Q1. The time period of a simple pendulum is given by $T = 2\pi\sqrt{\frac{l}{g}}$. The measured value of the length of the pendulum is 10 cm known to a 1 mm accuracy. The time for 200 oscillations of the pendulum is found to be 100 second using a clock of 1 s resolution. The percentage accuracy in the determination of g using this pendulum is x. The value of x to the nearest integer is:-

(1) 2%

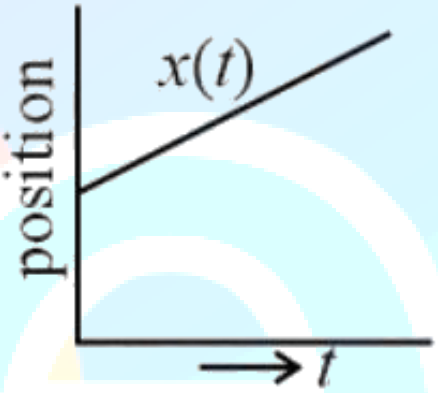
(2) 3%

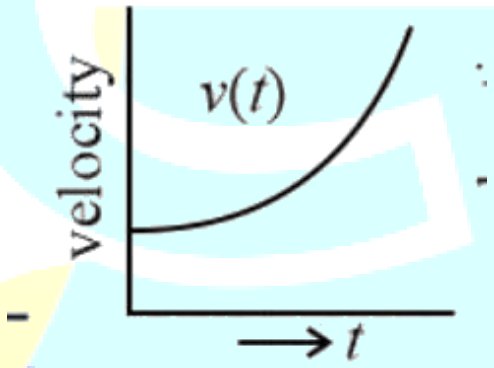
(3) 5%

(4) 4%

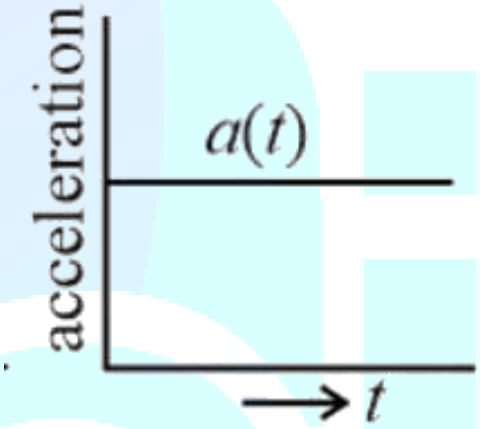
Q2. The position, velocity and acceleration of a particle moving with a constant acceleration can be represented by :

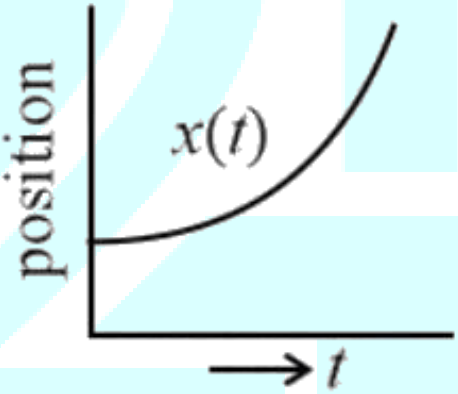
(1)

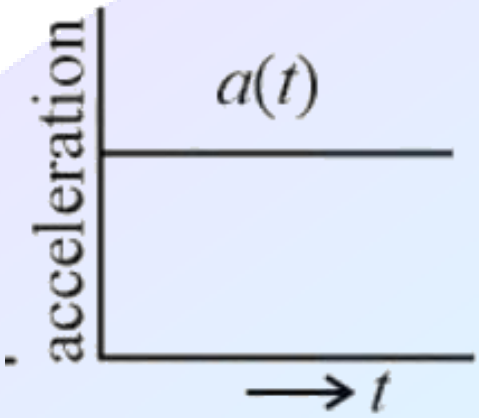




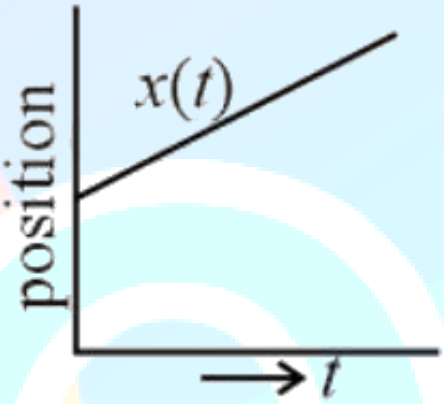
(2)

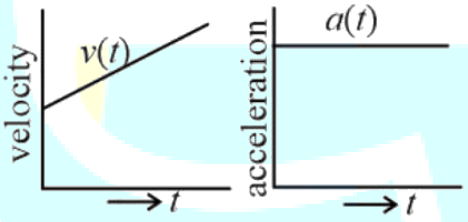




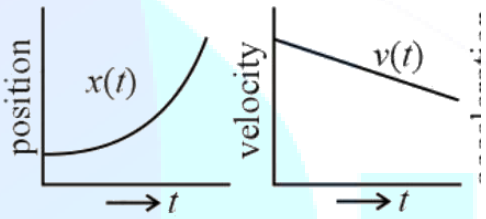


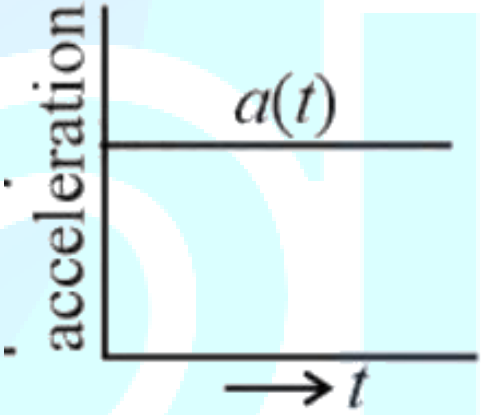
(3)





