

JEE ADVANCED — QUESTION PAPER (Tough)

Physics · Chemistry · Mathematics | 3 Hours | Total: 186 Marks

Duration:	3 Hours	Max Marks:	186
Questions:	90 (30 per subject)	Date:	13 April 2026

Instructions:

- Section A: One or more correct options. Full marks +4 only if ALL correct options are chosen. -2 for wrong/partial.
- Section B: Single digit integer (0–9). +3 for correct, no negative marking.
- Section C: Single correct option from paragraph. +3 correct, -1 wrong.
- No calculator. Use blue/black pen only. Rough work in space provided.

PART — PHYSICS (Q 1–30)

SECTION A — One or More Correct Options | +4 Correct, -2 Partial/Wrong

Q1. A uniform rod of mass M and length L is hinged at one end and held horizontal. When released, which statement(s) are correct at the instant of release?

- A. Angular acceleration = $3g/(2L)$
- B. Linear acceleration of free end = $3g/2$
- C. Reaction at hinge is $Mg/4$ upward
- D. Torque about hinge = $MgL/2$

Q2. For a particle executing SHM: $x = A \sin(\omega t + \phi)$. Select all correct statements:

- A. KE is maximum when displacement is zero
- B. $PE = (1/2)m\omega^2 A^2 \cos^2(\omega t + \phi)$
- C. Total energy is independent of phase ϕ
- D. Velocity amplitude = $A\omega$

Q3. Two conducting spheres of radii r and $2r$ carry charges Q and $2Q$. They are connected by a wire. After equilibrium:

- A. Charge on sphere of radius r is Q
- B. Surface charge densities are equal
- C. Electric potential is same on both spheres
- D. Charge distributes in ratio 1:2 ($r : 2r$)

Q4. In Young's double slit experiment with light of wavelength λ , slit separation d , screen distance D . Which change(s) increase fringe width?

- A. Increasing λ
- B. Decreasing d
- C. Increasing D
- D. Immersing apparatus in water ($n=1.33$)

Q5. A photon of energy 5 eV hits a metal surface ($\phi = 3.5$ eV). Correct statements:

- A. Maximum KE of photoelectron = 1.5 eV
- B. Stopping potential = 1.5 V
- C. Doubling intensity doubles max KE
- D. de Broglie wavelength of electron = $h/\sqrt{(2mKE_{\max})}$

Q6. A charged particle moves in a uniform magnetic field B . Which statement(s) are true?

- A. Speed of the particle remains constant
- B. Magnetic force does no work
- C. Path is always a circle
- D. KE remains constant

Q7. For an ideal gas undergoing a reversible adiabatic process ($\gamma = 5/3$):

- A. $TV^{\gamma-1} = \text{constant}$
- B. $PV^{\gamma} = \text{constant}$
- C. Work done by gas = $-\Delta U$
- D. Entropy of gas increases

Q8. An LCR series circuit is at resonance. Select correct statement(s):

- A. Impedance equals resistance R
- B. Current is maximum
- C. Voltage across L and C individually may exceed source voltage
- D. Phase difference between V and I is 90°

Q9. In Bohr's model of hydrogen atom ($n=2$ to $n=1$ transition):

- A. Energy of emitted photon = 10.2 eV
- B. Wavelength ≈ 122 nm (Lyman series)
- C. Angular momentum changes by h/π
- D. Radius of orbit decreases by factor 4

Q10. A Carnot engine operates between 500 K and 300 K with efficiency η . If both temperatures are raised by 100 K, the new efficiency η' :

- A. $\eta' < \eta$
- B. $\eta' = \eta$
- C. Work output per cycle increases for same heat input
- D. $\eta = 40\%$ for original engine

SECTION B — Integer Answer Type (0–9) | +3 Correct, 0 Wrong

Q11. A ball is thrown vertically up with 20 m/s from the top of a 45 m high tower ($g = 10 \text{ m/s}^2$). Time (in seconds) taken to reach the ground is:

Answer: []

Q12. Two resistors 3Ω and 6Ω are in parallel, connected to a 9 V battery of internal resistance 1Ω . Current (in A) drawn from battery is:

Answer: []

Q13. A convex mirror of focal length 20 cm forms an image at 10 cm behind the mirror. Magnification ($\times 10$) of the image is: (answer the digit of $10\times$ magnification)

Answer: []

