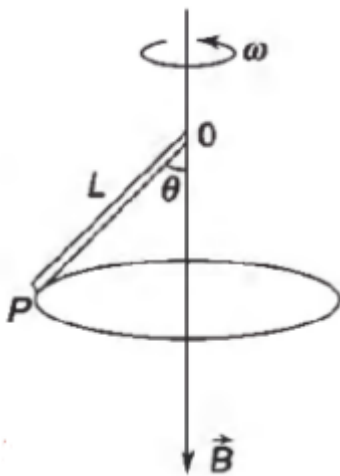## Physics Single Correct (Maximum Marks: 15)

Question No. 1

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

A conducting rod (OP) of length L rotates in form of a conical pendulum with an angular velocity ω about a fixed vertical axis passing through its end O. There is a uniform magnetic field B in vertically downward direction. The rod makes an angle θ with the direction of the magnetic field. The emf induced across the ends of the rod is

A. $\dfrac{B\omega L^2 \sin^2\theta}{2}$

B. $\dfrac{B\omega L^2 \cos^2\theta}{2}$

C. $\dfrac{B\omega L^2 \tan^2\theta}{2}$

D. $\dfrac{B\omega L^2}{2}$

Question No. 2

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

A charge Q is distributed over two concentric hollow spheres of radii r and $R(R > r)$ such that their surface densities are equal. Find the potential at the common centre. (Given $k = \dfrac{1}{4\pi\varepsilon_0}$)
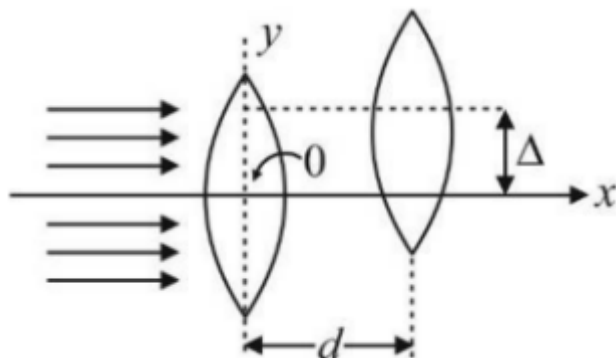
A. $\dfrac{kQ}{R+r}$

B. $\dfrac{kQ(R+r)}{R^2+r^2}$

C. $\dfrac{kQ}{r}$

D. $\dfrac{kQ}{R}$

Question No. 3
Only One Option Correct Type
Each question has multiple options out of which ONLY ONE is correct.

Two thin convex lenses of focal lengths f_1 and f_2 are separated by a horizontal distance d (where $d < f_1$ and $d < f_2$) and their centres are displaced by a vertical separation Δ as shown. Taking the origin of coordinates O at the centre of first lens, x and y coordinates of the focal point of this lens system, for a parallel beam of rays coming from the left, are given by: (Assume that $\Delta << f$)

A. $x = \dfrac{f_1 f_2}{f_1 + f_2}$, $y = \Delta$

B. $x = \dfrac{f_1(f_2 + d)}{f_1 + f_2 - d}$, $y = \dfrac{\Delta}{f_1 + f_2}$

C. $x = \dfrac{f_1 f_2 + d(f_1 - d)}{f_1 + f_2 - d}$, $y = \dfrac{\Delta(f_1 - d)}{f_1 + f_2 - d}$

D. $x = \dfrac{f_1 f_2 + d(f_1 - d)}{f_1 + f_2 - d}$, $y = 0$

Question No. 4
Only One Option Correct Type
Each question has multiple options out of which ONLY ONE is correct.

Three rods A, B and C of same length and cross-sectional area are joined in series. The thermal conductivities are in the ratio $1 : 2 : 1.5$. If the open ends of A and C are at $200°C$ and $18°C$, respectively. At equilibrium, the temperature at the junction of A and B is

   A. $74°C$
   B. $116°C$
   C. $156°C$
   D. $148°C$

Question No. 5
Only One Option Correct Type
Each question has multiple options out of which ONLY ONE is correct.

One mole of oxygen gas is made to undergo a process in which its molar heat capacity C depends on its absolute temperature T as $C = \alpha T$. Work done by it when heated from an initial temperature T_0 to a final temperature $2T_0$, will be :

   A. $4\alpha T_0^2$
   B. $(\alpha T_0 - 1)\dfrac{3T_0}{2}$
   C. $(3\alpha T_0 - 5R)\dfrac{T_0}{2}$
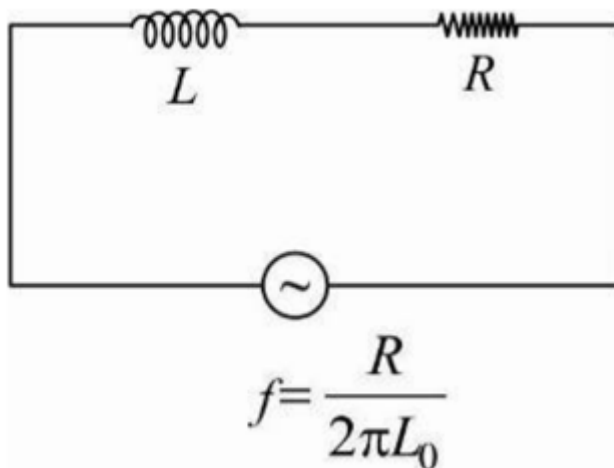   D. None of these

Physics Multiple Correct (Maximum Marks: 28)

Question No. 1
One or More Options Correct Type
The question has multiple options out of which ONE or MORE is/are correct.

An AC circuit contains a variable inductor L, connected in series with a light bulb of resistance R as shown.

$$f = \frac{R}{2\pi L_0}$$

Assume that the resistance of the light bulb is independent of its temperature. Now it is desired to reduce the power of the light bulb to one fourth then : (Frequency of AC source is $\frac{R}{2\pi L_0}$ where L_0 is initial inductance)

   A. Power factor of the circuit should be reduced to half
   B. Inductance of the circuit should be increased by a factor of $\sqrt{3}$
   C. Impedance of the circuit should be increased by a factor of 4
   D. RMS current in the circuit should be reduced to half

Question No. 2
One or More Options Correct Type
The question has multiple options out of which ONE or MORE is/are correct.

