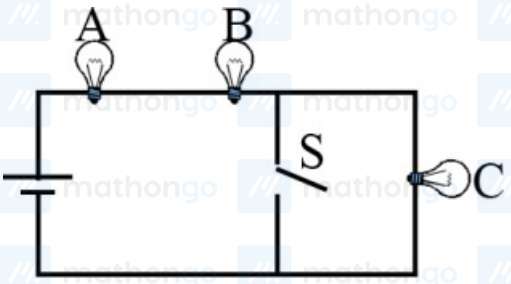
Q1

A circuit consists of three identical lamps connected to a battery as shown in the figure. When the switch S is closed then the intensities of lamps A and B



(1) will increase by eight times

(2) will decrease by two times

(3) will increase by more than two times

(4) will remain the same

Q2

Select the dimensional formula of $\frac{B^2}{2\mu_0}$

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

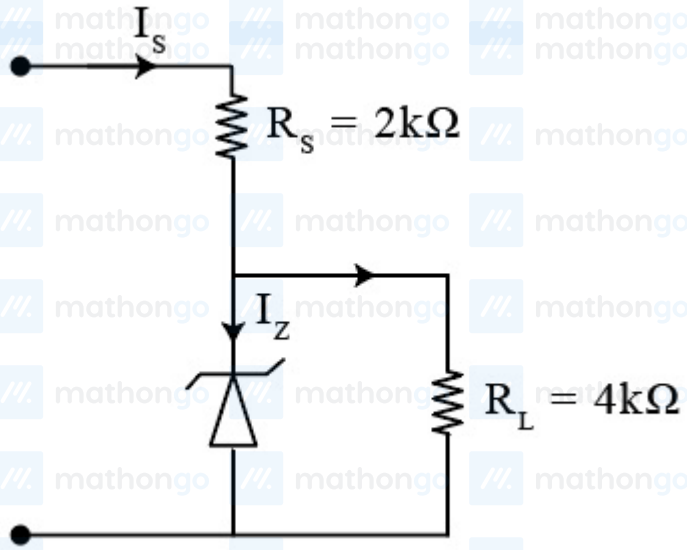
(2) $\left[\mathrm{M}^{-1}\mathrm{L}^1\mathrm{T}^2\right]$

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

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

Q3

In the figure there is a DC voltage regulator circuit, with a Zener breakdown voltage $= 6$ V. If the unregulated input voltage varies between 10 V to 16 V, then what is the maximum Zener current?



(1) $1.5\,mA$

(2) $7.5\,mA$

(3) $3.5\,mA$

(4) $2.5\,mA$

Q4

Between the plates of a parallel plate capacitor of plate area A and capacity $0.025\mu F$, a metal plate of area, A and thickness equal to $\frac{1}{3}$ of the separation between the plates of the capacitor is introduced. If the capacitor is charged to 100 V and battery is removed, then the amount of work done to remove the metal plate from the capacitor is

(1) $62.5\mu J$

(2) $30.2\mu J$

(3) $52.6\mu J$

(4) $93.8\mu J$

Q5

The pressure on a circular plate is measured by measuring the force on the plate and the radius of the plate. If the errors in measurement of the force and the radius are 5% and 3% respectively, the percentage of error in the measurement of pressure is

(1) 8

(2) 14

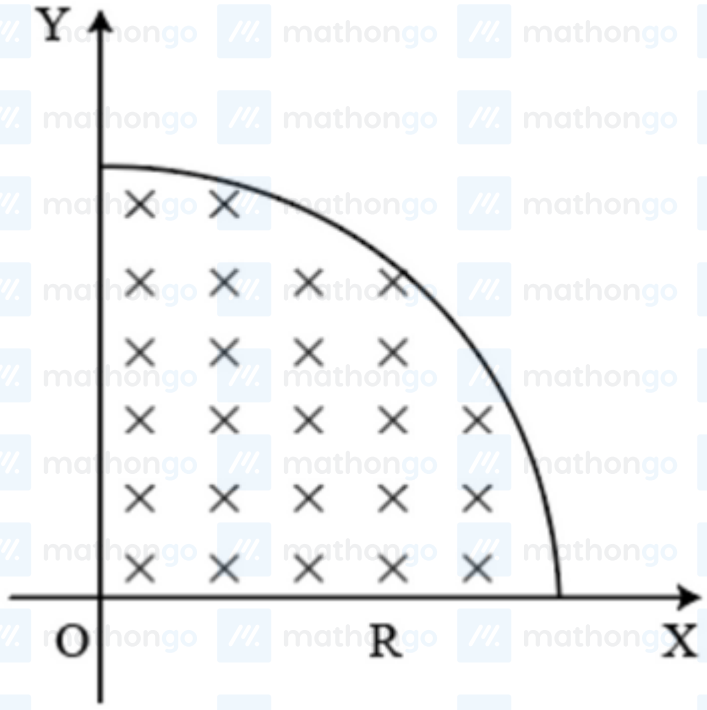
(3) 11

(4) 12

Q6

The quarter disc of radius R (see figure) has a uniform surface charge density σ.

Find electric potential at a point (O, O, Z).



(1) $\frac{\sigma}{8\epsilon_0}\left[1-\frac{Z}{\sqrt{R^2+Z^2}}\right]$

(2) $\frac{\sigma}{4\epsilon_0}\left[\sqrt{R^2+Z^2}+Z\right]$

(3) $\frac{\sigma}{8\epsilon_0}\left[\sqrt{R^2+Z^2}-Z\right]$

(4) $\frac{\sigma}{8\epsilon_0}\left[1+\frac{Z}{\sqrt{R^2+Z^2}}\right]$

Q7

A, B, C are points on a vertical line such that AB $=$ BC. If a body is dropped from rest at A, and t_1 and t_2 are the time to travel for distance AB and BC, then ratio $\left(\frac{t_2}{t_1}\right)$ is

(1) $\sqrt{2}+1$

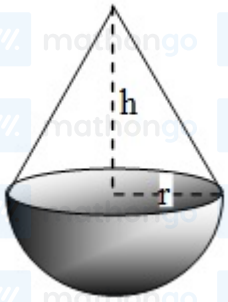
(2) $\sqrt{2}-1$

(3) $2\sqrt{2}$

(4) $\frac{1}{\sqrt{2}+1}$

Q8

A uniform solid right circular cone of base radius r is joined to a uniform solid hemisphere of radius r and of the same density, so as to have a common face. The centre of mass of the composite solid lies on the common face. The height of the cone is



(1) 2r

(2) $\sqrt{3}$r

(3) 3r

(4) $\sqrt{6}$r

Q9

Statement-1 : If equal charge is put uniformly on a surface of two identical plates one of metal and other non metal then electric field in front of metal plate will be more.

