

Advanced Practice Test-15

TIME : 3 hrs	M.M. : 240
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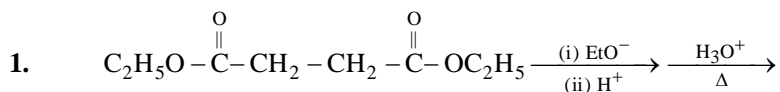
Read the following Instructions very carefully before you proceed.

- The question paper consists of 3 subjects :
(Subject I : Chemistry, Subject II : Physics, Subject III : Mathematics).
Each Part has 3 sections (Section I, Section II & Section III).
- Section-I** contains **10 Single Correct Answer Type Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or More Choices may be correct**.
➤ *Marking scheme [3 Marks for Correct answer & **-1 NEGATIVE MARKING** for wrong answer]*
- Section II** contains **10 Single Integer Value Type Questions**. The answer to each of the questions is a single-digit integer, ranging from 0 to 9 (both inclusive).
➤ *Marking scheme [5 Marks for Correct answer & **-1 NEGATIVE MARKING** for wrong answer]*
- No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc., except the Admit Card inside the examination hall/room.
- Rough work is to be done on the space provided for this purpose in the Test Booklet only.
- 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.
- On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator on duty in the Room/Hall. However, the candidates are allowed to take away this Test Booklet with them.
- Do not fold or make any stray marks on the Answer Sheet.
- No one will be permitted to leave the test room before the end of the test, i.e. 05:00 PM**

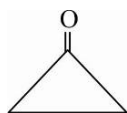
SECTION-I

MULTIPLE CORRECT TYPE

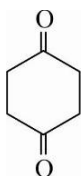
This section contains 10 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE OR MORE CHOICE may be Correct:



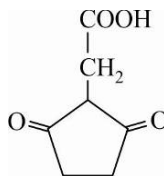
Which of the following product can be obtained by the above reaction (Do not consider Baeyer strain theory).



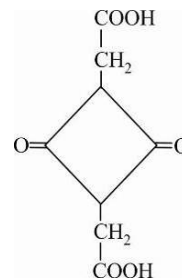
(A)



(B)

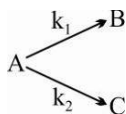


(C)



(D)

2. Consider the following case of COMPETING 1st order reactions :

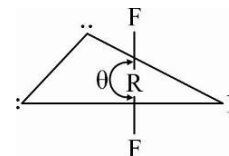


After the start of the reaction at $t = 0$ with only A, the $[B]$ is equal to $[C]$ at all times. The time in which all three concentrations will be equal is given by

(A) $t = \frac{1}{2k_1} \ln 3$ (B) $t = \frac{1}{2k_2} \ln 3$ (C) $t = \frac{1}{(k_1 + k_2)} \ln 3$ (D) $t = \frac{1}{(k_1 + k_2)} \ln \frac{3}{2}$

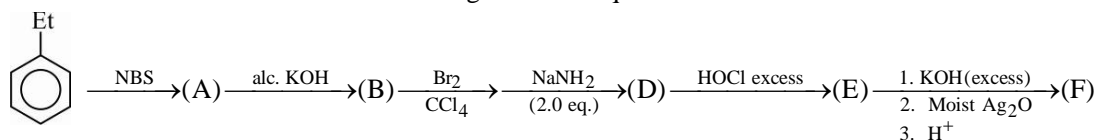
SPACE FOR ROUGH WORK

3. There are three elements 'P', 'Q' and 'R' which belong to p-block of the periodic table they all form trifluorides with F_2 such that PF_3 is Lewis acid but QF_3 is a weaker Lewis base (Dipole moment = 0.23 D). These two compounds react with each other in presence of F_2 to produce $QF_4^+ PF_4^-$. The compound RF_3 is a T-shape inter-halogen molecule. Which of the following is(are) correct statements with reference to above informations :



- (A) In the above structure the angle $\theta \neq 180^\circ$
 (B) All the R – F bond lengths are equal in RF_3 molecules
 (C) The 'Q' and 'P' both are sp^3 hybridized in the salt $QF_4^+ PF_4^-$
 (D) Among PF_3 , QF_3 and RF_3 only in PF_3 all the atoms lie in one plane i.e. only PF_3 is a planar molecule