Q14. A wire of resistance 8Ω is stretched to double its length. New resistance ($\div 8$) is (give the integer multiplier, i.e., new $R = ? \times 8\Omega$):

Answer: []

Q15. Half-life of a radioactive substance is 3 years. Fraction remaining after 9 years is $1/N$. Find N :

Answer: []

Q16. A 2 kg block on a frictionless surface is attached to a spring ($k = 200 \text{ N/m}$). Amplitude of oscillation is 0.1 m. Maximum speed (in m/s) of block is:

Answer: []

Q17. In a nuclear reaction: $^{235}\text{U} + n \rightarrow ^{141}\text{Ba} + ^{92}\text{Kr} + xn$. Find x:

Answer: []

Q18. A ray of light passes from glass ($n=1.5$) to air. Critical angle (in degrees, rounded to nearest integer) is:

Answer: []

Q19. Current through a 40 W, 200 V bulb at rated conditions (in tenths of an ampere, i.e., answer = $10 \times I$):

Answer: []

Q20. A particle moves in a circle of radius 2 m with uniform speed 4 m/s. Centripetal acceleration (in m/s^2) is:

Answer: []

SECTION C — Paragraph Based, Single Correct | +3 Correct, -1 Wrong

Paragraph: A bullet of mass 10 g travelling at 300 m/s embeds itself in a wooden block of mass 490 g initially at rest on a frictionless surface. The combined system then compresses a spring ($k = 1000 \text{ N/m}$) attached to a wall.

Q21. Velocity of bullet-block system just after collision (m/s):

- A. 300
- B. 6
- C. 60
- D. 3

Paragraph: (Same system as Q21)

Q22. Maximum compression of the spring (in cm):

- A. $6\sqrt{3} \text{ cm}$
- B. $3\sqrt{2} \text{ cm}$
- C. $6\sqrt{(0.9)} \text{ cm}$
- D. $60\sqrt{(0.018)} \text{ cm} \approx 8.05 \text{ cm}$

Paragraph: An RLC circuit: $R = 10\Omega$, $L = 0.1 \text{ H}$, $C = 100 \mu\text{F}$, driven by $V = 100\sin(100t) \text{ V}$.

Q23. Resonant angular frequency ω_0 (rad/s) of the circuit:

- A. 100
- B. 200
- C. 1000
- D. 316

Paragraph: (Same RLC circuit as Q23)

Q24. At resonance, peak current through circuit (A):

- A. 100
- B. 10
- C. 1
- D. 0.1

Paragraph: A satellite orbits Earth at height $h = R$ (R = radius of Earth). g on surface = 10 m/s^2 .

Q25. Orbital speed of satellite (in km/s, approx):

- A. 5.6
- B. 7.9
- C. 11.2
- D. 3.2

Paragraph: (Same satellite as Q25)

Q26. Time period of the satellite (in hours, approx):

- A. 1.4
- B. 2.4
- C. 4.7
- D. 8.0

Paragraph: A biconvex lens ($n=1.5$) has radii of curvature $R_1=20$ cm and $R_2=30$ cm.

Q27. Focal length of the lens (in cm):

- A. 12
- B. 24
- C. 16
- D. 48

Paragraph: (Same lens as Q27). An object is placed 30 cm from the lens.

Q28. Position of image (in cm from lens):

- A. 24
- B. 48
- C. 16
- D. 60

Paragraph: In Millikan's oil drop experiment, a drop of mass 3.2×10^{-15} kg is held stationary in field $E = 10^5$ V/m. ($g = 10$ m/s²)

Q29. Charge on the drop (in units of $e = 1.6 \times 10^{-19}$ C):

- A. 1
- B. 2
- C. 3
- D. 4

Paragraph: A string of length 1 m, fixed at both ends, vibrates in 3rd harmonic. Speed of wave = 300 m/s.

Q30. Frequency of 3rd harmonic (Hz):

- A. 300
- B. 450
- C. 150
- D. 600

PART — CHEMISTRY (Q 31–60)

SECTION A — One or More Correct Options | +4 Correct, –2 Partial/Wrong

Q31. Which of the following pairs are correctly matched (compound : hybridisation)?

- A. BeCl_2 : sp
- B. BF_3 : sp^2
- C. PCl_5 : sp^3d
- D. SF_6 : sp^3d^2

Q32. For a first-order reaction $\text{A} \rightarrow \text{B}$, half-life $t_{1/2} = 10$ min. Correct statements:

- A. Rate constant $k = \ln 2/10 \text{ min}^{-1}$
- B. 75% of A decomposes in 20 min
- C. $t_{1/2}$ is independent of initial concentration
- D. $t_{3/4}$ (time for 75% decomposition) = 20 min

Q33. Which of the following undergo(es) Friedel-Crafts acylation?

