

AP Physics 2 Practice Test 20

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. What is the internal energy of 4 mol of a monatomic ideal gas at 300 K? (Use $U = (3/2)nRT$ and $R = 8.31 \text{ J/mol}\cdot\text{K}$.)

- (A) 29916 J
- (B) 14958 J
- (C) 7479 J
- (D) 22437 J

Q2. A gas expands adiabatically and does 600 J of work on its surroundings. What is the change in its internal energy?

- (A) -1200 J
- (B) -600 J
- (C) -300 J
- (D) -900 J

Q3. A laboratory flask holds 3.5 mol of an ideal gas at 320 K in a volume of 0.03 m^3 . What is the pressure of the gas, in kPa? (Use $R = 8.31 \text{ J/mol}\cdot\text{K}$.)

- (A) 620.48 kPa
- (B) 310.24 kPa
- (C) 155.12 kPa
- (D) 465.36 kPa

Q4. 6 mol of an ideal gas at 350 K exerts a pressure of 200 kPa. What volume does the gas occupy? (Use $R = 8.31 \text{ J/mol}\cdot\text{K}$.)

- (A) 0.09 m^3
- (B) 0.17 m^3
- (C) 0.04 m^3
- (D) 0.13 m^3

Q5. An ideal gas sample of 5 mol in a 0.02 m^3 container exerts a pressure of 200 kPa. What is its temperature? (Use $R = 8.31 \text{ J/mol}\cdot\text{K}$.)

- (A) 192.54 K
- (B) 48.13 K
- (C) 144.4 K
- (D) 96.27 K

Q6. A 0.8 kg iron plate with specific heat capacity 385 J/kg·K is heated through 15 K. How much thermal energy is transferred to it?

- (A) 9240 J
- (B) 4620 J
- (C) 2310 J
- (D) 6930 J

Q7. 300 J of heat is added to a gas sample while it does 150 J of work on its surroundings. What is the change in its internal energy?

- (A) 150 J
- (B) 300 J
- (C) 75 J
- (D) 225 J

Q8. A gas expands at a constant pressure of 150 kPa, increasing its volume by 0.05 m³. How much work does the gas do?

- (A) 15000 J
- (B) 3750 J
- (C) 7500 J
- (D) 11250 J

Q9. A reversible heat engine operates between reservoirs at 800 K and 350 K. What is its maximum possible efficiency?

- (A) 112.5 %
- (B) 28.12 %
- (C) 56.25 %
- (D) 84.38 %

Unit 10: Electric Force, Field, and Potential

Q10. A charge of 2 μC is placed in a uniform electric field of 1000 N/C. What is the magnitude of the force on the charge, in mN?

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

Q11. What is the electric potential 40 cm from a point charge of 6 μC in a vacuum, taking potential at infinity as zero? (Use $k = 9.0 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$.)

- (A) 270000 V
- (B) 67500 V
- (C) 202500 V
- (D) 135000 V

Q12. How much work is done by an external agent moving a 4 μC charge through a potential difference of 400 V at constant speed? Give the answer in mJ.

- (A) 16 mJ
- (B) 0.16 mJ
- (C) 1.6 mJ
- (D) 3.2 mJ

Q13. The potential difference between two parallel plates 5 mm apart is 600 V. What is the magnitude of the uniform electric field between the plates?

- (A) 120000 N/C
- (B) 240000 N/C
- (C) 60000 N/C
- (D) 180000 N/C

Q14. Two point charges of 2 μC and 4 μC are held 20 cm apart. What is their electric potential energy? (Use $k = 9.0 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$, and take zero at infinity.)

- (A) 0.72 J
- (B) 0.18 J
- (C) 0.36 J
- (D) 0.54 J

Q15. A positively charged dust grain is placed in an electric field. In which direction does the electric force on it act?

- (A) Opposite to the field
- (B) Perpendicular to the field
- (C) In the direction of decreasing potential only
- (D) In the direction of the field

Q16. A alpha particle is moved slowly along a flat equipotential plane between parallel plates. How much work is done by the electric field?

