Q1. In terms of resistance R and time T, the dimensions of ratio $\frac{\mu}{\varepsilon}$ of the permeability μ and permittivity ε is:

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

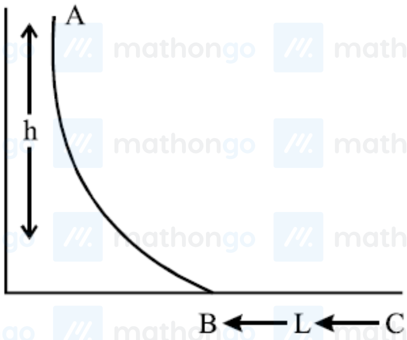
Q2. The initial speed of a bullet fired from a rifle is $630\ \mathrm{m/s}$. The rifle is fired at the centre of a target $700\ \mathrm{m}$ away at the same level as the target. How far above the centre of the target ?

(1) $1.0\ \mathrm{m}$
(2) $4.2\ \mathrm{m}$
(3) $6.1\ \mathrm{m}$
(4) $9.8\ \mathrm{m}$

Q3. A body of mass $5\ \mathrm{kg}$ under the action of constant force $\vec{F}=F_x\hat{i}+F_y\hat{j}$ has velocity at $\mathrm{t}=0\ \mathrm{s}$ as $\overrightarrow{\mathrm{v}}=(6\hat{\mathrm{i}}-2\hat{\mathrm{j}}\mathrm{m/s})$ and at $\mathrm{t}=10\ \mathrm{s}$ as $\overrightarrow{\mathrm{v}}=+6\hat{\mathrm{j}}\mathrm{m/s}$. The force $\overrightarrow{\mathrm{F}}$ is:

(1) $(-3\hat{\mathrm{i}}+4\hat{\mathrm{j}})\mathrm{N}$
(2) $\left(-\frac{3}{5}\hat{i}+\frac{4}{5}\hat{j}\right)N$
(3) $(3\hat{\mathrm{i}}-4\hat{\mathrm{j}})\mathrm{N}$
(4) $\left(\frac{3}{5}\hat{\mathrm{i}}-\frac{4}{5}\hat{\mathrm{j}}\right)\mathrm{N}$

Q4. A small ball of mass m starts at a point A with speed $\mathrm{v_o}$ and moves along a frictionless track AB as shown. The track BC has coefficient of friction μ. The ball comes to stop at C after travelling a distance L which is:

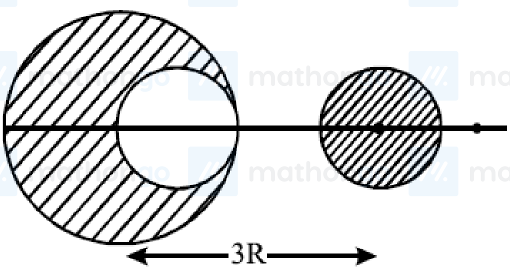


(1) $\frac{2\,\mathrm{h}}{\mu}+\frac{\mathrm{v_o^2}}{2\mu\mathrm{g}}$
(2) $\frac{\mathrm{h}}{\mu}+\frac{\mathrm{v_0^2}}{2\mu\mathrm{g}}$
(3) $\frac{\mathrm{h}}{2\mu}+\frac{\mathrm{v_o^2}}{\mu\mathrm{g}}$
(4) $\frac{\mathrm{h}}{2\mu}+\frac{\mathrm{v_0^2}}{2\mu\mathrm{g}}$

Q5. A thin bar of length L has a mass per unit length λ, that increases linearly with distance from one end. If its total mass is M and its mass per unit length at the lighter end is λ_{O}, then the distance of the centre of mass from the lighter end is:

(1) $\frac{\mathrm{L}}{2}-\frac{\lambda_0\mathrm{L}^2}{4\mathrm{M}}$
(2) $\frac{\mathrm{L}}{3}+\frac{\lambda_0\mathrm{L}^2}{8\mathrm{M}}$
(3) $\frac{\mathrm{L}}{3}+\frac{\lambda_0\mathrm{L}^2}{4\mathrm{M}}$
(4) $\frac{2\,\mathrm{L}}{3}-\frac{\lambda_0\mathrm{L}^2}{6\mathrm{M}}$

Q6. From a sphere of mass M and radius R, a smaller sphere of radius $\frac{\mathrm{R}}{2}$ is carved out such that the cavity made in the original sphere is between its centre and the periphery (See figure). For the configuration in the figure where the distance between the centre of the original sphere and the removed sphere is 3R, the gravitational force between the two sphere is:



(1) $\frac{41\mathrm{GM}^2}{3600\mathrm{R}^2}$
(2) $\frac{41\mathrm{GM}^2}{450\mathrm{R}^2}$
(3) $\frac{59\mathrm{GM}^2}{450\mathrm{R}^2}$
(4) $\frac{\mathrm{GM}^2}{225\mathrm{R}^2}$

Q7. The bulk moduli of ethanol, mercury and water are given as $0.9, 25$ and 2.2 respectively in units of $10^9 \mathrm{Nm}^{-2}$. For a given value of pressure, the fractional compression in volume is $\frac{\Delta \mathrm{V}}{\mathrm{V}}$. Which of the following statements about $\frac{\Delta V}{V}$ for these three liquids is correct ?

(1) Ethanol $>$ Water $>$ Mercury
(2) Water $>$ Ethanol $>$ Mercury
(3) Mercury $>$ Ethanol $>$ Water
(4) Ethanol $>$ Mercury $>$ Water

Q8. The average mass of rain drops is 3.0×10^{-5} kg and their avarage terminal velocity is $9 \mathrm{~m/s}$. Calculate the energy transferred by rain to each square metre of the surface at a place which receives 100 cm of rain in a year.

