VMC Vidyamandir Classes SINCE 1986

IIT JEE | MEDICAL | FOUNDATION

CODE A

Mock JEE Main - 6 | JEE

[redacted] Maximum Marks: 300

Timing: 04:00 PM to 04:00 AM

General Instructions

1. The test is of **3 hours** duration and the maximum marks is **300.**
2. The question paper consists of **3 Parts** (Part I: **Physics**, Part II: **Chemistry**, Part III: **Mathematics**). Each Part has **two** sections (Section 1 & Section 2).
3. **Section 1** contains **20 Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.
4. **Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted.**

   You will NOT be allowed to attempt the sixth question. If you wish to attempt any other question apart from the five already attempted, then you will have to delete any one response from the five previously answered and then proceed to answer the new one.

   The answer to each question is a NUMERICAL VALUE. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. (Example: 6, 81, 1.50, 3.25,

   0.08)
5. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. inside the examination room/hall.
6. On completion of the test, the candidate must hand over the Answer Sheet to the **Invigilator** on duty in the Room/Hall. **However, the candidates are allowed to take away this Test Booklet with them**.

Marking Scheme

1. **Section – 1:** +4 for correct answer, –1 (negative marking) for incorrect answer, 0 for all other cases.
2. **Section – 2:** +4 for correct answer, 0 for all other cases. There is no negative marking.

Name of the Candidate (In CAPITALS) : _____

Roll Number : _____

OMR Bar Code Number : _____

Candidate's Signature : _____ **Invigilator's Signature** _____

PART I : PHYSICS 100 MARKS

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

1. Which of these quantities has the same dimension as Planck's constant?

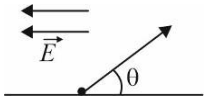
(A) (Momentum) × (Distance) **(B)** $\frac{(\text{Energy})}{(\text{Time})}$

(C) $\frac{(\text{Angular momentum})}{(\text{Volume})}$ **(D)** (Pressure) × (Distance)

2. The maximum acceleration of a particle executing SHM on a straight line is 1.8 m/s^2 and its maximum speed is 0.3 m/s. The time period (in seconds) is close to:

(A) 0.53 **(B)** 1.05 **(C)** 0.78 **(D)** 1.57

3. A particle of mass 0.1 kg and carrying positive charge 0.002 C is projected from the ground at an angle θ with the horizontal in a region with a uniform horizontally directed electric field of magnitude 500 *V*/*m* as shown. Which of the following statements are correct?



(i) If $\theta = 45°$, the minimum velocity of the particle during its flight is zero

(ii) The particle follows a parabolic path in the air

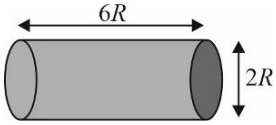
(iii) The acceleration of the particle during its flight is constant

(iv) If $\theta = 45°$, the particle returns to the point of projection

(A) (i), (ii), (iii) and (iv) **(B)** (i), (iii) and (iv)

(C) (i) and (iii) **(D)** (ii) and (iv)

4. A portion of length 6*R* is cut out from a long hollow cylindrical pipe of radius *R* and thickness *t* (such that $t << R$). The cut out portion is closed from both ends by attaching two circular discs of radius *R* and thickness 2*t* made from the same material as the pipe. If the total mass of the body formed is *M*, the moment of inertia of this body about an axis passing through the centres of both circular discs is:



(A) $\frac{5}{8}MR^2$ **(B)** $\frac{7}{8}MR^2$ **(C)** $\frac{13}{16}MR^2$ **(D)** $\frac{15}{16}MR^2$

5. Let *R* denote the radius of the earth and v_e denote the escape velocity from the surface of the earth. A particle is projected vertically from the surface of the earth with velocity $\frac{v_e}{2}$. The velocity of the particle when it reaches a height $\frac{R}{10}$ above the surface is:

(A) $\sqrt{\frac{11}{84}}v_e$ **(B)** $\sqrt{\frac{11}{63}}v_e$ **(C)** $\sqrt{\frac{7}{44}}v_e$ **(D)** $\sqrt{\frac{5}{22}}v_e$

6. If a spherical metal ball is heated from $20\,°C$ to $30\,°C$, its diameter increases by 0.04%. If it is heated from $20°C$ to $35°C$, the percentage change in its mass density is close to:

(A) 0.06 **(B)** 0.12 **(C)** 0.18 **(D)** 0.24

7. When a capillary tube of small diameter is dipped vertically into a liquid of density $625\ \text{kg/m}^3$ and surface tension 0.09 N/m such that the length of the capillary above the liquid surface is 10 dm, the liquid rises to a height 3 dm inside the capillary. The radius of curvature (in mm) of the surface of the liquid inside the capillary is:

(A) 0.048 **(B)** 0.064 **(C)** 0.072 **(D)** 0.096

8. A heat engine operating on the Carnot cycle has an efficiency of 25.0%. If the total heat absorbed by the engine during each isothermal expansion is 10 kJ, the total heat rejected (in kJ) during each isothermal compression is:

(A) 5 **(B)** 7.5 **(C)** 13.3 **(D)** 22.5

9. A monoatomic gas enclosed in a perfectly insulated piston cylinder is compressed to twice its initial pressure. The mean collision time of the gas molecules becomes 2^{-X} times. Then, X is equal to:

(A) $\frac{2}{5}$ **(B)** $\frac{4}{5}$ **(C)** $\frac{1}{3}$ **(D)** $\frac{4}{3}$

10. A total charge Q is distributed over two conducting spherical shells A and B of radius a and b (such that $a<b$) fixed concentrically. The surface charge density over each shell is uniform. If the potential at their common centre is zero, the ratio of their surface charge densities, $\frac{\sigma_A}{\sigma_B}$, is equal to:

(A) $\frac{b}{a}$ **(B)** $-\frac{b}{a}$ **(C)** $\frac{b^2}{a^2}$ **(D)** $-\frac{b^2}{a^2}$

11. A dielectric slab of dielectric constant 2 is inserted between the plates of a parallel-plate capacitor as shown. The slab covers the entire area of the plates, and the thickness of the slab is $\frac{2}{3}$ times the distance between the plates. If the capacitance before the insertion of the slab was C, the capacitance now becomes:

(A) $\frac{7}{3}C$ **(B)** $\frac{5}{3}C$ **(C)** $\frac{11}{6}C$ **(D)** $\frac{3}{2}C$

12. An electron is moving in a uniform magnetic field along the $+Y$ direction. At $t = 0$, it is at the origin and has velocity $v_0\hat{i} + v_0\hat{j}$. The electron again intersects the Y-axis at $t = T$. Which of the following statements are correct?

(i) The distance travelled by the electron between $t = 0$ and $t = T$ is $\sqrt{2}v_0T$

(ii) The velocity of the electron at $t = T$ is $v_0\hat{i} - v_0\hat{j}$

(iii) The Y-coordinate of the electron at $t = T$ is v_0T

(iv) The acceleration of the electron at $t = T$ is towards the $+Z$ direction

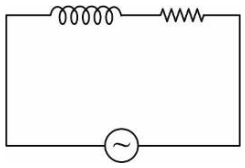
(A) (i), (ii) and (iii) **(B)** (i) and (iii)

(C) (ii), (iii) and (iv) **(D)** (ii) and (iv)

13. A thin circular ring is charged uniformly over its length. If the ring is rotated about its central axis at a constant angular speed, the magnitude of its magnetic moment is M_1. If it is rotated about a diameter with the same angular speed, the magnitude of its magnetic moment is M_2. The ratio $\frac{M_2}{M_1}$ is equal to:

(A) $\frac{1}{4}$ **(B)** $\frac{1}{2}$ **(C)** 2 **(D)** 4

14. The combination of an inductor coil and a resistance $12\ \Omega$ is connected to an *AC* source of variable frequency as shown. If the impedance of the combination at frequency 80 Hz is $20\ \Omega$, its impedance at frequency 60 Hz is:



(A) $12\sqrt{2}\ \Omega$ **(B)** $16\ \Omega$ **(C)** $8\sqrt{2}\ \Omega$ **(D)** $18\ \Omega$

15. A plane electromagnetic wave propagating in the direction of the unit vector $\frac{1}{\sqrt{2}}\left(\hat{i}-\hat{j}\right)$ passes through a point *P*. At a particular instant, the electric field of the wave at *P* is in the direction of the unit vector $\hat{k}$. Then, at the same instant, the magnetic field of the wave at *P* is in the direction of the unit vector:

(A) $\frac{1}{\sqrt{2}}\left(\hat{i}+\hat{j}\right)$ **(B)** $\frac{1}{\sqrt{2}}\left(-\hat{i}-\hat{j}\right)$ **(C)** $\frac{1}{\sqrt{2}}\left(\hat{i}-\hat{k}\right)$ **(D)** $\frac{1}{\sqrt{2}}\left(-\hat{i}+\hat{j}\right)$