Statement-2 : Electric field in front of non metal sheet is $\frac{\sigma}{2\varepsilon_0}$ where σ is the surface charge density.

(1) Statement- 1 is True, Statement- 2 is True, Statement- 2 is a correct explanation for statement-1

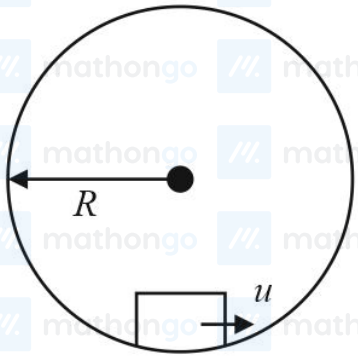
(2) Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement- 2 is True

Q10

A block of mass m is placed at the lowest point of a smooth vertical track of radius R. In this position, the block is given a horizontal velocity u such that the block is just able to perform a complete vertical circular motion. The acceleration of block, when its velocity is vertical is



(1) g

(2) 3g

(3) $g\sqrt{10}$

(4) $2\sqrt{2}g$

Q11

A galvanometer of resistance $22.8\ \Omega$ measures 1 A. How much shunt should be used, so that it can be used to measure 20 A?

(1) $1\ \Omega$

(2) $2\ \Omega$

(3) $1.2\ \Omega$

(4) $2.2\ \Omega$

Q12

An electron of charge e and mass m moving with an initial velocity $v_0\hat{i}$ is subjected to an electric field $E_0\hat{j}$. The de-Broglie wavelength of the electron at a time t is (Initial de-Broglie wavelength of the electron $= \lambda_0$)

(1) λ_0

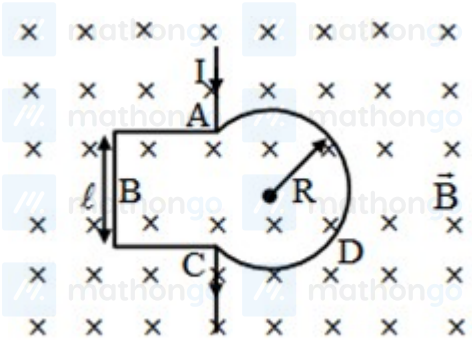
(2) $\lambda_0\sqrt{1+\frac{e^2E_0^2t^2}{m^2v_0^2}}$

(3) $\frac{\lambda_0}{\sqrt{1+\frac{e^2E_0^2t^2}{m^2v_0^2}}}$

(4) $\frac{\lambda_0}{\left(1+\frac{e^2E_0^2t^2}{mv_0^2}\right)}$

Q13

Figure shows a conducting loop ABCDA placed in a uniform magnetic field B perpendicular to its plane. The part ABC is the $\left(\frac{3}{4}\right)^{\text{th}}$ the portion of the square of side length l. The part ADC is a circular arc of radius R. The point A and C are connected to a battery which supplies a current I to the circuit. The magnetic force on the loop due to the field B is



(1) zero

(2) $2BIl$

(3) BIl

(4) $\frac{BIlR}{l+R}$

Q14

A spherical uniform planet is rotating about its axis. The velocity of a point on its equator is V. Due to the rotation of the planet about its axis the acceleration due to gravity g at equator is $1/2$ of g at poles. The escape velocity of a particle on the planet in terms of V from the pole of the planet is

(1) $V_e = 2V$

(2) $V_e = V$

(3) $V_e = V/2$

(4) $V_e = \sqrt{3}V$

Q15

Two identical vessels contain two different ideal gases at the same temperature. If the average speed of gas molecules in the first vessel is equal to the most probable speed of molecules in the second vessel, then the ratio of the mass of gas molecules in the first vessel to that in the second vessel is

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

(2) $\frac{8}{\pi}$

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

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

Q16

If the binding energy of N^{14} is 7.5 MeV per nucleon and that of N^{15} is 7.7 MeV per nucleon. then the energy required to remove a neutron from N^{15} is

(1) 5.25 MeV

(2) 0.2 MeV

(3) 10.5 MeV

(4) 0.4 MeV

Q17

A biconvex lens of focal length 15 cm is in front of a plane mirror. The distance between the lens and the mirror is 10 cm. A small object is kept at a distance of 30 cm from the lens. The final image is

(1) Virtual and at a distance of 16 cm from the mirror

(2) Real and at a distance of 16 cm from the mirror

(3) Virtual and at a distance of 20 cm from the mirror

(4) None of the above

Q18

Assertion: When height of a tube is less than liquid rise in the capillary tube, the liquid does not overflow.
Reason: Product of radius of meniscus and height of liquid in the capillary tube always remain constant.

(1) If both assertion and reason are true and reason is the correct explanation of assertion.

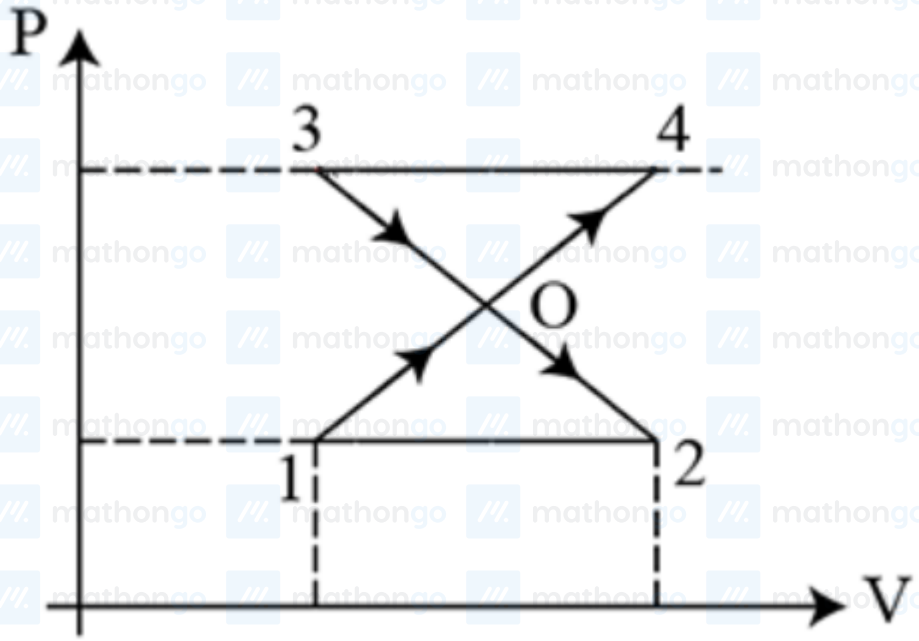
(2) If both assertion and reason are true but reason is not the correct explanation of assertion.

