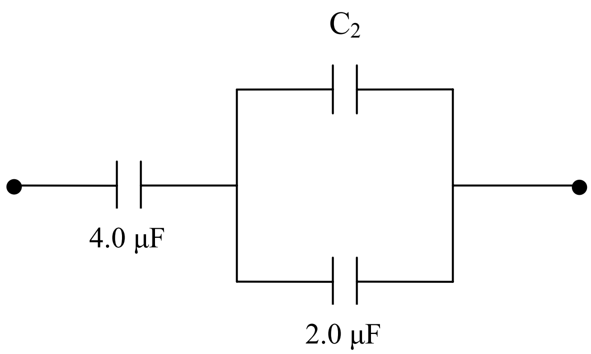
Second Major Solution

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

Fig#



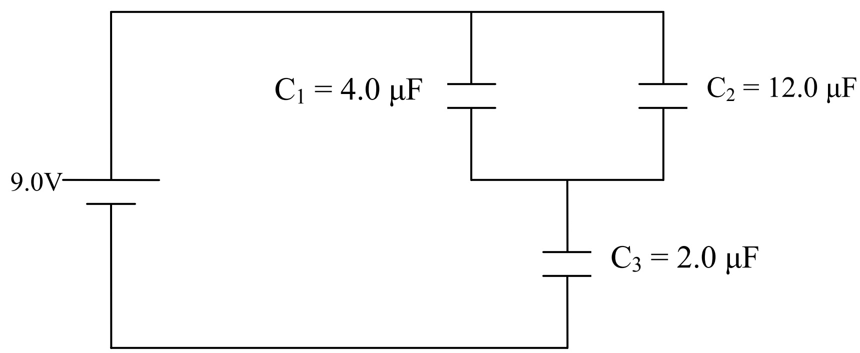
A) 7 μF
B) 2 μF
C) 4 μF
D) 3 μF
E) 6 μF

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 following figure?

Fig#



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. When a piece of paper is held with its face perpendicular to a uniform electric field the flux through it is 30.0 $N \cdot m^2/C$. When the paper is turned at certain angle with respect to the field the flux through it is 24.6 $N \cdot m^2/C$. What is the angle?

A) 35°
B) 45°
C) 25°
D) 40°
E) 55°

Q6. An infinitely long uniformly charged rod is coaxial with an infinitely long uniformly charged cylindrical shell of radius 5.0 cm. The linear density of the rod is + 15 × 10^{-9} C/m and that of the cylindrical shell is – 20 × 10^{-9} C/m. What is the magnitude of the electric field at a distance of 10 cm from the axis?

A) 900 N/C

B) 2700 N/C
C) 3600 N/C
D) 5400 N/C
E) 4500 N/C

Q7. A particle, of mass 1.0 g and charge 1.0×10^{-6} C, is held stationary between two parallel non-conducting sheets that carry equal but opposite surface charge densities. What is the magnitude of the surface charge density?

A) 8.7×10^{-8} C
B) 1.7×10^{-7} C
C) 3.4×10^{-7} C
D) 4.4×10^{-8} C
E) 2.2×10^{-8} C

Q8. An insulating spherical shell of radius 15 cm has a total charge of 10 μC uniformly distributed on its surface. Calculate the electric field intensity at a distance of 14 cm from the center of the shell.

A) 0
B) 6.4×10^5 N/C
C) 3.5×10^6 N/C
D) 4.6×10^5 N/C
E) 4.0×10^6 N/C

Q9. Which of the following statements are INCORRECT?

(1) The electric flux through a Gaussian surface depends on the shape of the surface.
(2) The electric flux through a closed surface depends on the net charge enclosed by the surface.
(3) The electric field inside a charged conductor in electrostatic equilibrium is zero.
(4) The electric potential inside a charged conductor in electrostatic equilibrium is zero.
(5) Electric field lines are always directed from negative charges to positive charges.

A) 1, 4 and 5
B) 1, 2 and 4
C) 2, 3, and 4
D) 3 and 4
E) 1 and 3

Q10. What is the external work required to bring four 3.0×10^{-9} C positive point charges from infinity and place them at the corner of a square of side 0.12 m

A) +3.7 μJ
B) - 3.7 μJ
C) 67 μJ
D) -67 μJ
E) 7.4 μJ

Q11. A point charge $q_1 = + 2.4$ μC is held stationary at the origin. A second point charge $q_2 = - 4.3$ μC moves from $x_1 = 0.15$ m, $y_1 = 0$ to a point $x_2 = 0.25$ m, $y_2 = 0.25$ m. How much is work done by the electric force on q_2 ?

