BIOLOGY QUESTION BANK

Answer-1 An inhibitory postsynaptic potential (IPSP) is a kind of synaptic potential that makes a postsynaptic neuron less likely to generate an action potential.

An excitatory postsynaptic potential (EPSP) is a temporary depolarization of postsynaptic membrane caused by the flow of positively charged ions into the postsynaptic cell as a result of opening of ligand-sensitive cells.

Answer-2 Value of resting potential = -70 mV
Value of action potential = -50 to -55 mV

Answer-3 ECG → Electrocardiography
EEG → Electroencephalogram

Answer-4
- After the gases have scattered in the lungs causing the blood to become oxygenated, leaving carbon dioxide, the next phase of oxygen-rich blood transport to the tissues takes place.
- Meanwhile, the next round of deoxygenated blood needs to be brought to the lungs for the cycle to continue.

- In the bloodstream, the transportation of gases occurs all through the body which is contributed to the cardiovascular system comprising of the blood vessels and the heart.
- The blood carrying oxygen leaves the lungs to flow into the heart through the pulmonary veins which are pumped to the rest of the body from the left ventricle through the aorta and its corresponding branches.

Answer-5 A bioelectrode is a conductor that is designed to serve as an interface between biological structures and electronic systems. Its function is to either sense and measure (passive) the electrical activity within the biological structure of or stimulate (active) it by inducing external electric potential.

Answer-6 Two properties of bioelectrodes are :-
- They should not polarize when a current flows through them.
- They should establish a good contact with the body and not cause motion.

Answer-7 Two types of surface electrodes are :-
(i) Metal plate electrodes
(ii) Suction cup electrodes.

Answer-8 The main difference between the two is: depolarization is described as the loss of resting membrane potential as a result of the alteration of the polarization of cell membrane while repolarization is described as the restoration of the resting membrane potential after every polarization event.

Answer-9 Synapses connect one neuron to another and are thus responsible for the transmission of messages from the nerves to the brain and vice versa. Neurons communicate with one another at junctions called synapses. At a synapse, one neuron sends a message to a target brain cell or muscle cell.

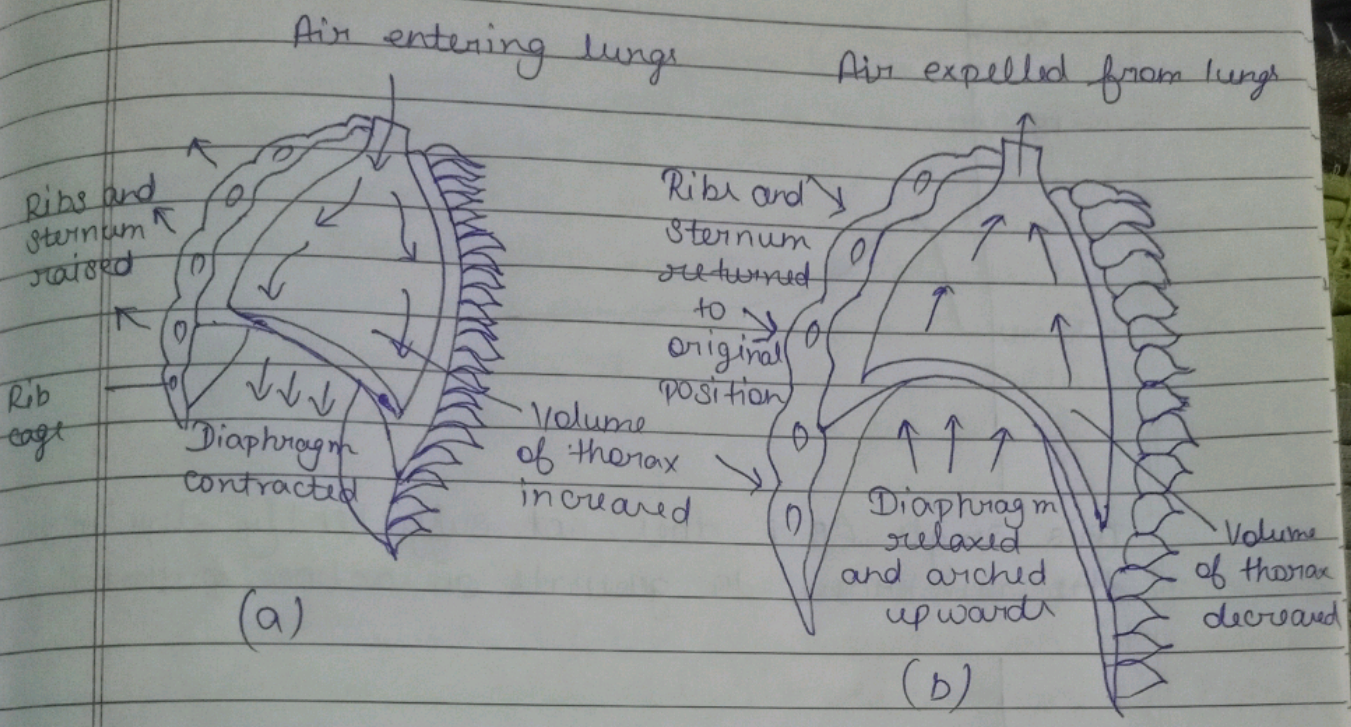
- The synapse, rather, is a small pocket of space between two cells where they can pass messages to communicate. A single neuron may contain thousands of synapses. In fact, one type of neuron called the Purkinje cell, found in the brian's cerebellum, may have as 100,000 synapses.
- Synapses are part of the circuit that connects sensory organs such as those that detect pain or touch.
- Synapses are also important within the brain and play a vital role in the process of memory formation.

