In [1]:
```
# KNN Classification
import pandas as pd
import numpy as np
from sklearn.model_selection import KFold
from sklearn.model_selection import cross_val_score
from sklearn.neighbors import KNeighborsClassifier
```

In [2]:
```
glass= pd.read_csv("D:\EXCLER solution\ASSIGNMENT\KNN\glass.csv")
glass.head()
```

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	0.0	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 [3]:
```
glass.isnull().sum()
```

Out[3]:
```
RI      0
Na      0
Mg      0
Al      0
Si      0
K       0
Ca      0
Ba      0
Fe      0
Type    0
dtype: int64
```

In [4]:
```
glass.duplicated().sum()
```

Out[4]:
```
1
```

In [5]:
```
glass.drop_duplicates(inplace=True)
```

In [6]:
```
glass.duplicated().sum()
```

Out[6]:
```
0
```

In [7]:
```
glass.Type.value_counts()
```

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

In [8]:
```
glass.shape
```

Out[8]:
```
(213, 10)
```

In [10]:
```
glass.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 213 entries, 0 to 213
Data columns (total 10 columns):
 #   Column  Non-Null Count  Dtype  
---  ------  --------------  -----  
 0   RI      213 non-null    float64
 1   Na      213 non-null    float64
 2   Mg      213 non-null    float64
 3   Al      213 non-null    float64
 4   Si      213 non-null    float64
 5   K       213 non-null    float64
 6   Ca      213 non-null    float64
 7   Ba      213 non-null    float64
 8   Fe      213 non-null    float64
 9   Type    213 non-null    int64  
dtypes: float64(9), int64(1)
memory usage: 18.3 KB
```

Normalizing data

In [11]:
```
from sklearn.preprocessing import scale

glass1=glass.iloc[:,:9]
```

In [12]:
```
# Converting into numpy array
glass2=glass1.values
```

In [13]:
```
# Normalizing the  data
glass_norm = scale(glass2)
```

Train test split

In [14]:
```
from sklearn.model_selection import train_test_split

x=glass_norm
y=glass['Type']
```

In [15]:
```
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.30, random_state=42)
```

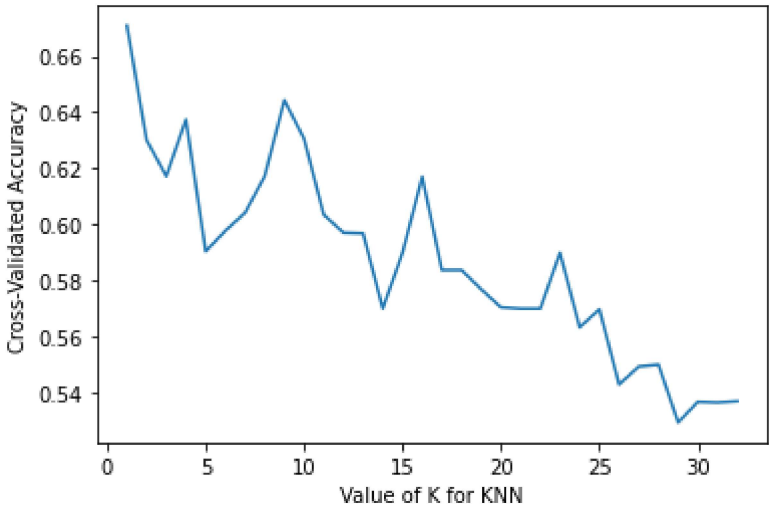
KNN (K Neighrest Neighbour Classifier)

In [16]:
```
from sklearn.model_selection import cross_val_score
from sklearn.neighbors import KNeighborsClassifier
import matplotlib.pyplot as plt
import seaborn as sns
```

Visualizing the CV results

In [17]:
```
k_range = range(1, 33)
```

```
k_scores = []
for k in k_range:
    knn = KNeighborsClassifier(n_neighbors=k)
    train_scores = cross_val_score(knn, x_train, y_train, cv=5)
    k_scores.append(train_scores.mean())
plt.plot(k_range, k_scores)
plt.xlabel('Value of K for KNN')
plt.ylabel('Cross-Validated Accuracy')
plt.show()
```



