

AP Physics 2 Practice Test 4

60 original multiple-choice questions covering all 7 AP Physics 2 units (Units 9–15). All questions are algebra-based (no calculus). 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 9: Thermodynamics

Q1. A sealed container holds 1 mol of helium in a volume of 50 L at a temperature of 354 K. What is the pressure of the gas? (Use $R = 8.31 \text{ J}/(\text{mol}\cdot\text{K})$.)

- (A) 117670 Pa
- (B) 29417 Pa
- (C) 88252 Pa
- (D) 58835 Pa

Q2. A weather balloon contains gas at constant pressure with an initial volume of 40 L at 360 K. The volume changes to 36 L. What is the new temperature of the gas?

- (A) 648 K
- (B) 324 K
- (C) 162 K
- (D) 486 K

Q3. A steam sample absorbs 300 J of heat while doing 100 J of work on its surroundings. What is the change in internal energy of the gas?

- (A) 200 J
- (B) 400 J
- (C) 100 J
- (D) 300 J

Q4. A gas expands at a constant pressure of 250 kPa, increasing its volume by 12 L. How much work is done by the gas?

- (A) 6000 J
- (B) 1500 J
- (C) 4500 J
- (D) 3000 J

Q5. A steel bolt of mass 2 kg is heated through a temperature rise of 10°C . The specific heat capacity of the material is $490 \text{ J}/(\text{kg}\cdot^\circ\text{C})$. How much heat is supplied?

- (A) 19600 J
- (B) 4900 J
- (C) 9800 J
- (D) 14700 J

Q6. A Carnot engine operates between a hot reservoir at 550 K and a cold reservoir at 350 K. What is its maximum possible efficiency?

- (A) 36.36 %
- (B) 54.55 %
- (C) 18.18 %
- (D) 63.64 %

Q7. A heat engine takes in 2000 J of heat in each cycle and rejects 1200 J to the cold reservoir. What is the efficiency of the engine?

- (A) 60 %
- (B) 80 %
- (C) 20 %
- (D) 40 %

Q8. A fixed volume of gas has a pressure of 120 kPa at 320 K. It is heated to 600 K at constant volume. What is its new pressure?

- (A) 450 kPa
- (B) 225 kPa
- (C) 112 kPa
- (D) 338 kPa

Q9. Two samples of the same liquid, of masses 3 kg at 80 °C and 1 kg at 10 °C, are mixed in an insulated container. What is the final temperature of the mixture? (Ignore heat loss.)

- (A) 62.5 °C
- (B) 45 °C
- (C) 70 °C
- (D) 93.75 °C

Unit 10: Electric Force, Field, and Potential

Q10. Two charged balls carry charges of 3 μC and 5 μC and are 15 cm apart in a vacuum. What is the magnitude of the electrostatic force between them? (Use $k = 9 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$.)

- (A) 12 N
- (B) 6 N
- (C) 3 N
- (D) 9 N

Q11. What is the magnitude of the electric field at a distance of 25 cm from a point charge of 4 μC in a vacuum? (Use $k = 9 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$.)

- (A) 1152000 N/C
- (B) 288000 N/C
- (C) 576000 N/C
- (D) 864000 N/C

Q12. Two parallel plates are 2 mm apart with a potential difference of 120 V between them. What is the magnitude of the uniform electric field between the plates?

- (A) 120000 N/C
- (B) 60000 N/C
- (C) 30000 N/C
- (D) 90000 N/C

Q13. What is the electric potential at a distance of 15 cm from a point charge of 6 μC in a vacuum? (Use $k = 9 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$.)

- (A) 360000 V
- (B) 720000 V
- (C) 180000 V
- (D) 540000 V

Q14. A charge of 20 μC is placed at a point where the electric potential is 300 V. What is its electric potential energy?

- (A) 0.012 J
- (B) 0.003 J
- (C) 0.009 J
- (D) 0.006 J

Q15. A charge of 4 μC is placed in a uniform electric field of strength 4000 N/C. What is the magnitude of the electric force on the charge?

- (A) 0.016 N
- (B) 0.032 N
- (C) 0.008 N
- (D) 0.024 N

Q16. A uniform electric field of 800 N/C points along a straight path of length 20 cm. What is the potential difference between the ends of the path?

