ECG Project (project 3), College physics II, phys 2020

Due Thursday 10/09/14

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Electric potential due dipole moment at point A (see Fig 1)

$$V(\vec{r}) = k\frac{qd\cos\theta}{r^2} = k\frac{p\cos\theta}{r^2} = k\frac{\vec{p}.\vec{r}}{r^3} = \frac{k}{r^3}[p_x x + p_y y + p_z z]$$

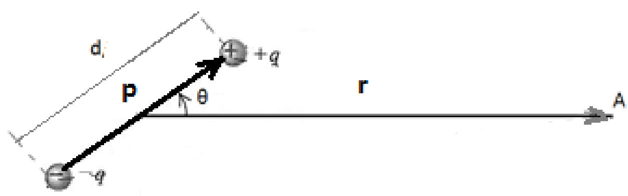


Fig 1.

For simplicity we consider the potential for a two dimensional case at point R, L and B (see Fig 2)

$$V(\overrightarrow{R_R}) = \frac{k}{{R_R}^3}[p_x x_R + p_y y_R]$$

$$V(\overrightarrow{R_L}) = \frac{k}{{R_L}^3}[p_x x_L + p_y y_L]$$

$$V(\overrightarrow{R_B}) = \frac{k}{{R_B}^3}[p_x x_B + p_y y_B]$$

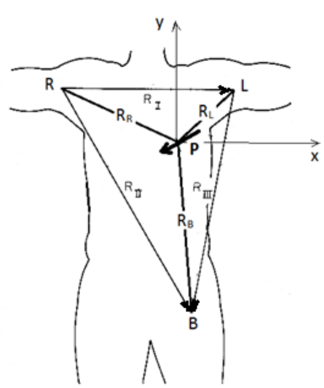


Fig 2.

Therefore $V_I = V(\overrightarrow{R_L}) - V(\overrightarrow{R_R})$, $V_{II} = V(\overrightarrow{R_B}) - V(\overrightarrow{R_R})$ and $V_{III} = V(\overrightarrow{R_{\boldsymbol{B}}}) - V(\overrightarrow{R_L})$

From the above equations we conclude $V_I \propto p_x$ (see Figs 2 and 3).

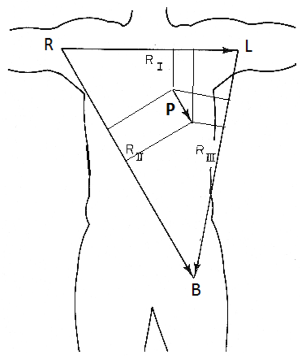
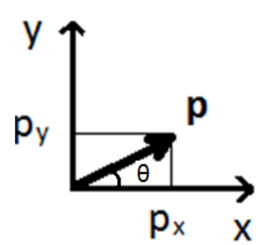


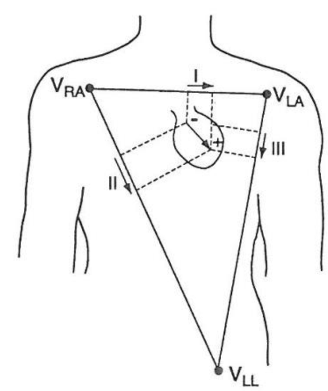
Fig 3.

Use the following data and plot p_y versus p_x, $\omega = \frac{\Delta\theta}{\Delta t}$ versus time and use $V_I \propto p_x$ to plot V_I potential (ECG) verses time.

ECG

t (s)	θ (rad)	P
0	3.141592654	0
0.01	4.188790205	0.1
0.02	4.36332313	0.2
0.03	4.537856055	0.3
0.04	4.886921906	0.7
0.06	5.235987756	1
0.09	5.759586532	0.8
0.12	6.108652382	0.4
0.14	6.283185307	0
0.17	2.35619449	0.1
0.18	2.792526803	0.3
0.185	3.141592654	0.4
0.187	3.316125579	0.5
0.188	3.665191429	0.6
0.19	3.926990817	0.7
0.195	4.188790205	0.9
0.2	4.71238898	1.3
0.205	5.235987756	2





0.21	5.497787144	2.8
0.215	5.759586532	4
0.22	5.934119457	3.8
0.23	0	3
0.24	0.785398163	2.2
0.25	1.570796327	2.1
0.26	2.094395102	1.8
0.28	2.094395102	0.2
0.34	0	0
0.4	5.235987756	0.4
0.45	5.497787144	1
0.52	5.759586532	1.4
0.56	0	1
0.6	0.523598776	0.5
0.64	0.785398163	0.25
0.66	1.047197551	0.2
0.68	0	0