



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF BIOMEDICAL ENGINEERING

19BMB302 - BIOMEDICAL SIGNAL PROCESSING

III YEAR/ V SEMESTER

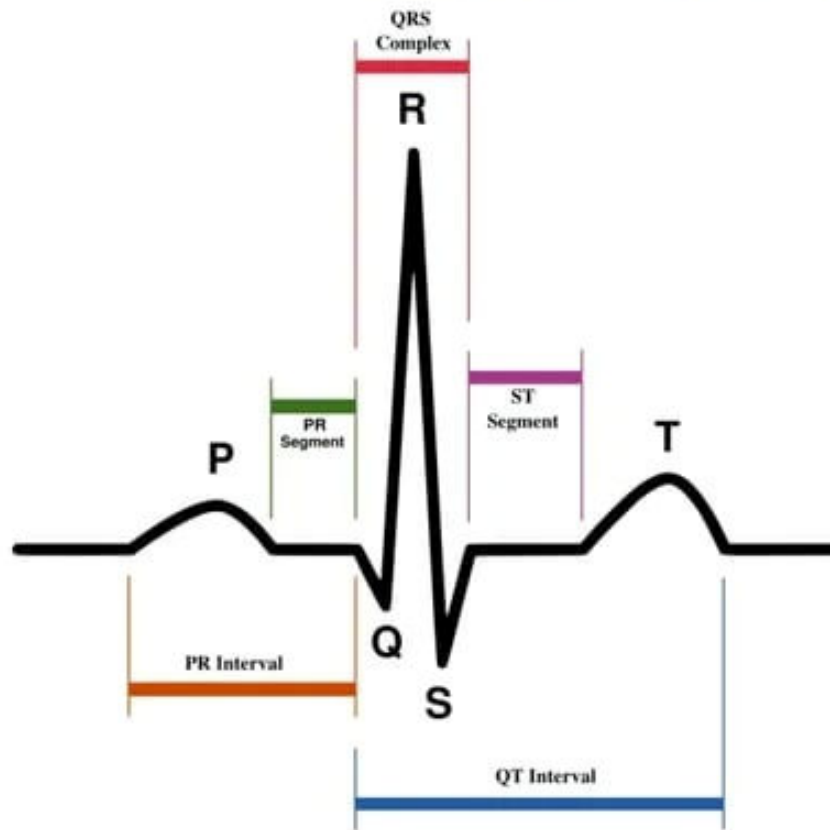
Unit IV : BIOSIGNALS AND THEIR CHARACTERISTICS



- Source of Bioelectric potential
- Resting and action potential
- Propagation of action potentials in nerves
- Characteristics of biomedical signals
- **The ECG-Cardiac electrophysiology**
- Relation of ECG components to cardiac events
- Clinical applications



