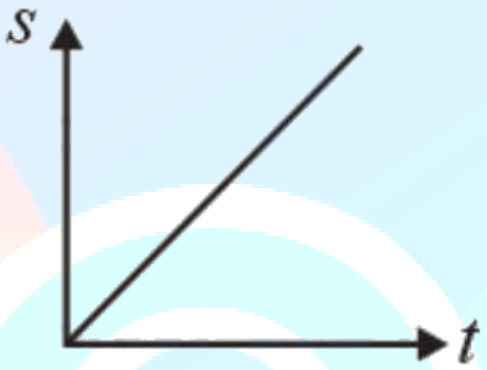
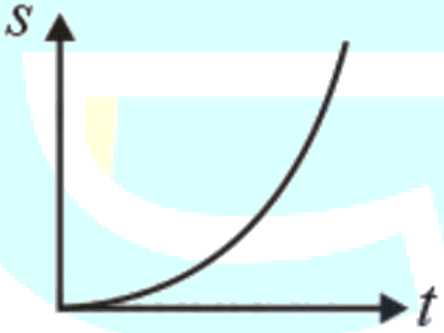
Q1. Amount of solar energy received on the earth's surface per unit area per unit time is defined a solar constant. Dimension of solar constant is:
(1) $ML^2\ T^{-2}$
(2) $ML^0\ T^{-3}$
(3) $M^2\ L^0\ T^{-1}$
(4) MLT^{-2}

Q2. A particle is moving unidirectional on a horizontal plane under the action of a constant power supplying energy source. The displacement (s) - time (t) graph that describes the motion of the particle is (graphs are drawn schematically and are not to scale):
(1)



(2)



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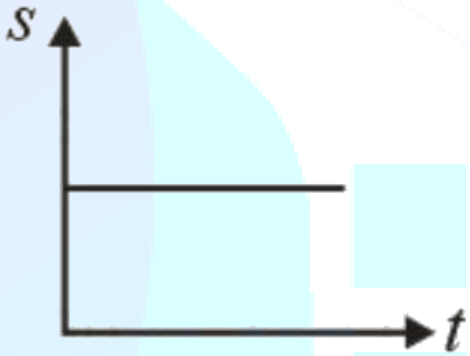
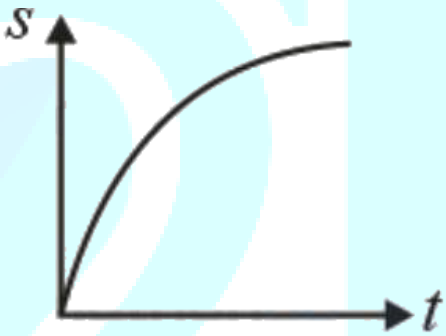


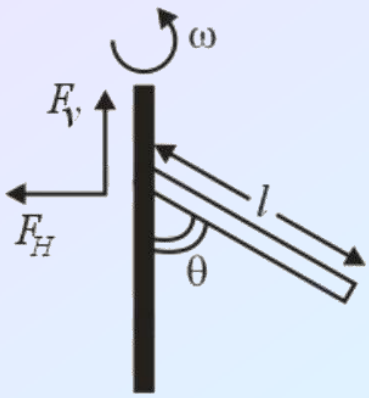
(4)



Q3. Hydrogen ion and singly ionized helium atom are accelerated, from rest, through the same potential difference. The ratio of final speeds of hydrogen and helium ions is close to:
(1) 1: 2
(2) 10: 7
(3) 2: 1
(4) 5: 7

Q4. A block of mass 1.9 kg is at rest at the edge of a table, of height 1 m . A bullet of mass 0.1 kg collides with the block and sticks to it. If the velocity of the bullet is 20 m s^{-1} in the horizontal direction just before the collision then the kinetic energy just before the combined system strikes the floor, is [Take $g = 10\ m\ s^{-2}$. Assume there is no rotational motion and loss of energy after the collision is negligible.]
(1) 21 J
(2) 20 J
(3) 19 J
(4) 23 J

Q5.



A uniform rod of length ' ℓ ' is pivoted at one of its ends on a vertical shaft of negligible radius. When the shaft rotates at angular speed ω the rod makes an angle θ with it (see figure). To find θ equate the rate of change of angular momentum (direction going into the paper) $\frac{m\ell^2}{12}\omega^2 \sin\theta$ about the centre of mass (CM) to the torque provided by the horizontal and vertical forces F_H and F_v about the CM . The value of θ is then such that:

(1) $\cos\theta = \frac{2g}{3\ell\omega^2}$
(2) $\cos\theta = \frac{g}{2\ell\omega^2}$
(3) $\cos\theta = \frac{g}{\ell\omega^2}$
(4) $\cos\theta = \frac{3g}{2\ell\omega^2}$

Q6. The mass density of a planet of radius R varies with the distance r from its centre as $\rho(r) = \rho_0\left(1 - \frac{r^2}{R^2}\right)$ Then the gravitational field is maximum at:

(1) $r = \sqrt{\frac{3}{4}}R$
(2) $r = R$
(3) $r = \frac{1}{\sqrt{3}}R$
(4) $r = \sqrt{\frac{5}{9}}R$

