VMC Vidyamandir Classes SINCE 1986
IIT JEE | MEDICAL | FOUNDATION

CODE A

JEE Main Home Practice Test - 8 | JEE - 2024

Date: 14/1/2024 **Maximum Marks: 300**

Timing: 10:00 AM to 1:00 PM **Duration : 3.0 Hours**

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 should be **rounded off to the nearest integer**.
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, –1 (negative marking) for incorrect answer, 0 for all other cases.

Syllabus:

Physics: Full Syllabus
Chemistry: Full Syllabus
Mathematics: Full Syllabus

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. The dimensions of $\frac{a}{b}$ in the equation $P=\frac{a-t^2}{bx}$ where P is pressure, x is distance and t is time are:

(A) $[M^2LT^{-3}]$ **(B)** $[MT^{-2}]$ **(C)** $[ML^3T^{-1}]$ **(D)** $[LT^{-3}]$

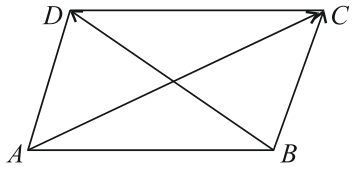
2. An electron and a proton are separated by a large distance. The electron starts approaching the proton with energy 2eV. The proton captures the electron and forms a hydrogen atom in first excited state. The resulting photon is incident on a photosensitive metal of threshold wavelength $4600\,\text{Å}$. The maximum K.E. of the emitted photoelectron is $(hc=12420\,eV\text{Å})$.

(A) 2.4 eV **(B)** 2.7 eV **(C)** 2.9 eV **(D)** 5.4 eV

3. If in the shown figure $\overrightarrow{AC}=\hat{i}+2\hat{j}+4\hat{k}$ & $\overrightarrow{BD}=\hat{i}-3\hat{j}+\hat{k}$ then $\overrightarrow{BC}$ is:

(A) $\frac{3}{2}\hat{i}-\frac{1}{2}\hat{j}+5\hat{k}$ **(B)** $\hat{i}-\frac{1}{2}\hat{j}+\frac{5}{2}\hat{k}$

(C) $2\hat{i}-\hat{j}+5\hat{k}$ **(D)** $\frac{3}{3}\hat{i}-2\hat{j}+3\hat{k}$



SPACE FOR ROUGH WORK

4. Heat flows radially outward through a spherical shell of outside radius R_2 and inner radius R_1. The temperature of inner surface of shell is θ_1 and that of outer is θ_2. The radial distance from centre of shell where the temperature is just half way between θ_1 & θ_2 is :

(A) $\frac{R_1+R_2}{2}$ **(B)** $\frac{R_1R_2}{R_1+R_2}$ **(C)** $\frac{2R_1R_2}{R_1+R_2}$ **(D)** R_2-R_1

5. If $\vec{a}$, $\vec{b}$ & $\vec{c}$ are the unit vectors along the incident ray, reflected ray and the outward normal to the reflector, then:

(A) $\vec{b}=\vec{a}-\vec{c}$ **(B)** $\vec{b}=\vec{a}+(\vec{a}\cdot\vec{c})\vec{c}$

(C) $\vec{b}=2\vec{a}-\vec{c}$ **(D)** $\vec{b}=\vec{a}-2(\vec{a}\cdot\vec{c})\vec{c}$

6. If the radius of the earth were increased by a factor of 2 keeping the mass constant, by what factor would its density have to be changed to keep *g* the same?

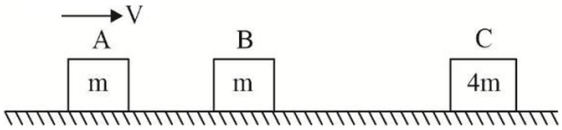
(A) $\frac{1}{8}$ **(B)** 4 **(C)** $\frac{1}{2}$ **(D)** $\frac{1}{4}$

7. If 2 moles of an ideal monoatomic gas at temperature T_0 is mixed with 4 moles of another ideal monoatomic gas at temperature $2T_0$, then the temperature of the mixture is:

(A) $\frac{5}{3}T_0$ **(B)** $\frac{3}{2}T_0$ **(C)** $\frac{4}{3}T_0$ **(D)** $\frac{5}{4}T_0$

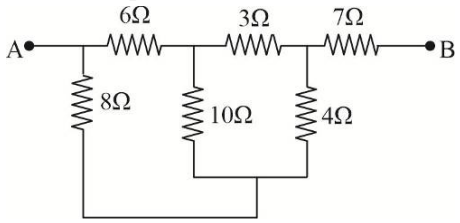
SPACE FOR ROUGH WORK

8. Three blocks are initially placed as shown in figure, block A has mass m and initial velocity v to the right, block B with mass m and block C with mass $4m$ are both initially at rest. Neglect friction. All collisions are elastic. The final velocity of block A is:



(A) 0.6 v to the left **(B)** 0.4 v to the left **(C)** v to the left **(D)** 0.4 v to the right

9. The equivalent resistance between the points A and B is:



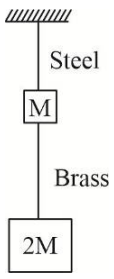
(A) $\frac{36}{7}\Omega$ **(B)** 10Ω **(C)** $\frac{85}{7}\Omega$ **(D)** 18Ω

10. Time period of a simple pendulum of length L is T_1 and time period of a uniform rod of the same length L pivoted about one end and oscillating in a vertical plane is T_2. Amplitude of oscillations in both the cases is small. Then T_1/T_2 is:

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

SPACE FOR ROUGH WORK

11. If the ratio of lengths, radii and Young's modulii of steel and brass wires in the figure are $a, b \& c$ respectively. Then the corresponding ratio of increase in their lengths would be:



(A) $\frac{2a^2c}{b}$ **(B)** $\frac{3a}{2b^2c}$

(C) $\frac{2ac}{b^2}$ **(D)** $\frac{3c}{2ab^2}$

12. Equations of a stationary and a travelling wave are as follows:

$y_1 = a \sin kx \cos \omega t$ and $y_2 = a \sin(\omega t - kx)$

The phase difference between two points $x_1 = \frac{\pi}{3k}$ and $x_2 = \frac{3\pi}{2k}$ are ϕ_1 and ϕ_2 respectively for the two waves. The ratio (ϕ_1 / ϕ_2) is:

(A) 1 **(B)** $\frac{5}{6}$ **(C)** $\frac{3}{4}$ **(D)** $\frac{6}{7}$

13. An electron having kinetic energy T is moving in a circular orbit of radius R perpendicular to a uniform magnetic induction B. If kinetic energy is doubled and magnetic induction tripled, the radius will become:

(A) $\frac{3R}{2}$ **(B)** $\sqrt{\frac{3}{2}}R$ **(C)** $\sqrt{\frac{2}{9}}R$ **(D)** $\sqrt{\frac{4}{3}}R$

SPACE FOR ROUGH WORK

14. Two rings of same radius (r) and mass (m) are placed such that their centers are at a common point and their planes are perpendicular to each other. The moment of inertia of the system about an axis passing through the centre and perpendicular to plane of one of the ring is:

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

15. A rectangular loop of size $(2m \times 1m)$ is placed in x-y plane. A uniform but time varying magnetic field of strength $B = (20t\,\hat{i} + 10t^2\,\hat{j} + 50\hat{k})T$ where t is time elapsed in second, exist in space. The magnitude of induced emf (in V) at time t is:

(A) $20 + 20t$ **(B)** 20 **(C)** $20t$ **(D)** zero

16. In a plane electromagnetic wave, the directions of electric field and magnetic field are represented by $\hat{k}$ and $2\hat{i} - 2\hat{j}$, respectively. What is the unit vector along direction of propagation of the wave?

(A) $\frac{1}{\sqrt{5}}(2\hat{i} + \hat{j})$ **(B)** $\frac{1}{\sqrt{2}}(\hat{j} + \hat{k})$ **(C)** $\frac{1}{\sqrt{2}}(\hat{i} + \hat{j})$ **(D)** $\frac{1}{\sqrt{5}}(\hat{i} + 2\hat{j})$

17. A person speaking normally produces a sound intensity of reasonable audibility of 40 dB at a distance of 1 m. If the threshold intensity for reasonable audibility is 20 dB, the maximum distance at which he can be heard clearly is:

(A) 4 m **(B)** 5 m **(C)** 10 m **(D)** 20 m

SPACE FOR ROUGH WORK

18. A square loop of wire, side length 10 *cm* is placed at an angle of 45º with a magnetic field that changes uniformly from 0.1 T to zero in 0.7 *s*. The induced current in the loop (its resistance is 1Ω) is:

(A) 1.0 *mA* **(B)** 2.5 *mA* **(C)** 3.5 *mA* **(D)** 4.0 *mA*

19. If mass of U^{235} = 235.12142 amu, mass of U^{236} = 236.12305 amu and mass of neutron = 1.008665 amu, then the energy required to remove one neutron from the nucleus U^{236} is nearly about:

(A) 75 MeV **(B)** 6.5 MeV **(C)** 1 eV **(D)** Zero

20. Choose the incorrect statement:

I. The electric lines of force exiting from a Gaussian surface provide positive flux

II. A charge q is placed at the centre of cube. The flux through all the faces will be the same and equal to $\frac{q}{6\varepsilon_0}$

III. In a uniform electric field net flux through a closed Gaussian surface containing no net charge, is zero

IV. When electric field is parallel to a Gaussian surface, it provides a finite non-zero flux

Choose the most appropriate answer from the options given below:

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

SPACE FOR ROUGH WORK

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 should be **rounded off to the nearest integer**.

1. A beam of identical charges passes undeflected through the mutually perpendicular electric and magnetic field. If electric field is cut-off and same magnetic field is maintained, the charges move in the magnetic field in a circular path of radius 8 *cm*. The ratio of charge to mass of charge is $r\times10^{10}\ C/kg$ if $E=4\times10^{3}\,N/C$ and the magnetic flux density is $5\times10^{-4}T$. Find the value of *r*.

2. A sample of gas with $\gamma=1.5$ is taken through an adiabatic process in which the volume is compressed from $1200\,cm^3\ to\ 300cm^3$. The initial pressure is 200 kPa and the final pressure is P_2. If $\frac{P_2}{800\,kPa}=\alpha$, find α.

3. A parallel plate capacitor of capacitance $200\mu F$ is connected to a battery of 200 V. A dielectric slab of dielectric constant 2 is now inserted into the space between plates of capacitor while the battery remain connected. The change in the value of charge will be $\_\_\_\_\_\times10^{-2}C$.

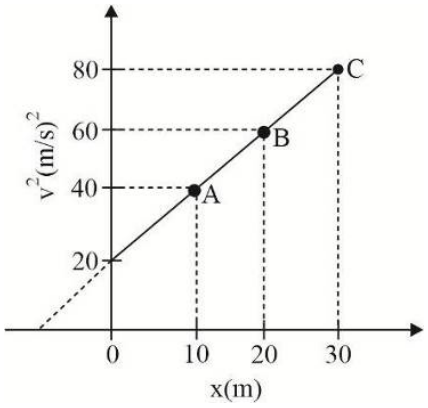
4. In a Young's double slit experiment, the slits are separated by 0.3 mm and the screen is 1.5 m away from the plane of slits. Distance between fourth bright fringes on both sides of central bright fringe is 2.4 cm. The wavelength of light used is $\_\_\_\_\_\times10^{-7}\,m$.

SPACE FOR ROUGH WORK

5. A charge particle of charge 10^{-15}C and mass 10^{-20} kg moves with velocity enters with $\vec{v} = 6\hat{i} + 8\hat{j}\,(m/s)$ in uniform magnetic field $\vec{B} = 2\times10^{-3}\hat{k}(T)$. Find the distance (in meters) traveled by the particle in 6.5 second in the magnetic field.

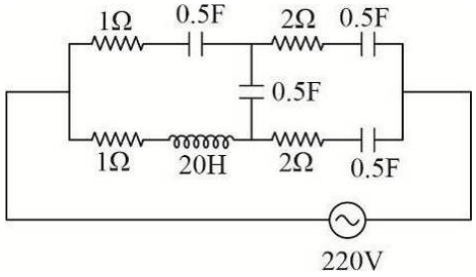
6. The diameter of a spherical bob is measured using a vernier calipers. 9 divisions of the main scale, in the vernier calipers are equal to 10 divisions of vernier scale. One main scale division is 1 mm. The main scale reading is 10 mm and 8^{th} division of vernier scale was found to coincide exactly with one of the main scale division. If the given vernier calipers has positive zero error of 0.04 cm, then the radius of the largest circumference circle which can be drawn on the surface of bob is _____$\times10^{-2}\,cm$.

7. A particle is moving with constant acceleration 'a'. Following graph shows v^2 versus x (displacement) plot. The acceleration of the particle is $a = \dfrac{\alpha^2}{25} m/s^2$. Find α.



SPACE FOR ROUGH WORK

8. At very high frequencies, the current in the given circuit will be _____ *A*.



9. A long solenoid with 500 turns/m has a core material with relative permeability 500 and volume $2\times10^3\ cm^3$. If the core material is replaced by another material having relative permeability of 750 with same volume maintaining same current of 2A in the solenoid, the fractional change in the magnetic moment of the core would be approximately $\left(\frac{x}{499}\right)$. Find the value of x.

