Vidyamandir Classes
Gurukul for IITJEE Preparation

# Mock Advanced Test-1 Paper-2

| TIME : 3 hrs | M.M. : 198 |
|---|---|

## Read the following Instructions very carefully before you proceed.

**A. General**

**1.** This booklet is your Question Paper. Do not break the seals of this booklet before being instructed to do so by the invigilators.

**2.** Blank papers, clipboards, log tables, slide rules, calculators, cameras, cellular phones, pagers, and electronic gadgets are NOT allowed inside the examination hall.

**3.** **Using a black ball point pen, darken the bubbles on the upper original sheet.** Apply sufficient pressure so that the impression is created on the bottom sheet.

**4.** DO NOT TAMPER WITH/MUTILATE THE OMR OR THE BOOKLET.

**5.** Read carefully the Instructions printed at the beginning of each section.

**B. Filling the Right Part of the OMR**

**6.** For answering a question, an ANSWER SHEET (OMR SHEET) is provided separately. Please fill your **Test Code, Roll No.** and **Group** properly in the space given in the ANSWER SHEET.

**C. Question Paper Format**

The question paper consists of **3 SUBJECTS** (Physics, Chemistry and Mathematics). Each SUBJECT consists of one section only. Each section contains three types (1, 2 & 3).

**12.** **TYPE-1** contains 8 Multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONLY ONE is correct.

**13.** **TYPE-2** contains 3 Paragraphs each describing theory, experiment, data etc. There are 6 multiple choice questions relating to three paragraphs with 2 questions on each paragraph. Each question of a particular paragraph has four choices (A), (B), (C) and (D) out of which ONLY ONE is correct.

**14.** **TYPE-3** contains 6 Multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE** are correct.

**D. Marking Scheme**

**15.** For each question of TYPE-1 and TYPE-2, you will be awarded 3 marks if you darken the bubble corresponding to the correct answer ONLY and zero (0) marks if no bubbles are darkened**. In all other cases, minus one (–1) mark will be awarded in these sections.**

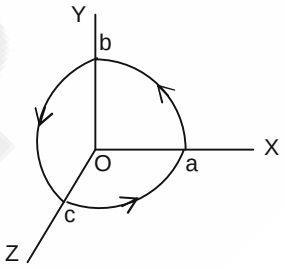
**16.** For each question of TYPE-3, you will be awarded 4 marks if you darken ALL the bubble(s) corresponding to the correct answer(s) ONLY. In all other cases zero (0) marks will be awarded. **No negative marks will be awarded for incorrect answer(s) in this section.**

| PART - I (PHYSICS) | 66 MARKS |
|---|---|

## TYPE-1
## SINGLE CORRECT ANSWER

**This section contains 8 Single Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct.**

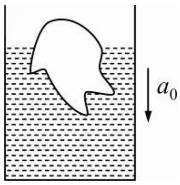
**1.** A wire is bent into three successive quadrants. The quadrant *ab* lies in the *xy* plane, *bc* in *yz* plane and *ca* in *xz* plane as shown in the diagram. What is the magnetic moment of this system if a current $I$ flows through it? Given : $r$ = radius of each quadrant.




**(A)** $\frac{\sqrt{3}\pi r^2 I}{4}$ **(B)** $\frac{\sqrt{2}\pi r^2 I}{4}$

**(C)** $\frac{\pi r^2 I}{4}$ **(D)** $\frac{\pi r^2}{4}$

**2.** A body floats in a liquid contained in a beaker. The whole system as shown in the figure falls with constant acceleration $a_0$. The upthrust on the body due to the liquid is :




**(A)** zero

**(B)** equal to the weight of the liquid displaced

**(C)** less than the weight of the liquid displaced

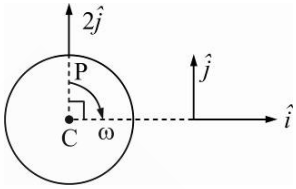
**(D)** equal to the weight of the immersed portion of the body

**3.** A flexible wire loop in the shape of a circle has a radius that grows linearly with time. There is a magnetic field perpendicular to the plane of the loop that has a magnitude inversely proportional to the distance from the centre of loop, $B(r) \propto \frac{1}{r}$. How does the emf induced ($E$) in the loop vary with time.

