MHT CET 2026 Sample Paper 4

Subjects : Physics, Chemistry & Mathematics

Question Booklet Version	MH-CET-2026 Roll No.	Question Booklet Sr. No.
4		
(Write this number on your Answer Sheet)	Answer Sheet No.	(Write this number on your Answer Sheet)

Day and Date :

Duration: 3.00 hours
Total Marks : 200

This is to certify that, the entries of MH-CET Roll No. and Answer Sheet No. have been correctly written and verified.

Candidate's Signature *Invigilator's Signature*

Instructions to Candidates

1. The test contains **150 Multiple Choice Questions (MCQs)** divided into three sections: **Physics (50)**, **Chemistry (50)**, and **Mathematics (50)**.
2. The total time allotted for the examination is **180 minutes**. The countdown timer on the top right of the screen will display the remaining time.
3. Candidates can toggle between sections (Physics, Chemistry, Mathematics) and questions at any time during the exam.
4. **Login Procedure:** Enter your Roll No. and Password as provided. Verify your name and photograph appearing on the screen. If there is a mismatch, report it to the invigilator immediately.
5. **Navigating Questions:** To select a question, click on the question number in the Question Palette on the right side of the screen.
6. **Answering:** To select your answer, click on the button of one of the options. To deselect, click on the chosen option again or click the **'Clear Response'** button.
7. **Saving:** You **MUST** click the **'Save & Next'** button to save your answer for any question. Clicking 'Mark for Review' will not save the answer for final evaluation unless it is specifically answered and saved.
8. **Marking Scheme:**
   - For **Physics** and **Chemistry**: Each correct response is awarded **one (1) mark**.
   - For **Mathematics**: Each correct response is awarded **two (2) marks**.
   - There is **no negative marking** for incorrect answers.
9. Status of questions will be shown by color codes: Green (Answered), Red (Not Answered), White (Not Visited), and Violet (Marked for Review).
10. Candidates are not allowed to open any other software or browser tabs. Doing so will result in the automated locking of the terminal.
11. **Rough Work:** All calculations must be done on the **Scribble Pad** provided. Candidates must write their Roll No. on the pad and return it to the invigilator before leaving the hall.
12. A digital Log Table/Calculator (if applicable) will be accessible via a button on the exam interface.
13. The test will automatically submit once the timer reaches zero. Candidates cannot submit the exam before the first 90 minutes.
14. Use of mobile phones, smartwatches, or any electronic gadgets is strictly prohibited.
15. No marks will be deducted for questions that are left unattempted.

Physics

1. A vector parallel to the line of intersection of the planes $\vec{r} \cdot (3\hat{i} - \hat{j} + \hat{k}) = 1$ and $\vec{r} \cdot (\hat{i} + 4\hat{j} - 2\hat{k}) = 2$ is:
(A) $-2\hat{i} + 7\hat{j} + 13\hat{k}$
(B) $2\hat{i} - 7\hat{j} + 13\hat{k}$
(C) $-\hat{i} + 4\hat{j} + 7\hat{k}$
(D) $\hat{i} - 4\hat{j} + 7\hat{k}$

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2. Correct Bernoulli's equation is (symbols have their usual meaning):
(A) $P + mgh + \frac{1}{2}mv^2 = \text{constant}$
(B) $P + \rho gh + \frac{1}{2}\rho v^2 = \text{constant}$
(C) $P + \rho gh + \rho v^2 = \text{constant}$
(D) $P + \frac{1}{2}\rho gh + \frac{1}{2}\rho v^2 = \text{constant}$

---

3. The angle of banking is independent of:
(A) Speed of vehicle
(B) Radius of curvature of road
(C) Height of inclination
(D) None of these

---

4. A particle is performing uniform circular motion along the circumference of a circle of radius R and T is the periodic time. In the time $\frac{T}{4}$, its displacement and distance covered are respectively:
(A) $\sqrt{2}R,\ \frac{\pi R}{4}$
(B) $\frac{\pi R}{2},\ \sqrt{2}R$
(C) $\sqrt{2}R,\ \pi R$
(D) $\sqrt{2}R,\ \frac{\pi R}{2}$

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5. The ratio of the angular speed of the hour hand of a clock to that of its minute hand is:
(A) 3600 : 1
(B) 1 : 24
(C) 1 : 12
(D) 12 : 1

---

6. A proton, an electron and an alpha particle have the same energy. Their de-Broglie wavelengths will be compared as:
(A) $\lambda_e > \lambda_\alpha > \lambda_p$

(B) $\lambda_\alpha > \lambda_p > \lambda_e$
(C) $\lambda_p > \lambda_e > \lambda_\alpha$
(D) $\lambda_e > \lambda_p > \lambda_\alpha$

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7. A point charge of $10\,\mu$C is placed at the origin. At what location on the X-axis should a point charge of $40\,\mu$C be placed so that the net electric field is zero at $x = 2\,$cm on the X-axis?
(A) $x = 6\,\text{cm}$
(B) $x = 4\,\text{cm}$
(C) $x = 8\,\text{cm}$
(D) $x = -4\,\text{cm}$

---

8. At which temperature is the r.m.s. velocity of a hydrogen molecule equal to that of an oxygen molecule at 47°C?
(A) $80\,\text{K}$
(B) $-73\,\text{K}$
(C) $4\,\text{K}$
(D) $20\,\text{K}$

---

9. Two vessels A and B are of the same size and are at the same temperature. A contains $1\,$g of hydrogen and B contains $1\,$g of oxygen. If P_A and P_B are the pressures of the gases in A and B respectively, then the ratio $\dfrac{P_A}{P_B}$ is:
(A) 8
(B) 16
(C) 32
(D) 4

---

10. A wire of length $1\,$m is moving with a velocity of $8\,\text{m s}^{-1}$ at right angles to a magnetic field of $2\,$T. The magnitude of induced emf between the ends of the wire will be:
(A) $20\,\text{V}$
(B) $8\,\text{V}$
(C) $12\,\text{V}$
(D) $16\,\text{V}$

