Name: _____

PHYS3101 Analytical Mechanics S23 Quiz #12 16 Nov 2023

You have fifteen minutes to complete this quiz. You may use books, notes, or computers you have with you, but you may not communicate with anyone other than the instructor.

Write your solution on this page, plus the back if necessary, and additional sheets if absolutely necessary. You must show the steps of your solution.

A slice of raisin bread with area A has N raisins embedded in it. Model each raisin as a sphere of radius R. If you fire 1000 BB's from a pellet gun normal to the plane of the bread slice, and randomly spread over its area, then, on average and in terms of A, N, and R, how many raisins would you expect to hit? You can assume that there are few enough raisins so that none of them overlap, and that the BB's have negligible size.

PHY3101 Analytical Mechanics Quiz #12 Solution

A slice of raisin bread with area A has N raisins embedded in it. Model each raisin as a sphere of radius R. If you fire 1000 BB's from a pellet gun normal to the plane of the bread slice, and randomly spread over its area, then, on average and in terms of A, N, and R, how many raisins would you expect to hit? You can assume that there are few enough raisins so that none of them overlap, and that the BB's have negligible size.

The area covered by raisins is $N \times \pi R^2$, and the probability of hitting a raisin is just this area divided by the total area of the bread slice, so you expect, on average,

$$n_{\text{hit}} = 1000 \times \frac{N\pi R^2}{A}$$