**(A)** $E \propto t^2$ **(B)** $E \propto t$ **(C)** $E \propto \sqrt{t}$ **(D)** $E$ is constant

**SPACE FOR ROUGH WORK**

**4.** A disc, having plane parallel to the horizontal is moving such that velocity of point *P* with respect to ground on its periphery is 2 m/s $\hat{j}$ as shown in the figure. If radius of disc is *R* = 1 m and angular speed of disc about vertical axis passing through disc is ω = 2 rad/s, the velocity of centre of disc in m/s is :

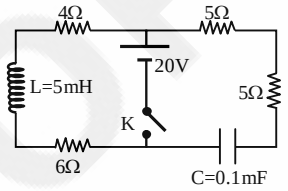



**(A)** $2\hat{j}$ **(B)** $2\hat{i}+2\hat{j}$ **(C)** $-2\hat{i}+2\hat{j}$ **(D)** None of these

**5.** A pipe of length $\ell_1$ closed at one end is kept in a chamber of gas of density $\rho_1$. A second pipe open at both ends is placed in a second chamber of gas of density $\rho_2$. The compressibility of both the gases are equal. Calculate the length of the second pipe if frequency of first overtone in both the cases are equal.

**(A)** $\frac{4}{3}\ell_1\sqrt{\frac{\rho_2}{\rho_1}}$ **(B)** $\frac{4}{3}\ell_1\sqrt{\frac{\rho_1}{\rho_2}}$ **(C)** $\ell_1\sqrt{\frac{\rho_2}{\rho_1}}$ **(D)** $\ell_1\sqrt{\frac{\rho_1}{\rho_2}}$

**6.** In the circuit shown, the key (*K*) is closed at *t* = 0, the current through the key at the instant $t=10^{-3}\ln 2$, is :




**(A)** 2 *A* **(B)** 3.5 *A*
**(C)** 2.5 *A* **(D)** zero

**7.** Let $\vec{v}$ and $\vec{a}$ be the instantaneous velocity and acceleration of a particle moving in a plane. The rate of change of speed $\frac{dv}{dt}$ of the particle is equal to

**(A)** $|\vec{a}|$ **(B)** $\frac{\vec{v}.\vec{a}}{v}$

**(C)** the component of $\vec{a}$ perpendicular to $\vec{v}$ **(D)** None of these

**8.** An ideal gas whose adiabatic exponent equals 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 the variables *T* and *V*

**(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**

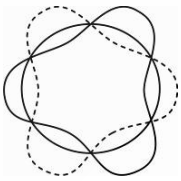
## TYPE-2

## LINK COMPREHENSION TYPE

**This section contains 6 multiple choice questions relating to three paragraphs with two questions on each paragraph. Each question has four choices A, B, C and D out of which ONLY ONE is correct.**

### Paragraph for Questions 9 - 10

Assuming that nature should exercise symmetry, Prince Louis victor de-Broglie, in 1923, hypothesised that matter has a dual (wave-particle) nature like radiation. Duality of radiation was already established. Matter was earlier supposed to have only the particle behaviour. de-Broglie idea of matter also as wave did not find an experimental evidence at that time but it was soon established from the experiments performed by Davisson and Germer and Thomson that electrons could be diffracted. These experiments verified de-Broglie's idea that matter has also a wave character. de-Broglie further concluded that wavelength of matter wave associated with a moving object could be expressed as $\lambda = h/p$, where $p$ is the linear momentum of the object.



Idea of duality of matter has some very important and immediate applications. It could explain quantisation of angular momentum and energy in the Bohr model of the atom. In fact, Bohr's modes has many shortcomings. It was not immediately clear why should angular momentum or energy be quantised so that only discrete values of these quantities are allowed. De-Broglie's concept, as applied to the motion of electrons in an atom, treated electron as matter waves bent into a circle around the nucleus.

It was suggested that allowed Bohr's orbits arise if the electron matter waves interfere constructively and that it will result in a stationary wave that fits into the circular orbit as shown in the figure. Also it could be shown that quantisation of angular momentum ($mvr = nh/2\pi$) was then a natural consequence of such a visualisation of waves fitting in the orbits. Answer the following questions

**9.** For an allowed orbit, radius will be an integral multiple of :

**(A)** $\lambda$ **(B)** $\lambda/2$ **(C)** $\lambda/\pi$ **(D)** $\lambda / 2\pi$

**10.** In the hydrogen atom, an electron makes a transition from $n = 2$ to $n = 1$. The magnetic field produced by the circulating electron at the nucleus

**(A)** decreases 16 times **(B)** increases 4 times

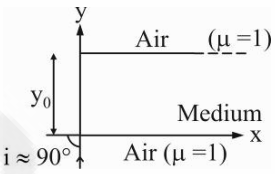
**(C)** decreases 4 times **(D)** increases 32 times

**SPACE FOR ROUGH WORK**

## Paragraph for Questions 11 - 12

Refraction is the bending of the path of a light wave as it passes from one material into another material. The refraction occurs at the boundary and is caused by a change in the speed of the light wave upon crossing the boundary. The tendency of a ray of light to bend one direction or another is dependent upon whether the light wave speeds up or slows down upon crossing the boundary. The speed of a light wave is dependent upon the optical density of the material through which it moves. For this reason, the direction that the path of a light wave bends depends on whether the light wave is traveling from a more dense (slow) medium to a less dense (fast) medium or from a less dense medium to a more dense medium.