10. A rise in temperature of 4°C is observed in a conductor by passing a current for some time. If the current is tripled, the rise of temperature (in °C) in the same time will be:

SPACE FOR ROUGH WORK

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. The incorrect statement among the following is :

(A) For adiabatic reversible process, $w = \frac{nR(T_2 - T_1)}{\gamma - 1}$ where $\gamma = C_p / C_v$

(B) U and H depend only upon temperature for an ideal gas

(C) $K = e^{\Delta G^\circ / RT}$ (where K is equilibrium constant)

(D) The work done by the gas is less when it is expanded reversibly from V_1 to V_2 under adiabatic conditions as compared to that when expanded reversibly from V_1 to V_2 under isothermal conditions

2. Match the Column I with Column II

Column I (Parameter)		Column II (Unit)	
I.	Conductance	**P.**	m^{-1}
II.	Equivalent conductivity	**Q.**	S
III.	Cell constant	**R.**	$g\ A^{-1} s^{-1}$
IV.	Electrochemical equivalent	**S.**	$Sm^2 eq^{-1}$

(A) I – Q ; II – S ; III – P ; IV – R **(B)** I – S ; II – Q ; III – R ; IV – P

(C) I – Q ; II – S ; III – R ; IV – P **(D)** None of these

3. The stability of hydrogen halides is in order:

(A) HF > HI > HBr > HCl **(B)** HI > HBr > HCl > HF

(C) HF > HCl > HBr > HI **(D)** HCl > HBr > HI > HF

SPACE FOR ROUGH WORK

4. The correct match between column 'I' and column 'II' is

Column-I (Reagent)		Column-II (Composition)	
(I)	Fehlings solution	**(P)**	$AgNO_3$/Ammonia solution
(II)	Tollens reagent	**(Q)**	$CuSO_4/OH^-$/Rochelle salt
(III)	Lucas reagent	**(R)**	Benzene sulphonyl chloride
(IV)	Hinsberg reagent	**(S)**	Anhydrous $ZnCl_2$/Con HCl

(A) I-Q, II-R, III-S, IV-P **(B)** I-R, II-P, III-Q, IV-S

(C) I-Q, II-P, III-S, IV-R **(D)** I-Q, II-P, III-R, IV-S

5. Assertion:- Potassium ferrocyanide is paramagnetic and potassium ferricyanide is diamagnetic.
Reason: In potassium ferrocyanide Fe has unpaired electron and in Potassium ferricyanide Fe has no unpaired electron

(A) Both A and R are correct and R is not the correct explanation of A.

(B) Both A and R are correct and R is the correct explanation of A

(C) A is correct but R is not correct

(D) Both A and R are not correct

6. The number of P = O bond in pyrophosphoric acid and orthophosphorus acid are respectively.

(A) 1 and 1 **(B)** 1 and 2 **(C)** 2 and 1 **(D)** None of these

7. Most common oxidation state of Ce (Cerium) are:

(A) +3, +4 **(B)** +2, +3 **(C)** +2, +4 **(D)** +3, +5

8. How many species among the following can not show disproportionation reaction?

ClO_2^-, ClO^-, ClO_3^-, ClO_4^-, H_2O_2, Mn^{3+}, MnO_4^-, MnO_4^{2-}, Fe^{2+}.

(A) 1 **(B)** 2 **(C)** 3 **(D)** None of these

9. Spin only magnetic moment in B.M. of $[V(H_2O)_6]Cl_2$ is:

(A) 3.9 **(B)** 2.9 **(C)** 4.9 **(D)** 1.7

SPACE FOR ROUGH WORK

10. Match the following

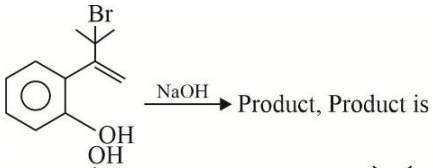
List-I		List-II	
(I)	Vitamin A	**(P)**	Calciferol
(II)	Vitamin D	**(Q)**	Tocopherol derivative
(III)	Vitamin E	**(R)**	Retinol
(IV)	Vitamin K	**(S)**	Anti haemorrhagic
		(T)	Thymine

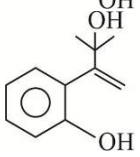
The correct match is

(A) I-R, II-P, III-Q, IV-S **(B)** I-R, II-P, III-Q, IV-T

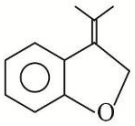
(C) I-R, II-P, III-S, IV-Q **(D)** I-P, II-R, III-Q, IV-S

11.

