automatic response that does not need conscious thought, such as pulling the hand away from a hot object or the knee jerk. Its pathway is called the reflex arc: receptor → sensory neuron → spinal cord → motor neuron → effector (muscle). Reflex actions protect the body from harm.

The Brain

The cerebrum is the largest part of the brain; it controls thinking, memory, learning and voluntary actions. The cerebellum controls balance and the coordination of muscles. The medulla controls involuntary actions such as heartbeat, breathing and swallowing. The spinal cord carries messages between the brain and the body and controls reflex actions.

The Endocrine System

The endocrine system is made of glands that release hormones into the blood. Hormones act slowly but for a long time. The pituitary gland is the master gland: it controls most other endocrine glands and produces the growth hormone. The thyroid gland produces thyroxine, which controls the rate of metabolism; thyroxine needs iodine, and lack of iodine causes goitre. The pancreas produces insulin, which lowers blood glucose; lack of insulin causes diabetes. The adrenal glands produce adrenaline, which prepares the body for an emergency — faster heartbeat, more glucose in the blood and quicker breathing, the 'fight or flight' response. The gonads produce testosterone in males and oestrogen in females, controlling the development of the reproductive organs and secondary sexual characters.

The Eye

The cornea and the lens focus light on the retina. The iris controls the size of the pupil. The retina has rods, which work in dim light, and cones, which work in bright light and detect colour. The optic nerve carries the message to the brain. In myopia (short sight) the image forms in front of the retina and is corrected by a concave lens; in hypermetropia (long sight) the image forms behind the retina and is corrected by a convex lens.

The Ear

The outer ear collects sound; the eardrum vibrates, and three small bones pass the vibrations to the cochlea, from where the auditory nerve carries the message to the brain. The semi-circular canals of the inner ear control balance.

Diagram to Practise

Draw a neuron — dendrites, cell body, axon and myelin sheath — and label each part. Then draw the eye and label the cornea, iris, pupil, lens, retina and optic nerve.

Chapter 3: Coordination and Control — Practice Questions

Multiple Choice Questions

1. The central nervous system consists of the

(a) brain and spinal cord (b) spinal cord and nerves (c) nerves only (d) brain and nerves

2. The part of a neuron that carries the impulse away from the cell body is the

(a) dendrite (b) axon (c) synapse (d) nucleus

3. A reflex action is

(a) found only in the brain (b) slow and thought out (c) fast and automatic (d) controlled by hormones

4. The pathway of a reflex action is called the

(a) nerve (b) impulse (c) synapse (d) reflex arc

5. The cerebrum is responsible for

(a) thinking and memory (b) breathing (c) balance (d) heartbeat

6. The master gland of the endocrine system is the

(a) pancreas (b) pituitary gland (c) adrenal gland (d) thyroid gland

7. Thyroxine is produced by the

(a) pancreas (b) pituitary gland (c) thyroid gland (d) adrenal gland

8. Lack of iodine in the diet causes

(a) rickets (b) anaemia (c) diabetes (d) goitre

9. Insulin controls the level of

(a) blood glucose (b) water in the body (c) calcium in bones (d) salts in the blood

10. Short sight (myopia) is corrected by a

(a) convex lens (b) concave lens (c) mirror (d) prism

Short Questions

1. What is a neuron?

Answer: A neuron is a nerve cell that carries messages as electrical impulses; it has dendrites, a cell body, an axon and a myelin sheath.

2. Define a reflex action.

Answer: A reflex action is a fast, automatic response to a stimulus that does not need conscious thought, such as pulling the hand away from a hot object.

3. What is a hormone?

Answer: A hormone is a chemical messenger produced by an endocrine gland, carried by the blood to a target organ, where it controls a body function.

4. Why is the pituitary called the master gland?

Answer: The pituitary is called the master gland because it controls the working of most other endocrine glands and also produces the growth hormone.

5. How does adrenaline prepare the body for an emergency?

Answer: Adrenaline makes the heartbeat faster, raises blood glucose and increases the breathing rate, so the body is ready to fight or run away.

Long Questions

1. Describe the structure of a neuron and explain how a nerve impulse travels.

Answer: A neuron has three main parts: dendrites, which receive messages; the cell body, which contains the nucleus; and the axon, which carries the impulse away from the cell body. Many axons are covered by a myelin sheath, which insulates the axon and speeds up the impulse. A nerve impulse is an electrical signal that travels along the neuron. Between two neurons there is a small gap called the synapse, across which the message passes by chemicals. Sensory neurons carry messages from receptors to the central nervous system, motor neurons carry messages from the central nervous system to muscles and glands, and interneurons connect them inside the brain and spinal cord.

