AP Physics C: Electricity and Magnetism Practice Test 7

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 5 μC and 12 μC and are held 0.25 m apart in a vacuum. What is the magnitude of the electrostatic force between them?

(A) 17.261 N
(B) 4.315 N
(C) 12.946 N
(D) 8.63 N

Q2. A point charge of 12 μC is fixed in space. What is the magnitude of the electric field it produces at a point 0.3 m away?

(A) 1.2×10^6 N/C
(B) 2.4×10^6 N/C
(C) 5.99×10^5 N/C
(D) 1.8×10^6 N/C

Q3. A closed Gaussian surface encloses a net charge of 6 μC. What is the total electric flux through the surface?

(A) 1.36×10^6 N·m^2/C
(B) 6.78×10^5 N·m^2/C
(C) 3.39×10^5 N·m^2/C
(D) 1.02×10^6 N·m^2/C

Q4. A solid conducting sphere of radius 0.2 m carries a total charge of 20 μC uniformly on its surface. What is the electric field magnitude at a point 0.4 m from its centre?

(A) 2.25×10^6 N/C
(B) 5.62×10^5 N/C
(C) 1.12×10^6 N/C
(D) 1.69×10^6 N/C

Q5. A nonconducting sphere of radius 0.4 m carries a total charge of 9 μC uniformly distributed through its volume. What is the electric field magnitude at a point 0.2 m from its centre?

(A) 5.06×10^5 N/C
(B) 1.26×10^5 N/C
(C) 3.79×10^5 N/C
(D) 2.53×10^5 N/C

Q6. An infinitely long straight wire carries a uniform linear charge density of 6 μC/m. What is the electric field magnitude at a perpendicular distance of 0.2 m from the wire?

(A) 5.39×10^5 N/C
(B) 1.08×10^6 N/C
(C) 2.7×10^5 N/C
(D) 8.09×10^5 N/C

Q7. An infinite nonconducting sheet carries a uniform surface charge density of 5 μC/m^2. What is the electric field magnitude near the sheet, on either side?

(A) 5.65×10^5 N/C
(B) 2.82×10^5 N/C
(C) 1.41×10^5 N/C
(D) 4.24×10^5 N/C

Q8. A thin spherical shell of radius 0.2 m carries a total charge of 4 μC on its surface. What is the electric field magnitude at a point inside the shell, 0.1 m from its centre?

(A) 3.6×10^6 N/C
(B) 8.99×10^5 N/C
(C) 0 N/C
(D) 1.8×10^6 N/C

Q9. A thin rod of length 0.5 m carries a uniform linear charge density of 4 μC/m. What is the electric field magnitude at a point on the rod's axis, 0.2 m beyond one end of the rod?

(A) 2.57×10^5 N/C
(B) 6.42×10^4 N/C
(C) 1.93×10^5 N/C
(D) 1.28×10^5 N/C

Q10. Two point charges, 4 μC and 5 μC, are fixed 0.3 m apart on the x-axis. What is the magnitude of the net electric field at the midpoint between them?

(A) 4×10^5 N/C
(B) 7.99×10^5 N/C
(C) 2×10^5 N/C
(D) 5.99×10^5 N/C

Q11. Two large parallel sheets carry surface charge densities of +6 μC/m^2 and -2 μC/m^2. What is the electric field magnitude in the region between the sheets?

(A) 9.04×10^5 N/C
(B) 4.52×10^5 N/C
(C) 2.26×10^5 N/C
(D) 6.78×10^5 N/C

Q12. An electric dipole has dipole moment 2×10^{-9} C·m. What is the approximate electric field magnitude on the dipole axis at a distance of 0.2 m from its centre, far from the dipole?

(A) 8990 N/C
(B) 2247.5 N/C
(C) 4495 N/C
(D) 6742.5 N/C

Unit 9: Electric Potential

Q13. What is the electric potential at a point 0.4 m from a point charge of 10 μC, taking the potential to be zero at infinity?

