MHT CET 2023 Mathematics Answer Key PDF

Answer Key

Mathematics

Question 1 -Option- (D) 8
Explanation: Characteristic equation of A A is A 2 8 A + 15 I = 0 0.5 A + 7.5 A 1 = 4 I A 2 8A+15I=00.5A+7.5A 1 =4I , so + = 8 +=8 . code Code

Question 2 -Option- (B) $k = 0$ or $k = -3$
Explanation: Setting the coplanarity determinant of direction vectors and the difference vector to zero yields $k^2 + 3k = 0$.

Question 3 -Option- (A) 833
Explanation: The variance of the first n even natural numbers is given by $\sigma^2 = \frac{n^2-1}{3} = \frac{2499}{3} = 833$.

Question 4 -Option- (D) p
Explanation: Using logical distribution laws, $[p \wedge (q \vee r)] \vee [p \wedge \sim (q \vee r)] = p \wedge T = p$.

Question 5 -Option- (D) $-\frac{1}{14}$
Explanation: Solving the functional equation gives $f(x) = \frac{8x-6/x+10}{28}$, whose derivative at $x = -1$ is $-1/14$.

Question 6 -Option- (B) $5 \times 6!$
Explanation: Total circular permutations minus arrangements where B_1, G_1 are together is $7! - 2(6!) = 5(6!)$.

Question 7 -Option- (B) $\frac{6}{17}$
Explanation: Let $\theta = \csc^{-1}(5/3) = \tan^{-1}(3/4)$, then $\cot(\tan^{-1}(3/4) + \tan^{-1}(2/3)) = 6/17$.

Question 8 -Option- (D) $xe^{x+\frac{1}{x}} + c$
Explanation: Differentiating $xe^{x+1/x}$ directly yields the integrand $(1 + x - 1/x)e^{x+1/x}$ by the product rule.

Question 9 -Option- (C) decreasing on $(0, \infty)$
Explanation: The derivative $f'(x)$ is strictly negative for all $x > 0$ since $\pi > e$.

Question 10 -Option- (D) $-\frac{8}{9}\pi^2$
Explanation: The linear differential equation yields $y \sin x = 2x^2 - \frac{\pi^2}{2}$, which at $x = \pi/6$ gives $-8\pi^2/9$.

Question 11 -Option- (C) $\frac{1}{b^3}[a + bx - 2a \log|a + bx| - \frac{a^2}{a+bx}] + c$
Explanation: Using substitution $u = a + bx$ simplifies the integral to standard logarithmic and algebraic parts.

Question 12 -Option- (C) 5
Explanation: Projection of $\bar{a}$ on $\bar{c}$ gives $\alpha = 2$ and $\bar{b} \times \bar{c}$ gives $\beta = 1$. Hence, $2\alpha + \beta = 5$.

Question 13 -Option- (D) 3 : 1
Explanation: Using $(m_1 - m_2)^2 = (m_1 + m_2)^2 - 4m_1m_2$ and $4ab = 3h^2$ yields the slope ratio 3 : 1.

Question 14 -Option- (D) $-1/2$
Explanation: Equating the sine and cosine forms yields $\frac{1}{\sqrt{1+(x+1)^2}} = \frac{1}{\sqrt{1+x^2}} \implies x = -1/2$.

Question 15 -Option- (A) $1/10$
Explanation: The sum of probabilities must equal 1, yielding $10p^2 + 9p - 1 = 0 \implies p = 1/10$.

Question 16 -Option- (A) 0.1
Explanation: Since $P(\text{exactly one}) = P(A \cup B) - P(A \cap B)$, we get $P(A \cap B) = 0.5 - 0.4 = 0.1$.

Question 17 -Option- (D) 91
Explanation: Expanding the complex cube yields $x = -198$ and $y = -107$, so $y - x = 91$.

Question 18 -Option- (A) $x + 2y \leq 6, 5x + 3y \geq 15, x \leq 7, y \leq 6, y \geq 0$
Explanation: These linear inequalities correctly bound the given shaded feasible region on the coordinate plane.

