Sec: SR.IIT_*CO-SC(MODEL-A,B&C) **Date:23-01-24**
Time: 3HRS **Max. Marks: 300**

Name of the Student: ____________________ **H.T. NO:**

23-01-24_SR.STAR CO-SUPER CHAINA(MODEL-A,B&C)_JEE-MAIN_GTM-25(N)_SYLLABUS

PHYSICS: **TOTAL SYLLABUS**

CHEMISTRY: **TOTAL SYLLABUS**

MATHEMATICS: **TOTAL SYLLABUS**

SUBJECT	MISTAKES		
	JEE SYLLABUS Q'S	JEE EXTRA SYLLABUS Q'S	TOTAL Q'S
MATHS			
PHYISCS			
CHEMISTRY			

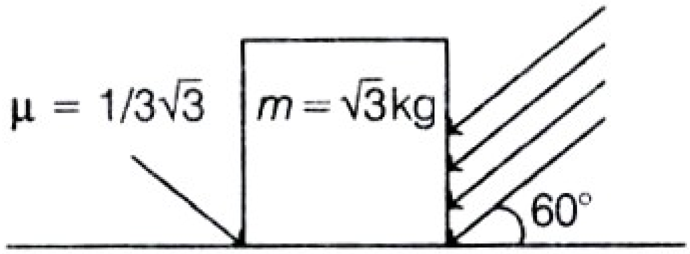
PHYSICS MAX.MARKS: 100

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** option can be correct.

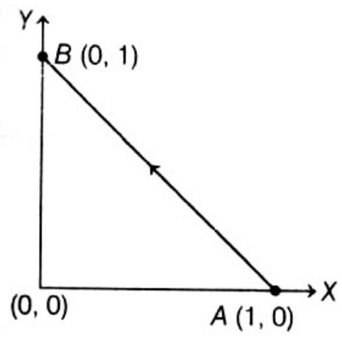
Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

1. As shown in the figure, a block of mass $\sqrt{3}$ kg is kept on a horizontal rough surface of coefficient of friction $1/3\sqrt{3}$. The critical force to be applied on the vertical surface as shown at an angle 60^0 with horizontal such that it does not move, will be 3x. The value of x will be ……… $[g = 10ms^{-2}; \sin 60^0 = \frac{\sqrt{3}}{2}; \cos 60^0 = \frac{1}{2}]$



A) 3.33 B) 4.33 C) 5.33 D) 6.33

2. Consider a force $\vec{F} = -x\hat{i} + y\hat{j}$. The work done by this force in moving a particle from point A(1,0) to B(0,1) along the line segment is (all quantities are in SI units)



A) $\frac{3}{2}$ B) 2 C) 1 D) $\frac{1}{2}$

3. An object of mass m_1 collides elastically with another object of mass m_2, which is at rest. After the collision, the objects move with equal speeds in opposite direction. The ratio of the masses $m_2 : m_1$ is

A) 3 : 1 B) 2 : 1 C) 1 : 2 D) 1 : 1

4. Moment of inertia (MI) of four bodies, having same mass and radius, are reported as

$I_1 = MI$ of thin circular ring about its diameter,

$I_2 = MI$ of circular disk about an axis perpendicular to plane of the disk and going through the centre,

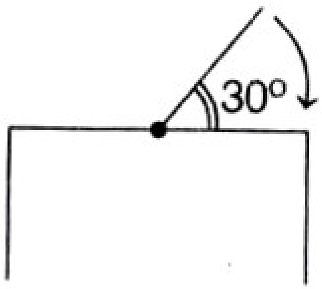
$I_3 = MI$ of solid cylinder about its axis

and $I_4 = MI$ of solid sphere about its diameter. Then,

A) $I_1 + I_2 = I_3 + \frac{5}{2} I_4$ B) $I_1 + I_3 < I_2 + I_4$

C) $I_1 = I_2 = I_3 < I_4$ D) $I_1 = I_2 = I_3 > I_4$

5. One end of a straight uniform 1m long bar is pivoted on horizontal table. It is released from rest when it makes an angle 30^0 from the horizontal (see figure). Its angular speed when its hits the table is given as $\sqrt{n}$ rad/sec, where n is an integer. The value of n is …



A) 15 B) 16 C) 17 D) 18

6. Given below are two statements: one is labeled as Assertion A and the other is labeled as Reason R.

Assertion (A) The escape velocities of planet A and B are same. But A and B are of unequal mass.

Reason (R) The product of their mass and radius must be same, $M_1R_1 = M_2R_2$

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

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

B) A is correct but R is not correct

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

D) A is not correct but R is correct.

7. The length of a metal wire is l_1, when the tension in it is T_1 and is l_2 when the tension is T_2. The natural length of the wire is

A) $\sqrt{l_1 l_2}$ B) $\frac{l_1T_2 - l_2T_1}{T_2 - T_1}$ C) $\frac{l_1T_2 + l_2T_1}{T_2 + T_1}$ D) $\frac{l_1 + l_2}{2}$

8. Two rods A and B of identical dimensions are at temperature 30^0C. If A is heated upto 180^0C and B upto T^0C, then new lengths are the same. If the ratio of the coefficients of linear expansion of A and B is 4 : 3, then the value of T is

A) 230^0C B) 270^0C C) 200^0C D) 250^0C

9. The specific heats, C_p and C_v of a gas of diatomic molecules A, are given (in units of J $mol^{-1}K^{-1}$) by 29 and 22, respectively. Another gas of diatomic molecules B, has the corresponding values 30 and 21. If they are treated as ideal gases, then choose the best possible answer based on given data.

