Tasks for student's self-dependent work

Variant 1

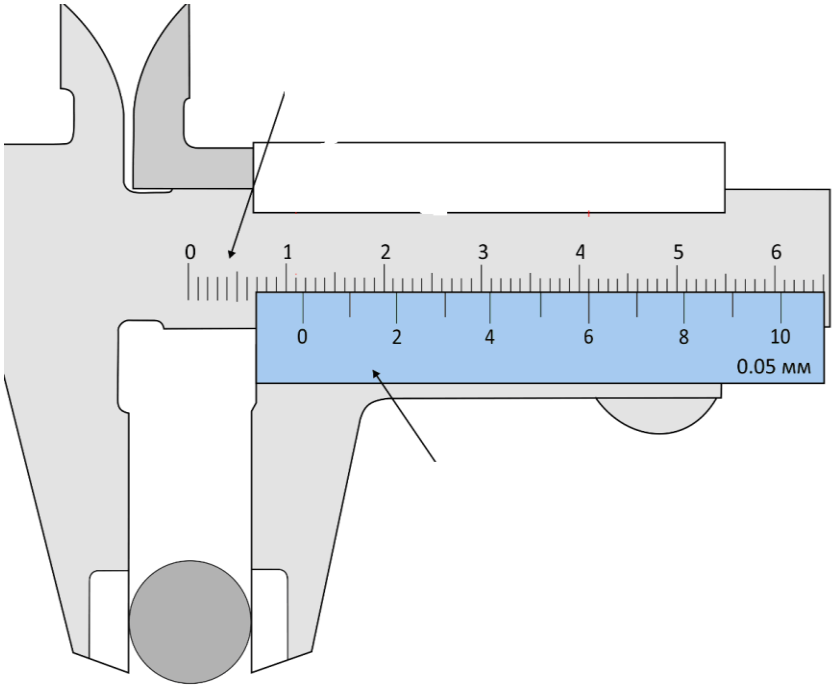
1. 10 measurements of the x value were made:
10.5
10.8
11.2
10.9
10.4
10.6
10.9
11.0
10.3
10.8

The Instrument error is 0.05.

Find the random error of the direct measurement, the relative error, and the total error of this measurement.

2. Determine the error of indirect measurement of material density from directly measured values of mass m and volume V of the sample, if m=(10.50± 0.05) kg, V=(0.050± 0.002) m^3.

3. Use the photo of the caliper to determine the **accuracy** of this device and the **current reading** using the vernier scale:



Variant 2

1. 10 measurements of the x value were made:

10.6

11.3

10.5

10.7

10.8

10.9

10.8

10.1

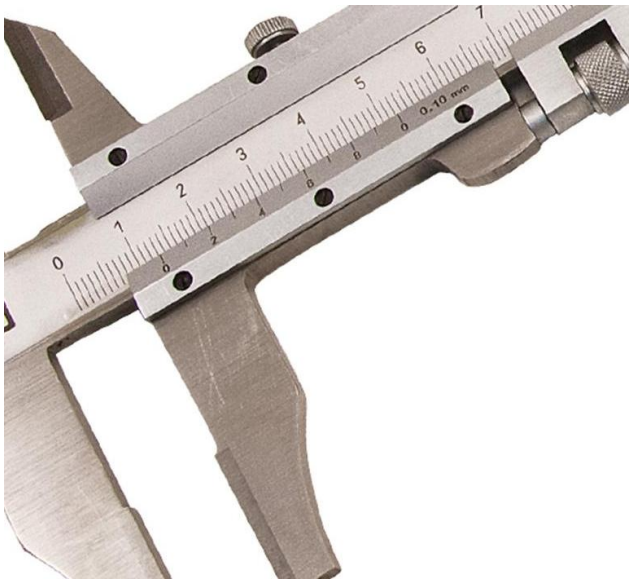
10.9

11.0

The instrument error is 0.05. Find the random error of the direct measurement, the relative error, and the total error of this measurement.

2. Find the error of indirect measurement of material density from directly measured values of mass m and volume V of the sample, if m=(0.110± 0.005) kg, V=(50.0±0.5) cm^3.

3. Use the photo of the caliper to determine the **accuracy** of this device and the **current reading** using the vernier scale:



Variant 3

1. 9 measurements of the x value were made:

12; 11; 14; 13,5; 12; 11; 15; 11; 10.

The instrument error is 0.5. Find the random error of direct measurement, the relative error and the total error of this measurement.

