In [1]:

```python
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import math
from scipy.interpolate import interp1d
from numpy import polyfit, poly1d, linspace
```

In [2]:

```python
plt.style.use('ggplot')
plt.rcParams['figure.figsize'] = (15, 5)
```

In [3]:

```python
df_04A_electrod = pd.read_excel('04A_electrod.xlsx', index_col='L')
```

In [4]:

```python
df_04A_electrod['log'] = np.log10(df_04A_electrod.I)
```
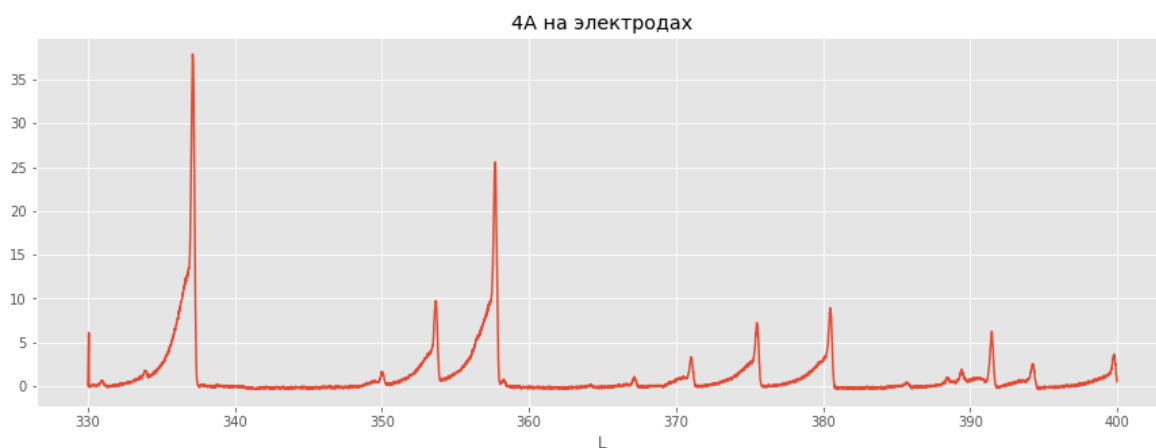
```
/home/danny/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.p
y:1: RuntimeWarning: invalid value encountered in log10
  """Entry point for launching an IPython kernel.
```

In [5]:

```python
df_04A_electrod['I'].plot().set_title('4A на электродах')
```

Out[5]:

```
Text(0.5,1,'4A на электродах')
```

In [6]:

```
1  df_04A_electrod['log'][335:336.75].plot().set_title('Логарифм 4А на электродах'
```

Out[6]:

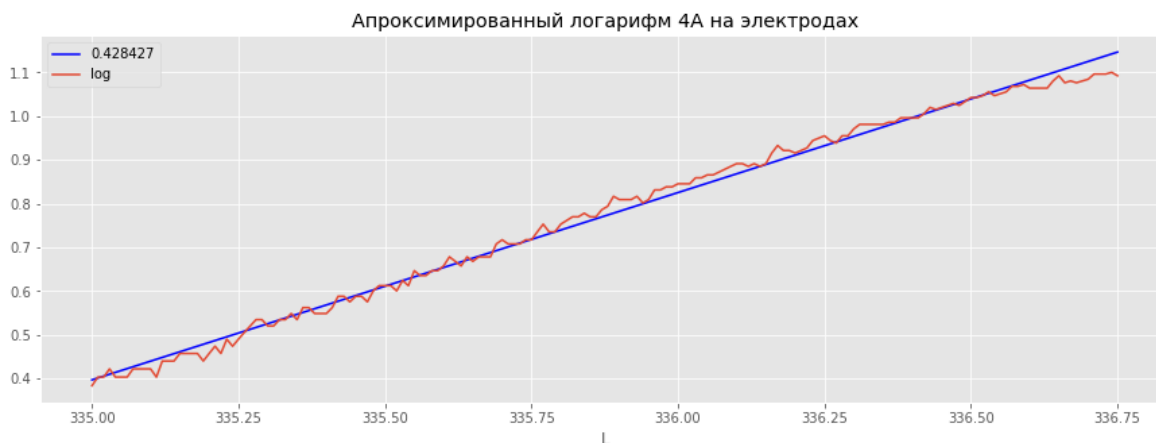Text(0.5,1,'Логарифм 4А на электродах')

In [7]:

```
1  y = df_04A_electrod.log[335:336.75].values
2  x = df_04A_electrod.index.values[500:676]
```

In [8]:

```
1  p = np.polyfit(x, y, 1)
2  yp = np.polyval(p, x)
3  print(p)
4
5  plt.plot(x, yp, 'b', label='0.428427')
6  df_04A_electrod['log'][335:336.75].plot().set_title('Апроксимированный логарифм
7  plt.legend()
8  plt.show()
```
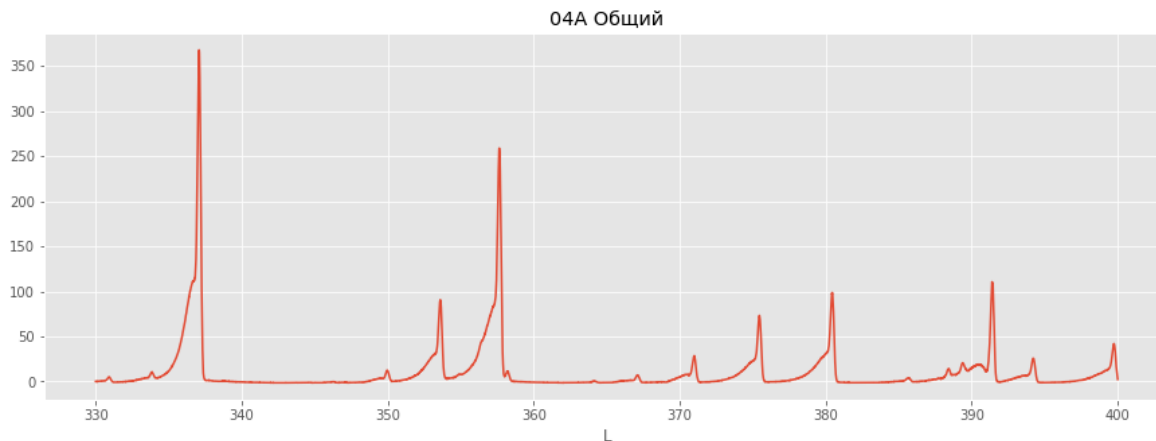
[0.428427   -143.1262341]

In [9]:

```
1  df_04A_general = pd.read_excel('04A_general.xlsx', index_col='L')
```

In [10]:

```
1  df_04A_general['I'].plot().set_title('04A Общий')
```

Out[10]:

Text(0.5,1,'04A Общий')

In [11]:

```
1  df_04A_general['log'] = np.log10(df_04A_general.I)
```
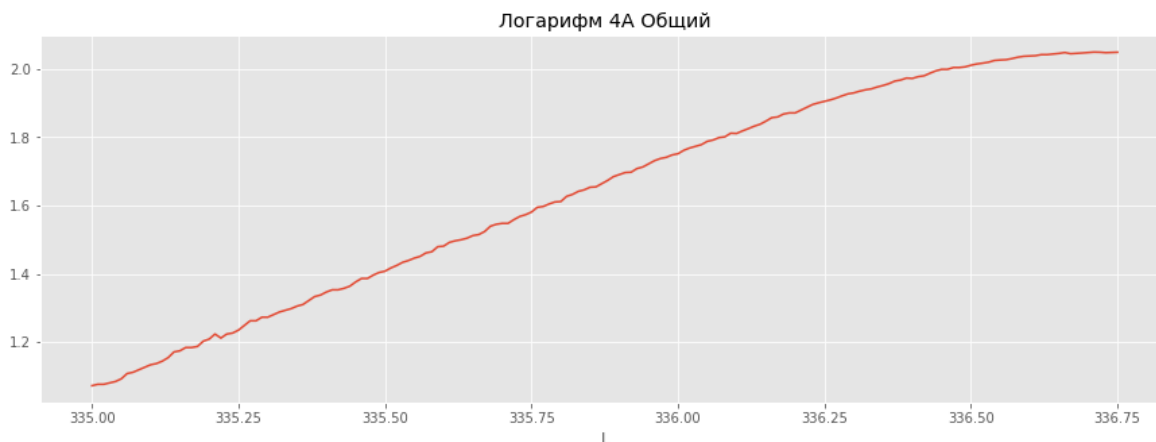
/home/danny/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.p
y:1: RuntimeWarning: invalid value encountered in log10
  """Entry point for launching an IPython kernel.

