

Boğaziçi University
Department of Physics

Phys 442

Spring 2011

Practice Exam

May 11th, 2011

Problem 1

Assume that, you measured a quantity in the laboratory, and found the value of a physical quantity to be $x_{\text{experimental}} = 12.315 \pm 0.001$ nm. Then you are that this has been already measured by a new technique with an incredible accuracy, such that it is the most accurate measurement on earth, and the value is given as $x_{\text{trust}} = 12.82 \pm 0.01$ nm. what can you tell about the precision and accuracy of you measurement.

Problem 2

On a certain kind of slot machine there are 3 different symbols that can appear in each of three windows. The symbols are lemon, melon, and apple. The machine pays off different amounts when either one, two, or three lemons appear.

- a) What should be the payoff ratio for each of the three possibilities if the machine is honest and there is no cut for the house.
- b) What is the mean, median, and the standard deviation of the payoff.

Problem 3

The probability that an electron is at a distance r from the center of the nucleus of a hydrogen atom is given by

$$P(r) = Cr^2 e^{-r/R}$$

Find the value of the constant C . Find the mean radius $\bar{r}$ and the standard deviation σ_r . (You may use $\int_0^\infty x^n e^{-x} = n!$)

Problem 4

You are to integrate a function that behaves like a sin function with half period in the region of integration. Estimate the number of numerical integration points you need in order to have 1% error if you have to use trapezoidal rule.

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Short Questions About the Experiments

Problem 5

Derive e/m ratio as a function of I , n , V , R and physical constants.

Problem 6

A laser beam is used for photoelectric effect.

- a) we have to decrease the wavelength (increase the energy/photon) of the laser beam,
- b) we have to increase the intensity of the laser beam,
- c) both of the above.

in order to increase the current.

Problem 7

What is the order of magnitude of the energy of a photon which can be classified as X-ray?

Problem 8

Derive the relation between half-life and lifetime for a radioactive material.

Problem 9

"When $\mu \gg 1$, Poisson distribution with μ looks like a Gaussian distribution with μ and $\sigma = \sqrt{\mu}$." This statement is

- a) true
- b) false

Problem 10

What is the dimension of cross section in 2D scattering experiment? What would be the dimension in a though 4D experiment?

Problem 11

Estimate the force between the small and large balls in the Cavendish experiment. What is the fraction when you compare this with the weight of the large ball?

Problem 12

What are the "deeps" you see in Frank-Hertz experiment? Explain the periodicity.