2. Determine the error of indirect measurement of material density from directly measured values of mass m and volume V of the sample, if m=(10.50± 0.05) kg, V=(0.05±0, 002) m^3.

3. Use the photo of the caliper to determine the **accuracy** of this device and the **current reading** using the vernier scale:

Variant 4

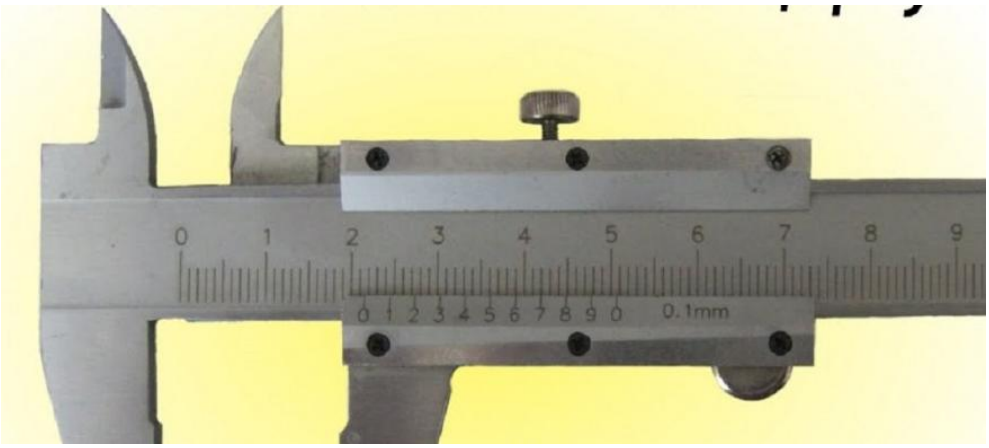
1. Using a stopwatch, n = 5 measurements of 10 pendulum oscillations were performed. As a result, experimental data were obtained:

15.3 s; 15.7 s; 15.4 s; 15.5 s; 15.4 s.

The instrument error is 0.05. Find the random error of the direct measurement, the relative error, and the total error of this measurement.

2. It is required to determine the error of indirect measurement of material density from directly measured values of mass m and volume V of the sample, if m=(15.20± 0.05) kg, V=(0.050± 0.002) m^3.

3. Use the photo of the caliper to determine the **accuracy** of this device and the **current reading** using the vernier scale:



Variant 5

1. 9 measurements of the x value were made:

1.0; 1,3; 2,1; 1,2; 1,2; 1,4; 1,5; 1,2; 1,4.

The instrument error is 0.05. Find the random error of the direct measurement, the relative error, and the total error of this measurement.

2. Find the error of indirect measurement of material density from directly measured values of mass m and volume V of the sample, if m=(10.50± 0.05) kg, V=(0.105± 0.005) m^3.

3. Use the photo of the caliper to determine the **accuracy** of this device and the **current reading** using the vernier scale:

Variant 6

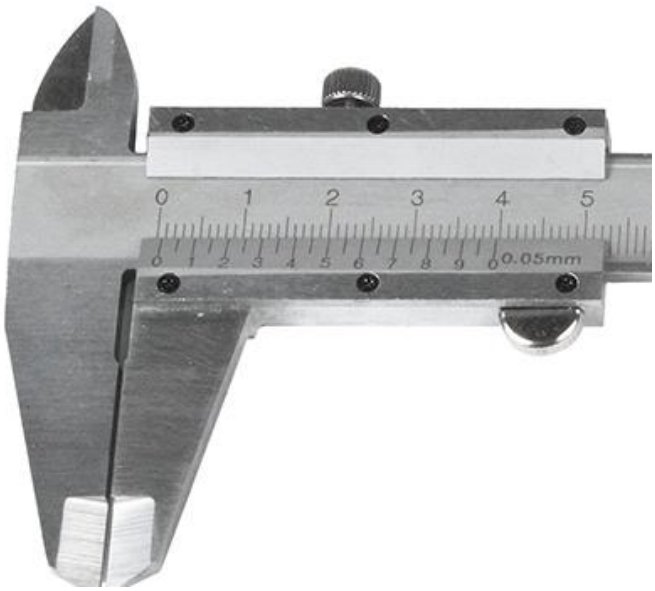
1. A number of measurements of the x value were made:

66; 65; 63; 64; 68; 61; 69; 62; 66; 65.

The instrument error is 0.5. Find the random error of direct measurement, the relative error and the total error of this measurement.

2. Calculate the error of indirect measurement of material density from directly measured values of mass m and volume V of the sample, if m=(15.05± 0.05) kg, V=(0.050± 0.002) m^3.

