

Physics Single Correct (Maximum Marks: 18)

Question No. 1

Only One Option Correct Type

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

Two identical small balls are interconnected with a light, inelastic and inextensible thread having length L . The system is on a smooth horizontal table with the thread just taut. Each ball is imparted a velocity v , one towards the other ball and the other in a direction that is perpendicular to the velocity given to the first ball. The thread will become taut again after time t_0 and the kinetic energy of the system after the string gets taut is K . The value of Kt_0 is



- A. $\frac{4}{3} mvL$
- B. $\frac{3}{4} mvL$
- C. $\frac{5}{4} mvL$
- D. mvL

Question No. 2

Only One Option Correct Type

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

An open bottle lies on a precise weighing scale. A fly then enters the bottle and flutters around in futile attempt to escape. Another fly, instead of using its wings to fly, uses a small helium filled balloon fitted to it by a microartist, in order to remain airborne.

Choose the correct option(s) from the following statements:

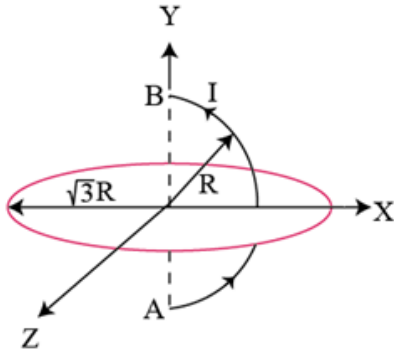
- A. reading will more in first case when it flutters
- B. reading will more in second case when it is using balloon
- C. reading in second cases is higher than reading before the fly entered the bottle.
- D. reading will be same in both cases and equal to reading before any fly entered the bottle

Question No. 3

Only One Option Correct Type

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

A conductor carrying current 'i' is in the form of a semicircle AB of radius R and lying in xy -plane with its center 'O' at origin as shown in the figure. Find the magnitude of $\oint \vec{B} \cdot d\vec{l}$ for the circle $x^2 + z^2 = 3R^2$ in xz -plane due to current in curve AB .



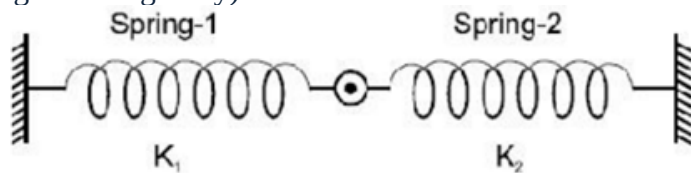
- A. $\frac{\mu_0 i}{2}$
- B. $\mu_0 i$
- C. $\frac{3}{2} \mu_0 i$
- D. $\frac{2}{3} \mu_0 i$

Question No. 4

Only One Option Correct Type

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

Spring -1 has a natural length of 0.5 meter and force constant $K_1 = 25 \text{ N/m}$ and spring -2 has a natural length of 1 meter and a force constant $K_2 = 10 \text{ N/m}$. They are joined together and their free ends are stretched so that the ends are fixed to the two walls 2 meter apart as shown in figure. The new lengths of the spring 1 and 2 at equilibrium are respectively: (springs are massless and ignore the gravity)



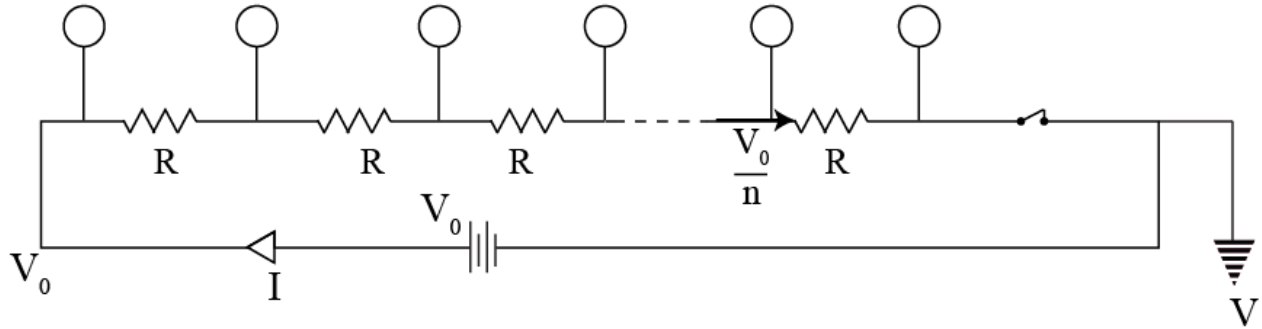
- A. $\frac{9}{14} \text{ m}, \frac{19}{14} \text{ m}$
- B. $\frac{8}{14} \text{ m}, \frac{20}{14} \text{ m}$
- C. $\frac{7}{14} \text{ m}, \frac{21}{14} \text{ m}$
- D. $\frac{16}{14} \text{ m}, \frac{12}{14} \text{ m}$

Question No. 5

Only One Option Correct Type

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

The given circuit consists of an ideal battery, n identical resistors each of resistance R and $n + 1$ identical conducting spheres each of radius r . Assume the spheres to be at great distances from each other as well from the circuit. Find the total charge finally accumulated on all the sphere after the key is closed



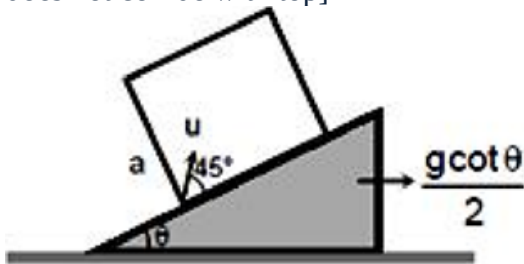
- A. $4\pi\epsilon_0 r V_0 (n + 1)$
- B. $3\pi\epsilon_0 r V_0 (n + 1)$
- C. $2\pi\epsilon_0 r V_0 (n + 1)$
- D. $\pi\epsilon_0 r V_0 (n + 1)$

Question No. 6

Only One Option Correct Type

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

The smooth wedge is accelerated at $\frac{g \cot \theta}{2}$ to the right. A cubical box of side a is at rest with respect to it. Inside the box a particle is projected with speed u relative to the box at an angle of 45° as shown. Find the time after which the particle will hit the box. [Assuming a is large, so that particle does not collide with top]