4. Dr. Robertson Nehwal worked out following reaction sequence.

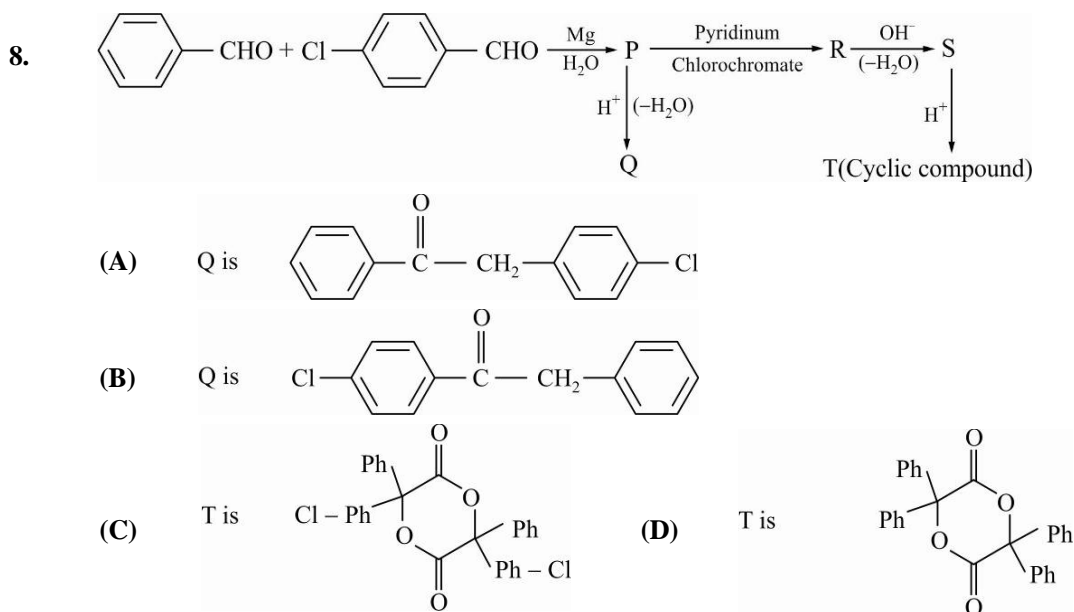


Select the correct statement(s)

- (A) F on heating gives benzoic acid
 (B) When D is treated with Na liq. NH_3 it gives trans alkene
 (C) E gives chloroform with NaOCl (D) E gives two oximes with NH_2OH
5. Which of the following pair are not chain isomers.
- (A) $(CH_3)_2 - NH - CH_2 - CH_2 - CH_2 - CH_3$ and $(CH_3)_2 - NH - \underset{\text{CH}_3}{\text{CH}} - CH_2 - CH_3$
- (B) $CH_3 - CH_2 - CH_2 - CH_2 - \overset{\text{O}}{\parallel} C - OCH_3$ and $CH_3 - \underset{\text{CH}_3}{\text{CH}} - CH_2 - \overset{\text{O}}{\parallel} C - OCH_3$
- (C) (N-ethyl ethanamine) and (N-methyl propanamine)
- (D) $CH_3 - CH_2 - CH_2 - \underset{\text{COOH}}{\text{CH}} - CH_3$ and $CH_3 - CH_2 - \underset{\text{COOH}}{\text{CH}} - CH_2 - CH_3$

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6. Choose the correct statement(s)
- (A) For the alkaline earth metals carbonates, solubility order decreases down the group
- (B) Hydrogen carbonates of all the alkali metals exist in the solid form except Lithium
- (C) In the alkaline earth metals, the tendency to form hydrates increases down the group
- (D) The oxide and hydroxides of alkaline earth metals, except beryllium, are amphoteric in nature
7. In Fe-extraction, the roasting/calcination is adopted for oxide ores to :
- (A) To remove water (B) To decompose carbonates
- (C) To oxidise sulphides (D) To reduce Iron



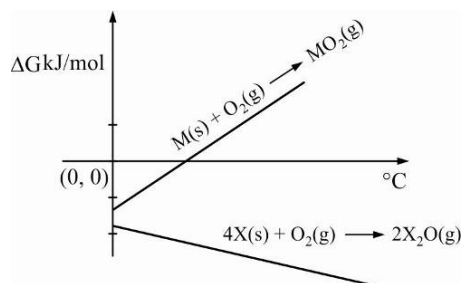
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9. Consider the following reactions showing formation of oxides of a hypothetical element M and a hypothetical element X.

