

BCo2 — Human Body — Physiology

BCO2 · CDS General Knowledge — Biology

★ Highest Priority — 4–5 Questions per Paper

Human physiology is the single highest-scoring chapter in CDS Biology. Questions cut across every organ system — from the nephron's filtration mechanism to the hormone that controls blood sugar. Work through each system methodically: understand its job first, then learn its parts, and finally memorise the disease that results when it fails.

✦ **CDS Focus:** Largest gland = liver; largest organ = skin; functional unit of kidney = nephron; pacemaker of heart = SA node; insulin from beta cells of islets of Langerhans (pancreas); adrenaline = fight-or-flight hormone; reflex arc does NOT involve brain (involves spinal cord). These exact facts repeat across every CDS paper.

PART 1 — DIGESTIVE SYSTEM

1. Digestive System

Digestion converts complex food into simple, absorbable molecules. The alimentary canal is a continuous tube from mouth to anus; associated glands add enzymes and juices at key points along the way.

FIG. 1 — ALIMENTARY CANAL: ORGANS, SECRETIONS AND FUNCTION AT EACH STAGE

ALIMENTARY CANAL — Organ, Enzyme/Juice, What Gets Digested

Organ	Secretion	Action	Key fact
Mouth (buccal cavity)	Salivary amylase (ptyalin) in saliva	Starch → Maltose	Digestion begins here
Stomach	Gastric juice: HCl, pepsin, mucus	Protein → Peptides HCl kills bacteria	pH 2 (acidic); churning
Small Intestine duodenum+jejunum	Bile (liver) + Pancreatic juice + Intestinal juice (lipase, amylase, protease)	ALL nutrients digested and absorbed here	Main absorption site; villi increase surface area
Large Intestine	No digestive enzymes	Water and mineral absorption; faeces formed	Colon absorbs water

ASSOCIATED GLANDS

Liver (largest gland): bile production; glycogen storage; detoxification
Pancreas: exocrine (digestive enzymes) + endocrine (insulin/glucagon hormones)

PART 2 — CIRCULATORY SYSTEM

2. Circulatory System

Blood is the river that connects every cell in the body — delivering oxygen and nutrients, removing waste, and carrying the immune defenders that protect against disease. The heart is the pump; blood vessels are the channels.

FIG. 2 — COMPONENTS OF BLOOD: CELL TYPE, QUANTITY, ORIGIN AND FUNCTION

COMPONENTS OF BLOOD			
Component	Normal Count	Function	Key Fact
RBC Erythrocytes	4.5–5.5 million per mm ³	Carry O ₂ via haemoglobin CO ₂ transport (some)	No nucleus in mature RBC Life span: 120 days
WBC Leukocytes	5,000–10,000 per mm ³	Immunity; fight infection; phagocytosis of pathogens	Have nucleus; 5 types Increased in infection
Platelets Thrombocytes	1.5–4 lakh per mm ³	Blood clotting (coagulation) prevents excessive bleeding	No nucleus; smallest blood cell; life span 8–10 days

PLASMA (55% of blood)
coloured liquid; 90% water; carries digested food, hormones, antibodies, CO₂, urea (waste) and fibrinogen (clotting protein)

Heart Facts for CDS:

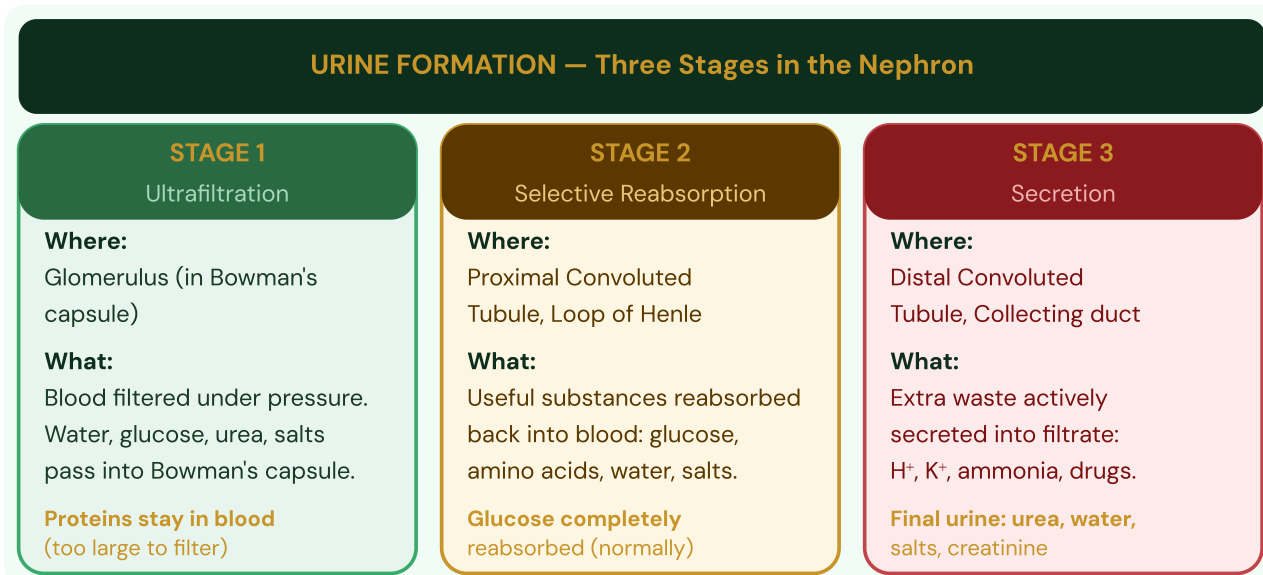
- **4 chambers:** Right Atrium, Right Ventricle, Left Atrium, Left Ventricle
- **SA node** (sinoatrial node) = natural pacemaker; initiates heartbeat in right atrium
- **Double circulation:** Pulmonary circulation (heart ↔ lungs for oxygenation) + Systemic circulation (heart ↔ body for oxygen delivery)
- **Oxygenated blood** flows in left side; **deoxygenated blood** flows in right side
- **Arteries** carry blood AWAY from heart; **Veins** carry blood TOWARD heart
- **Exception:** Pulmonary artery carries deoxygenated blood; pulmonary vein carries oxygenated blood (opposite of the usual rule!)

PART 3 – EXCRETORY & NERVOUS SYSTEMS

3. Excretory System – The Nephron

The kidney's job is to filter waste products from blood and eliminate them as urine. The functional unit doing this work is the **nephron** – there are about 1 million nephrons in each kidney.

FIG. 3 – URINE FORMATION IN THE NEPHRON: THREE STAGES



4. Nervous System & Endocrine System

⚡ Nervous System Key Points

☀ Endocrine Glands & Hormones

- ▶ **CNS:** Brain (cerebrum – thinking; cerebellum – balance; medulla – autonomic) + Spinal cord
- ▶ **PNS:** Somatic (voluntary, controls skeletal muscles) + Autonomic (involuntary: sympathetic/parasympathetic)
- ▶ **Reflex arc:** Receptor → Sensory neuron → Spinal cord → Motor neuron → Effector. Brain NOT involved
- ▶ **Neuron:** Basic unit; impulse travels via dendrite → cell body → axon → synapse
- ▶ Speed of nerve impulse: ~120 m/s in myelinated fibres

- ▶ **Pituitary** – "master gland"; controls other glands; GH, TSH, ADH
- ▶ **Thyroid** – Thyroxine (T₄); controls metabolic rate; iodine needed
- ▶ **Adrenal (cortex+medulla)** – Adrenaline: fight-or-flight; cortisol: stress
- ▶ **Pancreas** – Insulin (β-cells): lowers blood sugar; Glucagon (α-cells): raises blood sugar
- ▶ **Testes/Ovaries** – Testosterone/Oestrogen: secondary sex characters

PART 4 – RESPIRATORY & SKELETAL SYSTEMS

5. Respiratory System

Every cell needs oxygen to produce ATP and generates carbon dioxide as waste. The respiratory system is the exchange gateway – bringing O₂ in and removing CO₂ with each breath.

