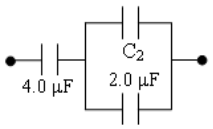
KFUPM – Physics Department

PHYS102 – Chapter 25 (Instructor: Dr. Al–Shukri)

Q1. The three capacitors in the **Figure** have an equivalent capacitance of 2.77 μF. What is C_2?

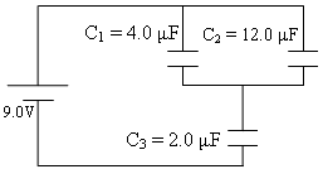


a. 7 μF b. 2 μF c. 4 μF d. 3 μF e. 6 μF

Q2. When the potential difference across a 5 μF capacitor is increased by 2 V, the energy stored increases by 10 %. What was the original potential difference?

a. 40 V b. 20 V c. 10 V d. 30 V e. 50 V

Q3. What is the charge on C_3 in the **Figure**?



a. 16 μC b. 4 μC c. 2 μC
d. 8 μC e. 20 μC

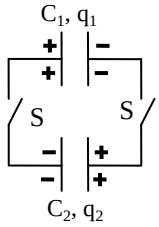
Q4. A parallel-plate capacitor is completely filled with a dielectric of dielectric constant 6, has a capacitance of 50 pF. If the plate separation is 0.1 mm, find the plate area.

a. 0.94 cm^2 b. 5.6 cm^2 c. 0.55 cm^2
d. 12 cm^2 e. 0.22 cm^2

Q5. The magnitude of the charge on each plate of a parallel plate capacitor is 2.5 μC. If the capacitor has a plate area of 0.25 m^2 and a plate separation of 0.1 mm, what is the electric field between its plates?

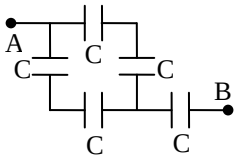
a. 1.1×10^6 V/m b. 1.0×10^5 V/m c. 1.0×10^{-5} V/m
d. 1.1×10^2 V/m e. 1.1×10^{-11} V/m

Q6. The **Figure** shows two capacitors C_1=30 μF carrying a charge q_1=200 μC and C_2=20 μF carrying a charge q_2=900 μC. If the switches S are closed, the voltage across C_1 will be



a. 14 V b. 20 V c. 23 V d. 33 V e. 0 V

Q7. If C = 12 μF and the potential between points A and B is 10 V, what is the total energy (in μJ) stored by the group of capacitors shown in the **Figure**?



a. 300 b. 2500 c. 1200 d. 600 e. 150

Q8. An air-filled parallel-plate capacitor is connected across a 24 V battery. When the battery is disconnected and then a dielectric slab is inserted into and fills the region between the plates, the voltage across the capacitor drops to 8 V. What is the dielectric constant of the slab?

a. 3.0 b. 1.5 c. 0.33 d. 0.66 e. 1.0

Q9. Suppose you have two capacitors C_1 = 1.0 μF and C_2 = 2.0 μF. C_2 is uncharged and C_1 is charged to a voltage of 5.0 V by a battery. The battery is disconnected from C_1 and then C_1 is connected directly to C_2. What will be the potential across each capacitor?

a. 1.7 V b. 0 V c. 5.0 V d. 2.5 V e. 3.0 V

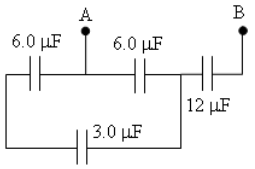
Q10. A 15-μF capacitor is connected to a 50 V battery and becomes fully charged. The battery is removed and a slab of dielectric that completely fills the space between the plates is inserted. If the dielectric has a dielectric constant of 5.0, what is the voltage across the capacitor's plates after the slab is inserted?

a. 10 V b. 250 V c. 2.0 V d. 75 V e. 3.0 V

Q11. A parallel plate capacitor is connected to a battery and becomes fully charged. The capacitor is then disconnected, and the separation between the plates is increased in such a way that no charge leaks off. What happens to the energy stored in this capacitor?

a. increases. b. decreases
c. becomes zero. d. does not change.
e. not enough data to choose the right answer.

Q12. Find the equivalent capacitance between the points A and B in the **Figure**.



a. 4.8 μF b. 4.0 μF
c. 5.1 μF d. 3.0 μF
e. 6.0 μF

Q13. You are to connect capacitors C_1= C and C_2 = 2C to the same battery, first individually, then in series and then in parallel. In which of the following cases, the charge stored is the smallest?

a. C_1 and C_2 in series b. C_1 and C_2 in parallel
c. C_1 individually d. C_2 individually
e. In all cases the same amount of charge is stored

Q14. Given a 9.4 pF air-filled capacitor, you are asked to convert it to a capacitor that can store 9.4 μJ, with a potential of 877 V. What is the dielectric constant of the material that you must insert between the plates of the capacitor?

a. 2.6 b. 0.39 c. 4.7 d. 0.21 e. 310

Q15. A capacitor C_1 = 1.00 μF and another capacitor C_2 = 2.00 μF are connected in series across a 900 V supply line. The charged capacitors are disconnected from the supply line then reconnected to each other with terminals of like sign together. Find the final charges on C_1 and C_2, respectively.

