In [1]:

```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
```

In [2]:

```
filename = "cars.csv"
```

In [3]:

```
dataset=pd.read_csv(filename)
dataset.head()
```

Out[3]:

	mpg	cylinders	cubicinches	hp	weightlbs	time-to-60	year	brand
0	14.0	8	350	165	4209	12	1972	US.
1	31.9	4	89	71	1925	14	1980	Europe.
2	17.0	8	302	140	3449	11	1971	US.
3	15.0	8	400	150	3761	10	1971	US.
4	30.5	4	98	63	2051	17	1978	US.

In [4]:

```
X= dataset.iloc[: ,:-1].values
X = pd.DataFrame(X)
```

In [5]:

```
X.columns=['mpg','cylinders', 'cubicinches', 'hp', 'weightlbs', 'time-to-60','year']
X=X.infer_objects()
```

In [6]:

```
X.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 261 entries, 0 to 260
Data columns (total 7 columns):
 #   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
 0   mpg          261 non-null    float64
 1   cylinders    261 non-null    int64  
 2   cubicinches  261 non-null    object 
 3   hp           261 non-null    int64  
 4   weightlbs    261 non-null    object 
 5   time-to-60   261 non-null    int64  
 6   year         261 non-null    int64  
dtypes: float64(1), int64(4), object(2)
memory usage: 14.4+ KB
```

In [7]:

```
X=X.apply(pd.to_numeric,errors="coerce")
```

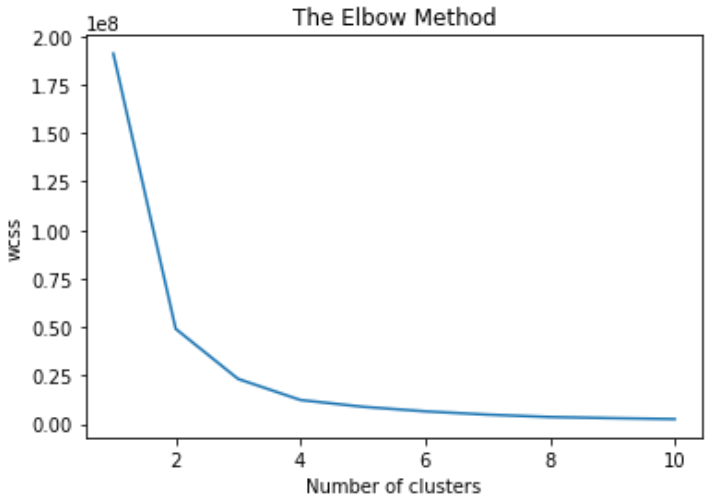
In [8]:

```
for i in X.columns:
    X[i]=X[i].fillna(int(X[i].mean()))
```

In [11]:

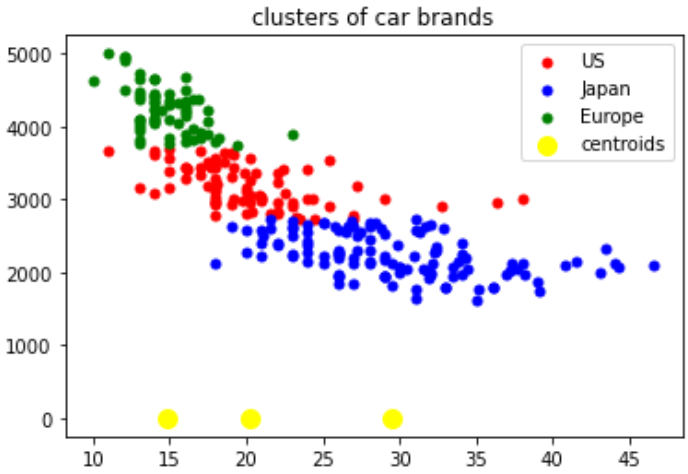
```
from sklearn.cluster import KMeans
wcss=[]
for i in range (1,11):
    kmeans=KMeans(n_clusters=i,init='k-means++',max_iter=300,n_init=10,random_state=0)
    kmeans.fit(X)
    wcss.append(kmeans.inertia_)

plt.plot(range(1,11),wcss)
plt.title('The Elbow Method')
plt.xlabel('Number of clusters')
plt.ylabel('wcss')
plt.show()
```



In [19]:

```
kmeans=KMeans(n_clusters=3,init='k-means++',max_iter=300,n_init=10,random_state=0)
y_kmeans=kmeans.fit_predict(X)
#X=X.to_numpy()
plt.scatter(X[y_kmeans==0,0],X[y_kmeans==0,4],s=25,c='red',label='US')
plt.scatter(X[y_kmeans==1,0],X[y_kmeans==1,4],s=25,c='blue',label='Japan')
plt.scatter(X[y_kmeans==2,0],X[y_kmeans==2,4],s=25,c='green',label='Europe')
plt.scatter(kmeans.cluster_centers_[:,0],kmeans.cluster_centers_[:,1],s=100,c='yellow',l
abel='centroids')
plt.title("clusters of car brands")
plt.legend()
plt.show()
```