(1) 3.5×10^5 J
(2) 4.05×10^4 J
(3) 3.0×10^5 J
(4) 9.0×10^4 J

Q9. A tank with a small hole at the bottom has been filled with water and kerosene (specific gravity 0.8). The height of water is 3 m and that of kerosene 2 m. When the hole is opened the velocity of fluid coming out from it is nearly: (take $\mathrm{g} = 10 \mathrm{~ms}^{-2}$ and density of water $= 10^3 \mathrm{~kg~m}^{-3}$)

(1) $10.7 \mathrm{~ms}^{-1}$
(2) $9.6 \mathrm{~ms}^{-1}$
(3) $8.5 \mathrm{~ms}^{-1}$
(4) $7.6 \mathrm{~ms}^{-1}$

Q10. An air bubble of radius 0.1 cm is in a liquid having surface tension $0.06 \mathrm{~N/m}$ and density $10^3 \mathrm{~kg/m}^3$. The pressure inside the bubble is $1100 \mathrm{Nm}^{-2}$ greater than the atmospheric pressure. At what depth is the bubble below the surface of the liquid? $(\mathrm{g} = 9.8 \mathrm{~ms}^{-2})$

(1) 0.1 m
(2) 0.15 m
(3) 0.20 m
(4) 0.25 m

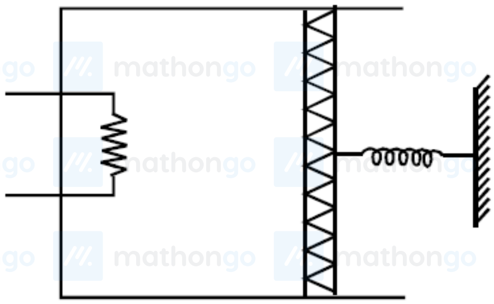
Q11. A hot body, obeying Newton's law of cooling is cooling down from its peak value $80^{\circ}\mathrm{C}$ to an ambient temperature of $30^{\circ}\mathrm{C}$. It takes 5 minutes in cooling down from $80^{\circ}\mathrm{C}$ to $40^{\circ}\mathrm{C}$. How much time will it take to cool down from $62^{\circ}\mathrm{C}$ to $32^{\circ}\mathrm{C}$? (Given In $2 = 0.693$, In $5 = 1.609$)

(1) 3.75 minutes
(2) 8.6 minutes
(3) 9.6 minutes
(4) 6.5 minutes

Q12. During an adiabatic compression, 830 J of work is done on 2 moles of a diatomic ideal gas to reduce its volume by 50%. The change in its temperature is nearly: $(\mathrm{R} = 8.3 \mathrm{JK}^{-1} \mathrm{~mol}^{-1})$

(1) 40 K
(2) 33 K
(3) 20 K
(4) 14 K

Q13. An ideal monoatomic gas is confined in a cylinder by a spring loaded piston of cross section $8.0 \times 10^{-3} \mathrm{~m}^2$. Initially the gas is at 300 K and occupies a volume of $2.4 \times 10^{-3} \mathrm{~m}^3$ and the spring is in its relaxed state as shown in figure. The gas is heated by a small heater until the piston moves out slowly by 0.1 m. The force constant of the spring is $8000 \mathrm{~N/m}$ and the atmospheric pressure is $1.0 \times 10^5 \mathrm{~N/m}^2$. The cylinder and the piston are thermally insulated. The piston and the spring are massless and there is no friction between the piston and the cylinder. The final temperature of the gas will be: (Neglect the heat loss through the lead wires of the heater. The heat capacity of the heater coil is also negligible).



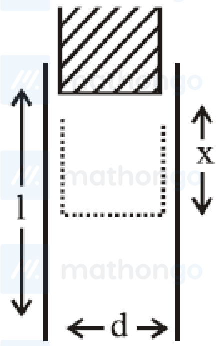
(1) 300 K
(2) 800 K
(3) 500 K
(4) 1000 K

Q14. The angular frequency of the damped oscillator is given by, $\omega=\sqrt{\left(\frac{k}{m}-\frac{r^2}{4 m^2}\right)}$ where k is the spring constant, m is the mass of the oscillator and r is the damping constant. If the ratio $\frac{r^2}{mk}$ is 8%, the change in time period compared to the undamped oscillator is approximately as follows:
(1) increases by 1%
(2) increases by 8%
(3) decreases by 1%
(4) decreases by 8%

Q15. Two factories are sounding their sirens at 800 Hz. A man goes from one factory to other at a speed of 2 m/s. The velocity of sound is 320 m/s. The number of beats heard by the person in one second will be:
(1) 2
(2) 4
(3) 8
(4) 10

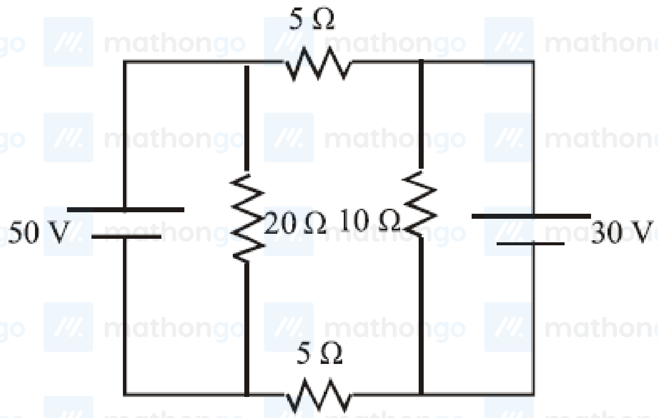
Q16. A cone of base radius R and height h is located in a uniform electric field $\vec{E}$ parallel to its base. The electric flux entering the cone is:
(1) $\frac{1}{2}EhR$
(2) EhR
(3) 2EhR
(4) 4EhR

