Physics 1320 – Spring 2025

Due Monday February 17.

Homework 03 – Rev B

SPN 3–01 [10 pts] – Electric field of point charges.
Do problem 63 from Chapter 5 of the text.

SPN 3–02 [10 pts] – Electric field of point charges II.
Do problem 64 from Chapter 5 of the text.

SPN 3–03 [10 pts] – Electric field of a wire.
A 50 m long wire has a total charge of one microCoulomb distributed uniformly along it.

[a] Calculate the linear charge density λ.
[b] Sketch the wire and draw electric field vectors near it. Show them getting smaller as they get more distant.
[c] Calculate the electric field one centimeter from the middle of the wire.
[d] Sketch the wire and a dust particle 30 cm away from the middle of it approximately to scale.
[e] Calculate the electric force on a 5 mC (milliCoulomb) dust particle that is thirty centimeters from the middle of the wire.
[f] Sketch the wire and a dust particle 1 km away approximately to scale.
[g] Calculate the electric force on the dust particle that is 1 km away from the wire.

SPN 3–04 [10 pts] – Electric field of a plate.
A 50 m by 50 m square plate wire has a total charge of one milliCoulomb (1 mC) distributed uniformly across it.

[a] Calculate the areal charge density σ.
[b] Sketch the plate and draw electric field vectors near it. (Do they get smaller as they get more distant?)
[c] Calculate the electric field one centimeter from the middle of the plate.
[d] Sketch the plate and a dust particle 30 cm away from the middle of it approximately to scale.
[e] Calculate the electric force on a 5 mC dust particle that is thirty centimeters from the middle of the plate.
[f] Sketch the plate and a dust particle 1 km away approximately to scale.
[g] Calculate the electric force on the dust particle that is 1 km away from the plate.

SPN 3–05 [10 pts] – Electric field inside a cylinder.
A 50 m long by 1 m diameter insulating cylinder has a total charge of one microCoulomb distributed uniformly throughout.

[a] Calculate the linear charge density λ.
[b] Calculate the volume charge density ρ.
[c] Sketch a gaussian cylinder centered on the center-line of the insulating cylinder. The gaussian cylinder should be 2 m long and have a 10 cm diameter.
[d] How much charge is enclosed in the 2 m by 10 cm gaussian cylinder?
[e] What is the electric field 10 cm from the axis of the insulating cylinder?
[f] Come up with a formula for the electric field an arbitrary distance s from the center of the cylinder provided that s is less than 50 cm.
[g] What is the formula for the electric field an arbitrary distance s from the center of the cylinder provided that s is greater than 50 cm?
[h] Show that these two formulae are equal when s=50 cm.