Q1. If two vectors $\vec{P} = \hat{i} + 2m\hat{j} + m\hat{k}$ and $\vec{Q} = 4\hat{i} - 2\hat{j} + m\hat{k}$ are perpendicular to each other. Then, the value of m will be

(1) -1 (2) 2

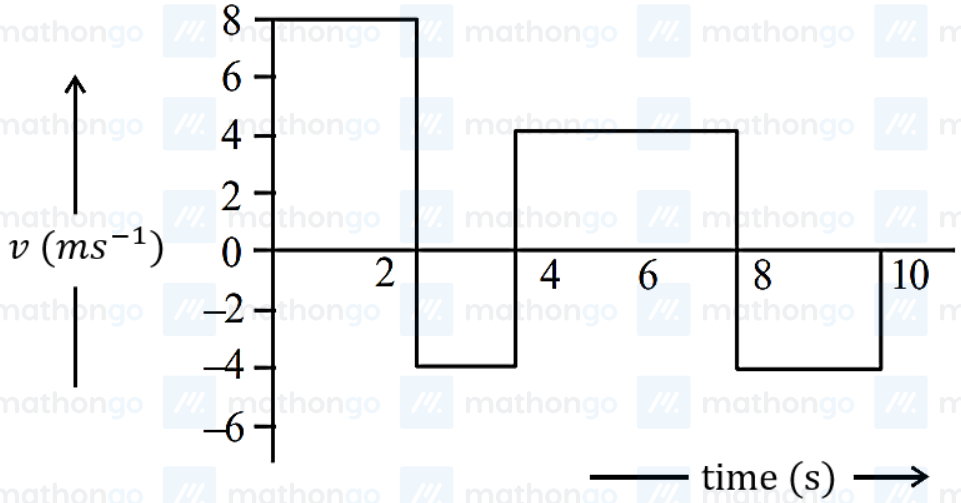
(3) 3 (4) 1

Q2. The frequency (ν) of an oscillating liquid drop may depend upon radius (r) of the drop, density (ρ) of liquid and the surface tension (s) of the liquid as: $\nu = r^a \rho^b s^c$. The values of $a,\ b$ and c respectively are

(1) $\left(-\frac{3}{2},\ -\frac{1}{2},\ \frac{1}{2}\right)$ (2) $\left(-\frac{3}{2},\ \frac{1}{2},\ \frac{1}{2}\right)$

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

Q3. The velocity-time graph of a body moving in a straight line is shown in figure.



The ratio of displacement and distance travelled by the body in time 0 to 10 s is

(1) 1 : 1 (2) 1 : 2

(3) 1 : 3 (4) 1 : 4

Q4. A body of mass 200 g is tied to a spring of spring constant 12.5 N m^{-1}, while the other end of spring is fixed at point O. If the body moves about O in a circular path on a smooth horizontal surface with constant angular speed 5 rad s^{-1}, then the ratio of extension in the spring to its natural length will be :

(1) 1 : 2 (2) 1 : 1

(3) 2 : 3 (4) 2 : 5

Q5. A body of mass 1 kg begins to move under the action of a time dependent force $\vec{F} = \left(t\hat{i} + 3t^2\hat{j}\right)$ N, where $\hat{i}$ and $\hat{j}$ are the unit vectors along x and y axis. The power developed by above force, at the time $t = 2$ s, will be _____W.

Q6. A uniform solid cylinder with radius R and length L has moment of inertia I_1, about the axis of cylinder. A concentric solid cylinder of radius $R' = \frac{R}{2}$ and length $L' = \frac{L}{2}$ is carved out of the original cylinder. If I_2 is the moment of inertia of the carved out portion of the cylinder then $\frac{I_1}{I_2} =$ _____.

(Both I_1 and I_2 are about the axis of the cylinder)

Q7. Given below are two statements:

Statement I: Acceleration due to earth's gravity decreases as you go 'up' or 'down' from earth's surface.

Statement II: Acceleration due to earth's gravity is same at a height 'h' and depth 'd' from earth's surface, if $h = d$.

In the light of above statements, choose the most appropriate answer form the options given below

(1) Statement I is incorrect but statement II is correct (2) Both Statement I and Statement II are incorrect

(3) Statement I is correct but statement II is incorrect (4) Both Statement I and II are correct

Q8. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A: A pendulum clock when taken to Mount Everest becomes fast.

Reason R: The value of g (acceleration due to gravity) is less at Mount Everest than its value on the surface of earth.

In the light of the above statements, choose the most appropriate answer from the options given below

(1) Both A and R are correct and R is the correct explanation of A

(2) Both A and R are correct but R is not the correct explanation of A

(3) A is correct but R is not correct

(4) A is not correct but R is correct

Q9. If the distance of the earth from Sun is 1.5×10^6 km, then the distance of an imaginary planet from Sun, if its period of revolution is 2.83 years is:

(1) 6×10^7 km

(2) 6×10^6 km

(3) 3×10^6 km

(4) 3×10^7 km

Q10. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion (A) : Steel is used in the construction of buildings and bridges.

Reason (R) : Steel is more elastic and its elastic limit is high.