16. In a Young's double slit experiment, the two points of complete darkness closest to the central maximum have angular position $\theta_1 = 10^{-4}$ rad. If the distance between the slits and the screen is 2 m, the fringe width (in mm) of the interference pattern is:

(A) 0.1 **(B)** 0.2 **(C)** 0.3 **(D)** 0.4

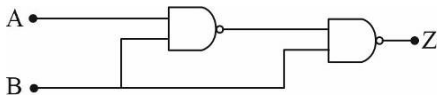
17. An electron initially at rest is accelerated through a potential difference 125 *V*. The de-Broglie wavelength of the electron is closest to:

(A) 1000 nm **(B)** 10 nm **(C)** 0.1 nm **(D)** 0.001 nm

18. An electron in the first Bohr orbit in a Hydrogen atom absorbs two photons in succession, transitioning first to the third and then to the sixth Bohr orbit. If the wavelength of the photons is λ_1 and λ_2 respectively, the ratio $\frac{\lambda_1}{\lambda_2}$ is:

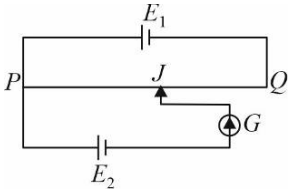
(A) $\frac{25}{21}$ **(B)** $\frac{42}{25}$ **(C)** $\frac{7}{6}$ **(D)** $\frac{35}{32}$

19. In the following digital circuit, if the inputs at (*A*, *B*) are (0, 0), (0, 1), (1, 0) and (1, 1), the outputs at *Z* are respectively:



(A) 1, 1, 1, 0 **(B)** 1, 0, 1, 0 **(C)** 1, 1, 0, 1 **(D)** 1, 0, 1, 1

20. In a potentiometer experiment, the main cell E_1 has emf 60 V and internal resistance $2\ \Omega$. The potentiometer wire PQ has length 120 cm and total resistance $20\ \Omega$. If the galvanometer shows zero deflection for the length PJ = 75 cm, the emf of the cell E_2 is:



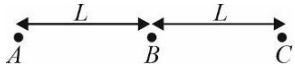
(A) 28.4 V **(B)** 34.1 V **(C)** 39.9 V **(D)** 44.6 V

SECTION-2

Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted.
The answer to each question is a NUMERICAL VALUE. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, Θ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)

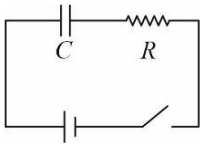
21. Two particles A and B of mass m and $2m$ moving with the same speed have a head-on collision. Due to the collision, the kinetic energies of A and B reduce respectively to $\frac{1}{4}$ and $\frac{1}{X}$ times their initial values. The value of X is _____.

22. Three particles A, B and C of mass m, $2m$ and $3m$ respectively are placed in a straight line as shown. The distance of the centre of mass of the system of the three particles from A is βL. The value of β is_____.



23. The lowest frequency at which a stretched wire of length L clamped at both ends can vibrate such that a point at a distance $\frac{L}{6}$ from one end of the wire has the same amplitude as the mid-point of the wire is 600 Hz. The fundamental frequency of the wire (in Hz) is _____.

24. An uncharged capacitor of capacitance $C = 2\ \mu F$ and a resistance $R = 50\ M\Omega$ are connected to an ideal battery as shown and the switch is closed. The time (in seconds) after which the rate of heat dissipation in the resistance reduces to half its initial value is _____.(Take $\log_e 2 = 0.69$)



25. An equi-convex lens of focal length 40 cm and refractive index 1.5 is silvered on one side and placed in a medium of air. The distance (in cm) at which a small object must be kept from the lens so that the image coincides with the object is _____.

26. A source emitting sound of a single frequency and an observer are both initially at rest. If the source and the observer start moving directly towards each other at constant velocities 2% and 3% the speed of sound in air, the percentage change (to the nearest integer) in the observed frequency is _____.

27. A girl looks at the surface of a liquid filled in a container through a polaroid, and sees the sun reflected in the surface. She notices that by rotating the polaroid (and hence changing the direction of its pass-axis), she can make the image of the sun completely disappear. If the angle of incidence at which the sun's rays strike the surface of the liquid is $\sin^{-1}(0.8)$, the refractive index of the liquid is _____.

