

AP Physics 2 Practice Test 12

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 reversible heat engine operates between a hot reservoir at 1000 K and a cold reservoir at 250 K. What is its maximum possible efficiency?

- (A) 75 %
- (B) 37.5 %
- (C) 25 %
- (D) 85 %

Q2. A heat engine takes in 1000 J of heat in one cycle and does 400 J of useful work. How much heat does it reject to the cold reservoir?

- (A) 1200 J
- (B) 300 J
- (C) 600 J
- (D) 1800 J

Q3. A gas at 200 kPa occupies 5 L at 600 K. Its pressure changes to 400 kPa and its volume changes to 2.5 L. What is its new temperature?

- (A) 600 K
- (B) 1200 K
- (C) 300 K
- (D) 1800 K

Q4. The average kinetic energy of the molecules of an ideal gas is doubled. By what factor does its absolute temperature change?

- (A) It halves
- (B) It increases by a factor of 4
- (C) It stays the same
- (D) It doubles

Q5. A closed laboratory flask holds 3 mol of an ideal gas at 400 K in a volume of 0.08 m^3 . What is the pressure of the gas? (Use $R = 8.31 \text{ J}/(\text{mol}\cdot\text{K})$.)

- (A) 124650 Pa
- (B) 249300 Pa
- (C) 62325 Pa
- (D) 373950 Pa

Q6. An ideal gas sample contains 4 mol at 273 K and a pressure of 150 kPa. What is its volume? (Use $R = 8.31 \text{ J}/(\text{mol}\cdot\text{K})$.)

- (A) 0.06 m^3
- (B) 0.12 m^3
- (C) 0.03 m^3
- (D) 0.18 m^3

Q7. A steam sample absorbs 1000 J of heat from its surroundings and does 250 J of work on its surroundings. What is the change in its internal energy?

- (A) 1500 J
- (B) 375 J
- (C) 2250 J
- (D) 750 J

Q8. A gas expands at a constant pressure of 400 kPa, increasing its volume by 0.03 m^3 . How much work does the gas do?

- (A) 24000 J
- (B) 12000 J
- (C) 6000 J
- (D) 36000 J

Q9. A 4 kg block of copper (specific heat capacity $390 \text{ J}/(\text{kg}\cdot\text{K})$) is heated so its temperature rises by 40 K. How much heat is supplied?

- (A) 124800 J
- (B) 31200 J
- (C) 187200 J
- (D) 62400 J

Unit 10: Electric Force, Field, and Potential

Q10. Two equal positive charges are fixed in place. At the midpoint between them, what is the electric field?

- (A) Zero
- (B) Twice the field of one charge
- (C) Half the field of one charge
- (D) Directed toward one of the charges

Q11. A charge of $5 \mu\text{C}$ sits at a point where the electric potential is 300 V. What is its electric potential energy?

- (A) $1.5 \times 10^{-3} \text{ J}$
- (B) $3 \times 10^{-3} \text{ J}$
- (C) $7.5 \times 10^{-4} \text{ J}$
- (D) $4.5 \times 10^{-3} \text{ J}$

Q12. Two small charged spheres carry charges of $6 \mu\text{C}$ and $8 \mu\text{C}$ and are 0.2 m apart in a vacuum. What is the magnitude of the electrostatic force between them? (Use $k = 9.0 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$.)

- (A) 21.6 N
- (B) 10.8 N
- (C) 5.4 N
- (D) 32.4 N

Q13. Both point charges are doubled, with their separation unchanged. By what factor does the electrostatic force change?

- (A) It becomes 2 times its original value
- (B) It becomes 8 times its original value
- (C) It becomes 4 times its original value
- (D) It stays the same

Q14. What is the magnitude of the electric field 0.1 m from a point charge of $20\ \mu\text{C}$ in a vacuum? (Use $k = 9.0 \times 10^9\ \text{N}\cdot\text{m}^2/\text{C}^2$.)

- (A) $3.6 \times 10^7\ \text{N/C}$
- (B) $1.8 \times 10^7\ \text{N/C}$
- (C) $9 \times 10^6\ \text{N/C}$
- (D) $5.4 \times 10^7\ \text{N/C}$

Q15. A small charge of $4\ \mu\text{C}$ is placed in a uniform electric field of $400\ \text{N/C}$. What is the magnitude of the electric force on the charge?

