

Ch 23 HW Assignment: Answers & HW Hints (Pt. 1)

Part 1: Electric Flux

Pg. 621-622 #1, 3, 2

Answers

1. $-0.015 \text{ Nm}^2/\text{C}$

3a. 0

b. $-3.92 \text{ Nm}^2/\text{C}$

c. 0

d. Zero, because...

2a. $-72 \text{ Nm}^2/\text{C}$

b. $+24 \text{ Nm}^2/\text{C}$

c. $-16 \text{ Nm}^2/\text{C}$

d. $0 \text{ Nm}^2/\text{C}$

e. $-48 \text{ Nm}^2/\text{C}$

Ch 23 HW Assignment: Answers & HW Hints (Pt. 2)

Part 2: Gauss' Law

Pg. 622-623 #4, 5, 7, 9, 11, 12, 14, 16

Answers

4. -4.3 nC

5. 203,298 Nm²/C

7. 3.01×10^{-9} Nm²/C

9. 3.54 μC

11a. 8.232 Nm²/C

b. 7.29×10^{-11} C

c. 8.232 Nm²/C

d. 7.29×10^{-11} C

12a. 1.77 μC

b. -5.31 μC

c. 8.85 μC

14. 2.12×10^{-10} C

16. b=2

Ch 23 #7

The book's hint is trying to make you realize that you can use Gauss' law (which doesn't require the distance measurements at all) to easily determine the net flux that would happen through an entire cube that surrounds the charge. So just do this, and then think about how much of that net flux would be passing through the bottom of the cube.

Ch 23 #12

If you think about the graph, it should make sense that there are only 3 different flux values as you go out to larger and larger radii. These 3 values correspond to the flux due to the just the particle, the flux due to the particle and sphere A, and the total flux due to the particle and both spheres.

So part A should be easy enough after you read the flux value from the graph ($2 \times 10^5 \text{ Nm}^2/\text{C}$).

Part B and C require the same thinking, but then also some subtraction to find only the charge you're interested in.

Ch 23 #16

Don't get freaked out by the fact that it's supposedly a "Level 3" problem. It's really not too rough. Start by solving for flux, which is SUPER easy. Then set that flux value equal to the total of all of the non-zero fluxes through the 6 sides of the box. The only thing that's really hard is figuring out the exact values to use during the flux calculations, but you can make these a lot easier if you just write in some position and length values on your diagram.

Ch 23 HW Assignment: Answers & HW Hints (Pt. 3)

Part 3: Applying Gauss' Law

Pg. 623 #17, 18, 21, 22, 24, 27

Answers

17a. $4.52 \times 10^{-7} \text{ Nm}^2/\text{C}$

b. $51,055 \text{ N/C}$

18a. $-7.97 \mu\text{C}$

b. $+11.51 \mu\text{C}$

c. $-5.31 \mu\text{C}$

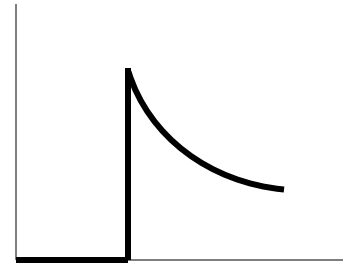
21a. $-3 \mu\text{C}$

b. $13 \mu\text{C}$

22a. 0

b. 5992 N/C

c.



24. $2.1 \times 10^{17} \text{ m/s}^2$

27a. 0.214 N/C

b. inward

c. 0.855 N/C

d. outward

e. -3.4 pC

f. -3.4 pC

Ch 23 #18

Notice the similarities to problem #12, with the exception on the graph being that flux drops to zero at a couple of important locations. Make sure you understand *why* it drops to zero at these locations.

As far as working the problem, it's really pretty much just like #12. so go back and check out that HW Hint again if you need it.

Ch 23 #21

For part A, think about a Gaussian surface that surrounds the cavity but is still within the conductor. The E field in the conductor must equal zero (or else charges would flow), and Gauss' law then tells us that q_{enclosed} must also equal zero. This leads directly to the answer.

For part B, remember that you already know the net charge on the conductor. Since all of the charge must lie on the surface of the conductor, it should make sense that $q_{\text{total}} = q_{\text{inner}} + q_{\text{outer}}$.