---

11. The difference between threshold wavelengths for two metal surfaces A and B having work functions $\phi_A = 9\,$eV and $\phi_B = 4.5\,$eV respectively is (in nm): (Given: $hc = 1242\,\text{eV} \cdot \text{nm}$)
(A) 264
(B) 138
(C) 276
(D) 540

12. A particle performs simple harmonic motion with amplitude A. Its speed is tripled at the instant that it is at a distance $\frac{2A}{3}$ from the equilibrium position. The new amplitude of the motion is:

(A) $A\sqrt{3}$

(B) $\frac{7A}{3}$

(C) $\frac{A}{3}\sqrt{41}$

(D) $3A$

---

13. The velocity of sound in a gas in which two wavelengths $4.08\,\mathrm{m}$ and $4.16\,\mathrm{m}$ produce 40 beats in $12\,\mathrm{s}$ is:

(A) $2.828\,\mathrm{m\ s^{-1}}$

(B) $175.5\,\mathrm{m\ s^{-1}}$

(C) $353.6\,\mathrm{m\ s^{-1}}$

(D) $707.2\,\mathrm{m\ s^{-1}}$

---

14. σ is the uniform surface charge density of a thin spherical shell of radius R. The electric field at any point on the surface of the spherical shell is:

(A) $\frac{\sigma}{\varepsilon_0 R}$

(B) $\frac{\sigma}{2\varepsilon_0}$

(C) $\frac{\sigma}{\varepsilon_0}$

(D) $\frac{\sigma}{4\varepsilon_0}$

---

15. Preliminary test of nanoparticles is:

(A) X-ray diffraction

(B) Scanning of neutron

(C) Scanning of electron

(D) None of these

---

16. Spheres of colour black, red, white and yellow are heated to the same temperature. The decreasing order of cooling is:

(A) Black ¿ Red ¿ Yellow ¿ White

(B) White ¿ Yellow ¿ Red ¿ Black

(C) Red ¿ Black ¿ Yellow ¿ White

(D) Yellow ¿ Red ¿ Black ¿ White

---

17. The ratio of the shortest wavelength of the Balmer series to the shortest wavelength of the Paschen series in the hydrogen spectrum is:

(A) $\frac{4}{9}$
(B) $\frac{9}{4}$
(C) $\frac{1}{4}$
(D) 4

---

18. Which of the following correctly defines the gyromagnetic ratio and the Bohr magneton?
(A) Gyromagnetic ratio is the ratio of magnetic moment to angular momentum, and Bohr magneton is the unit of magnetic moment
(B) Gyromagnetic ratio is the ratio of charge to mass, and Bohr magneton is the unit of angular momentum
(C) Gyromagnetic ratio is the ratio of force to charge, and Bohr magneton is the unit of energy
(D) Gyromagnetic ratio is the ratio of energy to frequency, and Bohr magneton is the unit of magnetic field

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19. In current electricity, a galvanometer of resistance G is converted into an ammeter by connecting a shunt resistance S in parallel. If the galvanometer gives full-scale deflection for current I_g and the ammeter range is I, then the resistance of the galvanometer is:
(A) $G = \frac{SI_g}{I - I_g}$
(B) $G = \frac{S(I - I_g)}{I_g}$
(C) $G = \frac{I}{SI_g}$
(D) $G = \frac{S}{I - I_g}$

---

20. In a parallel combination of resistances connected to a source of known voltage, the total current flowing through the circuit depends on:
(A) The sum of the resistances
(B) The reciprocal of the sum of reciprocals of the resistances
(C) The product of the resistances
(D) The average value of the resistances

---

21. Two projectiles are projected at 30° and 60° with the horizontal with the same speed. The ratio of the maximum height attained by the two projectiles respectively is:
(A) $2 : \sqrt{3}$
(B) $\sqrt{3} : 1$
(C) $1 : 3$
(D) $1 : \sqrt{3}$

22. A thin circular disc of mass M and radius R is rotating in a horizontal plane about an axis passing through its centre and perpendicular to its plane with angular velocity ω. If another disc of the same dimensions but of mass $\frac{M}{2}$ is placed gently on the first disc co-axially, then the new angular velocity of the system is:

(A) $\frac{4}{5}\omega$

(B) $\frac{5}{4}\omega$

(C) $\frac{2}{3}\omega$

(D) $\frac{3}{5}\omega$

---

23. Light emerges out of a convex lens when a source of light is kept at its focus. The shape of the wavefront of the light is:

(A) Both spherical and cylindrical

(B) Cylindrical

(C) Spherical

(D) Plane

---

24. A current of $200\,\mu$A deflects the coil of a moving coil galvanometer through $60°$. The current required to cause a deflection through $\frac{\pi}{10}$ radian is:

(A) $30\,\mu$A

(B) $120\,\mu$A

(C) $60\,\mu$A

(D) $180\,\mu$A

---

25. A solid metallic cube having total surface area $24\,\text{m}^2$ is uniformly heated. If its temperature is increased by $10°$C, calculate the increase in volume of the cube. (Given: $\alpha = 5.0 \times 10^{-4}\,°\text{C}^{-1}$)

(A) $2.4 \times 10^6\,\text{cm}^3$

(B) $1.2 \times 10^5\,\text{cm}^3$

(C) $6.0 \times 10^4\,\text{cm}^3$

(D) $4.8 \times 10^5\,\text{cm}^3$

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26. A monkey of mass $50\,$kg climbs on a rope which can withstand a tension of $350\,$N. If the monkey climbs upward with an acceleration of $4\,\text{m s}^{-2}$ and then climbs downward with an acceleration of $5\,\text{m s}^{-2}$, choose the correct option. (Given: $g = 10\,\text{m s}^{-2}$)

(A) $T = 700\,$N while climbing upward

(B) $T = 350\,$N while going downward

(C) Rope will break while climbing upward

(D) Rope will break while going downward

27. The force between two point charges q_1 and q_2 placed in vacuum at a distance r apart is F. The force between them when placed in a medium having dielectric constant $K = 5$ at $r/5$ cm apart will be:

(A) $\dfrac{F}{25}$

(B) $5F$

(C) $\dfrac{F}{5}$

(D) $25F$

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28. The value of acceleration due to gravity at the Earth's surface is $9.8\,\mathrm{m\ s^{-2}}$. The altitude above its surface at which the acceleration due to gravity decreases to $4.9\,\mathrm{m\ s^{-2}}$ is close to: (Radius of Earth $= 6.4 \times 10^6\,\mathrm{m}$)

(A) $2.6 \times 10^6\,\mathrm{m}$

(B) $6.4 \times 10^6\,\mathrm{m}$

(C) $9.6 \times 10^6\,\mathrm{m}$

(D) $3.2 \times 10^6\,\mathrm{m}$

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29. Relative permittivity and permeability of a material are ε_r and μ_r respectively. Which of the following values of these quantities are allowed for a diamagnetic material?