Q7. A metallic sphere cools from $50\,^{\circ}\mathrm{C}$ to $40^{\circ}\mathrm{C}$ in 300 s . If atmospheric temperature around is $20^{\circ}\mathrm{C}$, then the sphere's temperature after the nest 5 minutes will be close to:

(1) $31\,^{\circ}\mathrm{C}$
(2) $33\,^{\circ}\mathrm{C}$
(3) $28^{\circ}\mathrm{C}$
(4) $35\,^{\circ}\mathrm{C}$

Q8. A calorimeter of water equivalent 20 g contains 180 g of water at $25^{\circ}\mathrm{C}$. ′m′′ grams of steam at $100^{\circ}\mathrm{C}$ is mixed in it till the temperature of the mixture is $31^{\circ}\mathrm{C}$. The value of m′ is close to (Latent heat of water $= 540\mathrm{calgg}^{-1}$, specific heat of water $= 1\mathrm{cal}_{\mathrm{g}}{}^{-1^{\circ}}\mathrm{C}^{-1}$)

(1) 2
(2) 4
(3) 3.2
(4) 2.6

Q9. To raise the temperature of a certain mass of gas by $50^{\circ}\mathrm{C}$ at a constant pressure, 160 calories of heat is required. When the same mass of gas is cooled by $100^{\circ}\mathrm{C}$ at constant volume, 240 calories of heat is released. How many degrees of freedom does each molecule of this gas have (assume gas to be ideal)?

(1) 5
(2) 6
(3) 3
(4) 7

Q10. A block of mass m attached to a massless spring is performing oscillatory motion of amplitude 'A' on a frictionless horizontal plane. If half of the mass of the block breaks off when it is passing through its equilibrium point, the amplitude of oscillation for the remaining system become f A. The value of f is:

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

Q11. Concentric metallic hollow spheres of radii R and $4R$ hold charges Q_1 and Q_2 respectively. Given that surface charge densities of the concentric spheres are equal, the potential difference $V(R) - V(4R)$ is:

(1) $\frac{Q_2}{4\pi\varepsilon_0 R}$
(2) $\frac{3Q_2}{4\pi\varepsilon_0 R}$
(3) $\frac{3Q_1}{16\pi\varepsilon_0 R}$
(4) $\frac{3Q_1}{4\pi\varepsilon_0 R}$

Q12. Two resistors 400Ω and 800Ω are connected in series across a 6 V battery. The potential difference measured by a voltmeter of

$10\text{k}\Omega$ across 400Ω resistor is close to:
(1) 2 V
(2) 1.8 V
(3) 2.05 V
(4) 1.95 V

Q13. Which of the following will NOT be observed when a multimeter (operating in resistance measuring mode) probes connected across a component, are just reversed?
(1) Multimeter shows an equal deflection in both cases i.e., before and after reversing the probes if the chosen component is resistor.
(3) Multimeter shows a deflection, accompanied by a(4) splash of light out of connected component in one direction and NO deflection on reversing the probes if the chosen component is LED
(2) Multimeter shows NO deflection in both cases i.e. before and after reversing the probes if the chosen component is capacitor
Multimeter shows NO deflection in both cases i.e. before and after reversing the probes is the chsosen component is metal wire.

Q14. A perfectly diamagnetic sphere has a small spherical cavity at its centre, which is filled with a paramagnetic substance. The whole system is placed in a uniform magnetic field $\vec{\text{B}}$. Then the field inside the paramagnetic substance is:

(1) $\vec{B}$
(2) Zero
(3) much large than $|\vec{B}|$ and parallel to $\vec{B}$
(4) much large than $|\vec{B}|$ but opposite to $\vec{B}$

Q15. A uniform magnetic field B exists in a direction perpendicular to the plane of a square loop made of a metal wire. The wire has a diameter of 4 mm and a total length of 30 cm . The magnetic field changes with time at a steady rate $\text{dB/dt} = 0.032\text{Ts}^{-1}$. The induced current in the loopis close to (Resistivity of the metal wire is $1.23 \times 10^{-8}\Omega$ m)
(1) 0.43 A
(2) 0.61 A
(3) 0.34 A
(4) 0.53 A

Q16. The electric field of a plane electromagnetic wave propagating along the x direction in vacuum is $\vec{\text{E}} = \text{E}_0\text{j}\cos(\omega\text{t} - \text{kx})$. The magnetic field $\vec{\text{B}}$, at the moment $\text{t} = 0$ is:
(1) $\vec{\text{B}} = \frac{E_0}{\sqrt{\mu_0\epsilon_0}}\cos(kx)\hat{k}$
(2) $\vec{\text{B}} = \text{E}_0\sqrt{\mu_0\epsilon_0}\cos(\text{kx})\hat{\text{j}}$
(3) $\vec{\text{B}} = E_0\sqrt{\mu_0\varepsilon_0}\cos(kx)\hat{\text{k}}$
(4) $\vec{\text{B}} = \frac{E_0}{\sqrt{\mu_0\epsilon_0}}\cos(kx)\hat{\text{j}}$

Q17. Two sources of light emit X-rays of wavelength 1 nm and visible light of wavelength 500 nm , respectively. Both the sources emit light of the same power 200 W . The ratio of the number density of photons of X-rays to the number density of photons of the visible light of the given wavelengths is:
(1) $\frac{1}{500}$
(2) 250
(3) $\frac{1}{250}$
(4) 500

