AP Physics C: Electricity and Magnetism Practice Test 9

60 original multiple-choice questions covering all 6 AP Physics C: Electricity and Magnetism units (Units 8–13). All questions are calculus-based. Choose one answer for each question. The full answer key is on the last page — worked explanations for every question are free on the test page at QuaidianPoint.com.

Name: _____ Class: _____ Score: _____ / 60

Unit 8: Electric Charges, Fields, and Gauss's Law

Q1. Two small charged spheres carry charges of 6 μC and 8 μC and are held 0.3 m apart in a vacuum. What is the magnitude of the electrostatic force between them?

(A) 2.4 N
(B) 4.79 N
(C) 9.59 N
(D) 7.19 N

Q2. A point charge of 5 μC is fixed in space. What is the magnitude of the electric field it produces at a point 0.3 m away?

(A) 9.99×10^5 N/C
(B) 2.5×10^5 N/C
(C) 4.99×10^5 N/C
(D) 7.49×10^5 N/C

Q3. A closed Gaussian surface encloses a net charge of 18 μC. What is the total electric flux through the surface?

(A) 1.02×10^6 N·m^2/C
(B) 4.07×10^6 N·m^2/C
(C) 3.05×10^6 N·m^2/C
(D) 2.03×10^6 N·m^2/C

Q4. A solid conducting sphere of radius 0.1 m carries a total charge of 20 μC uniformly on its surface. What is the electric field magnitude at a point 0.6 m from its centre?

(A) 4.99×10^5 N/C
(B) 9.99×10^5 N/C
(C) 2.5×10^5 N/C
(D) 7.49×10^5 N/C

Q5. A nonconducting sphere of radius 0.5 m carries a total charge of 15 μC uniformly distributed through its volume. What is the electric field magnitude at a point 0.2 m from its centre?

(A) 4.32×10^5 N/C
(B) 2.16×10^5 N/C
(C) 1.08×10^5 N/C
(D) 3.24×10^5 N/C

Q6. An infinitely long straight wire carries a uniform linear charge density of 8 μC/m. What is the electric field magnitude at a perpendicular distance of 0.1 m from the wire?

(A) 2.88×10^6 N/C
(B) 7.19×10^5 N/C
(C) 1.44×10^6 N/C
(D) 2.16×10^6 N/C

Q7. An infinite nonconducting sheet carries a uniform surface charge density of 11 μC/m^2. What is the electric field magnitude near the sheet, on either side?

(A) 3.11×10^5 N/C
(B) 1.24×10^6 N/C
(C) 9.32×10^5 N/C
(D) 6.21×10^5 N/C

Q8. A thin spherical shell of radius 0.15 m carries a total charge of 8 μC on its surface. What is the electric field magnitude at a point inside the shell, 0.075 m from its centre?

(A) 0 N/C
(B) 1.28×10^7 N/C
(C) 3.2×10^6 N/C
(D) 6.39×10^6 N/C

Q9. A thin rod of length 0.4 m carries a uniform linear charge density of 8 μC/m. What is the electric field magnitude at a point on the rod's axis, 0.1 m beyond one end of the rod?

(A) 1.15×10^6 N/C
(B) 5.75×10^5 N/C
(C) 2.88×10^5 N/C
(D) 8.63×10^5 N/C

Q10. Two point charges, 4 μC and 8 μC, are fixed 0.4 m apart on the x-axis. What is the magnitude of the net electric field at the midpoint between them?

(A) 1.8×10^6 N/C
(B) 4.49×10^5 N/C
(C) 8.99×10^5 N/C
(D) 1.35×10^6 N/C

Q11. Two large parallel sheets carry surface charge densities of +8 μC/m^2 and -3 μC/m^2. What is the electric field magnitude in the region between the sheets?

(A) 1.24×10^6 N/C
(B) 3.11×10^5 N/C
(C) 9.32×10^5 N/C
(D) 6.21×10^5 N/C

Q12. An electric dipole has dipole moment 3×10^{-9} C·m. What is the approximate electric field magnitude on the dipole axis at a distance of 0.25 m from its centre, far from the dipole?

(A) 3.45×10^3 N/C
(B) 1.73×10^3 N/C
(C) 6.9×10^3 N/C
(D) 5.18×10^3 N/C

Unit 9: Electric Potential

Q13. What is the electric potential at a point 0.2 m from a point charge of 6 μC, taking the potential to be zero at infinity?