(A) $\varepsilon_r = 0.5,\ \mu_r = 1.5$

(B) $\varepsilon_r = 1.5,\ \mu_r = 0.5$

(C) $\varepsilon_r = 0.5,\ \mu_r = 0.5$

(D) $\varepsilon_r = 1.5,\ \mu_r = 1.5$

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30. The ratio of the mass densities of nuclei of $^{40}\mathrm{Ca}$ and $^{16}\mathrm{O}$ is close to:

(A) 1

(B) 0.1

(C) 5

(D) 2

---

31. Two coils are placed close to each other. The mutual inductance of the pair of coils depends upon:

(A) The rates at which currents are changing in the two coils

(B) Relative position and orientation of the two coils

(C) The materials of the wires of the coils

(D) The currents in the two coils

---

32. The magnetic flux through a coil perpendicular to its plane is varying according to the relation $\phi = (5t^3 + 4t^2 + 2t - 5)$ Wb. If the resistance of the coil is $5\,\Omega$, then the induced current through the coil at $t = 2\,\mathrm{s}$ will be:

(A) 15.6 A
(B) 16.6 A
(C) 17.6 A
(D) 18.6 A

---

33. The longest wavelength associated with the Paschen series is: (Given: $R_H = 1.097 \times 10^7\,\mathbf{m}^{-1}$)
(A) 1.094×10^{-6} m
(B) 2.973×10^{-6} m
(C) 3.646×10^{-6} m
(D) 1.876×10^{-6} m

---

34. An ice cube has a bubble inside. When viewed from one side, the apparent distance of the bubble is 12 cm. When viewed from the opposite side, the apparent distance of the bubble is observed as 4 cm. If the side of the ice cube is 24 cm, the refractive index of the ice cube is:
(A) $\frac{4}{3}$
(B) $\frac{3}{2}$
(C) $\frac{2}{3}$
(D) $\frac{6}{5}$

---

35. In an unbiased n-p junction, electrons diffuse from the n-region to the p-region because:
(A) Holes in the p-region attract them
(B) Electrons travel across the junction due to potential difference
(C) Only electrons move from n-region to p-region and not vice versa
(D) Electron concentration in the n-region is more compared to that in the p-region

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36. A magnetic needle is kept in a non-uniform magnetic field. It experiences:
(A) Neither a force nor a torque
(B) A torque but not a force
(C) A force but not a torque
(D) A force and a torque

---

37. A light emitting diode (LED) is fabricated using a GaAs semiconducting material whose band gap is 1.42 eV. The wavelength of light emitted from the LED is:
(A) 650 nm
(B) 1243 nm
(C) 875 nm
(D) 1400 nm

38. A steel wire with mass per unit length 7.0×10^{-3} kg m^{-1} is under tension of 70 N. The speed of transverse waves in the wire will be:
(A) 100 m s^{-1}
(B) 50 m s^{-1}
(C) 10 m s^{-1}
(D) 1 m s^{-1}

---

39. In a coil, the current changes from -2 A to $+2$ A in 0.2 s and induces an emf of 0.1 V. The self inductance of the coil is:
(A) 5 mH
(B) 1 mH
(C) 2.5 mH
(D) 4 mH

---

40. A particle is executing Simple Harmonic Motion (SHM). The ratio of potential energy to kinetic energy of the particle when its displacement is half of its amplitude will be:
(A) 1 : 1
(B) 2 : 1
(C) 1 : 4
(D) 1 : 3

---

41. Two identical particles each of mass m go round a circle of radius a under the action of their mutual gravitational attraction. The angular speed of each particle will be:
(A) $\sqrt{\dfrac{Gm}{2a^3}}$
(B) $\sqrt{\dfrac{Gm}{8a^3}}$
(C) $\sqrt{\dfrac{Gm}{4a^3}}$
(D) $\sqrt{\dfrac{Gm}{a^3}}$

---

42. Eight equal drops of water are falling through air with a steady speed of 10 cm s^{-1}. If the drops coalesce, the new velocity is:
(A) 10 cm s^{-1}
(B) 40 cm s^{-1}
(C) 16 cm s^{-1}
(D) 5 cm s^{-1}

---

43. A liquid is allowed to flow into a tube of truncated cone shape. Identify the correct statement from the following:
(A) The speed is high at the wider end and high at the narrow end
(B) The speed is low at the wider end and high at the narrow end
(C) The speed is same at both ends in a streamline flow
(D) The liquid flows with uniform velocity in the tube

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44. If n is the number density and d is the diameter of the molecule, then the average distance covered by a molecule between two successive collisions (i.e. mean free path) is represented by:
(A) $\dfrac{1}{\sqrt{2}\, n\pi d^2}$
(B) $\sqrt{2}\, n\pi d^2$
(C) $\dfrac{1}{\sqrt{2}\, n\pi^2 d^2}$
(D) $\dfrac{1}{\sqrt{2}\, n^2\pi d^2}$

---

45. A mixture of one mole of monoatomic gas and one mole of a diatomic gas (rigid) are kept at room temperature (27°C). The ratio of specific heats of the gases at constant volume respectively is:
(A) $\frac{7}{5}$
(B) $\frac{3}{2}$
(C) $\frac{5}{3}$
(D) $\frac{5}{3}$

---

46. In an a.c. circuit, voltage and current are given by $V = 100\sin(100t)$ V and $I = 100\sin\left(100t + \dfrac{\pi}{3}\right)$ mA respectively. The average power dissipated in one cycle is:
(A) 10 W
(B) 2.5 W
(C) 25 W
(D) 5 W