PR Interval

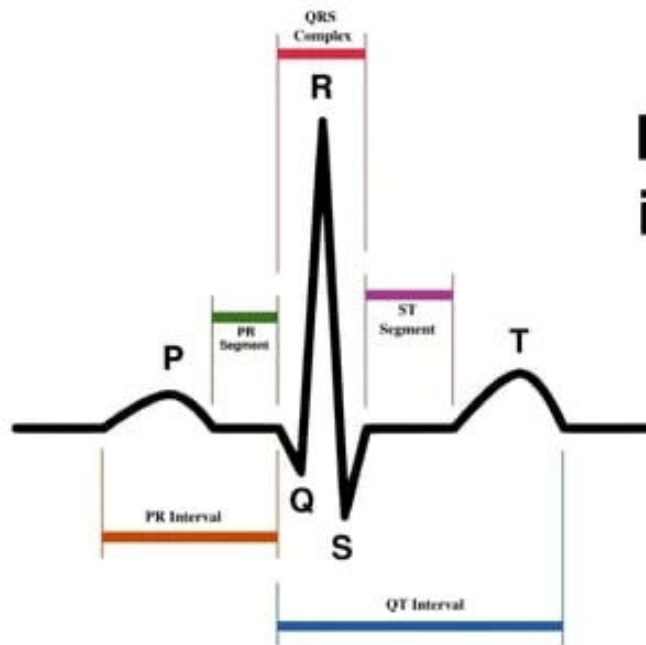


**Measurement:
0.12 – 0.20
seconds**

**Represents the
time from SA
node firing to
the end of AV
node delay**



PRI Abnormalities

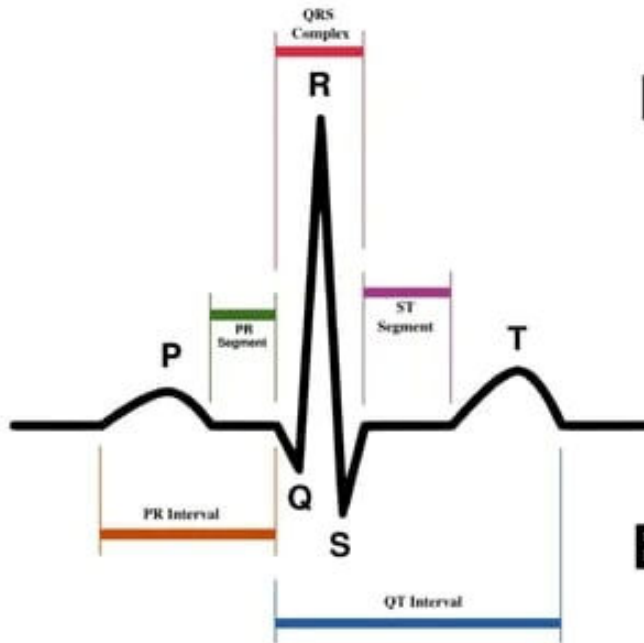


**Prolonged or
Inconsistent PRI's may
indicate a type of heart
block:**

**1st degree AVB
Mobitz 1 or Mobitz 2
Complete AVB**



PR Interval Abnormalities

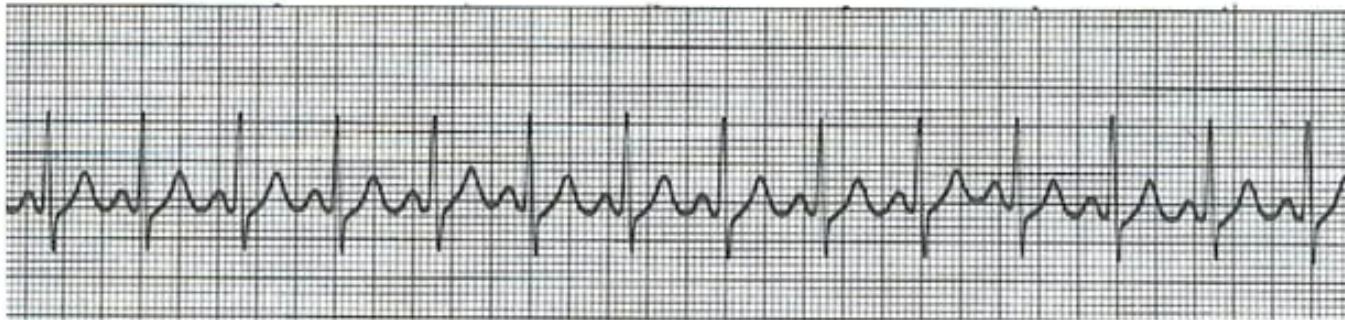


**Shortened or
Nonexistent PR's may
indicate:**

**Tachycardic Rhythms
WPW Syndrome
Junctional Rhythms
Ectopic Atrial Rhythms
Ventricular Rhythms**



PR Interval



