

1. Rhythm – is it regular?
2. Rate – how fast is the heart rate?
3. Is “P” wave upright & present?
4. “PR” interval measurement?
5. “QRS” duration?
6. “ST” is it elevated or depressed?
7. Any ectopic?

“**J-Point**” on isoelectric line is normal, if above the line it is elevated, if below the line it is depressed.

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### EKG:

- One small box = 0.04 seconds
  - One large box = 0.20 seconds
  - “**P**” wave = 3 small boxes or **0.06-0.12 seconds wide**
  - “**PR**” interval = 3-5 small boxes or **0.12 – 0.20 seconds wide**, if > 0.20 seconds wide means slow conduction; consider heart block
  - “**QRS**” complex = 1-2 ½ small boxes or **0.04 – 0.10 seconds wide if > 0.10 coming from the ventricles.**
  - “**T**” wave = upright, well rounded, and less than ½ the height of the “QRS” complex.
  - Determine Atrial rate = measure “P” to “P”
  - Determine Ventricular rate = measure “R” to “R”
  - “P” wave = atrial depolarization
  - “PR” interval = Atrial Kick from SAN to AVN. Rates > 130 bpm you lose atrial kick.
  - “QRS” = Ventricular depolarization = Contraction
  - “ST” = heart’s resting period (isoelectric)
  - “T” = Ventricular repolarization
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### Conduction:

- **SAN** (sinus rhythm) 60 – 100 bpm; < 60 bpm = sinus bradycardia; > 100 bpm = sinus tachycardia (have upright “P”)
- **AVN** (junctional) 40 – 60 bpm; < 40 bpm = junctional bradycardia; > 60 bpm = accelerated junctional; > 100 bpm =

accelerated junctional tachycardia (with no “P” or inverted “P”)

- **BB** (idio) 20 – 40 bpm; > 40 bpm = accelerated idioventricular rate (have no “P”)
  - **PF** (agonal) < 20 bpm
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### “QRS”:

- **Narrow “QRS” complex (0.04 – 0.10)**
    - “P” present = sinus rhythm can be normal: 60-100 bpm; Tachy > 100 bpm, Brady < 60 bpm
    - No “P” present or inverted = Junctional (nodal)
  - **Wide “QRS” complex (> 0.10 coming from the ventricles)**
    - Single PVC
    - Double = couplet PVC’s
    - Three or more PVC’s = VT or short run VT
    - 20-40 bpm coming from the ventricles, no “P” = idioventricular
    - Agonal < 20 bpm
    - Ventricular Tachycardia (VTach) 140 – 250 bpm
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### Deflections:

- 1<sup>st</sup> (–) deflection = ‘Q’
  - 1<sup>st</sup> (+) deflection = ‘R’
  - 2<sup>nd</sup> (–) deflection = ‘S’
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### Pacemakers:

- Count b/w the spikes to get the rate
  - ‘V’ paced = spike with ‘QRS’ = Ventricles.
  - ‘A’ paced = spike with ‘P’ = atria
  - AV paced = spike with every ‘P’ & spike with every ‘QRS’.
  - Demand pace will have a self-initiated normal beat
  - Failure to capture = spike without a response
  - Under-sensing/failure to sense = pacemaker does not recognize initiated beat then you see a spike.
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### Myocardial Status:

- “T” wave inversion = Ischemia
- “ST” depression = Injury
- “ST” elevation = Infarction

### Counting for the Rate:

- $1500 \div$  the # of small boxes between R  $\leftrightarrow$  R or P  $\leftrightarrow$  P
- Count the number of complexes in a six second strip x 10 (irregular rhythms)
- 5.....300
- 6.....250
- 7.....214
- 8.....188
- 9.....167
- 10.....150
- 11.....136
- 12.....125
- 13.....115
- 14.....107
- 15.....100
- 16.....94
- 17.....88
- 18.....84
- 19.....79
- 20.....75
- 21.....72
- 22.....68
- 23.....65
- 24.....63
- 25.....60
- 26.....58
- 27.....56
- 28.....54
- 29.....52
- 30.....50
- 31.....48
- 32.....47
- 33.....45
- 34.....44
- 35.....43
- 36.....42
- 37.....41
- 38.....40
- 39.....39
- 40.....38
- 41.....37
- 42.....36
- 43.....35
- 44.....34
- 45.....33

### Narrow ‘QRS’ Complexes (0.04 – 0.10):

‘P’ present = Sinus, can be either:

- Normal = 60 – 100 bpm
- Bradycardia = < 60 bpm
- Tachycardia = > 100 bpm

No ‘P’ present or all inverted = at the ‘AV’= Junctional (nodal) (40 – 60 bpm)

Can be either:

- Junctional bradycardia < 40 bpm
- Accelerated Junctional 60 – 100 bpm
- Junctional tachycardia > 100 bpm

### Wide ‘QRS’ Complex (> 0.10):

Coming from the Ventricles.

- Single = Premature Ventricular Contraction (PVC)
- Double = Couplet
- Three or more = short run VTach or VTach.

No ‘P’ wave – coming from the Bundle branch in the ventricles. Loss of atrial kick.