Q17. A parallel plate capacitor is made of two plates of length 1 , width w and separated by distance d. A dielectric slab (dielectric constant K) that fits exactly between the plates is held near the edge of the plates. It is pulled into the capacitor by a force $F=-\frac{\partial U}{\partial x}$ where U is the energy of the capacitor when dielectric is inside the capacitor up to distance x (See figure). If the charge on the capacitor is Q then the force on the dielectric when



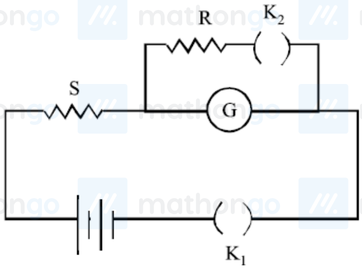
it is near the edge is:
(1) $\frac{Q^2 d}{2wl^2\varepsilon_o}K$
(2) $\frac{Q^2 W}{2dl^2\varepsilon_0}(K-1)$
(3) $\frac{Q^2 d}{2wl^2\varepsilon_o}(K-1)$
(4) $\frac{Q^2 w}{2dl^2\varepsilon_o}K$

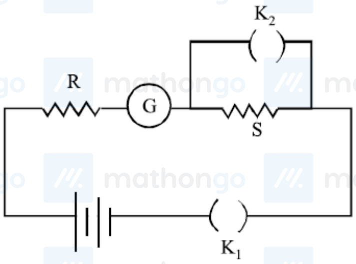
Q18. In the circuit shown, current (in A) through 50 V and 30 V batteries are, respectively:



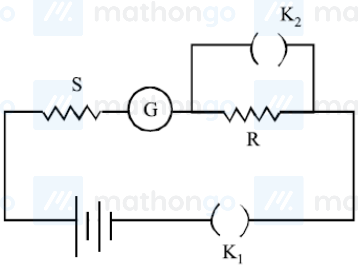
(1) 2.5 and 3
(2) 3.5 and 2
(3) 4.5 and 1
(4) 3 and 2.5

Q19. In the circuit diagrams (A, B, C and D) shown below, R is a high resistance and S is a resistance of the order of galvanometer resistance G. The correct circuit, corresponding to the half deflection method for finding the resistance and figure of merit of the galvanometer, is the circuit labelled as: (a)

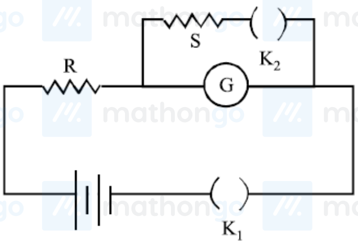




(b)



(C)



(d)

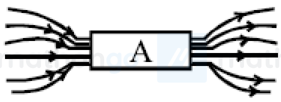
(1) Circuit A with $G = \frac{RS}{(R-S)}$

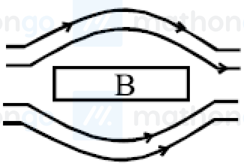
(2) Circuit B with $G = S$

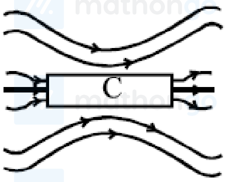
(3) Circuit C with $G = S$

(4) Circuit D with $G = \frac{RS}{(R-S)}$

Q20. Three identical bars A, B and C are made of different magnetic materials. When kept in a uniform magnetic field, the field lines around them look as follows:







Make the correspondence of these bars with their material being diamagnetic (D), ferromagnetic (F) and paramagnetic (P) :

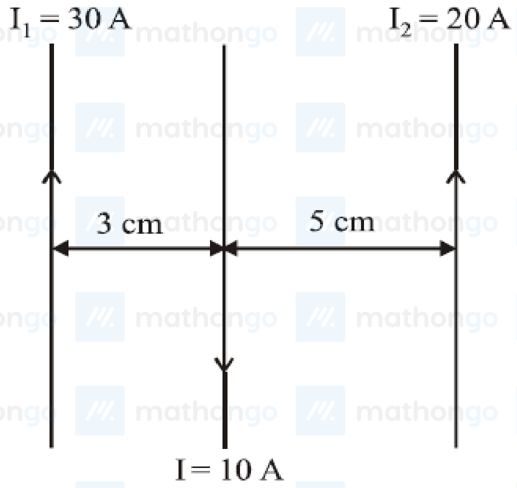
(1) $A \leftrightarrow D, B \leftrightarrow P, C \leftrightarrow F$

(2) $A \leftrightarrow F, B \leftrightarrow D, C \leftrightarrow P$

(3) $A \leftrightarrow P, B \leftrightarrow F, C \leftrightarrow D$

(4) $A \leftrightarrow F, B \leftrightarrow P, C \leftrightarrow D$

Q21. Three straight parallel current carrying conductors are shown in the figure. The force experienced by the



middle conductor of length 25 cm is:

(1) 3×10^{-4} N toward right

(2) 6×10^{-4} N toward right

(3) 9×10^{-4} N toward right

(4) Zero

Q22. A coil of circular cross-section having 1000 turns and 4 cm^2 face area is placed with its axis parallel to a magnetic field which decreases by 10^{-2} Wb m^{-2} in 0.01 s. The e.m.f. induced in the coil is:

(1) 400mV
(2) 200mV
(3) 4mV
(4) 0.4mV

Q23. An electromagnetic wave of frequency 1×10^{14} hertz is propagating along z-axis. The amplitude of electric field is 4 V/m. If $\varepsilon_0 = 8.8 \times 10^{-12} \text{C}^2/\text{N}-\text{ m}^2$, then average energy density of electric field will be:

(1) $35.2 \times 10^{-10} \text{ J/m}^3$
(2) $35.2 \times 10^{-11} \text{ J/m}^3$
(3) $35.2 \times 10^{-12} \text{ J/m}^3$
(4) $35.2 \times 10^{-13} \text{ J/m}^3$

Q24. An object is located in a fixed position in front of a screen. Sharp image is obtained on the screen for two positions of a thin lens separated by 10 cm. The size of the images in two situations are in the ratio 3 : 3. What is the distance between the screen and the object?