In [12]:

```
1  df_04A_general['log'][335:336.75].plot().set_title('Логарифм 4A Общий')
```

Out[12]:

Text(0.5,1,'Логарифм 4A Общий')

In [13]:

```
1  y = df_04A_general.log[335:336.75].values
2  x = df_04A_general.index.values[500:676]
```
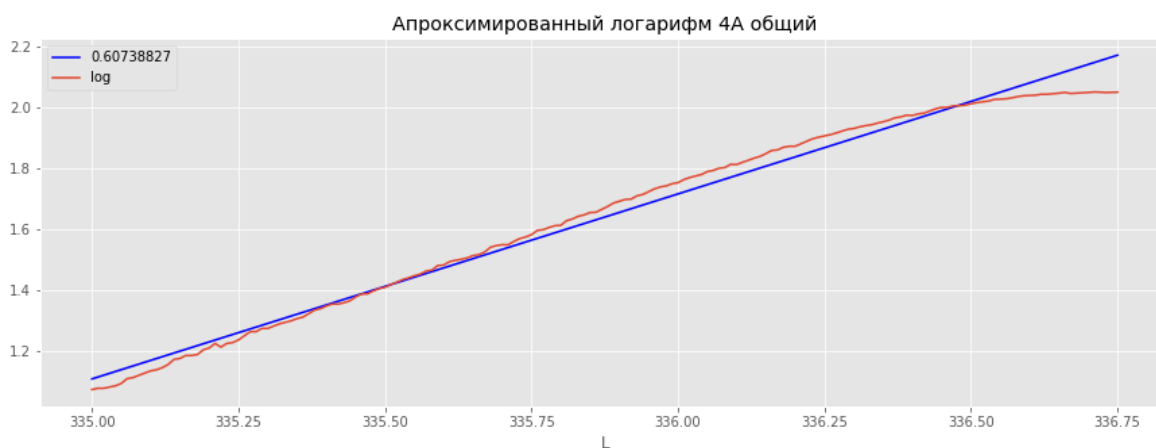
In [14]:

```python
p = np.polyfit(x, y, 1)
yp = np.polyval(p, x)
print(p)

plt.plot(x, yp, 'b', label='0.60738827')
df_04A_general['log'][335:336.75].plot().set_title('Апроксимированный логарифм
plt.legend()
plt.show()
```

[0.60738827 -202.36781824]

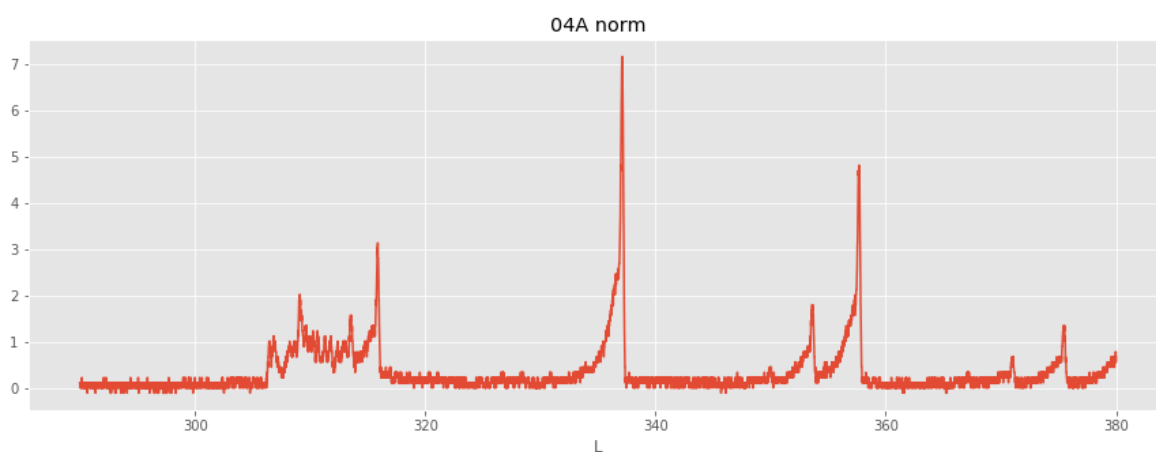Апроксимированный логарифм 4A общий

In [15]:

```python
df_04A_norm = pd.read_excel('04A_norm.xlsx', index_col='L')
```

In [16]:

```python
df_04A_norm['I'].plot().set_title('04A norm')
```

Out[16]:

Text(0.5,1,'04A norm')

04A norm

In [17]:

```python
df_04A_norm['log'] = np.log10(df_04A_norm.I)
```

/home/danny/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.p
y:1: RuntimeWarning: invalid value encountered in log10
  """Entry point for launching an IPython kernel.

In [18]:

```python
df_04A_norm['log'][335:336.75].plot().set_title('Логарифм 4A Norm')
```

Out[18]:

Text(0.5,1,'Логарифм 4A Norm')

In [19]:

```python
y = df_04A_norm.log[335:336.75].values
x = df_04A_norm.index.values[4501:4677]
```

In [20]:

```python
p = np.polyfit(x, y, 1)
yp = np.polyval(p, x)
print(p)

plt.plot(x, yp, 'b', label='0.36957941')
df_04A_norm['log'][335:336.75].plot().set_title('Апроксимированный логарифм 4A
plt.legend()
plt.show()
```

[0.36957941 -124.02861858]

