

AP Physics C: Electricity and Magnetism Practice Test 8

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 $5\ \mu\text{C}$ and $5\ \mu\text{C}$ and are held $0.2\ \text{m}$ apart in a vacuum. What is the magnitude of the electrostatic force between them?

- (A) $5.619\ \text{N}$
- (B) $11.237\ \text{N}$
- (C) $2.809\ \text{N}$
- (D) $8.428\ \text{N}$

Q2. A point charge of $4\ \mu\text{C}$ is fixed in space. What is the magnitude of the electric field it produces at a point $0.3\ \text{m}$ away?

- (A) $7.99 \times 10^5\ \text{N/C}$
- (B) $4 \times 10^5\ \text{N/C}$
- (C) $2 \times 10^5\ \text{N/C}$
- (D) $5.99 \times 10^5\ \text{N/C}$

Q3. A closed Gaussian surface encloses a net charge of $16\ \mu\text{C}$. What is the total electric flux through the surface?

- (A) $3.62 \times 10^6\ \text{N}\cdot\text{m}^2/\text{C}$
- (B) $9.04 \times 10^5\ \text{N}\cdot\text{m}^2/\text{C}$
- (C) $1.81 \times 10^6\ \text{N}\cdot\text{m}^2/\text{C}$
- (D) $2.71 \times 10^6\ \text{N}\cdot\text{m}^2/\text{C}$

Q4. A solid conducting sphere of radius $0.25\ \text{m}$ carries a total charge of $5\ \mu\text{C}$ uniformly on its surface. What is the electric field magnitude at a point $0.4\ \text{m}$ from its centre?

- (A) $5.62 \times 10^5\ \text{N/C}$
- (B) $1.4 \times 10^5\ \text{N/C}$
- (C) $4.21 \times 10^5\ \text{N/C}$
- (D) $2.81 \times 10^5\ \text{N/C}$

Q5. A nonconducting sphere of radius $0.3\ \text{m}$ carries a total charge of $9\ \mu\text{C}$ uniformly distributed through its volume. What is the electric field magnitude at a point $0.15\ \text{m}$ from its centre?

- (A) $4.5 \times 10^5\ \text{N/C}$
- (B) $8.99 \times 10^5\ \text{N/C}$
- (C) $2.25 \times 10^5\ \text{N/C}$
- (D) $6.74 \times 10^5\ \text{N/C}$

Q6. An infinitely long straight wire carries a uniform linear charge density of $4\ \mu\text{C/m}$. What is the electric field magnitude at a perpendicular distance of $0.05\ \text{m}$ from the wire?

- (A) $2.88 \times 10^6\ \text{N/C}$
- (B) $1.44 \times 10^6\ \text{N/C}$
- (C) $7.19 \times 10^5\ \text{N/C}$
- (D) $2.16 \times 10^6\ \text{N/C}$

Q7. An infinite nonconducting sheet carries a uniform surface charge density of $7\ \mu\text{C/m}^2$. What is the electric field magnitude near the sheet, on either side?

- (A) $1.98 \times 10^5\ \text{N/C}$
- (B) $7.91 \times 10^5\ \text{N/C}$
- (C) $3.95 \times 10^5\ \text{N/C}$
- (D) $5.93 \times 10^5\ \text{N/C}$

Q8. A thin spherical shell of radius $0.3\ \text{m}$ carries a total charge of $6\ \mu\text{C}$ on its surface. What is the electric field magnitude at a point inside the shell, $0.2\ \text{m}$ from its centre?

- (A) $3.6 \times 10^6\ \text{N/C}$
- (B) $8.99 \times 10^5\ \text{N/C}$
- (C) $1.8 \times 10^6\ \text{N/C}$
- (D) $0\ \text{N/C}$

Q9. A thin rod of length $0.6\ \text{m}$ carries a uniform linear charge density of $6\ \mu\text{C/m}$. What is the electric field magnitude at a point on the rod's axis, $0.3\ \text{m}$ beyond one end of the rod?

