**The laboratory work 9**

A piece of cork in the form of a parallelepiped with the area of the base S and height H floats in the water. The plug is immersed in water at a shallow depth of x0 and released. As a result, the cork begins to oscillate. Water resistance is not taken into account.



The change in the immersion depth of the plug in water x is described by the following
equation:

 with the start cases:



where ρв is the density of water, ρn is the density of the plug, and g is the acceleration due to gravity.

Let there be the second exactly the same "water-cork" system in which the cork at the initial moment of time was not immersed in water and released, but reported to it a speed equal to v0. Suppose that in this system there is a water resistance force proportional to the plug speed: Fc = -rv, where r is the proportionality coefficient. The oscillations in this system are described by the equation:

 with the start conditions  where m is mass of a plug.

Construct a model of a system consisting of these two water-cork systems, unconnected with each other. Also construct a system model in which every 20 seconds in the first system water instantly "turns" into mercury (and mercury with the same frequency turns into water).

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| --- | --- | --- | --- | --- | --- | --- | --- |
| Variant | S | H | x0 | $$ρ\_{b}$$ | $$ρ\_{n}$$ | $$v\_{0}$$ | r |
| 1 | $$6 m^{2}$$ | 0.1 m | 15 sm | $$1050 kg/m^{3}$$ | $$206 kg/m^{3}$$ | 0.9 m/s | 1.2 kg/s |
| 2 | $$4 m^{2}$$ | 0.2 m | 12 sm | $$1120 kg/m^{3}$$ | $$270 kg/m^{3}$$ | 1.1 m/s | 0.9 kg/s |
| 3 | $$2 m^{2}$$ | 0.3 m | 10 sm | $$1000 kg/m^{3}$$ | $$255 kg/m^{3}$$ | 0.8 m/s | 1.5 kg/s |
| 4 | $$1 m^{2}$$ | 0.5 m | 5 sm | $$1100 kg/m^{3}$$ | $$200 kg/m^{3}$$ | 1 m/s | 1 kg/s |
| 5 | $$5 m^{2}$$ | 0.1 m | 25 sm | $$1156 kg/m^{3}$$ | $$215 kg/m^{3}$$ | 1.5 m/s | 1.6 kg/s |
| 6 | $$3 m^{2}$$ | 0.09 m | 6 sm | $$1700 kg/m^{3}$$ | $$240 kg/m^{3}$$ | 0.6 m/s | 1.8 kg/s |
| 7 | $$8 m^{2}$$ | 0.2 m | 15 sm | $$1640 kg/m^{3}$$ | $$360 kg/m^{3}$$ | 1.9 m/s | 2.3 kg/s |
| 8 | $$4 m^{2}$$ | 0.4 m | 30 sm | $$1730 kg/m^{3}$$ | $$380 kg/m^{3}$$ | 1.7 m/s | 2.7 kg/s |

A density of mercury is $13540 kg/m^{3}$