VMC Vidyamandir Classes SINCE 1986
IIT JEE | MEDICAL | FOUNDATION

CODE A

JEE Advanced Home Practice Test -6 | Paper -2 | 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 **Four** sections (Section 1, Section 2 and Section 3).

2. **Section 1** contains **6 Single Digit Integer Questions** ranging from 0 to 9, Both Inclusive. For each question, enter the correct integer corresponding to the answer using the mouse and the on-screen virtual numeric keyboard in the place designated enter the 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.

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.

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 **6 Single Digit Integer Questions** ranging from 0 to 9, Both Inclusive. For each question, enter the correct integer corresponding to the answer using the mouse and the on-screen virtual numeric keyboard in the place designated enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks: $+3$ If ONLY the correct option is entered.

Zero Mark: 0 If 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.

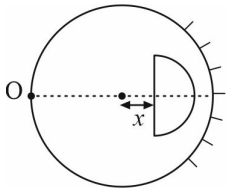
Zero Mark: 0 In all other cases.

SUBJECT I : PHYSICS 66 MARKS

Section – 1 | Single Digit Integer Type

This Section contains **6 Single Digit Integer Questions** ranging from 0 to 9, Both Inclusive. For each question, enter the correct integer corresponding to the answer using the mouse and the on-screen virtual numeric keyboard in the place designated enter the answer.

1. Consider a sphere of radius 16cm made of a material of refractive index 1.5. One half of the sphere is silvered and an object in placed on the other side such that the object lies on the principal axis of the mirrored side. A hemispherical cavity of radius 8cm is carved out of the sphere such that the principal axis of cavity coincides with that of the sphere. The center of the cavity lies at a distance x from the center of the sphere. Find the value of x (in cm) for which the image of an object O is formed at O itself. Report your answer by rounding off to the nearest integer.

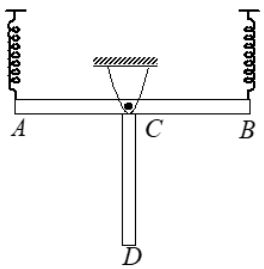


2. Consider a rod of length 12m hinged at the bottom of the swimming pool which is filled with a liquid of varying density given by $\rho_0\left(1+\frac{y}{6}\right)$, where y is the depth of the liquid from the surface. It contains liquid upto a depth of 6m. Assume the rod to be made up of a material of uniform density and uniform cross-sectional area. The density of the rod is $\frac{x\rho_0}{6}$ for the rod to be just fully submerged in the liquid. Find the value of x.

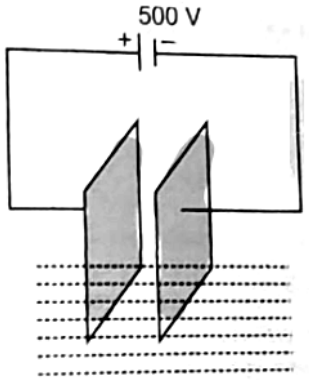
3. A man in a boat wishes to cross a 400 m wide river flowing at the rate of 2 m/s. Speed of boat in still water is 4 m/s. The person starts to row the boat perpendicular to the river flow from one bank of the river. When he reaches the middle of the river, in order to reach the point directly opposite to the starting point on the opposite bank, he starts to row the boat at an angle θ with the line perpendicular to river flow. The value of tan θ is $\frac{4}{n}$. Find value of n.

4. A radioactive substance $'A'$ is being generated at a constant rate of 10^8 atoms / sec. It disintegrates with decay constant $\lambda = 37\ s^{-1}$ to form B. Initially there are no A or B atoms. If the number of atoms of B after one mean life of A is $x \times 10^6$, then find the value of x.

5. A body is made of two identical rods AB and CD welded to form a T shape. Two springs are attached with this body and the body is free to rotate in a vertical plane about a horizontal axis passing through C as shown in the figure. The angular frequency of small oscillation of this system is $4n$ rad/s. Find the value of n. Mass of each rod is m = 6 kg and length is $2a = \frac{5}{52}$ m. Spring constant for each spring is K = 96 N/m.