In [18]:
```
model = KNeighborsClassifier(n_neighbors=2)
```

In [19]:
```
model.fit(x_train, y_train)
```

Out[19]:
```
KNeighborsClassifier(n_neighbors=2)
```

In [20]:
```
model.score(x_test, y_test)
```

Out[20]:
```
0.671875
```

In [27]:
```
k_scores
```

```
[0.6710344827586207,
```

Out[27]:
```
0.6301149425287356,
0.6172413793103448,
0.6374712643678161,
0.590344827586207,
0.5977011494252873,
0.6041379310344828,
0.6172413793103448,
0.6443678160919539,
0.6305747126436783,
0.603448275862069,
0.5970114942528737,
0.5967816091954024,
0.5698850574712644,
0.5898850574712644,
0.6170114942528736,
0.5836781609195402,
0.5836781609195402,
0.5767816091954022,
0.5703448275862069,
0.5698850574712644,
0.5698850574712644,
0.5898850574712643,
0.5632183908045977,
0.5696551724137932,
0.5427586206896551,
0.5491954022988506,
0.5498850574712644,
0.5291954022988505,
0.5365517241379311,
0.5363218390804597,
0.5367816091954023]
```

Grid Search for Algorithm Tuning

In [21]:
```
# Grid Search for Algorithm Tuning
from sklearn.neighbors import KNeighborsClassifier
from sklearn.model_selection import GridSearchCV
```

In [22]:
```
n_neighbors = np.array(range(1,40))
param_grid = dict(n_neighbors=n_neighbors)
```

In [23]:
```
model = KNeighborsClassifier()
grid = GridSearchCV(estimator=model, param_grid=param_grid)
grid.fit(x_train, y_train)
```

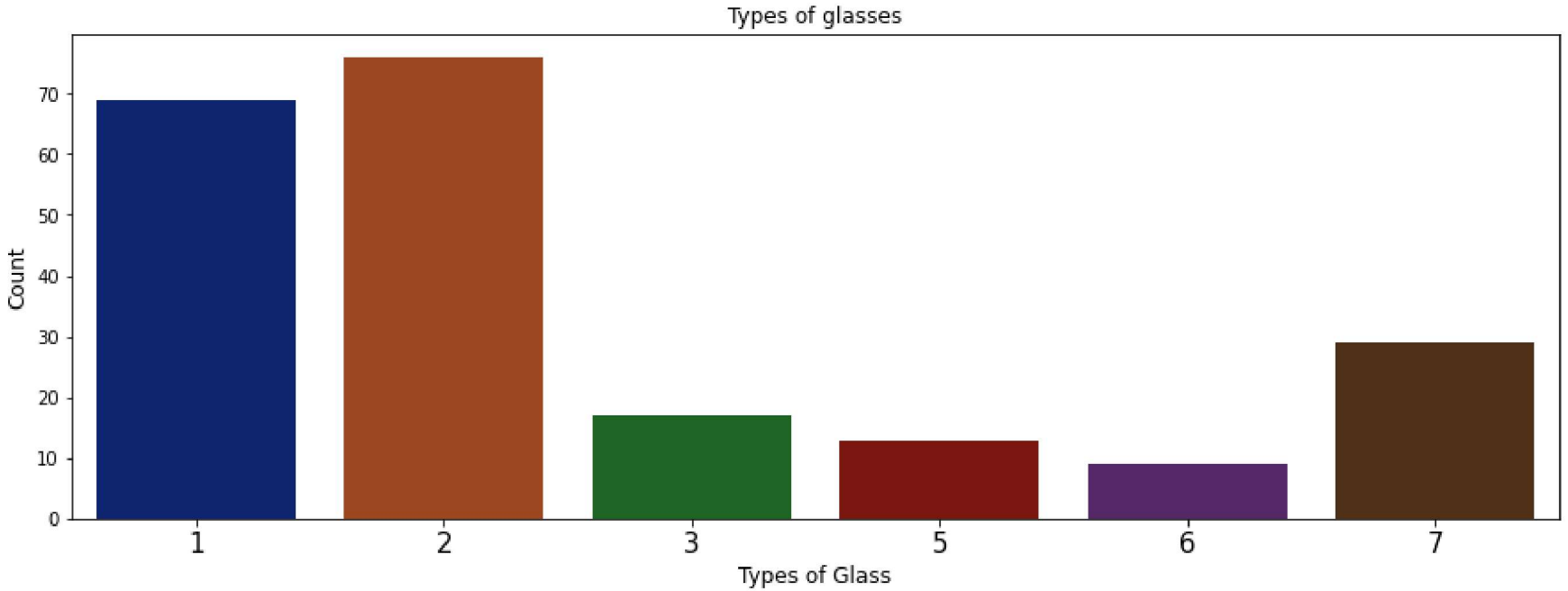
Out[23]:
```
GridSearchCV(estimator=KNeighborsClassifier(),
             param_grid={'n_neighbors': array([ 1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16, 17,
       18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34,
       35, 36, 37, 38, 39])})
```

