1. Describe the function of the following:

(i) Gills Block
An: Gills are tissues that are like short threads, protein structures called filaments. These filaments have many functions including the transfer of ions and water, as well as the exchange of oxygen, carbon dioxide, acids and ammonia. ... The gills push the oxygen-poor water out through openings in the sides of the pharynx.

(ii) Pacemaker in mammalian heart
An: Sino-atrial nodal cells of mammalian hearts: ionic currents and gene expression of pacemaker ionic channels. The cardiac pacemaker is a sino-atrial (SA) nodal cell. The signal induced by this pacemaker is distributed over the heart surface by a specialised conduction system and is clinically recorded as the ECG.

(iii) Lung surfactant
An: Lung surfactant, a lipo-protein complex, is a highly surface-active material found in the fluid lining the air-liquid interface of the alveolar surface. Surfactant plays a dual function of preventing alveolar collapse during breathing cycle and protection of the lungs from injuries and infections caused by foreign bodies and pathogens. Varying degrees of structure-function abnormalities of surfactant have been associated with obstructive lung diseases, respiratory infections, respiratory distress syndromes, interstitial lung diseases, pulmonary alveolar proteinosis, cardiopulmonary bypass surgery and smoking. For some pulmonary conditions, especially respiratory distress syndrome, surfactant therapy is on the horizon.

(iv) Salt glands in marine birds
An: The avian salt gland has two main ducts which are a medial and a lateral. Salt gland activations occurs from increased osmolality in the blood, stimulating the hypothalamic information processing, sending signal through the parasympathetic nerve activating vasodilation, the release of hormones (acetylcholine and vasoactive intestinal peptide). Acetylcholine binds to the receptor on the basolateral membrane of the gland. This in turn activates calcium release in the epithelial cells, opening potassium channels (flowing potassium out of the cells) on the basolateral membrane and chloride channels on the apical membrane to flow out of the cell. Ions are moved into the epithelial cells by a Na-K-Cl cotransporter, also in the basolateral membrane. Increases in sodium opens the sodium-potassium ATPase channels, removing the excess sodium back out across the basolateral membrane and allowing for potassium to come into the cell. An electrical gradient is formed from the chloride ions, allowing sodium to be passed through the tight junctions of the epithelial cells into the salt gland along with minimal amounts of water. As well, mitochondria rich cells are associated with changes in salt concentration, increasing with higher amounts and decreasing with lower exposure, assisting in the movement of salts. These glands excrete the hypertonic sodium-chloride (with few other ions) by the stimulus of central and peripheral osmoreceptors and volume receptors.

(v) Neurotransmitter endorphin
An: There are some chemicals that are present in the human brain that allow an impulse to pass through a nerve cell to another. These are called neurotransmitters. An example of a neurotransmitter is Serotonin. This helps in transmitting nerve impulses through various neurons or even through neurons and muscles. The axon endings of motor neurons contain neurotransmitters. Here, they stimulate the muscle fibers. These pituitary and adrenal glands produce the neurotransmitters. The impulse goes from the first nerve cell through the axon. Then it travels to the axon terminal and the synaptic knobs. Each of these synaptic knobs is in tune with a cell body of another specific neuron. The synaptic knobs also contain neurovesicles that release neurotransmitters. In it, Endorphin is a neurochemical. Endorphin contains two parts – endo and orphan. Endo and orphan stand for the words endogenous and morphine. The term endorphin indicates a substance that is similar to morphine and that originates within the body. Endorphin is released by the pituitary glands and the hypothalamus in vertebrates. When an impulse hits the spinal cord, the body produces endorphins which in turn prevent the release of more signals causing pain. Extreme stress, excitement, exercise, or even intake of spicy food cause this production. Endorphins are similar to opiates because they produce analgesia. This creates a pain-free, relaxed and relieving situation. In other words, endorphins act as genuine pain removers and they help in bearing the pain for an extended period.

It is interesting to note that the word endorphin rush is generally used in the context of exhilaration. This could be related to stress, or pain as mentioned above. The movement of molecules is redirected to the receptor sites seen on the post synaptic membrane after the neurotransmitters are released. The study of the actions of neurotransmitters most often lead to finding important information related to various conditions of mental disorders and other ailments.

Endorphin denotes a pharmacological activity. This activity corresponds to the activities that are performed by the corticosteroid biochemicals, in contrary to a peculiar chemical formulation. Endorphin is structured similar to the opioid such as opium, heroin etc. Another fact is that endorphin also performs similar functions. The opioid medicines work on the human body by attaching themselves to the receptor sites of endorphin. Endorphin is also perceived as a neurotransmitter that allows animals like bears to hibernate. In these cases, it slows down the general metabolism which results in hibernation.