A ray of light travelling in air is incident at an angle of incidence $i \approx 90°$ on a long rectangular slab of a transparent medium of thickness $y_0$. The medium has a variable refractive index of $\mu(x) = \sqrt{1+e^{2x/a}}$ $\forall x \geq 0$, where '$a$' is a positive constant.




**11.** In the above situation if $y_0 = a/2$, the coordinates of the point where the ray intersects the upper surface of the slab–air boundary are

**(A)** $\left[ae^2, \frac{a}{2}\right]$ **(B)** $\left[a\ln 2, \frac{a}{2}\right]$ **(C)** $\left[\frac{a}{2}\ln 2, \frac{a}{2}\right]$ **(D)** $\left[\sqrt{2}a, \frac{a}{2}\right]$

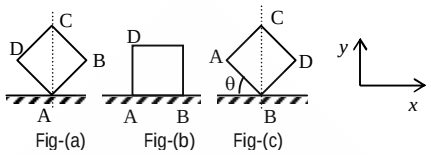
**12.** In the previous question, the angle made by light ray with +ve $x$-axis at the upper surface of slab-air boundary, inside the medium is

**(A)** $\pi/4$ **(B)** $\pi/3$ **(C)** $\tan^{-1}(2)$ **(D)** $\tan^{-1}\left(\frac{1}{2}\right)$

**SPACE FOR ROUGH WORK**

## Paragraph for Questions 13 - 14

A cube of mass *M* and edge a is released from rest with its corner *C* vertically above *A*. It rotates about A until its corner *B* strikes the floor, and then rotates about *B*. The floor is sufficiently rough to prevent slipping and the impact at *B* is perfectly plastic. $\omega_0$ denotes the angular speed of cube just before *B* strikes the floor. (Motion of cube is in *x*-*y* plane only)




**13.** The value of $\omega_0$ =

**(A)** $\sqrt{\left[\frac{3g\left(\sqrt{2}-1\right)}{2a}\right]}$ **(B)** $\sqrt{\left[\frac{3g\left(\sqrt{2}-1\right)}{2\sqrt{2}a}\right]}$

**(C)** $\sqrt{\frac{3g}{a}}$ **(D)** None of these

**14.** The angular speed of cube after *B* strikes the floor is :

**(A)** $\frac{\omega_0}{3}$ **(B)** $\frac{2\omega_0}{3}$ **(C)** $\frac{\omega_0}{4}$ **(D)** $\frac{\omega_0}{2}$

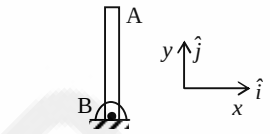
**SPACE FOR ROUGH WORK**

## TYPE-3

## MULTIPLE CORRECT ANSWERS TYPE

**This section contains 6 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct:**

**15.** A uniform rod of mass 1 *kg* and length $L = 1$ *m* stands vertical. Rod is free to rotate about hinge at *B* in *x-y* plane only. A force $\vec{F} = 3\hat{i} + 4\hat{j} + 5\hat{k}$ starts acting on the rod at point *A*. Then immediately after force $\vec{F}$ starts acting on the rod



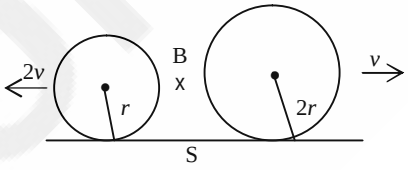

**(A)** angular acceleration of rod will be $9(-\hat{k})$ rad/s$^2$

**(B)** angular acceleration of rod will be $12\sqrt{34}(-\hat{k})$ rad/s$^2$

**(C)** reaction torque of hinge on rod about *B* will be $5(-\vec{i})$ *Nm*

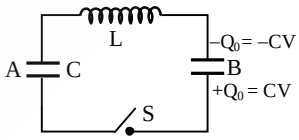
**(D)** reaction torque of hinge on rod about *B* will be 0

**16.** Two conducting rings of radii *r* and 2*r* move in opposite directions with velocities 2*v* and *v* respectively on a conducting surface *S*. There is a uniform magnetic field of magnitude *B* perpendicular to the plane of the rings. The potential difference between the highest points of the two rings is :




**(A)** zero **(B)** $2rvB$ **(C)** $4rvB$ **(D)** $8rvB$

**17.** An inductor and two capacitor are connected in the circuit as shown in the figure. Initially capacitor *A* has no charge and capacitor *B* has *CV* charge. Assume circuit has no resistance at all.