(4)





Q3. A constant power delivering machine has towed a box, which was initially at rest, along a horizontal straight line. The distance moved by the box in time t is proportional to :-

(1) $t^{\frac{2}{3}}$

(2) $t^{\frac{3}{2}}$

(3) t

(4) $t^{\frac{1}{2}}$

Q4. A thin circular ring of mass M and radius r is rotating about its axis with an angular speed ω. Two particles having mass m each are now attached at diametrically opposite points. The angular speed of the ring will become:

(1) $\omega \frac{M}{M+m}$

(2) $\omega \frac{M+2m}{M}$

(3) $\omega \frac{M}{M+2m}$

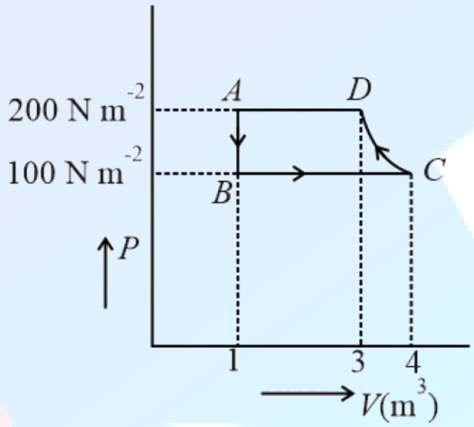
(4) $\omega \frac{M-2m}{M+2m}$

Q5. The time period of a satellite in a circular orbit of the radius R is T. The period of another satellite in a circular orbit of the radius $9R$ is:

(1) $9T$

(2) $27T$
(3) $12T$
(4) $3T$

Q6. The $P-V$ diagram of a diatomic ideal gas system going under cyclic process as shown in figure. The work done during an adiabatic process CD is (use $\gamma = 1.4$) :

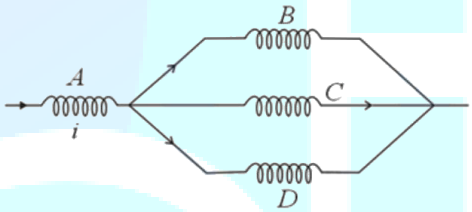


(1) -500 J
(2) -400 J
(3) 400 J
(4) 200 J

Q7. What will be the average value of energy along one degree of freedom for an ideal gas in thermal equilibrium at a temperature T ? (k_B is Boltzmann constant)
(1) $\frac{1}{2}k_BT$
(2) $\frac{2}{3}k_BT$
(3) $\frac{3}{2}k_BT$
(4) k_BT

Q8. In the experiment of Ohm's law, a potential difference of 5.0 V is applied across the end of a conductor of length 10.0 cm and diameter of 5.00 mm . The measured current in the conductor is 2.00 A . The maximum permissible percentage error in the resistivity of the conductor is :-
(1) 3.9
(2) 8.4
(3) 7.5
(4) 3.0

Q9. Four identical long solenoids A, B, C and D are connected to each other as shown in the figure. If the magnetic field at the center of A is 3 T the field at the center of C would be : (Assume that the magnetic field is confined with in the volume of respective solenoid).



(1) 12 T
(2) 6 T
(3) 9 T
(4) 1 T

Q10. A loop of flexible wire of irregular shape carrying current is placed in an external magnetic field. Identify the effect of the field on the wire.
(1) Loop assumes circular shape with its plane normal to the field.
(2) Loop assumes circular shape with its plane parallel to the field.
(3) Wire gets stretched to become straight.
(4) Shape of the loop remains unchanged.

Q11. In a scries LCR resonance circuit, if we change the resistance only, from a lower to higher value :
(1) The bandwidth of resonance circuit will increase.
(2) The resonance frequency will increase.
(3) The quality factor will increase.
(4) The quality factor and the resonance frequency will remain constant.

Q12. An AC source rated $220\ \text{V}, 50\ \text{Hz}$ is connected to a resistor. The time taken by the current to change from its maximum to the rms value is :
(1) 2.5 ms
(2) 25 ms
(3) 2.5 s
(4) 0.25 ms

Q13. A plane electromagnetic wave of frequency 100 MHz is traveling in a vacuum along the x-direction. At a particular point in space and time, $\vec{B} = 2.0 \times 10^{-8}\hat{k}$T. (where, $\hat{k}$ is unit vector along z-direction) What is $\vec{E}$ at this point?
(1) $0.6\hat{j}\text{Vm}^{-1}$
(2) $6.0\hat{k}\text{Vm}^{-1}$
(3) $6.0\hat{j}\text{Vm}^{-1}$
(4) $0.6\hat{k}\text{Vm}^{-1}$

Q14. Your friend is having eye sight problem. She is not able to see clearly a distant uniform window mesh and it appears to her as nonuniform and distorted. The doctor diagnosed the problem as :
(1) Astigmatism
(2) Myopia with Astigmatism
(3) Presbyopia with Astigmatism
(4) Myopia and hypermetropia

Q15. In Young's double slit arrangement, slits are separated by a gap of 0.5 mm , and the screen is placed at a distance of 0.5 m from them. The distance between the first and the third bright fringe formed when the slits are illuminated by a monochromatic light of 5890 is :-
(1) 1178×10^{-9} m
(2) 1178×10^{-6} m
(3) 1178×10^{-12} m
(4) 5890×10^{-7} m

Q16. An oil drop of the radius 2 mm with a density 3 g cm^{-3} is held stationary under a constant electric field
3.55×10^5 V m^{-1} in the Millikan's oil drop experiment. What is the number of excess electrons that the oil drop will possess? (consider $g = 9.81$ m s^{-2}).
(1) 48.8×10^{11}
(2) 1.73×10^{10}
(3) 17.3×10^{10}
(4) 1.73×10^{12}