- (A) $1.2 \times 10^5\ \text{N/C}$
- (B) $2.4 \times 10^5\ \text{N/C}$
- (C) $5.99 \times 10^4\ \text{N/C}$
- (D) $1.8 \times 10^5\ \text{N/C}$

Q10. Two point charges, $6\ \mu\text{C}$ and $5\ \mu\text{C}$, are fixed $0.4\ \text{m}$ apart on the x-axis. What is the magnitude of the net electric field at the midpoint between them?

- (A) $4.5 \times 10^5\ \text{N/C}$
- (B) $2.25 \times 10^5\ \text{N/C}$
- (C) $1.12 \times 10^5\ \text{N/C}$
- (D) $3.37 \times 10^5\ \text{N/C}$

Q11. Two large parallel sheets carry surface charge densities of $+8\ \mu\text{C/m}^2$ and $-4\ \mu\text{C/m}^2$. What is the electric field magnitude in the region between the sheets?

- (A) $3.39 \times 10^5\ \text{N/C}$
- (B) $1.36 \times 10^6\ \text{N/C}$
- (C) $6.78 \times 10^5\ \text{N/C}$
- (D) $1.02 \times 10^6\ \text{N/C}$

Q12. An electric dipole has dipole moment $3 \times 10^{-9}\ \text{C}\cdot\text{m}$. What is the approximate electric field magnitude on the dipole axis at a distance of $0.3\ \text{m}$ from its centre, far from the dipole?

- (A) $3995.556\ \text{N/C}$
- (B) $998.889\ \text{N/C}$
- (C) $2996.667\ \text{N/C}$
- (D) $1997.778\ \text{N/C}$

Unit 9: Electric Potential

Q13. What is the electric potential at a point 0.4 m from a point charge of 6 μC , taking the potential to be zero at infinity?

- (A) $1.35 \times 10^5 \text{ V}$
- (B) $2.7 \times 10^5 \text{ V}$
- (C) $6.74 \times 10^4 \text{ V}$
- (D) $2.02 \times 10^5 \text{ V}$

Q14. A charge of 5 μC is moved through a potential difference of 100 V. How much work is done by the electric field if the charge moves from the higher potential to the lower potential?

- (A) $1 \times 10^{-3} \text{ J}$
- (B) $5 \times 10^{-4} \text{ J}$
- (C) $2.5 \times 10^{-4} \text{ J}$
- (D) $-5 \times 10^{-4} \text{ J}$

Q15. A conducting sphere of radius 0.3 m carries a charge of 9 μC . What is the electric potential at its surface, with zero potential at infinity?

- (A) $1.35 \times 10^5 \text{ V}$
- (B) $5.39 \times 10^5 \text{ V}$
- (C) $2.7 \times 10^5 \text{ V}$
- (D) $4.05 \times 10^5 \text{ V}$

Q16. A thin rod of length 0.5 m carries a uniform linear charge density of 3 $\mu\text{C}/\text{m}$. What is the electric potential at a point on the rod's axis, 0.2 m beyond one end?

- (A) $6.76 \times 10^4 \text{ V}$
- (B) $1.69 \times 10^4 \text{ V}$
- (C) $5.07 \times 10^4 \text{ V}$
- (D) $3.38 \times 10^4 \text{ V}$

Q17. A ring of radius 0.2 m carries a total charge of 8 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) $1.61 \times 10^5 \text{ V}$
- (B) $3.22 \times 10^5 \text{ V}$
- (C) $8.04 \times 10^4 \text{ V}$
- (D) $2.41 \times 10^5 \text{ V}$

Q18. Two point charges of 2 μC and 4 μC are held 0.3 m apart. What is the electric potential energy of this pair?

- (A) 0.479 J
- (B) 0.24 J
- (C) 0.12 J
- (D) 0.36 J

Q19. In a region of space the electric potential varies as $V(x) = 30x^2 + 10$, where V is in volts and x is in metres. What is the x -component of the electric field at $x = 2$ m?

- (A) 120 V/m
- (B) -240 V/m
- (C) -120 V/m
- (D) -60 V/m

Q20. A thin conducting spherical shell of radius 0.15 m carries a charge of $9\text{ }\mu\text{C}$. What is the electric potential at a point inside the shell, halfway to its centre?