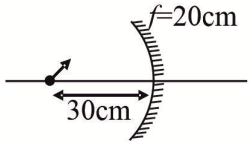
6. A capacitor is made from two metallic squares plates having side 1 m and at distance 8.85 mm apart. The plates are then lowered vertically into a medium of dielectric constant (k = 11) at speed of 1 mm/s. Neglecting resistance of connecting wires, the current drawn from the battery during the process is_____$\times 10^{-9}$ *Ampere* .



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 point object is projected from a point on the principal axis of a concave mirror of focal length 20 cm with a speed of $\sqrt{5}$ m/s at an angle of $\tan^{-1} 2$ with the principal axis as shown in figure. Which of the following statement(s) is (are) correct for the moment just after projection?



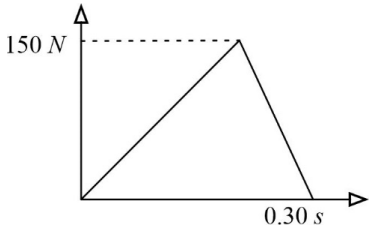
(A) Image is formed at a distance of 60 cm from the mirror

(B) Image speed is $5\sqrt{2}$ m/s

(C) Image velocity makes an angle of 45º with the principal axis

(D) Relative speed of image with respect to object is $\sqrt{61}$ m/s

8. Two bodies A and B of masses 5 kg and 10 kg respectively moving in opposite directions with velocities 4.00 m/s and 0.50 m/s respectively make head-on collision in free space. The force of their mutual interaction varies according to the given graph.



What can you conclude from the given information.

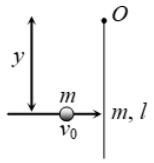
(A) Period of deformation is 0.20 s.

(B) Coefficient of restitution is 0.50.

(C) Body A will move with velocity 0.50 m/s in the original direction.

(D) Body B will move with velocity 1.75 m/s in the original direction.

9. A uniform rod of mass m and length l is free to rotate about a fixed horizontal axis O. A small ball of mass m moving horizontally with velocity v_0 strikes the rod at depth y from O as shown in figure. If angular velocity of rod and velocity of ball just after the collision, be ω (anti-clockwise) and v (parallel to v_0) respectively, then the correct statement(s) will be:



(A) If $y = \ell/3$, then in case of elastic collision, $|v| = \frac{v_0}{2}$ and $\omega = \frac{3v_0}{2\ell}$

(B) If $y = \ell/2$, then in case of elastic collision, $v = \frac{v_0}{2}$ and $\omega = \frac{v_0}{\ell}$

(C) Ball can come to rest on hitting the rod if $y \le \frac{\ell}{\sqrt{3}}$

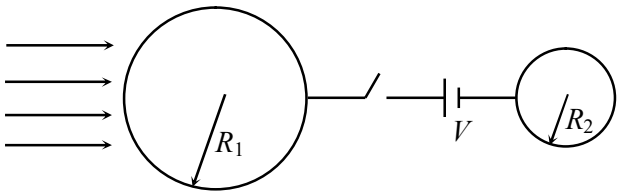
(D) If momentum of ball-rod system remains conserved, then $y > \frac{l}{2}$.

10. A planet of mass m is orbiting a star of mass M. The planet experiences a small drag force $F = -\alpha v$ due to motion through the star's dense atmosphere where v is its velocity. Assuming an essentially circular orbit with initial radius $r = r_0$ at $t = 0$, choose the correct statement(s).

(A) Energy is lost at the rate αv^2 **(B)** Energy is lost at the rate $\frac{\alpha GM}{r}$

(C) Planet is at $r = \frac{r_0}{2}$ at $t = \frac{2\alpha}{m}\ln 2$ **(D)** Planet is at $r = \frac{r_0}{2}$ at $t = \frac{m}{2\alpha}\ln 2$

11. Two conducting uncharged spheres of radius R_1 and R_2 ($R_1 > R_2$) are connected to a battery with a switch as shown. Light rays of frequency f are incident on the bigger sphere and simultaneously the switch is closed. Work function of bigger sphere is ϕ. After some time the charge on bigger sphere becomes q_1, and on smaller sphere becomes $-q_2$ and it remains constant there after. Assuming the spheres to be far apart, choose the correct statement (s) (e is the magnitude of charge on an electron)



(A) $\frac{q_1}{4\pi\varepsilon_0 R_1} + \frac{q_2}{4\pi\varepsilon_0 R_2} = V$

(B) The number of electrons emitted by larger sphere is $\frac{q_1 - q_2}{e}$

(C) $\frac{eq_1}{4\pi\varepsilon_0 R_1} = hf - \phi$

(D) The number of electrons emitted by larger sphere is independent of the potential of the battery

12. Velocity of a particle moving in a curvilinear path varies with time as $\vec{v} = (2t\,\hat{i} + t^2\,\hat{j})$ m/s, where t is in second. Choose the correct statement(s) at t = 1s.