(1) 124.5 cm
(2) 144.5 cm
(3) 65.0 cm
(4) 99.0 cm

Q25. In a compound microscope the focal length of objective lens is 1.2 cm and focal length of eye piece is 3.0 cm. When object is kept at 1.25 cm in front of objective, final image is formed at infinity. Magnifying power of the compound microscope should be:

(1) 200
(2) 100
(3) 400
(4) 150

Q26. Two monochromatic light beams of intensity 16 and 9 units are interfering. The ratio of intensities of bright and dark parts of the resultant pattern is:

(1) $\frac{16}{9}$
(2) $\frac{4}{3}$
(3) $\frac{7}{1}$
(4) $\frac{49}{1}$

Q27. A photon of wavelength λ is scattered from an electron, which was at rest. The wavelength shift $\Delta\lambda$ is three times of λ and the angle of scattering θ is 60°. The angle at which the electron recoiled is ϕ. The value of $\tan\phi$

is : (electron speed is much smaller than the speed of light)

(1) 0.16
(2) 0.22
(3) 0.25
(4) 0.28

Q28. Match the List-I (Phenomenon associated with electromagnetic radiation) with List-II (Part of electromagnetic spectrum) and select the correct code from the choices given below this lists:

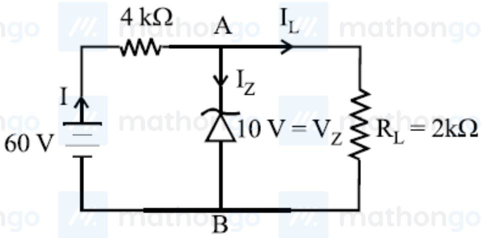
	List I		List II
I	Doublet of sodium	(A)	Visible radiation
II	Wavelength corresponding to temperature associated with the isotropic radiation filling all space	(B)	Microwave
III	Wavelength emitted by atomic hydrogen in interstellar space	(C)	Short radio wave
IV	Wavelength of radiation arising from two close energy levels in hydrogen	(D)	X-rays

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

Q29. A radioactive nuclei with decay constant $0.5/\mathrm{s}$ is being produced at a constant rate of 100 nuclei/s. If at $t=0$ there were no nuclei, the time when there are 50 nuclei is:

(1) 1 s
(2) $2 \ln \left(\frac{4}{3}\right) \mathrm{s}$
(3) $\ln 2$ s
(4) $\ln \left(\frac{4}{3}\right) \mathrm{s}$

Q30. A Zener diode is connected to a battery and a load as show below:



The currents, $\mathrm{I}, \mathrm{I}_{\mathrm{Z}}$ and I_{L} are respectively.

(1) $15 \mathrm{~mA}, 5 \mathrm{~mA}, 10 \mathrm{~mA}$
(2) $15 \mathrm{~mA}, 7.5 \mathrm{~mA}, 7.5 \mathrm{~mA}$
(3) $12.5 \mathrm{~mA}, 5 \mathrm{~mA}, 7.5 \mathrm{~mA}$
(4) $12.5 \mathrm{~mA}, 7.5 \mathrm{~mA}, 5 \mathrm{~mA}$

Q31. A gaseous compound of nitrogen and hydrogen contains 12.5% (by mass) of hydrogen. The density of the compound relative to hydrogen is 16. The molecular formula of the compound is:

(1) NH_2
(2) N_3H
(3) NH_3
(4) N_2H_4

Q32. If λ_0 and λ be threshold wavelength and wavelength of incident light, the velocity of photoelectron ejected from the metal surface is:

(1) $\sqrt{\frac{2h}{m}(\lambda_0 - \lambda)}$
(2) $\sqrt{\frac{2hc}{m}(\lambda_o - \lambda)}$
(3) $\sqrt{\frac{2hc}{m}\left(\frac{\lambda_0 - \lambda}{\lambda\lambda_0}\right)}$
(4) $\sqrt{\frac{2h}{m}\left(\frac{1}{\lambda_o} - \frac{1}{\lambda}\right)}$

Q33. Based on the equation:

$$\Delta E = -2.0 \times 10^{-18}\ J\left(\frac{1}{n_2^2} - \frac{1}{n_1^2}\right)$$

the wavelength of the light that must be absorbed to excite hydrogen electron from level $n = 1$ to level $n = 2$ will be: $(h = 6.625 \times 10^{-34} Js, C = 3 \times 10^8\ ms^{-1})$

(1) 1.325×10^{-7} m
(2) 1.325×10^{-10} m
(3) 2.650×10^{-7} m
(4) 5.300×10^{-10} m

Q34. Which of the following series correctly represents relations between the elements from X to Y ? $X \rightarrow Y$

(1) ${}_3Li \rightarrow {}_{19}K$ Ionization enthalpy increases
(2) ${}_9F \rightarrow {}_{35}Br$ Electron gain enthalpy (negative sign) increases
(3) ${}_6C \rightarrow {}_{32}Ge$ Atomic radii increases
(4) ${}_{18}Ar \rightarrow {}_{54}Xe$ Noble character increases

Q35. The correct order of bond dissociation energy among N_2, O_2, O_2^- is shown in which of the following arrangements?

