York U. PHYS 1420 (F19): **WRITTEN** HW Assignment #1

Purpose: Obtain experience (and graded feedback) w/ regard to clearly writing out solutions to relevant problems

➢ You are expected to do all problems and write out clear/coherent solutions for such

➢ You will be graded based upon a spot-check for completeness & 2-3 problems will be chosen at random and graded thoroughly

➢ To get full credit, your solutions must lay out a legible and clearly-explained (e.g., step-by-step) path, all the way from assumptions made to the final (boxed) answer

➢ Solutions will be posted after the specified due date. Late submissions will be accepted as per the Lateness Policy spelled out in the syllabus
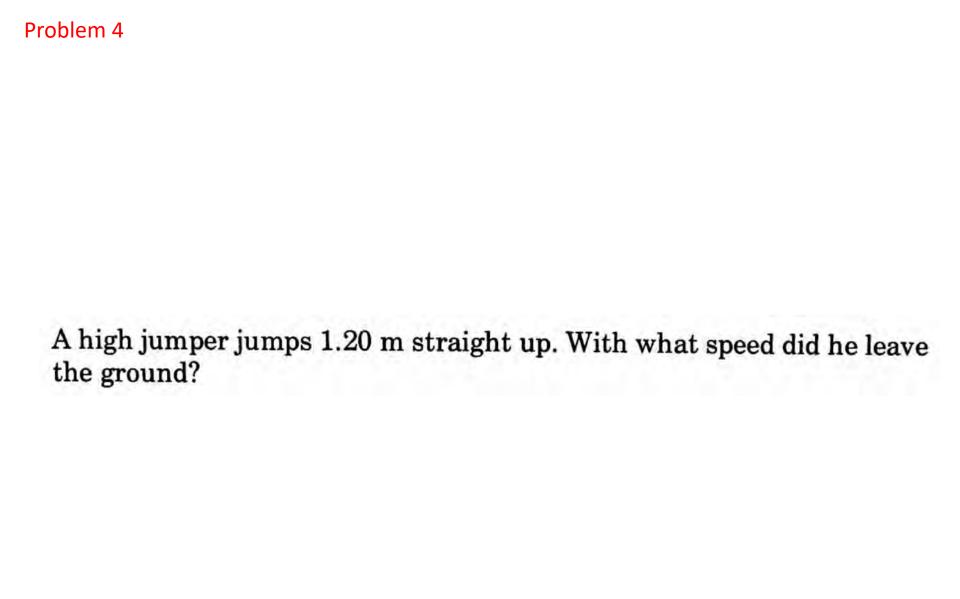
An ion traveling east through a biological membrane at 150 m/s enters an electric field which reduces its velocity to 100 m/s toward the east. While this acceleration (assumed constant) is occurring, the ion undergoes a displacement of 50.0 Å in the same direction (1 Å = 10^{-10} m).

(a) How long did the electric field take to cause this velocity change?

(b) What acceleration did the ion experience?

A ball is thrown straight up from the edge of a cliff with an initial speed of 15.0 m/s. As it falls back, it just misses the edge and strikes the ground 75.0 m below the point from which it was thrown. What height does the ball reach and how long is it in the air?

A cat leaps horizontally with a velocity of 4.00 m/s from a tree branch 2.00 m above the ground. What is its velocity when it strikes the ground?

A high jumper jumps 1.20 m straight up. With what speed did he leave the ground?

(a)   How high does a ball rise if it is thrown vertically upward at 7.00 m/s?

(b)   How long does it take to reach its highest position?

(c)   How long does it take to return to your hand after leaving it?

(d)   What is its velocity when it strikes your hand?

‖ Let $\vec{A} = (3.0 \text{ m}, 20°$ south of east), $\vec{B} = (2.0 \text{ m}, \text{north})$, and $\vec{C} = (5.0 \text{ m}, 70°$ south of west).

a. Draw and label $\vec{A}$, $\vec{B}$, and $\vec{C}$ with their tails at the origin. Use a coordinate system with the x-axis to the east.

b. Write $\vec{A}$, $\vec{B}$, and $\vec{C}$ in component form, using unit vectors.

c. Find the magnitude and the direction of $\vec{D} = \vec{A} + \vec{B} + \vec{C}$.

A child on a swing weighs 200 N. Find the size of the horizontal force required to pull the child back so that the swing makes an angle of 30.0° with the vertical direction

‖ A gray kangaroo can bound across level ground with each jump carrying it 10 m from the takeoff point. Typically the kangaroo leaves the ground at a 20° angle. If this is so:

a. What is its takeoff speed?

b. What is its maximum height above the ground?

‖ A typical laboratory centrifuge rotates at 4000 rpm. Test tubes have to be placed into a centrifuge very carefully because of the very large accelerations.

a. What is the acceleration at the end of a test tube that is 10 cm from the axis of rotation?

b. For comparison, what is the magnitude of the acceleration a test tube would experience if dropped from a height of 1.0 m and stopped in a 1.0-ms-long encounter with a hard floor?