Q18. Two light waves having the same wavelength λ in vacuum are in phase initially. Then the first wave travels a path L_1 through a medium of refractive index n_1 while the second wave travels a path of length L_2 through a medium of refractive index n_2. After this the phase difference between the two waves is:
(1) $\frac{2\pi}{\lambda}\left(\frac{L_2}{n_1} - \frac{L_1}{n_2}\right)$
(2) $\frac{2\pi}{\lambda}\left(\frac{L_1}{n_1} - \frac{L_2}{n_2}\right)$

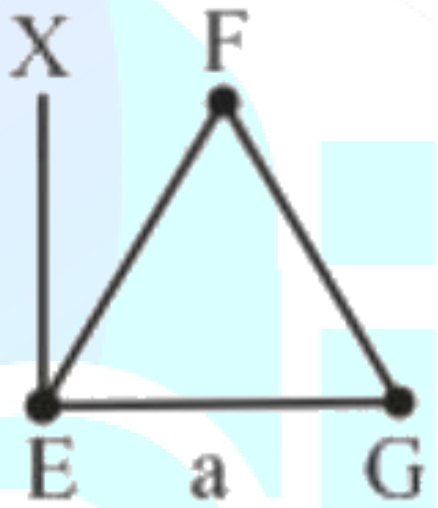
(3) $\frac{2\pi}{\lambda}(n_1 L_1 - n_2 L_2)$
(4) $\frac{2\pi}{\lambda}(n_2 L_1 - n_1 L_2)$

Q19. The radius R of a nucleus of mass number A can be estimated by the formula $R = (1.3 \times 10^{-15})A^{1/3}$ m. It follows that the mass density of n nucleus is of the order of: $\left(M_{prot} \cong M_{neut} \simeq 1.67 \times 10^{-27} \text{ kg}\right)$
(1) 10^3 kg m^{-3}
(2) 10^{10} kg m^{-3}
(3) 10^{24} kg m^{-3}
(4) 10^{17} kg m^{-3}

Q20. If a semiconductor photo diode can detect a photon with a maximum wavelength of 400 nm , then its band gap energy is: Planck's constant $h = 6.63 \times 10^{-34}$ J. s Speed of light $c = 3 \times 10^8$ m s^{-1}
(1) 1.1 eV
(2) 2.0 eV
(3) 1.5 eV
(4) 3.1 eV

Q21. A block starts moving up an inclined plane of inclination 30° with an initial velocity of v_0. It comes back to its initial position with velocity $\frac{v_0}{2}$. The value of the coefficient of kinetic friction between the block and the inclined plane is close to $\frac{1}{1000}$, The nearest integer to I is :

Q22. An massless equilateral triangle EFG of side 'a' (As shown in figure) has three particles of mass m situated at its vertices. The moment of inertia of the system about the line EX perpendicular to EG in the plane of EFG is $\frac{N}{20}ma^2$ where N is an integer. The value of N is .



Q23. If minimum possible work is done by a refrigerator in converting 100 grams of water at 0°C to ice, how much heat (in calories) is released to the surroundings at temperature 27°C (Latent heat of ice = 80Cal/gram) to the nearest integer?

Q24. A galvanometer coil has 500 turns and each turn has an average area of 3×10^{-4} m^2. If a torque of 1.5 Nm is required to keep this coil parallel to a magnetic field when a current of 0.5 A is flowing through it, the strength of the field (in T) is .

Q25. When an object is kept at a distance of 30 cm from a concave mirror, the image is formed at a distance of 10 cm from the mirror. If the object is moved with a speed of 9 cm s^{-1}, the speed (in cms^{-1}) with which image moves at that instant is

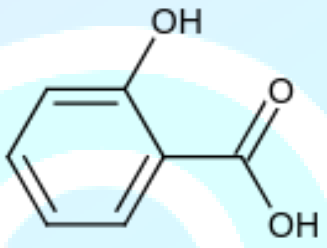
Q26. The strengths of 5.6 volume hydrogen peroxide (of density 1 g/mL) in terms of mass percentage and molarity (M) respectively, are: (Take molar mass of hydrogen peroxide as 34 g/mol)
(1) 1.7 and 0.5
(2) 0.85 and 0.25
(3) 1.7 and 0.25
(4) 0.85 and 0.5

Q27. Consider the hypothetical situation where the azimuthal quantum number, ℓ, takes values

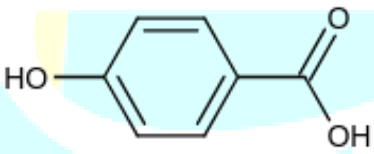
0,1,2, ... n + 1. Where n is the principal quantum number. Then, the element with atomic number:
(1) 9 is the first alkali metal
(2) 13 has a half-filled valence subshell
(3) 8 is the first noble gas
(4) 6 has a $2p$-valence subshell

Q28. The five successive ionization enthalpies of an element are
800,2427,3658,3502432824 kJ mol^{-1}. The number of valence electrons in the element is:
(1) 5
(2) 4
(3) 3
(4) 2

Q29. Consider the following molecules and statements related to them:
(A)



(B)