- A. $\frac{u}{\sqrt{2}g \sin \theta}$
- B. $\frac{2\sqrt{2}u}{g \cos \theta}$
- C. $\frac{u}{g \sin \theta}$
- D. $\frac{u}{\sqrt{2}g \cos \theta}$

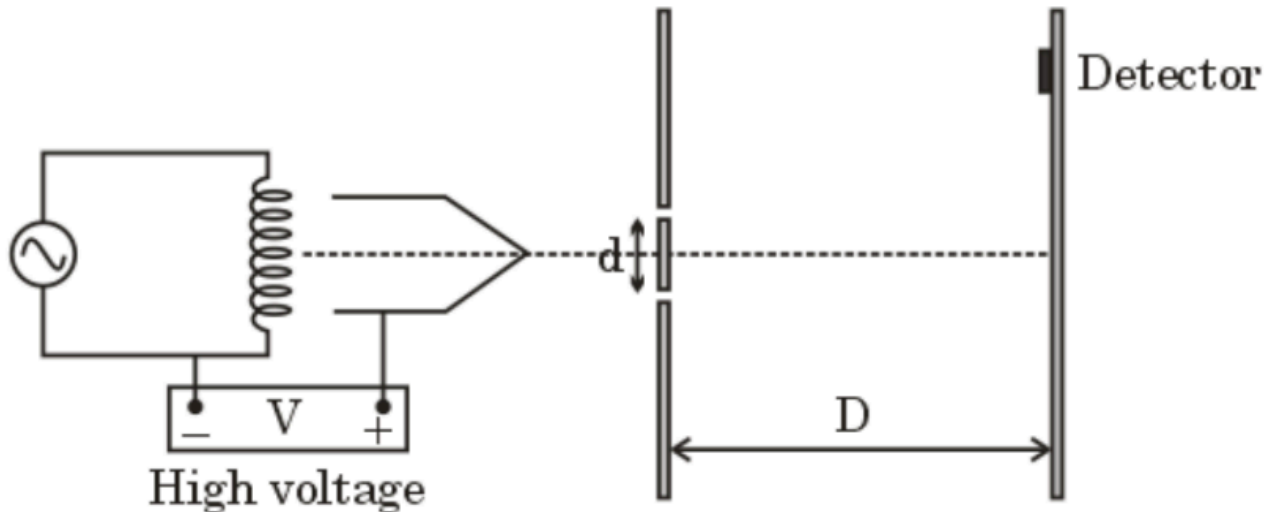
Physics Multiple Correct (Maximum Marks: 24)

Question No. 1

One or More Options Correct Type

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

As shown in the figure; an electron gun emits thermal electrons with negligible speed. These electrons are accelerated through a potential difference V and made to pass through a hole. These electrons then pass through the slits on wall and finally hits a screen at different locations.



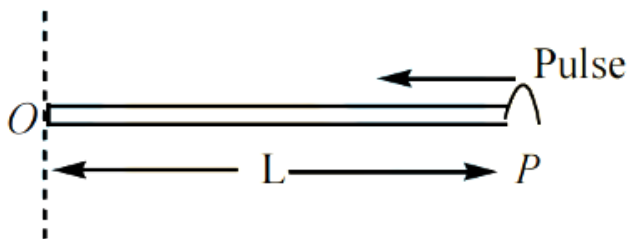
- A. the wavelength of electrons after it comes out of the gun is $\frac{h}{\sqrt{2meV}}$
- B. fringe width can be increased by decreasing the voltage V .
- C. If $V^2 > \frac{h^2}{2med^2}$, then at least 3 maximas will be obtained on the screen.
- D. Fringe width can be increased by increasing the voltage

Question No. 2

One or More Options Correct Type

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

A metallic rod of length L , linear mass density μ rotates about one of its end 'O' on a smooth horizontal plane with an angular velocity ω about an axis passing through one end which is perpendicular to plane of rotation shown in figure. A transverse pulse generated at the free end P to reach the axis of rotation. (neglect the gravitational effect)



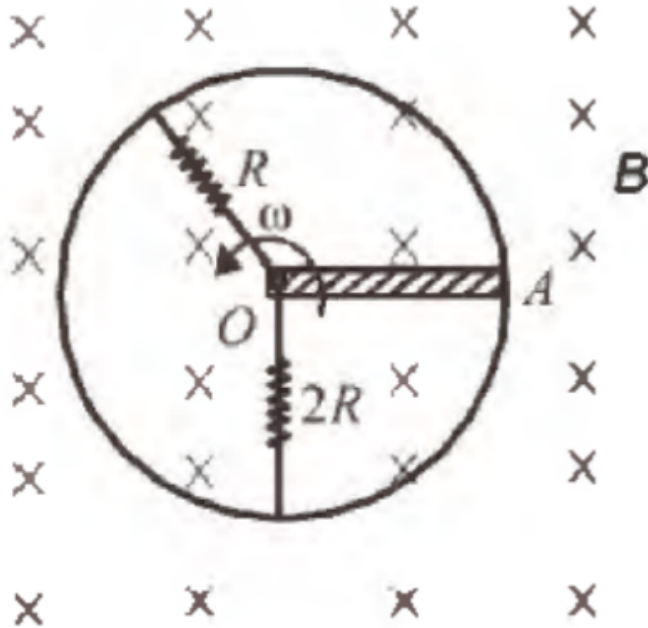
- The speed of the transverse pulse just after generated at the free end point P with respect to
 - A. ground is $L\omega$
- The speed of the transverse pulse when it reaches the mid point of metallic rod with respect to
 - B. ground is $\frac{\sqrt{5}L\omega}{\sqrt{8}}$
- C. The tension in the metallic rod at a distance 'x' from the free end $\frac{\mu[L^2 - (L-x)^2]}{2} \omega^2$
- D. The time taken by the transverse pulse to reach the axis of rotation from the free end is $\frac{\pi}{\sqrt{2}\omega}$

Question No. 3

One or More Options Correct Type

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

A rod OA of length l is rotating (about end O) over a conducting ring in crossed magnetic field B with constant angular velocity ω as shown in figure



- A. Current flowing through the rod is $\frac{3B\omega l^2}{4R}$
 B. Magnetic force acting on the rod is $\frac{3B^2\omega l^3}{4R}$
 C. Torque due to magnetic force acting on the rod is $\frac{3B^2\omega l^4}{8R}$
 D. constant angular speed is $\frac{3B^2\omega l^4}{8R}$