Q17. A particle is travelling 4 times as fast as an electron. Assuming the ratio of de-Broglie wavelength of a particle to that of electron is 2: 1, the mass of the particle is :-
(1) $\frac{1}{16}$ times the mass of e^-
(2) 8 times the mass of e^-
(3) 16 times the mass of e^-
(4) $\frac{1}{8}$ times the mass of e^-

Q18. Imagine that the electron in a hydrogen atom is replaced by a muon (μ). The mass of muon particle is 207 times that of an electron and charge is equal to the charge of an electron. The ionization potential of this hydrogen atom will be:-
(1) 13.6 eV
(2) 2815.2 eV
(3) 331.2 eV
(4) 27.2 eV

Q19. A radioactive sample disintegrates via two independent decay processes having half lives $T_{1/2}^{(1)}$ and $T_{1/2}^{(2)}$ respectively. The effective half-life $T_{1/2}$ of the nuclei is :
(1) $T_{1/2} = \frac{T_{1/2}^{(1)} + T_{1/2}^{(2)}}{T_{1/2}^{(1)} - T_{1/2}^{(2)}}$
(2) $T_{1/2} = T_{1/2}^{(1)} + T_{1/2}^{(2)}$
(3) $T_{1/2} = \frac{T_{1/2}^{(1)} T_{1/2}^{(2)}}{T_{1/2}^{(1)} + T_{1/2}^{(2)}}$
(4) None of the above

Q20. Match List-I with List-II.

List-I

(a) 10 km height over earth's surface
(b) 70 km height over earth's surface
(c) 180 km height over earth's surface
(d) 270 km height over earth's surface

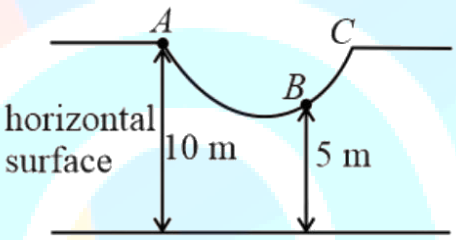
List-II

(i) Thermosphere
(ii) Mesosphere
(iii) Stratosphere
(iv) Troposphere
(1) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)
(2) (a)-(i), (b)-(iv), (c)-(iii), (d)-(ii)
(3) (a)-(iii), (b)-(ii), (c)-(i), (d)-(iv)
(4) (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)

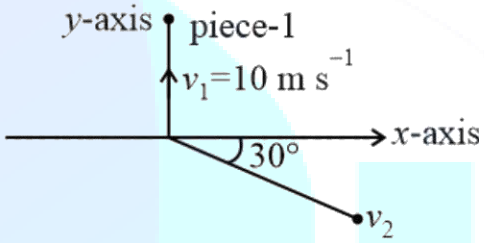
Q21. A person is swimming with a speed of $10\ \text{m s}^{-1}$ at an angle of 120° with the flow and reaches to a point directly opposite on the other side of the river. The speed of the flow is $x\ \text{m s}^{-1}$. The value of x to the nearest integer is ___

Q22. A bullet of mass 0.1 kg is fired on a wooden block to pierce through it, but it stops after moving a distance of 50 cm into it. If the velocity of the bullet before hitting the wood is $10\ \text{m s}^{-1}$ and, it slows down with uniform deceleration, then the magnitude of effective retarding force on the bullet is x N. The value of x to the nearest integer is,

Q23. As shown in the figure, a particle of mass 10 kg is placed at a point A. When the particle is slightly displaced to its right, it starts moving and reaches the point B. The speed of the particle at B is $x\ \text{m s}^{-1}$. (Take $g = 10\ \text{m s}^{-2}$) The value of x to the nearest integer is



Q24. A ball of mass 10 kg moving with a velocity $10\sqrt{3}\ \text{m s}^{-1}$ along the x-axis, hits another ball of mass 20 kg which is at rest. After the collision, first ball comes to rest while the second ball disintegrates into two equal pieces. One piece starts moving along y-axis with a speed of $10\ \text{m s}^{-1}$. The second piece starts moving at an angle of 30° with respect to the x-axis. The velocity of the ball moving at 30° with x-axis is $x\ \text{m s}^{-1}$. The configuration of pieces after the collision is shown in the figure below. The value of x to the nearest integer is

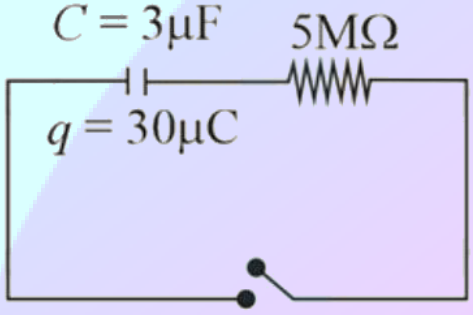


Q25. Two separate wires A and B are stretched by 2 mm and 4 mm respectively, when they are subjected to a force of 2 N . Assume that both the wires are made up of same material and the radius of wire B is 4 times that of the radius of wire A. The length of the wires A and B are in the ratio of $a:b$. Then $\frac{a}{b}$ can be expressed as $\frac{1}{x}$, where x is ___ .