3. Use the photo of the caliper to determine the **accuracy** of this device and the **current reading** using the vernier scale:



Variant 7

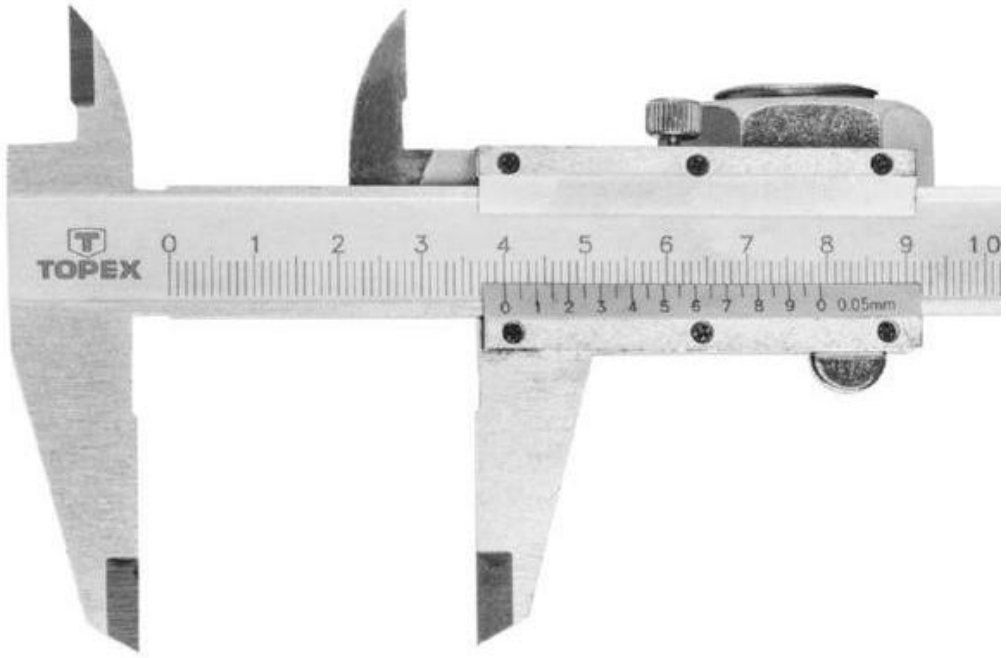
1. A number of measurements of the x value were made:

0.55; 0.56; 0.53; 0.50; 0.49; 0.52; 0.51; 0.58; 0.53; 0.51

The instrument error is 0.005. Find the random error of the direct measurement, the relative error, and the total error of this measurement.

2. Find the error of indirect measurement of material density from directly measured values of mass m and volume V of the sample, if m=(10.12± 0.01) kg, V=(0.050± 0.002) m^3.

3. Use the photo of the caliper to determine the **accuracy** of this device and the **current reading** using the vernier scale:



Variant 8

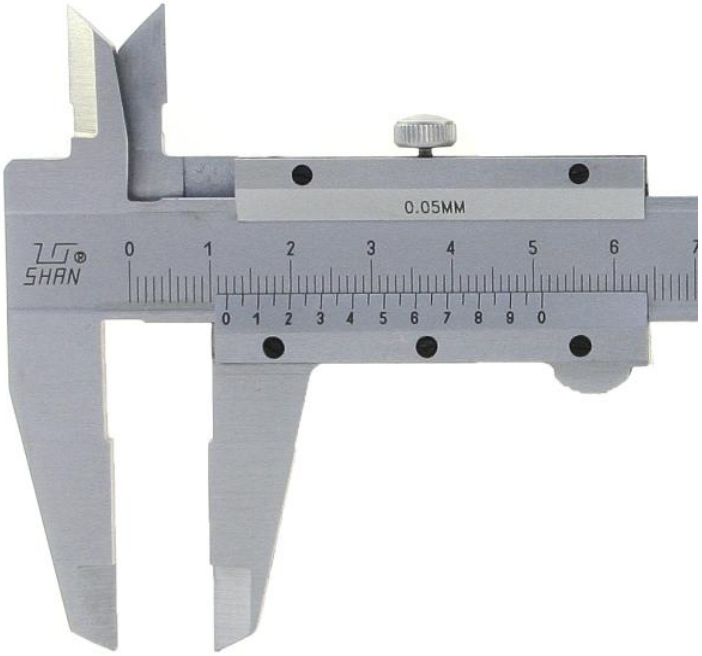
1. A number of measurements of the x value were made:

562; 580; 577; 590; 569; 587; 591; 568; 576; 588;

The instrument error is 0.5. Find the random error of direct measurement, the relative error and the total error of this measurement.