An inductor and two capacitors are connected in the circuit as shown in figure. Initially capacitor A has no charge and capacitor B has CV charge. Assume that the circuit has no resistance at all. At $t = 0$, switch S is closed, then [given $LC = \dfrac{2}{\pi^2 \times 10^4} s^2$ and $CV = 100mC$]
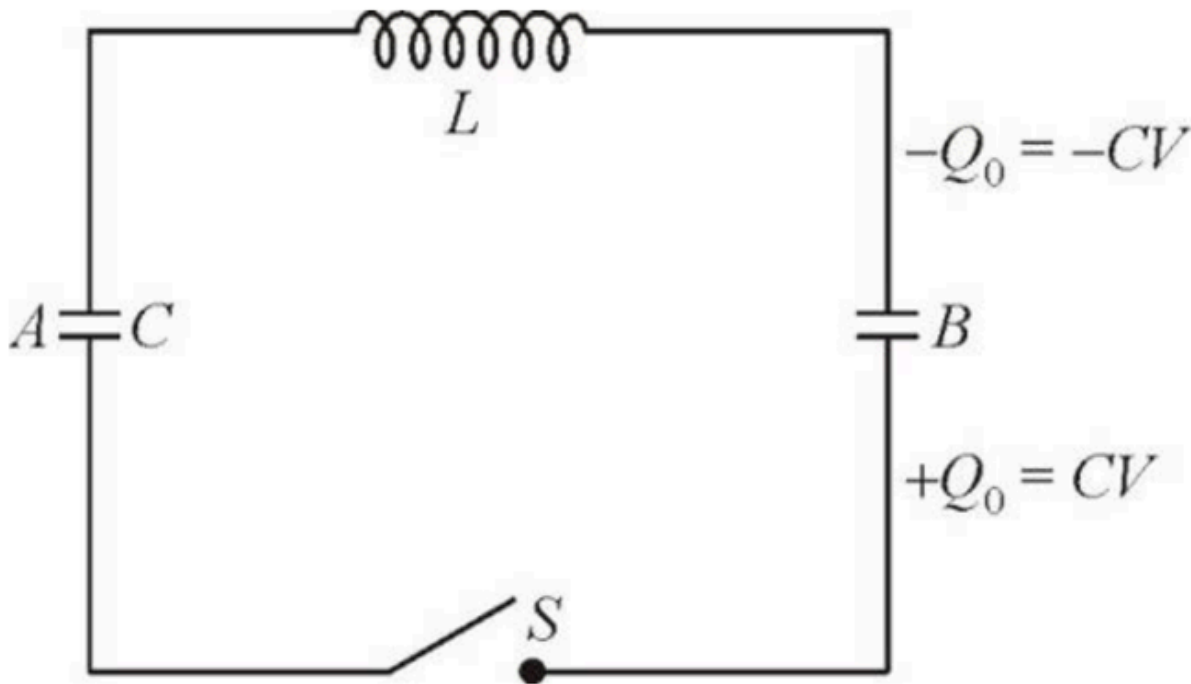

A. When current in the circuit is maximum, charge on each capacitor is same

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
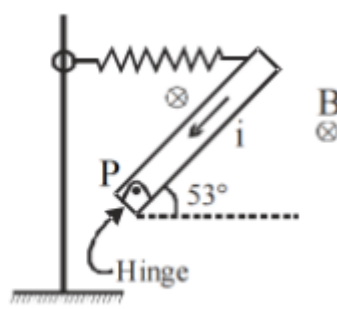
Question No. 3

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

A thin uniform rod with negligible mass and length ℓ is attached to the floor by a frictionless hinge at point P. A horizontal spring with force constant k connects the other end to wall. The rod is in a uniform magnetic field B directed into the plane of paper. What is extension in spring in equilibrium when a current i is passed through the rod in direction shown. Assuming spring to be in natural length initially.
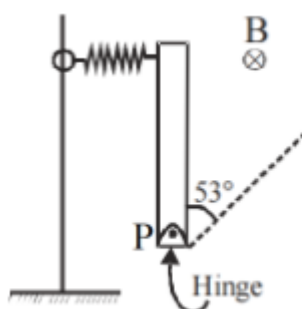
Spring in relaxed position   In equilibrium position

A. $\frac{5i\ell B}{8k}$

B. $\frac{3i\ell B}{8k}$

C. $\frac{5i\ell B}{4k}$

D. $\frac{5i\ell B}{6k}$

Question No. 4

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Which of the following expressions represent SHM?

A. $A\cos\omega t\sin^2\omega t$

B. $A\sin(2\omega t)$

C. $A\sin\omega t + B\cos\omega t$

D. $A\sin^2\omega t$

Question No. 5

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Two cars X and Y are moving with speed 15 m/s and 11 m/s respectively in opposite directions approaching each other from far. The driver in car X blows a horn which has components of frequencies ranging from 650 Hz to 800 Hz. The band width of frequencies is thus 150 Hz, speed of sound is 340 m/s . The correct statement(s) for observer in car Y is : The bandwidth of frequencies is 150

A. The bandwidth of frequencies is 150 Hz

B. The bandwidth of frequencies is 162 Hz

C. Speed of sound of horn is 351 m/s

D. Speed of sound of horn is 329 m/s

Question No. 6

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

The potential energy of a particle of mass 0.1 kg, moving along the x-axis, is given by :

$U = 5x(x-4)J$, where x is in meters. It can be concluded that :

A. the particle is acted upon by a constant force

B. the speed of the particle is maximum at $x = 2$ m

C. the particle executes SHM

D. the period of oscillation of the particle is $(\pi/5)$sec

One or More Options Correct Type
The question has multiple options out of which ONE or MORE is/are correct.

Two coherent monochromatic point source S_1 and S_2 of wavelength $\lambda = 600$ nm are placed symmetrically on either side of the centre of the circle as shown in the figure. The sources are separated by a distance $d = 1.8$ mm . This arrangement produces interference fringes visible as alternate bright and dark spots on the circumference of the circle.