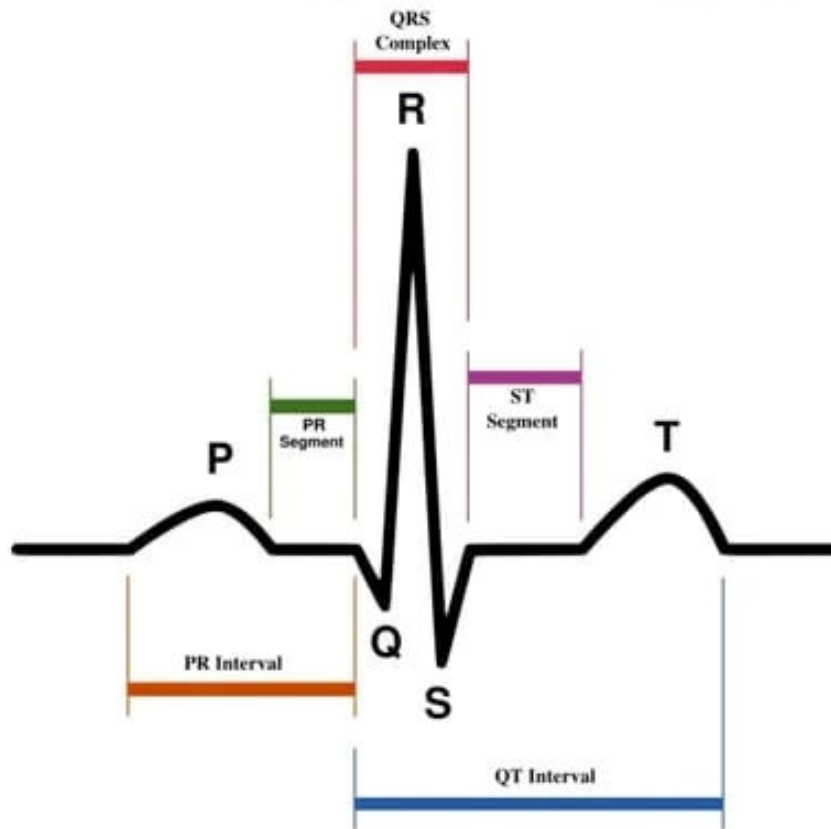
PRI=



PRI=



QRS Duration



Measurement:
0.04 – 0.10
seconds

Represents the
travel time of
electrical
activity through
the ventricles



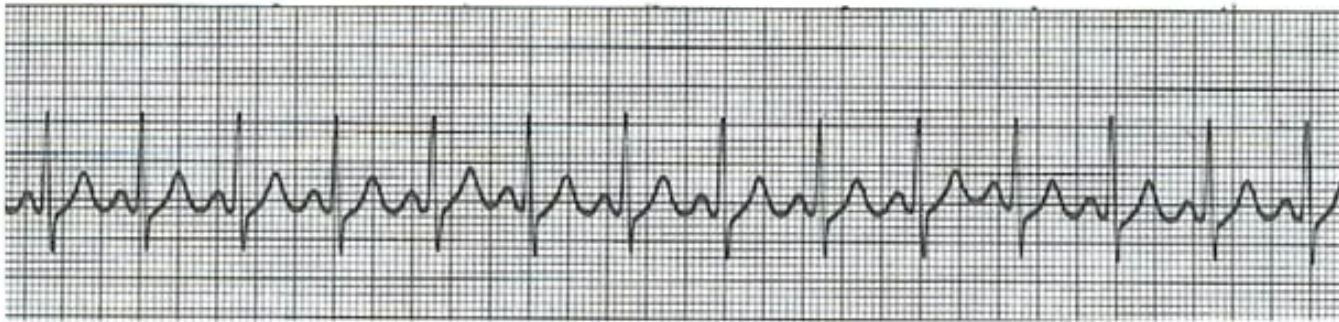
QRS Complex Variations

Wide and/or notched QRS complexes:

- BBB's
- Aberrant ventricular conductivity
- Rhythms with Ventricular Focus



QRS Duration



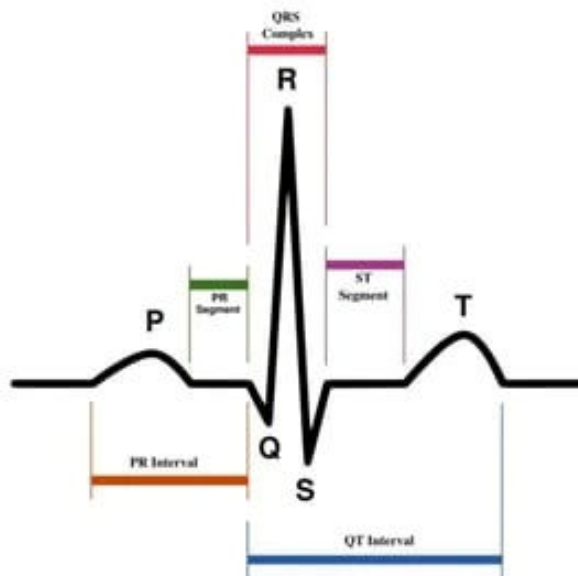
QRS=



QRS=



QT Interval



Measurement:
< 1/2 the distance of the preceding R-R interval

Represents travel time through ventricles to the end of ventricular repolarization