A) A has a vibrational mode but B does not have

B) Both A and B have a vibrational mode each

C) A has one vibrational mode and B has two

D) A is rigid but B has a vibrational mode

10. A mass M, attached to a horizontal spring, executes SHM with amplitude A_1. When the mass M passes through its mean position, then a smaller mass m is placed over it and both of them move together with amplitude A_2. The ratio of $\left(\frac{A_1}{A_2}\right)$ is

A) $\frac{M+m}{M}$ B) $\left(\frac{M}{M+m}\right)^{1/2}$ C) $\left(\frac{M+m}{M}\right)^{1/2}$ D) $\frac{M+m}{M}$

11. Three harmonic waves having equal frequency v and same intensity l_0, have phase angles $0, \frac{\pi}{4}$ and $-\frac{\pi}{4}$, respectively. When they are superimposed, the intensity of the resultant wave is called to (take $\sqrt{2} = 1.4$).

A) $0.2l_0$ B) l_0 C) $3l_0$ D) $5.8l_0$

12. Two charges each equal to q, are kept at x = -a and x = a on the x-axis. A particle of mass m and charge $q_0 = -q/2$ is placed at the origin. If charge q_0 is given, a small displacement (y<<a) along the y-axis, the net force acting on the particle is proportional to

A) y B) -y C) 1/y D) -1/y

13. Two capacitors of capacitances C and 2C are charged to potential differences V and 2V respectively. These are then connected in parallel in such a manner that the positive terminal of one is connected to the negative terminal of the other. The final energy of this configuration is

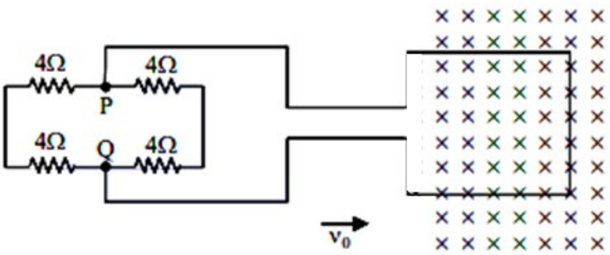
A) $\frac{9}{2}CV^2$ B) $\frac{3}{2}CV^2$ C) $\frac{25}{6}CV^2$ D) zero

14. A coil having N turns is wound tightly in the form of a spiral with inner and outer radii a and b, respectively. Find the magnetic field at centre, when a current I passes through coil

A) $\frac{\mu_0 IN}{2(b-a)}\ln\left(\frac{b}{a}\right)$ B) $\frac{\mu_0 I}{8}\ln\left[\frac{a+b}{a-b}\right]$

C) $\frac{\mu_0 I}{4(a-b)}\ln\left[\frac{1}{a}-\frac{1}{b}\right]$ D) $\frac{\mu_0 I}{8}\ln\left(\frac{a-b}{a+b}\right)$

15. A square loop of side 20 cm and resistance 1Ω is moved towards right with a constant speed v_0. The right arm of the loop is in a uniform magnetic field of 5T. The field is perpendicular to the plane of the loop and is going into it. The loop is connected to a network of resistors each of value 4Ω. What should be the value of v_0, so that a steady current of 2 mA flows in the loop?



A) 1 m/s B) 1 cm/s C) $10^2 m/s$ D) $10^{-2} cm/s$

16. In a plane electromagnetic wave, the directions of electric field and magnetic field are represented by $\hat{K}$ and $2\hat{i}-2\hat{j}$, respectively. What is the unit vector along direction of propagation of the wave?

A) $\frac{1}{\sqrt{2}}(\hat{i}+\hat{j})$ B) $\frac{1}{\sqrt{2}}(\hat{j}+\hat{k})$ C) $\frac{1}{\sqrt{5}}(\hat{i}+2\hat{j})$ D) $\frac{1}{\sqrt{5}}(2\hat{i}+\hat{j})$

17. A plano – convex lens of refractive index μ_1 and focal length f_1 is kept in contact with another plano-concave lens of refractive index μ_2 and focal length f_2. If the radius of curvature of their spherical faces is R each and $f_1 = 2f_2$, then μ_1 *and* μ_2 are related as

A) $3\mu_2 - 2\mu_1 = 1$ B) $2\mu_2 - \mu_1 = 1$ C) $2\mu_1 - \mu_2 = 1$ D) $\mu_1 + \mu_2 = 3$

18. In a hydrogen atom, electron makes a transition from (n+1)th level to the nth level. If n>>1, the frequency of radiation emitted is proportional to

A) $\frac{1}{n}$ B) $\frac{1}{n^3}$ C) $\frac{1}{n^2}$ D) $\frac{1}{n^4}$

19. Consider an electron in a hydrogen atom, revolving in its second excited state (having radius 4.65 $\overset{o}{A}$). The de-Broglie wavelength of this electron is (approximately)

A) $3.5\overset{o}{A}$ B) $6.6\overset{o}{A}$ C) $12.9\overset{o}{A}$ D) $9.7\overset{o}{A}$

20. The binding energy per nucleon of ${}_1H^2$ and ${}_2He^4$ 1.1MeV and 7 MeV respectively. The energy released in the process ${}_1H^2 + {}_1H^2 \rightarrow {}_2He^4$ is