- A. Benzene with $\text{CH}_3\text{COCl}/\text{AlCl}_3$
- B. Nitrobenzene with $\text{CH}_3\text{COCl}/\text{AlCl}_3$
- C. Toluene with $\text{CH}_3\text{COCl}/\text{AlCl}_3$
- D. Aniline with $\text{CH}_3\text{COCl}/\text{AlCl}_3$ (without protection)

Q34. Which of the following statements about d-block elements are correct?

- A. Zn, Cd, Hg are not true transition metals
- B. Cr has configuration $[\text{Ar}]3\text{d}^5 4\text{s}^1$
- C. The highest oxidation state of Mn is +7
- D. Cu^{2+} is more stable than Cu^+ in aqueous solution

Q35. For a galvanic cell: $\text{Zn}|\text{Zn}^{2+}(1\text{M})||\text{Cu}^{2+}(1\text{M})|\text{Cu}$, $E^\circ_{\text{cell}} = 1.10 \text{ V}$. Correct statements:

- A. Zn is the anode
- B. Standard EMF decreases with temperature
- C. $\Delta G^\circ = -nFE^\circ = -212.3 \text{ kJ/mol}$
- D. Equilibrium constant $K = e^{nFE^\circ/RT}$

Q36. Which of the following are nucleophiles?

- A. CN^-
- B. BF_3
- C. NH_3
- D. AlCl_3

Q37. Correct statements about colligative properties:

- A. Relative lowering of vapour pressure = mole fraction of solute
- B. Osmotic pressure $\pi = MRT$
- C. Elevation of boiling point depends on nature of solvent
- D. van't Hoff factor $i > 1$ for electrolytes

Q38. Which reactions produce a primary alcohol as major product?

- A. Reduction of formaldehyde with NaBH_4
- B. Hydroboration-oxidation of propene
- C. Acid-catalysed hydration of propene
- D. Grignard reagent + CO_2 then H_3O^+

Q39. Select correct statements about coordination compounds:

- A. $[\text{Co}(\text{NH}_3)_6]^{3+}$ is an inner orbital complex
- B. CFSE is larger for strong field ligands
- C. CN^- is a stronger field ligand than F^-
- D. Magnetic moment of $[\text{Fe}(\text{CN})_6]^{4-} \approx 0 \text{ BM}$

Q40. For the reaction: $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$, $\Delta H^\circ = -198 \text{ kJ}$. Which conditions favour SO_3 formation?

- A. High pressure
- B. Low temperature
- C. Use of V_2O_5 catalyst
- D. Removal of SO_3 as formed

SECTION B — Integer Answer Type (0–9) | +3 Correct, 0 Wrong

Q41. Number of lone pairs on the central atom in XeF_4 :

Answer: []

Q42. pH of 0.001 M HCl solution (strong acid, fully dissociated):

Answer: []

Q43. Oxidation state of S in H_2SO_4 :

Answer: []

Q44. Number of isomers of C_4H_{10} (butane including branched):

Answer: []

Q45. Atomicity of ozone (O_3):

Answer: []

Q46. Equivalent weight of H_2SO_4 (mol. wt = 98) in acid-base reactions (give mol.wt/n-factor):

Answer: []

Q47. Number of pi bonds in CO_2 :

Answer: []

Q48. Van't Hoff factor i for K_2SO_4 (assume complete dissociation):

Answer: []

Q49. Maximum oxidation state of Mn:

Answer: []

Q50. Number of electrons in 2p subshell of Ne (atomic number 10):

Answer: []

SECTION C — Paragraph Based, Single Correct | +3 Correct, –1 Wrong

Paragraph: Compound X (mol. formula C_3H_6O) gives silver mirror test, does not give iodoform test. On oxidation gives a carboxylic acid with same number of carbons.