- (A) $3.2 \times 10^{-3}\ \text{N}$
- (B) $1.6 \times 10^{-3}\ \text{N}$
- (C) $8 \times 10^{-4}\ \text{N}$
- (D) $4.8 \times 10^{-3}\ \text{N}$

Q16. What is the electric potential 0.2 m from a point charge of $10\ \mu\text{C}$ in a vacuum? (Use $k = 9.0 \times 10^9\ \text{N}\cdot\text{m}^2/\text{C}^2$.)

- (A) 900000 V
- (B) 225000 V
- (C) 450000 V
- (D) $1.35 \times 10^6\ \text{V}$

Q17. Two point charges of $5\ \mu\text{C}$ and $4\ \mu\text{C}$ are 0.5 m apart in a vacuum. What is their electric potential energy? (Use $k = 9.0 \times 10^9\ \text{N}\cdot\text{m}^2/\text{C}^2$.)

- (A) 0.72 J
- (B) 0.36 J
- (C) 0.18 J
- (D) 1.08 J

Q18. A charge of $2\ \mu\text{C}$ is moved through a potential difference of 500 V. How much work is done by the electric field if the charge moves to a lower potential energy state by that full amount?

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

Unit 11: Electric Circuits

Q19. A potential difference of 60 V is applied across a resistor of $8\ \Omega$. What current flows through it?

- (A) 7.5 A
- (B) 15 A
- (C) 3.75 A
- (D) 22.5 A

Q20. Resistors of $5\ \Omega$, $2\ \Omega$, and $8\ \Omega$ are connected in series. What is their equivalent resistance?

- (A) $30\ \Omega$
- (B) $15\ \Omega$
- (C) $7.5\ \Omega$
- (D) $45\ \Omega$

Q21. Resistors of $12\ \Omega$ and $4\ \Omega$ are connected in parallel. What is their equivalent resistance?

- (A) $3\ \Omega$
- (B) $6\ \Omega$
- (C) $1.5\ \Omega$
- (D) $9\ \Omega$

Q22. A $18\ \Omega$ resistor has a potential difference of $60\ \text{V}$ across it. What power is dissipated in it?

- (A) $400\ \text{W}$
- (B) $100\ \text{W}$
- (C) $200\ \text{W}$
- (D) $600\ \text{W}$

Q23. Resistors of $6\ \Omega$ and $3\ \Omega$ are connected in parallel, and this combination is connected in series with a $4\ \Omega$ resistor. What is the equivalent resistance of the whole combination?

- (A) $6\ \Omega$
- (B) $12\ \Omega$
- (C) $3\ \Omega$
- (D) $18\ \Omega$

Q24. A capacitor of capacitance $10\ \mu\text{F}$ is connected across a $12\ \text{V}$ battery. What charge is stored on the capacitor?

- (A) $240\ \mu\text{C}$
- (B) $60\ \mu\text{C}$
- (C) $360\ \mu\text{C}$
- (D) $120\ \mu\text{C}$

Q25. A $5\ \mu\text{F}$ capacitor is charged to $50\ \text{V}$. How much energy is stored in it, in millijoules?

- (A) $12.5\ \text{mJ}$
- (B) $3.12\ \text{mJ}$
- (C) $6.25\ \text{mJ}$
- (D) $18.75\ \text{mJ}$

Q26. Capacitors of $10\ \mu\text{F}$ and $10\ \mu\text{F}$ are connected in series. What is their equivalent capacitance?

- (A) $5\ \mu\text{F}$
- (B) $10\ \mu\text{F}$
- (C) $2.5\ \mu\text{F}$
- (D) $15\ \mu\text{F}$

Q27. A 60 V battery is connected across resistors of $10\ \Omega$ and $4\ \Omega$ in series. What is the potential difference across the $10\ \Omega$ resistor?

- (A) 85.71 V
- (B) 21.43 V
- (C) 42.86 V
- (D) 128.57 V

Unit 12: Magnetism and Electromagnetism

Q28. A long solenoid has 800 turns per metre and carries a current of 5 A. What is the magnetic field strength inside the solenoid, in millitesla? (Use $\mu_0 = 4\pi \times 10^{-7}\ \text{T}\cdot\text{m/A}$.)

- (A) 10.05 mT
- (B) 2.51 mT
- (C) 5.03 mT
- (D) 15.08 mT

Q29. A long straight wire carries a current of 10 A. What is the magnetic field strength at a distance of 0.2 m from the wire, in microtesla? (Use $\mu_0 = 4\pi \times 10^{-7}\ \text{T}\cdot\text{m/A}$.)