28. Two blocks *A* and *B* of mass 5 kg and 1 kg respectively are arranged as shown with a massless string and ideal pulley. The block *A* rests on a rough horizontal table. After the blocks are released from rest, their acceleration is $1\ \text{m/s}^2$. If the coefficient of friction between the block *A* and the table is μ, find the value of 100μ.

29. The activity of a sample of a radioactive element is A_0 at $t = 0$. If the half-life of the element is 3 days, the time (to the nearest integer in days) after which the activity of the sample has reduced to $\frac{A_0}{100}$ is _____. $\left(\log_e(2) = 0.7,\ \log_e(10) = 2.3\right)$

30. A metal sphere is heated to temperature 900 *K* and placed in an evacuated room whose walls are maintained at temperature 300 *K*. The rate at which the sphere loses heat initially is R_1. When the temperature of the sphere has reduced to 600 *K*, the rate at which it loses heat is R_2. The value of $\left(\frac{R_2}{R_1} \times 100\right)$ (to the nearest integer) is _____.

PART II : CHEMISTRY 100 MARKS

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

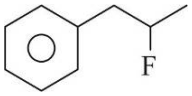
1. Which of the following has maximum number of isomers?

(A) $[Mn(en)_3]^{2+}$ **(B)** $[Mn(H_2O)_4Cl_2]$

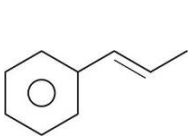
(C) $[Mn(gly)_3]$ **(D)** $[Mn(H_2O)_2(en)_2]^{2+}$

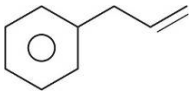
2. Consider the following reaction, $MF + XeF_4 \longrightarrow \overset{\oplus}{M}\overset{\ominus}{A}$. M is alkali metal cation. Total number of atoms present in one plane in anionic part of A are:

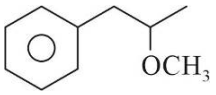
(A) 4 **(B)** 5 **(C)** 6 **(D)** 3

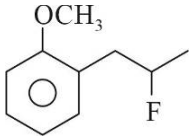
3.  $\xrightarrow[\Delta]{CH_3ONa}$ X (Major product)

Product X obtained is:


(A)


(B)


(C)


(D)

4. Which of the following statement is incorrect?

(A) The colour of $CoCl_4^{2-}$ changes on addition of water

(B) The magnitude of CFSE of square planar complexes is higher than that of tetrahedral complexes

(C) $[Co(C_2O_4)_3]^{3-}$ contain 4 unpaired electrons

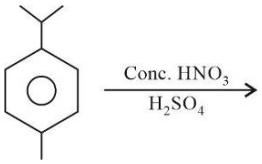
(D) wavelength of light absorbed by $[Fe(H_2O)_6]^{2+}$ is more than that of $[Fe(NH_3)_6]^{2+}$

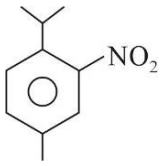
5. In which of the following, $\Delta V_{mix} > 0$

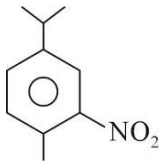
(A) Carbon disulphide and acetone **(B)** Acetone and $CHCl_3$

(C) Benzene and Toluene **(D)** Phenol and Aniline

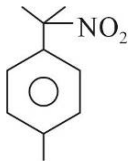
6. The major product of the following reaction is:



(A) 

(B) 

(C) 

(D) 

7. Which of the following enzyme convert starch to maltose?

(A) Invertase **(B)** Zymase **(C)** Diastase **(D)** Urease

8. For the reaction

$5Cl^-_{(aq)} + ClO^-_{3(aq)} + 6H^+_{(aq)} \longrightarrow 3Cl_{2(aq)} + 3H_2O(\ell)$ the rate expression was found to be

$$\frac{-d[ClO_3^-]}{dt} = k[Cl^-][H^+]^2[ClO_3^-]$$

Doubling the initial concentration of all the reactants will increase reaction rate by a factor

(A) 4 **(B)** 8 **(C)** 16 **(D)** 32

9. Which of the following does not illustrate the anomalous properties of lithium?

(I) Li forms nitride Li_3N unlike group first metals

(II) Li is much softer of all the alkali metals

(III) LiCl do not form hydrates

(IV) Li form solid hydrogen carbonate

(A) II, III **(B)** II, IV, I **(C)** II, III, IV **(D)** III, IV

10. Interaction energy between rotating polar molecule is proportional to _____

(A) $\frac{1}{r^3}$ **(B)** $\frac{1}{r^6}$ **(C)** $\frac{1}{r}$ **(D)** $\frac{1}{r^2}$