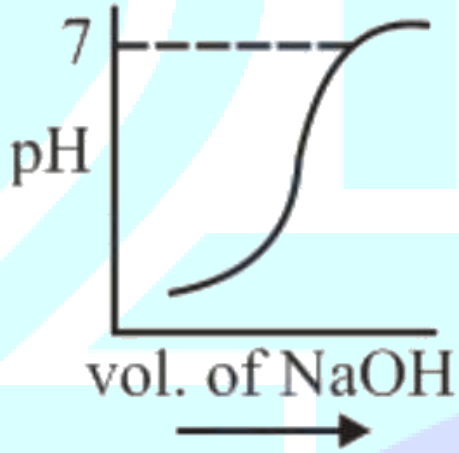


(a) (B) is more likely to be crystaline than (A)
(b) (B) has higher boiling point than (A)
(c) (B) dissolves more readily than (A) in water

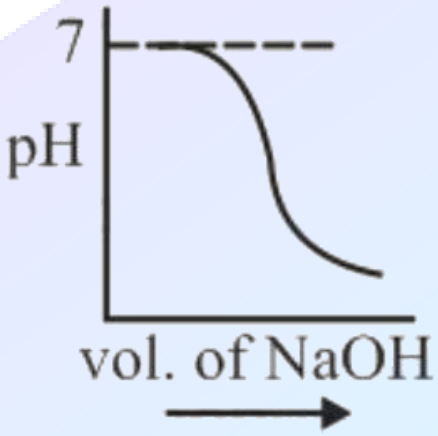
Identify the correct option from below:
(1) (a) and (b) are true
(2) (a) and (c) are true
(3) only (a) is true
(4) (b) and (c) are true

Q30. A mixture of one mole each of H_2, He and O_2 each are enclosed in a cylinder of volume V at temperature T . If the partial pressure of H_2 is 2 atm , the total pressure of the gases in the cylinder is:
(1) 6 atm
(2) 38 atm
(3) 14 atm
(4) 22 atm

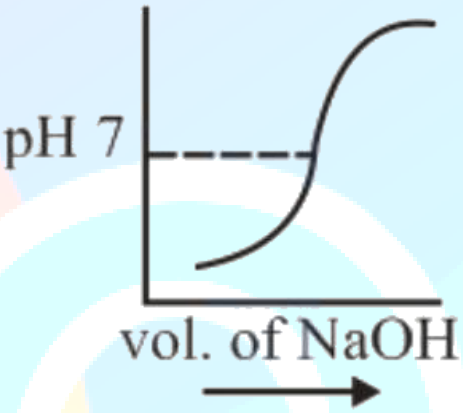
Q31. 100 mL of 0.1 M HCl is taken in a beaker and to it 100 mL 0.1 M NaOH of is added in steps of 2 mL and the pH is continuously measured. Which of the following graphs correctly depicts the change in pH ?
(1)



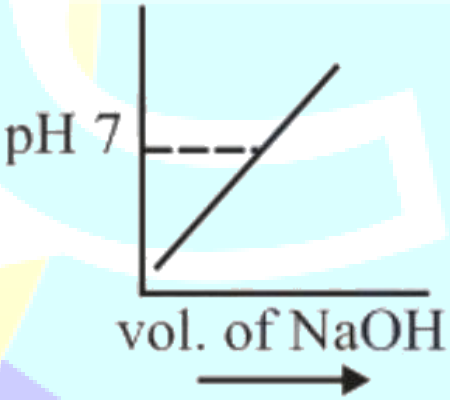
(2)



(3)



(4)



Q32. Among the statement (I − IV), the correct ones are:
(I) Be has smaller atomic radius compared to Mg .
(II) Be has higher ionization enthalpy than AI.
(III) Charge/radius ratio of Be is greater than that of Al .
(IV) Both Be and Al form mainly covalent compounds
(1) (I), (II) and (IV)
(2) (I), (III) and (IV)
(3) (II), (III) and (IV)
(4) (I), (II) and (III)

Q33. The incorrect statement(s) among (a) - (d) regarding acid rain is (are):
a) It can corrode water pipes
(b) It can damage structures made up of stone.
(c) It cannot cause respiratory ailments in animals
(d) It is not harmful for trees
(1) (a), (c) and (d)
(2) (c) only
(3) (a), (b) and (d)
(4) (c) and (d)

Q34. For the reaction $2A + 3B + \frac{3}{2}C \rightarrow 3P$, which statement is correct?
(1) $\frac{dn_A}{dt} = \frac{3}{2}\frac{dn_B}{dt} = \frac{3}{4}\frac{dn_C}{dt}$
(2) $\frac{\mathrm{dn_A}}{\mathrm{dt}} = \frac{\mathrm{dn_B}}{\mathrm{dt}} = \frac{\mathrm{dn_C}}{\mathrm{dt}}$
(3) $\frac{\mathrm{dn_A}}{\mathrm{dt}} = \frac{2}{3}\frac{dn_B}{\mathrm{dt}} = \frac{4}{3}\frac{\mathrm{dn_C}}{\mathrm{dt}}$
(4) $\frac{\mathrm{dn_A}}{\mathrm{dt}} = \frac{2}{3}\frac{\mathrm{dn_B}}{\mathrm{dt}} = \frac{3}{4}\frac{\mathrm{dn_C}}{\mathrm{dt}}$

