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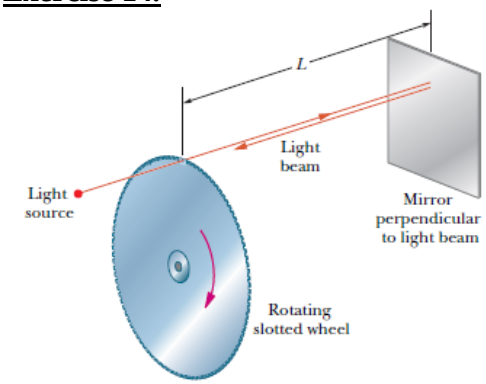
Physics 1 for Nano: written Exercises 3

WS 2019 (sheet 3)
https://www.zahlen-kern.de/editor/

Exercise 13.

The angular position of a point on a rotational wheel of radius r=3cm is given by $\Theta(t)=2.0 + 4.0t^2+2.0\ t^3$. where Θ is in radians and t in seconds. At t=0, what are (a) the point´s angular position and (b) it angular velocity ? (c) What is its angular velocity and tangential velocity at t=4,0s ? (d) and its angular acceleration at t=2.0s ? (e) is it angular acceleration constant ?

Exercise 14.



As early method to measure the speed of light makes use of a rotating slotted wheel. A beam of light passes through one of the slots at the outside edge of the wheel as seen in figure, travels to a distant mirror and returns to the wheel just in time to pass through the next slot in the wheel. One such slotted wheel has the radius of 5.0 cm and 500slots around its edge. Measurements taken when the mirror is at L=500m from the wheel indicate a speed of light of c= 3.0 10^6 km/s. (a) what is the (constant) angular speed of the wheel (b) what is the linear speed of a point on the edge of the wheel.

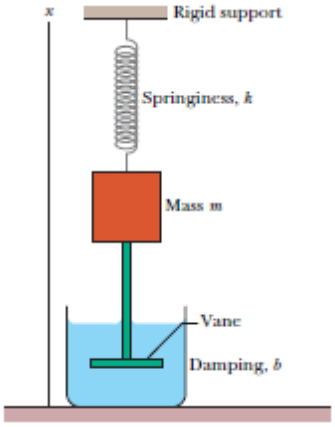
Excercise 15)

The uniform rectangular solid block has a mass of 0.25kg and an edge length of a = 3.5 cm, b= 8.4 cm and c= 1.4 cm. Calculate the rotational inertia about the axis through one corner parallel c and perpendicular to e face (a x b). What is the inerta if the rotational axis is parallel b and perpendicular to the face c x a?

Exercise 16

A harmonic oscillator consists of a block of mass 2.50 kg attached to a spring of spring constant 100 N/m. When t = 1.00 s, the position and velocity of the block are x = 0.129 m and v = 3.415 m/s. (a) What is the amplitude and the period of the oscillations? What were the (b) position and (c) velocity of the block at t= 0 s and t = 3s and 5s?

Exercise 17.



In the neighbored figure the block has a mass of m=1.50 kg and the spring constant is k =8.00 N/m. The damping force is given by $b(dx/dt)$, where b = 230 g/s. The block is pulled down 12.0 cm and released. (a) Calculate the time required for the amplitude of the resulting oscillations to fall to one-third of its initial value. (b) How many oscillations are made by the block in this time? (c) How much the frequency is reduced compared to undamped oscillation ?

Excercise 18)

A 5.00 kg object on a horizontal frictionless surface is attached to a spring with k 1000 N/m. The object is displaced from equilibrium 50.0 cm horizontally and given an initial velocity of 10.0 m/s back toward the equilibrium position. What are (a) the motion's frequency, (b) the initial potential energy of the block–spring system, (c) the initial kinetic energy, and (d) the motion's amplitude ?

Note:
Exercises have to give back at lecture 12.11.19. It will be discussed in exercises hours at 13.11.18