In [1]:

```
import pandas as pd
import numpy as np
import seaborn as sns
from matplotlib import pyplot as plt

from sklearn.neighbors import KNeighborsClassifier
from sklearn.model_selection import train_test_split,cross_val_score
from sklearn.metrics import accuracy_score,classification_report,confusion_matrix
from sklearn.preprocessing import StandardScaler
```

In [2]:

```
glass_data=pd.read_csv('glass.csv')
glass_data
```

Out[2]:

	RI	Na	Mg	Al	Si	K	Ca	Ba	Fe	Type
0	1.52101	13.64	4.49	1.10	71.78	0.06	8.75	0.00	0.0	1
1	1.51761	13.89	3.60	1.36	72.73	0.48	7.83	0.00	0.0	1
2	1.51618	13.53	3.55	1.54	72.99	0.39	7.78	0.00	0.0	1
3	1.51766	13.21	3.69	1.29	72.61	0.57	8.22	0.00	0.0	1
4	1.51742	13.27	3.62	1.24	73.08	0.55	8.07	0.00	0.0	1
...	...	...	...	...	...	...	...	...	...	...
209	1.51623	14.14	0.00	2.88	72.61	0.08	9.18	1.06	0.0	7
210	1.51685	14.92	0.00	1.99	73.06	0.00	8.40	1.59	0.0	7
211	1.52065	14.36	0.00	2.02	73.42	0.00	8.44	1.64	0.0	7
212	1.51651	14.38	0.00	1.94	73.61	0.00	8.48	1.57	0.0	7
213	1.51711	14.23	0.00	2.08	73.36	0.00	8.62	1.67	0.0	7

214 rows × 10 columns

In [3]:

```
glass_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 214 entries, 0 to 213
Data columns (total 10 columns):
 #   Column  Non-Null Count  Dtype  
---  ------  --------------  -----  
 0   RI      214 non-null    float64
 1   Na      214 non-null    float64
 2   Mg      214 non-null    float64
 3   Al      214 non-null    float64
 4   Si      214 non-null    float64
 5   K       214 non-null    float64
 6   Ca      214 non-null    float64
 7   Ba      214 non-null    float64
 8   Fe      214 non-null    float64
 9   Type    214 non-null    int64  
dtypes: float64(9), int64(1)
memory usage: 16.8 KB
```

In [4]:

```
glass_data.dtypes
```

Out[4]:

```
RI      float64
Na      float64
Mg      float64
Al      float64
Si      float64
K       float64
Ca      float64
Ba      float64
Fe      float64
Type      int64
dtype: object
```

In [5]:

```
glass_data.isnull().sum()
```

Out[5]:

```
RI      0
Na      0
Mg      0
Al      0
Si      0
K       0
Ca      0
Ba      0
Fe      0
Type    0
dtype: int64
```

In [6]:

```
glass_data.duplicated().sum()
```

Out[6]:

```
1
```

In [7]:

```
glass_data[glass_data.duplicated()]
```

Out[7]:

	RI	Na	Mg	Al	Si	K	Ca	Ba	Fe	Type
39	1.52213	14.21	3.82	0.47	71.77	0.11	9.57	0.0	0.0	1

In [8]:

```
glass_data.drop_duplicates(inplace=True)
```

In [9]:

```
glass_data.duplicated().sum()
```

Out[9]:

```
0
```

In [10]:

```
glass_data.head()
```

Out[10]:

	RI	Na	Mg	Al	Si	K	Ca	Ba	Fe	Type
0	1.52101	13.64	4.49	1.10	71.78	0.06	8.75	0.0	0.0	1
1	1.51761	13.89	3.60	1.36	72.73	0.48	7.83	0.0	0.0	1
2	1.51618	13.53	3.55	1.54	72.99	0.39	7.78	0.0	0.0	1
3	1.51766	13.21	3.69	1.29	72.61	0.57	8.22	0.0	0.0	1
4	1.51742	13.27	3.62	1.24	73.08	0.55	8.07	0.0	0.0	1

In [11]:

```
glass_data.shape
```

Out[11]:

```
(213, 10)
```

In [12]:

```
glass_data['Type'].unique()
```

Out[12]:

```
array([1, 2, 3, 5, 6, 7], dtype=int64)
```

In [13]:

```
glass_data.describe()
```

Out[13]:

	RI	Na	Mg	Al	Si	K	Ca	
count	213.000000	213.000000	213.000000	213.000000	213.000000	213.000000	213.000000	21
mean	1.518348	13.404085	2.679202	1.449484	72.655070	0.498873	8.954085	
std	0.003033	0.816662	1.443691	0.495925	0.773998	0.653185	1.425882	
min	1.511150	10.730000	0.000000	0.290000	69.810000	0.000000	5.430000	
25%	1.516520	12.900000	2.090000	1.190000	72.280000	0.130000	8.240000	
50%	1.517680	13.300000	3.480000	1.360000	72.790000	0.560000	8.600000	
75%	1.519150	13.810000	3.600000	1.630000	73.090000	0.610000	9.150000	
max	1.533930	17.380000	4.490000	3.500000	75.410000	6.210000	16.190000	

In [14]:

```
glass_data["Type"].value_counts()
```

Out[14]:

```
2    76
1    69
7    29
3    17
5    13
6     9
Name: Type, dtype: int64
```

In [15]:

```
X= glass_data.drop('Type',axis=1)
y=glass_data[['Type']]
X_train,X_test,y_train,y_test = train_test_split(X,y,test_size=0.20,random_state=10)
X_train.shape,y_train.shape
```

Out[15]:

```
((170, 9), (170, 1))
```

In [16]:

```
X_test.shape,y_test.shape
```

Out[16]:

```
((43, 9), (43, 1))
```

In [17]:

```
knn = KNeighborsClassifier(n_neighbors=1)
knn.fit(X_train,y_train)
```

```
C:\Users\sowmya sandeep\anaconda3\lib\site-packages\sklearn\neighbors\_class
ification.py:200: DataConversionWarning: A column-vector y was passed when a
1d array was expected. Please change the shape of y to (n_samples,), for exa
mple using ravel().
  return self._fit(X, y)
```

Out[17]:

KNeighborsClassifier

KNeighborsClassifier(n_neighbors=1)

In [18]:

```
#prediction for training
pred_y= knn.predict(X_train)
```

In [19]:

```
#accuracy Score
accuracy_score(y_train,pred_y)
```

Out[19]:

```
1.0
```

In [20]:

```
#counfusion Matrix
confusion_matrix(y_train,pred_y)
```

Out[20]:

```
array([[47,  0,  0,  0,  0,  0],
       [ 0, 66,  0,  0,  0,  0],
       [ 0,  0, 13,  0,  0,  0],
       [ 0,  0,  0, 12,  0,  0],
       [ 0,  0,  0,  0,  6,  0],
       [ 0,  0,  0,  0,  0, 26]], dtype=int64)
```

In [21]:

```
print(classification_report(y_train,pred_y))
```

```
              precision    recall  f1-score   support

           1       1.00      1.00      1.00        47
           2       1.00      1.00      1.00        66
           3       1.00      1.00      1.00        13
           5       1.00      1.00      1.00        12
           6       1.00      1.00      1.00         6
           7       1.00      1.00      1.00        26

    accuracy                           1.00       170
   macro avg       1.00      1.00      1.00       170
weighted avg       1.00      1.00      1.00       170
```

In [22]:

```
#prediction for testing data
y_pred=knn.predict(X_test)
#accuracy score for test data
accuracy_score(y_test,y_pred)
```

Out[22]:

```
0.6976744186046512
```

In [23]:

```
#confusion Matrix
confusion_matrix(y_test,y_pred)
```

Out[23]:

```
array([[12,  6,  4,  0,  0,  0],
       [ 0, 10,  0,  0,  0,  0],
       [ 1,  0,  3,  0,  0,  0],
       [ 0,  0,  0,  1,  0,  0],
       [ 0,  1,  0,  1,  1,  0],
       [ 0,  0,  0,  0,  0,  3]], dtype=int64)
```

In [24]:

```python
print(classification_report(y_test,y_pred))
```

	precision	recall	f1-score	support
1	0.92	0.55	0.69	22
2	0.59	1.00	0.74	10
3	0.43	0.75	0.55	4
5	0.50	1.00	0.67	1
6	1.00	0.33	0.50	3
7	1.00	1.00	1.00	3
accuracy			0.70	43
macro avg	0.74	0.77	0.69	43
weighted avg	0.80	0.70	0.69	43