In [21]:

```
1  df_05A = pd.read_excel('05A.xlsx', index_col='L')
```

In [22]:

```
1  df_05A['log'] = np.log10(df_05A.I)
```

/home/danny/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.p
y:1: RuntimeWarning: invalid value encountered in log10
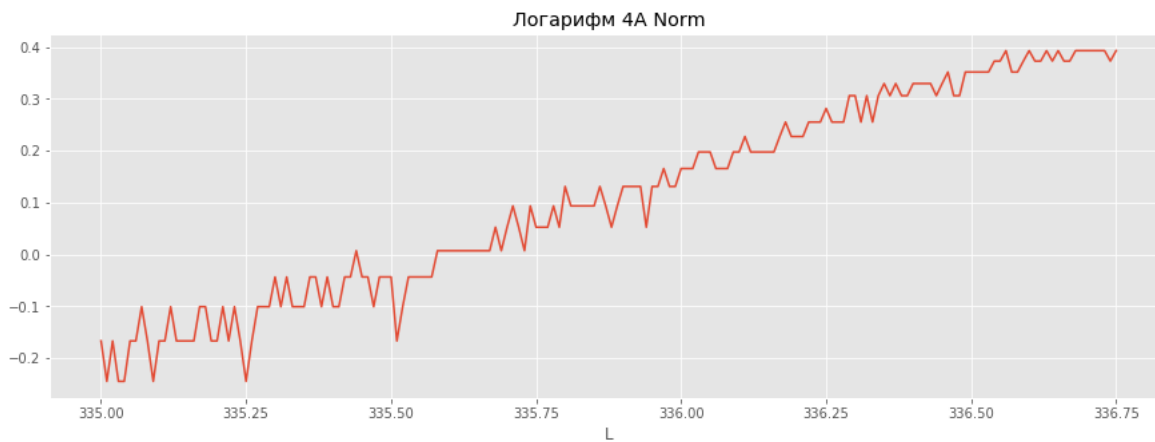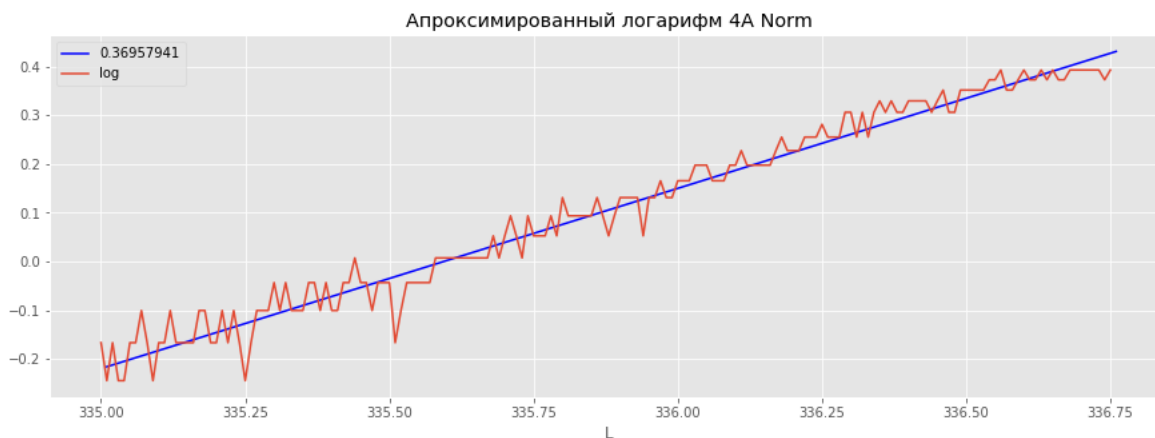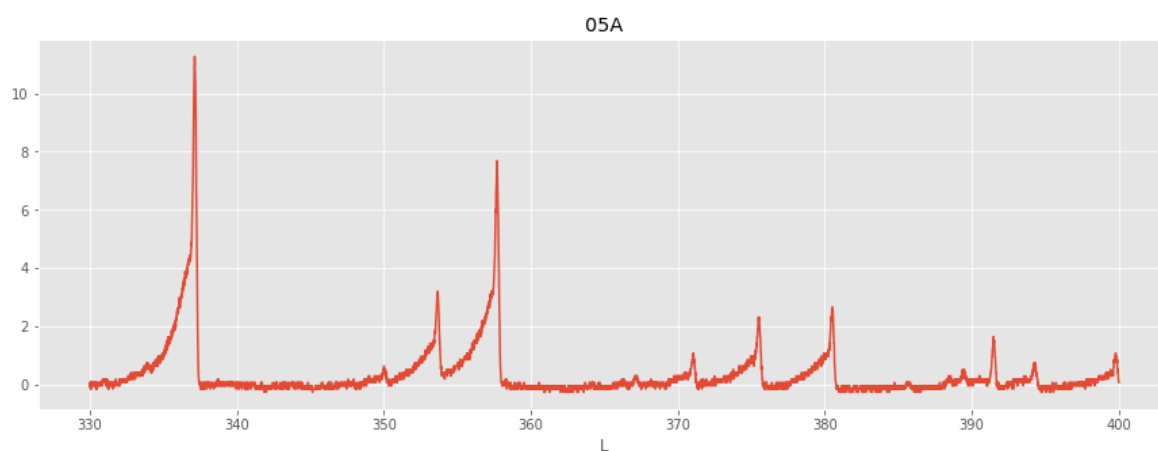 """Entry point for launching an IPython kernel.

In [23]:

```
1  df_05A['I'].plot().set_title('05A')
```

Out[23]:

Text(0.5,1,'05A')

In [24]:

```
1  df_05A['log'][335:336.75].plot().set_title('Логарифм 5А')
```

Out[24]:

Text(0.5,1,'Логарифм 5А')

In [25]:

```
1  y = df_05A.log[335:336.75].values
2  x = df_05A.index.values[500:676]
```

In [26]:

```
1  p = np.polyfit(x, y, 1)
2  yp = np.polyval(p, x)
3  print(p)
4
5  plt.plot(x, yp, 'b', label='0.35982667')
6  df_05A['log'][335:336.75].plot().set_title('Апроксимированный логарифм 5А')
7  plt.legend()
8  plt.show()
```

[0.35982667 -120.51184113]
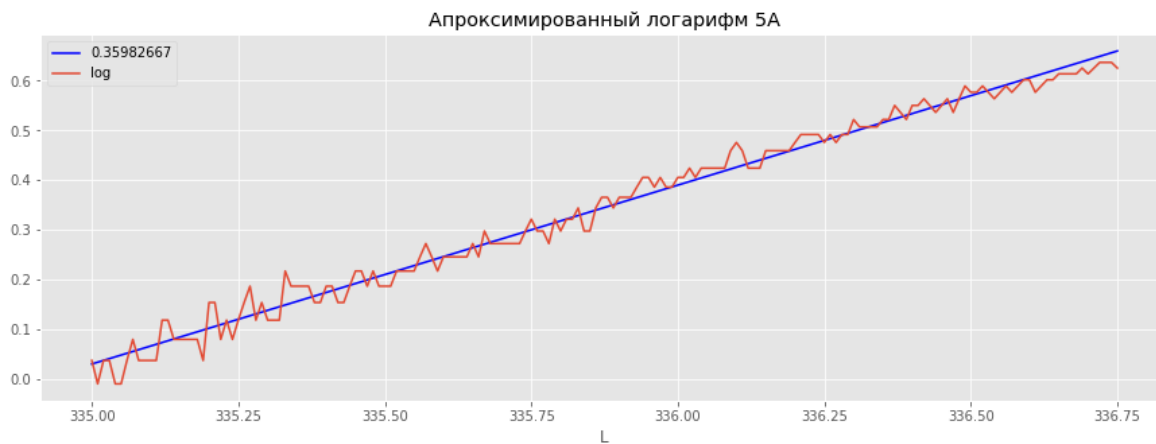
In [27]:

```
1  df_05A_electrod = pd.read_excel('05A_electrod.xlsx', index_col='L')
```

In [28]:

```
1  df_05A_electrod['I'].plot().set_title('05A на электродах')
```

Out[28]:

Text(0.5,1,'05A на электродах')

In [29]:

```python
df_05A_electrod['log'] = np.log10(df_05A_electrod.I)
```

/home/danny/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.p
y:1: RuntimeWarning: invalid value encountered in log10
  """Entry point for launching an IPython kernel.

In [30]:

```python
df_05A_electrod['log'][335:336.75].plot().set_title('Логарифм 5А на электродах'
```

Out[30]:

Text(0.5,1,'Логарифм 5А на электродах')

In [31]:

```python
y = df_05A_electrod.log[335:336.75].values
x = df_05A_electrod.index.values[500:676]
```

In [32]:

```python
p = np.polyfit(x, y, 1)
yp = np.polyval(p, x)
print(p)

plt.plot(x, yp, 'b', label='0.36721703')
df_05A_electrod['log'][335:336.75].plot().set_title('Апроксимированный логарифм
plt.legend()
plt.show()
```

[0.36721703 -122.3481155]

Апроксимированный логарифм 5A на электродах

In [33]:

```python
df_05A_general = pd.read_excel('05A_general.xlsx', index_col='L')
```

In [34]:

```python
df_05A_general['I'].plot().set_title('05A Общий')
```

Out[34]:

Text(0.5,1,'05A Общий')

05A Общий
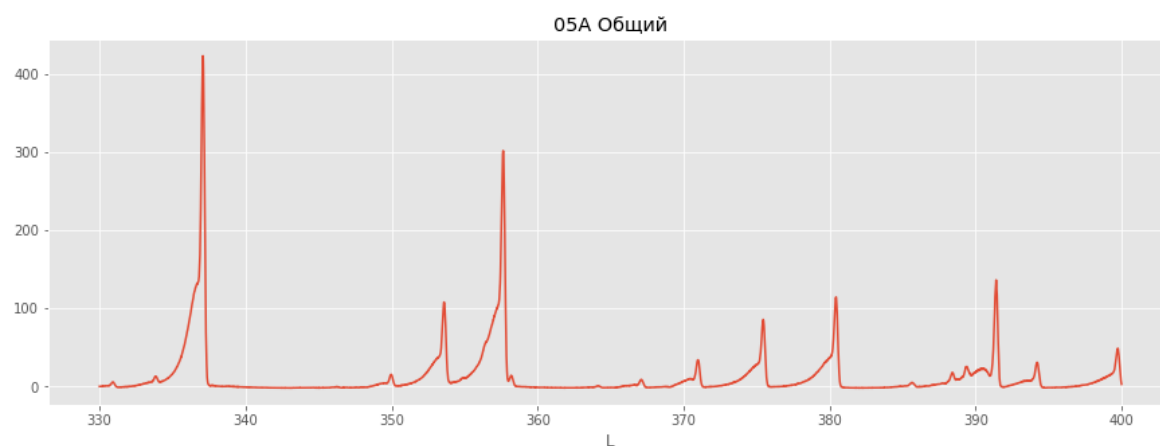
In [35]:

```python
df_05A_general['log'] = np.log10(df_05A_general.I)
```

```
/home/danny/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.p
y:1: RuntimeWarning: invalid value encountered in log10
  """Entry point for launching an IPython kernel.
```

