

AP Physics C: Electricity and Magnetism Practice Test 5

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. An infinitely long straight wire carries a uniform linear charge density of 82 nC/m. What is the magnitude of the electric field 44 cm from the wire?

- (A) 1.68×10^3 N/C
- (B) 3.35×10^3 N/C
- (C) 6.7×10^3 N/C
- (D) 1.34×10^4 N/C

Q2. A very large flat sheet carries a uniform surface charge density of $24 \mu\text{C}/\text{m}^2$. What is the magnitude of the electric field near the sheet, away from its edges?

- (A) 6.78×10^5 N/C
- (B) 1.36×10^6 N/C
- (C) 2.71×10^6 N/C
- (D) 3.39×10^5 N/C

Q3. A solid insulating sphere of radius 14 cm carries a total charge of $5 \mu\text{C}$ uniformly distributed through its volume. What is the magnitude of the electric field at a point 34 cm from its centre?

- (A) 1.94×10^5 N/C
- (B) 7.78×10^5 N/C
- (C) 3.89×10^5 N/C
- (D) 1.56×10^6 N/C

Q4. A thin ring of radius 23 cm carries a total charge of $25 \mu\text{C}$ uniformly around its circumference. What is the magnitude of the electric field on the ring's axis 36 cm from its centre?

- (A) 5.19×10^5 N/C
- (B) 2.08×10^6 N/C
- (C) 1.04×10^6 N/C
- (D) 2.59×10^5 N/C

Q5. A thin rod of length 25 cm carries a total charge of 10 nC uniformly along its length. What is the magnitude of the electric field on the rod's axis 11 cm beyond one end?

- (A) 2.27×10^3 N/C
- (B) 1.14×10^3 N/C
- (C) 4.54×10^3 N/C
- (D) 9.08×10^3 N/C

Q6. A closed surface encloses a net charge of $15\ \mu\text{C}$. What is the net electric flux through the surface?

- (A) $8.47 \times 10^5\ \text{N}\cdot\text{m}^2/\text{C}$
- (B) $3.39 \times 10^6\ \text{N}\cdot\text{m}^2/\text{C}$
- (C) $4.24 \times 10^5\ \text{N}\cdot\text{m}^2/\text{C}$
- (D) $1.69 \times 10^6\ \text{N}\cdot\text{m}^2/\text{C}$

Q7. A particle of mass $12\ \text{mg}$ and charge $7\ \mu\text{C}$ is placed in a uniform electric field of $1136\ \text{N/C}$. Ignoring gravity, what is the magnitude of its initial acceleration?

- (A) $331\ \text{m/s}^2$
- (B) $1.33 \times 10^3\ \text{m/s}^2$
- (C) $663\ \text{m/s}^2$
- (D) $166\ \text{m/s}^2$

Q8. An electric dipole consists of charges $+11\ \mu\text{C}$ and $-11\ \mu\text{C}$ separated by $16\ \text{mm}$. Estimate the magnitude of the electric field on the dipole axis $37\ \text{cm}$ from its centre, where the distance is much larger than the separation.

- (A) $6.25 \times 10^4\ \text{N/C}$
- (B) $3.12 \times 10^4\ \text{N/C}$
- (C) $1.25 \times 10^5\ \text{N/C}$
- (D) $2.5 \times 10^5\ \text{N/C}$

Q9. A thin rod of length $46\ \text{cm}$ carries a uniform linear charge density λ . Which integral gives the magnitude of the electric field at a point on the rod's axis $31\ \text{cm}$ beyond one end, where x is the distance from a charge element dq to the point?

- (A) $\int k\lambda\ dx / x$
- (B) $\int k\lambda\ dx / x^3$
- (C) $\int k\lambda\ dx / x^2$
- (D) $\int \lambda\ dx / x^2$

Q10. Two charged beads carry charges $11\ \mu\text{C}$ and $21\ \mu\text{C}$ and are $56\ \text{cm}$ apart in vacuum. What is the magnitude of the electrostatic force between them?

- (A) $6.62\ \text{N}$
- (B) $3.31\ \text{N}$
- (C) $13.2\ \text{N}$
- (D) $1.66\ \text{N}$

Q11. A point charge of $-29\ \mu\text{C}$ is fixed in vacuum. What is the magnitude of the electric field at a point $11\ \text{cm}$ from the charge?