In [25]:

```python
import matplotlib.pyplot as plt
%matplotlib inline
# choose k between 1 to 41
k_range = range(1, 41)
k_scores = []
# use iteration to caclulator different k in models, then return the average accuracy based
for k in k_range:
    knn = KNeighborsClassifier(n_neighbors=k)
    scores = cross_val_score(knn, X, y, cv=5)
    k_scores.append(scores.mean())
```

```
  return self._fit(X, y)
C:\Users\sowmya sandeep\anaconda3\lib\site-packages\sklearn\neighbors\_cla
ssification.py:200: DataConversionWarning: A column-vector y was passed wh
en a 1d array was expected. Please change the shape of y to (n_samples,),
for example using ravel().
  return self._fit(X, y)
C:\Users\sowmya sandeep\anaconda3\lib\site-packages\sklearn\neighbors\_cla
ssification.py:200: DataConversionWarning: A column-vector y was passed wh
en a 1d array was expected. Please change the shape of y to (n_samples,),
for example using ravel().
  return self._fit(X, y)
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ssification.py:200: DataConversionWarning: A column-vector y was passed wh
en a 1d array was expected. Please change the shape of y to (n_samples,),
for example using ravel().
  return self._fit(X, y)
C:\Users\sowmya sandeep\anaconda3\lib\site-packages\sklearn\neighbors\_cla
ssification.py:200: DataConversionWarning: A column-vector y was passed wh
en a 1d array was expected. Please change the shape of y to (n_samples,),
for example using ravel().
```
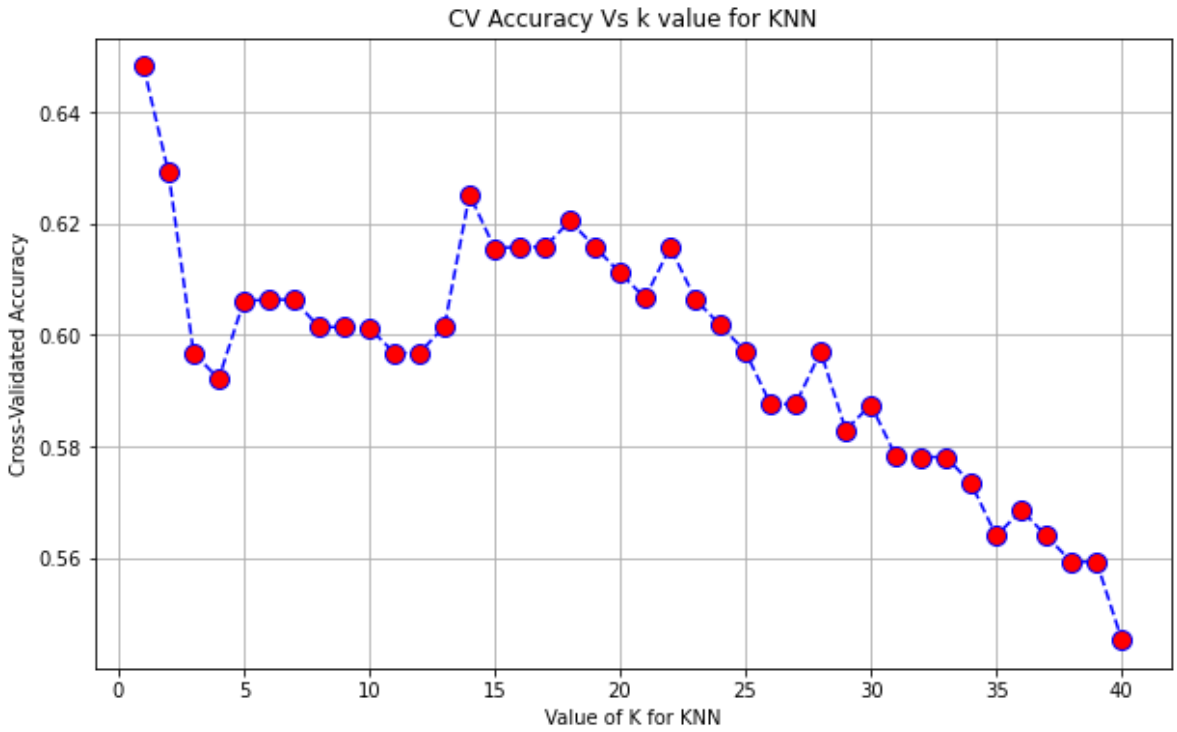

In [26]:

```
# plot to see clearly
plt.figure(figsize=(10,6))
plt.plot(k_range, k_scores,color='blue',linestyle='dashed',marker='o',markerfacecolor='red'
plt.grid(True)
plt.title('CV Accuracy Vs k value for KNN')
plt.xlabel('Value of K for KNN')
plt.ylabel('Cross-Validated Accuracy')
plt.show()
```



In [ ]:

```
```