In [36]:

```
1  df_05A_general['log'][335:336.75].plot().set_title('Логарифм 5А Общий')
```

Out[36]:

Text(0.5,1,'Логарифм 5А Общий')
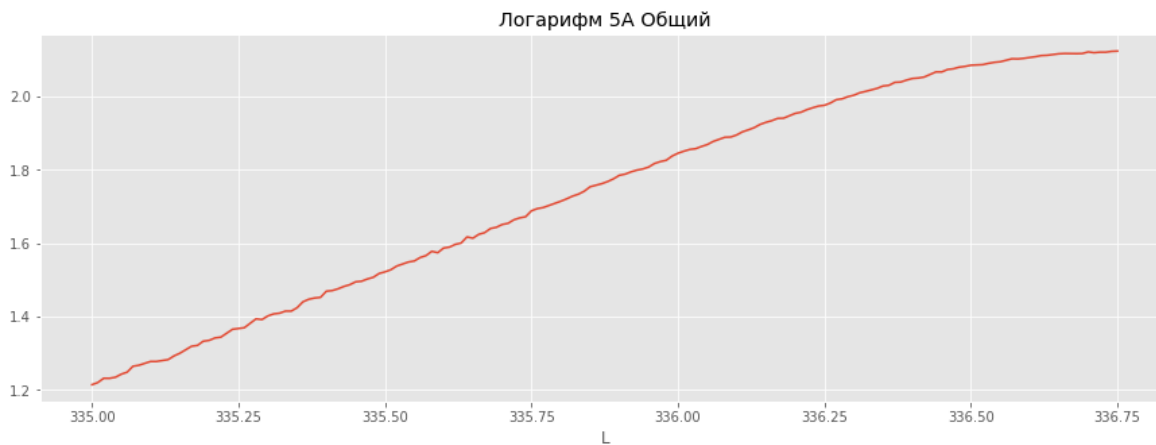
In [37]:

```
1  y = df_05A_general.log[335:336.75].values
2  x = df_05A_general.index.values[500:676]
```

In [38]:

```
1  p = np.polyfit(x, y, 1)
2  yp = np.polyval(p, x)
3  print(p)
4
5  plt.plot(x, yp, 'b', label='0.56204893')
6  df_05A_general['log'][335:336.75].plot().set_title('Апроксимированный логарифм
7  plt.legend()
8  plt.show()
```

[0.56204893 -187.04140158]

In [39]:

```
1  df_changedP_04A = pd.read_excel('changedP_04A.xlsx', index_col='L')
```

In [40]:

```
1  df_changedP_04A['I'].plot().set_title('04A измененное давление')
```

Out[40]:

Text(0.5,1,'04A измененное давление')

In [41]:

```
1  df_changedP_04A['log'] = np.log10(df_changedP_04A.I)
```

/home/danny/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.p
y:1: RuntimeWarning: invalid value encountered in log10
 """Entry point for launching an IPython kernel.

In [42]:

```
1  df_changedP_04A['log'][335:336.75].plot().set_title('Логарифм 4A измененное дав
```

Out[42]:
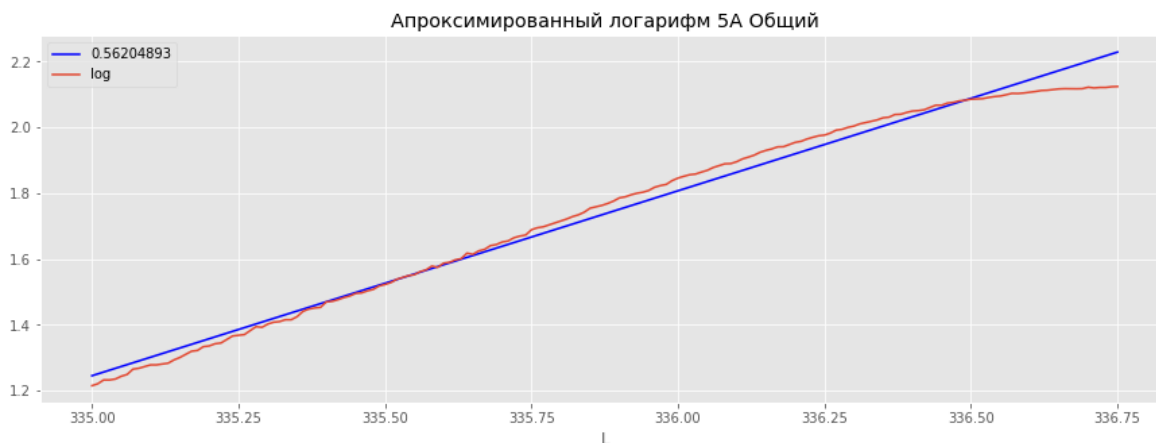
Text(0.5,1,'Логарифм 4A измененное давление')
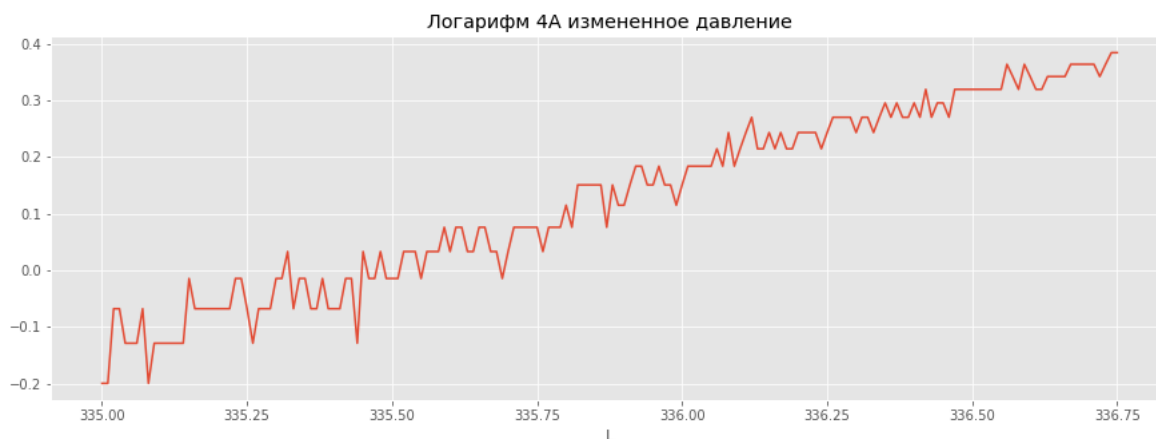
In [43]:

```
1  y = df_changedP_04A.log[335:336.75].values
2  x = df_changedP_04A.index.values[500:676]
```

In [44]:

```
1  p = np.polyfit(x, y, 1)
2  yp = np.polyval(p, x)
3  print(p)
4
5  plt.plot(x, yp, 'b', label='0.30476565')
6  df_changedP_04A['log'][335:336.75].plot().set_title('Апроксимированный логарифм
7  plt.legend()
8  plt.show()
```

[0.30476565 -102.23811392]