- (A) $2.15 \times 10^7\ \text{N/C}$
- (B) $1.08 \times 10^7\ \text{N/C}$
- (C) $4.31 \times 10^7\ \text{N/C}$
- (D) $8.62 \times 10^7\ \text{N/C}$

Q12. Two positive point charges $6\ \mu\text{C}$ and $15\ \mu\text{C}$ lie on the x -axis $43\ \text{cm}$ apart. A point P lies on the x -axis $22\ \text{cm}$ beyond the second charge, on the side away from the first. What is the magnitude of the net electric field at P ?

- (A) $1.46 \times 10^6\ \text{N/C}$
- (B) $5.83 \times 10^6\ \text{N/C}$
- (C) $2.91 \times 10^6\ \text{N/C}$
- (D) $7.28 \times 10^5\ \text{N/C}$

Unit 9: Electric Potential

Q13. A charge is moved slowly along an equipotential surface held at 258 V, from one point to another on the same surface. How much work is done by the electric field during this move?

- (A) 258 J
- (B) 129 J
- (C) 516 J
- (D) 0 J

Q14. A point charge of $-22\ \mu\text{C}$ is fixed in vacuum, with zero potential at infinity. What is the electric potential 68 cm from the charge?

- (A) $-2.91 \times 10^5\ \text{V}$
- (B) $-1.45 \times 10^5\ \text{V}$
- (C) $-5.82 \times 10^5\ \text{V}$
- (D) $2.91 \times 10^5\ \text{V}$

Q15. A charge of $14\ \mu\text{C}$ is moved slowly from a point at potential 370 V to a point at potential 620 V. How much work is done by an external agent, ignoring any change in kinetic energy?

- (A) 0.00175 J
- (B) 0.007 J
- (C) 0.0035 J
- (D) 0.000875 J

Q16. Two point charges $2\ \mu\text{C}$ and $-15\ \mu\text{C}$ are held 40 cm apart. What is the electric potential energy of this pair?

- (A) -0.337 J
- (B) -0.674 J
- (C) -1.35 J
- (D) 0.674 J

Q17. In a region, the electric potential varies with position as $V(x) = 13x^2 + (-37)x + 20$, where V is in volts and x is in metres. What is the x -component of the electric field at $x = 1.0\ \text{m}$?

- (A) 5.5 N/C
- (B) 22 N/C
- (C) 11 N/C
- (D) -11 N/C

Q18. A thin ring of radius 25 cm carries a total charge of $33\ \mu\text{C}$ uniformly around its circumference. What is the electric potential on the ring's axis 43 cm from its centre, with zero potential at infinity?

- (A) $2.98 \times 10^5\ \text{V}$
- (B) $1.19 \times 10^6\ \text{V}$
- (C) $1.49 \times 10^5\ \text{V}$
- (D) $5.96 \times 10^5\ \text{V}$

Q19. A thin spherical shell of radius 26 cm carries a total charge of 23 μC uniformly on its surface. What is the electric potential at a point 5 cm from its centre, with zero potential at infinity?

- (A) $3.98 \times 10^5 \text{ V}$
- (B) $1.59 \times 10^6 \text{ V}$
- (C) $3.18 \times 10^6 \text{ V}$
- (D) $7.95 \times 10^5 \text{ V}$

Q20. A particle of mass 45 μg and charge 50 nC starts from rest and accelerates through a potential drop of 554 V. What is its final speed, ignoring gravity and other forces?

- (A) 17.5 m/s
- (B) 35.1 m/s
- (C) 70.2 m/s
- (D) 8.77 m/s

Q21. Point charges 5 μC and 10 μC are fixed in vacuum. At a certain point P, the distances to the two charges are 34 cm and 35 cm respectively. What is the electric potential at P, with zero potential at infinity?

- (A) $1.95 \times 10^5 \text{ V}$
- (B) $7.78 \times 10^5 \text{ V}$
- (C) $-3.89 \times 10^5 \text{ V}$
- (D) $3.89 \times 10^5 \text{ V}$

Unit 10: Conductors and Capacitors

Q22. Capacitors of 6 μF , 17 μF and 4 μF are connected in parallel. What is their equivalent capacitance?