(1) $N_2 > O_2^- > O_2$
(2) $O_2^- > O_2 > N_2$
(3) $N_2 > O_2 > O_2^-$
(4) $O_2 > O_2^- > N_2$

Q36. Which one of the following does not have a pyramidal shape?

(1) $(CH_3)_3N$
(2) $(SiH_3)_3N$
(3) $P(CH_3)_3$
(4) $P(SiH_3)_3$

Q37. In allene (C_3H_4), the type(s) of hybridization of the carbon atoms is (are) :

(1) sp and sp^3
(2) sp^2 and sp
(3) only sp^2
(4) sp^2 and sp^3

Q38. The initial volume of a gas cylinder is 750.0 mL. If the pressure of gas inside the cylinder changes from 840.0 mmHg to 360.0 mmHg, the final volume the gas will be:

(1) 1.750 L
(2) 3.60 L
(3) 4.032 L
(4) 7.50 L

Q39. The molar heat capacity (C_p) of CD_2O is 10 cals at 1000 K. The change in entropy associated with cooling of 32 g of CD_2O vapour from 1000 K to 100 K at constant pressure will be: (D = deuterium, atomic mass = 2u)

(1) $23.03 cal deg^{-1}$
(2) $-23.03 cal deg^{-1}$
(3) $2.303 cal deg^{-1}$
(4) $-2.303 cal deg^{-1}$

Q40. Consider the following equilibrium

$$AgCl \downarrow + 2NH_3 \rightleftharpoons [Ag(NH_3 2_2]^+ + Cl^-$$

White precipitate of AgCl appears on adding which of the following?

(1) NH_3
(2) aqueous NaCl
(3) aqueous HNO_3
(4) aqueous NH_4Cl

Q41. Assuming that the degree of hydrolysis is small, the pH of 0.1M solution of sodium acetate $\left(K_a = 1.0 \times 10^{-5}\right)$ will be:
(1) 5.0
(2) 6.0
(3) 8.0
(4) 9.0

Q42. Which of the following statements about Na_2O_2 is not correct?
(1) It is diamagnetic in nature
(2) It is derivative of H_2O_2
(3) Na_2O_2 oxidises Cr^{3+} to CrO_4^{2-} in acid medium.
(4) It is the super oxide of sodium

Q43.

The reagent needed for converting
(1) Cat. Hydrogenation
(2) H_2 /Lindlar Cat.
(3) Li/NH_3
(4) $LiAlH_4$

Q44. The gas liberated by the electrolysis of Dipotassium succinate solution is:
(1) Ethane
(2) Ethyne
(3) Ethene
(4) Propene

Q45. Which of the following statements about the depletion of ozone layer is correct?
(1) The problem of ozone depletion is less serious at poles because NO_2 solidifies and is not available for consuming ClO° radicals.
(2) The problem of ozone depletion is more serious at poles because ice crystals in the clouds over poles act as catalyst for photochemical reactions involving the decomposition of ozone of $Cl^{\bullet}$ and $ClO^{\bullet}$ radicals.
(3) Freons, chlorofluorocarbons, are inert. Chemically, they do not react with ozone in stratosphere.
(4) Oxides of nitrogen also do not react with ozone in stratosphere.

Q46. The appearance of colour in solid alkali metal halides is generally due to:
(1) Schottky defect
(2) Frenkel defect
(3) Interstitial position
(4) F-centres

Q47. In some solutions, the concentration of H_3O^+ remains constant even when small amounts of strong acid or strong base are added to them. These solutions are known as:
(1) Ideal solutions
(2) Colloidal solutions
(3) True solutions
(4) Buffer solutions

Q48. Given

$$Fe^{3+}(aq) + e^- \rightarrow Fe^{2+}(aq); E^0 = +0.77\ V$$
$$Al^{3+}(aq) + 3e^- \rightarrow Al(s); E^0 = -1.66\ V$$
$$Br_2(aq) + 2e^- \rightarrow 2Br^-; E^0 = +1.09\ V$$

Considering the electrode potentials, which of the following represents the correct order of reducing power?

(1) $Fe^{2+} < Al < Br^-$
(2) $Br^- < Fe^{2+} < Al$
(3) $Al < Br^- < Fe^{2+}$
(4) $Al < Fe^{2+} < Br^-$

Q49. In the reaction of formation of sulphur trioxide by contact process $2SO_2 + O_2 \rightleftharpoons 2SO_3$ the rate of reaction was measured as $\frac{d[O_2]}{dt} = -2.5 \times 10^{-4}$ mol L^{-1} s^{-1}. The rate of reaction is terms of $[SO_2]$ in molL^{-1} s^{-1} will be:
(1) -1.25×10^{-4}
(2) -2.50×10^{-4}
(3) -3.75×10^{-4}
(4) -5.00×10^{-4}

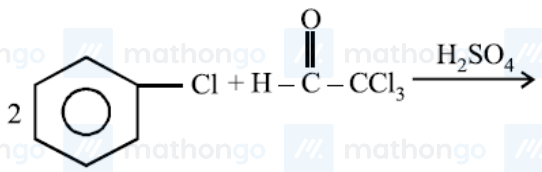
Q50. For the reaction, $2N_2O_5 \rightarrow 4NO_2 + O_2$, the rate equation can be expressed in two ways $-\frac{d[N_2O_5]}{dt} = k[N_2O_5]$ and $+\frac{d[NO_2]}{dt} = k'[N_2O_5]$ k and k' are related as:
(1) $k = k'$
(2) $2k = k'$
(3) $k = 2k'$
(4) $k = 4k'$