11. Number of electrons having $m + \ell = 0$ in Ca (Z = 20) is:

(A) 8 **(B)** 12 **(C)** 10 **(D)** 6

12. $KMnO_4 \xrightarrow{\Delta} X + Y + Z(gas)$

$Z + HCl \xrightarrow{CuCl_2} P(gas)$

Z and P are respectively

(A) Paramagnetic and Diamagnetic **(B)** Diamagnetic and Paramagnetic

(C) Both paramagnetic **(D)** Both diamagnetic

13. The dipole moment of AY_3, BY_3 and CY_3 are 1.7D, 0.3D and 0D respectively. The possible shapes of molecules respectively are:

(A) Pyramidal, T-shape, Trigonal planar **(B)** T-shape, pyramidal, Trigonal planar

(C) Trigonal planar, T-shape, Pyramidal **(D)** Pyramidal, square planar, Trigonal planar

14. $Ag + PCl_5 \longrightarrow X\downarrow + Y$

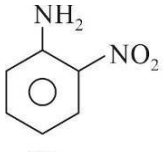
$Y + H_2O \longrightarrow Z$

Product 'Z' obtained is:

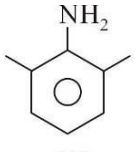
(A) Phosphinic acid **(B)** Phosphonic acid

(C) Hypo phosphoric acid **(D)** Ortho phosphoric acid

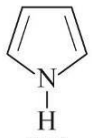
15.



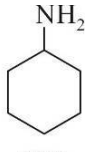
(I)



(II)



(III)



(IV)

Compounds less basic than aniline are:

(A) I, III **(B)** II, III **(C)** I, II, III **(D)** I, II, III, IV

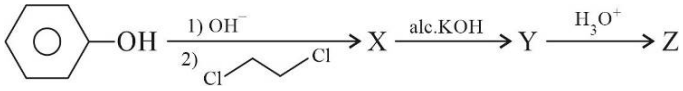
16. Correct statement for Terpineol

(A) It is optically inactive

(B) It reacts with Baeyer's reagent to form a triol

(C) On ozonolysis, it gives a compound with molecular formula $C_{10}H_{18}O_2$

(D) It reacts with Baeyer's reagent to form a diol

17. 

Correct statement

(A) Z gives positive Iodoform test **(B)** Y is phenol

(C) X contain phenolic group **(D)** degree of unsaturation of Y is 4

18. Monomer used in Glyptal are:

(I) Phenol (II) Urea (III) Ethylene Glycol

(IV) Formaldehyde (V) Phthalic acid

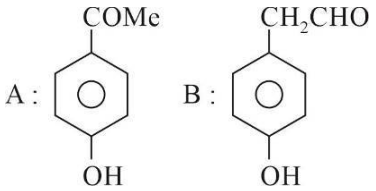
(A) I and IV **(B)** III and V **(C)** II and IV **(D)** I and V

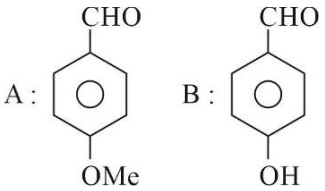
19. 100 ml of 0.3 M acetic acid is shaken with 0.8 g charcoal. The final concentration of acetic acid in the solution after adsorption is 0.1 M. The mass of acetic acid adsorbed per gram of charcoal is:

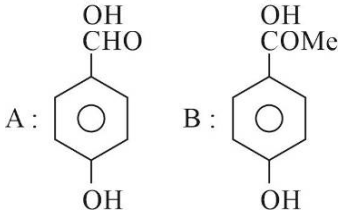
(A) 1.2 g **(B)** 1.5 g **(C)** 1500 g **(D)** 15 g

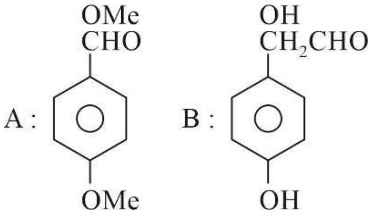
20. Two isomeric p-substituted aromatic compounds (A) and (B) with molecular formula $C_8H_8O_2$ are given. They show following chemical tests.