Question 19 -Option- (A) $9p^2 = 4q^2$
Explanation: Perpendicularity of the internal and external division vectors $\bar{r} \cdot \bar{s} = 0$ yields $9p^2 = 4q^2$.

Question 20 -Option- (B) $1/\sqrt{3}$
Explanation: Volume $V = a^3 - a + 1$. Minimizing by setting $dV/da = 3a^2 - 1 = 0$ yields $a = 1/\sqrt{3}$.

Question 21 -Option- (B) 3.0009
Explanation: Linear approximation using $f(x) \approx f(x_0) + f'(x_0)\Delta x$ yields $3 + \frac{2\log_{10} e}{1000} \approx 3.0009$.

Question 22 -Option- (A) a
Explanation: The sum of the coordinate axes intercepts made by any tangent to the curve is constant and equal to a.

Question 23 -Option- (B) $\sqrt{3} : (2 + \sqrt{3})$
Explanation: The angles are $120°, 30°, 30°$. By the sine rule, the side-to-perimeter ratio is $\sqrt{3} : (2 + \sqrt{3})$.

Question 24 -Option- (D) is a singleton set
Explanation: The equation simplifies to $6x^2 + 5x - 1 = 0$, giving $x = 1/6$ as the only valid positive solution.

Question 25 -Option- (D) $23/\sqrt{17}$
Explanation: Substituting $(13, 32)$ into $x/c + y/3 = 1$ yields parameters to find the parallel distance.

Question 26 -Option- (A) $-1/2$
Explanation: The logarithmic term is odd (integrates to 0), and the greatest integer function $[x]$ integrates to $-1/2$.

Question 27 -Option- (C) 2
Explanation: Using $g'(1) = 1/f'(0)$ since $f(0) = 1$, we differentiate to find $f'(0) = 1/2$, so $g'(1) = 2$.

Question 28 -Option- (C) $x = 2r$
Explanation: Minimizing total area $A = x^2 + \pi r^2$ subject to constraint $4x + 2\pi r = 2$ yields $x = 2r$.

Question 29 -Option- (B) $\frac{-\hat{i}-7\hat{j}+5\hat{k}}{5\sqrt{3}}$
Explanation: The normalized cross product of the two direction vectors $(3, 1, 2) \times (1, 2, 3)$ yields this unit vector.

Question 30 -Option- (A) 88
Explanation: Midpoint and perpendicularity conditions for the point and its image yield $a = -56, b = -32 \implies |a + b| = 88$.

Question 31 -Option- (B) $23/36$
Explanation: Summing probabilities to 1 yields $k = 1/6$, so $P(X > 2) = 3k + 5k^2 = 23/36$.

Question 32 -Option- (C) two
Explanation: The coplanarity determinant simplifies to $-\lambda^6 + 3\lambda^2 + 2 = 0$, yielding $\lambda = \pm\sqrt{2}$.

Question 33 -Option- (D) $2f(x)$
Explanation: Substituting $\frac{2x}{1+x^2}$ into the logarithmic function yields $\log\left(\frac{1-x}{1+x}\right)^2 = 2f(x)$.

Question 34 -Option- (A) 0
Explanation: The cross product of the plane normal vectors is zero, indicating that the planes are parallel/coincident.

Question 35 -Option- (C) $e^{\sin\theta}(\log\sin\theta - \csc\theta) + c$
Explanation: Using substitution $t = \sin\theta$ simplifies the integral to the standard form $\int e^t(f(t) + f'(t))dt$.

Question 36 -Option- (A) $x^2 + y^2 - 6x - 8y + 9 = 0$
Explanation: Perpendicular distance from $(3, 4)$ to $5x + 12y - 11 = 0$ is $R = 4$. Equation is $(x-3)^2 + (y-4)^2 = 16$.

Question 37 -Option- (D) $2\sqrt{2}$ units
Explanation: The plane equation is $x + y + 1 = 0$. Perpendicular distance from $(1, 2, 2)$ is $4/\sqrt{2} = 2\sqrt{2}$.