(A) 4.49×10^5 V
(B) 1.12×10^5 V
(C) 3.37×10^5 V
(D) 2.25×10^5 V

Q14. A charge of 3 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) 1.2×10^{-3} J
(B) 2.4×10^{-3} J
(C) 6×10^{-4} J
(D) -1.2×10^{-3} J

Q15. A conducting sphere of radius 0.1 m carries a charge of 12 μC. What is the electric potential at its surface, with zero potential at infinity?

(A) 2.16×10^6 V
(B) 1.08×10^6 V
(C) 5.39×10^5 V
(D) 1.62×10^6 V

Q16. A thin rod of length 0.6 m carries a uniform linear charge density of 5 μC/m. What is the electric potential at a point on the rod's axis, 0.2 m beyond one end?

(A) 1.25×10^5 V
(B) 3.12×10^4 V
(C) 6.23×10^4 V
(D) 9.35×10^4 V

Q17. A ring of radius 0.2 m carries a total charge of 12 μC uniformly around its circumference. What is the electric potential on the ring's axis at a distance of 0.3 m from its centre?

(A) 5.98×10^5 V
(B) 1.5×10^5 V
(C) 4.49×10^5 V
(D) 2.99×10^5 V

Q18. Two point charges of 4 μC and 3 μC are held 0.4 m apart. What is the electric potential energy of this pair?

(A) 0.27 J
(B) 0.539 J
(C) 0.135 J
(D) 0.405 J

Q19. In a region of space the electric potential varies as $V(x) = 50x^2 + 10$, where V is in volts and x is in metres. What is the x-component of the electric field at x = 1.5 m?

(A) 150 V/m
(B) -150 V/m
(C) -300 V/m
(D) -75 V/m

Q20. A thin conducting spherical shell of radius 0.15 m carries a charge of 15 μC. What is the electric potential at a point inside the shell, halfway to its centre?

(A) 4.5×10^5 V
(B) 1.8×10^6 V
(C) 8.99×10^5 V
(D) 1.35×10^6 V

Q21. A uniformly charged disk of radius 0.3 m carries a surface charge density of 3 $\mu C/m^2$. What is the electric potential on the disk's axis at a distance of 0.2 m from its centre?

(A) 5.44×10^4 V
(B) 1.36×10^4 V
(C) 4.08×10^4 V
(D) 2.72×10^4 V

Unit 10: Conductors and Capacitors

Q22. A parallel-plate capacitor has plates of area 0.02 m^2 separated by 4 mm in air. What is its capacitance?

(A) 4.43×10^{-11} F
(B) 8.85×10^{-11} F
(C) 2.21×10^{-11} F
(D) 6.64×10^{-11} F

Q23. A capacitor of capacitance 50 pF is filled completely with a dielectric of dielectric constant 5, with no change in plate separation. What is the new capacitance?

(A) 500 pF
(B) 250 pF
(C) 125 pF
(D) 260 pF

Q24. A 20 pF capacitor is charged to 24 V. How much energy is stored in the capacitor?

(A) 1.15×10^{-8} J
(B) 2.88×10^{-9} J
(C) 5.76×10^{-9} J
(D) 8.64×10^{-9} J

Q25. Capacitors of 20 μF and 4 μF are connected in series. What is their equivalent capacitance?

(A) 6.667 μF
(B) 1.667 μF
(C) 5 μF
(D) 3.333 μF

Q26. Capacitors of 4 μF and 14 μF are connected in parallel across a 24 V battery. What total charge is drawn from the battery?

(A) 4.32×10^{-4} C
(B) 8.64×10^{-4} C
(C) 2.16×10^{-4} C
(D) 6.48×10^{-4} C

Q27. The plates of a parallel-plate capacitor carry surface charge densities of magnitude 4 μC/m^2. What is the electric field magnitude between the plates?