In [24]:
```
print(grid.best_score_)
print(grid.best_params_)
```

```
0.6710344827586207
{'n_neighbors': 1}
```

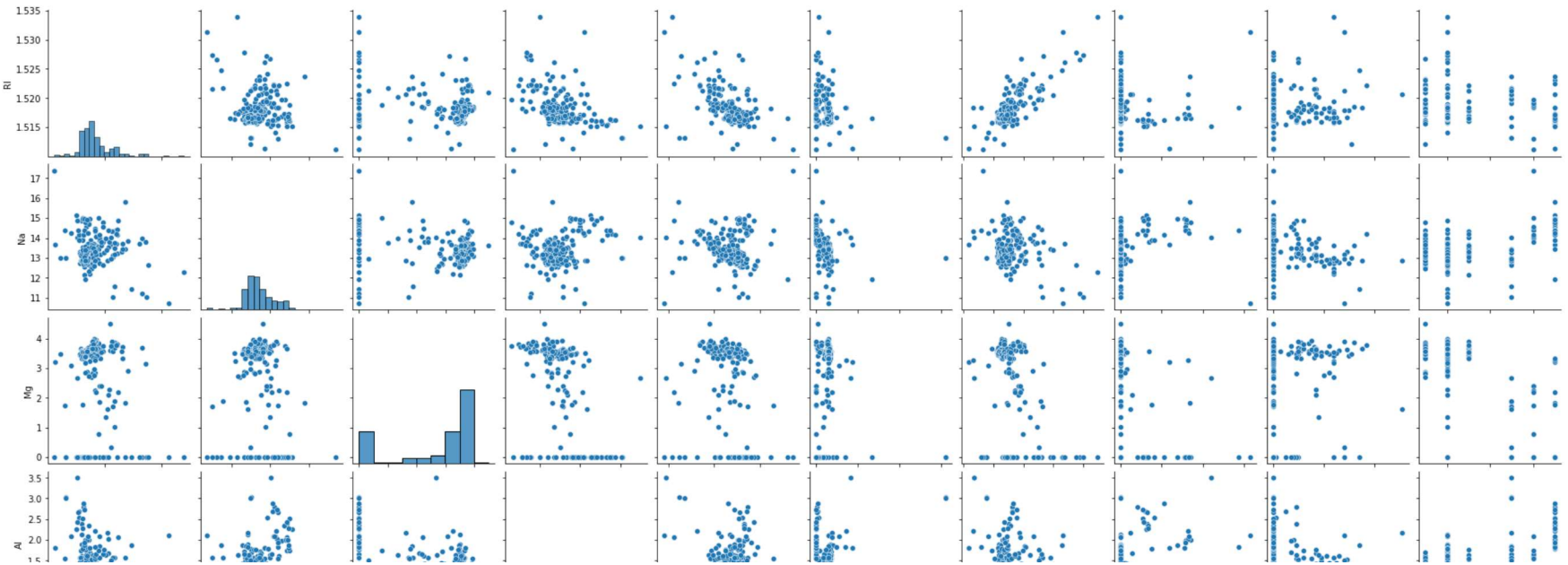
In [25]:
```
import matplotlib.pyplot as plt
import seaborn as sns

plt.figure(figsize=(15, 5))

plt.title("Types of glasses")
sns.countplot(data=glass, x="Type",palette = "dark")
plt.xticks(rotation = 0, size = 15)
plt.xlabel("Types of Glass", fontsize=12)
plt.ylabel("Count", fontsize=12)
```