The angular separation between two consecutive bright spots is $\Delta\theta$. Which of the following options is/are correct?
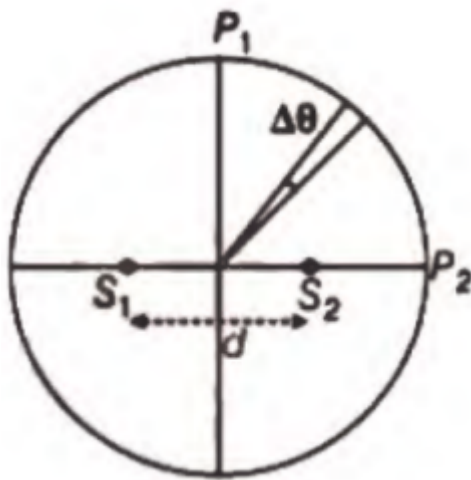
    The angular separation between two consecutive bright spots decreases as
A. we move from P_1 to P_2 along the first quadrant
B. A dark spot will be formed at the point P_2
    The total number of fringes produced between P_1 and P_2 in the first
C. quadrant is close to 3000
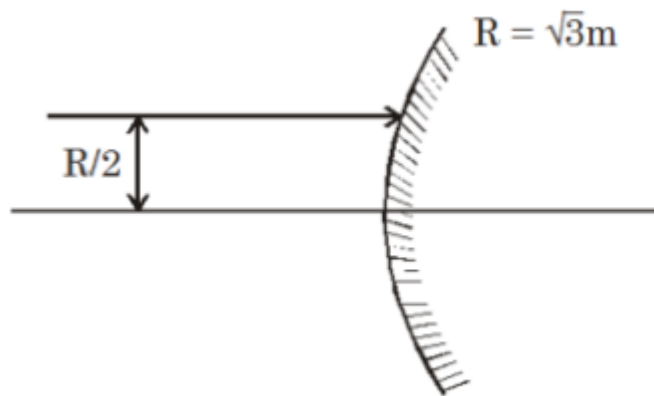D. At P_2 the order of the fringe will be maximum

Physics Numerical (Maximum Marks: 24)

Numerical Type
The answer has to be filled into the input box provided below.

A ray strikes the convex mirror as shown in the figure. The distance (in m) of point from center of curvature where the ray appears to cut the principal axis after reflection is

$R = \sqrt{3}m$

R/2

Question No. 2
Numerical Type
The answer has to be filled into the input box provided below.

A rod of mass ' M ' and length $6R$ is pivoted at its centre (Point P) to rotate in vertical plane as shown. Two discs of same radius ' R ' are joined at the ends O_1 and O_2 of the rod. Mass of the discs A and B are ' M ' and ' $2M$ ' respectively. Initial angular velocities of discs are shown in figure. The system is released from rest from horizontal position. The angular velocity of the rod when it is vertical is $\sqrt{\frac{g}{\lambda R}}$. Find the value of λ .
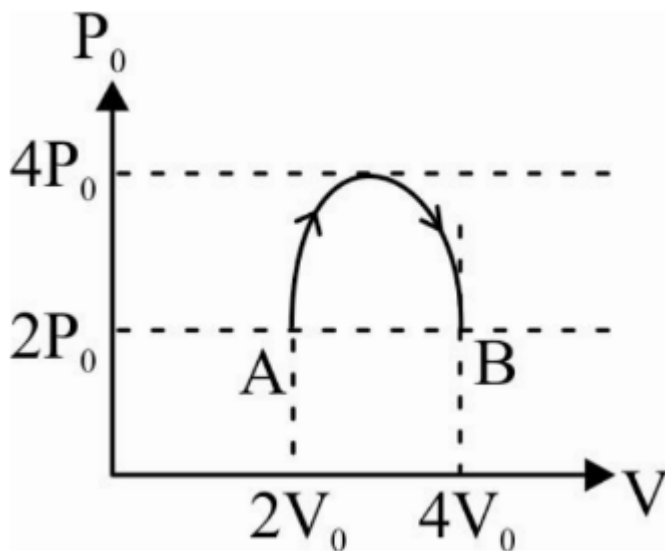
A
$2\omega_0$
O_1
P
ω_0
O_2
B
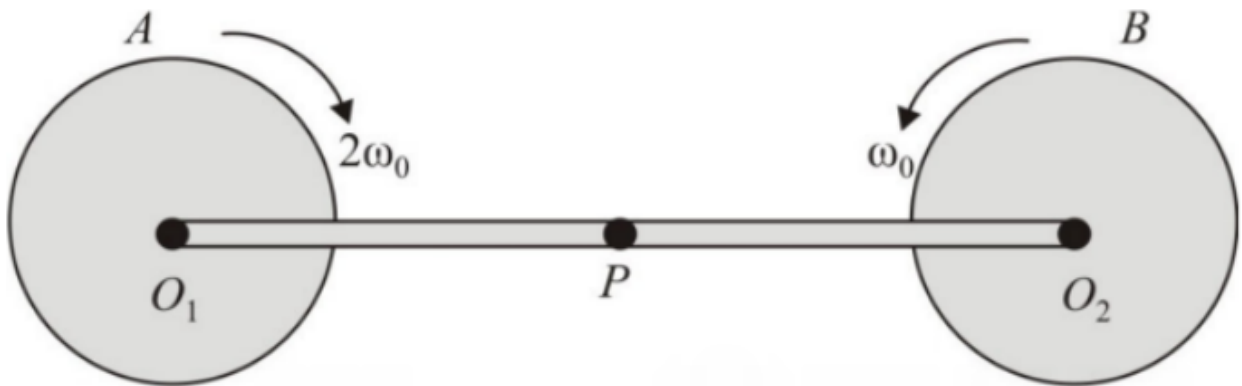
Question No. 3
Numerical Type
The answer has to be filled into the input box provided below.