Normally varies according to age, sex, and particularly heart rate



QT Rate Corrected

HR ↑ = QT interval ↓

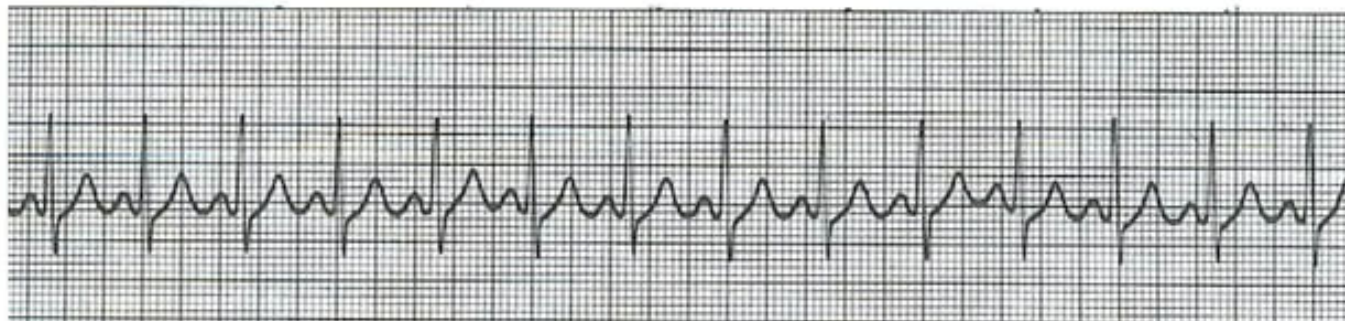
HR ↓ = QT interval ↑

QTc =

QT + 1.75 (ventricular rate – 60)



QT Interval



QT=

QTc=

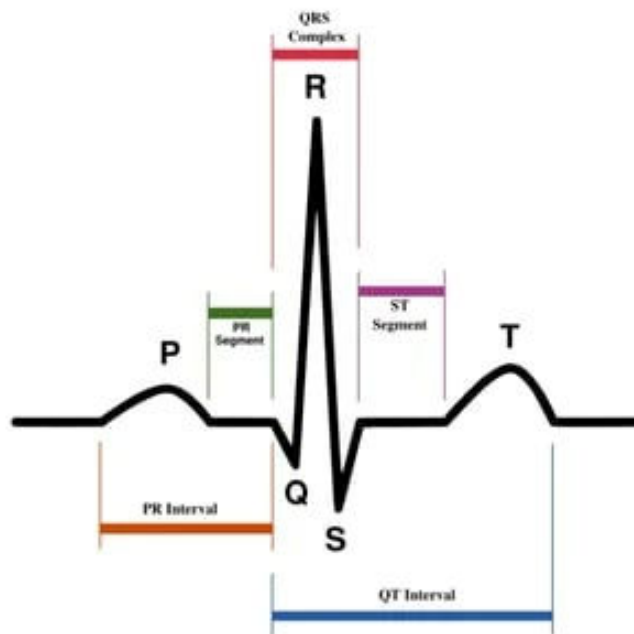


QT=

QTc=



Prolonged QT Intervals



**Represents a
prolonged time to
repolarization**

**May lead to
R-on-T
Phenomenon and
ventricular
dysrhythmias!!!**



Basics to Interpreting Strips



Rhythm

Rate

P Wave

PR Interval (PRI)

QRS Duration



RHYTHM



Determine regularity or irregularity

Use calipers for accuracy

Measure distance from R-R wave

Regular Rhythm = R-R distance does not vary (less than 3 small boxes of variation does not count)

Irregular Rhythm = R-R distance varies (3 small small boxes or greater)