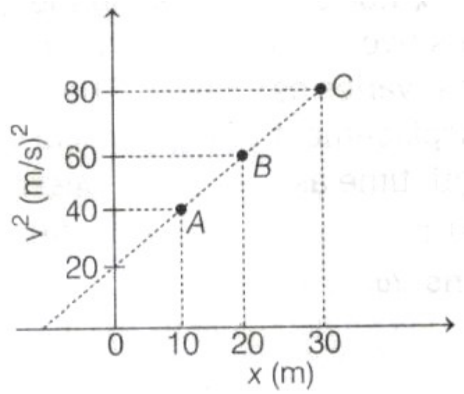
A) 20.8 MeV B) 16.6 MeV C) 25.2 MeV D) 23.6 MeV

SECTION-II
(NUMERICAL VALUE ANSWER TYPE)

This section contains 10 questions. The answer to each question is a Numerical value. If the Answer in the decimals , **Mark nearest Integer only. Have to Answer any 5 only out of 10 questions** and question will be evaluated according to the following marking scheme:
Marking scheme: +4 for correct answer, -1 in all other cases.

21. The diameter of a spherical bob is measured using a Vernier calipers. 9 divisions of the main scale, in the vernier calipers, are equal to 10 divisions of vernier scale. One main scale division is 1 mm. The main scale reading is 10 mm and 8th division of vernier scale was found to coincide exactly with one of the main scale division. If the given vernier calipers has positive zero error of 0.04 cm, then the radius of the bob is ……. $\times 10^{-2}$ cm.

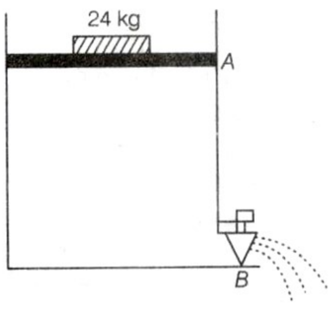
22. A particle is moving with constant acceleration a. Following graph shows v^2 versus x (displacement) plot. The acceleration of the particle is ….. m/s^2



23. The position of the centre of mass of a uniform semi-circular wire of radius R placed in XY-plane with its centre at the origin and the line joining its ends as X-axis is given by $\left(0, \frac{xR}{\pi}\right)$. Then, the value of |x| is ……

24. Consider a water tank as shown in the figure. It's cross-sectional area is $0.4 m^2$. The tank has an opening B near the bottom whose cross-section area is 1 cm^2. A load of 24 kg is applied on the water at the top when the height of the water level is 40 cm above the bottom, the velocity of water coming out the opening B is $v\ ms^{-1}$. The value of v, to the nearest integer, is ……..

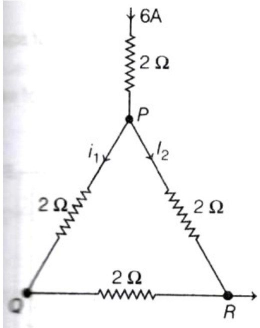
(Take value of g to be 10 ms^{-2})



25. 1 mole of rigid diatomic gas at low temperature performs a work of Q/5 when heat Q is supplied to it. The molar heat capacity of the gas during this transformation is $\frac{xR}{8}$, The value of x is …..

[R = universal gas constant]

26. A current of 6A enters one corner P of an equilateral triangle PQR having three wires of resistance 2Ω each and leaves by the corner R. The currents i_1 in ampere is ______

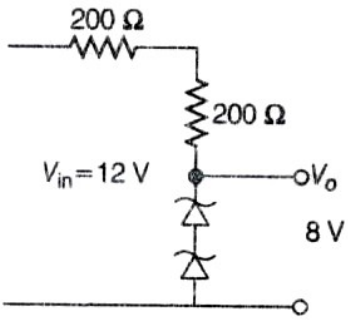


27. In an L-C series circuit, an inductor of inductance 30 mH and a resistor 1Ω are connected to an AC source of angular frequency 300 rad/s. The value of capacitance for which, the current leads the voltage by 45^0 is $\frac{1}{x}\times10^{-3}F$. Then, the value of x is _____

28. A Young's double slit experiment is performed using monochromatic light of wavelength λ. The intensity of light at a point on the screen, where the path difference is λ, is K units. The intensity of light at a point where the path difference is $\frac{\lambda}{6}$ is given by $\frac{nK}{12}$, where n is an integer. The value of n is …….

29. The surface of a metal is illuminated alternately with photons of energies $E_1 = 4eV$ and $E_2 = 2.5eV$ respectively. The ratio of maximum speeds of the photoelectrons emitted in the two cases is 2. The work function of the metal (in eV) is …….

30. The circuit shown below is working as a 8 V DC regulated voltage source. When 12 V is used as input, the power dissipated (in mW) in each diode is; (considering both Zener diodes are identical) …….



CHEMISTRY MAX.MARKS: 100

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

31. Some statements are given. Among them the correct statements are

I) IP_2 of sodium is greater than IP_2 of Magnesium

II) IP_2 of lithium greater than IP_1 of Helium

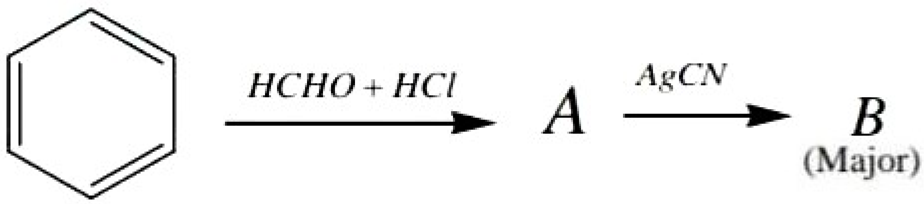
III) IP_2 sodium greater than IP_1 of Neon