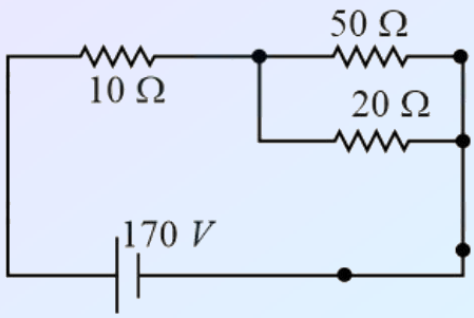
Q26. A particle performs simple harmonic motion with a period of 2 second. The time taken by the particle to cover a displacement equal to half of its amplitude from the mean position is $\frac{1}{a}$ s. The value of a to the nearest integer is

Q27. A parallel plate capacitor has plate area $100\ \text{m}^2$ and plate separation of 10 m . The space between the plates is filled up to a thickness 5 m with a material of dielectric constant of 10 . The resultant capacitance of the system is xpF. The value of $\varepsilon_0 = 8.85 \times 10^{-12}\ \text{F m}^{-1}$. The value of x to the nearest integer is ___ .

Q28. The circuit shown in the figure consists of a charged capacitor of capacity 3μ F and a charge of 30μC. At time $t = 0$, when the key is closed, the value of current flowing through the 5MΩ resistor is $x\mu$ A. The value of x to the nearest integer is



Q29. The voltage across the 10Ω resistor in the given circuit is x volt.



The value of x to the nearest integer is .

Q30. An npn transistor operates as a common emitter amplifier with a power gain of 10^6. The input circuit resistance is 100Ω and the output load resistance is $10k\Omega$. The common emitter current gain β will be (Round off to the Nearest Integer)

Q31. A certain orbital has no angular nodes and two radial nodes. The orbital is:
(1) 2 s
(2) 3 s
(3) 3 p
(4) 2 p

Q32. The ionic radius of Na^+ions is 1.02. The ionic radii (in) of Mg^{2+} and Al^{3+}, respectively, are
(1) 1.05 and 0.99
(2) 0.72 and 0.54
(3) 0.85 and 0.99
(4) 0.68 and 0.72

Q33. Given below are two statements: One is labelled as Assertion A and the other labelled as reason R Assertion A : During the boiling of water having temporary hardness, $Mg(HCO_3)_2$ is converted to $MgCO_3$ Reason R : The solubility product of $Mg(OH)_2$ is greater than that of $MgCO_3$.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both A and R are true but R is not the correct explanation of A
(3) Both A and R are true and R is the correct explanation of A
(2) A is true but R is false
(4) A and R both are false.

Q34. Match List-I with List- II
List-I
(a) $Ca(OCl)_2$
(b) $CaSO_4 \cdot \frac{1}{2}H_2O$
(c) CaO
(d) $CaCO_3$
List-II
(i) Antacid
(ii) Cement
(iii) Bleach
(iv) Plaster of paris

Choose the most appropriate answer from the
(1) $a-i, b-iv, c-iii, d-ii$
(2) $a-iii, b-ii, c-iv, d-i$
(3) $a-iii, b-iv, c-ii, d-i$
(4) $a-iii, b-ii, c-i, d-iv$

Q35. Reagent, 1-naphthylamine and sulphanilic acid in acetic acid is used for the detection of
(1) N_2O
(2) NO_3^-
(3) NO
(4) NO_2^-

Q36. Compound with molecular formula C_3H_6O can show:
(1) Positional isomerism
(2) Both positional isomerism and metamerism
(3) Metamerism
(4) Functional group isomerism

Q37. The satements that are TRUE:
(A) Methane leads to both global warming and photochemical smog
(B) Methane is generated from paddy fields
(C) Methane is a stronger global warming gas than CO_2
(D) Methane is a part of reducing smog

Choose the most appropriate answer from the options given below:
(1) (A), (B), (C) only
(2) (A) and (B) only
(3) (B), (C), (D) only
(4) (A), (B), (D) only

Q38. In a binary compound, atoms of element A form a hcp structure and those of element M occupy $2/3$ of the tetrahedral voids of the hcp structure. The formula of the binary compound is:
(1) M_2A_3
(2) M_4A_3
(3) M_4 A
(4) MA_3

Q39. The chemical that is added to reduce the melting point of the reaction mixture during the extraction of aluminium is:
(1) Cryolite
(2) Bauxite
(3) Calamine
(4) Kaolite

Q40. The number of ionisable hydrogens present in the product obtained from a reaction of phosphorus trichloride and phosphonic acid is:
(1) 3
(2) 0
(3) 2
(4) 1

Q41. Match List-I with List- II

List-I (process)
(a) Deacon's process
(b) Contact process
(c) Cracking of hydrocarbons
(d) Hydrogenation of vegetable oils

List - II (catalyst)
(i) ZSM $-$ 5
(ii) $CuCl_2$
(iii) Ni
(iv) V_2O_5

Choose the most appropriate answer from the options given below-
(1) $a-ii, b-iv, c-i, d-iii$
(2) $a-i, b-ii, c-ii, d-iv$
(3) $a-iii, b-i, c-iv, d-ii$
(4) a $-$ iv, b $-$ ii, c $-$ i, d $-$ iii

Q42. Match List-I with List-II

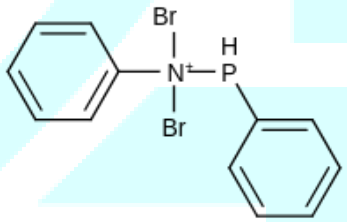
List-I
(a) Chlorophyll
(b) Vitamin- B_{12}
(c) Anticancer drug
(d) Grubbs catalyst

List- II

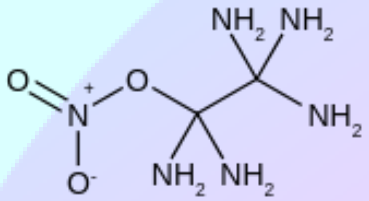
(i) Ruthenium
(ii) Platinum
(iii) Cobalt
(iv) Magnesium

Choose the most appropriate answer from the options given below:
(1) $a-iii, b-ii, c-iv, d-i$
(2) $a-iv, b-iii, c-ii, d-i$
(3) $a-iv, b-iii, c-i, d-ii$
(4) $a-iv, b-ii, c-iii, d-i$

Q43. The correct structures of trans $-[NiBr_2(PPh_3)_2]$ and meridional $-[Co(NH_3)_3(NO_2)_3]$ respectively, are:
(1)



and



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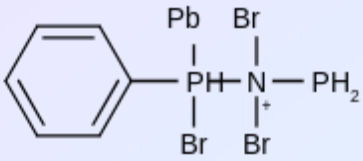

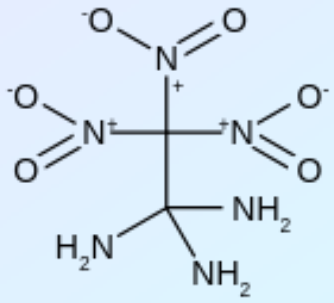

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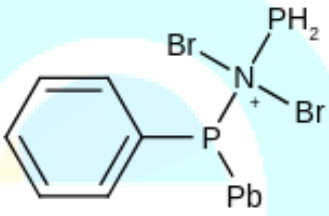

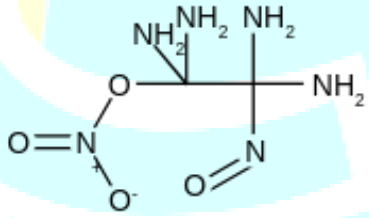

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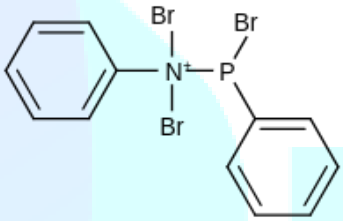
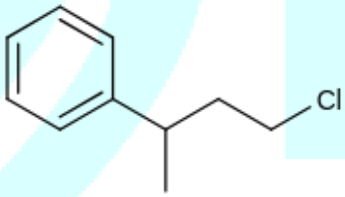
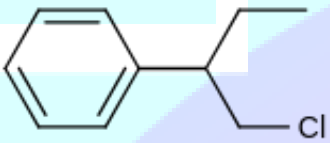


and

Q44. Reaction of Grignard reagent, C_2H_5MgBr with C_8H_8O followed by hydrolysis gives compound A , which reacts instantly with Lucas reagent to give compound B($C_{10}H_{13}Cl$).
The Compound B is:
(1)



(2)



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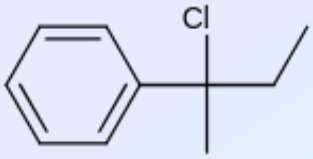

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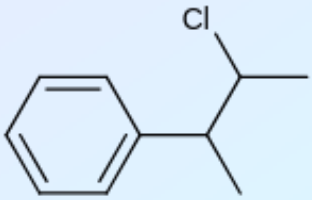


Q45. Match List-I with List-II :

List-I
(Chemicals)
(a) Alcoholic potassium hydroxide
(b) $Pd/BaSO_4$
(c) BHC (Benzene hexachloride)
(d) Polyacetylene

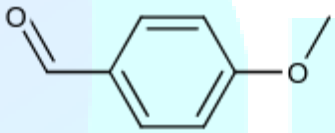
Choose the most appropriate match
(1) $a - ii, b - i, c - iv, d - iii$
(2) $a - iii, b - iv, c - ii, d - i$
(3) $a - iii, b - i, c - iv, d - ii$
(4) $a - ii, b - iv, c - i, d - iii$

Q46. CH_3

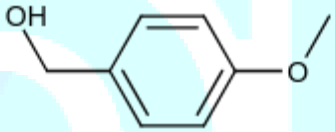
$\xrightarrow[H^+]{\text{Alkaline } KMnO_4}$ X

OCH_3

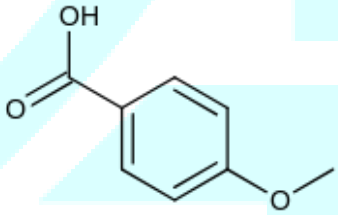
Considering the above chemical reaction, identify the product X :
(1)



(2)

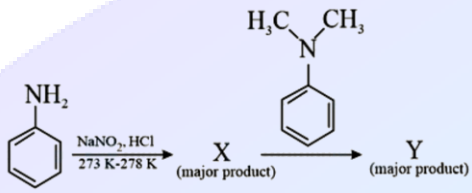


(3)



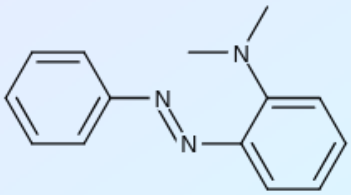
(4)

Q47.

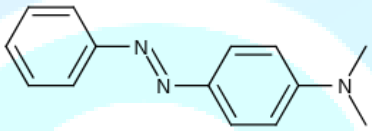


Considering the above reaction, X and Y respectively are:

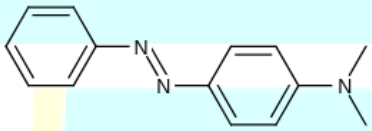
(1)



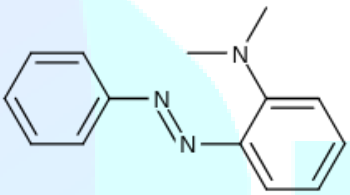
(2)



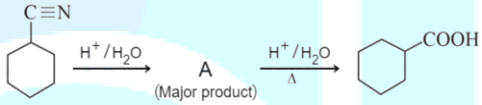
(3)



(4)

