Q.148

A pregnant female delivers a baby who suffers from stunted growth, mental retardation, low intelligence quotient, and abnormal skin. This is the result of:

1. Deficiency of iodine in diet
2. Low secretion of growth hormone
3. Cancer of the thyroid gland
4. Over secretion of pars distalis

Correct Answer: 1. Deficiency of iodine in diet

Explanation:

- The symptoms described (stunted growth, mental retardation, low intelligence quotient, and abnormal skin) are indicative of a condition called **congenital hypothyroidism** or **cretinism**.
- This condition is primarily caused by a **deficiency of iodine** in the mother's diet during pregnancy. Iodine is crucial for the production of thyroid hormones, which are essential for normal growth, brain development, and metabolism. Without sufficient iodine, the thyroid gland cannot produce adequate amounts of these hormones, leading to the severe developmental issues mentioned.

Endocrine Glands and Corresponding Hormones

List of endocrine glands in the human body along with the hormones they produce and their primary functions:

Sl. No.	**Gland**	**Location**	**Hormones Produced**	**What Does the Hormone Do?**
1	**Pituitary Gland**	Base of the brain	**Anterior Pituitary (Pars Distalis)**	
			Growth Hormone (GH)	Stimulates growth of bones and tissues, regulates metabolism.
			Thyroid-Stimulating Hormone (TSH)	Stimulates the thyroid gland to produce thyroid hormones.
			Adrenocorticotropic Hormone (ACTH)	Stimulates the adrenal cortex to produce cortisol.
			Follicle-Stimulating Hormone (FSH)	Stimulates egg or sperm production.

			Luteinizing Hormone (LH)	Triggers ovulation in females and testosterone production in males.
			Prolactin	Promotes milk production in lactating females.
	Posterior Pituitary		Antidiuretic Hormone (ADH)	Promotes water reabsorption in kidneys, regulates water balance.
			Oxytocin	Stimulates uterine contractions during childbirth and milk ejection during breastfeeding.

2	**Thyroid Gland**	Neck, below Adam's apple	Thyroxine (T4)	Regulates metabolism, growth, and development.
			Triiodothyronine (T3)	Regulates metabolism, growth, and development (more potent than T4).
			Calcitonin	Lowers blood calcium levels by inhibiting bone resorption.
3	**Parathyroid Glands**	Embedded in the thyroid gland	Parathyroid Hormone (PTH)	Increases blood calcium levels by stimulating bone resorption.
4	**Adrenal Glands**	On top of each kidney	**Adrenal Cortex**	
			Cortisol	Regulates metabolism,

				immune response, and stress response.
			Aldosterone	Regulates sodium and potassium balance, and blood pressure.
			Androgens	Contributes to the development of male secondary sexual characteristics.
	Adrenal Medulla		Epinephrine (Adrenaline)	Increases heart rate, blood pressure, and energy supply (fight or flight response).
			Norepinephrine (Noradrenaline)	Works with epinephrine in the fight or flight

				response, also increases blood pressure.
5	**Pancreas (Islets of Langerhans)**	Abdomen, behind the stomach	Insulin	Lowers blood glucose levels by promoting glucose uptake into cells.
			Glucagon	Raises blood glucose levels by promoting glucose release from the liver.
6	**Pineal Gland**	Center of the brain	Melatonin	Regulates sleep-wake cycles (circadian rhythms).
7	**Ovaries (in females)**	Pelvic cavity	Estrogen	Promotes the development of female secondary sexual characteristics and

				regulates the menstrual cycle.
			Progesterone	Regulates the menstrual cycle and supports pregnancy.
8	**Testes (in males)**	Scrotum	Testosterone	Promotes the development of male secondary sexual characteristics and sperm production.
9	**Thymus**	Upper chest	Thymosin	Stimulates the development of T-cells (important for the immune response).

Notes:

- The pituitary gland is often referred to as the "master gland" because it regulates the activity of many other endocrine glands.

- Hormones like insulin and glucagon from the pancreas are critical in maintaining blood glucose levels.
- The adrenal glands have distinct regions that produce different hormones, each with vital roles in stress response and metabolism.

Here is the corrected table:

Sl. No.	**Function**	**Hormones**	**Action**
1	**Growth**	Growth Hormone (GH)	Stimulates growth of bones and tissues, regulates metabolism.
		Insulin-like Growth Factor (IGF-1)	Mediates the effects of GH, promoting cell growth and development.
		Thyroid Hormones (T3, T4)	Regulate overall growth, development, and metabolism.
2	**Development**	Thyroid Hormones (T3, T4)	Essential for normal brain development and growth in children.
		Estrogen	Promotes the development of female secondary sexual characteristics.

		Testosterone	Promotes the development of male secondary sexual characteristics.
		Thymosin	Stimulates the development of T-cells, important for immune system development.
3	**Metabolism**	Thyroid Hormones (T3, T4)	Increase metabolic rate, regulate protein synthesis, and influence growth and development.
		Insulin	Lowers blood glucose levels by promoting glucose uptake into cells.
		Glucagon	Raises blood glucose levels by promoting glucose release from the liver.
		Cortisol	Regulates metabolism of proteins, fats, and carbohydrates; stress response; suppresses inflammation.
		Epinephrine (Adrenaline)	Increases heart rate, blood pressure, and

			energy supply during the fight or flight response.
		Norepinephrine (Noradrenaline)	Works with epinephrine to increase blood pressure and heart rate during stress.
		Aldosterone	Regulates sodium and potassium balance, which indirectly influences water balance and blood pressure.
		Calcitonin	Lowers blood calcium levels by inhibiting bone resorption.
		Parathyroid Hormone (PTH)	Increases blood calcium levels by stimulating bone resorption and increasing calcium absorption in the intestines and kidneys.
4	**Reproduction**	Follicle-Stimulating Hormone (FSH)	Stimulates egg production in females and sperm production in males.