2. Compare the nervous system and the endocrine system.

Answer: The nervous system sends messages as fast electrical impulses along nerves, so its responses are quick and short-lived, for example pulling the hand away from a hot object. The endocrine system sends messages as hormones carried in the blood, so its responses are slow to start but last longer, for example growth and the control of blood glucose. The nervous system acts on one part at a time through nerves, while hormones reach many parts of the body through the blood. The two systems work together: the brain controls the pituitary gland, which controls the other endocrine glands.

Chapter 4: Support and Movement

The Human Skeleton

An adult human has 206 bones. The skeleton is divided into the axial skeleton — the skull, vertebral column and ribs — and the appendicular skeleton — the bones of the arms, legs and the shoulder and hip girdles.

Functions of the Skeleton

- Support: the skeleton supports the body and gives it shape.
- Protection: the skull protects the brain, and the ribs protect the heart and lungs.
- Movement: bones act as levers that are pulled by muscles.
- Production of blood cells: red bone marrow makes red and white blood cells.
- Storage of minerals: bones store calcium and phosphorus.

Bones, Cartilage, Ligaments and Tendons

Bone is hard because it contains calcium salts. Cartilage is soft and flexible; it covers the ends of bones and is found in the nose and ears. A ligament joins bone to bone at a joint, while a tendon joins a muscle to a bone.

Joints

Fixed joints, such as those of the skull, allow no movement. Slightly movable joints, such as those between the vertebrae, allow a little movement. Freely movable joints allow the most movement: the hinge joint, such as the elbow and knee, moves in one direction only, while the ball-and-socket joint, such as the shoulder and hip, moves in many directions.

Muscles

There are three types of muscle. Voluntary (skeletal) muscle is attached to bones and is under conscious control. Involuntary (smooth) muscle is found in the walls of the stomach, intestines and blood vessels and is not under conscious control. Cardiac muscle is found in the heart; it works without rest and is not under conscious control. Muscles can only pull, never push, so they work in antagonistic pairs: when the biceps contracts the triceps relaxes to bend the arm, and the reverse straightens it.

Disorders of Bones and Joints

- Fracture: a broken bone, set in a plaster cast so it can heal.
- Arthritis: inflammation of the joints, causing pain, stiffness and swelling.
- Osteoporosis: bones become weak and brittle with age, due to loss of calcium.
- Rickets: soft, weak bones in children due to lack of vitamin D.
- Dislocation: a bone slips out of its joint.

Movement in Plants

Plants show slow movements called tropisms: phototropism is growth towards light, geotropism is the growth of roots downwards and shoots upwards in response to gravity, and thigmotropism is the response to touch. Plant movement is growth, not muscle action.

Diagram to Practise

Draw the human skeleton and label the skull, vertebral column, ribs, humerus, radius, ulna, femur, tibia and fibula. Then draw a hinge joint and a ball-and-socket joint and label the bones, cartilage and ligament in each.

Chapter 4: Support and Movement — Practice Questions

Multiple Choice Questions

1. An adult human has

(a) 226 bones (b) 106 bones (c) 206 bones (d) 306 bones

2. The skull protects the

(a) lungs (b) stomach (c) heart (d) brain

3. Blood cells are produced in the

(a) bone marrow (b) spleen (c) kidney (d) liver

4. A ligament joins

(a) muscle to bone (b) bone to bone (c) muscle to muscle (d) skin to bone

5. The elbow is an example of a

(a) gliding joint (b) ball-and-socket joint (c) hinge joint (d) fixed joint

6. The shoulder is an example of a

(a) fixed joint (b) pivot joint (c) hinge joint (d) ball-and-socket joint

7. Cardiac muscle is found in the

(a) heart (b) legs (c) stomach (d) arms

8. When the biceps contracts, the triceps

(a) also contracts (b) relaxes (c) stops working (d) grows longer

9. Rickets in children is caused by lack of

(a) vitamin A (b) vitamin C (c) vitamin D (d) iron

10. Osteoporosis is a disorder in which bones become

(a) heavier (b) shorter (c) longer (d) weak and brittle

Short Questions

1. Give two functions of the skeleton.

Answer: The skeleton supports the body and gives it shape, and it protects delicate organs — the skull protects the brain and the ribs protect the heart and lungs.

2. What is the difference between a ligament and a tendon?

Answer: A ligament joins bone to bone at a joint, while a tendon joins a muscle to a bone.

3. What is a hinge joint? Give one example.

Answer: A hinge joint is a freely movable joint that allows movement in one direction only, for example the elbow or the knee.

4. Name the three types of muscle.

Answer: Voluntary (skeletal) muscle, involuntary (smooth) muscle and cardiac muscle.