Question 38 -Option- (C) 4
Explanation: Converting to sine and cosine yields $\frac{2\sin(60°-20°)}{\frac{1}{2}\sin 40°} = 4$.

Question 39 -Option- (A) $\pi/6$
Explanation: Vector expansion of $\bar{a} \times (\bar{a} \times \bar{c}) + \bar{b} = 0$ yields $\bar{a} \cdot \bar{c} = \sqrt{3}$, so $\theta = \pi/6$.

Question 40 -Option- (A) $1/\sqrt{3}$
Explanation: Area is given by $\frac{1}{3a^2} = 1$. Since $a > 0$, this yields $a = 1/\sqrt{3}$.

Question 41 -Option- (B) $\frac{1}{3}(\tan x - \cot x)^3 + c$
Explanation: Let $u = \tan x - \cot x$ to simplify the integrand directly via substitution.

Question 42 -Option- (B) 4
Explanation: Maximizing $P = (3 - y)y^2$ by setting $dP/dy = 6y - 3y^2 = 0$ yields maximum $P = 4$ at $y = 2$.

Question 43 -Option- (C) $x\log|y| = 2(x - 1)$
Explanation: Integrating yields $\log|y| = -2/x + c$. Substituting the center $(1, 1)$ gives $c = 2$.

Question 44 -Option- (B) $\frac{n(n+1)(2n+1)}{6}$
Explanation: Taking the logarithm and differentiating at $x = 0$ yields a sum of squares of integers.

Question 45 -Option- (D) $11/3^5$
Explanation: Binomial probability of 4 or 5 correct answers is ${}^5C_4(1/3)^4(2/3) + {}^5C_5(1/3)^5 = 11/3^5$.

Question 46 -Option- (A) $\frac{2\log 10}{\log 2}$
Explanation: Using decay $x = x_0(1/2)^t$, setting $x = 0.01x_0$ yields $t = \frac{\log 100}{\log 2} = \frac{2\log 10}{\log 2}$.

Question 47 -Option- (A) 2
Explanation: Simplifying the limit using standard trigonometric approximations as $x \to 0$ leads directly to 2.

Question 48 -Option- (C) $(\sqrt{2}, 1 - \sqrt{3})$
Explanation: Continuity at boundary points $x = 1$ and $x = \sqrt{2}$ yields $a = \sqrt{2}$ and $b = 1 - \sqrt{3}$.

Question 49 -Option- (C) T, F, T
Explanation: For the implication to be false, the antecedent must be true and consequent false, meaning $p = T, q = F, r = T$.

Question 50 -Option- (C) $7/\sqrt{3}$
Explanation: Using the cosine rule yields $a = 7$. Thus, the circumradius $R = \frac{a}{2\sin A} = 7/\sqrt{3}$.

Chemistry

Question 51 -Option- (C) 868 nm
Explanation: Wavelength is the reciprocal of the wave number: = 1 11516 cm 868 nm = 11516 1 cm868 nm .

Question 52 -Option- (A) 1/8
Explanation: After 3 half-lives, the remaining fraction of a first-order reactant is $(1/2)^3 = 1/8$.

Question 53 -Option- (D) p-Benzoquinone
Explanation: Oxidation of phenol with chromic acid (CrO_3) yields the conjugated diketone para-benzoquinone.

Question 54 -Option- (C) 534 mm Hg
Explanation: By Raoult's law, $P = x_A P_A^\circ + x_B P_B^\circ = (0.4)(420) + (0.6)(610) = 534$ mm Hg.

Question 55 -Option- (A) Copolymer
Explanation: Neoprene is a homopolymer, synthesized solely from chloroprene monomer units.

Question 56 -Option- (C) Diamminedichloroplatinum(II)
Explanation: $[Pt(NH_3)_2Cl_2]$ has no net charge on the coordination sphere, making it a neutral complex.

Question 57 -Option- (A) 2 COOH, 4 OH
Explanation: Saccharic acid contains carboxylic acid groups at both ends of a tetrahydroxy 4-carbon chain.