Answer-10 Mechanism of respiration in man takes place in two phases, namely inspiration and expiration. Inspiration is the process of inhaling air into the lungs. During inspiration, the muscles of diaphragm contract and the diaphragm moves downward. This results in the increase in the volume of the chest cavity. The air pressure inside the chest cavity decreases. The oxygenated air present outside the body being at high-pressure flow rapidly into the lungs. In the lungs, oxygenated air reaches the alveoli. Alveoli are thin walled and are sourrounded by a network of blood capillaries. The oxygen passes through the walls of the alveoli into the blood present in blood capillaries. The oxygen is then supplied to all the tissues of the body. From the tissues, the waste, carbon dioxide is absorbed by blood and carried to the alveoli of lungs for expiration. Expiration is the process of exhaling air from lungs. During expiration, the muscles of diaphragm move upward. This results in the decrease in the volume of the chest cavity. The air pressure inside the chest cavity increases. This pushes out carbon dioxide outside the body.

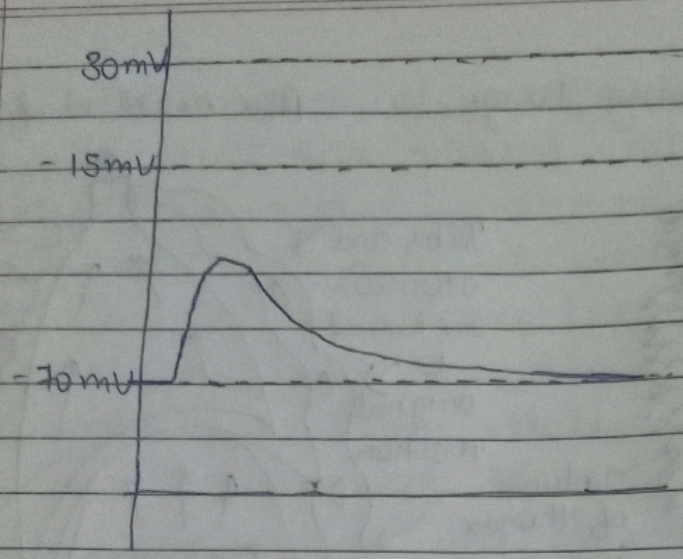
Mechanism of breathing

(a) inspiration

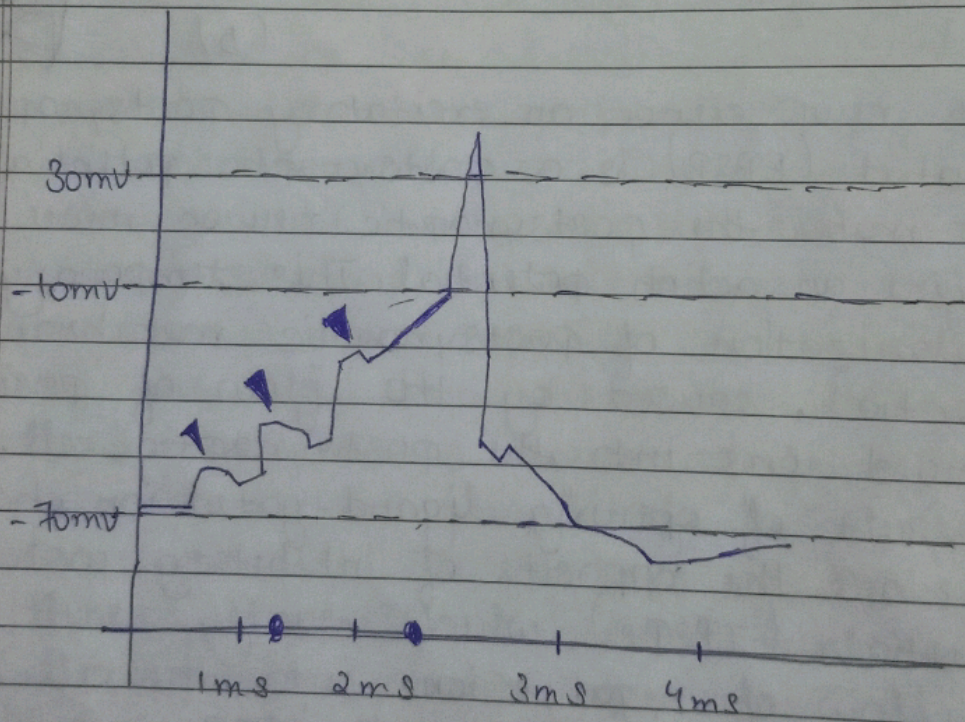
(b) expiration



Answer-11 In neuroscience, an excitatory postsynaptic potential (EPSP) is a postsynaptic potential that makes the postsynaptic neuron more likely to fire an action potential. This temporary depolarization of postsynaptic membrane potential, caused by the flow of positively charged ions into the postsynaptic cell, is a result of opening ligand-gated ion channels. These are the opposite of inhibitory postsynaptic potentials (IPSPs), which