In the light of above statements, choose the most appropriate answer from the options given below

(1) Both A and R are correct and R is the correct explanation of A

(2) Both A and R are correct but R is NOT the correct explanation of A

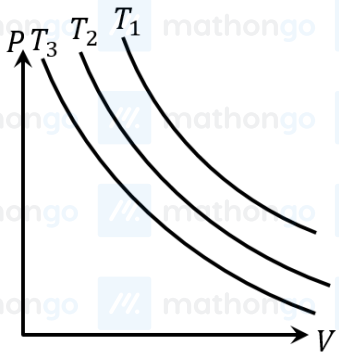
(3) A is correct but R is not correct

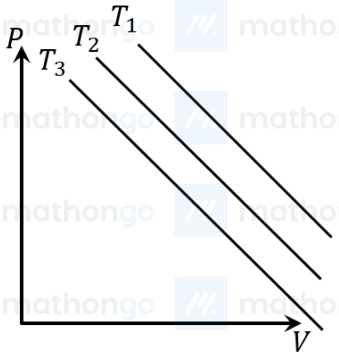
(4) A is not correct but R is correct

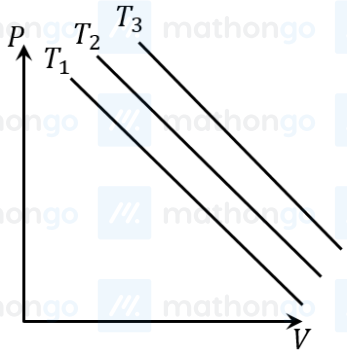
Q11. A spherical ball of radius 1 mm and density 10.5 g cc^{-1} is dropped in glycerine of coefficient of viscosity 9.8 poise and density 1.5 g cc^{-1}. Viscous force on the ball when it attains constant velocity is 3696×10^{-x} N. The value of x is

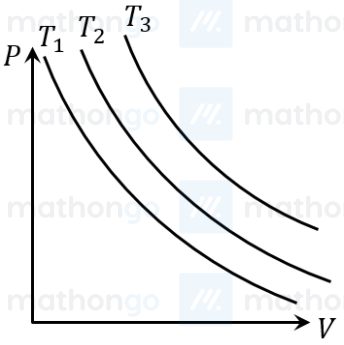
(Given, $g = 9.8$ m s^{-2} and $\pi = \frac{22}{7}$)

Q12. In an Isothermal change, the change in pressure and volume of a gas can be represented for three different temperature; $T_3 > T_2 > T_1$ as:

(1) 

(2) 

(3) 

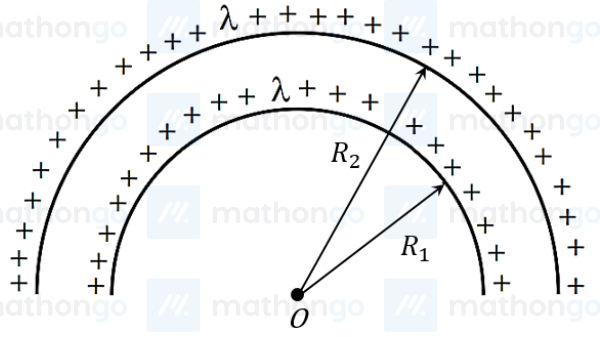
(4) 

Q13. Let γ_1 be the ratio of molar specific heat at constant pressure and molar specific heat at constant volume of a monoatomic gas and γ_2 be the similar ratio of diatomic gas. Considering the diatomic gas molecule as a rigid rotator, the ratio $\frac{\gamma_1}{\gamma_2}$ is:

(1) $\frac{27}{35}$ (2) $\frac{35}{27}$
(3) $\frac{25}{21}$ (4) $\frac{21}{25}$

Q14. A mass m attached to free end of a spring executes SHM with a period of 1 s. If the mass is increased by 3 kg the period of oscillation increases by one second, the value of mass m is _____ kg.

Q15. The electric potential at the centre of two concentric half rings of radii R_1 and R_2, having same linear charge density λ is



(1) $\frac{2\lambda}{\epsilon_0}$ (2) $\frac{\lambda}{2\epsilon_0}$
(3) $\frac{\lambda}{4\epsilon_0}$ (4) $\frac{\lambda}{\epsilon_0}$

Q16. A parallel plate capacitor with air between the plate has a capacitance of 15 pF. The separation between the plate becomes twice and the space between them is filled with a medium of dielectric constant 3.5. Then the capacitance becomes $\frac{x}{4}$ pF. The value of x is____.

Q17. A cell of emf 90 V is connected across series combination of two resistors each of 100 Ω resistance. A voltmeter of resistance 400 Ω is used to measure the potential difference across each resistor. The reading of the voltmeter will be:

(1) 40 V (2) 45 V

(3) 80 V (4) 90 V

Q18. If a copper wire is stretched to increase its length by 20%. The percentage increase in resistance of the wire is _____%.

Q19. A long solenoid is formed by winding 70 turns cm^{-1} . If 2.0 A current flows, then the magnetic field produced inside the solenoid is _____.

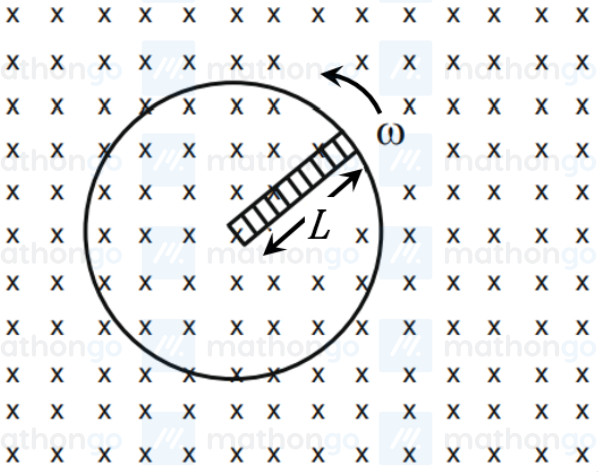
$(\mu_0 = 4\pi \times 10^{-7}\ T\ m\ A^{-1})$

(1) 1232×10^{-4} T (2) 176×10^{-4} T

(3) 352×10^{-4} T (4) 88×10^{-4} T

Q20. A single turn current loop in the shape of a right angle triangle with sides 5 cm, 12 cm, 13 cm is carrying a current of 2 A. The loop is in a uniform magnetic field of magnitude 0.75 T whose direction is parallel to the current in the 13 cm side of the loop. The magnitude of the magnetic force on the 5 cm side will be $\frac{x}{130}$ N. The value of x is _____.