Апроксимированный логарифм 4А измененное давление
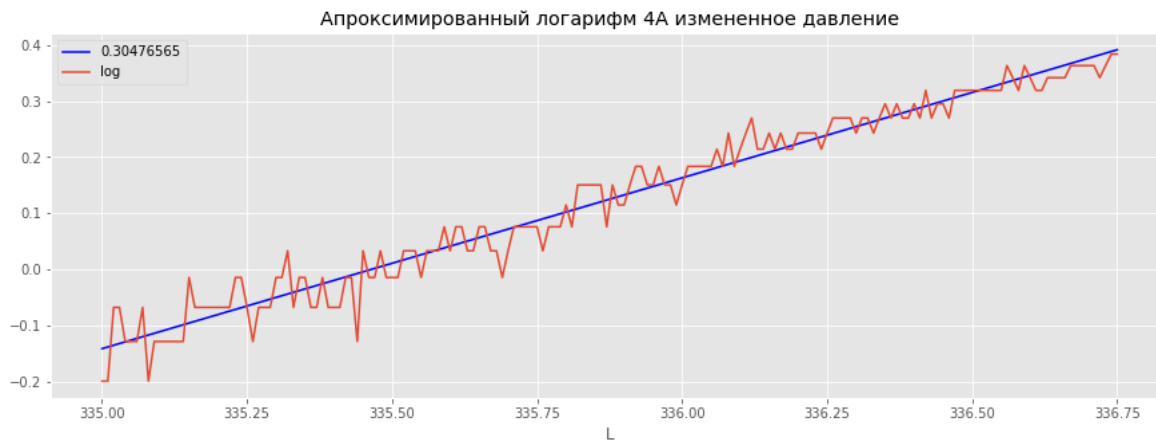
In [45]:

```
1  df_changedP_04A_general = pd.read_excel('changedP_04A_general.xlsx', index_col=
```

In [46]:

```
1  df_changedP_04A_general['I'].plot().set_title('changedP_04A_general')
```

Out[46]:

Text(0.5,1,'changedP_04A_general')

changedP_04A_general
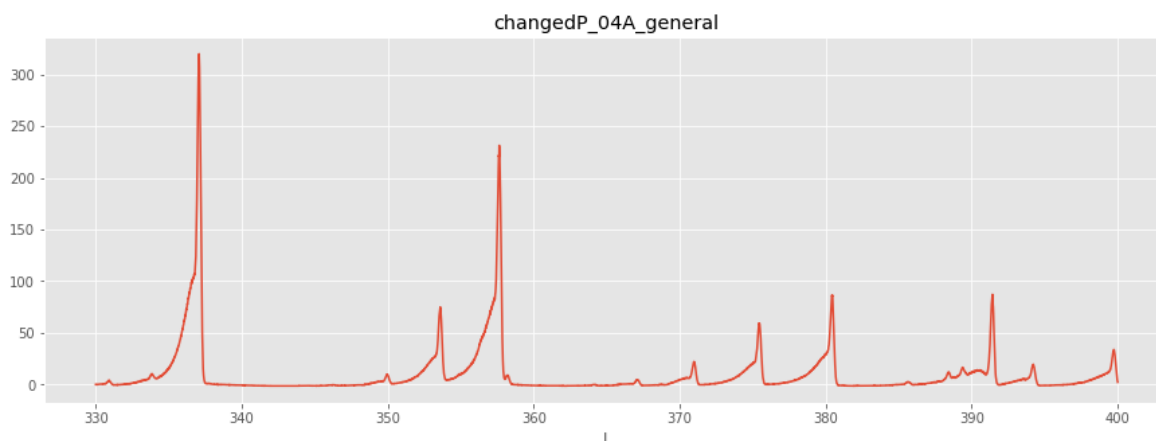
In [47]:

```
1  df_changedP_04A_general['log'] = np.log10(df_changedP_04A_general.I)
```

```
/home/danny/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.p
y:1: RuntimeWarning: invalid value encountered in log10
  """Entry point for launching an IPython kernel.
```

In [48]:

```
1  df_changedP_04A_general['log'][335:336.75].plot().set_title('Логарифм 4A измене
```

Out[48]:

Text(0.5,1,'Логарифм 4A измененное давление общий')
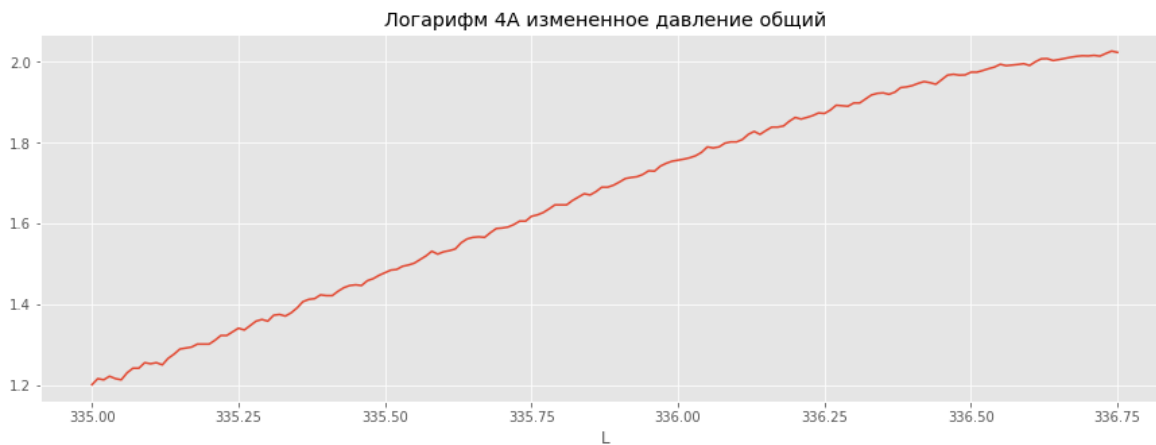
In [49]:

```
1  y = df_changedP_04A_general.log[335:336.75].values
2  x = df_changedP_04A_general.index.values[500:676]
```

In [50]:

```
1  p = np.polyfit(x, y, 1)
2  yp = np.polyval(p, x)
3  print(p)
4
5  plt.plot(x, yp, 'b', label='0.50185566')
6  df_changedP_04A_general['log'][335:336.75].plot().set_title('Апроксимированный
7  plt.legend()
8  plt.show()
```

[0.50185566 -166.89546725]
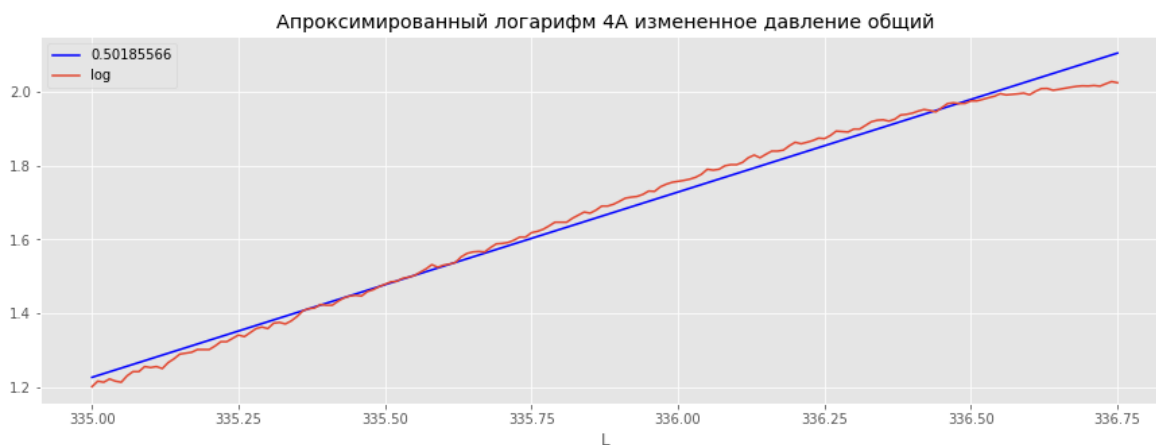
In [51]:

```
1  df_M_04A_electrod = pd.read_excel('maximum/04A_electrod_maximum.xlsx')
```

In [52]:

```
1  df_M_04A_electrod['x'] = np.log(df_M_04A_electrod.I/(3*10**17/df_M_04A_electrod
2  df_M_04A_electrod['y'] = df_M_04A_electrod.G/0.6925
```

In [53]:

```
1  df_M_04A_electrod
```

Out[53]:

	jump	L	I	q	G	x	y
0	0-0	337.13	37.871372	0.45270	1016.7	-134.846691	1468.158845
1	1-2	353.66	9.576049	0.20330	3011.1	-136.830699	4348.158845
2	0-1	357.71	25.569057	0.32910	1016.7	-135.321356	1468.158845
3	3-5	367.16	1.076267	0.09426	6826.0	-139.635244	9857.039711
4	2-4	371.02	3.313051	0.16050	4951.9	-137.936803	7150.758123
5	1-3	375.51	7.227425	0.19900	3011.1	-136.893663	4348.158845
6	0-2	380.51	8.905013	0.14620	1016.7	-136.940351	1468.158845