- (A) 1.08×10^6 V
- (B) 2.7×10^5 V
- (C) 8.09×10^5 V
- (D) 5.39×10^5 V

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

- (A) 2.81×10^4 V
- (B) 5.62×10^4 V
- (C) 1.4×10^4 V
- (D) 4.21×10^4 V

Unit 10: Conductors and Capacitors

Q22. A parallel-plate capacitor has plates of area 0.1 m^2 separated by 1 mm in air. What is its capacitance?

- (A) 1.77×10^{-9} F
- (B) 8.85×10^{-10} F
- (C) 4.42×10^{-10} F
- (D) 1.33×10^{-9} F

Q23. A capacitor of capacitance 60 pF is filled completely with a dielectric of dielectric constant 4, with no change in plate separation. What is the new capacitance?

- (A) 120 pF
- (B) 480 pF
- (C) 240 pF
- (D) 360 pF

Q24. A 40 pF capacitor is charged to 12 V. How much energy is stored in the capacitor?

- (A) 5.76×10^{-9} J
- (B) 1.44×10^{-9} J
- (C) 4.32×10^{-9} J
- (D) 2.88×10^{-9} J

Q25. Capacitors of $8\ \mu\text{F}$ and $8\ \mu\text{F}$ are connected in series. What is their equivalent capacitance?

- (A) $4 \times 10^6\ \mu\text{F}$
- (B) $2 \times 10^6\ \mu\text{F}$
- (C) $8 \times 10^6\ \mu\text{F}$
- (D) $6 \times 10^6\ \mu\text{F}$

Q26. Capacitors of $10\ \mu\text{F}$ and $14\ \mu\text{F}$ are connected in parallel across a $24\ \text{V}$ battery. What total charge is drawn from the battery?

- (A) $1.15 \times 10^{-3}\ \text{C}$
- (B) $5.76 \times 10^{-4}\ \text{C}$
- (C) $2.88 \times 10^{-4}\ \text{C}$
- (D) $8.64 \times 10^{-4}\ \text{C}$

Q27. The plates of a parallel-plate capacitor carry surface charge densities of magnitude $6\ \mu\text{C}/\text{m}^2$. What is the electric field magnitude between the plates?

- (A) $3.39 \times 10^5\ \text{N/C}$
- (B) $1.36 \times 10^6\ \text{N/C}$
- (C) $6.78 \times 10^5\ \text{N/C}$
- (D) $1.02 \times 10^6\ \text{N/C}$

Q28. A spherical capacitor consists of concentric conducting spheres of radii $0.05\ \text{m}$ and $0.2\ \text{m}$. What is its capacitance?

- (A) $1.48 \times 10^{-11}\ \text{F}$
- (B) $3.71 \times 10^{-12}\ \text{F}$
- (C) $1.11 \times 10^{-11}\ \text{F}$
- (D) $7.41 \times 10^{-12}\ \text{F}$

Q29. The electric field in a region of space has magnitude $3000\ \text{N/C}$. What is the electric energy density in that region?

- (A) $3.98 \times 10^{-5}\ \text{J/m}^3$
- (B) $1.99 \times 10^{-5}\ \text{J/m}^3$
- (C) $7.96 \times 10^{-5}\ \text{J/m}^3$
- (D) $5.97 \times 10^{-5}\ \text{J/m}^3$

Unit 11: Electric Circuits

Q30. A $48\ \text{V}$ battery is connected across a $6\ \Omega$ resistor. What current flows through the resistor?

- (A) $4\ \text{A}$
- (B) $8\ \text{A}$
- (C) $16\ \text{A}$
- (D) $12\ \text{A}$

Q31. Resistors of $20\ \Omega$ and $15\ \Omega$ are connected in parallel. What is their equivalent resistance?

- (A) $17.143\ \Omega$
- (B) $4.286\ \Omega$
- (C) $8.571\ \Omega$
- (D) $12.857\ \Omega$

Q32. A resistor of $24\ \Omega$ is connected across a $120\ \text{V}$ source. What power is dissipated in the resistor?

