Q1. Two vectors $\vec{X}$ and $\vec{Y}$ have equal magnitude. The magnitude of $\left(\vec{X}-\vec{Y}\right)$ is n times the magnitude of $\left(\vec{X}+\vec{Y}\right)$. The angle between $\vec{X}$ and $\vec{Y}$ is :

(1) $\cos^{-1}\left(\frac{-n^2-1}{n^2-1}\right)$ (2) $\cos^{-1}\left(\frac{n^2-1}{-n^2-1}\right)$

(3) $\cos^{-1}\left(\frac{n^2+1}{-n^2-1}\right)$ (4) $\cos^{-1}\left(\frac{n^2+1}{n^2-1}\right)$

Q2. The force is given in terms of time t and displacement x by the equation $F = A\cos Bx + C\sin Dt$
The dimensional formula of $\frac{AD}{B}$ is:

(1) $\left[\mathrm{M^0\ L\ T^{-1}}\right]$ (2) $\left[\mathrm{ML^2\ T^{-3}}\right]$

(3) $\left[\mathrm{M^1\ L^1\ T^{-2}}\right]$ (4) $\left[\mathrm{M^2\ L^2\ T^{-3}}\right]$

Q3. The relation between time t and distance x for a moving body is given as $t = mx^2 + nx$, where m and n are constants. The retardation of the motion is: (When v stands for velocity)

(1) $2mv^3$ (2) $2mnv^3$

(3) $2nv^3$ (4) $2n^2v^3$

Q4. A balloon was moving upwards with a uniform velocity of 10 m $\mathrm{s^{-1}}$. An object of finite mass is dropped from the balloon when it was at a height of 75 m from the ground level. The height of the balloon from the ground when object strikes the ground was around: (takes the value of g as 10 m $\mathrm{s^{-2}}$)

(1) 300 m (2) 200 m

(3) 125 m (4) 250 m

Q5. The instantaneous velocity of a particle moving in a straight line is given as $v = \alpha t + \beta t^2$, where α and β are constants. The distance travelled by the particle between 1 s and 2 s is:

(1) $3\alpha + 7\beta$ (2) $\frac{3}{2}\alpha + \frac{7}{3}\beta$

(3) $\frac{\alpha}{2} + \frac{\beta}{3}$ (4) $\frac{3}{2}\alpha + \frac{7}{2}\beta$

Q6. A force $\vec{F} = \left(40\hat{\mathrm{i}} + 10\hat{\mathrm{j}}\right)$ N acts on a body of mass 5 kg. If the body starts from rest, its position vector $\vec{r}$ at time $t = 10$ s will be

(1) $\left(100\hat{\mathrm{i}} + 400\hat{\mathrm{j}}\right)$ m (2) $\left(100\hat{\mathrm{i}} + 100\hat{\mathrm{j}}\right)$ m

(3) $\left(400\hat{\mathrm{i}} + 100\hat{\mathrm{j}}\right)$ m (4) $\left(400\hat{\mathrm{i}} + 400\hat{\mathrm{j}}\right)$ m

Q7. Consider a planet in some solar system that has a mass double the mass of earth and density equal to the average density of the earth. If the weight of an object on earth is W, the weight of the same object on that planet will be:

(1) $2W$ (2) W

(3) $2^{\frac{1}{3}}W$ (4) $\sqrt{2}\,W$

Q8. A heat engine has an efficiency of $\frac{1}{6}$. When the temperature of sink is reduced by 62°C, its efficiency get doubled. The temperature of the source is :

(1) 124°C (2) 37°C

(3) 62°C (4) 99°C

Q9. Two spherical soap bubbles of radii r_1 and r_2 in vacuum combine under isothermal conditions. The resulting bubble has a radius equal to:

(1) $\frac{r_1 r_2}{r_1+r_2}$ (2) $\sqrt{r_1 r_2}$

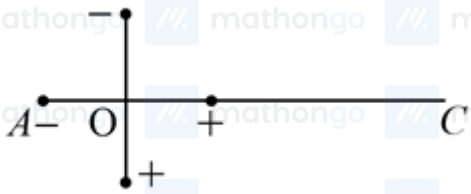
(3) $\sqrt{r_1^2+r_2^2}$ (4) $\frac{r_1+r_2}{2}$

Q10. In a simple harmonic oscillation, what fraction of total mechanical energy is in the form of kinetic energy, when the particle is midway between mean and extreme position.

(1) $\frac{1}{2}$ (2) $\frac{3}{4}$

(3) $\frac{1}{3}$ (4) $\frac{1}{4}$

Q11. Two ideal electric dipoles A and B, having their dipole moment p_1 and p_2 respectively are placed on a plane with their centres at O as shown in the figure. At point C on the axis of dipole A, the resultant electric field is making an angle of 37° with the axis. The ratio of the dipole moment of A and B, $\frac{p_1}{p_2}$ is: $\left(\text{take } \sin 37^\circ = \frac{3}{5}\right)$