Test	**A**	**B**
Tollen's Test	Positive	Positive
Neutral $FeCl_3$ solution	Negative	Positive
Iodoform Test	Negative	Negative

(A) 

(B) 

(C) 

(D) 

SECTION-2

Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted.
The answer to each question is a NUMERICAL VALUE. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, Θ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)

21. Ka for HCN is 5×10^{-10} at 25°C. For maintaining a constant pH of 10, the volume of 5M KCN solution required to be added to 10 ml of 2M HCN solution is: (log 5 = 0.7)

22. Sum of oxidation states of Fe in $Na_2[Fe(CO)_5]$, $[Fe(H_2O)_5(NO)]SO_4$, $Na_4[Fe(CN)_5NOS]$ and FeS_2 is:

23. Number of Cl atoms present per molecule of sucralose is _____

24. In a sample of excited hydrogen atoms, electrons make transition from n = 3 to n = 1. Emitted quanta strike on a metal of work function 4.2 eV. Calculate maximum KE of the photo electrons.

25. Oxidation state of iron and chromium in chromite ore is x and y respectively. Value of $2x + y$ is:

26. How many of the following are considered as Non viable particulate pollutants?
Smoke, Dust, Fumes, mist, Algae, Smog, Bacteria, Moulds

27. One mole of a gas undergoes a change of state from (2.0 atm, 3L, 100K) to (4 atm, 4L, 250 K) with a change in internal energy $\Delta U = 30$ L atm. The change in enthalpy of a process in L atm is:

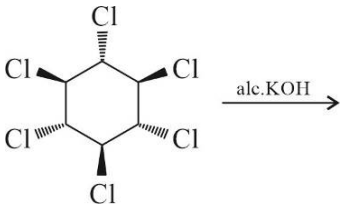
28. Ksp of $Al(OH)_3 = 10^{-36}$

$E^{o}_{Al^{3+}/Al} = -1.66V$

Reduction potential of Al^{3+}/Al couple at $pH = 11$ and 298K is xV. Value of $|x|$ is:

[Take $\frac{2.303RT}{F} = 0.06V$]

29.



Number of alc.KOH required in the following reaction for dehydrohalogenation are _____ .

30. A tetrapeptide has –COOH group on alanine. This produces glycine(Gly), Valine(Val), Phenyl alanine(Phe) and Alanine (Ala) on complete hydrolysis. For this tetrapeptide, the number of possible sequences (primary structures) with $-NH_2$ group attached to a chiral center is:

PART III : MATHEMATICS 100 MARKS

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

1. Let $f(x)$ be a quadratic polynomial ax^2+bx+c such that $f(\alpha)+f(\beta)=0$. If one root of $f(x)$ is γ, then the other root is given by :

(A) $\dfrac{\alpha^2+\beta^2-\gamma(\alpha+\beta)}{\alpha+\beta-\gamma}$ **(B)** $\dfrac{\alpha^2+\beta^2-\gamma(\alpha+\beta)}{\alpha+\beta-2\gamma}$

(C) $\dfrac{\alpha^2+\beta^2-2\gamma(\alpha+\beta)}{\alpha+\beta-\gamma}$ **(D)** $\dfrac{\alpha^2+\beta^2-2\gamma(\alpha+\beta)}{\alpha+\beta-2\gamma}$

2. For $\theta\in\left(0,\dfrac{\pi}{2}\right)$, if the ratio of the lengths of latus rectum of the hyperbola $\dfrac{y^2}{\sin^2\theta}-\dfrac{x^2}{1}=1$ and parabola $y^2=(\sin\theta)x$ is 4 and if m be the slope of their common tangent, then m is given by:

(A) $32\,m^4-16\,m^2+1=0$ **(B)** $32\,m^4+16\,m^2-1=0$

(C) $32\,m^4-16\,m^2-1=0$ **(D)** None of these

3. If a curve $y=f(x)$, passing through the point $(\pi,2\pi)$, is the solution of the differential equation $xy\,dy=(y^2+x^4\sin x)dx$, then $y(-2\pi)$ can be :

(A) $2\sqrt{2}\pi\sqrt{1+\pi}$ **(B)** $4\pi\sqrt{1+\dfrac{\pi}{2}}$ **(C)** $4\pi\sqrt{2+\pi}$ **(D)** $2\pi\sqrt{1+\dfrac{\pi}{2}}$

4. The plane passing through the point $(0,0,0)$ and containing the line $2x-y+3z+4=0=x+3y-z+1$ also contains the point

(A) $(-4,1,-3)$ **(B)** $(-4,-1,3)$ **(C)** $(-4,-1,-3)$ **(D)** $(4,-1,-3)$

5. Let S_n be the sum of first n terms of the series

$(1)+\left(\dfrac{1-x^2}{1+x}\right)+\left(\dfrac{1+x^3}{1+x}\right)+\left(\dfrac{1-x^4}{1+x}\right)+.....(x\neq-1)$ then $(1+x)^2\,S_9-9-x^{10}=$

