**1).** Long-term regulation involves mainly the regulation of extracellular fluid volume. There are several physiological mechanisms that regulate blood pressure in the long-term they include:

1. **Renin-angiotensin-aldosterone system (RAAS).** *Renin* is a peptide hormone released by the granular cells of the**juxtaglomerular apparatus** in the kidney. It is released in response to: Sympathetic stimulation, Reduced sodium-chloride delivery to the distal convoluted tubule, Decreased blood flow to the kidney.
2. **Anti-Diuretic Hormone (ADH)** The second mechanism by which blood pressure is regulated is release of Anti Diuretic Hormone (ADH) from the OVLT of the hypothalamus in response to thirst or an increased plasma osmolarity.
3. **Atrial natriuretic peptide (ANP)** is synthesised and stored in cardiac myocytes. It is released when the atria are stretched, indicating of high blood pressure. ANP acts to promote sodium excretion. It dilates the **afferent arteriole** of the glomerulus, increasing blood flow (GFR). Moreover, ANP inhibits sodium reabsorption along the nephron. Conversely, ANP secretion is low when blood pressure is low.
4. **Prostaglandins:** act as local vasodilators to increase GFR and reduce sodium reabsorption. They also act to prevent excessive vasoconstriction triggered by the sympathetic nervous and renin-angiotensin-aldosterone systems.

**2).** a. **Pulmonary circulation** is the portion of the circulatory system which carries deoxygenated blood away from the right ventricle, to the lungs, and returns oxygenated blood to the left atrium and ventricle of the heart.  It begins on the right ventricle and ends on the left atrium

b. **Circle of Willis** is the joining area of several arteries at the bottom (inferior) side of the brain. At the Circle of Willis, the internal carotid arteries branch into smaller arteries that supply oxygenated blood to over 80% of the cerebrum.

c. **Splanchnic circulation** consists of the blood supply to the gastrointestinal tract, liver, spleen, and pancreas. It consists of two large capillary beds partially in series. The small splanchnic arterial branches supply the capillary beds, and then the efferent venous blood flows into the PV.

d. **Coronary circulation** is the circulation of blood in the blood vessels that supply the heart muscle (myocardium). Coronaryarteries supply oxygenated blood to the heart muscle, and cardiac veins drain away the blood once it has been deoxygenated.

e**. Cutaneous circulation** is the circulation and blood supply of the skin.

**3).** The integrated response to servere exericse involves fourfold to fivefold increases in cardiac output, which are due primarily to increases in cardiac rate and to a lesser extent to augmentation of stroke volume. The increase in stroke volume is partly due to an increase in end-diastolic cardiac size (Frank-Starling mechanism) and secondarily due to a reduction in end-systolic cardiac size. The full role of the Frank-Starling mechanism is masked by the concomitant tachycardia. The reduction in end-systolic dimensions can be related to increased contractility, mediated by beta adrenergic stimulation. Beta adrenergic blockade prevents the inotropic response, the decrease in end-systolic dimensions, and approximately 50% of the tachycardia of exercise.

The enhanced cardiac output is distributed preferentially to the exercising muscles including the heart. Blood flow to the heart increases four-fold to fivefold as well, mainly reflecting the augmented metabolic requirements of the myocardium due to near maximal increases in cardiac rate and contractility. Blood flow to the inactive viscera (e.g., kidney and gastrointestinal tract) is maintained during severe exercise.