IV) IP_1 of oxygen is greater than IP_1 of Nitrogen

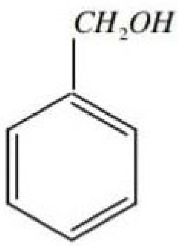
A) I,IV are correct B) II, III, IV are correct

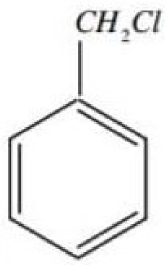
C) I, II and III are correct D) I,II,IV are correct

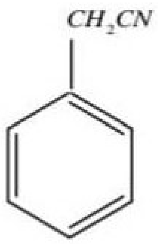
32. The compounds A & B in the following reaction are

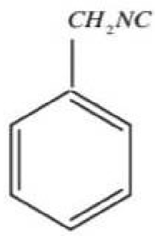


The major product B is

A) 

B) 

C) 

D) 

33. The value of ΔH in KJ/mole for the reaction $\frac{1}{2}X_2(s) + e^- \longrightarrow X^-(aq); \Delta H = ?$

If 'X' is F, Cl, Br, I respectively.

A) $-597.5, -766.5, -537.5, -537.5$ B) $-766.5, -597.5, -537.5, -437$

C) $-766.5, -597.5, -437, -537.5$ D) $-437, -537.5, -597.5, -766.5$

34. Oxidation state of Fe in $Fe_{0.94}O_1$ is

A) + 200 B) $+\frac{200}{94}$ C) $+\frac{94}{200}$ D) + 2

35. The value of ΔH^0 for the reaction $2A_{(g)} + B_{(g)} \rightleftarrows A_2B_{(g)}$ for which $Kp = 1.0\times10^{-10} atm^{-2}$ and $\Delta S^0 = 5JK^{-1}$ and $T = 300K$ is

A) $53.93kJ$ B) $58.94kJ$ C) $56.24kJ$ D) $68.24kJ$

36. Benzene and naphthalene form an ideal solution at room temperature. For this process, the wrong statement is

A) $\Delta H_{system} = 0$ B) ΔS_{system} is positive C) $\Delta S_{surroundings} = 0$ D) ΔG is positive

37. A: Permanganate titrations are not preferred in presence of hydrochloric acid

R: Chlorine is formed as a consequence of oxidation of hydrochloric acid

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

B) Both A and R are true but R is not the correct explanation of A

C) A is true but R is falseA is false but R is true

38. Which of the following is **incorrect** combination of group of cations and group reagent.

Cations precipitated	**Group reagent**
A) Cu^{2+}, Cd^{2+}	$H_2S + dil.HCl$
B) Pb^{2+}, Ag^{+}	Dil. HCl
C) $Fe^{3+}, Cr^{3+}, Al^{3+}$	$NH_4Cl + NH_4OH + (NH_4)_2CO_3$
D) $Ni^{2+}, Mn^{2+}, Zn^{2+}$	H_2S in the presence of $NH_4OH + NH_4Cl$

39. **Column – I** **Column – II**

(A) Glycosidic linkage (p) Globural protein

(B) Maltase (q) Connects two monosaccharide units

(C) Peptide bond (r) Monomeric unit of nucleic acids

(D) Nucleotide (s) Connects two amino acid units

A) A – s, B – r, C – q, D – p B) A – r, B – s, C – p, D – q

C) A – q, B – p, C – s, D – r D) A – p, B – q, C – r, D – s

40. For a reaction $A + B \rightarrow$ Product, it is observed that :

i) on doubling the initial concentration of A only, the rate of reaction is also doubled and

ii) on doubling the initial concentrations of both A and B, there is a change by a factor of 8 in the rate of the reaction.

The rate of this reaction is given by :

A) rate $=k[A][B]$ B) rate $=k[A]^2[B]$

C) rate $=k[A][B]^2$ D) rate $=k[A]^2[B]^2$

41. Which of the following on electrolysis liberate oxygen at anode and hydrogen at cathode

A) Aqueous K_2SO_4 B) Aqueous KCl

C) Aqueous $CuSO_4$ D) Molten NaCl

42. Choose the correct code

Column – I		Column – II	
(P)	pK_b of $X^-(K_a\ of\ HX=10^{-6})$	(1)	6.9
(Q)	pH of $10^{-8}M\ HCl$	(2)	8
(R)	pH of 10^{-2}M acetic solution (Take Ka of acetic acid $=1.6\times10^{-5}$)	(3)	4.3
(S)	pH of a solution obtained by mixing equal volumes of solution with pH 4 and 5.	(4)	3.4

	P	Q	R	S
A)	1	2	4	3
B)	4	3	2	1
C)	2	1	4	3
D)	1	2	3	4

43. Which set of quantum numbers is not possible?

A) $n=2,l=1,m=0,s=-\frac{1}{2}$ B) $n=4,l=3,m=-2,s=-\frac{1}{2}$

C) $n=4,l=3,m=-3,s=\frac{1}{2}$ D) $n=3,l=2,m=-3,s=\frac{1}{2}$

44. Which among the following statements are correct

I) order of 'O – O' bond length is $O_2[AsF_6]<O_2<KO_2$

II) Though ethyl alcohol and dimethyl ether have same molecular weights, dimethyl ether is more volatile then ethyl alcohol.