(1) $\frac{3}{8}$ (2) $\frac{3}{2}$

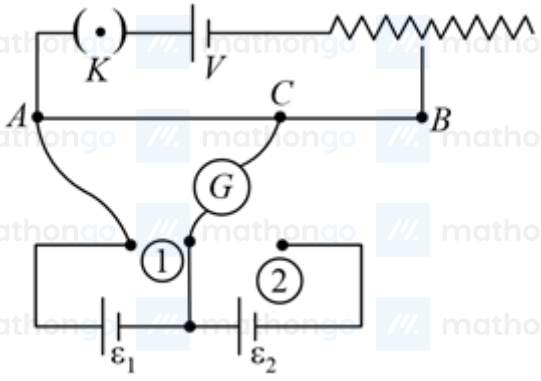
(3) $\frac{2}{3}$ (4) $\frac{4}{3}$

Q12. If q_f is the free charge on the capacitor plates and q_b is the bound charge on the dielectric slab of dielectric constant k placed between the capacitor plates, then bound charge q_b can be expressed as :

(1) $q_b = q_f\left(1-\frac{1}{\sqrt{k}}\right)$ (2) $q_b = q_i\left(1-\frac{1}{k}\right)$

(3) $q_b = q_f\left(1+\frac{1}{\sqrt{k}}\right)$ (4) $q_b = q_f\left(1+\frac{1}{k}\right)$

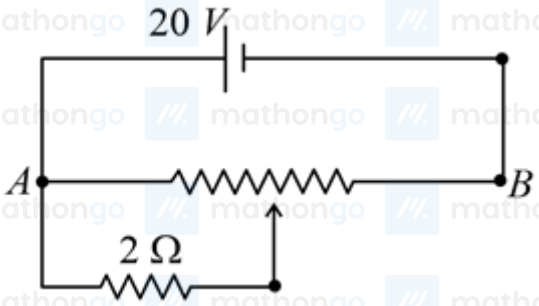
Q13. In the given potentiometer circuit arrangement, the balancing length AC is measured to be 250 cm. When the galvanometer connection is shifted from point (1) to point (2) in the given diagram, the balancing length becomes 400 cm. The ratio of the emf of two cells $\frac{\varepsilon_1}{\varepsilon_2}$ is:



(1) $\frac{5}{3}$ (2) $\frac{8}{5}$

(3) $\frac{4}{3}$ (4) $\frac{3}{2}$

Q14. The given potentiometer has its wire of resistance $10\ \Omega$. When the sliding contact is in the middle of the potentiometer wire, the potential drop across $2\ \Omega$ resistor is:



(1) 10 V
(2) 5 V
(3) $\frac{40}{9}$ V
(4) $\frac{40}{11}$ V

Q15. Two ions having same mass have charges in the ratio $1:2$. They are projected normally in a uniform magnetic field with their speeds in the ratio $2:3$. The ratio of the radii of their circular trajectories is,

(1) $1:4$
(2) $4:3$
(3) $3:1$
(4) $2:3$

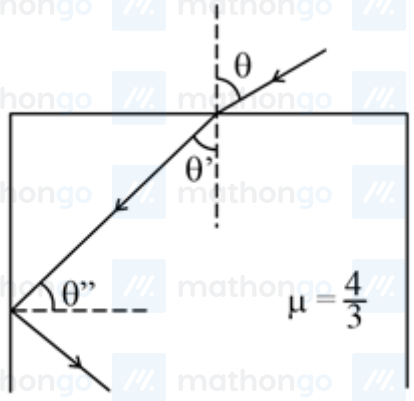
Q16. A $10\ \Omega$ resistance is connected across $220\ \text{V} - 50\ \text{Hz}$ AC supply. The time taken by the current to change from its maximum value to the rms value is:

(1) $2.5\ \text{ms}$
(2) $1.5\ \text{ms}$
(3) $3.0\ \text{ms}$
(4) $4.5\ \text{ms}$

Q17. A prism of refractive index μ and angle of prism A is placed in the position of minimum angle of deviation. If minimum angle of deviation is also A, then in terms of refractive,

(1) $2\cos^{-1}\left(\frac{\mu}{2}\right)$
(2) $\sin^{-1}\left(\frac{\mu}{2}\right)$
(3) $\sin^{-1}\left(\sqrt{\frac{\mu-1}{2}}\right)$
(4) $\cos^{-1}\left(\frac{\mu}{2}\right)$

Q18. A ray of light entering from air into a denser medium of refractive index $\frac{4}{3}$, as shown in figure.
The light ray suffers total internal reflection at the adjacent surface as shown. The maximum value of angle θ should be equal to:



(1) $\sin^{-1}\frac{\sqrt{7}}{3}$ (2) $\sin^{-1}\frac{\sqrt{5}}{4}$
(3) $\sin^{-1}\frac{\sqrt{7}}{4}$ (4) $\sin^{-1}\frac{\sqrt{5}}{3}$

Q19. An electron moving with speed v and a photon moving with speed c, have the same D-Broglie wavelength. The ratio of the kinetic energy of the electron to that of a photon is:
(1) $\frac{3c}{v}$ (2) $\frac{v}{3c}$
(3) $\frac{v}{2c}$ (4) $\frac{2c}{v}$

Q20. When radiation of wavelength λ is incident on a metallic surface, the stopping potential of ejected photoelectrons is 4.8 V. If the same surface is illuminated by radiation of double the previous wavelength, then the stopping potential becomes 1.6 V. The threshold wavelength of the metal is:
(1) 2λ (2) 4λ
(3) 8λ (4) 6λ

Q21. A force of $F = \left(5y + 20\right)\hat{j}$ N acts on a particle. The work done by this force when the particle is moved from $y = 0$ m to $y = 10$ m is _____J.