In [54]:

```
1  x = df_M_04A_electrod.x
2  y = df_M_04A_electrod.y
```

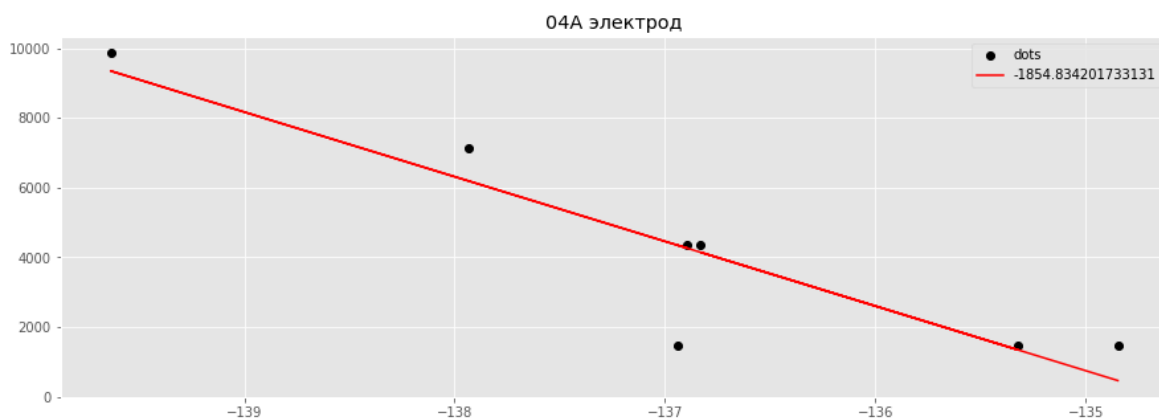In [55]:

```
1  p = np.polyfit(x, y, 1)
2  yp = np.polyval(p, x)
3  print(p)
4
5  plt.plot(x, y, 'o', label='dots', color='k')
6  plt.plot(x, yp, 'r', label=p[0])
7  plt.legend()
8  plt.title('04A электрод')
9  plt.show()
```

[-1854.83420173 -249653.34623729]

In [56]:

```
df_M_04A_general = pd.read_excel('maximum/04A_general_maximum.xlsx')

df_M_04A_general['x'] = np.log(df_M_04A_general.I/(3*10**17/df_M_04A_general.L*
df_M_04A_general['y'] = df_M_04A_general.G/0.6925

df_M_04A_general
```

Out[56]:

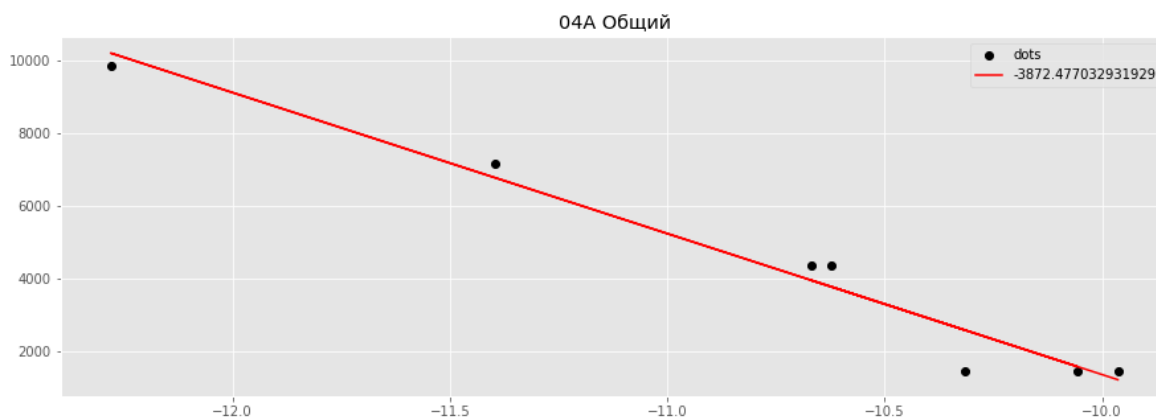|	jump	L	I	q	G	x	y
0	0-0	337.12	348.226501	0.45270	1016.7	-10.315424	1468.158845
1	1-2	353.60	90.660759	0.20330	3011.1	-10.669696	4348.158845
2	0-1	357.64	258.866943	0.32910	1016.7	-10.056743	1468.158845
3	3-5	367.12	7.228692	0.09426	6826.0	-12.280047	9857.039711
4	2-4	371.00	28.589985	0.16050	4951.9	-11.395233	7150.758123
5	1-3	375.46	73.213837	0.19900	3011.1	-10.622116	4348.158845
6	0-2	380.44	98.601341	0.14620	1016.7	-9.963380	1468.158845

In [57]:

```
x = df_M_04A_general.x
y = df_M_04A_general.y

p = np.polyfit(x, y, 1)
yp = np.polyval(p, x)
print(p)

plt.plot(x, y, 'o', label='dots', color='k')
plt.plot(x, yp, 'r', label=p[0])
plt.legend()
plt.title('04A Общий')
plt.show()
```

[-3872.47703293 -37357.02220841]

In [58]:

```
df_M_04A_norm = pd.read_excel('maximum/04A_norm_maximum.xlsx')

df_M_04A_norm['x'] = np.log(df_M_04A_norm.I/(3*10**17/df_M_04A_norm.L**4*df_M_0
df_M_04A_norm['y'] = df_M_04A_norm.G/0.6925

df_M_04A_norm
```

Out[58]:

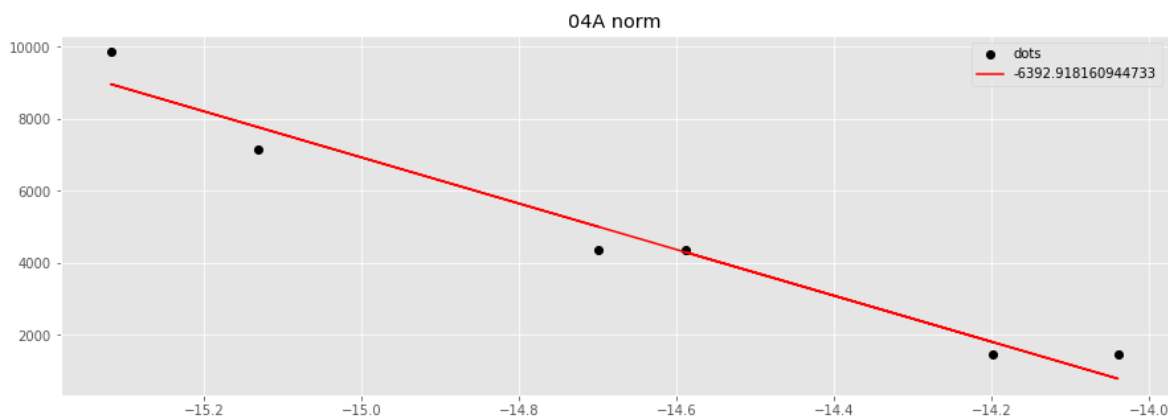|	jump	L	I	q	G	x	y
0	0-0	337.12	7.168229	0.45270	1016.7	-14.198619	1468.158845
1	1-2	353.63	1.799945	0.20330	3011.1	-14.588725	4348.158845
2	0-1	357.69	4.819605	0.32910	1016.7	-14.039807	1468.158845
3	3-5	367.15	0.346035	0.09426	6826.0	-15.318993	9857.039711
4	2-4	371.01	0.681553	0.16050	4951.9	-15.131563	7150.758123
5	1-3	375.52	1.240749	0.19900	3011.1	-14.699146	4348.158845

In [59]:

```
x = df_M_04A_norm.x
y = df_M_04A_norm.y

p = np.polyfit(x, y, 1)
yp = np.polyval(p, x)
print(p)

plt.plot(x, y, 'o', label='dots', color='k')
plt.plot(x, yp, 'r', label=p[0])
plt.legend()
plt.title('04A norm')
plt.show()
```

[-6392.91816094 -88964.73027057]

