MHT CET 2026 Sample Paper 1

Subjects : Physics, Chemistry & Mathematics

Question Booklet Version	MH-CET-2026 Roll No.	Question Booklet Sr. No.
1		
(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. The magnetic moment of a sample of mass $2\,\mathrm{g}$ is $8 \times 10^{-7}\,\mathrm{A{\cdot}m^2}$. If the density $\rho = 4\,\mathrm{g/cm^3}$, then the magnetisation M of the sample is:

(A) $0.4\,\mathrm{A/m}$
(B) $1.6\,\mathrm{A/m}$
(C) $4.0\,\mathrm{A/m}$
(D) $6.4\,\mathrm{A/m}$

---

2. A cube of edge $4\,\mathrm{cm}$ has mass $256\,\mathrm{g}$. The density of the material in SI units is:

(A) $4\,\mathrm{kg/m^3}$
(B) $1600\,\mathrm{kg/m^3}$
(C) $4000\,\mathrm{kg/m^3}$
(D) $1000\,\mathrm{kg/m^3}$

---

3. A force $F = 5x\,\mathrm{N}$ acts on a body and displaces it from $x = 0$ to $x = 2\,\mathrm{m}$. The work done by the force is:

(A) $10\,\mathrm{J}$
(B) $20\,\mathrm{J}$
(C) $5\,\mathrm{J}$
(D) $15\,\mathrm{J}$

---

4. A body starts from rest and moves with uniform acceleration. If it travels a distance of $20\,\mathrm{m}$ in $4\,\mathrm{s}$, the acceleration of the body is:
(A) $2.5\,\mathrm{m/s^2}$
(B) $1.25\,\mathrm{m/s^2}$
(C) $5\,\mathrm{m/s^2}$
(D) $10\,\mathrm{m/s^2}$

---

5. The dimensional formula of force is:
(A) $[MLT^{-2}]$
(B) $[ML^2T^{-2}]$
(C) $[ML^{-1}T^{-2}]$
(D) $[M^2LT^{-2}]$

---

6. A stone is thrown vertically upwards with a velocity of $20\,\mathrm{m/s}$. The maximum height reached by the stone is (take $g = 10\,\mathrm{m/s^2}$):

(A) 10 m
(B) 15 m
(C) 20 m
(D) 25 m

---

7. The work done in moving a charge of 5 C through a potential difference of 10 V is:
(A) 2 J
(B) 50 J
(C) 15 J
(D) 5 J

---

8. The SI unit of electric field intensity is:
(A) N/C
(B) V/C
(C) C/N
(D) J/C

---

9. A wire of resistance 10 Ω is stretched to double its length. The new resistance of the wire becomes:
(A) 10 Ω
(B) 20 Ω
(C) 40 Ω
(D) 5 Ω

---

10. The frequency of AC mains in India is:
(A) 25 Hz
(B) 50 Hz
(C) 60 Hz
(D) 100 Hz

---

11. Which of the following electromagnetic waves has the highest frequency?
(A) Infrared rays
(B) Ultraviolet rays
(C) X-rays
(D) Radio waves

---

12. The phenomenon of splitting of white light into its constituent colours is called:
(A) Reflection

(B) Refraction
(C) Dispersion
(D) Diffraction

---

13. The energy of a photon is directly proportional to its:
(A) Wavelength
(B) Frequency
(C) Amplitude
(D) Velocity

---

14. A $5\,\Omega$ resistor is connected to a $10\,\text{V}$ battery. The current flowing through the resistor is:
(A) $1.0\,\text{A}$
(B) $2.0\,\text{A}$
(C) $0.5\,\text{A}$
(D) $0.2\,\text{A}$

---

15. A charge of $2\,\mu\text{C}$ is placed in an electric field of intensity $4 \times 10^3\,\text{N/C}$. The force experienced by the charge is:
(A) $8 \times 10^{-3}\,\text{N}$
(B) $8 \times 10^{-6}\,\text{N}$
(C) $4 \times 10^{-3}\,\text{N}$
(D) $4 \times 10^{-6}\,\text{N}$

---

16. A copper ball at 80°C is brought to 60°C in 5 minutes, with surrounding temperature at 20°C. Find the temperature of the ball after 20 minutes.
(A) 35°C
(B) 30°C
(C) 25°C
(D) 20°C

---

17. Given $f'(1) = 3$, $f(1) = 1$ and $y = f(f(f(x))) + (f(x))^2$, find $\dfrac{dy}{dx}$ at $x = 1$.
(A) 9
(B) 12
(C) 15
(D) 18

---

18. What is the energy stored in a capacitor of capacitance $C = 10\,\mu F$ when a potential difference of $V = 20V$ is applied across it?
(A) 0.01 J
(B) 2 J
(C) 4 J
(D) 0.1 J

