

Phys 21-bio
 Quiz 11, Probability
 April 26, 2012

Name_____

1. (5 points) Your theory of motion of paramecium confined to a narrow channel predicts the probability for the velocity of a foraging protist to be given by the following table:

V_x (mm/s)	Probability
-70	0.015625
-40	0.09375
-10	0.234375
20	0.3125
50	0.234375
80	0.09375
110	0.015625

What is the expectation value of the velocity?

V_x (mm/s)	Probability	xP	$.5*m*v^2P$
-70	0.015625	-1.09375	2.29688E-15
-40	0.09375	-3.75	4.5E-15
-10	0.234375	-2.34375	7.03125E-16
20	0.3125	6.25	3.75E-15
50	0.234375	11.71875	1.75781E-14
80	0.09375	7.5	1.8E-14
110	0.015625	1.71875	5.67188E-15
SUM	1	20	5.25E-14

What is the expectation value of the kinetic energy of the protist? Assume a mass of 60×10^{-9} g.

See last column above, $\langle KE \rangle = 5.25 \times 10^{-14}$ J

2. (5 points) Briefly describe the motion of the motion of the protist. i.e. is it random, is there a general drift in a given direction?

The motion is a mixture of random with deterministic. The protist moves generally in the +x direction with a speed of 20 mm/s but with many steps to the left and the right.