- (A) 13.5 μF
- (B) 54 μF
- (C) 27 μF
- (D) 20.2 μF

Q23. A 39 μF capacitor is charged to 95 V. How much energy is stored in the capacitor?

- (A) 0.176 J
- (B) 0.088 J
- (C) 0.352 J
- (D) 0.044 J

Q24. A 7 μF capacitor is connected across a 21 V battery. What charge is stored on each plate?

- (A) $7.35 \times 10^{-5} \text{ C}$
- (B) 0.000294 C
- (C) 0.000147 C
- (D) 0.000588 C

Q25. A spherical capacitor consists of two concentric conducting shells of radii 7 cm and 17 cm. What is its capacitance?

- (A) $6.62 \times 10^{-12} \text{ F}$
- (B) $1.32 \times 10^{-11} \text{ F}$
- (C) $2.65 \times 10^{-11} \text{ F}$
- (D) $3.31 \times 10^{-12} \text{ F}$

Q26. The voltage across a parallel-plate capacitor is 352 V and the plate separation is 8 mm. What is the magnitude of the uniform electric field between the plates?

- (A) $4.4 \times 10^4 \text{ N/C}$
- (B) $2.2 \times 10^4 \text{ N/C}$
- (C) $8.8 \times 10^4 \text{ N/C}$
- (D) $1.76 \times 10^5 \text{ N/C}$

Q27. A parallel-plate capacitor has plates of area 129 cm^2 separated by 8 mm in vacuum. What is its capacitance?

- (A) $7.14 \times 10^{-12} \text{ F}$
- (B) $2.85 \times 10^{-11} \text{ F}$
- (C) $5.71 \times 10^{-11} \text{ F}$
- (D) $1.43 \times 10^{-11} \text{ F}$

Q28. A parallel-plate capacitor has capacitance 176 pF in vacuum. The gap is then completely filled with a dielectric of constant 2.5 while the plates remain isolated. What is the new capacitance?

- (A) 440 pF
- (B) 220 pF
- (C) 880 pF
- (D) 110 pF

Q29. Capacitors of $4 \mu\text{F}$ and $7 \mu\text{F}$ are connected in series. What is their equivalent capacitance?

- (A) $1.27 \mu\text{F}$
- (B) $5.09 \mu\text{F}$
- (C) $10.2 \mu\text{F}$
- (D) $2.55 \mu\text{F}$

Unit 11: Electric Circuits

Q30. A current of 4 A flows in a wire of cross-sectional area 2 mm^2 . The free-electron density is $8.5 \times 10^{28} \text{ m}^{-3}$. What is the drift speed of the electrons?

- (A) $7.35 \times 10^{-5} \text{ m/s}$
- (B) 0.000294 m/s
- (C) 0.000588 m/s
- (D) 0.000147 m/s

Q31. Resistors of $58\ \Omega$ and $85\ \Omega$ are connected in series across a $25\ \text{V}$ battery. What is the voltage across the $85\ \Omega$ resistor?

- (A) $14.9\ \text{V}$
- (B) $7.43\ \text{V}$
- (C) $29.7\ \text{V}$
- (D) $3.72\ \text{V}$

Q32. A current of $1\ \text{A}$ flows uniformly through a wire of cross-sectional area $1\ \text{mm}^2$. What is the current density in the wire?

- (A) $5 \times 10^5\ \text{A/m}^2$
- (B) $1 \times 10^6\ \text{A/m}^2$
- (C) $2 \times 10^6\ \text{A/m}^2$
- (D) $2.5 \times 10^5\ \text{A/m}^2$

Q33. A wire of resistivity $16.0 \times 10^{-8}\ \Omega\cdot\text{m}$ has length $4\ \text{m}$ and cross-sectional area $1.5\ \text{mm}^2$. What is its resistance?

- (A) $0.213\ \Omega$
- (B) $0.853\ \Omega$
- (C) $0.107\ \Omega$
- (D) $0.427\ \Omega$

Q34. Resistors of $59\ \Omega$, $117\ \Omega$ and $21\ \Omega$ are connected in series. What is their equivalent resistance?