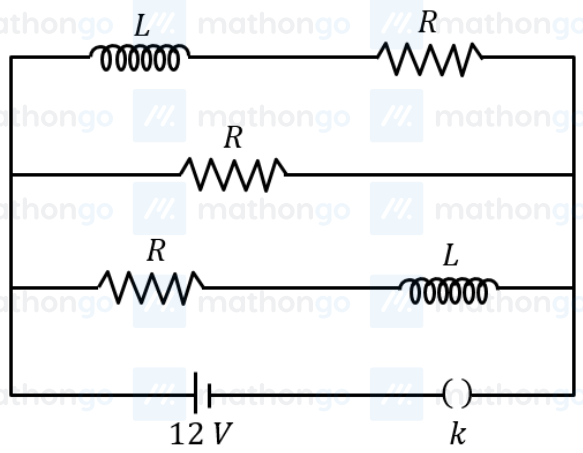
Q21. A metallic rod of length L is rotated with an angular speed of ω normal to a uniform magnetic field B about an axis passing through one end of rod as shown in figure. The induced emf will be :



(1) $\frac{1}{2}B^2L^2\omega$ (2) $\frac{1}{4}BL^2\omega$

(3) $\frac{1}{2}BL^2\omega$ (4) $\frac{1}{4}B^2L\omega$

Q22. Three identical resistors with resistance $R = 12\ \Omega$ and two identical inductors with sell inductance $L = 5$ mH are connected to an ideal battery with emf of 12 V as shown in figure. The current through the battery long after the switch has been closed will be_____A.



Q23. The electric field and magnetic field components of an electromagnetic wave going through vacuum is described by

$E_x = E_0 \sin(kz - \omega t)$

$B_y = B_0 \sin(kz - \omega t)$

Then the correct relation between E_0 and B_0 is given by

(1) $E_0 B_0 = \omega k$ (2) $E_0 = kB_0$

(3) $kE_0 = \omega B_0$ (4) $\omega E_0 = kB_0$

Q24. When a beam of white light is allowed to pass through convex lens parallel to principal axis, the different colours of light converge at different point on the principle axis after refraction. This is called :

(1) Scattering (2) Chromatic aberration

(3) Spherical aberration (4) Polarisation

Q25. A convex lens of refractive index 1.5 and focal length 18 cm in air is immersed in water. The change in focal length of the lens will be_____cm.

(Given refractive index of water$= \frac{4}{3}$)

Q26. An α particle, a proton and an electron have the same kinetic energy. Which one of the following is correct in case of their de-Broglie wavelength:

(1) $\lambda_\alpha > \lambda_p > \lambda_e$ (2) $\lambda_\alpha < \lambda_p < \lambda_e$

(3) $\lambda_\alpha = \lambda_p = \lambda_e$ (4) $\lambda_\alpha > \lambda_p < \lambda_e$

Q27. A photon is emitted in transition from $n = 4$ to $n = 1$ level in hydrogen atom. The corresponding wavelength for this transition is (given, $h = 4 \times 10^{-15}$ eV s)

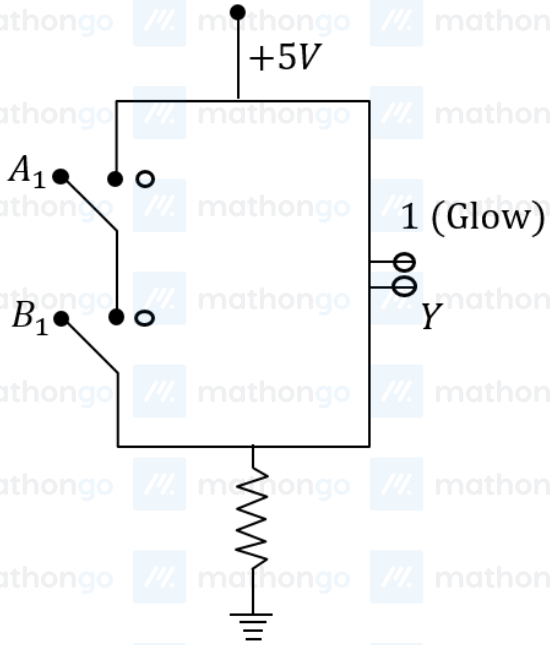
(1) 941 nm (2) 974 nm

(3) 99.3 nm (4) 94.1 nm

Q28. The energy released per fission of nucleus of ^{240}X is 200 MeV. The energy released if all the atoms in 120 g of pure ^{240}X undergo fission is _____$\times 10^{25}$ MeV.

(Given $N_A = 6 \times 10^{23}$)

Q29. The logic gate equivalent to the given circuit diagram is :



(1) OR
(2) NAND
(3) NOR
(4) AND

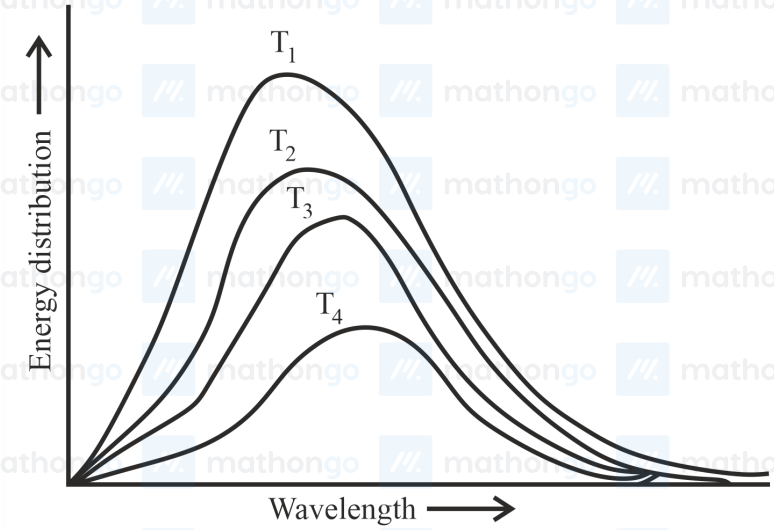
Q30. Match List I with List II

	LIST I		LIST II
A	AM Broadcast	I	$88 - 108$ MHz
B	FM Broadcast	II	$540 - 1600$ kHz
C	Television	III	$3.7 - 4.2$ GHz
D	Satellite Communication	IV	54 MHz $-$ 590 MHz