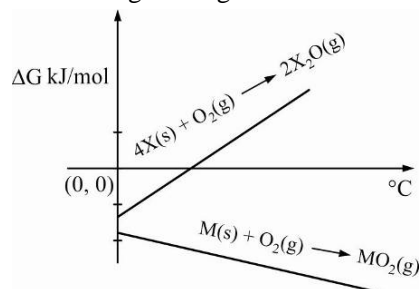


Which of the following is(are) true (assuming $\Delta C_p \approx 0$. For both reaction 1 and reaction 2)

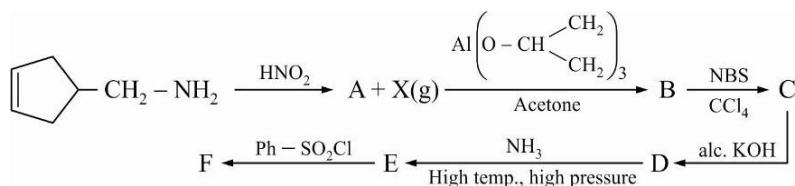
- (A) Element X will be able to reduce the oxide of element M at very high temperature
 (B) Element M will be able to reduce the oxide of element X at very high temperature
 (C) The probable Ellingham diagram for the above two reaction is



- (D) The probable Ellingham diagram for the above two reaction is



10.



Select correct statement(s):

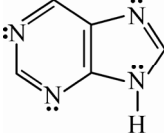
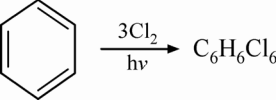
- (A) X is inert, colourless, odourless gas
 (B) B gives 1, 4-addition (conjugated addition) product and 1, 2-addition product with CH_3MgBr
 (C) D gives positive test with neutral ferric chloride
 (D) F is soluble in alkali

SPACE FOR ROUGH WORK

SECTION - II

SINGLE INTEGER VALUE CORRECT TYPE

This section contains 10 Single Integer Value Correct type Questions. Each question has an integer answer between 0 and 9. Fill the answer bubbles in the OMR Sheet APPROPRIATELY and CAREFULLY.

- The number of delocalizable electron pairs that form a close loop in the compound given below are _____.
- 
- How many meso isomers are possible for $C_6H_6Cl_6$ formed in reaction given below ?
- 
- A hypothetical 'Xeton' at rest with mass equivalent to a He nucleus absorbs (n) photons of frequency ν_0 . Its de-Broglie wavelength was later found to be $\frac{1}{8} \sqrt{\frac{h}{m\nu_0}}$ (m = mass of proton), then value of n is _____.
 - Light of wavelength 2000 \AA falls on an aluminium surface [work function = 4.2 eV]. Calculate K.E. of the fastest emitted photoelectron in eV.
 - Ethane gas is obtained in Kolbe's electrolysis of CH_3COONa . How many milli moles of ethane gas would be obtained by passing a current of 40 milli amp (50% efficient) for 965 min?

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6. The total number of iron atoms present in the Prussian Blue coloured precipitate in qualitative analysis is _____
7. The number of moles of oxalate ions oxidized by one mole of MnO_4^- ions is $\frac{x}{y}$. The value of $(x + y)$ is _____.
8. The unit cell of hydrated $\text{TlAl}(\text{SO}_4)_2$ is face centered with unit cell length 'a' = 1.19 nm. If the density of the salt is 2.32 g/cc, then the approximate number of water of hydration units per $\text{TlAl}(\text{SO}_4)_2$ unit will be (Molar mass of $\text{TlAl}(\text{SO}_4)_2$ is 423.5).
9. Find out the ratio of optically active isomers to meso-isomers for the following reaction:
- $$\text{CH}_3\text{-CH}=\text{CH-CH}_3 \xrightarrow[\text{in CCl}_4]{\text{Br}_2} \text{products .}$$
10. 736 g of $\text{K}_4[\text{Fe}(\text{CN})_6]$ reacts with 40 L of 0.2 M H_2SO_4 to undergo non-redox reaction to liberate CO gas. The number of moles of CO released is _____.

SPACE FOR ROUGH WORK

SECTION-I

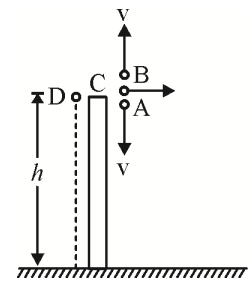
MULTIPLE CORRECT TYPE

This section contains 10 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE OR MORE CHOICE may be Correct:

1. Current in an AC Circuit is given by

$$I = 3 \sin(\omega t) + 4 \cos(\omega t) \text{ then :}$$

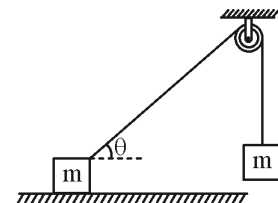
- (A) RMS value of this current is 5A
 (B) Mean value of this current in any half period will be $\frac{10}{\pi}$
 (C) If voltage applied is $V = V_m \sin(\omega t)$, then the circuit may be containing resistance and inductance only
 (D) If voltage applied is $V = V_m \sin(\omega t)$, the circuit may contain resistance and capacitance
2. The particles A, B and C are projected simultaneously from the top of a tower with equal speeds as shown in the figure, whereas the particle D is dropped from rest at the same time. Then:



- (A) all the particles hit the ground with equal speed
 (B) $h = \frac{1}{2} g t_A t_B$ and $v = \frac{g}{2} (t_B - t_A)$
 (C) $t_C = t_D = \sqrt{t_A t_B}$
 (D) $t_A > t_C = t_D > t_B$

3. Two blocks are in equilibrium. Ignoring the mass of the string and friction at the pulley, the magnitude of friction between the block and ground is:

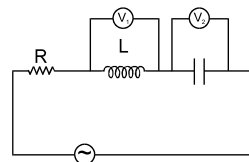
- (A) $mg \cos \theta$ (B) $\leq \mu mg (1 - \sin \theta)$
 (C) $\frac{\mu mg}{\sin \theta + \mu \cos \theta}$ (D) zero



SPACE FOR ROUGH WORK

4. In the experiment on photoelectric effect using light having frequency greater than the threshold frequency, the photocurrent will certainly increase when
- (A) Anode voltage is increased
 - (B) Area of cathode surface is increased
 - (C) Intensity of incident light is increased
 - (D) Distance between anode and cathode is increased

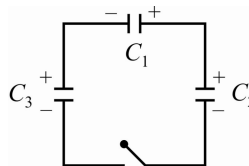
5. In the figure shown, $R = 100 \Omega$, $L = \frac{2}{\pi}$ H and $C = \frac{8}{\pi} \mu F$ are connected in series with an a.c. source of 200 volt and frequency f . V_1 and V_2 are two hot-wire voltmeters. If the readings of V_1 and V_2 are same then :



- (A) $f = 125 \text{ Hz}$
 - (B) $f = 250 \pi \text{ Hz}$
 - (C) current through R is 2A
 - (D) $V_1 = V_2 = 1000 \text{ volt}$
6. In the figure a conductor of non-uniform cross-section is shown. A steady current I flows in it.
- (A) The electric field at A is more than at B.
 - (B) The electric field at B is more than at A.
 - (C) The thermal power generated at A is more than at B in an element of small width.
 - (D) The thermal power generated at B is more than at A in an element of small width.



7. Three capacitor $C_1 = 2\mu F$, $C_2 = 3\mu F$ and $C_3 = 4\mu F$ are separately charged with battery of potential difference 40 V, 30 V and 10 V respectively and then disconnected. After then they are connected to each other as shown in figure.

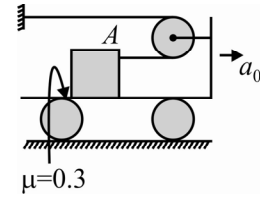


- (A) Final charge on capacitor $C_1 = \frac{800}{13} \mu C$
- (B) Final charge on capacitor $C_2 = \frac{800}{13} \mu C$
- (C) Final charge on capacitor $C_3 = \frac{280}{13} \mu C$
- (D) Amount of charge flow in circuit = zero

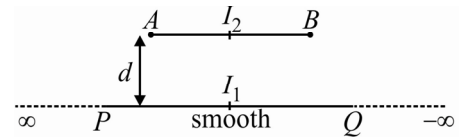
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8. A flat car is pulled with constant acceleration 2 m/s^2 as shown in figure. There is friction between block (having mass 50 kg) and flat car surface. Also the wheels of car are rolling without slipping. Then :

- (A) Tension in the string is 350 N
 (B) Friction force between them 150 N
 (C) Acceleration of block A is 4 m/s^2
 (D) Acceleration of centre of wheel is 1 m/s^2

