In [1]:

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.preprocessing import LabelEncoder
```

In [3]:

```
df = pd.read_csv('D:\\Ботва\\Магистратура\\2сем\\ММО\\РК\\Лосева\\winequality-red.cs
df
```

Out[3]:

| | fixed acidity | volatile acidity | citric acid | residual sugar | chlorides | free sulfur dioxide | total sulfur dioxide | density | pH | sulphates | alcohol |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 7.4 | 0.700 | 0.00 | 1.9 | 0.076 | 11.0 | 34.0 | 0.9978 | 3.51 | 0.56 | 9.4 |
| **1** | 7.8 | 0.880 | 0.00 | 2.6 | 0.098 | 25.0 | 67.0 | 0.9968 | 3.20 | 0.68 | 9.8 |
| **2** | 7.8 | 0.760 | 0.04 | 2.3 | NaN | 15.0 | 54.0 | 0.9970 | 3.26 | 0.65 | 9.8 |
| **3** | 11.2 | 0.280 | 0.56 | 1.9 | 0.075 | 17.0 | 60.0 | 0.9980 | 3.16 | 0.58 | 9.8 |
| **4** | 7.4 | 0.700 | 0.00 | 1.9 | NaN | 11.0 | 34.0 | 0.9978 | 3.51 | 0.56 | 9.4 |
| **5** | 7.4 | 0.660 | 0.00 | 1.8 | 0.075 | 13.0 | 40.0 | 0.9978 | 3.51 | 0.56 | 9.4 |
| **6** | 7.9 | 0.600 | 0.06 | 1.6 | 0.069 | 15.0 | 59.0 | 0.9964 | 3.30 | 0.46 | 9.4 |
| **7** | 7.3 | 0.650 | 0.00 | 1.2 | 0.065 | 15.0 | 21.0 | 0.9946 | 3.39 | 0.47 | 10.0 |
| **8** | 7.8 | 0.580 | 0.02 | 2.0 | NaN | 9.0 | 18.0 | 0.9968 | 3.36 | 0.57 | 9.5 |
| **9** | 7.5 | 0.500 | 0.36 | 6.1 | 0.071 | 17.0 | 102.0 | 0.9978 | 3.35 | 0.80 | 10.5 |
| **10** | 6.7 | 0.580 | 0.08 | 1.8 | 0.097 | 15.0 | 65.0 | 0.9959 | 3.28 | 0.54 | 9.2 |
| **11** | 7.5 | 0.500 | 0.36 | 6.1 | NaN | 17.0 | 102.0 | 0.9978 | 3.35 | 0.80 | 10.5 |
| **12** | 5.6 | 0.615 | 0.00 | 1.6 | 0.089 | 16.0 | 59.0 | 0.9943 | 3.58 | 0.52 | 9.9 |
| **13** | 7.8 | 0.610 | 0.29 | 1.6 | 0.114 | 9.0 | 29.0 | 0.9974 | 3.26 | 1.56 | 9.1 |
| **14** | 8.9 | 0.620 | 0.18 | 3.8 | 0.176 | 52.0 | 145.0 | 0.9986 | 3.16 | 0.88 | 9.2 |
| **15** | 8.9 | 0.620 | 0.19 | 3.9 | 0.170 | 51.0 | 148.0 | 0.9986 | 3.17 | 0.93 | 9.2 |
| **16** | 8.5 | 0.280 | 0.56 | 1.8 | 0.092 | 35.0 | 103.0 | 0.9969 | 3.30 | 0.75 | 10.5 |
| **17** | 8.1 | 0.560 | 0.28 | 1.7 | 0.368 | 16.0 | 56.0 | 0.9968 | 3.11 | 1.28 | 9.3 |
| **18** | 7.4 | 0.590 | 0.08 | 4.4 | NaN | 6.0 | 29.0 | 0.9974 | 3.38 | 0.50 | 9.0 |
| **19** | 7.9 | 0.320 | 0.51 | 1.8 | 0.341 | 17.0 | 56.0 | 0.9969 | 3.04 | 1.08 | 9.2 |
| **20** | 8.9 | 0.220 | 0.48 | 1.8 | 0.077 | 29.0 | 60.0 | 0.9968 | 3.39 | 0.53 | 9.4 |
| **21** | 7.6 | 0.390 | 0.31 | 2.3 | 0.082 | 23.0 | 71.0 | 0.9982 | 3.52 | 0.65 | 9.7 |
| **22** | 7.9 | 0.430 | 0.21 | 1.6 | 0.106 | 10.0 | 37.0 | 0.9966 | 3.17 | 0.91 | 9.5 |
| **23** | 8.5 | 0.490 | 0.11 | 2.3 | NaN | 9.0 | 67.0 | 0.9968 | 3.17 | 0.53 | 9.4 |
