4.1 Explain what is meant by a dielectric.

4.2 If electrons represent negative charge in a capacitor, what constitutes positive charge?

4.3 If the two plates of a capacitor are insulated from each other, why does it appear that under some circumstances a current flows between them?

4.4 Why does the presence of charge on the plates of a capacitor represent the storage of energy?

4.5 How is the voltage across a capacitor related to the stored charge?

4.6 What are the units of measurement of capacitance?

4.7 A 100 μF capacitor has 5 V across its terminals. What quantity of charge is stored in it?

4.8 A 22 μF capacitor holds 1 mC of stored charge. What voltage is seen across its terminals?

4.9 A capacitor has a voltage of 25 V across it when it holds 500 μC of charge. What is its capacitance?

4.10 Why does a capacitor appear to pass AC signals while blocking DC signals?

4.11 How is the capacitance of a parallel-plate capacitor related to its dimensions?

4.12 The conducting plates of a capacitor are 5 X 15 mm and have a separation of 10 μm. What would be the capacitance of such a device if the space between the plates were filled with air?

4.13 What would be the capacitance of the device described in Exercise 4.12 if the space between the plates were filled with a dielectric with a relative permittivity of 200?

4.14 What is meant by stray capacitance, and why is this sometimes a problem?

4.15 Explain what is meant by an electric field and by electric field strength.

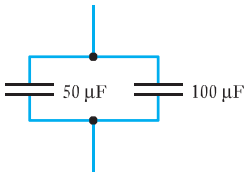
4.16 The plates of a capacitor have 250 V across them and have a separation of 15 μm. What is the electric field strength in the dielectric?

4.17 What is meant by dielectric strength?

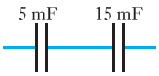
4.18 Explain what is meant by electric flux and by electric flux density.

4.19 The plates of a capacitor are 15 x 35 mm and store a charge of 35 μC. Calculate the electric flux density in the dielectric.

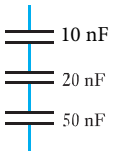
4.20 Determine the effective capacitance of each of the following arrangements.



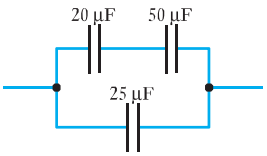
(a)



(b)

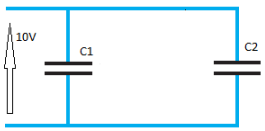


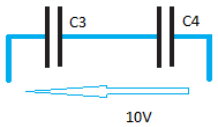
(c)



(d)

4.21 Given that C_1 = 10 μF, C_2 = 20 μF, C_3 = 10 μF and C_4 = 20 μF, determine the voltages across the capacitors in the following arrangements.

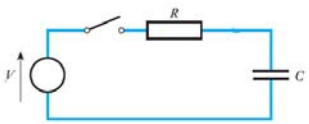




4.22 Determine the charge stored in the capacitors C_1, C_2, C_3 and C_4 in the arrangements shown in exercise 4.21.

4.23 How is voltage related to current in a capacitor?

4.24 Explain what is meant by a time constant. Given that R = 50 kΩ and C = 10μF, what is the time constant of the following arrangement?



4.25 If the resistor in the circuit of Exercise 4.24 was increased by a factor of 10 to 500 kΩ, what value of capacitor would be required to leave the time constant of the circuit unchanged?

4.26 Describe the relationship between the voltage across a capacitor and the current if the voltage is sinusoidal.

4.27 Give an expression for the energy stored in a charged capacitor.

4.28 A 5 mF capacitor is charged to 15 V. What is the energy stored in the capacitor?

4.29 A 50 μF capacitor contains 1.25 mC of charge. What energy is stored in the capacitor?