VMC Vidyamandir Classes SINCE 1986
IIT JEE | MEDICAL | FOUNDATION

CODE A

JEE Main Home Practice Test – 3 | JEE - 2024

Date: 05/01/2024 **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 : _____

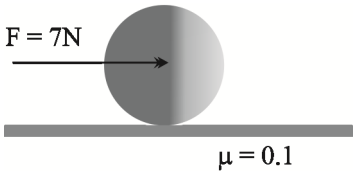
Candidate's Signature : _____ **Invigilator's Signature** _____

PART - I : PHYSICS 100 MARKS

SECTION-1

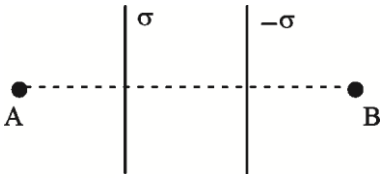
This section contains 20 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

1. A solid sphere of mass 10 kg is placed on a rough surface having coefficient of friction $\mu = 0.1$. A constant force $F = 7N$ is applied along a line passing through the centre of the sphere as shown in the figure. The value of frictional force on the sphere is:

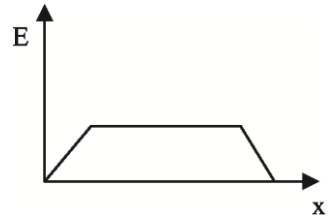


(A) 1 N **(B)** 2N **(C)** 3 N **(D)** 7 N

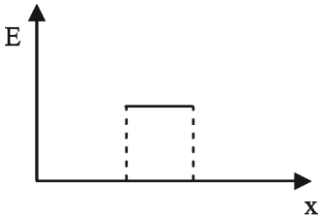
2. Two large parallel sheets charged uniformly with surface charge density σ and $-\sigma$ are located as shown in the figure. Which one of the following graphs shows the variation of electric field along a line perpendicular to the sheets as one moves from *A* to *B*?



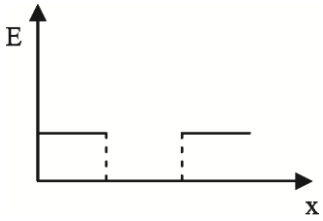
(A)



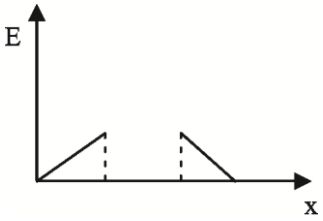
(B)



(C)

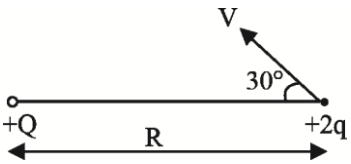


(D)



SPACE FOR ROUGH WORK

3. In the diagram shown, the charge $+Q$ is fixed. Another charge $+2q$ and mass *M* is projected from a distance *R* from the fixed charge. Minimum separation between the two charges if the velocity becomes $\frac{1}{\sqrt{3}}$ times of the projected velocity, at this moment is (Assume gravity to be absent).



(A) $\frac{\sqrt{3}}{2}R$ **(B)** $\frac{1}{\sqrt{3}}R$ **(C)** $\frac{1}{2}R$ **(D)** None of these

4. The acceleration of a particle is increasing linearly with time *t* as *bt*. The particle starts from the origin with an initial velocity v_0. The distance travelled by the particle in time *t* will be:

(A) $v_0t+\frac{1}{6}bt^3$ **(B)** $v_0t+\frac{1}{3}bt^3$ **(C)** $v_0t+\frac{1}{3}bt^2$ **(D)** $v_0t+\frac{1}{2}bt^2$

5. The relative permittivity of a liquid is 64. The velocity of light in the liquid will be : (Given $\mu_r=1$).

(A) $3.75\times10^7\ m/s$ **(B)** $4.70\times10^6\ m/s$

(C) $2.33\times10^8\ m/s$ **(D)** $5.33\times10^7\ m/s$

6. **Assertion A:** If in ten complete rotations of the circular scale, the distance travelled on main scale of the screw gauge is 5 mm and there are 50 total divisions on circular scale, then least count is 0.001 cm.

Reason R : Least count = $\frac{Pitch}{Total\ circular\ divisions}$

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

(B) A is not correct but R is correct

(C) A is correct but R is not correct

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

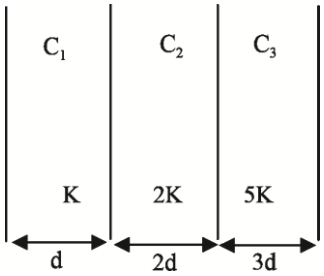
SPACE FOR ROUGH WORK

7. A 100 g of iron nail is hit by a 1.5 kg hammer striking at a velocity of $60\,ms^{-1}$. What will be the rise in the temperature of the nail if one fourth of energy of the hammer goes into heating the nail?