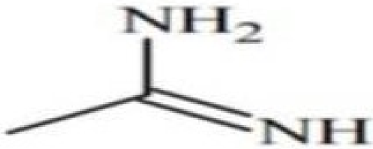
III) The order of bond order is : $N_2>N_2{}^+>N_2{}^{2-}$

IV) Ice has more density than water

A) I, II, IV B) I, II, III C) I, III, IV A) I, II, III, IV

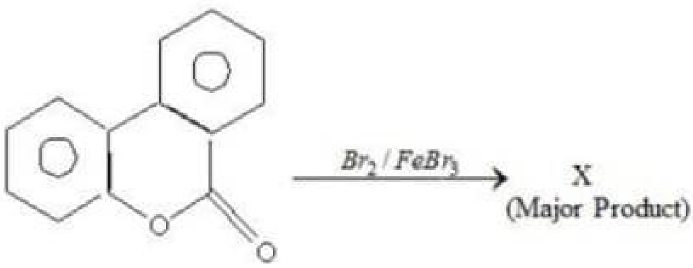
45. The increasing order of basicity of the following compounds is

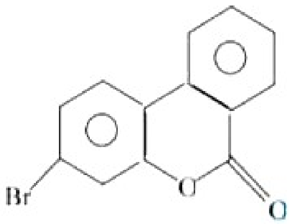
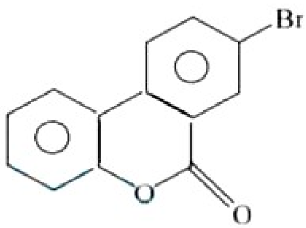
1) 
2) 

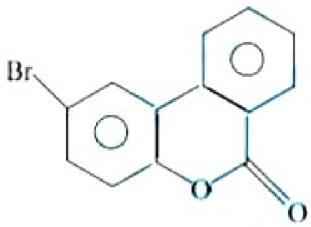
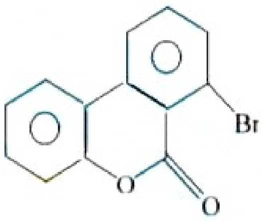
3) 
4) 

A) (4) < (2) < (1) < (3)
B) (1) < (2) < (3) < (4)
C) (2) < (1) < (3) < (4)
D) (2) < (1) < (4) < (3)

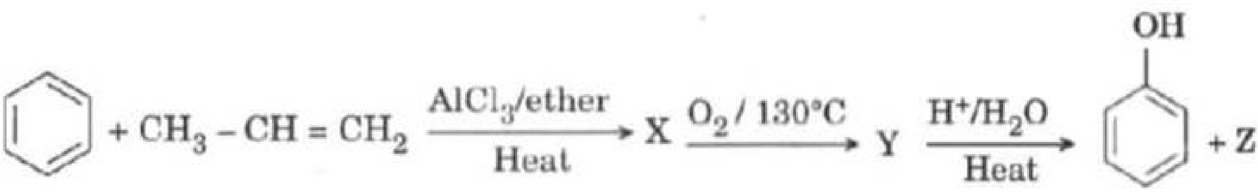
46.



A) 
B) 

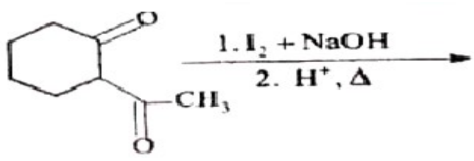
C) 
D) 

47. The products X and Z in the following reaction sequences are

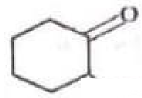


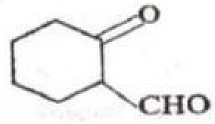
A) Isopropyl benzene and acetone
B) Cumene peroxide and acetone
C) Isopropyl benzene and isopropyl alcohol
D) Phenol and acetone

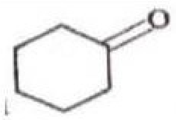
48. End product of the following sequence of reaction is



A) Yellow ppt. of CHI_3



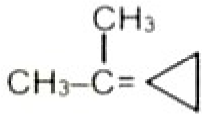
B) Yellow ppt. of CHI_3 and 

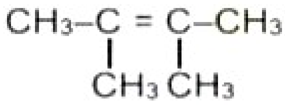
C) Yellow ppt. of CHI_3 and 

D) Yellow ppt. of CHI_3 and 

49. An unsaturated hydrocarbon X on ozonolysis gives A. Compound A when warmed with ammonical silver nitrate forms a bright silver mirror along the sides of the test tube. The unsaturated hydrocarbon X is :

A) $CH_3-C\equiv C-CH_3$

B) 

C) 

D) $HC\equiv C-CH_2-CH_3$

50. Ammonolysis of Alkyl halides followed by the treatment with NaOH solution can be used to prepare primary, secondary and tertiary amines. The purpose of NaOH in the reaction is :

A) to remove acidic impurities

B) to remove basic impurities

C) to increase the reactivity of alkyl halide

D) to activate NH_3 in the reaction

SECTION-II
(NUMERICAL VALUE ANSWER TYPE)

This section contains 10 questions. The answer to each question is a Numerical value. If the Answer in the decimals , **Mark nearest Integer only. Have to Answer any 5 only out of 10 questions** and question will be evaluated according to the following marking scheme:

Marking scheme: +4 for correct answer, -1 in all other cases.

51. A certain mass of a substance when dissolved in 100 g C_6H_6 lowers the freezing point by 1.28^0C. The same mass of solute dissolved in 100 g of water lowers the freezing point by 1.40^0C. The substance has normal molecular mass in benzene and is completely dissociated in water. The number of ions furnished by one molecule of the solute is ?