(A) $10\,x$ **(B)** $9x$ **(C)** $11x$ **(D)** None of these

6. Suppose, in a city, metro rail starts from station A and ends at station B. In between there are 30 stations $S_1, S_2....., S_{30}$. If on a particular day, driver stops the rail at any 5 stations from S_1 to S_{30}, in how many ways driver can stop so that no two stops are consecutive stations:

(A) ${}^{24}C_4$ **(B)** ${}^{24}C_5$ **(C)** ${}^{26}C_5$ **(D)** ${}^{25}C_5$

7. Consider a region $R=\{(x,y)\in R^2:\sin x\le y\le\cos x,\ \ x\in[0,\pi/4]\}$. If a line $x=h$ divides the area of region R into two equal parts, then which of the following is true?

(A) $h=\dfrac{\pi}{8}$ **(B)** $h=\dfrac{1}{2}\sin^{-1}\left(\dfrac{2\sqrt{2}+1}{4}\right)$

(C) $h=\dfrac{1}{2}\sin^{-1}\left(\dfrac{\sqrt{2}-1}{4}\right)$ **(D)** $h=\dfrac{1}{2}\sin^{-1}\left(\dfrac{2\sqrt{2}-1}{4}\right)$

8. $\lim\limits_{x\to 0}(\cos x)^{\text{cosec}^2 x} =$

(A) e^2 **(B)** $\sqrt{e}$ **(C)** $\frac{1}{\sqrt{e}}$ **(D)** 1

9. Let a, b, c be the distinct roots of $x^3 - 2x^2 + 2x - 1 = 0$, if the matrix $A = \begin{pmatrix} a & b & c \\ b & c & a \\ c & a & b \end{pmatrix}$, and $B = A^T A$ then $\det(A+B)$ is ($\det(X)$ is determinant of matrix X)

(A) 36 **(B)** 24 **(C)** 0 **(D)** None of these

10. Let $f(x) = \begin{cases} \frac{e^x - 1}{x} & x \neq 0 \\ 1 & x = 0 \end{cases}$, then function $f(x)$:

(A) increases in $(-\infty, 1)$ and decreases in $(1, \infty)$

(B) decreases in R

(C) increases in R

(D) decreases in $(-\infty, 1)$ and increases in $(1, \infty)$

11. The set of all possible values of θ in the interval $(0, \pi)$ so that $4\sin^2\theta - 2(\sqrt{2}+\sqrt{3})\sin\theta + \sqrt{6} < 0$ is :

(A) $\left(0, \frac{\pi}{3}\right) \cup \left(\frac{2\pi}{3}, \pi\right)$ **(B)** $\left(\frac{\pi}{6}, \frac{\pi}{3}\right) \cup \left(\frac{2\pi}{3}, \frac{5\pi}{6}\right)$

(C) $\left(\frac{\pi}{4}, \frac{3\pi}{4}\right)$ **(D)** $\left(\frac{\pi}{4}, \frac{\pi}{3}\right) \cup \left(\frac{2\pi}{3}, \frac{3\pi}{4}\right)$

12. Which of the following is a fallacy ?

(A) $((\sim p) \wedge (p \vee q)) \to q$ **(B)** $(p \to q) \wedge (p \wedge \sim q)$

(C) $(p \to q) \vee (q \to p)$ **(D)** $(p \wedge ((\sim p) \vee q)) \leftrightarrow (p \wedge q)$

13. If the product of first 11 terms of a G.P. $a_1, a_2, a_3, ..., a_{11}$ is 20 and product of next 11 terms $a_{12}, a_{13}, ... a_{22}$ is 100 then common ratio of the G.P. is :

(A) $5^{1/11}$ **(B)** 5 **(C)** $5^{1/22}$ **(D)** $5^{1/121}$

14. The perimeter of an equilateral triangle inscribed in the parabola $y^2 = 4ax$, with one of its vertices on the vertex of the parabola is :

(A) $24\sqrt{3}\,a$ **(B)** $12\sqrt{3}\,a$ **(C)** $36\sqrt{3}\,a$ **(D)** $27\sqrt{3}\,a$