---

47. The masses of proton, neutron and helium nucleus are respectively $1.0073\,u$, $1.0087\,u$ and $4.0015\,u$. The binding energy of the helium nucleus is:
(A) 14.2 MeV
(B) 56.8 MeV
(C) 28.4 MeV
(D) 7.1 MeV

---

48. The difference between threshold wavelengths for two metal surfaces A and B having work functions $\phi_A = 9\,\text{eV}$ and $\phi_B = 4.5\,\text{eV}$ respectively is (in nm): (Given, $hc = 1242\,\text{eV}\cdot\text{nm}$)
(A) 264
(B) 138
(C) 276
(D) 540

---

49. A series LCR circuit is subjected to an AC signal of $200\,\text{V}, 50\,\text{Hz}$. If the voltage across the inductor ($L = 10\,\text{mH}$) is $31.4\,\text{V}$, the current in this circuit is:
(A) 68 A
(B) 63 A
(C) 10 A
(D) 10 mA

---

50. When two soap bubbles of radii a and b ($b > a$) coalesce, the radius of curvature of the common surface is:
(A) $\dfrac{ab}{b-a}$
(B) $\dfrac{ab}{a+b}$
(C) $\dfrac{b-a}{ab}$
(D) $\dfrac{a+b}{ab}$

Chemistry

51. What is the rate law of a reaction if the rate is directly proportional to the square of the concentration of B and independent of the concentration of A?
(A) Rate $= k[A][B]$
(B) Rate $= k[B]^2$
(C) Rate $= k[A]^2[B]$
(D) Rate $= k[A][B]^2$

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52. When ammoniacal silver nitrate reacts with organic compounds, the test is called:
(A) Tollens' test
(B) Fehling's test
(C) Benedict's test
(D) Baeyer's test

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53. How many unpaired electrons are present in the element of atomic number 27

in the +2 oxidation state?
(A) 1
(B) 2
(C) 3
(D) 4

---

54. Identify the correct name reactions corresponding to Swarts reaction and Wittig reaction respectively:
(A) Conversion of alkyl chlorides/bromides into alkyl fluorides; conversion of aldehydes or ketones into alkenes using phosphorus ylide
(B) Oxidation of alcohols to aldehydes; reduction of carbonyl compounds to alcohols
(C) Reduction of aldehydes using Zn–Hg/conc. HCl; oxidation of alkenes using ozone
(D) Conversion of alkenes into alkynes; formation of Grignard reagent

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55. Which of the following represents an adiabatic process?
(A) A process occurring at constant temperature
(B) A process in which no heat is exchanged with the surroundings
(C) A process occurring at constant pressure
(D) A process in which heat is absorbed continuously

---

56. The reactivity of alkyl alcohols towards haloacids (HX) follows the order:
(A) $1^\circ > 2^\circ > 3^\circ$
(B) $2^\circ > 1^\circ > 3^\circ$
(C) $3^\circ > 2^\circ > 1^\circ$
(D) $1^\circ = 2^\circ = 3^\circ$

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57. The ratio of abundance of chlorine isotopes having atomic masses 35 and 37 is approximately:
(A) 1 : 1
(B) 2 : 1
(C) 3 : 1
(D) 4 : 1

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58. Butter is an example of which type of colloid?
(A) Liquid in solid
(B) Solid in liquid
(C) Liquid in liquid
(D) Gas in liquid

---

59. Which element shows lower oxidation state in 3d series?
(A) Sc
(B) Ti
(C) Zn

(D) None of the above

---

60. How many unit particles are there in a BCC unit cell?
(A) 2
(B) 1
(C) 4
(D) 3

---

61. Which of the following alkane is tertiary?
(A) n-Butane
(B) Isobutane
(C) n-Pentane
(D) Ethane

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62. In 2-chloro-3,4-dimethylhexane, how many chiral carbon atoms are present?
(A) 1
(B) 2
(C) 3
(D) 4

---

63. Which of the following represents Clemmensen reduction?
(A) Reduction of aldehydes and ketones using Zn–Hg/conc. HCl
(B) Reduction of aldehydes and ketones using NH_2NH_2/KOH
(C) Oxidation of alcohols using acidified $KMnO_4$
(D) Reduction of nitro compounds using Sn/HCl

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64. What is the concentration of H^+ ions if the pH is 2.7?
(A) 2.0×10^{-3} mol L^{-1}
(B) 5.0×10^{-3} mol L^{-1}
(C) 2.0×10^{-2} mol L^{-1}
(D) 5.0×10^{-2} mol L^{-1}

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65. The relationship between the solubility of a gas in a liquid at constant temperature and external pressure is:
(A) Solubility is directly proportional to pressure
(B) Solubility is inversely proportional to pressure
(C) Solubility is independent of pressure
(D) Solubility decreases exponentially with pressure

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66. The most suitable reagent for the conversion of $R-CH_2OH \rightarrow R-CHO$ is:
(A) Acidified $KMnO_4$
(B) PCC (Pyridinium chlorochromate)

(C) $NaBH_4$
(D) Concentrated H_2SO_4

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67. The edge length of a BCC unit cell is related to the atomic radius r as:
(A) $a = 2r$
(B) $a = \dfrac{4r}{\sqrt{3}}$
(C) $a = \sqrt{2}\,r$
(D) $a = 4r$

---

68. The IUPAC name of the following haloarene is:
(A) Chlorobenzene
(B) Bromobenzene
(C) 1-Chloro-2-methylbenzene
(D) 1-Bromo-3-methylbenzene

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69. Ortho-sulphobenzimide is used as:
(A) Anti oxidant
(B) Artificial sweetener
(C) Food preservative
(D) Food supplement

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70. In which of the following compounds does manganese exhibit the highest oxidation number?
(A) MnO_2
(B) Mn_3O_4
(C) K_2MnO_4
(D) $MnSO_4$

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71. Alkali metals are powerful reducing agents because:
(A) They are metals
(B) They are monovalent
(C) Their ionic radii are large
(D) Their ionisation energies are low

---

72. The wavelength of the radiation emitted, when in a hydrogen atom an electron falls from infinity to stationary state $n = 1$, would be (Rydberg constant $= 1.097 \times 10^7\,\mathbf{m}^{-1}$):
(A) 406 nm
(B) 192 nm
(C) 91 nm
(D) 9.1×10^{-8} nm