(3) If assertion is true but reason is false.

(4) If both assertion and reason are false.

Q19

Determine the work done by an ideal gas undergoing a cyclic process from $1 \rightarrow 4 \rightarrow 3 \rightarrow 2 \rightarrow 1$. Given $P_1 = 10^5$ Pa, $P_0 = 3 \times 10^5$ Pa, $P_3 = 4 \times 10^5$ Pa and $V_2 - V_1 = 10$ L



(1) 740 J

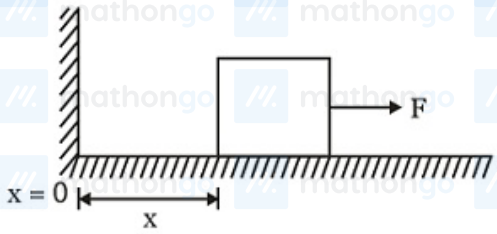
(2) 750 J

(3) 730 J

(4) 745 J

Q20

The block of mass 'm' initially at x = 0 is acted upon by a horizontal force F = a - bx as shown in the figure. The coefficient of friction between the surfaces of contact is μ. The net work done on the block is zero if the block travels a distance of _____.



(1) $(a-\mu mg)/2b$

(2) $(a-\mu mg)/b$

(3) $2(a-\mu mg)/b$

(4) $(a-2\mu mg)/b$

Q21

Consider a hydrogen like atom whose energy in n^{th} excited state is given by $E_n = -\frac{13.6}{n^2}Z^2$ when this excited atom makes a transition from an excited state to ground state. The most energetic photons have energy $E_{max} = 52.224eV$ and the least energetic photons have energy $E_{min} = 1.224eV$. Find the atomic number of atom.

Q22

The magnetic flux through metal ring varies with time t according to $\phi = 3\left(at^3 - bt^2\right)$ Wb. with $a = 2sec^{-3}$ and $b = 6sec^{-2}$. The resistance of the ring is 3Ω. Determine the maximum current induced in the ring during internal from $t = 0$ to $t = 2sec$. (Mark absolute value as answer)

Q23

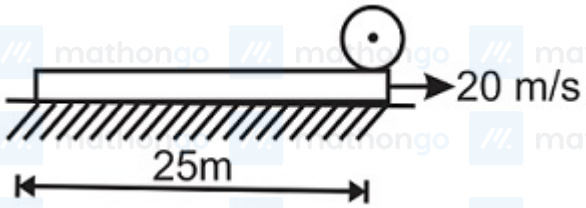
In Young's double-slit experiment, the two slits which are separated by 1.2 mm are illuminated with a monochromatic light of wavelength 6000 $\mathring{A}$. The interference pattern is observed on a screen placed at a distance of 1 m from the slits. Find the number of bright fringes formed over 1 cm width on the screen.

Q24

If two wires of same length l and area of the cross-section A with Young modulus Y and $2Y$ connect in series and one end is fixed on roof and another end with mass m make simple harmonic motion, then the time period is $2\pi\sqrt{\frac{Kml}{2YA}}$, find integral value of K.

Q25

A solid cylinder is kept on one edge of a plank of same mass and length 25 m placed on a smooth surface as shown in the figure. The coefficient of friction between the cylinder and the plank is 0.5. The plank is given a velocity of 20 m s^{-1} towards right. Find the time (in s) after which plank and cylinder will separate. [g = 10 m s^{-2}]



Q26

Match the following.

List-I (Molecules)		List-II (Dipole moment)
A. HBr	I	1.04
B. H_2S	II.	0
C. NH_3	III.	0.79
D $CHCl_3$	IV.	0.95
	V.	1.47

The correct match is

A B C D

(1) I V IV III

(2) III IV V I

(3) I V II IV

(4) IV V I III

Q27

Which of the following pair is expected to exhibit the same colour in solution?

(1) $VOCl_2$; $ZnSO_4$

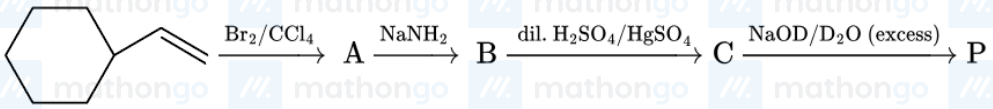
(2) $MnCl_2$; $ZnSO_4$

(3) $CuCl_2$, $HgCl_2$

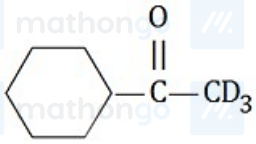
(4) $CuCl_2$; $VOCl_2$

Q28

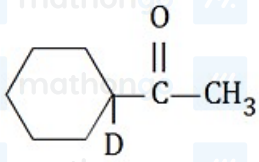
Final product (p) in the sequence of reaction is



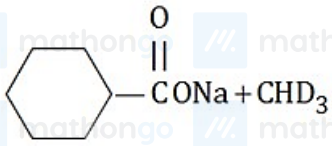
(1)



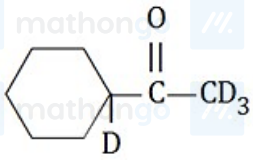
(2)



(3)



(4)



Q29

At 400 K, in a 1.0 L vessel, N_2O_4 is allowed to attain equilibrium, $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ At equilibrium, the total pressure is 600 mmHg, when 20% of N_2O_4 is dissociated. The value of K_p for the reaction is

(1) 125

(2) 100

(3) 150

(4) 200

Q30

Which of the following sets is in the correct order regarding the property mentioned against them?