(A) 5.39×10^5 V
(B) 2.7×10^5 V
(C) 1.35×10^5 V
(D) 4.05×10^5 V

Q14. A charge of 5 μC is moved through a potential difference of 400 V. How much work is done by the electric field if the charge moves from the higher potential to the lower potential?

(A) 4×10^{-3} J
(B) 1×10^{-3} J
(C) 2×10^{-3} J
(D) -2×10^{-3} J

Q15. A conducting sphere of radius 0.25 m carries a charge of 10 μC. What is the electric potential at its surface, with zero potential at infinity?

(A) 1.8×10^5 V
(B) 7.19×10^5 V
(C) 5.39×10^5 V
(D) 3.6×10^5 V

Q16. A thin rod of length 0.8 m carries a uniform linear charge density of 2 μC/m. What is the electric potential at a point on the rod's axis, 0.1 m beyond one end?

(A) 3.95×10^4 V
(B) 7.9×10^4 V
(C) 1.98×10^4 V
(D) 5.93×10^4 V

Q17. A ring of radius 0.3 m carries a total charge of 10 μC uniformly around its circumference. What is the electric potential on the ring's axis at a distance of 0.4 m from its centre?

(A) 3.6×10^5 V
(B) 1.8×10^5 V
(C) 8.99×10^4 V
(D) 2.7×10^5 V

Q18. Two point charges of 4 μC and 6 μC are held 0.3 m apart. What is the electric potential energy of this pair?

(A) 1.438 J
(B) 0.36 J
(C) 0.719 J
(D) 1.079 J

Q19. In a region of space the electric potential varies as $V(x) = 40x^2 + 10$, where V is in volts and x is in metres. What is the x-component of the electric field at x = 0.5 m?

(A) 40 V/m
(B) -80 V/m
(C) -20 V/m
(D) -40 V/m

Q20. A thin conducting spherical shell of radius 0.2 m carries a charge of 18 μC. What is the electric potential at a point inside the shell, halfway to its centre?

(A) 8.09×10^5 V
(B) 4.05×10^5 V
(C) 1.62×10^6 V
(D) 1.21×10^6 V

Q21. A uniformly charged disk of radius 0.2 m carries a surface charge density of 6 $\mu C/m^2$. What is the electric potential on the disk's axis at a distance of 0.1 m from its centre?

(A) 8.38×10^4 V
(B) 4.19×10^4 V
(C) 2.09×10^4 V
(D) 6.28×10^4 V

Unit 10: Conductors and Capacitors

Q22. A parallel-plate capacitor has plates of area 0.04 m^2 separated by 4 mm in air. What is its capacitance?

(A) 1.77×10^{-10} F
(B) 4.43×10^{-11} F
(C) 8.85×10^{-11} F
(D) 1.33×10^{-10} F

Q23. A capacitor of capacitance 20 pF is filled completely with a dielectric of dielectric constant 3, with no change in plate separation. What is the new capacitance?

(A) 120 pF
(B) 30 pF
(C) 70 pF
(D) 60 pF

Q24. A 30 pF capacitor is charged to 30 V. How much energy is stored in the capacitor?

(A) 1.35×10^{-8} J
(B) 6.75×10^{-9} J
(C) 2.7×10^{-8} J
(D) 2.02×10^{-8} J

Q25. Capacitors of 12 μF and 3 μF are connected in series. What is their equivalent capacitance?

(A) 4.8 μF
(B) 2.4 μF
(C) 1.2 μF
(D) 3.6 μF

Q26. Capacitors of 6 μF and 6 μF are connected in parallel across a 24 V battery. What total charge is drawn from the battery?

(A) 5.76×10^{-4} C
(B) 1.44×10^{-4} C
(C) 2.88×10^{-4} C
(D) 4.32×10^{-4} C

Q27. The plates of a parallel-plate capacitor carry surface charge densities of magnitude 3 μC/m^2. What is the electric field magnitude between the plates?

(A) 1.69×10^{5} N/C
(B) 6.78×10^{5} N/C
(C) 5.08×10^{5} N/C
(D) 3.39×10^{5} N/C

Q28. A spherical capacitor consists of concentric conducting spheres of radii 0.15 m and 0.25 m. What is its capacitance?

(A) 4.17×10^{-11} F
(B) 2.09×10^{-11} F
(C) 8.34×10^{-11} F
(D) 6.26×10^{-11} F

Q29. The electric field in a region of space has magnitude 5000 N/C. What is the electric energy density in that region?