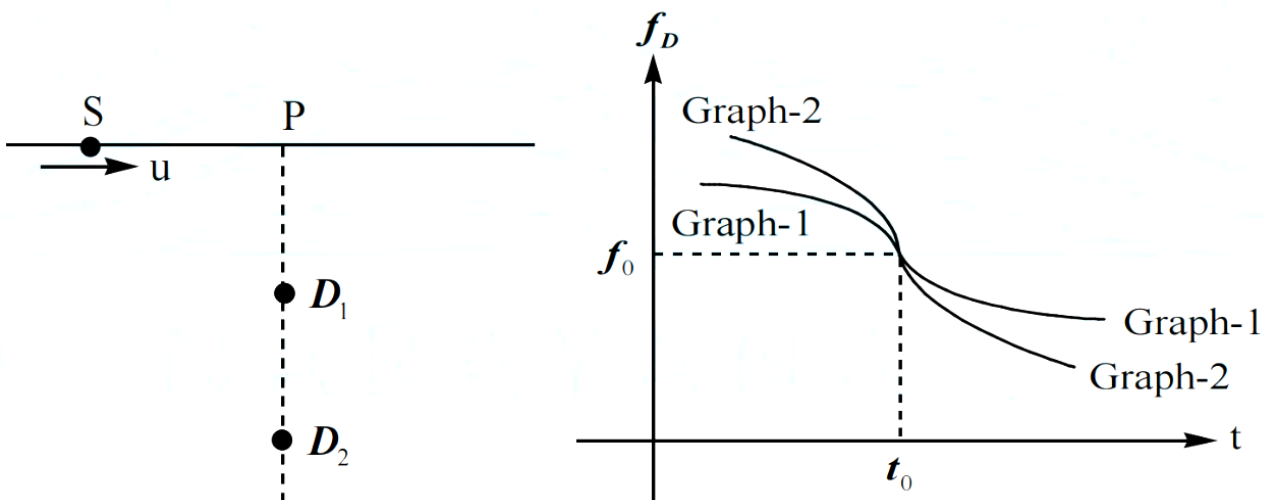
Magnitude of external force that acts perpendicularly at the end of the rod to maintain the

Question No. 4

One or More Options Correct Type

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

A source 'S' emitting sound of frequency f moves uniformly along a straight line with a velocity u as shown. The velocity of sound in the medium is $v(>u)$. Two detectors D_1 and D_2 are placed on the line perpendicular to line of motion of S. Point P represents the point of closest approach of S to the detectors. The frequency detected (f_D) by D_1 and D_2 versus time t graph is shown on the same graph paper.



Choose the incorrect option(s)

- A. Graph-1 belongs to detector D_1
 B. $t = t_0$ is the instant when source S is at P
 C. The value of f_0 is f

D. The value of f_0 is $(\frac{v^2}{v^2 - u^2})f$

Question No. 5

One or More Options Correct Type

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

The diameter of a cylinder is measured using a vernier calipers with no zero error. While measuring diameter of a cylinder, it is found that the zero of vernier scale lies between 5.10 cm and 5.15 cm of the main scale. Vernier scale has 50 divisions whose total length is equivalent to 2.45 cm. The closest division of the vernier scale that almost coincides with a main scale division is 23rd VSD but this 23rd VSD actually falls slightly to the right of the main scale division. The diameter of cylinder may be (each MSD = 0.05 cm)

- A. 51.238 mm
- B. 51.236 mm
- C. 51.242 mm
- D. 51.246 mm

Question No. 6

One or More Options Correct Type

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

A dipole of dipole moment p is placed at a distance $2R$ from the centre of a neutral conducting sphere of radius R . The direction of dipole is towards the centre of the sphere. A tangent is drawn from the dipole to the sphere which meets the sphere at point A.

- A. The potential at point A is $p/16\pi\epsilon_0 R^2$
- B. The potential at point A is $\sqrt{3}p/24\pi\epsilon_0 R^2$
- C. The potential at point A due to induced charges is $(3 - 2\sqrt{3})p/48\pi\epsilon_0 R^2$
- D. The potential at point A due to dipole is $\sqrt{3}p/24\pi\epsilon_0 R^2$

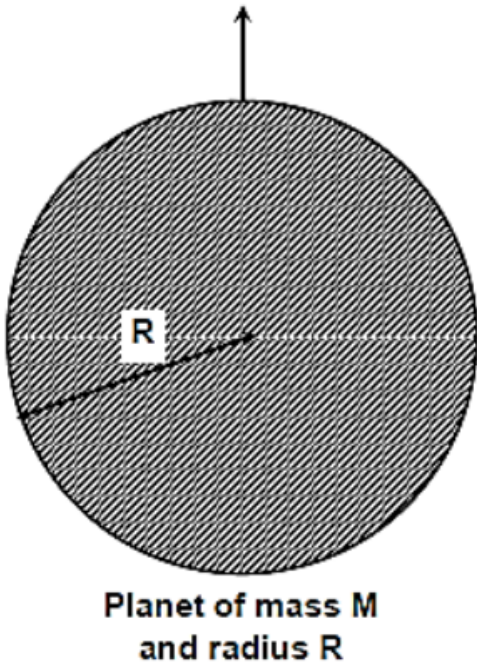
Physics Numerical (Maximum Marks: 24)

Question No. 1

Numerical Type

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

A small body of mass 'm' is projected up from the surface of given planet as shown in the figure. If small body has velocity which is just sufficient to get out from the gravity of planet then time taken by small body to reach at height of $3R$ from the surface of planet is $K\sqrt{\frac{2R^3}{GM}}$. Find the value of K .