Choose the correct answer from the options given below:

(1) A-II, B-I, C-IV, D-III
(2) A-IV, B-III, C-I, D-II
(3) A-II, B-III, C-I, D-IV
(4) A-I, B-III, C-II, D-IV

Q31. Following figure shows spectrum of an ideal black body at four different temperatures. The number of correct statement/s from the following is _____.



A. $T_4 > T_3 > T_2 > T_1$

B. The black body consists of particles performing simple harmonic motion.

C. The peak of the spectrum shifts to shorter wavelength as temperature increases.

D. $\frac{T_1}{\nu_1} = \frac{T_2}{\nu_2} = \frac{T_3}{\nu_3}$

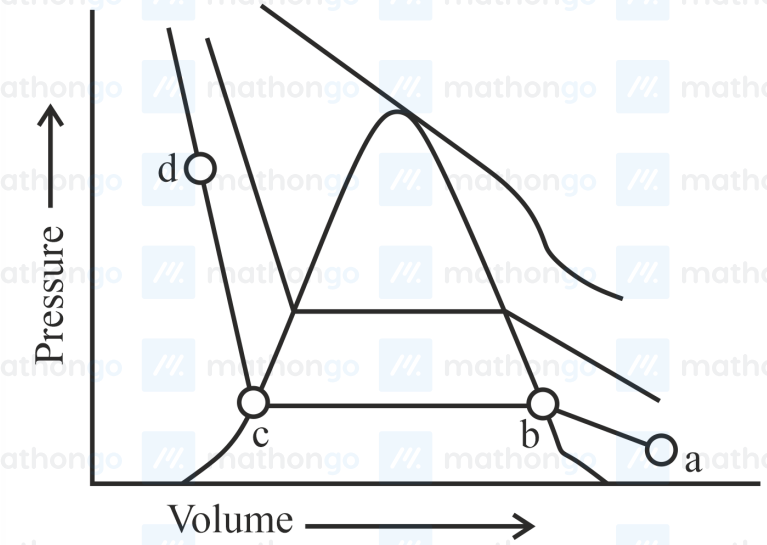
E. The given spectrum could be explained using quantisation of energy

Q32. What is the number of unpaired electron(s) in the highest occupied molecular orbital of the following species : $N_2,\ N_2^+,\ O_2,\ O_2^+$?

(1) 0, 1, 2, 1
(2) 2, 1, 2, 1
(3) 0, 1, 0, 1
(4) 2, 1, 0, 1

Q33. Sum of π-bonds present in peroxodisulphuric acid and pyrosulphuric acid is

Q34. The number of statement's, which are correct with respect to the compression of carbon dioxide from point (a) in the Andrews isotherm from the following is _____.



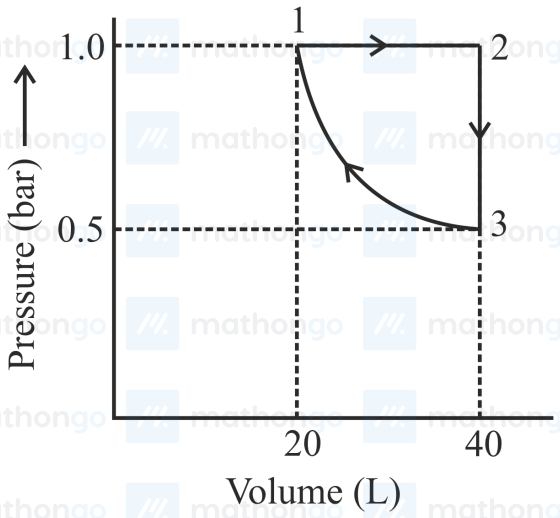
A. Carbon dioxide remains as a gas upto point (b)

B. Liquid carbon dioxide appears at point (c)

C. Liquid and gaseous carbon dioxide coexist between points (b) and (c)

D. As the volume decreases from (b) to (c), the amount of liquid decreases

Q35. One mole of an ideal monoatomic gas is subjected to changes as shown in the graph. The magnitude of the work done (by the system or on the system) is _____ J (nearest integer)

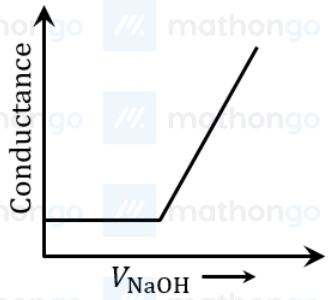


Given : log 2 = 0.3, ln 10 = 2.3

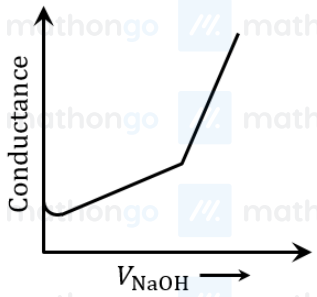
Q36. If the pKa of lactic acid is 5, then the pH of 0. 005 M calcium lactate solution at 25° C is _____ $\times 10^{-1}$ (Nearest integer)

Q37. Choose the correct representation of conductometric titration of benzoic acid vs sodium hydroxide.