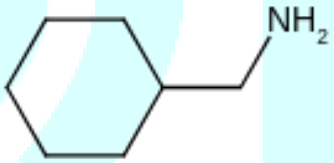


Q48. C ≡ N

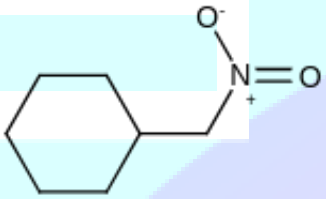


Consider the above chemical reaction and identify product A

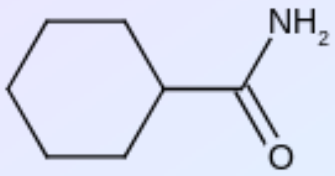
(1)



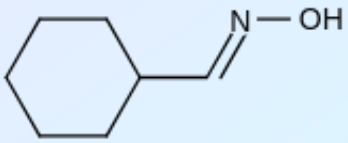
(2)



(3)



(4)



Q49. Match the list-I with list- II
List-I
(Class of Drug)
(a) Antacid
(b) Artificial sweetener
(c) Antifertility
(d) Tranquilizers

List- II
(Example)
Novestrol
Cimetidine
Valium
Alitame
(1) a − ii, b − iv, c − i, d − iii
(2) a − iv, b − i, c − ii, d − iii
(3) $a-iv, b-iii, c-i, d-ii$
(4) $a-ii, b-iv, c-iii, d-i$

Q50. A non-reducing sugar A hydrolyses to give two reducing mono saccharides. Sugar A is
(1) Fructose
(2) Galactose
(3) Glucose
(4) Sucrose

Q51. grams of 3 -Hydroxy propanal (MW = 74) must be dehydrated to produce 7.8 g of acrolein (MW = 56) (C_3H_4O) if the percentage yield is 64 . (Round off to the Nearest Integer).
[Given: Atomic masses : C : 12.0u, H: 1.0u, O: 16.0u]

Q52. Complete combustion of 3 g of ethane gives x × 10^{22} molecules of water. The value of x is (Round off to the Nearest Integer).
[Use : $N_A = 6.023 \times 10^{23}$; Atomic masses in u: C : 12.0; O: 16.0; H: 1.0]

Q53. AX is a covalent diatomic molecule where A and X are second row elements of periodic table. Based on Molecular orbital theory, the bond order of AX is 2.5. The total number of electrons in AX is . (Round off to the Nearest Integer).

Q54. For the reaction
$C_2H_6 \rightarrow C_2H_4 + H_2$
the reaction enthalpy $\Delta_r H$ in $kJmol^{-1}$ is (Round off to the Nearest Integer).
[Given : Bond enthalpies in $kJmol^{-1}$: C − C : 347, C = C: 611; C − H: 414, H − H: 436]

Q55. In order to prepare a buffer solution of pH 5.74 , sodium acetate is added to acetic acid. If the concentration of acetic acid in the buffer is 1.0 M , the concentration of sodium acetate in the buffer is M. (Round off to the Nearest Integer). [Given : pKa(acetic acid) = 4.74]

Q56.2 molal solution of a weak acid HA has a freezing point of 3.885°C. The degree of dissociation of this acid is × 10^{-3}. (Round off to the Nearest Integer). [Given : Molal depression constant of water = 1.85 K kg mol^{-1} Freezing point of pure water = 0°C]

Q57.For the reaction
$2Fe^{3+}(aq) + 2I^-(aq) \rightarrow 2Fe^{2+}(aq) + I_2(s)$
the magnitude of the standard molar free energy change, $\Delta_r G^\circ_m =$ − kJ (Round off to the Nearest Integer).

$$\begin{bmatrix} E^\circ_{Fe^{2+}/Fe(s)} = -0.440\ V; E^0_{Fe^{3+}/Fe(s)} = -0.036\ V \\ E^\circ_{I_2/2I^-} = 0.539\ V;\ F = 96500C \end{bmatrix}$$

Q58. $2NO(g) + Cl_2(g) \rightleftharpoons 2NOCl(s)$
This reaction was studied at −10°C and the following data was obtained run $[NO]_0$ $[Cl_2]_0$ r_0
1 0.10 0.10 0.18
2 0.10 0.20 0.35
3 0.20 0.20 1.40
$[NO]_0$ and $[Cl_2]_0$ are the initial concentrations and r_0 is the initial reaction rate. The overall order of the reaction is

(Round off to the Nearest Integer).
Q59. The total number of unpaired electrons present in the complex $K_3[Cr\ (oxalate)\ )_3]$ is .

Q60. A reaction of 0.1 mole of Benzylamine with bromomethane gave 23 g of Benzyl trimethyl ammonium bromide. The number of moles of bromomethane consumed in this reaction are $n \times 10^{-1}$, when n = (Round off to the Nearest Integer).
(Given : Atomic masses: C : 12.0u, H: 1.0u, N: 14.0u, Br: 80.0u)
Q61. The value of $3+\frac{1}{4+\frac{1}{3+\frac{1}{4+3+\cdots\infty}}}$ is equal to
(1) $1.5+\sqrt{3}$
(2) $2+\sqrt{3}$
(3) $3+2\sqrt{3}$
(4) $4+\sqrt{3}$

Q62. If the equation $a|z|^2+\overline{\bar{\alpha}z+\alpha\bar{z}}+d=0$ represents a circle where a, d are real constants then which of the following condition is correct?
(1) $|\alpha|^2-ad\neq 0$
(2) $|\alpha|^2-ad>0$ and $a\in R-\{0\}$
(3) $|\alpha|^2-ad\geq 0$ and $a\in R$
(4) $\alpha=0, a, d\in R^+$

Q63. The sum of all the 4 -digit distinct numbers that can be formed with the digits 1,2,2 and 3 is:
(1) 26664
(2) 122664
(3) 122234
(4) 22264