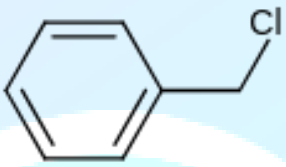
Q35. The incorrect statement is:
(1) Manganate and permanganate ions are tetrahedral
(2) In manganate and permanganate ions, the π-bonding takes place by overlap of p-orbitals of oxygen and dorbitals of maganese
(3) Manganate and permanganate ions are paramagnetic
(4) Manganate ion is green in colour and permanganate ion is purple in colour

Q36. Complex A has a composition of $H_{12}O_6Cl_3Cr$. If the complex on treatment with conc. H_2SO_4 loses 13.5% of its original mass, the correct molecular formulas of A is:
[Given : atomic mass of $Cr = 52$amu and $CI =$

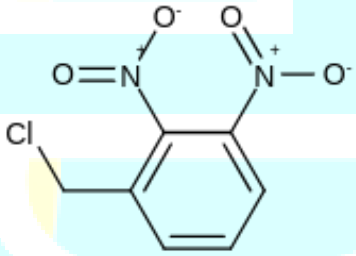
35amu]
(1) $[Cr(H_2O_6]Cl_3$
(2) $[Cr(H_2O)_3Cl_3] \cdot 3H_2O$
(3) $[Cr(H_2O)_5Cl]Cl_2 \cdot H_2O$
(4) $[Cr(H_2O)_4Cl_2]Cl \cdot 2H_2O$

Q37. The d-electron configuration of $[Ru(en)_3]Cl_2$, and $[Fe(H_2O)_6]Cl_2$ respectively are:
(1) $t_{2g}^6 e_g^0$ and $t_{2g}^6 e_g^0$
(2) $t_{2g}^4 e_g^2$ and $t_{2g}^6 e_g^0$
(3) $t_{2g}^6 e_g^0$ and $t_{2g}^4 e_g^2$
(4) $t_{2g}^4 e_g^2$ and $t_{2g}^4 e_g^2$

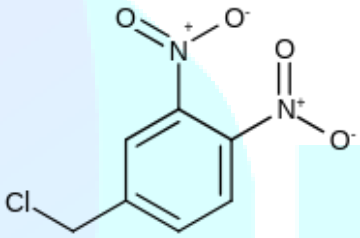
Q38. The decreasing order of reactivity of the following compounds towards nucleophilic substitution (S_N2) is:



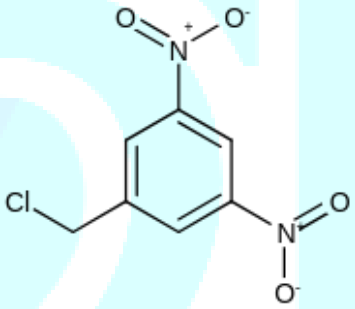
(I)



(II)

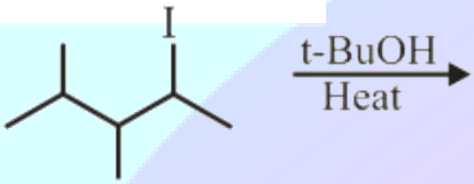


(I)

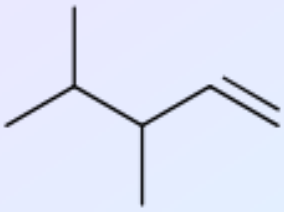


(IV)
(1) (II) > (III) > (I) > (IV)
(2) (II) > (III) > (IV) > (I)
(3) (III) > (II) > (IV) > (I)
(4) (IV) > (II) > (III) > (I)

Q39. The major product in the following reaction is:



(1)



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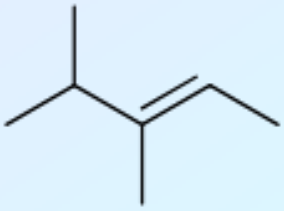

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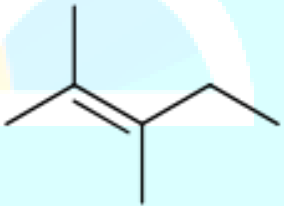

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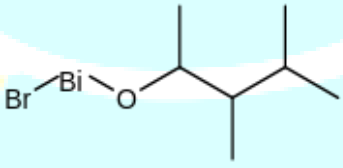
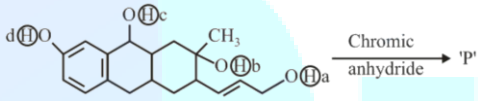


Q40. Consider the following reaction:

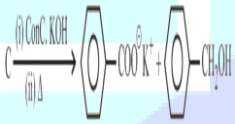


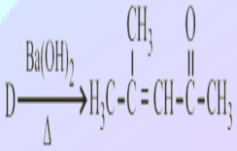
The product/P/gives positive ceric ammonium nitrate test. This is because of the presence of which of these -OH group(s)?
(1) (b) only
(2) (c) and (d)
(3) (d) only
(4) (b) and (d)

Q41. The increasing order of the reactivity of the following compounds in nucleophile addition reaction is:
Propanal, Benzaldehyde, Propanone, Butanone
(1) Benzaldehyde > Butanone < Propanone < Propanal
(2) Butanone < Propanone < Benzaldehyde < Propanal
(3) Propanal < Propanone < Butanone < Benzaldehyde
(4) Benzaldehyde < Propanal < Propanone < Butanone

Q42. The compound A in the following reactions is:

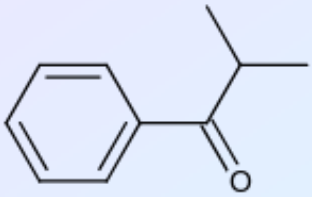
$$A \xrightarrow[\text{(ii) Conc. } H_2SO_4/\Delta]{\text{(i) } CH_3MgBr/H_2OB} \xrightarrow[\text{(ii) } Zn/H_2O]{\text{(i) } O_3} C + D$$



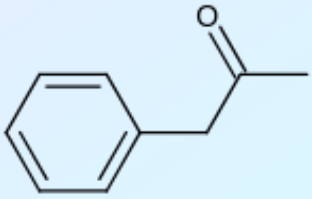


(1)

(2)



(3)



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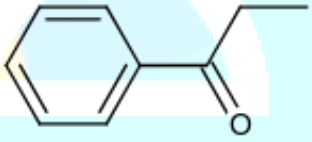


Q43. Three isomers A, B and C (mol. formula $C_8H_{11}N$) give the following results:

A and C $\xrightarrow{\text{Dianotization}}$ P + Q

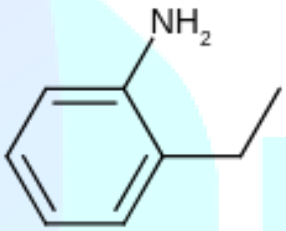
(i) Hydrolyds

R has lower boiling point than S

B $\xrightarrow{C_6H_5SO_2Cl}$ alkali-insoluble product

A, B and C , respectively are:

(1)



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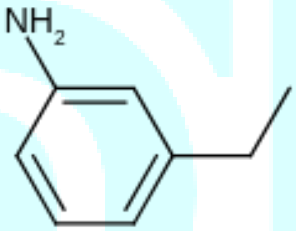

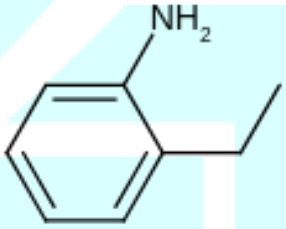

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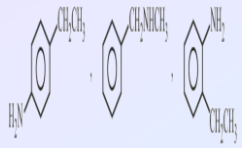

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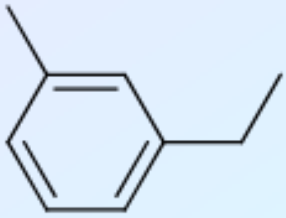
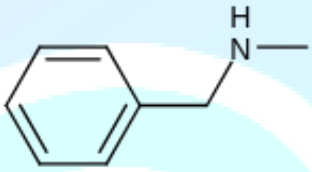
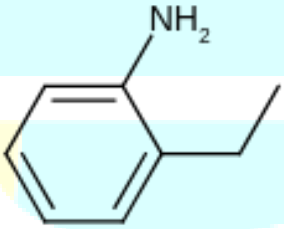
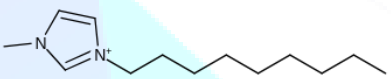






Q44. An ionic micelle is formed on the addition of:
(1) liquid diethyl ether to aqueous $NaCl$ solution
(2) excess water to liquid

(3) excess water to liquid
(4) Sodium stearate to pure toluene



Q45. Match the following drugs with their therapeutic actions:
(i) Ranitidine
(ii) Nardil (Phenelzine)
(iii) Chloramphenicol
(iv) Dimetane (Brompheniramine)
(a) Antidepressant
(b) Antibiotic
(c) Antihistamine
(d) Antacid
(e) Analgesic
(1) (i)-(a); (ii)-(c); (iii)-(b); (iv)-(e);
(2) (i)-(d); (ii)-(a); (iii)-(b); (iv)-(c);
(3) (i)-(e); (ii)-(a); (iii)-(c); (iv)-(d);
(4) (i)-(d); (ii)-(c); (iii)-(a); (iv)-(e);

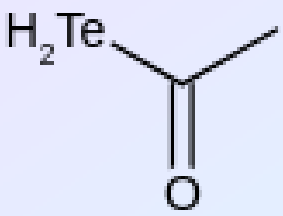
Q46.0. 023×10^{22} molecules are present in 10 gof a substance ' x '. The molarity of a solution containing 5 g of substance ' x ' in 2 L solution is $\times 10^{-3}$

Q47. If 250 cm^3 of an aqueous solution containing 0.73 g of a protein A is isotonic with one litre of another aqueous solution containing 1.65 g of a protein B , at 298 K , the ratio of the molecular masses of A and B is $\times 10^{-2}$ (to the nearest integer).

Q48. An acidic solution of dichromate is electrolyzed for 8 minutes using 2 A current. As per the following equation $Cr_2O_7^{2} + 14H^{+} + 6e^{-} \rightarrow 2Cr^{3+} + 7H_2O$
The amount of Cr^{3+}. obtained was 0.104 g . The efficiency of the process (in %) is (Take : $F = 960000C$, At. mass of chromium $= 52$)

Q49. The volume (in mL) of 0.1 N NaOH required to neutralise 10 mL of 0.1 N phosphinic acid is

Q50.



groups present in a tripeptide Asp - Glu - Lys is

Q51. The set of all real values of λ for which the quadratic equation $(\lambda^2+1)x^2-4\lambda x+2=0$ always have exactly one root in the interval $(0,1)$ is :
(1) $(-3,-1)$
(2) $(0,2)$
(3) $(1,3]$
(4) $(2,4]$

Q52. If z_1, z_2 are complex numbers such that $\text{Re}(z_1)=|z_1-1|$ and $\text{Re}(z_2)=|z_2-1|$ and $\arg(z_1-z_2)=\frac{\pi}{6}$, then $\text{Im}(z_1+z_2)$ is equal to :
(1) $2\sqrt{3}$
(2) $\frac{\sqrt{3}}{2}$
(3) $\frac{1}{\sqrt{3}}$
(4) $\frac{2}{\sqrt{3}}$

Q53.If the sum of the series $20+19\frac{3}{5}+19\frac{1}{5}+18\frac{4}{5}+\cdots$ ... ... up to n^{th} term is 488 and the n^{th} term is negative, then :
(1) n^{th} term is $-4\frac{2}{5}$
(2) $n=41$
(3) n^{th} term is -4
(4) $n=60$

Q54.If the term independent of x in the expansion of $\left(\frac{3}{2}x^2-\frac{1}{3x}\right)^9$ is k, then $18k$ is equal to:
(1) 11
(2) 5
(3) 9
(4) 7

Q55.If a $\triangle ABC$ has vertices $A(-1,7), B(-7,1)$ and $C(5,-5)$, then its orthocentre has coordinates:
(1) $(-3,3)$
(2) $(3,-3)$
(3) $\left(-\frac{3}{5},\frac{3}{5}\right)$
(4) $\left(\frac{3}{5},-\frac{3}{5}\right)$

Q56. Let the latus rectum of the parabola $y^2=4x$ be the common chord to the circles C_1 and C_2 each of them having radius $2\sqrt{5}$. Then, the distance between the centres of the circles C_1 and C_2 is :
(1) 12
(2) 8
(3) $8\sqrt{5}$
(4) $4\sqrt{5}$

Q57. Let e_1 and e_2 be the eccentricities of the ellipse $\frac{x^2}{25}+\frac{y^2}{b^2}=1(b<5)$ and the hyperbola $\frac{x^2}{16}-\frac{y^2}{b^2}=1$ respectively satisfying $e_1e_2=1$. If α and β are the distances between the foci of the ellipse and the foci of the hyperbola respectively, then the ordered pair (α,β) is equal to:
(1) $(8,10)$
(2) $\left(\frac{20}{3},12\right)$
(3) $(8,12)$
(4) $\left(\frac{24}{5},10\right)$

Q58. $\lim_{x\to a}\frac{(a+2x)^{\frac{1}{3}}-(3x)^{\frac{1}{3}}}{(3a+x)^{\frac{1}{3}}-(4x)^{\frac{1}{3}}}(a\neq 0)$ is equal to:
(1) $\left(\frac{2}{9}\right)\left(\frac{2}{3}\right)^{\frac{1}{3}}$
(2) $\left(\frac{2}{3}\right)^{\frac{4}{3}}$
(3) $\left(\frac{2}{9}\right)^{\frac{4}{3}}$
(4) $\left(\frac{2}{3}\right)\left(\frac{2}{9}\right)^{\frac{1}{3}}$

Q59. Let p,q,r be three statements such that the truth value of $(p\wedge q)\to(\sim q\vee r)$ is F. Then the truth values of p,q,r are respectively :
(1) T,T,F
(2) T,T,T
(3) T,F,T
(4) F,T,F

Q60. Let $x_i (1 \le i \le 10)$ be ten observation of a random variable X. If $\sum_{i=1}^{10} (x_i - p) = 3$ and $\sum_{i=1}^{10} (x_i - p)^2 = 9$ where $0 \ne p \in R$, then the standard deviation of these observations is:
(1) $\frac{4}{5}$
(2) $\sqrt{\frac{3}{5}}$
(3) $\frac{9}{10}$
(4) $\frac{7}{10}$

Q61. Let R_1 and R_2 be two relations defined as follows :
$R_1 = \{(a,b) \in R^2 : a^2 + b^2 \in Q\}$ and $R_2 = \{(a,b) \in R^2 : a^2 + b^2 \notin Q\}$, where Q is the set of all rational numbers, then
(1) R_1 is transitive but R_2 is not transitive.
(2) R_2 is transitive but R_1 is not transitive.
(3) Neither R_1 nor R_2 is transitive.
(4) R_1 and R_2 are both transitive.