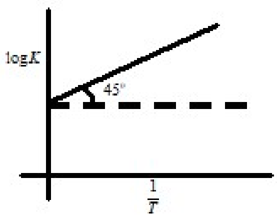
(K_f for H_2O and C_6H_6 are 1.86 and 5.12 K $mol^{-1}kg$ respectively).

52. The limiting molar conductivities at 25^0C of $HCl, NaCl$ and NaA are $426\Omega^{-1}cm^2mole^{-1}$; $126\Omega^{-1}cm^2mole^{-1}$ and $83\Omega^{-1}cm^2mole^{-1}$ respectively. The conductivity of $0.001M$ acid (HA) solution is $3.83\times10^{-5}\Omega^{-1}cm^{-1}$. The pH of the acid solution is ----

[consider, $(1-\alpha)\approx1$]

53. A mixture of $CaCl_2$ and $NaCl$ weighing 4.44 g is treated with sodium carbonate solution to precipitate all the Ca^{2+} ions as calcium carbonate. The calcium carbonate so obtained is heated strongly to get 0.56 g of CaO. The percentage of $NaCl$ in the mixture is (atomic mass Ca = 40)

54. Variation of $\log K_{eq}$ with $\frac{1}{T}$ is shown by the following graph.



The standard enthalpy of the reaction (ΔH^0) (in Calories) is $(-y\times10^{-1})$. The value of 'y' is **(Given** $\ln10 = 2.3\log10;\ R = 2cal.mol^{-1}K^{-1}$)

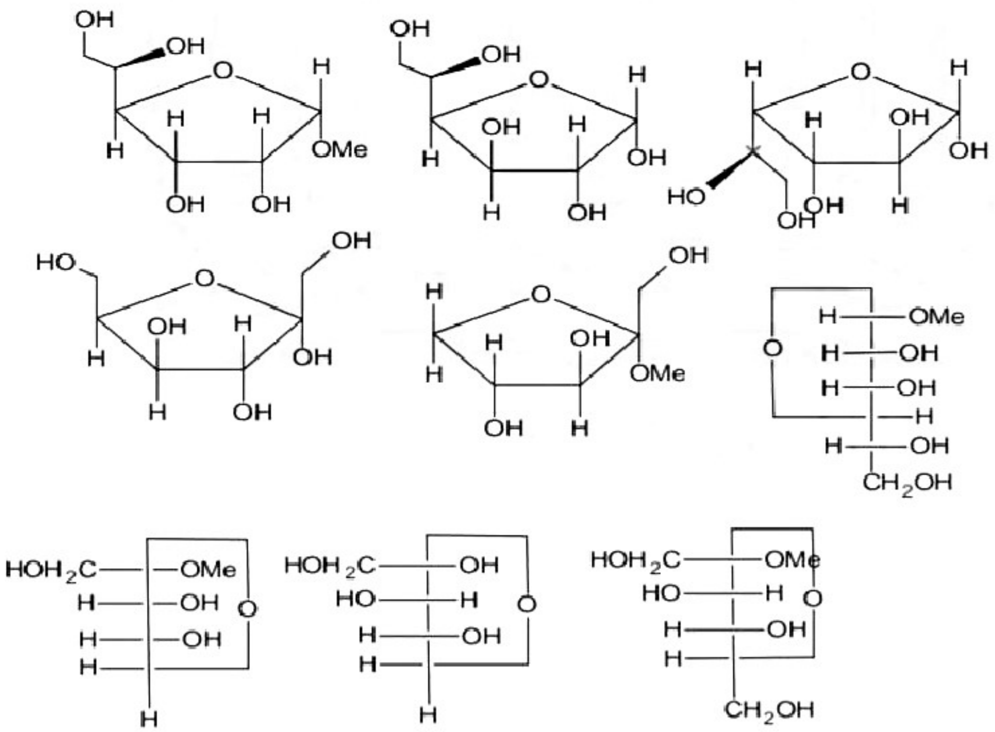
55. Efficiency of the following cell is 84%.
$A(s)+B^{2+}(aq)\rightleftharpoons A^{2+}(aq)+B(s);\Delta H=-285KJ$. The standard electrode potential of the cell is $(y\times10^{-2})V$. The value of 'y' is ______

56. 200 mL of 0.2M HCl is mixed with 300 mL of 0.1M NaOH. The molar heat of neutralization of this reaction is – 57.1 kJ. The increase in temperature in ^{0}C of the system on mixing is $(x\times10^{-2})$. The value of 'x' is _____. (Nearest integer)

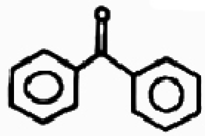
[Given : Specific heat of water = 4.18 J g^{-1} K^{-1} ; Density of water = 1.00 g cm^{-3}]

(Assume no volume change on mixing)

57. The number of reducing sugars among the following is:



58. How many of the following cannot form stable hydrates

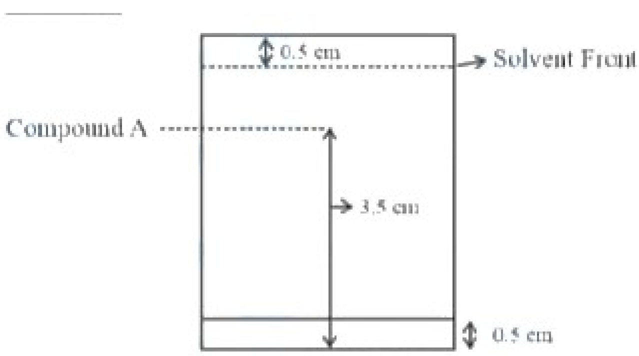
$CH_3-CH_3-\overset{O}{\overset{||}{C}}-CH_3, H-\overset{O}{\overset{||}{C}}-H, CCl_3-\overset{O}{\overset{||}{C}}-H$, 

$CH_3-\overset{O}{\overset{||}{C}}-CH_2-CH_2-CH_3, CH_3-\overset{O}{\overset{||}{C}}-H, CH_3CH_2CHO$

59. Total number of enol possible for the compound formed during given reaction will be (including stereoisomer)

$\left(CH_3\right)_2 Cd + CH_3CH_2COCl \rightarrow$ _________

60. Following chromatography was developed by adsorption of compound 'A' on a 6 cm TLC glass plate. Retardation factor of the compound 'A' is _____ x10^{-1}.



MATHEMATICS MAX.MARKS: 100

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

61. If $A(z_1), B(z_2), C(z_3)$ are vertices of a triangle such that $z_3 = \left(\dfrac{z_2 - iz_1}{1-i}\right)$ and $|z_1| = 3, |z_2| = 4$ and $|z_2 + iz_1| = |z_1| + |z_2|$ then area of triangle ABC is

A) $\frac{5}{2}$ B) 0 C) $\frac{25}{2}$ D) $\frac{25}{4}$

62. If maximum and minimum values of the determinant $\begin{vmatrix} 1+Sin^2x & Cos^2x & Sin2x \\ Sin^2x & 1+Cos^2x & Sin2x \\ Sin^2x & Cos^2x & 1+Sin2x \end{vmatrix}$ are α *and* β respectively, then which of the statements are FALSE?

A) $\alpha + \beta^{99} = 4$

B) $\alpha^3 - \beta^{17} = 26$

C) $\alpha^{2n} - \beta^{2n}$ is always an even integer for $n \in N$

D) A triangle can be constructed having it's sides as α, β and $\alpha - \beta$

63. The least integral value of 'a' such that $(a-3)x^2 + 12x + (a+6) > 0\ \forall x \in R$ is

A) 7 B) 3 C) 5 D) 4

64. There are 12 pairs of shoes in a box, then the possible number of ways of picking 7 shoes in a box, so that there are exactly two pairs of shoes are

A) 63360 B) 63300 C) 63260 D) 63060

65. A $2n$ digit number starts with 2 and all its digits are prime, then the probability that the sum of any two consecutive digits of the number is prime is

A) 2×2^{-3n} B) 4×2^{-3n} C) 2^{-3n} D) 2^{-4n}

66. There are three coins. One is two headed coin (having head on both faces), another is biased coin that comes up heads 75% of the time and third is an unbiased coin, one of the three coins is chosen at random and tossed. If it shows heads, then the probability that it was two headed coin is ______

A) $\frac{1}{3}$ B) $\frac{4}{9}$ C) $\frac{2}{9}$ D) $\frac{4}{7}$

67. Two cards are drawn successively with replacement from a well-shuffled deck of 52 cards. The standard deviation of getting aces is

A) $\frac{2\sqrt{6}}{15}$ B) $\frac{2\sqrt{6}}{13}$ C) $\frac{2\sqrt{5}}{13}$ D) $\frac{2\sqrt{5}}{14}$

68. Observe the following columns

Column – I	**Column – II**
A) Number of distinct terms in the expansion of $(x+y-z)^{16}$	P) 2^{12}
B) Number of terms in the expansion of $\left(x+\sqrt{x^2-1}\right)^6+\left(x-\sqrt{x^2-1}\right)^6$	Q) 97
C) The number of irrational terms in $\left(\sqrt[8]{5}+\sqrt[6]{2}\right)^{100}$	R) 4
D) The sum of numerical coefficients in the expansion of $\left(1+\frac{x}{3}+\frac{2y}{3}\right)^{12}$	S) 153

A) $A\to P, B\to Q, C\to R, D\to S$ B) $A\to S, B\to R, C\to Q, D\to P$

C) $A\to R, B\to S, C\to P, D\to Q$ D) $A\to Q, B\to P, C\to S, D\to R$

69. A circle of radius 4 units touches the coordinate axes in the first quadrant. The equation of its image with respect to the line mirror $y=0$ is

A) $x^2+y^2-8x+8y+16=0$ B) $x^2+y^2-8x-8y+16=0$

C) $x^2+y^2-4x-4y+4=0$ D) $x^2+y^2+4x-4y+4=0$

70. If $\int \frac{\sin x}{\sin 4x}dx = A\ln\left|\frac{1-\sin x}{1+\sin x}\right| + B\ln\left|\frac{1-\sqrt{2}\sin x}{1+\sqrt{2}\sin x}\right| + c$ (where c is the integral constant).

