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Biopac Student Lab® Lesson 6
ELECTROCARDIOGRAPHY (ECG) II
Analysis Procedure

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V. DATA ANALYSIS

FAST TRACK DATA ANALYSIS

1. Enter the **Review Saved Data** mode.
   - Note Channel Number (CH) designations:

Channel	*Displays*
CH 1	**Lead I**
CH 2	**Lead III**
CH 40	**Lead II** (calculated)

   - Note measurement box settings:

Channel	*Measurement*
CH 1	**Delta**
CH 2	**Delta**
CH40	**Delta**

2. Set up the display window for optimal viewing of the first data recording.

Data Analysis continues…

DETAILED EXPLANATION OF DATA ANALYSIS STEPS

If entering **Review Saved Data** mode from the Startup dialog or lessons menu, make sure to choose the correct file.

Note: After **Done** was pressed in the final recording section, the program used Einthovenõs Law to automatically calculate Lead II from Leads I and III and added a channel for Lead II to the initial two channel recording (Fig. 6.15).

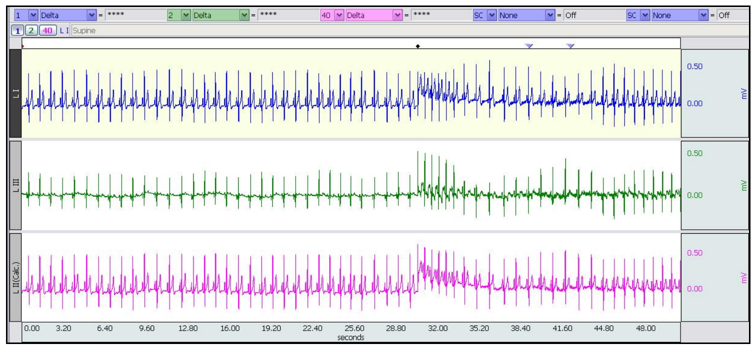

Fig. 6.15 Example data

The measurement boxes are above the marker region in the data window. Each measurement has three sections: channel number, measurement type, and result. The first two sections are pull-down menus that are activated when you click them.

Brief definition of measurements:

Delta: Computes the difference in amplitude between the first point and the last point of the selected area. It is particularly useful for taking ECG measurements, because the baseline does not have to be at zero to obtain accurate, quick measurements.

Rate Mean: If CH 40 Heart Rate data was recorded, use the Rate Mean measurement, which is designed specifically for rate data and calculates accurate statistical means using one value only for every cardiac cycle. This avoids any unintentional weighting due to time variation in heart rate, unlike the amplitude "Mean" measurement.

The ñselected areaò is the area selected by the **I-beam** tool (including endpoints).

Note: The append event markers ◆ mark the beginning of each recording. Click on (activate) the event marker to display its label.

Useful tools for changing view:

Display menu: Autoscale Horizontal, Autoscale Waveforms, Zoom Back, Zoom Forward

Scroll Bars: Time (Horizontal); Amplitude (Vertical)

Cursor Tools: Zoom Tool

Buttons: Overlap, Split, Show Grid, Hide Grid, -, +

Hide/Show Channel: ñAlt + clickò (Windows) or ñOption + clickò (Mac) the channel number box to toggle channel display.

The data window should resemble Fig. 6.16.

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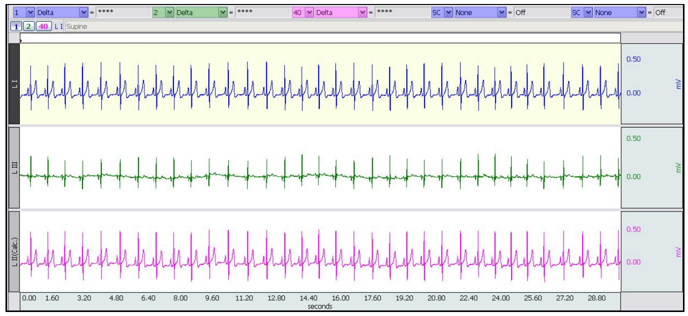


Fig. 6.16 Supine data

3. Zoom in to select two consecutive ñcleanò cardiac cycles in the ñ**Supine**ò recording.

A clean cardiac cycle has ECG components that are easy to discern (Fig. 6.17).