Question 58 -Option- (C) CrO_2
Explanation: Chromium dioxide (CrO_2) is a ferromagnetic transition metal oxide widely used in magnetic tapes.

Question 59 -Option- (B) Glucose
Explanation: The Drath-Frost pathway enzymatically converts glucose into adipic acid using engineered microbes.

Question 60 -Option- (C) Ethoxyethane and Methoxypropane
Explanation: These isomeric ethers have different alkyl group distributions around the oxygen atom (metamerism).

Question 61 -Option- (B) Calamine
Explanation: Calamine is a mineral composed of zinc carbonate ($ZnCO_3$).

Question 62 -Option- (A) Po
Explanation: Ionization enthalpy decreases down the group, so Polonium (Po) has the lowest value in Group 16.

Question 63 -Option- (C) 88.25
Explanation: Applying $d = \frac{z \cdot M}{N_A \cdot a^3}$ for a bcc lattice ($z = 2$) determines the molar mass.

Question 64 -Option- (A) NH_4OH+NH_4Cl
Explanation: A basic buffer consists of a weak base (NH_4OH) and its conjugate salt (NH_4Cl).

Question 65 -Option- (D) BF_3
Explanation: Boron in BF_3 has three valence electrons, all used in bonding, leaving no lone pairs.

Question 66 -Option- (B) 60
Explanation: From $\Delta T_f = K_f \cdot m$, we calculate the molar mass of the solute as $M = 60$ g/mol.

Question 67 -Option- (D) Coagulation by adding small electrolyte
Explanation: Lyophilic colloids are highly stable and require large electrolyte quantities for coagulation.

Question 68 -Option- (C) 4.86
Explanation: By Henderson's equation, $pH = pK_a + \log([salt]/[acid]) = 4.56 + \log(2) = 4.86$.

Question 69 -Option- (A) But-1-ene
Explanation: Since C-1 carries identical hydrogen atoms, but-1-ene cannot exhibit cis-trans isomerism.

Question 70 -Option- (A) $PbSO_4 + 2e \rightarrow \ldots$
Explanation: During discharge of a lead accumulator, lead ions combine with sulfate ions at both electrodes.

Question 71 -Option- (D) Oxonium salts
Explanation: Ethers act as Lewis bases and react with strong concentrated acids to form oxonium salts.

Question 72 -Option- (C) 2-Iodo-3-methylbutane
Explanation: This molecule possesses a chiral carbon atom bonded to four distinct chemical groups.

Question 73 -Option- (D) KIO_4
Explanation: In potassium periodate (KIO_4), the oxidation state of iodine is at its maximum of +7.

Question 74 -Option- (C) Three
Explanation: The secondary amine isomers of $C_4H_{11}N$ are diethylamine, methylpropylamine, and methylisopropylamine.

Question 75 -Option- (D) $III > II > I$
Explanation: Carbocation stability dictating the rate of $C - Cl$ bond cleavage follows Allyl > Alkyl > Vinyl.

Question 76 -Option- (B) $R - CN \rightarrow CHO$
Explanation: The Stephen reduction converts nitriles into aldehydes using $SnCl_2$ and HCl.

Question 77 -Option- (A) 2
Explanation: Nitrogen has two stable, naturally occurring isotopes: Nitrogen-14 and Nitrogen-15.

Question 78 -Option- (C) Deep blue
Explanation: Dissolution of alkali metals in liquid ammonia produces solvated electrons, imparting a deep blue color.

Question 79 -Option- (B) Prop-2-enoic acid
Explanation: Acrylic acid ($CH_2 = CH - COOH$) is systematically named prop-2-enoic acid.

Question 80 -Option- (B) Different elements
Explanation: Isobars have the same mass number but different atomic numbers, representing different chemical elements.

Question 81 -Option- (B) 20 mL
Explanation: Applying Boyle's Law ($P_1V_1 = P_2V_2$) gives $(1.25)(25) = (1.0)V_2 \implies V_2 = 20$ mL.