Q64. If α, β are natural numbers such that $100^{\alpha}-199\beta=(100)(100)+(99)(101)+(98)(102)+\cdots\ldots+(1)(199)$, then the slope of the line passing through (α, β) and origin is:
(1) 540
(2) 550
(3) 530
(4) 510

Q65. $\frac{1}{3^2-1}+\frac{1}{5^2-1}+\frac{1}{7^2-1}+\cdots+\frac{1}{(201)^2-1}$ is equal to
(1) $\frac{101}{404}$
(2) $\frac{25}{101}$
(3) $\frac{101}{408}$
(4) $\frac{99}{400}$

Q66. Let $(1+x+2x^2)^{20}=a_0+a_1x+a_2x^2+\cdots+a_{40}x^{40}$, then $a_1+a_3+a_5+\cdots+a_{37}$ is equal to
(1) $2^{20}(2^{20}-21)$
(2) $2^{19}(2^{20}-21)$
(3) $2^{19}(2^{20}+21)$
(4) $2^{20}(2^{20}+21)$

Q67.
The solutions of the equation
$\begin{vmatrix} 1+\sin^2 x & \sin^2 x & \sin^2 x \\ \cos^2 x & 1+\cos^2 x & \cos^2 x \\ 4\sin 2x & 4\sin 2x & 1+4\sin 2x \end{vmatrix}=0, (0<x<\pi)$, are
(1) $\frac{\pi}{12}, \frac{\pi}{6}$
(2) $\frac{\pi}{6}, \frac{5\pi}{6}$
(3) $\frac{5\pi}{12}, \frac{7\pi}{12}$
(4) $\frac{7\pi}{12}, \frac{11\pi}{12}$

Q68. The number of integral values of m so that the abscissa of point of intersection of lines $3x+4y=9$ and $y=mx+1$ is also an integer, is:
(1) 1
(2) 2
(3) 3
(4) 0

Q69. The equation of one of the straight lines which passes through the point $(1,3)$ and makes an angles $\tan^{-1}(\sqrt{2})$ with the straight line, $y+1=3\sqrt{2}x$ is
(1) $4\sqrt{2}x+5y-(15+4\sqrt{2})=0$
(2) $5\sqrt{2}x+4y-(15+4\sqrt{2})=0$
(3) $4\sqrt{2}x+5y-4\sqrt{2}=0$
(4) $4\sqrt{2}x-5y-(5+4\sqrt{2})=0$

Q70. Choose the correct statement about two circles whose equations are given below:
$x^2+y^2-10x-10y+41=0$
$x^2+y^2-22x-10y+137=0$
(1) circles have same centre
(2) circles have no meeting point
(3) circles have only one meeting point
(4) circles have two meeting points

Q71. For the four circles M, N, O and P, following four equations are given:
Circle $M: x^2 + y^2 = 1$
Circle $N: x^2 + y^2 - 2x = 0$
Circle $O: x^2 + y^2 - 2x - 2y + 1 = 0$
Circle $P: x^2 + y^2 - 2y = 0$
If the centre of circle M is joined with centre of the circle N, further centre of circle N is joined with centre of the circle O, centre of circle O is joined with the centre of circle P and lastly, centre of circle P is joined with centre of circle M, then these lines form the sides of a
(1) Rhombus
(2) Square
(3) Rectangle
(4) Parallelogram

Q72. If $\lim_{x\to 0} \frac{\sin^{-1} x - \tan^{-1} x}{3x^3}$ is equal to L, then the value of $(6L + 1)$ is
(1) $\frac{1}{6}$
(2) $\frac{1}{2}$
(3) 6
(4) 2

Q73. Let $A + 2B = \begin{bmatrix} 1 & 2 & 0 \\ 6 & -3 & 3 \\ -5 & 3 & 1 \end{bmatrix}$ and $2A - B = \begin{bmatrix} 2 & -1 & 5 \\ 2 & -1 & 6 \\ 0 & 1 & 2 \end{bmatrix}$. If $\mathrm{Tr}(A)$ denotes the sum of all diagonal elements of the matrix A, then $\mathrm{Tr}(A) - \mathrm{Tr}(B)$ has value equal to
(1) 1
(2) 2
(3) 0
(4) 3

Q74. Let α, β, γ be the real roots of the equation, $x^3 + ax^2 + bx + c = 0, (a, b, c \in R$ and $a, b \neq 0)$. If the system of equations (in, u, v, w) given by $\alpha u + \beta v + \gamma w = 0, \beta u + \gamma v + \alpha w = 0, \gamma u + \alpha v + \beta w = 0$ has non-trivial solution, then the value of $\frac{a^2}{b}$ is
(1) 5
(2) 3
(3) 1
(4) 0

Q75. The real valued function $f(x) = \frac{\mathrm{cosec}^{-1} x}{\sqrt{x - [x]}}$, where $[x]$ denotes the greatest integer less than or equal to x, is defined for all x belonging to:
(1) all reals except integers
(2) all non-integers except the interval $[-1,1]$
(3) all integers except $0, -1, 1$
(4) all reals except the Interval $[-1,1]$

Q76. If the functions are defined as $f(x) = \sqrt{x}$ and $g(x) = \sqrt{1 - x}$, then what is the common domain of the following functions: $f + g, f - g, f/g, g/f, g - f$, where $(f \pm g)(x) = f(x) \pm g(x), (f/g)(x) = \frac{f(x)}{g(x)}$
(1) $0 \leq x \leq 1$
(2) $0 \leq x < 1$
(3) $0 < x < 1$
(4) $0 < x \leq 1$

Q77. If $f(x) = \begin{cases} \frac{1}{|x|} & ; |x| \geq 1 \\ ax^2 + b & ; |x| < 1 \end{cases}$ is differentiable at every point of the domain, then the values of a and b are respectively:
(1) $\frac{1}{2}, \frac{1}{2}$
(2) $\frac{1}{2}, -\frac{3}{2}$
(3) $\frac{5}{2}, -\frac{3}{2}$
(4) $-\frac{1}{2}, \frac{3}{2}$

