

3:30 PM

12th Oct

360/360

180/180

130 Oct

=> match

Sr/Jr

Human Circulatory System - VI

Course on Human Physiology: Body Fluids & Circulation

from 14th Oct → Endocrine System

176
180

2021



CARDIAC CYCLE

The cardiac events that occur from the beginning of one heart beat to beginning of the next are called cardiac cycle. The action potential travels rapidly through both atria and then through the AV bundle into the all of ventricles. Because of special arrangement of the conducting system from the atria to the ventricles, there is a delay of more than $1/10$ th a second between passage of the cardiac impulse from the atria into the ventricles. This allows the atria to contract ahead of the ventricles, thereby pumping blood into the ventricles before the strong ventricular contraction begins.

Thus the atria are the primer pumps for the ventricles, and ventricles then provide the major source of power for moving blood through the vascular system.

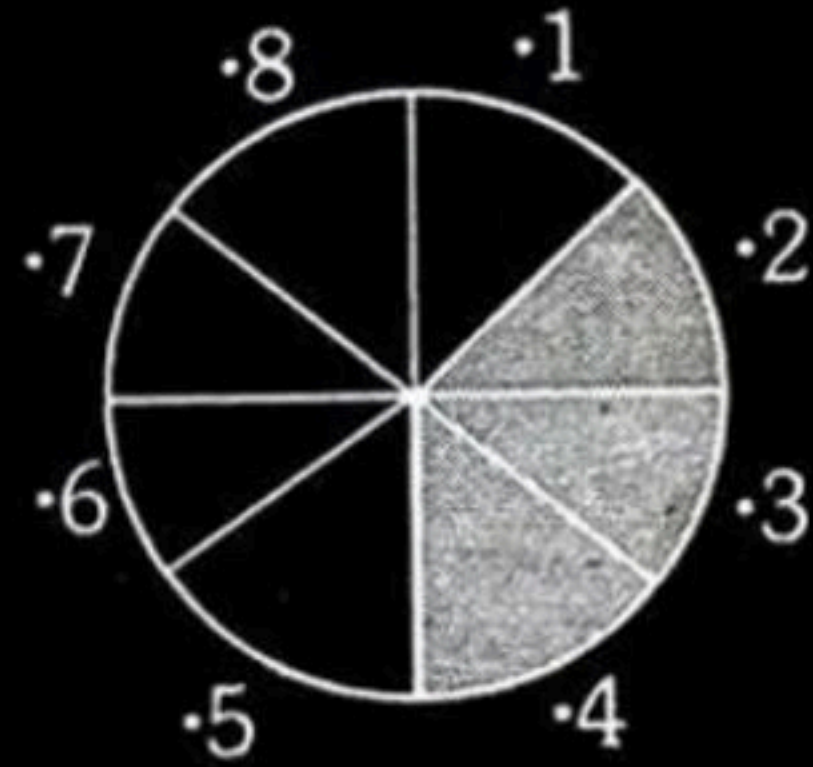
Cardiac-Cycle - The process of heart-beat begins from the time of embryonal development. Once the heart beat starts, it continues throughout the life. In resting stage of man in 1 minute the heart beats around **72** times and during this 1 minute, 5 litres of blood is pumped to different parts of the body through heart through left ventricle.

- The serial wise or sequential changes which takes place in the heart are called cardiac-cycle.
- The contraction of the auricles is termed as Auricular systole or Atrial-systole, and their relaxation is called Atrial diastole.
- Same way the contraction and relaxation of ventricles is termed as ventricular systole and ventricular Diastole.
- The time of cardiac-cycle is the reverse ratio of heart beat per minute. If heart beat per minute is 72, then the time of cardiac-cycle is $60/72 = 0.8$ seconds.

Cardiac Events



Atria



Ventricles

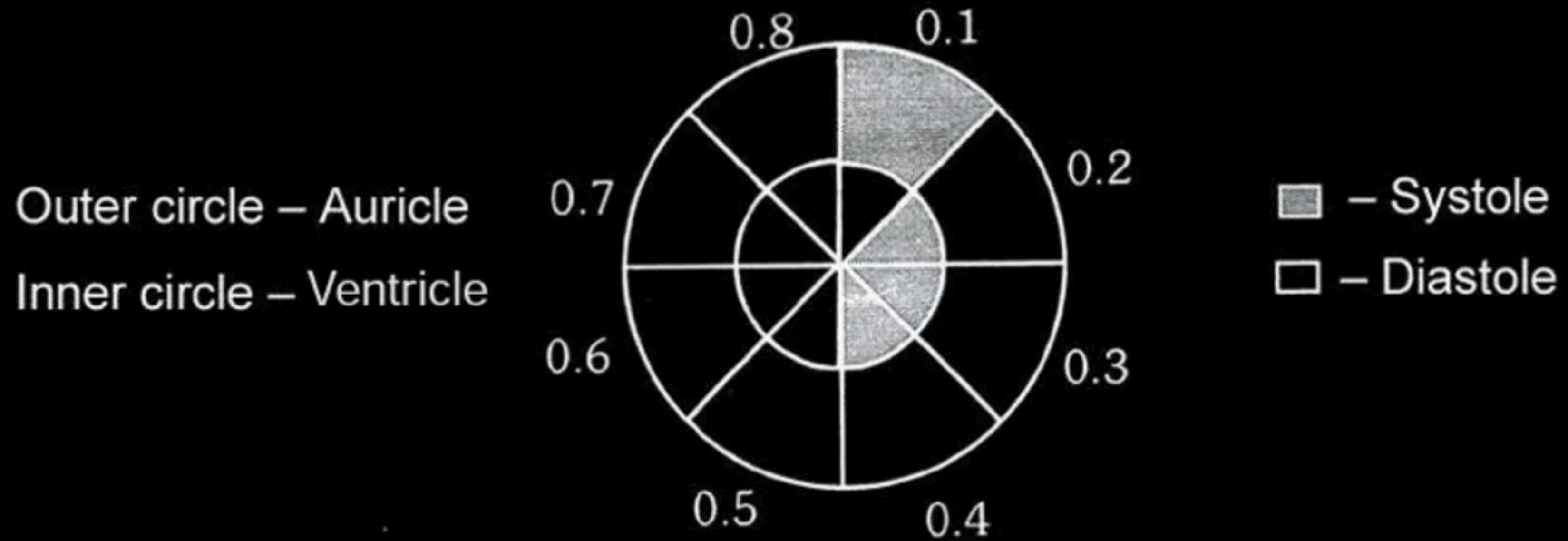
– Systole
 – Diastole

Joint Diastole. $8 - .4 = 4$ sec. (Period during which entire heart is in Diastole)