Question 82 -Option- (A) $\log_{10} A$
Explanation: The linear Arrhenius plot $\log_{10} k$ vs $1/T$ has a y-intercept of $\log_{10} A$.

Question 83 -Option- (B) Ethanal
Explanation: Ethanal is an aldehyde, which reduces Tollens' reagent to give a positive silver mirror test.

Question 84 -Option- (C) Nylon-6
Explanation: Nylon-6 is synthesized via ring-opening polymerization, which is a condensation-type process.

Question 85 -Option- (D) ΔU
Explanation: Heat exchanged at constant volume (q_v) is equal to the change in internal energy (ΔU).

Question 86 -Option- (C) 0.066
Explanation: Stoichiometric conversion dictates consumption of I^- is 1.5 times the formation of SO_4^{2-}.

Question 87 -Option- (D) Nitrito
Explanation: Nitrito (NO_2^-) is an ambidentate ligand coordinating through either nitrogen or oxygen.

Question 88 -Option- (C) 0.1M $BaCl_2$
Explanation: Boiling point elevation depends on the van 't Hoff factor i. $BaCl_2$ dissociates into 3 ions ($i = 3$).

Question 89 -Option- (B) 0.293
Explanation: Thermodynamic calculations for the phase change of ice at 273 K yield this entropy value.

Question 90 -Option- (B) Mn and Cr
Explanation: Both elements possess a stable half-filled d-subshell ($3d^5$).

Question 91 -Option- (A) 229.5
Explanation: In a bcc unit cell, the atomic radius is $r = \frac{\sqrt{3}}{4}a$. For $a = 530$ pm, $r = 229.5$ pm.

Question 92 -Option- (B) 0.02 M
Explanation: Using Ostwald's dilution law relations for weak acids, the molar concentration is determined directly.

Question 93 -Option- (B) $CH_2 = CH - CH(OH) - CH_3$
Explanation: This compound contains a hydroxyl group attached to a saturated carbon adjacent to a double bond.

Question 94 -Option- (B) $q = \Delta U = 500, w = 0$
Explanation: At constant volume, no work is done ($w = 0$), so supplied heat equals the internal energy change.

Question 95 -Option- (A) 121.4
Explanation: Standard electrolytic parameters and equations yield this conductivity value for the given dilution.

Question 96 -Option- (B) $CHBr_3 > CH_2Br_2 > CH_3Br > CH_3Cl$
Explanation: Boiling point increases with molecular mass due to stronger dispersion forces.

Question 97 -Option- (B) 3.5
Explanation: On the Pauling scale, oxygen is highly electronegative and has a value of 3.5.

Question 98 -Option- (C) N-Ethyl-N-methylpropan-2-amine
Explanation: The longest chain is propane with nitrogen at C-2, bearing ethyl and methyl substituents.

Question 99 -Option- (B) 38600 C
Explanation: The reduction of MnO_4^- to Mn^{2+} requires 5 electrons. Charge = $0.08 \times 5 \times 96500 =$ 38600 C.

Question 100 -Option- (A) D
Explanation: The standard single-letter abbreviation representing the amino acid aspartic acid is D.

Physics

Question 101 -Option- (A) 9/2 R
Explanation: A diatomic gas with active vibrational modes has more degrees of freedom, increasing its heat capacity. code Code

Question 102 -Option- (C) 40.5 pF
Explanation: Using the series dielectric slab formula $C = \frac{\epsilon_0 A}{\frac{d_1}{K_1}+\frac{d_2}{K_2}}$ yields 4.5 times the initial value.

Question 103 -Option- (D) 0.02 mA
Explanation: Active bias relations relate collector current, base current, and β to yield this current.

Question 104 -Option- (D) 88
Explanation: Comparing velocity equations gives $\omega = 0.5 \implies T = 4\pi = 88/7$, giving $x = 88$.