		Luteinizing Hormone (LH)	Triggers ovulation in females and stimulates testosterone production in males.
		Estrogen	Regulates the menstrual cycle, supports pregnancy, and develops female secondary sexual characteristics.
		Progesterone	Prepares the uterus for pregnancy, regulates the menstrual cycle, and supports early stages of pregnancy.
		Testosterone	Regulates sperm production and develops male secondary sexual characteristics.
		Prolactin	Promotes milk production in lactating females.
		Oxytocin	Stimulates uterine contractions during childbirth and milk ejection during breastfeeding.

Explanation:

- **Growth**: Hormones like Growth Hormone (GH) and Thyroid Hormones (T3, T4) are crucial for stimulating growth and maintaining healthy development.
- **Development**: Hormones such as Estrogen, Testosterone, and Thyroid Hormones contribute significantly to sexual and physical development, especially during puberty.
- **Metabolism**: Metabolic hormones like Insulin, Glucagon, and Cortisol regulate the body's use of energy and resources, maintaining glucose levels and responding to stress.
- **Reproduction**: Hormones like Follicle-Stimulating Hormone (FSH), Luteinizing Hormone (LH), Estrogen, Progesterone, and Testosterone are essential for reproductive processes, including gamete production, menstruation, pregnancy, and secondary sexual characteristic development.

hormones along with diseases caused by their overproduction and underproduction:

Sl. No.	**Hormone**	**Disease Due to Overproduction**	**Disease Due to Underproduction**
1	**Growth Hormone (GH)**	Gigantism (in children), Acromegaly (in adults)	Dwarfism, Growth Hormone Deficiency

2	**Thyroid Hormones (T3, T4)**	Hyperthyroidism, Grave's Disease	Hypothyroidism, Cretinism (in infants), Myxedema (in adults)
3	**Cortisol**	Cushing's Syndrome	Addison's Disease
4	**Insulin**	Hypoglycemia (if administered in excess)	Diabetes Mellitus (Type 1 Diabetes)
5	**Aldosterone**	Hyperaldosteronism (Conn's Syndrome)	Addison's Disease, Hypoaldosteronism
6	**Parathyroid Hormone (PTH)**	Hyperparathyroidism (Bone Resorption, Kidney Stones)	Hypoparathyroidism (Tetany, Muscle Spasms)
7	**Prolactin**	Hyperprolactinemia (Galactorrhea, Infertility)	Inadequate Lactation
8	**Estrogen**	Estrogen dominance (Endometrial hyperplasia, Breast cancer)	Menstrual Irregularities, Osteoporosis
9	**Testosterone**	Androgen excess (Polycystic Ovary Syndrome in females, Aggressive behavior)	Hypogonadism (Reduced fertility, Low libido)

10	**Adrenaline (Epinephrine)**	Pheochromocytoma (Hypertension, Rapid heart rate)	None (Adrenal insufficiency affects cortisol more significantly)
11	**Thyroid-Stimulating Hormone (TSH)**	Hyperthyroidism due to pituitary adenoma	Hypothyroidism
12	**Luteinizing Hormone (LH)**	None specific	Infertility, Hypogonadism
13	**Follicle-Stimulating Hormone (FSH)**	None specific	Infertility, Hypogonadism
14	**Oxytocin**	None specific	Difficulty in childbirth (weak uterine contractions)
15	**Antidiuretic Hormone (ADH)**	SIADH (Syndrome of Inappropriate ADH Secretion)	Diabetes Insipidus

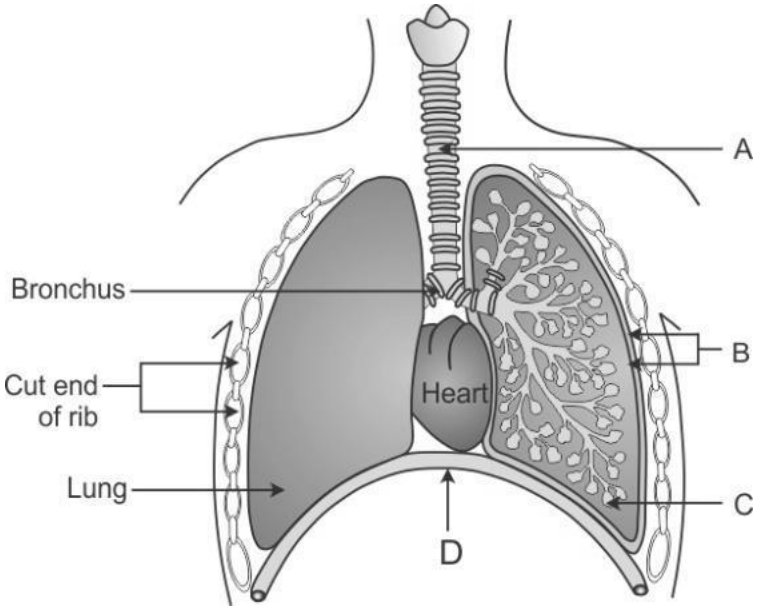
Explanation:

- **Overproduction**: Some hormones, when produced in excess, can lead to conditions where the body experiences abnormal growth, excessive stress responses, or metabolic imbalances.

- **Underproduction**: Insufficient production of these hormones can result in various deficiency diseases, impacting growth, metabolism, reproductive functions, and overall health.

Q.149

The figure shows a diagrammatic view of the human respiratory system with labels A, B, C, and D. Select the option which gives correct identification and main function and/or characteristic:



1. A - trachea - long tube supported by complete cartilaginous rings for conducting inspired air
2. B - pleural membrane - surrounds ribs on both sides to provide cushion against rubbing
3. C - Alveoli - thin-walled vascular bag-like structures for exchange of gases
4. D - Lower end of lungs - diaphragm pulls it down during inspiration

Correct Answer: 3. C - Alveoli - thin-walled vascular bag-like structures for exchange of gases

Explanation:

- **C** is correctly identified as **Alveoli**. These are tiny, thin-walled, sac-like structures in the lungs where the exchange of gases (oxygen and carbon dioxide) takes place. They are surrounded by a network of capillaries, allowing oxygen to enter the blood and carbon dioxide to be expelled from the blood into the lungs.

Additional Questions:

1. Cartilage Design Around Trachea:

- The trachea (windpipe) is supported by C-shaped rings of **hyaline cartilage**. These rings provide structural support, keeping the trachea open for air to pass through to the lungs.

2. Why Semicircular Rings in Cartilage?

- The cartilage rings are C-shaped (not complete circles) to allow the trachea to remain open while also being flexible. The open part of the "C" faces the esophagus, allowing the trachea to expand slightly when swallowing food.

3. Importance of Diaphragm for Breathing:

- The **diaphragm** is a dome-shaped muscle located below the lungs. During **inspiration (inhaling)**, the diaphragm contracts and flattens, pulling downward. This action increases the space in the chest cavity, allowing the lungs to expand and draw in air. During **expiration (exhaling)**, the diaphragm relaxes and moves upward, pushing air out of the lungs.

4. Pleural Membrane and Its Significance:

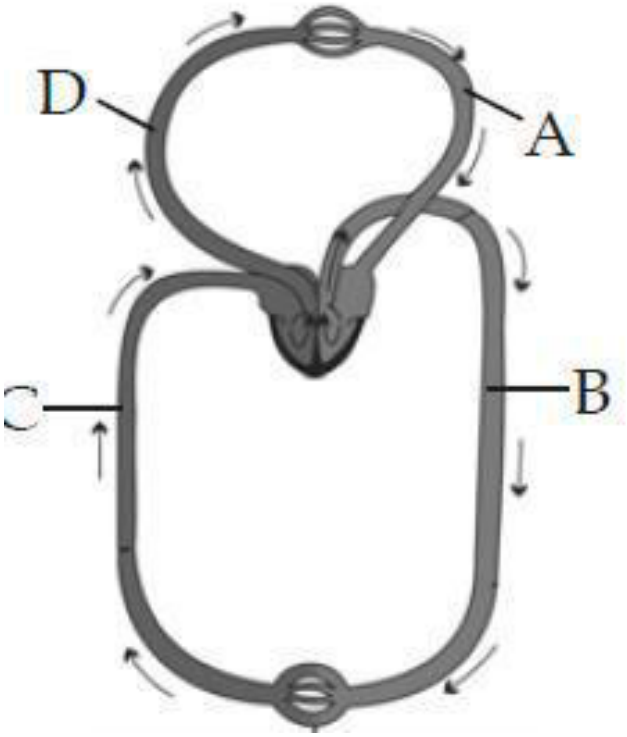
- The **pleural membrane** is a double-layered membrane surrounding each lung. The outer layer (parietal pleura) attaches to the chest wall, and the inner layer (visceral pleura) covers the lungs. The space between these layers, called the pleural cavity, contains a small amount of fluid that reduces friction and allows the lungs to move smoothly during breathing.

5. Structure of Alveoli:

- **Alveoli** are tiny, balloon-like structures at the end of the bronchioles in the lungs. They have very thin walls (one cell thick) and are surrounded by a dense network of capillaries. The thin walls and large surface area of alveoli facilitate efficient gas exchange, allowing oxygen to diffuse into the blood and carbon dioxide to diffuse out of the blood into the alveoli to be exhaled.

Q.150

The figure shows a schematic plan of blood circulation in humans with labels A to D. Identify the label and give its function/s:



1. A – Pulmonary vein – takes impure blood from body parts, PO2 = 60 mm Hg
2. B – Pulmonary artery – takes blood from heart to lungs, PO2 = 90 mm Hg
3. C – Vena Cava – takes blood from body parts to right auricle, PCO2 = 45 mm Hg
4. D – Dorsal aorta – takes blood from heart to body parts, PO2 = 95 mm Hg

Correct Answer: 4. D – Dorsal aorta – takes blood from heart to body parts, PO_2 = 95 mm Hg

Explanation:

- **D** is the **Dorsal aorta**, which is the main artery that carries oxygen-rich blood from the left ventricle of the heart to the rest of the body. The partial pressure of oxygen (PO_2) in the

blood carried by the dorsal aorta is typically around **95 mm Hg**, as it contains oxygenated blood.

Why the Other Options Are Incorrect:

1. **A – Pulmonary vein**: The pulmonary vein carries oxygenated blood from the lungs to the heart, not impure blood. It has a PO_2 of about 95-100 mm Hg, not 60 mm Hg.
2. **B – Pulmonary artery**: The pulmonary artery carries deoxygenated blood from the heart to the lungs, with a PO_2 around 40 mm Hg (not 90 mm Hg). The value given is incorrect.
3. **C – Vena Cava**: The vena cava carries deoxygenated blood from the body to the right atrium of the heart. The PCO_2 is about 45 mm Hg, which is correct, but the function description matches this vessel, not the other options.

Additional Questions:

1. What is Partial Pressure?

- **Partial Pressure** is the pressure exerted by a single type of gas in a mixture of gases. For example, in the air, the partial pressure of oxygen (PO_2) refers to the pressure exerted by oxygen molecules alone.

2. Why is it Important to Consider Partial Pressure While Studying Gas Exchange?

- Partial pressure is crucial in understanding how gases like oxygen and carbon dioxide move in and out of the blood and tissues. Gases diffuse from areas of higher partial pressure to areas of lower partial pressure. For example, oxygen moves

from the lungs (high PO_2) into the blood (lower PO_2) and from the blood (higher PO_2) into the tissues (lower PO_2).