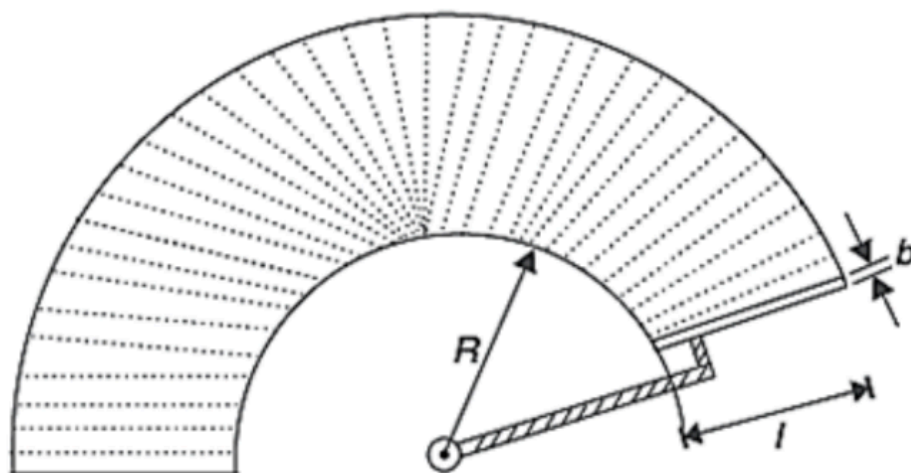
Question No. 2

Numerical Type

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

A car windshield wiper blade sweeps the wet windshield rotating at a constant angular speed of ω . R is the radius of innermost arc swept by the blade. Length and width of the blade are ℓ and b respectively. Coefficient of viscosity of water is η . The torque delivered by the motor to rotate the blade assuming that there is a uniform layer of water of thickness t on the glass surface is

$\frac{\eta b \omega R^3}{\alpha t} \left[\left(1 + \frac{L}{R}\right)^3 - 1 \right]$. Find the value of α .



Question No. 3

Numerical Type

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

One end of copper rod of uniform cross section and length 13.5 m is kept in contact with ice and other end with water at 100°C . At what distance 'x' (in meter) from 100°C water along its length should a temperature of 400°C be maintained so that in steady state, the mass of ice melting is equal to that of the steam produced in same time interval of time? Assume that whole system is insulated from surrounding. Latent heat of fusion of ice and vaporization of water are 80cal/gm and 540cal/gm , respectively.

Question No. 4

Numerical Type

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

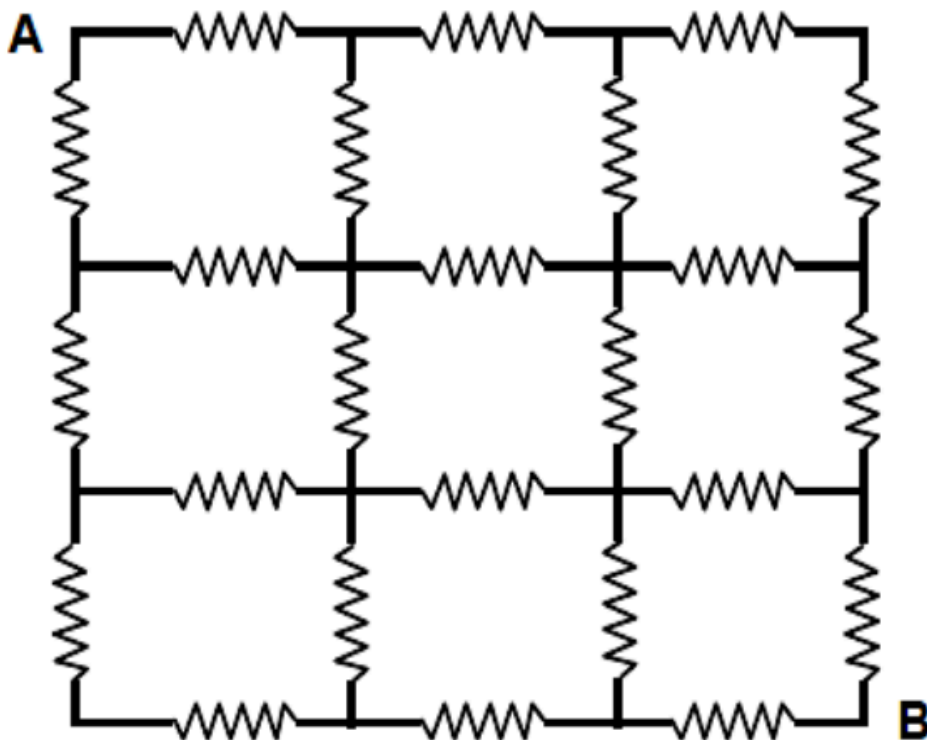
A conductor of mass $m = 5\text{ kg}$ and length $l = 4\text{ m}$ is placed on horizontal surface and a uniform magnetic field $B = 2\text{ Tesla}$ exist parallel to horizontal surface but perpendicular to the conductor. Suddenly, a certain amount of charge is passes through it, then it is found to jump to a height $h = 5\text{ m}$. Then, find the amount of charge that passes through the conductor in coulomb. (take $g = 10\text{ m/s}^2$)

Question No. 5

Numerical Type

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

24 resistors each of $\frac{28}{65}\Omega$ are arranged in a square as shown. Equivalent resistance of the network between points A and B is (in Ω)



Question No. 6

Numerical Type

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

Electrons in a hydrogen like atom ($Z = 3$) make transitions from the fourth excited state to the third excited state and from the third excited state to the second excited state.

The resulting radiations are incident on a metal plate to eject photoelectrons. The stopping potential for photoelectrons ejected by shorter wavelength is 3.95V . Find the stopping potential for the photoelectrons ejected by the longer wavelength.

(Take energy of the hydrogen atom in ground state as -13.6eV)

Chemistry Single Correct (Maximum Marks: 18)

Question No. 1

Only One Option Correct Type

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

An electron in a hydrogen atom makes a transition $n_1 \rightarrow n_2$ where n_1 and n_2 are the principal quantum numbers of the two states. Assume Bohr's model is valid in this case. The frequency of the orbital motion of the electron in the initial state is $1/27^{\text{th}}$ of that in the final state. The possible values of n_1 and n_2 are :

- A. $n_1 = 6, n_2 = 3$
- B. $n_1 = 4, n_2 = 2$
- C. $n_1 = 8, n_2 = 1$
- D. $n_1 = 3, n_2 = 1$

Question No. 2

Only One Option Correct Type

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

When a mixture of NaCl and $\text{K}_2\text{Cr}_2\text{O}_7$ is gently warmed with conc. H_2SO_4

- (i) an orange-red vapour is evolved
- (ii) the vapour formed when passed into NaOH solution gives yellow solution of Na_2CrO_4
- (iii) Chlorine gas is not evolved at all
- (iv) chromyl chloride gas is formed
- (v) SnCl_4 used instead of NaCl also gives same observations

- A. All statements are correct
- B. 2 statements are correct
- C. 3 statements are correct
- D. none of the statements are correct

Question No. 3

Only One Option Correct Type

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

A mixture of chlorides of copper, cadmium, chromium, iron and aluminium was dissolved in water.

It was acidified with dilute HCl and then hydrogen sulphide gas was passed for a sufficient time.

It was filtered, boiled and a few drops of nitric acid were added, while boiling. To this solution, ammonium chloride and ammonium hydroxide were added. To this, an excess of sodium hydroxide was added and then filtered. The filtrate shall give the test for:

- A. sodium and iron
- B. sodium, chromium and aluminium
- C. aluminium and iron
- D. sodium, iron, cadmium and aluminium

Question No. 4

Only One Option Correct Type

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

Some aqueous solutions are given below. Find the solution whose pH changes maximum by adding 10 millimoles amount of pure H_2SO_4 · [$\log 7 = 0.84$]

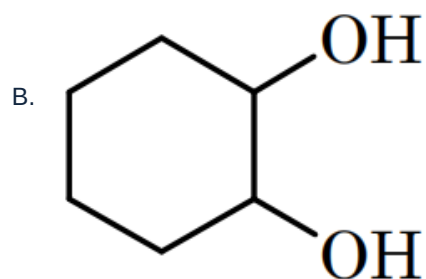
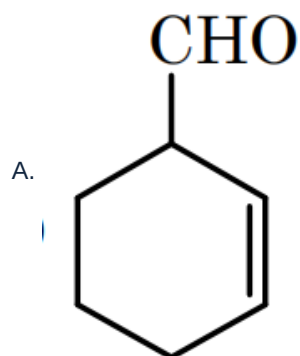
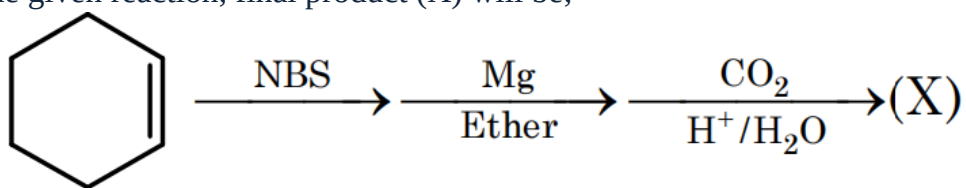
- A. 100 mL, 0.1M HCl + 100 mL, 0.5M $\text{Ca}(\text{OH})_2$
- B. 100 mL, 0.1M $\text{Ca}(\text{OH})_2$ + 100 mL, 0.4M H_2S
- C. 100 mL, 0.1M NaOH + 100 mL, 0.2M K_2SO_4
- D. 100 mL, 0.5M CH_3COOH + 100 mL, 0.1M $\text{Ba}(\text{OH})_2$

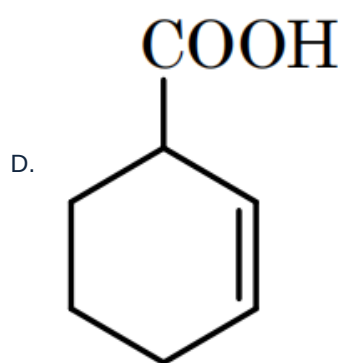
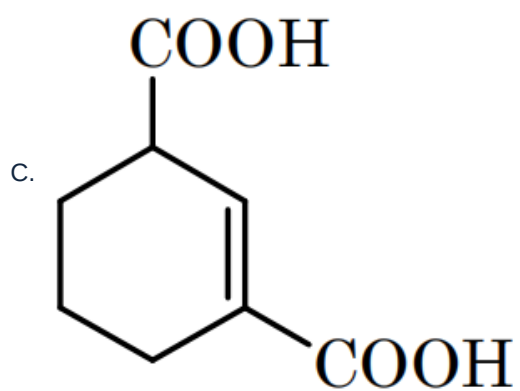
Question No. 5

Only One Option Correct Type

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

In the given reaction, final product (X) will be;



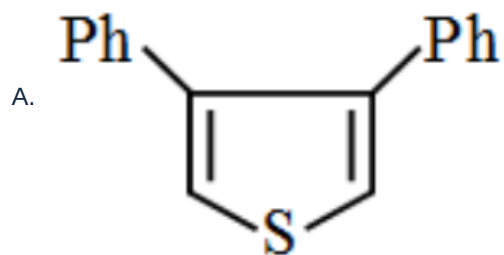
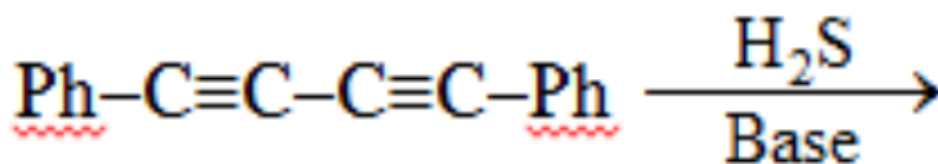


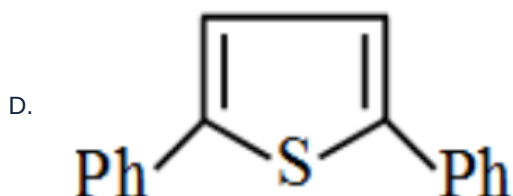
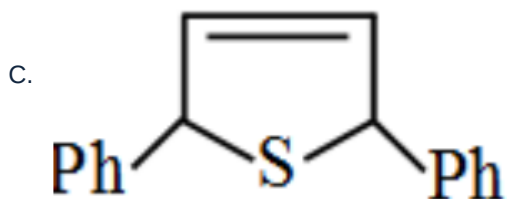
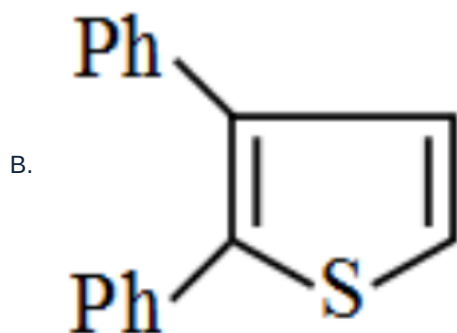
Question No. 6

Only One Option Correct Type

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

Write the major product of the following reaction?





Chemistry Multiple Correct (Maximum Marks: 24)

Question No. 1

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):

- A. Ziese's salt does not obey the Sidgwick EAN rule
- B. $[\text{Pd}(\text{H}_2\text{O})(\text{NH}_3)(\text{Cl})(\text{Br})]$ has two cis and one trans isomer
- C. $[\text{Cu}(\text{gly})_2]^-$ can show optical isomerism.
- D. $[\text{Co}(\text{EDTA})]^-$ can show both optical & geometrical isomerism.

Question No. 2

One or More Options Correct Type

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

Select INCORRECT statement(s) :

- A. pka value of $\text{B}(\text{OH})_3$ (aq.) increases on adding glycerol.
- B. aqueous solution of $\text{Ca}(\text{OH})_2$ can not be used for removal of temporary hardness of water.
- C. Crystals of borax on heating does not produce any neutral oxide.
- D. Two layers of solid orthoboric acid are connected together by hydrogen bonds.

Question No. 3

One or More Options Correct Type

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

For metal olefin complexes (i) $[\text{PtCl}_3(\text{C}_2\text{H}_4)]^-$ and (ii) $[\text{PtCl}_3(\text{C}_2\text{F}_4)]^-$, the incorrect statement is/are that :

- A. carbon-carbon bond length is same both in (i) and (ii).
- B. carbon-carbon bond length in (i) is smaller than in (ii).
- C. carbon-carbon bond length in (i) is larger than in (ii).
- D. chelation takes place in both the complexes.

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 substance(s) produce Brown colouration with solution of NaI in dilute CH_3COOH :-

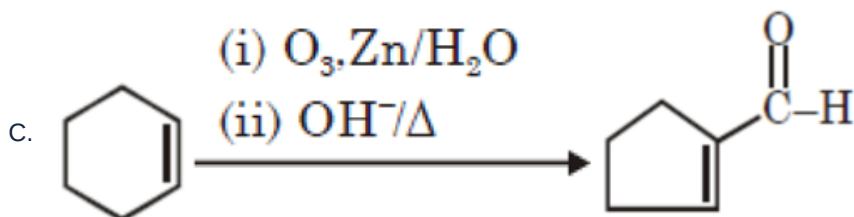
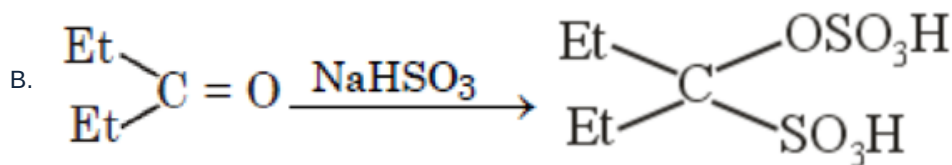
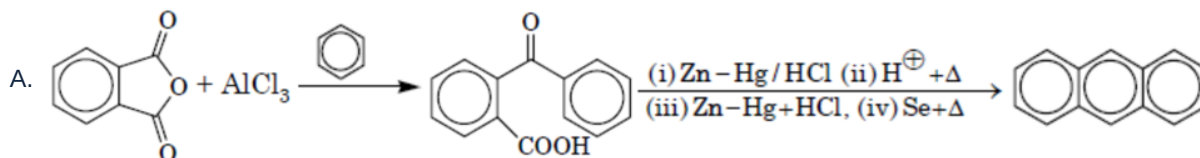
- A. CaOCl_2
- B. CuSO_4
- C. CaCl_2
- D. Gas (X) which is obtained on anode by electrolysis of $\text{NaCl}_{(\text{aq})}$

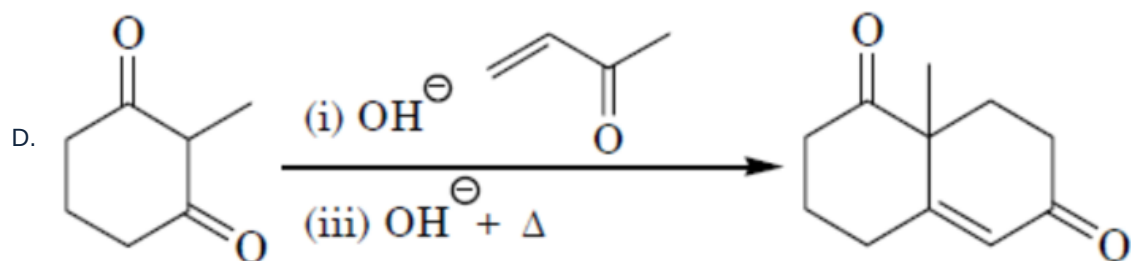
Question No. 5

One or More Options Correct Type

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

Which of the following reaction(s) give correct product as shown



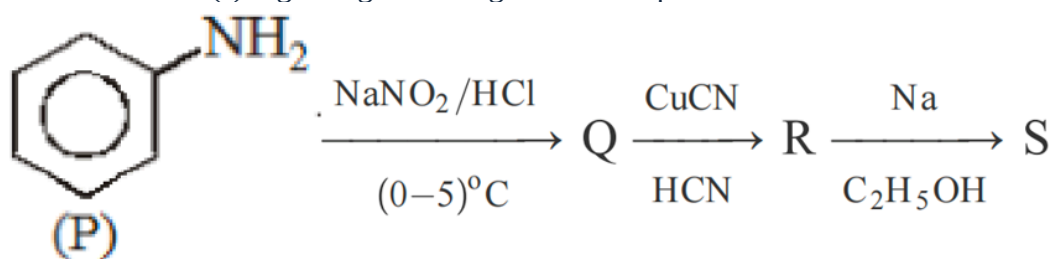


Question No. 6

One or More Options Correct Type

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

Correct statement(s) regarding following reaction sequence is/are :



- A. *P* & *S* can be distinguished by dye azo test
- B. *S* is more basic than *P*
- C. *R* give benzophenone with PhMgBr followed by H_3O^+
- D. *Q* on passing with steam produces phenol

Chemistry Numerical (Maximum Marks: 24)

Question No. 1

Numerical Type

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

How many blood cells of 5ml each having $[\text{K}^+] = 0.1\text{M}$ should burst into 25ml of blood plasma having $[\text{K}^+] = 0.02\text{M}$ so as to give final $[\text{K}^+] = 0.06\text{M}$

Question No. 2

Numerical Type

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

KMnO_4 is a good oxidising agent and commonly used to estimate many compounds. 400ml of KMnO_4 solution was divided in two parts. $\frac{3}{4}$ part of solution was completely reacted with 200ml of H_2O_2 solution and remaining $\frac{1}{4}$ part was completely reacted with 200ml of 50M $\text{H}_2\text{C}_2\text{O}_4$ solution, both in acidic medium.