- (A) $98.5\ \Omega$
- (B) $394\ \Omega$
- (C) $197\ \Omega$
- (D) $148\ \Omega$

Q35. Resistors of $60\ \Omega$ and $20\ \Omega$ are connected in parallel. What is their equivalent resistance?

- (A) $7.5\ \Omega$
- (B) $15\ \Omega$
- (C) $30\ \Omega$
- (D) $60\ \Omega$

Q36. A resistor of $47\ \Omega$ is connected across a $60\ \text{V}$ source. How much power is dissipated in the resistor?

- (A) $76.6\ \text{W}$
- (B) $38.3\ \text{W}$
- (C) $153\ \text{W}$
- (D) $19.1\ \text{W}$

Q37. A battery of emf $29\ \text{V}$ and internal resistance $4\ \Omega$ is connected to an external resistor of $26\ \Omega$. What is the current in the circuit?

- (A) $0.483\ \text{A}$
- (B) $0.967\ \text{A}$
- (C) $1.93\ \text{A}$
- (D) $3.87\ \text{A}$

Q38. A resistor of $32\text{ k}\Omega$ and a capacitor of $9\text{ }\mu\text{F}$ are connected in series. What is the time constant of this RC circuit?

- (A) 0.288 s
- (B) 0.144 s
- (C) 0.576 s
- (D) 0.072 s

Q39. An initially uncharged capacitor is connected in series with a $29\text{ k}\Omega$ resistor to a battery. The RC time constant is not given directly. How long after connection will the capacitor reach 75% of its maximum charge? The capacitance is $90\text{ }\mu\text{F}$.

- (A) 1.81 s
- (B) 3.62 s
- (C) 7.24 s
- (D) 0.905 s

Q40. A capacitor charged to 81 V discharges through a resistor. The RC time constant is 1 s . What is the voltage across the capacitor 0.5 s after discharge begins?

- (A) 24.6 V
- (B) 98.3 V
- (C) 49.1 V
- (D) 12.3 V

Q41. An uncharged capacitor is connected to a 58 V battery through a resistor. The RC time constant is 1.5 s . What is the voltage across the capacitor 2 s after connection?

- (A) 42.7 V
- (B) 21.4 V
- (C) 85.4 V
- (D) 10.7 V

Unit 12: Magnetic Fields and Electromagnetism

Q42. An electron (mass $9.11 \times 10^{-31}\text{ kg}$, charge $1.60 \times 10^{-19}\text{ C}$) moves perpendicular to a uniform magnetic field of 30 mT . What is the period of its circular motion?

- (A) $5.96 \times 10^{-10}\text{ s}$
- (B) $1.19 \times 10^{-9}\text{ s}$
- (C) $2.38 \times 10^{-9}\text{ s}$
- (D) $2.98 \times 10^{-10}\text{ s}$

Q43. Two long parallel wires 17 cm apart carry currents of 13 A and 14 A in the same direction. What is the magnitude of the magnetic force per unit length on either wire?

- (A) 0.000214 N/m
- (B) 0.000107 N/m
- (C) 0.000428 N/m
- (D) 0.000856 N/m

Q44. A rectangular loop of area 31 cm^2 has 50 turns and carries a current of 3 A in a uniform magnetic field of 47 mT. The angle between the loop's normal and the field is 45° . What is the magnitude of the torque on the loop?

- (A) $0.00773 \text{ N}\cdot\text{m}$
- (B) $0.0309 \text{ N}\cdot\text{m}$
- (C) $0.00386 \text{ N}\cdot\text{m}$
- (D) $0.0155 \text{ N}\cdot\text{m}$

Q45. A long solid cylindrical wire of radius 10 cm carries a current of 28 A uniformly distributed over its cross-section. What is the magnitude of the magnetic field inside the wire at a distance 6 cm from its axis?

- (A) $1.68 \times 10^{-5} \text{ T}$
- (B) $3.36 \times 10^{-5} \text{ T}$
- (C) $6.72 \times 10^{-5} \text{ T}$
- (D) 0.000134 T

Q46. A long straight wire carries a current of 16 A. What is the magnitude of the magnetic field 28 cm from the wire?