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73. In NO_3^- ion, the number of bond pairs and lone pairs of electrons on nitrogen atom are:
(A) 2, 2
(B) 3, 1
(C) 1, 3
(D) 4, 0

---

74. Which one of the following is used as an eye lotion?
(A) Milk of magnesia
(B) Silver sol
(C) Colloidal antimony
(D) Chromium salt sol

---

75. If the length of the body diagonal of a FCC unit cell is x Å, the distance between two octahedral voids in the cell (in Å) is:
(A) $\frac{x}{\sqrt{2}}$
(B) $\frac{x}{\sqrt{3}}$
(C) $\frac{x}{\sqrt{6}}$
(D) $\frac{x}{\sqrt{8}}$

---

76. Which one of the following carbanions is the least stable?
(A) $CH_2\overset{\ominus}{-}NO_2$
(B) $CH_2\overset{\ominus}{-}CHO$
(C) $CH_2\overset{\ominus}{-}CH_3$
(D) $\overset{\ominus}{C}H_3$

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77. A balloon filled with an air sample occupies $3\,L$ volume at $35°C$. On lowering the temperature to T, the volume decreases to $2.5\,L$. The temperature T is: (Assume pressure is constant)
(A) 16°C
(B) −16°C
(C) 24°C
(D) −20°C

---

78. The specific conductance of $0.1\,M$ HNO_3 is $6.3 \times 10^{-2}\,\Omega^{-1}cm^{-1}$. The molar conductance of the solution is:
(A) $100\,\Omega^{-1}cm^2$
(B) $515\,\Omega^{-1}cm^2$
(C) $630\,\Omega^{-1}cm^2$

(D) $6300\,\Omega^{-1}\text{cm}^2$

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79. Identify the ortho- and para-directing groups from the following: I — $-CHO$, II — $-NHCOCH3$, III — $-OCH3$, IV — $-SO3H$
(A) III, IV
(B) II, III
(C) II, IV
(D) I, IV

---

80. In O_2^-, O_2 and O_2^{2-} molecular species, the total number of antibonding electrons respectively are:
(A) 7, 6, 8
(B) 1, 0, 2
(C) 6, 6, 6
(D) 8, 6, 8

---

81. For As_2S_3 sol, the most effective coagulating agent is:
(A) $CaCO_3$
(B) NaCl
(C) $FeCl_3$
(D) Clay

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82. Element not showing variable oxidation state is:
(A) Bromine
(B) Iodine
(C) Chlorine
(D) Fluorine

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83. Which of the following arrangements does not represent the correct order of the property stated against it?
(A) $V^{2+} > Cr^{2+} < Mn^{2+} < Fe^{2+}$: paramagnetic behaviour
(B) $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$: ionic size
(C) $Co^{3+} < Fe^{3+} < Cr^{3+} < Sc^{3+}$: stability in aqueous solution
(D) Sc < Ti < Cr < Mn : number of oxidation states

---

84. The IUPAC name for the complex $[Co(ONO)(NH_3)_5]Cl_2$ is:
(A) Pentaamminenitrito-O-cobalt(II) chloride
(B) Pentaamminenitrito-O-cobalt(III) chloride
(C) Nitrito-N-pentaamminecobalt(III) chloride
(D) Nitrito-N-pentaamminecobalt(II) chloride

---

85. Which one of the following is not correct for an ideal solution?

(A) It must obey Raoult's law
(B) $\Delta H = 0$
(C) $\Delta H = \Delta V \neq 0$
(D) All are correct

---

86. Nitration of a compound is carried out; this compound gives a red–orange ppt with 2,4-DNP, undergoes Cannizzaro reaction but not aldol condensation. The possible product due to nitration is:
(A) 3-nitroacetophenone
(B) (2-*nitro*)-2-*phenylethanal*
(C) (2-*nitro*)-1-*phenylpropan*-2-*one*
(D) 3-nitrobenzaldehyde

---

87. Which of the following reactions will not give a primary amine?
(A) $CH_3CONH_2 \xrightarrow{Br_2/KOH}$
(B) $CH_3CN \xrightarrow{LiAlH_4}$
(C) $CH_3NC \xrightarrow{LiAlH_4}$
(D) $CH_3CONH_2 \xrightarrow{LiAlH_4}$

---

88. Which one of the lanthanoids given below is the most stable in divalent form?
(A) Ce (Atomic Number 58)
(B) Sm (Atomic Number 62)
(C) Eu (Atomic Number 63)
(D) Yb (Atomic Number 70)

---

89. The value of the spin-only magnetic moment for one of the following configurations is 2.84 BM. The correct one is:
(A) d^5 (in strong ligand field)
(B) d^3 (in weak as well as in strong fields)
(C) d^4 (in weak ligand fields)
(D) d^4 (in strong ligand fields)

---

90. Which of the following represents the correct order of the acidity in the given compounds?
(A) $FCH_2COOH > CH_3COOH > BrCH_2COOH > ClCH_2COOH$
(B) $BrCH_2COOH > ClCH_2COOH > FCH_2COOH > CH_3COOH$
(C) $FCH_2COOH > ClCH_2COOH > BrCH_2COOH > CH_3COOH$
(D) $CH_3COOH > BrCH_2COOH > ClCH_2COOH > FCH_2COOH$

---

91. Ethyl alcohol can be prepared from a Grignard reagent by the reaction of:
(A) HCHO
(B) R_2CO

(C) RCN
(D) RCOCl

---

92. For 1 molal aqueous solution of the following compounds, which one will show the highest freezing point?
(A) $[Co(H_2O)_6]Cl_3$
(B) $[Co(H_2O)_5Cl]Cl_2 \cdot H_2O$
(C) $[Co(H_2O)_4Cl_2]Cl \cdot 2H_2O$
(D) $[Co(H_2O)_3Cl_3] \cdot 3H_2O$

---

93. Which of the following expression correctly represents molar conductivity?
(A) $\Lambda_m = \dfrac{K}{C}$
(B) $\Lambda_m = \dfrac{KA}{l}$
(C) $\Lambda_m = KV$
(D) All of these

