Competishun

52/6, Opposite Metro Mas Hospital, Shipra Path, Mansarovar

Date: 04/01/2024

Time: 3 hours **Max. Marks:** 300

MFST-10 (23-24) & UTS-2_MT-2

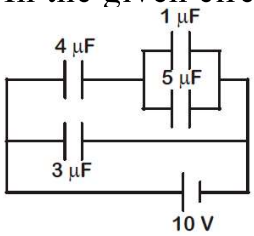
Physics

Single Choice Question

Q1 The impedance of a series RL circuit is same as the series RC circuit when connected to the same AC source separately keeping the same resistance. The frequency of the source is

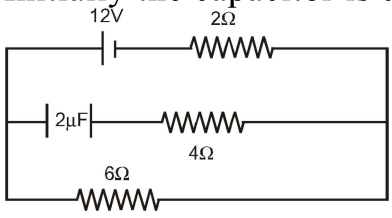
a) $\frac{1}{\sqrt{LC}}$ **b)** $\frac{1}{2\pi\sqrt{LC}}$ **c)** $\frac{R}{L}$ **d)** $\frac{1}{RC}$

Q2 In the given circuit, the charge on 4 μF capacitor will be



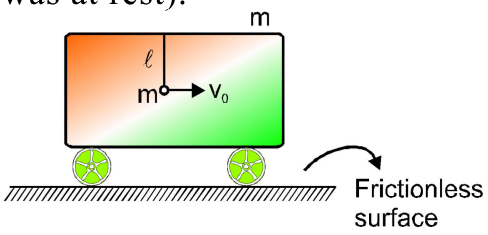
a) 5.4 μC **b)** 9.6 μC **c)** 13.4 μC **d)** 24 μC

Q3 Initially the capacitor is uncharged. The charge on capacitor (in μC) in steady state is:



a) 6 **b)** 12 **c)** 18 **d)** 24

Q4 A small bob of mass 'm' is suspended by a massless string from a cart of the same mass 'm' as shown in the figure.The friction between the cart and horizontal ground is negligible. The bob is given a velocity V_0 in horizontal direction as shown. The maximum height attained by the bob is, (initially whole system (bob + string + cart) was at rest).



a) $\frac{2V_0^2}{g}$ **b)** $\frac{V_0^2}{g}$ **c)** $\frac{V_0^2}{4g}$ **d)** $\frac{V_0^2}{2g}$

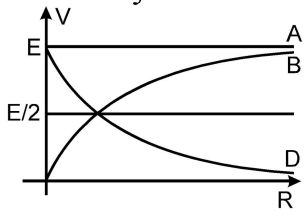
Q5 Two particles are moving towards each other along a line joining them, so that their centre of mass does not move. After elastic collision between them,

a) their centre of mass will move **b)** their velocities will not change

c) their speeds will not change

d) their velocities will not change only if they have equal mass

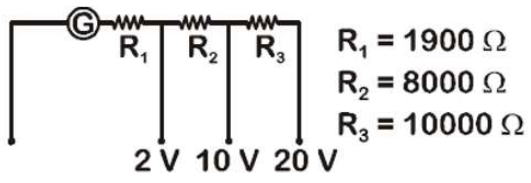
Q6 A cell of emf E having an internal resistance ' r ' is connected to a variable external resistance R. The potential difference ' v ' across the resistance R varies with R as shown by the curve:



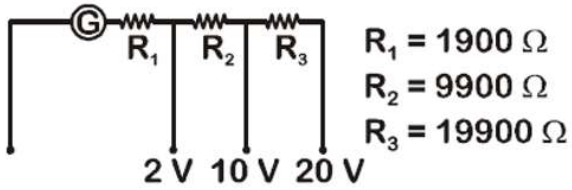
a) A **b)** B **c)** C **d)** D

Q7 A galvanometer of resistance 100 Ω has 50 divisions on its scale and has sensitivity of 20 μA/division. It is to be converted to a voltmeter with three ranges, of 0-2 V, 0-10 V and 0-20 V. The appropriate circuit to do so is :

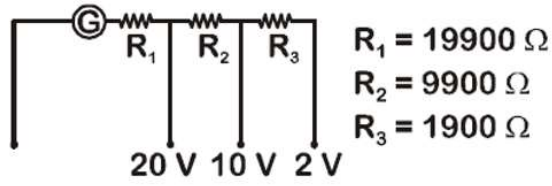
a)



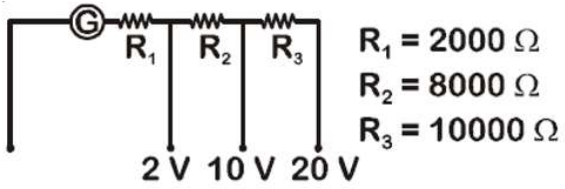
b)



c)



d)



Q8 Two conducting spheres of radii r and 3 r initially have charges 3 q & q respectively. Their separation is much larger than their radii. If they are joined by a conductor of high resistance, the force between them will:

a) increase continuously **b)** decrease continuously **c)** first increase, then decrease

d) first decrease, then increase.