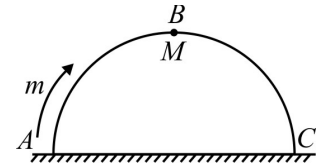


9. Wire AB of length l and PQ lie in a same vertical plane and AB remains in equilibrium due to magnetic repulsive force. Then the time period of oscillation of the rod AB if it displaced by a small distance in vertical plane. (Where PQ is fixed on a horizontal surface)



- (A) $\pi \sqrt{\frac{2\pi m d^2}{\mu_0 I_1 I_2 \ell}}$ (B) $2\pi \sqrt{\frac{\pi m d^2}{\mu_0 I_1 I_2 \ell}}$ (C) $2\pi \sqrt{\frac{2\pi m d^2}{\mu_0 I_1 I_2 \ell}}$ (D) $2\pi \sqrt{\frac{3\pi m d^2}{\mu_0 I_1 I_2 \ell}}$

10. A semicircular wedge of mass M is placed on a horizontal floor. A man of mass m starts moving on the wedge from position A with constant speed v relative to the wedge. Initially, both man and wedge were at rest. Neglect friction between the wedge and horizontal floor. The man does not slip on wedge while moving from position A to C relative to wedge.



- (A) Speed of wedge will first increase and then decrease
 (B) Net work done by contact force between man and wedge on system containing man and wedge during the walking of man is zero
 (C) The wedge will get displaced by $2mR(M + m)$ towards left after the mans reaches C
 (D) Speed of the wedge will be maximum when man reaches B

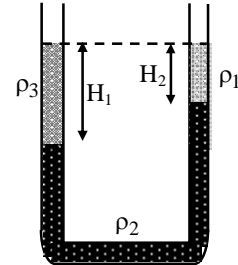
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SECTION - II

SINGLE INTEGER VALUE CORRECT TYPE

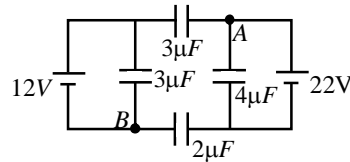
This section contains 10 Single Integer Value Correct type Questions. Each question has an integer answer between 0 and 9. Fill the answer bubbles in the OMR Sheet APPROPRIATELY and CAREFULLY.

1. There are three different liquids, with density ρ_1 , ρ_2 and ρ_3 , in a U-shaped container as shown in the picture. The lengths of ρ_3 and ρ_1 shown are $H_1 = 15 \text{ cm}$ and $H_2 = 10 \text{ cm}$, respectively.

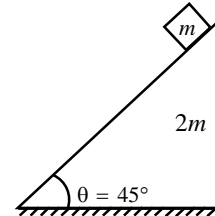


Find the value of $\frac{6\rho_3}{2\rho_1 + \rho_2}$.

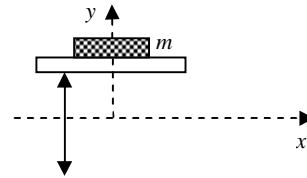
2. In the circuit shown in figure, find the value of $\frac{1}{2}(V_A - V_B)$ in Volt.



3. A wedge of mass $2m$ and a cube of mass m are shown in figure. Between cube and wedge, there is no friction. The minimum coefficient of friction between wedge and ground so that wedge does not move is μ then find the value of 10μ .



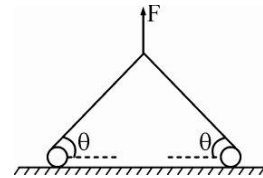
4. A horizontal platform with a mass m placed on it is executing SHM along y -axis. The time period of oscillation is $\frac{\pi}{10} \text{ sec}$. The maximum amplitude of SHM for the mass not to be detached from the platform is A (in mm) then the value of $A/5$ is _____ . (Take $g = 10 \text{ m/sec}^2$)



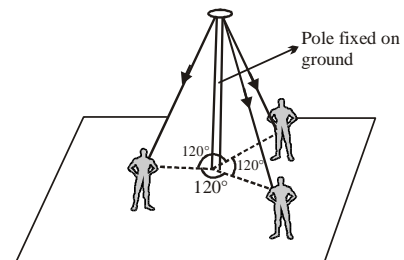
SPACE FOR ROUGH WORK

5. A rope under tension of 200 N and fixed at both ends, oscillates in a second harmonic standing wave pattern. The displacement of the rope is given by $y = (0.10\text{m})\sin\left(\frac{\pi x}{3}\right)\cos(12\pi t)$, where $x = 0$ at one end of the rope. X is in meters and t is in seconds. Find the length of the rope in meters.
6. A rigid body rotates about a fixed axis. Its angular velocity is variable and is given by $\alpha - \beta t$, where α and β are constants and t is the time. The angle through which it rotates before coming to rest is given $\theta = \frac{\alpha^2}{I\beta}$, where I is an integer. Find I .