In a single cardiac cycle of man -

(1) Auricular systole	=	0.1 sec	} 0.8 sec
(2) Auricular diastole	=	0.7 sec	
(3) Ventricular systole	=	0.3 sec	} 0.8 sec
(4) Ventricular diastole	=	0.5 sec	

- Following events are related to the Cardiac-cycle -



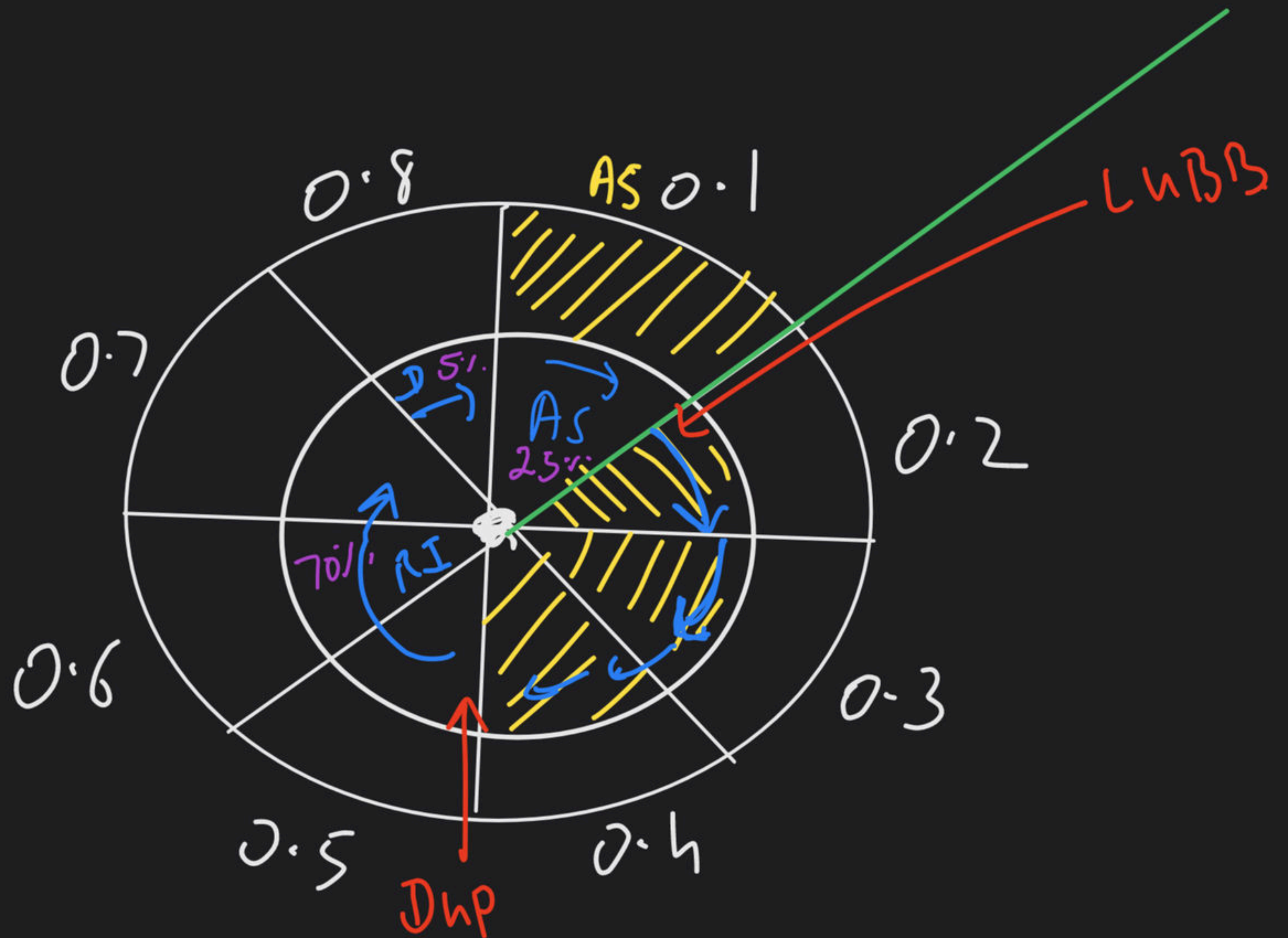
Common diagram showing events of both auricle & ventricles

- (1) **"Ventricular-systole"** - It is important process because during it the blood is pumped out of the heart into the arteries. It has four main parts.
- (a) **"Isometric-contraction"** - Walls of the ventricles start contracting, due to which pressure is more in the ventricles. Due to the increase of this pressure the "Cuspid valves" close producing "LUBB" sound.
 - (b) **"Period of Ejection"** - During this cycle when pressure increases in the ventricles, then the semi-lunar valves of the arches open and blood rapidly enters into the arches pushing the valves on one side.
 - Oxygenated blood from the left-ventricle enters into the caotico-systemic arch or aorta and deoxygenated blood from the right-ventricle enter into the pulmonary-arch.
 - (c) **"Protodiastole"** - Due to the ejection of blood from the ventricles now the inter-ventricular pressure decreases and the rate of blood ejection from the ventricles also decreases.
 - (d) **"Isometric Relaxation"** - When due to blood-ejection, the pressure inside the ventricles decreases as compared to the pressure inside the arches. The blood stops moving out and the ventricles prepare for relaxation.