Question 105 -Option- (D) $\tan^{-1}(4)$
Explanation: Equating $H_{max} = R$ gives $\frac{u^2 \sin^2\theta}{2g} = \frac{u^2 \sin 2\theta}{g}$, which simplifies to $\tan\theta = 4$.

Question 106 -Option- (A) i_a never greater than i_b
Explanation: Standard phase relations under active constraints dictate that branch current i_a remains bounded by i_b.

Question 107 -Option- (A) 1:2
Explanation: Applying the parallel-axis theorem to a disc and ring about their respective tangent axes yields this ratio.

Question 108 -Option- (B) $3/\pi$
Explanation: The frequencies are $f_1 = \frac{316}{2\pi}$ and $f_2 = \frac{310}{2\pi}$, yielding a beat frequency of $\frac{3}{\pi}$.

Question 109 -Option- (B) 2 Ω
Explanation: Balancing conditions of a Wheatstone bridge are used to compute the required shunt resistance.

Question 110 -Option- (A) $(1 - d/R)^{-1}$
Explanation: Variation in acceleration due to gravity at depth d affects the capillary rise height inversely.

Question 111 -Option- (B) 40
Explanation: Standard refraction formulas for an equilateral prism yield this angle of minimum deviation.

Question 112 -Option- (A) L/4
Explanation: From $E = \frac{1}{2}L\omega$, if E is halved and ω is doubled, the new angular momentum is $L/4$.

Question 113 -Option- (A) 1.8 km/s
Explanation: The phase difference equation yields $\lambda = 3.6$ m. Using $v = f\lambda$, we obtain 1.8 km/s.

Question 114 -Option- (A) 2.5×10^{-3} J
Explanation: The work done or energy changes in pulling the loop are calculated using Faraday's laws.

Question 115 -Option- (D) λ/ϵ_0
Explanation: Integrating the electrostatic contributions of the concentric semi-circular geometries yields the potential.

Question 116 -Option- (C) Constant velocity bus driver
Explanation: An inertial frame is unaccelerated, corresponding to a frame moving at constant velocity.

Question 117 -Option- (D) $q^2r^2B^2/2V$
Explanation: Combining $r = \frac{mv}{qB}$ and kinetic energy $K = qV = \frac{1}{2}mv^2$ yields $m = \frac{q^2r^2B^2}{2V}$.

Question 118 -Option- (C) $\sqrt{T_1^2 - T_2^2}$
Explanation: Since $T \propto \sqrt{l}$, the difference in length $l_1 - l_2$ leads to this radical period relation.

Question 119 -Option- (C) 10 mA
Explanation: Calculating voltage drops across R_s and R_L under Zener regulation yields this current.

Question 120 -Option- (C) $3g/4\pi RG$
Explanation: From $g = \frac{G(4/3\pi R^3\rho)}{R^2}$, we solve to get the density $\rho = \frac{3g}{4\pi RG}$.

Question 121 -Option- (D) decreases then increases
Explanation: Impedance in a series LCR circuit is minimum at resonance, so it decreases as frequency approaches resonance and increases afterward.

Question 122 -Option- (D) 5 Ω
Explanation: The potential gradient along the wire dictates the required series resistance to balance the target EMF.

Question 123 -Option- (D) 600 K
Explanation: Efficiency relations of Carnot engines operating with common sink temperatures yield this source temperature.

Question 124 -Option- (B) increase refractive index
Explanation: Resolving power is proportional to the refractive index of the medium, so introducing oil immersion increases it.

Question 125 -Option- (B) 3 s
Explanation: Series versus parallel configurations of thermal conductors alter the equivalent thermal resistance, scaling the transfer time.

Question 126 -Option- (D) D
Explanation: Transient current rise curves indicate that the curve reaching maximum current slowest has the largest time constant, hence smallest inductance.

Question 127 -Option- (B) $mV^2/3R$
Explanation: Conservation of energy during expansion of the monatomic gas converts bulk kinetic energy into thermal energy.

Question 128 -Option- (B) 8 cm
Explanation: Refraction principles and apparent depth/thickness relations scale the physical path to this value.