	Sets	Property
I.	$NCCH_2COOH > FCH_2COOH > H_3CCH_2COOH$	Acidity
II.	$CH_3CH_2CHO > PhCOCH_3 > PhCHO$	Reactivity
III.	$H_3COCH_2CH_3 < H_3CCH_2CHO < H_3CCH_2CH_2OH$	Boiling points

(1) I, II only

(2) I, III only

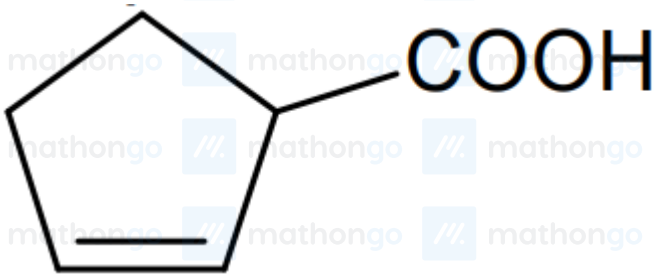
(3) II, III only

(4) I, II, III

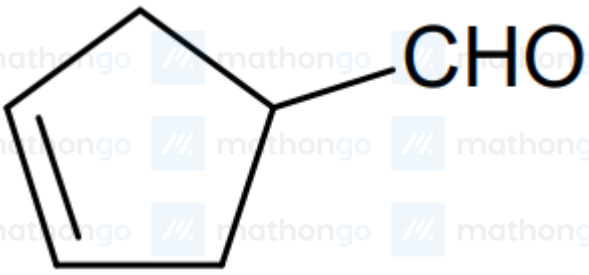
Q31

Cyclohexene on ozonolysis followed by reaction with zinc dust and water gives compound B. Compound B on further treatment with aqueous NaOH followed by heating yields compound C . The compound ' *C* ' is:

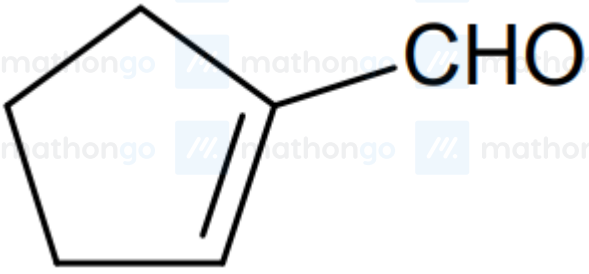
(1)

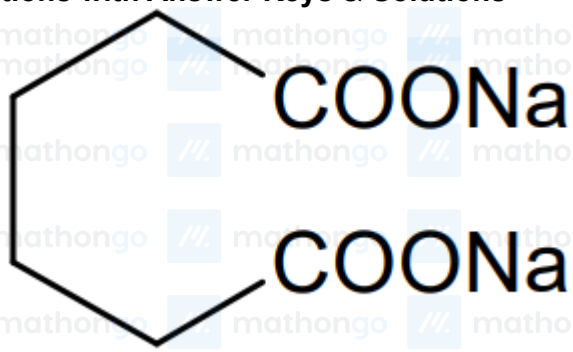


(2)



(3)





(4)

Q32

The solubility of $Fe(OH)_3$ in a buffer solution of $pH = 4$ is 4.32×10^{-2} mol/L. How many times is this solubility greater than its solubility in pure water. (Ignore the hydrolysis of Fe^{3+} ions) Given: $4.32/\sqrt{0.4} = 6.83$

(1) 10^9

(2) 6.83×10^6

(3) 2.16×10^9

(4) none of these

Q33

If 4 g of metal reacts with 17.75 g of chlorine to give metal chloride. How many kilograms of metal oxide is produced from 76 kg of metal carbonate?

(1) 24

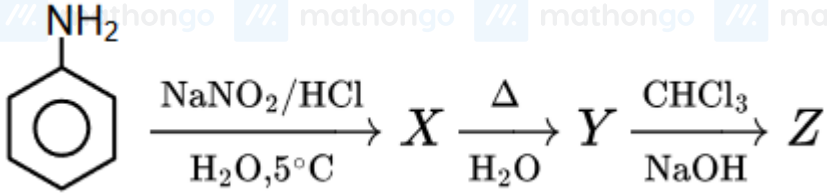
(2) 37

(3) 32

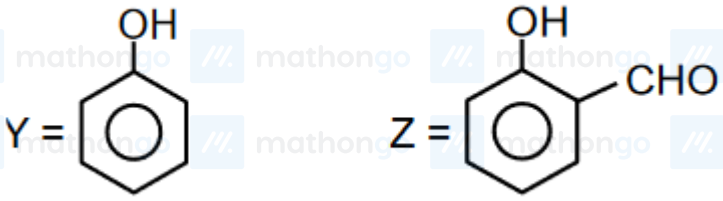
(4) 27

Q34

Identify the Y and Z in the following reaction.

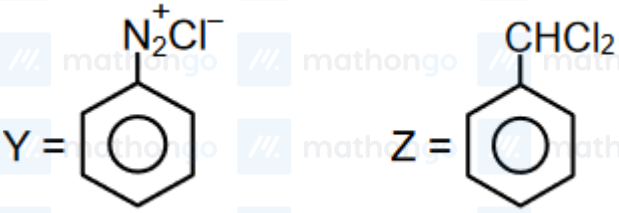


(1)



(2)

(3)



(4)

Q35

A : The IUPAC name of the compound $\left[Cr(NH_3)_5(NCS)\right]\left[ZnCl_4\right]$ is pentaamminethiocyanato-N-chromate(III) tetrachlorozincate (II).

B : Mohr's salt $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$ is an example of double salt.

C : In $\left[Co(NH_3)_4(NO_2)_2\right]NO_3$ coordination number of cobalt is 6 .

D : In $[Fe(CO)_5]$ secondary valency of iron is 0 .

(1) only B and D are correct

(2) only B and C are correct

(3) only A, B and C are correct

(4) A, B, C, D are correct

Q36

Assertion: The electron gain enthalpy of N is +ve while that of P is -ve.