(2) **"Ventricular Diastole"** - Ventricular start relaxing now due to which pressure inside them falls further. As a result of this, closure of semilunar valves occurs due to which 'DUP' sound is heard at the onset of ventricular diastole.

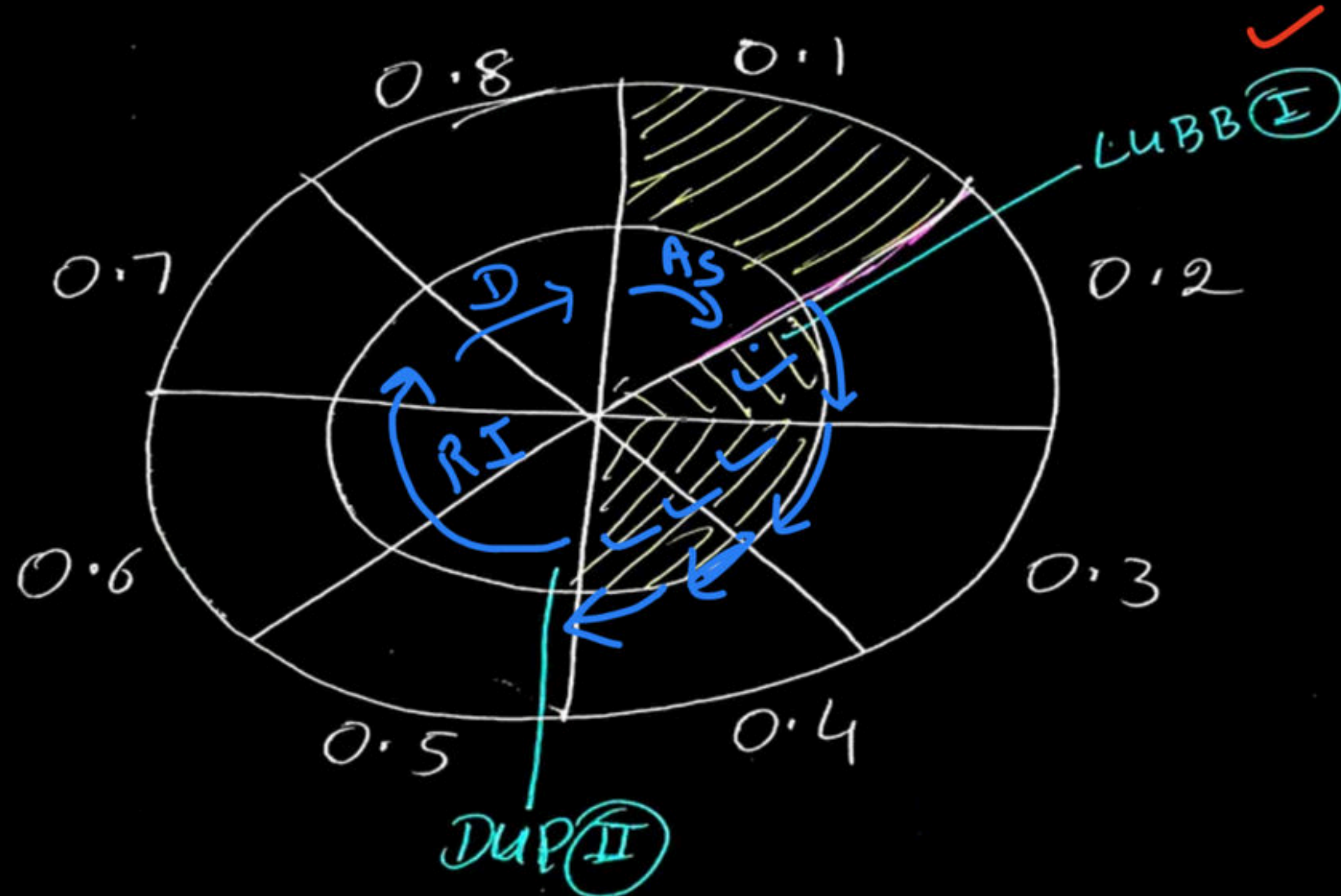
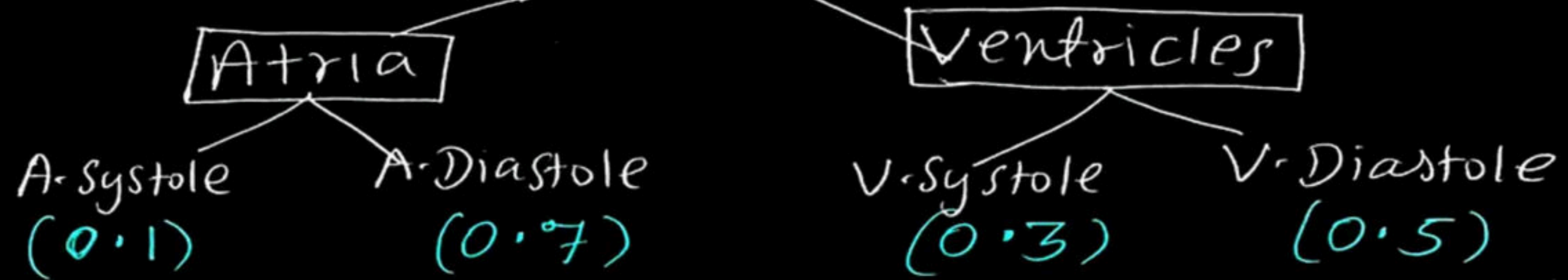
Ventricular-diastole has two sub-stages -

- (a) **"Rapid in-flow"** - After the systole in the ventricles the systolic pressure reduces very much. This pressure becomes very less than atrial-pressure. Moreover due to relaxation in ventricles the pressure inside them falls further. So, now the cuspid-valves open up and blood flows rapidly from the auricles to the ventricles.
 - (b) **"Diastasis"** - After rapid in flow, the auricles transfer the blood to the ventricles at the same rate at which they receive blood from the veins. So the inflow of blood reduces considerably. At this moment pressure inside all four chambers is equal and entire heart is in diastole. Also at this moment of this time, the AV valves are open but semilunar valves are closed.
- (3) **"Auricle-Systole"** - Due to contraction in the auricles the remaining blood comes into the ventricles so the Atrial pressure now becomes zero.
- (4) **"Auricle-Diastole"** - Auricle start relaxing now. Due to the presence of almost zero pressure in the auricles. the auricles now start receiving further blood from the veins.