4. Place an **event marker** above the second R-wave to indicate which cardiac cycle will be used for measurements.

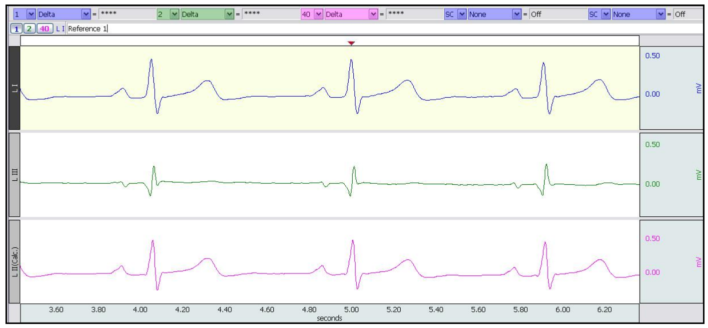


Fig. 6.17 Zoom in on Supine data

Insert the event marker directly above the R wave of the second cardiac cycle in the display.

To place an event marker (inverted triangle,) Right-click with the cursor in the event marker region and choose the contextual menu item ñInsert New Event.ò You can then move the marker by holding down the ñAltò key while clicking and dragging it.

Type ñ**Reference 1**ò to label the marker.

5. Use the **I-Beam** cursor to select the area from the midpoint between the cycles (baseline) and the R-wave of the second cycle

   A, B

Start at the midpoint between the T-wave of cardiac cycle 1 (left) and the P-wave of cardiac cycle 2. Press and hold the mouse and sweep the cursor to the right until the end of the selected area is at peak of the desired waveð monitor the Delta measurement to determine when the actual peak is reached; small movements to the right or left may be necessary.

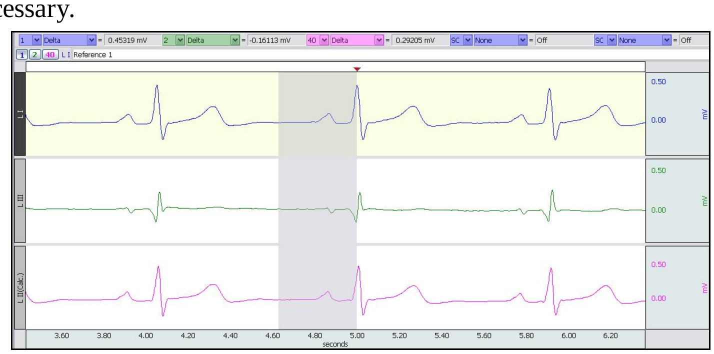


Fig. 6.18 Selection from baseline to R wave peak

Note R-waves may be inverted on some of the leads; include the polarity of the Delta result in the Data Report tables.

6. Scroll to the ñ**Seated**ò recording, select two consecutive cardiac cycles and repeat the procedure described in Steps 4 and 5.

Do not use a section between the ñ**Start of inhale**ò and ñ**Start of exhale**ò event markers.

Note All remaining measurements are taken on Lead I and Lead III only so you may choose to hide Lead II (CH 40).

Data Analysis continues…

7. Scroll to the ñ**Start of inhale**ò section and select two consecutive cardiac cycles and repeat the procedure described in Steps 4 and 5.

   B

   Type ñ**Reference 2**ò to label the marker.

8. Scroll to the ñ**Start of exhale**ò section and select two consecutive cardiac cycles and repeat the procedure described in Steps 4 and 5.

   B

   Type ñ**Reference 3**ò to label the marker.

9. Go back to the ñ**Reference 1**ò marker created in Step 4.

   Use the event marker left and right arrows to move to different markers.

10. Measure the waves of the **QRS** complex and record the amplitudes for **Lead I** and **Lead III**.

    C

    To measure a wave, select the area from the baseline (Isoelectric Line) to the peak of the wave.