---

19. What is the frequency of a wave with a wavelength of $2m$ and a velocity of $4m/s$?
(A) 2 Hz
(B) 0.5 Hz
(C) 1 Hz
(D) 4 Hz

---

20. What is the gravitational force between two objects of masses $m_1 = 10kg$ and $m_2 = 20kg$, separated by a distance of $r = 5m$?
(Gravitational constant $G = 6.67 \times 10^{-11}\, Nm^2/kg^2$)
(A) 1.33×10^{-9} N
(B) 2.67×10^{-9} N
(C) 4.67×10^{-9} N
(D) 5.33×10^{-9} N

---

21. A car travels a distance of 200 meters in 20 seconds. What is the average speed of the car?
(A) 10 m/s
(B) 20 m/s
(C) 5 m/s
(D) 40 m/s

---

22. A block of mass 5 kg is placed on a frictionless surface. If a force of 10 N is applied to the block, what will be the acceleration of the block?
(A) $2m/s^2$
(B) $5m/s^2$
(C) $0.5m/s^2$
(D) $10m/s^2$

---

23. A 0.2 kg ball is thrown vertically upwards with an initial velocity of 10 m/s. What is the maximum height reached by the ball?
(Acceleration due to gravity $g = 9.8m/s^2$)
(A) 5 m

(B) 10 m
(C) 20 m
(D) 2 m

---

24. A 1.5 kg object is moving with a velocity of 4 m/s. What is its kinetic energy?
(A) 12 J
(B) 24 J
(C) 6 J
(D) 48 J

---

25. The resistance of a wire is 10Ω and the current passing through it is 2 A. What is the potential difference across the wire?
(A) 20 V
(B) 5 V
(C) 15 V
(D) 10 V

---

26. A 2 kg object is in a gravitational field where the acceleration due to gravity is $9.8m/s^2$. What is the gravitational potential energy of the object at a height of 5 m?
(A) 98 J
(B) 49 J
(C) 196 J
(D) 10 J

---

27. A light ray passes from air ($n_1 = 1$) into water ($n_2 = 1.33$). If the angle of incidence is 30°, what is the angle of refraction in water?
(A) 22°
(B) 30°
(C) 23.6°
(D) 40°

---

28. A ball is thrown vertically upwards with an initial velocity of $20\,\mathrm{m/s}$. How high will the ball rise? (Take $g = 10\,\mathrm{m/s^2}$)

(1) $20\,\mathrm{m}$
(2) $40\,\mathrm{m}$
(3) $10\,\mathrm{m}$
(4) $25\,\mathrm{m}$

29. What is the resistance of a wire of length $L = 2\,\text{m}$ and cross-sectional area $A = 1 \times 10^{-6}\,\text{m}^2$ made of a material with resistivity $\rho = 1.5 \times 10^{-7}\,\Omega\,\text{m}$?

(1) $3 \times 10^{-7}\,\Omega$
(2) $3 \times 10^{-6}\,\Omega$
(3) $2 \times 10^{-7}\,\Omega$
(4) $5 \times 10^{-6}\,\Omega$

---

30. A lens has focal length $f = 20\,\text{cm}$. What is the power of the lens?

(1) $+5\,\text{D}$
(2) $+10\,\text{D}$
(3) $-5\,\text{D}$
(4) $-10\,\text{D}$

---

31. A sound wave has a frequency of $440\,\text{Hz}$. What is its time period?

(1) $0.00227\,\text{s}$
(2) $0.002\,\text{s}$
(3) $0.0025\,\text{s}$
(4) $0.004\,\text{s}$

---

32. What is the kinetic energy of a body of mass $2\,\text{kg}$ moving with a velocity of $5\,\text{m/s}$?

(1) $25\,\text{J}$
(2) $10\,\text{J}$
(3) $50\,\text{J}$
(4) $5\,\text{J}$

---

33. A capacitor has a capacitance of $5\,\mu\text{F}$ and a potential difference of $10\,\text{V}$ is applied across it. What is the charge on the capacitor?

(1) $5 \times 10^{-5}\,\text{C}$
(2) $5 \times 10^{-6}\,\text{C}$
(3) $5 \times 10^{-7}\,\text{C}$
(4) $5 \times 10^{-8}\,\text{C}$

---

34. A stone is thrown horizontally from the top of a tower with a speed of $10\,\text{m/s}$. If the height of the tower is $45\,\text{m}$, how much time will the stone take to reach the ground?

(1) $3\,\text{s}$
(2) $4\,\text{s}$
(3) $5\,\text{s}$
(4) $2\,\text{s}$

---

35. A current of $2\,\text{A}$ flows through a conductor for 10 minutes. What is the total charge that flows through the conductor?

(1) $1200\,\text{C}$
(2) $1000\,\text{C}$
(3) $200\,\text{C}$
(4) $1500\,\text{C}$

---

36. An object is placed at a distance of $10\,\text{cm}$ from a concave mirror of focal length $15\,\text{cm}$. What is the image distance?