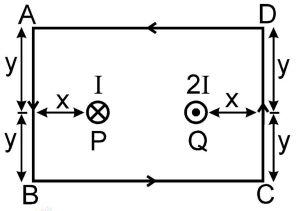
Q9 Charge is distributed within a sphere of radius R with volume charge density $\rho(r)=\frac{A}{r^2}e^{\frac{-2r}{a}}$, where A and a are constants. If Q is the total charge of this charge distribution, the radius R is:

a) $\frac{a}{2}\log\left(\frac{1}{1-\frac{Q}{2\pi aA}}\right)$ **b)** $\frac{a}{2}\log\left(\frac{1}{2\pi aA}\right)$ **c)** $a\log\left(1-\frac{Q}{2\pi aA}\right)$ **d)** $a\log\left(\frac{1}{1-\frac{Q}{2\pi aA}}\right)$

Q10 A conducting sphere of radius 'R' in vaccum carries a charge 'q'. There is a imaginary concentric spherical surface of radius R_0 (> R). If half the energy stored in the surrounding space lies from conducting surface to imginary surface, then radius R_0 of this spherical surface is :

a) 4R **b)** 9R **c)** 2R **d)** R

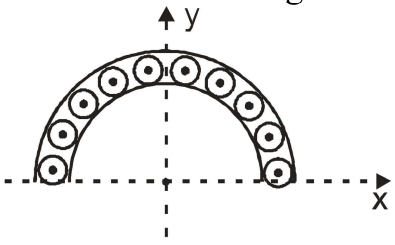
Q11 Let B_P and B_Q be the magnetic field produced by the wire P and Q which are placed symmetrically in a rectangular loop ABCD as shown in figure. Current in wire P is I directed inward and in Q is 2 I directed outwards.



if $\int_A^B \vec{B}_Q.\overrightarrow{d\ell}=2\mu_0$ tesla meter , $\int_D^A \vec{B}_P.\overrightarrow{d\ell}=-2\mu_0$ tesla meter & $\int_A^B \vec{B}_P.\overrightarrow{d\ell}=-\mu_0$ tesla meter the value of I will be :

a) 8A **b)** 4A **c)** 5A **d)** 6A

Q12 A very long conducting sheet is bent in the form of a semi cylinder of radius R. A current 'I' flows out of the plane of the paper along the sheet. Axis of the cylinder is the z-axis. The magnetic field at (0, 0, 0) is :

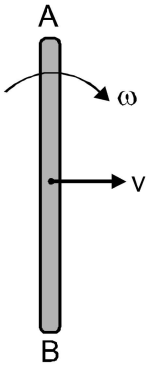


a) $\left[\frac{\mu_0 i}{\pi^2 R}\right]\hat{i}$ **b)** $\left[\frac{\mu_0 i}{\pi^2 R}\right](-\hat{i})$ **c)** $\left[\frac{\mu_0 i}{\pi^2 R}\right](+\hat{j})$ **d)** $\left[\frac{\mu_0 i}{\pi^2 R}\right](-\hat{j})$

Q13 Induced emf produced in a coil rotating about a diameter with constant angular velocity and axis (diameter) perpendicular to a uniform magnetic field will be maximum when the angle between the plane of coil & direction of magnetic field is

a) 0^o **b)** 90^o **c)** 45^o **d)** none

Q14 A metal rod of length ℓ, moving with an angular velocity ω and velocity of its centre is v. Find potential difference between points A and B at the instant shown in figure. A uniform magnetic field of strength B exist perpendicular to plane of paper :



a) $Bv\ell$ **b)** $Bv\ell + \frac{1}{2}B\omega\ell^2$ **c)** $B\omega\ell - \frac{1}{2}B\omega\ell^2$ **d)** $Bv\ell + B\omega\left(\frac{\ell}{2}\right)^2$

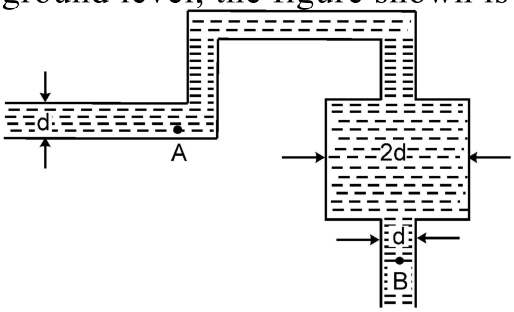
Q15 A pressure-pump has a horizontal tube of cross-sectional area 10 cm^2 for the outflow of water at a speed of 20 m/s. The force exerted on the vertical wall just in front of the tube which stops water horizontally flowing out of the tube, is: [given : density of water = 1000 kg/m^3]

a) 300 N **b)** 500 N **c)** 250 N **d)** 400 N

Q16 Pressure gradient in the horizontal direction in a static fluid is represented by (z–direction is vertically upwards, and x-axis is along horizontal,d is density of fluid) :

a) $\frac{\partial p}{\partial z} = -dg$ **b)** $\frac{\partial p}{\partial x} = dg$ **c)** $\frac{\partial p}{\partial x} = 0$ **d)** $\frac{\partial p}{\partial z} = 0$