Q22. A solid disc of radius 20 cm and mass 10 kg is rotating with an angular velocity of 600 rpm, about an axis normal to its circular plane and passing through its centre of mass. The retarding torque required to bring the disc at rest in 10 s is _____$\pi \times 10^{-1}$ N m

Q23. A system consists of two types of gas molecules A and B having the same number density 2×10^{25} m^{-3}. The diameter of A and B are $10A$ and $5A$ respectively. They suffer collisions at room temperature. The ratio of average distance covered by the molecule A to that of B between two successive collisions is _____ $\times 10^{-2}$

Q24. A 16 Ω wire is bent to form a square loop. A 9 V supply having an internal resistance of 1 Ω is connected across one of its sides. The potential drop across the diagonals of the square loop is _____$\times 10^{-1}$ V.

Q25. Two circuits are shown in figure (a) and (b). At a frequency of _____ rad s^{-1} the average power dissipated in one cycle will be the same in both the circuits.

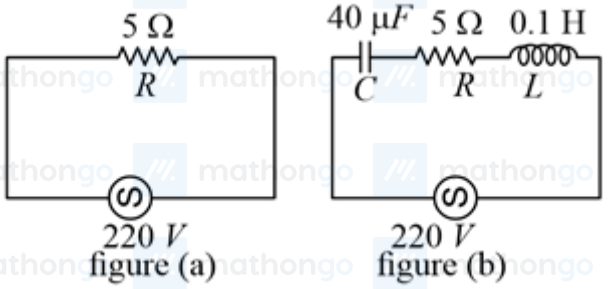


figure (a) figure (b)

Q26. A light beam of wavelength 500 nm is incident on a metal having work function of 1.25 eV, placed in a magnetic field of intensity B. The electrons emitted perpendicular to the magnetic field B, with maximum kinetic energy are bent into a circular arc of radius 30 cm. The value of B is _____$\times 10^{-7}$ T. Given $hc = 20 \times 10^{-26}$ J m, the mass of the electron$= 9 \times 10^{-31}$ kg.

Q27. From the given data, the amount of energy required to break the nucleus of aluminium $^{27}_{13}\mathrm{Al}$ is _____ $x \times 10^{-3}$ J

Mass of neutron $= 1.00866$ u

Mass of proton $= 1.00726$ u

Mass of Aluminium nucleus $= 27.18846$ u

(Assume 1 u corresponds to x J of energy)

(Round off to the nearest integer)

Q28. The nuclear activity of a radioactive element becomes $\left(\frac{1}{8}\right)^{\text{th}}$ of its initial value in 30 years. The half-life of radioactive element is _____ years.

Q29. In a semiconductor, the number density of intrinsic charge carriers at $27^{\circ}\mathrm{C}$ is $1.5 \times 10^{16}\ \mathrm{m}^{-3}$. If the semiconductor is doped with an impurity atom, the hole density increases to $4.5 \times 10^{22}\ \mathrm{m}^{-3}$. The electron density in the doped semiconductor is _____ $\times 10^{9}\ \mathrm{m}^{-3}$

Q30. A message signal of frequency 20 kHz and peak voltage of 20 V is used to modulate a carrier wave of frequency 1 MHz and peak voltage of 20 V. The modulation index will be:

Q31. The spin only magnetic moments (in BM) for free Ti^{3+}, V^{2+} and Sc^{3+} ions respectively are

(At.No. Sc : 21, Ti : 22, V : 23)

(1) $3.87, 1.73, 0$

(2) $1.73, 3.87, 0$

(3) $1.73, 0, 3.87$

(4) $0, 3.87, 1.73$

Q32. The ionic radii of F^{-} and O^{2-} respectively are 1.33 A and 1.4A, while the covalent radius of N is 0.74A The correct statement for the ionic radius of N^{3-} from the following is :

(1) It is smaller than F^{-} and N

(2) It is bigger than O^{2-} and F^{-}

(3) It is bigger than F^{-} and N, but smaller than of O^{2-}

(4) It is smaller than O^{2-} and F^{-}, but bigger than of N

Q33. In the following the correct bond order sequence is:

(1) $\mathrm{O}_2^{2-} > \mathrm{O}_2^{+} > \mathrm{O}_2^{-} > \mathrm{O}_2$

(2) $\mathrm{O}_2^{+} > \mathrm{O}_2^{-} > \mathrm{O}_2^{2-} > \mathrm{O}_2$

(3) $\mathrm{O}_2^{+} > \mathrm{O}_2 > \mathrm{O}_2^{-} > \mathrm{O}_2^{2-}$

(4) $\mathrm{O}_2 > \mathrm{O}_2^{-} > \mathrm{O}_2^{2-} > \mathrm{O}_2^{+}$

Q34. Identify the species having one π -bond and maximum number of canonical forms from the following :

(1) SO_3

(2) O_2

(3) SO_2

(4) CO_3^{2-}

Q35. Identify the process in which change in the oxidation state is five :

(1) $\mathrm{Cr}_2\,\mathrm{O}_7^{2-} \rightarrow 2\,\mathrm{Cr}^{3+}$

(2) $\mathrm{MnO}_4^{-} \rightarrow \mathrm{Mn}^{2+}$

(3) $\mathrm{CrO}_4^{2-} \rightarrow \mathrm{Cr}^{3+}$

(4) $\mathrm{C}_2\mathrm{O}_4^{2-} \rightarrow 2\,\mathrm{CO}_2$

Q36. Which one of the following metals forms interstitial hydride easily ?