At $t = 0$ switch *S* is closed, then [Given $LC = \frac{2}{\pi^2 \times 10^4}\sec^2$ & $CV = 100$ *mC*]

**(A)** when current in the circuit is maximum, charge on each capacitor is same

**(B)** when current in the circuit is maximum charge on capacitor *A* is twice the charge on capacitor *B*

**(C)** $q = 50\,(1 + \cos 100\,\pi t)$ *mC*, where *q* is the charge on capacitor *B* at time *t*

**(D)** $q = 50(1 - \cos 100\,\pi t)$ *mC*, where *q* is the charge on capacitor *B* at time *t*

**SPACE FOR ROUGH WORK**

**18.** A ring of radius $R$ carries a uniformly distributed charge $+Q$. A point charge $(-q)$ is placed on the axis of the ring at a distance $2R$ from the centre of the ring and released from rest.

**(A)** The motion is harmonic is nature

**(B)** The motion is periodic

**(C)** The electric field strength at an arbitrary position of $(-q)$ along the axis of the ring is $\frac{kqx}{(R^2+x^2)^{3/2}}$ inwardly directed $[k=(4\pi\varepsilon_0)^{-1}]$

**(D)** The electric force strength is $\frac{kQqx}{(R^2+x^2)^{3/2}}$ inwardly directed at an arbitrary position of $(-q)$ along the axis of the ring

**19.** A small satellite of mass $m$ is revolving around earth in a circular orbit of radius $r_0$ with speed $v_0$. At certain point of its orbit, the direction of motion of satellite is suddenly changed by angle $\theta=\cos^{-1}(3/5)$ by turning its velocity vector in the plane of the motion of the satellite such that speed remains constant. The satellite, consequently goes to elliptical orbit around earth. The ratio of speed at perigee to speed at apogee is : (Perigee is the closest point in the orbit and apogee is the farthest in the orbit from the centre of the earth)

**(A)** 3 **(B)** 9 **(C)** 1/3 **(D)** 1/9

**20.** Starting from rest a particle is first accelerated for time $t_1$ with constant acceleration $a_1$ and then stops in time $t_2$ with constant retardation $a_2$. Let $v_1$ be the average velocity in this case and $s_1$ the total displacement. In the second case it is accelerated for the same time $t_1$ with constant acceleration $2a_1$ and comes to rest with constant retardation $a_2$ in time $t_3$. If $v_2$ is the average velocity in this case and $s_2$ the total displacement. Then :

**(A)** $2v_1 < v_2 < 4v_1$ **(B)** $v_2 = 2v_1$ **(C)** $s_2 = 2s_1$ **(D)** $2s_1 < s_2 < 4s_1$

**SPACE FOR ROUGH WORK**

| PART - II (CHEMISTRY) | 66 MARKS |
|---|---|

## TYPE-1

## SINGLE CORRECT ANSWER TYPE

**This section contains 8 Single Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct.**

**1.** $\left[ Ni\left\{ P\left(C_2H_5\right)\left(C_6H_5\right)_2 \right\}_2 Br_2 \right]$ exist in both square planar as well as in tetrahedral forms. Magnetic behaviour in square planar form and tetrahedral form are respectively :

**(A)** diamagnetic and paramagnetic **(B)** diamagnetic in both forms

**(C)** paramagnetic and diamagnetic **(D)** paramagnetic in both forms

**2.** In the cyanide extraction process of silver from argentite ore, the method of concentration of ore and method of reduction are :

**(A)** Froth floatation and self reduction respectively

**(B)** Leaching and metal reduction respectively

**(C)** Froth floatation and carbon reduction respectively

**(D)** Leaching and electrolytic reduction respectively

**3.** The reaction of $NaHXeO_4$ with aqueous NaOH gives xenon, along with another xenon containing compound. The reaction type ; the oxidation state of xenon in xenon containing product is respectively.