---

94. One of the essential α-amino acids is:
(A) Lysine
(B) Serine
(C) Glycine
(D) Proline

---

95. Which of the following statements is true about a peptide bond (RCONHR)**?**
(A) It is non-planar
(B) It is capable of forming a hydrogen bond
(C) The cis configuration is favoured over the trans configuration
(D) Single bond rotation is permitted between nitrogen and the carbonyl group

---

96. The compounds $[PtCl_2(NH_3)_4]Br_2$ **and** $[PtBr_2(NH_3)_4]Cl_2$ **constitute a pair of:**
(A) Coordination isomers
(B) Linkage isomers
(C) Ionization isomers
(D) Optical isomers

---

97. Tincture of iodine is the common name for:
(A) Iodoform
(B) 2-iodopropane
(C) 2–3% iodine solution in alcohol–water
(D) Iodobenzene

---

98. The monomers of Buna-S rubber are:

(A) Isoprene and butadiene
(B) Butadiene and phenol
(C) Styrene and butadiene
(D) Vinyl chloride and sulphur

---

99. Propane nitrile on reaction with ethyl magnesium iodide in presence of dry ether gives a complex. This imine complex on acid hydrolysis forms:
(A) Propanone
(B) Butanone
(C) Pentan-2-one
(D) Pentanal

---

100. Which of the following elements are radioactive? i. Argon ii. Polonium iii. Astatine iv. Tellurium
(A) i and iv
(B) ii and iii
(C) i, ii and iii
(D) ii, iii and iv

Mathematics

101. The statement $(p \wedge (\sim q)) \vee ((\sim p) \wedge q) \vee ((\sim p) \wedge (\sim q))$ **is equivalent to:**
(A) $(\sim p) \vee (\sim q)$
(B) $p \vee (\sim q)$
(C) $p \vee q$
(D) $(\sim p) \vee q$

---

102. The value of $\sin(\cot^{-1}(x))$ **is:**
(A) $\dfrac{1}{\sqrt{1+x^2}}$
(B) $\sqrt{1+x^2}$
(C) $\dfrac{1}{x\sqrt{1+x^2}}$
(D) $x\sqrt{1+x^2}$

---

103. If $y = 5\cos x - 3\sin x$**, then** $\dfrac{d^2y}{dx^2} + y$ **equals:**
(A) $8\sin x \cos x$
(B) $3\sin x \cos x$
(C) 1
(D) 0

---

104. The integral of $\sec^{2/3} x \csc^{4/3} x\, dx$ from $\frac{\pi}{6}$ to $\frac{\pi}{3}$ is equal to:
(A) $3^{5/6} - 3^{2/3}$
(B) $3^{7/6} - 3^{5/6}$
(C) $3^{5/3} - 3^{1/3}$
(D) $3^{4/3} - 3^{1/3}$

---

105. The distribution function $F(X)$ of discrete random variable X is given by:

X	1	2	3	4	5	6
$F(X = x)$	0.20	0.37	0.48	0.62	0.85	1

Then $P[X = 4] + P[X = 5]$ is:
(A) 0.14
(B) 0.85
(C) 0.37
(D) 0.23

---

106. If the lines $\frac{x-k}{2} = \frac{y+1}{3} = \frac{z-1}{4}$ and $\frac{x-3}{1} = \frac{y-\frac{9}{2}}{2} = \frac{z}{1}$ intersect, then the value of k is:
(A) $\frac{1}{2}$
(B) -1
(C) 1
(D) $\frac{3}{2}$

---

107. A wire of length 20 units is divided into two parts such that the product of one part and the cube of the other part is maximum, then the product of these parts is:
(A) 5
(B) 75
(C) 15
(D) 70

---

108. A wire of length 20 units is divided into two parts such that the product of one part and the cube of the other part is maximum, then the product of these parts is:
(A) 5
(B) 75
(C) 15
(D) 70

---

109. The angle between the lines, whose direction cosines l, m, n satisfy the equations $l + m + n = 0$ and $2l^2 + 2m^2 - n^2 = 0$, is:

(A) 60°
(B) 180°
(C) 90°
(D) 30°

---

110. If X is a random variable with p.m.f. as follows: $P(X = x) = \frac{5}{16}$, $x = 0, 1$; $P(X = x) = \frac{kx}{48}$, $x = 2$; $P(X = x) = \frac{1}{4}$, $x = 3$, then $E(X)$ is:
(A) 1.1875
(B) 1.3125
(C) 1.5625
(D) 0.5625

---

111. The surface area of a spherical balloon is increasing at the rate 2 cm^2/sec. Then the rate of increase in the volume of the balloon is, when the radius of the balloon is 6 cm:
(A) 4 cm^3/sec
(B) 16 cm^3/sec
(C) 36 cm^3/sec
(D) 6 cm^3/sec

---

112. If $f(x) = 2x^3 - 15x^2 - 144x - 7$, then $f(x)$ is strictly decreasing in:
(A) $(-8, 3)$
(B) $(-3, 8)$
(C) $(3, 8)$
(D) $(-8, -3)$

---

113. If $y = (\sin x)^y$, then $\frac{dy}{dx}$ is:
(A) $\frac{y^2 \cot x}{1 - y \log(\sin x)}$
(B) $\frac{y^2 \cot x}{1 - y \log(x)}$
(C) $\frac{y^2 \cot x}{1 + y \log(\sin x)}$
(D) $\frac{y^2 \cot x}{1 + y \log(x)}$

---

114. If $\sin^{-1} x + \cos^{-1} y = \frac{3\pi}{10}$, then the value of $\cos^{-1} x + \sin^{-1} y$ is:
(A) $\frac{\pi}{10}$
(B) $\frac{7\pi}{10}$

(C) $\frac{9\pi}{10}$
(D) $\frac{3\pi}{10}$

---

115. $\sin^{-1}[\sin(-600^\circ)] + \cot^{-1}(-\sqrt{3}) =$
(A) $\frac{\pi}{6}$
(B) $\frac{\pi}{4}$
(C) $\frac{\pi}{3}$
(D) $\frac{7\pi}{6}$