- (A) 320 V
- (B) 160 V
- (C) 80 V
- (D) 240 V

Q17. A stationary charge of 2 μC is accelerated from rest through a potential difference of 400 V. What kinetic energy does it gain? (Ignore gravity.)

- (A) 0.0008 J
- (B) 0.0016 J
- (C) 0.0004 J
- (D) 0.0012 J

Q18. Two point charges exert a force of 48 N on each other. If the distance between them is doubled while everything else stays the same, what is the new force between them?

- (A) 24 N
- (B) 6 N
- (C) 12 N
- (D) 18 N

Unit 11: Electric Circuits

Q19. A torch bulb of resistance $12\ \Omega$ is connected across a $18\ \text{V}$ battery. What current flows through it? (Ignore internal resistance.)

- (A) $3\ \text{A}$
- (B) $0.75\ \text{A}$
- (C) $1.5\ \text{A}$
- (D) $2.25\ \text{A}$

Q20. Three resistors of $20\ \Omega$, $10\ \Omega$ and $20\ \Omega$ are connected in series. What is their combined resistance?

- (A) $100\ \Omega$
- (B) $25\ \Omega$
- (C) $50\ \Omega$
- (D) $75\ \Omega$

Q21. Resistors of $8\ \Omega$ and $8\ \Omega$ are connected in parallel. What is their combined resistance?

- (A) $4\ \Omega$
- (B) $8\ \Omega$
- (C) $2\ \Omega$
- (D) $6\ \Omega$

Q22. A kettle operates at $120\ \text{V}$ and draws a current of $4\ \text{A}$. What power does it use?

- (A) $480\ \text{W}$
- (B) $960\ \text{W}$
- (C) $240\ \text{W}$
- (D) $720\ \text{W}$

Q23. A oven rated at $1500\ \text{W}$ runs for 2 hours. How much electrical energy does it use, in kilowatt-hours?

- (A) $3\ \text{kWh}$
- (B) $6\ \text{kWh}$
- (C) $1.5\ \text{kWh}$
- (D) $4.5\ \text{kWh}$

Q24. A cell of emf $15\ \text{V}$ and internal resistance $2\ \Omega$ is connected to an external resistor of $14\ \Omega$. What current flows in the circuit?

- (A) $1.875\ \text{A}$
- (B) $0.46875\ \text{A}$
- (C) $1.406\ \text{A}$
- (D) $0.9375\ \text{A}$

Q25. In a parallel circuit, one branch of resistance $10\ \Omega$ is connected across a $36\ \text{V}$ supply. What current flows through that branch?

- (A) $7.2\ \text{A}$
- (B) $1.8\ \text{A}$
- (C) $5.4\ \text{A}$
- (D) $3.6\ \text{A}$

Q26. A wire has a resistance of $15\ \Omega$. If its length is doubled and its area is halved while the material and temperature stay the same, what is its new resistance?

- (A) $120\ \Omega$
- (B) $30\ \Omega$
- (C) $90\ \Omega$
- (D) $60\ \Omega$

Q27. Resistors of $12\ \Omega$ and $4\ \Omega$ are connected in parallel, and this combination is connected in series with a $8\ \Omega$ resistor. What is the total resistance of the circuit?

- (A) $22\ \Omega$
- (B) $11\ \Omega$
- (C) $5.5\ \Omega$
- (D) $16.5\ \Omega$

Unit 12: Magnetism and Electromagnetism

Q28. A charge of $8\ \mu\text{C}$ moves at $4000\ \text{m/s}$ perpendicular to a uniform magnetic field of $0.2\ \text{T}$. What is the magnitude of the magnetic force on the charge?

- (A) $0.0128\ \text{N}$
- (B) $0.0064\ \text{N}$
- (C) $0.0032\ \text{N}$
- (D) $0.0096\ \text{N}$

Q29. A straight wire of length $0.5\ \text{m}$ carries a current of $2\ \text{A}$ perpendicular to a uniform magnetic field of $0.8\ \text{T}$. What is the magnitude of the magnetic force on the wire?