HEART RATE



Use 1500-rule and the 6-second rule for all **regular** rhythms

6-second rule only for **irregular** rhythms



Calculating Heart Rates



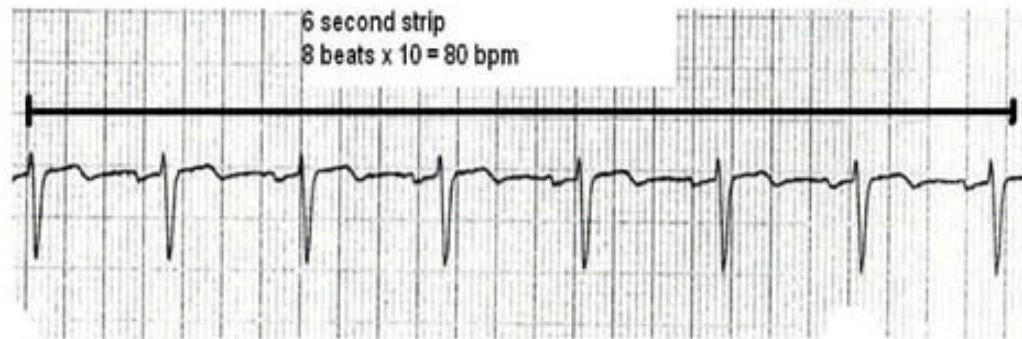
The 6-Second Rule

The Rule of 300's

The 1500 Rule



6-Second Strip



Count number of R waves in a 6-second strip and multiply by 10

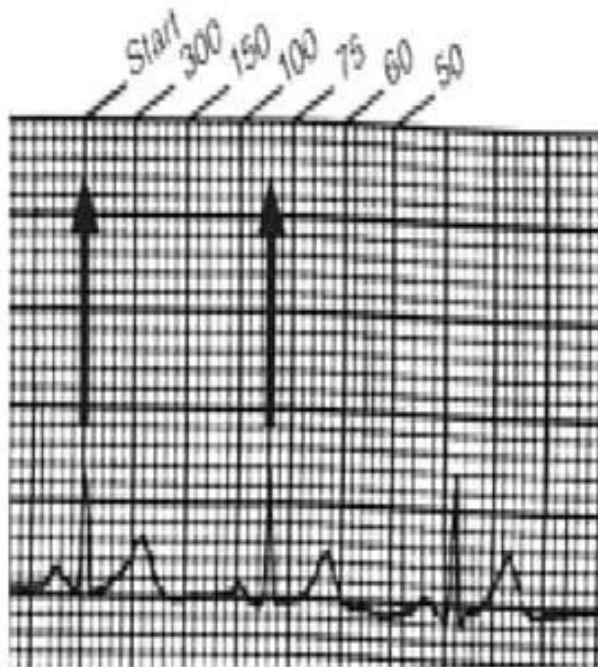
A.K.A. Rapid Rate Calculation

$$\mathbf{HR = \# R\ waves \times 10}$$

- *Not very accurate*
- *Used only for very quick estimate*



Rule of 300's



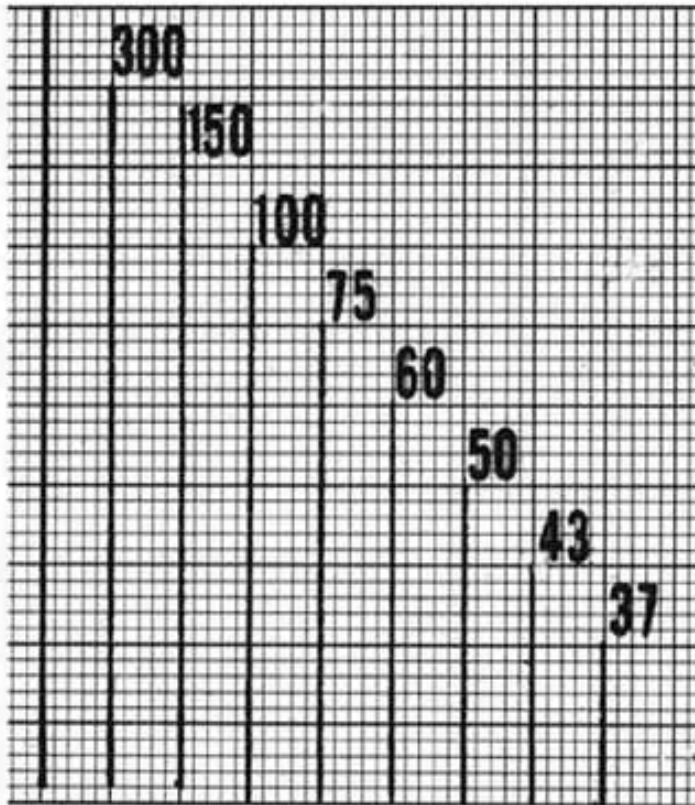
Count number of large squares between 2 consecutive R waves and divide into 300.

$$HR = 300 / \# \text{ large squares}$$

- Very quick
- Used only with regular rhythms
- Not very accurate with fast rates



Rule of 300's



Scale of 300

- 1 large square = 300 bpm
- 2 large squares = 150 bpm
- 3 large squares = 100 bpm
- 4 large squares = 75 bpm
- 5 large squares = 60 bpm
- 6 large squares = 50 bpm



1500 Rule

Count number of small squares between 2 consecutive R waves and divide into 1500

A.K.A. – Precise Rate Calculation

- Most accurate
- Used only with regular rhythms
 - Time-consuming



P Waves



- Upright
- Uniform
- Precedes each QRS complex
 - Any extra P waves



PRI



- Measure from beginning of P wave to the end of the PR segment
 - 0.12 – 0.20 seconds
 - Constant



QRS Complex



- Measure from beginning to the end of QRS complex (1st deflection from baseline after the PR segment to the beginning of the ST segment)
 - 0.04 – 0.10 seconds
 - Notched???, Wide, etc.