Q51. Compound X is:

- A. Acetone
- B. Propanal
- C. Propan-1-ol
- D. Propan-2-ol

Paragraph: (Same compound X as Q51)

Q52. Product of Fehling's test with X:

- A. No reaction
- B. Red precipitate of Cu_2O
- C. White precipitate
- D. Blue precipitate

Paragraph: An electrochemical cell has $E^\circ_{cell} = 1.10$ V at $25^\circ C$. $n = 2$ electrons transferred. ($F = 96500$ C/mol, $R = 8.314$ J/mol·K)

Q53. ΔG° for the cell reaction (kJ/mol):

- A. -212.3
- B. +212.3
- C. -106.15
- D. -424.6

Paragraph: (Same cell as Q53)

Q54. Equilibrium constant K at $25^\circ C$ (approx, using $\log K = nE^\circ/0.0591$):

- A. 10^{17}
- B. 10^{37}
- C. 10^7
- D. 10^{27}

Paragraph: A solution contains 0.1 M CH_3COOH ($K_a = 1.8 \times 10^{-5}$).

Q55. Degree of dissociation α of acetic acid (approx):

- A. 1.34%
- B. 13.4%
- C. 0.134%
- D. 0.0134%

Paragraph: (Same solution as Q55)

Q56. pH of the solution (approx):

- A. 5.87
- B. 4.87
- C. 2.87
- D. 3.87

Paragraph: In the reaction: $CH_3Br + KOH(aq) \rightarrow \text{Product}$. The mechanism is SN_2 .

Q57. The stereochemical outcome of SN_2 on a chiral centre is:

- A. Retention
- B. Inversion (Walden inversion)
- C. Racemisation
- D. No stereo change

Paragraph: A gas occupies 5 L at 300 K and 2 atm. It is heated to 600 K at constant volume.

Q58. New pressure of the gas (atm):

- A. 1
- B. 2
- C. 4
- D. 8

Paragraph: Compound A ($\text{C}_6\text{H}_5\text{NH}_2$) is treated with NaNO_2/HCl at $0-5^\circ\text{C}$ followed by CuCN .

Q59. Final product is:

- A. $\text{C}_6\text{H}_5\text{CN}$
- B. $\text{C}_6\text{H}_5\text{OH}$
- C. $\text{C}_6\text{H}_5\text{Cl}$
- D. $\text{C}_6\text{H}_5\text{N}_2\text{Cl}$

Paragraph: For a reaction, $\Delta H = -100 \text{ kJ/mol}$ and $\Delta S = -200 \text{ J/mol}\cdot\text{K}$.

Q60. Temperature above which the reaction becomes non-spontaneous:

- A. 200 K
- B. 400 K
- C. 500 K
- D. 1000 K

PART — MATHEMATICS (Q 61–90)

SECTION A — One or More Correct Options | +4 Correct, –2 Partial/Wrong

Q61. Let $f(x) = x^3 - 3x$. Which statement(s) are correct?

- A. f has local maximum at $x = -1$
- B. f has local minimum at $x = 1$
- C. f is strictly increasing on $(-\infty, -1) \cup (1, \infty)$
- D. $f''(-1) < 0$

Q62. For vectors $\mathbf{a} = (1, 2, 3)$ and $\mathbf{b} = (2, 1, -1)$, select correct statement(s):

- A. $\mathbf{a} \cdot \mathbf{b} = 1$
- B. $|\mathbf{a} \times \mathbf{b}| = \sqrt{110}$
- C. $\mathbf{a}$ and $\mathbf{b}$ are perpendicular
- D. Projection of $\mathbf{a}$ on $\mathbf{b} = 1/\sqrt{6}$

Q63. The complex number z satisfies $|z-2| = |z-4|$. Correct statement(s):

- A. $\operatorname{Re}(z) = 3$ for all such z
- B. z lies on the perpendicular bisector of segment joining 2 and 4 on real axis
- C. z can be purely imaginary
- D. $|z|$ can take any non-negative value

Q64. Which of the following integrals converge?

- A. $\int_1^\infty 1/x^2 \, dx$
- B. $\int_1^1 1/\sqrt{x} \, dx$
- C. $\int_0^\infty 1/x \, dx$
- D. $\int_0^1 \ln(x) \, dx$

Q65. The equation of a circle passing through $(0,0)$, $(4,0)$, $(0,3)$:

- A. $x^2 + y^2 - 4x - 3y = 0$
- B. Centre at $(2, 3/2)$
- C. Radius = $5/2$
- D. The circle also passes through $(4,3)$

Q66. For the matrix $A = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$, correct statements include:

- A. Eigenvalues are 1 and 3
- B. $\det(A) = 3$
- C. A is positive definite
- D. $\operatorname{Trace}(A) = 4$

Q67. Which of the following are correct for the parabola $y^2 = 12x$?