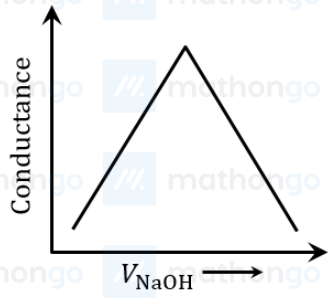
(1)



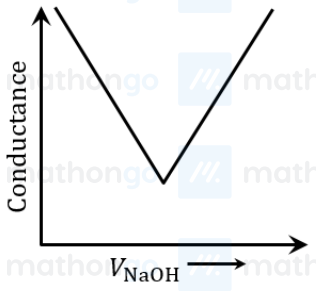
(2)



(3)



(4)



Q38. In which of the following reactions the hydrogen peroxide acts as a reducing agent?

(1) $PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$

(2) $2\,Fe^{2+} + H_2O_2 \rightarrow 2\,Fe^{3+} + 2\,OH^-$

(3) $HOCl + H_2O_2 \rightarrow H_3O^+ + Cl^{-1} + O_2$

(4) $Mn^{2+} + H_2O_2 \rightarrow Mn^{4+} + 2\,OH^-$

Q39. Identify the correct statements about alkali metals.

A. The order of standard reduction potential $(M^+ \mid M)$ for alkali metal ions is $Na > Rb > Li$.

B. CsI is highly soluble in water.

C. Lithium carbonate is highly stable to heat.

D. Potassium dissolved in concentrated liquid ammonia is blue and paramagnetic.

E. All alkali metal hydrides are ionic solids.

Choose the correct answer from the options given below

(1) A, B, D only

(2) C and E only

(3) A and E only

(4) A, B and E only

Q40. Given below are two statements, one is labelled as **Assertion A** and the other is labelled as **Reason R**.

Assertion A : Beryllium has less negative value of reduction potential compared to the other alkaline earth metals

Reason R : Beryllium has large hydration energy due to small size of Be^{2+}but relatively large value of atomisation enthalpy.

In the light of the above statements, choose the most appropriate answer from the options given below.

(1) A is correct but R is not correct

(2) Both A and R are correct and R is the correct explanation of A

(3) A is not correct but R is correct

(4) Both A and R are correct and R is NOT the correct explanation of A

Q41. The number of s-electrons present in an ion with 55 protons in its unipositive state is

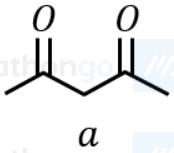
(1) 8

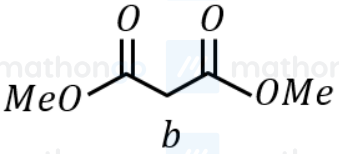
(2) 9

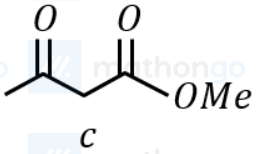
(3) 12

(4) 10

Q42. Which will undergo deprotonation most readily in basic medium?


a

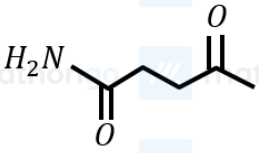
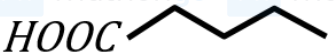

b


c

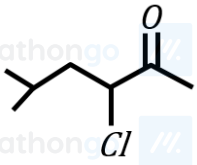
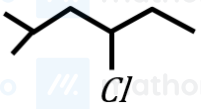
(1) a only
(2) c only
(3) Both a and c
(4) b only

Q43. Given below are two statements :

Statement I :


under Clemmensen reduction conditions will give 

Statement II :


under Wolff-Kishner reduction condition will give 

In the light of the above statements, choose the correct answer from the options given below :
(1) Statement I is false but Statement II is true
(2) Both Statement I and Statement II are false
(3) Statement I is true but Statement II is false
(4) Both Statement I and Statement II are true

Q44. Given below are two statements, one is labelled as **Assertion A** and the other is labelled as **Reason R.**

Assertion A : Benzene is more stable than hypothetical cyclohexatriene.

Reason R : The delocalized π electron cloud is attracted more strongly by nuclei of carbon atoms.

In the light of the above statements, choose the correct answer from the options given below:
(1) A is true but R is false.
(2) A is false but R is true.
(3) Both A and R are correct and R is the correct explanation of A.
(4) Both A and R are correct but R is NOT the correct explanation of A.

Q45. The Total pressure observed by mixing two liquid A and B is 350 mm Hg when their mole fractions are 0.7 and 0.3 respectively. The Total pressure becomes410 mm Hg if the mole fractions are changed to 0.2 and 0.8 respectively for A and B. The vapour pressure of pure A is _____ mm Hg. (Nearest integer)
Consider the liquids and solutions behave ideally

Q46. The number of units, which are used to express concentration of solutions from the following is _____.
(Mass percent, Mole, Mole fraction, Molarity, ppm, Molality.)

Q47. A student has studied the decomposition of a gas AB_3 at $25^\circ C$. He obtained the following data

$p\ (mm\ Hg)$	50	100	200	400
Relative $t_{\frac{1}{2}}(s)$	4	2	1	0.5

The order of the reaction is

(1) 0.5 (2) 2
(3) 1 (4) 0 (zero)

Q48. The number of statement/s which are the characteristics of physisorption is _____.

A. It is highly specific in nature
B. Enthalpy of adsorption is high
C. It decreases with increase in temperature
D. It results into unimolecular layer
E. No activation energy is needed

Q49. The metal which is extracted by oxidation and subsequent reduction from its ore is :

(1) Al (2) Ag
(3) Cu (4) Fe

Q50. Which one amongst the following are good oxidising agents?