In [60]:

```python
df_M_05A_electrod = pd.read_excel('maximum/05A_electrod_maximum.xlsx')

df_M_05A_electrod['x'] = np.log(df_M_05A_electrod.I/(3*10**17/df_M_05A_electrod
df_M_05A_electrod['y'] = df_M_05A_electrod.G/0.6925

df_M_05A_electrod
```

Out[60]:

	jump	L	I	q	G	x	y
0	0->0	337.14	54.400	0.45270	1016.7	-12.171676	1468.158845
1	2->3	350.02	2.628	0.06345	4951.9	-13.086872	7150.758123
2	1->2	353.69	14.150	0.20330	3011.1	-12.526088	4348.158845
3	0->1	357.72	35.396	0.32910	1016.7	-12.045564	1468.158845
4	3->5	367.23	1.285	0.09426	6826.0	-14.006148	9857.039711
5	2->4	371.08	4.640	0.16050	4951.9	-13.212712	7150.758123
6	1->3	375.54	9.670	0.19900	3011.1	-12.645620	4348.158845
7	0->2	380.51	11.798	0.14620	1016.7	-12.085799	1468.158845

In [61]:

```python
x = df_M_05A_electrod.x
y = df_M_05A_electrod.y

p = np.polyfit(x, y, 1)
yp = np.polyval(p, x)
print(p)

plt.plot(x, y, 'o', label='dots', color='k')
plt.plot(x, yp, 'r', label=p[0])
plt.legend()
plt.title('05A электрод')
plt.show()
```

[-4589.8514883   -53737.24238597]

In [62]:

```
1  df_M_05A_general = pd.read_excel('maximum/05A_general_maximum.xlsx')
2
3  df_M_05A_general['x'] = np.log(df_M_05A_general.I/(3*10**17/df_M_05A_general.L*
4  df_M_05A_general['y'] = df_M_05A_general.G/0.6925
5
6  df_M_05A_general
```

Out[62]:

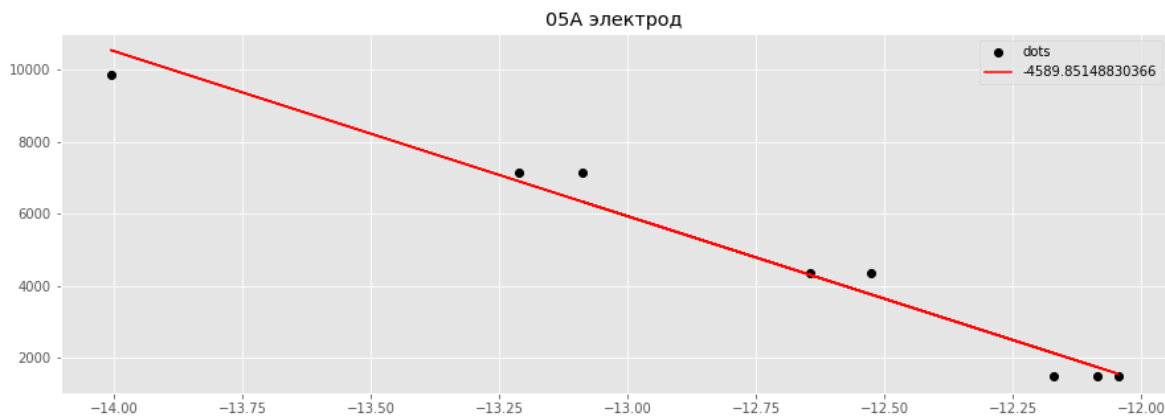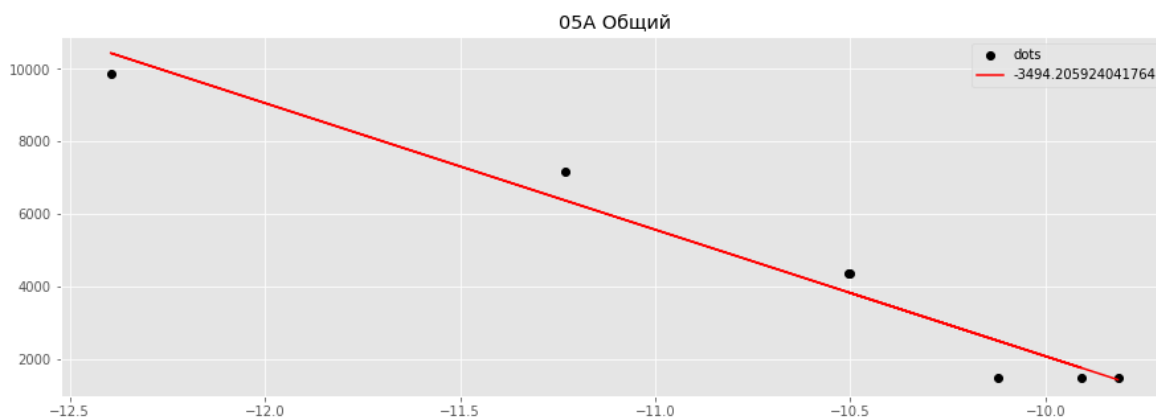|	jump	L	I	q	G	x	y
0	0 -> 0	337.08	423.390	0.45270	1016.7	-10.120458	1468.158845
1	1->2	353.64	106.990	0.20330	3011.1	-10.503633	4348.158845
2	0->1	357.63	300.360	0.32910	1016.7	-9.908188	1468.158845
3	3->5	367.20	6.440	0.09426	6826.0	-12.394705	9857.039711
4	2->4	371.01	33.730	0.16050	4951.9	-11.229794	7150.758123
5	1->3	375.49	82.600	0.19900	3011.1	-10.501171	4348.158845
6	0->2	380.44	114.367	0.14620	1016.7	-9.815053	1468.158845

In [63]:

```
1  x = df_M_05A_general.x
2  y = df_M_05A_general.y
3
4  p = np.polyfit(x, y, 1)
5  yp = np.polyval(p, x)
6  print(p)
7
8  plt.plot(x, y, 'o', label='dots', color='k')
9  plt.plot(x, yp, 'r', label=p[0])
10  plt.legend()
11  plt.title('05A Общий')
12  plt.show()
```

[-3494.20592404 -32873.63060653]

In [64]:

```python
df_M_05A_maximum = pd.read_excel('maximum/05A_maximum.xlsx')

df_M_05A_maximum['x'] = np.log(df_M_05A_maximum.I/(3*10**17/df_M_05A_maximum.L*
df_M_05A_maximum['y'] = df_M_05A_maximum.G/0.6925

df_M_05A_maximum
```

Out[64]:

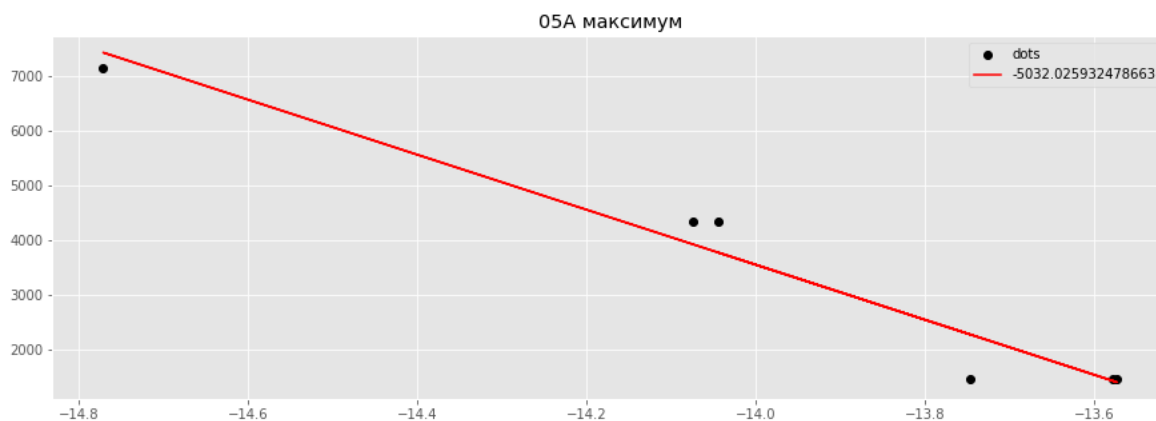|	jump	L	I	q	G	x	y
0	0-0	337.14	11.266798	0.4527	1016.7	-13.746180	1468.158845
1	1-2	353.66	3.102534	0.2033	3011.1	-14.043923	4348.158845
2	0-1	357.71	7.687943	0.3291	1016.7	-13.572622	1468.158845
3	2-4	371.02	0.977588	0.1605	4951.9	-14.770740	7150.758123
4	1-3	375.53	2.319659	0.1990	3011.1	-14.073335	4348.158845
5	0-2	380.50	2.655177	0.1462	1016.7	-13.577323	1468.158845