- A. Focus is at $(3, 0)$
- B. Directrix is $x = -3$
- C. Length of latus rectum = 12
- D. Vertex is at origin

Q68. The probability of getting exactly 2 heads in 5 fair coin tosses:

- A. $P = C(5,2) \times (1/2)^5$
- B. $P = 10/32$
- C. $P = 5/16$
- D. $P = 3/8$

Q69. For the differential equation $dy/dx = y/x$ with $y(1) = 2$:

- A. Solution is $y = cx$ where c is constant
- B. Particular solution is $y = 2x$
- C. The equation is homogeneous
- D. $y(2) = 4$

Q70. Let $f(x) = \sin(x)/x$ for $x \neq 0$. Correct statements:

- A. $\lim_{x \rightarrow 0} f(x) = 1$
- B. f is continuous at $x=0$ if $f(0)=1$ is defined
- C. f is differentiable at $x=0$
- D. f is an even function

SECTION B — Integer Answer Type (0–9) | +3 Correct, 0 Wrong

Q71. Number of real roots of $x^4 - 5x^2 + 4 = 0$:

Answer: []

Q72. If ${}^nC_2 = 21$, find n :

Answer: []

Q73. The value of $\sin(75^\circ) + \cos(75^\circ)$ expressed as $\sqrt{N}/2$. Find N :

Answer: []

Q74. Number of terms in the expansion of $(x+y+z)^5$:

Answer: []

Q75. Area (in sq units) of triangle with vertices $(0,0)$, $(4,0)$, $(0,3)$:

Answer: []

Q76. If $\log_2 8 = x$, find x :

Answer: []

Q77. Sum of first 10 terms of AP: 2, 5, 8, ... is:

Answer: []

Q78. Value of $|\det([[1,2], [3,4]])|$:

Answer: []

Q79. Number of onto functions from $\{1,2,3\}$ to $\{a,b\}$ (surjective):

Answer: []

Q80. Remainder when 7^{100} is divided by 5:

Answer: []

SECTION C — Paragraph Based, Single Correct | +3 Correct, –1 Wrong

Paragraph: Let $f(x) = x^3 + px + q$. It is given that $f(x) = 0$ has repeated roots.

Q81. The condition for repeated roots is:

- A. $4p^3 + 27q^2 = 0$
- B. $p^2 + 4q = 0$
- C. $p + q = 0$
- D. $p^3 = q^2$

Paragraph: (Continued from Q81). For the cubic $f(x) = x^3 - 3x + 2$.

Q82. The roots of $f(x) = 0$ are:

- A. 1, 1, -2
- B. -1, -1, 2
- C. 1, 2, -3
- D. -1, 2, -1

Paragraph: An ellipse has equation $x^2/16 + y^2/9 = 1$.

Q83. Eccentricity of the ellipse:

- A. $\sqrt{7}/4$
- B. $\sqrt{7}/3$
- C. $3/4$
- D. $4/3$

Paragraph: (Same ellipse as Q83)

Q84. Length of latus rectum of the ellipse:

- A. $9/2$
- B. $9/4$
- C. 9
- D. $9/8$

Paragraph: A bag contains 3 red and 4 blue balls. Two balls are drawn without replacement.

Q85. Probability both balls are red:

- A. $1/7$
- B. $3/21$
- C. $9/49$
- D. $1/6$

Paragraph: (Same bag as Q85)

Q86. Probability at least one ball is blue:

- A. $6/7$
- B. $5/7$
- C. $4/7$
- D. $3/7$

Paragraph: The line L passes through (1,2,3) and is parallel to vector (2,-1,1). The plane P: $2x - y + z = 5$.

Q87. Point where line L meets plane P:

- A. (3,1,4)
- B. (1,2,3)
- C. (5,0,5)
- D. (2,1,2)

Paragraph: (Same line L as Q87)

Q88. Angle between line L and plane P (approx):

- A. 0°
- B. 30°
- C. 90°
- D. 45°

Paragraph: Using integration: $\int_0^\pi x \cdot \sin(x) \, dx$

Q89. Value of the integral:

- A. 0
- B. π
- C. 2π
- D. 1

Paragraph: The number of ways to arrange 5 distinct books on a shelf such that a specific book is always in the middle.

Q90. Number of arrangements:

- A. 24
- B. 48
- C. 120
- D. 60