One mole of an ideal monoatomic gas is taken through a thermodynamic process shown in the $P - V$ diagram. The heat supplied to the system in this process is $K \times (\pi + 10)P_0 V_0$. Determine the value of K.
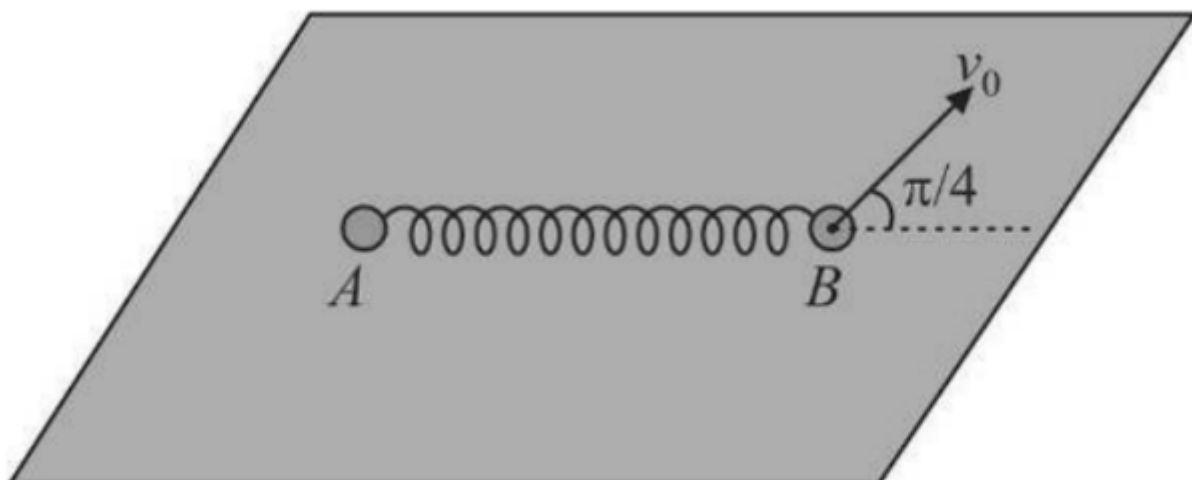
Numerical Type
The answer has to be filled into the input box provided below.

A dumbbell consists of two balls A and B each of mass $m = 1 \text{ kg}$ and connected by a spring. The whole system is placed on a smooth horizontal surface as shown in the figure. Initially the spring is at its natural length, the ball B is imparted a velocity $v_0 = \frac{8}{\sqrt{7}} \text{ m/s}$ in the direction shown. The spring constant of the spring is adjusted so that the length of the spring at maximum elongation is twice that of the natural length of the spring. Find the maximum potential energy stored (in Joule) in the spring during the motion.
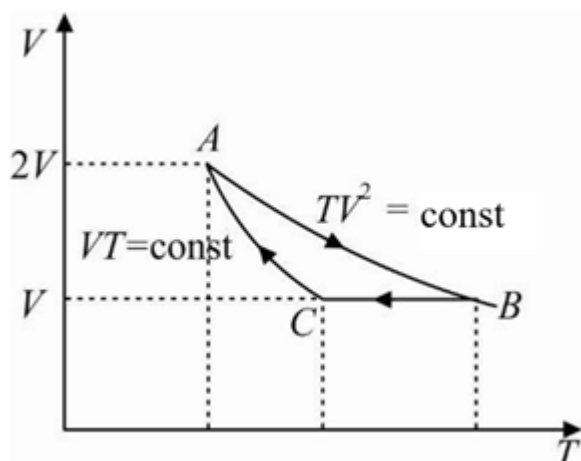

Question No. 5
Numerical Type
The answer has to be filled into the input box provided below.

Figure shows the VT diagram for helium gas in a cyclic process. Find the ratio of maximum and minimum pressure of the gas during the cycle.

Question No. 6
Numerical Type
The answer has to be filled into the input box provided below.

A uniform rope of length L and mass m is held at one end and whirled in a horizontal circle with angular velocity ω. You can ignore the force of gravity on rope. The time required for a transverse wave to travel from one end of rope to other is $\frac{\pi}{\sqrt{n\omega}}$, then the value of n is _____.

Chemistry Single Correct (Maximum Marks: 15)

Question No. 1
Only One Option Correct Type
Each question has multiple options out of which ONLY ONE is correct.

An organic compound with the formula $C_6H_{12}O_6$ forms a yellow crystalline solid with phenylhydrazine and gives a mixture of sorbitol and mannitol when reduced with sodium. Which among the following could be the compound ?

   A. Fructose
   B. Glucose
   C. Mannose
   D. Sucrose

Question No. 2
Only One Option Correct Type
Each question has multiple options out of which ONLY ONE is correct.

A colorless aqueous solution contains nitrates of two metals, **X** and **Y**. When it was added to an aqueous solution of NaCl, a white precipitate was formed. This precipitate was found to be partly soluble in hot water to give a residue **P** and a solution **Q**. The residue **P** was soluble in aq. NH_3 and also in excess sodium thiosulfate. The hot solution **Q** gave a yellow precipitate with KI. The metals **X** and **Y**, respectively, are

A. Ag and Pb
B. Ag and Cd
C. Cd and Pb
D. Cd and Zn

Question No. 3

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

The olivine series of minerals consists of crystal in which Fe^{2+} and Mg^{2+} ions may substitute for each-other causing substitutional impurity defect without changing the volume of the unit cell. In olivine series of mineral, oxide ion exist as fcc with Si^{4+} occupying $\frac{1}{4}$ th of octahedral void and divalent ion occupying $\frac{1}{4}$ th of tetrahedral void. The density of forsterite (Magnesium silicate) is 3.21 g/cc and that of fayalite (Ferrous silicate) is 4.34 g/cc . If density of olivine is 3.88 g/cc , then which of the following statement is INCORRECT.

A. Forsterite $= Mg_2SiO_4$; Fayalite $= Fe_2SiO_4$
B. An olivine contains 40.71% Forsterite and 59.29% Fayalite
C. Forsterite Mg_2SiO_4 with 59.29% percentage
D. (A) & (B)

Question No. 4

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

A solution of sucrose (Molar mass $=$ 342) has been prepared by dissolving 68. 4g of sucrose in one kg of water. K_f for water is 1 .86 K kg mol^{-1} The freezing point of the solution will be

A. -0.684^0 C
B. -0.342^0 C
C. -0.372^0 C
D. -0.186^0 C

Question No. 5

Only One Option Correct Type

Each question has multiple options out of which ONLY ONE is correct.

The fat, glyceryl trioleate, is metabolized via the following reaction. Given the enthalpies of formation, calculate the energy (kJ) liberated when 1.0 g of this fat reacts.

$$C_{57}H_{104}O_6(s) + 80O_2(g) \longrightarrow 57CO_2(g) + 52H_2O(\ell)$$

$\Delta_f H°(C_{57}H_{104}O_6, s) = -70870 KJ/mol;$

$\Delta_f H°(H_2O, \ell) = -285.8 \text{ kJ/mol}; \Delta_f H°(CO_2, g) = -393.5 \text{ kJ/mol}$

    A. -37.98
    B. -40.4
    C. -33.4
    D. -30.2

Chemistry Multiple Correct (Maximum Marks: 28)

Question No. 1
One or More Options Correct Type
The question has multiple options out of which ONE or MORE is/are correct.

