VMC Vidyamandir Classes SINCE 1986
IIT JEE | MEDICAL | FOUNDATION

CODE A

# JEE Advanced Home Practice Test -6 | Paper -1 | JEE 2024

**Date: 7/05/2024** **Maximum Marks: 198**

**Duration : 3.0 Hours**

## General Instructions

1. The question paper consists of 3 Subject (Subject I: **Physics**, Subject II: **Chemistry**, Subject III: **Mathematics**). Each Part has **Three** sections (Section 1, Section 2 and Section 3).

2. **Section 1** contains **6 Single Correct Answer Type Questions**. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.

3. **Section 2** contains **6 Multiple Correct Answers Type Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

4. **Section 3** contains **6 Numerical Value Questions**. The answer to each question is a **Numerical Value.** For each question, enter the correct numerical value of the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, **truncate/roundoff** the value to **TWO** decimal places.

5. 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.

**Name of the Candidate (In CAPITALS) :** _____

**Roll Number :** _____

**OMR Bar Code Number :** _____

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

# MARKING SCHEME

**SECTION – 1 | (Maximum Marks: 18)**

- This section contains **SIX (06) Single Correct Answer Type Questions**. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme.

*Full Marks* : +3 If ONLY the correct option is chosen.

*Zero Marks* : 0 If none of the options is chosen (i.e. the question is unanswered).

*Negative Marks* : −1 In all other cases.

**SECTION – 2 | (Maximum Marks: 24)**

- This section consists of **Six (06)** Questions. Each question has **FOUR** options. **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:

**Full Marks:** +4 If only (all) the correct option(s) is(are) chosen

**Partial Marks:** +3 If all the four options are correct but ONLY three options are chosen

**Partial Marks:** +2 If three or more options are correct but ONLY two options are chosen and both of which are correct

**Partial Marks:** +1 If two or more options are correct but ONLY one option is chosen, and it is a correct option

**Zero Mark:** 0 if none of the options is chosen (i.e. the question is unanswered)

**Negative Marks:** –2 In all other cases.

**SECTION – 3 | (Maximum Marks: 24)**

- This **Section** contains **6 Numerical Value Question**. The answer to each question is a **Numerical Value**. For each question, enter the correct numerical value of the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, **truncate/roundoff** the value to **TWO** decimal places.
- Answer to each question will be evaluated according to the following marking scheme:

**Full Marks:** +4 If ONLY the correct numerical value is entered at the designated place.

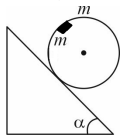
**Zero Mark:** 0 In all other cases.

## SUBJECT I : PHYSICS 66 MARKS

### Section – 1 | Single Correct Type

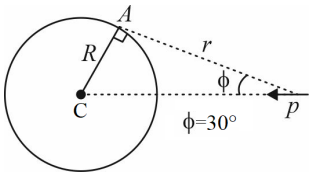
This Section contains **6 Single Correct Answer Type Questions**. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.

**1.** A fixed inclined plane with angle of inclination $\alpha$ has a cylinder resting on it. A small block of same mass is attached inside it. Assume incline plane is highly rough. The system is in equilibrium. The maximum value of $\alpha$ so that system can be adjusted to be in equilibrium is:




**(A)** $\tan^{-1}\left(\frac{1}{3}\right)$ **(B)** $30°$ **(C)** $45°$ **(D)** $\tan^{-1}\left(\frac{2}{3}\right)$

**2.** A small dipole having dipole moment $p$ is placed in front of a fixed solid uncharged conducting sphere as shown in the diagram.



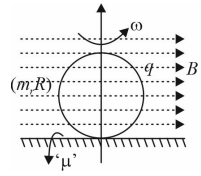

The potential at point $A$ lying on the surface due to induced charge on the sphere will be:

**(A)** $\frac{p}{16\pi\in_0 r^2}$ **(B)** $\frac{-p}{16\pi\in_0 r^2}$ **(C)** $\frac{-3p}{16\pi\in_0 r^2}$ **(D)** $0$

**3.** A circular disc of radius $R$ carries surface charge density $\sigma(r)=\sigma_0\left(1-\frac{r^2}{R^2}\right)$, where $\sigma_0$ is a constant and $r$ is the distance from the centre of the disc. Assume that disc is in $xz$-plane and its axis is $y$-axis. We have an imaginary hollow sphere of radius $R$ and centre at $\left(0,\frac{3}{5}R,0\right)$. The flux of electric field through this imaginary sphere is:

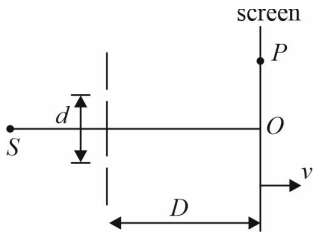
**(A)** $\frac{369}{1250}\left(\frac{\sigma_0\pi R^2}{\in_0}\right)$ **(B)** $\frac{272}{625}\left(\frac{\sigma_0\pi R^2}{\in_0}\right)$ **(C)** $\frac{1}{2}\left(\frac{\sigma_0\pi R^2}{\in_0}\right)$ **(D)** $\frac{136}{625}\left(\frac{\sigma_0\pi R^2}{\in_0}\right)$

**4.** A non-conducting hollow sphere of mass m and radius $R$ having total charge '$q$' is rotating with constant angular velocity '$\omega$' about a vertical axis as shown in the figure. The sphere is then gently placed at $t=0$ on the horizontal surface having a magnetic field applied in the horizontal direction as shown. If there is sufficient friction to prevent any slipping, then the friction force acting on the sphere at $t=0$ is:



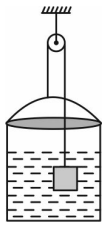

**(A)** $\frac{q\omega RB}{5}$ **(B)** $\frac{2q\omega RB}{5}$ **(C)** $\frac{q\omega RB}{7}$ **(D)** $\frac{2q\omega RB}{7}$

**5.** In YDSE apparatus shown in figure wavelength of light used is $\lambda$. The screen is moved away from the source with a constant speed $V$. Initial distance between screen and plane of slits was $D$. Suppose $P$ is the point where $8^{th}$ order minima was lying at $t = 0$. Then $3^{rd}$ order maxima will lie at this point after a time:




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

**6.** A solid iron cube of volume $10\ cm^3$ is fastened to one end of a cord, the other end of which is attached to a light plastic bucket containing water. The cord, which has negligible mass, passes over a pulley, and the iron cube is suspended in the water, as shown in the figure. It is found that the system is in equilibrium with iron cube completely submerged in water. If density of iron is known to be 8 times the densiy of water then volume of water in the bucket is:



**(A)** $80\ cm^3$ **(B)** $90\ cm^3$ **(C)** $140\ cm^3$ **(D)** $60\ cm^3$

**SPACE FOR ROUGH WORK**

## Section – 2 | Multiple Correct Type

This Section contains **6 Multiple Correct Answer Type Questions.** Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).

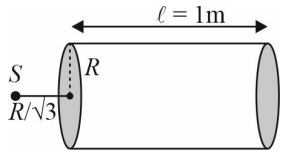
**7.** In a hypothetical hydrogen like atom, potential energy between electron and nucleus is given by $U = k\ell n(r)$. Where $r$ is orbital radius and $k$ is a contant. The expression for orbital radius ($r$) and total energy (E) for such an atom according to Bohr's model are:

**(A)** $r = \dfrac{nh}{2\pi\sqrt{mk}}$ **(B)** $r = \dfrac{nk}{2\pi\sqrt{mk}}$

**(C)** $E = \left[\dfrac{1}{2} + \ell n\left(\dfrac{nh}{2\pi\sqrt{mk}}\right)\right]k$ **(D)** $E = k\ell n\left(\dfrac{nh}{2\pi\sqrt{nk}}\right)$

**8.** A conducting cylinder of radius R has curved surface covered with insulated layer. Flat surfaces are perfect absorbers with surface area $\dfrac{3}{17}$ $m^2$. A point source is placed on the axis of cylinder at a distance of $\dfrac{R}{\sqrt{3}}$ from left face. Temperature of surrounding is 0 $K$. In steady state temperature of left face is 200 $K$ and right face 100 $K$. Then, which of the following statements is(are) correct?

(Stefan's contant $= \dfrac{17}{3}\times 10^{-8} W/m^2K^4$)




**(A)** Power emitted by source is 34 W

**(B)** Power emitted by source is 68 W

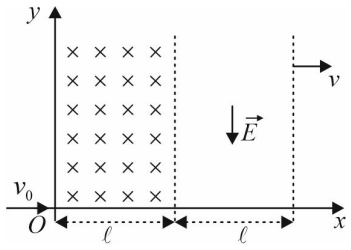
**(C)** Thermal conductivity of cylinder is 0.057 W/mK

**(D)** Thermal conductivity of cylinder is 0.023 W/mK

**9.** If charge on a parallel plate capacitor is given by $Q = I\alpha e^{-\left(\frac{tI}{\Delta V \in_0 \beta}\right)}$, where $\alpha, \beta$ are constants, $t =$ time, $I =$ current, $\Delta V =$ potential differnece, $\in_0 =$ permittivity of free space. Then the dimension of $\dfrac{\beta}{\alpha}$ is same as dimension of : ($\mu_0 =$ permeability of free space and $d =$ seperation between plates)

**(A)** $\dfrac{1}{\sqrt{\mu_0 \in_0}}$ **(B)** $\sqrt{\mu_0 \in_0}$ **(C)** $\dfrac{Qd^2}{I}$ **(D)** $\dfrac{Id}{Q}$

**10.** There is a uniform magnetic field $\vec{B} = -B_0\hat{k}$ from $x = 0$ to $x = \ell$. In the region from $x = \ell$ to $x = 2\ell$ there is a uniform electric field $\vec{E} = -E_0\hat{j}$. A positively charged particle of charge $q$ and mass $m$ moving along $x$-axis enters the region of magnetic field with velocity $\vec{v} = v_0\hat{i}$. After passing through the region of magnetic and electric field it emerges parallel to its initial direction of motion with speed $v$ as shown in the figure. Then choose the correct option(s) (given $\ell = \frac{mv_0}{2qB_0}$)



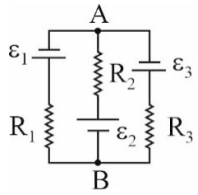

**(A)** $\frac{E_0}{B_0} = \frac{3v_0}{4}$

**(B)** $\frac{E_0}{B_0} = \frac{\sqrt{3}v_0}{2}$

**(C)** Total time of its motion in the regions of electric and magnetic fields is $(\pi + 2\sqrt{3})\frac{m}{6qB_0}$

**(D)** $v = \frac{v_0}{2}$

**11.** In the circuit shown in figure the sources have emfs $\varepsilon_1 = 1.5V, \varepsilon_2 = 2.0V, \varepsilon_3 = 2.5V,$ and the resistances are equal to $R_1 = 10\Omega, R_2 = 20\Omega, R_3 = 30\Omega.$ The internal resistances of the sources are negligible. Which of the following statement(s) is(are) correct?



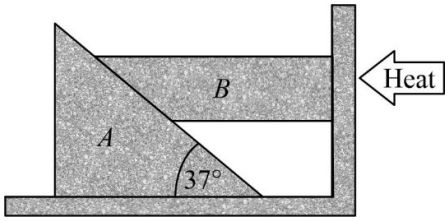

**(A)** the current flowing through the resistance $R_1$ is 0.08A

**(B)** the current flowing through the resistance $R_3$ is 0.12A

**(C)** potential difference $V_B - V_A$ between the points B and A is 0.73V

**(D)** potential difference $V_B - V_A$ between the points B and A is 0.5V

**12.** A wax bar $B$ rests between a wedge $A$ and a vertical wall as shown in the figure. The wedge starts moving towards the wall with a constant acceleration of $0.5mm/s^2$, and at the same instant heat given to the wall starts melting $1.0mm$ length of the wax bar per second. The bar always remains horizontal. Use satisfactorily approximate value $\sin 37° = 3/5$.




Which of the following descriptions suits the above physical situation?

**(A)** The bar first moves downwards and then upward.

**(B)** The bar stops momentarily after 2 seconds from the beginning.

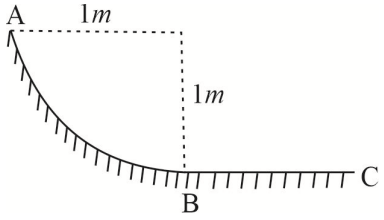
**(C)** Modulus of displacement of the bar in the first four seconds is $1.5mm$.

**(D)** Distance travelled by the bar in the first four seconds is $1.5mm$.

## Section – 3 | Numerical Value Type

**This Section** contains **6 Numerical Value Questions**. The answer to each question is a **Numerical Value.** For each question, enter the correct numerical value of the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, **truncate/roundoff** the value to **TWO** decimal places

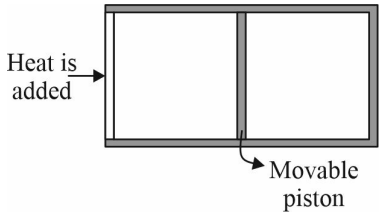
**13.** Circular part AB of the track shown below is smooth and beyond point-B, horizontal track is rough. A block of mass 2 kg is released from rest at point A and it stops after travelling 4 *m* on track BC. The value of friction coefficient $\mu$ between block and track BC is_____.




**14.** A glass capillary sealed at the upper end is of length 0.11 m and internal diameter $2\times10^{-5}$ m. This tube is immersed vertically into a liquid of surface tension $5.05\times10^{-2}$ N/m. When the length '*x*' m of the tube is immersed in liquid then the liquid level inside and outside the capillary tube becomes the same, then the value of *x* is_____. (Assume atmoshperic pressure is $1.01\times10^{5}\,\frac{N}{m^2}$)

**15.** Sea water at frequency $v=4\times10^{8}\,Hz$ has permittivity $\varepsilon\approx80\,\varepsilon_0$, permeability $\mu\approx\mu_0$ and resistivity $\rho=0.25\,\Omega-m$. Imagine a parallel plate capacitor immersed in sea water and driven by alternating voltage source $V(t)=V_0\sin(2\pi vt)$. What fraction of the conduction current density is the displacement current density?

**16.** A rigid vessel is divided into two compartments by an insulating piston that can slide without friciton. All walls of the vessel are insulating except the left wall of the left compartment. Initially, both compartments contain $0.1\ \text{m}^3$ of the same monoatomic gas at temperature 300 K and pressure $10^4\ \text{N/m}^2$. Now, an amount of heat $\Delta Q$ is added slowly to the vessel through the left wall such that the volume of the right compartment reduces to $0.09\ \text{m}^3$. Find the value of $\Delta Q$ (in joules). [Given : $(0.9)^{-5/3}=1.2$ ]



**17.** There are two horns $H_1$ and $H_2$ in a car. When they are sounded together, the driver records 35 beats in 10 sec. With horn $H_2$ blowing alone and car moving towards a wall, at a speed of 5 m/sec, the driver noticed a beat frequency of 5 Hz with the echo. When frequency of $H_1$ is decreased, the beat frequency when two horns sounded together increases (speed of sound in still air is 332 m/sec). Then the frequency of $H_1$ (in $Hz$) is _____.

**18.** A ball of radius $R$ = 20 cm has a mass $m$ = 6 kg and moment of inertia about its diameter $I = 0.1$ $\text{kg m}^2$. The ball rolls without slipping over a rough horizontal floor with velocity $v_0 = 20\,\text{m/s}$ towards a smooth vertical wall. If coefficient of restitution between the wall and ball is $e = 0.7$, then the velocity of the ball (in m/s) long time after collision is_____. $(g = 10\ \text{m/s}^2)$

**SPACE FOR ROUGH WORK**

## SUBJECT III : CHEMISTRY 66 MARKS

### Section – 1 | Single Correct Type

This Section contains **6 Single Correct Answer Type Questions**. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.

**1.** The two equilibria, $XY \rightleftharpoons X^+ + Y^-$ and $XY + Y^- \rightleftharpoons XY_2^-$ are simultaneously maintained in a solution with equilibrium constants $K_1$ and $K_2$ respectively. The ratio of $X^+$ to $XY_2^-$ in the solution is:

**(A)** Inversely proportional to the square of the concentration of $Y^-$

**(B)** Directly proportional to the square of the concentration of $Y^-$

**(C)** Inversely proportional to the concentration of $Y^-$

**(D)** Directly proportional to the concentration of $Y^-$

**2.** Select the incorrect statement.

**(A)** Fullerene is aromatic

**(B)** Dipole moment of the p-dimethylbenzene molecule is not zero

**(C)** In dry ice molecules are held by London forces

**(D)** $I_2$ molecules are held in the solid lattice by London forces

**3.** $PbF_4$ exist but $PbI_4$ do not exist because of:

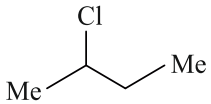
**(A)** Large size of $I^-$

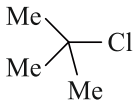
**(B)** Strong oxidising character of $Pb^{4+}$

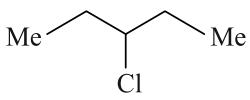
**(C)** Strong reducing character of $Pb^{4+}$

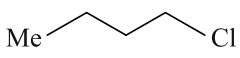
**(D)** Low electronegativity of $I^-$

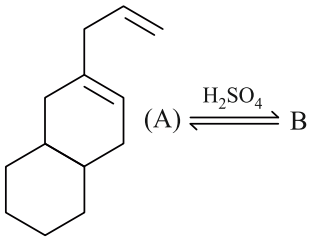
**4.** Equal amount of an $RCl(C_4H_9Cl)$ is reacted at the same temperature with equal volume of 0.2 M and 0.4 M solution of KOH, respectively, in two separate experiments. The time taken for the 50% reaction of $(C_4H_9Cl)$ was found to be same, the alkyl halide is:

**(A)** 

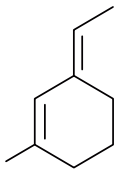
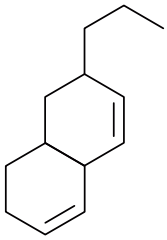
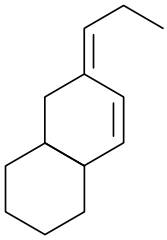
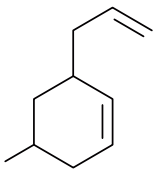

**(B)** 

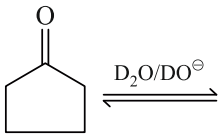

**(C)** 


**(D)** 

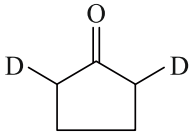
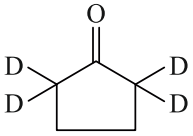
**5.** 

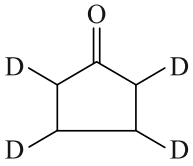
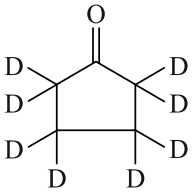

A isomerise to B on addition of traces of acid $H_2SO_4$. Compound (B) is:

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

**6.** 

; Prolonged treatment of (A) with $D_2O / DO^{\ominus}$ gives:

**(A)**  **(B)** 

**(C)**  **(D)** 

**SPACE FOR ROUGH WORK**

## Section – 2 | Multiple Correct Type

This Section contains **6 Multiple Correct Answer Type Questions.** Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).

**7.** Select the correct statements:

**(A)** $\Delta_f H(PCl_3, g)$, $\Delta_f H(Cl, g)$ and $\Delta_{atomisation} H(P, s)$ are 300, 120 and 320 kJ $mol^{-1}$ respectively. Bond enthalpy of P – Cl bond = 66.66 kJ $mol^{-1}$

**(B)** $CH_3OH(g) + HCl(g) \longrightarrow CH_3Cl(g) + H_2O(g)$ $\quad \Delta_r H = -10$ kJ $mol^{-1}$

B. E. of (C – H), (C – O), (O – H), (H – Cl) and (C – Cl) are 400, 330, 450, 430 and 320 kJ $mol^{-1}$ respectively

**(C)** B. E. of (N – N), (H – H), (N ≡ N) and (N – H) are 160, 430, 940 and 400 kJ $mol^{-1}$ respectively

$\Delta_f H°$ of $N_2H_4(g) = 40$ kJ $mol^{-1}$

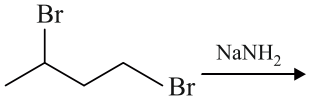
**(D)** The enthalpy change for the reaction $C_2H_6(g) \longrightarrow 2C(g) + 6H(g)$, is X kJ.

B.E. of (C – H) bond is X/6 kJ

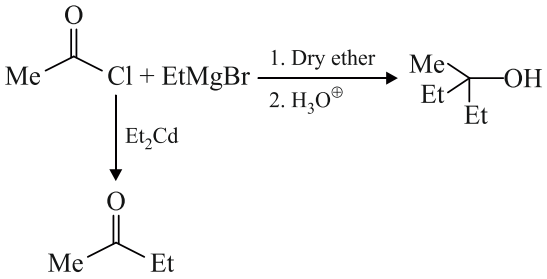
**8.** In which of the following reaction(s), an alkyne product is formed?

**(A)** $Al_4C_3 + H_2O \longrightarrow$ **(B)** $CaC_2 + H_2O \longrightarrow$

**(C)** $CH_3C \equiv CMgI + H_2O \longrightarrow$ **(D)**




**9.** Which of the statements are correct about the following reaction?




**(A)** Ketones are more reactive than RCOCl, therefore ketones further react with RMgX to give 3° alcohols.

**(B)** (C – Mg) bond is more ionic than (C – Cd) bond.

**(C)** Nucleophile $R^{\ominus}$ from Grignard reagent is more reactive than nucleophile $R^{\ominus}$ from $R_2Cd$ and the reaction of RMgX with RCOCl is a nucleophilic addition reaction

**(D)** Water can be used as solvent in Grignard reactions

**10.** In which of the following options both the complex are tetrahedral?

**(A)** $[Cu(CN)_4]^{3-}$ and $[Cu(Py)_4]^{+}$ **(B)** $[Ni(CO)_4]$ and $[Ni(CN)_4]^{2-}$

**(C)** $[Co(CO)_4]^{-}$ and $[CoCl_4]^{2-}$ **(D)** $[Fe(CO)_4]^{2-}$ and $[FeCl_4]^{-}$

**11.** Select correct statements:

**(A)** PbO can't dissolved completely in $H_2SO_4$ due to formation of insoluble $PbSO_4$

**(B)** $PbO_2$ shows oxidizing properties with HCl to give $Cl_2$

**(C)** $Pb_3O_4$ reacts with conc. HCl to give $Cl_2$ gas

**(D)** $Sn^{2+}$ and $Fe^{3+}$ cannot co-exist in the same solution due to redox reaction between these ions

**12.** Identify the correct statements.

**(A)** The solution formed by mixing equal volumes of 0.1 M urea and 0.1 M glucose will have the same osmotic pressure

**(B)** 0.1 M $K_4[Fe(CN)_6]$ and 0.1 M $Al_2(SO_4)_3$ are isotonic solutions

**(C)** For association of a solute in a solution, $i > 1$

**(D)** The ratio of van't Hoff factors for 0.2 M glucose and 0.1 M sucrose is 2 : 1

## Section – 3 | Numerical Value Type

**This Section** contains **6 Numerical Value Questions**. The answer to each question is a **Numerical Value.** For each question, enter the correct numerical value of the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, **truncate/roundoff** the value to **TWO** decimal places

**13.** How many of the following 0.1 M solutions are acidic?

| | | | | | |
|---|---|---|---|---|---|
| **a.** | $NH_4Cl$ | **b.** | NaOH | **c.** | $CH_3COOH$ |
| **d.** | NaCl | **e.** | $NH_3 + NH_4Cl$ | **f.** | $NH_3$ |
| **g.** | HCl | **h.** | $HClO_4$ | **i.** | $(NH_4)_2SO_4$ |
| **j.** | $K_2SO_4$ | | | | |

**14.** The polymerisation of propene to linear polypropene is represented by the reaction,

$$n\left(\begin{array}{l} CH_3 \\ | \\ CH = CH_2 \end{array}\right) \longrightarrow \left(\begin{array}{l} CH_3 \\ | \\ -CH - CH_2 - \end{array}\right)_n$$

where n has large integral value, the average enthalpies of bond dissociation for (C = C) and (C – C) at 298K are +590 and $+331$ kJ $mol^{-1}$, respectively. The enthalpy of polymerisation is $-360$ kJ $mol^{-1}$. Find the value of n.

**15.** Hydrogen peroxide can be prepared by successive reactions:

$$2NH_4HSO_4 \rightarrow H_2 + (NH_4)_2S_2O_8$$

$$(NH_4)_2S_2O_8 + 2H_2O \rightarrow 2NH_4HSO_4 + H_2O_2$$

The first reaction is an electrolytic reaction and the second is steam distillation. What amount of current would have to be used in first reaction to produce enough intermediate to yield 100 g pure $H_2O_2$ per hour? Assume 50% anode current efficiency.

**16.** A 200 mL solution of $I_2$ is divided into two unequal parts.

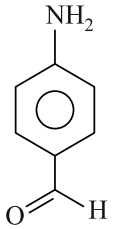
Part I interacts with hypo solution in acidic medium and requires 8 mL of 2 M hypo solution for complete neutralisation.

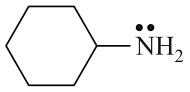
Part II was added with 300 mL of 0.1 M NaOH solution.

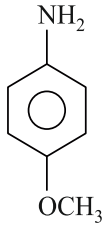
Residual base required 30 mL of $0.1\ M\ H_2SO_4$ solution for complete neutralization. Calculate the value of 20 times the initial concentration of $I_2$ ?

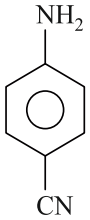
**17.** Two reactions proceed at 25°C at the same rate, the temperature coefficient of the rate of the first reaction is 2.0 and of the second, 2.5. Find the approximate ratio of rates of these reaction at 95°C.

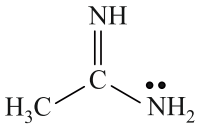
**18.** Identify how many compounds are more basic than aniline.

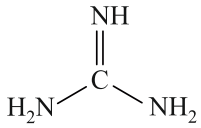
**1.** 

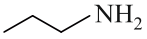

**2.** 

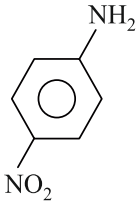

**3.** 

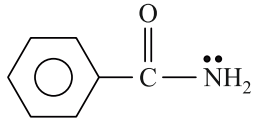

**4.** 


**5.** 


**6.** 


**7.** 


**8.** 


**9.** 

## SUBJECT III : MATHEMATICS 66 MARKS

### Section – 1 | Single Correct Type

This Section contains **6 Single Correct Answer Type Questions**. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.

**1.** If the curves $\frac{x^2}{4}+y^2=1$ and $x^2+\frac{y^2}{4}=1$ cut on four concyclic points, the equation of circle passing through these four points is:

**(A)** $x^2+y^2=\frac{8}{5}$ **(B)** $x^2+y^2=1$ **(C)** $x^2+y^2=4$ **(D)** $x^2+y^2=\frac{5}{4}$

**2.** If $\alpha,\beta$ are roots of $x^2+px+q=0$ and $\gamma,\delta$ are the roots of $x^2+px-r=0$, then $\left(\frac{\alpha-\gamma}{\beta-\gamma}\right)\times\left(\frac{\alpha-\delta}{\beta-\delta}\right)$ is equal to:

**(A)** 1 **(B)** –1 **(C)** $\frac{q+r}{p+r}$ **(D)** $\frac{q-r}{p-r}$

**3.** The area enclosed by the curve $f(x)=\max\left\{\cos^{-1}\cos x,\ |x-\pi|\right\}$ between the lines $x = 0$ and $x = 2\pi$ and the $x$-axis, is:

**(A)** $\frac{\pi^2}{2}$ **(B)** $\frac{3\pi^2}{2}$ **(C)** $2\pi^2$ **(D)** None of these

**4.** If $a$ and $b$ are randomly chosen from set {1, 2, 3, 4, 5, 6, 7, 8, 9}, then probability that the expression $ax^4+bx^3+(a+1)x^2+bx+1$ has positive value for all real values of $x$ is:

**(A)** $\frac{34}{81}$ **(B)** $\frac{31}{81}$ **(C)** $\frac{32}{81}$ **(D)** $\frac{10}{27}$

**5.** Let $g$ be a function from set $X$ to $X$ such that $g\{g(x)\}=x$ for all $x\in X$, then $g$ is:

**(A)** One one but not onto.

**(B)** Onto but not one-one.

**(C)** One-one as well as onto.

**(D)** Neither one-one nor onto

**6.** Find area enclosed by $y=\sin^{-1}(|x|-1)$ and $y=\frac{\pi}{10}(x^2+1)$ is $\frac{p}{q}\pi$, where $p,q\in N$ (H.C.F of $p$, $q$ is unity), then find least value of $q-p$.

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

## Section – 2 | Multiple Correct Type

This Section contains **6 Multiple Correct Answer Type Questions.** Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).

**7.** A ray of light come along the line $L$ and strikes the plane mirror kept along plane $p = 0$ at point $B \cdot A(2,1,\lambda)$ is a point on the line $L$ whose image about $p = 0$ is $A'$. It is given that line $L$ is $\frac{x-2}{3} = \frac{y-1}{4} = \frac{z-6}{5}$ and plane $p = 0$ is $x + y - 2z = 3$ then:

**(A)** The co-ordinate of $A'$ are (6, 5, –2)

**(B)** The co-ordinate of $A'$ are (6, 5, 2)

**(C)** Equation of reflected ray is $\frac{x+10}{4} = \frac{y+15}{5} = \frac{z+14}{3}$

**(D)** Equation of reflected ray is $\frac{x+10}{4} = \frac{y-15}{4} = \frac{z+2}{3}$

**8.** Four points $z_1, z_2, z_3, z_4$ in a complex plane such that.

$|z_1| > \frac{4}{3}, |z_2| = 1, |z_3| \le 1$ and $z_3 = \frac{z_2(z_1 - z_4)}{\overline{z}_1 z_4 - 1}$, then $|z_4|$ can be equal to:

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

**9.** In a $\Delta ABC$, a semicircle is inscribed, which lies on side c. If $x$ is the length of the angle bisector, through Angle $C$, then radius of semicircle is:

**(A)** $\frac{abc}{4R^2(\sin A + \sin B)}$ **(B)** $\frac{\Delta}{x}$

**(C)** $x \sin\frac{c}{2}$ **(D)** $\frac{2\sqrt{S(S-a)(S-b)(S-c)}}{S}$

**10.** Given $I_1 = \int_0^{\pi/2} \cos(\sin x)\,dx$, $I_2 = \int_0^{\pi/2} \sin(\cos x)\,dx$, $I_3 = \int_0^{\pi/2} \cos x\,dx$, then which of following is/are incorrect?

**(A)** $I_1 > I_3 > I_2$ **(B)** $I_3 > I_1 > I_2$

**(C)** $I_1 > I_2 > I_3$ **(D)** $I_3 > I_2 > I_1$

**11.** Let $P$ and $Q$ are two square matrix of order 3, then which of the following statement is/are always correct?

**(A)** $PQP^T$ is symmetric matrix.

**(B)** $PQ - QP$ is skew symmetric matrix.

**(C)** If $Q = |P|P^{-1}, |P| \neq 0$, then $adj(P^T) - Q$ is skew symmetric matrix.

**(D)** $Q + P^T = 0$ and $P$ is skew symmetric matrix and $Q^{15}$ is also skew symmetric matrix.

**12.** Let $f(x)=\begin{cases}\left\{\cos\left(\frac{1}{x}\right)\right\}\times\left\{\ln^2(1+x)\right\}, & x>0\\ 0 & x\le 0\end{cases}$

Then which of the following is/are correct?

**(A)** $f(x)$ is continuous at $x = 0$ **(B)** $f(x)$ is differentiable at $x = 0$

**(C)** $f'(x)$ is continuous at $x = 0$ **(D)** $f'(x)$ is non-derivable at $x = 0$

## Section – 3 | Numerical Value Type

**This Section** contains **6 Numerical Value Questions**. The answer to each question is a **Numerical Value.** For each question, enter the correct numerical value of the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, **truncate/roundoff** the value to **TWO** decimal places

**13.** The minimum value of

$$f(x)=\frac{(x-2)^{10}+(x-2)^{11}+3(x-2)^{12}+(x-2)^{15}+(x-2)^{23}+(x-2)^{25}}{(x-2)^{15}}\ \forall\ x>2$$

is $A$. Find value of $\frac{A}{5}$?

**14.** Let $\vec{a},\vec{b}$ and $\vec{c}$ are three unit vector such that $\left|\vec{a}+\vec{b}+\vec{c}\right|=\sqrt{3}$ and let a

$\left(\vec{a}\times\vec{b}\right)\cdot\left(\vec{b}\times\vec{c}\right)+\left(\vec{b}\times\vec{c}\right)\cdot\left(\vec{c}\times\vec{a}\right)+\left(\vec{c}\times\vec{a}\right)\cdot\left(\vec{a}\times\vec{b}\right)=\lambda$ when $\lambda$ is maximum then value of

$\left|\left(2\vec{a}+3\vec{b}+4c\right)\cdot\left(\vec{a}\times\vec{b}+5\vec{b}\times\vec{c}+6\vec{c}\times\vec{a}\right)\right|$ is $K$. Find value of $\frac{K}{10}$?

**15.** If $\lim\limits_{x\to 1^-}\frac{1-\cos\left(a\cos^{-1}x\right)}{1-x^2}=18,$ then. Find value of $\frac{|a|}{5}$.

**16.** Let us consider a function $2f(x)+xf\left(\frac{1}{x}\right)-2f\left[\left|\sqrt{2}\sin\left[\pi\left(x-\frac{1}{4}\right)\right]\right|\right]=4\cos^2\frac{\pi x}{2}+x\cos\frac{\pi}{x}$ then find value of $\frac{f\left(\frac{1}{2}\right)+f\left(\frac{1}{2}\right)+f(1)+5}{2}$. (Here $|\ |$ is representing mod.)

**17.** Consider two functions, $f(x) = x^2 + x + \frac{3}{4}$ and $g(x) = x^2 + ax + 1, a\in(-10,10)$. The number of integral values of '$a$' for which $g(f(x)) = 0$ has no real solution is_____.

**18.** A sequence $a_1,a_2,a_3,.....a_n$ of real numbers is such that $a_1=0,\ |a_2|=|a_1+1|,|a_3|=|a_2+1|,$ .....

$|a_n|=|a_{n-1}+1|$. Then minimum value of arithmetic mean of $a_1,a_2,a_3...a_n$ is $\frac{-p}{q}$. Then $p + q =$