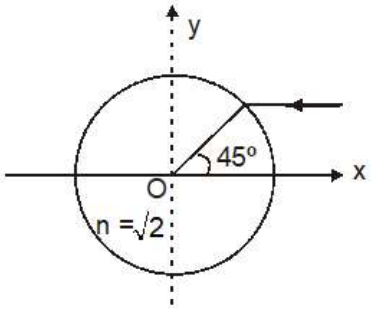
Q17 An ideal fluid is flowing through the given tubes which is placed on a horizontal surface. If the liquid has velocities V_A and V_B, and pressures P_A and P_B at points A and B respectively, then the correct relation is (A and B are at same height from ground level, the figure shown is as if the system is seen from the top) :



a) $V_A > V_B$, $P_A < P_B$ **b)** $V_A < V_B$, $P_A > P_B$ **c)** $V_A = V_B$, $P_A = P_B$

d) $V_A > V_B$, $P_A = P_B$

Q18 A light ray parallel to x-axis is incident on a transparent sphere of refreactive index $\sqrt{2}$ as shown in figure. Then unit vector in the direction of emergent ray is-



a) $-\hat{j}$ **b)** $-\frac{1}{\sqrt{2}}\hat{i}-\frac{1}{\sqrt{2}}\hat{j}$ **c)** $-\frac{1}{2}\hat{i}-\frac{\sqrt{3}}{2}\hat{j}$ **d)** $-\frac{\sqrt{3}}{2}\hat{i}-\frac{1}{2}\hat{j}$

Q19 A satellite is in a circular orbit around the earth has kinetic energy E_k. Minimum amount of energy that is added so that it escapes the earth's gravitational field is:

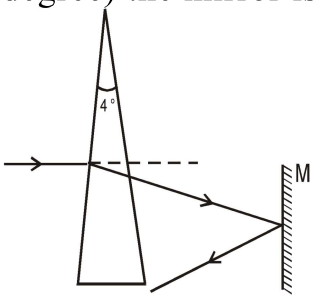
a) E_k **b)** $E_k/2$ **c)** $E_k/4$ **d)** $2\,E_k$

Q20 A ideal gas is expanded to double its volume by two different process. One is isobaric and the other is isothermal. Let W_1 and W_2 be the respective work done, then :

a) $W_2 = W_1 \ln(2)$ **b)** $W_2 = \frac{W_1}{\ln(2)}$ **c)** $W_2 = \frac{W_1}{2}$ **d)** $W_1 = \frac{W_2}{2}$

Numerical

Q21 A horizontal light ray passes through a prism ($\mu = 1.5$) of angle 4°. Further, it is incident on a plane mirror M, that has been placed vertically. By what angle (in degree) the mirror is rotated so that the ray after reflection becomes horizontal?



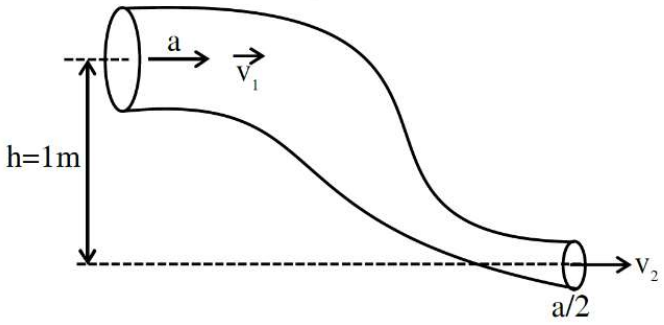
Q22 In Bohr's atomic model, the electron is assumed to revolve in a circular orbit of radius 0.5 Å. If the speed of electron is 2.2×16^6 m/s, then the current associated with the electron will be _____ $\times 10^{-2}$ mA. [Take π as $\frac{22}{7}$]

Q23 The kinetic energy of a particle decreases by 10%. It's Debroglie wavelength increased by x% then X is equal to

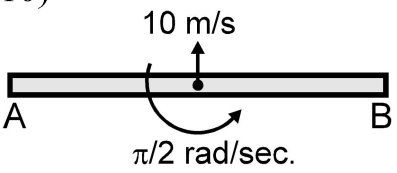
Q24 In the resonance tube experiment, first resonant length is ℓ_1 and the second resonant length is ℓ_2 , then the third resonant length is $n\,\ell_2 - m\,\ell_1$, find (m + n).

Q25 A string fixed at both ends is vibrating in the lowest mode of vibration for which a point at quarter of its length from one end is a point of maximum displacement. The frequency of vibration in this mode is 100 Hz the frequency emitted when it vibrates in the next mode such that this point is again a point of maximum displacement is $\eta \times$ 100 Hz. Find the value of

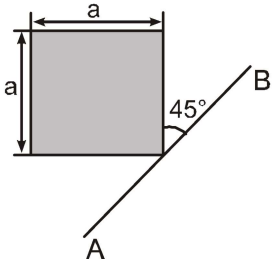
Q26 An ideal fluid of density 800 kgm^{-3}, flows smoothly through a bent pipe (as shown in figure) that tapers in cross-sectional area from a to $\frac{a}{2}$. The pressure difference between the wide and narrow sections of pipe is 4100 Pa. At wider section, the velocity of fluid is $\frac{\sqrt{x}}{6} ms^{-1}$ for x = ... (Given g = 10 m^{-2})



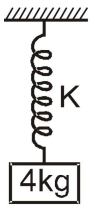
Q27 A uniform rod AB of length 4m and mass 12 kg is thrown such that just after the projection the centre of mass of the rod moves vertically upwards with a velocity 10 m/s and at the same time it is rotating with an angular velocity $\frac{\pi}{2}$ rad/sec about a horizontal axis passing through its mid point. Just after the rod is thrown it is horizontal and is as shown in the figure. Find the acceleration (in m/sec^2) of the point A in m/s^2 when the centre of mass is at the highest point. (Take g = $10m/s^2$ and π^2 = 10)



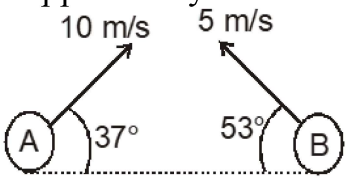
Q28 Find the moment of inertia (in $kg.m^2$) of a thin uniform square sheet of mass M = 3kg and side a = 2m about the axis AB which is in the plane of sheet :



Q29 A body of mass 4 kg is suspended from a spring of spring constant 400 N/m. Another body of mass 4 kg moving vertically upward with 2 m/s hits it & gets embedded in it. If amptitude is $\frac{1}{x}\sqrt{\frac{3}{4}}$ m. find 'x'.