(a) Sm^{2+}
(b) Ce^{2+}
(c) Ce^{4+}
(d) Tb^{4+}

Choose the most appropriate answer from the options given below :

(1) C only (2) D only
(3) A and B only (4) C and D only

Q51. $K_2Cr_2O_7$ paper acidified with dilute H_2SO_4 turns green when exposed to

(1) Carbon dioxide (2) Sulphur trioxide
(3) Hydrogen sulphide (4) Sulphur dioxide

Q52. Which of the following cannot be explained by crystal field theory?

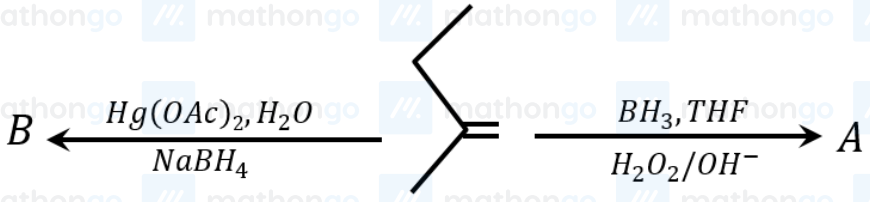
(1) The order of spectrochemical series (2) Magnetic properties of transition metal complexes
(3) Colour of metal complexes (4) Stability of metal complexes

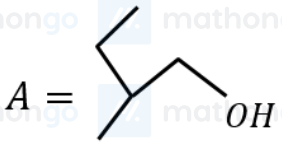
Q53. The hybridization and magnetic behaviour of cobalt ion in $[Co(NH_3)_6]^{3+}$ complex, respectively is

(1) sp^3d^2 and diamagnetic (2) d^2sp^3 and paramagnetic
(3) d^2sp^3 and diamagnetic (4) sp^3d^2 and paramagnetic

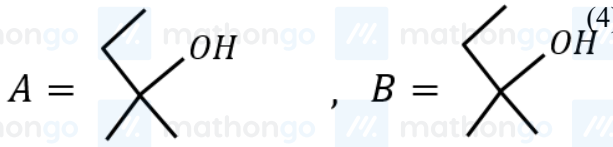
Q54. Maximum number of isomeric monochloro derivatives which can be obtained from 2,2,5,5- tetramethylhexane by chlorination is _____

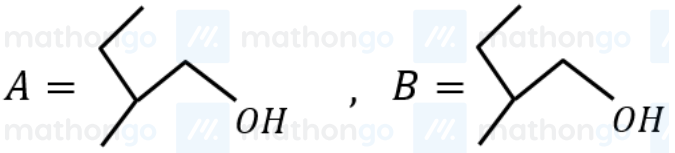
Q55. Find out the major products from the following reactions.



(1) 

(2) 

(3) 

(4) 

Q56. Given below are two statements :

Statement I : Pure Aniline and other arylamines are usually colourless.

Statement II : Arylamines get coloured on storage due to atmospheric reduction.

In the light of the above statements, choose the most appropriate answer from the options given below :

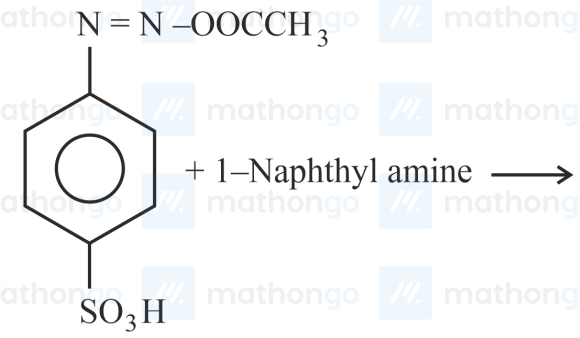
(1) Both Statement I and Statement II are incorrect

(2) Both Statement I and Statement II are correct

(3) Statement I is correct but Statement II is incorrect

(4) Statement I is incorrect but Statement II is correct

Q57. Choose the correct colour of the product for the following reaction.



(1) Yellow

(2) White

(3) Red

(4) Blue

Q58. Correct statement is :

(1) An average human being consumes more food than air

(2) An average human being consumes nearly 15 times more air than food

(3) An average human being consumes equal amount of food and air

(4) An average human being consumes 100 times more air than food

Q59. Match List I with List II

	LIST I Type		**LIST II Name**
A	Antifertility drug	I	Norethindrone
B	Tranquilizer	II	Meprobomate
C	Antihistamine	III	Seldane
D	Antibiotic	IV	Ampicillin

Choose the correct answer from the options given below :

(1) A-II, B-I, C-III, D-IV (2) A-IV, B-III, C-II, D-I

(3) A-I, B-III, C-II, D-IV (4) A-I, B-II, C-III, D-IV

Q60. Total number of tripeptides possible by mixing of valine and proline is _____ .

Q61. The number of real solutions of the equation $3\left(x^2+\frac{1}{x^2}\right)-2\left(x+\frac{1}{x}\right)+5=0$, is

(1) 4 (2) 0

(3) 3 (4) 2

Q62. The value of $\left(\frac{1+\sin\frac{2\pi}{9}+i\cos\frac{2\pi}{9}}{1+\sin\frac{2\pi}{9}-i\cos\frac{2\pi}{9}}\right)^3$ is

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

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

Q63. The number of integers, greater than 7000 that can be formed, using the digits $3,5,6,7,8$ without repetition is

(1) 120 (2) 168

(3) 220 (4) 48

Q64. If $\frac{1^3+2^3+3^3\ldots\ldots\text{upto } n \text{ terms}}{1\cdot3+2\cdot5+3\cdot7+\ldots\text{upto } n \text{ terms}}=\frac{9}{5}$ then the value of n is