- (A) $5.71 \times 10^{-6} \text{ T}$
- (B) $2.29 \times 10^{-5} \text{ T}$
- (C) $4.57 \times 10^{-5} \text{ T}$
- (D) $1.14 \times 10^{-5} \text{ T}$

Q47. A circular loop of radius 13 cm has 20 turns and carries a current of 9 A. What is the magnitude of the magnetic field at the centre of the loop?

- (A) 0.00087 T
- (B) 0.000435 T
- (C) 0.00174 T
- (D) 0.000217 T

Q48. A solenoid of length 80 cm has 378 turns and carries a current of 1 A. What is the magnitude of the magnetic field inside the solenoid, away from its ends?

- (A) 0.000297 T
- (B) 0.00119 T
- (C) 0.00238 T
- (D) 0.000594 T

Q49. A straight wire of length 32 cm carries a current of 15 A in a uniform magnetic field of 51 mT. The angle between the wire and the field is 90° . What is the magnitude of the magnetic force on the wire?

- (A) 0.122 N
- (B) 0.245 N
- (C) 0.49 N
- (D) 0.0612 N

Q50. A proton (mass $1.67 \times 10^{-27} \text{ kg}$, charge $1.60 \times 10^{-19} \text{ C}$) moves at $4 \times 10^5 \text{ m/s}$ perpendicular to a uniform magnetic field of 31 mT. What is the radius of its circular path?

- (A) 0.0673 m
- (B) 0.269 m
- (C) 0.135 m
- (D) 0.539 m

Unit 13: Electromagnetic Induction

Q51. An inductor of 122 mH carries a current of 1 A. How much energy is stored in its magnetic field?

- (A) 0.0305 J
- (B) 0.122 J
- (C) 0.244 J
- (D) 0.061 J

Q52. An inductor of 94 mH is connected in series with a resistor of 45 Ω . What is the time constant of this LR circuit?

- (A) 0.00104 s
- (B) 0.00209 s
- (C) 0.00418 s
- (D) 0.000522 s

Q53. An LR circuit with time constant 2.5 s is connected to a 15 V battery through a 26 Ω resistor. What is the current 1.5 s after the switch is closed, starting from zero current?

- (A) 0.13 A
- (B) 0.521 A
- (C) 0.0651 A
- (D) 0.26 A

Q54. An inductor carrying an initial current of 1 A is disconnected from its battery and discharges through a resistor. The LR time constant is 1.5 s. What is the current 0.5 s after discharge begins?

- (A) 0.358 A
- (B) 1.43 A
- (C) 0.717 A
- (D) 2.87 A

Q55. An LC circuit consists of an inductor of 125 mH and a capacitor of 70 μF . What is the frequency of oscillation of the circuit?

- (A) 26.9 Hz
- (B) 53.8 Hz
- (C) 108 Hz
- (D) 13.5 Hz

Q56. A flat loop of area 136 cm^2 is placed in a uniform magnetic field of 30 mT. The angle between the field and the normal to the loop is 60°. What is the magnetic flux through the loop?

- (A) 0.000204 Wb
- (B) 0.000102 Wb
- (C) 0.000408 Wb
- (D) 5.1×10^{-5} Wb

Q57. A coil of 50 turns and area 55 cm^2 is perpendicular to a magnetic field that increases uniformly from 37 mT to 107 mT in 48 ms. What is the magnitude of the induced emf in the coil?

- (A) 0.201 V
- (B) 0.802 V
- (C) 0.401 V
- (D) 0.1 V

Q58. A conducting rod of length 85 cm moves at 1 m/s perpendicular to a uniform magnetic field of 38 mT, with its length perpendicular to both the velocity and the field. What is the motional emf between its ends?

- (A) 0.0161 V
- (B) 0.0646 V
- (C) 0.0323 V
- (D) 0.129 V

Q59. An emf of 0.5 V is induced in a coil of resistance 10Ω . What is the induced current in the loop?

- (A) 0.025 A
- (B) 0.1 A
- (C) 0.0125 A
- (D) 0.05 A

Q60. A solenoid has 1005 turns, a cross-sectional area of 64 cm^2 and a length of 26 cm. What is its self-inductance?

- (A) 0.0156 H
- (B) 0.0312 H
- (C) 0.0625 H
- (D) 0.00781 H

Answer Key

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

Worked explanations for all 60 questions:

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