

PHYS121 2021-2022 Fall Semester

Final exam

90 minutes

1	2	3	4	5	Total

Name Surname: Student No: Lecturer:

Department:

Calculators are allowed but not their exchange. Each question is worth 20 points

Unless otherwise stated, take $g=9,80 \text{ m/s}^2$. **Good luck.**

1)- A light spring of force constant 3.85 N/m is compressed by 8.00 cm and held between a 0.250-kg block on the left and a 0.500-kg block on the right. Both blocks are at rest on a horizontal surface. The blocks are released simultaneously so that the spring tends to push them apart. Find the maximum velocity each block attains if the coefficient of kinetic friction between each block and the surface is (a) 0, (b) 0.100, and (c) 0.462. Assume the coefficient of static friction is greater than the coefficient of kinetic friction in every case.

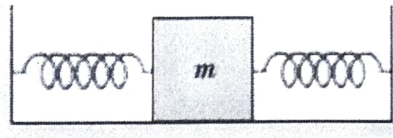
2)- A large wooden turntable in the shape of a flat uniform disk has a radius of 2.00 m and a total mass of 120 kg. The turntable is initially rotating at 3.00 rad/s about a vertical axis through its center. Suddenly, a 70.0-kg parachutist makes a soft landing on the turntable at a point near the outer edge. ($I = 1/2MR^2$)

a)- Find the angular speed of the turntable after the parachutist lands. (Assume that you can treat the parachutist as a particle.)

b)- Compute the kinetic energy of the system before and after the parachutist lands.

c)- Why are these kinetic energies not equal?

3)- In the figure, two springs of spring constants k_1 and k_2 are attached to a block that can oscillate over a frictionless floor. If the left spring is removed, the block oscillates at a frequency of 30 Hz. If, instead, the spring on the right is removed, the block oscillates at a frequency of 45 Hz. At what frequency does the block oscillate with both springs attached?



4)- A sinusoidal wave in a wire with a mass per unit length of $\mu=0.4$ kg/m is given as $y(x,t)=0.35\sin(0.2\pi x-6t)$ m. (a) What is the amplitude, wavelength, period, and velocity of the wave? (b) What is the tension in the wire?

5)- A heat source is providing heat energy at a rate 50 cal/s. Consider 50 g of ice at 0 °C initially.

How long does it take for it to transform into:

- a) Water,
- b) Steam.
- c) Draw a graph of temperature (y-axis) versus time (x-axis) for this process.
- d) How much of **the water** is transformed into steam at $t = 288 \text{ s}$?

(Latent heat of fusion, specific heat and latent heat of vaporization of water are: $L_f = 80 \text{ cal/g}$, $c_w = 1 \text{ cal/g}^\circ\text{C}$, $L_v = 540 \text{ cal/g}$, respectively)