- (A) $1200\ \text{W}$
- (B) $300\ \text{W}$
- (C) $900\ \text{W}$
- (D) $600\ \text{W}$

Q33. A battery of emf $24\ \text{V}$ and internal resistance $1\ \Omega$ is connected to an external resistor of $8\ \Omega$. What is the terminal voltage of the battery?

- (A) $21.333\ \text{V}$
- (B) $42.667\ \text{V}$
- (C) $10.667\ \text{V}$
- (D) $32\ \text{V}$

Q34. An RC circuit has resistance $10000\ \Omega$ and capacitance $100\ \mu\text{F}$. What is its time constant?

- (A) $2\ \text{s}$
- (B) $1\ \text{s}$
- (C) $0.5\ \text{s}$
- (D) $1.5\ \text{s}$

Q35. A capacitor of $50\ \mu\text{F}$, initially uncharged, is connected in series with a $4000\ \Omega$ resistor across a $24\ \text{V}$ battery. What is the voltage across the capacitor after one time constant has elapsed?

- (A) $30.342\ \text{V}$
- (B) $7.585\ \text{V}$
- (C) $15.171\ \text{V}$
- (D) $22.756\ \text{V}$

Q36. A capacitor charged to $10\ \text{V}$ discharges through a $2000\ \Omega$ resistor. Its capacitance is $100\ \mu\text{F}$. What is the voltage across the capacitor after two time constants?

- (A) $2.707\ \text{V}$
- (B) $0.677\ \text{V}$
- (C) $2.03\ \text{V}$
- (D) $1.353\ \text{V}$

Q37. A capacitor discharges through a $2000\ \Omega$ resistor. Its capacitance is $50\ \mu\text{F}$. How long does it take for the charge on the capacitor to fall to 0.25 of its initial value?

- (A) $0.139\ \text{s}$
- (B) $0.277\ \text{s}$
- (C) $0.069\ \text{s}$
- (D) $0.208\ \text{s}$

Q38. A battery of emf $24\ \text{V}$ is connected in series with resistors of $10\ \Omega$ and $20\ \Omega$. What is the voltage across the $10\ \Omega$ resistor?

- (A) $4\ \text{V}$
- (B) $8\ \text{V}$
- (C) $16\ \text{V}$
- (D) $12\ \text{V}$

Q39. A current of 4 A flows through a resistor of $12\ \Omega$. What power is dissipated as heat in the resistor?

- (A) 96 W
- (B) 384 W
- (C) 192 W
- (D) 288 W

Q40. A total current of 9 A splits between two parallel resistors of $4\ \Omega$ and $12\ \Omega$. What current flows through the $4\ \Omega$ resistor?

- (A) 13.5 A
- (B) 3.375 A
- (C) 10.125 A
- (D) 6.75 A

Q41. A series RC circuit with resistance $12\ \Omega$ and capacitance $20\ \mu\text{F}$ is connected to a 12 V battery and left for a very long time. What is the final voltage across the capacitor?

- (A) 12 V
- (B) 6 V
- (C) 3 V
- (D) 24 V

Unit 12: Magnetic Fields and Electromagnetism

Q42. A particle of charge $2\ \mu\text{C}$ moves at 2000 m/s perpendicular to a uniform magnetic field of 0.2 T. What is the magnitude of the magnetic force on the particle?

- (A) $1.6 \times 10^{-3}\ \text{N}$
- (B) $8 \times 10^{-4}\ \text{N}$
- (C) $4 \times 10^{-4}\ \text{N}$
- (D) $1.2 \times 10^{-3}\ \text{N}$

Q43. A straight wire of length 0.2 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) 2 N
- (B) 0.5 N
- (C) 1 N
- (D) 1.5 N

Q44. A long straight wire carries a current of 5 A. What is the magnetic field magnitude at a distance of 0.05 m from the wire?

- (A) $4 \times 10^{-5}\ \text{T}$
- (B) $1 \times 10^{-5}\ \text{T}$
- (C) $3 \times 10^{-5}\ \text{T}$
- (D) $2 \times 10^{-5}\ \text{T}$

Q45. A circular loop of radius 0.2 m carries a current of 10 A. What is the magnetic field magnitude at the centre of the loop?