(1) $30\,\text{cm}$
(2) $20\,\text{cm}$
(3) $50\,\text{cm}$
(4) $60\,\text{cm}$

---

37. What is the energy stored in a capacitor of capacitance $C = 10\,\mu\text{F}$ when a potential difference of $V = 20\,\text{V}$ is applied across it?
(1) 0.01 J
(2) 2 J
(3) 4 J
(4) 0.1 J

---

38. What is the frequency of a wave with a wavelength of 2 m and a velocity of 4 m/s?
(1) 2 Hz
(2) 0.5 Hz
(3) 1 Hz
(4) 4 Hz

---

39. What is the gravitational force between two objects of masses $m_1 = 10\,\text{kg}$ and $m_2 = 20\,\text{kg}$, separated by a distance of $r = 5\,\text{m}$? (Gravitational constant

$G = 6.67 \times 10^{-11}\,\mathbf{N\ m^2/kg^2}$)
(1) 1.33×10^{-9} N
(2) 2.67×10^{-9} N
(3) 4.67×10^{-9} N
(4) 5.33×10^{-9} N

---

40. A car travels a distance of 200 meters in 20 seconds. What is the average speed of the car?
(1) 10 m/s
(2) 20 m/s
(3) 5 m/s
(4) 40 m/s

---

41. A block of mass 5 kg is placed on a frictionless surface. If a force of 10 N is applied to the block, what will be the acceleration of the block?
(1) 2 $\mathrm{m/s^2}$
(2) 5 $\mathrm{m/s^2}$
(3) 0.5 $\mathrm{m/s^2}$
(4) 10 $\mathrm{m/s^2}$

---

42. A 0.2 kg ball is thrown vertically upwards with an initial velocity of 10 m/s. What is the maximum height reached by the ball? (Acceleration due to gravity $g = 9.8\,\mathbf{m/s^2}$)
(1) 5 m
(2) 10 m
(3) 20 m
(4) 2 m

---

43. A 1.5 kg object is moving with a velocity of 4 m/s. What is its kinetic energy?
(1) 12 J
(2) 24 J
(3) 6 J
(4) 48 J

---

44. The resistance of a wire is $10\,\Omega$ **and the current passing through it is 2 A. What is the potential difference across the wire?**
(1) 20 V
(2) 5 V
(3) 15 V
(4) 10 V

45. A 2 kg object is in a gravitational field where the acceleration due to gravity is $9.8\,\text{m/s}^2$. What is the gravitational potential energy of the object at a height of 5 m?
(1) 98 J
(2) 49 J
(3) 196 J
(4) 10 J

---

46. A light ray passes from air (refractive index $n_1 = 1$) into water (refractive index $n_2 = 1.33$). If the angle of incidence is 30°, what is the angle of refraction in the water?
(1) 22°
(2) 30°
(3) 23.6°
(4) 40°

---

47. A force of 100 N is applied to an object at an angle of 30° to the horizontal. What is the work done by the force in moving the object a distance of 5 m?
(1) 500 J
(2) 250 J
(3) 433 J
(4) 100 J

---

48. A wire has a resistance of $10\,\Omega$ at 20°C. If the temperature coefficient of resistance of the material is 0.004 per $^\circ$C, what is the resistance of the wire at 50°C?
(1) 12 Ω
(2) 10.6 Ω
(3) 15 Ω
(4) 20 Ω

---

49. A car accelerates uniformly from rest to a velocity of $25\,\text{m/s}$ in 10 seconds. What is the acceleration of the car?

(1) $2.5\,\text{m/s}^2$
(2) $5\,\text{m/s}^2$
(3) $10\,\text{m/s}^2$
(4) $15\,\text{m/s}^2$

---

50. A block of mass $5\,\text{kg}$ is placed on a horizontal surface. The coefficient of friction between the block and the surface is 0.4. What is the force of friction acting on

the block?

(1) 10 N
(2) 15 N
(3) 20 N
(4) 25 N

Chemistry

1. Which of the following statements is correct regarding the coordination compound $[Fe(CN)_6]^{4-}$ and fructose structure?

(A) The EAN of iron is 36 and fructose forms a pyranose ring
(B) The EAN of iron is 36 and fructose forms a furanose ring
(C) Ionisation isomerism and fructose is non-reducing
(D) The EAN is 30 and fructose forms a pyranose ring

---

2. The effective atomic number (EAN) of cobalt in the complex $[Co(NH_3)_6]^{3+}$ is:

(A) 27
(B) 30
(C) 33
(D) 36

---

3. The van't Hoff factor for a solution of K_2SO_4 in water is:

(A) 1
(B) 2
(C) 3
(D) 4

---

4. Rosenmund reduction is used to convert acyl chlorides into:

(A) Alcohols
(B) Carboxylic acids
(C) Aldehydes
(D) Ketones

---

5. In the electrolysis of molten NaCl, the product obtained at the cathode is:

(A) Cl_2 gas
(B) Sodium metal
(C) NaOH
(D) H_2 gas

---

6. Which of the following is an example of physisorption?

(A) NH_3 on charcoal
(B) H_2 on Ni
(C) Noble gases on solids
(D) O_2 on heated metal

