1. **Heart** is a pumping organ that lies beneath sternum in mediastinum. Apex of the heart is tilted to the left side. The left side ventricle beats stronger and aorta passes from the left side; we feel the heart on left side of chest.

2. **Pericardium** – It is a serous membrane; outer parietal and inner visceral pericardium, cavity filled with pericardial fluid makes the frictionless movements of heart. Outer pericardium is fixed to diaphragm.

3. 3- layers of heart wall = Epicardium – connective tissue, Myocardium – is the thickest middle layer of cardiac muscles and inner Endocardium – endothelium. Fig 12.4a

4. **Flow of Blood** through heart and records Pulmonary and Systemic circuits. Superior and Inferior Vena cava → Right Atrium → Tricuspid valve → right ventricle → semi-lunar valve → pulmonary trunk → pulmonary artery → Capillary bed in Lungs → pulmonary veins → left atrium → bicuspid valve → left ventricle → semi-lunar valve → aorta → capillary beds in tissues of body → superior and inferior vena cava. Fig 12.1 and 12.5

5. **Heart Sounds**: Lubb – 1st sound of heart caused due to closure of AV valves; Dupp – is the 2nd sound of heart caused due to closure of Semi-lunar valves. Lubb-Dupp………………………… Lubb-Dupp………………………… Lubb-Dupp…………………………

6. **Bicuspid valve = Mitral's valve** is formed of 2 cusps and **tricuspid valve** is formed of 3 cusps. Fig 12.6

7. **Chordae Tendinae** – White collagenic cords are attached to cusps of valves at one end and fixed to muscles of ventricles at the other end. These help in keeping the cusps in position and prevent back-flow of blood into atria. Fig 30.2b

8. **Coronary circulation**: left and right coronary arteries supply blood to the muscles of heart. This blood is returned through coronary veins and coronary sinus to right atrium. Fig 12.7


10. **Contraction of heart = Systole**, Relaxation of heart = **diastole**

11. Fig 12.8 explains the difference between skeletal and cardiac muscle fiber contractions.

<table>
<thead>
<tr>
<th>Skeletal muscle fiber</th>
<th>Cardiac muscle fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spike like Action potential, lasts 2-3 milliseconds</td>
<td>Action potential is wide, lasts for 250 milliseconds</td>
</tr>
<tr>
<td>results in a quick contraction, completed in &lt; 100milliseconds</td>
<td>Results in slow contraction/relaxation, 300milliseconds</td>
</tr>
<tr>
<td>Suits for quick actions of skeletal muscles</td>
<td>Suits for pumping function, gives time for filling blood</td>
</tr>
</tbody>
</table>
Conduction system: Fig 12.9

12. **Conduction system** is formed of special cardiac muscle fibers and has 5 parts: SA node, AV node, AV bundle, Bundle branches, and Purkinje fibers.
   
a. **SA Node** is sino-atrial node. It lies in RA near the base of superior vena cava. It acts as the pace maker of heart because it possesses a spontaneous rhythmic contraction. It stimulates the atria for contraction. SA node also stimulates AV node.
   
b. **AV Node** is present in interatrial septum. It receives the impulse from SA node and passes the action potential to AV bundle

13. **ECG** = Electrocardiogram – detects and records electrical activity of cardiac muscles and the time intervals taken for different parts of cardiac cycle. ECG detects abnormal pattern of cardiac activity = **cardiac arrythmias**. ECG can also measure the electrical potential generated in p-wave and qrs-complex. It gives the information if heart mass has increased or decreased. Fig 12.10

14. P- wave impulses travel from SA node to atria and result in atrial systole.

15. QRS – complex impulses travel from AV node to ventricles and result in ventricular contraction = ventricular systole.

16. T – wave indicates relaxation of ventricles = ventricular diastole.

17. **Cardiac Cycle** fig 12.11. Study the notes accompanying the figure and remember them.

18. **Flow of blood** is Superior and Inferior Vena cava → Atria → Ventricles → Pulmonary and Aortic trunks. The part receiving blood always has lower blood pressure than part passing blood into it.

19. **Stroke Volume** is amount of blood pumped by one ventricle in one systole. Average is 80mls.

20. **Cardiac output** is amount of blood pumped / minute by one ventricle. Average is 80mls X 72 heart beats = 5.6L.

21. **Hormonal Regulation** – Epinephrine and Norepinephrine increase both heart beat and stroke volume. Thyroid hormone and Glucagon increase force of contraction = stroke volume.

22. **Sympathetic NS** – post ganglionic nerve fibers release Norepinephrine and increase both heart beat and stroke volume. Stimulant.