
PHYS 2326 University Physics II – Class number

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1. Three point charges, two positive and one negative, each having a magnitude of 20 μC are placed at the vertices of an equilateral triangle (30 cm on a side). What is the magnitude of the electrostatic force on one of the positive charges?

   a. 69 N
   b. 40 N
   c. 80 N
   d. 57 N
   e. 20 N

2. A particle (mass = 5.0 g, charge = 40 mC) moves in a region of space where the electric field is uniform and is given by E_x = 2.5 N/C, $E_y = E_z = 0$. If the velocity of the particle at t = 0 is given by v_y = 50 m/s, $v_x = v_z = 0$, what is the speed of the particle at t = 2.0 s?

   a. 81 m/s
   b. 72 m/s
   c. 64 m/s
   d. 89 m/s
   e. 25 m/s

3. A charge of 50 nC is uniformly distributed along the y axis from y = 3.0 m to y = 5.0 m. What is the magnitude of the electric field at the origin?

   a. 18 N/C
   b. 50 N/C
   c. 30 N/C
   d. 15 N/C
   e. 90 N/C

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4. Charge of uniform density (40 pC/m^2) is distributed on a spherical surface (radius = 1.0 cm), and a second concentric spherical surface (radius = 3.0 cm) carries a uniform charge density of 60 pC/m^2. What is the magnitude of the electric field at a point 4.0 cm from the center of the two surfaces?

a. 3.8 N/C
b. 4.1 N/C
c. 3.5 N/C
d. 3.2 N/C
e. 0.28 N/C

5. The electric field just outside the surface of a hollow conducting sphere of radius 20 cm has a magnitude of 500 N/C and is directed outward. An unknown charge Q is introduced into the center of the sphere and it is noted that the electric field is still directed outward but has decreased to 100 N/C. What is the magnitude of the charge Q?

a. 1.5 nC
b. 1.8 nC
c. 1.3 nC
d. 1.1 nC
e. 2.7 nC

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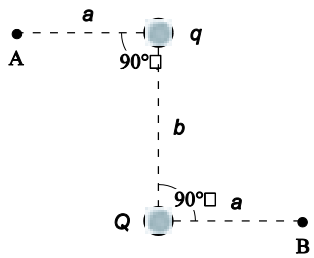
6. An alpha particle (m = 6.7 × 10^{-27} kg, q = +3.2 × 10^{-19} C) has a speed of 20 km/s at point A and moves to point B where it momentarily stops. Only electric forces act on the particle during this motion. Determine the electric potential difference $V_A - V_B$.

a. +4.2 V
b. –4.2 V
c. –9.4 V
d. +9.4 V
e. –8.4 V

7. Point charges q and Q are positioned as shown. If q = +2.0 nC, Q = –2.0 nC, a = 3.0 m, and b = 4.0 m, what is the electric potential difference, $V_A - V_B$?



a. 8.4 V
b. 6.0 V
c. 7.2 V
d. 4.8 V
e. 0 V

8. A rod (length = 2.0 m) is uniformly charged and has a total charge of 5.0 nC. What is the electric potential (relative to zero at infinity) at a point which lies along the axis of the rod and is 3.0 m from the center of the rod?

a. 22 V
b. 19 V
c. 16 V
d. 25 V
e. 12 V

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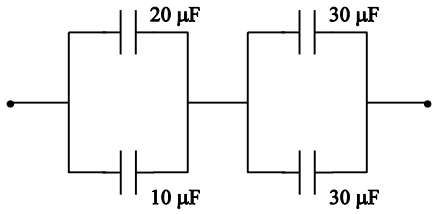
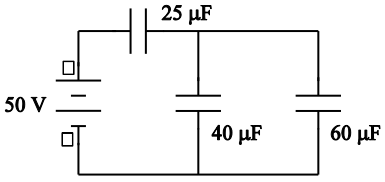
9. What is the equivalent capacitance of the combination shown?



a. 20 μF
b. 90 μF
c. 22 μF
d. 4.6 μF
e. 67 μF

10. Determine the energy stored in the 60-μF capacitor.



a. 2.4 mJ
b. 3.0 mJ
c. 3.6 mJ
d. 4.3 mJ
e. 6.0 mJ

11. A 25-μF capacitor charged to 50 V and a capacitor C charged to 20 V are connected to each other, with the two positive plates connected and the two negative plates connected. The final potential difference across the 25-μF capacitor is 36 V. What is the value of the capacitance of C?

a. 43 μF
b. 29 μF
c. 22 μF
d. 58 μF
e. 63 μF

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12. A small bulb is rated at 7.5 W when operated at 125 V. The tungsten filament has a temperature coefficient of resistivity $\alpha = 4.5\times10^{-3}/°C$. When the filament is hot and glowing, its temperature is seven times room temperature (20 °C). What is the resistance of the filament (in ohms) at room temperature?

a. 1280.
b. 1350.
c. 1911.
d. 4530.
e. 5630.