- (A) $3.14 \times 10^{-5} \text{ T}$
- (B) $6.28 \times 10^{-5} \text{ T}$
- (C) $1.57 \times 10^{-5} \text{ T}$
- (D) $4.71 \times 10^{-5} \text{ T}$

Q46. A solenoid has 800 turns per metre and carries a current of 3 A. What is the magnetic field magnitude inside the solenoid, far from its ends?

- (A) $6.03 \times 10^{-3} \text{ T}$
- (B) $3.02 \times 10^{-3} \text{ T}$
- (C) $1.51 \times 10^{-3} \text{ T}$
- (D) $4.52 \times 10^{-3} \text{ T}$

Q47. An electron (mass $9.11 \times 10^{-31} \text{ kg}$, charge magnitude $1.60 \times 10^{-19} \text{ C}$) moves at 4000000 m/s perpendicular to a uniform magnetic field of 0.015 T. What is the radius of its circular path?

- (A) $7.59 \times 10^{-4} \text{ m}$
- (B) $3.04 \times 10^{-3} \text{ m}$
- (C) $1.52 \times 10^{-3} \text{ m}$
- (D) $2.28 \times 10^{-3} \text{ m}$

Q48. A rectangular coil of 100 turns and area 0.02 m^2 carries a current of 3 A in a magnetic field of 0.5 T. What is the maximum torque on the coil?

- (A) 6 N·m
- (B) 1.5 N·m
- (C) 4.5 N·m
- (D) 3 N·m

Q49. In a velocity selector, a charged particle passes undeflected through crossed electric and magnetic fields of 500 V/m and 0.4 T. What is the speed of the particle?

- (A) 1250 m/s
- (B) 2500 m/s
- (C) 625 m/s
- (D) 1875 m/s

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

- (A) $4 \times 10^{-5} \text{ T}$
- (B) $2 \times 10^{-5} \text{ T}$
- (C) $1 \times 10^{-5} \text{ T}$
- (D) $3 \times 10^{-5} \text{ T}$

Unit 13: Electromagnetic Induction

Q51. A flat loop of area 0.02 m^2 lies perpendicular to a uniform magnetic field of 0.8 T . What is the magnetic flux through the loop?

- (A) 0.032 Wb
- (B) $8 \times 10^{-3} \text{ Wb}$
- (C) 0.016 Wb
- (D) 0.024 Wb

Q52. A coil of 100 turns and area 0.02 m^2 experiences a magnetic field change of 0.4 T in 0.1 s , with the field perpendicular to the coil. What is the magnitude of the induced emf?

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

Q53. A conducting rod of length 0.4 m moves at 4 m/s perpendicular to a uniform magnetic field of 0.8 T , sliding on conducting rails. What is the motional emf induced between the ends of the rod?

- (A) 1.28 V
- (B) 2.56 V
- (C) 0.64 V
- (D) 1.92 V

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

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

Q55. A solenoid has 1000 turns per metre, cross-sectional area 0.01 m^2 , and length 0.5 m . What is its self-inductance?

- (A) 0.013 H
- (B) $3.14 \times 10^{-3} \text{ H}$
- (C) $6.28 \times 10^{-3} \text{ H}$
- (D) $9.42 \times 10^{-3} \text{ H}$

Q56. An LR circuit has inductance 2 H and resistance 50Ω . What is its inductive time constant?

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

Q57. An inductor of 4 H carries a current of 2 A . How much energy is stored in its magnetic field?

- (A) 8 J
- (B) 16 J
- (C) 4 J
- (D) 12 J

Q58. An LC circuit has inductance 20 mH and capacitance 50 μ F. What is its natural frequency of oscillation?

- (A) 318.31 Hz
- (B) 159.155 Hz
- (C) 79.577 Hz
- (D) 238.732 Hz

Q59. A coil of 200 turns and area 0.02 m² 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) 160 V
- (B) 40 V
- (C) 80 V
- (D) 120 V

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

- (A) 189.737 V
- (B) 47.434 V
- (C) 142.302 V
- (D) 94.868 V

Answer Key

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

Worked explanations for all 60 questions:

quaidianpoint.com/ap-physics-c-electromagnetism-practice-test-8/ — plus 80 free AP Physics practice tests at QuaidianPoint.com.