---

7. For a first-order reaction, the time required to reduce the concentration of the reactant to half of its initial value is:

(A) $\dfrac{0.3010}{k}$
(B) $\dfrac{1}{k}$
(C) $\dfrac{0.693}{k}$
(D) $\dfrac{2.303}{k}$

---

8. Which of the following statements is correct regarding the coordination compound $[Fe(CN)_6]^{4-}$ and fructose structure?
(A) The EAN of iron in $[Fe(CN)_6]^{4-}$ is 36 and fructose forms a pyranose ring
(B) The EAN of iron in $[Fe(CN)_6]^{4-}$ is 36 and fructose forms a furanose ring
(C) The compound exhibits ionisation isomerism and fructose is a non-reducing sugar
(D) The EAN of Fe is 30 and fructose forms a pyranose ring

---

9. The effective atomic number (EAN) of cobalt in the complex $[Co(NH_3)_6]^{3+}$ is:
(A) 27
(B) 30
(C) 33
(D) 36

---

10. The density of a cube of edge $4\,\mathrm{cm}$ having mass $256\,\mathrm{g}$ in SI units is:
(A) $4\,\mathrm{kg/m^3}$

(B) $1600\,\mathrm{kg/m^3}$
(C) $4000\,\mathrm{kg/m^3}$
(D) $1000\,\mathrm{kg/m^3}$

---

11. The van't Hoff factor for K_2SO_4 in aqueous solution is:
(A) 1
(B) 2
(C) 3
(D) 4

---

12. Rosenmund reduction is used to convert acyl chlorides into:
(A) Alcohols
(B) Carboxylic acids
(C) Aldehydes
(D) Ketones

---

13. In the electrolysis of molten NaCl, the substance obtained at the cathode is:
(A) Cl_2 gas
(B) Sodium metal
(C) NaOH
(D) H_2 gas

---

14. Which of the following is an example of physisorption?
(A) Adsorption of NH_3 on charcoal
(B) Adsorption of H_2 on Ni
(C) Adsorption of noble gases on a solid surface
(D) Adsorption of O_2 on heated metal

---

15. For a first-order reaction, the half-life period is given by:
(A) $\frac{0.3010}{k}$
(B) $\frac{1}{k}$
(C) $\frac{0.693}{k}$
(D) $\frac{2.303}{k}$

---

16. Which of the following colligative properties depends only on the number of solute particles?

(A) Osmotic pressure
(B) Surface tension
(C) Viscosity
(D) Optical rotation

---

17. The rate constant of a chemical reaction depends on:
(A) Initial concentration
(B) Time
(C) Temperature
(D) Pressure only

---

18. Which of the following gases is most soluble in water?
(A) Oxygen
(B) Nitrogen
(C) Carbon dioxide
(D) Hydrogen

---

19. Which of the following elements does not have a completely filled outermost shell in its ground state?
(A) Neon
(B) Helium
(C) Oxygen
(D) Argon

---

20. Which of the following is an example of a redox reaction?
(A) NaCl dissolving in water
(B) $2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$
(C) NaOH dissolving in water
(D) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

---

21. In the reaction $2H_2 + O_2 \rightarrow 2H_2O$, if 4 moles of hydrogen react completely with oxygen, how many moles of water will be produced?
(A) 2 mol
(B) 4 mol
(C) 8 mol
(D) 1 mol

---

22. What is the volume of oxygen required for complete combustion of 0.25 mole of methane at STP?

(A) 22.4 L
(B) 5.6 L
(C) 11.2 L
(D) 7.46 L

---

23. What is the correct order of thermal stability of the following carbonates? $BaCO_3,\ MgCO_3,\ SrCO_3,\ CaCO_3$
(A) $MgCO_3 < CaCO_3 < SrCO_3 < BaCO_3$
(B) $BaCO_3 < SrCO_3 < CaCO_3 < MgCO_3$
(C) $BaCO_3 > MgCO_3 > SrCO_3 > CaCO_3$
(D) $MgCO_3 > CaCO_3 > SrCO_3 > BaCO_3$

---

24. Which of the following plots gives a straight line for a zero-order reaction?
(A) $[A]$ vs t
(B) $\log[A]$ vs t
(C) $1/[A]$ vs t
(D) $\ln[A]$ vs t

---

25. For a first-order reaction, the slope of the graph between $\log[A]$ vs time is equal to:
(A) $-\dfrac{k}{2.303}$
(B) k
(C) $2.303k$
(D) $-2.303k$