- (A) Positive
- (B) Zero
- (C) Negative
- (D) Cannot be determined without the charge

Q17. The distance between two charged particles is halved while both charges stay the same. By what factor does the electrostatic force between them change?

- (A) It doubles
- (B) It halves
- (C) It becomes one-quarter as large
- (D) It becomes four times as large

Q18. Parallel plates 10 mm apart have a potential difference of 120 V. A 5 μC charge between them experiences what force magnitude?

- (A) 0.12 N
- (B) 0.03 N
- (C) 0.09 N
- (D) 0.06 N

Unit 11: Electric Circuits

Q19. Resistors of 12 Ω and 6 Ω are connected in parallel across a 12 V battery. What is the total current drawn from the battery?

- (A) 6 A
- (B) 1.5 A
- (C) 3 A
- (D) 4.5 A

Q20. A device operates at 48 V and draws 5 A. At what rate does it dissipate energy?

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

Q21. A current of 3 A flows through a $20\ \Omega$ resistor. How much power is dissipated as heat in the resistor?

- (A) 360 W
- (B) 180 W
- (C) 90 W
- (D) 270 W

Q22. A wire of length 25 m and cross-sectional area $2\ \text{mm}^2$ is made of a material of resistivity $2.8 \times 10^{-8}\ \Omega\cdot\text{m}$. What is the resistance of the wire?

- (A) $0.7\ \Omega$
- (B) $0.18\ \Omega$
- (C) $0.35\ \Omega$
- (D) $0.53\ \Omega$

Q23. A $20\ \mu\text{F}$ capacitor is connected across a 60 V battery. What charge is stored on each plate, in μC ?

- (A) $2400\ \mu\text{C}$
- (B) $600\ \mu\text{C}$
- (C) $1800\ \mu\text{C}$
- (D) $1200\ \mu\text{C}$

Q24. A $40\ \mu\text{F}$ capacitor charged to 20 V stores how much energy, in mJ?

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

Q25. Capacitors of $50\ \mu\text{F}$ and $30\ \mu\text{F}$ are connected in parallel across a 12 V battery. What total charge is stored, in μC ?

- (A) $1920\ \mu\text{C}$
- (B) $480\ \mu\text{C}$
- (C) $960\ \mu\text{C}$
- (D) $1440\ \mu\text{C}$

Q26. Capacitors of $10\ \mu\text{F}$ and $30\ \mu\text{F}$ are connected in series across a 36 V battery. What charge is stored on each capacitor, in μC ?

- (A) $540\ \mu\text{C}$
- (B) $135\ \mu\text{C}$
- (C) $270\ \mu\text{C}$
- (D) $405\ \mu\text{C}$

Q27. A circuit contains a $100\text{ k}\Omega$ resistor in series with a $10\text{ }\mu\text{F}$ capacitor. What is the time constant of the circuit?

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

Unit 12: Magnetism and Electromagnetism

Q28. A proton (mass $1.67 \times 10^{-27}\text{ kg}$, charge $1.6 \times 10^{-19}\text{ C}$) moves at $8 \times 10^5\text{ m/s}$ perpendicular to a uniform magnetic field of 0.25 T . What is the radius of its circular path, in mm?

- (A) 66.8 mm
- (B) 33.4 mm
- (C) 16.7 mm
- (D) 50.1 mm

Q29. The magnetic flux through a closed wire loop increases. According to Lenz's law, the induced current in the loop creates a magnetic field that:

- (A) opposes the increase in flux
- (B) opposes the decrease in flux
- (C) reinforces the change in flux
- (D) is zero

Q30. What is the magnetic field at the centre of a circular loop of radius 25 cm carrying a current of 4 A ?

- (A) $20.11\text{ }\mu\text{T}$
- (B) $10.05\text{ }\mu\text{T}$
- (C) $5.03\text{ }\mu\text{T}$
- (D) $15.08\text{ }\mu\text{T}$

Q31. Two long parallel cables carry currents in the opposite direction. The magnetic force between them is:

- (A) attractive
- (B) zero
- (C) perpendicular to both wires
- (D) repulsive

Q32. A $4\text{ }\mu\text{C}$ particle moves at $3 \times 10^4\text{ m/s}$ perpendicular to a magnetic field of 2.0 T . What is the magnitude of the magnetic force on it, in mN?