[Specific heat capacity of iron = $0.42\ Jg^{-1}\,°C^{-1}$]

(A) 675 °C **(B)** 1600 °C **(C)** 16.07 °C **(D)** 6.75 °C

8. In the reported figure, a capacitor is formed by placing a compound dielectric between the plates of parallel plate capacitor. The expression for the capacity of the said capacitor will be: (Given area of plate = *A*).



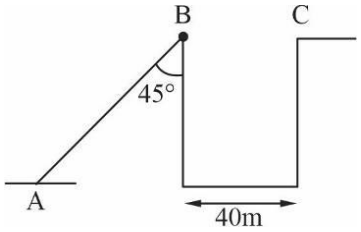
(A) $\frac{9}{6}\frac{K\in_0 A}{d}$ **(B)** $\frac{25}{6}\frac{K\in_0 A}{d}$

(C) $\frac{15}{6}\frac{K\in_0 A}{d}$ **(D)** $\frac{15}{39}\frac{K\in_0 A}{d}$

9. Two capacitors of capacities 3*C* and *C* are joined in parallel and charged up to potential *V*. The battery is removed and the capacitor of capacity *C* is filled completely with a medium of dielectric constant *K*. The potential difference across the capacitors will be:

(A) $\frac{V}{K}$ **(B)** $\frac{3V}{K+2}$ **(C)** $\frac{3V}{K}$ **(D)** $\frac{4V}{3+K}$

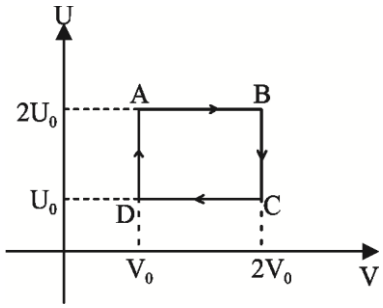
10. A body is projected up a smooth inclined plane with velocity V from the point A shown in the figure. The angle of inclination is 45° and the top is connected to a well of diameter 40 m. If the body just manages to cross the well, what is the value of V? (Length of inclined plane is $20\sqrt{2}m$).



(A) $40\,ms^{-1}$ **(B)** $40\sqrt{2}\,ms^{-1}$ **(C)** $20\,ms^{-1}$ **(D)** $20\sqrt{2}\,ms^{-1}$

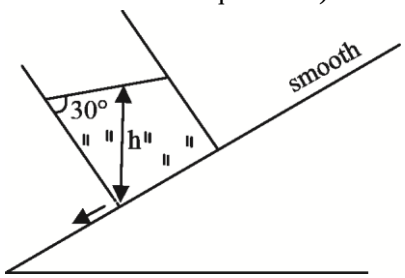
SPACE FOR ROUGH WORK

11. One mole of an ideal gas is taken through a cyclic process as shown. V represents volume and U represent internal energy. The minimum temperature during the cycle is 300 *K*. Then, net exchange of heat for complete cycle is:



(A) 600 R ln2 **(B)** 300 R ln2 **(C)** $-300R\ln 2$ **(D)** $900R\ln 2$

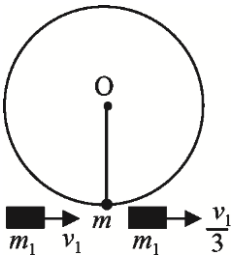
12. A container with cross-section area *A* has a hole of area $a\left(<< A\right)$ at bottom. It is filled with liquid of density ρ such that the surface is at a height of *h* from hole as shown. Which of the following value of h is the minimum value for which container does not slide initially after the hole is opened and container is also released? (mass of container with liquid = M).