---

26. The magnetic moment of Mn^{3+} is:
(A) 1.73 BM
(B) 2.83 BM
(C) 4.90 BM
(D) 5.92 BM

---

27. Which trend is correct regarding ionic radius in the $4f$-series (lanthanides)?
(A) Radius increases from La^{3+} to Lu^{3+}
(B) Radius remains same
(C) Radius decreases across the series
(D) No regular trend observed

---

28. Which of the following d-block elements has the highest melting point?
(A) Zn
(B) Fe
(C) Cr
(D) W

---

29. At a given temperature, which statement is correct regarding solubility of a solid in a liquid?
(A) Always increases with temperature
(B) Always decreases with temperature
(C) May increase or decrease depending on enthalpy change
(D) Does not depend on temperature

---

30. Which of the following is a primary alcohol?
(A) $CH_3CH_2CH_2OH$
(B) $(CH_3)_2CHOH$
(C) $(CH_3)_3COH$
(D) None of these

---

31. Which of the following monomers undergo addition polymerization?
(A) Ethene
(B) Acetic acid
(C) Glucose
(D) Glycerol

---

32. Which of the following is the polymer formed from acrylonitrile?
(A) PVC
(B) Polyacrylonitrile (PAN)
(C) Teflon
(D) Nylon-6

---

33. Thermal stability order of Group 1 hydroxides is:
(A) LiOH < NaOH < KOH < RbOH < CsOH
(B) CsOH < RbOH < KOH < NaOH < LiOH
(C) LiOH > NaOH > KOH > RbOH > CsOH
(D) LiOH = NaOH = KOH = CsOH

---

34. Which of the following is not a transition metal?
(A) Zn

(B) Fe
(C) Cr
(D) Cu

---

35. What is the molecular mass of Na_2SO_4?

(1) 142 g/mol
(2) 120 g/mol
(3) 158 g/mol
(4) 98 g/mol

---

36. Which of the following is the correct IUPAC name for CH_3CH_2OH?

(1) Ethanol
(2) Methanol
(3) Propanol
(4) Butanol

---

37. What is the pH of a 0.01 M solution of HCl?

(1) 2
(2) 4
(3) 1
(4) 3

---

38. What is the empirical formula of C_6H_6?

(1) CH
(2) C_2H_3
(3) C_3H_3
(4) C_6H_6

---

39. Which of the following ions will have the highest lattice energy?

(1) NaCl
(2) MgO
(3) KCl
(4) LiF

---

40. The oxidation number of chlorine in Cl_2O is:

(1) $+1$
(2) -1
(3) 0
(4) $+3$

---

41. What is the molar concentration of hydrogen ions in a solution of $0.1\,M$ HCl?

(1) $0.1\,M$
(2) $0.05\,M$
(3) $0.2\,M$
(4) $1\,M$

---

42. Which of the following gases has the highest density at STP?

(1) CO_2
(2) O_2
(3) N_2
(4) CH_4

---

43. What is the molar mass of a gas, if 2.5 g of the gas occupies 1.12 L at STP?
(1) 32 g/mol
(2) 22.4 g/mol
(3) 44 g/mol
(4) 28 g/mol

---

44. Which of the following is the correct electronic configuration for the element with atomic number 16?
(1) $1s^2 2s^2 2p^6 3s^2 3p^4$
(2) $1s^2 2s^2 2p^6 3s^2 3p^6$
(3) $1s^2 2s^2 2p^6 3s^2 3p^5$
(4) $1s^2 2s^2 2p^6 3s^2 3p^3$

---

45. What is the pH of a solution when the concentration of hydrogen ions $[H^+]$ is 1×10^{-5} mol/L?
(1) 5
(2) 9
(3) 7
(4) 4

46. What is the mass of 0.5 moles of water (H_2O)?
(1) 9 g
(2) 18 g
(3) 36 g
(4) 45 g

---

47. Which of the following represents the correct IUPAC name for CH_3CH_2OH?
(1) Methanol
(2) Ethanol
(3) Propanol
(4) Butanol

---

48. Which of the following gases is responsible for the greenhouse effect?
(1) Oxygen
(2) Carbon dioxide
(3) Nitrogen
(4) Hydrogen

---

49. What is the oxidation state of chlorine in Cl_2O_7?
(1) +7
(2) +5
(3) -1
(4) +3

---

50. Which of the following is the strongest acid in aqueous solution?
(1) HCl
(2) H_2SO_4
(3) HNO_3
(4) HF

Mathematics

1. The ratio of areas bounded by the curves $y = \cos x$ and $y = 0$ between $x = 0$ to $x = \frac{\pi}{3}$ and $x = \frac{\pi}{3}$ to $x = \frac{2\pi}{3}$, with the x-axis is:
(A) $2 : 1$
(B) $\sqrt{2} : 1$
(C) $1 : 1$
(D) $1 : 3$

