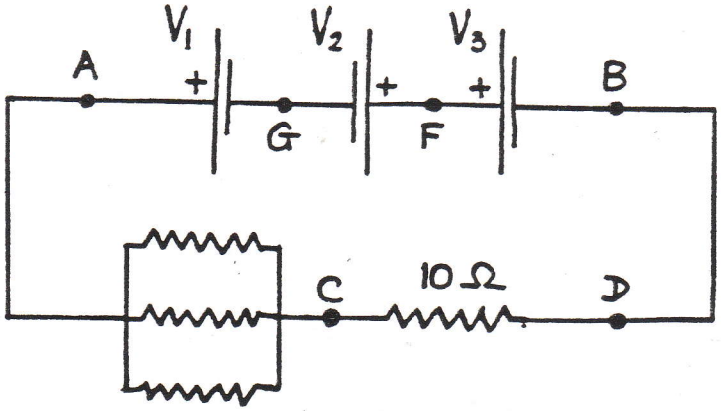
Physics 8B (Sec. 2) First Midterm Exam Oct. 10, 1986

You may use the sheet of notes agreed upon, but no other papers, and no books. The exam totals 100 points and the three problems are arranged in estimated order of increasing difficulty.

(40) (1) Consider the circuit shown below, in which each of the



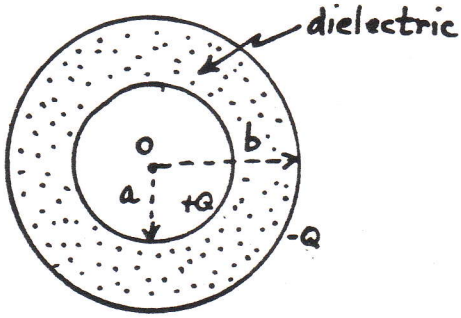
resistors in the parallel combination is 30 ohms, $V_1 = 6$ volts, $V_2 = 3$ volts, and $V_3 = 6$ volts. (a) Calculate the magnitude of the conventional current at point C; (b) Is the direction of the conventional current at point C to the left (on the diagram) or to the right? Justify your answer; (c) Calculate the difference $(V_C - V_D)$, including sign, in electrostatic potential between points C and D; (d) Calculate the difference $(V_F - V_A)$ in electrostatic potential between points F and A. [Each part = 10 points]

(continued on reverse) →

(20) (2) A very long straight wire carries a current I. A proton (charge +e) moves antiparallel to the wire, as shown. (a) Using a

diagram, show the direction of the magnetic force exerted on the proton and of $\vec{B}$ at the position of the proton; (b) Calculate the magnitude of the magnetic force on the proton. [(a) = (b) = 10 each].

(40) (3) Given two spherical conducting shells of radii a and b ($b > a$). The space between them is filled with a dielectric of dielectric coefficient K. The inner shell bears a total positive charge (+Q) and the outer shell bears an equal but opposite charge. You may assume that the electric field in the space between the shells is radial in direction. (a) Calculate the



electrostatic potential V(r) at a point a distance r (where $a \leq r \leq b$) from the common center O, if V_a is the potential at any point on the inner shell; (b) From your answer to Part (a), show that, for $r > a$, $V(r) < V_a$, meaning that the electrostatic potential decreases as one moves away from the inner shell [Part (a) = 30, (b) = 10]