Ch 23 #22

For part C, it's okay to just do a sketch without labeling any quantities. The important thing is to think about what happens to E as r increases while *inside* the conductor, and then what happens once you're *outside* the conductor.

Ch 23 #24

Don't get freaked out that you don't have an equation relating Gauss' law to acceleration. Just think about what we can solve for with Gauss' law, and how that quantity relates (through a couple of formulas, one of which is Newton's 2nd law) to acceleration.

Ch 23 #27

The wording on this one is confusing. Here's a summary of the important points...

Inner Rod:

$$R_1 = 1.3\text{mm}$$

$$L_1 = 11\text{m}$$

$$Q_1 = +3.4\text{pC}$$

Outer Rod:

$$R_2 = 1.3\text{cm}$$

$$L_2 = 11\text{m}$$

$$Q_2 = -6.8\text{pC}$$

Parts A & B are referring to $r=2.6\text{cm}$, and parts C & D are referring to $r=6.5\text{mm}$.

Ch 23 HW Assignment: Answers & HW Hints (Pt. 4)

Part 4: More Applications of Gauss' Law

Pg. 624-627 #35a, 39, 41, 44-47, 58, 80

Answers

35a. $5.29 \times 10^7 \text{ N/C}$

39. $4.43 \times 10^{-4} \text{ m}$

41. $5.01 \times 10^{-6} \text{ C/m}^2$

44a. $-750 \text{ Nm}^2/\text{C}$

b. -6.64 nC

45. -7.51 nC

46. $2.26 \text{ } \mu\text{C}$

47a. $24,966 \text{ N/C}$

b. $13,482 \text{ N/C}$

58a. 4217 N/C

b. 2354 N/C

80a. 15.0 N/C

b. 25.3 N/C

Ch 23 #35a

For this problem, realize that the charge is spread over *both* sides of the plate. This means, when you calculate the surface charge density, the charge is spread over twice as much area as just for a one-sided sheet. But when you calculate charge enclosed by your cylindrical Gaussian surface through the plate, there's also twice as much charge enclosed as there would be for a one-sided sheet. So if you take both of those factors into account, it ends up working similarly to a one-sided sheet of charge.

Ch 23 #39

Give some thought to basic strategy... The ideas are that the E-field due to the plate exerts a force on the electron, stealing its energy away and bringing it to a stop. So you can start by finding the E-field due to the sheet. (Remember that the exact position of the electron doesn't matter, because E-field due to a sheet of charge doesn't change based on distance from the sheet.) Then you can use the E-field to find the force on the electron, and then you've got a couple different options of how to calculate stopping distance. (Acceleration/Kinematics, or Work/Energy ideas.)

Ch 23 #41

Here's some general strategy... You could find surface charge density with Gauss' law if you knew the E-field strength. The E-field is responsible for exerting a horizontal force on the ball, balancing out the x-component of the tension. Tension's y-component, on the other hand, is in equilibrium with the ball's weight. So start by finding the ball's weight, and therefore the tension's y-component. Use it (with some trig) to find the x-component, and therefore the electric force. After this, you just need to use $E=F/q$ and Gauss' law, and you're golden!

Ch 23 #46

You could technically find the charge by considering E-field at any location. But since it's a nonconductor (which you should be able to tell from the graph), it's relatively difficult to figure deal with E-field inside the conductor. And if you get outside of the conductor, then none of the E-field values are easy to read at integer radius values. So here's the point... this one is way easier to do if you just consider the E-field right at the surface of the sphere.

Ch 23 #58

Part A could be a little rough, just because you're not told the charge enclosed by the 3.5cm-radius Gaussian surface. But you should be able to find it with the volume charge density.

Part B should be easy since you're at a location outside of the sphere, so you can just use $E=kq/r^2$. The only problem is that you still don't know q , and you have to do a little work to find it before you can begin.

Ch 23 #80

Part A should be a piece of cake. Part B requires some thinking though, since you're *inside* of a nonconductor, where you don't know charge enclosed by your Gaussian surface. The easiest way is to write out an expression for q_{enc} based on Q_{total} , V_{total} , and V_{enclosed} .