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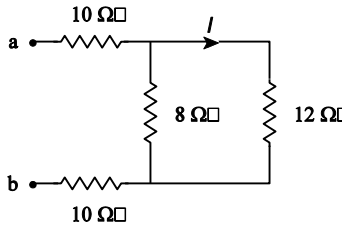
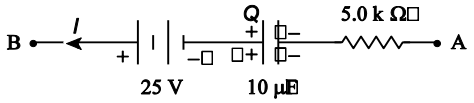
13. If I = 0.40 A in the circuit segment shown below, what is the potential difference $V_a - V_b$?



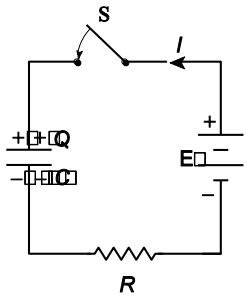
a. 31 V
b. 28 V
c. 25 V
d. 34 V
e. 10 V

14. If Q = 350 μC and I = 4.0 mA in the circuit segment shown below, determine the potential difference, $V_A - V_B$.



a. –30 V
b. +80 V
c. +40 V
d. –40 V
e. +10 V

15. At t = 0 the switch S is closed with the capacitor uncharged. If C = 50 μF, E = 20 V, and R = 4.0 kΩ, what is the charge on the capacitor when I = 2.0 mA?



a. 360 μC
b. 480 μC
c. 240 μC
d. 600 μC
e. 400 μC

16. A capacitor in a single-loop RC circuit is charged to 85% of its final potential difference in 2.4 s. What is the time constant for this circuit?

a. 1.5 s
b. 1.3 s
c. 1.7 s
d. 1.9 s
e. 2.9 s

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17. A straight 10-cm wire bent at its midpoint so as to form an angle of 90° carries a current of 10 A. It lies in the xy plane in a region where the magnetic field is in the positive z direction and has a constant magnitude of 3.0 mT. What is the magnitude of the magnetic force on this wire?

a. 3.2 mN
b. 2.1 mN
c. 5.3 mN
d. 4.2 mN
e. 6.0 mN

18. An electron moves in a region where the magnetic field is uniform, has a magnitude of 60 μT, and points in the positive x direction. At t = 0 the electron has a velocity that has an x component of 30 km/s, a y component of 40 km/s, and a z component of zero. What is the radius of the resulting helical path?

a. 4.7 mm
b. 18 mm
c. 3.8 mm
d. 2.8 mm
e. 5.7 mm

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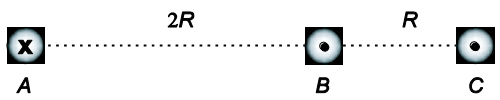
20. The figure shows a cross section of three parallel wires each carrying a current of 24 A. The currents in wires B and C are out of the paper, while that in wire A is into the paper. If the distance R = 5.0 mm, what is the magnitude of the force on a 4.0-m length of wire A?



a. 15 mN
b. 77 mN
c. 59 mN
d. 12 mN
e. 32 mN

21. A hollow cylindrical (inner radius = 2.0 mm, outer radius = 4.0 mm) conductor carries a current of 24 A parallel to its axis. This current is uniformly distributed over a cross section of the conductor. Determine the magnitude of the magnetic field at a point that is 5.0 mm from the axis of the conductor.

a. 0.96 mT
b. 1.7 mT
c. 0.55 mT
d. 1.2 mT
e. 0.40 mT

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22. A long solenoid (radius = 3.0 cm, 2500 turns per meter) carries a current given by $I = 0.30 \sin(200\,t)$ A, where t is measured in s. When $t = 2.5$ ms, what is the magnitude of the induced electric field at a point which is 4.0 cm from the axis of the solenoid?

a. 9.3×10^{-3} V/m
b. 8.0×10^{-3} V/m
c. 6.7×10^{-3} V/m
d. 5.3×10^{-3} V/m
e. 1.9×10^{-3} V/m

23. A long solenoid has a radius of 4.0 cm and has 800 turns/m. If the current in the solenoid is increasing at the rate of 3.0 A/s, what is the magnitude of the induced electric field at a point 2.2 cm from the axis of the solenoid?

a. 3.3×10^{-5} V/m
b. 3.6×10^{-5} V/m
c. 3.9×10^{-5} V/m
d. 4.2×10^{-5} V/m
e. 6.0×10^{-5} V/m

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24. A series *LC* circuit contains a 100 mH inductor, a 36.0 mF capacitor and a 12 V battery. The period of the electromagnetic oscillations in the circuit is

a. 0.0227 s.
b. 0.376 s.
c. 2.26 s.
d. 105 s.
e. 1750 s.