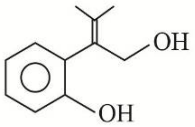




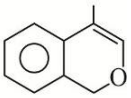
(A)



(B)



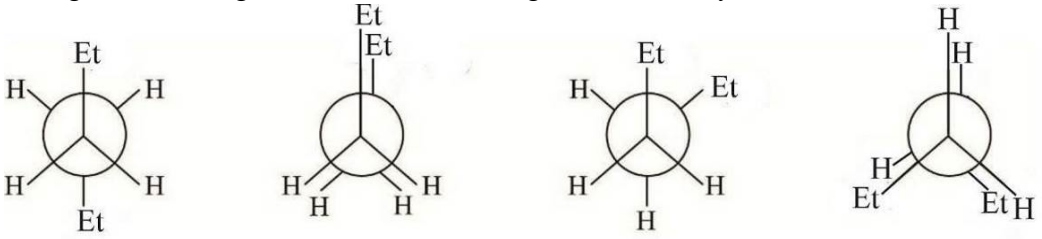
(C)



(D)

SPACE FOR ROUGH WORK

12. Arrange the following conformers in descending order of stability

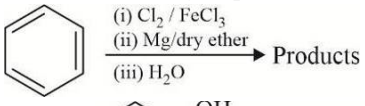


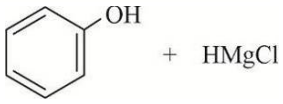
I. II. III. IV.

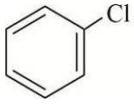
(A) I > III > IV > II **(B)** I > IV > III > II

(C) I > II > IV > III **(D)** III > I > II > IV

13. For the following sequence of reactions, the correct products are:



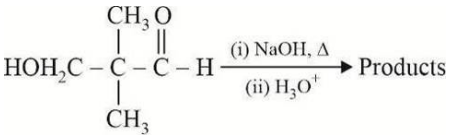
(A)  + HMgCl

(B)  + $Mg(OH_2)(Cl)$

(C)  + $Mg(OH_2)(Cl)$

(D)  + Mg(OH)Cl

14. For the reaction given below



The compound which is not formed as a product in the reaction is:

(A) Diol

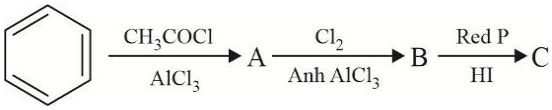
(B) Monocarboxylic acid

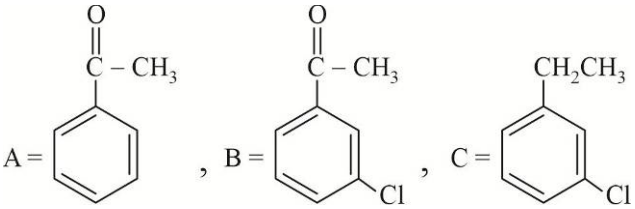
(C) Dicarboxylic acid

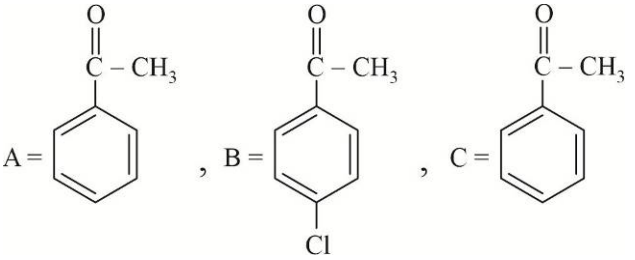
(D) Compound with both alcohol and acid functional groups

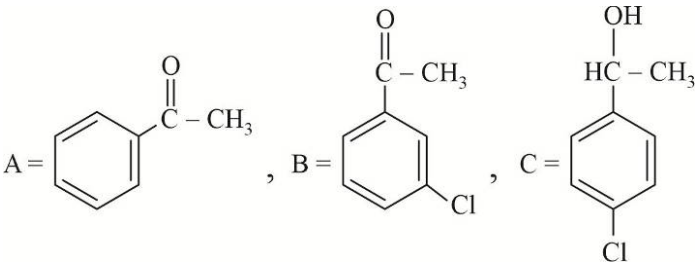
SPACE FOR ROUGH WORK

15. Identify correct product A, B and C in the reaction sequence given below



(A) 

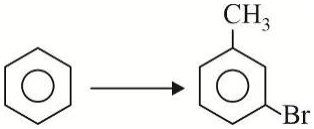
(B) 

(C) 

(D) None of these

SPACE FOR ROUGH WORK

16. Which of the following is best sequence of reagents for the conversion of:

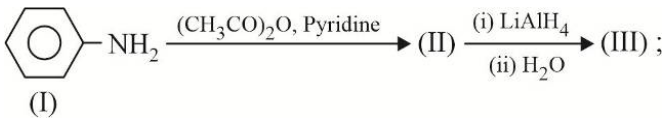


(A) $\xrightarrow{Br_2/Fe} \xrightarrow[\Delta]{\text{conc. } H_2SO_4} \xrightarrow{CH_3Cl/AlCl_3} \xrightarrow[\Delta]{H_3O^+}$

(B) $\xrightarrow{CH_3Cl/AlCl_3} \xrightarrow{\text{conc, } H_2SO_4} \xrightarrow{Br_2/Fe} \xrightarrow[\Delta]{H_3O^+}$

(C) $\xrightarrow{CH_3Cl/AlCl_3} \xrightarrow{3Cl_2/hv} \xrightarrow{Br_2/Fe} \xrightarrow{Zn/HCl}$

(D) $\xrightarrow{HNO_3+\text{conc. } H_2SO_4} \xrightarrow{CH_3Cl/AlCl_3} \xrightarrow{Sn/HCl} \xrightarrow{CuBr}$

17. 