$H_2 A$ is a weak diprotic acid. If the pH of 0.1 M $H_2 A$ solution is 3 and concentration of A^{2-} is 10^{-12} at 25°C.
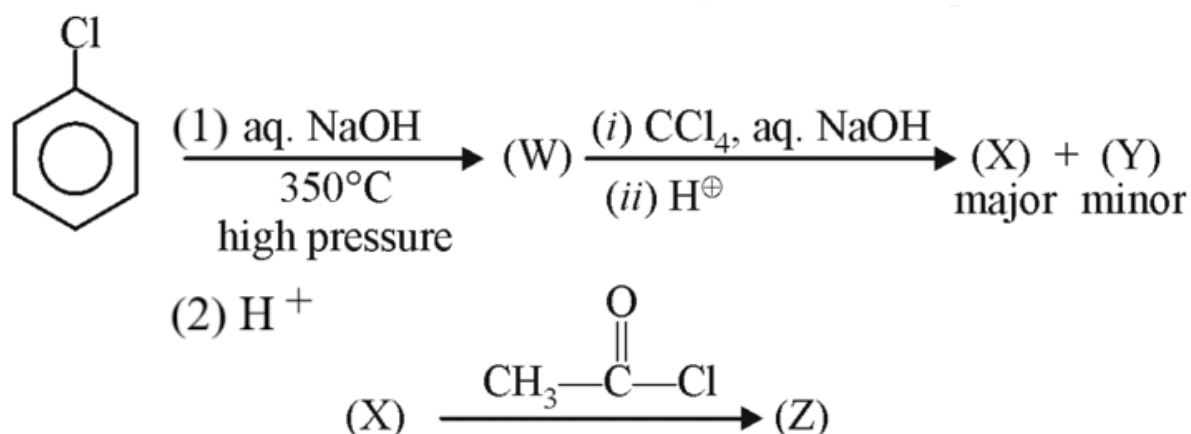
Select correct statement(s)

    A. $[H^+]_{total} \approx [H^+]$ from first step of ionization of acid $H_2 A$
    B. Concentration of OH^- in solution is 10^{-3} M
    C. The value of K_{a_1} is nearly 10^{-5}
    D. $pK_{a_2} - pK_1 = 9$

Question No. 2
One or More Options Correct Type
The question has multiple options out of which ONE or MORE is/are correct.

The correct statement(s) about the following reaction sequence is (are):

A. W gives dark violet coloration with 1% aqueous $FeCl_3$ solution
B. X gives effervescence of a colorless, odorless gas with aq. $NaHCO_3$
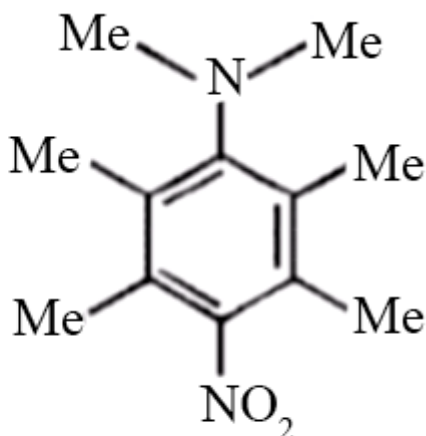C. Z is used as anti-inflammatory drug
D. Z can give X on acidic hydrolysis

Question No. 3

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.
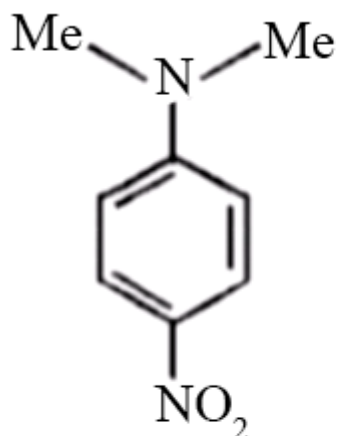
(I)   (II)

Dipole moment of above compound will be

A. I - 4.11D ; II - 6.87D
B. I-6.87D; II - 4.11D
C. I - 4.11D; II - 4.11D
D. I-6.87D; II - 0D

Question No. 4

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

$CaCO_3$ decomposed according to the equation
$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$. The equilibrium constant K_p for the reaction is 4 atm . When solid carbon introduced in the vessel a new equilibrium $[CO_2(g) + C(s) \rightleftharpoons 2CO(g)]$ is established. The equilibrium constant of this is 2×10^{-2} atm . Then

A. $p_{CO_2} = 4$ atm
B. $p_{CO} = 0.28$ atm
   At same temperature, if small amount of $CaO(s)$ is added then partial
C. pressure of $CO_2(g)$ will decrease.
   At same temperature, if small amount of $CaO(s)$ is added then partial
D. pressure of $CO(g)$ will remain same.
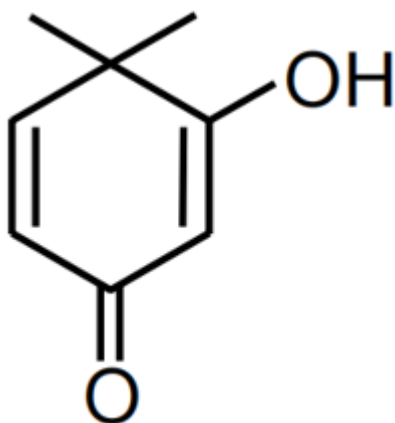
One or More Options Correct Type
The question has multiple options out of which ONE or MORE is/are correct.

Select the correct statement(s).
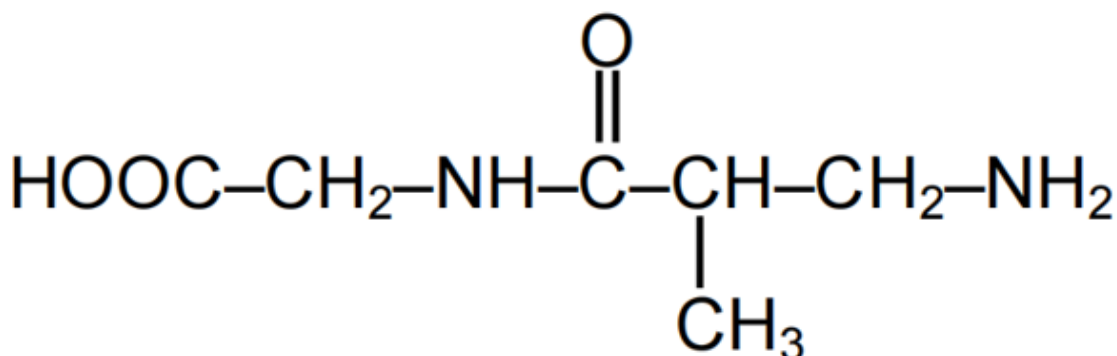
is a dipeptide of Glycine & Alanine, whose abbreviated

A. name is GLY-ALA
   Compound

B. show Keto-enol tautomerism.
C. Phenol \& benzoic acid can be distinguished by $NaHCO_3$.
D. Order of basicity in aqueous medium $MeNH_2 < Me_2NH < Me_3N$

Question No. 6
One or More Options Correct Type
The question has multiple options out of which ONE or MORE is/are correct.