If molarity of KMnO_4 is 'X' then find the value of $(\frac{X}{10})$.

Question No. 3

Numerical Type

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

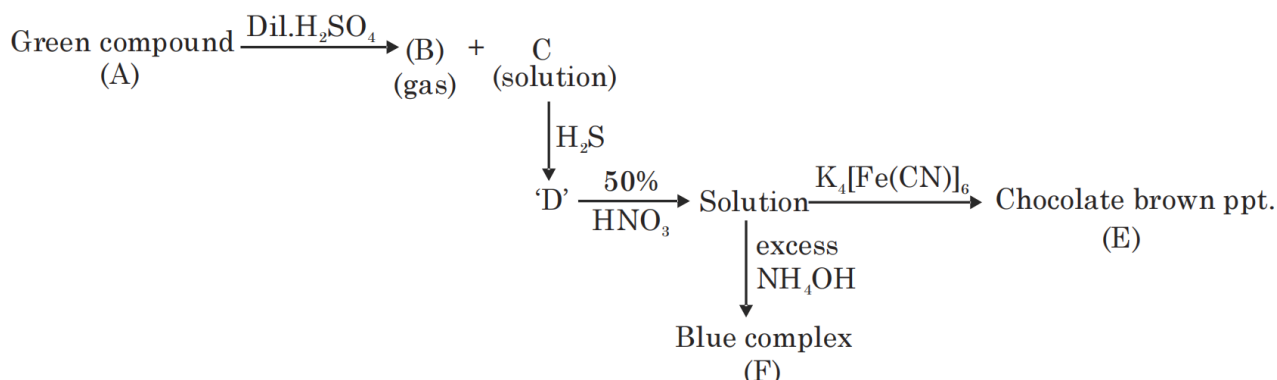
Select the total number of substance which is/are given below existing as most stable allotrope of corresponding element and having their standard enthalpy of formation zero -

- (i) Graphite
- (ii) Ozone
- (iii) Black phosphorus
- (iv) Rhombic sulphur
- (v) White tin
- (vi) $\text{Cl}_2(\text{g})$
- (vii) $\text{Br}_2(\text{g})$

Question No. 4

Numerical Type

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



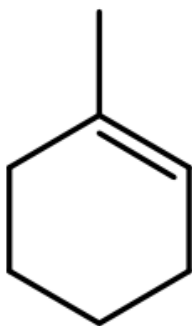
Find the total number of unpaired electrons in per molecule of *E* and *F* :

Question No. 5

Numerical Type

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

How many alcohols belongs to molecular formula $\text{C}_7\text{H}_{14}\text{O}$ (excluding stereoisomers) and having six or less carbon ring on dehydration with conc. H_2SO_4 at high temperature give



major product.

Question No. 6

Numerical Type

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

How many tripeptides are possible from three different amino acids if each is used only once ?

Question No. 1

Only One Option Correct Type

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

Evaluate $I = \int \frac{x^2}{(x^4-1)\sqrt{x^4+1}} dx$

- A. $\frac{1}{4\sqrt{2}} \left[\log\left(\frac{\sqrt{x^4+1}-x\sqrt{2}}{x^2-1}\right) + \tan^{-1}\left(\frac{\sqrt{x^4+1}}{x\sqrt{2}}\right) \right] + c$
- B. $\frac{1}{4\sqrt{2}} \left[\log\left(\frac{\sqrt{x^4+1}-x\sqrt{2}}{x^2-1}\right) - \tan^{-1}\left(\frac{\sqrt{x^4+1}}{x\sqrt{2}}\right) \right] + c$
- C. $\frac{1}{2\sqrt{2}} \left[\log\left(\frac{\sqrt{x^4+1}-x\sqrt{2}}{x^2-1}\right) - \tan^{-1}\left(\frac{\sqrt{x^4+1}}{x\sqrt{2}}\right) \right] + c$
- D. $\frac{1}{2\sqrt{2}} \left[\log\left(\frac{\sqrt{x^4+1}-x\sqrt{2}}{x^2-1}\right) + \tan^{-1}\left(\frac{\sqrt{x^4+1}}{x\sqrt{2}}\right) \right] + c$

Question No. 2

Only One Option Correct Type

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

Let $x = 7 + t$ be any chord of $y^2 = 28x$ meeting it at A & B and the tangents drawn to the parabola at A & B meet at C, the locus of the circumcentre of $\triangle ABC$ is -

- A. $y^2 = 14(x - 7)$
- B. $y^2 = 14x - 7$
- C. $y^2 = 14x + 7$
- D. $y^2 = 14x$

Question No. 3

Only One Option Correct Type

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

$\sum_{r=1}^{20} \sum_{p=0}^{(r-1)} {}^{20}C_r {}^r C_p \cdot 5^p$ is equal to -

- A. $7^{20} - 2 + 6^{20}$
- B. $7^{20} - 6^{20} + 5^{20}$
- C. $7^{20} + 6^{20}$
- D. $7^{20} - 6^{20}$

Question No. 4

Only One Option Correct Type

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

If $f(x)$ is invertible polynomial function of degree 'n' defined on $x \in R$ (where $n > 2$) and $f''(x) = 0$ has $(n-2)$ distinct real roots if

- A. $f'(x) = 0$ has $\frac{n-1}{2}$ distinct real root
- B. $f'(x) = 0$ has $n-1$ distinct real root
- C. all the distinct root of $f'(x) = 0$ are repeated at least three times
- D. None of these