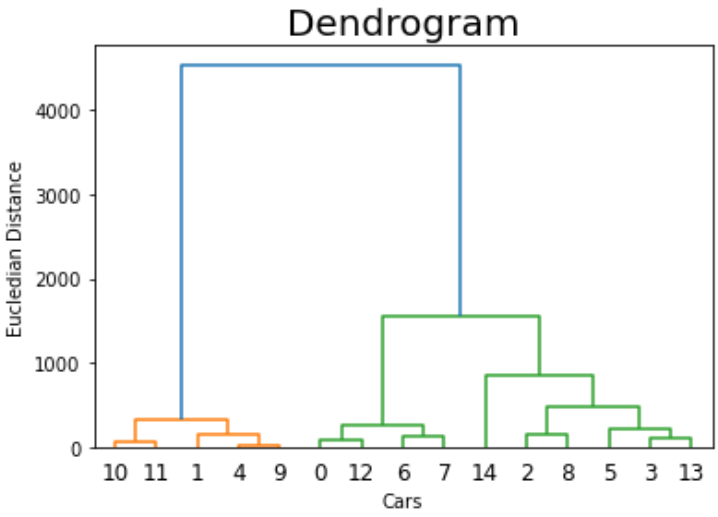
In [20]:

```
import scipy.cluster.hierarchy as sch
```

In [22]:

```
dendrogram=sch.dendrogram(sch.linkage(X[:15,:],method='ward'))
plt.title('Dendrogram',fontsize=20)
plt.xlabel('Cars')
plt.ylabel("Eucledian Distance")
```

```
plt.show()
```



In [23]:

```
from sklearn.cluster import AgglomerativeClustering
cluster=AgglomerativeClustering(n_clusters=3,affinity='euclidean',linkage='ward')
cluster.fit_predict(X)
```

Out[23]:

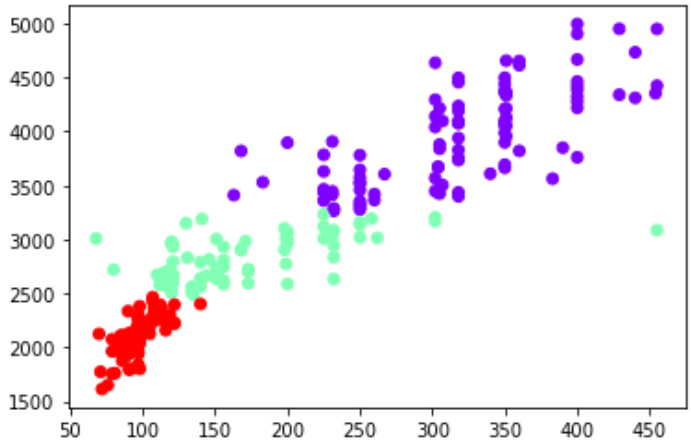
```
array([0, 2, 0, 0, 2, 0, 0, 0, 0, 2, 2, 2, 0, 0, 1, 0, 2, 0, 2, 2, 2, 1,
       1, 0, 2, 2, 2, 0, 0, 2, 2, 0, 1, 1, 2, 0, 2, 1, 0, 0, 0, 0, 0, 0,
       1, 1, 0, 2, 2, 1, 0, 1, 0, 2, 0, 0, 1, 2, 2, 0, 1, 2, 1, 2, 0, 0,
       2, 2, 2, 0, 1, 1, 2, 1, 2, 1, 1, 1, 2, 2, 0, 0, 0, 1, 2, 2, 1, 0,
       2, 1, 2, 2, 0, 0, 2, 0, 0, 1, 0, 0, 0, 0, 2, 2, 2, 1, 2, 2, 1, 0,
       2, 1, 0, 2, 2, 0, 1, 1, 2, 0, 2, 2, 0, 1, 2, 1, 0, 2, 1, 2, 2, 1,
       0, 0, 0, 0, 2, 1, 1, 1, 1, 2, 1, 2, 0, 1, 0, 1, 0, 1, 1, 1, 0, 1,
       2, 0, 2, 2, 1, 0, 1, 0, 1, 1, 2, 0, 0, 1, 1, 2, 2, 1, 1, 1, 2, 2,
       0, 0, 0, 2, 1, 2, 0, 0, 2, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 2, 1, 2,
       2, 2, 2, 1, 0, 0, 2, 0, 2, 1, 0, 1, 1, 0, 2, 2, 1, 1, 2, 0, 1, 0,
       1, 1, 0, 0, 0, 2, 0, 2, 1, 1, 0, 1, 1, 0, 1, 2, 0, 1, 2, 2, 0, 1,
       0, 1, 0, 0, 0, 2, 2, 1, 2, 1, 1, 0, 1, 2, 0, 2, 1, 0, 0],
      dtype=int64)
```

In [24]:

```
plt.scatter(X[:,2],X[:,4],c=cluster.labels_,cmap='rainbow')
```

Out[24]:

```
<matplotlib.collections.PathCollection at 0x19672bcff10>
```



In [ ]:

```

```