Table of Partial Pressures:

Sl. No.	Structure	pO_2 (mm Hg)	pCO_2 (mm Hg)
1	**Alveoli (with inhaled air)**	100-104	40
2	**Tissue (before receiving oxygen)**	~40	45-50
3	**Arterial Blood**	95	40
4	**Venous Blood**	40	45-50
5	**Alveoli (with air to be exhaled)**	40	45-50

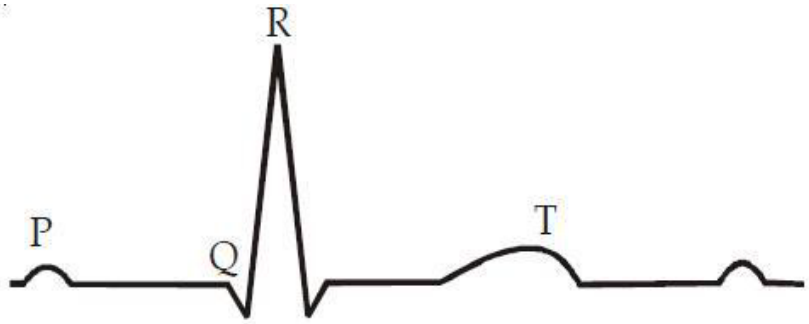
Explanation of Table:

- **Alveoli (with inhaled air)**: This is where the oxygen concentration is highest (PO_2 ~100-104 mm Hg) because fresh air is brought into the lungs.
- **Tissue (before receiving oxygen)**: Tissues have a low PO_2 (~40 mm Hg) because oxygen has been used up by cells, and a higher PCO_2 (45-50 mm Hg) due to the production of CO_2.
- **Arterial Blood**: Blood just leaving the lungs, fully oxygenated, with PO_2 around 95 mm Hg and low PCO_2 (~40 mm Hg).
- **Venous Blood**: Blood returning to the lungs from the body, deoxygenated, with PO_2 around 40 mm Hg and higher PCO_2 (45-50 mm Hg).

- **Alveoli (with air to be exhaled)**: The air here has exchanged gases with the blood, so it has lower oxygen (PO_2 ~40 mm Hg) and higher CO_2 (PCO_2 45-50 mm Hg).

Q.151

The diagram given here is the standard ECG of a normal person. The P-wave represents the:



1. Contraction of both the atria
2. Initiation of the ventricular contraction
3. Beginning of the systole
4. End of systole

Correct Answer: 1. Contraction of both the atria

Explanation:

- The **P-wave** in an ECG represents the **depolarization of the atria**, which is the electrical activity that triggers the **contraction of both atria**. This depolarization causes the atria to contract and push blood into the ventricles.

Why the Other Choices Are Incorrect:

2. **Initiation of the ventricular contraction**: This is represented by the **QRS complex**, not the P-wave. The QRS complex corresponds to the depolarization of the ventricles, leading to their contraction.
3. **Beginning of the systole**: Systole refers to the contraction phase of the heart cycle, particularly the ventricles. The beginning of systole is also associated with the QRS complex, not the P-wave.
4. **End of systole**: The end of systole is associated with the **T-wave**, which represents the repolarization (relaxation) of the ventricles.

Summary:

- **P-wave**: Atrial depolarization leading to atrial contraction.
- **QRS complex**: Ventricular depolarization leading to ventricular contraction.
- **T-wave**: Ventricular repolarization leading to ventricular relaxation.

1. What is an ECG?

- **Question**: What is an ECG and why is it important?
- **Answer**: An ECG (Electrocardiogram) is a test that measures the electrical activity of the heart. It is important because it helps doctors see how well your heart is working and can detect any problems, like irregular heartbeats or damage to the heart muscle.

2. How does an ECG work?

- **Question**: How does an ECG machine know what's happening in my heart?

- **Answer**: The ECG machine uses small sticky pads called electrodes that are placed on your chest, arms, and legs. These electrodes pick up the electrical signals that your heart produces when it beats. The machine then records these signals and displays them as waves on a graph.

3. What do the waves on an ECG mean?

- **Question**: What do the different waves (P, QRS, T) on the ECG mean?
- **Answer**: The waves on an ECG represent different stages of your heart's beating process:
    - **P-wave**: This shows the electrical activity that causes your atria (the upper chambers of the heart) to contract and push blood into the ventricles.
    - **QRS complex**: This shows the electrical activity that causes your ventricles (the lower chambers of the heart) to contract and pump blood to your lungs and the rest of your body.
    - **T-wave**: This shows the ventricles resetting and relaxing after they contract.

4. Why do doctors use ECGs?

- **Question**: Why do doctors use ECGs, and what can they find out?
- **Answer**: Doctors use ECGs to check how well your heart is working. They can find out if your heart is beating normally, if you have any problems with the heart's rhythm, or if there is any damage to your heart muscle, like from a heart attack.

5. Is getting an ECG painful?

- **Question**: Does it hurt to get an ECG?
- **Answer**: No, getting an ECG is not painful at all. The electrodes are just placed on your skin, and the test only takes a few minutes. You won't feel anything from the machine because it's just recording your heart's electrical activity.

6. What is the difference between a heartbeat and the waves on an ECG?

- **Question**: How is my heartbeat related to the waves on an ECG?
- **Answer**: Your heartbeat is the sound of your heart pumping blood, and the waves on an ECG show the electrical signals that make your heart beat. The P-wave shows the signals that make the upper part of your heart beat, and the QRS complex shows the signals that make the lower part of your heart beat.

7. Can an ECG detect a heart attack?

- **Question**: Can an ECG tell if someone is having or had a heart attack?
- **Answer**: Yes, an ECG can help doctors see if someone is having a heart attack or if they've had one in the past. During a heart attack, the heart muscle gets damaged, and this damage changes the electrical activity of the heart, which shows up on the ECG.

