EXPERIMENTAL WORK 4

Subject. The rotation period measurements, the rotation frequency and the velocity of the object along the circumference.

Theoretical data and practical advice

Uniform motion of a material point in a circle – this is a curvilinear motion, during which the point moving along a circular trajectory, passes through at any time intervals the same path.

The rotation period is a physical quantity equal to the time for which the material point moves uniformly in a circle, making one revolution.

The rotation period is denoted by the symbol ***T***. *A unit of the rotation period is Cl –* **second**: $[T]$ = s.

To determine the rotation period ***T***, it is necessary to calculate the number of revolutions ***N*** performed during the time interval ***t*** and use the formula: $\boldsymbol{T} = \frac{\boldsymbol{t}}{\boldsymbol{N}}$.

Rotation frequency is a physical quantity equal to the number of revolutions per unit time.

The rotating frequency is denoted by the symbol ***n*** and is determined by the formula: $n = \frac{N}{t}$, where t – rotation time; N – number of turns made during this time.

Unit of rotating frequency ***n*** in *SI* – **turn per second**: $[n] = \frac{\text{turn}}{\text{s}} = \frac{1}{\text{s}}$.

The speed of any uniform motion of the body is calculated by the formula:

$$v = \frac{l}{t}.$$

If the object moves uniformly in a circle a time equal to the period ($t = T$), the object makes one full turnover, that is, it overcomes the path equal to the circumference.

The length of the circle l can be determined by the formula:

$$l = 2\pi R,$$

where π = 3,14; R – radius of a circle.

Having determined the path and time for which this distance is traversed, we obtain a formula for calculating the speed uniform motion of the object along the circle:

$$v = \frac{l}{t}; \quad v = \frac{2\pi R}{\mathrm{T}}.$$

Subject. The rotation period measurements, the rotation frequency and the velocity of the object along the circumference.

Target: to measure the period of rotation, measure the period of rotation, the rotating frequency and speed of the object with its uniform motion along the circle.

Equipment: disk with contours of circles of different diameters, ball on the thread, stopwatch, ruler.

Figure 1

Execution

The results of the measurements I'm writing down into the table:

Table 1

Movement time *t*, s	Amount of turns, *N*	Rotation period *T*, s	Rotation frequency *n*, rot/s	Motion speed *v*, m/s

1. I'm fixing the rod in the coupling of the tripod and placing a disk with the contours of circles on the table (see Fig.).
2. Hanging the ball on the string so that it is placed over the center of the disk at a height of 2–3 mm from its plane.
3. I'm taking the thread in the place of attachment to the rod and untwist it so that the ball moves along the contour of one of the applied circles. I try not to change the speed of the ball.
4. I'm measuring the time t_1, during the object makes $N_1 = 10$ turns: $t_1 =$ _____ s.
5. Repeating the experiment, causing the ball to move around a circle of a smaller or larger radius.

6. I'm measuring the time t_2, during the object makes $N_2 = 10$ turns: $t_2 =$ _____ s.
7. I'm determining the rotation period and the rotating frequency of the object (ball) for each of the following cases:

$T_1 = \frac{t_1}{N_1}$; $T_1 = \frac{\quad}{\quad} =$ _____ s; $n_1 = \frac{N_1}{t_1}$; $n_1 = \frac{\quad}{\quad} =$ _____ $\frac{1}{s}$;

$T_2 = \frac{t_2}{N_2}$; $T_2 = \frac{\quad}{\quad} =$ _____ s; $n_2 = \frac{N_2}{t_2}$; $n_2 = \frac{\quad}{\quad} =$ _____ $\frac{1}{s}$;

8. I'm measuring the radius of each of the circles: $R_1 =$ _____ m; $R_2 =$ _____ m;
9. I'm calculating speed of uniform motion of the ball in circles: $v_1 = \frac{2\pi R_1}{T_1}$;

$v_1 = \frac{\quad}{\quad} =$ _____ $\frac{\text{m}}{\text{s}}$; $v_2 = \frac{2\pi R_2}{T_2}$; $v_2 = \frac{\quad}{\quad} =$ _____ $\frac{\text{m}}{\text{s}}$;

10. Results of the object rotation period measurements I'm recording in the form: $T = T_{meas.} \pm \Delta T$.
    Considering that, $\Delta t = 0.2$ s, and $\Delta T < \Delta t$ so many times as the number of turns performed by the object:

11. Analyzing the results of the experiment:

The work was done by the student________________________________of the ________ grade

The work was checked by the teacher____