| **24** | 6.9 | 0.400 | 0.14 | 2.4 | 0.085 | 21.0 | 40.0 | 0.9968 | 3.43 | 0.63 | 9.7 |
| **25** | 6.3 | 0.390 | 0.16 | 1.4 | NaN | 11.0 | 23.0 | 0.9955 | 3.34 | 0.56 | 9.3 |
| **26** | 7.6 | 0.410 | 0.24 | 1.8 | 0.080 | 4.0 | 11.0 | 0.9962 | 3.28 | 0.59 | 9.5 |
| **27** | 7.9 | 0.430 | 0.21 | 1.6 | 0.106 | 10.0 | 37.0 | 0.9966 | 3.17 | 0.91 | 9.5 |

| | fixed acidity | volatile acidity | citric acid | residual sugar | chlorides | free sulfur dioxide | total sulfur dioxide | density | pH | sulphates | alcohol |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **28** | 7.1 | 0.710 | 0.00 | 1.9 | 0.080 | 14.0 | 35.0 | 0.9972 | 3.47 | 0.55 | 9.4 |
| **29** | 7.8 | 0.645 | 0.00 | 2.0 | NaN | 8.0 | 16.0 | 0.9964 | 3.38 | 0.59 | 9.8 |
| **30** | 6.7 | 0.675 | 0.07 | 2.4 | 0.089 | 17.0 | 82.0 | 0.9958 | 3.35 | 0.54 | 10.1 |
| **31** | 6.9 | 0.685 | 0.00 | 2.5 | 0.105 | 22.0 | 37.0 | 0.9966 | 3.46 | 0.57 | 10.6 |
| **32** | 8.3 | 0.655 | 0.12 | 2.3 | 0.083 | 15.0 | 113.0 | 0.9966 | 3.17 | 0.66 | 9.8 |
| **33** | 6.9 | 0.605 | 0.12 | 10.7 | 0.073 | 40.0 | 83.0 | 0.9993 | 3.45 | 0.52 | 9.4 |
| **34** | 5.2 | 0.320 | 0.25 | 1.8 | NaN | 13.0 | 50.0 | 0.9957 | 3.38 | 0.55 | 9.2 |
| **35** | 7.8 | 0.645 | 0.00 | 5.5 | 0.086 | 5.0 | 18.0 | 0.9986 | 3.40 | 0.55 | 9.6 |
| **36** | 7.8 | 0.600 | 0.14 | 2.4 | 0.086 | 3.0 | 15.0 | 0.9975 | 3.42 | 0.60 | 10.8 |
| **37** | 8.1 | 0.380 | 0.28 | 2.1 | NaN | 13.0 | 30.0 | 0.9968 | 3.23 | 0.73 | 9.7 |
| **38** | 5.7 | 1.130 | 0.09 | 1.5 | 0.172 | 7.0 | 19.0 | 0.9940 | 3.50 | 0.48 | 9.8 |
| **39** | 7.3 | 0.450 | 0.36 | 5.9 | 0.074 | 12.0 | 87.0 | 0.9978 | 3.33 | 0.83 | 10.5 |
| **40** | 7.3 | 0.450 | 0.36 | 5.9 | 0.074 | 12.0 | 87.0 | 0.9978 | 3.33 | 0.83 | 10.5 |
| **41** | 8.8 | 0.610 | 0.30 | 2.8 | 0.088 | 17.0 | 46.0 | 0.9976 | 3.26 | 0.51 | 9.3 |
| **42** | 7.5 | 0.490 | 0.20 | 2.6 | 0.332 | 8.0 | 14.0 | 0.9968 | 3.21 | 0.90 | 10.5 |
| **43** | 8.1 | 0.660 | 0.22 | 2.2 | 0.069 | 9.0 | 23.0 | 0.9968 | 3.30 | 1.20 | 10.3 |
| **44** | 6.8 | 0.670 | 0.02 | 1.8 | NaN | 5.0 | 11.0 | 0.9962 | 3.48 | 0.52 | 9.5 |
| **45** | 4.6 | 0.520 | 0.15 | 2.1 | 0.054 | 8.0 | 65.0 | 0.9934 | 3.90 | 0.56 | 13.1 |
| **46** | 7.7 | 0.935 | 0.43 | 2.2 | 0.114 | 22.0 | 114.0 | 0.9970 | 3.25 | 0.73 | 9.2 |
| **47** | 8.7 | 0.290 | 0.52 | 1.6 | 0.113 | 12.0 | 37.0 | 0.9969 | 3.25 | 0.58 | 9.5 |
| **48** | 6.4 | 0.400 | 0.23 | 1.6 | NaN | 5.0 | 12.0 | 0.9958 | 3.34 | 0.56 | 9.2 |
| **49** | 5.6 | 0.310 | 0.37 | 1.4 | 0.074 | 12.0 | 96.0 | 0.9954 | 3.32 | 0.58 | 9.2 |

In [4]:

```python
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 50 entries, 0 to 49
Data columns (total 12 columns):
 #   Column                Non-Null Count  Dtype  
---  ------                --------------  -----  
 0   fixed acidity         50 non-null     float64
 1   volatile acidity      50 non-null     float64
 2   citric acid           50 non-null     float64
 3   residual sugar        50 non-null     float64
 4   chlorides             38 non-null     float64
 5   free sulfur dioxide   50 non-null     float64
 6   total sulfur dioxide  50 non-null     float64
 7   density               50 non-null     float64
 8   pH                    50 non-null     float64
 9   sulphates             50 non-null     float64
 10  alcohol               50 non-null     float64
 11  quality               50 non-null     int64  
```

```
dtypes: float64(11), int64(1)
memory usage: 4.8 KB
```

In [13]:

```
median_h = df1['chlorides'].median()
df1 = df.select_dtypes(include=[np.number])
df1['chlorides'] = df['chlorides'].fillna(median_h)
```

In [14]:

```
df1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 50 entries, 0 to 49
Data columns (total 12 columns):
 #   Column                Non-Null Count  Dtype  
---  ------                --------------  -----  
 0   fixed acidity         50 non-null     float64
 1   volatile acidity      50 non-null     float64
 2   citric acid           50 non-null     float64
 3   residual sugar        50 non-null     float64
 4   chlorides             50 non-null     float64
 5   free sulfur dioxide   50 non-null     float64
 6   total sulfur dioxide  50 non-null     float64
 7   density               50 non-null     float64
 8   pH                    50 non-null     float64
 9   sulphates             50 non-null     float64
 10  alcohol               50 non-null     float64
 11  quality               50 non-null     int64  
dtypes: float64(11), int64(1)
memory usage: 4.8 KB
```

In [15]:

```
min = np.percentile(df1.sulphates, 5)
max = np.percentile(df1.sulphates, 95)
print(min, max)
```

```
0.489 1.1459999999999997
```

In [16]:

```
df1[(df1.sulphates < min)] = min
df1[(df1.sulphates > max)] = max
```

In [17]:

```
df1
```

Out[17]:

| | fixed acidity | volatile acidity | citric acid | residual sugar | chlorides | free sulfur dioxide | total sulfur dioxide | density | pH | sulphates | alcohol |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 7.400 | 0.700 | 0.000 | 1.900 | 0.076 | 11.000 | 34.000 | 0.9978 | 3.510 | 0.560 | 9.400 |
| **1** | 7.800 | 0.880 | 0.000 | 2.600 | 0.098 | 25.000 | 67.000 | 0.9968 | 3.200 | 0.680 | 9.800 |
| **2** | 7.800 | 0.760 | 0.040 | 2.300 | 0.086 | 15.000 | 54.000 | 0.9970 | 3.260 | 0.650 | 9.800 |
| **3** | 11.200 | 0.280 | 0.560 | 1.900 | 0.075 | 17.000 | 60.000 | 0.9980 | 3.160 | 0.580 | 9.800 |
| **4** | 7.400 | 0.700 | 0.000 | 1.900 | 0.086 | 11.000 | 34.000 | 0.9978 | 3.510 | 0.560 | 9.400 |
| **5** | 7.400 | 0.660 | 0.000 | 1.800 | 0.075 | 13.000 | 40.000 | 0.9978 | 3.510 | 0.560 | 9.400 |
| **6** | 0.489 | 0.489 | 0.489 | 0.489 | 0.489 | 0.489 | 0.489 | 0.4890 | 0.489 | 0.489 | 0.489 |
| **7** | 0.489 | 0.489 | 0.489 | 0.489 | 0.489 | 0.489 | 0.489 | 0.4890 | 0.489 | 0.489 | 0.489 |
| **8** | 7.800 | 0.580 | 0.020 | 2.000 | 0.086 | 9.000 | 18.000 | 0.9968 | 3.360 | 0.570 | 9.500 |
| **9** | 7.500 | 0.500 | 0.360 | 6.100 | 0.071 | 17.000 | 102.000 | 0.9978 | 3.350 | 0.800 | 10.500 |

| | fixed acidity | volatile acidity | citric acid | residual sugar | chlorides | free sulfur dioxide | total sulfur dioxide | density | pH | sulphates | alcohol |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **10** | 6.700 | 0.580 | 0.080 | 1.800 | 0.097 | 15.000 | 65.000 | 0.9959 | 3.280 | 0.540 | 9.200 |
| **11** | 7.500 | 0.500 | 0.360 | 6.100 | 0.086 | 17.000 | 102.000 | 0.9978 | 3.350 | 0.800 | 10.500 |
| **12** | 5.600 | 0.615 | 0.000 | 1.600 | 0.089 | 16.000 | 59.000 | 0.9943 | 3.580 | 0.520 | 9.900 |
| **13** | 1.146 | 1.146 | 1.146 | 1.146 | 1.146 | 1.146 | 1.146 | 1.1460 | 1.146 | 1.146 | 1.146 |
| **14** | 8.900 | 0.620 | 0.180 | 3.800 | 0.176 | 52.000 | 145.000 | 0.9986 | 3.160 | 0.880 | 9.200 |
| **15** | 8.900 | 0.620 | 0.190 | 3.900 | 0.170 | 51.000 | 148.000 | 0.9986 | 3.170 | 0.930 | 9.200 |
| **16** | 8.500 | 0.280 | 0.560 | 1.800 | 0.092 | 35.000 | 103.000 | 0.9969 | 3.300 | 0.750 | 10.500 |