Pathway of Air (Inhalation):

Nose → Pharynx → Larynx (voice box) → Trachea (windpipe) → Bronchi → Bronchioles → **Alveoli** (actual gas exchange site)

Gas Exchange in Alveoli (by diffusion):

O₂ from alveoli → crosses thin alveolar wall → enters blood capillaries → binds haemoglobin in RBC → transported to tissues

CO₂ from blood → diffuses into alveoli → exhaled. (CO₂ mostly carried as bicarbonate ions in plasma, not haemoglobin)

Key Volumes: Tidal volume (normal breath) " 500 mL | Vital capacity " 3,500 mL | Total lung capacity " 6,000 mL

✦ **CDS Direct Point – Haemoglobin Affinity:** Carbon monoxide (CO) binds haemoglobin with **240× more affinity** than oxygen – forming stable carboxyhaemoglobin. This blocks O₂ transport → CO poisoning causes suffocation even with normal breathing. This is why CO from vehicle exhaust or burning charcoal in an enclosed room is lethal.

6. Skeletal System

Feature Detail **Total bones** 206 in adults (infant: ~270; fuse during development) **Longest bone** Femur (thigh bone) **Smallest bone** Stapes (in middle ear) **Hardest substance** Enamel (tooth enamel; made of calcium phosphate hydroxyapatite) **Bone composition** Calcium phosphate (Ca₃(PO₄)₂) gives hardness; collagen fibres give flexibility **Joint types (CDS tested)** Ball-and-socket: shoulder, hip (full rotation) | Hinge: elbow, knee (one plane) | Pivot: atlas-axis (head rotation) | Gliding: wrist, ankle | Fixed (suture): skull bones **Functions of skeleton** Support, protection of organs (skull→brain; ribcage→heart+lungs), movement (with muscles), blood cell production (red marrow), mineral storage (Ca, P)



CDS PYQs – Human Body

Q1. The functional unit of the kidney is the: CDS PYQ

(a) Nephron (b) Neuron (c) Alveolus (d) Glomerulus

✓ **Answer: (a) Nephron**

The **nephron** is the structural and functional unit of the kidney. Each human kidney contains approximately 1 million nephrons. Each nephron consists of a Bowman's capsule (containing the glomerulus for filtration), a proximal convoluted tubule, loop of Henle, distal convoluted tubule, and collecting duct. The glomerulus is just one component of the nephron – it is the filtration site, not the functional unit itself.

Q2. The natural pacemaker of the human heart is: CDS PYQ

(a) AV node (b) Bundle of His (c) SA node (d) Purkinje fibres

✓ **Answer: (c) SA node (Sinoatrial node)**

The **SA node** (sinoatrial node), located in the right atrium wall, generates the electrical impulse that initiates every heartbeat — making it the natural pacemaker. The impulse travels to the AV node → Bundle of His → Purkinje fibres, causing coordinated heart muscle contraction. When the SA node fails, an artificial pacemaker is surgically implanted. Normal resting heart rate: 72 beats/minute.

Q3. Insulin is produced by which cells of the pancreas?

CDS PYQ

- (a) Acinar cells (b) Alpha cells of islets (c) Beta cells of islets (d) Delta cells

✓ Answer: (c) Beta cells of islets of Langerhans

The pancreas has two roles: exocrine (digestive enzymes via pancreatic duct) and endocrine. The **Islets of Langerhans** are clusters of endocrine cells. **Beta (β) cells** secrete insulin when blood glucose rises — insulin allows cells to absorb glucose, lowering blood sugar. Alpha (α) cells secrete glucagon (raises blood sugar). Deficiency of insulin causes Diabetes mellitus (Type 1). This is one of the most frequently repeated CDS questions.