(1) Cr

(2) Fe

(3) Mn

(4) Co

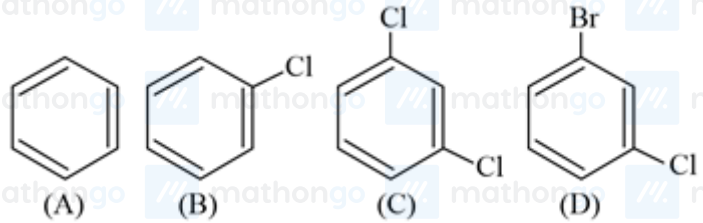
Q37. Match List I with List II :

List-I Elements		List-II Properties
(a) Li	(i)	Poor water solubility of I^- salt
(b) Na	(ii)	Most abundant element in cell fluid
(c) K	(iii)	Bicarbonate salt used in fire extinguisher
(d) Cs	(iv)	Carbonate salt decomposes easily on heating

Choose the correct answer from the options given below:

(1) (a) – (iv), (b) – (iii), (c) – (ii), (d) – (i)
(2) (a) – (i), (b) – (iii), (c) – (ii), (d) – (iv)
(3) (a) – (iv), (b) – (ii), (c) – (iii), (d) – (i)
(4) (a) – (i), (b) – (ii), (c) – (iii), (d) – (iv)

Q38. The correct decreasing order of densities of the following compounds is :

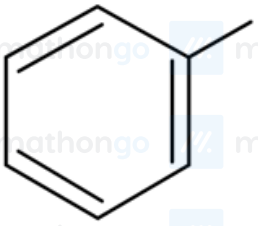


(1) (D) > (C) > (B) > (A)
(2) (C) > (D) > (A) > (B)
(3) (C) > (B) > (A) > (D)
(4) (A) > (B) > (C) > (D)

Q39. Which among the following is the strongest acid?

(1) $CH_3\,CH_2\,CH_2\,CH_3$

(2)



(3)

(4)

Q40. Given below are two statements :

Statement I : Chlorofluoro carbons breakdown by radiation in the visible energy region and release chlorine gas in the atmosphere which then reacts with stratospheric ozone.

Statement II : Atmospheric ozone reacts with nitric oxide to give nitrogen and oxygen gases, which add to the atmosphere.

For the above statements choose the correct answer from the options given below :

(1) Statement I is incorrect but statement II is true (2) Both statement I and II are false
(3) Statement I is correct but statement II is false (4) Both statement I and II are correct

Q41. Match List I with List II :

List-I Example of colloids	List-II Classification
(a) Cheese	(i) dispersion of liquid in liquid
(b) Pumice stone	(ii) dispersion of liquid in gas
(c) Hair cream	(iii) dispersion of gas in solid
(d) Cloud	(iv) dispersion of liquid in solid

Choose the most appropriate answer from the options given below

(1) (a) – (iv), (b) – (iii), (c) – (ii), (d) – (i) (2) (a) – (iv), (b) – (i), (c) – (iii), (d) – (ii)
(3) (a) – (iii), (b) – (iv), (c) – (i), (d) – (ii) (4) (a) – (iv), (b) – (iii), (c) – (i), (d) – (ii)

Q42. Match List I with List II : (Both having metallurgical terms)

	List-I		List-II
(a)	Concentration of Ag ore	(i)	Reverberatory furnace
(b)	Blast furnace	(ii)	Pig iron
(c)	Blister copper	(iii)	Leaching with dilute NaCN solution
(d)	Froth floatation method	(iv)	Sulfide ores

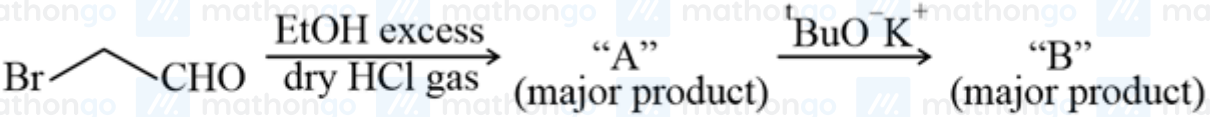
Choose the correct answer from the options given below:

(1) (a) – (iii), (b) – (ii), (c) – (i), (d) – (iv) (2) (a) – (iii), (b) – (iv), (c) – (i), (d) – (ii)
(3) (a) – (iv), (b) – (i), (c) – (iii), (d) – (ii) (4) (a) – (iv), (b) – (iii), (c) – (ii), (d) – (i)

Q43. Which one of the following metal complexes is most stable?