| **17** | 1.146 | 1.146 | 1.146 | 1.146 | 1.146 | 1.146 | 1.146 | 1.1460 | 1.146 | 1.146 | 1.146 |
| **18** | 7.400 | 0.590 | 0.080 | 4.400 | 0.086 | 6.000 | 29.000 | 0.9974 | 3.380 | 0.500 | 9.000 |
| **19** | 7.900 | 0.320 | 0.510 | 1.800 | 0.341 | 17.000 | 56.000 | 0.9969 | 3.040 | 1.080 | 9.200 |
| **20** | 8.900 | 0.220 | 0.480 | 1.800 | 0.077 | 29.000 | 60.000 | 0.9968 | 3.390 | 0.530 | 9.400 |
| **21** | 7.600 | 0.390 | 0.310 | 2.300 | 0.082 | 23.000 | 71.000 | 0.9982 | 3.520 | 0.650 | 9.700 |
| **22** | 7.900 | 0.430 | 0.210 | 1.600 | 0.106 | 10.000 | 37.000 | 0.9966 | 3.170 | 0.910 | 9.500 |
| **23** | 8.500 | 0.490 | 0.110 | 2.300 | 0.086 | 9.000 | 67.000 | 0.9968 | 3.170 | 0.530 | 9.400 |
| **24** | 6.900 | 0.400 | 0.140 | 2.400 | 0.085 | 21.000 | 40.000 | 0.9968 | 3.430 | 0.630 | 9.700 |
| **25** | 6.300 | 0.390 | 0.160 | 1.400 | 0.086 | 11.000 | 23.000 | 0.9955 | 3.340 | 0.560 | 9.300 |
| **26** | 7.600 | 0.410 | 0.240 | 1.800 | 0.080 | 4.000 | 11.000 | 0.9962 | 3.280 | 0.590 | 9.500 |
| **27** | 7.900 | 0.430 | 0.210 | 1.600 | 0.106 | 10.000 | 37.000 | 0.9966 | 3.170 | 0.910 | 9.500 |
| **28** | 7.100 | 0.710 | 0.000 | 1.900 | 0.080 | 14.000 | 35.000 | 0.9972 | 3.470 | 0.550 | 9.400 |
| **29** | 7.800 | 0.645 | 0.000 | 2.000 | 0.086 | 8.000 | 16.000 | 0.9964 | 3.380 | 0.590 | 9.800 |
| **30** | 6.700 | 0.675 | 0.070 | 2.400 | 0.089 | 17.000 | 82.000 | 0.9958 | 3.350 | 0.540 | 10.100 |
| **31** | 6.900 | 0.685 | 0.000 | 2.500 | 0.105 | 22.000 | 37.000 | 0.9966 | 3.460 | 0.570 | 10.600 |
| **32** | 8.300 | 0.655 | 0.120 | 2.300 | 0.083 | 15.000 | 113.000 | 0.9966 | 3.170 | 0.660 | 9.800 |
| **33** | 6.900 | 0.605 | 0.120 | 10.700 | 0.073 | 40.000 | 83.000 | 0.9993 | 3.450 | 0.520 | 9.400 |
| **34** | 5.200 | 0.320 | 0.250 | 1.800 | 0.086 | 13.000 | 50.000 | 0.9957 | 3.380 | 0.550 | 9.200 |
| **35** | 7.800 | 0.645 | 0.000 | 5.500 | 0.086 | 5.000 | 18.000 | 0.9986 | 3.400 | 0.550 | 9.600 |
| **36** | 7.800 | 0.600 | 0.140 | 2.400 | 0.086 | 3.000 | 15.000 | 0.9975 | 3.420 | 0.600 | 10.800 |