8. Why are there different letters (P, QRS, T) used in an ECG?

- **Question**: Why are the waves called P, QRS, and T on the ECG?
- **Answer**: The letters P, QRS, and T are just names given to the different parts of the ECG wave to make it easier for doctors

to talk about them. Each letter corresponds to a specific part of the heart's electrical activity during a heartbeat.

9. What happens if my ECG is not normal?

- **Question**: What does it mean if my ECG is not normal?
- **Answer**: If your ECG is not normal, it means there might be something unusual about your heart's rhythm or electrical activity. This doesn't always mean something is wrong, but your doctor may want to do more tests to find out what's happening.

10. Can everyone's ECG look different?

- **Question**: Do all ECGs look the same, or can they be different for different people?
- **Answer**: Everyone's ECG can look a little different because every heart is unique. However, there are certain patterns that are normal, and doctors know what these patterns should look like. They compare your ECG to these patterns to see if your heart is working properly.

Table correlating the stages of the cardiac cycle with the electrical conduction system, electrical activity, and what is observed on the ECG:

Electrical Conduction	**Electrical Activity**	**Cardiac Cycle Stage**	**Corresponding ECG Wave**
SA Node (Sinoatrial Node) initiates impulse	Atrial depolarization	**Atrial Systole**	**P-wave**

SA Node → Internodal Pathway → AV Node	Electrical impulse spreads through the atria, causing atrial contraction	Atrial systole continues, ventricles start filling	P-wave
Impulse delays slightly at AV Node	No immediate contraction; allows complete atrial contraction	**End of Atrial Systole/Start of Ventricular Systole**	End of P-wave/Start of Q wave
AV Node → Bundle of His → Bundle Branches → Purkinje Fibers	Ventricular depolarization	**Ventricular Systole**	**QRS Complex**
Impulse spreads rapidly through ventricles	Ventricles contract, pumping blood to lungs and body	Ventricular systole continues	QRS complex continues
Ventricles begin repolarization	Electrical resetting of ventricles	**Ventricular Diastole**	**T-wave**

SAN resets	No significant electrical activity	**Joint Diastole** (Atria and Ventricles relaxed)	End of T-wave/Flatline before next P-wave

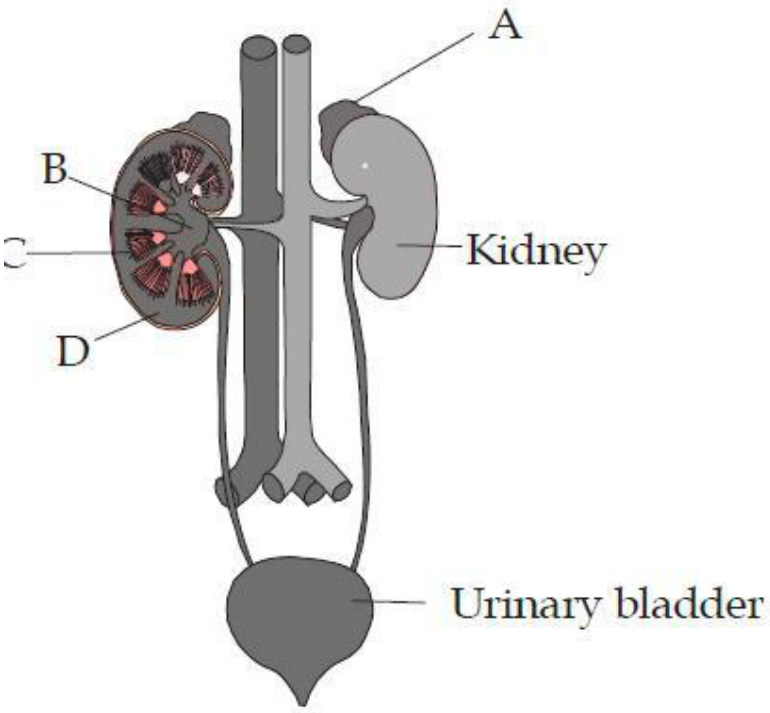
Explanation:

1. **Electrical Conduction**:
    - **SA Node (Sinoatrial Node)**: The pacemaker of the heart where the electrical impulse originates. It triggers the beginning of the cardiac cycle.
    - **AV Node (Atrioventricular Node)**: The impulse from the SA node pauses here, allowing the atria to fully contract before the ventricles start contracting.
    - **Bundle of His → Bundle Branches → Purkinje Fibers**: These pathways carry the impulse rapidly through the ventricles, ensuring a coordinated contraction.
2. **Electrical Activity**:
    - **Atrial Depolarization**: The atria are contracting due to the electrical signal from the SA node (seen as the P-wave on an ECG).
    - **Ventricular Depolarization**: The ventricles are contracting as the electrical impulse travels through the Bundle of His and Purkinje fibers (seen as the QRS complex on an ECG).
    - **Ventricular Repolarization**: The ventricles reset electrically, preparing for the next cycle (seen as the T-wave on an ECG).

3. **Cardiac Cycle Stages**:
    - **Atrial Systole**: The atria contract, pushing blood into the ventricles.
    - **Ventricular Systole**: The ventricles contract, pumping blood to the lungs and the rest of the body.
    - **Joint Diastole**: Both the atria and ventricles are relaxed, allowing the heart to fill with blood.
4. **Corresponding ECG Wave**:
    - **P-wave**: Corresponds to atrial depolarization and contraction.
    - **QRS Complex**: Corresponds to ventricular depolarization and contraction.
    - **T-wave**: Corresponds to ventricular repolarization and relaxation.