a. 400 μC, 800 μC b. 200 μC, 400 μC
c. 100 μC, 200 μC d. 800 μC, 400 μC
e. 400 μC, 200 μC

Q16. Two capacitors each of capacitance 250 μF are connected in parallel across a battery of 120V. How much energy is produced after both capacitors are completely discharged?

a. 3.6 J b. 5.8 J c. 8.6 J d. 12 J e. 36 J

Q17. To charge a 1.0-μF capacitor with 2.0 μC requires a potential difference of:

a. 2.0 V b. 0.2 V c. 5.0 V
d. 0.5 V e. none of these

Q18. The capacitance of a parallel-plate capacitor is:

a. proportional to the plate area
b. proportional to the charge stored
c. independent of any material inserted between the plates
d. proportional to the potential difference of the plates
e. proportional to the plate separation

Q19. The units of capacitance are equivalent to:

a. C^2/J b. J/C c. V/C d. J^2/C e. C/J

Q20. If the plate area of an isolated charged parallel-plate capacitor is doubled:

a. the potential difference is halved
b. the electric field is doubled
c. the charge on each plate is halved
d. the surface charge density on each plate is doubled
e. the potential difference is doubled

Q21. If the plate separation of an isolated charged parallel-plate capacitor is doubled:

a. the potential difference is doubled
b. the electric field is doubled
c. the potential difference is halved
d. the charge on each plate is halved
e. the surface charge density on each plate is doubled

Q22. Pulling the plates of an isolated charged capacitor apart:

a. increases the potential difference
b. increases the capacitance
c. does not affect the potential difference
d. decreases the potential difference
e. does not affect the capacitance

Q23. Two capacitors are identical except that one is field with air and the other with oil. Both capacitors carry the same charge. The ratio of the electric fields $E_{air} = E_{oil}$ is:

a. greater than 1 b. less than 1 c. 0
d. 1 e. infinite

Q24. One of the materials listed below is to be placed between two identical metal sheets, with no air gap, to form a parallel-plate capacitor. Which produces the greatest capacitance?

a. material of thickness 0.1 mm and dielectric constant 2
b. material of thickness 0.2 mm and dielectric constant 1
c. material of thickness 0.2 mm and dielectric constant 3
d. material of thickness 0.3 mm and dielectric constant 2
e. material of thickness 0.3 mm and dielectric constant 4

Q25. An air-filled parallel-plate capacitor has a capacitance of 5.0 nF. The plate separation is then doubled and a polystyrene dielectric is inserted, completely filling the space between the plates. As a result, the capacitance becomes 6.5 nF. Find the dielectric constant of the polystyrene.

a. 2.6 b. 1.5 c. 0.7 d. 1.3 e. 5.1

Q26. A parallel-plate capacitor has a plate area of 0.20 m^2 and a plate separation of 0.20 mm. If the charge on each plate has a magnitude of 5.0 μC then the force exerted by one plate on the other has a magnitude of about:

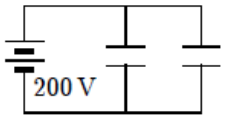
a. 7.1 N b. 1.6 N c. 16 N d. 5.0 e. 0

Q27. A certain capacitor has a capacitance of 5.0 μF. After it is charged to 6.0 μC and isolated, the plates are brought closer together so its capacitance becomes 10 μF. The work done by the agent is about:

a. –1.8 μJ b. +1.8 μJ c. –7.2 μJ
d. +7.2 μJ e. zero

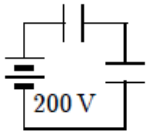
Q28. To store a total of 80 mJ of energy in the two identical capacitors shown in the **Figure** , each should have a capacitance of:

a. 2.0 μF b. 0.5 μF
c. 4.0 μF d. 6.3 μF
e. 4.5 μF



Q29. To store a total of 80 mJ of energy in the two identical capacitors shown in the **Figure**, each should have a capacitance of:

a. 8.0 μF b. 2.0 μF
c. 4.0 μF d. 6.3 μF
e. 4.5 μF



Q30. Two parallel-plate capacitors with different plate separation but the same capacitance are connected in series to a battery. Both capacitors are filled with air. The quantity that is NOT the same for both capacitors when they are fully charged is:

a. electric field between the plates
b. potential difference
c. stored energy
d. charge on the positive plate
e. dielectric constant

Q31. Capacitors A and B are identical. Capacitor A is charged so it stores 4.0 J of energy and capacitor B is uncharged. The capacitors are then connected in parallel. The total stored energy in the capacitors is now:

a. 2.0 J b. 4.0 J c. 8.0 J d. 16 J e. 1.0 J

Q32. Two conducting spheres have radii of R_1 and R_2, with R_1 greater than R_2. If they are far apart, then the capacitance is proportional to:

a. $R_1R_2 / (R_1 - R_2)$ b. $R^2_1 - R^2_2$ c. $(R_1 - R_2) / R_1R_2$
d. $R^2_2 + R^2_1$ e. none of these

Q33. If V_{ab} is equal to 50 V, find the charge stored and the potential difference across the 25 μF capacitor shown in the **Figure**.

a. 250 μC & 10 V
b. 300 μC & 20 V
c. 600 μC & 10 V
d. 600 μC & 20 V
e. 250 μC & 40 V