(A) 5.53×10^{-5} J/m^3
(B) 1.11×10^{-4} J/m^3
(C) 2.21×10^{-4} J/m^3
(D) 1.66×10^{-4} J/m^3

Unit 11: Electric Circuits

Q30. A 24 V battery is connected across a 8 Ω resistor. What current flows through the resistor?

(A) 6 A
(B) 1.5 A
(C) 3 A
(D) 4.5 A

Q31. Resistors of 40 Ω and 60 Ω are connected in parallel. What is their equivalent resistance?

(A) 12 Ω
(B) 48 Ω
(C) 36 Ω
(D) 24 Ω

Q32. A resistor of 24 Ω is connected across a 24 V source. What power is dissipated in the resistor?

(A) 24 W
(B) 48 W
(C) 12 W
(D) 36 W

Q33. A battery of emf 12 V and internal resistance 2 Ω is connected to an external resistor of 4 Ω. What is the terminal voltage of the battery?

(A) 16 V
(B) 8 V
(C) 4 V
(D) 12 V

Q34. An RC circuit has resistance 4700 Ω and capacitance 10 μF. What is its time constant?

(A) 0.094 s
(B) 0.023 s
(C) 0.047 s
(D) 0.07 s

Q35. A capacitor of 10 μF, initially uncharged, is connected in series with a 4000 Ω resistor across a 20 V battery. What is the voltage across the capacitor after one time constant has elapsed?

(A) 25.285 V
(B) 6.321 V
(C) 18.964 V
(D) 12.642 V

Q36. A capacitor charged to 14 V discharges through a 2500 Ω resistor. Its capacitance is 50 μF. What is the voltage across the capacitor after two time constants?

(A) 1.89 V
(B) 0.947 V
(C) 3.79 V
(D) 2.84 V

Q37. A capacitor discharges through a 500 Ω resistor. Its capacitance is 25 μF. How long does it take for the charge on the capacitor to fall to 0.25 of its initial value?

(A) 0.035 s
(B) 0.017 s
(C) 8.66×10^{-3} s
(D) 0.026 s

Q38. A battery of emf 24 V is connected in series with resistors of 6 Ω and 12 Ω. What is the voltage across the 12 Ω resistor?

(A) 32 V
(B) 8 V
(C) 16 V
(D) 24 V

Q39. A current of 5 A flows through a resistor of 8 Ω. What power is dissipated as heat in the resistor?

(A) 100 W
(B) 400 W
(C) 300 W
(D) 200 W

Q40. A total current of 12 A splits between two parallel resistors of 4 Ω and 12 Ω. What current flows through the 4 Ω resistor?

(A) 9 A
(B) 18 A
(C) 4.5 A
(D) 13.5 A

Q41. A series RC circuit with resistance 6 Ω and capacitance 10 μF is connected to a 24 V battery and left for a very long time. What is the final voltage across the capacitor?

(A) 12 V
(B) 24 V
(C) 6 V
(D) 48 V

Unit 12: Magnetic Fields and Electromagnetism

Q42. A particle of charge 4 μC moves at 4000 m/s perpendicular to a uniform magnetic field of 0.4 T. What is the magnitude of the magnetic force on the particle?

(A) 0.013 N
(B) 3.2×10^{-3} N
(C) 6.4×10^{-3} N
(D) 9.6×10^{-3} N

Q43. A straight wire of length 0.6 m carries a current of 8 A perpendicular to a uniform magnetic field of 0.6 T. What is the magnitude of the magnetic force on the wire?

(A) 1.44 N
(B) 5.76 N
(C) 4.32 N
(D) 2.88 N

Q44. A long straight wire carries a current of 10 A. What is the magnetic field magnitude at a distance of 0.1 m from the wire?

(A) 2×10^{-5} T
(B) 4×10^{-5} T
(C) 1×10^{-5} T
(D) 3×10^{-5} T

Q45. A circular loop of radius 0.05 m carries a current of 4 A. What is the magnetic field magnitude at the centre of the loop?

(A) 1.01×10^{-4} T
(B) 5.03×10^{-5} T
(C) 2.51×10^{-5} T
(D) 7.54×10^{-5} T

Q46. A solenoid has 500 turns per metre and carries a current of 4 A. What is the magnetic field magnitude inside the solenoid, far from its ends?

(A) 5.03×10^{-3} T
(B) 1.26×10^{-3} T
(C) 2.51×10^{-3} T
(D) 3.77×10^{-3} T

Q47. An electron (mass 9.11×10^{-31} kg, charge magnitude 1.60×10^{-19} C) moves at 2000000 m/s perpendicular to a uniform magnetic field of 0.02 T. What is the radius of its circular path?