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

Q33. A straight wire of length 0.5 m carries a current of 5 A perpendicular to a uniform magnetic field of 0.5 T . What is the magnitude of the force on the wire?

- (A) 2.5 N
- (B) 0.62 N
- (C) 1.25 N
- (D) 1.88 N

Q34. What is the magnitude of the magnetic field 10 cm from a long straight wire carrying a current of 2 A?

- (A) $8\ \mu\text{T}$
- (B) $2\ \mu\text{T}$
- (C) $4\ \mu\text{T}$
- (D) $6\ \mu\text{T}$

Q35. A solenoid has 1000 turns per metre and carries a current of 4 A. What is the magnetic field inside the solenoid, in mT? (Use $\mu_0 = 4\pi \times 10^{-7}\ \text{T}\cdot\text{m/A}$.)

- (A) 10.05 mT
- (B) 2.51 mT
- (C) 7.54 mT
- (D) 5.03 mT

Unit 13: Geometric Optics

Q36. Total internal reflection at a diamond-air boundary can occur only when light travels:

- (A) from diamond to air at an angle above the critical angle
- (B) from air to diamond
- (C) at normal incidence
- (D) from diamond to air at any angle

Q37. An book stands 1.6 m in front of a plane mirror. How far behind the mirror does its image appear to be?

- (A) 1.6 m
- (B) 3.2 m
- (C) 0.8 m
- (D) 2.4 m

Q38. A concave lens of focal length -20 cm always forms an image that is:

- (A) real, inverted and magnified
- (B) virtual, inverted and magnified
- (C) real, upright and diminished
- (D) virtual, upright and diminished

Q39. A ray strikes a plane mirror at 20° to the normal. At what angle to the normal is the reflected ray?

- (A) 20 degrees
- (B) 40 degrees
- (C) 10 degrees
- (D) 30 degrees

Q40. An object is placed 45 cm in front of a concave mirror of focal length 18 cm. How far from the mirror is the image formed?

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

Q41. An object 15 cm in front of a concave mirror forms an image 30 cm from the mirror. What is the lateral magnification?

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

Q42. An object is placed 108 cm in front of a converging lens of focal length 36 cm. How far from the lens is the image formed?

- (A) 54 cm
- (B) 108 cm
- (C) 27 cm
- (D) 81 cm

Q43. A concave mirror has a radius of curvature of 36 cm. What is its focal length?

- (A) 36 cm
- (B) 9 cm
- (C) 27 cm
- (D) 18 cm

Unit 14: Waves, Sound, and Physical Optics

Q44. A wave has frequency 20 Hz and wavelength 1.2 m. What is its speed?

- (A) 48 m/s
- (B) 12 m/s
- (C) 24 m/s
- (D) 36 m/s

Q45. A oscillator completes one oscillation in 0.8 s. What is its frequency?

- (A) 2.5 Hz
- (B) 0.62 Hz
- (C) 1.25 Hz
- (D) 1.88 Hz

Q46. A string of length 0.5 m fixed at both ends supports waves travelling at 480 m/s. What is the frequency of its 3th harmonic?

- (A) 1440 Hz
- (B) 2880 Hz
- (C) 720 Hz
- (D) 2160 Hz

Q47. An open pipe of length 0.75 m resonates with sound waves travelling at 340 m/s. What is its fundamental frequency?

- (A) 226.67 Hz
- (B) 453.33 Hz
- (C) 113.33 Hz
- (D) 340 Hz

Q48. A pipe closed at one end has length 0.42 m. Sound travels at 340 m/s. What is its fundamental frequency?

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

Q49. Two tuning forks of frequencies 440 Hz and 448 Hz sound together. What is the beat frequency heard?