Reason : This is due to the smaller atomic size of N in which there is a considerable electron-electron repulsion and hence the additional electron is not accepted easily.

(1) If both assertion and reason are true and reason is the correct explanation of assertion.

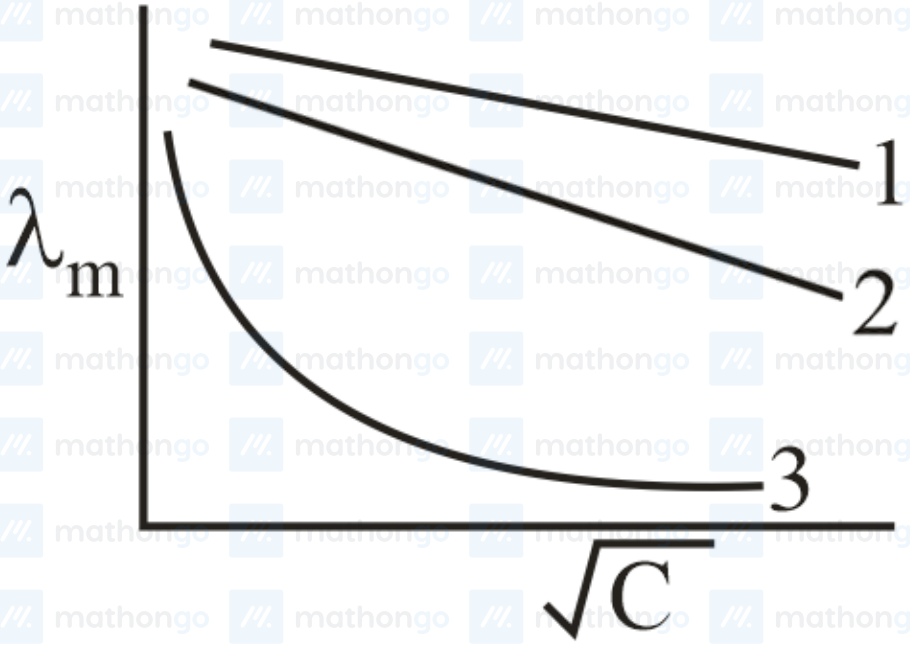
(2) If both assertion and reason are true but reason is not the correct explanation of assertion.

(3) If assertion is true but reason is false.

(4) If both assertion and reason are false.

Q37

A graph of molar conductivity of three electrolytes (NaCl, HCl and NH_4OH) is plotted against $\sqrt{C}$



Which of the following options is correct?

(1) $\overset{(1)}{NaCl}$ $\overset{(2)}{HCl}$ $\overset{(3)}{NH_4OH}$

(2) $\overset{(1)}{NH_4OH}$ $\overset{(2)}{NaCl}$ $\overset{(3)}{HCl}$

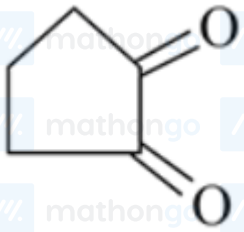
(3) $\overset{(1)}{HCl}\ \overset{(2)}{NaCl}\ \overset{(3)}{NH_4OH}$

(4) $\overset{(1)}{NH_4OH}\ \overset{(2)}{HCl}\ \overset{(3)}{NaCl}$

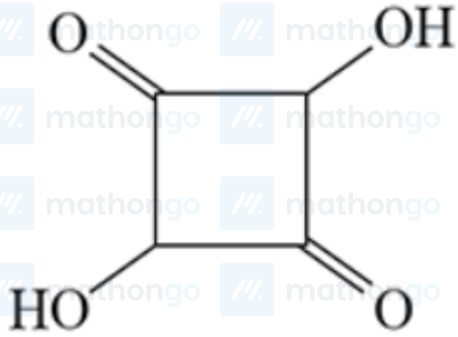
Q38

Compound (A) $\xrightarrow{2 \text{ mol of } HIO_4}$ two moles of glyoxalic acid. The compound ' A ' is

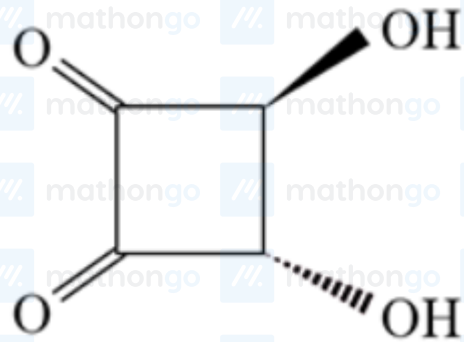
(1)



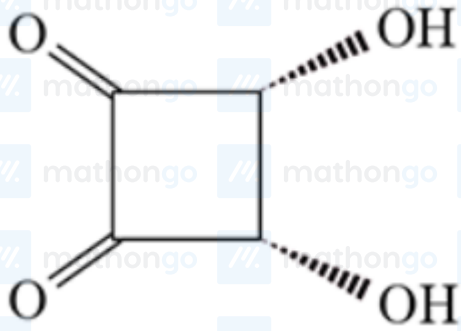
(2)



(3)



(4)



Q39

Which of the following statements regarding adsorption chromatography is correct?

(1) Different compounds are adsorbed on an adsorbent to different degrees

(2) Paper chromatography is a type of adsorption chromatography

(3) The stationary phase used is a gas

(4) The technique involved is based on the continuous differential partitioning

Q40

Which of the following is tetrahedral and paramagnetic complex?

(1) $[NiCl_4]^{2-}$

(2) $[Ni(CN)_4]^{2-}$

(3) $\left[Cu(NH_3)_4\right]^{2+}$

(4) $[Ni(CO)_4]$

Q41

Assertion: PbO_2 is an oxidising agent and reduced to PbO.

Reason: Stability of $Pb(II) > Pb(IV)$ on account of inert pair effect.

(1) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(2) Both Assertion and Reason are true but Reason is NOT the correct explanation of Assertion.

