Physics 525 – Homework # 5

Due Mar. 27, 2024

5.1 (30 points) Consider quadrupole static electrical charges configuration with charges at these locations:

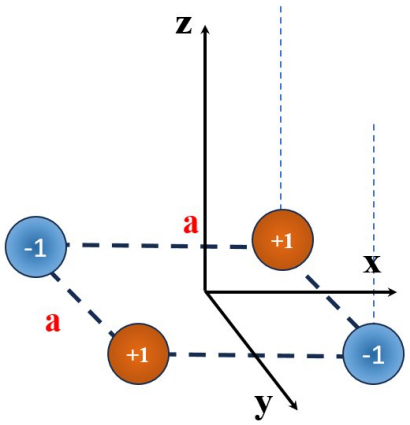
$a/2, a/2, 0$	-1
$-a/2, a/2, 0$	+1
$-a/2, -a/2, 0$	-1
$a/2, -a/2, 0$	+1

Calculate the electrical field distribution along the lines:

(a) $a/2, a/2, z$

(b) $-a/2, a/2, z$

(c) $0, 0, z$



5.2 (40 points) The figure below shows the hysteresis loop of "some" ferromagnetic material. Based on the information provided by this graph, calculate:

(a) Unsaturated magnetic permeability of the material,

(b) Energy dissipation by one cycle of H variation ($0 \to 400 \to -400 \to 0$),

(c) Power dissipation while driving the material with

$$H = H_0 \sin \omega t.$$

Here $\omega = 2\pi f$, $f = 60\text{Hz}$ and $H_0 = 400\text{A/m}$.