In [1]:

```
# Load dataset
import pandas as pd

image_feature_train = pd.read_csv('dataset/image_feature_train.csv', hea
der=None)[1].fillna(value='')
question_feature_train = pd.read_csv('dataset/question_feature_train.cs
v', header=None)[1].fillna(value='')
y_train = pd.read_csv('dataset/y_train.csv', header=None)[1].fillna(valu
e='')

image_feature_val = pd.read_csv('dataset/image_feature_val.csv', header=
None)[1].fillna(value='')
question_feature_val = pd.read_csv('dataset/question_feature_val.csv', h
eader=None)[1].fillna(value='')
y_val = pd.read_csv('dataset/y_val.csv', header=None)[1].fillna(value=''
)

image_feature_test = pd.read_csv('dataset/image_feature_test.csv', heade
r=None)[1].fillna(value='')
question_feature_test = pd.read_csv('dataset/question_feature_test.csv',
header=None)[1].fillna(value='')


print(y_train.shape)
print(y_val.shape)
```

```
(20000,)
(2000,)
```

In [2]:

```
# One hot encoding
import numpy as np
from sklearn.feature_extraction.text import CountVectorizer

def one_hot_transform(text):
    count = CountVectorizer()
    bag = count.fit_transform(text).toarray()
    return bag


image_feature = pd.concat([image_feature_train, image_feature_val, image
_feature_test], axis=0)
question_feature = pd.concat([question_feature_train, question_feature_v
al, question_feature_test], axis=0)

image_feature_transformed = pd.DataFrame(one_hot_transform(image_feature
))
question_feature_transformed = pd.DataFrame(one_hot_transform(question_f
eature))

X = pd.concat([image_feature_transformed, question_feature_transformed],
axis=1)

X_train = X[:20000]
X_val = X[20000:22000]
X_test = X[22000:22100]

print(X_train.shape)
print(X_val.shape)
print(X_test.shape)
```

```
(20000, 3572)
(2000, 3572)
(100, 3572)
```

In [3]:

```
# Dimension reduction
from sklearn.metrics import accuracy_score
from sklearn.decomposition import PCA
from sklearn.neural_network import MLPClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.linear_model import LogisticRegression
import matplotlib.pyplot as plt
%matplotlib inline

# X_train = X_train[:4000]
# y_train = y_train[:4000]

principal_com = []
accuracy = []
for i in range(1, 1800, 60):
    pca = PCA(n_components=i)
    pca.fit(X_train)
    X_train_reduced = pca.transform(X_train)
    X_val_reduced = pca.transform(X_val)
    model = LogisticRegression()
    model.fit(X_train_reduced, y_train)
    y_val_predicted = model.predict(X_val_reduced)
    accuracy.append(accuracy_score(y_val, y_val_predicted))
    principal_com.append(i)

plt.plot(principal_com, accuracy)
plt.xlabel("Principal Components")
plt.ylabel("Accuracy")
plt.show()
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/linear_model/logistic.p
y:433: FutureWarning: Default solver will be changed to 'lbfgs' in 0.2
2. Specify a solver to silence this warning.
  FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/linear_model/logistic.p
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```

```
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2. Specify a solver to silence this warning.
  FutureWarning)
```

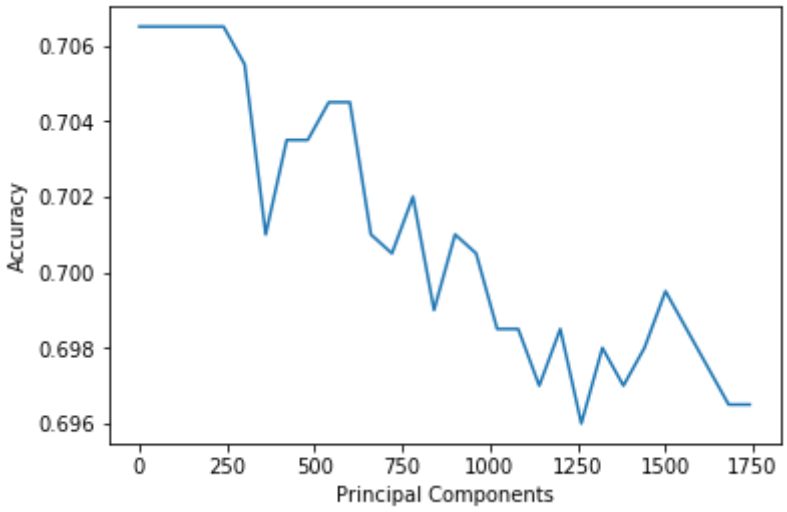

In [5]:
```
pca = PCA(n_components=61)
pca.fit(X_train)
X_train_reduced = pca.transform(X_train)
X_val_reduced = pca.transform(X_val)

model = LogisticRegression()
model.fit(X_train_reduced, y_train)
y_val_predicted = model.predict(X_val_reduced)

print("Accuracy on test set: {:.2f}".format(accuracy_score(y_val_predict
ed, y_val)))
```

```
Accuracy on test set: 0.71

/anaconda3/lib/python3.7/site-packages/sklearn/linear_model/logistic.p
y:433: FutureWarning: Default solver will be changed to 'lbfgs' in 0.2
2. Specify a solver to silence this warning.
  FutureWarning)
```

In [ ]:
```
# Ensemble learning
from sklearn.linear_model import LogisticRegression
from sklearn.ensemble import VotingClassifier
from sklearn.ensemble import BaggingClassifier
from sklearn.ensemble import AdaBoostClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.svm import SVC
from sklearn.neural_network import MLPClassifier
pca = PCA(n_components=0.99)
pca.fit(X_train)
X_train_reduced = pca.transform(X_train)
X_val_reduced = pca.transform(X_val)

#logistic = LogisticRegression()
mlp = MLPClassifier(hidden_layer_sizes=(2048,4096,4096),max_iter=1000,ra
ndom_state=42,activation='relu',solver='adam')
bagging = BaggingClassifier(max_samples=50)
boost = AdaBoostClassifier(base_estimator=DecisionTreeClassifier(max_dep
th=10), n_estimators=500,learning_rate=0.1)
svc = SVC(random_state=42)

for model in [mlp, bagging, boost, svc]:
    model.fit(X_train_reduced, y_train)
    y_val_predicted = model.predict(X_val_reduced)
    print(accuracy_score(y_val_predicted, y_val))
```

In [ ]:
```
```

In [33]:
```
# Predict test data

model = SVC()
model.fit(X_train_reduced, y_train)
X_test_reduced = pca.transform(X_test)
y_test_predicted = model.predict(X_test_reduced)
print(y_test_predicted)
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:196: FutureW
arning: The default value of gamma will change from 'auto' to 'scale' i
n version 0.22 to account better for unscaled features. Set gamma expli
citly to 'auto' or 'scale' to avoid this warning.
  "avoid this warning.", FutureWarning)

[1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1]
```

In [34]:
```
data = pd.DataFrame(y_test_predicted)
data.to_csv('prediction.csv', index=False, header=False)
```

In [ ]:
```
```