Question No. 5

Only One Option Correct Type

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

Let x_1 & x_2 be the roots of the quadratic equation $x^2 + ax + b = 0$, where

$$2x_1 = \frac{2x_2 - 1}{8x_2 - 1} \quad (x_2 \neq \frac{1}{8}) \text{ \& } f(x) = \begin{cases} x^2 & x \leq \alpha \\ ax + b & x > \alpha \end{cases} \quad (\alpha \neq 0) \quad \text{is differentiable } \forall x \in R, \text{ then}$$

possible value of $a(a > 0)$ is -

- A. $\cos 0$
- B. $\cos 18^\circ$
- C. $\cos 36^\circ$
- D. $\cos 54^\circ$

Question No. 6

Only One Option Correct Type

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

For the frequency distribution: Variate (x) : $x_1, x_2, x_3, \dots, x_{15}$

Frequency (f) : $f_1, f_2, f_3, \dots, f_{15}$

where $0 < x_1 < x_2 < x_3 < \dots < x_{15} = 10$ and $\sum_{i=1}^{15} f_i > 0$, the standard deviation cannot be

- A. 4
- B. 1
- C. 6
- D. 2

Mathematics Multiple Correct (Maximum Marks: 24)

Question No. 1

One or More Options Correct Type

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

Let $\vec{a} \times \vec{r} + (\vec{r} \cdot \vec{b})\vec{b} = \vec{a}$ and $\frac{|\vec{a}||\vec{b}|}{2} \leq \vec{a} \cdot \vec{b} \leq \frac{|\vec{a}||\vec{b}|}{\sqrt{2}}$. If $f(\theta) = [\vec{r} \quad \vec{a} \quad \vec{b}]$ where θ is angle between vectors \vec{a} and \vec{b} then (where \vec{a} and \vec{b} are unit vectors)

- A. Maximum value of $f(\theta)$ is $\frac{1}{\sqrt{2}}$
- B. Maximum value of $f(\theta)$ is $\frac{3}{2}$
- C. Minimum value of $f(\theta)$ is $\frac{1}{\sqrt{2}}$
- D. Minimum value of $f(\theta)$ is $\frac{1}{2}$

Question No. 2

One or More Options Correct Type

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

Consider two parabolas, P_1 and P_2 with vertices at $V_1(0, 4)$ and $V_2(6, 0)$ respectively. P_1 and P_2 are tangent to each other at point P, have their axis of symmetry parallel to y-axis and their concavity in opposite direction. Then

- A. either sum of latus rectum or difference of latus rectum equal to 9
- B. If P_1 and P_2 are equal then length of their latus rectum equal to $\frac{9}{2}$
- C. If P_1 and P_2 are equal then length of their latus rectum equal to 9
- D. P is (3, 2) if P_1 and P_2 are equal parabolas

Question No. 3

One or More Options Correct Type

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

Let $(1 + x + x^2)^{2014} = a_0 + a_1x + a_2x^2 + a_3x^3 + \dots + a_{4028}x^{4028}$ and let

$$A = a_0 - a_3 + a_6 - \dots + a_{4026}$$

$$B = a_1 - a_4 + a_7 - \dots - a_{4027}$$

$$C = a_2 - a_5 + a_8 - \dots + a_{4028}$$

Then

- A. $|B| > |C|$
- B. $|B| < |C|$
- C. $|A| = |C|$
- D. $|A| < |B|$

Question No. 4

One or More Options Correct Type

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

If rectangle whose vertices are $(5, 3, -3), (5, 9, 9), (0, 5, 11)$ and $(0, -1, -1)$ is rotated about its diagonal (whose direction cosines are $(\frac{1}{3}, \frac{2}{3}, \frac{2}{3})$ in such a way that new position of rectangle is perpendicular to its old position then

- A. one of the vertices of rectangle in new position can be $(5, -3, 3)$
- B. one of the vertices of rectangle in new position can be $(0, 11, 5)$
- C. one of the vertices of rectangle in new position can be $(-3, 5, -1)$
- D. one of the vertices of rectangle in new position can be $(8, 3, 9)$

Question No. 5

One or More Options Correct Type

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

The area of the region which consists of all the points satisfying the conditions $|x - y| + |x + y| \leq 8, xy \geq 2, x \geq 0$ and $y \geq 0$ is equal to -

- A. $14 - \ln 64$
- B. $28 - \ln 64$
- C. $14 + \ln 4$
- D. $18 - \ln 4$

Question No. 6

One or More Options Correct Type

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

A bag contains n white and n black balls. Pairs of balls are drawn from the bag without replacement until the bag is empty. Probability that each draw consists of one white and one black ball is given by $P(n)$, then-

- A. $P(2) = \frac{2}{3}$
- B. $P(6) = \frac{32}{231}$
- C. $P(2) = \frac{1}{3}$
- D. $P(6) = \frac{16}{231}$

Mathematics Numerical (Maximum Marks: 24)

Question No. 1

Numerical Type

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

In a tetrahedron OABC, G is the centre of the tetrahedron, P, Q and R are the mid points of OA, OB and OC respectively. If the shortest distance between the line GR and PQ is $\frac{1}{2k}$, then the value of k is (where O is origin, $\vec{OA} = \hat{i}$, $\vec{OB} = \hat{j}$ and $\vec{OC} = \hat{k}$)

Question No. 2

Numerical Type

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

If the probability that randomly selected point inside area bounded by parabola $y^2 = 8x$ and its latus rectum lies inside the ellipse $\frac{x^2}{2} + \frac{y^2}{16} = 1$ is $\frac{\sqrt{2(a\pi+b)}}{32}$, then value of $(a + b)$ is

Question No. 3

Numerical Type

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

Let $y = f(x) = x^3 + x^2 + x + 1$, then the value of $\int_{-2}^1 f(x)dx + \int_1^4 f^{-1}(y)dy$ is-

Question No. 4

Numerical Type

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

If $k = \int_{-2021}^{2021} \frac{dx}{1+x^{2019}+\sqrt{1+x^{4038}}}$ then the value of $\frac{k}{100}$ is

Question No. 5

Numerical Type

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

Let the angle of intersection of the curves $y = [|\sin x| + |\cos x|]$ and $xy = 2$, (where $[.]$ denotes greatest integer function) is θ then $|\tan \theta|$ is

Question No. 6

Numerical Type

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

Let triangle ABC ($\angle C = \frac{\pi}{2}$) is right angled triangle of area equal to 12 units lie in xy plane so that its perpendicular sides are parallel to coordinates axes and the medians through A and B lie on the lines $y = 3x + 1$ and $y = mx + 2$ ($m \in \mathbb{I}$) respectively. If the coordinates of vertex C is (a, b) then $\frac{1}{|ab|}$ is equal to