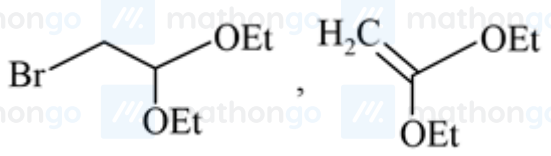
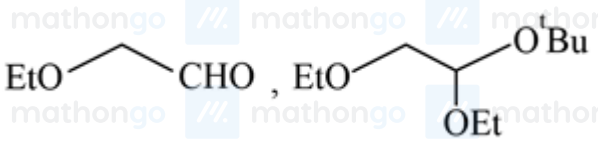
(1) $[Co(en)(NH_3)_4]Cl_2$ (2) $[Co(en)_3]Cl_2$
(3) $[Co(en)_2(NH_3)_2]Cl_2$ (4) $[Co(NH_3)_6]Cl_2$

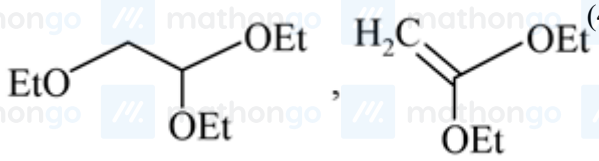
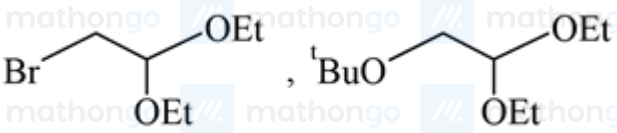
Q44.



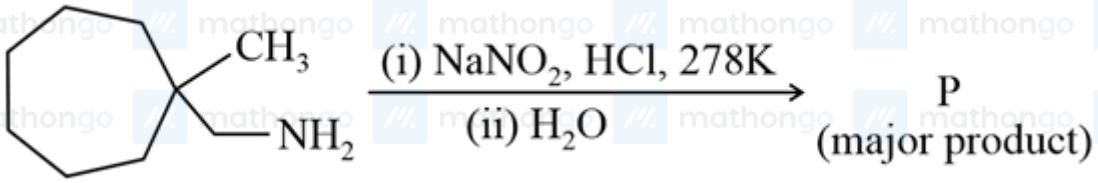
[Where Et ⇒ - C_2H_5 ^tBu ⇒ $(CH_3)_3C$-]

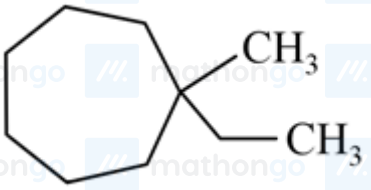
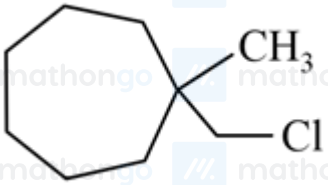
Consider the above reaction sequence, Product "A" and Product "B" formed respectively are:

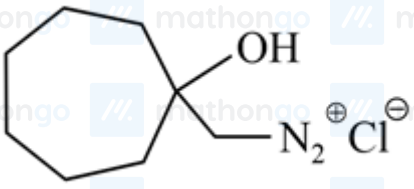
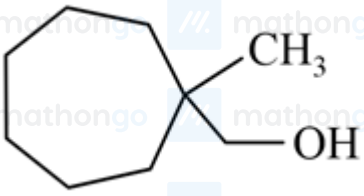
(1)  (2) 

(3)  (4) 

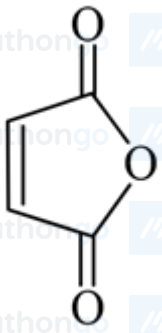
Q45. What is the major product "P" of the following reaction ?



(1)  (2) 

(3)  (4) 

Q46.



Maleic anhydride

Maleic anhydride can be prepared by :

(1) Heating trans-but-2-enedioic acÄ±d

(2) Heating cis-but-2-enedioic acid

(3) Treating cis-but-2-enedioic acid with alcohol and acid

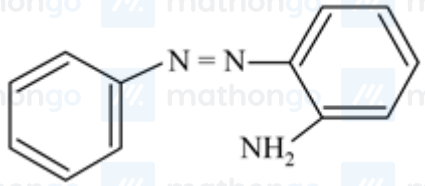
(4) Treating trans-but-2-enedioic acid with alcohol and acid

Q47.

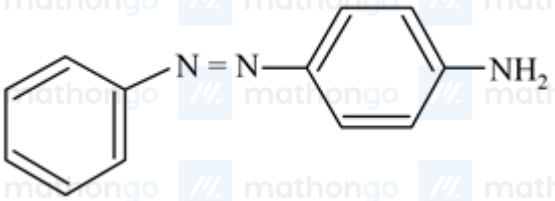
$$C_6H_5NO_2 \xrightarrow{Sn + HCl} \text{“A”} \xrightarrow[H^{\oplus}]{C_6H_5N_2^{\oplus}Cl^{\ominus}} \underset{\text{(Yellow coloured compound)}}{P}$$

Consider the above reaction, the Product "P" is :

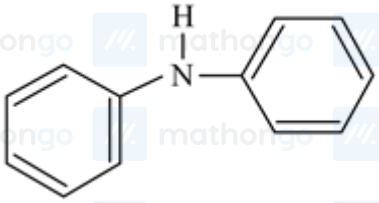
(1)



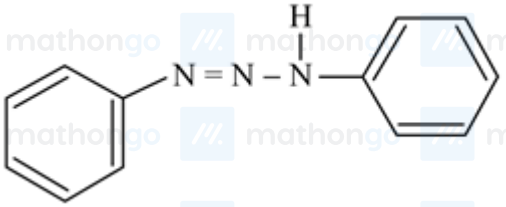
(2)



(3)



(4)



Q48. A reaction of benzonitrile with one equivalent CH_3MgBr followed by hydrolysis produces a yellow liquid "P". The compound "P" will give positive _____