- Idioventricular 20 – 40 bpm
- Ventricular Tachycardia (Vtach) 140 – 250 bpm
- Agonal < 20 bpm (bad, death)

### Heart Blocks: (key is the ‘PR’ interval

Non-Lethal:

- 1<sup>st</sup> degree AV block – ‘PR’ interval > 0.20 & the length is constant.
  - Rate is normal
  - No dropped beats
  - Atrial rate =s Ventricular rate
- 2<sup>nd</sup> degree AV block type I (Mobitz I, Wenkebach) – two complexes then drops one.
  - Rate is normal
  - ‘PR’ interval progressively gets longer, variable.
  - Drops a beat

Lethal:

- 2<sup>nd</sup> degree AV block type II (Mobitz II). Mobitz of ‘P’s, too many ‘P’s’.
  - Rate is slower
  - More than one dropped beat
  - ‘PR’ interval same length with each beat, does not progressively get longer.
- 3<sup>rd</sup> degree AV block (complete heart block). No association with one another, complexes doing their own thing.
  - No communication going on

- The 'R' is constant.
- Rate is very slow
- Pacemaker needed

**Paroxysmal** – sudden onset or stop of any arrhythmias.

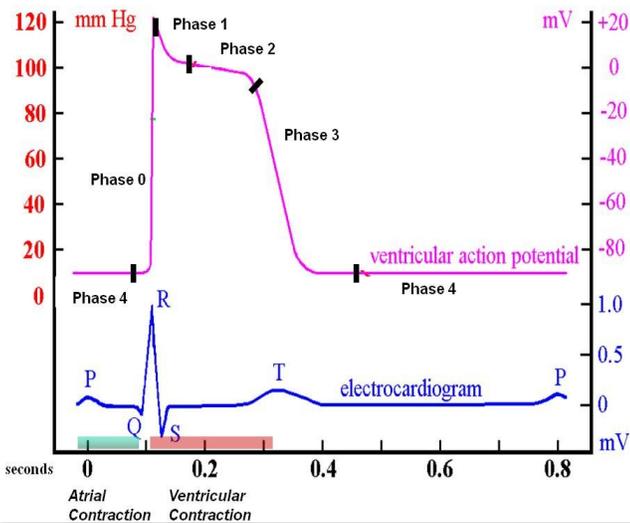
**Bundle Branch Block:**

- Has 'P's
- 'QRS'  $\geq 0.10$
- 'QRS' may or may not have rabbit ears
- Occurs at bundle of HIS
- Rate is slow

**Narrow Complex Atrial Tachcardia:**

Sinus tachcardia:

- Sinus Tachcardia (ST) 100 - 130bpm
  - Have 'P's
- Atrial Tachcardia (AT) 130 – 170bpm
- Supraventricular Tachcardia > 170bpm

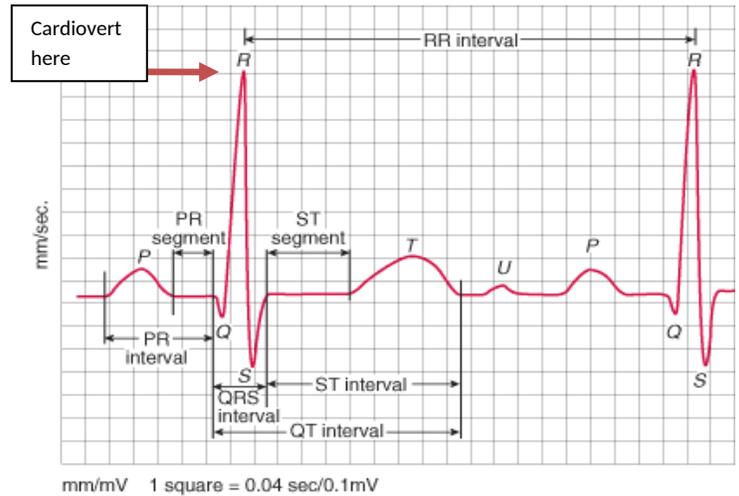


Phase 4: This is the cells **resting phase**. The cell is ready to receive an electrical stimulus (associated with diastole)  
 Phase 0: Is the **upstroke**; the cell receives an impulse from a neighboring cell and depolarizes, during this phase the cell depolarized and begins to contract.  
 Phase 1: Is the **spike**; contraction is in process and the cell begins an early, rapid, partial repolarization.

Phase 2: Is the **plateau**; contraction completes and the cell begins to relax. This is a prolonged phase of slow repolarization.

Phase 3: is the downslope; this is the final phase of rapid repolarization and is complete by the end of phase 3.

Phase 4: Returns back to the resting period and is the period between action potentials



- Cardiovert the tip of the 'R' wave
- J-point of the 'Q' to the upslope of the 'T' wave = Absolute Refractory Period (ARP) – cannot respond to stimulus.
- Relative Refractory Period (RRP) – can respond if strong stimulus on top of the 'T' wave.
- Supernormal Period (SNP) – irritable phase, easily thrown into VTACH, if PVC hits on the downslope of the 'T' wave

Chronotropic – Rate

Inotropic – Contractility

Dromotropic – AV node Conduction

**Axis Deviation:**

Leads	Normal	Right	Left	NML
I	^	v	^	v
AVF	^	^	v	v
Axis	0 - +90	190 - ±180	0 - -90	-90 - ±180

**Cardiac Death:**

- Endocardium is the inner part of the heart:  
takes 20-30 minutes to die
- Myocardium is the thick muscle mass of the  
heart: takes 3 hours to die.
- Epicardium is the outer surface of the heart
- Transmural meaning the entire heart: takes  
5-8 hours to die.