Q.152

Figure shows the human urinary system with structures labeled A to D. Select the option which correctly identifies them and gives their characteristics and/or functions:



1. A - Adrenal gland - located at the anterior part of kidney. Secretes Catecholamines which stimulate glycogen breakdown
2. B - Pelvis - broad funnel-shaped space inner to hilum, directly connected to loops of Henle
3. C - Medulla - inner zone of kidney and contains complete nephrons
4. D - Cortex - outer part of kidney and does not contain any part of nephrons

Correct Answer: 1. A - Adrenal gland - located at the anterior part of kidney. Secretes Catecholamines which stimulate glycogen breakdown

Explanation:

- **A** is the **Adrenal gland**. It sits on top of the kidney (not anterior, but superior to the kidney). The adrenal gland secretes catecholamines, such as adrenaline and noradrenaline,

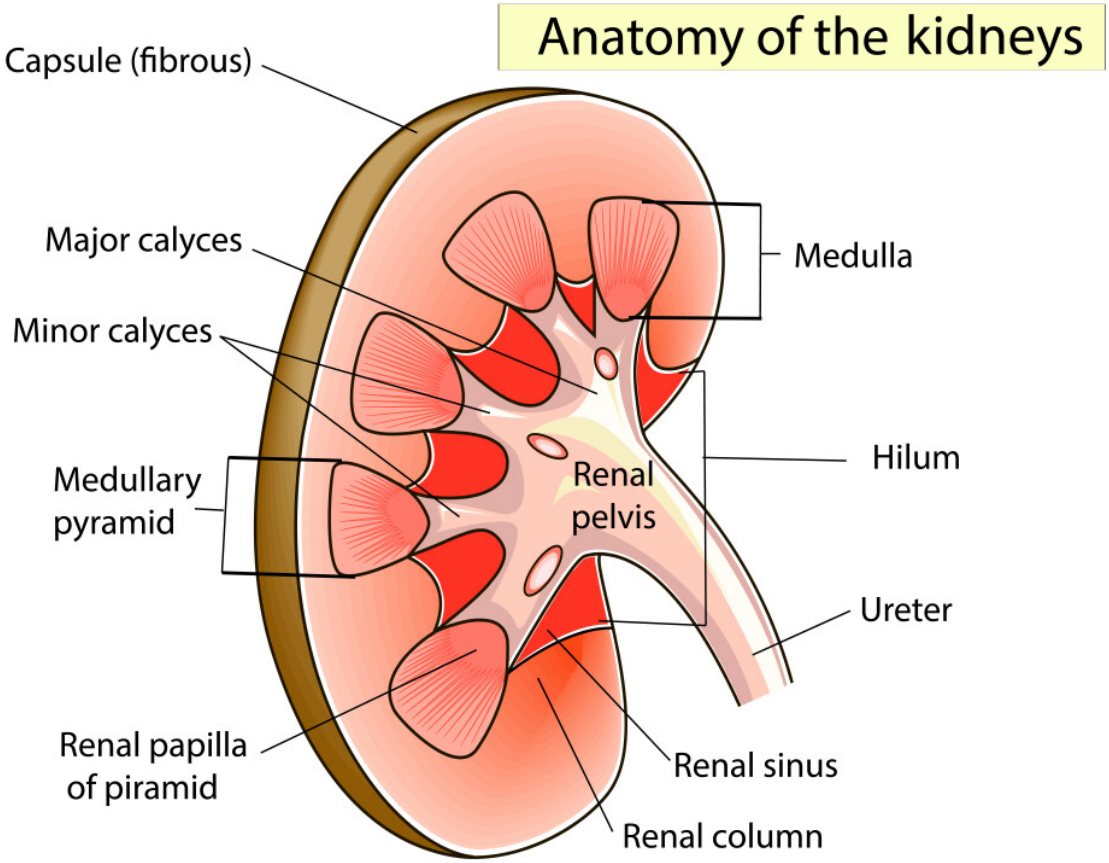
which stimulate the breakdown of glycogen into glucose, increasing blood sugar levels during stress or emergency situations.

Why the Other Options Are Incorrect:

2. **B - Pelvis**: The pelvis is indeed a broad funnel-shaped space in the kidney, but it is not directly connected to the loops of Henle. Instead, it collects urine from the calyces and channels it into the ureter.
3. **C - Medulla**: The medulla is the inner zone of the kidney, but it does not contain complete nephrons. Nephrons span both the cortex (outer part) and the medulla, with only parts of the nephron like the loop of Henle extending into the medulla.
4. **D - Cortex**: The cortex is the outer part of the kidney, and it does contain parts of the nephrons, including the renal corpuscle and proximal and distal convoluted tubules. So, the statement that it does not contain any part of the nephrons is incorrect.

Summary of Identifications:

- **A - Adrenal Gland**: Produces hormones like adrenaline and noradrenaline, which are important for the body's stress response.
- **B - Pelvis**: Collects urine from the nephrons and channels it into the ureter.
- **C - Medulla**: Contains portions of the nephrons, including the loops of Henle and the collecting ducts.
- **D - Cortex**: Contains the renal corpuscles and the beginning and end of the nephron tubules.



step-by-step trace of the path that metabolic wastes take from their presence in the blood to being excreted via the urethra:

1. Filtration in the Glomerulus:

- **Blood enters the kidney** through the renal artery, which branches into smaller arterioles and eventually into a tiny network of capillaries called the **glomerulus** within the nephron.
- **Filtration**: As blood flows through the glomerulus, water, salts, glucose, amino acids, and waste products (like urea) are filtered out of the blood into the **Bowman's capsule**. This fluid is now called **glomerular filtrate**.

2. Reabsorption in the Proximal Convoluted Tubule (PCT):

- The glomerular filtrate then enters the **proximal convoluted tubule (PCT)**.
- Here, **useful substances** like glucose, amino acids, and some salts are **reabsorbed** back into the blood. However, waste products like urea remain in the filtrate.

3. Formation of Concentrated Urine in the Loop of Henle:

- The filtrate moves into the **Loop of Henle**, which extends into the medulla of the kidney.
- **Water and salts** are reabsorbed here, helping to concentrate the urine.

4. Further Processing in the Distal Convoluted Tubule (DCT):

- The filtrate then travels to the **distal convoluted tubule (DCT)**, where more **reabsorption** of water and ions occurs, further concentrating the urine.
- **Secretion**: Additional wastes and excess ions are secreted from the blood into the DCT.

5. Collection in the Collecting Duct:

- The urine formed in the DCT flows into the **collecting duct**.
- Multiple nephrons drain into a single collecting duct, which further concentrates the urine by reabsorbing more water as it passes through the medulla.

6. Flow to the Renal Pelvis:

- The collecting ducts merge and drain the urine into the **renal pelvis**, the funnel-shaped space in the kidney that collects urine from all the nephrons.

7. Transport through the Ureter:

- Urine from the renal pelvis flows into the **ureter**, a tube that connects each kidney to the bladder.

8. Storage in the Urinary Bladder:

- The ureters transport urine to the **urinary bladder**, where it is stored until it is ready to be excreted.

9. Excretion through the Urethra:

- When the bladder is full, **stretch receptors** signal the need to urinate.
- Urine is then excreted from the body through the **urethra** during urination (micturition).

Summary of the Path:

1. **Blood** → **Glomerulus** (filtration) →
2. **Bowman's capsule** → **Proximal Convoluted Tubule (PCT)** (reabsorption) →
3. **Loop of Henle** (concentration) →
4. **Distal Convoluted Tubule (DCT)** (reabsorption and secretion) →
5. **Collecting Duct** → **Renal Pelvis** →
6. **Ureter** → **Urinary Bladder** (storage) →
7. **Urethra** (excretion).

Pathway that traces the structures in continuity from the nephron to the urethra:

1. Nephron:

- **Bowman's Capsule**: The nephron begins with Bowman's capsule, which surrounds the glomerulus where filtration of blood occurs.
- **Proximal Convoluted Tubule (PCT)**: Filtrate from Bowman's capsule enters the PCT, where reabsorption of water, ions, and nutrients occurs.
- **Loop of Henle**: The filtrate then moves into the Loop of Henle, which has a descending limb (where water is reabsorbed) and an ascending limb (where salts are reabsorbed).
- **Distal Convoluted Tubule (DCT)**: The filtrate continues to the DCT, where further reabsorption and secretion occur.
- **Collecting Duct**: The filtrate, now called urine, moves from the DCT into the collecting duct. Multiple nephrons drain into a single collecting duct.

2. Renal Pyramid:

- **Collecting ducts** from different nephrons converge as they travel through the **renal pyramids** in the medulla of the kidney.

3. Renal Papilla:

- The collecting ducts merge at the tip of the renal pyramid, called the **renal papilla**, where urine is funneled into the next structure.

4. Minor Calyx:

- Urine from the renal papilla drains into a small chamber called the **minor calyx**.

5. Major Calyx:

- Several minor calyces join together to form a larger chamber called the **major calyx**.

6. Renal Pelvis:

- The major calyces combine to form the **renal pelvis**, a funnel-shaped structure that collects urine and channels it into the ureter.

7. Ureter:

- The **ureter** is a tube that transports urine from the renal pelvis of each kidney to the urinary bladder.

8. Urinary Bladder:

- The **urinary bladder** is a muscular sac that stores urine until it is ready to be excreted.

9. Urethra:

- During urination, urine is expelled from the bladder through the **urethra**, the final structure in this pathway, leading to the outside of the body.

Summary of Pathway:

- **Nephron (Bowman's Capsule → PCT → Loop of Henle → DCT → Collecting Duct) → Renal Pyramid → Renal Papilla → Minor Calyx → Major Calyx → Renal Pelvis → Ureter → Urinary Bladder → Urethra**

Q.153

Select the correct statement with respect to locomotion in humans:

1. A decreased level of progesterone causes osteoporosis in old people.
2. Accumulation of uric acid crystals in joints causes their inflammation.
3. The vertebral column has 10 thoracic vertebrae.
4. The joint between adjacent vertebrae is a fibrous joint.

Correct Answer: 2. Accumulation of uric acid crystals in joints causes their inflammation.

Explanation:

- **Accumulation of uric acid crystals in joints** is a condition known as **gout**. Gout leads to the formation of sharp uric acid crystals in the joints, causing inflammation, pain, and swelling. This condition is common in joints like the big toe, knees, and ankles.

Why the Other Options Are Incorrect:

1. **A decreased level of progesterone causes osteoporosis in old people**: Osteoporosis is mainly associated with a decrease in **estrogen** levels, not progesterone. Estrogen plays a crucial role in maintaining bone density, and its decrease during menopause can lead to osteoporosis.
2. **The vertebral column has 10 thoracic vertebrae**: This statement is incorrect. The vertebral column actually has **12**

thoracic vertebrae. These vertebrae are part of the middle section of the spine and are connected to the ribs.

3. **The joint between adjacent vertebrae is a fibrous joint**: This is incorrect. The joints between adjacent vertebrae are **cartilaginous joints**, specifically **symphyses**, which allow for limited movement and provide cushioning between the vertebrae.

table summarizing the parts of the human body and the bones associated with each part:

Part	**Bones Associated with It**
Skull	Cranium (Frontal, Parietal, Temporal, Occipital, Sphenoid, Ethmoid), Mandible (Jawbone), Maxilla, Nasal bones, Zygomatic bones, Lacrimal bones, Palatine bones, Vomer, Inferior nasal conchae
Vertebral Column	Cervical Vertebrae (7), Thoracic Vertebrae (12), Lumbar Vertebrae (5), Sacrum, Coccyx
Thorax	Ribs (12 pairs), Sternum (Manubrium, Body, Xiphoid process)
Shoulder Girdle	Clavicle (Collarbone), Scapula (Shoulder blade)
Upper Limb (Arm)	Humerus (Upper arm), Radius (Forearm, thumb side), Ulna (Forearm, pinky side)
Wrist and Hand	Carpals (Wrist bones - 8), Metacarpals (Palm bones - 5), Phalanges (Finger bones - 14)
Pelvic Girdle	Hip bones (Ilium, Ischium, Pubis)