Q65. If $\left({}^{30}C_1\right)^2+2\left({}^{30}C_2\right)^2+3\left({}^{30}C_3\right)^2\ldots\ldots\ldots\ldots30\left({}^{30}C_{30}\right)^2=\frac{\alpha60!}{(30!)^2}$, then α is equal to

(1) 30 (2) 60

(3) 15 (4) 10

Q66. Let he sum of the coefficient of first three terms in the expansion of $\left(x-\frac{3}{x^2}\right)^n;\ x=0,\ n\in N$ be 376. Then, the coefficient of x^4 is equal to:

Q67. Let $S=\{\theta\in[0,2\pi):\ \tan(\pi\cos\theta)+\tan(\pi\sin\theta)=0\}$, then $\sum_{\theta\in S}\sin^2\left(\theta+\frac{\pi}{4}\right)$ is equal to

Q68. The equations of the sides $AB,\ BC$ & CA of a triangle ABC are $2x+y=0$, $x+py=21a\ (a\neq0)$ and $x-y=3$ respectively. Let $P(2,a)$ be the centroid of the triangle ABC, then $(BC)^2$ is equal to

Q69. The locus of the middle points of the chords of the circle $C_1:\ (x-4)^2+(y-5)^2=4$ which subtend an angle θ_i at the centre of the circle C_i, is a circle of radius r_i. If $\theta_1=\frac{\pi}{3}$, $\theta_3=\frac{2\pi}{3}$ and ${r_1}^2={r_2}^2+{r_3}^2$, then θ_2 is equal to

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

(3) $\frac{\pi}{6}$ (4) $\frac{\pi}{2}$

Q70. The equations of sides AB and AC of a triangle ABC are $(\lambda+1)x+\lambda y=4$ and $\lambda x+(1-\lambda)y+\lambda=0$ respectively. Its vertex A is on the $y-$axis and its orthocentre is $(1,2)$. The length of the tangent from the point C to the part of the parabola $y^2=6x$ in the first quadrant is

(1) $\sqrt{6}$ (2) $2\sqrt{2}$

(3) 2 (4) 4

Q71. The set of values of a for which $\lim_{x \to a}([x-5]-[2x+2])=0$, where, $[\zeta]$ denotes the greatest integer less than or equal to ζ is equal to

(1) $(-7.5,-6.5)$ (2) $(-7.5,-6.5]$
(3) $[-7.5,-6.5]$ (4) $[-7.5,-6.5)$

Q72. Let p and q be two statements. Then $\sim(p \wedge(p \rightarrow \sim q)$ is equivalent to

(1) $p \vee(p \wedge(\sim q))$ (2) $p \vee((\sim p) \wedge q)$
(3) $(\sim p) \vee q$ (4) $p \vee(p \wedge q)$

Q73. Let the six numbers $a_1, a_2, \ldots, a_6$ be in A. P. and $a_1+a_3=10$.If the mean of these six numbers is $\frac{19}{2}$ and their variance is σ^2, then $8 \sigma^2$ is equal to

(1) 220 (2) 210
(3) 200 (4) 105

Q74. The minimum number of elements that must be added to relation $R=\{(a, b),(b, c),(b, d)\}$ on the set $\{a, b, c, d\}$, so that it is an equivalence relation is

Q75. The number of square matrices of order 5 with entries from the set $\{0,1\}$, such that the sum of all the elements in each row is 1 and the sum of all the elements in each column is also 1, is

(1) 225 (2) 120
(3) 150 (4) 125

Q76. Let A be a 3×3 matrix such that $|adj(adj(adj.\ A))|=12^4$. Then $\left|A^{-1} adj\ A\right|$ is equal to

(1) $2 \sqrt{3}$ (2) $\sqrt{6}$
(3) 12 (4) 1

Q77. If the system of equations $x+2y+3z=3$, $4x+3y-4z=4$ and $8x+4y-\lambda z=9+\mu$ has infinitely many solutions, then the ordered pair (λ, μ) is equal to

(1) $\left(\frac{72}{5}, \frac{21}{5}\right)$ (2) $\left(\frac{-72}{5}, \frac{-21}{5}\right)$
(3) $\left(\frac{72}{5}, \frac{-21}{5}\right)$ (4) $\left(\frac{-72}{5}, \frac{21}{5}\right)$

Q78. If $f(x)=\frac{2^{2x}}{2^{2x}+2}$, $x \in \mathrm{R}$, then $f\left(\frac{1}{2023}\right)+f\left(\frac{2}{2023}\right)+f\left(\frac{3}{2023}\right) \ldots \ldots \ldots f\left(\frac{2022}{2023}\right)$ is equal to

(1) 2011 (2) 1010
(3) 2010 (4) 1011

Q79. Let $f(x)$ be a function such that $f(x+y)=f(x) \cdot f(y)$ for all $x, y \in \mathrm{N}$, If $f(1)=3$ and $\sum_{k=1}^{n} f(k)=3279$, then the value of n is

(1) 6 (2) 8
(3) 7 (4) 9

Q80. If $f(x)=x^3-x^2 f'(1)+x f''(2)-f'''(3)$, $x \in \mathrm{R}$, then

(1) $3f(1)+f(2)=f(3)$ (2) $f(3)-f(2)=f(1)$
(3) $2f(0)-f(1)+f(3)=f(2)$ (4) $f(1)+f(2)+f(3)=f(0)$

Q81. $\int_{\frac{3\sqrt{2}}{4}}^{\frac{3\sqrt{3}}{4}} \frac{48}{\sqrt{9-4x^2}} dx$ is equal to

