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Chapter 25 Homework (Capacitors and Dielectrics) (Homework)

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Current Score

QUESTION	1	2	3	4	5	6	7	8	9	10
POINTS	1/1 ✓	1/1 ✓	1/1 ✓	1/1 ✓	1/1 ✓	1/1 ✓	1/1 ✓	1/1 ✓	1/1 ✓	1/1 ✓

TOTAL SCORE

10/10	100.0%

Due Date Past Due

SAT, OCT 10, 2020
11:59 PM GMT+4

Request Extension

Assignment Submission & Scoring

Assignment Submission

For this assignment, you submit answers by question parts. The number of submissions remaining for each question part only changes if you submit or change the answer.

Assignment Scoring

Your last submission is used for your score.

The due date for this assignment has passed.

Your work can be viewed below, but no changes can be made.

Important! Before you view the answer key, decide whether or not you plan to request an extension. Your Instructor may not grant you an extension if you have viewed the answer key. Automatic extensions are not granted if you have viewed the answer key.

Request Extension | View Key

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1. **[1/1 Points]** DETAILS | PREVIOUS ANSWERS | **SERPSE10 25.2.OP.002.MI.**

MY NOTES | ASK YOUR TEACHER | PRACTICE ANOTHER

An air-filled spherical capacitor is constructed with an inner-shell radius of 7.10 cm and an outer-shell radius of 15.6 cm.

(a) Calculate the capacitance of the device.

14.5 ✓ pF

(b) What potential difference between the spheres results in a 4.00 μC charge on the capacitor?

276 ✓ kV

(c) **What If?** What would be the length (in cm) of a cylindrical air-filled capacitor with the same inner and outer radii as the spherical capacitor if it were to have the same capacitance as the spherical capacitor?

20.5 ✓ cm

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2. **[1/1 Points]** DETAILS PREVIOUS ANSWERS **SERPSE10 25.2.OP.005.MI.**

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

An air-filled capacitor consists of two parallel plates, each with an area of 7.60 cm^2, separated by a distance of 1.70 mm. A 25.0-V potential difference is applied to these plates.

(a) Calculate the electric field between the plates.

14.7 ✓ kV/m

(b) Calculate the surface charge density.

130 ✓ nC/m^2

(c) Calculate the capacitance.

3.96 ✓ pF

(d) Calculate the charge on each plate.

98.9 ✓ pC

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3. **[1/1 Points]** DETAILS PREVIOUS ANSWERS **SERPSE10 25.2.OP.006.**

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

An isolated charged conducting sphere has a radius R = 11.0 cm. At a distance of r = 22.0 cm from the center of the sphere the electric field due to the sphere has a magnitude of $E = 4.90 \times 10^4$ N/C.

(a) What is its surface charge density (in $\mu C/m^2$)?

1.73 ✓ $\mu C/m^2$

(b) What is its capacitance (in pF)?

12.2 ✓ pF

(c) **What If?** A larger sphere of radius 23.0 cm is now added so as to be concentric with the first sphere. What is the capacitance (in pF) of the two-sphere system?

23.45 ✓ pF

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4. **[1/1 Points]** DETAILS PREVIOUS ANSWERS **SERPSE10 25.3.OP.007.**

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

Two capacitors, C_1 = 4.00 μF and C_2 = 15.0 μF, are connected in parallel, and the resulting combination is connected to a 9.00-V battery.

(a) Find the equivalent capacitance of the combination.

19 ✓ μF

(b) Find the potential difference across each capacitor.

V_1 = 9 ✓ V

V_2 = 9 ✓ V

(c) Find the charge stored on each capacitor.

Q_1 = 36 ✓ μC

Q_2 = 135 ✓ μC

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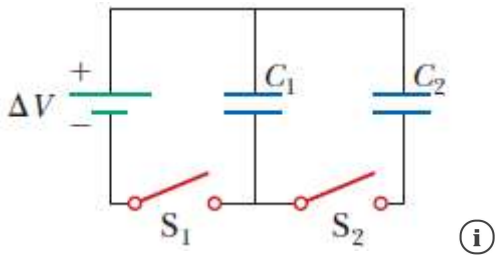
5. **[1/1 Points]** DETAILS PREVIOUS ANSWERS **SERPSE10 25.3.OP.011.MI.**

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

Consider the circuit shown in the figure below, where C_1 = 8.00 μF, C_2 = 8.00 μF, and ΔV = 22.0 V. Capacitor C_1 is first charged by closing switch S_1. Switch S_1 is then opened, and the charged capacitor is connected to the uncharged capacitor by closing S_2.



(a) Calculate the initial charge (in μC) acquired by C_1. (Round your answer to at least one decimal place.)

176 ✓ μC

(b) Calculate the final charge (in μC) on each capacitor. (Round your answers to at least the nearest integer.)

Q_1 = 88 ✓ μC

Q_2 = 88 ✓ μC

(c) **What If?** After a very long time, switch S_1 is also closed. By what amount does the charge on the second capacitor change after S_1 has been closed for a very long time? (Give your answer in μC.)

88 ✓ μC

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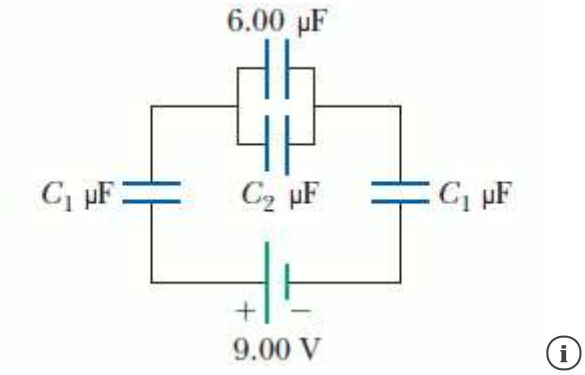
6. **[1/1 Points]** DETAILS PREVIOUS ANSWERS **SERPSE10 25.3.OP.012.**

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

For her electronics class, Gabriella configures a circuit as shown in the figure. Find the following. (Assume C_1 = 33.0 μF and C_2 = 3.13 μF.)



(a) the equivalent capacitance (in μF)

5.88 ✓ μF

(b) the charge on each capacitor (in μC)

C_1 (left)	52.9 ✓	μC
C_1 (right)	52.9 ✓	μC
C_2	18.12 ✓	μC
6.00 μF capacitor	34.8 ✓	μC

(c) the potential difference across each capacitor (in V)

C_1 (left)	1.6 ✓	V
C_1 (right)	1.6 ✓	V
C_2	5.79 ✓	V
6.00 μF capacitor	5.79 ✓	V

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7. [1/1 Points] DETAILS PREVIOUS ANSWERS SERPSE10 25.4.P.017.

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

(a) A 4.00-μF capacitor is connected to a 9.00-V battery. How much energy is stored in the capacitor?
162 ✔ μJ

(b) Had the capacitor been connected to a 6.00-V battery, how much energy would have been stored?
72 ✔ μJ

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8. [1/1 Points] DETAILS PREVIOUS ANSWERS SERPSE10 25.5.OP.017.

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

(a) How much charge can be placed on a capacitor with air between the plates before it breaks down if the area of each plate is 6.00 cm^2?
15.9 ✔ nC

(b) Find the maximum charge if neoprene rubber is used between the plates instead of air.
427 ✔ nC

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9. **[1/1 Points]** DETAILS PREVIOUS ANSWERS **SERPSE10 25.5.OP.018.**

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

A student working in the physics laboratory connects a parallel-plate capacitor to a battery, so that the potential difference between the plates is 275 V. Assume a plate separation of d = 1.64 cm and a plate area of A = 25.0 cm^2. When the battery is removed, the capacitor is plunged into a container of distilled water. Assume distilled water is an insulator with a dielectric constant of 80.0.

(a) Calculate the charge on the plates (in pC) before and after the capacitor is submerged. (Enter the magnitudes.)

before Q_i = 371 ✓ pC
after Q_f = 371 ✓ pC

(b) Determine the capacitance (in F) and potential difference (in V) after immersion.

C_f = 107.9e-12 ✓ F
ΔV_f = 3.4 ✓ V

(c) Determine the change in energy (in nJ) of the capacitor.

ΔU = -50.4 ✓ nJ

(d) **What If?** Repeat parts (a) through (c) of the problem in the case that the capacitor is immersed in distilled water while still connected to the 275 V potential difference.

Calculate the charge on the plates (in pC) before and after the capacitor is submerged. (Enter the magnitudes.)

before Q_i = 371 ✓ pC
after Q_f = 29.7e3 ✓ pC

Determine the capacitance (in F) and potential difference (in V) after immersion.

C_f = 107.9e-12 ✓ F
ΔV_f = 275 ✓ V

Determine the change in energy (in nJ) of the capacitor.

ΔU = 4.08e3 ✓ nJ

ΔU = 4.08e3 nJ

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10. [1/1 Points] DETAILS PREVIOUS ANSWERS SERPSE10 25.6.OP.019.MI.

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

A small, rigid object carries positive and negative 3.00 nC charges. It is oriented so that the positive charge has coordinates (−1.20 mm, 1.00 mm) and the negative charge is at the point (1.90 mm, −1.30 mm).

(a) Find the electric dipole moment of the object.

-9.3e-12 C · m $\hat{\mathbf{i}}$ + 6.9e-12 C · m $\hat{\mathbf{j}}$

(b) The object is placed in an electric field $\vec{\mathbf{E}} = (7.80 \times 10^3\ \hat{\mathbf{i}} - 4.90 \times 10^3\ \hat{\mathbf{j}})$ N/C. Find the torque acting on the object.

-8.25e-9 N · m k

(c) Find the potential energy of the object–field system when the object is in this orientation.

106.4e-9 J

(d) Assuming the orientation of the object can change, find the difference between the maximum and the minimum potential energies of the system.

213e-9 J

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