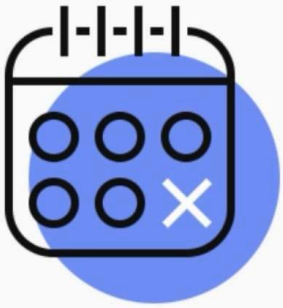
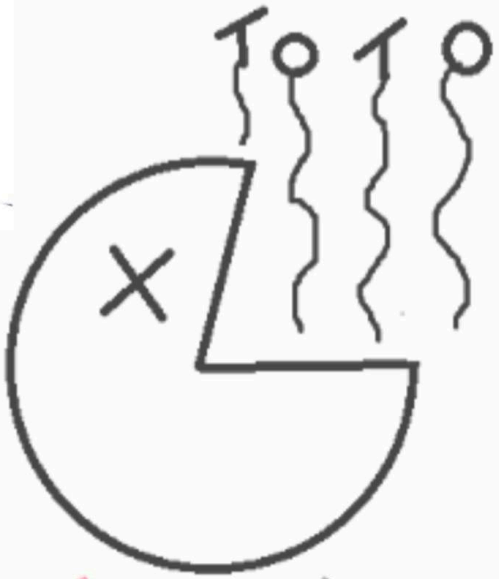
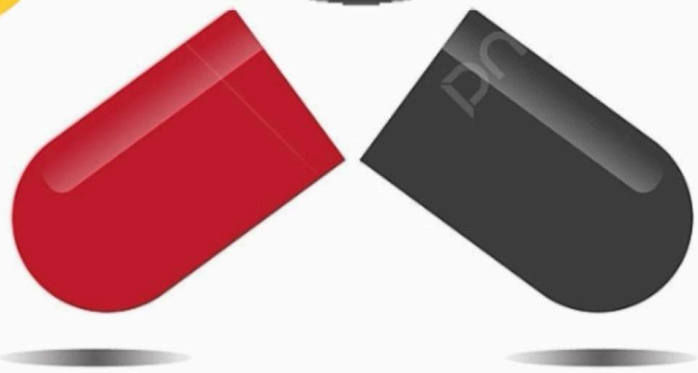



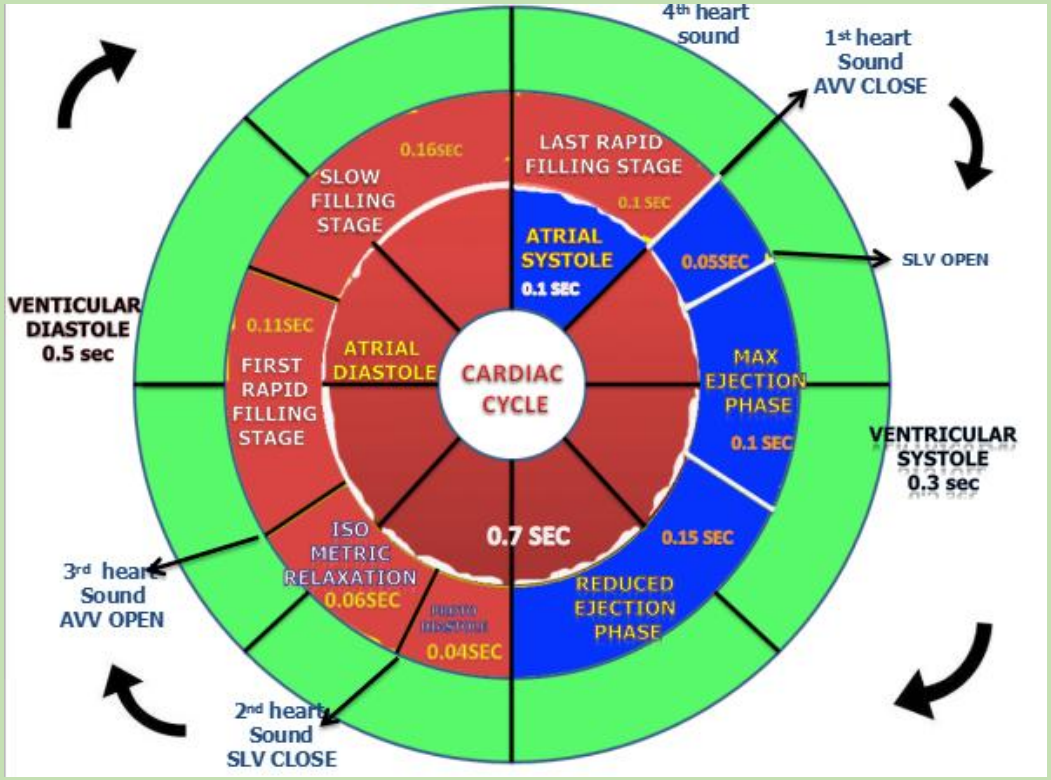



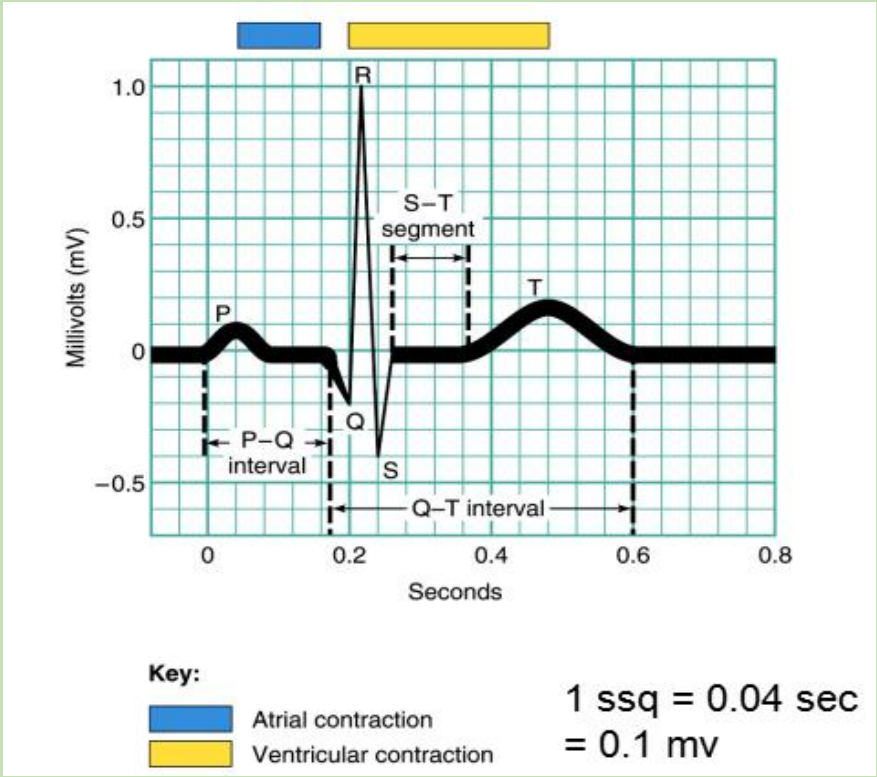
Totoz Collection

Learn Today, Lead Tomorrow

CARDIAC CYCLE

The Cardiac Cycle is the series of mechanical and electrical events that occur from the beginning of one heart beat to the beginning of the next.





ISOMETRIC CONTRACTION PHASE = 0.05seconds

Ventricular Volume	Ventricular pressure	Valves	Sounds	Atrial pressure	Aortic and pulmonary artery Pressure	ECG
➢ Remains the same	➢ Rises sharply	➢ All valves in the heart are closed	➢ Closure of A-v Valves produces first sound	➢ Increases slightly on closure of the A-v valves	➢ Gradually decrease . (diastolic blood pressure = 80mmHg mu aorta and 9mmHg in the pulmonary artery)	➢ Q wave starts about 0.02s before this phase, while R and S waves are recorded during it.

MAXIMUM (RAPID) EJECTION PHASE = 0.1sec

Ventricular Volume	Ventricular pressure	Valves	Sounds	Atrial pressure	Aortic and pulmonary artery Pressure	ECG
➢ Rapidly decreases	➢ Increases gradually to a max of 120mmHg left ventricle and 25mmHg right ventricle	➢ AV valves closed but semi-lunar valves open coz of ventricular pressure exceeding that of diastolic blood pressure	➢ First sound continues for a brief period in this phase	➢ Initially decreases due to widening of the atrial cavities. It then gradually increases	➢ Increases gradually till it equals that of the ventricles I. e 120mmHg in the aorta and 25 mm Hg mu pulmonary artery (systolic blood pressure)	➢ S-T segment is recorded and the T wave starts in this phase

				due to the continuous venous return		
➢						

REDUCED (SLOW) EJECTION PHASE = 0.15sec

Ventricular Volume	Ventricular pressure	Valves	Sounds	Atrial pressure	Aortic and pulmonary artery Pressure	ECG
➢ Further reduces	➢ Starts to decrease due to pumping of most of the blood	➢ Semilunar valves are open while the A-V valves remain closed	➢ There are no sounds	➢ Still increasing due to to continuous venous return	➢ Decrease as the amount coming from the ventricle becomes smaller than that going to the body	➢ The ascending limb & top of the T wave

PROTODIASTOLE This is a very short period that was described between the end of ventricular systole and start of ventricular diastole. However, sometimes this period is generally considered a part or the isovolumetric relaxation phase. = 0.04sec

ISOMETRIC(ISOVOLUMIC) RELAXATION PHASE = 0.06sec

Ventricular Volume	Ventricular pressure	Valves	Sounds	Atrial pressure	Aortic and pulmonary artery Pressure	ECG

➢ Remains constant	➢ Drops sharply to 0	➢ A-V Valves remain closed and now the semi-lunar valves also are closed	➢ 2nd heart sound	➢ Still increasing from venous return	➢ Gradually increase with appearance of a dicrotic notch and a dicrotic wave (windkessel effect)	➢ Descending limb of the T wave

RAPID PASSIVE (MAXIMAL) FILING PHASE = 0.11sec

Ventricular Volume	*Ventricular pressure*	*Valves*	*Sounds*	*Atrial pressure*	*Aortic and pulmonary artery Pressure*	*ECG*
➢ *increases*	➢ *Initially decreases from ventricular relaxation, but increases gradually with the increase amount of blood coming from atria*	➢ *A-V valves open while the Semilunar valves close*	➢ *3rd heart sound*	➢ *Initially decreases due to rush of blood from atria to ventricle but then increases due to venous return*	➢ *Decreases gradually*	➢ *Early part of the T-P segment and the U-wave (if present) are recorded*

SLOW (REDUCED) FILLING PHASE = 0.19sec

Ventricular Volume	Ventricular pressure	Valves	Sounds	Atrial pressure	Aortic and pulmonary artery Pressure	ECG
➢ Gradually increase but at a slow rate	➢ Gradually increase but at a slow rate	➢ Semilunar valves closed while the A-V valves are still open	➢ No sound here	➢ Still increasing due to venous return	➢ Still decreasing due to continuous blood flow	➢ Late part of the T-P segment and the start of the P wave

LAST RAPID FILLING PHASES = 0.1sec

Ventricular Volume	Ventricular pressure	Valves	Sounds	Atrial pressure	Aortic and pulmonary artery Pressure	ECG
➢ Slightly increase by effect of the blood pump from the atria	➢ Slightly increase by effect of the blood pump from the atria	➢ Semilunar valves closed but A-V valves open	➢ 4^{th} sound	➢ Initially increases from decrease in atrial volume but decreases due to rush of blood	➢ Gradually decrease	➢ P wave starts about 0.02 sec before this phase, while the main part of the p wave, the P-R segment and the Q

				into the ventricles		wave occur during this phase

❖ THE DICROTIC NOTCH and WAVE (WINDKESSEL EFFECT)

At the start or isometric relaxation, the blood in the aorta and pulmonary artery flows back towards the corresponding ventricles (because of the higher pressures in these vessels)· This results in

- Closure or the semi-lunar valves leading to production or the second heart sound
- A small disturbance on down-slope of the aortic and pulmonary arterial pressure curves called the dicrotic notch or incisura ·
- Following the dicrotic notch, a wave called the dicrotic wave is recorded due to a slight increase in the aortic and pulmonary arterial pressures (which then decrease gradually due to flow of blood to the peripheral smaller vessels)· This wave is produced as a result of elastic recoil of the aortic and pulmonary arterial walls·

The latter effect is produced by a mechanism called the windkessel effect, which occurs as follows :

- The aorta and pulmonary artery are stretched during the ejection phases creating potential energy in their walls.
- during isometric relaxation, this energy is converted into kinetic energy which causes these vessels to rebound (leading to their recoil).

The windkessel effect maintains forward movement or blood during ventricular diastole's which renders the blood flow to the tissues to be continuous and not pulsatile.