Q62.
Let A be a 3×3 matrix such that adj $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 0 & 2 \\ 1 & -2 & -1 \end{bmatrix}$ and $B = \text{adj}(\text{adj}A)$. If $|A| = \lambda$ and $|(B^{-1})^T| = \mu$, then the ordered pair $(|\lambda|, \mu)$ is equal to
(1) $\left(3, \frac{1}{81}\right)$
(2) $\left(9, \frac{1}{9}\right)$
(3) $(3,81)$
(4) $\left(9, \frac{1}{81}\right)$

Q63. Suppose $f(x)$ is a polynomial of degree four having critical points at $-1, 0, 1$. If $T = \{x \in R \mid f(x) = f(0)\}$, then the sum of squares of all the elements of T is:
(1) 4
(2) 6
(3) 2
(4) 8

Q64. If the surface area of a cube is increasing at a rate of 3.6 cm^2/sec, retaining its shape; then the rate of change of its volume (in cm^3/sec), when the length of a side of the cube is 10 cm , is:
(1) 20
(2) 10
(3) 18
(4) 9

Q65. If $\int \sin^{-1}\left(\frac{\sqrt{x}}{1+x}\right) dx = A(x)\tan^{-1}(\sqrt{x}) + B(x) + C$, where C is a constant of integration, then the ordered pair $(A(x), B(x))$ can be :
(1) $(x-1, \sqrt{x})$
(2) $(x-1, -\sqrt{x})$
(3) $(x+1, \sqrt{x})$
(4) $(x+1, -\sqrt{x})$

Q66. If the value of the integral $\int_0^{\frac{1}{2}} \frac{x^2}{(1-x^2)^{\frac{3}{2}}} dx$ is $\frac{k}{6}$, then k is equal to:
(1) $2\sqrt{3} + \pi$
(2) $2\sqrt{3} - \pi$
(3) $3\sqrt{2} + \pi$
(4) $3\sqrt{2} - \pi$

Q67. If $x^3 dy + xy \cdot dx = x^2 dy + 2y dx; y(2) = e$ and $x > 1$, then $y(4)$ is equal to :
(1) $\frac{\sqrt{e}}{2}$
(2) $\frac{1}{2} + \sqrt{e}$
(3) $\frac{3}{2}\sqrt{e}$
(4) $\frac{3}{2} + \sqrt{e}$

Q68. Let $a, b, c \in R$ be such that $a^2 + b^2 + c^2 = 1$. If $a\cos\theta = b\cos\left(\theta + \frac{2\pi}{3}\right) = c\cos\left(\theta + \frac{4\pi}{3}\right)$, where $\theta = \frac{\pi}{9}$, then the angle between the vectors $a\hat{i} + b\hat{j} + c\hat{k}$ and $b\hat{i} + c\hat{j} + a\hat{k}$ is:
(1) 0
(2) $\frac{2\pi}{3}$
(3) $\frac{\pi}{2}$
(4) $\frac{\pi}{9}$

Q69. The plane which bisects the line joining the points $(4, -2, 3)$ and $(2, 4, -1)$ at right angles also passes through the point :
(1) $(0, -1, 1)$
(2) $(4, 0, -1)$
(3) $(4, 0, 1)$
(4) $(0, 1, -1)$

Q70. The probability that a randomly chosen 5 -digit number is made from exactly two digits is :

(1) $\frac{135}{10^4}$

(2) $\frac{150}{10^4}$

(3) $\frac{134}{10^4}$

(4) $\frac{121}{10^4}$

Q71. The total number of 3 -digit numbers whose sum of digits is 10 , is

Q72. If m arithmetic means (A.Ms) and three geometric means (G.Ms) are inserted between 3 and 243 such that 4^{th} A.M. is equal to 2^{nd} G.M., then m is equal to:

Q73. Let S be the set of all integer solutions (x, y, z) of the system of equations $x - 2y + 5z = 0$

$-2x + 4y + z = 0$

$-7x + 14y + 9z = 0$

such that $15 \leq x^2 + y^2 + z^2 \leq 150$. Then, the number of elements in the set S is equal to

Q74. If the tangent to the curve $y = e^x$ at a point (c, e^c) and the normal to the parabola $y^2 = 4x$ at the point $(1,2)$ intersect at the same point on the x-axis, then the value of c is

Q75. Let a plane P contain two lines $\vec{r} = \hat{\imath} + \lambda(\hat{\imath} + \hat{\jmath}), \lambda \in R$ and $\vec{r} = -\hat{\jmath} + \mu(\hat{\jmath} - \hat{k}), \mu \in R$. If $Q(\alpha, \beta, \gamma)$ is the foot of the perpendicular drawn from the point $M(1,0,1)$ to P , then $3(\alpha + \beta + \gamma)$ equals

ANSWER KEYS

1. (2) natho	2. (2)	3. (3)	4. (1)	5. (4) athoi	6. (4)	ma 7. (2)	8. (1)
9. (2)	10. (4)	11. (3)	12. (4)	13. (2)	14. (2)	15. (2)	16. (3)
17. (1)	18. (3)	mat 19. (4)	20. (4)	21. (346)	22. (25)	⋯ 23. (8791)	24. (20) a
25. (1)	26. (1)	27. (2)	28. (3)	29. (4)	30. (1)	31. (3)	32. (1)
33. (4)	34. (3)	35. (3)	36. (4)	37. (3)	38. (2)	39. (3)	40. (1)
41. (2)	42. (3)	43. (2)	44. (3)	45. (2)	46. (25)	47. (177)	48. (60)
49. (10)	50. (5)	51. (3)	52. (1)	53. (3)	54. (4)	55. (1)	56. (2)
57. (1)	58. (4)	59. (1)	60. (3)	61. (3)	62. (1)	mo63. (1)	64. (4) a (
65. (4)	66. (2)	67. (3)	68. (3)	69. (2)	70. (1)	71. (54)	72. (39)
73. (8)	74. (4)	75. (5)					