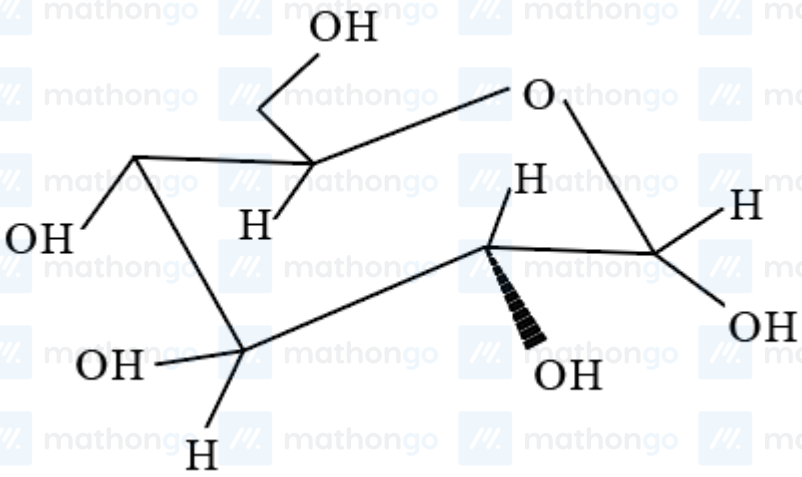
(3) Assertion is true but Reason is false.

(4) Assertion is false but Reason is true.

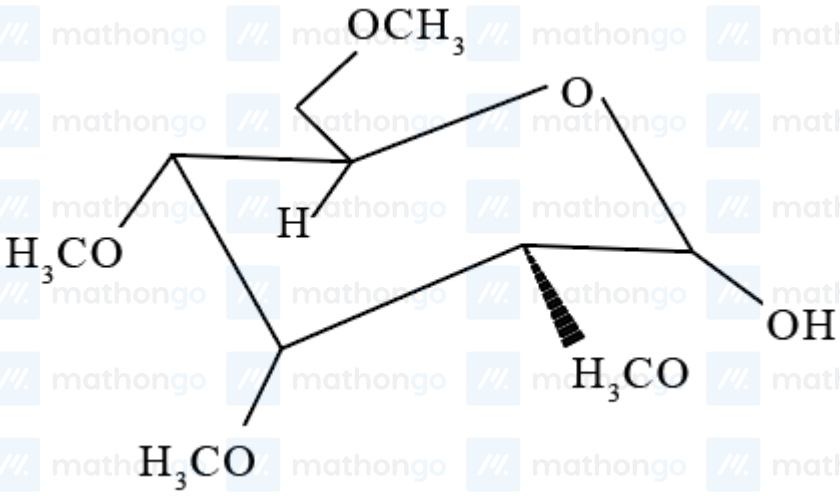
Q42

Identify the non-reducing sugar.

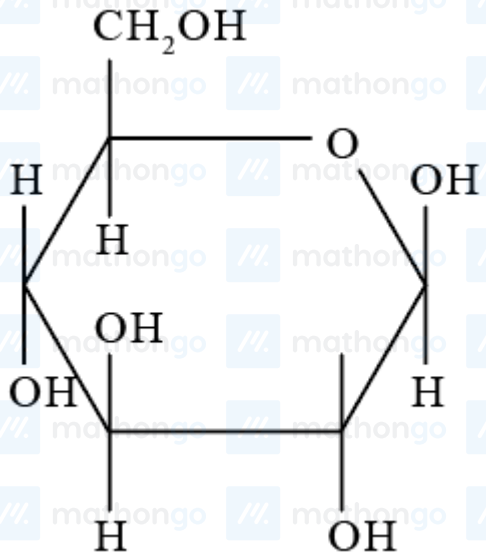
(1)



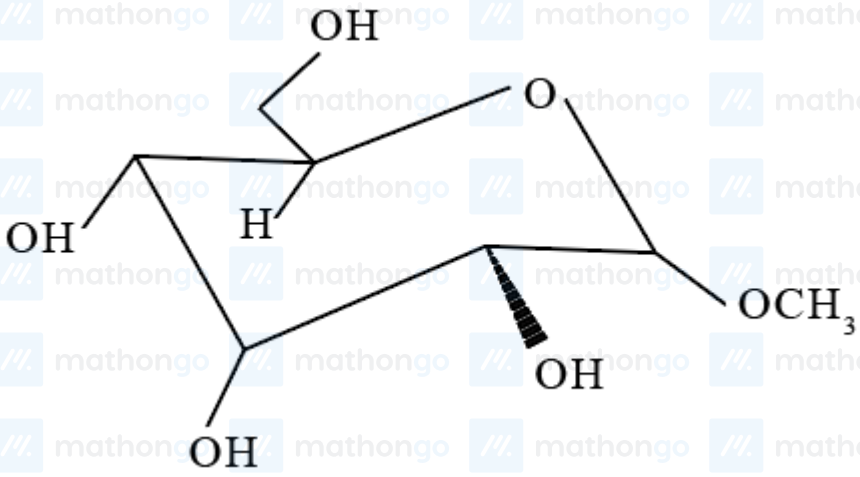
(2)



(3)



(4)



Q43

Maximum number of electrons possible with spin quantum number $+\frac{1}{2}$ with principal quantum number $n = 4$ in an atom is

(1) 16

(2) 9

(3) 4

(4) 25

Q44

The following reaction occurs

$2H^+ + 2e^- + \frac{1}{2}O_2 \rightarrow H_2O; E^o = +1.23\ V$

$Fe^{2+} + 2e^- \rightarrow Fe(s); E^0 = -0.44\ V$

Calculate magnitude of $\Delta G^\circ(kJ)$ for the net process

$Fe(s) + 2H^+ + \frac{1}{2}O_2 \rightarrow Fe^{2+} + H_2O$

(Take 1 F = 96500 and mark answer to nearest whole number)

(1) 244 KJ

(2) 344 KJ

(3) 322 KJ

(4) 422 KJ

Q45

Which of the following statements is (are) incorrect?

(i) Order of polarizing power of cationic species is $K^+ < Ca^{2+} < Mg^{2+} < Be^{2+}$

(ii) From H_2O to H_3O^+, the geometry around O atom changes drastically.

(iii) The most stable oxidation state for element with atomic number 113 is expected to be +2.

(iv) The 2^{nd} ionization energy of Ca is greater than 1^{st} ionization energy of it but lower than 2^{nd} ionization energy of K.