The basicity order of I, II and III is

(A) III > I > II **(B)** I > II > III **(C)** III > II > I **(D)** II > III > I

18. Given below are two statements

Statement-I: Ce (IV) in an aqueous solution is used in chemical analysis

Statement-II: Due to its very slow kinetic reduction to Ce (III), Ce(IV) in an aqueous solution is quite stable.

(A) Both Statement I and Statement II are true

(B) Both Statement I and Statement II are false

(C) Statement I is true but Statement II is false

(D) Statement I is false, but Statement II is true

SPACE FOR ROUGH WORK

19. Which of the following is not an example of globular protein?

(A) Myoglobin **(B)** Amylase **(C)** Insulin **(D)** Keratin

20. Match Column I with Column II

Column I (Metal ion)		**Column II (Group in qualitative analysis)**	
I.	Ag^{+}	**P.**	Group V
II.	Bi^{3+}	**Q.**	Group III
III.	Al^{3+}	**R.**	Group II
IV.	Ca^{2+}	**S.**	Group I

(A) I – S ; II – R ; III – Q ; IV – P **(B)** I – R ; II – S ; III – P ; IV – Q

(C) I – R ; II – P ; III – S ; IV – Q **(D)** I – S ; II – R ; III – P ; IV – Q

SPACE FOR ROUGH WORK

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 should be **rounded off to the nearest integer**.

1. Sodium oxide and water react to produce NaOH. 31g of Na_2O is dissolved in 1L of water. Calculate the Molarity of resulting NaOH solution (Assume there is no change in volume of water).

2. Amongst the following, the number of oxides(s) which are paramagnetic in nature is
Na_2O, KO_2, NO_2, N_2O, ClO_2, NO, SO_2, Cl_2O

3. The value of azimuthal quantum number of outermost electron of Fe^+ is?

4. According to molecular orbital theory the number of unpaired electrons in O_2^- is.

5. A solute 'S' undergoes a reversible trimerization when dissolved in a certain solvent. The boiling point elevation of its 0.1 molal solution was found to be identical to the boiling point elevation in case of a 0.08 molal solution of solute in the same solvent which neither undergoes association nor dissociation. To what percent had the solute 'S' undergone trimerization?

SPACE FOR ROUGH WORK

6. 100 ml of 1/2 M HCl and 50 ml of 1 M NaOH is mixed at 25°C $(K_w = 10^{-14})$. The pH of the solution is:

7. For the reaction $B \rightarrow D$, the rate constant $k(\text{in } s^{-1})$ is given by $\log_{10} k = 100 - \frac{3\times10^3}{T}$. The activation energy in kJ/mole would be (nearest integer)?

8. Primary valence is *x* and secondary valency is *y* for $COCl_3.4NH_3$. Then $\frac{y}{2} - x$ is _____

9. $CH_3 - CH = CH_2 \xrightarrow[(ii)\ H_2O_2, OH^-]{(i)\ BH_3.THF} CH_3CH_2CH_2OH$

Number of moles of alkenes used in the complete reaction is _____

10. The reaction taking place in Dumas method is?

$C_3H_9N + \left(2x + \frac{y}{2}\right)CuO \longrightarrow xCO_2 + \frac{y}{2}H_2O + \frac{z}{2}N_2 + \left(2x + \frac{y}{2}\right)Cu$. The value of y is:

SPACE FOR ROUGH WORK

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. A light ray emits from the origin making an angle 30º with the positive x-axis. After getting reflected by the line $x + y = 1$, if this ray intersects x-axis at Q, then the abscissa of Q is:

(A) $\frac{\sqrt{3}}{2(\sqrt{3}+1)}$ **(B)** $\frac{2}{(\sqrt{3}-1)}$ **(C)** $\frac{2}{3-\sqrt{3}}$ **(D)** $\frac{2}{3+\sqrt{3}}$

2. If $\vec{a}, \vec{b}$ are two perpendicular unit vectors such that $\vec{x} = \vec{b} - \vec{a} \times \vec{x}$ then $|\vec{x}|$ is:

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

3. Domain of $f(x) = \cos^{-1}\left(\frac{6-3x}{4}\right) + \operatorname{cosec}^{-1}\left(\frac{x-1}{2}\right)$, $x \in R$, is:

(A) $[2/3, 10/3]$ **(B)** $[3, 10/3]$

(C) $(-\infty, 2/3) \cup (10/3, \infty)$ **(D)** $(0, 3)$

4. Let $A = \{1, 2, 3, 4\}$, $B = \{1, 2, 3, ..., 9, 10\}$. If an increasing function f from A to B are defined, then probability that f is such that $f(4) = 8$, is:

(A) 1/2 **(B)** 1/3 **(C)** 1/4 **(D)** 1/6

SPACE FOR ROUGH WORK

5. If f is a function so that $f(0)=2,\ f(1)=3$ & $f(x+2)=2f(x)-f(x+1)$ for every real x then $f(5)$ is:

(A) 17 **(B)** 18 **(C)** 13 **(D)** 5

6. The shortest distance between the z-axis and the line $x+y+2z-3=0,\ 2x+3y+4z-4=0$, is:

(A) 1 **(B)** 2 **(C)** 3 **(D)** 5

7. The points of intersection of the line $ax+by=0,\ (a\neq b)$ and the circle $x^2+y^2-2x=0$ are $A(\alpha,\ 0)$ and $B(1,\ \beta)$. The image of the circle with AB as a diameter in the line $x + y + 2 = 0$ is:

(A) $x^2+y^2+3x+5y+8=0$ **(B)** $x^2+y^2-5x-5y+12=0$

(C) $x^2+y^2+3x+3y+4=0$ **(D)** $x^2+y^2+5x+5y+12=0$

8. If $a=\lim\limits_{n\to\infty}\sum\limits_{r=1}^{n}\dfrac{1}{(r+2)r!}$ & $b=\lim\limits_{x\to 0}\dfrac{e^{\sin x}-e^{x}}{\sin x-x}$ then:

(A) $a=b$ **(B)** $a=2b$ **(C)** $2a=b$ **(D)** $a+b=0$

9. Let T and C respectively be the transverse and conjugate axes of the hyperbola $16x^2-y^2+64x+4y+44=0$. Then the area of the region above the parabola $x^2=y+4,$ below the transverse axis T and on the right of the conjugate axis C is:

(A) $4\sqrt{6}-\dfrac{28}{3}$ **(B)** $4\sqrt{6}+\dfrac{28}{3}$ **(C)** $4\sqrt{6}+\dfrac{44}{3}$ **(D)** $4\sqrt{6}-\dfrac{44}{3}$

10. Solution of equation $dy/dx=(y\times\phi'(x)-y^2)/\phi(x)$ is given by, where C is integration constant:

(A) $y=(\phi(x)+C)/x$ **(B)** $y=(\phi(x))/(x+C)$

(C) $y=\phi(x)+C$ **(D)** $y=\phi(x)+\dfrac{1}{x}$

SPACE FOR ROUGH WORK

11. Let $y = f(x)$ represent a parabola with focus $\left(-\frac{1}{2}, 0\right)$ and directrix $y = -\frac{1}{2}$. Then $S = \left\{x \in R: \tan^{-1}\left(\sqrt{f(x)}\right) + \sin^{-1}\left(\sqrt{f(x)+1}\right) = \frac{\pi}{2}\right\}$:

(A) is an infinite set **(B)** is an empty set

(C) contains exactly two elements **(D)** contains exactly one element

12. If $\frac{dy}{dx} = \frac{(x+1)^2 + (y-3)}{(x+1)}$ and $y(1) = 1$, then minimum value of $y(x)$ is:

(A) 1/2 **(B)** 2/3 **(C)** 3/4 **(D)** 3/5

13. Number of solutions of $2\log_2 \log_2 x + \log_{1/2} \log_2 \left(2\sqrt{2}x\right) = 1$ is:

(A) 3 **(B)** 1 **(C)** 2 **(D)** 0

14. If $z_1 = 1 + i$, $z_2 = 2i$, and z be point on real axis, then least value of $|z - z_1| + |z - z_2|$ is:

(A) $\sqrt{2}$ **(B)** $2\sqrt{2}$ **(C)** $\sqrt{10}$ **(D)** $2\sqrt{11}$

15. If $a_1, a_2, a_3, ..., a_{4001}$ in A.P. so that $\frac{1}{a_1 a_2} + \frac{1}{a_2 a_3} + ... + \frac{1}{a_{4000} a_{4001}} = 10$ and $a_2 + a_{4000} = 50$, then $|a_1 - a_{4001}|$ equals to:

(A) 70 **(B)** 30 **(C)** 40 **(D)** 45

16. Let A be the set of all points (α, β) such that the area of triangle formed by the points (5,6), (3,2) and (α, β) is 2 square units. Then the least possible length of a line segment joining the origin to a point A, is:

(A) $\frac{4}{\sqrt{5}}$ **(B)** $\frac{6}{\sqrt{5}}$ **(C)** $\frac{8}{\sqrt{5}}$ **(D)** $\frac{2}{\sqrt{5}}$

SPACE FOR ROUGH WORK

17. Let $f:(0,1)\to R$ be a function defined by $f(x)=\dfrac{1}{1-e^{-x}}$ and $g(x)=(f(-x)-f(x))$.

Consider two statements.

I. g is an increasing function in (0, 1)

II. g is one-one in (0, 1)

Then:

(A) Only II is true **(B)** Neither I nor II is true

(C) Only I is true **(D)** Both I and II are true

18. Let $f(x)=\begin{cases} x^2\sin\left(\dfrac{1}{x}\right), & x\neq 0 \\ 0, & x=0 \end{cases}$

Then at $x = 0$

(A) f is continuous but f' is not continuous **(B)** f' is continuous but not differentiable

(C) f is continuous but not differentiable **(D)** f and f' both are continuous

19. If $[x]$ is the greatest integer $\le x$, then $\pi^2\int_0^2\left(\cos\dfrac{\pi x}{2}\right)(x-[x])^{[x]}dx$ is equal to:

(A) $2(\pi-1)$ **(B)** $4(\pi-1)$ **(C)** $4(\pi+1)$ **(D)** $2(\pi-2)$

20. In an experiment with 15 observations on x, the following results were available $\sum x^2=2830, \sum x=170$. One observation that was 20, was found to be wrong and was replaced by the correct value 30. Then the corrected variance is:

(A) 78.00 **(B)** 188.66 **(C)** 177.33 **(D)** 8.33

SPACE FOR ROUGH WORK

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 should be **rounded off to the nearest integer**.

1. The coefficient of $a^5b^3c^4$ in the expansion of $\left(ab-\frac{2bc}{3}-\frac{ca}{2}\right)^6$ is _____.

2. Let 5 digit numbers be constructed using the digits 0, 2, 3, 4, 7, 9 with repetition allowed, and are arranged in ascending order with serial numbers. Then the last two digits of the serial number of the number 42923 is _____.

3. Total number of 5 digits numbers divisible by 6 that can be formed using 0,1,2,3,4,5 if repetition of digit is not allowed, is _____.

4. $\int\frac{\cos x}{\cos^3 x+\sin^3 x}dx=\alpha\log_e|1+\cot x|+\beta\log_e|1-\cot x+\cot^2 x|+\gamma\tan^{-1}\left(\frac{2\cot x-1}{\sqrt{3}}\right)+c$

where c is the constant of integration, then the value of 18 $(\alpha+\beta+\gamma)^2$ is_____.

5. If the co-efficient of x^9 in $\left(ax^3+\frac{1}{\beta x}\right)^{11}$ and the co-efficient of x^{-9} in $\left(\alpha x-\frac{1}{\beta x^3}\right)^{11}$ are equal, then $(\alpha\beta)^2$ is equal to _____.

SPACE FOR ROUGH WORK

6. Let $P(a_1, b_1)$ and $Q(a_2, b_2)$ be two distinct points on a circle with centre $C(\sqrt{2}, \sqrt{3})$. let O be the origin and OC be perpendicular to both CP and CQ. If the area of the triangle OCP is $\frac{\sqrt{35}}{2}$, then $a_1^2 + a_2^2 + b_1^2 + b_2^2$ is equal to _____.

7. If A and B are two matrices such that AB = A and BA = B, then number of elements in the set $\left\{A = \begin{bmatrix} a & b \\ 0 & d \end{bmatrix} : a, b, d \in \{-1, 0, 1\}\right\}$, where I is 2×2 matrix, is _____.

8. Area bounded by the parabola $y^2 = 2x$ and the ordinates $x = 1$, $x = 4$ is $\frac{k\sqrt{2}}{3}$ square units, then k is _____.

9. If the x-intercept of a focal chord of the parabola $y^2 = 8x + 4y + 4$ is 3, then the length of this chord is equal to _____.

10. Let $f(x)$ be a polynomial of degree 3 such that $f(-1) = 10$, $f(1) = -6$, $f(x)$ has critical point at $x = -1$ and $f'(x)$ has a critical point at $x = 1$. Then $f(x)$ has a local minima at x =_____.

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

••• End of JEE Main Home Practice Test - 8 [JEE - 2024] •••