Choose the correct statement(s) among the following :

A. $[FeCl_4]^-$ has tetrahedral geometry.
B. $[Co(en)(NH_3)_2Cl_2]^+$ has 2 geometrical isomers.
   $[FeCl_4]^-$ has higher spin-only magnetic moment than
C. $[Co(en)(NH_3)_2Cl_2]^+$.

D. The cobalt ion in $[Co(en)(NH_3)_2Cl_2]^+$ has $sp^3 d^2$ hybridization.

Question No. 7
One or More Options Correct Type
The question has multiple options out of which ONE or MORE is/are correct.

In the reaction scheme shown below **Q, R** and **S** are the major products.
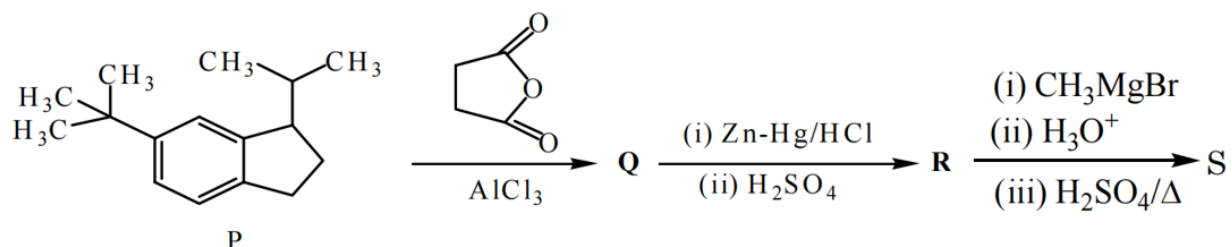
The correct structure of

S is

A.

Q is

B.

R is

C.
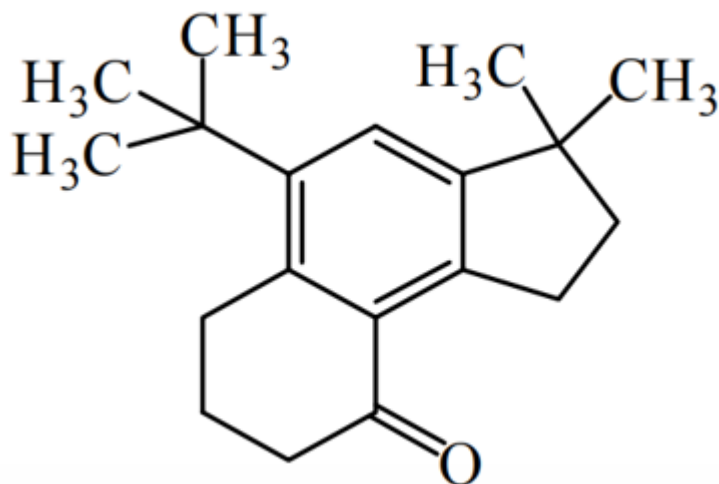
S is

D.
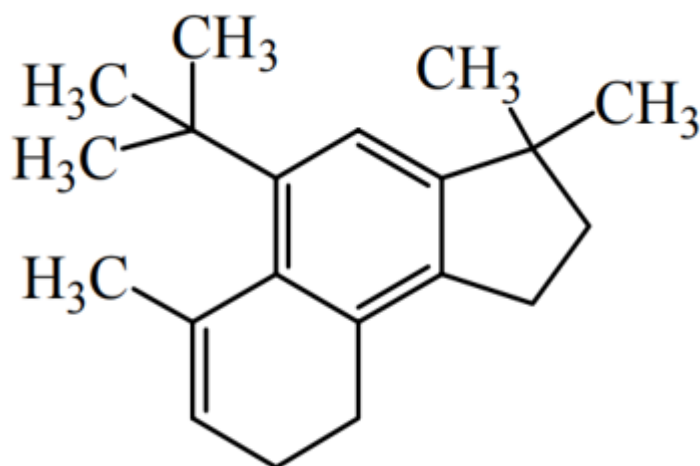
Chemistry Numerical (Maximum Marks: 24)

Question No. 1

Numerical Type

The answer has to be filled into the input box provided below.

$$X(s) \xrightarrow{\text{dil. HCl}} Y \uparrow \xrightarrow[\text{NaOH}]{\text{Na}_2[\text{Fe(CN)}_5(\text{NO})]} \text{Purple solution}$$
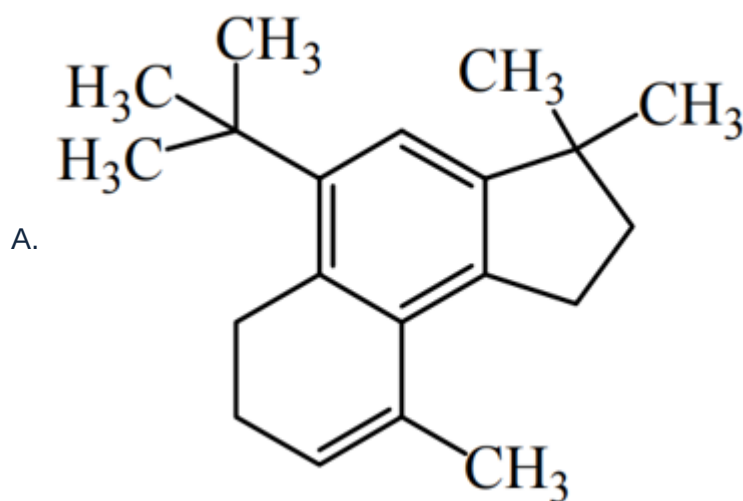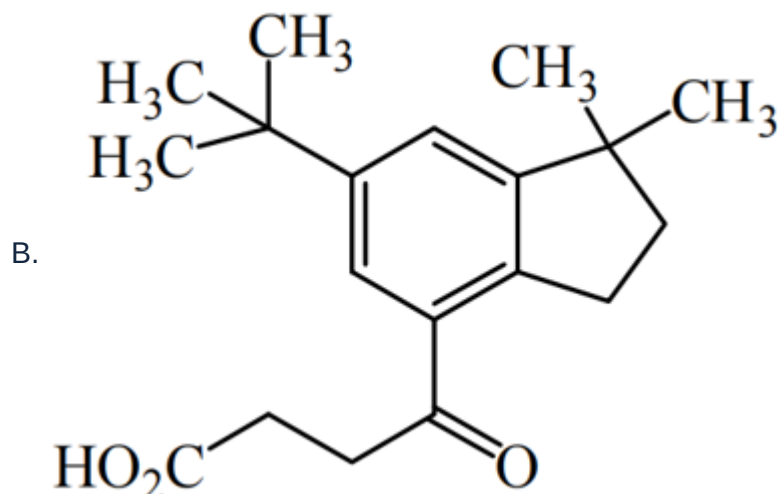$$\underset{\text{Black}}{}$$
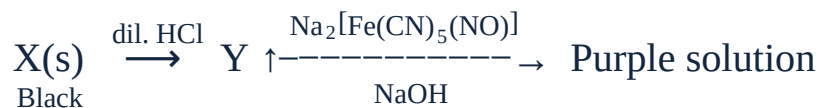
Gas Y has been allowed to react with following species in neutral/acidic medium :

(a) $FeCl_3$

(b) $CuSO_4$

(c) $BaCl_2$

(d) SO_2

(e) $Cr_2O_7^{2-}$

(f) CH_3COONa

(g) Hg^{2+}

Then calculate value of $(P - Q)/R$:

P : Number of species which undergoes redox reaction with gas Y.

Q : Number of species with which gas Y undergoes precipitation without going into redox reaction.

R : Number of species with gas Y produce no observable change.

Question No. 2
Numerical Type
The answer has to be filled into the input box provided below.

How many of the following are diamagnetic ?

(a) $K_4[Fe(CN)_6]$

(b) $Na_3[Co(ox)_3]$

(c) $[Pt(NH_3)_3Cl]Br$

(d) $[Fe(H_2O)_6]^{2+}$

(e) $[Zn(NH_3)_4]Cl_2$

(f) $[MnO_4]^{2-}$

(g) $Li[AlH_4]$

(h) $[V(H_2O)_6]^{2+}$
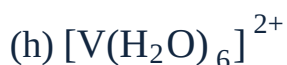
Question No. 3
Numerical Type
The answer has to be filled into the input box provided below.

Liquids **A** and **B** form ideal solution for all compositions of **A** and **B** at 25°C. Two such solutions with 0.25 and 0.50 mole fractions of **A** have the total vapor pressures of 0.3 and 0.4 bar, respectively. What is the vapor pressure of pure liquid **B** in bar?

Question No. 4
Numerical Type
The answer has to be filled into the input box provided below.

An acidified solution of potassium chromate was layered with an equal volume of amyl alcohol. When it was shaken after the addition of 1 mL of 3%H_2O_2, a blue alcohol layer was obtained. The blue color is due to the formation of a chromium (VI) compound '**X** '. What is the number of oxygen atoms bonded to chromium through only single bonds in a molecule of **X** ?

Question No. 5
Numerical Type
The answer has to be filled into the input box provided below.

A monoatomic ideal gas at 1200 K is expanded adiabatically from 1 L to 8 L, such that its final temperature is 280 K. How many of the following statements is/are true for this process?
(A) This is freg adiabatic expansion.
(B) This is reversible adiabatic expansion
(C) This is irreversible adiabatic expansion
(D) This is an impossible process

Question No. 6
Numerical Type
The answer has to be filled into the input box provided below.

The total number of isomers for the alkyne with molecular formula $C_3HDClBr$ is :

Mathematics Single Correct (Maximum Marks: 15)

Question No. 1
Only One Option Correct Type
Each question has multiple options out of which ONLY ONE is correct.

The sum $S = \frac{1}{9!} + \frac{1}{3!7!} + \frac{1}{5!5!} + \frac{1}{7!3!} + \frac{1}{9!}$ equals

A. $\frac{2^9}{10!}$

B. $\frac{2^{10}}{8!}$

C. $\frac{2^{11}}{9!}$

D. $\frac{2^{10}}{7!}$

Question No. 2
Only One Option Correct Type
Each question has multiple options out of which ONLY ONE is correct.

In the XY -plane, the length of the shortest path from $(0, 0)$ to $(12, 16)$ that does not go inside the circle $(x - 6)^2 + (y - 8)^2 = 25$, is

A. $10\sqrt{3}$

B. $10\sqrt{5}$

C. $10\sqrt{3} + \frac{5\pi}{6}$

D. $10\sqrt{3} + \frac{5\pi}{3}$

Question No. 3
Only One Option Correct Type
Each question has multiple options out of which ONLY ONE is correct.

The value of definite integral $\int_1^2 \frac{(x-1)e^{2x-3}}{1+(x-1)(e^{2x-3}-1)} \, dx$ is equal to :

A. $\frac{1}{2}$

B. $\frac{1}{4}$

C. $\frac{1}{8}$

D. 1

Question No. 4
Only One Option Correct Type
Each question has multiple options out of which ONLY ONE is correct.

If $f(x)$ be a function such that $f(x+1) = \frac{f(x)-1}{f(x)+1}$, $\forall x \in N$ and $f(1) = 2$ then $f(999)$ is -

A. -3

B. 2

C. $\frac{1}{3}$

D. $-\frac{1}{2}$

Question No. 5
Only One Option Correct Type
Each question has multiple options out of which ONLY ONE is correct.

If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors equally inclined to each other at an angle $\alpha(\neq 0)$, then the angle between $\vec{a} \times \vec{b}$ and the plane containing $\vec{b}$ and $\vec{c}$ is :

A. $\sin^{-1}\left(\tan\frac{\alpha}{2} \cdot |\cot\alpha|\right)$

B. $\cos^{-1}\left(\tan\frac{\alpha}{2} \cdot |\cot\alpha|\right)$

C. $\cos^{-1}\left(\cot\frac{\alpha}{2} \cdot |\tan\alpha|\right)$

D. $\sin^{-1}\left(\cot\frac{\alpha}{2} \cdot |\tan\alpha|\right)$

Mathematics Multiple Correct (Maximum Marks: 28)

Question No. 1
One or More Options Correct Type
The question has multiple options out of which ONE or MORE is/are correct.

$f : [0, 1] \rightarrow R$ is a differentiable function such that $f(0) = 0$ and $|f'(x)| \leq k|f(x)|$ for all $x \in [0, 1]$ $(k > 0)$, then which of the following is/are not always true?

A. $f(x) = 0, \forall x \in R$
B. $f(x) = 0, \forall x \in [0, 1]$
C. $f(x) \neq 0, \forall x \in [0, 1]$
D. $f(1) = k$

Question No. 2

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Which of the following statement(s) are correct -

A. If $f(x) \equiv 6x^7 + 5x^6 + 4x^5 + 3x^4 + 2x^3 + x^2 + x + 1$, then the equation $f'(x) = 0$ must have a real root.

B. If $(x - 2)$ is a factor of the polynomial $P(x)$ (degrees 5) repeated 3 times, then 2 is the root of the equation $P'(x) = 0$ repeated 2 times

C. If $f(x)$ is a differentiable function, then if its graph is symmetric about origin, then the graph of $f'(x)$ will be symmetric about y-axis.

D. If $y = \sin^{-1}(\cos(\sin^{-1} x)) + \cos^{-1}(\sin(\cos^{-1} x))$ then $\frac{dy}{dx}$ is independent of x.

Question No. 3

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

The curves $y = ax^3 + 4x(a \neq 0)$ & $xy = 1$ touch each other at points P and Q, where P is in first quadrant. A triangle is formed by drawing a tangent to $y = ax^3 + 4x$ at point Q and coordinate axes. Then which of the following is/are correct?

A. The value of a is -4
B. The area of the triangle formed is 2
C. The value of a is -2
D. The area of the triangle formed is 1

Question No. 4

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

A complex number z with argument θ satisfies the equation $|z - 1| = 1$ and if $\frac{z-2}{z} = ai\tan(k\theta)$ then value $a^2 + k = ($ where $a, k \in R)$

A. $\frac{3}{2}$

B. $\frac{5}{4}$

C. $\frac{7}{4}$

D. 2

Question No. 5

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

Let $f : R \to (0, \infty)$ be a real valued function satisfying
$\int_0^x tf(x-t)dt = e^{2x} - 1$, then which of the following is(are) correct?

A. The value $(f^{-1})^{'}(4)$ equal $\frac{1}{8}$

B. Derivative of $f(x)$ with respect to e^x at \boldsymbol$x = 0$ is equal to 8

C. The value of $\lim_{z \to 0} \frac{f(z)-4}{z}$ equals 4

D. The value of $f(0)$ is equal to 4

Question No. 6

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

The probability of the events $A \cap B, A, B, A \cup B$ are respectively in A.P. with second term equals to the common difference then which of the following statements is(are) true ?

(A and B are exhaustive events)

A. A, B are mutually exclusive

B. A, B are independent

C. Probability of B is twice that of A

D. $P(A) = \frac{1}{3}$ and $P(B) = \frac{2}{3}$

Question No. 7

One or More Options Correct Type

The question has multiple options out of which ONE or MORE is/are correct.

If $\cot(3\alpha - 7\beta)\tan(5\beta - \alpha) = 1, \alpha \in (0, \pi), \beta \in (0, \frac{\pi}{3})$ and

$L = 2\sqrt{2}\sin(\frac{\alpha-3\beta}{3})$, then which is/are correct

A. Number of integral values of L is 2 .

B. Number of integral values of L is 3

C. Number of irrational values of L is 4

D. Number of irrational values of L is 3

Mathematics Numerical (Maximum Marks: 24)

Question No. 1
Numerical Type
The answer has to be filled into the input box provided below.

Complex numbers a, b and c are zeroes of polynomials $P(z) = z^3 + qz + r$ (where $q, r \in R$) and $|a^2| + |b^2| + |c^2| = 250$. If the points corresponding to a,b and c in complex plane are A, B, C respectively forming vertices of a right angle triangle right angled at C, with length of hypotenuse h, then $(\frac{h^2}{125})$ is

Question No. 2
Numerical Type
The answer has to be filled into the input box provided below.

t_1, t_2, t_3 are three points on $y^2 = 4x$ such that normal at t_1 intersects parabola at t_2 and normal at t_2 intersects parabola at t_3. Also t_1 be last digit in 7^{2016}, then $(3t_3 - 3)$ is

Question No. 3
Numerical Type
The answer has to be filled into the input box provided below.

Let $f : (0, \infty) \to R$ be a function such that

(i) f is strictly increasing and

(ii) $f(x) \cdot f(f(x) + \frac{1}{x}) = 1, \forall x > 0$

then the value of $(f(1))^2 - (f(1))$ is

Question No. 4
Numerical Type
The answer has to be filled into the input box provided below.

Let M be a 3×3 matrix such that $M\begin{pmatrix} -2 \\ 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 6 \\ -3 \\ 0 \end{pmatrix}$ and suppose that

$M^3 \begin{pmatrix} 1 \\ -1/2 \\ 0 \end{pmatrix} = \begin{pmatrix} \alpha \\ \beta \\ \gamma \end{pmatrix}$ for some $\alpha, \beta, \gamma \in R$. Then $\sqrt[\beta]{|\alpha|}$ is equal to

Question No. 5
Numerical Type
The answer has to be filled into the input box provided below.

A is a set containing n elements. A subset P_1 is chosen and A is reconstructed by replacing the elements P_1. The same process is repeated for subsets $P_1, P_2, \ldots \ldots P_m$ with $m > 1$. The number of ways of choosing $P_1, P_2, \ldots \ldots P_m$, so that $P_1 \cup P_2 \cup \ldots \ldots \cup P_m = A$ is $(2^m - 1)^{Kn}$. Find K

Question No. 6
Numerical Type
The answer has to be filled into the input box provided below.

If area bounded by curve $xy^2 = (2 - x)$ with $x = 0$ is $k\pi$ sq. units, then the value of k is equal to