7. Two small spheres each of same mass m connected by a string of length $2l$ are kept on a smooth surface. A vertical force F is applied at the middle of the string. If the maximum value of F for which the spheres do not lose contact with the surface is kmg then the value of K is _____.



8. Figure shows three people pulling down via ropes each with force of 2 N , on the top of a pole 20 m tall. If they stand at equal distance from the base of the pole along lines 120° apart, what is the net force (in Newton) they exert on the pole? The distance of each person from bottom of pole is $20\sqrt{3}\text{ m}$.



9. Two pendulums A and B of lengths 144 cm and 100 cm are initially in same phase at their equilibrium position. After how many complete oscillations of pendulum B , both the pendulums are again in same phase at the equilibrium
10. A $2\ \mu\text{F}$ capacitor is charged to 100 volt and then its plates are connected by a conducting wire. The heat produced is H then value of $100H$ will be in J .

SPACE FOR ROUGH WORK

SECTION-I

MULTIPLE CORRECT TYPE

This section contains 10 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE OR MORE CHOICE may be Correct:

- If $\tan \frac{t}{2}$ is the root of quadratic equation $ax^2 + bx + 1 = 0$, where $b, c \in R$ and $\sin t + \cos t = \frac{4}{3}$ then :

(A) $a + b = 1$ (B) $a + b = 8$ (C) $2a + 3b = 3$ (D) $2a + b = 8$
- If α, β are the roots of the equation $\lambda(x^2 - x) + x + 5 = 0$. If λ_1 and λ_2 are two values of λ for which the roots α, β are related by $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{4}{5}$, then the value of $\frac{\lambda_1}{\lambda_2} + \frac{\lambda_2}{\lambda_1} + 4$ is divisible by :

(A) 2 (B) 6 (C) 3 (D) 4
- Let $S_n (n \geq 1)$ be a sequence of sets defined by $S_1 = \{0\}$.

$$S_2 = \left\{ \frac{3}{2}, \frac{5}{2} \right\}, S_3 = \left\{ \frac{8}{3}, \frac{11}{3}, \frac{14}{3} \right\}, S_4 = \left\{ \frac{15}{4}, \frac{19}{4}, \frac{23}{4}, \frac{27}{4} \right\}, \dots$$

Then :

(A) Third element in S_{20} is $\frac{439}{20}$ (B) Third element in S_{20} is $\frac{431}{20}$

(C) Sum of elements in S_{20} is 589 (D) Sum of elements in S_{20} is 609
- If $|z - 1 - i| = 1$, then the locus of points represented by the complex number $(5(z - i) - 6)$ is a circle such that :

(A) Centre of circle is (1, 0) (B) Centre is (-1, 0)

(C) Radius is 5 units (D) Radius is 3 units
- If $\tan \theta_i ; i = 1, 2, 3, 4$ are the roots of equation $x^4 - x^3 \sin 2\beta + x^2 \cos 2\beta - x \cos \beta - \sin \beta = 0$, then $\tan(\theta_1 + \theta_2 + \theta_3 + \theta_4)$ is equal to :

(A) $\frac{1 - \cos 2\beta}{\sin 2\beta}$ (B) $\frac{1 + \cos 2\beta}{\sin 2\beta}$ (C) $\tan \beta$ (D) $\cot \beta$