2. If $A = \begin{bmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$**, and** A_{11}, A_{12}, A_{13} **are the cofactors of** a_{11}, a_{12}, a_{13} **respectively, then the value of** $a_{11}A_{11} + a_{12}A_{12} + a_{13}A_{13}$ **is:**

(A) -1
(B) 1
(C) 0
(D) 2

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3. If $f(x) = 2(\cos x + i\sin x)(\cos 3x + i\sin 3x)\cdots(\cos(2n-1)x + i\sin(2n-1)x)$**, where** $n \in \mathbb{N}$**, then the value of** $f''(x)$ **is:**

(A) $-n^2 f(x)$
(B) $n^2 f(x)$
(C) $-n^4 f(x)$
(D) $n^4 f(x)$

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4. The smallest angle of a triangle whose sides are $6 + \sqrt{12}, \sqrt{48}, \sqrt{54}$ **is:**

(A) $\frac{\pi}{4}$
(B) $\frac{\pi}{2}$
(C) $\frac{\pi}{6}$
(D) $\frac{\pi}{3}$

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5. A box contains 9 tickets numbered from 1 to 9 inclusive. Three tickets are drawn from the box one at a time. What is the probability that they are alternatively either (odd, even, odd) or (even, odd, even)?

(A) $\frac{5}{16}$
(B) $\frac{5}{17}$
(C) $\frac{4}{17}$
(D) $\frac{5}{16}$

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6. A plane passes through the point $(1, -2, 1)$ and is perpendicular to both the planes $2x - 2y - 2z = 5$ and $x - y + 2z = 24$. Then the distance of the point $(1, 2, 2)$ from this plane is:

(A) $2\sqrt{2}$
(B) 1
(C) $\sqrt{2}$
(D) 2

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7. Solve the equation: $x + \log_{15}(5 + 3x) = x \log_{15} 5 + \log_{15} 24$.

(A) 2
(B) 1
(C) 5
(D) 8

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8. An ellipse has OB as the semi-minor axis and S, S' as the foci. If $\angle SBS'$ is a right angle, then the eccentricity e of the ellipse is:

(A) $\sqrt{2}$
(B) $\dfrac{1}{2}$
(C) $\dfrac{1}{\sqrt{2}}$
(D) $\dfrac{1}{3}$

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9. The value of $\displaystyle\int_1^4 \log(\lfloor x \rfloor)\, dx$, where $\lfloor x \rfloor$ is the greatest integer less than or equal to x, is:

(A) $\log 2$
(B) $\log 5$
(C) $\log 6$
(D) $\log 3$

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10. In a triangle ABC, with usual notation, if $\dfrac{b+c}{11} = \dfrac{c+a}{12} = \dfrac{a+b}{13}$, then the ratio $\cos A : \cos B : \cos C$ is:

(A) 19 : 7 : 25
(B) 7 : 19 : 25
(C) 12 : 14 : 20
(D) 19 : 25 : 7

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11. The value of $\int_1^4 \log(\lfloor x \rfloor)\, dx$, where $\lfloor x \rfloor$ denotes the greatest integer less than or equal to x, is:

(A) $\log 6$
(B) $\log 5$
(C) $\log 2$
(D) $\log 3$

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12. A population $P(t)$ of 1000 bacteria introduced to a nutrient medium grows according to $P(t) = \dfrac{1000t + 1000t}{100 + t^2}$. The maximum size of this bacterial population is:

(A) 1250
(B) 1100
(C) 1050
(D) 950

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13. If the angle θ between the line $\dfrac{2t+1}{1} = \dfrac{y-1}{2} = \dfrac{z}{2}$ and the plane $2x - \dfrac{y}{\sqrt{7}} + z + 4 = 0$ is such that $\sin\theta = \dfrac{8}{\sqrt{3}}$, then the value of the expression is:

(A) $-5\sqrt{3}$
(B) $5\sqrt{3}$
(C) $8\sqrt{3}$
(D) $-8\sqrt{3}$

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14. The distance of the point $(-3, 2, 3)$ from the line passing through $(4, 6, -2)$ and having direction ratios $-1, 2, 3$ is:

(A) $4\sqrt{17}$
(B) $2\sqrt{17}$
(C) $2\sqrt{19}$
(D) $4\sqrt{19}$

15. If $y = y(x)$ satisfies $\left(\frac{2+\sin x}{1+y}\right)\frac{dy}{dx} = -\cos x$, such that $y(0) = 2$, then the value of $y\left(\frac{\pi}{2}\right)$ is:

(A) 3
(B) 4
(C) 2
(D) 1

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16. Let $f(x) = (\cos x + \sin x)(\cos 3x + i \sin 3x) \cdots (\cos(2n-1)x + i \sin(2n-1)x)$, where $n \in \mathbb{N}$ and $i = \sqrt{-1}$. Then $f''(x)$ is:

(A) $-n^4 f(x)$
(B) $n^2 f(x)$
(C) $-n^2 f(x)$
(D) $n^4 f(x)$

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17. If $[2\vec{p} - 3\vec{q}, \vec{q}, \vec{s}] + [3\vec{p} + 2\vec{q}, \vec{r}, \vec{s}] = m[\vec{p}, \vec{r}, \vec{s}] + n[\vec{q}, \vec{r}, \vec{s}] + l[\vec{p}, \vec{q}, \vec{s}]$, then the values of m, n, l respectively are:

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

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18. Given $\vec{a} = \hat{j} - \hat{k}$ and $\vec{c} = \hat{i} - \hat{j} - \hat{k}$. The vector $\vec{b}$ satisfies $\vec{a} \times \vec{b} + \vec{c} = 0$ and $\vec{a} \cdot \vec{b} = 3$. Find the vector $\vec{b}$.

(A) $-\hat{i} + \hat{j} - 2\hat{k}$
(B) $\hat{i} + \hat{j} + 2\hat{k}$
(C) $\hat{i} - \hat{j} + 2\hat{k}$
(D) $-\hat{i} + \hat{j} + \hat{k}$

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19. Evaluate the integral $\int_{-1}^{1} \log\left(\frac{2-x}{2+x}\right) dx$.

(A) $2\log\left(\frac{1}{2}\right)$
(B) $\log\left(\frac{3}{4}\right)$

(C) 0
(D) $\log 2$

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20. Find the area bounded between the parabola $y^2 = 4x$ and the line $y = 2x - 3$.

(A) $\displaystyle\int_{1+\sqrt{7}}^{1-\sqrt{7}} \left(\frac{y+3}{2} - \frac{y^2}{4}\right) dy$
(B) $\displaystyle\int_{1+\sqrt{7}}^{1-\sqrt{7}} \left(\frac{y^2}{4} - \frac{y+3}{2}\right) dy$
(C) $\displaystyle\int_{-2}^{2} \left(\frac{y^2}{4} - y\right) dy$
(D) $\displaystyle\int_{1+\sqrt{7}}^{1-\sqrt{7}} \left(\frac{y^2+y+3}{2}\right) dy$

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21. The value of the definite integral $\int_0^{\pi} \sin^2 x \, dx$ is:
(A) $\frac{\pi}{2}$
(B) $\frac{\pi}{4}$
(C) $\frac{\pi}{3}$
(D) $\frac{\pi}{6}$

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22. The distance between the points $A(3, 4)$ and $B(-1, -2)$ is:
(A) 5
(B) 6
(C) 7
(D) 8

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23. A bag contains 5 red balls and 3 green balls. If two balls are drawn at random without replacement, what is the probability that both balls drawn are red?
(A) $\frac{5}{28}$
(B) $\frac{5}{21}$
(C) $\frac{3}{14}$
(D) $\frac{1}{3}$

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24. If $\tan\theta = 2$, then the value of $\sec^2\theta$ is:
(A) 5
(B) 4
(C) 3
(D) 2

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25. If the roots of the quadratic equation $x^2 - 7x + 12 = 0$ are α and β, then the value of $\alpha + \beta$ is:
(A) 7
(B) 12
(C) 5
(D) 6

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26. The general solution of the differential equation $\dfrac{dy}{dx} = 3x^2$ is:
(A) $y = x^3 + C$
(B) $y = 3x^3 + C$
(C) $y = \dfrac{3}{2}x^3 + C$
(D) $y = x^3 + 3C$

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27. If $A = \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix}$, then the determinant of matrix A is:
(A) 4
(B) 5
(C) 7
(D) 10

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28. The value of $\lim_{x\to 0} \dfrac{\sin x}{x}$ is:
(A) 1
(B) 0
(C) ∞
(D) Does not exist

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29. If $\vec{A} = 2\hat{i} + 3\hat{j}$ and $\vec{B} = 4\hat{i} - \hat{j}$, then the dot product $\vec{A} \cdot \vec{B}$ is:
(A) 5
(B) 6
(C) 7
(D) 8

30. The maximum value of the function $f(x) = -2x^2 + 4x + 1$ occurs at:
(A) $x = 1$
(B) $x = -1$
(C) $x = 0$
(D) $x = 2$

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31. The value of the integral $\int_0^1 x^2 dx$ is:
(A) $\frac{1}{3}$
(B) $\frac{1}{2}$
(C) $\frac{2}{3}$
(D) 1

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32. If $z = 3 + 4i$, then the modulus of z is:
(A) 5
(B) 7
(C) 9
(D) 10

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33. A die is rolled. What is the probability of getting a number less than or equal to 4?
(A) $\frac{2}{3}$
(B) $\frac{1}{2}$
(C) $\frac{3}{6}$
(D) $\frac{1}{3}$

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34. In how many ways can 5 people be arranged in a row?
(A) 120
(B) 60
(C) 24
(D) 10

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35. The feasible region of the LPP given by $x + y \leq 6$, $x \geq 0$, $y \geq 0$. What is the maximum value of $x + y$?

