#5 from 2.5 Decipher the following text under the assumption that it was Vigenere enciphered using a three-letter English word.

RLWRV MRLAQ EDUEQ QWGKI LFMFE XZYXA QXGJH FMXKM QWRLA
LKLFE LGWCL SOLMX RLWPI OCVWL SKNIS IMFES JUVAR MFEXZ
CVWUS MJHTC RGRVM RLSZS MREFW XZGRIY RLWPI OMYDB SFJCT
CZYX AQ

We arrange the cipher text into three rows. The first row is every fourth letter starting with the first R. The second row is every fourth letter starting with the first L. The third row is every fourth letter starting with the first W.

RRRQUQKFEYQJMMRLFGLLRPCNLIERCUJCRRZRWGRPMBJCX
LVLEEWMXXHXLKEWSMLIVSIMSVMXVSHRVLSEXRLIYSCZA
WMADQGLFZAGFKWALLCOXWOKWSFJAFZWMTGMSMFZYWODFTYQ

Each row is now a simple shift cipher. We count the frequencies below:

<table>
<thead>
<tr>
<th>row 1</th>
<th>freq</th>
<th>row 2</th>
<th>freq</th>
<th>row 3</th>
<th>freq</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>10</td>
<td>L</td>
<td>6</td>
<td>F</td>
<td>6</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>S</td>
<td>6</td>
<td>W</td>
<td>6</td>
</tr>
<tr>
<td>L</td>
<td>4</td>
<td>X</td>
<td>6</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td>E</td>
<td>3</td>
<td>V</td>
<td>5</td>
<td>M</td>
<td>4</td>
</tr>
<tr>
<td>J</td>
<td>3</td>
<td>E</td>
<td>4</td>
<td>G</td>
<td>3</td>
</tr>
<tr>
<td>M</td>
<td>3</td>
<td>I</td>
<td>4</td>
<td>L</td>
<td>3</td>
</tr>
<tr>
<td>Q</td>
<td>3</td>
<td>M</td>
<td>4</td>
<td>O</td>
<td>3</td>
</tr>
<tr>
<td>U</td>
<td>3</td>
<td>H</td>
<td>2</td>
<td>Z</td>
<td>3</td>
</tr>
<tr>
<td>F</td>
<td>2</td>
<td>R</td>
<td>2</td>
<td>D</td>
<td>2</td>
</tr>
<tr>
<td>G</td>
<td>2</td>
<td>W</td>
<td>2</td>
<td>K</td>
<td>2</td>
</tr>
<tr>
<td>P</td>
<td>2</td>
<td>Q,S</td>
<td>2</td>
<td>T,Y</td>
<td>2</td>
</tr>
</tbody>
</table>
Now we wish to search for a three letter key word. Based on our frequency counts for the three rows as given above, let's make the assumptions that

1. One of the plaintext letters *etaions* enciphers as cipher text R.
2. Three of the plaintext letters *etaions* enciphers as the cipher letters LSX.
3. Two of the plaintext letters *etaions* enciphers as the cipher letters FW.

Using the Vigenere square (pg. 11 from text), these assumptions give, for example, the following table.

<table>
<thead>
<tr>
<th></th>
<th>R</th>
<th>S</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>e</td>
<td>n</td>
<td>o</td>
<td>s</td>
</tr>
<tr>
<td>t</td>
<td>y</td>
<td>z</td>
<td>d</td>
</tr>
<tr>
<td>a</td>
<td>r</td>
<td>s</td>
<td>w</td>
</tr>
<tr>
<td>o</td>
<td>d</td>
<td>e</td>
<td>i</td>
</tr>
<tr>
<td>i</td>
<td>j</td>
<td>k</td>
<td>o</td>
</tr>
<tr>
<td>n</td>
<td>e</td>
<td>f</td>
<td>j</td>
</tr>
<tr>
<td>s</td>
<td>z</td>
<td>a</td>
<td>e</td>
</tr>
</tbody>
</table>

Here, for example, if *t* enciphers as R, then the first letter of the key word must be *y* according to the Vigenere table. If *n* enciphers as S, then the second letter of the key word must be *f* etc... This table gives possible keywords under assumptions on R, S, and W (which could be wrong). So now we look for frequency of key letters by creating a bigger table with all our assumptions 1, 2, and 3 above represented. We also extend the possible plaintext letters to include *hr*. We give this table on the next page.
Note: in the columns corresponding to the second position in the key word (i.e. the cols starting with L,S,X), the key letter “e” shows up the most (a count of 3). This leads us to think the second letter of the key word is e. In a similar fashion we can choose “s” as the third letter since it shows up in the last two columns both times. This leads to the key word “yes” which, as it turns out, is the correct key.