---

116. If $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & a & 1 \end{bmatrix}$ **and** $A^{-1} = \frac{1}{2}\begin{bmatrix} 1 & -1 & 1 \\ -8 & 6 & 2c \\ 5 & -3 & 1 \end{bmatrix}$**, then the values of** a **and** c **are respectively:**
(A) $\frac{1}{2}, \frac{1}{2}$
(B) $-1, 1$
(C) $2, -\frac{1}{2}$
(D) $1, -1$

---

117. The p.m.f. of random variate X **is** $P(X = x) = \frac{2x}{n(n+1)}$, $x = 1, 2, 3, \ldots, n$ **and** 0 **otherwise. Then** $E(X)$ **is:**
(A) $\frac{n+1}{3}$
(B) $\frac{2n+1}{3}$
(C) $\frac{n+2}{3}$
(D) $\frac{2n-1}{2}$

---

118. One of the principal solutions of $\sqrt{3}\sec x = -2$ **is equal to:**
(A) $\frac{\pi}{4}$
(B) $\frac{2\pi}{3}$
(C) $\frac{\pi}{6}$
(D) $\frac{5\pi}{6}$

---

119. The general solution of $\left(x\frac{dy}{dx} - y\right)\sin\left(\frac{y}{x}\right) = x^3e^x$ is:

(A) $e^x(x-1) + \cos\left(\frac{y}{x}\right) + c = 0$

(B) $xe^x + \cos\left(\frac{y}{x}\right) + c = 0$

(C) $e^x(x+1) + \cos\left(\frac{y}{x}\right) + c = 0$

(D) $e^x - \cos\left(\frac{y}{x}\right) + c = 0$

---

120. If $p \wedge q$ is F and $p \to q$ is F, then the truth values of p and q are:

(A) T, T

(B) T, F

(C) F, T

(D) F, F

---

121. The inverse of the matrix $\begin{bmatrix} 1 & 0 & 0 \\ 3 & 3 & 0 \\ 5 & 2 & -1 \end{bmatrix}$ is:

(A) $-\frac{1}{3}\begin{bmatrix} -3 & 0 & 0 \\ 3 & 0 & 0 \\ 9 & 2 & -3 \end{bmatrix}$

(B) $-\frac{1}{3}\begin{bmatrix} -3 & 0 & 0 \\ 3 & -1 & 0 \\ -9 & -2 & 3 \end{bmatrix}$

(C) $-\frac{1}{3}\begin{bmatrix} 3 & 0 & 0 \\ 3 & -1 & 0 \\ -9 & -2 & 3 \end{bmatrix}$

(D) $-\frac{1}{3}\begin{bmatrix} -3 & 0 & 0 \\ -3 & -1 & 0 \\ -9 & -2 & 3 \end{bmatrix}$

---

122. If $B = \begin{bmatrix} 3 & \alpha & -1 \\ 1 & 3 & 1 \\ -1 & 1 & 3 \end{bmatrix}$ is the adjoint of a 3×3 matrix A and $|A| = 4$, then α is equal to:

(A) 1

(B) 0

(C) -1

(D) -2

---

123. If $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$**, then** A^{-1} **is:**

(A) $\frac{1}{2}\begin{bmatrix} 0 & 1 & 2 \\ 3 & 2 & 1 \\ 4 & 2 & 3 \end{bmatrix}$

(B) $\begin{bmatrix} \frac{1}{2} & -\frac{1}{2} & \frac{1}{2} \\ -4 & 3 & -1 \\ \frac{5}{2} & -\frac{3}{2} & \frac{1}{2} \end{bmatrix}$

(C) $\begin{bmatrix} \frac{1}{2} & -1 & \frac{5}{2} \\ 1 & -6 & 3 \\ 1 & 2 & -1 \end{bmatrix}$

(D) $\frac{1}{2}\begin{bmatrix} 1 & -1 & -1 \\ -8 & 6 & -2 \\ 5 & -3 & 1 \end{bmatrix}$

---

124. The converse of $((\sim p) \wedge q) \Rightarrow r$ **is:**

(A) $((\sim p) \vee q) \Rightarrow r$

(B) $(\sim r) \Rightarrow p \wedge q$

(C) $(p \vee (\sim q)) \Rightarrow (\sim r)$

(D) $(\sim r) \Rightarrow ((\sim p) \wedge q)$

---

125. The negative of $(p \wedge (\sim q)) \vee (\sim p)$ **is equivalent to:**

(A) $p \wedge q$

(B) $p \wedge (\sim q)$

(C) $p \wedge (q \wedge (\sim p))$

(D) $p \vee (q \vee (\sim p))$

---

126. The variance of the following probability distribution is:

x	0	1	2
$P(X)$	$\frac{9}{16}$	$\frac{3}{8}$	$\frac{1}{16}$

(A) $\frac{1}{8}$

(B) $\frac{5}{8}$

(C) $\frac{1}{4}$

(D) $\frac{3}{8}$

---

127. The number of four letter words that can be formed using the letters of the word *barrack* is:
(A) 120
(B) 264
(C) 270
(D) 144

---

128. If $y = \sec(\tan^{-1} x)$, then $\frac{dy}{dx}$ at $x = 1$ is:
(A) $\frac{1}{2}$
(B) 1
(C) $\frac{1}{\sqrt{2}}$
(D) $\sqrt{2}$

---

129. The equation $(\cos p - 1)x^2 + (\cos p)x + \sin p = 0$, where x is a variable with real roots. Then the interval of p may be any one of the following:
(A) $(0, 2\pi)$
(B) $(-\pi, 0)$
(C) $(-\pi/2, \pi/2)$
(D) $(0, \pi)$

---

130. If $AX = B$, where

$$A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}, \quad X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, \quad B = \begin{bmatrix} 4 \\ 0 \\ 2 \end{bmatrix}$$

then $2x + y - z$ is:
(A) 2
(B) 1
(C) 4
(D) -2

---

131. The equation of the plane passing through the point $(1, 1, 1)$ and perpendicular to the planes $2x + y - 2z = 5$ and $3x - 6y - 2z = 7$ is:
(A) $14x + 2y - 15z = 1$
(B) $-14x + 2y + 15z = 3$
(C) $14x - 2y + 15z = 27$
(D) $14x + 2y + 15z = 31$