Heart Rate = 72/min

CARDIAC Cycle (0.8 sec)



CARDIAC CYCLE

V. Systole

- Isometric Contraction
- Period of Ejection
- Protodiastole
- Isometric Relaxation

AV Valve



LHBB

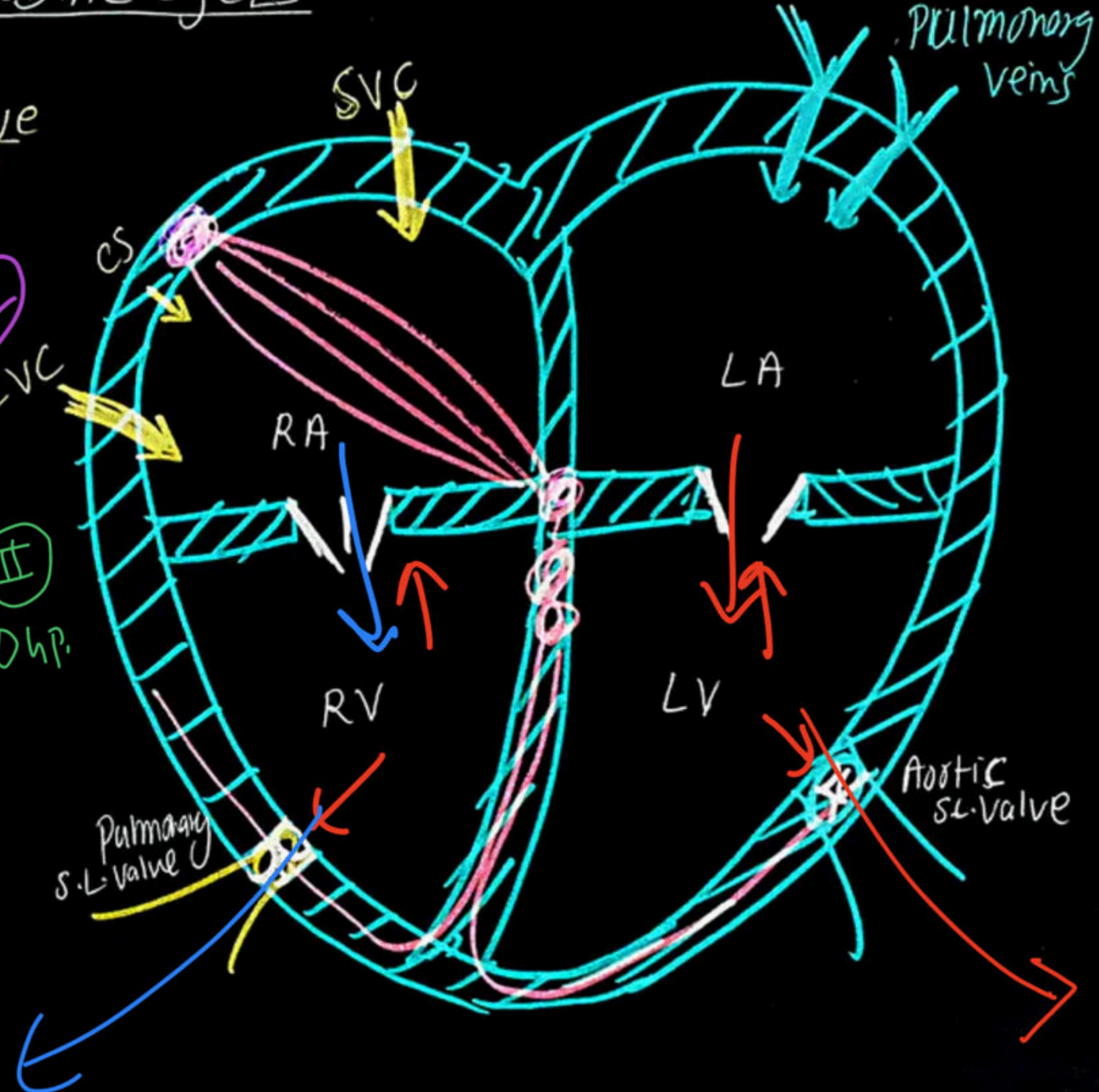
SL Valve



IVC



DHP



V. Diastole

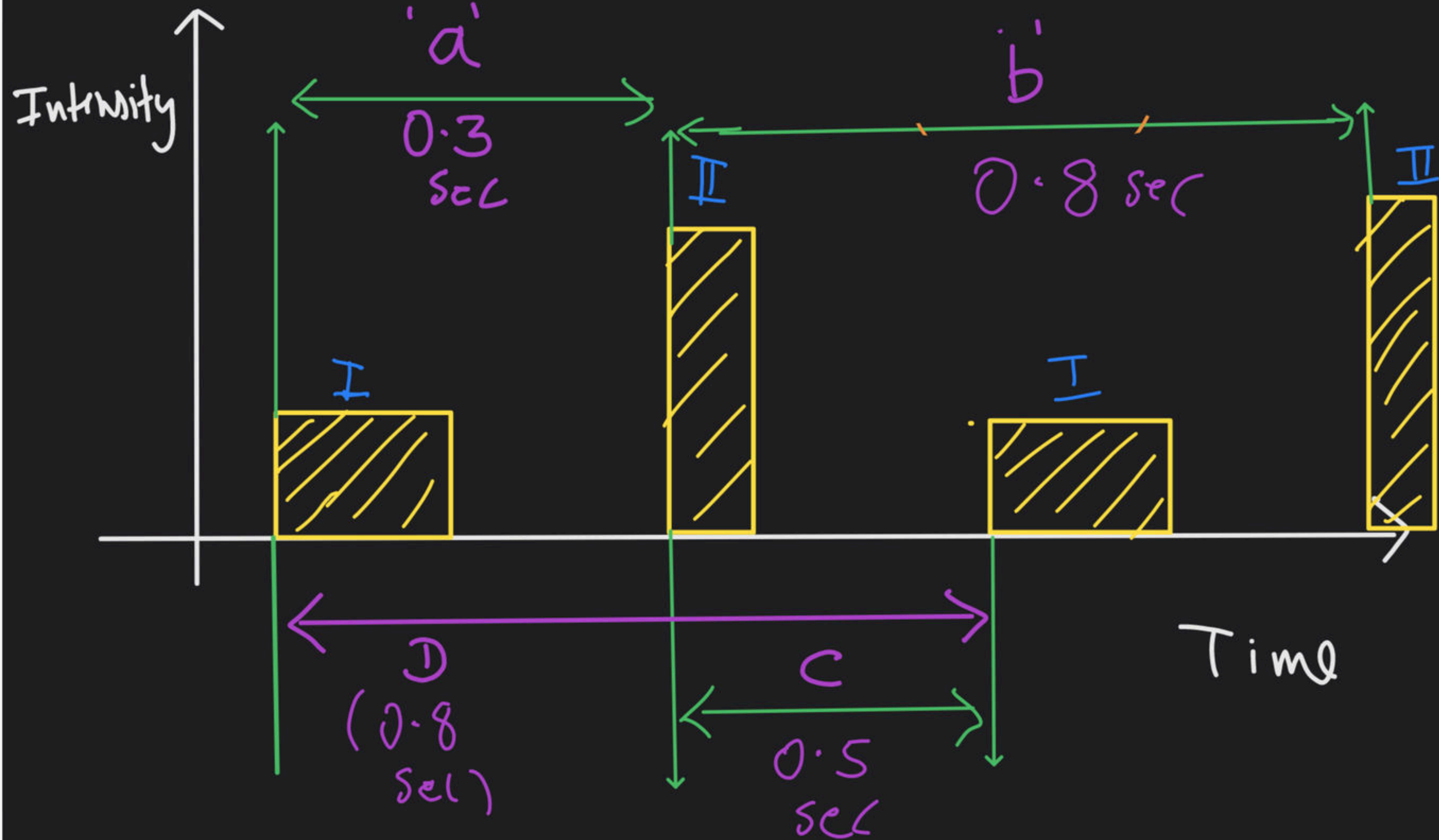
- Rapid Inflow 70%
- Diastasis 5%

A. Systole

25%

A. Diastole

Phono Cardiogram (HR=72 Per mt)



HEART-SOUND

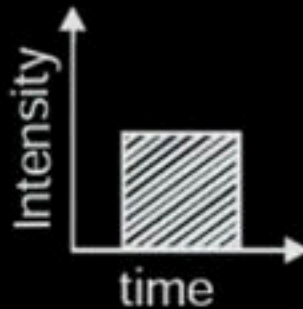

(1) **Ist Sound** – This is a contraction sound which denotes the begining of ventricle-contraction. it arises due to closing of mitral vave and the tricuspid valve. It is weak and appears in the form of "**Lubb**" (L - U - B - B)

(2) **IInd Sound** – This is a diastolic sound which denotes the beginning of ventricular diastole. This arises due to the closing of the semi-lunar valves of the two arches and is heard in the form of "**Dup**". It is shriller than the Ist sound and takes less time.

- These "Lubb" and "Dup" sounds of the heart can be heard with the help of an instrument called "**Stethoscope.**"
- The study of heart-sounds by marking them on a Graph is termed as "**Phona-Cardiography**"
- The measurement of the electrical-activity of the cardiac muscles at the time of heart-beat is necessary for the healthy working of the heart. The transmission of impulses in the sarcolemma of cardiac muscle fibres is in the form of electro-chemical waves.