(A) 1.14×10^{-3} m
(B) 2.85×10^{-4} m
(C) 8.54×10^{-4} m
(D) 5.69×10^{-4} m

Q48. A rectangular coil of 250 turns and area 0.015 m^2 carries a current of 2 A in a magnetic field of 0.6 T. What is the maximum torque on the coil?

(A) 4.5 N·m
(B) 2.25 N·m
(C) 9 N·m
(D) 6.75 N·m

Q49. In a velocity selector, a charged particle passes undeflected through crossed electric and magnetic fields of 600 V/m and 0.3 T. What is the speed of the particle?

(A) 1×10^{3} m/s
(B) 2×10^{3} m/s
(C) 4×10^{3} m/s
(D) 3×10^{3} m/s

Q50. Two long parallel wires 0.2 m apart carry currents of 5 A and 10 A in opposite directions. What is the magnetic field magnitude at the midpoint between the wires?

(A) 6×10^{-5} T
(B) 1.5×10^{-5} T
(C) 3×10^{-5} T
(D) 4.5×10^{-5} T

Unit 13: Electromagnetic Induction

Q51. A flat loop of area 0.02 m^2 lies perpendicular to a uniform magnetic field of 0.5 T. What is the magnetic flux through the loop?

(A) 0.02 Wb
(B) 5×10^{-3} Wb
(C) 0.015 Wb
(D) 0.01 Wb

Q52. A coil of 500 turns and area 0.01 m^2 experiences a magnetic field change of 0.4 T in 0.2 s, with the field perpendicular to the coil. What is the magnitude of the induced emf?

(A) 10 V
(B) 20 V
(C) 5 V
(D) 15 V

Q53. A conducting rod of length 0.4 m moves at 2 m/s perpendicular to a uniform magnetic field of 0.3 T, sliding on conducting rails. What is the motional emf induced between the ends of the rod?

(A) 0.48 V
(B) 0.24 V
(C) 0.12 V
(D) 0.36 V

Q54. A loop of resistance 12 Ω experiences an induced emf of 6 V. What is the magnitude of the induced current in the loop?

(A) 1 A
(B) 0.25 A
(C) 0.5 A
(D) 0.75 A

Q55. A solenoid has 1000 turns per metre, cross-sectional area 0.04 m^2, and length 0.4 m. What is its self-inductance?

(A) 0.04 H
(B) 0.01 H
(C) 0.03 H
(D) 0.02 H

Q56. An LR circuit has inductance 3 H and resistance 60 Ω. What is its inductive time constant?

(A) 0.05 s
(B) 0.025 s
(C) 0.1 s
(D) 0.075 s

Q57. An inductor of 2 H carries a current of 3 A. How much energy is stored in its magnetic field?

(A) 18 J
(B) 9 J
(C) 4.5 J
(D) 13.5 J

Q58. An LC circuit has inductance 30 mH and capacitance 20 μF. What is its natural frequency of oscillation?

(A) 103 Hz
(B) 411 Hz
(C) 205 Hz
(D) 308 Hz

Q59. A coil of 50 turns and area 0.02 m^2 rotates at angular speed 50 rad/s in a uniform magnetic field of 0.2 T. What is the maximum induced emf in the coil?

(A) 20 V
(B) 5 V
(C) 15 V
(D) 10 V

Q60. In an LC circuit, the maximum current is 2 A. The inductance is 20 mH and the capacitance is 10 μF. What is the maximum voltage across the capacitor?

(A) 89.443 V
(B) 178.885 V
(C) 44.721 V
(D) 134.164 V

Answer Key

Q1: B	Q11: D	Q21: B	Q31: D	Q41: B	Q51: D
Q2: C	Q12: A	Q22: C	Q32: A	Q42: C	Q52: A
Q3: D	Q13: B	Q23: D	Q33: B	Q43: D	Q53: B
Q4: A	Q14: C	Q24: A	Q34: C	Q44: A	Q54: C
Q5: B	Q15: D	Q25: B	Q35: D	Q45: B	Q55: D
Q6: C	Q16: A	Q26: C	Q36: A	Q46: C	Q56: A
Q7: D	Q17: B	Q27: D	Q37: B	Q47: D	Q57: B
Q8: A	Q18: C	Q28: A	Q38: C	Q48: A	Q58: C
Q9: B	Q19: D	Q29: B	Q39: D	Q49: B	Q59: D
Q10: C	Q20: A	Q30: C	Q40: A	Q50: C	Q60: A

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