MHT CET 2021 Mathematics Answer Key PDF

Answer Key

Question 1 Option (1) – $-\frac{a^2x}{y}$

Explanation: Let $t = \tan\theta$, giving the parametric equations $x = \cos 2\theta$ and $y = a\sin 2\theta$. Differentiating with respect to θ yields
$\frac{dy}{dx} = \frac{2a\cos 2\theta}{-2\sin 2\theta} = -a\cot 2\theta = -\frac{a^2x}{y}$.

Question 2
Option (1) – $\frac{\pi x}{4} + \frac{x^2}{4} + C$
Explanation: The integrand simplifies using half-angle formulas to $\tan^{-1}\tan(\pi/4 + x/2) = \pi/4 + x/2$. Integrating this linear function with respect to x yields $\frac{\pi x}{4} + \frac{x^2}{4} + C$.

Question 3
Option (2) – 11
Explanation: The number of diagonals of an n-sided polygon is given by $D = \frac{n(n-3)}{2}$. Solving $\frac{n(n-3)}{2} = 44$ yields the quadratic equation $n^2 - 3n - 88 = 0$, which gives the positive root $n = 11$.

Question 4
Option (1) – $\tan 3A - \tan 2A - \tan A$
Explanation: Using the compound angle formula for $\tan 3A = \tan(2A + A)$ and multiplying across the denominator, we derive the standard trigonometric identity $\tan 3A \tan 2A \tan A = \tan 3A - \tan 2A - \tan A$.

Question 5
Option (2) – $2\sqrt{3}v_e$
Explanation: The escape velocity formula is $v_e = \sqrt{2GM/R}$. For the planet, substituting $M_p = 6M_e$ and $R_p = R_e/2$ yields $v_p = \sqrt{\frac{12GM_e}{R_e/2}} = \sqrt{12}v_e = 2\sqrt{3}v_e$.

Question 6
Option (2) – 15.625 mg
Explanation: The number of half-life cycles in 30 days is $n = 30/5 = 6$. The remaining mass of the Bismuth isotope is calculated using the relation $M = M_0/2^n = 1000/64 = 15.625$ mg.

Question 7
Option (3) – 3
Explanation: The general unit of a rate constant is $(\text{mol L}^{-1})^{1-n}\text{s}^{-1}$ where n is the order. Comparing this with the given unit $\text{L}^2\text{mol}^{-2}\text{s}^{-1} = (\text{mol L}^{-1})^{-2}\text{s}^{-1}$ yields $1 - n = -2 \implies n = 3$.

Question 8
Option (2) – Selenium
Explanation: Selenium (Se) is a Group 16 element, belonging to the oxygen family (Chalcogens), whereas phosphorus and antimony belong to Group 15, and iodine belongs to Group 17.

Question 9
Option (4) – $HClO_4$
Explanation: Among the oxoacids of chlorine, acidity increases with the oxidation state of

the central chlorine atom due to greater resonance stabilization of the conjugate base, making perchloric acid ($HClO_4$) the strongest.

Question 10 – (2) HDPE
Explanation: High-density polyethylene (HDPE) is highly crystalline, rigid, and exhibits superior chemical and impact resistance, making it the preferred polymer for manufacturing durable floor tiles.

Question 11
Option (3) – Catechol
Explanation: Benzene-1,2-diol is commonly known by its IUPAC-accepted trivial name, catechol, whereas resorcinol is benzene-1,3-diol and quinol is benzene-1,4-diol.

Question 12
Option (1) – $5\sqrt{2}, 4\sqrt{2}$
Explanation: The maximum area rectangle inscribed in an ellipse $x^2/a^2 + y^2/b^2 = 1$ has vertices at $(\pm a/\sqrt{2}, \pm b/\sqrt{2})$. With $a = 5$ and $b = 4$, the dimensions are $\sqrt{2}a = 5\sqrt{2}$ and $\sqrt{2}b = 4\sqrt{2}$.

Question 13
Option (3) – d-block
Explanation: The d-block elements, spanning groups 3 to 12 in the periodic table, are commonly known as the transition elements because they represent a transition in properties between s and p-blocks.

Question 14
Option (2) – 14 u
Explanation: Successive members of a homologous organic series differ by a methylene ($-CH_2-$) group. The mass difference of this group is $12 + 2(1) = 14$ u.

Question 15
Option (2) – $\pi^2/2$
Explanation: Since the integrand is an even function, we write $I = 2\int_0^{\pi} \frac{x \sin x}{1+\cos^2 x} dx$. Applying the property $x \to \pi - x$ and integrating yields $I = \frac{\pi^2}{2}$.

Question 16
Option (3) – Groups 3 to 12
Explanation: The transition elements are d-block elements, which are positioned in the center of the periodic table spanning from Group 3 to Group 12.

Question 17
Option (1) – $\frac{|(\vec{a}_2 - \vec{a}_1) \cdot (\vec{b}_1 \times \vec{b}_2)|}{|\vec{b}_1 \times \vec{b}_2|}$
Explanation: The shortest distance between two skew lines in vector form is the projection of the vector joining points on both lines $(\vec{a}_2 - \vec{a}_1)$ onto the unit vector perpendicular to both lines $(\vec{b}_1 \times \vec{b}_2)$.

Question 18
Option (2) – 54
Explanation: For a binomial distribution, mean $np = 18$ and variance $npq = 12$. Dividing gives $q = 2/3 \implies p = 1/3$. Substituting p back into the mean equation yields $n = 54$.

Question 19
Option (3) – $\frac{\text{Mass of desired product}}{\text{Mass of all reactants}} \times 100$
Explanation: Atom economy is a green chemistry metric calculated as the ratio of the molecular mass of the desired product to the total molecular mass of all starting reactants, expressed as a percentage.

Question 20
Option (3) – g/4

Explanation: The acceleration due to gravity at an altitude h is $g(h) = g\frac{R^2}{(R+h)^2}$. Substituting $h = R$ yields $g(R) = g\frac{R^2}{(2R)^2} = g/4$.