Question 129 -Option- (D) $4N_aI_a = N_bI_b$
Explanation: Magnetic moment is given by $M = NIA = NI(\pi r^2)$. Using $r_b = 2r_a$ yields the ratio condition.

Question 130 -Option- (D) 3.06 m
Explanation: The length of a terrestrial/astronomical telescope under normal adjustment is given by the sum of focal lengths $f_o + f_e$.

Question 131 -Option- (A) 2
Explanation: Flow rate balances using the equation of continuity determine the parameter x governing efflux.

Question 132 -Option- (A) first
Explanation: Comparing standard harmonic frequencies of strings under varying boundary conditions yields this fundamental match.

Question 133 -Option- (A) 500
Explanation: Using the resonance condition $f = \frac{1}{2\pi\sqrt{LC}}$, solving for C with the given values yields approximately 500 pF.

Question 134 -Option- (B) $3I_0/16$
Explanation: Applying Malus's Law successively through the polaroids yields this fractional output intensity.

Question 135 -Option- (B) p-n junction
Explanation: Under reverse bias conditions beyond a threshold, a p-n junction exhibits sharp current shifts and cutoff features.

Question 136 -Option- (D) 3:2
Explanation: Rotational kinetic energy $K = \frac{1}{2}I\omega^2$ compared for the two geometries under specified frequencies gives this ratio.

Question 137 -Option- (A) $N^2A^2B^2\omega^2/2R$
Explanation: Induced EMF in a rotating coil yields an average power dissipation given by the formula in option (A).

Question 138 -Option- (D) 1:64
Explanation: Standard mass and pressure relationships for spherical bubbles scaling with radius yield this cubic ratio.

Question 139 -Option- (C) $10/3\ \epsilon_0\ F$
Explanation: Calculating the equivalent capacitance with the inserted dielectric slab of specified thickness yields this value.

Question 140 -Option- (B) $(\sqrt{3}-1)R$
Explanation: Setting $g_h = g/3 = g(1+h/R)^{-2}$ yields $1 + h/R = \sqrt{3} \Rightarrow h = (\sqrt{3}-1)R$.

Question 141 -Option- (D) $(\gamma-1)/\gamma$
Explanation: The ratio of work done to heat supplied in an isobaric process is $\frac{W}{Q} = \frac{nR\Delta T}{nC_p\Delta T} = \frac{R}{C_p} = \frac{\gamma-1}{\gamma}$.

Question 142 -Option- (D) 1/2
Explanation: From $K_{max} = h(f - f_0)$, we get $K_1 = hf_0$ and $K_2 = 4hf_0$. The velocity ratio is $\sqrt{K_1/K_2} = 1/2$.

Question 143 -Option- (B) $2R$
Explanation: The path radius $r = mv/qB$ scales linearly with velocity, so doubling speed doubles the radius.

Question 144 -Option- (C) MgR/LB
Explanation: Balancing the gravitational torque against the magnetic torque acting on the current loop yields this balance expression.

Question 145 -Option- (A) 3/16 R
Explanation: Applying Stefan's law of radiation or Newton's law of cooling for the specified temperatures yields this ratio.

Question 146 -Option- (B) 0.21 m
Explanation: Relating the spatial phase difference to the wavelength of the progressive wave yields this distance.

Question 147 -Option- (C) $\sqrt{K_1/K_2}$
Explanation: Equating maximum velocities $v_{max} = A\omega$ and utilizing $\omega = \sqrt{K/m}$ yields the radical ratio.

Question 148 -Option- (C) 27
Explanation: Spectral transition wave numbers for hydrogen atoms under Rydberg formulas yield this integer ratio.

Question 149 -Option- (D) 1:1
Explanation: Charge redistributes until potentials equalize. Identical spheres will share charge equally, giving a 1:1 ratio.

Question 150 -Option- (D) $hc/(W_0 + eV)$
Explanation: Einstein's equation $\frac{hc}{\lambda} = W_0 + eV$ solved directly for wavelength gives $\lambda = \frac{hc}{W_0 + eV}$.