(1) Only i

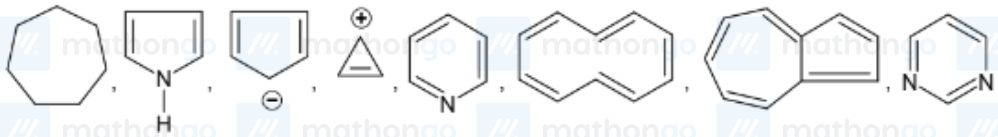
(2) i, ii, iii

(3) ii, iii

(4) iii, iv

Q46

Number of aromatic compounds among the following:



Q47

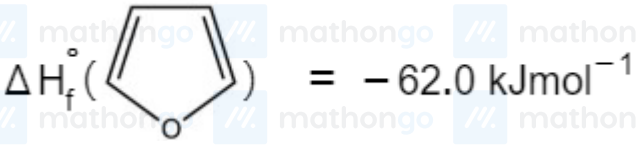
At T(K) if the rate constant for a zero order reaction is 2.5×10^{-3} ms^{-1}, the time required for the initial concentration of reactant, R to fall from 0.10M to 0.075M at the same temperature in seconds is

Q48

An aqueous solution containing 46.5 gm of ethylene glycol in 160 gm of water is cooled to $-11.16^{\circ}\mathrm{C}$. If $\mathrm{K_f}$ for water is 1.86 K/ molal then calculate the amount of ice (in g) that separates out on cooling the above solution.

Q49

Calculate heat of atomization of furan in $\mathrm{kJmol^{-1}}$ using the data



Heats of atomization of C, H, O are 717, 218, 249 $\mathrm{kJmol^{-1}}$ each isolated atom.

Q50

Consider the following reactions

$\mathrm{NaCl + K_2Cr_2O_7 + Conc.\ H_2SO_4 \rightarrow (A) + side\ products}$

$\mathrm{(A) + NaOH \rightarrow (B) + side\ products}$

$\mathrm{(B) + dilute\ H_2SO_4 + H_2O_2 \rightarrow (C) + Side\ products}$

The sum of atoms in one molecule each of (A), (B) and (C) is

Q51

For an increasing geometric sequence $a_1, a_2, a_3, \ldots, a_n$, if $a_6 = 4a_4$ & $a_9 - a_7 = 192$ and $\sum_{i=4}^{n} a_i = 1016$, then n is

(1) 8

(2) 9

(3) 10

(4) 11

Q52

The function $\mathrm{f(x) = \sin^{-1}(2x - x^2) + \sqrt{2 - \frac{1}{|x|}} + \frac{1}{[x^2]}}$ is defined in the interval (where $[\cdot]$ is the greatest integer function)

(1) $\mathrm{x \in \left(1 - \sqrt{2}, 1\right)}$

(2) $\mathrm{x \in \left[1, 1 + \sqrt{2}\right]}$

(3) x $\in\left[1-\sqrt{2}, 1+\sqrt{2}\right]$

(4) x $\in\left[1-\sqrt{2}, 2\right]$

Q53

A biased coin is tossed repeatedly until a tail appears for the 1st time. The head is 2 times likely to appear as tail. The probability that the number of tosses required will be more than 6 given that in 1st three tosses, no tail has occured is

(1) $\frac{16}{81}$

(2) $\frac{32}{243}$

(3) $\frac{64}{729}$

(4) none of these

Q54

If $\lim_{x\to 0}\left\{1+x\log\left(1+a^2\right)\right\}^{1/x}=2a\sin^2\theta, a>0$ and $\theta\in R$, then

(1) $\theta=n\pi\pm\frac{\pi}{2},(n\in Z)$

(2) $\theta=2n\pi\pm\frac{\pi}{4},(n\in Z)$

(3) $\theta=n\pi+\frac{\pi}{4},(n\in Z)$

(4) $\theta=n\pi\pm\frac{\pi}{4},(n\in Z)$

Q55

A function $f:\mathbf{R}\to\mathbf{R}$ is such that $f(1)=2$ and $f(x+y)=f(x)\cdot f(y)\forall x,y$. The area (in square units) enclosed by the lines $2|x|+5|y|\leq 4$ expressed in terms of $f(1), f(2)$ and $f(4)$ is

(1) $\frac{f(4)}{f(1)+2f(2)}$

(2) $\frac{f(4)}{1+f(2)}$

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

(4) $\frac{f(4)}{2f(1)+f(2)}$

Q56

If z is a complex number which simultaneously satisfies the equations $3|z-12|=5|z-8i|$ and $|z-4|=|z-8|$, then $\mathrm{Im}(z)$ can be

(1) 15

(2) 16

(3) 17

(4) 13

Q57

Let the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ contains the circle $(x-1)^2+y^2=1$ and has least area. If $a^2+b^2=2n$, then find the value of $n \in N$.

(1) 5

(2) 2

(3) 4

(4) 3

Q58

Let $x, y, z \in R^+$ such that $x+y+z=27$. If maximum value of $x^2y^3z^4$ is $\lambda \cdot 6^{10}$, then the value of λ is

(1) 12

(2) 9

(3) 7

(4) 6

Q59

Let matrix $\mathrm{A}=\begin{bmatrix} x & y & -\mathrm{z} \\ 1 & 2 & 3 \\ 1 & 1 & 2 \end{bmatrix}$, where $x, y, \mathrm{z} \in \mathrm{N}$.