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

Q50. A source emitting 850 Hz moves towards a stationary observer at 17 m/s. Sound travels at 340 m/s. What frequency does the observer hear?

- (A) 894.74 Hz
- (B) 1789.47 Hz
- (C) 447.37 Hz
- (D) 1342.11 Hz

Q51. In a double-slit experiment, light of wavelength 500 nm passes through slits 0.5 mm apart, with a screen 2 m away. How far from the central maximum is the 1th bright fringe, in mm?

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

Unit 15: Modern Physics

Q52. Photoelectrons are emitted with maximum kinetic energy 2.5 eV. What stopping potential is needed to bring the fastest electrons to rest?

- (A) 2.5 V
- (B) 5 V
- (C) 1.25 V
- (D) 3.75 V

Q53. An electron (mass 9.11×10^{-31} kg) moves at 4×10^6 m/s. What is its de Broglie wavelength, in pm? (Use $h = 6.63 \times 10^{-34}$ J·s.)

- (A) 363.89 pm
- (B) 90.97 pm
- (C) 272.91 pm
- (D) 181.94 pm

Q54. A hydrogen atom transitions from energy level $n = 3$ to $n = 2$. What is the energy of the photon emitted, in eV? (Levels: $E_n = -13.6 \div n^2$ eV.)

- (A) 3.78 eV
- (B) 1.89 eV
- (C) 0.94 eV
- (D) 2.83 eV

- Q55. Calculate the energy of a hydrogen atom in level $n = 5$, in eV? (Use $E_n = -13.6 \div n^2$ eV.)**
- (A) -1.09 eV
(B) -0.27 eV
(C) 1.09 eV
(D) -0.54 eV
- Q56. A radioactive sample of mass 320 g has a half-life of one hour. How much of it remains undecayed after 4 hours?**
- (A) 40 g
(B) 20 g
(C) 10 g
(D) 30 g
- Q57. A fission reaction has a mass defect of 0.01 u. How much energy is released? (Use $1 \text{ u} = 931.5 \text{ MeV}/c^2$.)**
- (A) 18.63 MeV
(B) 4.66 MeV
(C) 13.97 MeV
(D) 9.31 MeV
- Q58. A caesium surface has work function 3.5 eV. What is its threshold frequency, in units of 10^{14} Hz? (Use $h = 6.63 \times 10^{-34} \text{ J}\cdot\text{s}$ and $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$.)**
- (A) $16.89 \times 10^{14} \text{ Hz}$
(B) $4.22 \times 10^{14} \text{ Hz}$
(C) $8.45 \times 10^{14} \text{ Hz}$
(D) $12.67 \times 10^{14} \text{ Hz}$
- Q59. The photoelectric effect is best explained if light behaves as:**
- (A) particles (photons)
(B) waves only
(C) a continuous fluid
(D) a magnetic field only
- Q60. According to the Heisenberg uncertainty principle, measuring a neutron's momentum more precisely necessarily:**
- (A) increases the uncertainty in its momentum
(B) decreases the uncertainty in the other quantity
(C) increases the uncertainty in its position
(D) leaves the other uncertainty unchanged

Answer Key

Q1: B	Q11: D	Q21: B	Q31: D	Q41: C	Q51: B
Q2: B	Q12: C	Q22: C	Q32: B	Q42: A	Q52: A
Q3: B	Q13: A	Q23: D	Q33: C	Q43: D	Q53: D
Q4: A	Q14: C	Q24: B	Q34: C	Q44: C	Q54: B
Q5: D	Q15: D	Q25: C	Q35: D	Q45: C	Q55: D

Q6: B	Q16: B	Q26: C	Q36: A	Q46: A	Q56: B
Q7: A	Q17: D	Q27: A	Q37: A	Q47: A	Q57: D
Q8: C	Q18: D	Q28: B	Q38: D	Q48: B	Q58: C
Q9: C	Q19: C	Q29: A	Q39: A	Q49: D	Q59: A
Q10: B	Q20: A	Q30: B	Q40: D	Q50: A	Q60: C

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