Lower Limb (Leg)	Femur (Thigh bone), Patella (Kneecap), Tibia (Shinbone), Fibula (Calf bone)
Ankle and Foot	Tarsals (Ankle bones - 7), Metatarsals (Foot bones - 5), Phalanges (Toe bones - 14)

Explanation:

- **Skull**: Consists of several bones that protect the brain and form the structure of the face.
- **Vertebral Column**: Made up of individual vertebrae that protect the spinal cord and provide structural support.
- **Thorax**: Includes the ribs and sternum, which protect the heart and lungs.
- **Shoulder Girdle**: Connects the arms to the axial skeleton.
- **Upper Limb**: Consists of bones in the arm, forearm, wrist, and hand.
- **Pelvic Girdle**: Supports the weight of the body and connects the spine to the lower limbs.
- **Lower Limb**: Includes the bones in the thigh, leg, ankle, and foot.

Parts and bones - sumamrised

Part	Bones Associated with It	Total Number of Bones	Total Number of Separate Bones
Skull	Cranium (8), Face (14)	22	22
Vertebral Column	Cervical (7), Thoracic (12), Lumbar (5), Sacrum (5 fused), Coccyx (4 fused)	33	26 (Sacrum and Coccyx counted as 1 each)
Thorax	Ribs (24), Sternum (3 parts)	27	25 (Sternum counted as 1)
Shoulder Girdle	Clavicle (2), Scapula (2)	4	4
Upper Limb (Arm)	Humerus (2), Radius (2), Ulna (2)	6	6
Wrist and Hand	Carpals (16), Metacarpals (10), Phalanges (28)	54	54
Pelvic Girdle	Hip bones (Ilium, Ischium, Pubis - 2 on each side, fused)	2	2
Lower Limb (Leg)	Femur (2), Patella (2), Tibia (2), Fibula (2)	8	8

Ankle and Foot	Tarsals (14), Metatarsals (10), Phalanges (28)	52	52

| **Total** | | **206** | **199** |

Explanation of Totals:

- **Total Number of Bones**: **206** (The standard count for an adult human skeleton)
- **Total Number of Separate Bones**: **199** (Counting fused bones like the sacrum and coccyx as one each)

Q.154

The characteristics and an example of a synovial joint in humans is:

1. Fluid cartilage between two bones, limited movements – Knee joints
2. Fluid filled between two joints, provides cushion – Skull bones
3. Fluid-filled synovial cavity between two bones – Joint between atlas and axis
4. Lymph-filled between two bones, limited movement – Gliding joint between carpals

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Q.155

A diagram showing axon terminal and synapse is given. Identify correctly at least two of A-D:

1. A – Receptor
   C - Synaptic vesicles
2. B - Synaptic connection
   D - K+
3. A – Neurotransmitter
   B - Synaptic cleft
4. C – Neurotransmitter
   D - Ca++

Q.156

Parts A, B, C, and D of the human eye are shown in the diagram. Select the option which gives correct identification along with its functions/characteristics:

1. A – Retina – contains photoreceptors – rods and cones
2. B – Blind spot – has only a few rods and cones
3. C – Aqueous chamber – reflects the light which does not pass through the lens
4. D – Choroid – its anterior part forms the ciliary body

Q.157

Which of the following statements is correct in relation to the endocrine system?

1. Adenohypophysis is under direct neural regulation of the hypothalamus.
2. Organs in the body like the gastrointestinal tract, heart, kidney, and liver do not produce any hormones.

3. Non-nutrient chemicals produced by the body in trace amount that act as intercellular messengers are known as hormones.
4. Releasing and inhibitory hormones are produced by the pituitary gland.

Q.158

Select the answer which correctly matches the endocrine gland with the hormone it secretes and its function/deficiency symptom:

1. Anterior pituitary - Oxytocin - Stimulates uterus contraction during childbirth
2. Posterior pituitary - Growth Hormone (GH) - Oversecretion stimulates abnormal growth
3. Thyroid gland - Thyroxine - Lack of iodine in the diet results in goiter
4. Corpus luteum - Testosterone - Stimulates spermatogenesis

Q.159

What is the correct sequence of sperm formation?

1. Spermatid, Spermatocyte, Spermatogonia, Spermatozoa
2. Spermatogonia, Spermatocyte, Spermatozoa, Spermatid
3. Spermatogonia, Spermatozoa, Spermatocyte, Spermatid
4. Spermatogonia, Spermatocyte, Spermatid, Spermatozoa

Q.160

Menstrual flow occurs due to lack of:

1. Progesterone
2. FSH
3. Oxytocin
4. Vasopressin

Q.161

Which one of the following is not the function of placenta? It:

1. Facilitates the supply of oxygen and nutrients to the embryo.
2. Secretes estrogen.
3. Facilitates the removal of carbon dioxide and waste material from the embryo.
4. Secretes oxytocin during parturition.

Q.162

One of the legal methods of birth control is:

1. Abortion by taking an appropriate medicine
2. By abstaining from coitus from day 10 to 17 of the menstrual cycle
3. By having coitus at the time of daybreak
4. By premature ejaculation during coitus

Q.163

Which of the following cannot be detected in a developing fetus by amniocentesis?

1. Klinefelter syndrome
2. Sex of the fetus
3. Down syndrome
4. Jaundice

Q.164

Artificial insemination means:

1. Transfer of sperms of a healthy donor to a test tube containing ova
2. Transfer of sperms of husband to a test tube containing ova
3. Artificial introduction of sperms of a healthy donor into the vagina
4. Introduction of sperms of a healthy donor directly into the ovary

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Q.173

The cell-mediated immunity inside the human body is carried out by:

1. T-lymphocytes
2. B-lymphocytes
3. Thrombocytes
4. Erythrocytes