If $|(\mathrm{adj}(\mathrm{adj}(\mathrm{adj}(\mathrm{adj}\,\mathrm{A}))))| = 4^8 \cdot 5^{16}$, then the number of such matrices A is equal to

(1) 24

(2) 27

(3) 36

(4) 32

Q60

Let $\vec{a} = x\hat{i} + y\hat{j} + z\hat{k}$ makes equal angles with $\vec{b} = y\hat{i} - 2z\hat{j} + 3x\hat{k}$ and $\vec{c} = 2z\hat{i} + 3x\hat{j} - y\hat{k}$. Let $\vec{d} = \hat{i} - \hat{j} + 2\hat{k}$ such that $\vec{a} \perp \vec{d}$ and if $|\vec{a}| = 2\sqrt{3}$, then

The value of $\vec{a} \cdot \vec{b}$ is equal to

(1) 12

(2) -12

(3) 24

(4) -24

Q61

The equations of sides $\mathbf{AB}, \mathbf{BC}$ and $\mathbf{CA}$ of a $\triangle ABC$ are $2x + y = 0, x + py = q$ and $x - y = 3$ respectively. If $P(2, 3)$ is its orthocenter, then the value of $p + q$ equals

(1) 50

(2) 47

(3) 65

(4) 74

Q62

The value of $\int_{-1}^{1} \tan^{-1}\left[x^2 + \frac{1}{2}\right]dx + \int_{-1}^{1} \cot^{-1}\left[x^2 - \frac{1}{2}\right]dx$ is equal to (where [.] denotes greatest integer function)

(1) $\frac{3\pi}{4}\left(1 - \frac{1}{\sqrt{2}}\right)$

(2) $\frac{3\pi}{4}\left(1 + \frac{1}{\sqrt{2}}\right)$

(3) $\frac{\pi}{4}\left(1 - \frac{1}{\sqrt{2}}\right)$

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

Q63

If both the mean and the standard deviation of 50 observations $x_1,\ x_2,\ \ldots,\ x_{50}$ are equal to 16, then the mean of $(x_1-4)^2,\ (x_2-4)^2,\ \ldots,(x_{50}-4)^2$ is

(1) 525

(2) 480

(3) 400

(4) 380

Q64

The general solution of the differential equation $\frac{dy}{dx}=\left(x^3-2x\tan^{-1}y\right)\left(1+y^2\right)$ is -

(1) $2\tan^{-1}x=y^2-1+2\text{ce}^{-x^2}$

(2) $2\tan^{-1}y=x^2-1+2\text{ce}^{-x^2}$

(3) $2\tan^{-1}y=y^2-1+2\text{ce}^{-x^2}$

(4) $2\tan^{-1}x=x^2-1+2\text{ce}^{-y^2}$

Q65

If the straight lines $\frac{x}{1}=\frac{y}{1}=\frac{z}{1}$ and $\frac{x}{1}=\frac{y}{2}=\frac{z}{3}$ and a third line passing through the point $Q(1,1,1)$ form a triangle whose area is $6\frac{1}{2}$ sq. units, then the point of intersection of second line with third line is:

(1) $(1,\ 2,\ 3)$

(2) $(2,\ 4,\ 6)$

(3) $\left(\frac{4}{3},\ \frac{8}{3},\ \frac{12}{3}\right)$

(4) $(2,\ 1,\ 3)$

Q66

Let N represent the set of natural numbers, and a relation R in the set N of natural numbers be defined as $(\text{x},\text{y})\Leftrightarrow \text{x}^2-8\text{xy}+7\text{y}^2=0\ \forall\ x,y\in R$. Then R is

(1) reflexive and symmetric

(2) reflexive and transitive

(3) symmetric and transitive but not reflexive

(4) reflexive but neither symmetric nor transitive

Q67

Let $f(x)=\lim_{n\to\infty}\frac{x^{2n-1}+ax^3+bx^2}{x^{2n}+1}$ is continuous for all $x\in R$. If points $A(-a,3)$ and $B((b+1),-1)$ are points of relative maximum and minimum of a cubic polynomial $y=g(x)$, then the value of $g(2)$ is:

(1) 1

(2) 2

(3) 3

(4) 4

Q68

If p_1, p_2 are the roots of the quadratic equation $ax^2+bx+c=0$ and q_1, q_2 are the roots of the quadratic equation $cx^2+bx+a=0(a,b,c\in R)$ such that p_1, q_1, p_2, q_2 are in A.P. of distinct terms, then $\frac{a}{c}$ equals

(1) -1

(2) 1

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

(4) 2

Q69

The number of 7 digit integers $abcdefg$, with all digits distinct where $a<b<c<d>e>f>g$ such that $a,b,c,d,e,f,g\in\{1,2,3,\ldots,9\}$, are

(1) 700

(2) 20

(3) 720

(4) 800

Q70

Find the sum of all integral values of a for which all the roots of the equation $x^4-4x^3-8x^2+a=0$ are real.

(1) 5

(2) 6

(3) 7

(4) 8

Q71

Let $\mathrm{A}=\begin{bmatrix}1 & \frac{3}{2}\\ 1 & 2\end{bmatrix}, \mathrm{B}=\begin{bmatrix}4 & -3\\ -2 & 2\end{bmatrix}$ and $\mathrm{C_r}=\begin{bmatrix}\mathrm{r}\cdot 3^{\mathrm{r}} & 2^{\mathrm{r}}\\ 0 & (1-\mathrm{r})3^{\mathrm{r}}\end{bmatrix}$ be given matrices.

If $\sum_{\mathrm{r}=1}^{50}\mathrm{tr.}\left((\mathrm{AB})^{\mathrm{r}}\mathrm{C_r}\right)=\frac{a(a^b-1)}{2}$, where tr. (A) denotes trace of matrix A, then find the value of $(\mathrm{a}+\mathrm{b})$.
[Where a and b are relatively prime.]

Q72

The centre of a square of side 4 units length is $(3,7)$ and one of the diagonals is parallel to the line $y=x$. If $(x_1,y_1),(x_2,y_2),(x_3,y_3)$ and (x_4,y_4) are the vertices of this square, then $\frac{y_1y_2y_3y_4}{x_1x_2x_3x_4}=$

Q73

The remainder obtained when 27^{40} is divided by 12 is

Q74

$OABC$ is a tetrahedron in which O is the origin and position vector of points A, B, C are $\hat{i}+2\hat{j}+3\hat{k}$, $2\hat{i}+\alpha\hat{j}+\hat{k}$ and $\hat{i}+3\hat{j}+2\hat{k}$ respectively. An integral value of α for which shortest distance between OA and BC is $\sqrt{\frac{3}{2}}$ is

_____

Q75

Let $y=f(x)$ be a differentiable curve satisfying $2+\int_2^x f(t)dt=\frac{x^2}{2}+\int_x^2 t^2f(t)dt$, then $\int_{-\pi/4}^{\pi/4}\frac{f(x)+x^9-x^3+x+1}{\cos^2 x}dx$ equals