- (A) $10\ \mu\text{T}$
- (B) $20\ \mu\text{T}$
- (C) $5\ \mu\text{T}$
- (D) $30\ \mu\text{T}$

Q30. A flat coil of area $0.04\ \text{m}^2$ sits in a uniform magnetic field of 0.2 T. The field makes an angle of 60° with the normal to the coil. What is the magnetic flux through the coil?

- (A) $8 \times 10^{-3}\ \text{Wb}$
- (B) $4 \times 10^{-3}\ \text{Wb}$
- (C) $2 \times 10^{-3}\ \text{Wb}$
- (D) $0.01\ \text{Wb}$

Q31. A coil with 10 turns experiences a change in magnetic flux of 0.2 Wb in 0.1 s. What is the magnitude of the induced emf in the coil?

- (A) 40 V
- (B) 10 V
- (C) 20 V
- (D) 60 V

Q32. A conducting rod of length 0.5 m moves at 2 m/s perpendicular to a uniform magnetic field of 1 T. What is the motional emf induced between its ends?

- (A) 2 V
- (B) 0.5 V
- (C) 1 V
- (D) 3 V

Q33. A rectangular coil with 50 turns, area 0.02 m^2 , carries 5 A in a magnetic field of 0.5 T. The angle in the torque formula is 30° . What is the magnitude of the magnetic torque on the coil?

- (A) $2.5 \text{ N}\cdot\text{m}$
- (B) $0.62 \text{ N}\cdot\text{m}$
- (C) $1.25 \text{ N}\cdot\text{m}$
- (D) $3.75 \text{ N}\cdot\text{m}$

Q34. A positively charged particle moves into a magnetic field directed into the page, travelling to the right. In which direction does the magnetic force initially act?

- (A) Downward
- (B) Into the page
- (C) Out of the page
- (D) Upward

Q35. The speed of a charged particle moving perpendicular to a magnetic field is doubled and the field strength is halved. By what factor does the magnetic force change?

- (A) It doubles
- (B) It stays the same
- (C) It halves
- (D) It becomes 4 times larger

Unit 13: Geometric Optics

Q36. Light travels at $2.25 \times 10^8 \text{ m/s}$ in a sample of clear plastic. What is the refractive index of the sample? (Use $c = 3.00 \times 10^8 \text{ m/s}$.)

- (A) 2.67
- (B) 0.67
- (C) 1.33
- (D) 4

Q37. A transparent material has refractive index 1.25. At what speed does light travel in it, in units of 10^8 m/s ? (Use $c = 3.00 \times 10^8 \text{ m/s}$.)

- (A) $4.8 \times 10^8 \text{ m/s}$
- (B) $1.2 \times 10^8 \text{ m/s}$
- (C) $7.2 \times 10^8 \text{ m/s}$
- (D) $2.4 \times 10^8 \text{ m/s}$

Q38. Light in a medium of refractive index 1.5 strikes the boundary with a medium of refractive index 1.33. What is $\sin$ of the critical angle for total internal reflection?

- (A) 0.44
- (B) 0.89
- (C) 0.11
- (D) 0.69

Q39. A spherical mirror has a radius of curvature of 64 cm. What is its focal length?

- (A) 64 cm
- (B) 32 cm
- (C) 16 cm
- (D) 96 cm

Q40. A converging lens of focal length 25 cm forms an image 50 cm from the lens. How far from the lens is the object?

- (A) 100 cm
- (B) 50 cm
- (C) 25 cm
- (D) 150 cm

Q41. A ray of light passes from air into water. What happens to its speed and wavelength?

- (A) Both increase
- (B) Speed decreases and wavelength increases
- (C) Speed increases and wavelength decreases
- (D) Both decrease

Q42. An object is placed 30 cm from a concave mirror of focal length 10 cm. What is the image distance?

- (A) 30 cm
- (B) 7.5 cm
- (C) 45 cm
- (D) 15 cm

Q43. An object is 20 cm from a mirror and its image forms 30 cm from the mirror. What is the lateral magnification?

- (A) -1.5
- (B) -3
- (C) -0.75
- (D) -4.5

Unit 14: Waves, Sound, and Physical Optics

Q44. A source emitting 600 Hz moves away from a stationary observer at 170 m/s. The speed of sound is 340 m/s. What frequency does the observer hear?