(A) 9.04×10^{5} N/C
(B) 4.52×10^{5} N/C
(C) 2.26×10^{5} N/C
(D) 6.78×10^{5} N/C

Q28. A spherical capacitor consists of concentric conducting spheres of radii 0.12 m and 0.3 m. What is its capacitance?

(A) 1.11×10^{-11} F
(B) 4.45×10^{-11} F
(C) 2.22×10^{-11} F
(D) 3.34×10^{-11} F

Q29. The electric field in a region of space has magnitude 10000 N/C. What is the electric energy density in that region?

(A) 8.85×10^{-4} J/m^3
(B) 2.21×10^{-4} J/m^3
(C) 6.64×10^{-4} J/m^3
(D) 4.42×10^{-4} J/m^3

Unit 11: Electric Circuits

Q30. A 12 V battery is connected across a 6 Ω resistor. What current flows through the resistor?

(A) 2 A
(B) 4 A
(C) 1 A
(D) 3 A

Q31. Resistors of 30 Ω and 15 Ω are connected in parallel. What is their equivalent resistance?

(A) 20 Ω
(B) 10 Ω
(C) 5 Ω
(D) 15 Ω

Q32. A resistor of 60 Ω is connected across a 12 V source. What power is dissipated in the resistor?

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

Q33. A battery of emf 18 V and internal resistance 1 Ω is connected to an external resistor of 4 Ω. What is the terminal voltage of the battery?

(A) 28.8 V
(B) 7.2 V
(C) 21.6 V
(D) 14.4 V

Q34. An RC circuit has resistance 2000 Ω and capacitance 20 μF. What is its time constant?

(A) 0.04 s
(B) 0.08 s
(C) 0.02 s
(D) 0.06 s

Q35. A capacitor of 10 μF, initially uncharged, is connected in series with a 5000 Ω resistor across a 12 V battery. What is the voltage across the capacitor after one time constant has elapsed?

(A) 15.171 V
(B) 7.585 V
(C) 3.793 V
(D) 11.378 V

Q36. A capacitor charged to 20 V discharges through a 1000 Ω resistor. Its capacitance is 40 μF. What is the voltage across the capacitor after two time constants?

(A) 5.413 V
(B) 1.353 V
(C) 2.707 V
(D) 4.06 V

Q37. A capacitor discharges through a 2000 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) 0.139 s
(B) 0.035 s
(C) 0.104 s
(D) 0.069 s

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

(A) 9.6 V
(B) 19.2 V
(C) 4.8 V
(D) 14.4 V

Q39. A current of 3 A flows through a resistor of 10 Ω. What power is dissipated as heat in the resistor?

(A) 180 W
(B) 90 W
(C) 45 W
(D) 135 W

Q40. A total current of 6 A splits between two parallel resistors of 4 Ω and 12 Ω. What current flows through the 4 Ω resistor?

(A) 9 A
(B) 2.25 A
(C) 4.5 A
(D) 6.75 A

Q41. A series RC circuit with resistance 12 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) 6 V
(C) 48 V
(D) 24 V

Unit 12: Magnetic Fields and Electromagnetism

Q42. A particle of charge 3 μC moves at 4000 m/s perpendicular to a uniform magnetic field of 0.5 T. What is the magnitude of the magnetic force on the particle?

(A) 6×10^{-3} N
(B) 0.012 N
(C) 3×10^{-3} N
(D) 9×10^{-3} N

Q43. A straight wire of length 0.5 m carries a current of 10 A perpendicular to a uniform magnetic field of 0.5 T. What is the magnitude of the magnetic force on the wire?

(A) 5 N
(B) 2.5 N
(C) 1.25 N
(D) 3.75 N

Q44. A long straight wire carries a current of 10 A. What is the magnetic field magnitude at a distance of 0.05 m from the wire?