(A) acceleration of particle is 8 m/s^2

(B) tangential acceleration of particle is $\frac{6}{\sqrt{5}} m/s^2$

(C) radial acceleration of particle is $\frac{2}{\sqrt{5}} m/s^2$

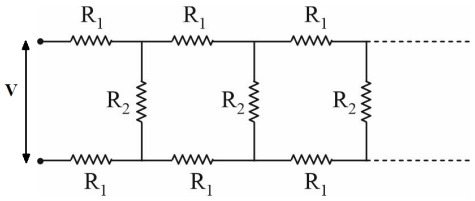
(D) radius of curvature to the path is $\frac{5\sqrt{5}}{2} m$

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

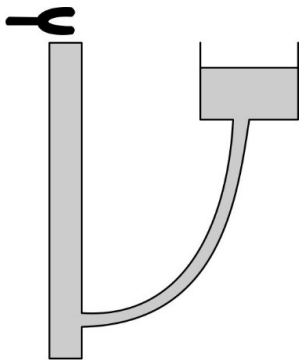
13. A vertical cylinder with a massless piston is filled with one mole of an ideal gas. The piston can move freely without friction. Initially the piston is in equilibrium. The piston is now slowly raised so that the gas expands isothermally at temperature 300 K. Find the amount of work done (in Joule) by the external agent in increasing the volume of gas to twice of the initial volume. ($R = \frac{25}{3}$ J/ mol/ K, $\log_e 2 = 0.7$)

14. Consider the circuit shown in the figure. If the potential difference decreases by a factor of 5 after every ladder then find the ratio of $\frac{R_1}{R_2}$.



15. A body is weighed in air and is found to be $(10.0 \pm 0.1)g$. When the same body is weighed in water, it is found to weigh $(5.0 \pm 0.1)g$. Find the percentage error in the relative density of the material. (Take density of water as $1g/cm^3$)

16. In resonance column experiment, a tuning fork of frequency $f = 400\ Hz$ is held above the pipe as shown in figure. The reservoir is raised and lowered to change the level of water and thus the length of the column of air in the tube. The area of cross section of the reservoir is 6 times that of the pipe. Initially, the reservoir is kept so that the pipe is full up to the brim. Tuning fork is sounded and the reservoir is lowered. When the reservoir is lowered by $21\ cm$, first resonance is recorded. When the reservoir is lowered further by 49 cm the second resonance is heard. Find the speed of sound in air (in m/s)



17. A resistor R and an inductor L are connected in series to a battery of emf E with zero internal resistance at $t = 0$. As current grows, magnetic energy stored in the inductor increases. Find time (in seconds) after which the rate of increase of energy in inductor is maximum.
(Use R = 5Ω, L = 5H, E = 10V, $\log_e 2 = 0.693$)

18. A metal cylinder of mass 0.5 kg is heated electrically by a 12 W heater in a room at 15° C. Its temperature rises uniformly to 25° C in 5 minutes and finally becomes constant at 45°C. Assuming that the rate of heat loss is proportional to the excess temperature over the surroundings, the rate of loss of heat of the cylinder to surrounnding (in W) at 20°C is _____.

SUBJECT II : CHEMISTRY 66 MARKS

Section – 1 | Single Digit Integer Type

This Section contains **6 Single Digit Integer Questions** ranging from 0 to 9, Both Inclusive. For each question, enter the correct integer corresponding to the answer using the mouse and the on-screen virtual numeric keyboard in the place designated enter the answer.

1. Successive I.E of two representative active elements (in kJ/mol) are given below.

Element	IE_1	IE_2	IE_3	IE_4	IE_5	IE_6
X	120	133	167	719	797	850

The group number of the element X according to long form of periodic table (1–18 convention) is_____.

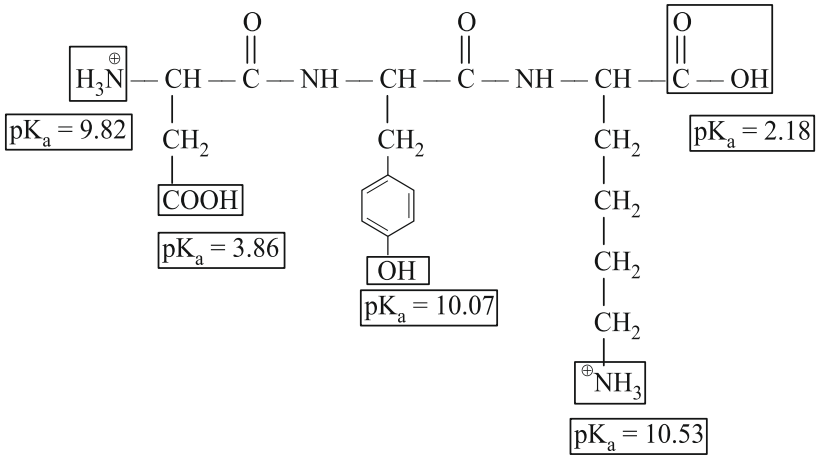
2. Number of paramagnetic substances from the following is:

KO_2, K_2O_2, KCN, Na_2C_2, O_2

3. In a chemical reaction between CrI_3 and H_2O_2 in alkaline medium, number of moles of potassium periodate formed for 2 moles of CrI_3 is:

4. Solid pyrolusite ore on treatment with solid KOH and KNO_3 and heating at 500°C gives a green color melt. This green colored compound is quite stable in alkali medium but gives purple coloration in water or acidic medium. On heating this purple compound at 200°C gives black (X) and green (Y) residues. The difference in oxidation state of transition element in these compounds (Y) and (X) is _____.

5. Calculate the net charge on the given tripeptide at pH = 8?



6. $C_9H_{12}O(A)$ rotates plane polarized light, evolves H_2 with Na metal, reacts with I_2 and NaOH to produce yellow ppt. of CHI_3, it reacts with Lucas reagent in 5 mins. It does not react with Br_2 / CCl_4. It reacts with hot $KMnO_4$ to form (B) $C_7H_6O_2$ which can be obtained by reaction of benzene with $COCl_2$ in presence of $AlCl_3$ followed by hydrolysis. (A) loses optical activity on reaction with Red phosphores with HI and forms (C). molecular mass of C is xg/mol value of $\frac{x}{24}$ is_____ .

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. Which of the following pairs of compound has same EAN value but those are not equal to atomic number of a noble gas?

(A) $Fe(CO)_5$, $Ni(CO)_4$ **(B)** $[Fe(NH_3)_6]^{2+}$, $[Cr(C_2O_4)_3]^{3-}$

(C) $[Fe(H_2O)_5NO]^{2+}$, $[Mn(CO)_6]$ **(D)** $[Ti(CO)_6]$, $[Mn(C_2O_4)_3]^{3-}$

8. For the consecutive reaction: $A \xrightarrow{k_1(time^{-1})} B \xrightarrow{k_2(time^{-1})} C$

Following curves were obtained depending on relative value of k_1 and k_2.

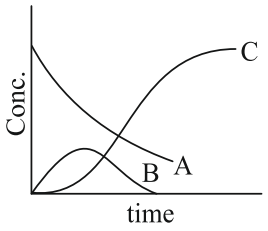


Figure 1

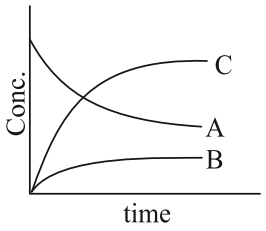


Figure 2

(A) Figure 1 $(k_1 < k_2)$ **(B)** Figure 2 $(k_1 < k_2)$

(C) Figure 2 $(k_1 >> k_2)$ **(D)** Figure 1 $(k_1 >> k_2)$

9. In extraction of Al the coke powder is used at the top of electrolyte melt because:

(A) It makes surface rough by which the radiation loss is minimized.