usually result from the flow of negative ions into the cell or positive ions out of the cell. EPSPs can also result from a decrease in outgoing positive charges, while IPSPs are sometimes caused by an increasing increase in positive charge outflow. The flow of ions that causes an EPSP is an excitatory postsynaptic current (EPSC).



This single EPSP does not sufficiently depolarize the membrane to generate an action potential.



The summation of these three EPSPs generates an action potential.

Answer 12 (i) An electrocardiogram (ECG) is a simple test that can be used to check your heart's rhythm and electrical activity.
Sensors attached to the skin are used to detect the electric signals produced by your heart each time it beats.
These signals are recorded by a machine and are looked at by a doctor to see if they're unusual.

(ii) Electromyography (EMG) is a diagnostic procedure to assess the health of muscles and the nerve cells that control them (motor neurons). EMG results can reveal nerve dysfunction, muscle dysfunction or problems with nerve-to-muscle signal transmission.
Motor neurons transmit electric signals that cause muscles to contract. An EMG uses tiny devices called electrodes to translate there signals into graphs, sounds or numerical values that are then interpreted by a specialist.

(iii) An electroencephalogram (EEG) is a test that measures electrical activity in the brain using small, metal discs (electrodes) attached to the scalp. Brain cells communicate via electrical impulses and are active all the time, even during asleep. This activity shows up as wavy lines on an EEG recording.
EEG helps us to diagnose brain disorders like brain tumors, brain damage from head injury etc.

(iv) A pulse oximeter is a device used to monitor the amount of oxygen carried in the body. This noninvasive tool attaches painlessly to your fingertip, sending two wavelengths of light through the finger to measure your pulse rate and how much oxygen is in your body. Once the oximeter finishes its assessment, its screen will display the percent of oxygen in your blood coming from your heart - as well as your current pulse rate.

Answer-13 The action of breathing in and out is due to changes of pressure in thorax, in comparison with the outside. This action is also known as external respiration. When we inhale the intercoastal muscles (between the ribs) and diaphragm contract to expand the chest cavity. The diaphragm flattens and moves downwards and the intercoastal muscles moves the rib cage upwards and out.

Inspiration :- This increase in size decreases the internal air pressure and so air from the outside (at a now higher pressure that inside the thorax) rushes into the lungs to equalise the pressures.

Expiration :- When we exhale the diaphragm and intercoastal muscles relax and return to their resting positions. This reduces the size of the thoraic cavity, thereby increasing the pressure and forcing air out of the lungs.

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Answer-14 Same as (iv) part of answer 12.

Answer-15 Bioelectrodes should possess the following properties:-

- They should be good conductors.
- They should have low impedance.
- They should not polarize when a current flows through them.
- They should establish a good contact with the body and not cause motion.
- Potentials generated at the metal electrolyte (jelly) surface should be low.
- They should not catch itchings, swelling or discomfort to the patient for example the metal should not be toxic.
- They should be mechanically rugged.
- They should be chemically inert.
- They should be easy clean.

Answer-16 Application of bioelectrodes:-

(i) Bioelectrodes are used in cardiac monitoring.

(ii) Bioelectrodes are used in sleep encephalography.

(iii) Bioelectrodes are used in diagnostic muscle activity.

(iv) Bioelectrodes are used in infant cardiopulmonary monitoring.

(v) Bioelectrodes are used in implanted telemetry of biopotentials.

Answer-17 Surface electrodes are those which are placed in contact with the skin of the subject in order to obtain bioelectric potentials from the surface.

Body surface electrodes are of many sizes and types. In spite of the type, any surface electrode can be used to sense ECG, EEG, EMG, etc.

There are many types of surface skin electrodes are as following:-

(i) Immersion electrodes were simply buckets of saline solution in which the subject placed his hands and feet.

(ii) Plate electrodes have generally smaller contact area and they do not totally seal on the patient.

(iii) Floating electrodes can eliminate the movement errors which is a main problem with plate electrodes.

(iv) Suction electrodes are well suited for the attachment to flat surfaces of body and to regions where the underlying tissue is soft, due to the presence of contact surface.

(v) Ear-clip & scalp electrodes are widely used in the measurement of EEG exclusively.

Answer-20 ECG is a graphic recording or display of the time variant voltages generated by the muscles of heart during cardiac cycle.

1. One complete heart Or cardiac cycle includes 3 waves → P wave, QRS wave and T wave.

2. P waves → Atrial depolarization & contraction → amplitude → 0.1 to 0.3 mV

3. QRS waves → Complex waves → ventricular depolarization & contraction is occured. And also Repolarization of Atria.

4. T wave → Repolarization of ventricles.

5. PQ interval → It indicates the time between the onset of atrial muscle depolarization & onset of the ventricle muscle depolarization Time: 0.15 sec — 0.16 sec

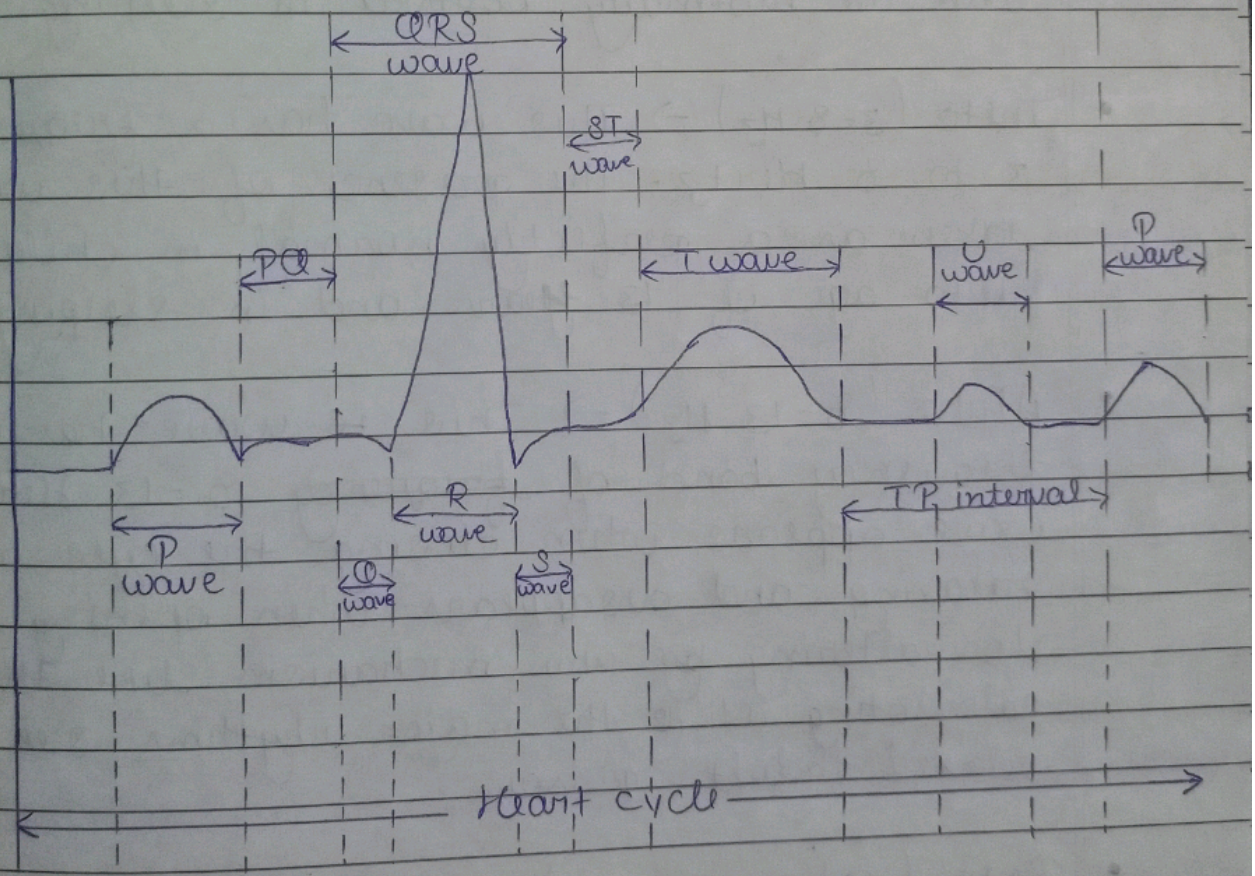
6. QRS interval → It indicates the time between onset of ventricle muscle depolarization & onset of ventricle muscle contraction. Time: 0.09 sec

7. ST interval → Time interval between the onset of ventricle muscle contraction & the start of ventricle Repolarization. Time: 0.05 to 0.15

8. TP interval → It is the time between two successive ventricular depolarization.

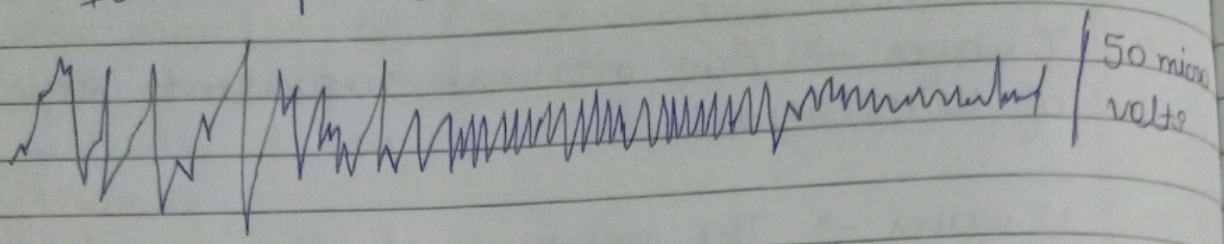
9. T waves → This interval represent Repolarization of both ventricles.

10. U waves → The presence of U wave is believed to be the result of after potential in the ventricular muscle.



Answer-21

Delta | Theta | Alpha | Beta



- Delta (1-3 Hz) → This band has a frequency of 3 Hertz or lesser it tends to be the highest in amplitude and the lowest frequency this wave is normally observed in sleeping infants.

- Theta (3-8 Hz) → This wave has a frequency of 3 to 8 Hertz. The presence of this wave is taken as a perfectly normal in children upto age of 13 years and in sleeping adults.

- Alpha (8-13 Hz) → This wave has a frequency band of 8-13 Hertz. This wave appears when closing the eyes and relaxing and disappears when opening the eyes for altering by any mechanism like thinking or calculating. It is the major rhythms seen in normal relaxed adult persons.

- Beta (above 13 Hz) → This wave represents fast activity and has a frequency band of 13 Hzs and above upto 30 Hertz. It is the dominant rhythm in patients who are alert or anxious or have their eyes open and is generally regarded as a normal rhythm.

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Answer-22 Action Potential

An action potential is a rapid rise and subsequent fall in voltage or membrane potential across a cellular membrane with a charcteristic pattern. Sufficient current is required to initiate a voltage response in a cell membrane; if the current is insufficient to depolarize the membrane to the threshold level, an action potential will not fire. Examples of cells that signals via action potentials are neurons & muscle cells.

Resting Potential

A resting (non-signaling) neuron has a voltage across its membrane called the resting membrane potential, or simply the resting potential. The resting potential is determined by concentration gradients of ions across the membrane and by membrane permeability to each type of ion. In a resting neuron, there are concentration gradients across the membrane for Na^+ and K^+ ions. Ions move down their gradients via channels, leading to a separation of charge that creates the resting potential.

Synapses

Neurons communicate with one another at junctions called synapses. At a synapse, one neuron sends a message to a target neuron – another cell. Most synapses are chemical; these synapses communicate using chemical messengers. Other synapses are electrical; in these synapses, ions flow directly between cells.
At a chemical synapse, an action potential triggers the presynaptic neuron to release neurotransmitters. These molecules bind to receptors on the post synaptic cell and make it more or less likely to fire an action potential.

Answer-23 Depolarization

Depolarization occurs when a stimulus reaches a resting neuron. During the depolarization phase, the gated sodium ion channels on the neuron's membrane suddenly open and allow sodium ions (Na^+) present outside the membrane to rush into the cell. As the sodium ions quickly enter the cell, the internal charge of the nerve changes from -70 mV to -55 mV.

Repolarization

In repolarization, the potassium channels open to allow the potassium ions (K^+) to move out of membrane (efflux). As this happens, the electrical potential gradually becomes more negative inside the nerve cell until the original resting potential of -70 mV is attained again.

Hyperpolarization

Hyperpolarization is a change in a cell's membrane potential that makes it more negative. It is the opposite of a depolarization. It inhibits action potentials by increasing the stimulus required to move the membrane potential to the action potential threshold.

Hyperpolarization is often caused by efflux of K^+ (a cation) through K^+ channels, or influx of Cl^- (an anion) through Cl^- channels.

Answer-24(i) Microelectrodes are very small electrodes (about one micrometer in dimensions) that can be inserted into the plasma membrane while not destroying or causing damage to the cell. They are used for studying the electrophysiology of living cells and tissues. They are used to record the neural signals or the electrical stimulation of the nervous tissue. They are used specifically for potential recording, current injection, introduction of ion-selective resins into the cell

in order to measure the resting and action potentials or the free concentration of cytosolic constituents.

(ii) A fine wire through which electrical current may flow when attached to a power source, used to carry high frequency electrical currents that create heat or destroy diseased tissue (called radiofrequency ablation) or seal blood vessels. There are two types of needle electrodes: a simple straight needle, and a straight, hollow needle that contains several retractable electrodes that extend when needed. Needle electrodes may also be a part of devices that monitor electrical activity for diagnostic purposes such as in the performance of electromyography and nerve conduction studies.

Answer-25 (i) ECG

Electrocardiography is the process of producing an electrocardiogram, a recording of the heart's electrical activity. It is an electrogram of the heart which is a graph of voltage versus time of the electrical activity of the heart. using electrodes placed on the skin. These electrodes detects the small electrical changes that are a consequence of cardiac muscle depolarization followed by repolarization during each cardiac cycle (heartbeat).

(ii) EEGr

An electroencephalogram (EEGr) is a test used to find problems related to electrical activity of the brain.
An EEGr tracks and records brain wave patterns. Small metal discs with thin wires (electrodes) are placed on the scalp, and then send signals to a computer to record the results. Normal electrical activity in the brain make a recognizable pattern. Through an EEGr, doctors can look for abnormal patterns that indicate seizures and other problems.

(iii) EMGr

Electromyography (EMGr) is a diagnostic procedure to assess the health of muscles and the nerve cells that control them (motor neurons). EMGr results can reveal nerve dysfunction, muscle dysfunction or problems with nerve to muscle signal transmission.
Motor neurons transmit electrical signals that cause muscles to contract. An EMGr uses tiny devices called electrodes to translate these signals into graphs, sounds or numerical values that are then interpreted by a specialist.

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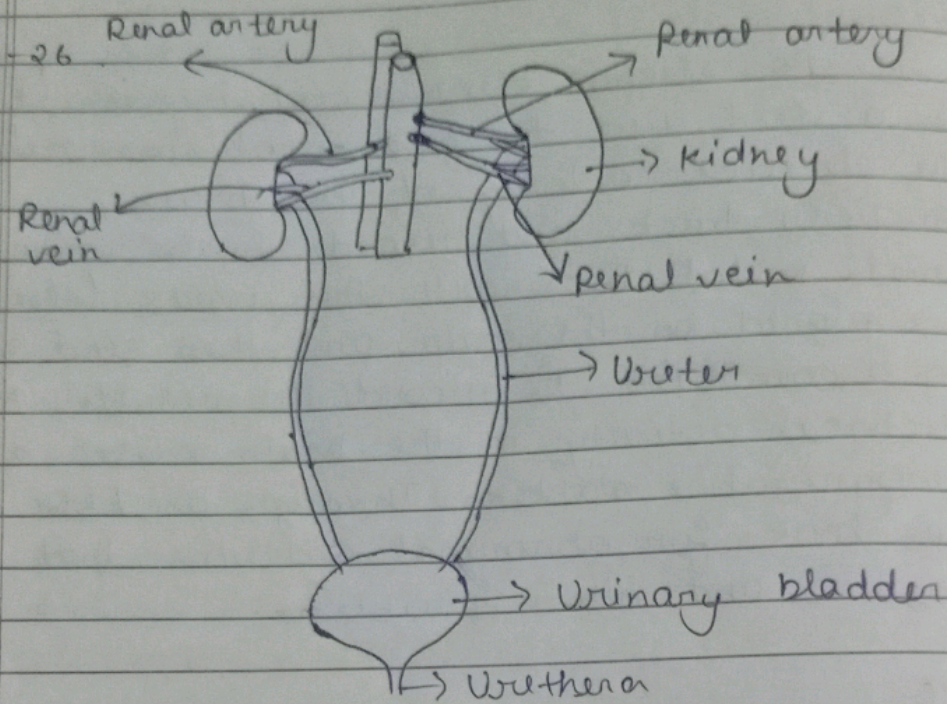
Answer-26.



(iii)

The excretory system ~~mainly~~ ~~contai~~ in humans mainly includes a pair of kidneys, a pair of ureters, urinary bladder and urethera

(i) Kidneys :- Kidney filter the blood and remove nitrogenous waster and other toxic substances from the blood and help in urine formation. An average person has around 5 litres of blood which the kidney filter about 400 times a day.

(ii) Ureter :- The ureters are the tubes that carry urine from kidneys to the urinary bladder.

(iii) Urinary bladder – It is the reservoir of urine and stores urines until it is excreted out.