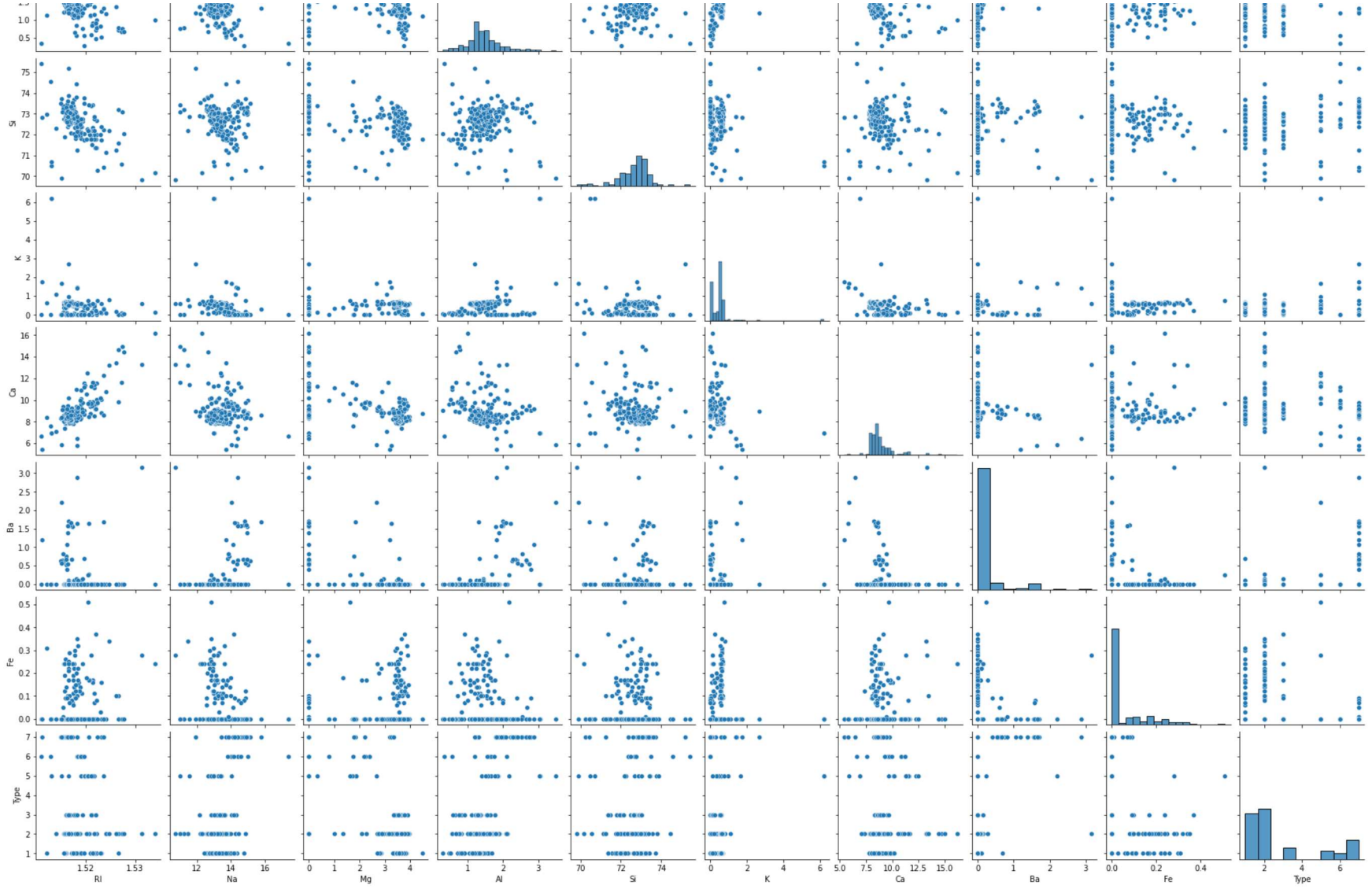
Out[25]:
```
Text(0, 0.5, 'Count')
```



In [26]:
```
sns.pairplot(glass)
```

Out[26]:
```
<seaborn.axisgrid.PairGrid at 0x20bc94b6970>
```





In [ ]: