TSPH EduCare Private Limited

2023_JEE Actual Paper_31 Jan_1st Shift

FULL SYLLABUS

Date : 31-1-2023

Marks : 300

PHYSICS

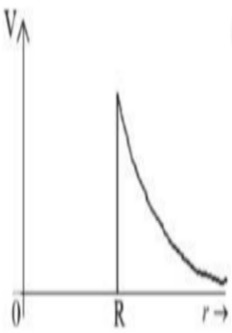
1) **At a certain depth "d " below surface of earth, value of acceleration due to gravity becomes four times that of its value at a height 3R above earth surface, Where R is Radius of earth (Take R = 6400 km). The depth d is equal to**

a) 5260 km
b) 2560 km
c) 4800 km
d) 640 km

2) **The drift velocity of electrons for a conductor connected in an electrical circuit is V_d. The conductor in now replaced by another conductor with same material and same length but double the area of cross section. The applied voltage remains same, The new drift velocity of electrons will be**

a) V_D
b) $\frac{V_d}{2}$
c) $2V_d$
d) $\frac{V_d}{4}$

3) **Which of the following correctly represents the variation of electric potential (V) of a charged spherical conductor of radius (R) with, radial distance (r) from the center?**

a)


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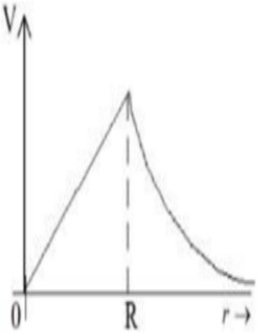
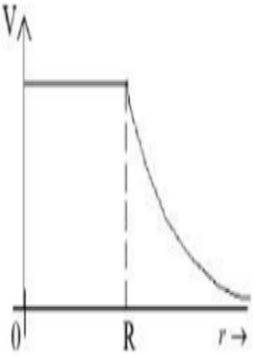


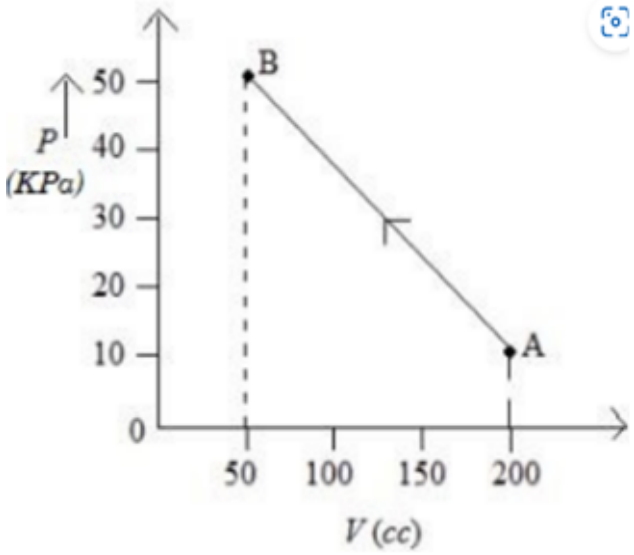
c)


d)


4) **Two polaroide A and B are placed in such a way that the pass-axis of polaroids are perpendicular to each other. Now. another polaroid C is placed between A and B bisecting angle between them. If intensity of impolarized light is I_0 then intensity of transmitted Light after passing through polaroid B will be:**

a) $\frac{I_0}{4}$
b) Zero
c) $\frac{I_0}{8}$
d) $\frac{I_0}{2}$

5) **The pressure of a gas changes linearly with volume from A to B as shown in figure. If no heat is supplied to or extracted from the gas then change in the internal energy of the gas will be**



a) -4.5J
b) 6J
c) zero
d) 4.5J

6) **Spherical insulating ball and a spherical metallic ball of same size and mass are dropped from the same height. Choose the correct statement out of the following (Assume negligible air friction}**

a) Time taken by them to reach the earth's surface will be independent of the properties of their materials

b) Both will reach the earth's surface simultaneously

c) Metal ball will reach the earth's surface earlier than the insulating ball

d) Insulating ball will reach the earth's surface earlier than the metal ball

7) **The initial speed of a projectile fired from around is u. At the highest point during its motion, the speed of projectile is** $\frac{\sqrt{3}}{2}u$ **. The time of flight of the piojectile is :**

a) $\frac{\sqrt{3}u}{g}$
b) $\frac{2u}{g}$
c) $\frac{u}{g}$
d) $\frac{u}{2g}$

8) **The maximum potential energy of a block executing simple harmonic motion is 25 J. A is amplitude of oscillation. At A/2, the kinetic energy of the block is**

a) 9.75 J
b) 18.75 J
c) 37.5 J
d) 12.5 J

9) **A rod with circular cross-section area 2 cm^2 and length 40 cm is wound uniformly with 400 turns of an insulated wire. If a current of 0.4 A flows in the wire windings, the total magnetic flux produced inside windings is $4\Pi \times 10^{-6}$ Wb. The relative permeability of the rod is (Given : Permeability of vacuum $\mu_0 = 4\Pi \times 10^{-7}$ N A^{-2})**

a) 125
b) $\frac{5}{16}$
c) $\frac{32}{5}$
d) 12.5

10) Given below are two statements : One is labelled as Assertion A and the other is labelled as Reason R

Assertion A : The beam of electrons show wave nature and exhibit interference and diffraction.

Reason R : Davisson Gemier Experimentally verified the wave nature of electrons.