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

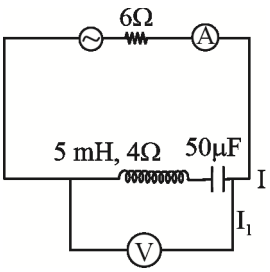
SPACE FOR ROUGH WORK

13. A pendulum consists of a wooden bob of mass *m* and length *l*. A bullet of mass m_1 is fired towards the pendulum with a speed v_1 and it emerges from the bob with speed $\frac{v_1}{3}$. The bob just completes motion along a vertical circle. Then v_1 is:



(A) $\frac{m}{m_1}\sqrt{5gl}$ **(B)** $\frac{3m}{2m_1}\sqrt{5gl}$ **(C)** $\frac{2}{3}\left(\frac{m}{m_1}\right)\sqrt{5gl}$ **(D)** $\left(\frac{m_1}{m}\right)\sqrt{gl}$

14. In the circuit shown in figure, the *AC* source gives a voltage $V = 20\cos(2000t)$. Neglecting source resistance, the voltmeter and ammeter readings will be:



(A) 0V, 2.0 A **(B)** 0V, 1.4 A
(C) 5.6 V,1.4A **(D)** 8V, 2.0 A

15. The de Broglie wavelengths for an electron and a photon are λ_e and λ_p respectively. For the same kinetic energy of electron and photon, which of the following presents the correct relation between the de Broglie wavelengths of two?

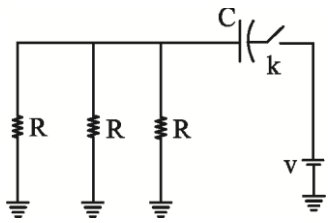
(A) $\lambda_p \propto \lambda_e^2$ **(B)** $\lambda_p \propto \lambda_e$ **(C)** $\lambda_p \propto \sqrt{\lambda_e}$ **(D)** $\lambda_p \propto \sqrt{\frac{1}{\lambda_e}}$

SPACE FOR ROUGH WORK

16. A particle starts executing simple harmonic motion (SHM) of amplitude 'a' and total energy E. At any instant, its kinetic energy is 19% of total energy then its displacement 'y' is given by:

(A) $y=\frac{a}{2}$ **(B)** $y=\frac{9a}{10}$ **(C)** $y=\frac{3}{5}a$ **(D)** $y=\frac{a}{4}$

17. The switch shown in the figure is closed at $t=0$. The charge on the capacitor as a function of time is given by:



(A) $CV\left(1-e^{-t/RC}\right)$ **(B)** $3CV\left(1-e^{-t/RC}\right)$

(C) $CV\left(1-e^{-3t/RC}\right)$ **(D)** $CV\left(1-e^{-t/3RC}\right)$

18. An ideal gas of adiabatic exponent γ is expanded so that the amount of heat transferred to the gas is equal to the decrease of its internal energy. Then, the equation of the process in terms of the variables T and V is:

(A) $TV^{\frac{\gamma-1}{2}}=C$ **(B)** $TV^{\frac{(\gamma-2)}{2}}=C$ **(C)** $TV^{\frac{(\gamma-1)}{4}}=C$ **(D)** $TV^{\frac{(\gamma-2)}{4}}=C$

SPACE FOR ROUGH WORK

19.

List I		List II	
A.	MI of the rod (length 2L Mass M) about an axis perpendicular to the rod, passing through the midpoint.	(i)	$\frac{32ML^2}{3}$
B.	MI of the rod (length 2L, mass 2M) about an axis perpendicular to the rod passing through one of its end	(ii)	$\frac{ML^2}{12}$
C.	MI of the rod (length L, Mass M) about an axis perpendicular to rod passing through its midpoint.	(iii)	$\frac{ML^2}{3}$
D.	MI of the rod (length 4L mass 2M) about an axis perpendicular to the rod passing through one of its end	(iv)	$\frac{8ML^2}{3}$

(A) $(a)-(iii),(b)-(iv),(c)-(i),(d)-(ii)$

(B) $(a)-(ii),(b)-(i),(c)-(iii),(d)-(iv)$

(C) $(a)-(ii),(b)-(i),(c)-(ii),(d)-(iv)$

(D) $(a)-(iii),(b)-(iv),(c)-(ii),(d)-(i)$

20. The intensity due to each of the two slits in Young's double slit experiment is I_0. Calculate the minimum separation between the two points on the screen where intensities are $2I_0$ and I_0. Given, the fringe width equal to β.

(A) $\frac{\beta}{4}$ **(B)** $\frac{\beta}{3}$ **(C)** $\frac{\beta}{12}$ **(D)** None of these

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**.

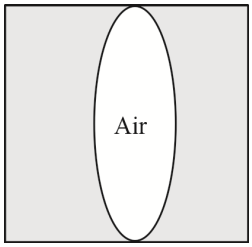
1. A particle of mass 6.6×10^{-27} kg travels in a medium with a speed of $10^{6} m/s$ and a photon of a radiation of linear momentum $10^{-22}\, kg\, m/s$ travels in vacuum. The wavelength of photon is _____times the wavelength of the particle.