2. Determine the error of indirect measurement of material density from directly measured values of mass m and volume V of the sample, if m=(5.50± 0.05) kg, V=(0.050± 0.002) m^3.

3. Use the photo of the caliper to determine the **accuracy** of this device and the **current reading** using the vernier scale:



Variant 9

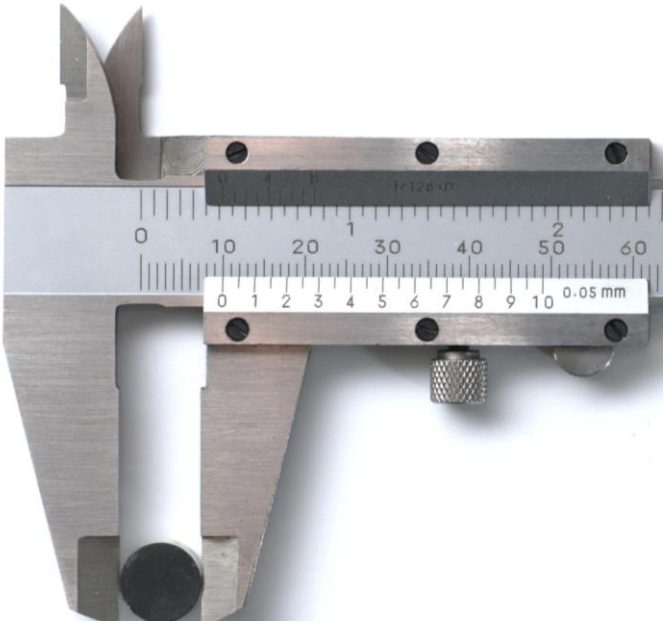
1. A number of measurements of the x value were made:

0.55; 0.56; 0.53; 0.50; 0.49; 0.52; 0.51;

The instrument error is 0.05. Find the random error of the direct measurement, the relative error, and the total error of this measurement.

2. Find the error of indirect measurement of material density from directly measured values of mass m and volume V of the sample, if m=(25.50± 0.05) kg, V=(0.050± 0.002) m^3.

3. Use the photo of the caliper to determine the **accuracy** of this device and the **current reading** using the vernier scale:



Variant 10

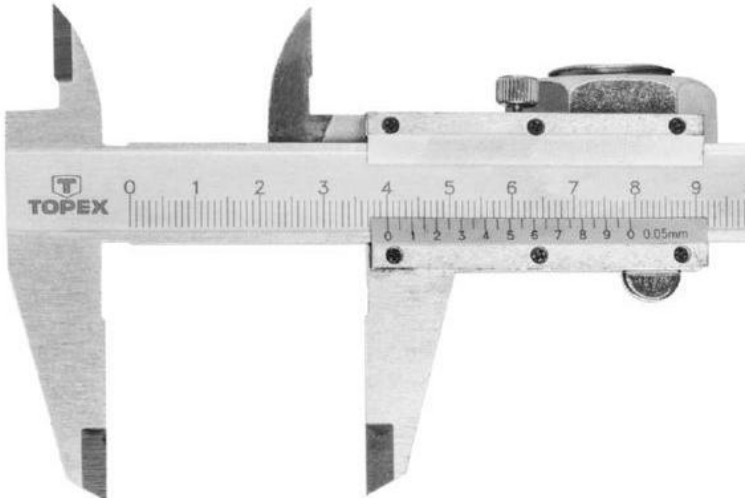
1. A number of measurements of the x value were made:

0.001; 0.002; -0.004; -0.003; 0.007; -0.006; 0.004;

The instrument error is 0.0005. Find the random error of the direct measurement, the relative error, and the total error of this measurement.

2. It is required to determine the error of indirect measurement of material density from directly measured values of mass m and volume V of the sample, if m=(12.06± 0.01) kg, V=(0.050± 0.001) m^3.

3. Use the photo of the caliper to determine the **accuracy** of this device and the **current reading** using the vernier scale:



Variant 11

1. A number of measurements of the x value were made:

0.2; 0; 0.3; -0.8; 0; -0.6; 0; 0.14; -0.1; 0.7; -0.4;

The instrument error is 0.01. Find the random error of the direct measurement, the relative error, and the total error of this measurement.

2. it is required to determine the error of indirect measurement of material density from directly measured values of mass m and volume V of the sample, if m=(0.20± 0.01) kg, V=(0.054± 0.001) m^3.