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

a) Both A and R are correct and R is the correct explanation of A

b) A is not correct but R is correct

c) Both A and R are correct but R is Not the correct explanation of A

d) A is correct but R is not correct

11) **The amplitude of 15 sin (1000π t) is modulated by 10 sin (4π t) signal. The amplitude modulated signal contains frequency (ies) of**

A. 500 Hz **B. 2 Hz**

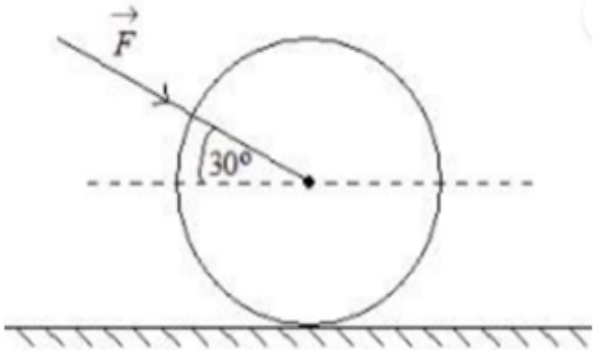
C. 250 Hz **D. 498 Hz**

E. 502 Hz

Choose the correct answer from the options siren below:

a) A, D and E Only
b) B Only
c) A Only
d) A and B Only

12) **As shown in figure, a 70 kg garden roller is pushed with a force of $\vec{F}$ = 200 N at an angle of 30° with horizontal. The normal reaction on the roller is (Given g = 10 m s^{-2})**



a) $200\sqrt{3}N$
b) 800N
c) $800\sqrt{2}N$
d) 600N

13) **The effect of increase in temperature on the number of electrons in conduction band (n_e) and resistance of a semiconductor will be as:**

a) n_e increases, resistance decreases
b) Both n_e and resistance increase
c) Both n_e and resistance decrease
d) n_e decreases, resistance increases

14) **If a source of electromagnetic radiation having power 15 kW produces 10^{16} photons per second, the radiation belongs to a part of spectrum is.**

(Take Planck constant h= 6×10^{-34} Js)

a) Micro waves
b) Gamma rays
c) Ultraviolet rays
d) Radio waves

15) **A bar magnet with a magnetic moment 5.0 Am^2 is placed in parallel position relative to a magnetic field of 0.4 T. The amount of required - work done in turning the magnet from parallel to antiparallel position relative to the field direction is _____ .**

a) 2J
b) zero
c) 1J
d) 4J

16) **A free neutron decays into a proton but a free proton does not decay into neutron. This is because**

a) neutron is a composite particle made of a proton and an electron
b) proton is a charged particle
c) neutron has larger rest mass than proton
d) neutron is an uncharged particle

17) **If R, X_L, and X_C represent resistance, inductive reactance and capacitive reactance. Then which of the following is dimensionless :**

a) $R\,X_L X_C$
b) $R\frac{X_L}{X_C}$
c) $\frac{R}{\sqrt{X_L X_C}}$
d) $\frac{R}{X_L X_C}$

18) **If 1000 droplets of water of surface tension 0.07 N/m. having same radius 1 mm each, combine to form a single drop. In the process the released surface energy is-**

$\left(Take\ \pi = \frac{22}{7}\right)$

a) 7.92×10^{-4}J
b) 8.8×10^{-5}J
c) 9.68×10^{-4}J
d) 7.92×10^{-6}J

19) **100 balls each of mass m moving with speed v simultaneously strike a wall normally and reflected back with same speed, in time t s. The total force exerted by the balls on the wall is**

a) 200mvt
b) $\frac{100mv}{t}$
c) $\frac{200mv}{t}$
d) $\frac{mv}{100t}$

20) **The correct relation between $\gamma = \frac{c_p}{c_v}$ and temperature T is :**

a) $\gamma\alpha\frac{1}{T}$
b) $\gamma\alpha\frac{1}{\sqrt{T}}$
c) $\gamma\,\alpha\,T$
d) $\gamma\,\alpha\,T°$

21) A lift of mass M = 500 kg is descending with speed of 2 ms^{-1}. Its supporting cable begins to slip thus allowing it to fall with a constant acceleration of 2 ms^{-2}. The kinetic energy of the lift at the end of fall through to a distance of 6 m will be _____ kJ

)

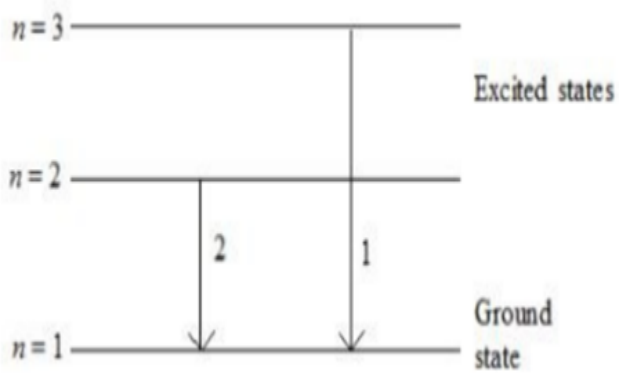
22) Two identical cells, when connected either in parallel or in series gives same current Ω an external resistance 5 Ω. The internal resistance of each cell will be _____ Ω.

)

23) An inductor of 0.5 mH, a capacitor of 20 μF and resistance of 20 Ω are connected in series with a 220 V ac source. If the current is in phase with the emf. the amplitude of current of the circuit is $\sqrt{x}$A, The value of x is

)

24) For hydrogen atom, λ_1 and λ_2 are the wavelengths corresponding to the transitions 1 and 2 respectively as shown in figure. The ratio of λ_1 and λ_2 is x/32. The value of x is _____



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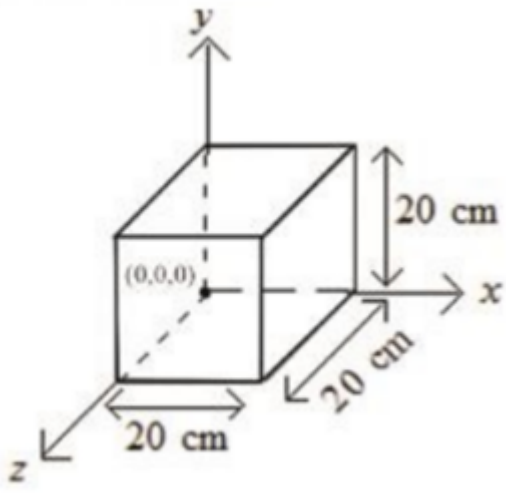
25) A thin rod having a length of 1 m and area of cross-section 3 × 10^{-6} m^2 is suspended vertically from one end. The rod is cooled from 210°C to 160°C. After cooling, a mass M is attached at the lower end of the rod such that the length of rod again becomes 1 m, Young's modulus and coefficient of linear expansion of the rod are 2 × 10^{11} N m^{-2} and 2 < 10^{-5} K^{-1}, respectively. The value of M is _____ kg (Take g = 10 ms^{-2})

)

26) The speed of a swimmer is 4 km h^{-1} in still water. If the swimmer makes his strokes normal to the flow of river of width 1 km, he reaches a point 750 m down the stream on the opposite bank. The speed of the river water is _____ km h^{-1}

)

27) Expression for an electric field is given by $\vec{E} = 4000x^2\hat{i}\frac{V}{m}$. The electric flux through the cube of side 20 cm when placed in electric field (as shown in the figure) is _____ V cm.



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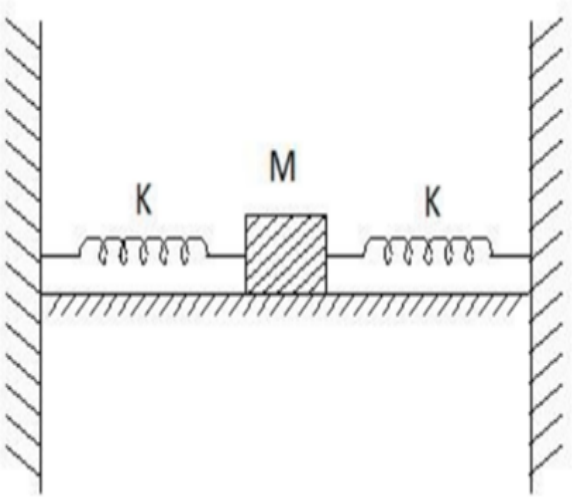
28) In a medium the speed of light wave decreases to 0.2 times to its speed in free space The ratio of relative permittivity to the refractive index of the medium is x : 1. The value of x is _____.

(Given speed of light in free space = 3×10^8 m s^{-1} and for the given medium $\mu_r = 1$)

)

29) In the figure given below, a block of mass M = 490 g placed on a frictionless table is connected with two springs having same spring constant (K = 2 N m^{-1}). If the block is horizontally displaced through 'X' m then the number of complete oscillations it will make in 14π seconds will be _____



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30) A solid sphere of mass 1 kg rolls without slipping on a plane surface. Its kinetic energy is 7×10^{-3} J. The speed of the centre of mass of the sphere is _____ cms^{-1}

)

CHEMISTRY

31) **Cobalt chloride when dissolved in water forms pink colored complex X which has octahedral geometry. This solution on heating with cone HCl forms deep blue complex. Y which has a Z geometry. X. Y and Z, respectively; are**

a) X = $[_{Co}(H_2O)_6]^{2+}$, Y= $[CoCl_4]^{2-}$. Z = Tetrahedral

b) X = $[Co(H_2O)_6]^{3+}$, Y= $[CoCl_6]^{3-}$, Z = Octahedral

c) X = $[Co(H_2O)_4Cl_2]^{+}$. Y = $[CoCl_4]^{2-}$ Z = Tetrahedral

d) X = $[Co(H_2O)_6]^{2-}$, Y= $[CoCl_6]^{3-}$., Z = Octahedral

32) **When Cu^{2+} ion is treated with KI, a white precipitate. X appears, in solution. The solution is titrated with sodium thiosulphate, the compound Y is fomied, X and Y respectively are**

a) $X = Cu_2I_2$ $Y = Na_2S_4O_5$

b) $X = CuI_2$ $Y = Na_2S_2O_3$

c) $X = CuI_2$ $Y = Na_2S_4O_6$

d) $X = Cu_2I_2$ $Y = Na_2S_4O_6$

33) **The methods NOT involved in concentration of ore are**

A. Liquation **B. Leaching**

C. Electro lysis **D. Hydraulic washing**

E. Froth floatation

Choose the correct answer from the options given below :

a) C, D and E only b) A and C only

c) B. D and E only d) B, D and C only

34) **Choose the correct set of reagents for the following conversion.**

trans (Ph – CH = CH – CH_3) → cis (Ph – CH = CH – CH_3)

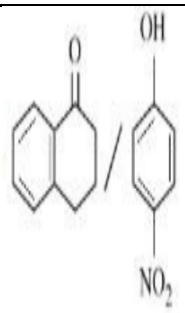
a) Br_2, aq.KOH. $NaNH_2$, H_2 Lindlar Catalyst

b) Br_2. Aq.KOH. $NaNH_2$, Na (Liq NH_3)

c) Br_2, alc.KOH. $NaNH_2$. H_2 Lindlar Catalyst

d) Br_2, alc.KOH. $NaNH_2$. Na (Liq NH_3)

35) **Match items of column I and II**

	Column I (Mixture of compounds)		**Column II (Separation Technique)**
A.	H_2O/CH_2Cl_2	i.	Crystallization
B.		ii.	Differential solvent extraction
C.	Kerosene / Naphthalene	iii.	Column chromatoagraphy
D.	$C_6H_{12}O_6$/NaCl	iv.	Fractional Distillation

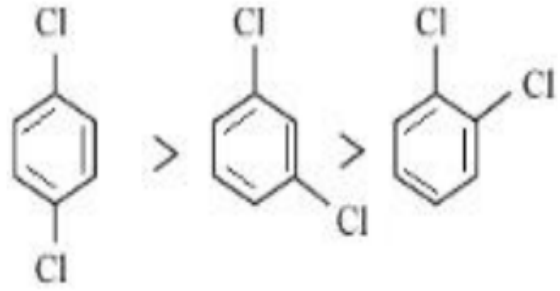
Correct match is

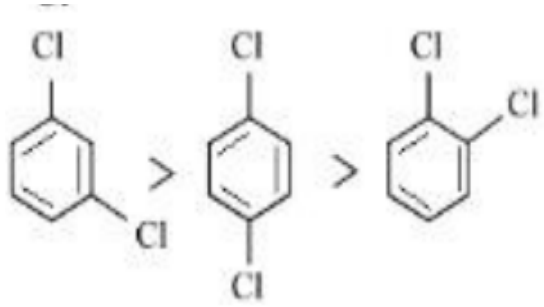
a) A-(i). B-(iii). C-(ii), D-(iv)
b) A-(ii)- B-(iv). C-(i), D-(iii)
c) A-(iii), B-(iv}, C-(ii), D-(i)
d) A-(ii), B-(iii), C-(iv), D-(i)

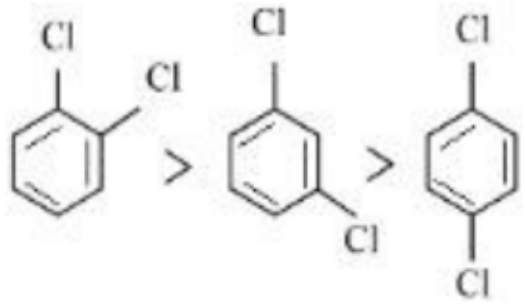
36) **H_2O_2 acts as a reducing agent in**

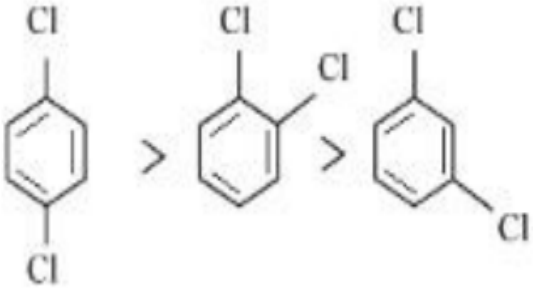
a) $Na_2S + 4H_2O_2 \rightarrow Na_2SO_4 + 4H_2O$
b) $2NaOCl + H_2O_2 \rightarrow 2\ NaCl + H_2O + O_2$
c) $Mn^{2+} - 2H_2O_2 \rightarrow MnO_2 + 2H_2O$
d) $2Fe^{2+} + 2H^+ + H_2O_2 \rightarrow 2Fe^{3+} + 2H_2O$

37) **The correct order of melting points of dichlorobenzenes is**

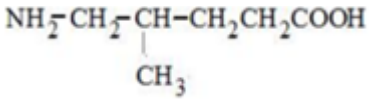
a) 

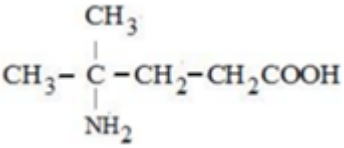
b) 

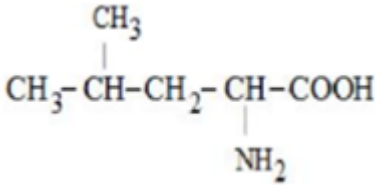
c) 

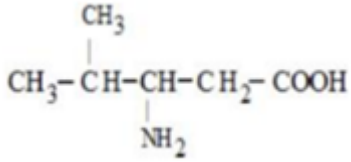
d) 

38) **A protein 'X' with molecular weight of 70,000 u. on hydrolysis gives amino acids. One of these amino acid is**

a) 

b) 

c) 

d) 

39) **Which of the following artificial sweeteners has the highest sweetness value in comparison to cane sugar ?**

a) Saccharin b) Aspartame

c) Sucralose d) Alitame

40) **Nd^{2+} = _____**

a) $4f^3$ b) $4f^4$

c) $4f^46s^2$ d) $4f^26s^2$

41) **The correct increasing order of the ionic radii is**

a) $S^{2-} < Cl^- < Ca^{2+} < K^+$

b) $Ca^{2+} < K^+ < Cl^- < S^{2-}$

c) $K^+ < S^{2-} < Ca^{2+} < Cl^-$

d) $Cl^- < Ca^{2+} < K^+ < S^{2-}$

42) **The correct order of basicity of oxides of vanadium is**

a) $V_2O_3 > V_2O_5 > V_2O_4$ b) $V_2O_5 > V_2O_4 > V_2O_3$

c) $V_2O_3 > V_2O_4 > V_2O_5$ d) $V_2O_4 > V_2O_3 > V_2O_5$

43) **Consider the following reaction**

Propanal + Methanal $\xrightarrow[(ii)\ \Delta \\ (iii)\ NaCN \\ (iv) H_3O^+]{(i)\ dil.\ NaOH} \underset{(C_5H_8O_3)}{Product\ B}$

The correct statement for product B is. It is

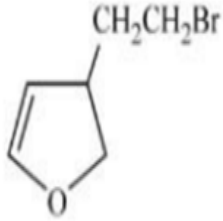
a) optically active and adds one mole of bromine

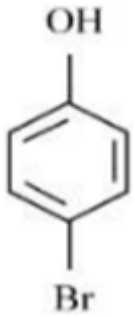
b) racemic mixture and gives a gas with saturated $NaHCO_3$ solution

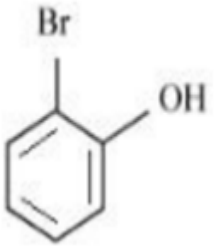
c) optically active alcohol and is neutral

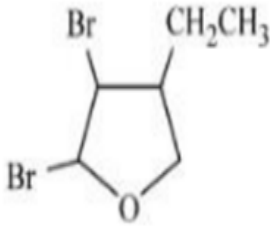
d) racemic mixture and is neutral

44) **An organic compound 'A' with emperical formula C_6H_6O gives sooty flame on burning. Its reaction with bromine solution in low polarity solvent results in high yield of B, B is**

a) 

b) 

c) 

d) 

45) **Identify X, Y and Z in the following reaction. (Equation not balanced)**

$ClO + \dot{N}O_2 \rightarrow \underline{X} \xrightarrow{H_2O} \underline{Y} + \underline{Z}$

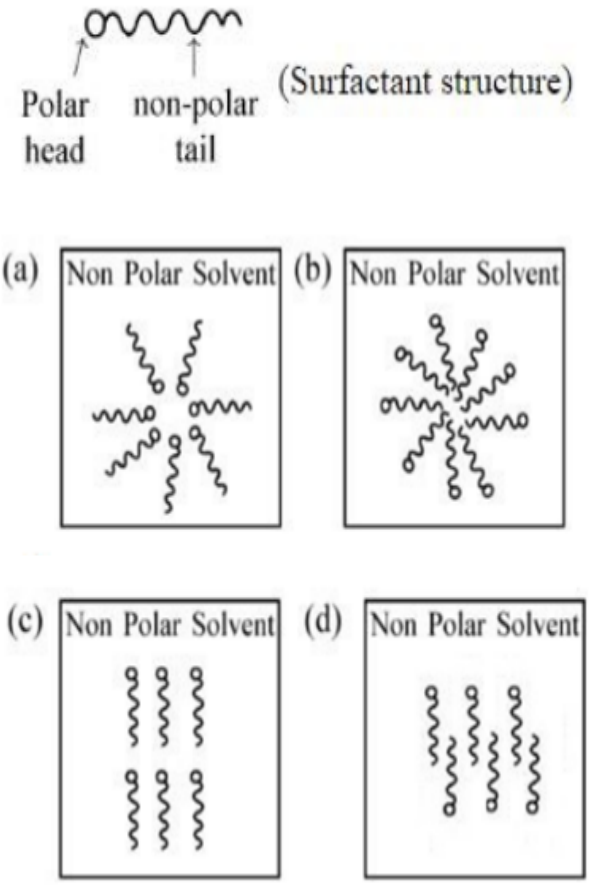
a) X = $ClONO_2$, Y = HOCl, Z = NO_2

b) X = $ClNO_2$, Y = HCl, Z = HNO_3

c) X = $ClONO_2$, Y = HOCl, Z = HNO_3

d) X = $ClNO_3$,. Y = Cl_2, Z = NO_2

46) **Adding surfactants in non polar solvent, the micelles structure will look like**



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

47) **Which transition in the hydrogen spectrum would have the same wavelength as the Balmer type transition from n = 4 to is n = 2 of He^+ spectrum**

a) n = 2 to n = 1
b) n = 3 to n = 4
c) n = 1 to n = 2
d) n = 1 to n = 3

48) **Which one of the following statements is correct for electrolysis of brine solution ?**

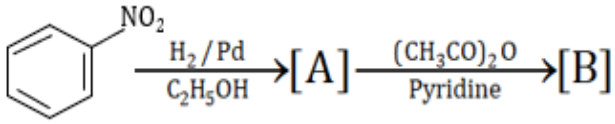
a) H_2 is formed at anode
b) OH^- is formed at cathode
c) Cl_2 is formed at cathode
d) O_2 is formed at cathode

49) **Match List I with List II**

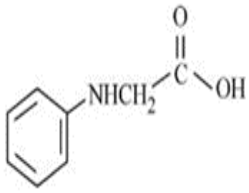
	Column I (Mixture of compounds)		**Column II (Separation Technique)**
A.	XeF_4	I.	See-saw
B.	SF_4	II.	Square planar
C.	NH_4^+	III.	Bern T-shaped
D.	BrF_3	IV.	Tetrahedral

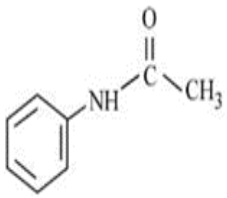
Choose the correct answer from the options given below

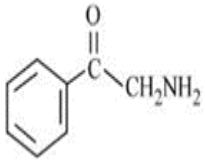
a) A-IV, B-III, C-II, D-I
b) A-II, B-I, C-III, D-IV
c) A-IV B-I, C-II, D-III
d) A-D, B-I, C-IV, D-III

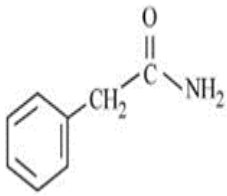
50) 

Consider the above reaction and identify the product B.

a) 

b) 

c) 

d) 

51) The rate constants of the above reaction at 200 K and 300 K are 0.03 min^{-1} and 0.05 min^{-1} respectively. The activation energy for the reaction is _____ J (Nearest integer)

(Given : In 10 = 2.3

R = 8.3 J $K^{-1}mol^{-1}$ log 5 = 0.70

log 3 = 0.48 log 2 =0.30)

)

52) The total pressure of a mixture of non-reacting gases X (0.6 g) and Y (0.45 g) in a vessel is 740 mm of Hg. The partial pressure of the gas X is _____ mm of Hg. (Nearest Integer)

(Given : molar mass X = 20 and Y = 45 g mol^{-1})

)

53) At 27°C, a solution containing 2.5 g of solute in 250.0 mL of solution exerts an osmotic pressure of 400 Pa. The molar mass of the solute is _____ g mol^{-1} (Nearest integer) (Given : R = 0.083 L bar K^{-1} mol^{-1})

)

54) The logarithm of equilibrium constant for the reaction Pd^{2+} + $4Cl^{-}$ = $PdCl_4^{2-}$ is _____ (Nearest integer)

Given: $\frac{2.303RT}{F} = 0.06V$

$Pd^{2+}_{(aq)} + 2e^- \rightleftharpoons Pd(s) \quad E^\circ = 0.83V$

$\mathrm{PdCl_4^{2-}(aq) + 2e^- \rightleftharpoons Pd() + 4\,Cl^-(aq)\ E^\circ = 0.65V}$

)

55) On complete combustion, 0.492 g of an organic compound gave 0.792 g of CO_2. The % of carbon in the organic compound is _____ (Nearest integer)

)

56) Zinc reacts with hydrochloric acid to give hydrogen and zinc chloride. The volume of hydrogen gas produced at STP from the reaction of 11.5 g of zinc with excess HCl is _____ L (Nearest integer) (Given : Molar mass of Zn is 65.4s mol^{-1} and Molar volume of H_2 at STP = 22.7 L)

)

57) For reaction:

$\mathrm{SO_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons SO_3(g)}$

$K_p = 2 \times 10^{12}$ at 27°C and 1 atm pressure. The K_c for the _____ $\times 10^{13}$. (Nearest integer) (Given R = 0.082 L atm K^{-1} mol^{-1})

)

58) The oxidation state of phosphorus in hypophosphoric acid is + _____

)

59) The enthalpy change for the conversion of $Cl_2(g)$ to Cl^- (aq) is (–) _____ kJ mol^{-1} (Nearest integer)

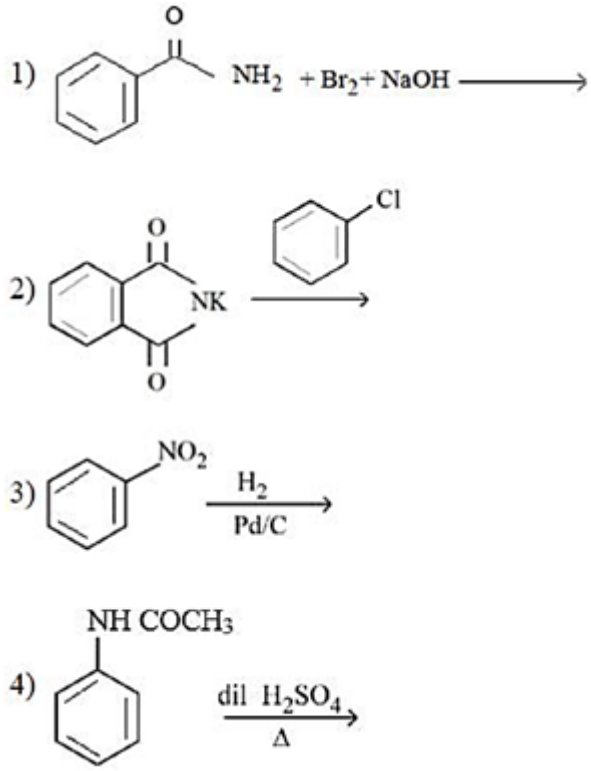
Given: $\Delta_{dis}H^-_{Cl_2(g)} = 240kJ\ mol^{-1}$,

$\Delta_{eg}H^-_{Cl_{(g)}} = -350kJ\ mol^{-1}$

$\Delta_{hyd}H^-_{Cl^-_{(g)}} = -380kJ\ mol^{-1}$

)

60) How many of the transformations given below would result in aromatic amines ?



)

MATHEMATICS

61) **For the system of linear equations**

x + y – z = 6

αx + βy +7z = 3

x + 2y + 3z = 14,

which of the following is NOT true ?

a) There is a unique point (α, β) on the line x + 2y + 18 = 0 for which the system has infinitely many solutions

b) If $\alpha = \beta = 7$, then the system has no solution

c) For every point (α, β) $\neq$ (7, 7) on the line x – 2y + 7 = 0, the system has infinitely many solutions

d) If $\alpha = \beta$ and $\alpha \neq 7$, then the system has a unique solution

62) **If the sum and product of four positive consecutive terms of a G.P., are 126 and 1296. respectively, then the sum of common ratios of all such GPs is**

a) 3 b) 14

c) $\frac{9}{2}$ d) 7

63) **Let a differentiable function f satisfy** $f\left(x\right) + \int_3^x \frac{f(t)}{t}dt = \sqrt{x+1}$,, **x ≥ 3. Then 12f(8) is equal to**

a) 1 b) 19

c) 17 d) 34

64) **Let** $\overrightarrow{a} = 2\hat{i} + \hat{j} + \hat{k}$ **and** $\overrightarrow{b}\ and\ \overrightarrow{c}$ **be two nonzero vectors such that** $\left|\overrightarrow{a} + \overrightarrow{b} + \overrightarrow{c}\right| = \left|\overrightarrow{a} + \overrightarrow{b} - \overrightarrow{c}\right|\ and\ \overrightarrow{b}.\overrightarrow{c} = 0$

Consider the following two statements:

A. $\left|\overrightarrow{a} + \lambda\overrightarrow{c}\right| \geq \left|\overrightarrow{a}\right|$ **for all $\lambda \in R$**

B. $\overrightarrow{a}\ and\ \overrightarrow{c}$ **are always parallel.**

Then.

a) only (B) is correct b) only (A) is correct

c) neither (A) nor (B) is correct d) both (A) and (B) are correct

65) **(S1) (p ⇒ q) ∨ (p ∧ (~q)) is a tautology**

(S2) ((~p) ⇒ (~q)) ∧ ((~p) ∨ q) is a contradiction.

Then

a) only (S2) is correct b) both (S1) and (S2) are correct

c) both (S1) and (S2) are wrong d) only (S1) is correct

66) **If** $\sin^{-1}\frac{\alpha}{17} + \cos^{-1}\frac{4}{5} - \tan^{-1}\frac{77}{36} = 0$, **0 < α < 13, then $\sin^{-1}$ (sin α) + $\cos^{-1}$ (cos α) is equal to**

a) $16 - 5\pi$ b) 16

c) π d) 0

67) **Let** $A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 4 & -1 \\ 0 & 12 & -3 \end{pmatrix}$**. Then the sum of the diagonal elements of the matrix (A + I)^{11} is equal to**

a) 6144 b) 4097

c) 4094 d) 2050

68) **Let R be a relation on N × N defined by (a, b) R (c, d) if and only if ad(b – c) = bc(a – d). Then R is**

a) transitive but neither reflexive nor symmetric

b) symmetric but neither reflexive nor transitive

c) reflexive and symmetric but not transitive

d) symmetric and transitive but not reflexive

69) **A wire of length 20 m is to be cut into two pieces. A piece of length l_1 is bent to make a square of area A_1 and the other piece of length l_2 is made into a circle of area A_2. If $2A_1 + 3A_2$, is minimum then $(\pi l_1) : l_2$ is equal to :**

a) 6 : 1 b) 3 : 1

c) 1 : 6 d) 4 : 1

70) Let y = f(x) = $\sin^3\left(\frac{\pi}{3}\left(\cos\left(\frac{\pi}{3\sqrt{2}}\left(-4x^3+5x^2+1\right)^{\frac{3}{2}}\right)\right)\right)$. Then, at x = 1,

a) $y' + 3\pi^2 = 0$ b) $\sqrt{2}y' - 3\pi^2 y = 0$

c) $2y' + \sqrt{3}\pi^2 y = 0$ d) $2y' + 3\pi^2 y = 0$

71) **Let y = f(x) represent a parabola with focus** $\left(-\frac{1}{2}, 0\right)$ **and directrix y =** $-\frac{1}{2}$**.Then**

$$S = \left\{x \in R : \tan^{-1}\left(\sqrt{f(x)}\right) + \sin^{-1}\left(\sqrt{f(x)+1}\right) = \frac{\pi}{2}\right\}$$

a) contains exactly one element
b) is an empty set
c) contains exactly two elements
d) is an infinite set

72) **Let a circle C_1 be obtained on rolling the circle $x^2 + y^2 - 4x - 6y + 11 = 0$ upwards 4 units on the tangent T to it at the point (3, 2). Let C_2 be the image of C_1 in T. Let A and B be the centers of circles C_1 and C_2 respectively, and M and N be respectively the feet of perpendiculars drawn from A and B on the x-axis. Then the area of the trapezium AMNB is :**

a) $3 + 2\sqrt{2}$ b) $2\left(1 + \sqrt{2}\right)$
c) $4\left(1 + \sqrt{2}\right)$ d) $2\left(2 + \sqrt{2}\right)$

73) **If the domain of the function f(x) =** $\frac{[x]}{1+x^2}$**, where [x] is greatest integer** $\leq$ **x, is [2, 6), then its range is**

a) $\left(\frac{5}{26}, \frac{2}{5}\right]$ b) $\left(\frac{5}{37}, \frac{2}{5}\right]$
c) $\left(\frac{5}{26}, \frac{2}{5}\right] - \left\{\frac{9}{29}, \frac{27}{109}, \frac{18}{89}, \frac{9}{53}\right\}$ d) $\left(\frac{5}{37}, \frac{2}{5}\right] - \left\{\frac{9}{29}, \frac{27}{109}, \frac{18}{89}, \frac{9}{53}\right\}$

74) **If the maximum distance of normal to the ellipse** $\frac{x^2}{4} + \frac{y^2}{b^2} = 1$**, b < 2, from the origin is 1, then the eccentricity of the ellipse is :**

a) $\frac{1}{2}$ b) $\frac{\sqrt{3}}{2}$
c) $\frac{\sqrt{3}}{4}$ d) $\frac{1}{\sqrt{2}}$

75) **A bag contains 6 balls. Two balls are drawn from it at random and both are found to be black. The probability that the bag contains at least 5 black balls is**

a) $\frac{5}{6}$ b) $\frac{3}{7}$
c) $\frac{5}{7}$ d) $\frac{2}{7}$

76) **Let** $\alpha \in (0, 1)$ **and** $\beta = \log_e(1 - \alpha)$ **, Let** $P_n(x) = x + \frac{x^2}{2} + \frac{x^3}{3} + \ldots + \frac{x^n}{n}$**, x** $\in (0, 1)$**. Then the integral** $\int_0^{\alpha} \frac{t^{50}}{1-t} dt$ **is equal to**

a) $\beta - P_{50}(\alpha)$ b) $P_{50}(\alpha) - \beta$
c) $\beta + P_{50}(\alpha)$ d) $-(\beta + P_{50}(\alpha))$

77) **Let the shortest distance between the lines** $L : \frac{x-5}{-2} = \frac{y-\lambda}{0} = \frac{z+\lambda}{1}$**,** $\lambda \geq 0$ **and L_1 : x + 1 = y – 1 = 4 – z be** $2\sqrt{6}$**. If** (α, β, γ) **lies on L, then which of the following is NOT possible ?**

a) $\alpha + 2\gamma = 24$ b) $2\alpha - \gamma = 9$
c) $\alpha - 2\gamma = 19$ d) $2\alpha + \gamma = 7$

78) **The value of** $\int_{\frac{\pi}{3}}^{\frac{\pi}{2}} \frac{(2+3\sin x)}{\sin x(1+\cos x)} dx$ **is equal to**

a) $\frac{7}{2} - \sqrt{3} - \log_e \sqrt{3}$ b) $\frac{10}{3} - \sqrt{3} + \log_e \sqrt{3}$
c) $\frac{10}{3} - \sqrt{3} - \log_e \sqrt{3}$ d) $-2 + 3\sqrt{3} + \log_e \sqrt{3}$

79) **The number of real roots of the equation** $\sqrt{x^2 - 4x + 3} + \sqrt{x^2 - 9} = \sqrt{4x^2 - 14x + 6}$**, is**

a) 1 b) 0
c) 2 d) 3

80) **For all z** $\in$ **C on the C_1 : |z| = 4, let the locus of the cuve point** $z + \frac{1}{z}$ **be the curve C_2. Then**

a) the curves C_1 and C_2 intersect at 2 points
b) the curve C_1 lies inside C_2
c) the curve C_2 lies inside C_1
d) the curves C_1 and C_2 intersect at 4 points

81) The remainder on dividing 5^{99} by 11 is

_____

)

82) Let for x ∈ R,

$$f\left(x\right)=\frac{x+|x|}{2}\ and\ g\left(x\right)=\begin{cases}x, & x<0\\ x^2, & x\geq 0\end{cases}$$

Then area bounded by the curve y = (fog) (x) and the lines y = 0, 2y – x = 15 is equal to

_____

)

83) Let the line $L:\frac{x-1}{2}=\frac{y+1}{-1}=\frac{z-3}{1}$ intersect the plane 2x + y + 3z = 16 at the point P. Let the point Q be the foot of perpendicular from the point R(1, – 1, – 3) on the line L. If α is the area of triangle PQR. then α^2 is equal to

_____

)

84) Let 5 digit numbers be constructed using the digits 0, 2, 3, 4, 7, 9 with repetition allowed, and are arranged in ascending order with serial numbers. Then the serial number of the number 42923 is _____

)

85) Let $a_1, a_2, ..., a_n$ be in A.P. If $a_5 = 2a_7$ and $a_{11} = 18$. Then $12\left(\frac{1}{\sqrt{a_{10}}+\sqrt{a_{11}}}+\frac{1}{\sqrt{a_{11}}+\sqrt{a_{12}}}+\ldots+\frac{1}{\sqrt{a_{17}}+\sqrt{a_{18}}}\right)$ is equal to

)

86) Number of 4-digit numbers that are less than or equal to 2800 and either divisible by 3 or by 11, is equal to _____ .

)

87) Let $\overrightarrow{a}\ and\ \overrightarrow{b}$ be two vectors such that $\left|\overrightarrow{a}\right|=\sqrt{14},\left|\overrightarrow{b}\right|=\sqrt{6}\ and\ \left|\overrightarrow{a}\times\overrightarrow{b}\right|=\sqrt{48}$. Then $\left(\overrightarrow{a}.\overrightarrow{b}\right)^2$ is equal to _____

)

88) Let $\alpha > 0$, be the smallest number such that the expansion of $\left(x^{\frac{2}{3}}+\frac{2}{x^3}\right)^{30}$ has a term $\beta x^{-\alpha}$, $\beta \in N$. Then α is equal to_____ .

)

89) Let θ be the angle between the planes $P_1:\overrightarrow{r}.\left(\hat{i}+\hat{j}+2\hat{k}\right)=9$ and $P_2:\overrightarrow{r}.\left(2\hat{i}-\hat{j}+\hat{k}\right)=15$. Let L be the line that meets P_2 at the point (4, – 2, 5) and makes an angle θ with the normal of P_2 . If α is the angle between L and P_2, then $(\tan^2\theta)(\cot^2\alpha)$ is equal to _____ .

)

90) If the variance of the frequency distribution

x_i	2	3	4	5	6	7	8
Frequency f_i	3	6	16	α	9	5	6

is 3, then α is equal to _____.

)