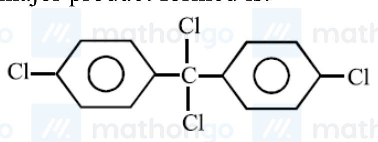
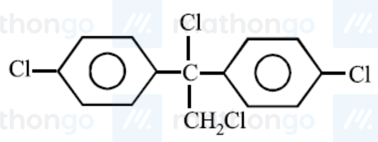
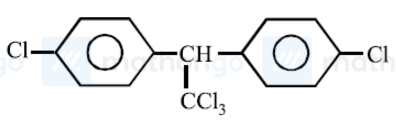
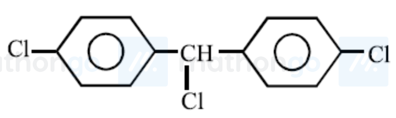
Q51. Shapes of certain interhalogen compounds are stated below. Which one of them is not correctly stated?
(1) IF_7 : pentagonal bipyramid
(2) BrF_5 : trigonal bipyramid
(3) BrF_3 : planar T-shaped
(4) ICl_3 : planar dimeric

Q52. Which of the following name formula combinations is not correct?
(1) $K_2[Pt(CN)_4]$ - Potassium tetracyanoplatinate (II)
(2) $[Mn(CN)_5]^{2-}$ - Pentacyanomagnate (II) ion
(3) $K[Cr(NH_3)_2Cl_4]$ - Potassium diammine tetrachlorochromate (III)
(4) $[Co(NH_3)_4(H_2O)I]SO_4$ - Magnetron value.

Q53. Consider the coordination compound, $[Co(NH_3)_6]Cl_3$. In the formation of this complex, the species which acts as the Lewis acid is:
(1) $[Co(NH_3)_6]^{3+}$
(2) Cl^-
(3) Co^{3+}
(4) NH_3

Q54. Chlorobenzne reacts with trichloro acetaldehyde in the presence of H_2SO_4.



The major product formed is:
(1)

(2)

(3)

(4)


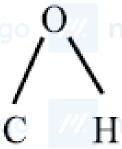
Q55. Tischenko reaction is a modification of:
(1) Aldol condensation
(2) Claisen condensation
(3) Cannizzaro reaction
(4) Pinacol-pinacolon reaction

Q56. Which one of the following statements is not correct?

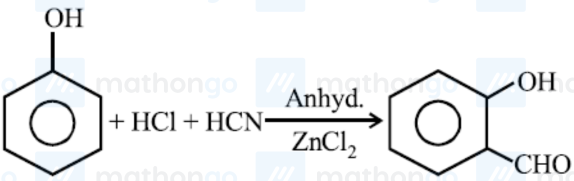
(1) Alcohols are weaker acids than water

(2) Acid strength of alcohols decreases in the following $RCH_2OH > R_2CHOH > R_3COH$

(3) Carbon-oxygen bond length in methanol, CH_3OH is shorter than that of $C-O$ bond length in phenol.

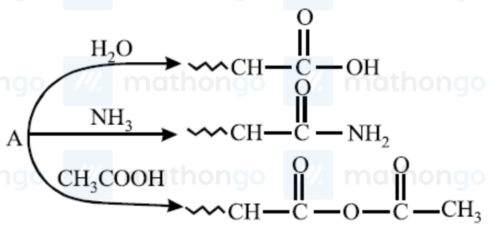
(4) The bond angle  in methanol is 108.9°.

Q57. The following reaction is known as:

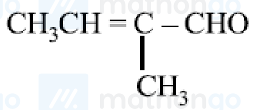


(1) Perkin reaction
(2) Gatterman-Koch Formylation
(3) Kolbe's reaction
(4) Gattermann reaction

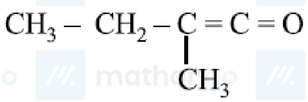
Q58. An organic compound A, C_5H_8O; reacts with H_2O, NH_3 and CH_3COOH as described below:

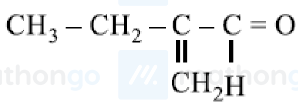


A is:

(1) 

(2) 

(3) 

(4) 

Q59. Complete reduction of benzene-diazonium chloride with Zn/HCl gives:

(1) Aniline
(2) Phenylhydrazine
(3) Azobenzene
(4) Hydrazobenzene

Q60. Which one of the following is used as Antihistamine?

(1) Omeprazole
(2) Chloranphenicol
(3) Diphenhydramine
(4) Norethindrone

Q61. If α and β are roots of the equation, $x^2-4\sqrt{2}kx+2e^{4\ln k}-1=0$ for some k, and $\alpha^2+\beta^2=66$, then $\alpha^3+\beta^3$ is equal to:

(1) $248\sqrt{2}$
(2) $280\sqrt{2}$
(3) $-32\sqrt{2}$
(4) $-280\sqrt{2}$

Q62. If z_1, z_2 and z_3, z_4 are 2 pairs of complex conjugate numbers, then $\arg\left(\frac{z_1}{z_4}\right)+\arg\left(\frac{z_2}{z_3}\right)$ equals:

(1) 0
(2) $\frac{\pi}{2}$
(3) $\frac{3\pi}{2}$
(4) π

Q63. An eight digit number divisible by 9 is to be formed using digits from 0 to 9 without repeating the digits. The number of ways in which this can be done is:

(1) 72(7!) (2) 18(7!)
(3) 40(7!) (4) 36(7!)