- (A) $1.6\ \text{N}$
- (B) $0.8\ \text{N}$
- (C) $0.4\ \text{N}$
- (D) $1.2\ \text{N}$

Q30. A particle of mass $0.005\ \text{kg}$ and charge $0.25\ \text{C}$ moves at $30\ \text{m/s}$ perpendicular to a uniform magnetic field of $0.5\ \text{T}$. What is the radius of its circular path?

- (A) $2.4\ \text{m}$
- (B) $1.2\ \text{m}$
- (C) $0.6\ \text{m}$
- (D) $1.8\ \text{m}$

Q31. A long straight wire carries a current of $10\ \text{A}$. What is the magnitude of the magnetic field at a distance of $10\ \text{cm}$ from the wire?

- (A) $0.00004\ \text{T}$
- (B) $0.00002\ \text{T}$
- (C) $0.00001\ \text{T}$
- (D) $0.00003\ \text{T}$

Q32. A solenoid has 400 turns per metre and carries a current of 2 A. What is the magnetic field strength inside the solenoid, far from its ends? (Use $\mu_0 = 4\pi \times 10^{-7} \text{ T}\cdot\text{m/A}$.)

- (A) 0.002011 T
- (B) 0.000503 T
- (C) 0.001508 T
- (D) 0.001005 T

Q33. A flat loop of area 0.05 m^2 sits in a uniform magnetic field of 0.8 T, with the field making an angle of 60° with the normal to the loop. What is the magnetic flux through the loop?

- (A) 0.04 Wb
- (B) 0.02 Wb
- (C) 0.01 Wb
- (D) 0.03 Wb

Q34. A coil of 50 turns and area 0.1 m^2 experiences a magnetic field change of 0.2 T in 0.1 s, with the field perpendicular to the coil. What is the magnitude of the induced emf in the coil?

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

Q35. A conducting rod of length 2 m moves at 5 m/s perpendicular to a uniform magnetic field of 0.5 T, sliding on rails as in a motional emf setup. What is the induced emf across the rod?

- (A) 5 V
- (B) 10 V
- (C) 2.5 V
- (D) 7.5 V

Unit 13: Geometric Optics

Q36. An object is placed 60 cm in front of a concave mirror of focal length 30 cm. What is the image distance? (A positive value means a real image in front of the mirror.)

- (A) 120 cm
- (B) 30 cm
- (C) 60 cm
- (D) 90 cm

Q37. An object placed 50 cm from a mirror forms an image 25 cm from the mirror. What is the lateral magnification?

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

Q38. An object is placed 30 cm in front of a converging lens of focal length 15 cm. What is the image distance? (A positive value means a real image on the opposite side of the lens.)

- (A) 60 cm
- (B) 15 cm
- (C) 45 cm
- (D) 30 cm

Q39. A light ray in air ($n = 1$) strikes a glass block at an angle of incidence of 30° and refracts at an angle of 45° to the normal. What is the refractive index of the glass? (Use $\sin 30^\circ = 0.5$ and $\sin 45^\circ = 0.707$.)

- (A) 1.06
- (B) 1.41
- (C) 0.71
- (D) 0.35

Q40. Light inside a material of refractive index 1.5 strikes the boundary with air. What is the critical angle for total internal reflection?

- (A) 48.2°
- (B) 41.8°
- (C) 20.9°
- (D) 62.7°

Q41. Light travels at 200000000 m/s in a transparent solid. Taking the speed of light in a vacuum as 3×10^8 m/s, what is the refractive index of the solid?

- (A) 3
- (B) 0.75
- (C) 2.25
- (D) 1.5

Q42. A spherical mirror has a radius of curvature of 30 cm. What is its focal length?

- (A) 30 cm
- (B) 7.5 cm
- (C) 22.5 cm
- (D) 15 cm

Q43. An object is placed 10 cm in front of a converging lens of focal length 25 cm, inside the focal point. What is the image distance? (A negative value means a virtual image on the same side as the object.)

- (A) 16.667 cm
- (B) -33.333 cm
- (C) -8.333 cm
- (D) -16.667 cm

Unit 14: Waves, Sound, and Physical Optics

Q44. A wave has a frequency of 200 Hz and a wavelength of 1 m. What is its speed?