2. The longest wavelength of the Lyman series for hydrogen atom is the same as the wavelength of a certain line in the spectrum of He^{+} when the electron makes a transition from $n \to 2$. The value of *n* is:

3. A stone of mass 20 g is projected from a rubber catapult of length 0.1 m and area of cross section $10^{-6} m^{2}$ stretched by an amount 0.03 m. The velocity of the projected stone is _____ m/s.
(Young's modulus of rubber $= 0.5\times10^{9} N/m^{2}$)

4. A flat circular coil of n turns, area *A* and resistance *R* is placed in a uniform magnetic field *B*. The plane of coil is initially perpendicular to *B*. When the coil is rotated through an angle of 180° about one of its diameter, a charge Q_1 flows through the coil. When the same coil after being brought to its initial position, is rotated through an angle of 360° about the same axis a charge Q_2 flows through it. Then Q_2/Q_1 is_____.

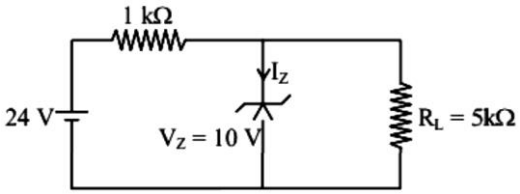
5. In figure, an air lens of radius of curvature of each surface equal to 10 cm is cut into a cylinder of glass of refractive index 1.5.



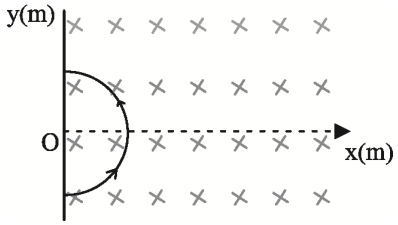
The magnitude of focal length of lens in cm is _____.

SPACE FOR ROUGH WORK

6. For the given circuit, the power across Zener diode is _____ mW.



7. A wire carrying a current of 3A is bent in the form of a parabola $y^2 = 4 - x$ as shown in figure, where x and y are in meter. The wire is placed in a uniform magnetic field $B = 5k$ tesla. The force acting on the wire is_____(in Newtons).



8. A body of mass 2 kg is moving under the influence of a central force whose potential energy is given by $U = 2r^3\ J$. If the body is moving in a circular orbit of 5 m, its energy will be_____ (in Joule).

9. The work function of a substance is 1.6 eV. The longest wavelength of light that can produce photoemission from the substance is _____ (nearest integer in Å).

10. The first overtone frequency of an open organ pipe is equal to the fundamental frequency of a closed organ pipe. If the length of the closed organ pipe is 20 cm. The length of the open organ pipe is _____ cm.

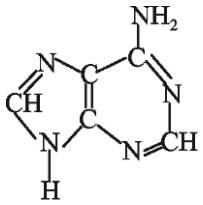
SPACE FOR ROUGH WORK

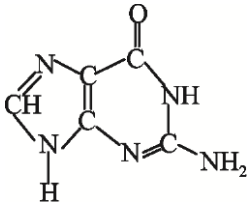
PART - II : CHEMISTRY 100 MARKS

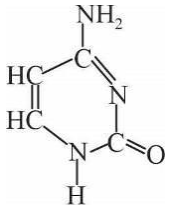
SECTION-1

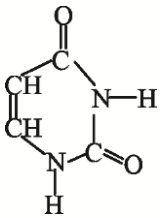
This section contains 20 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

1. Which of the nitrogen containing heterocylic compound (BASE) is not present in DNA.

(A) 

(B) 

(C) 

(D) 

2. Read the assertion and reason carefully to mark the correct option out of the options given below:

Assertion: 2, 2-dimethyl propanal undergoes cannizzaro reaction with concentrated NaOH.

Reason: Cannizzaro is a disproportionation reaction.

(A) If both assertion and reason are true and the reason is the correct explanation of the assertion

(B) If both assertion and reason are true but reason is not the correct explanation of the assertion

(C) If assertion is true but reason is false

(D) If the assertion and reason both are false

3. Which of the following is correct ?

(A) D (+) glucose and D (–) -fructose gives same osazone

(B) Glucose and Fructose give schiff's Test

(C) D (+) glucose and D (–)-fructose are epimers.

(D) Glucose give Tollen's test but Fructose does not give tollens test

4. Read the assertion and reason carefully to mark the correct option out of the options given below:

Assertion: Benzaldehyde undergoes aldol condensation.

Reason: Aldehydes that do not have α-hydrogen undergo aldol condensation.

(A) If both assertion and reason are true and the reason is the correct explanation of the assertion

(B) If both assertion and reason are true but reason is not the correct explanation of the assertion

(C) If assertion is true but reason is false

(D) If the assertion and reason both are false

SPACE FOR ROUGH WORK

5. Select the correct statements:

(i) $\left[\mathrm{Zn(gly)_2}\right]$ is optically active

(ii) $\left[\mathrm{PdClBr(gly)}\right]^-$ exhibit geometrical isomerism

(iii) $\left[\mathrm{IrBr_4(en)}\right]^-$ shows cis-trans isomerism

(iv) $\left[\mathrm{RhCl_2(NH_3)_4}\right]^+$ number of stereo isomers is equal to number of Geometrical isomerism.

(A) (i), (ii), (iv) **(B)** (ii), (iii), (iv) **(C)** (ii), (iii) **(D)** (i), (iii), (iv)

6. Which of the following is correct as per the properties mentioned against each.

(A) $\mathrm{K > Na > Ca > Mg(density)}$

(B) $\mathrm{Li < Na < K < Rb < Cs(Melting\,point)}$

(C) $\mathrm{Be^{2+} > Mg^{2+} > Ca^{2+} > Sr^{2+} > Ba^{2+}(Hydration\,energy)}$

(D) $\mathrm{Mg < Ca < Sr < Ba < Be(Reducing\ property\,in\,aq.medium)}$

7. The most stable conformation of ethylene glycol is:

(A) Anti form **(B)** Fully eclipsed **(C)** Gauche form **(D)** All forms are stable

8. Which of the following is incorrect statement:

(A) $\mathrm{(HPO_3)_3} \rightarrow$ contains no P–P linkage. **(B)** $\mathrm{HNO_3} \rightarrow$ Contain no O–O linkage

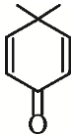
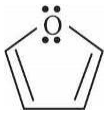
(C) $\mathrm{S_3O_9}-$ Contain S-S linkage **(D)** $\mathrm{S_2O_8^{2-}}$ contains no S-S linkage.

SPACE FOR ROUGH WORK

9. Among the following, the maximum covalent character is shown by the compound:

(A) $FeCl_2$ **(B)** $SnCl_2$ **(C)** $AlCl_3$ **(D)** $MgCl_2$

10. Which of the following molecule is least resonance stablised.

(A)  **(B)**  **(C)**  **(D)** 

11. Given below are two statements.

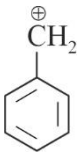
S1 : Ethanol is weaker acid than phenol.

S2: phenoxide ion is produced due to deprotonation gets stabilized due to resonance.

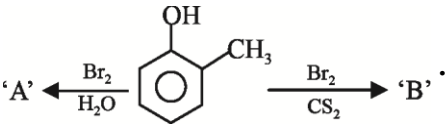
(A) S1 is true and S2 is false **(B)** S1 is false S2 is true

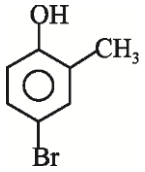
(C) Both S1 and S2 are false **(D)** Both S1 and S2 are true

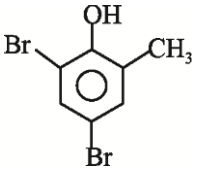
12. The order of stability of the following carbocations is

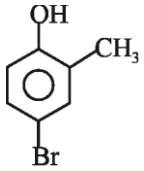
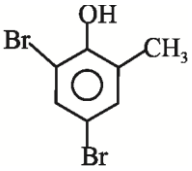
$CH_2=CH-\overset{\oplus}{C}H_2$; $CH_3-CH_2-\overset{\oplus}{C}H_2$; 

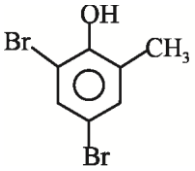
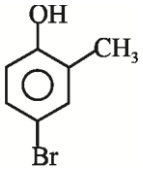
(A) III > II > I **(B)** II > III > I **(C)** I > II > III **(D)** III > I > II

13.  . "A and B are respectively:

(A) Both are 

(B) Both are 

(C)  and 

(D)  and 

SPACE FOR ROUGH WORK

14. Which of the following is the unit of rate constant for second order reaction.

(A) $\text{mol L}^{-1}\text{s}^{-1}$ **(B)** $\text{mol}^{-1}\text{ L s}^{-1}$ **(C)** mol L s^{-1} **(D)** s^{-1}

15. 1-butyne and 2-butyne can be distinguished by**.**

(A) $\text{Na} + \text{liq.NH}_3, \text{C}_2\text{H}_5\text{OH}$ **(B)** $\text{Br}_2 / \text{H}_2\text{O}$

(C) Baeyer's reagent **(D)** $\text{Cu}_2\text{Cl}_2 / \text{NH}_4\text{OH}$

16. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R:
Assertion A: Group 1 elements forms more stable carbonates as compared to group 2 elements.
Reasons R: Extent of polarization is higher in group 1 elements.
In the light of the above statements, choose most appropriate answer from the options given below.

(A) A is true but R is false
(B) Both A and R are true and R is the correct explanation of A
(C) A is false but R is true
(D) Both A and R are but R is NOT the correct explanation of A

17. Which of the following factor will favour the reverse reaction in following equilibrium.

$$\text{A}(\ell) + \text{B}(\text{aq}) \rightleftharpoons \text{C}(\text{aq}) + \text{D}(\text{g}).\ \Delta\text{H} < 0$$

(A) Introduction of inert gas at constant pressure **(B)** Increase in volume
(C) Increasing temperature **(D)** Decreasing pressure

18. Given below are two statements:
Statement -1 : The position of electron can be exactly determined using electron microscope.
Statement-2 : The product of uncertainty in measurement of its momentum and uncertainty in measurement of position cannot be less than a finite limit.
In the light of the above statements, choose the most appropriate answer from the options given below

(A) Both Statements I and statement II are true.
(B) Statement I is false but statement II is true.
(C) Statement I is true but statement II is false
(D) Both statement I and statement II are false.

19. Peroxodisulphate on hydrolysis yields:

(A) Water **(B)** Dihydrogen
(C) Hydrogen peroxide **(D)** Sulphurous acid

20. The reaction $\left[\text{Fe}(\text{CN})_6\right]^{3-} \rightarrow \left[\text{FeF}_6\right]^{3-}$ takes place with.

(A) Decrease in magnetic moment **(B)** Increase in magnetic moment
(C) Decrease in co-ordination No **(D)** Increase in co-ordination number

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. How many chiral compounds are possible on mono-chlorination of 2-methyl-butane?

2. Assuming no '2s – 2p' mixing, find the sum of total number of electrons in $\pi(2p_x)$ and $\pi(2p_y)$ molecular orbitals of B_2, C_2, N_2.

3. The molarity of the solution containing 2.8% (mass /volume) solution of KOH is M. Write the value of 10M. (Molar mass of KOH = 56)

4. How many of the following species have different bond angle compared to ideal geometry bond angle.
$BeCl_2, XeF_2, H_2O, NH_3, D_2O, IF_3, PH_3, CH_4, BCl_3$

5. For Complex $\left[Pt(H_2O)(NH_3)(Cl)(Br)\right]$.
If oxidation state of Pt = a Coordination number = b. total number of Geometrical isomers = c. Then find the value of $\frac{a+b}{c}$.

SPACE FOR ROUGH WORK

6. In the Kjeldahl's method for estimation of nitrogen present in soil sample, ammonia evolved from 1.25 gm of sample neutralized 25 ml and of 1 M H_2SO_4. % of nitrogen in the soil sample was x. Find x_____. (round it off upto nearest integer.)

7. $A(g)+2B(s)\rightleftharpoons 2C(g)$

Initially 2 mol A(g), 4 mole of B(s) and 1 mole of an inert gas are present in a closed container. After equilibrium is attained total pressure of container becomes 9 atm. If A(g) is consumed 50% at equilibrium the K_p will be 'x' atm. Write value of x _____.

8. 1 mole of monoatomic ideal gas is subjected to irreversible adiabatic expansion against constant external pressure 1 atm starting from initial pressure 5 atm and initial temperature 300 K till final pressure is 3 atm. What is final temperature. (Take $R = 2\frac{cal}{mol\,k}$) (Approximate to nearest integer)

9. Resistance of an aqueous solution containing 2 moles NH_4Cl and is completely filled in between electrodes which are 20 cm apart was found to be 100 ohm. Molar conductivity of NH_4Cl is_____.

10. 0.15 g of acetic acid is added to 20 g of benzene. Its freezing point decreases by 0.5°C. If % dimerisation of acetic acid is X%. Find value of (X) . $K_{f\ Benzene} = 5K\,Kg\,mol^{-1}$.

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. Let *P* and *Q* are the two distinct points on a circle which has centre at $C(4,3)$ and which pass through origin. If *OC* is perpendicular to both the line segment *CP* and *CQ*, then the set (P,Q) is:

(A) $(1,7),(7,1)$ **(B)** $(1,7),(7,-1)$ **(C)** $(7,1),(1,-7)$ **(D)** $(-7,1),(7,-1)$

2. Let $|\vec{a}|=|\vec{b}|=|\vec{c}|$ and angle between each pair of vectors is $\frac{\pi}{3}$ if $|\vec{a}+\vec{b}+\vec{c}|=\sqrt{12}$ then the value of $|2\vec{a}-\vec{b}+\vec{c}|$ is equal to:

(A) $\sqrt{10}$ **(B)** $\sqrt{2}$ **(C)** $\sqrt{6}$ **(D)** $\sqrt{8}$

3. The value of *r* satisfying the equation. ${}^{69}C_{3r-1}-{}^{69}C_{r^2}={}^{69}C_{r^2-1}-{}^{69}C_{3r}$ is:

(A) 4 **(B)** 5 **(C)** 6 **(D)** **7**

4. The area bounded by the line $y=3x+7$ and the parabola $y=x^2-2x-7$ is:

(A) $\frac{81}{2}$ **(B)** 243 **(C)** $\frac{243}{2}$ **(D)** $\frac{343}{2}$

5. Let $A=\begin{bmatrix}1 & -1\\ 4 & 2\end{bmatrix}$, if $A^{-1}=\alpha A+\beta I$, I is 2×2 identify matrix, then $\frac{\alpha}{\beta}$ is:

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

SPACE FOR ROUGH WORK

6. Two tangents are drawn from $P(-2,3)$ to touch the circle $x^2+y^2-8x+10y-8=0$ at *A* and *B* then the Area of circumcircle of triangle *PAB* is:

(A) 100π **(B)** 25π **(C)** 75π **(D)** 49π

7. Let *C* be the set of all complex numbers. Let

$S_1=\{z\in C:|z-1-i|=4\}$

$S_2=\{z\in C:|z+1+i|=4\}$

$S_3=\{z\in C:\mathrm{Re}(z)=\mathrm{Im}(\bar{z})\}$

Then the no of elements in $S_1\cap S_2\cap S_3$ is:

(A) 0 **(B)** 1 **(C)** 2 **(D)** 4

8. The point of intersection of the lines $\frac{x+1}{3}=\frac{y+3}{5}=\frac{z+5}{7}$ and $\frac{x-2}{1}=\frac{y-4}{3}=\frac{z-6}{5}$ is:

(A) $\left(\frac{1}{2},\frac{1}{2},-\frac{3}{2}\right)$ **(B)** $\left(-\frac{1}{2},-\frac{1}{2},\frac{3}{2}\right)$

(C) $\left(\frac{1}{2},-\frac{1}{2},-\frac{3}{2}\right)$ **(D)** $\left(-\frac{1}{2},\frac{1}{2},\frac{3}{2}\right)$

9. If both the roots of $x^2+4x+(m-3)=0$ are less than 3 then complete values of *m* is given by:

(A) $[7,18)$ **(B)** $(-18,7]$ **(C)** $[-7,18)$ **(D)** $(3,7]$

10. If $\lim\limits_{x\to 1}\left(3-x+a[x-2]+b[x+2]\right)$ exits where [.] denotes greatest integer function, then:

(A) $a=2,b=-1$ **(B)** $a=1,b=-2$ **(C)** $a=2,b=-2$ **(D)** $a=-2,b=4$

SPACE FOR ROUGH WORK

11. If the radius of a circle $x^2+y^2+(2a-3)x+(a-7)y-3=0$ does not exceed 7, then the number of possible integer values of *a* is:

(A) 12 **(B)** 11 **(C)** 13 **(D)** 10

12. If the mean and variance of the data x_i is α and β then mean and variance of $(2x_i+5);\ i\in[1,n], i,n\in N$ is:

(A) $2\alpha+5, 4\beta$ **(B)** $2\alpha, 4\beta$ **(C)** $2\alpha+5, 4\beta+5$ **(D)** $2\alpha+5, 2\beta$

13. Let $\frac{xdy}{dx}-y=x^2\left(xe^x+e^x-1\right)\forall x\in R-\{0\}$ such that $y(1)=e-1$, then $y(2)$ is equal to

(A) $4(e-1)$ **(B)** $4\left(e^2-1\right)$ **(C)** $2\left(e^2-1\right)$ **(D)** $4\left(e^2+1\right)$

14. If $(2a-7)\sin\theta+(a+3)\cos\theta=(3a-1)$ has real solution for $\theta\in R$ then the no of possible integer values of *a* is:

(A) 7 **(B)** 8 **(C)** 9 **(D)** 10

15. A dice is thrown 3 times at randomly, then the probability of getting sum 10 is:

(A) $\frac{1}{6}$ **(B)** $\frac{1}{8}$ **(C)** $\frac{1}{9}$ **(D)** $\frac{25}{216}$

SPACE FOR ROUGH WORK

16. Let E_1 and E_2 be two ellipse $\frac{x^2}{a^2}+y^2=1$ and $x^2+\frac{y^2}{a^2}=1$, and the point of intersection of the ellipse lie on a circle of radius *r*, then:

(A) $r=a$ **(B)** $r^2=\frac{2a^2}{1+a^2}$ **(C)** $r^2=\frac{2a^2}{a^2-1}$ **(D)** $r^2=a^2+1$

17. If $|\alpha|,|\beta|<1, 1-\alpha+\alpha^2-\alpha^3+...\infty=s_1,$ then $1-\alpha\beta+a^2\beta^2-a^3\beta^3+....\infty$ equals :

(A) s_1s_2 **(B)** $\frac{s_1s_2}{1+s_1s_2}$

(C) $\frac{s_1s_2}{1-s_1-s_2+2s_1s_2}$ **(D)** $\frac{1}{1+s_1s_2}$

18. If $f:R\to R$ be a function such that $f(2)=3$ and $f'(2)=-1$ then the value of $\lim\limits_{x\to2}\frac{x^2f(2)-4f(x)}{x-2}$ is equal to:

(A) 16 **(B)** 12 **(C)** 8 **(D)** 20

19. The function $f(x)=\begin{cases}ax^2-bx+2, & x<3\\ bx^2-3, & x\geq3\end{cases}$ is differentiable everywhere, then:

(A) $a-b=1$ **(B)** $3a-2b=5$ **(C)** $a-2b=\frac{4}{9}$ **(D)** none of these

20. If $\int x^2e^{2x}dx=f(x).e^{2x}+c$ then the minimum value of $f(x)$ is:

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

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 parallelogram is constructed on vectors $\vec{a}=3\vec{\alpha}-\vec{\beta},\vec{b}=\vec{\alpha}+3\vec{\beta}$ if $\left|\vec{\alpha}\right|=\left|\vec{\beta}\right|=1$ and angle between $\vec{\alpha}$ and $\vec{\beta}$ is $\frac{\pi}{3}$ then sum of square of length of diagonal is_____.

2. If $\begin{vmatrix} 6i & -3i & 1 \\ 4 & 3i & -i \\ 20 & 3 & i \end{vmatrix}=x+iy,$ then $\frac{x}{y}$ is _____.

3. Let $f(x)$ be a continuous function satisfying $\int_0^x f(t)dt+\int_0^x (x-t)f(t)dt=e^{-x}+x-1$ and $f(0)=0$ then $f(8)e^8$ is equal to_____.

4. If $\vec{a}$ is perpendicular to $\vec{b}+\vec{c},\vec{b}$ is perpendicular to $\vec{c}+\vec{a}$ and $\vec{c}$ is perpendicular to $\vec{a}+\vec{b}$ given that $|\vec{a}|=2,|\vec{b}|=3,$ and $|\vec{c}|=6$ then $\left|\vec{a}+\vec{b}+\vec{c}\right|-3$ is equal to _____.

5. If [.] denotes greatest integer function and $\{.\}$ denotes fraction part function then the number of solution of $4[x]+7\{x\}=12.$

SPACE FOR ROUGH WORK

6. Let $S=\frac{1}{1.3.5}+\frac{1}{3.5.7}+\frac{1}{5.7.9}+.....\infty$ then the value of $\left(6S+\frac{7}{2}\right)$ is _____.

7. The system of lines equation $x+y-z=0, 2x+ay+z=0$ and $3x-2y+7z=0$ has infinitely many solutions then the value of $18a$ is _____.

8. The number of ordered pair (m,n) such that 3^m+7^n is divisible by 10 is k, if $m,n\in\{1,2,3,....,20\}$ then the value of $\frac{1}{2}\sqrt{k}$ is_____.

9. $y=f(x)$ be the solution of $\frac{dy}{dx}=\sin 2x+3y\cot x$ and $f\left(\frac{\pi}{2}\right)=3$ then the value of $\left|f\left(-\frac{\pi}{2}\right)\right|$ is_____.

10. The value of $\lim\limits_{x\to 0}\left(\left[\frac{\sin x}{x}\right]+\left[\frac{\sin^{-1}x}{x}\right]+\left[\frac{x}{\tan^{-1}x}\right]+\left[\frac{\tan x}{x}\right]\right)$ is equal to_____.

([.] denotes greatest integer function)

SPACE FOR ROUGH WORK

••• End of JEE Main Home Practice Test – 3 [JEE - 2024] •••