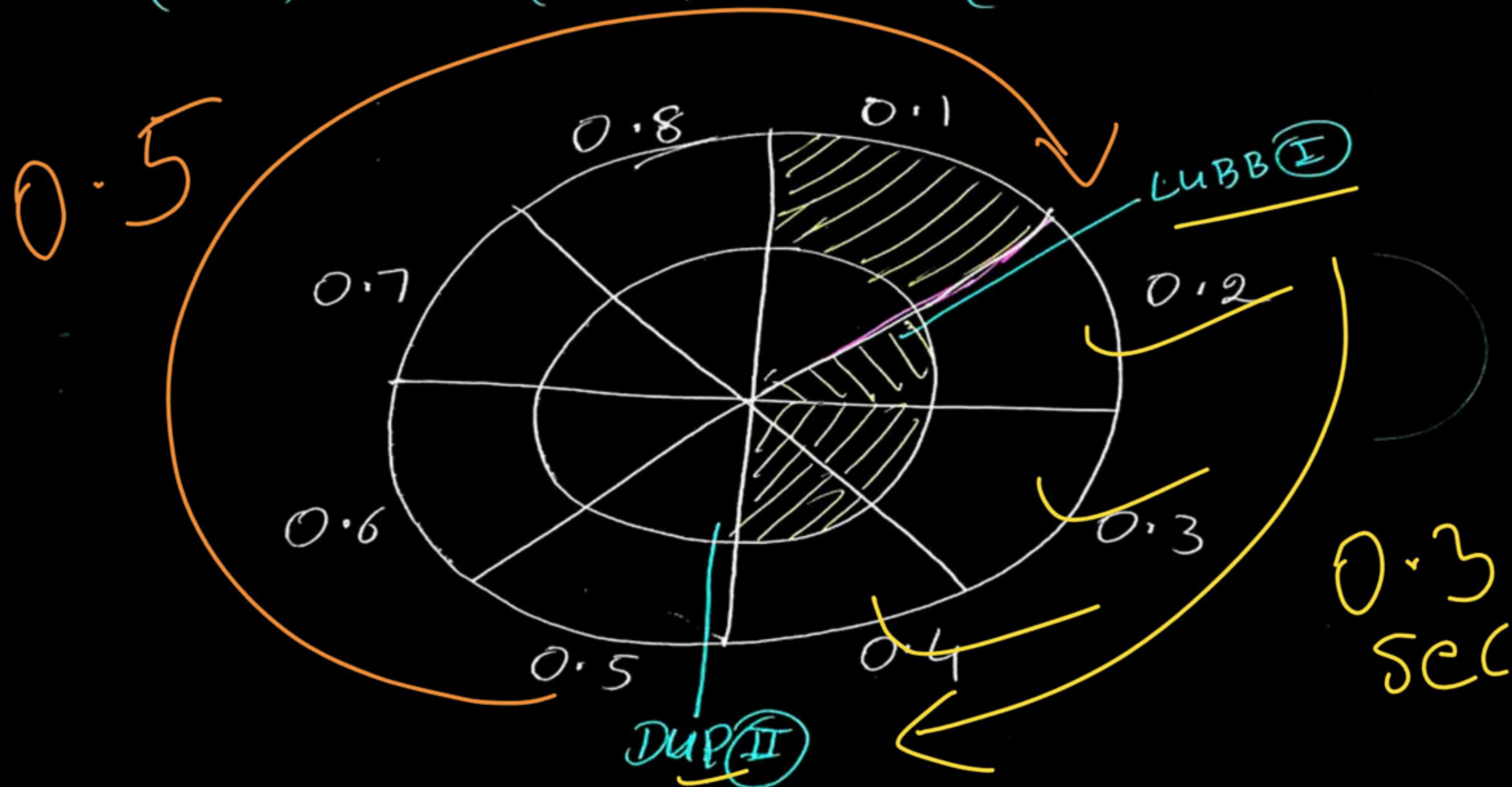
The graph which is marked by the machine due to the voltage difference is termed as the "**E.C.G.**" "**or**" **Electro Cardio Gram**" and this process is termed as "**Electro Cardio Graphy**"

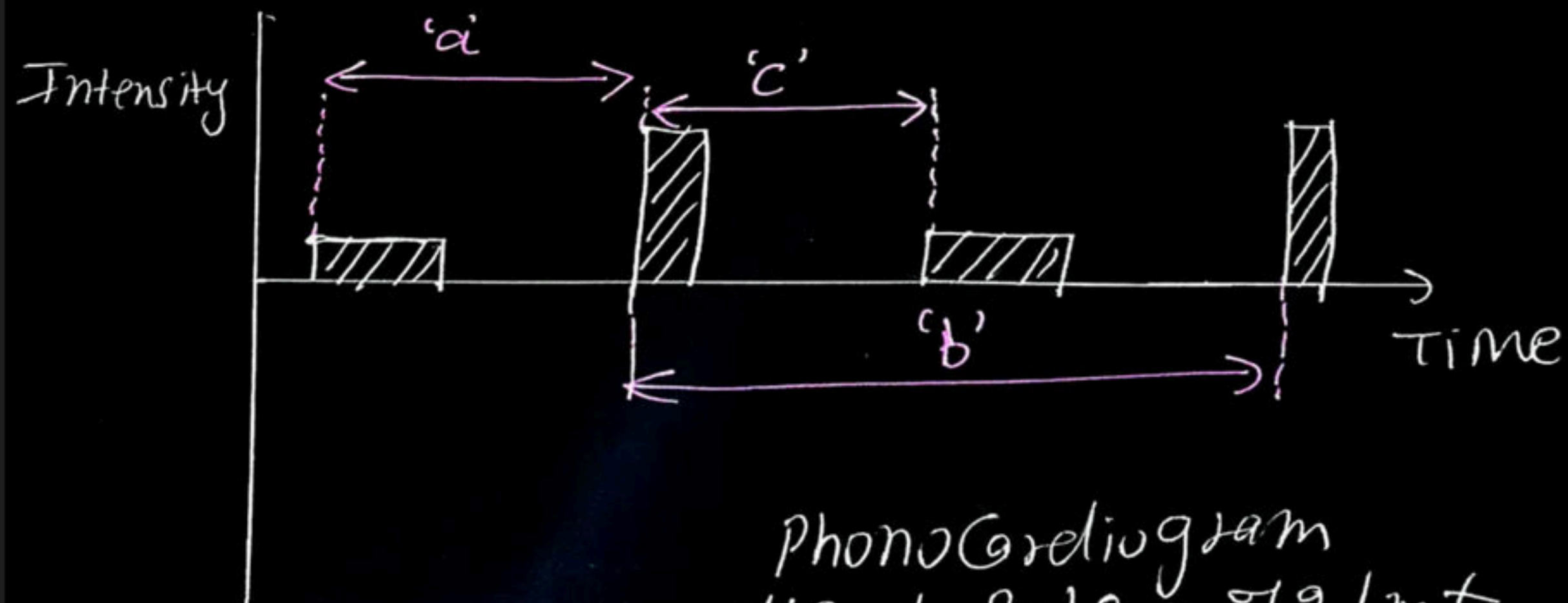
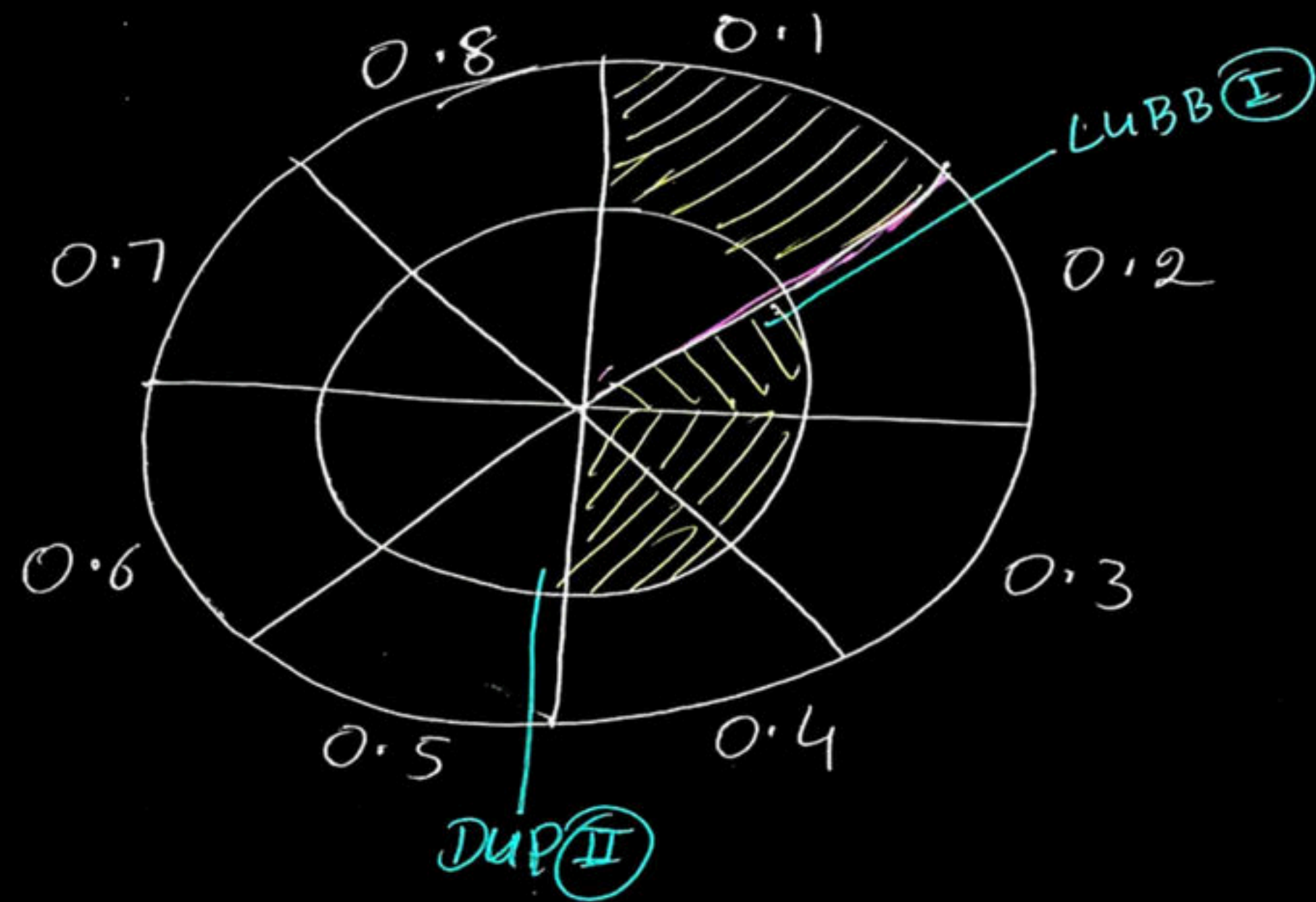
- It was first of all recorded by "**Waller**"
- "**Einthovan**" is known as the father of Electro Cardio Graphy.