(B) It prevents oxidation of electrolyte by air

(C) It reacts with evolved oxygen at anode and prevent corrosion of anode

(D) It increases the electrical conductivity of the melt

10. Consider following statements and choose the correct ones.

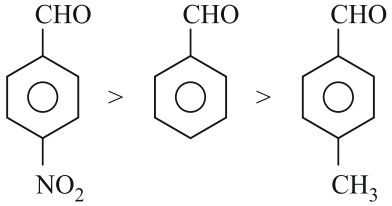
(A) The number P = O and P–O–H bond in H_3PO_4 are 1 and 3 respectively.

(B) Zn is paramagnetic in nature

(C) In diborane there are two $3c-2e^-$ bond and four $2c-2e^-$ bonds

(D) $PbCl_4$ act as oxidizing agent while $SnCl_2$ as reducing agent

11. Which of the following are arranged in correct order as indicated?

(A) 

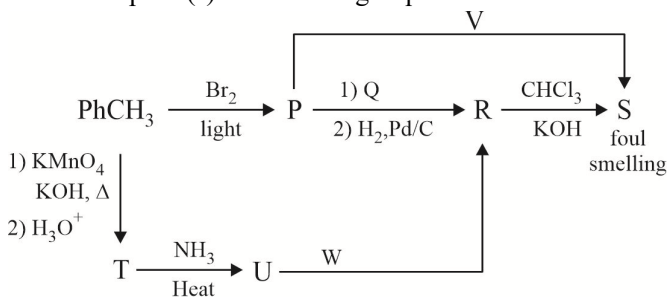
[Nucleophilic addition reaction]

(B) $CH_3COCl > (CH_3CO)_2O > CH_3COOCH_3$ [Acyl S_N2 reaction]

(C) $CH_3CH_2COOH > CH_3COOH > HCOOH$ [acidic character]

(D) $CH_3COCl > (CH_3CO)_2O > CH_3CONH_2$ [Rate of acid catalyzed hydrolysis]

12. Select the correct option(s) for following sequence of reactions.



(A) $Q = KNO_2,\ W = LiAlH_4$

(B) R = Phenyl methanamine, $V = AgCN$

(C) $Q = AgNO_2$, R = Phenylmethanamine

(D) $W = LiAlH_4,\ V = AgCN$

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. On titration of 40 ml, 0.1 M H_2S solution with 0.08 M NaOH.
pH of the solution on addition of 40 ml of NaOH is x, and on addition of 50 ml of NaOH is y then value of (y – x) is: (pK_{a_1} of $H_2S = 7$ and pK_{a_2} of $H_2S = 14.2$ take log2 = 0.3)

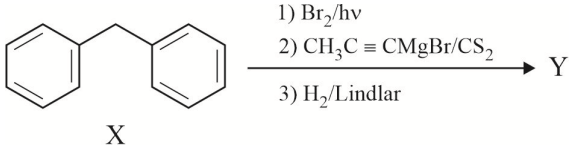
14. In a cold climate, water gets frozen causing damage to radiator of cars. Ethylene glycol is used as an antifreeze. If $Y \times 10^2$ g of glycol to be added to 4.0 kg of water to prevent it from freezing at –6°C. $K_f,\ H_2O = 1.86\ K\ kg/mol$. Value of Y is:

15. The Schrodinger wave equation for hydrogen atom is:

$$\psi_{2s} = \frac{1}{4\sqrt{2}\pi}\left(\frac{1}{r_0}\right)^{\frac{1}{2}}\left(x^2 - \frac{r}{r_0}\right)e^{\left(\frac{-1}{r_0}\right)}$$

Where r_0 is Bohr radius. If radial node in 2s be at $r = 4r_0$, the value of x is _____.

16. Consider a conversion from X to Y. The overall yield of Y after series of reaction was found to be 67%. If initial amount of X was 16.8g. Find the amount (g) of Y formed.