Q78. The integral $\int \frac{(2x-1)\cos\sqrt{(2x-1)^2+5}}{\sqrt{4x^2-4x+6}} dx$ is equal to (where c is a constant of integration)
(1) $\frac{1}{2}\sin\sqrt{(2x-1)^2+5} + c$
(2) $\frac{1}{2}\cos\sqrt{(2x+1)^2+5} + c$
(3) $\frac{1}{2}\cos\sqrt{(2x-1)^2+5} + c$
(4) $\frac{1}{2}\sin\sqrt{(2x+1)^2+5} + c$

Q79. The differential equation satisfied by the system of parabolas $y^2 = 4a(x + a)$ is
(1) $y\left(\frac{dy}{dx}\right)^2 - 2x\left(\frac{dy}{dx}\right) - y = 0$
(2) $y\left(\frac{dy}{dx}\right)^2 - 2x\left(\frac{dy}{dx}\right) + y = 0$
(3) $y\left(\frac{dy}{dx}\right)^2 + 2x\left(\frac{dy}{dx}\right) - y = 0$
(4) $y\left(\frac{dy}{dx}\right) + 2x\left(\frac{dy}{dx}\right) - y = 0$

Q80. A vector $\vec{a}$ has components $3p$ and 1 with respect to a rectangular cartesian system. This system is rotated through a certain angle about the origin in the counter clockwise sense. If, with respect to new system, $\vec{a}$ has components $p+1$ and $\sqrt{10}$, then a value of p is equal to:

(1) 1

(2) $-\frac{5}{4}$

(3) $\frac{4}{5}$

(4) -1

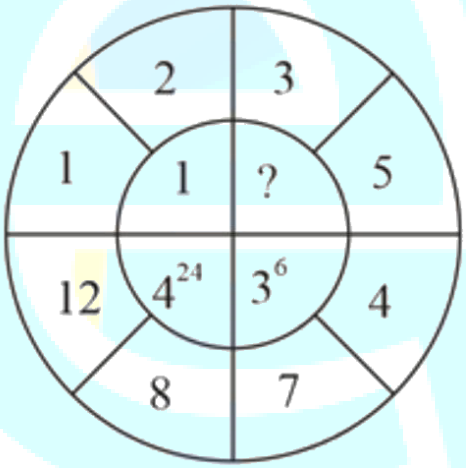
Q81. Let z_1, z_2 be the roots of the equation $z^2 + az + 12 = 0$ and z_1, z_2 form an equilateral triangle with origin. Then, the value of $|a|$ is

Q82. The number of times the digit 3 will be written when listing the integers from 1 to 1000 is

Q83. The number of solutions of the equation $|\cot x| = \cot x + \frac{1}{\sin x}$ in the interval $[0,2\pi]$ is

Q84. A square $ABCD$ has all its vertices on the curve $x^2y^2 = 1$. The midpoints of its sides also lie on the same curve. Then, the square of area of $ABCD$ is

Q85. The missing value in the following figure is



Q86. The mean age of 25 teachers in a school is 40 years. A teacher retires at the age of 60 years and a new teacher is appointed in his place. If the mean age of the teachers in this school now is 39 years, then the age (in years) of the newly appointed teacher is

Q87. If $f(x) = \int \frac{5x^8+7x^6}{(x^2+1+2x^7)^2}dx, (x \geq 0), f(0) = 0$ and $f(1) = \frac{1}{K}$, then the value of K is

Q88. Let $f(x)$ and $g(x)$ be two functions satisfying $f(x^2) + g(4-x) = 4x^3$ and $g(4-x) + g(x) = 0$, then the value of $\int_{-4}^{4} f(x^2)dx$ is

Q89. Let the plane $ax + by + cz + d = 0$ bisect the line joining the points $(4,-3,1)$ and $(2,3,-5)$ at the right angles. If a, b, c, d are integers, then the minimum value of $(a^2 + b^2 + c^2 + d^2)$ is

Q90. The equation of the planes parallel to the plane $x - 2y + 2z - 3 = 0$ which are at unit distance from the point $(1,2,3)$ is $ax + by + cz + d = 0$. If $(b-d) = K(c-a)$, then the positive value of K is

ANSWER KEYS

1. (2) atho	2. (2)	3. (2)	4. (3)	5. (2)	6. (1)	ma. (1)	8. (1)
9. (4)	10. (1)	11. (1)	12. (1)	13. (3)	14. (2)	15. (2)	16. (2)
17. (4)	18. (2)	mat 19. (3)	20. (1)	21. (5)	22. (10)	mo 23. (10)	24. (20)
25. (32)	26. (6)	27. (161)	28. (2)	29. (70)	30. (100)	31. (2)	32. (2)
33. (4)	34. (3)	35. (4)	36. (4)	37. (1)	38. (2)	39. (1)	40. (3)
41. (1)	42. (2)	43. (4)	44. (3)	45. (2)	46. (3)	47. (2)	48. (3)
49. (1)	50. (4)	51. (16)	52. (18)	53. (15)	54. (128)	55. (10)	56. (50)
57. (45)	58. (3)	59. (3)	60. (3)	61. (1)	62. (2)	mo63. (1)	64. (2)
65. (2)	66. (2)	67. (4)	68. (2)	69. (1)	70. (3)	71. (2)	72. (4)
73. (2)	74. (2)	75. (2)	76. (3)	77. (4)	78. (1)	79. (3)	80. (4)
81. (6)	82. (300)	83. (1)	84. (80)	85. (4)	86. (35)	87. (4)	88. (512)
89. (28)	90. (4)						