| **37** | 8.100 | 0.380 | 0.280 | 2.100 | 0.086 | 13.000 | 30.000 | 0.9968 | 3.230 | 0.730 | 9.700 |
| **38** | 0.489 | 0.489 | 0.489 | 0.489 | 0.489 | 0.489 | 0.489 | 0.4890 | 0.489 | 0.489 | 0.489 |
| **39** | 7.300 | 0.450 | 0.360 | 5.900 | 0.074 | 12.000 | 87.000 | 0.9978 | 3.330 | 0.830 | 10.500 |
| **40** | 7.300 | 0.450 | 0.360 | 5.900 | 0.074 | 12.000 | 87.000 | 0.9978 | 3.330 | 0.830 | 10.500 |
| **41** | 8.800 | 0.610 | 0.300 | 2.800 | 0.088 | 17.000 | 46.000 | 0.9976 | 3.260 | 0.510 | 9.300 |
| **42** | 7.500 | 0.490 | 0.200 | 2.600 | 0.332 | 8.000 | 14.000 | 0.9968 | 3.210 | 0.900 | 10.500 |
| **43** | 1.146 | 1.146 | 1.146 | 1.146 | 1.146 | 1.146 | 1.146 | 1.1460 | 1.146 | 1.146 | 1.146 |
| **44** | 6.800 | 0.670 | 0.020 | 1.800 | 0.086 | 5.000 | 11.000 | 0.9962 | 3.480 | 0.520 | 9.500 |

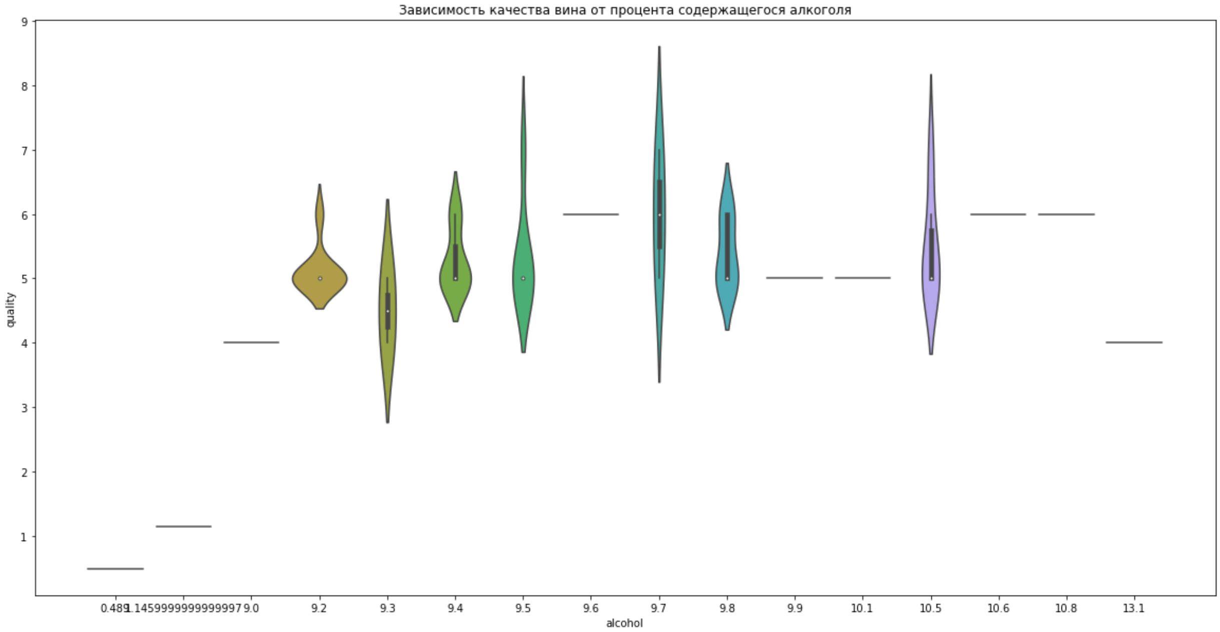
| | fixed acidity | volatile acidity | citric acid | residual sugar | chlorides | free sulfur dioxide | total sulfur dioxide | density | pH | sulphates | alcohol |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **45** | 4.600 | 0.520 | 0.150 | 2.100 | 0.054 | 8.000 | 65.000 | 0.9934 | 3.900 | 0.560 | 13.100 |
| **46** | 7.700 | 0.935 | 0.430 | 2.200 | 0.114 | 22.000 | 114.000 | 0.9970 | 3.250 | 0.730 | 9.200 |
| **47** | 8.700 | 0.290 | 0.520 | 1.600 | 0.113 | 12.000 | 37.000 | 0.9969 | 3.250 | 0.580 | 9.500 |
| **48** | 6.400 | 0.400 | 0.230 | 1.600 | 0.086 | 5.000 | 12.000 | 0.9958 | 3.340 | 0.560 | 9.200 |
| **49** | 5.600 | 0.310 | 0.370 | 1.400 | 0.074 | 12.000 | 96.000 | 0.9954 | 3.320 | 0.580 | 9.200 |

In [87]:

```
plt.figure(figsize=(20, 10))
ax = sns.violinplot(df1.alcohol, df1.quality)
ax.set(xlabel='alcohol', ylabel='quality', title='Зависимость качества вина от проце
plt.plot()
```

```
c:\users\sveta\documents\virtualenvs\tensorflow\lib\site-packages\seaborn\_decorator
s.py:43: FutureWarning: Pass the following variables as keyword args: x, y. From ver
sion 0.12, the only valid positional argument will be `data`, and passing other argu
ments without an explicit keyword will result in an error or misinterpretation.
  FutureWarning
```

Out[87]: []




In [ ]: