This print-out should have 9 questions. Multiple-choice questions may continue on the next column or page—find all choices before answering.

001 10.0 points
Consider an equilateral triangle with sides of lengths 3.4 $\mu$m and charge $-0.2 \mu$C, 1.7 $\mu$C and 1.8 $\mu$C located at the corners of the triangle.
Find the minimum work required to move the first point charge to infinity. Answer in units of J.

002 10.0 points
A charge of 9 $\mu$C is distributed uniformly along the circumference of a circle with a radius of 59 cm.
The Coulomb constant is $8.98755 \times 10^9$ N $\cdot$ m$^2$/C$^2$.
How much external energy is required to bring a charge of 31 $\mu$C from infinity to the center of the circle? Answer in units of J.

003 10.0 points
Particles A (of mass $m$ and charge $Q$) and B (of $m$ and charge 5 $Q$) are released from rest with the distance between them equal to 0.5079 m.
If $Q = 20 \mu$C, what is the kinetic energy of particle B at the instant when the particles are 2.5079 m apart? Answer in units of J.

004 (part 1 of 3) 10.0 points
A proton is released from rest in a uniform electric field of magnitude $1.5 \times 10^5$ V/m directed along the positive x-axis. The proton undergoes a displacement of 0.3 m in the direction of the electric field as shown in the figure.
The mass of a proton is $1.672623 \times 10^{-27}$ kg.

Find the change in the electric potential if the proton moves from the point A to B. Answer in units of V.

005 (part 2 of 3) 10.0 points
Find the change in potential energy of the proton for this displacement. Answer in units of J.

006 (part 3 of 3) 10.0 points
Apply the principle of energy conservation to find the speed of the proton after it has moved 0.3 m, starting from rest. Answer in units of m/s.

007 10.0 points
A uniform electric field of magnitude 281 V/m is directed in the positive x-direction. Suppose a 24 $\mu$C charge moves from the origin to point A at the coordinates, (28 cm, 52 cm).

What is the absolute value of the change in potential from the origin to point A? Answer in units of V.

008 (part 1 of 2) 10.0 points
A deuteron (a nucleus that consists of one proton and one neutron) is accelerated through a 4.23 kV potential difference.
How much kinetic energy does it gain? Answer in units of J.
009 (part 2 of 2) 10.0 points
How fast is it going if it starts from rest?
Answer in units of m/s.