- (A) 400 m/s
- (B) 100 m/s
- (C) 300 m/s
- (D) 200 m/s

Q45. An oscillator completes one full cycle in 0.1 s. What is its frequency?

- (A) 20 Hz
- (B) 5 Hz
- (C) 10 Hz
- (D) 15 Hz

Q46. A sound source radiates 50 W uniformly in all directions. What is the sound intensity at a distance of 5 m from the source? (Use $\pi = 3.14$.)

- (A) 0.31831 W/m^2
- (B) 0.159155 W/m^2
- (C) 0.079577 W/m^2
- (D) 0.238732 W/m^2

Q47. A string of length 2 m, fixed at both ends, supports waves travelling at 300 m/s. What is the frequency of its 3th harmonic?

- (A) 450 Hz
- (B) 112 Hz
- (C) 338 Hz
- (D) 225 Hz

Q48. An air column of length 0.25 m, closed at one end, has a fundamental frequency given by $v \div 4L$ with $v = 343 \text{ m/s}$. What is its fundamental frequency?

- (A) 686 Hz
- (B) 172 Hz
- (C) 343 Hz
- (D) 514 Hz

Q49. Two tuning forks of frequencies 800 Hz and 808 Hz sound together. What is the beat frequency heard?

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

Q50. In a double-slit experiment, light of wavelength 650 nm passes through slits 0.2 mm apart, with a screen 2 m away. What is the distance from the central bright fringe to the first bright fringe on the screen?

- (A) 1.3 cm
- (B) 0.325 cm
- (C) 0.65 cm
- (D) 0.975 cm

- Q51. A siren emitting 600 Hz moves toward a stationary observer at 60 m/s. Taking the speed of sound as 343 m/s, what frequency does the observer hear?**
- (A) 511 Hz
 - (B) 727 Hz
 - (C) 600 Hz
 - (D) 873 Hz

Unit 15: Modern Physics

- Q52. What is the energy, in electron-volts, of a violet photon of wavelength 400 nm? (Use $hc = 1240 \text{ eV}\cdot\text{nm}$.)**
- (A) 3.1 eV
 - (B) 6.2 eV
 - (C) 1.55 eV
 - (D) 4.65 eV
- Q53. Light of photon energy 3 eV strikes a potassium surface whose work function is 1 eV. What is the maximum kinetic energy of an emitted photoelectron?**
- (A) 4 eV
 - (B) 1 eV
 - (C) 2 eV
 - (D) 3 eV
- Q54. An electron of mass $9.11 \times 10^{-31} \text{ kg}$ moves at 2000000 m/s. What is its de Broglie wavelength? (Use $h = 6.63 \times 10^{-34} \text{ J}\cdot\text{s}$.)**
- (A) 0.728 nm
 - (B) 0.182 nm
 - (C) 0.364 nm
 - (D) 0.546 nm
- Q55. What is the energy of a hydrogen atom in the $n = 4$ energy level? (Ground-state energy is -13.6 eV.)**
- (A) -54.4 eV
 - (B) -0.85 eV
 - (C) 0.85 eV
 - (D) -3.4 eV
- Q56. A hydrogen atom drops from the $n = 5$ level to the $n = 1$ level. What is the energy of the photon emitted?**
- (A) 13.06 eV
 - (B) 6.53 eV
 - (C) 26.11 eV
 - (D) 0.54 eV
- Q57. A nucleus has a mass defect of 0.01 u. What is its total binding energy in MeV? (1 u corresponds to 931.5 MeV.)**
- (A) 9.315 MeV
 - (B) 18.63 MeV
 - (C) 4.657 MeV
 - (D) 13.973 MeV

Q58. An cobalt-60 sample of mass 64 g decays through 3 half-lives. What mass remains?

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

Q59. A clock moving at $0.6c$ relative to an observer ticks with a proper time interval of 2 s between two events. What time interval does the stationary observer measure?

- (A) 1.6 s
- (B) 2 s
- (C) 2.5 s
- (D) 3.75 s

Q60. A rod of proper length 50 m moves at $0.8c$ relative to an observer. What length does the observer measure?

- (A) 30 m
- (B) 83.34 m
- (C) 50 m
- (D) 15 m

Answer Key

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

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