Q30 Two stones are in the same horizontal line and are $50\sqrt{5}$ m away. They are projected with a velocity of 10 m/s and 5 m/s. respectively and with an angle of 37° and 53° with horizontal respectively. Find the minimum distance between them in meters. Suppose they don't strike the ground during the motion. (take g = 10m/s^2)



Chemistry

Single Choice Question

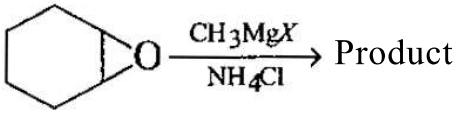
Q31 $CH_2 = CH - CH = CH_2 \xrightarrow{CCl_3Br, H_2O_2}$ product. The major product is :

a) $Br - CH_2 - CH = CH - CH_2 - CCl_3$

b) $CH_2 = CH - \underset{\displaystyle Br}{\overset{\displaystyle CH}{|}} - CH_2 - CCl_3$

c) $CH_2 = CH - \underset{\displaystyle CCl_3}{\overset{\displaystyle CH}{|}} - CH_2 - Br$

d) none is correct

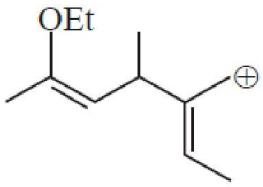
Q32 

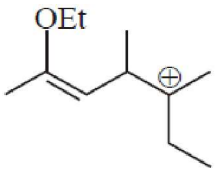
Product

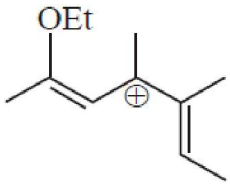
What is the product ?

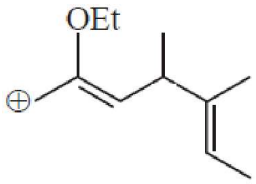
a) Enantiomer **b)** Diastereoisomer **c)** Meso **d)** Achiral

Q33 Which of the following is most stable carbocation.

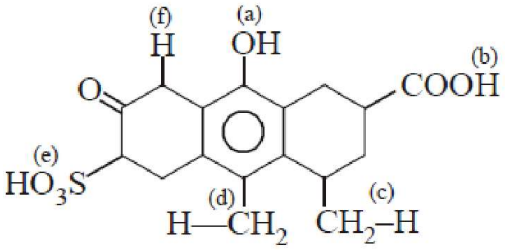
a) 

b) 

c) 

d) 

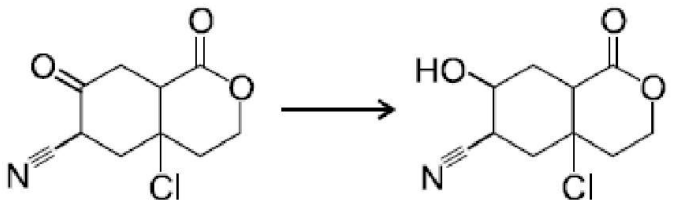
Q34 Arrange the following in increasing order of acid strength.



a) c < f < d < a < b < e **b)** f < d < c < b < e < a **c)** f < c < d < b < e < a

d) c < d < f < a < b < e

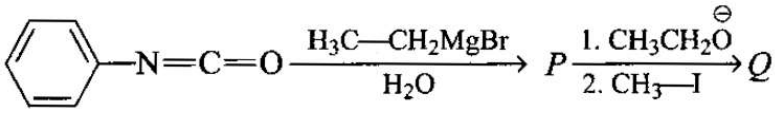
Q35 The best reaction/reagent for the following reduction would be :



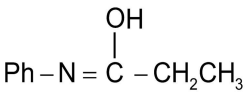
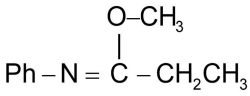
a) Zn–Hg / conc. HCl **b)** $LiAlH_4$ / THF **c)** $NaBH_4$ / EtOH

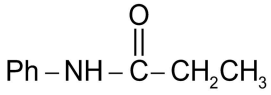
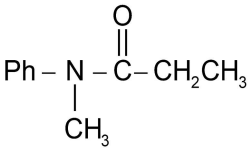
d) $Al(O\text{—}\prec)_3$ / $HO\text{—}\prec$

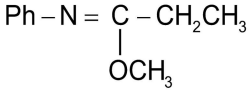
Q36



Find out P and Q :

a) P is  and Q is 

b) P is  and Q is 

c) P is Ph – NH –  – CH_2CH_3 and Q is 

d) P and Q both are same

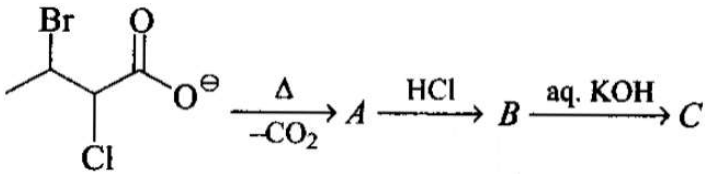
Q37 Which of the following is correct statement ?

a) Starch is a polymer of α-glucose **b)** Amylose is a component of cellulose

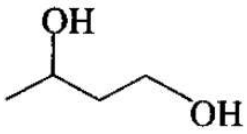
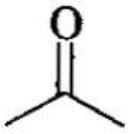
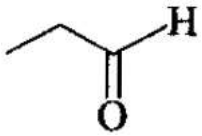
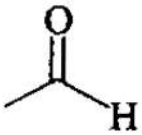
c) Proteins are composed of only one type of amino acid

d) Cyclic structure of fructose, is hemiacetal with furanose structure.

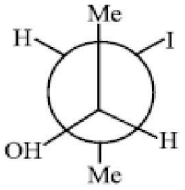
Q38

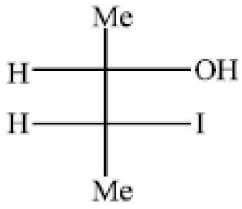


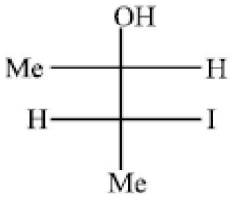
; Product C is:

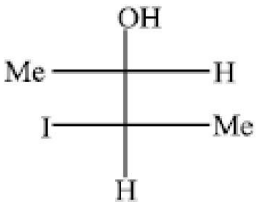
a)  **b)**  **c)**  **d)** 

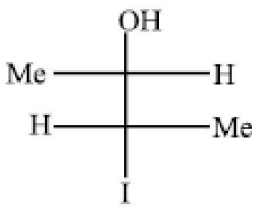
Q39 Which of the following is the diastereoisomers of the compound



a) 

b) 

c) 

d) 

Q40 The impure 6 g of NaCl is dissolved in water and then treated with excess of silver nitrate solution. The weight of precipitate of silver chloride is found to be 14 g. The % purity of NaCl solution would be :

a) 95% **b)** 85% **c)** 75% **d)** 65%

Q41 A certain public water supply contains 0.10 ppb (part per billion) of chloroform ($CHCl_3$). How many molecules of $CHCl_3$ would be obtained in 0.478 mL drop of this water ? (assumed d = 1 g/mL)

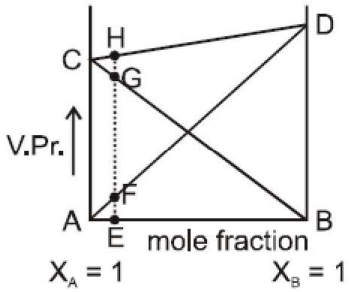
a) $4 \times 10^{-3} \times N_A$ **b)** $10^{-3} \times N_A$ **c)** $4 \times 10^{-10} \times N_A$ **d)** None of these

Q42 Which reaction involves a change in the electron–pair geometry for the under lined element ?

a) $\underline{B}F_3 + F^- \longrightarrow \underline{B}F_4^-$ **b)** $\underline{N}H_3 + H^+ \longrightarrow \underline{N}H_4^+$ **c)** $2\,\underline{S}O_2 + O_2 \longrightarrow 2\,\underline{S}O_3$

d) $H_2\underline{O} + H^+ \longrightarrow H_3\underline{O}^+$

Q43 Based on the given diagram, which of the following statements regarding the homogenous solutions of two volatile liquids are correct ?



(a) Plots AD and BC show the Raoult's law is obeyed for the solution in which B is a solvent and A is the solute and as well as for that in which A is solvent and B is solute.
(b) Plot CD shows that Dalton's law of partial pressure is obeyed by the binary solution of components A and B.
(c) EF + EG = EH; and AC and BD correspond to the vapour pressure of the pure solvents A and B respectively.
Select the correct answer using the options given below :

a) Only (a) **b)** (b) and (c) **c)** (a) and (c) **d)** All

Q44 Consider the following four elements, which are represented according to long form of periodic table.

	Y	
W	X	Z

Here W,Y and Z are left, up and right elements with respect to the element 'X' and 'X' belongs to 16th group and 3rd period. Then according to given information the incorrect statement regarding given elements is:

a) Maximum electronegativity: Y
b) Maximum catenation property: X
c) Maximum electron affinity: Z
d) Y exhibits variable covalency

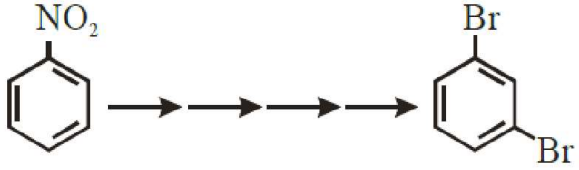
Q45 Which of the following is incorrect about the chemical equilibrium ?

a) $(\Delta G)_{T,P} = 0$
b) Equilibrium constant is independenht of initial concentration of reactants
c) Catalyst has no effect on equilibrium state
d) Reaction stops at equilibrium

Q46 $Fe(OH)_2$ is diacidic base has $K_{b1} = 10^{-4}$ and $K_{b2} = 2.5 \times 10^{-6}$
What is the concentration of $Fe(OH)_2$ in 0.1 M $Fe(NO_3)_2$ solution?