---

132. A student scores the following marks in five tests: 45, 54, 41, 57, 43. His score is not known for the sixth test. If the mean score is 48 in the six tests, then the standard deviation of the marks in six tests is:

(A) $\frac{100}{3}$
(B) $\frac{10}{3}$
(C) $\frac{10}{\sqrt{3}}$
(D) $\frac{100}{\sqrt{3}}$

---

133. A committee of 11 members is to be formed out of 8 males and 5 females. If m is the number of ways the committee is formed with at least 6 males and n is the number of ways with at least 3 females, then:
(A) $n = m = 8$
(B) $m = n = 78$
(C) $m = n = 68$
(D) $m + n = 68$

---

134. The value of $\int \frac{x}{\cos^2\left(1 + \log\tan\frac{x}{2}\right)}\,dx$ is equal to:
(A) $\sin^2\left[1 + \log\tan\frac{x}{2}\right] + C$
(B) $\tan\left[1 + \log\tan\frac{x}{2}\right] + C$
(C) $-\tan\left[1 + \log\tan\frac{x}{2}\right] + C$
(D) $\sec^2\left[1 + \log\tan\frac{x}{2}\right] + C$

---

135. The variance of first 50 even natural numbers is:
(A) 833
(B) $\frac{437}{4}$
(C) $\frac{833}{4}$
(D) 437

---

136. If the statement $p \leftrightarrow (q \rightarrow p)$ is false, then the true statement / statement pattern is:
(A) p
(B) $p \rightarrow (\sim p \vee \sim q)$
(C) $p \wedge (\sim pq)$
(D) $(p \vee \sim q) \rightarrow p$

---

137. The statement $[(p \rightarrow q) \sim q] \rightarrow r$ is a tautology, when r is equivalent to:
(A) $p \wedge \sim q$

(B) $q \vee p$
(C) $p \wedge q$
(D) $\sim q$

---

138. A lot of 100 bulbs contains 10 defective bulbs. Five bulbs are selected at random from the lot and are sent to a retail store. Then the probability that the store will receive at most one defective bulb is:
(A) $\frac{7}{5}\left(\frac{9}{10}\right)^4$
(B) $\frac{7}{5}\left(\frac{9}{10}\right)^5$
(C) $\frac{6}{5}\left(\frac{9}{10}\right)^4$
(D) $\frac{6}{5}\left(\frac{9}{10}\right)^5$

---

139. The length of the perpendicular drawn from the point $(1, 2, 3)$ to the line $\frac{z-6}{3} = \frac{y-7}{2} = \frac{z-7}{-2}$ is:
(A) 4 units
(B) 5 units
(C) 6 units
(D) 7 units

---

140. If $|\vec{a}| = \sqrt{3}$, $|\vec{b}| = 5$, $|\vec{c}| = 10$, the angle between $\vec{b}$ and $\vec{c}$ is $\pi/3$, and $\vec{a}$ is perpendicular to $\vec{b} \times \vec{c}$, then the value of $\left|\vec{a} \times (\vec{b} \times \vec{c})\right|$ is:
(A) 20
(B) 30
(C) 60
(D) 40

---

141. Let X be a random variable having Binomial distribution $B(7, p)$. If $P[X = 3] = 5P[X = 4]$, then the variance of X is:
(A) $\frac{7}{6}$
(B) $\frac{35}{36}$
(C) $\frac{77}{36}$
(D) $\frac{1}{36}$

---

142. The value of the integral $\int_0^1 \sqrt{\frac{1-x}{1+x}}\, dx$ is:

(A) $\left(\frac{\pi}{2}+1\right)$
(B) $\left(\frac{\pi}{2}-1\right)$
(C) 1
(D) -1

---

143. The value of $\int_0^2 |2x-3|\,dx$ is:
(A) $\frac{3}{10}$
(B) $\frac{5}{2}$
(C) $\frac{10}{3}$
(D) $\frac{3}{5}$

---

144. If $\alpha+\beta=\frac{\pi}{2}$ and $\beta+\gamma=\alpha$, then the value of $\tan\alpha$ is:
(A) $\tan\beta+\tan\gamma$
(B) $2(\tan\beta+\tan\gamma)$
(C) $\tan\beta+2\tan\gamma$
(D) $2\tan\beta+\tan\gamma$

---

145. If the mean and variance of a binomial variate X are 2 and 1 respectively, then the probability that X takes a value greater than 1 is:
(A) $\frac{2}{3}$
(B) $\frac{4}{3}$
(C) $\frac{7}{8}$
(D) $\frac{15}{16}$

---

146. The sides of a triangle are $\sin\alpha$, $\cos\alpha$ and $\sqrt{(1+\sin\alpha\cos\alpha)}$ for some $0<\alpha<\frac{\pi}{2}$. Then, the greatest angle of the triangle is:
(A) 60°
(B) 90°
(C) 120°
(D) 150°

---

147. If the curves $y^2=6x$ and $9x^2+by^2=16$ intersect each other at right angles, then the value of b is:
(A) $\frac{9}{2}$

(B) 4
(C) 6
(D) $\frac{7}{2}$

---

148. The length of the perpendicular drawn from the point $(1, 2, 3)$ to the line $\frac{z-6}{3} = \frac{y-7}{2} = \frac{z-7}{-2}$ is:
(A) 4 units
(B) 5 units
(C) 6 units
(D) 7 units

---

149. If $|\vec{a}| = \sqrt{3}$, $|\vec{b}| = 5$, $|\vec{b}||\vec{c}| = 10$, the angle between $\vec{b}$ and $\vec{c}$ is $\pi/3$, and $\vec{a}$ is perpendicular to $\vec{b} \times \vec{c}$, then the value of $|\vec{a} \times (\vec{b} \times \vec{c})|$ is:
(A) 20
(B) 30
(C) 60
(D) 40

---

150. Let X be a random variable having Binomial distribution $B(7, p)$. If $P[X = 3] = 5P[X = 4]$, then the variance of X is:
(A) $\frac{7}{6}$
(B) $\frac{35}{36}$
(C) $\frac{77}{36}$
(D) $\frac{1}{36}$
