

MHT CET 2021 Mathematics Answer Key PDF

Answer Key

Question 1 -Option- (4) No real solution

Explanation: The maximum value of $4 \sin^2 x + 6 \cos^2 x$ is $4 + 6 = 10$. Since $10 < 9.42$, the equation has no real solution.

Question 2 -Option- (2) s^{-1}

Explanation: For a first-order reaction, the rate constant unit is determined from $k = \text{Rate}/[A]$. Dividing $(\text{mol L}^{-1} \text{s}^{-1})$ by (mol L^{-1}) yields s^{-1} .

Question 3 -Option- (1) $\frac{|(\vec{a}-\vec{a}) \times \vec{b}|}{|\vec{b}|}$

Explanation: The perpendicular distance from a point to a line is the magnitude of the projection of the vector $(\vec{a} - \vec{a})$ orthogonal to the line's direction vector $\vec{b}$.

Question 4 -Option- (3) ZnS

Explanation: Frenkel defects are typically exhibited by ionic crystals like ZnS and silver halides where there is a large difference in size between the cations and anions.

Question 5 -Option- (2) $-x \cot(x/2) + C$

Explanation: Resolving the standard integral $\int \frac{x - \sin x}{1 - \cos x} dx$ (corrected for typographical error in the numerator) using integration by parts yields $-x \cot(x/2) + C$.

Question 6 -Option- (1) $\frac{\sqrt{5}-1}{4}$

Explanation: The exact trigonometric value of $\sin 18^\circ$ is mathematically derived using multiple-angle formulas to be $\frac{\sqrt{5}-1}{4}$.

Question 7 -Option- (3) $x \log(\sec x + \tan x) - \int x \sec x dx$

Explanation: Integrating by parts with $u = \log(\sec x + \tan x)$ and $dv = dx$ gives $du = \sec x dx$ and $v = x$, yielding $x \log(\sec x + \tan x) - \int x \sec x dx$.

Question 8 -Option- (2) Palladium (Pd)

Explanation: Palladium ($Z = 46$) has an exceptional ground-state configuration of $[\text{Kr}]4d^{10}5s^0$, meaning it possesses a completely filled $4d$ orbital.

Question 9 -Option- (3) $\Delta V = 0$

Explanation: An isochoric thermodynamic process is characterized by constant volume, which means the change in volume (ΔV) is zero.

Question 10 -Option- (3) Silica

Explanation: Diamond, graphite, and fullerene are pure allotropic forms of carbon, whereas silica (SiO_2) is a compound of silicon and oxygen containing no carbon.

Question 11 -Option- (3) Lactose

Explanation: Lactose, a disaccharide sugar composed of glucose and galactose subunits, is the primary sugar present in milk.

Question 12 -Option- (3) $5/2$

Explanation: Rationalizing the limit as $x \rightarrow \infty$ yields $\lim_{x \rightarrow \infty} \frac{5x-7}{\sqrt{x^2+5x-7}+x}$. Dividing through by x gives the limit value $\frac{5}{1+1} = 5/2$.

Question 13 -Option- (2) 11

Explanation: Undecane is a saturated alkane with the chemical formula $C_{11}H_{24}$, containing exactly 11 carbon atoms in its chain.

Question 14 -Option- (2) $\frac{n^2-1}{12}$

Explanation: Adding a constant to every observation in a dataset does not change its dispersion. Thus, the variance remains equal to the original variance of $\frac{n^2-1}{12}$.

Question 15 -Option- (3) Bromine

Explanation: Bromine is the only halogen, and one of only two elements in the periodic table, that exists in the liquid state at standard room temperature.

Question 16 -Option- (2) Oil seals and tank linings

Explanation: Buna-N (nitrile rubber) is highly resistant to oils, fuel, and other chemicals, making it exceptionally suited for manufacturing industrial oil seals and tank linings.

Question 17 -Option- (2) Polyacrylamide

Explanation: Polyacrylamide gels are widely used as the standard porous supporting medium in gel electrophoresis (PAGE) to separate proteins and nucleic acids.

Question 18 -Option- (4) PVC

Explanation: Due to its polymer properties and ease of blending, plasticized PVC and modified vinyl formulations are widely used as adhesives in commercial tiles and pipes.

Question 19 -Option- (3) 128 pm

Explanation: The resonance hybrid structure of the ozone (O_3) molecule results in equalized O-O bonds with a measured average bond length of 128 pm.

Question 20 -Option- (2) Gold sol

Explanation: Lyophobic sols like gold sol and sulfur sol are formed by the aggregation of a large number of atoms or small molecules, classifying them as multimolecular colloids.

Question 21 -Option- (2) 120°

Explanation: Since the magnitudes satisfy $|\vec{e}_1| = |\vec{e}_2| = |\vec{e}_1 + \vec{e}_2| = 1$, they form the sides of an equilateral triangle, meaning the angle between the two unit vectors is 120° .

Question 22 -Option- (3) 119°

Explanation: Due to the presence of one lone pair on the sulfur atom exerting repulsion on the bond pairs, the bond angle in SO_2 is reduced from 120° to approximately 119° .

Question 23 -Option- (2) First order

Explanation: All natural and artificial radioactive decay processes follow spontaneous first-order nuclear reaction kinetics.

Question 24 -Option- (3) KCl

Explanation: Potassium chloride (KCl) solutions of highly precise concentrations are standardly used to calibrate and determine the cell constant of a conductivity cell.

Question 25 -Option- (2) AC to DC

Explanation: A rectifier is an electrical device designed specifically to convert alternating current (AC), which periodically reverses direction, into direct current (DC).

Question 26 -Option- (2) $4\sqrt{2}/5$

Explanation: $\cos x = 24/25 \implies \sin x = 7/25$. Expanding $(\sin(x/2) + \cos(x/2))^2 = 1 + \sin x = 32/25$ yields the positive root value of $4\sqrt{2}/5$.

Question 27 -Option- (1) Hexanal

Explanation: Boiling points of aldehydes increase with increasing molecular mass and surface area due to stronger London dispersion forces. Hexanal has the longest chain here.

Question 28 -Option- (3) Clay sol

Explanation: Metal hydroxides form positively charged sols, whereas metal sols, starch, and clay sols carry a net negative charge.

Question 29 -Option- (1) Cellulose nitrate

Explanation: Cellulose nitrate (celluloid) was the historical and primary thermoplastic polymer used specifically in the manufacture of photographic and cinema films.

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