SPACE FOR ROUGH WORK

6. The co-ordinates of the vertices A, B, C of a triangle ABC whose orthocentre is $H(-3, 10)$ and circumcentre $O(-2, -3)$ and mid point of BC is $D(1, 3)$ are :
- (A) $(-9, -2)$ (B) $(3, 2)$ (C) $(11, 8)$ (D) $(-1, 4)$
7. Let $f: R \rightarrow R$ be defined by $f(x) = \begin{cases} x + 2x^2 \sin \frac{1}{x} & \text{for } x \neq 0 \\ 0 & \text{for } x = 0 \end{cases}$ then :
- (A) $f(x)$ is differentiable for all ' x ' but $f'(x)$ is not continuous at $x = 0$
 (B) $f'(0) = 1$
 (C) $f(x)$ is increasing in neighborhood of $x = 0$
 (D) Both $f(x)$ and $f'(x)$ are differentiable for all ' x '
8. The projection of line $3x - y + 2z - 1 = 0 = x + 2y - z - 2$ on the plane $3x + 2y + z = 0$ is :
- (A) $\frac{x+1}{11} = \frac{y-1}{-9} = \frac{z-1}{-15}$ (B) $3x - 8y + 7z + 4 = 0 = 3x + 2y + z$
 (C) $\frac{x+12}{11} = \frac{y+8}{-9} = \frac{z+14}{15}$ (D) $\frac{x+12}{11} = \frac{y+8}{-9} = \frac{z+14}{-15}$
9. Let A be an n th order square matrix and B be its adjoint, then $|AB + KI_n|$ is (where K is a scalar quantity)
- (A) $(|A| + K)^{n-2}$ (B) $(|A| + K)^n$ (C) $(|A| + K)^{n-1}$ (D) None of these
10. If the area of the quadrilateral formed by the tangents from the origin to the circle $x^2 + y^2 + 6x - 10y + c = 0$ and the radii corresponding to the points of contact is 15, then values of c is (are):
- (A) 9 (B) 4 (C) 5 (D) 25

SPACE FOR ROUGH WORK

SECTION - II

SINGLE INTEGER VALUE CORRECT TYPE

This section contains 10 Single Integer Value Correct type Questions. Each question has an integer answer between 0 and 9. Fill the answer bubbles in the OMR Sheet APPROPRIATELY and CAREFULLY.

1. The absolute value of the difference of the real roots of the equation

$$x^2 - 2^{2010}x + |x - 2^{2009}| + 2(2^{4017} - 1) = 0 \text{ is } \underline{\hspace{2cm}}.$$

2. In a triangle ABC , the bisector of angles B and C lie along the lines $x = y$ and $y = 0$. If A is $(1, 2)$ then $\sqrt{10}d(A, BC)$ where $d(A, BC)$ represents the perpendicular distance of point A from side BC is $\underline{\hspace{2cm}}$.

3. A man wants to divide 101 coins, a rupee each, among his 3 sons with the condition that no one receives more money than the combined total of other two. If the number of ways of doing this is λ , then the sum of digits of $\left(\frac{\lambda}{25}\right)$ is equal to $\underline{\hspace{2cm}}$.

4. If α, β are two distinct real roots of the equation $ax^3 + x - 1 - a = 0$ ($a \neq -1, 0$), none of which is equal to unity, then the value of $\lim_{x \rightarrow (1/\alpha)} \frac{(1+a)x^3 - x^2 - a}{(e^{1-\alpha x} - 1)(x-1)}$ is $\frac{a\ell(k\alpha - \beta)}{\alpha}$. The value of $k\ell$ is $\underline{\hspace{2cm}}$.

5. Let $f: (-1, 1) \rightarrow R$ be a differentiable function with $f(0) = -1$ and $f'(0) = 1$. Let $g(x) = (f(2f(x) + 2))^2$, then $|g'(0)|$ is equal to $\underline{\hspace{2cm}}$.

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6. The number of values of θ between $-\pi$ and $\frac{3\pi}{2}$ that satisfies the equation $5\cos 2\theta + 2\cos^2 \frac{\theta}{2} + 1 = 0$ is equal to _____.
7. A differentiable function $f(x)$ satisfying $f(xy) = (f(x))^y \forall x, y \in R$ and $f(1) = \frac{1}{4}$
 If $\lim_{n \rightarrow \infty} (1 \cdot \sqrt{f(x+1)} + 2 \cdot \sqrt{f(x+2)} + \dots + n \cdot \sqrt{f(x+n)}) = k \sqrt{f(x)}$, then k is equal to _____.
8. If a_1 is the value of a for which function $f(x) = x^2 + \frac{a}{x}$ has a local minimum at $x = 2$ and a_2 is the value of a for which $f''(1)$ vanishes, then the value of $\frac{a_1 + a_2}{3}$ is equal to _____.
9. Let $a \in \left(0, \frac{\pi}{2}\right)$, then the reciprocal of $\lim_{a \rightarrow 0} \frac{1}{a^3} \int_0^a \ln(1 + \tan a \tan x) dx$ is equal to _____.
10. The number of solution of $\max\{x, x^2\} = \min\{1, 2 - x^2\}$ is _____.

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