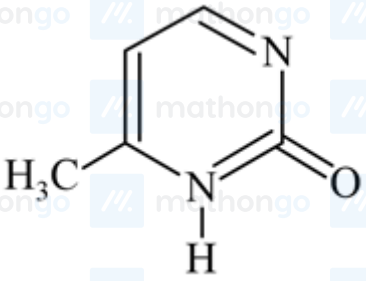
(1) Iodoform test
(2) Schiff's test
(3) Ninhydrin's test
(4) Tollen's test

Q49. A biodegradable polyamide can be made from:

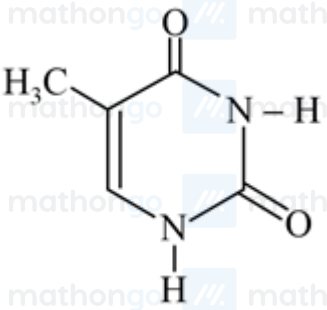
(1) Glycine and isoprene
(2) Hexamethylene diamine and adipic acid
(3) Glycine and aminocaproic acid
(4) Styrene and caproic acid

Q50. Which one of the following is correct structure for cytosine ?

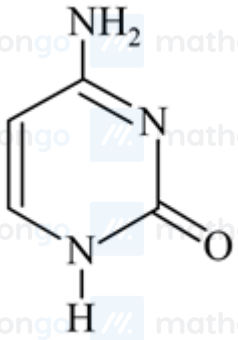
(1)



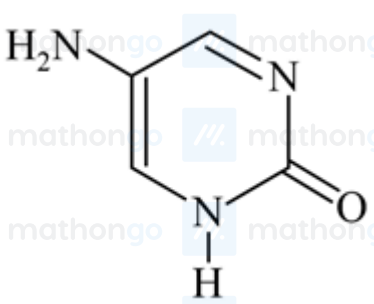
(2)



(3)



(4)



Q51. The number of significant figures in 0.00340 is _____

Q52. An accelerated electron has a speed of 5×10^6 ms^{-1} with an uncertainty of 0.02%. The uncertainty in finding its location while in motion is $x \times 10^{-9}$ m.
The value of x is _____. (Nearest integer)
[Use mass of electron$= 9.1 \times 10^{-31}$ kg,
$h = 6.63 \times 10^{-34}$ Js, $\pi = 3.14$]

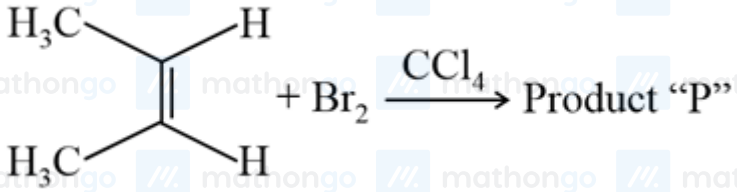
Q53. An LPG cylinder contains gas at a pressure of 300 kPa at 27°C. The cylinder can withstand the pressure of 1.2×10^6 Pa. The room in which the cylinder is kept catches fire. The minimum temperature at which the bursting of cylinder will take place is _____ $^{\circ}$C. (Nearest integer)

Q54. A system does 200 J of work and at the same time absorbs 150 J of heat. The magnitude of the change in internal energy is _____J. (Nearest integer)

Q55. Assuming that $Ba(OH)_2$ is completely ionised in aqueous solution under the given conditions the concentration of H_3O^+ ions in 0.005M
aqueous solution of $Ba(OH)_2$ at 298 K is _____ $\times 10^{-12}$ mol L^{-1}. (Nearest integer)

Q56. 0.8 g of an organic compound was analysed by Kjeldahl's method for the estimation of nitrogen. If the percentage of nitrogen in the compound was found to be 42%, then..... mL of 1M H_2SO_4 would have been neutralized by the ammonia evolved during the analysis.

Q57.



Consider the above chemical reaction. The total number of stereoisomers possible for Product "P" is _____

Q58. When 3.00 g of a substance X' is dissolved in 100 g of CCl_4, it raises the boiling point by 0.60 K. The molar mass of the substance ' X′ is ___ g mol^{-1}.
(Nearest integer).
[Given K_b for CCl_4 is 5.0 K kg mol^{-1}]

Q59. For a chemical reaction A → B, it was found that concentration of B is increased by 0.2 mol L^{-1} in 30 min. The average rate of the reaction is _____ $\times 10^{-1}$ mol L^{-1} h^{-1}. (in nearest integer)

Q60. Number of electrons present in 4f orbital of Ho^{3+} ion is _____ (Given Atomic No. of Ho =67)

Q61. The number of real solutions of the equation, $x^2 - |x| - 12 = 0$ is:
(1) 2 (2) 3
(3) 1 (4) 4

Q62. The sum of all those terms which are rational numbers in the expansion of $\left(2^{\frac{1}{3}} + 3^{\frac{1}{4}}\right)^{12}$ is:
(1) 89 (2) 27
(3) 35 (4) 43

Q63. If the greatest value of the term independent of x in the expansion of $\left(x \sin\alpha + a\frac{\cos\alpha}{x}\right)^{10}$ is $\frac{10!}{(5!)^2}$, then the value of a is equal to:
(1) -1 (2) 1
(3) -2 (4) 2

Q64. The lowest integer which is greater than $\left(1 + \frac{1}{10^{100}}\right)^{10^{100}}$ is
(1) 3 (2) 4
(3) 2 (4) 1

