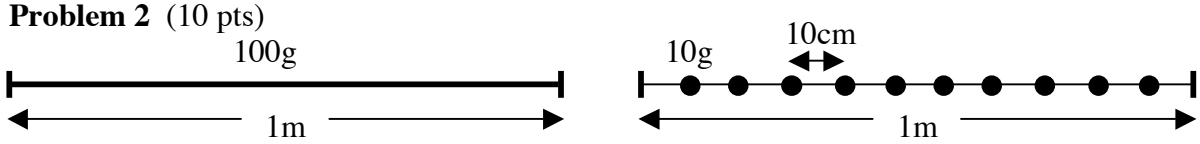
PHYSICS 4B **QUIZ 5** SPRING QUARTER 2018
PROF. HIRSCH **3 Problems** JUNE 4

Problem 1 (10 pts)
A transverse traveling wave in a cord is represented by the function
$y(x,t) = 0.45\cos(2.4x - 18t)$
where y and x are in meters and t in seconds. What is:
(a) the wavelength (in m)
(b) the frequency (in Hz)
(c) the velocity of the wave (in m/s)
(d) the maximum and minimum speed of particles in the cord (in m/s)
(e) the maximum acceleration of particles in the cord (in m/s^2)

Problem 2 (10 pts)



An elastic string of length 1m and mass 100g is tied at both ends as shown in the figure to the left. The tension of the string is 40N.
(a) Find the lowest frequency of transverse oscillations of this string, in Hz.
(b) Assume the string is oscillating at frequency 1000Hz. What is the wavelength of this mode, in cm?
(c) Assume that instead of a continuous string of mass 100g you have 10 masses of 10g each, connected by massless strings of tension 40N, at distance 10cm from each other, as shown in the figure to the right. Find approximately (i) the lowest frequency of transverse oscillations and (ii) the highest frequency of transverse oscillations, in Hz.

Problem 3 (10 pts + 3 pts extra credit)
A transverse standing wave in a string of length 20cm and mass 40g is given by
$y(x,t) = A\sin(kx)\cos(\omega t)$ with A=2cm, $k=0.2\pi cm^{-1}$, $\omega=80\pi s^{-1}$
(a) Find the maximum and minimum instantaneous kinetic energies that this string will have in the presence of this standing wave. Give your answers in erg (= g cm^2/s^2). *Hint*: the average of $\sin^2$ is ½.
(b) What are the three lowest frequencies of standing waves that this string can have, in Hz?
(c) Write the standing wave y(x,t) given above as a superposition of two traveling waves. At what speed do these traveling waves travel?
(d) Find the energy per unit time transported by one of these traveling waves, in erg/s.
(e) Explain the relation between the results found in (a) and in (d).