15. If A, B, C are pair wise independent events such that $P(A) = \frac{1}{3}, P(B) = \frac{1}{4}, P(C) = \frac{1}{5}$ and $P(A \cap B \cap C) = 0$ then $P(A \cap B' \cap C') + P(A' \cap B \cap C') + P(A' \cap B' \cap C)$ is : (here X' denotes complement of event X)

(A) $\frac{23}{30}$ **(B)** $\frac{23}{60}$

(C) $\frac{7}{12}$ **(D)** Cannot be determined

16. Consider the curve $y=(\sin x)^{\cos x}+(\cos x)^{\sin x}$, then $\left(\frac{dy}{dx}\right)_{x=\frac{\pi}{4}}$ is :

(A) $\left(\frac{1}{\sqrt{2}}\right)^{\frac{1}{\sqrt{2}}}$ **(B)** $\left(\frac{1}{\sqrt{2}}\right)^{\frac{1}{\sqrt{2}}+1}\cdot 2$

(C) 0 **(D)** $\left(\frac{1}{\sqrt{2}}\right)^{\frac{1}{\sqrt{2}}+1}\ln(\sqrt{2})$

17. The argument of $\sqrt{2-2\sqrt{3}\,i}+\sqrt{2i}$ cannot be :

(A) 0 **(B)** π **(C)** $-\tan^{-1}(\sqrt{3}+1)$ **(D)** $-\tan^{-1}(\sqrt{3}-1)$

18. Consider a system of equations $x+2y+3z=0,\ 3x+y+2z=0,\ 3x-4y-5z=0$ and $x^2+y^2+z^2-4x+1=0$ (where $x, y, z\in R$). The given system has :

(A) No solution **(B)** More than two solutions

(C) Exactly two solutions **(D)** Only one solution

19. Let $f(x)=\frac{1}{2021^x+1}$, then $\sum_{r=1}^{2021}\left(f\left(\frac{1}{r}\right)+f\left(\frac{-1}{r}\right)\right)$ is λ, then number of positive divisors of λ is :

(A) 2 **(B)** 4 **(C)** 6 **(D)** 8

20. If the equation $(|\sin x|^3+|\cos x|^3)\lambda=1$ has real solutions for x, then λ lies in the interval :

(A) $\left[\frac{1}{\sqrt{2}},\ 1\right]$ **(B)** $[1,\sqrt{2}]$ **(C)** $(\sqrt{2},2]$ **(D)** None of these

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21. The value of $\int_0^1 |x-\{2x\}|\,dx$ is _____ ($\{x\}$ denotes fractional part of x)

22. For a positive integer n, if the coefficients of three consecutive terms of $(1+x)^n$ are in the ratio 2 : 9 : 24, then n is equal to _____.

23. If the variance of first n natural numbers is 14, then variance of first $(2n)$ natural numbers is _____.

24. If $\sum_{k=0}^{5} \cos^{-1}(\cos(2k+1)) = a\pi + b$, where a and b are integers, then $a+b$ is _____ .

25. Let the position vectors of points $`A'$ & $`B'$ be $\hat{i}-\hat{j}-\hat{k}$ & $4\hat{i}+2\hat{j}-\hat{k}$, respectively. If points P & Q divide AB in the ratio 2 : 1 internally & externally respectively then volume of parallelopiped formed by $\overrightarrow{OP}, \overrightarrow{OQ}$ & $\overrightarrow{OP}\times\overrightarrow{OQ}$ is ____ . (where O is origin)

26. Distance of (0, 0, 0) from the line of intersection of planes $x+2y-z=2$ and $3x+y-2z=0$ is d then d^2 is ____ .

27. Sum of values of $`x'$ which are points of discontinuity of function $y=[\sin 2x]$ in $[0,\pi]$ is $k\pi$ then k is _____ ([.] denotes greatest integer function)

28. Consider a ΔABC, $A(0,0)$, $B(5,0)$, $C(1,2)$. If a line passing through centroid & orthocentre of ΔABC touches circle $x^2+y^2=r^2$ then its radius r is _____ .

29. If a word is selected from all possible words formed by arrangements of letters of word $A\,AAA\,BBB\,CC\,D$, the probability that no two $B's$ are together is $\frac{p}{q}$ (where p, q are coprime natural numbers) then $p+q$ is _____ .

30. $\int e^x(x+1)^2\,dx = ax^2e^x + bxe^x + ce^x + d$ then $a+b+c$ is _____.
(where d is constant of integration and a, b, c are integers)

End of Mock JEE Main - 6 | JEE