- (A) 800 Hz
- (B) 200 Hz
- (C) 1200 Hz
- (D) 400 Hz

Q45. A wave completes one full oscillation in 0.05 s. What is its frequency?

- (A) 20 Hz
- (B) 40 Hz
- (C) 10 Hz
- (D) 60 Hz

Q46. Light passes through a narrow single slit. What happens to the width of the central diffraction maximum if the slit is made narrower?

- (A) It becomes narrower
- (B) It stays the same
- (C) It becomes wider
- (D) It disappears

Q47. A pipe closed at one end has length 1.7 m and sound travels at 340 m/s inside it. What is the frequency of its third harmonic? (Only odd harmonics exist for this pipe.)

- (A) 300 Hz
- (B) 75 Hz
- (C) 150 Hz
- (D) 450 Hz

Q48. A wave has frequency 500 Hz and wavelength 1 m. What is its speed?

- (A) 500 m/s
- (B) 1000 m/s
- (C) 250 m/s
- (D) 1500 m/s

Q49. A string of length 0.75 m is fixed at both ends. Waves travel along it at 240 m/s. What is the frequency of its fourth harmonic?

- (A) 1280 Hz
- (B) 640 Hz
- (C) 320 Hz
- (D) 1920 Hz

Q50. An open pipe of length 0.85 m is filled with air in which sound travels at 340 m/s. What is its fundamental frequency?

- (A) 400 Hz
- (B) 100 Hz
- (C) 200 Hz
- (D) 600 Hz

Q51. Two tuning forks of frequencies 512 Hz and 516 Hz sound together. What is the beat frequency heard?

- (A) 8 Hz
- (B) 2 Hz
- (C) 12 Hz
- (D) 4 Hz

Unit 15: Modern Physics

Q52. A photon has energy 1.99×10^{-19} J. What is its frequency, in units of 10^{14} Hz? (Use $h = 6.63 \times 10^{-34}$ J·s.)

- (A) 6×10^{14} Hz
- (B) 3×10^{14} Hz
- (C) 1.5×10^{14} Hz
- (D) 9×10^{14} Hz

Q53. Light of frequency below the threshold frequency falls on a metal, even at very high intensity. How many photoelectrons are emitted?

- (A) A few with low kinetic energy
- (B) Many with high kinetic energy
- (C) One per photon regardless of frequency
- (D) None

Q54. A photon has frequency 4×10^{14} Hz. What is its energy? (Use $h = 6.63 \times 10^{-34}$ J·s.)

- (A) 5.3×10^{-19} J
- (B) 1.33×10^{-19} J
- (C) 7.96×10^{-19} J
- (D) 2.65×10^{-19} J

Q55. What is the energy of a photon of wavelength 600 nm? (Use $h = 6.63 \times 10^{-34}$ J·s and $c = 3.00 \times 10^8$ m/s.)

- (A) 6.63×10^{-19} J
- (B) 1.66×10^{-19} J
- (C) 9.94×10^{-19} J
- (D) 3.31×10^{-19} J

Q56. Light of photon energy 4.2 eV falls on a metal with work function 1.9 eV. What is the maximum kinetic energy of the emitted photoelectrons?

- (A) 2.3 eV
- (B) 4.6 eV
- (C) 1.15 eV
- (D) 6.9 eV

Q57. A particle has momentum 33.15×10^{-24} kg·m/s. What is its de Broglie wavelength, in units of 10^{-10} m? (Use $h = 6.63 \times 10^{-34}$ J·s.)

- (A) 0.4
- (B) 0.2
- (C) 0.1
- (D) 0.6

Q58. In the Bohr model, the energy of level n is $E_n = -13.6 \div n^2$ eV. What is the energy of level $n = 4$?

- (A) -1.7 eV
- (B) -0.42 eV
- (C) -2.55 eV
- (D) -0.85 eV

Q59. An electron in a hydrogen atom drops from level $n = 2$ to level $n = 1$. What is the energy of the photon emitted?

- (A) 20.4 eV
- (B) 5.1 eV
- (C) 30.6 eV
- (D) 10.2 eV

Q60. A radioactive sample initially has mass 160 g. After 3 half-lives, what mass remains undecayed?

- (A) 40 g
- (B) 10 g
- (C) 20 g
- (D) 60 g

Answer Key

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

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