**(A)** redox reaction ; +6 **(B)** redox reaction ; +8

**(C)** disproportionation reaction, +6 **(D)** disproportionation reaction ; +8

**4.** The structure of $XeF_6$ molecule is :

**(A)** pentagonal bipyramidal **(B)** distorted octahedral

**(C)** pentagonal pyramidal **(D)** square pyramidal

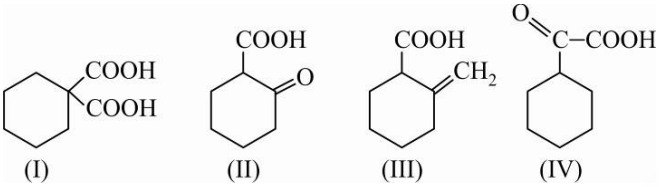
**5.** Interferon is a water soluble protein. A solution prepared by dissolving 15.0 mg of interferon in 2.50 ml of $H_2O$ exhibits an osmotic pressure of 5.80 mm Hg at 25°C. What is the molar mass of interferon ?

**(A)** $1.92\times10^4$ g $mol^{-1}$ **(B)** $1.92\times10^7$ g $mol^{-1}$

**(C)** $1.95\times10^6$ g $mol^{-1}$ **(D)** $1.61\times10^3$ g $mol^{-1}$

**SPACE FOR ROUGH WORK**

**6.** The compound that undergoes decarboxylation most readily under mild condition is :




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

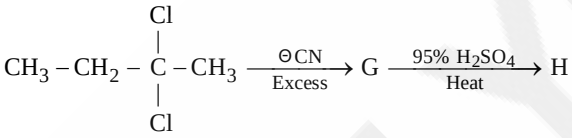
**7.** Using the bond dissociation enthalpies (BDE) in the table estimate $\Delta H^\circ$ for the disproportionation of hydrazin described in the equation below :

$$3\,N_2H_4(g) \longrightarrow 4\,NH_3(g) + N_2(g)$$

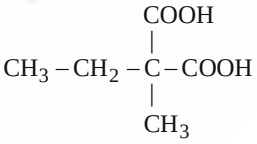
| Bond | BDE, $kJ\,mol^{-1}$ | Bond | BDE, $kJ\,mol^{-1}$ |
|---|---|---|---|
| N – N | 163 | N ≡ N | 944 |
| N = N | 409 | N – H | 388 |

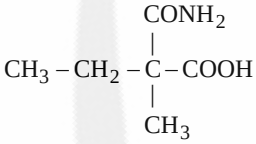
**(A)** $+283\,kJ\,mol^{-1}$ **(B)** $-283\,kJ\,mol^{-1}$ **(C)** $-393\,kJ\,mol^{-1}$ **(D)** $-455\,kJ\,mol^{-1}$

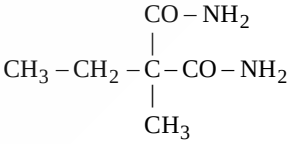
**8.** The major product H of the given reaction sequence is :




**(A)** 


**(B)** 


**(C)** 


**(D)** 


**SPACE FOR ROUGH WORK**

## TYPE-2

## LINK COMPREHENSION TYPE

**This section contains 6 multiple choice questions relating to three paragraphs with two questions on each paragraph. Each question has four choices A, B, C and D out of which ONLY ONE is correct.**

### Paragraph for Questions 9 - 10

Bleaching substances are produced on a large scale and used in several bleaching processes. The bleaching action of a substance can be permanent as well as temporary.

**9.** Hydrolysis of $NCl_3$ produced an oxoacid as one of its hydrolysis product. The anhydride of that oxoacid is :

**(A)** $N_2O_3$ **(B)** $Cl_2O_7$ **(C)** $N_2O_5$ **(D)** $Cl_2O$

**10.** In which of the following the bleaching action is temporary.

**(A)** Moist $Na_2O_2$ **(B)** Moist $O_3$ **(C)** Moist $SO_2$ **(D)** Moist $ClO_2$

### Paragraph for Questions 11 - 12

The standard potential of the following cell is 0.23 V at 15°C and 0.21 V at 35°C.

$$Pt(s)\,|\,\underset{1atm}{H_2(g)}\,|\,\underset{1M}{HCl(aq)}\,|\,AgCl(s)\,|\,Ag(s)$$

Assume that enthalpy change and entropy change of cell reaction remain constant in given range of temperature change. The standard reduction potential of the $Ag^+(aq)\,|\,Ag(s)$ couple is 0.80 V at 25°. [Use $\frac{2.303RT}{F} = 0.059$ ]

**11.** What is the value of log $K_{sp}$ of AgCl in water at 25°C ?

**(A)** 9.665 **(B)** $-9.83$ **(C)** $-13.05$ **(D)** $-10$

**12.** The reaction that occurs in the cell is :

**(A)** $H_2(g) + 2Ag^+(aq) \longrightarrow 2Ag(s) + 2H^+(aq)$

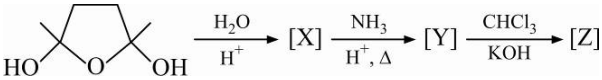
**(B)** $2Cl^-(aq) + 2Ag^+(aq) \longrightarrow 2Ag(s) + Cl_2(g)$

**(C)** $H_2(g) + 2AgCl(s) \longrightarrow 2Ag(s) + 2H^+(aq) + 2Cl^-(aq)$

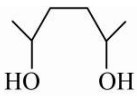
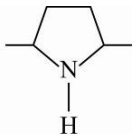
**(D)** $2Ag(s) + 2H^+(aq) \longrightarrow 2Ag^+(aq) + H_2(g)$

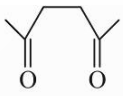
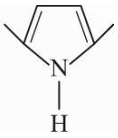
**SPACE FOR ROUGH WORK**

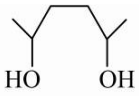
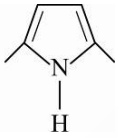
**Paragraph for Questions 13 - 14**

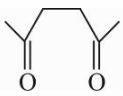
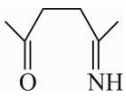



**13.** Identify compound [X] and [Y] formed in above sequence of reaction.

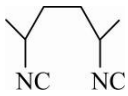
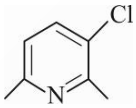
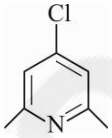
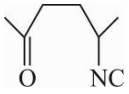
**(A)** [X] =  ; [Y] = 

**(B)** [X] =  ; [Y] = 

**(C)** [X] =  ; [Y] = 

**(D)** [X] =  ; [Y] = 

**14.** The compound [Z] is :

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

**SPACE FOR ROUGH WORK**

## TYPE-3

## MULTIPLE CORRECT ANSWERS TYPE

**This section contains 6 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct:**

**15.** Two moles of a perfect gas undergo the following processes.

**I.** a reversible isobaric expansion from (1.0 atm, 20.0 L) to (1.0 atm, 40.0 L)

**II.** a reversible isochoric change of state from (1.0 atm, 40.0 L) to (0.5 atm, 40.0 L)

**III.** a reversible isothermal compression from (0.5 atm, 40.0 L) to (1.0 atm, 20.0 L)

Which of the following statement(s) is(are) correct ?

**(A)** $w_{Total} = 620.14\,J$ **(B)** $q_{Total} = 620.14\,J$

**(C)** $\Delta U = 1240.28\,J$ **(D)** $\Delta H = 0;\ \Delta S = 0$

**16.** According to Tyndall effect, a beam of light becomes visible when passed through a(n) :

**(A)** aerosol **(B)** colloid **(C)** emulsion **(D)** solution

**17.** For the given aqueous reactions, which of the statement(s) is (are) true ?

$$\text{excess}\,KCN + CuSO_4 \longrightarrow \underset{\text{colour less}}{[X]} + \underset{\text{gas}}{[Y]}$$

$$[Y] \xrightarrow[\text{in } H_2O]{\text{Dissolved}} \xrightarrow{CaCl_2(aq)} \text{white precipitate}$$

**(A)** The first reaction is a redox reaction.

**(B)** [X] is $K_3\left[Cu(CN)_4\right]$.

**(C)** White precipitate decolourizes acidified $KMnO_4$ solution.

**(D)** Gas [Y] in NaOH solution undergoes disproportionation.

**18.** With respect to white, red and black phosphorous, which of the statement(s) given below is (are) correct ?

**(A)** White phosphorous is most reactive form

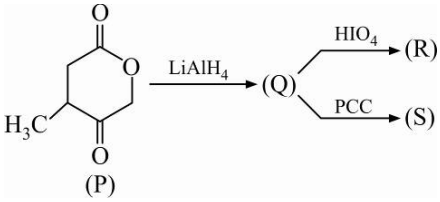
**(B)** Black phosphorous is thermodynamically most stable form

**(C)** $\Delta_f H°$ of white phosphorous is zero

**(D)** Red phosphorous is linear polymeric form

**SPACE FOR ROUGH WORK**

**19.** With refrence to the scheme given, which of the given statement(s) about P, Q, R and S is (are) correct ?



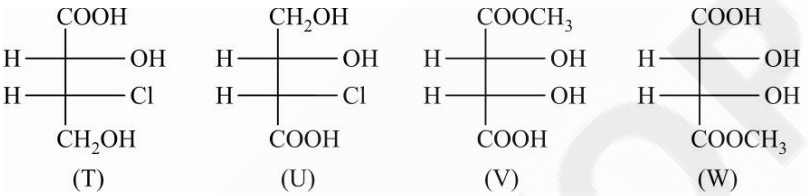

**(A)** (P) is soluble in hot aqueous NaOH

**(B)** (Q) exist in four stereoisomeric forms

**(C)** Molecular formula of (R) is $C_5H_{10}I$

**(D)** (S) form silver mirror on treatment with Tollen's reagent

**20.** Which of the given statement(s) about T, U, V, W is (are) correct ?




**(A)** (T) and (U) are structural isomers **(B)** (V) and (W) are enantiomers

**(C)** (T) and (U) are diastereomers **(D)** (V) and (W) are identical

**SPACE FOR ROUGH WORK**

| PART - III (MATHEMATICS) | 66 MARKS |
|---|---|

## TYPE-1

## SINGLE CORRECT ANSWER TYPE

**This section contains 8 Single Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct.**

**1.** The equation of a plane passing thorough the line $\frac{x-1}{1}=\frac{y-2}{1}=\frac{z-2}{-2}$ and making an angle of $30^0$ with the plane $x + y + z = 5$.

**(A)** $x+(3+2\sqrt{2})y+(2+\sqrt{2})z-11-6\sqrt{2}=0$

**(B)** $x+(3+2\sqrt{2})y+(2+\sqrt{2})z-11=0$

**(C)** $(3+2\sqrt{2})x+y+(2+\sqrt{2})z-11=0$

**(D)** $(3+2\sqrt{2})x+y+(2+\sqrt{2})z-6\sqrt{2}=0$

**2.** If $\hat{\alpha}$ and $\hat{\beta}$ be two perpendicular unit vectors such that $\vec{x} = \hat{\beta} - (\hat{\alpha} \times \vec{x})$, then $|\vec{x}|$ is equal to :

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

**3.** In a triangle ABC a = 7, b = 8 and c= 9. Then the length of median from B to AC is given by :

**(A)** 9 **(B)** 8 **(C)** 7 **(D)** 6

**4.** Four die are thrown simultaneously. The probability that 4 and 3 appear on two of the die given that 5 and 6 have appeared on other two die is :

**(A)** $\frac{1}{6}$ **(B)** $\frac{1}{36}$ **(C)** $\frac{12}{151}$ **(D)** None of these

**5.** The value of $\int_{-3/4}^{11/4}(x-1)\left(\ln(2x-x^2)+\sin\frac{\pi x}{2}\right)dx$ is :

**(A)** 2 **(B)** $\frac{7}{2}$ **(C)** 0 **(D)** –2

**SPACE FOR ROUGH WORK**

**6.** For the matrix $A = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 2 & 1 \\ 2 & 1 & 0 \end{bmatrix}$, which is correct?

**(A)** $A^3 + 3A^2 - I = 0$ **(B)** $A^3 - 3A^2 - I = 0$

**(C)** $A^3 + 2A^2 - I = 0$ **(D)** $A^3 - A^2 + I = 0$

**7.** The first two terms of an H.P. are $\frac{2}{5}$ and $\frac{12}{23}$. The value of the largest term of the H.P. is :

**(A)** $\frac{72}{73}$ **(B)** 6 **(C)** $\frac{1}{6}$ **(D)** none of these

**8.** If $\alpha$ is a root of $x^2 + ax + 1 = 0$, then $\lim\limits_{x \to 1/\alpha} \frac{\sin\left(x^2 + ax + 1\right)}{(\alpha x - 1)}$ is equal to :

**(A)** $2a\alpha$ **(B)** $a\alpha^2$ **(C)** $\frac{1-\alpha^2}{\alpha^2}$ **(D)** does not exist

**SPACE FOR ROUGH WORK**

## TYPE-2

## LINK COMPREHENSION TYPE

**This section contains 6 multiple choice questions relating to three paragraphs with two questions on each paragraph. Each question has four choices A, B, C and D out of which ONLY ONE is correct.**

### Paragraph for Questions 9 - 10

Let $f(x)$ is a differentiable function such that $f'(x) = f(x) + \int_0^2 f(x)dx$, if $f(0) = \frac{4-e^2}{3}$, then :

**9.** The number of solution(s) of $x + f(x) = 0$ is :

**(A)** 0 **(B)** 1 **(C)** 2 **(D)** None of these

**10.** $\int_0^1 f(x)dx$ equal to :

**(A)** $\frac{3e-e^2-2}{3}$ **(B)** $\frac{3e+e^2-4}{3}$ **(C)** $\frac{3e-e^2-4}{3}$ **(D)** none of these

### Paragraph for Questions 11 - 12

A partition of a positive integer $n$ is an unordered selection of positive integers whose sum is $n$ for example $5 = 5 = 4 + 1 = 3 + 2 = 3 + 1 + 1 = 2 + 2 + 1$.

The partitions (3, 1, 1) and (2, 2, 1) are 3-partitions of 5 since we get 5 by adding 3 numbers. Similarly (4, 1), (3, 2) are called 2-partitions of 5 and so on.

**11.** The number of triangles whose sides are integers and whose perimeter is equal to 7 must be :

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

**12.** The number of garlands which can be made by 7 identical flowers of one kind and 2 identical flowers of another kind must be :

**(A)** $2^7$ **(B)** $\frac{9!}{2!7!}$ **(C)** 4 **(D)** 6

**SPACE FOR ROUGH WORK**

## Paragraph for Questions 13 - 14

To the circle $x^2 + y^2 = 4$ two tangents are drawn from P(–4, 0), which touches the circle at $T_1$ and $T_2$ and a rhombus $PT_1 P'T_2$ is completed.

**13.** Circumcentre of the triangle $PT_1T_2$ is at :

**(A)** (–2, 0) **(B)** (2, 0) **(C)** $\left(\frac{\sqrt{3}}{2}, 0\right)$ **(D)** none of these

**14.** If P is taken to be at (h, 0) such that P′ lies on the circle, the area of the rhombus is :

**(A)** $6\sqrt{3}$ **(B)** $2\sqrt{3}$ **(C)** $3\sqrt{3}$ **(D)** none of these

**SPACE FOR ROUGH WORK**

## TYPE-3

## MULTIPLE CORRECT ANSWERS TYPE

**This section contains 6 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct:**

**15.** If A and B are two events such that P**(A)** = 1/2 and P**(B)** = 2/3, then :

**(A)** $P(A \cup B) \geq 2/3$ **(B)** $P(A \cap B') \leq 1/3$

**(C)** $1/6 \leq P(A \cap B) \leq 1/2$ **(D)** $1/6 \leq P(A' \cap B) \leq 1/2$

**16.** Let f (x) = $\int_0^x (\sin t - \cos t)\left(e^t - 2\right)(t-1)^3 (t-2)^5 \, dt$ $(0 < x \leq 4)$. Then $f(x)$ has

**(A)** local maximum at $\frac{5\pi}{4}$ **(B)** local minimum at $\frac{5\pi}{4}$

**(C)** Decreasing in $\left(\ln 2, \frac{\pi}{4}\right)$ **(D)** $f'''(c) = 0$ for at least 3 values of $c \in (0, 4)$

**17.** If $a_1 = \sqrt{ab_1}$, $b_1 = \frac{a+b}{2}$, $a_2 = \sqrt{a_1 b_2}$, $b_2 = \frac{a_1 + b_1}{2}$ ... and so on, and $a = \sqrt{2}b$ for (a > b > 0), then :

**(A)** $\lim_{n\to\infty} a_n = \frac{4b}{\pi}$ **(B)** $\lim_{n\to\infty} b_n = \frac{4b}{\pi}$ **(C)** $\lim_{n\to\infty} a_n = \frac{4a}{\pi}$ **(D)** $\lim_{n\to\infty} b_n = \frac{4a}{\pi}$

**18.** A line $L_1$ with direction ratios (–3, 2, 4) passes through the point A(7, 6, 2) and a line $L_2$ with direction ratios (2, 1, 3) passes through the point B(5, 3, 4). A line $L_3$ with direction ratios (2, –2, –1) intersects $L_1$ and $L_2$ at C and D. Then C and D are :

**(A)** (1, 10, 10) **(B)** (–1, 12, 11) **(C)** (7, 4, 7) **(D)** (3, 8, 9)

**19.** If A is an idempotent matrix and $A^n + B = I$, then :

**(A)** $AB = 0$ **(B)** $A + B^n = I$ **(C)** $AB = I$ **(D)** $A + B + 2AB = I$

**20.** If $f(\theta) = \frac{(2\cos\theta - 1)(2\cos 2\theta - 1)(2\cos 4\theta - 1)\cdots\left(2\cos 2^{n-1}\theta - 1\right)}{2\cos 2^n \theta + 1}$ for $n \in N$

and $\theta \neq 2m\pi \pm \frac{2\pi}{3}$, $m \in I$, then :

**(A)** $f\left(\frac{\pi}{4}\right) = \sqrt{2} - 1$ **(B)** $f\left(\cos^{-1}\frac{1}{\sqrt{3}}\right) = 2\sqrt{3} - 3$

**(C)** $f\left(\frac{\pi}{6}\right) = \frac{\sqrt{3}-1}{2}$ **(D)** $f\left(\frac{\pi}{6}\right) = \sqrt{3} - 1$

**SPACE FOR ROUGH WORK**