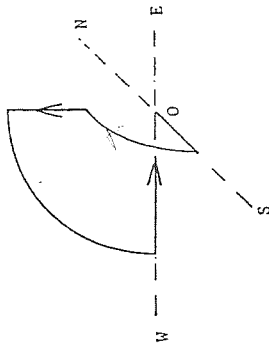


1. Two infinite, parallel, 10^{-6} m thick plates of positive charge are 10^{-6} m apart. The uniform charge density in the plates is 5C/m^2 . A parallel plate of negative charge is 2×10^{-6} m thick. The electrically neutral gap between the negative plates and the positive one is 10^{-6} m wide. The total charge of the system is zero and the relative permittivity of the medium everywhere is 10.

- Plot the electric field of the system and, determine the amount of work required, or gained in moving an electron from the surface of the negative plate facing the positive one, to the outer surface of the positive plate.

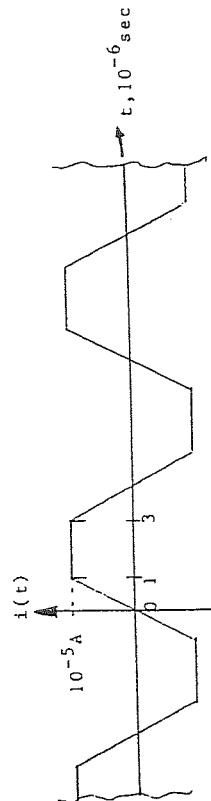
2. The shape of a current loop is given in the sketch below. The radii of the two quadrants are 8 cm and 4 cm, the magnitude of the circulating current is 5 Ampère.

- Determine the magnitude and the direction of the magnetic flux density vector B at the common centre O .



3. The parameters of a long thin solenoid of circular cross-section are: radius of cross-section 1 mm, length 5 cm, number of turns 100. The shape of time varying current flowing in the solenoid is shown in the diagram below.

- Plot the voltage induced in the solenoid as a function of time. Choose the reference polarity for the voltage so, that positive terminal is the one through which positive current enters the windings.



4. A negative charge $-e$ is uniformly distributed on the circumference (not on the area) of a circle of 0.5×10^{-10} m radius. A positive charge $+e$ is located at the centre of the circle. On the axis of the circle, perpendicular to the plane thereof, at a point 2×10^{-10} m away from the positive charge

determine:

- the magnitude and the direction of the electric field intensity vector E and,
- the potential with respect to infinity.

5. The internal resistance of a 12 Volt battery is 0.2 Ohm. The battery drives a load through an on-off switch. The load consists of two arms connected in parallel. One arm is a 0.5 Ohm resistor, while the other arm is a series connection of an inductor in series with a 0.1 Ohm resistor.

Determine the battery current

- immediately after the switch has been closed and,
- after a long time interval thereafter, when the system has settled to a steady state.

6. All four particles of two electron-proton combinations lie on a straight line. The distance between the protons is 2×10^{-10} m, the distance between an electron and its proton is 0.5×10^{-10} m. Both electrons lie outside the segment of the line joining the two protons.

How much energy is absorbed (or gained) in moving both electrons to the opposite sides of their parent protons, at the original, 0.5×10^{-10} m separations?