3. Use the photo of the caliper to determine the **accuracy** of this device and the **current reading** using the vernier scale:

Variant 12

1. A number of measurements of the x value were made:

0.2; 0.3; 0.1; 0.3; 0.4; 0.1; 0.2 the

Instrument error is 0.01. Find the random error of the direct measurement, the relative error, and the total error of this measurement.

2. Calculate the error of indirect measurement of material density from directly measured values of mass m and volume V of the sample, if m=(23.120± 0.005) kg, V=(0.030± 0.001) m^3.

3. Use the photo of the caliper to determine the **accuracy** of this device and the **current reading** using the vernier scale:

Variant 13

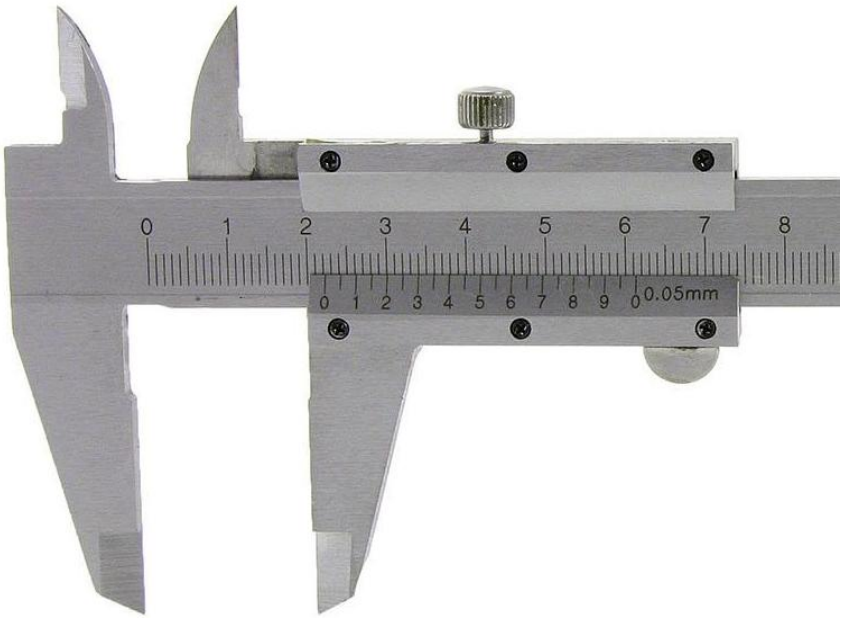
1. A number of measurements of the x value were made:

0.21; 0.32; 0.19; 0.30; 0.25; 0.28; 0.31 the

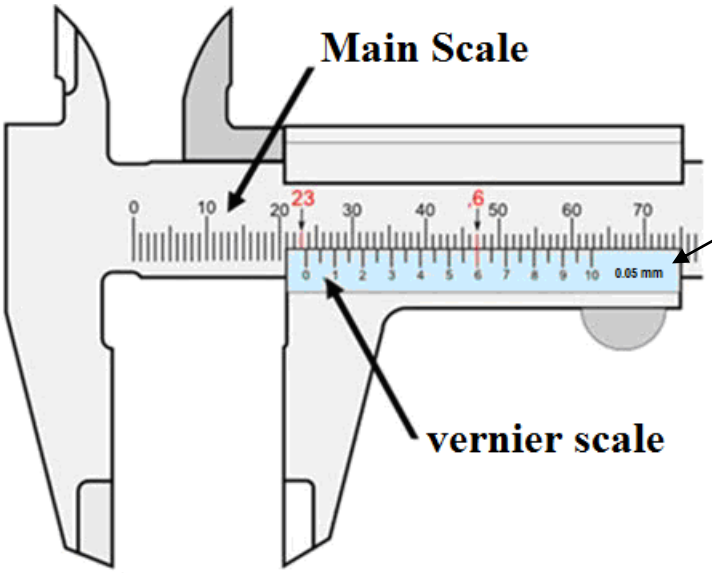
Instrument error is 0.01. Find the random error of the direct measurement, the relative error, and the total error of this measurement.

2. Calculate the error of indirect measurement of material density from directly measured values of mass m and volume V of the sample, if m=(23.120± 0.005) kg, V=(0.030± 0.001) m^3.

3. Use the photo of the caliper to determine the **accuracy** of this device and the **current reading** using the vernier scale:



Example for №3.



The **accuracy** of this device: 0.05 mm

The result:

23+0.6=23.6 mm