A) 0.36 J
B) 0.30 J
C) 0.45 J
D) 0.50 J
E) 0.25 J

Q12. An electron is accelerated from a speed of 3×10^6 m/s to 8×10^6 m/s. Calculate the potential through which electron has to pass to gain this acceleration?

A) 157 V
B) 126 V
C) 165 V
D) 185 V
E) 205 V

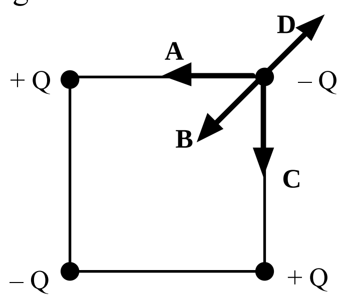
Q13. The electric potential in a certain region is described by $V(x,y,z) = 2xy - 4x^2 + 6y$. Find the magnitude of the net electric field at x = -1 and y = 1?

A) 11 N/C
B) 9 N/C
C) 13 N/C
D) 6.0 N/C
E) 0

Q14. A conducting sphere with a radius of 10 cm, has a surface charge density of 4×10^{-6} C/m^2. The electric potential, at *r* = 5 cm from the center of the sphere is (assume V= 0 at infinity):
A) 4.5×10^4 V
B) 9.0×10^4 V
C) 10×10^4 V
D) 35×10^4 V
E) 72×10^4 V

Q15. Four point charges, each of the same magnitude, with varying signs are arranged at the corners of a square as shown in the figure. Which of the arrows labeled **A**, **B**, **C**, and **D** gives the correct direction of the net force that acts on the charge at the upper right corner?

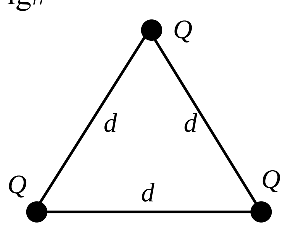
Fig#



A) B
B) A
C) C
D) D
E) The net force on that charge is zero.

Q16. Three identical point charges, *Q*, are placed at the corners of an equilateral triangle as shown in the figure. The length of each side of the triangle is *d*. Determine the magnitude and direction of the total electrostatic force on the charge at the top of the triangle.

Fig#

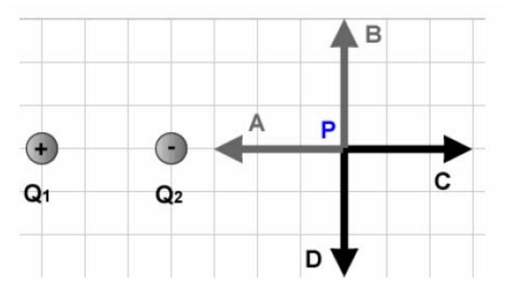


A) $\frac{kQ^2\sqrt{3}}{d^2}$, directed upward
B) $\frac{2kQ^2}{d^2}$, directed downward
C) $\frac{kQ^2\sqrt{3}}{d^2}$, directed downward

D) $\frac{2kQ^2}{d^2}$, directed upward
E) Zero

Q17. Two charges Q_1 and Q_2 of equal magnitudes and opposite signs are positioned as shown in the figure. Which of the shown arrows represents correctly the electric field at point P?

Fig#



A) A
B) B
C) C
D) D
E) The electric field is zero.

Q18. Consider two conducting spheres, **A** and **B**, having the same size. Sphere **A** carries a charge of −2.0 μC and sphere **B** carries a charge of + 6.0 μC. The spheres are touched together and then separated. What is the final charge on sphere A?

A) + 2.0 μC.
B) zero.
C) +8.0 μC.
D) + 6.0 μC.
E) + 4.0 μC.

Q19. A uniform electric field has a magnitude of 2.0×10^4 N/C and points to the right. An electron is released from rest in this electric field. How far will the electron travel in two nanoseconds after its release?

A) 7.0 mm to the left
B) 7.0 mm to the right
C) 14 mm to the left
D) 3.5 mm to the left

E) 3.5 mm to the right

Q20. Four equal negative point charges are located at the corners of a square centered at the origin, their positions in the xy plane are (1, 1), (-1, 1), (-1, -1), (1, -1). The direction of the electric field at (1, 0) is:

A) along the negative x axis
B) along the positive x axis
C) along the positive y axis
D) along the negative y axis
E) along the positive z axis