a) 4×10^{-9}
b) 2.5×10^{-6}
c) 10^{-10}
d) 10^{-14}

Q47 What is the correct sequence of reagents used for converting nitrobenzene into m-dibromobenzene ?



a) $\xrightarrow{NaNO_2} / \xrightarrow{HCl} / \xrightarrow{KBr} / \xrightarrow{H^+}$

b) $\xrightarrow{Br_2/Fe} / \xrightarrow{Sn/HCl} / \xrightarrow{NaNO_2/HCl} / \xrightarrow{CuBr/HBr}$

c) $\xrightarrow{Sn/HCl} / \xrightarrow{KBr} / \xrightarrow{Br_2} / \xrightarrow{H^+}$

d) $\xrightarrow{Sn/HCl} / \xrightarrow{Br_2} / \xrightarrow{NaNO_2} / \xrightarrow{NaBr}$

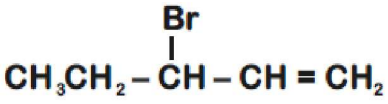
Q48 Kjeldahl's method cannot be used to estimate nitrogen for which of the following compounds?

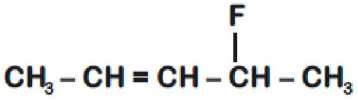
a) $CH_3CH_2 - C \equiv N$
b) $NH_2 - \overset{\overset{O}{\|}}{C} - NH_2$
c) $C_6H_5NO_2$
d) $CH_3CH_2NH_2$

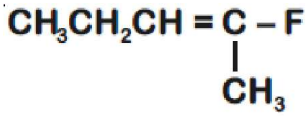
Q49 Among (a) – (d), the complexes that can display geometrical isomerism are
(a) $[Pt(NH_3)_3Cl]^+$ (b) $[Pt(NH_3)Cl_5]^-$
(c) $[Pt(NH_3)_2Cl(NO_2)]$ (d) $[Pt(NH_3)_4ClBr]^{2+}$

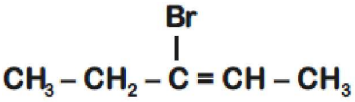
a) (c) and (d)
b) (a) and (b)
c) (b) and (c)
d) (d) and (a)

Q50 The major product obtained from $-E_2$ elimination of 3-bromo-2-fluoropentane is

a) 

b) 

c) 

d) 

Numerical

Q51 At 727°C and 1.23 atm of total equilibrium pressure, SO_3 is partially dissociated into SO_2 and O_2 according to $SO_3(g) \rightleftharpoons SO_2(g) + 1/2O_2(g)$. The density of equilibrium mixture is 0.9 g/litre. if degree of dissociation is A then 3A is :

Q52 If enthalpy of dissociation of CH_4 and C_2H_6 are 320 and 600 calories respectively then bond energy of C–C bond (in cal) is : (report your answer by dividing 10)

Q53 Reaction $A + B \longrightarrow C + D$ follows rate law, $r = k\,[A]^{1/2}\,[B]^{1/2}$ starting with 1M of A and B each. What is the time taken (in sec.) for concentration of A become 0.1 M, If your answer is X then what will be the value of $\frac{x}{10}$?
[Given $k = 2.303 \times 10^{-2}$ sec^{-1}].

Q54 If the frequency of violet radiation is 7.5×10^{14} Hz, then the value of wavenumber in m^{-1} for it is $p \times 10^5$. Give the value of p?

Q55 Conductivity of a saturated solution of $Cu_2[Fe(CN)_6]$ after subtracting the conductivity of water is 1.28×10^{-5} Ω^{-1} cm^{-1}. Calculate value of solubility of $Cu_2[Fe(CN)_6]$. [Λ_m^∞ $(CuSO_4) = 260$ S cm^2 mol^{-1}, Λ_m^∞ $(K_2SO_4) = 300$ S cm^2 mol^{-1}, Λ_m^∞ $(K_4Fe(CN)_6) = 720$ S cm^2 mol^{-1}]
Report your answer as (solubility) × (10^5)

Q56 How many of the following ions would form coloured complexes in water ?
Cu^{2+}, Zn^{2+}, Ti^{3+}, Ti^{+4}, Cd^{2+}, Mn^{2+}

Q57 At constant volume, 4 mol of an ideal gas when heated from 300 K to 500 K changes its internal energy by 5000 J. The molar heat capacity at constant volume is _____. If your answer is X then what will be the value of 4X.

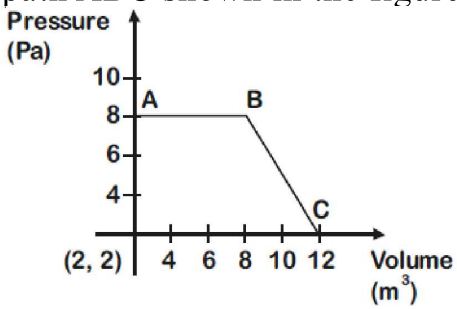
Q58 For an electrochemical cell $Sn(s)|Sn^{2+}(aq, 1M)\ ||Pb^{2+}(aq, 1M)|Pb(s)$ the ratio $\frac{[Sn^{2+}]}{[Pb^{2+}]}$ when this cell attains equilibrium is _____. (Report your answer interms of nearest integer.)

(Given: $E^0_{Sn^{2+}|Sn} = -0.14V$

$$E^0_{Pb^{2+}|Pb} = -0.13V.\frac{2.303RT}{F} = 0.06\Big)$$

Q59 The number of chiral centres in penicillin is _____.

Q60 The magnitude of work done by a gas that undergoes reversible expansion along the path ABC shown in the figure is _____.



Mathematics

Single Choice Question

Q61 $\int_0^{\infty} \frac{\ln(2x)}{1+x^2}dx$ is equal to

a) 0 **b)** $\frac{\pi}{8}\ell n2$ **c)** $\frac{\pi}{4}\ell n2$ **d)** $\frac{\pi}{2}\ell n2$

Q62 Function f(x) is defined such that $f(x)\begin{cases}\int_0^x (5+|1-t|)dt, & x>2\\ 5x+1, & x\le 2\end{cases}$ then identify the **INCORRECT** option?

a) f(x) is non-differentiable at x = 2 **b)** f(x) is continuous at x = 2

c) f(x) is increasing at x = 2 **d)** $\int_0^3 f(x)dx = \frac{140}{3}$

Q63 If z_1, z_2, z_3 are three points lying on the circle $|z| = 2$ then the minimum value of $|z_1 + z_2|^2 + |z_2 + z_3|^2 + |z_3 + z_1|^2$ is equal to

a) 6 **b)** 12 **c)** 15 **d)** 24

Q64 The expression $\left(\sqrt{2x^2+1}+\sqrt{2x^2-1}\right)^6 + \left(\frac{2}{\sqrt{2x^2+1}+\sqrt{2x^2-1}}\right)^6$ is a polynomial of degree

a) 6 **b)** 4 **c)** 2 **d)** 0

Q65 The sum of 20 terms of the series whose r^{th} term is given by $T(n) = (-1)^n \frac{n^2+n+1}{n!}$ is

a) $\frac{20}{19!} - 2$ **b)** $\frac{21}{20!} - 1$ **c)** $\frac{21}{20!}$ **d)** none of these

Q66 Let A and B are two points (1, 0) and (3, 0) and P is a variable point on y-axis then maximum value of angle APB is equal to

a) $22\frac{1}{2}^o$ **b)** 30^o **c)** 45^o **d)** 60^o

Q67 Let f(x) and g(x) are twice differentiable functions such that f(x). g(x) = 1 for all x and f '(x) and g'(x) are never equal to zero then $\frac{f''(x)}{f'(x)} - \frac{g''(x)}{g'(x)}$ is equal to

a) $-\frac{2f'(x)}{f(x)}$ **b)** 0 **c)** $-\frac{f'(x)}{f(x)}$ **d)** $\frac{2f'(x)}{f(x)}$

Q68 One ticket is selected at random from 100 tickets numbered 00, 01, 02,..., 99. Suppose A and B are, the sum and product of the digit found on the ticket. Then P((A = 7)/(B = 0)) is given by

a) 2/13 **b)** 2/19 **c)** 1/50 **d)** none of these

Q69 A cube of ice melts without changing its shape at the uniform rate of 4 cm^3/min. The rate of change of the surface area of the cube, in cm^2/min, when the volume of the cube is 125 cm^3, is

a) –4 **b)** –16/5 **c)** –16/6 **d)** –8/15

Q70 If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + \hat{k}$, then the vector $\vec{c}$ such that $\vec{a}.\vec{c} = 2$ and $\vec{a} \times \vec{c} = \vec{b}$ is-

a) $\frac{1}{3}(\hat{i} - 2\hat{j} + \hat{k})$ **b)** $\frac{1}{3}(-\hat{i} + 2\hat{j} + 5\hat{k})$ **c)** $\frac{1}{3}(\hat{i} + 2\hat{j} - 5\hat{k})$

d) $\frac{1}{3}(-\hat{i} + 2\hat{j} - \hat{k})$

Q71 If $y = \int \frac{dx}{(1+x^2)^{3/2}}$ and y = 0 when x = 0, the value of y when x = 1 is

a) $\frac{1}{\sqrt{2}}$ **b)** $\sqrt{2}$ **c)** $2\sqrt{2}$ **d)** None of these

Q72 If P, Q and R are three points with co-ordinates (1, 4), (4, 2) and (m, 2m – 1) respectively then the value of m for which PR + RQ is minimum will be equal to

a) $\frac{17}{8}$ **b)** $\frac{5}{2}$ **c)** $\frac{7}{2}$ **d)** $\frac{15}{8}$

Q73 The point ([p + 1], [p]) lying inside the circle $x^2 + y^2 - 2x - 15 = 0$, then set of all values of p is (where [.] represent greatest integer function)

a) [–2, 3) **b)** (–2, 3) **c)** [–2, 0) ∪ (0, 3) **d)** [0, 3)

Q74 The position vectors of point A,B and C are $\hat{i}+\hat{j}+\hat{k}, \hat{i}+5\hat{j}-\hat{k}$ and $2\hat{i}+3\hat{j}+5\hat{k}$, respectively. The greatest angle of triangle ABC is.

a) 120° **b)** 90° **c)** $\cos^{-1}(3/4)$ **d)** None of these

Q75 The domain of the function $f(x) = \left[\log_{10}\left(\frac{5x - x^2}{4}\right)\right]^{1/2}$ is

a) $-\infty < x < \infty$ **b)** $1 \le x \le 4$ **c)** $4 \le x \le 16$ **d)** $-1 \le x \le 1$