QT Interval or QTc



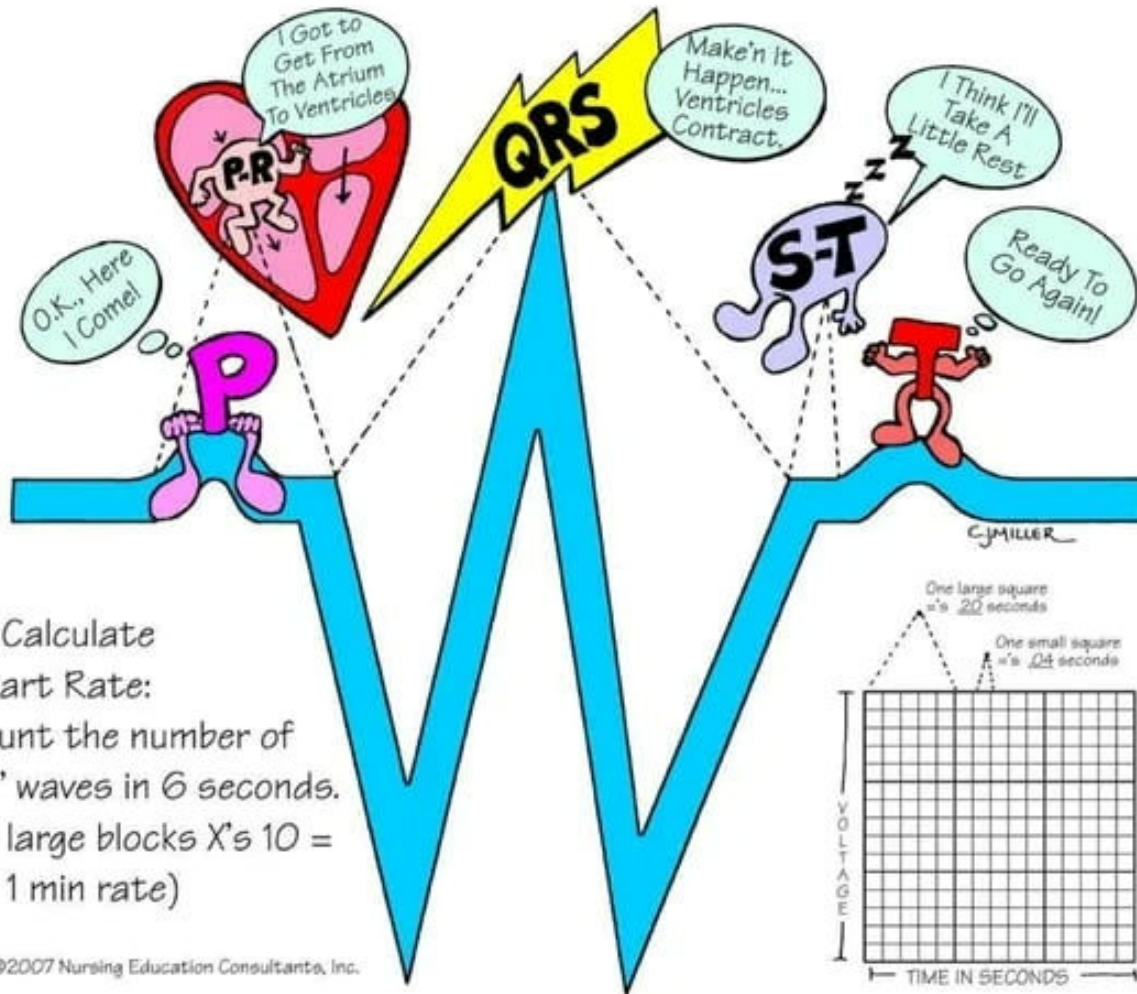
- QT Interval = Count the # of small boxes from beginning QRS complex to the end of the T wave. Should be less than $\frac{1}{2}$ the distance of the preceding R-R interval
- $QTc = QT + 1.75 (\text{ventricular rate} - 60)$



Extras???



- P waves without QRS complexes
- ST-segment depression or elevation



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Thank You!