(A) 8×10^{-5} T
(B) 2×10^{-5} T
(C) 4×10^{-5} T
(D) 6×10^{-5} T

Q45. A circular loop of radius 0.1 m carries a current of 4 A. What is the magnetic field magnitude at the centre of the loop?

(A) 5.03×10^{-5} T
(B) 1.26×10^{-5} T
(C) 3.77×10^{-5} T
(D) 2.51×10^{-5} T

Q46. A solenoid has 650 turns per metre and carries a current of 3 A. What is the magnetic field magnitude inside the solenoid, far from its ends?

(A) 2.45×10^{-3} T
(B) 1.23×10^{-3} T
(C) 4.9×10^{-3} T
(D) 3.68×10^{-3} T

Q47. An electron (mass 9.11×10^{-31} kg, charge magnitude 1.60×10^{-19} C) moves at 3000000 m/s perpendicular to a uniform magnetic field of 0.02 T. What is the radius of its circular path?

(A) 4.27×10^{-4} m
(B) 8.54×10^{-4} m
(C) 1.71×10^{-3} m
(D) 1.28×10^{-3} m

Q48. A rectangular coil of 150 turns and area 0.03 m^2 carries a current of 3 A in a magnetic field of 0.4 T. What is the maximum torque on the coil?

(A) 2.7 N·m
(B) 10.8 N·m
(C) 5.4 N·m
(D) 8.1 N·m

Q49. In a velocity selector, a charged particle passes undeflected through crossed electric and magnetic fields of 400 V/m and 0.4 T. What is the speed of the particle?

(A) 2000 m/s
(B) 500 m/s
(C) 1500 m/s
(D) 1000 m/s

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

(A) 4×10^{-5} T
(B) 8×10^{-5} T
(C) 2×10^{-5} T
(D) 6×10^{-5} T

Unit 13: Electromagnetic Induction

Q51. A flat loop of area 0.04 m^2 lies perpendicular to a uniform magnetic field of 0.4 T. What is the magnetic flux through the loop?

(A) 0.032 Wb
(B) 0.016 Wb
(C) 8×10^{-3} Wb
(D) 0.024 Wb

Q52. A coil of 200 turns and area 0.02 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) 16 V
(B) 4 V
(C) 8 V
(D) 12 V

Q53. A conducting rod of length 0.4 m moves at 3 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) 0.72 V
(B) 0.18 V
(C) 0.54 V
(D) 0.36 V

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

(A) 1 A
(B) 2 A
(C) 0.5 A
(D) 1.5 A

Q55. A solenoid has 500 turns per metre, cross-sectional area 0.02 m^2, and length 0.5 m. What is its self-inductance?

(A) 6.28×10^{-3} H
(B) 3.14×10^{-3} H
(C) 1.57×10^{-3} H
(D) 4.71×10^{-3} H

Q56. An LR circuit has inductance 10 H and resistance 10 Ω. What is its inductive time constant?

(A) 2 s
(B) 0.5 s
(C) 1 s
(D) 1.5 s

Q57. An inductor of 5 H carries a current of 3 A. How much energy is stored in its magnetic field?

(A) 11.2 J
(B) 45 J
(C) 33.8 J
(D) 22.5 J

Q58. An LC circuit has inductance 10 mH and capacitance 25 μF. What is its natural frequency of oscillation?

(A) 318.31 Hz
(B) 636.62 Hz
(C) 159.155 Hz
(D) 477.465 Hz

Q59. A coil of 50 turns and area 0.04 m^2 rotates at angular speed 50 rad/s in a uniform magnetic field of 0.4 T. What is the maximum induced emf in the coil?

(A) 80 V
(B) 40 V
(C) 20 V
(D) 60 V

Q60. In an LC circuit, the maximum current is 3 A. The inductance is 20 mH and the capacitance is 10 μF. What is the maximum voltage across the capacitor?

(A) 268.328 V
(B) 67.082 V
(C) 134.164 V
(D) 201.246 V

Answer Key

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

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