HEART SOUND	
I Heart Sound	II Heart Sound
<p>1. LUBB</p>  <p>Intensity</p> <p>time</p> <p>2. DULL ; Prolonged</p> <p>3. Systolic (Ventricular) onset</p> <p>4.. Caused by vibrations due to <u>Closure of AV valves</u></p>	<p>DUP</p>  <p>Intensity</p> <p>time</p> <p>✓ Sharp, <u>Shorter</u> timed, High pitch</p> <p>✓ Diastolic Sound</p> <p><u>Caused by Closes of Semilunar valves</u></p>

Heart Rate = 72/min

CARDIAC cycle (0.8 sec)





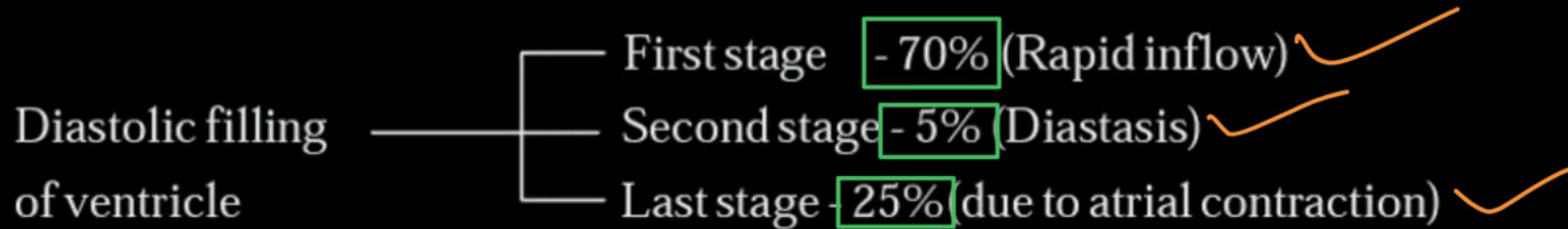
Phonocardiogram
Heart Rate = 72/min

Filling of Heart (Ventricles) :

Blood normally flows from the great veins into the atria. About 75% of the blood flows directly through the atrial into the ventricles even before the atria contracts. Then atrial contraction usually causes an additional 25% filling of the ventricles.

The period of Atrial Systole – Fills 25 % of ventricles.

The period of Atrial Diastole fills 75% of ventricles.



murmur

S₁ S₂

Any Abnormal Heart Sound other than
LUBB & DUP can be a murmur

Due to flow of
Blood in Abnormal
Direction

⇒ Pathological murmur due to defects

Congenital
Heart
Disease

Defect in / Leakage
Valves of Heart
(Valvular Stenosis)



Volumes of blood related with cardiac cycle.