(1) $\frac{\pi}{3}$ (2) $\frac{\pi}{2}$
(3) $\frac{\pi}{6}$ (4) 2π

Q82. Let f be a differentiable function defined on $\left[0, \frac{\pi}{2}\right]$ such that $f(x) > 0$ and $f(x) + \int_0^x f(t)\sqrt{1 - (\log_e(f(t)))^2}dt = e \; \forall x \in \left[0, \frac{\pi}{2}\right]$, then $\left\{6\log_e\left(f\left(\frac{\pi}{6}\right)\right)\right\}^2$ is equal to

Q83. If the area of the region bounded by the curves $y^2 - 2y = -x$ and $x + y = 0$ is A, then $8A =$

Q84. Let $\mathrm{y} = \mathrm{y}(\mathrm{x})$ be the solution of the differential equation $\left(\mathrm{x}^2 - 3\mathrm{y}^2\right)\mathrm{dx} + 3\,\mathrm{xy}\;\mathrm{dy} = 0,\; \mathrm{y}(1) = 1$. Then $6\mathrm{y}^2(\mathrm{e})$ is equal to

(1) $3\mathrm{e}^2$ (2) e^2
(3) $2\mathrm{e}^2$ (4) $\frac{3\mathrm{e}^2}{2}$

Q85. Let $\vec{\alpha} = 4\hat{\mathrm{i}} + 3\hat{\mathrm{j}} + 5\hat{\mathrm{k}}$ and $\vec{\beta} = \hat{\mathrm{i}} + 2\hat{\mathrm{j}} - 4\hat{\mathrm{k}}$. Let $\vec{\beta}_1$ be parallel to $\vec{\alpha}$ and $\vec{\beta}_2$ be perpendicular to $\vec{\alpha}$. If $\vec{\beta} = \vec{\beta}_1 + \vec{\beta}_2$, then the value of $5\vec{\beta}_2 \cdot \left(\hat{\mathrm{i}} + \hat{\mathrm{j}} + \hat{\mathrm{k}}\right)$ is

(1) 6 (2) 11
(3) 7 (4) 9

Q86. Let $\vec{a} = \hat{i} + 2\hat{j} + \lambda\hat{k}, \vec{b} = 3\hat{i} - 5\hat{j} - \lambda\hat{k}, \vec{a}\cdot\vec{c} = 7, 2\left(\vec{b}\cdot\vec{c}\right) + 43 = 0, \vec{a}\times\vec{c} = \vec{b}\times\vec{c}$, then $\vec{a}\cdot\vec{b}$ is equal to

Q87. Let the plane containing the line of intersection of the planes $P_1 :\; x + (\lambda + 4)y + z = 1$ and $P_2 :\; 2x + y + z = 2$ pass through the points $(0, 1, 0)$ and $(1, 0, 1)$. Then the distance of the point $(2\lambda, \lambda, -\lambda)$ from the plane P_2 is

(1) $5\sqrt{6}$ (2) $4\sqrt{6}$
(3) $2\sqrt{6}$ (4) $3\sqrt{6}$

Q88. If the foot of the perpendicular drawn from $(1, 9, 7)$ to the line passing through the point $(3, 2, 1)$ and parallel the planes $x + 2y + z = 0$ and $3y - z = 3$ is (α, β, γ), then $\alpha + \beta + \gamma$ is equal to

(1) -1 (2) 3
(3) 1 (4) 5

Q89. If the shortest distance between the lines $\frac{x+\sqrt{6}}{2} = \frac{y-\sqrt{6}}{3} = \frac{z-\sqrt{6}}{4}$ and $\frac{x-\lambda}{3} = \frac{y-2\sqrt{6}}{4} = \frac{z+2\sqrt{6}}{5}$ is 6, then sum of squares of all possible values(s) of λ is

Q90. The urns A, B and C contains 4 red, 6 black; 5 red, 5 black and λ red, 4 black balls respectively. One of the urns is selected at random and a ball is drawn. If the ball drawn is red and the probability that it is drawn from urn C is 0.4, then the square of length of the side of largest equilateral triangle, inscribed in the parabola $y^2 = \lambda x$ with one vertex at vertex of parabola is

ANSWER KEYS

1. (2)	**2.** (1)	**3.** (3)	**4.** (3)	**5.** (3)	**6.** (4)	**7.** (3)	**8.** (1)
9. (4)	**10.** (3)	**11.** (2)	**12.** (1)	**13.** (2)	**14.** (3)	**15.** (3)	**16.** (2)
17. (2)	**18.** (4)	**19.** (2)	**20.** (1)	**21.** (100)	**22.** (32)	**23.** (7)	**24.** (1)
25. (105)	**26.** (44)	**27.** (9)	**28.** (3)	**29.** (54)	**30.** (6)	**31.** (1)	**32.** (2)
33. (3)	**34.** (3)	**35.** (2)	**36.** (4)	**37.** (1)	**38.** (3)	**39.** (3)	**40.** (2)
41. (2)	**42.** (4)	**43.** (4)	**44.** (1)	**45.** (3)	**46.** (1)	**47.** (3)	**48.** (3)
49. (2)	**50.** (4)	**51.** (2)	**52.** (8)	**53.** (2)	**54.** (620)	**55.** (85)	**56.** (314)
57. (5)	**58.** (2)	**59.** (3)	**60.** (8)	**61.** (2)	**62.** (3)	**63.** (2)	**64.** (3)
65. (4)	**66.** (2)	**67.** (1)	**68.** (3)	**69.** (2)	**70.** (2)	**71.** (1)	**72.** (3)
73. (4)	**74.** (3)	**75.** (3)	**76.** (4)	**77.** (3)	**78.** (3)	**79.** (4)	**80.** (4)
81. (5)	**82.** (405)	**83.** (2)	**84.** (122)	**85.** (13)	**86.** (27)	**87.** (36)	**88.** (8)
89. (384)	**90.** (432)						