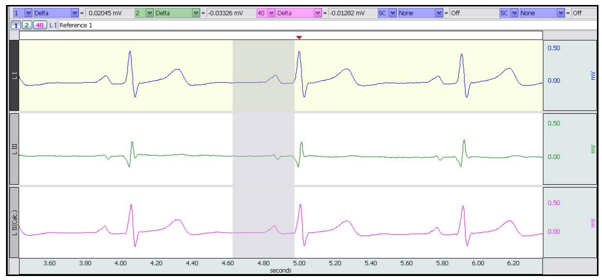


Fig. 6.19 Sample measurement of the Q wave

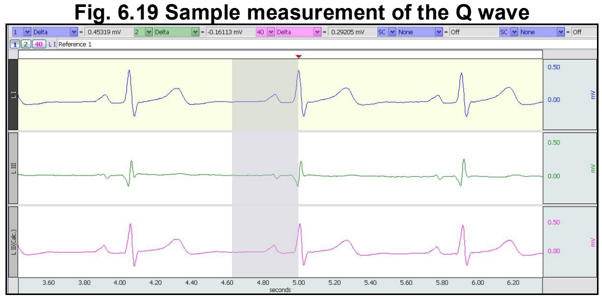


Fig. 6.20 Sample measurement of the R wave

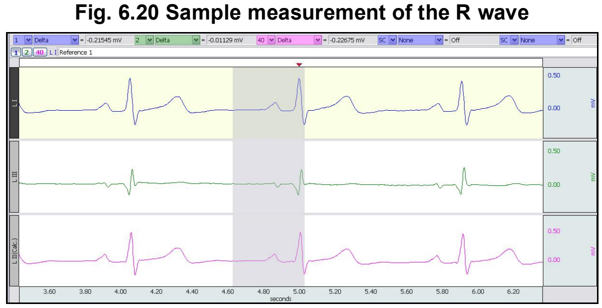


Fig. 6.21 Sample measurement of the S wave

11. Fill in the vectorgrams.
12. Answer the questions at the end of the Data Report.
13. **Save** or **Print** the data file.
14. **Quit** the program.

- The L06 Vectorgrams are contained in the printed manual, or can be printed directly from the Help menu.
- An electronically editable **Data Report** is located in the journal (following the lesson summary,) or immediately following this Data Analysis section. Your instructor will recommend the preferred format for your lab.

END OF DATA ANALYSIS

END OF LESSON 6

Complete the Lesson 6 Data Report that follows.

ELECTROCARDIOGRAPHY II

- *Bipolar Leads (Leads I, II, III,) Einthoven's Law, and*
- *Mean Electrical Axis on the Frontal Plane*

DATA REPORT

Studentôs Name: ____

Lab Section: ____

Date: ____

Subject Profile

Name:____ Height:____________________

Age:________________ Gender: Male / Female Weight:____________________

I. Data and Plots

A. **Einthoven's Law—Simulated Confirmation: Lead I + Lead III = Lead II**

Table 6.1 Supine

Lead	*Same Single Cardiac Cycle*	mV*	
Lead I	1 Delta		*Include the polarity (+ or -) of the Delta result since R-waves may be inverted on some of the leads.
Lead III	2 Delta		
Lead II	40 Delta		

B. **Mean Electrical Axis of the Ventricles (QRS Axis) and Mean Ventricular Potential—Graphical Estimate**

Use Table 6.2 to record measurements from the Data Analysis section:

Table 6.2

CONDITION	QRS Lead I 1 Delta	QRS Lead III 2 Delta
Supine		
Seated		
Start of inhale		
Start of exhale		

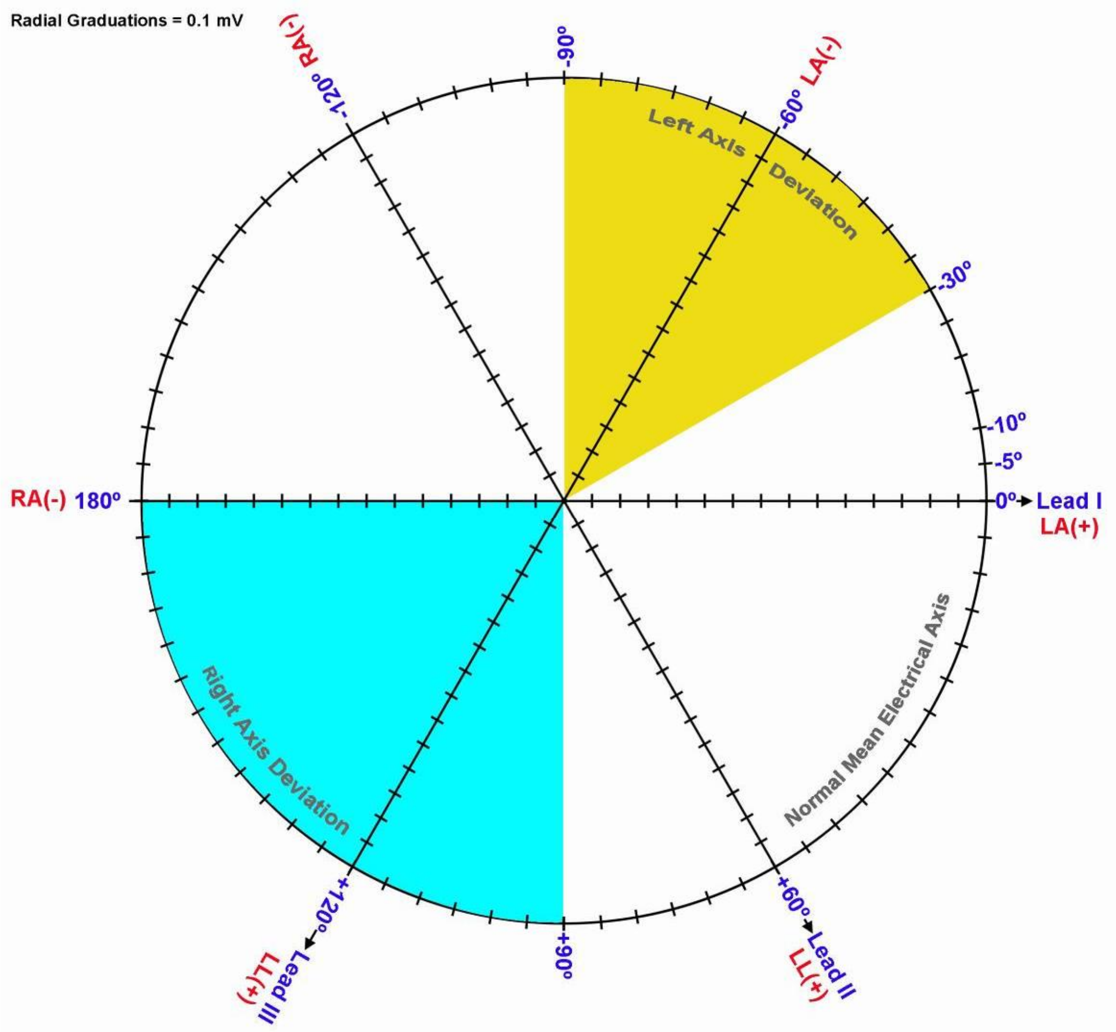
One way to approximate the mean electrical axis in the frontal plane is to plot the magnitude of the R wave from Lead I and Lead III, as shown in the Introduction (Fig. 6.4).

1. Draw a perpendicular line from the ends of the vectors (right angles to the axis of the Lead) using a protractor or right angle guide.
2. Determine the point of intersection of these two perpendicular lines.
3. Draw a new vector from point 0.0 to the point of intersection.

The direction of this resulting vector approximates the mean electrical axis (QRS Axis) of the ventricles. The length of this vector approximates the mean ventricular potential.

Create two plots on each of the following graphs, using data from Table 6.2. Use a different color pencil or pen for each plot.

Graph 1: ***Supine and Seated***



From the above graph, find the following values:

Condition	Mean Ventricular Potential	Mean Ventricular (QRS) Axis
Supine	____________________	____________________
Seated	____________________	____________________

Explain the difference (if any) in Mean Ventricular Potential and Axis under the two conditions:

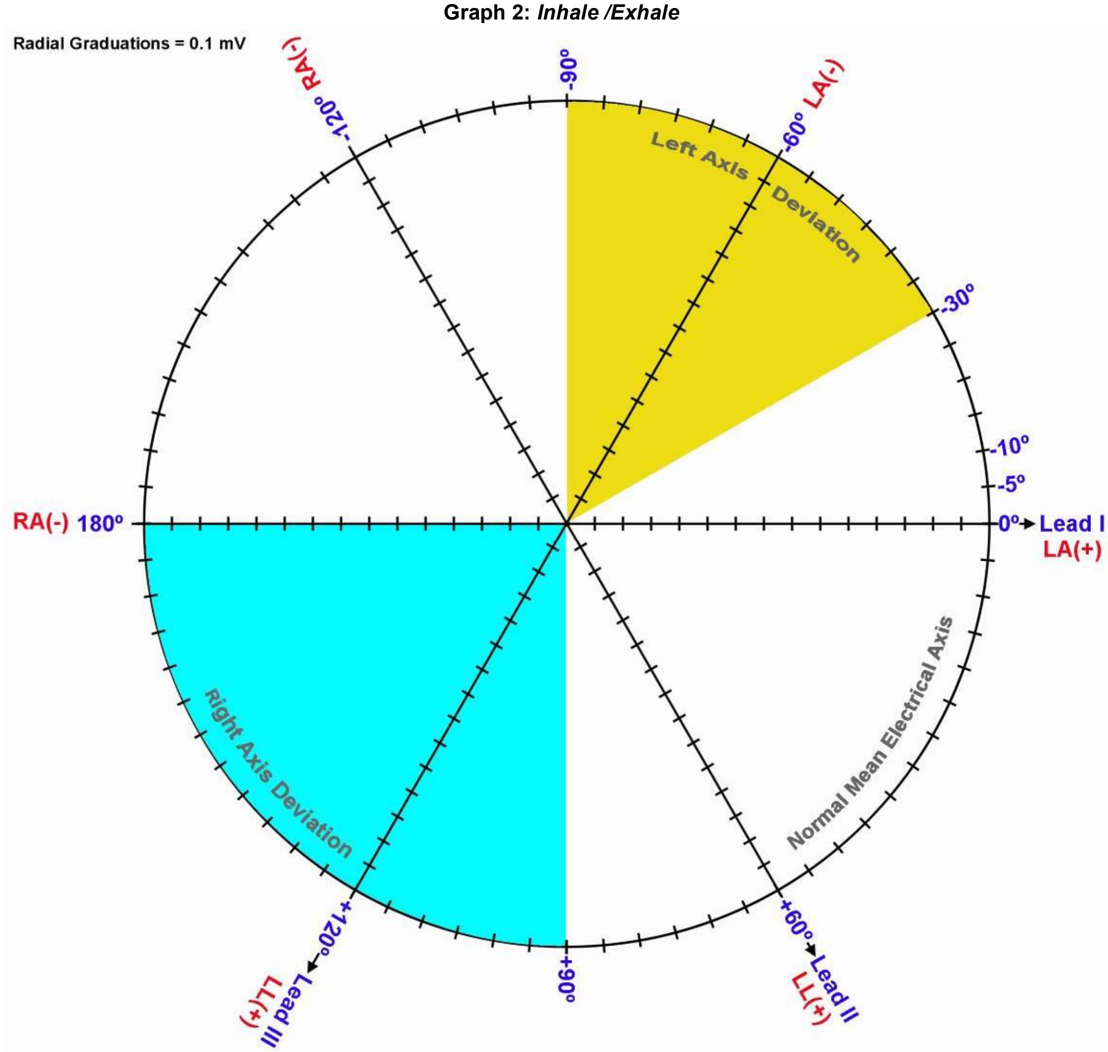
____

____

____

____

Graph 2: *Inhale /Exhale*



From the above graph, find the following values:

Condition	Mean Ventricular Potential	Mean Ventricular (QRS) Axis
Start of inhale	____________________	____________________
Start of exhale	____________________	____________________

Explain the difference (if any) in Mean Ventricular Potential and Axis under the two conditions:

____

____

____

____

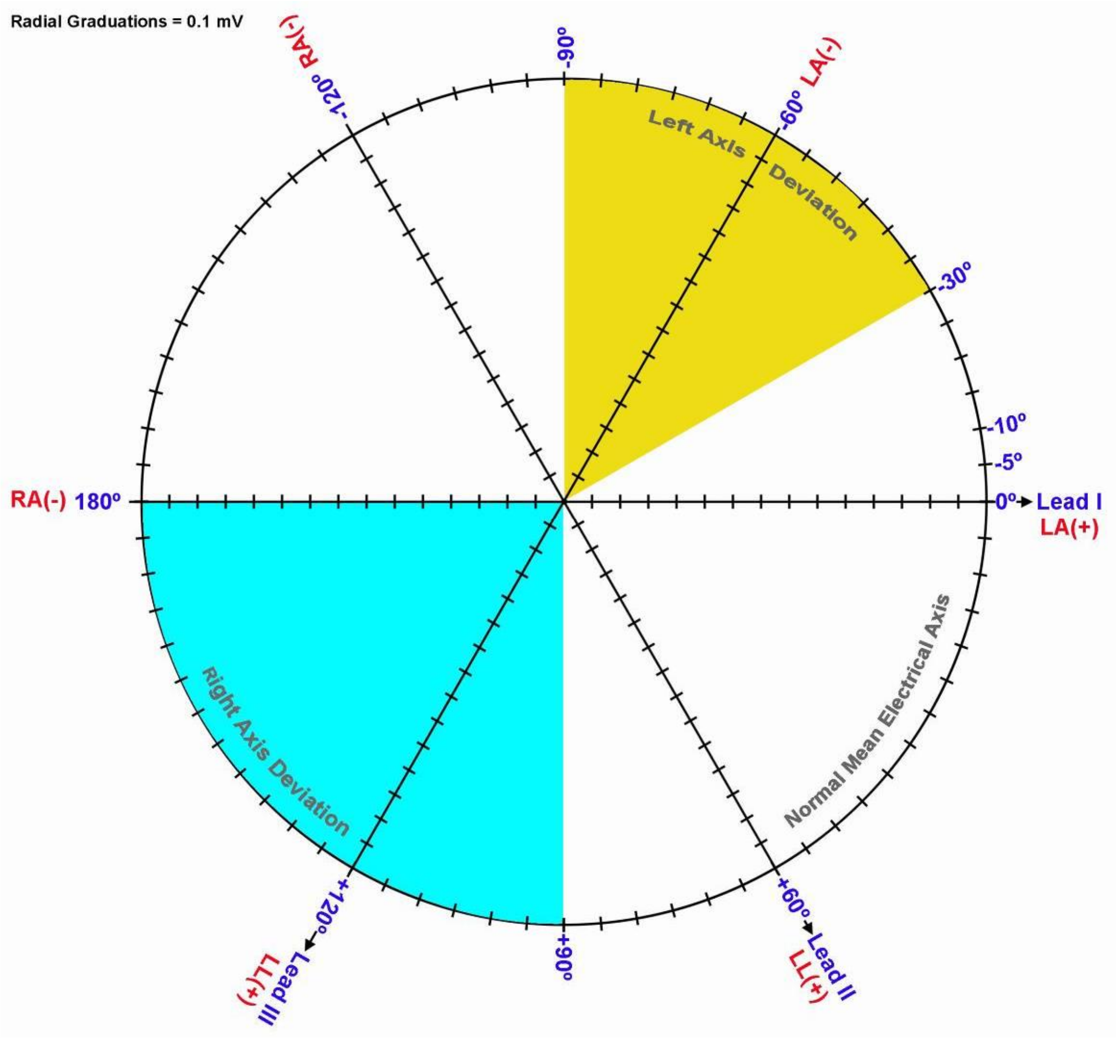
C. **Mean Electrical Axis of the Ventricles (QRS Axis) and Mean Ventricular Potential—More Accurate Approximation**

Use Table 6.3 to add the Q, R, and S potentials to obtain net potentials for Recording 1ð Supine.

Table 6.3

POTENTIAL	QRS Lead I [1] [Delta]	QRS Lead III [2] [Delta]
Q		
R		
S		
QRS Net		

Graph 3: *Supine*



From the above graph, find the following values:

Condition	Mean Ventricular Potential	Mean Ventricular (QRS) Axis
Supine	______________________	______________________

Explain the difference in Mean Ventricular Potential and Axis for the Supine data in this plot (Graph 3) and the first plot (Graph 1).

____

____

____

II. Questions

D. Define **ECG**.

E. Define **Einthoven's Law**.

F. Define **Einthoven's Triangle** and give an example of its application.

G. What normal factors effect a change the orientation of the **Mean Ventricular (QRS) Axis**?

H. Define **Left Axis Deviation (LAD)** and its causes.

I. Define **Right Axis Deviation (RAD)** and its causes.

J. What factors affect the amplitude of the R wave recorded on the different leads?

III. OPTIONAL Active Learning Portion

A. ***Hypothesis***

B. ***Materials***

C. ***Method***

D. ***Set Up***

E. ***Experimental Results***

End of Lesson 6 Data Report