Q65. If ${}^nP_r = {}^nP_{r+1}$ and ${}^nC_r = {}^nC_{r-1}$, then the value of r is equal to:
(1) 1 (2) 4
(3) 2 (4) 3

Q66. The value of $\cot\frac{\pi}{24}$ is:
(1) $\sqrt{2}+\sqrt{3}+2-\sqrt{6}$ (2) $\sqrt{2}+\sqrt{3}+2+\sqrt{6}$
(3) $\sqrt{2}-\sqrt{3}-2+\sqrt{6}$ (4) $3\sqrt{2}-\sqrt{3}-\sqrt{6}$

Q67. The number of distinct real roots of $\begin{vmatrix} \sin x & \cos x & \cos x \\ \cos x & \sin x & \cos x \\ \cos x & \cos x & \sin x \end{vmatrix} = 0$ in the interval $-\frac{\pi}{4} \leq x \leq \frac{\pi}{4}$ is:

(1) 4 (2) 1

(3) 2 (4) 3

Q68. Let the equation of the pair of lines, $y = px$ and $y = qx$, can be written as $(y - px)(y - qx) = 0$. Then the equation of the pair of the angle bisectors of the lines $x^2 - 4xy - 5y^2 = 0$ is:

(1) $x^2 - 3xy + y^2 = 0$ (2) $x^2 + 4xy - y^2 = 0$

(3) $x^2 + 3xy - y^2 = 0$ (4) $x^2 - 3xy - y^2 = 0$

Q69. If a tangent to the ellipse $x^2 + 4y^2 = 4$ meets the tangents at the extremities of its major axis at B and C, then the circle with BC as diameter passes through the point.

(1) $\left(\sqrt{3}, 0\right)$ (2) $\left(\sqrt{2}, 0\right)$

(3) $(1, 1)$ (4) $(-1, 1)$

Q70. Consider the statement "The match will be played only if the weather is good and ground is not wet". Select the correct negation from the following:

(1) The match will not be played and weather is not good and ground is wet.

(2) If the match will not be played, then either weather is not good or ground is wet.

(3) The match will be played and weather is not good or ground is wet.

(4) The match will not be played or weather is good and ground is not wet.

Q71. The first of the two samples in a group has 100 items with mean 15 and standard deviation 3. If the whole group has 250 items with mean 15. 6 and standard deviation $\sqrt{13.44}$, then the standard deviation of the second sample is:

(1) 8 (2) 6

(3) 4 (4) 5

Q72. If $P = \begin{bmatrix} 1 & 0 \\ \frac{1}{2} & 1 \end{bmatrix}$, then P^{50} is:

(1) $\begin{bmatrix} 1 & 0 \\ 25 & 1 \end{bmatrix}$ (2) $\begin{bmatrix} 1 & 50 \\ 0 & 1 \end{bmatrix}$

(3) $\begin{bmatrix} 1 & 25 \\ 0 & 1 \end{bmatrix}$ (4) $\begin{bmatrix} 1 & 0 \\ 50 & 1 \end{bmatrix}$

Q73. If $[x]$ be the greatest integer less than or equal to x, then $\sum_{n=8}^{100} \left[\frac{(-1)^n n}{2}\right]$ is equal to:

(1) 0 (2) 4

(3) -2 (4) 2

Q74. Consider function $f : A \to B$ and $g : B \to C (A, B, C \subseteq R)$ such that $(gof)^{-1}$ exists, then:

(1) f and g both are one-one (2) f and g both are onto

(3) f is one-one and g is onto (4) f is onto and g is one-one

Q75. If $f(x)=\begin{cases}\int_0^x(5+|1-t|)dt, & x>2\\ 5x+1, & x\le 2\end{cases}$, then

(1) $f(x)$ is not continuous at$x=2$ (2) $f(x)$ is everywhere differentiable

(3) $f(x)$ is continuous but not differentiable at $x=2$ (4) $f(x)$ is not differentiable at $x=1$

Q76. The value of the integral $\int_{-1}^{1}\log\left(x+\sqrt{x^2+1}\right)dx$ is:

(1) 2 (2) 0

(3) -1 (4) 1

Q77. Let $y=y(x)$ be the solution of the differential equation $xdy=\left(y+x^3\cos x\right)dx$ with $y(\pi)=0$, then $y\left(\frac{\pi}{2}\right)$ is equal to:

(1) $\frac{\pi^2}{4}+\frac{\pi}{2}$ (2) $\frac{\pi^2}{2}+\frac{\pi}{4}$

(3) $\frac{\pi^2}{2}-\frac{\pi}{4}$ (4) $\frac{\pi^2}{4}-\frac{\pi}{2}$

Q78. Let a, b and c be distinct positive numbers. If the vectors $a\hat{i}+a\hat{j}+c\hat{k}, \hat{i}+\hat{k}$ and $c\hat{i}+c\hat{j}+b\hat{k}$ are co-planar, then c is equal to:

(1) $\frac{2}{\frac{1}{a}+\frac{1}{b}}$ (2) $\frac{a+b}{2}$

(3) $\frac{1}{a}+\frac{1}{b}$ (4) $\sqrt{ab}$

Q79. If $\left|\vec{a}\right|=2, \left|\vec{b}\right|=5$ and $\left|\vec{a}\times\vec{b}\right|=8$, then $\left|\vec{a}\cdot\vec{b}\right|$ is equal to:

(1) 6 (2) 4

(3) 3 (4) 5

Q80. Let X be a random variable such that the probability function of a distribution is given by $P(X=0)=\frac{1}{2}, P(X=j)=\frac{1}{3^j}(j=1,2,3,\ldots,\infty)$. Then the mean of the distribution and $P(X$ is positive and even) respectively, are:

(1) $\frac{3}{8}$ and $\frac{1}{8}$ (2) $\frac{3}{4}$ and $\frac{1}{8}$

(3) $\frac{3}{4}$ and $\frac{1}{9}$ (4) $\frac{3}{4}$ and $\frac{1}{16}$

Q81. If $a+b+c=1, ab+bc+ca=2$ and $abc=3$, then the value of $a^4+b^4+c^4$ is equal to:

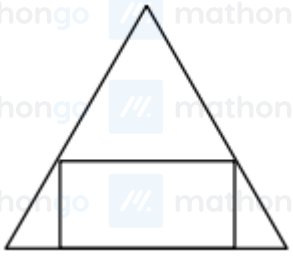
Q82. The equation of a circle is $\text{Re}\left(z^2\right)+2(\text{Im}(z))^2+2\ \text{Re}\ (z)=0$, where $z=x+iy$. A line which passes through the centre of the given circle and the vertex of the parabola, $x^2-6x-y+13=0$, has y-intercept equal to _____.

Q83. Let $n\in\boldsymbol{N}$ and $[x]$ denote the greatest integer less than or equal to x. If the sum of $(n+1)$ terms of ${}^nC_0, 3\cdot{}^nC_1, 5\cdot{}^nC_2, 7\cdot{}^nC_3,\ldots$ is equal to $2^{100}\cdot 101$, then $2\left[\frac{n-1}{2}\right]$ is equal to

Q84. If the co-efficient of x^7 and x^8 in the expansion of $\left(2+\frac{x}{3}\right)^n$ are equal, then the value of n is equal to :

Q85. Consider the function $f(x)=\frac{P(x)}{\sin(x-2)}$, $x\neq 2$, and $f(x)=7$, $x=2$where $P(x)$ is a polynomial such that $P''(x)$ is always a constant and $P(3)=9$. If $f(x)$ is continuous at $x=2$, then $P(5)$ is equal to _____.

Q86. If a rectangle is inscribed in an equilateral triangle of side length $2\sqrt{2}$ as shown in the figure, then the square of the largest area of such a rectangle is _____.



Q87. Let a curve $y = f(x)$ pass through the point $\left(2, (\log_e 2)^2\right)$ and have slope $\frac{2y}{x \log_e x}$ for all positive real values of x. Then the value of $f(e)$ is equal to _____.

Q88. If $\vec{a}$ and $\vec{b}$ are unit vectors and $\left(\vec{a} + 3\vec{b}\right)$ is perpendicular to $\left(7\vec{a} - 5\vec{b}\right)$ and $\left(\vec{a} - 4\vec{b}\right)$ is perpendicular to $\left(7\vec{a} - 2\vec{b}\right)$, then the angle between $\vec{a}$ and $\vec{b}$ (in degrees) is _____.

Q89. If the lines $\frac{x-k}{1} = \frac{y-2}{2} = \frac{z-3}{3}$ and $\frac{x+1}{3} = \frac{y+2}{2} = \frac{z+3}{1}$ are co-planar, then the value of k is _____.

Q90. A fair coin is tossed $n-$ times such that the probability of getting at least one head is at least 0.9. Then the minimum value of n is _____.

ANSWER KEYS

1. (2)	**2.** (2)	**3.** (1)	**4.** (3)	**5.** (2)	**6.** (3)	**7.** (3)	**8.** (4)
9. (3)	**10.** (2)	**11.** (3)	**12.** (2)	**13.** (1)	**14.** (3)	**15.** (2)	**16.** (1)
17. (1)	**18.** (1)	**19.** (3)	**20.** (2)	**21.** (450)	**22.** (4)	**23.** (25)	**24.** (45)
25. (500)	**26.** (125)	**27.** (27)	**28.** (10)	**29.** (5)	**30.** (1)	**31.** (2)	**32.** (2)
33. (3)	**34.** (4)	**35.** (2)	**36.** (1)	**37.** (1)	**38.** (1)	**39.** (4)	**40.** (2)
41. (4)	**42.** (1)	**43.** (2)	**44.** (1)	**45.** (4)	**46.** (2)	**47.** (2)	**48.** (1)
49. (3)	**50.** (3)	**51.** (3)	**52.** (58)	**53.** (927)	**54.** (50)	**55.** (1)	**56.** (12)
57. (2)	**58.** (250)	**59.** (4)	**60.** (10)	**61.** (1)	**62.** (4)	**63.** (4)	**64.** (1)
65. (3)	**66.** (2)	**67.** (2)	**68.** (3)	**69.** (1)	**70.** (3)	**71.** (3)	**72.** (1)
73. (2)	**74.** (3)	**75.** (3)	**76.** (2)	**77.** (1)	**78.** (4)	**79.** (1)	**80.** (2)
81. (13)	**82.** (1)	**83.** (98)	**84.** (55)	**85.** (39)	**86.** (3)	**87.** (1)	**88.** (60)
89. (1)	**90.** (4)						