Q64. In a geometric progression, if the ratio of the sum of first 5 terms to the sum of their reciprocals is 49 , and the sum of the first and the third term is 35. Then the first term of this geometric progression is:

(1) 7 (2) 21
(3) 28 (4) 42

Q65. The sum of the first 20 terms common between the series $3+7+11+15+$ and $1+6+11+16+\ldots..$ is

(1) 4000 (2) 4020
(3) 4200 (4) 4220

Q66. The coefficient of x^{50} in the binomial expansion of $(1+x)^{1000}+x(1+x)^{999}+x^2(1+x)^{998}+\ldots+x^{1000}$ is:

(1) $\frac{(1000)!}{(50)(!95\varphi!}$ (2) $\frac{(1000)!}{(49)(!95)!}$
(3) $\frac{(1001)!}{(51)(!95\phi!}$ (4) $\frac{(1001)!}{(50)(!95)!}$

Q67. If $2\cos\theta+\sin\theta=1\left(\theta\neq\frac{\pi}{2}\right)$, then $7\cos\theta+6\sin\theta$ is equal to:

(1) $\frac{1}{2}$ (2) 2
(3) $\frac{11}{2}$ (4) $\frac{46}{5}$

Q68. The base of an equilateral triangle is along the line given by $3x+4y=9$. If a vertex of the triangle is $(1,2)$, then the length of a side of the triangle is:

(1) $\frac{2\sqrt{3}}{15}$ (2) $\frac{4\sqrt{3}}{15}$
(3) $\frac{4\sqrt{3}}{5}$ (4) $\frac{2\sqrt{3}}{5}$

Q69. The set of all real values of λ for which exactly two common tangents can be drawn to the circles $x^2+y^2-4x-4y+6=0$ and $\mathrm{x}^2+\mathrm{y}^2-10\mathrm{x}-10\mathrm{y}+\lambda=0$ is the interval:

(1) $(12,32)$ (2) $(18,42)$
(3) $(12,24)$ (4) $(18,48)$

Q70. Let L_1 be the length of the common chord of the curves $x^2+y^2=9$ and $y^2=8x$, and L_2 be the length of the latus rectum of $y^2=8x$, then:

(1) $\mathrm{L}_1>\mathrm{L}_2$ (2) $\mathrm{L}_1=\mathrm{L}_2$
(3) $\mathrm{L}_1<\mathrm{L}_2$ (4) $\frac{\mathrm{L}_1}{\mathrm{L}_2}=\sqrt{2}$

Q71. A stair-case of length l rests against a vertical wall and a floor of a room. Let P be a point on the stair-case, nearer to its end on the wall, that divides its length in the ratio 1 : 2. If the staircase begins to slide on the floor, then the locus of P is:

(1) an ellipse of eccentricity $\frac{1}{2}$ (2) an ellipse of eccentricity $\frac{\sqrt{3}}{2}$
(3) a circle of radius $\frac{1}{2}$ (4) a circle of radius $\frac{\sqrt{3}}{2}l$

Q72. Let $\mathrm{P}(3\sec\theta,2\tan\theta)$ and $\mathrm{Q}(3\sec\phi,2\tan\phi)$ where $\theta+\phi=\frac{\pi}{2}$, be two distinct points on the hyperbola $\frac{x^2}{9}-\frac{y^2}{4}=1$. Then the ordinate of the point of intersection of the normals at P and Q is:

(1) $\frac{11}{3}$ (2) $-\frac{11}{3}$
(3) $\frac{13}{2}$ (4) $-\frac{13}{2}$

Q73. If $\lim_{x\rightarrow 2}\frac{\tan(x-2\{x^2+k+2x-2k\}}{x^2-4x+4}=5$, then k is equal to:

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

Q74. The proposition $\sim(p\vee\sim q)\vee\sim(p\vee q)$ is logically equivalent to:

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

Q75. Two ships A and B are sailing straight away from a fixed point O along routes such that $\angle \mathrm{AOB}$ is always 120°. At a certain instance, $\mathrm{OA}=8$ km, $\mathrm{OB}=6$ km and the ship A is sailing at the rate of 20 km/hr while the ship B sailing at the rate of 30 km/hr. Then the distance between A and B is changing at the rate (in km/hr):

(1) $\frac{260}{\sqrt{37}}$
(2) $\frac{260}{37}$
(3) $\frac{80}{\sqrt{37}}$
(4) $\frac{80}{37}$

Q76. The angle of elevation of the top of a vertical tower from a point P on the horizontal ground was observed to be α. After moving a distance 2 metres from P towards the foot of the tower, the angle of elevation changes to β. Then the height (in metres) of the tower is:

(1) $\frac{2\sin\alpha\sin\beta}{\sin(\beta-\alpha)}$
(2) $\frac{\sin\alpha\sin\beta}{\cos(\beta-\alpha)}$
(3) $\frac{2\sin(\beta-\alpha)}{\sin\alpha\sin\beta}$
(4) $\frac{\cos(\beta-\alpha)}{\sin\alpha\sin\beta}$

Q77. Let $\mathrm{A}(2,3,5), \mathrm{B}(-1,3,2)$ and $\mathrm{C}(\lambda,5,\mu)$ be the vertices of a $\triangle\mathrm{ABC}$. If the median through A is equally inclined to the coordinate axes, then:

(1) $5\lambda-8\mu=0$
(2) $8\lambda-5\mu=0$
(3) $10\lambda-7\mu=0$
(4) $7\lambda-10\mu=0$

Q78. Let A be a 3×3 matrix such that

$$\mathrm{A}\begin{bmatrix}1 & 2 & 3\\ 0 & 2 & 3\\ 0 & 1 & 1\end{bmatrix}=\begin{bmatrix}0 & 0 & 1\\ 1 & 0 & 0\\ 0 & 1 & 0\end{bmatrix}$$

Then A^{-1} is:

(1) $\begin{bmatrix}3 & 1 & 2\\ 3 & 0 & 2\\ 1 & 0 & 1\end{bmatrix}$
(2) $\begin{bmatrix}3 & 2 & 1\\ 3 & 2 & 0\\ 1 & 1 & 0\end{bmatrix}$
(3) $\begin{bmatrix}0 & 1 & 3\\ 0 & 2 & 3\\ 1 & 1 & 1\end{bmatrix}$
(4) $\begin{bmatrix}1 & 2 & 3\\ 0 & 1 & 1\\ 0 & 2 & 3\end{bmatrix}$

Q79. Let for $\mathrm{i}=1,2,3, \mathrm{p_i}(\mathrm{x})$ be a polynomial of degree 2 in $x, p'_i(x)$ and $p''_i(x)$ be the first and second order derivatives of $p_i(x)$ respectively. Let,

$$\mathrm{A}(\mathrm{x})=\left(\begin{bmatrix}\mathrm{p}_1(\mathrm{x}) & \mathrm{p}'_1(\mathrm{x}) & \mathrm{p}''_1\mathrm{x}(\\ \mathrm{p}_2(\mathrm{x}) & \mathrm{p}'_2(\mathrm{x}) & \mathrm{p}''_2(\\ \mathrm{p}_3(\mathrm{x}) & \mathrm{p}'_3(\mathrm{x}) & \mathrm{p}''_3(\mathrm{x}\end{bmatrix}\right)$$

and $\mathrm{B}(\mathrm{x})=[\mathrm{A}(\mathrm{x})]^{\mathrm{T}}\mathrm{A}(\mathrm{x})$. Then determinant of $\mathrm{B}(\mathrm{x})$:

(1) is a polynomial of degree 6 in x.
(2) is a polynomial of degree 3 in x.
(3) is a polynomial of degree 2 in x.
(4) does not depend on x.

Q80. Let f be an odd function defined on the set of real numbers such that for $\mathrm{x}\geq 0$, $f(x)=3\sin x+4\cos x$. Then f(x) at $\mathrm{x}=-\frac{11\pi}{6}$ is equal to:

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

Q81. Let $f(x)=x|x|, g(x)=\sin x$ and $h(x)=(g\circ f)(x)$. Then
(1) h(x) is not differentiable at x = 0.
(2) h(x) is differentiable at x = 0, but h′(x) is not continuous at $x=0$
(3) h′(x) is continuous at x = 0 but it is not differentiable at $x=0$
(4) h′(x) is differentiable at x = 0

Q82. For the curve $\mathrm{y}=3\sin\theta\cos\theta, \mathrm{x}=\mathrm{e}^{\theta}\sin\theta, 0\leq\theta\leq\pi$, the tangent is parallel to x-axis when θ is:
(1) $\frac{3\pi}{4}$
(2) $\frac{\pi}{2}$
(3) $\frac{\pi}{4}$
(4) $\frac{\pi}{6}$

Q83. The volume of the largest possible right circular cylinder that can be inscribed in a sphere of radius $=\sqrt{3}$ is:
(1) $\frac{4}{3}\sqrt{3}\pi$
(2) $\frac{8}{3}\sqrt{3}\pi$
(3) 4π
(4) 2π

Q84. The integral $\int x\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)dx(x>0)$ is equal to:
(1) $-x+\left(1+x^2\right)\tan^{-1}x+c$
(2) $x-\left(1+x^2\right)\cot^{-1}x+c$
(3) $-x+\left(1+x^2\right)\cot^{-1}x+c$
(4) $x-\left(1+x^2\right)\tan^{-1}x+c$

Q85. If for $\mathrm{n}\geq 1, \mathrm{P}_{\mathrm{n}}=\int_1^{\mathrm{e}}(\log\mathrm{x}^{\mathrm{n}})\mathrm{dx}$, then $\mathrm{P}_{10}-90\mathrm{P}_8$ is equal to:
(1) -9
(2) 10e
(3) -9e
(4) 10

Q86. If the general solution of the differential equation $y'=\frac{y}{x}+\Phi\left(\frac{x}{y}\right)$, for some function Φ, is given by $y\ln|cx|=x$, where c is an arbitrary constant, then $\Phi(2)$ is equal to:
(1) 4
(2) $\frac{1}{4}$
(3) -4
(4) $-\frac{1}{4}$

Q87. If $|\vec{c}|^2=60$ and $\vec{c}\times(\hat{i}+2\hat{j}+5\hat{k})=\overrightarrow{0}$, then a value of $\vec{c}\cdot(-7\hat{i}+2\hat{j}+3\hat{k})$ is:
(1) $4\sqrt{2}$
(2) 12
(3) 24
(4) $12\sqrt{2}$

Q88. The plane containing the line $\frac{\mathrm{x}-1}{1}=\frac{\mathrm{y}-2}{2}=\frac{\mathrm{z}-3}{3}$ and parallel to the line $\frac{\mathrm{x}}{1}=\frac{\mathrm{y}}{1}=\frac{\mathrm{z}}{4}$ passes through the point:
(1) $(1,-2,5)$
(2) $(1,0,5)$
(3) $(0,3,-5)$
(4) $(-1,-3,0)$

Q89. A set S contains 7 elements. A non-empty subset A of S and an element x of S are chosen at random. Then the probability that $\mathrm{x}\in\mathrm{A}$ is:
(1) $\frac{1}{2}$
(2) $\frac{64}{127}$
(3) $\frac{63}{128}$
(4) $\frac{31}{128}$

Q90. If X has a binomial distribution, $B(n,p)$ with parameters n and p such that $P(X=2)=P(X=3)$, then E(X), the mean of variable X, is
(1) $2-\mathrm{p}$
(2) $3-p$
(3) $\frac{\mathrm{p}}{2}$
(4) $\frac{p}{3}$

ANSWER KEYS

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