In [65]:

```python
x = df_M_05A_maximum.x
y = df_M_05A_maximum.y

p = np.polyfit(x, y, 1)
yp = np.polyval(p, x)
print(p)

plt.plot(x, y, 'o', label='dots', color='k')
plt.plot(x, yp, 'r', label=p[0])
plt.legend()
plt.title('05A максимум')
plt.show()
```

```
[ -5032.02593248 -66892.05435325]
```

In [66]:

```
maximum = pd.read_excel('maximum/changedP_04A_general_maximum.xlsx')

maximum['x'] = np.log(df_changedP_04A_general_maximum.I/(3*10**17/df_changedP_04A_g

maximum['y'] = df_changedP_04A_general_maximum.G/0.6925

maximum
```

Out[66]:

|	jump	L	I	q	G	x	y
0	0->0	337.08	319.85800	0.45270	1016.7	-10.400875	1468.158845
1	2->3	350.03	8.49800	0.06345	4951.9	-11.913149	7150.758123
2	1->2	353.61	75.04200	0.20330	3011.1	-10.858660	4348.158845
3	0->1	357.65	228.15065	0.32910	1016.7	-10.182940	1468.158845
4	3->5	367.26	1.56400	0.09426	6826.0	-13.809334	9857.039711
5	2->4	371.04	19.34680	0.16050	4951.9	-11.785331	7150.758123
6	1->3	375.49	56.70000	0.19900	3011.1	-10.877407	4348.158845
7	0->2	380.42	86.33800	0.14620	1016.7	-10.096406	1468.158845

In [67]:

```
x = df_changedP_04A_general_maximum.x
y = df_changedP_04A_general_maximum.y

p = np.polyfit(x, y, 1)
yp = np.polyval(p, x)
print(p)

plt.plot(x, y, 'o', label='dots', color='k')
plt.plot(x, yp, 'r', label=p[0])
plt.legend()
plt.title('04A Общий максимум')
plt.show()
```

[-2446.72577384 -22845.03325072]

04A Общий максимум
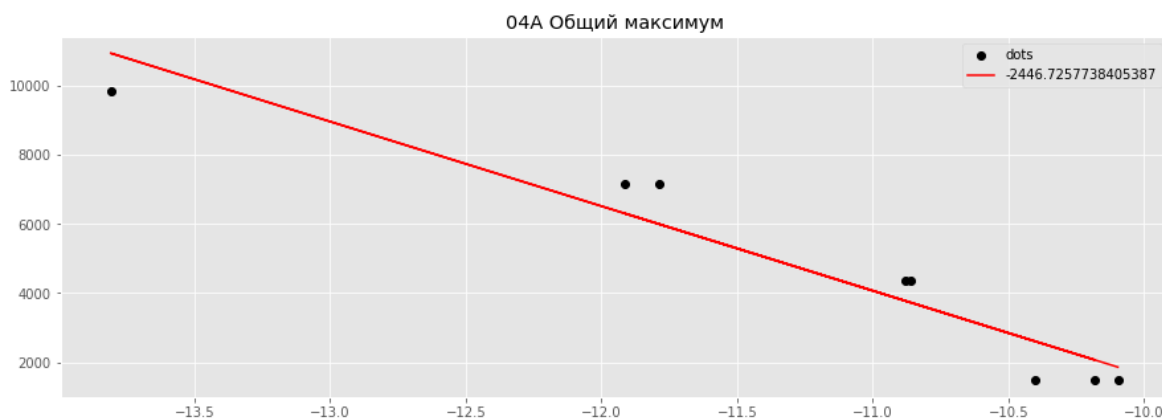
In [68]:

```
df_changedP_04A_maximum = pd.read_excel('maximum/changedP_04A_maximum.xlsx')

df_changedP_04A_maximum['x'] = np.log(df_changedP_04A_maximum.I/(3*10**17/df_ch
df_changedP_04A_maximum['y'] = df_changedP_04A_maximum.G/0.6925

df_changedP_04A_maximum
```

Out[68]:

|	jump	L	l	q	G	x	y
0	0->0	337.12	6.22300	0.4527	1016.7	-14.340025	1468.158845
1	1->2	353.65	1.52600	0.2033	3011.1	-14.753605	4348.158845
2	0->1	357.71	3.98667	0.3291	1016.7	-14.229319	1468.158845
3	1->3	375.49	1.07890	0.1990	3011.1	-14.839239	4348.158845
4	0->2	380.49	1.41400	0.1462	1016.7	-14.207517	1468.158845

In [69]:

```
x = df_changedP_04A_maximum.x
y = df_changedP_04A_maximum.y

p = np.polyfit(x, y, 1)
yp = np.polyval(p, x)
print(p)

plt.plot(x, y, 'o', label='dots', color='k')
plt.plot(x, yp, 'r', label= p[0])
plt.legend()
plt.title('04A максимум с измененным давлением')
plt.show()
```

```
[ -5153.82654209 -71976.02286776]
```
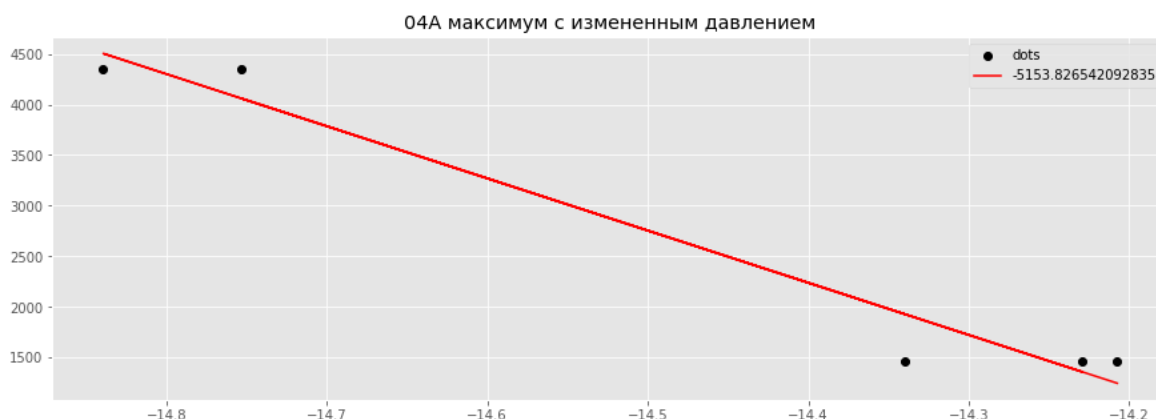

В рот ебал

In [70]:

```
final_data_base = pd.DataFrame(np.array([6700, 6700, 6700, 6700, 6700, 6700, 97
```

In [75]:

```
ta_base['index'] = np.array(['Central', 'Electrod', 'General', 'Central', 'Electrod'
```

In [76]:

```
1  final_data_base['A'] = np.array([0.4, 0.4, 0.4, 0.5, 0.5, 0.5, 0.4, 0.4])
```

In [77]:

```
1  final_data_base['T_rot'] = [1100, 1000, 800, 1200, 1100, 950, 1500, 900]
```

In [78]:

```
1  final_data_base['T_vib'] = [6300, 2000, 3800, 3200, 4500, 3500, 2500, 5100]
```

In [79]:

```
1  final_data_base.set_index('index')
2
```

Out[79]:

	P	A	T_rot	T_vib
index				
Central	6700	0.4	1100	6300
Electrod	6700	0.4	1000	2000
General	6700	0.4	800	3800
Central	6700	0.5	1200	3200
Electrod	6700	0.5	1100	4500
General	6700	0.5	950	3500
Central	9700	0.4	1500	2500
General	9700	0.4	900	5100

In [ ]:

```
1
```