Q76 Consider a system of equations

x + ay + z = 0
bx + y + bz = 1
x + by + z = – 1

The ordered pair (a, b) for which system will have infinite solution is(are)

a) (1, -1) **b)** (2, -1) **c)** (2, 1) **d)** (2, -2)

Q77 $\lim\limits_{x\to 0}\dfrac{\sin^{-1}x-\tan^{-1}x}{x^3}$ is equal to

a) 2 **b)** 1 **c)** -1 **d)** $1/2$

Q78 A parabola whose axis is parallel to x-axis passes through three points (2, 0), (0, –1) and (6, 1) then area enclosed by the parabola and line $x - 2y - 8 = 0$ is equal to

a) $\frac{125}{6}$ **b)** $\frac{64}{3}$ **c)** $\frac{108}{5}$ **d)** $\frac{41}{2}$

Q79 The point of intersection of the lines $\frac{x-5}{3}=\frac{y-7}{-1}=\frac{z+2}{1}$ and $\frac{x+3}{-36}=\frac{y-3}{2}=\frac{z-6}{4}$ is.

a) $\left(21,\frac{5}{3},\frac{10}{3}\right)$ **b)** $(2,10,4)$ **c)** $(-3,3,6)$ **d)** $(5,7,-2)$

Q80 If the focal distance of an end of the minor axis of any ellipse (its axes as x and y axis respectively) is k and the distance between the foci is 2h, then its equation is-

a) $\frac{x^2}{k^2}+\frac{y^2}{h^2}=1$ **b)** $\frac{x^2}{k^2}+\frac{y^2}{k^2-h^2}=1$ **c)** $\frac{x^2}{k^2}-\frac{y^2}{k^2-h^2}=1$ **d)** $\frac{x^2}{k^2}+\frac{y^2}{k^2+h^2}=1$

Numerical

Q81 Let a, b, c, d be four distinct real numbers in A.P. Then the smallest positive value of k satisfying $2(a-b)+k(b-c)^2+(c-a)^3=2(a-d)+(b-d)^2+(c-d)^3$ is.

Q82 If for $x \geq 0$, $y = y(x)$ is the solution of the differential equation, $(x+1)dy = ((x+1)^2 + y-3)\,dx$, $y(2) = 0$, then $y(3)$ is equal to_____.

Q83 If the area of the region $\{(x, y): 0 \leq y \leq x^2 + 1, 0 \leq y \leq x + 1, 0 \leq x \leq 2\}$ is A, then the value of $6A - 17$ is____.

Q84 If the matrices $A=\begin{bmatrix}1 & 1 & 2\\ 1 & 3 & 4\\ 1 & -1 & 3\end{bmatrix}$, B = adj A and C = 3A, then $\frac{|\text{adjB}|}{|C|}$ is equal to

Q85 Let $A = \{1, 2, 3, 4\}$ and R be a relation on the set $A \times A$ defined by $R = \{((a,b),(c,d)) : 2a + 3b = 4c + 5d\}$. Then the number of elements in R is :

Q86 The mean and variance of 7 observations are 8 and 16 respectively. If one observation 14 is omitted a and b are respectively mean and variance of remaining 6 observation, then $a + 3b - 5$ is equal to_____.

Q87 If α, β, γ are roots of $x^3 + 2x^2 + 3x + 3 = 0$ then value of $\left(\frac{\alpha}{\alpha+1}\right)^3+\left(\frac{\beta}{\beta+1}\right)^3+\left(\frac{\gamma}{\gamma+1}\right)^3$ is equal to?

Q88 If R is remainder when $6^{83} + 8^{83}$ is divided by 49, then the value of R/5 is

Q89 A man has 3 friends. If N is number of ways he can invite one friend everyday for dinner on 6 successive nights so that no friend is invited more than 3 times then the value of N/30 is.

Q90 If n is the number of terms of the series $\cot^{-1} 3$, $\cot^{-1} 7$, $\cot^{-1} 13$, $\cot^{-1} 21$, ..., whose sum is $\frac{1}{2}\cos^{-1}\left(\frac{24}{145}\right)$, then the value of n is _____.

Answer Key

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**B**	**D**	**C**	**C**	**C**	**B**	**A**	**C**	**A**	**C**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**D**	**A**	**A**	**A**	**D**	**C**	**C**	**D**	**A**	**A**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**1**	**112**	**5**	**3**	**3**	**363**	**5**	**7**	**5**	**20**
Que.	31	32	33	34	35	36	37	38	39	40
Ans.	**A**	**A**	**C**	**D**	**D**	**B**	**A**	**C**	**D**	**A**
Que.	41	42	43	44	45	46	47	48	49	50
Ans.	**A**	**A**	**D**	**D**	**D**	**C**	**B**	**C**	**A**	**C**
Que.	51	52	53	54	55	56	57	58	59	60
Ans.	**2**	**12**	**10**	**25**	**2**	**3**	**25**	**2**	**3**	**48**
Que.	61	62	63	64	65	66	67	68	69	70
Ans.	**D**	**D**	**B**	**A**	**B**	**B**	**D**	**B**	**B**	**B**
Que.	71	72	73	74	75	76	77	78	79	80
Ans.	**A**	**A**	**A**	**B**	**B**	**A**	**D**	**A**	**A**	**B**
Que.	81	82	83	84	85	86	87	88	89	90
Ans.	**16**	**3**	**6**	**8**	**6**	**37**	**44**	**7**	**17**	**11**