(A) 6
(B) 5
(C) 4
(D) 3

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36. Water is being poured at the rate of $36\,\mathrm{m}^3/\mathrm{min}$ into a cylindrical vessel whose circular base is of radius 3 meters. Then the water level in the cylinder increases at the rate of:
(A) 4π m/min
(B) $\dfrac{4}{\pi}$ m/min
(C) $\dfrac{1}{4\pi}$ m/min
(D) $\dfrac{\pi}{4}$ m/min

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37. If $\vec{a} = 2\hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j}$ are vectors such that $\vec{a} + \lambda\vec{b}$ is perpendicular to $\vec{c}$, then the value of λ is:
(A) 6
(B) -6
(C) 8
(D) -8

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38. If $\cos^{-1}\left(\dfrac{12}{13}\right) + \sin^{-1}\left(\dfrac{3}{5}\right) = \sin^{-1} P$, then the value of P is:
(A) $\dfrac{63}{65}$
(B) $\dfrac{56}{65}$
(C) $\dfrac{48}{65}$
(D) $\dfrac{36}{65}$

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39. The area enclosed between the parabola $y^2 = 4x$ and the line $y = 2x - 4$ is:
(A) $\dfrac{17}{3}$ sq. units
(B) 15 sq. units
(C) $\dfrac{19}{3}$ sq. units
(D) 9 sq. units

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40. If $y = \tan^{-1}\left(\frac{2+3x}{3-2x}\right) + \tan^{-1}\left(\frac{4x}{1+5x^2}\right)$**, then** $\frac{dy}{dx}$ **is:**

(A) $\frac{1}{1+25x^2}$

(B) $\frac{5}{1+25x^2}$

(C) $\frac{1}{1+5x^2}$

(D) $\frac{5}{1+5x^2}$

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41. The particular solution of the differential equation $xy\frac{dy}{dx} = x^2 + 2y^2$**, when** $y(1) = 0$**, is:**

(A) $\frac{x^2+y^2}{x^3} = 1$

(B) $x^2 + y^2 = x$

(C) $x^2 + y^2 = x^4$

(D) $x^2 + 2y^2 = x^4$

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42. If the angle between the line $2(x+1) = y = z$ **and the plane** $2x - y + \sqrt{2}z + 4 = 0$ **is** $\frac{\pi}{6}$**, then the value of** λ **is:**

(A) $\frac{135}{7}$

(B) $\frac{45}{11}$

(C) $\frac{45}{7}$

(D) $\frac{135}{11}$

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43. If the volume of the tetrahedron whose vertices are $A(1,2,3)$**,** $B(-3,-1,1)$**,** $C(2,1,3)$ **and** $D(-1,2,x)$ **is** $\frac{11}{6}$ **cubic units, then the value of** x **is:**

(A) 3

(B) -2

(C) 4

(D) -1

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44. Evaluate the integral $\int \sin^5 x\, dx$**.**

(A) $-\frac{1}{5}\cos x(5 - 10\sin^2 x + \sin^4 x) + C$

(B) $-\frac{\cos x}{3} + \frac{\cos 3x}{3} - \frac{\cos 5x}{5} + C$

(C) $\frac{1}{5}\sin^5 x + C$
(D) $\int \sin^5 x dx = \int \sin^3 x \cdot \sin^2 x dx$

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45. Evaluate the determinant of the matrix $\begin{vmatrix} 1 & \tan x \\ -\tan x & 1 \end{vmatrix}$.

(A) $1 - \tan^2 x$
(B) $1 + \tan^2 x$
(C) $\sec^2 x$
(D) 0

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46. Evaluate the expression $f(f(f(x))) + (f(f(x)))^2$ **if** $x = 1$.
(A) $f(f(f(1))) + (f(f(1)))^2$
(B) $f(f(f(1))) + (f(1))^2$
(C) $(f(1))^2 + f(1)$
(D) Cannot be determined

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47. If $a(4 + x^2) = x + y - x^3 = a^3\frac{dy}{dx}$ **at** $x = 1$**, then the value of** $\frac{dy}{dx}$ **is:**
(A) 5
(B) 4
(C) 3
(D) 2

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48. Evaluate the definite integral: $\int_0^{\frac{\pi}{2}} \frac{dx}{1 + (\cot x)^{101}} = ?$
(A) $\frac{\pi}{4}$
(B) $\frac{\pi}{2}$
(C) $\frac{1}{2}$
(D) 1

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49. For all real x**, the minimum value of the function** $f(x) = \frac{1 - x + x^2}{1 + x + x^2}$ **is:**
(A) $\frac{1}{3}$
(B) 0
(C) 3
(D) 1

50. Approximate value of $\cos 59^\circ$ is:
(A) 0.50
(B) 0.61
(C) 0.75
(D) 0.85