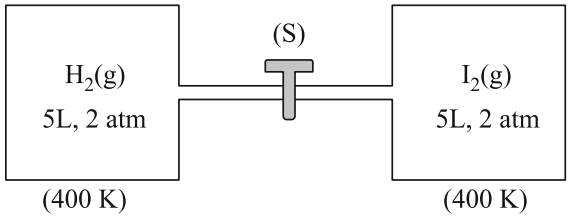


17. Isothermal intermixing of $H_2(g)$ and $I_2(g)$ occurs on removal of the stopper (S). These gases then reacts to form $HI(g)$ by following reversible reaction.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

If K_p for the reaction is 9 then mass of HI(g) produced at the equilibrium is: (Atomic mass of I is 127)

(Take $R = \frac{1}{12}$ atm–L/mole–K)



18. Consider a solution containing Hg^{2+} and Fe^{2+}, both at 10^{-2} M. It is to be saturated by 0.1 M H_2S. Calculate highest pH that this solution could have that would keep Fe^{2+} in solution but causing Hg^{2+} to precipitate as HgS.

Given : $(K_{a_1} \times K_{a_2})_{H_2S} = 10^{-21}$

$K_{sp}(FeS) = 6 \times 10^{-19} M^2$

$K_{sp}(HgS) = 2 \times 10^{-53} M^2$; $\log 1.291 = 0.1$

SUBJECT III : MATHEMATICS 66 MARKS

Section – 1 | Single Digit Integer Type

This Section contains **6 Single Digit Integer Questions** ranging from 0 to 9, Both Inclusive. For each question, enter the correct integer corresponding to the answer using the mouse and the on-screen virtual numeric keyboard in the place designated enter the answer.

1. If $\arg(z^{1/3}) = \frac{1}{2}\arg(z^2 + \bar{z}z^{1/3})$, then the value of $|z|$ (where z is a non-real complex number) is _____.

2. A circle of radius $2r$ passes through the origin O and cuts XY-axes at A and B. If the locus of the foot of the perpendicular from O to AB is $(x^2 + y^2)^3 = \lambda(rxy)^2$ the value of $\frac{\lambda}{8}$ is _____.

3. The number of integers in the interval [–10, 10] which will not lie in the domain of $f(x) = \frac{1}{[|x-1|]+[|5-x|]-4}$ will be _____.

4. The value of $\lim\limits_{n\to\infty} \frac{72}{n^4}\left[3\left(\sum\limits_{k=1}^{n} k\right) + 4\left(\sum\limits_{k=1}^{n-1} k\right) + 5\left(\sum\limits_{k=1}^{n-2} k\right) + \ldots + (n+2)\cdot 1\right] =$ _____.

5. Let S be the set of all 3 × 3 matrices having 3 entries equal to 1 and 6 entries equal to 0.1 A matrix M is picked uniformly at random from the set S. Then the total number of matrices in the set S is λ, probability that M is non-singular $= \frac{1}{t}$ and probability that M has trace equal to 0 is $\frac{s}{21}$. The value of $\frac{\lambda}{t} - s$ is _____.

6. Let E and M be 3 × 3 matrices satisfying the system of equations

$$EM^T = (EM)^T = 20I$$

and $(E+M)^T = 17(E-M)^T$

where I denotes identity matrix of order 3.

If $E^2 + M^2 = \frac{a}{b}I$ (where a and b are co-prime), then the value of $a + b - 740$ is _____.

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. Let $\vec{a} = \hat{i} + \hat{j}$ and $\vec{b} = 2\hat{i} - \hat{k}$. The point of intersection of the lines $\vec{r} \times \vec{a} = \vec{b} \times \vec{a}$ and $\vec{r} \times \vec{b} = \vec{a} \times \vec{b}$ satisfies:

(A) $x + y + z - 3 = 0$ **(B)** $x + y + z - 2 = 0$

(C) $x - y + z - 1 = 0$ **(D)** $3x - 4y + z = 0$

8. A variable straight line is such that the algebraic sum of perpendiculars from the points of intersection of the ellipse $2x^2 + y^2 = 2$ and hyperbola $2x^2 - 4y^2 = 1$ is 0. The coordinates of the fixed point through which the straight line always passes, satisfy the following options:

(A) Sum of abscissa and ordinate is 0 **(B)** Product of abscissa and ordinate is 4

(C) Difference of abscissa and ordinate is 0 **(D)** sum of abscissa and ordinate is 4

9. The point $P(\lambda, \lambda^2, -\lambda)$ is equidistant from the following two lines:

$$y - mx = 0 = z - c \; ; \; y + mx = 0 = z + c$$

The possible value of λ are:

(A) 0 **(B)** $\sqrt{c\left(m + \frac{1}{m}\right)}$ **(C)** $-\sqrt{c\left(m + \frac{1}{m}\right)}$ **(D)** $\pm\sqrt{cm}$

10. Let $f(x) = \begin{Bmatrix} xe^{ax}, & x \le 0 \\ x + ax^2 - x^3, & x > 0 \end{Bmatrix}$, where a is a positive constant. Let $L(a)$ denote the total length of all the interval(s) on which $f'(x)$ is increasing. Note that L is a function of a. For $a = 3$, the value of $\frac{1}{L'(a)}$ is a multiple of:

(A) 2 **(B)** 3 **(C)** 4 **(D)** 9

11. Let $f(x)$ and $g(x)$ be continuous on R (set of real numbers). If

$\lim\limits_{x\to 0} \frac{f(x)}{\sin^2 x} = 8$, $\lim\limits_{x\to 0} \frac{g(x)}{2\cos x - xe^x + x^3 + x - 2} = \lambda$ and $\lim\limits_{x\to 0} (1 + 2f(x))^{1/g(x)} = \frac{1}{e}$, then the value of λ is a divisor of:

(A) 8 **(B)** 24 **(C)** 30 **(D)** 32

12. If $C_0, C_1, C_2, ...C_n$ have their usual meanings, then

$\frac{C_0}{n(n+1)} - \frac{C_1}{(n+1)(n+2)} + \frac{C_2}{(n+2)(n+3)} - ....$ to $(n+1)$ terms is equal to:

(A) $\int\limits_0^1 x^{n+1}(1-x)^{n+1}\,dx$ **(B)** $\int\limits_0^1 x^{n}(1-x)^{n+1}\,dx$

(C) $\int\limits_0^1 x^{n-1}(1-x)^{n+1}\,dx$ **(D)** $\int\limits_0^1 x^{n+1}(1-x)^{n-1}\,dx$

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 smallest positive integer n for which the following relation is satisfied

$\frac{1}{\cos 45^\circ \sin 46^\circ} + \frac{1}{\cos 47^\circ \sin 48^\circ} + ... + \frac{1}{\cos 133^\circ \sin 134^\circ} = \frac{1}{\sin n^\circ}$, is _____.

14. Let f be a real valued function defined for all real numbers x such that $f(x) \in \left[0, \frac{1}{2}\right]$ and for some fixed $a > 0$, $f(x+a) = \frac{1}{2} - \sqrt{f(x) - (f(x))^2}$. The period of $f(x)$ is $5\lambda a$. The value of $[\lambda + 3]$ is _____. {[.] denotes GIF}

15. Let $\lambda = \left(\frac{\pi}{3}\right)^{1/3}$. The value of $\int_{-\lambda}^{\lambda} \frac{x^2}{(1+\sin^2 x^3)(1+e^{x^7})}\,dx$ is $\frac{a}{6}\tan^{-1} b$. The value of $a^2 + b^2$ is _____.

16. Cards are drawn one by one without replacement from a well shuffled pack of 52 playing cards until 2 aces are obtained for the first time. If N is the number of cards required to be drawn, then the probability $P(N = n) = \frac{1}{k}(n-a)(n-b)(n-c)$, where $k, a, b, c \in N$ with $a > b > c$. Then the value of $a + b + c$ is _____.

17. 50 identical marbles ore to be distributed among four boys, A_1, A_2, A_3 and A_4. The number of marbles receiving by them in the distribution are as follows:

A_1 : 1, 3, 5, 7.....

A_2 : 4, 6, 8, 10.....

A_3 : 5, 7, 9, 11.....

A_4 : 2, 4, 6, 8,.....

The total number of ways of distribution is ${}^{p}C_3$.

If A_4 is receiving not more than 14 marbles, then number of ways of distribution is q. The value of $q - 10p$ is _____.

18. Let n and k be positive integers such that $n \geq \frac{k(k+1)}{2}$. If the number of solutions $(x_1, x_2, ...x_k)$, where $x_1 \geq 1, x_2 \geq 2, ...x_k \geq k$, all being integers satisfying $x_1 + x_2 + ... + x_k = n$ is ${}^{m}C_{k-1}$, such that $m = n - f(k)$, then $f(20)$ is equal to _____.