During diastole, filling of the ventricles normally increases the volume of each ventricle to about 120 millilitres. This volume is known as *end diastolic volume*. Then as the ventricles empty during systole, the volume decrease by 70 millilitres, which is called the *stroke volume*. (i.e. the volume of blood pumped by left ventricle in the aorta in one stroke or beat). The remaining volume in each ventricle is now about 50 millilitres and is called *end systolic volume*.

The fraction of the end diastolic volume which is ejected out is called the **ejection fraction**. (usually around 60% or 7/12). $EF = SV/EDV$

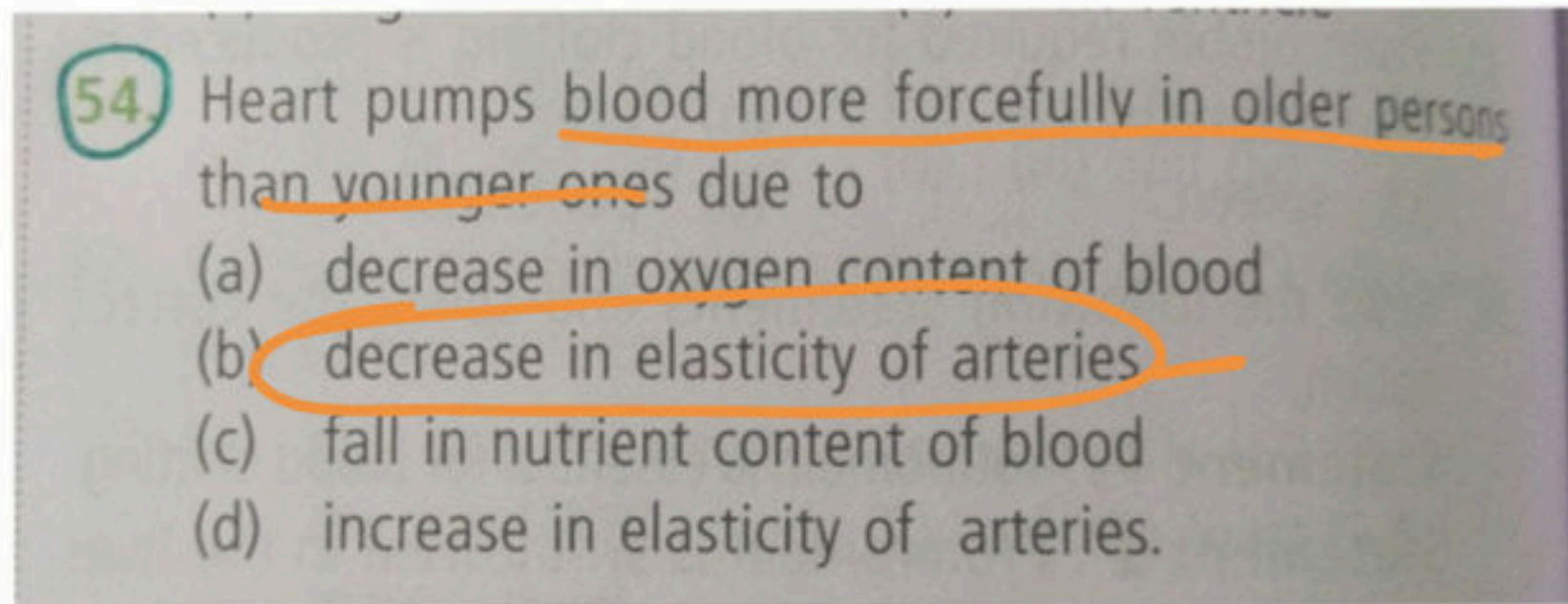
Cardiac output it is the amount of blood pumped by the left ventricle in the aorta in a minute. Its value in a normal adult is about 5 litre/minute.

Cardiac output = stroke volume \times heart rate.

- End diastolic volume \Rightarrow 120 ml.
- End systolic volume $\Rightarrow EDV - SV = 50$ ml (approx)
Stroke Volume = $EDV - ESV = 70$ ml (approx)

▲ 12 • Asked by Anshu

Please help me with this doubt



Sir, answer is (b)

***But, Old age mai arteries ki
elasticity decrease kyu ho
jaati h ???
please explain..***

▲ 12 • Asked by Shrutibodk...

Please help me with this doubt

How many polypeptide chains are present in one subunit of a myosin filament?

1. 2 heavy chains and 2 light chains.
2. 2 heavy chains and 4 light chains.
3. 4 heavy chains and 2 light chains.
4. 4 heavy chains and 4 light chains.

▲ 11 • Asked by Jubin

Please help me with this doubt

24. Which one of the following statements is correct with respect to the principle of safe blood transfusion?
- (a) The donor's red blood corpuscles should not contain antibodies against the recipient's serum.
 - (b) The recipient's serum should not contain antigens against the donor's antibodies.
 - ☒ (c) The recipient's serum should not contain the antibodies against the red blood corpuscles of the donor.
 - (d) The recipient's red blood corpuscles should not contain antibodies against the donor's antigen.

25. Detection of blood groups is done by ...

▲ 11 • Asked by Aastha

what is sinous vinous?????????

▲ 8 • Asked by Priyansu

Please help me with this doubt

Q. why the outer surface of internal organs should be moist?

Q. In heart failure does the myocardial infarction occur because the muscle of the heart stop working and the chambers don't get blood?

Q. Can a person donate his heart who died due to heart attack because his the muscles of the heart are dead?



Distribution of blood in Body

Systemic – 84%

- Arteries – 13%
- Veins – 64%
- Capillaries – 7%
&
Arterioles

Pulmonary – 9%

Heart – 7%

Distribution of Blood Flow in various organs at rest in Man

Brain	–	700 ml/mt	(14%)	approx
Heart	–	300 ml/mt	(7%)	
Muscles	–	1200 ml/mt	(20%)	
Skin	–	500 ml/mt	(8%)	
Kidney	–	1100– 1300 ml/mt	(20–25%)	
Abdominal organs	–	1400 ml/mt	(20–25%)	
Others	–	600 ml/mt	(10%)	
Total		<u>5800 ml / mt</u>	<u>100%</u>	