5. What is arthritis?

Answer: Arthritis is the inflammation of the joints, which causes pain, stiffness and swelling, and makes movement difficult.

Long Questions

1. Describe the human skeleton and its functions.

Answer: The human skeleton of an adult has 206 bones. It is divided into the axial skeleton — the skull, vertebral column and ribs — and the appendicular skeleton — the bones of the arms, legs and the shoulder and hip girdles. The skeleton has five main functions: it supports the body and gives it shape; it protects delicate organs, such as the brain inside the skull and the heart and

lungs inside the rib cage; it allows movement, because bones act as levers pulled by muscles; it produces blood cells in the red bone marrow; and it stores minerals such as calcium and phosphorus.

2. Explain how muscles work in antagonistic pairs, using the arm as an example.

Answer: Muscles can only pull, never push, so they work in pairs that pull in opposite directions. In the arm, the biceps is the flexor and the triceps is the extensor. To bend the arm, the biceps contracts and shortens, pulling the forearm up, while the triceps relaxes. To straighten the arm, the triceps contracts and the biceps relaxes. In this way the two muscles work against each other — one contracts while the other relaxes — to move the bone in both directions.

Chapter 5: Reproduction

Asexual Reproduction

In asexual reproduction one parent produces offspring identical to itself, without gametes. Its methods are: binary fission, in which an Amoeba splits into two; budding, in which a bud grows on a Hydra or yeast and separates; spore formation in fungi and ferns; and vegetative propagation, in which new plants grow from stem cuttings, grafting or layering. Asexual reproduction is fast and produces many offspring, but it gives no variation, so all the offspring are equally affected by disease or a change in the environment.

Sexual Reproduction in Plants

A flower has male and female parts. The sepals protect the bud and the petals attract insects. The stamen is the male part: its anther makes pollen. The carpel is the female part: its stigma receives pollen, its style connects the stigma to the ovary, and the ovary contains ovules. Pollination is the transfer of pollen to the stigma — self-pollination within the same flower, or cross-pollination between flowers of the same species — by wind, insects, water or birds. After pollination a pollen tube grows to the ovule, and the male gamete fuses with the egg inside it; this is fertilisation, and the zygote formed grows into an embryo. The ovule becomes a seed and the ovary becomes a fruit. Seeds are dispersed by wind, water, animals or explosion.

Human Reproduction — Male

The testes produce sperms and the hormone testosterone. Sperms are tiny cells with a tail for swimming; they travel through the sperm duct and are delivered into the female body through the penis.

Human Reproduction — Female

The ovaries produce ova (eggs) and the hormones oestrogen and progesterone. One ovum is released each month, which is called ovulation. The oviduct carries the ovum to the uterus, where the baby develops.

Fertilisation and Development

Fertilisation takes place in the oviduct, where a sperm fuses with an ovum to form a zygote. The zygote divides repeatedly to form an embryo, which implants in the wall of the uterus. The embryo is fed through the placenta and the umbilical cord, and its wastes are removed the same way. After about nine months the baby is born. Identical twins come from one zygote splitting into two embryos, while fraternal twins come from two ova fertilised separately.

Diagram to Practise

Draw a flower and label the sepal, petal, stamen (anther and filament) and carpel (stigma, style and ovary). Then draw the human female reproductive system and label the ovary, oviduct, uterus and vagina.

Chapter 5: Reproduction — Practice Questions

Multiple Choice Questions

1. Asexual reproduction involves

(a) one parent only (b) gametes (c) flowers (d) two parents

2. Binary fission occurs in

(a) Hydra (b) Amoeba (c) yeast (d) rose

3. Budding is seen in

(a) wheat (b) Amoeba (c) Hydra (d) fern

4. The male part of a flower is the

(a) petal (b) carpel (c) sepal (d) stamen

5. Pollen is produced in the

(a) anther (b) style (c) ovary (d) stigma

6. After fertilisation, the ovule becomes a

(a) fruit (b) seed (c) flower (d) leaf

7. Sperms are produced in the

(a) ovary (b) uterus (c) testes (d) oviduct

8. Fertilisation in humans takes place in the

(a) vagina (b) uterus (c) ovary (d) oviduct

9. The embryo is fed through the

(a) umbilical cord and placenta (b) oviduct (c) wall of the uterus (d) amniotic fluid only

10. Identical twins develop from

(a) two ova (b) one zygote splitting into two (c) two sperms (d) two embryos

Short Questions

1. Define asexual reproduction.

Answer: Asexual reproduction is reproduction by one parent without gametes, producing offspring that are identical to the parent, for example binary fission in Amoeba.

2. What is vegetative propagation? Give one example.

Answer: Vegetative propagation is asexual reproduction in plants from a part of the plant other than a seed, for example growing a new rose plant from a stem cutting.

3. What is pollination?

Answer: Pollination is the transfer of pollen grains from the anther to the stigma of a flower, by wind, insects, water or birds.

4. What is fertilisation?

Answer: Fertilisation is the fusion of a male gamete (sperm or pollen) with a female gamete (ovum or egg) to form a zygote.

5. What is the function of the placenta?

Answer: The placenta supplies food and oxygen from the mother's blood to the developing baby and removes its waste products through the umbilical cord.

Long Questions

1. Describe sexual reproduction in a flowering plant.

Answer: A flower has male and female parts: the stamen, whose anther makes pollen, and the carpel, whose stigma receives pollen and whose ovary contains ovules. Pollination transfers pollen

to the stigma, by wind or insects. A pollen tube then grows down through the style to the ovule, and the male gamete fuses with the egg inside the ovule — this is fertilisation, and the zygote formed grows into an embryo. After fertilisation the ovule becomes a seed and the ovary becomes a fruit. The seed is then dispersed by wind, water or animals and germinates into a new plant.

2. Describe fertilisation and the development of the baby in humans.

Answer: In humans, fertilisation takes place in the oviduct, where a sperm fuses with an ovum to form a zygote. The zygote divides repeatedly to form an embryo, which implants in the wall of the uterus. The embryo is fed and supplied with oxygen through the placenta and the umbilical cord, and its wastes are removed the same way. It grows into a foetus and, after about nine months, the baby is born. Identical twins form when one zygote splits into two embryos, while fraternal twins form when two separate ova are fertilised.

Chapter 6: Inheritance

Gregor Mendel

Gregor Mendel (1822–1884), an Austrian monk, is called the father of genetics. He studied pea plants, choosing contrasting traits such as tall and dwarf plants and round and wrinkled seeds, and found that traits are passed from parents to offspring in fixed patterns.

Genes and Chromosomes

A gene is a unit of heredity; genes are carried on chromosomes. Human body cells have 46 chromosomes in 23 pairs. The sex chromosomes are XX in females and XY in males.

Dominant and Recessive

A dominant allele shows its effect even when only one copy is present, for example tallness in pea plants. A recessive allele shows its effect only when two copies are present, for example dwarfness. The genotype is the set of genes an organism has for a trait, while the phenotype is the trait that can be seen. Homozygous means two same alleles (TT or tt); heterozygous means two different alleles (Tt).

Mendel's Laws

The law of segregation states that the two alleles of a gene separate during gamete formation, so each gamete carries only one allele. The law of independent assortment states that the alleles of different genes are passed on independently of one another.

The Punnett Square

A Punnett square is a table that predicts the offspring of a cross. For example, crossing pure tall plants (TT) with pure dwarf plants (tt) gives all tall offspring in the first generation (Tt). Crossing two of these (Tt × Tt) gives a second generation in the ratio of 3 tall to 1 dwarf.

Sex Determination

The mother always gives an X chromosome. If the father's sperm gives an X, the child is a girl (XX); if it gives a Y, the child is a boy (XY). The father's sperm therefore decides the sex of the child.

Variation

Variation is the differences between organisms of the same species. Continuous variation, such as height and weight, is controlled by many genes and the environment. Discontinuous variation, such as blood group and tongue rolling, is controlled by one gene. Variation is caused by mutation, by recombination during meiosis, and by the environment.

Genetic Disorders

Colour blindness, in which a person cannot tell red from green, and haemophilia, in which the blood does not clot properly, are carried on the X chromosome and are more common in males. Thalassaemia is caused by faulty haemoglobin genes and is common in Pakistan, so carriers should be tested before marriage. Down syndrome is caused by an extra copy of chromosome 21, giving 47 chromosomes instead of 46.

Blood Groups

The ABO blood-group system has four groups: A, B, AB and O. Blood group is inherited: groups A and B are dominant over O. Group O is the universal donor of red blood cells, and group AB is the universal recipient.

Diagram to Practise

Draw a Punnett square for the cross Tt × Tt and label the genotypes and phenotypes of the offspring, showing the 3:1 ratio of tall to dwarf plants.

Chapter 6: Inheritance — Practice Questions

Multiple Choice Questions

1. The father of genetics is

(a) Watson (b) Darwin (c) Mendel (d) Lamarck

2. A gene is

(a) a chromosome pair (b) a protein (c) a cell (d) a unit of heredity

3. Human body cells have

(a) 46 chromosomes (b) 48 chromosomes (c) 23 chromosomes (d) 44 chromosomes

4. A recessive trait appears only when

(a) one copy is present (b) two copies are present (c) the gene is absent (d) the organism is male

5. The genotype Tt is called

(a) homozygous dominant (b) homozygous recessive (c) heterozygous (d) pure

6. In a cross Tt × Tt, the ratio of tall to dwarf plants in the F2 generation is

(a) 1:3 (b) 2:1 (c) 1:1 (d) 3:1

7. The sex of a child is decided by the

(a) father's sperm (b) placenta (c) environment (d) mother's ovum

8. A female has the sex chromosomes

(a) XY (b) XX (c) YY (d) XO

9. Down syndrome is caused by

(a) a virus (b) a gene mutation (c) an extra copy of chromosome 21 (d) a missing chromosome

10. The universal donor blood group is

(a) AB (b) A (c) B (d) O

Short Questions

1. Who is called the father of genetics and why?

Answer: Gregor Mendel is called the father of genetics because his experiments with pea plants first showed how traits are inherited in fixed patterns.

2. What is the difference between genotype and phenotype?

Answer: Genotype is the set of genes an organism has for a trait, while phenotype is the trait that can be seen, for example tall or dwarf.

3. State Mendel's law of segregation.

Answer: The law of segregation states that the two alleles of a gene separate during gamete formation, so each gamete carries only one allele.

4. How is the sex of a child determined?

Answer: The mother always gives an X chromosome; if the father's sperm gives X, the child is a girl (XX), and if it gives Y, the child is a boy (XY).

5. What is a mutation?

Answer: A mutation is a sudden change in a gene or chromosome, which can produce a new trait; it is a cause of variation.

Long Questions

1. Explain Mendel's experiment with tall and dwarf pea plants and the 3:1 ratio.

Answer: Mendel crossed pure tall plants (TT) with pure dwarf plants (tt). All the first-generation (F1) plants were tall (Tt), showing that tall is dominant and dwarf is recessive. When he crossed two F1 plants (Tt × Tt), the offspring (F2) were 75% tall and 25% dwarf — a ratio of 3:1. This happens because the two alleles separate during gamete formation (law of segregation): each F1 plant makes T and t gametes in equal numbers, and their combinations give TT, Tt, Tt and tt — three tall and one dwarf.

2. Describe the inheritance of blood groups and genetic disorders.

Answer: Blood group is inherited through genes: groups A and B are dominant over O, so a child of AO parents can be group A or O. Genetic disorders are also inherited: colour blindness and haemophilia are carried on the X chromosome and are more common in males; thalassaemia is caused by faulty haemoglobin genes and is common in Pakistan, so carriers should be tested before marriage; Down syndrome is caused by an extra copy of chromosome 21, giving 47 chromosomes instead of 46.

Chapter 7: Man and His Environment

Ecology and Ecosystems

Ecology is the study of the relationships between organisms and their environment. An ecosystem is a community of organisms together with the non-living (abiotic) factors — light, temperature, water, air and soil — that affect them. A habitat is the place where an organism lives, a population is all the members of one species in an area, and a community is all the populations living together.

Food Chains and Food Webs

Producers, the green plants, make food by photosynthesis. Consumers eat other organisms: herbivores eat plants, carnivores eat animals, and omnivores eat both. Decomposers, bacteria and fungi, break down dead matter. A food chain shows who eats whom; a food web is many linked food chains. Energy flows from the sun to producers to consumers, and only about 10% of the energy passes to the next trophic level.

Cycles of Nature

In the water cycle, water evaporates, condenses and falls as rain. In the carbon cycle, plants take in carbon dioxide for photosynthesis, while respiration, decay and the burning of fuels return carbon dioxide to the air. In the nitrogen cycle, nitrogen-fixing bacteria change nitrogen gas into nitrates in the soil, plants absorb the nitrates, and decomposers return nitrogen to the soil and air.

Pollution

Air pollution comes from smoke, vehicles and factories and causes breathing diseases and smog. Water pollution comes from sewage, industrial waste and fertilisers in rivers and seas and spreads disease and kills aquatic life. Land pollution comes from plastics, chemicals and solid waste and damages the soil. Noise pollution also harms health.

Global Warming and Acid Rain

The greenhouse effect is the trapping of heat in the atmosphere by gases such as carbon dioxide. Burning fossil fuels increases carbon dioxide and warms the Earth — global warming — melting ice and changing rainfall. Acid rain forms when sulphur dioxide and nitrogen oxides from burning fuels mix with rainwater; it damages crops, forests and buildings.

Conservation

Conservation means the wise use and protection of nature: planting trees, protecting forests and wildlife, national parks, saving water, using renewable energy such as sun, wind and water, and the 3Rs — reduce, reuse, recycle. Population growth increases the demand for food, water and land, so conservation matters more every year.

Diagram to Practise

Draw a food chain of a grassland (grass → rabbit → fox) and a food web joining it to other chains, labelling producers, consumers and decomposers. Then draw the carbon cycle and label photosynthesis, respiration and combustion.

Chapter 7: Man and His Environment — Practice Questions

Multiple Choice Questions

1. The study of relationships between organisms and their environment is

(a) ecology (b) physiology (c) anatomy (d) genetics

2. Producers in an ecosystem are

(a) animals (b) green plants (c) fungi (d) bacteria

3. Decomposers are

(a) herbivores (b) carnivores (c) bacteria and fungi (d) producers

4. In a food chain, the amount of energy passed to the next level is about

(a) 90% (b) 100% (c) 50% (d) 10%

5. Nitrogen-fixing bacteria change nitrogen gas into

(a) nitrates (b) carbon dioxide (c) ammonia only (d) oxygen

6. Smog is mainly caused by

(a) rain (b) smoke and fog from vehicles and factories (c) dust storms (d) sunlight

7. Global warming is mainly caused by an increase in

(a) oxygen (b) nitrogen (c) carbon dioxide (d) argon

8. Acid rain is formed when rainwater mixes with

(a) carbon monoxide only (b) dust (c) oxygen (d) sulphur dioxide and nitrogen oxides

9. The 3Rs of conservation are

(a) reduce, reuse, recycle (b) rain, river, reservoir (c) root, stem, leaf (d) read, write, recite

10. A habitat is

(a) the food of an organism (b) the place where an organism lives (c) a group of animals (d) a type of soil

Short Questions

1. Define an ecosystem.

Answer: An ecosystem is a community of living organisms together with the non-living factors of their environment, such as light, temperature, water, air and soil, all interacting with one another.

2. What is the difference between a food chain and a food web?

Answer: A food chain is a single line showing who eats whom, while a food web is a network of many linked food chains in an ecosystem.

3. Name two causes of water pollution.

Answer: Sewage and industrial waste discharged into rivers and seas, and fertilisers and pesticides washed from fields into water.

4. What is the greenhouse effect?

Answer: The greenhouse effect is the trapping of heat in the atmosphere by gases such as carbon dioxide, which keeps the Earth warm but, when increased by burning fossil fuels, causes global warming.

5. Give two ways of conserving nature.

Answer: Planting trees and protecting forests, and saving water and using renewable energy such as sunlight and wind.

Long Questions

1. Describe the flow of energy through a food chain and the roles of producers, consumers and decomposers.

Answer: Energy enters an ecosystem from the sun. Producers, the green plants, capture sunlight by photosynthesis and store it as food. Herbivores eat the producers, carnivores eat the herbivores, and omnivores eat both plants and animals. At each step only about 10% of the energy passes to the next trophic level; the rest is used for life processes or lost as heat. Decomposers — bacteria and fungi — break down dead plants and animals, returning nutrients to the soil for producers to use again. In this way energy flows in one direction while nutrients are recycled.

2. Explain the causes and effects of pollution and how it can be controlled.

Answer: Air pollution comes from smoke, vehicles and factories and causes breathing diseases and smog. Water pollution comes from sewage, industrial waste and fertilisers and spreads disease and kills aquatic life. Land pollution comes from plastics, chemicals and solid waste and damages the soil. Pollution can be controlled by treating sewage and factory waste before it is discharged, using filters on chimneys and exhausts, planting trees, reducing the use of plastics, and using renewable energy instead of fossil fuels. Every person can help by saving water and energy and by not littering.

Chapter 8: Biotechnology

What Is Biotechnology?

Biotechnology is the use of living organisms, cells or biological processes to make useful products for humans — in medicine, agriculture, food and industry.

Fermentation

In fermentation, microorganisms break down sugars without oxygen. Yeast ferments sugar to make alcohol and carbon dioxide, which makes bread rise and is used in brewing. Lactic acid bacteria ferment milk to make yogurt and cheese. Biogas is made when bacteria break down animal waste.

Genetic Engineering

Genetic engineering means changing the genes of an organism: a useful gene is taken from one organism and put into another, making recombinant DNA. For example, the human insulin gene is put into bacteria, which then produce human insulin for diabetic patients. In crops, genes are added to make them resist insects, such as Bt cotton, or to survive drought.

Cloning and Tissue Culture

Cloning makes a genetically identical copy of an organism; Dolly the sheep (1996) was the first cloned mammal. Tissue culture grows many new plants from a small piece of plant tissue, giving disease-free plants quickly.

Biotechnology in Medicine

Vaccines, antibiotics and hormones such as insulin and growth hormone are made with biotechnology. Gene therapy aims to treat genetic diseases by correcting faulty genes.

Benefits and Care

Biotechnology gives more food, better medicines and new treatments. But genetically modified organisms and cloning raise safety and ethical questions, so research must be done carefully and under rules.

Diagram to Practise

Draw a flow chart showing how human insulin is produced by genetic engineering: human insulin gene → put into bacteria → bacteria multiply in a tank → insulin collected and purified → used as medicine.

Chapter 8: Biotechnology — Practice Questions

Multiple Choice Questions

1. Biotechnology is the use of

(a) minerals (b) chemicals only (c) living organisms to make useful products (d) machines only

2. Yeast is used in bread-making because it produces

(a) nitrogen (b) hydrogen (c) oxygen (d) carbon dioxide

3. Yogurt is made by

(a) lactic acid bacteria (b) viruses (c) algae (d) yeast

4. In genetic engineering, a gene is

(a) destroyed (b) moved from one organism to another (c) copied by hand (d) heated

5. Human insulin is now produced by

(a) chemical synthesis only (b) plants (c) bacteria with the human insulin gene (d) animals

6. Bt cotton is an example of a

(a) fermented food (b) vaccine (c) cloned animal (d) GM crop

7. Dolly the sheep was famous as the first

(a) cloned mammal (b) test-tube baby (c) vaccine (d) GM crop

8. Tissue culture is used to produce

(a) biogas (b) many disease-free plants quickly (c) new animals (d) medicines only

9. Gene therapy aims to treat diseases by

(a) exercise (b) surgery only (c) correcting faulty genes (d) giving painkillers

10. Biogas is produced by bacteria breaking down

(a) metals (b) plastics (c) rocks (d) animal waste

Short Questions

1. Define biotechnology.

Answer: Biotechnology is the use of living organisms, cells or biological processes to make useful products for humans, in medicine, agriculture, food and industry.

2. What is fermentation?

Answer: Fermentation is the breakdown of sugars by microorganisms without oxygen, for example yeast making alcohol and carbon dioxide, and lactic acid bacteria making yogurt from milk.

3. What is genetic engineering?

Answer: Genetic engineering is the changing of an organism's genes by taking a useful gene from one organism and putting it into another, for example putting the human insulin gene into bacteria.

4. What is a GM crop? Give one example.

Answer: A GM crop is a crop whose genes have been changed to give it a useful quality, for example Bt cotton, which resists insect attack.

5. What is cloning?

Answer: Cloning is making a genetically identical copy of an organism, for example Dolly the sheep, the first cloned mammal.

Long Questions

1. Explain how genetic engineering is used to produce human insulin.

Answer: In genetic engineering, scientists take the human gene for insulin and put it into the DNA of bacteria, making recombinant DNA. The bacteria are then grown in large tanks, and as they

multiply they produce human insulin. The insulin is collected, purified and used as medicine by diabetic patients whose own bodies do not make enough insulin. This method produces large amounts of pure human insulin safely and cheaply.

2. Describe the uses of biotechnology in food and agriculture.

Answer: In food, biotechnology is used in fermentation: yeast makes bread rise and produces alcohol, and lactic acid bacteria turn milk into yogurt and cheese. In agriculture, tissue culture produces many disease-free plants quickly from a small piece of tissue. Genetic engineering produces GM crops such as Bt cotton, which resists insects, and crops that survive drought or poor soil. Biotechnology also produces biogas from animal waste, giving fuel and fertiliser. These uses increase food production and reduce the need for chemical sprays.

Chapter 9: Pharmacology

What Is Pharmacology?

Pharmacology is the study of drugs: where they come from, how they work, and how they affect the body. A drug is a substance that changes the working of the body.

Sources of Drugs

Plants give many drugs: quinine from the bark of the cinchona tree treats malaria, morphine from the opium poppy relieves severe pain, and aspirin was first obtained from willow bark. Animals give drugs such as insulin, which was first obtained from animals. Minerals give salts of iron and zinc used as medicines. Most modern drugs are synthetic, made in laboratories.

Medicinal Drugs

Antibiotics kill bacteria: penicillin, discovered by Alexander Fleming in 1928, was the first antibiotic. Vaccines protect against disease by training the immune system, for example the polio, measles and hepatitis vaccines. Painkillers relieve pain, and antiseptics clean wounds and kill germs.

How Vaccines Work

A vaccine contains a weakened or dead germ, or part of it. It trains the body's immune system to recognise the germ, so if the real germ attacks later, the body fights it quickly. Vaccination has controlled diseases such as polio and measles.

Drug Abuse

Drug abuse is the misuse of drugs, especially narcotics such as heroin, cocaine and opium. These drugs cause addiction: the body depends on the drug, and stopping it causes illness. Abuse damages the brain, liver and lungs, ruins health, wastes money and breaks families. Prevention needs awareness in schools and homes, treatment and rehabilitation centres, and never taking drugs without a doctor's advice.

Using Medicines Safely

Take medicines only on a doctor's prescription. Complete the full course of antibiotics: stopping early lets bacteria survive and become resistant. Never share medicines with others, store them safely away from children, and remember that self-medication can be dangerous.

Diagram to Practise

Draw a table of the sources of drugs with one example each: plants (quinine from cinchona bark), animals (insulin), minerals (iron salts) and synthetic drugs (modern antibiotics made in a laboratory).

Chapter 9: Pharmacology — Practice Questions

Multiple Choice Questions

1. Pharmacology is the study of

(a) drugs and their effects on the body (b) diseases only (c) the brain (d) plants

2. Quinine, used to treat malaria, comes from the

(a) opium poppy (b) cinchona tree (c) willow tree (d) neem tree

3. The first antibiotic, penicillin, was discovered by

(a) Robert Koch (b) Louis Pasteur (c) Alexander Fleming (d) Edward Jenner

4. Antibiotics are used to kill

(a) fungi only (b) worms only (c) viruses (d) bacteria

5. A vaccine works by

(a) training the immune system (b) reducing fever only (c) cleaning wounds (d) killing germs in water

6. Morphine is obtained from the

(a) cinchona tree (b) opium poppy (c) neem tree (d) willow tree

7. Drug addiction means the body

(a) becomes strong (b) hates the drug (c) depends on the drug (d) cures itself

8. Which of these is a narcotic drug?

(a) Aspirin (b) Vitamin C (c) Penicillin (d) Heroin

9. An antiseptic is used to

(a) clean wounds and kill germs (b) reduce pain (c) kill bacteria inside the body (d) treat malaria

10. The full course of an antibiotic must be completed because

(a) it tastes better (b) stopping early lets bacteria survive and become resistant (c) the doctor says so only (d) it is cheaper

Short Questions

1. Define pharmacology.

Answer: Pharmacology is the study of drugs — where they come from, how they work and how they affect the body.

2. Name two plant sources of drugs and the drug each gives.

Answer: The cinchona tree gives quinine, which treats malaria, and the opium poppy gives morphine, which relieves severe pain.

3. What is an antibiotic?

Answer: An antibiotic is a drug that kills bacteria or stops them from growing, for example penicillin.

4. How does a vaccine protect the body?

Answer: A vaccine trains the immune system to recognise a germ, so when the real germ attacks later, the body fights it quickly and the person does not fall ill.

5. Why is self-medication dangerous?

Answer: Self-medication is dangerous because the wrong drug or wrong dose can harm the body, hide the real disease, or make bacteria resistant to antibiotics.

Long Questions

1. Describe the sources of drugs, giving examples.

Answer: Drugs come from four sources. Plants give many drugs: quinine from the bark of the cinchona tree treats malaria, morphine from the opium poppy relieves severe pain, and aspirin was first obtained from willow bark. Animals give drugs such as insulin, which was first obtained from animals. Minerals give salts of iron and zinc used as medicines. Most modern drugs are synthetic, made in laboratories, such as many antibiotics and painkillers. In every case the drug must be tested for safety before it is used as medicine.

2. Explain drug abuse and its effects, and how it can be prevented.

Answer: Drug abuse is the misuse of drugs, especially narcotics such as heroin, cocaine and opium. These drugs cause addiction, meaning the body depends on them and suffers illness when they are stopped. Abuse damages the brain, liver and lungs, ruins health, wastes money and breaks families. It can be prevented by awareness in schools and homes, by never taking drugs without a doctor's advice, and by treatment and rehabilitation centres that help addicts give up drugs and return to normal life.

MCQ Answer Key

Each chapter has 10 MCQs, numbered 1 to 10.

Chapter	1	2	3	4	5	6	7	8	9	10
Ch. 1	A	B	C	D	A	B	C	D	A	B
Ch. 2	C	D	A	B	C	D	A	B	C	D
Ch. 3	A	B	C	D	A	B	C	D	A	B
Ch. 4	C	D	A	B	C	D	A	B	C	D
Ch. 5	A	B	C	D	A	B	C	D	A	B
Ch. 6	C	D	A	B	C	D	A	B	C	D
Ch. 7	A	B	C	D	A	B	C	D	A	B
Ch. 8	C	D	A	B	C	D	A	B	C	D
Ch. 9	A	B	C	D	A	B	C	D	A	B

Score guide: count your correct answers out of 10 for each chapter. Re-read the notes for every chapter in which you scored less than 7 out of 10.

End of the book. Good luck with your studies — revise regularly and check bsek.edu.pk for the current model paper.