Q4. A reflex action is controlled by:

CDS PYQ

- (a) Cerebrum (b) Cerebellum (c) Medulla oblongata (d) Spinal cord

✓ Answer: (d) Spinal cord

A **reflex arc** bypasses the brain entirely. The pathway: Stimulus → Receptor → Sensory neuron → **Spinal cord** → Motor neuron → Effector (muscle/gland). The spinal cord integrates the reflex response. Examples: knee-jerk reflex, withdrawal reflex (hand from fire). The brain perceives the sensation afterwards — this is why you pull your hand away BEFORE feeling pain. CDS tests this "where is reflex controlled?" concept directly.

Q5. Which of the following carries oxygenated blood from the lungs to the heart?

⚡ Tricky

- (a) Pulmonary artery (b) Pulmonary vein (c) Aorta (d) Vena cava

✓ Answer: (b) Pulmonary vein

This is the classic CDS trap: arteries carry blood away from the heart; veins carry blood toward the heart. The **pulmonary vein** is the exception — it carries oxygenated blood FROM the lungs TO the left atrium. The pulmonary artery carries deoxygenated blood FROM the right ventricle TO the lungs for oxygenation. Remember: pulmonary vein = oxygenated (despite being a vein!).

Q6. The smallest bone in the human body is:

CDS PYQ

- (a) Patella (b) Stapes (c) Malleus (d) Incus

✓ Answer: (b) Stapes

The **stapes** (stirrup bone) in the middle ear is the smallest and lightest bone in the human body – approximately 3 mm long. All three middle ear ossicles (malleus, incus, stapes) are tiny, but the stapes is the smallest. They transmit sound vibrations from the eardrum to the inner ear. The largest bone is the femur (thigh bone). This contrast (largest/smallest bone) is a classic direct CDS question.

Q7. Gas exchange in the human lungs occurs in the: CDS PYQ

- (a) Trachea (b) Bronchi (c) Alveoli (d) Bronchioles

✓ Answer: (c) Alveoli

The **alveoli** are tiny, thin-walled air sacs at the end of the bronchioles – around 700 million in both lungs, providing a surface area of ~70 sq metres (size of a badminton court). Their thin walls and rich capillary network enable rapid diffusion of O₂ (into blood) and CO₂ (into alveoli). Breathing moves air to alveoli; actual gas exchange happens here by simple diffusion driven by concentration gradients.

Quick Memory Chart – BCo2

Digestion

- ◆ Starch: salivary amylase (mouth)
- ◆ Protein: pepsin (stomach, acidic)
- ◆ All: small intestine (main site)
- ◆ Liver: largest gland; bile (emulsifies fat)
- ◆ Pancreas: insulin + digestive enzymes

Heart & Blood

- ◆ SA node = pacemaker (right atrium)
- ◆ RBC: no nucleus; 120-day life; O₂ transport
- ◆ WBC: immunity; have nucleus
- ◆ Platelets: clotting; no nucleus
- ◆ Pulmonary vein: carries oxygenated blood!

Hormones

- ◆ Pituitary: master gland; GH, ADH
- ◆ Insulin (β -cells): lowers blood glucose
- ◆ Glucagon (α -cells): raises blood glucose
- ◆ Adrenaline: fight-or-flight
- ◆ Reflex: spinal cord (NOT brain)



Practice Exercise

E1. Which part of the brain controls balance and coordination?

- (a) Cerebrum (b) Medulla oblongata (c) Cerebellum (d) Hypothalamus

E2. The largest gland in the human body is the:

- (a) Pancreas (b) Thyroid (c) Liver (d) Spleen

E3. In diabetic patients, glucose appears in urine because:

- (a) Kidneys stop filtering
(b) Blood glucose exceeds renal threshold; tubules cannot reabsorb all of it
(c) Insulin is over-produced (d) Glomerular filtration rate is zero

Answers:

E1 → (c) Cerebellum [co-ordinates fine motor movement and maintains posture/balance]
| E2 → (c) Liver [~1.5 kg; functions: bile, glycogen storage, detox, plasma protein synthesis]
| E3 → (b) Renal threshold exceeded [normal renal threshold for glucose ~180 mg/dL; above this, tubules cannot reabsorb all filtered glucose → glycosuria]



Mock Tests



Subject Quiz



Telegram

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