Then $\sqrt{2}A+B=$

A) $-\frac{1}{8}$ B) $\frac{1}{8}$ C) $\frac{1}{4\sqrt{2}}$ D) 0

71. If $[x]$ denotes the greatest integer less than or equal to x then the value of

$$\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} [[x]-\sin x]dx =$$

A) 1 B) π C) 0 D) $-\pi$

72. Let $f(x)=\max\left\{x^2,(1-x)^2,2x(1-x)\right\}$. The area bounded by the curve $y=f(x)$ the x-axis and $x=0,\ x=1$ is

A) $\frac{17}{27}$ B) $\frac{19}{27}$ C) $\frac{14}{27}$ D) $\frac{11}{27}$

73. Which of the following is true for $y(x)$ that satisfies the differential equation $\frac{dy}{dx}=xy-1+x-y,\ y(0)=0$ *then*

A) $y(1)=e^{\frac{1}{2}}-e^{\frac{-1}{2}}$ B) $y(1)=e^{\frac{1}{2}}-1$

C) $y(1)=1$ D) $y(1)=e^{\frac{-1}{2}}-1$

74. If $S_n=1+\frac{1}{2}(1+2)+\frac{1}{3}(1+2+3)+\frac{1}{4}(1+2+3+4)+....n$ terms then $\frac{S_{20}-15}{20}=$

A) 115 B) 5 C) 6 D) 7

75. The average marks of 10 students in a class was 60 with a standard deviation 4, while the average marks of other ten students with 40 with a standard deviation 6. If all the 20 students are taken together, their standard deviation will be

A) 5 B) $\sqrt{96}$ C) $\sqrt{106}$ D) $\sqrt{126}$

76. The value of $\tan 78^0 \tan 42^0 - \tan 12^0 \tan 48^0 =$

A) $2\sqrt{3}$ B) $\sqrt{3}$ C) 4 D) 2

77. Set A has m elements and set B has n elements. If the total number of subsets of A is 112 more than the number of subsets of B then the value of mn is

A) 21 B) 28 C) 18 D) 24

78. Considering the principal values of the inverse trigonometric functions, the sum of all the solutions of the equation $\cos^{-1}x-2\sin^{-1}x=\cos^{-1}2x$ is equal to

A) 0 B) 1 C) $\frac{1}{2}$ D) $-\frac{1}{2}$

79. Assertion (A): The length of the chord of the parabola $y^2 = x$ which is bisected at (2, 1) is $2\sqrt{5}$.

Reason (R): Length of the chord joining the points t_1, t_2 on the parabola $y^2 = 4ax$ is $|a(t_1 - t_2)|\sqrt{(t_1 + t_2)^2 + 4}$.

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

B) Both (A) and (R) are true and (R) is not the correct explanation of (A)

C) (A) is true but (R) is false

D) (A) is false but (R) is true

80. Assertion (A): The co-ordinate of the point which divided the line segment joining the points (2,3,1) and (5,1,2) internally in the ratio 3:2 are $\left(\frac{17}{5}, \frac{9}{5}, \frac{8}{5}\right)$.

Reason (R): Co-ordinate of the point $R(x, y, z)$ which divides the line segment PQ joining the points $P(x_1, y_1, z_1)$ and $Q(x_2, y_2, z_2)$ externally in the ratio m:n are given by $x = \frac{mx_2 - nx_1}{m - n}, y = \frac{my_2 - ny_1}{m - n}, z = \frac{mz_2 - nz_1}{m - n}$.

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

B) Both (A) and (R) are true and (R) is not the correct explanation of (A)

C) (A) is true but (R) is false

D) (A) is false but (R) is true

SECTION-II
(NUMERICAL VALUE ANSWER TYPE)

This section contains 10 questions. The answer to each question is a Numerical value. If the Answer in the decimals , **Mark nearest Integer only. Have to Answer any 5 only out of 10 questions** and question will be evaluated according to the following marking scheme:
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81. If the exhaustive set of all possible values of c such that

$f(x) = e^{2x} - (c+1)e^x + 2x + \cos 2 + \sin 1$, is monotonically increasing for all $x \in R$, is

$(-\infty, \lambda]$, then the value of λ is,

82. For $p > 0$, a vector $\overline{v_2} = 2\bar{i} + (p+1)\bar{j}$ is obtained by rotating the vector $\overline{v_1} = \sqrt{3}p\bar{i} + \bar{j}$ by an angle θ about origin in counter clockwise direction. If $Tan\theta = \frac{\alpha\sqrt{3} - 2}{4\sqrt{3} + 3}$ then α is

83. The value of $|k|\ (k \in R)$, for which the following system of linear equations

$3x - y + 4z = 3,\ x + 2y - 3z = -2,\ 6x + 5y + kz = -3$ has infinitely many solutions, is

84. Let $F(x)$ be a cubic polynomial defined by $F(x) = \frac{x^3}{3} + (a-3)x^2 + x - 13$ Then the sum of all possible integral value(s) of 'a' lying in the interval [1,100] for which $F(x)$ has negative point of local minima is k. then $\frac{k}{10} =$

85. Consider a triangle having vertices A(-2,3),B(1,9) and C(3,8). If a line passing through the circumcentre of triangle ABC, bisects line BC, and intersects y-axis at a point $\left(0, \frac{\alpha}{2}\right)$ then real value of α is.

86. The area of the region bounded by $x = -1,\ x = 2,\ y = x^2 + 1$ and $y = 2x - 2$ is

87. For every positive real number x, let $g(x) = \lim_{r \to 0}\left((x+1)^{r+1} - x^{r+1}\right)^{\frac{1}{r}}$

Then the value of $\left[\lim_{x \to \infty} \frac{g(x)}{x}\right]$ is_______ ([x] represents greatest integer less than or equal to x)

88. Number of points of discontinuity of $f(x) = \left\{\frac{x}{5}\right\} + \left[\frac{x}{2}\right]$ in $x \in [0,100]$ is/are (where [.] denotes greatest integer function and {.} denotes fractional part function)

89. Let f be the real valued differentiable function on R such that

$e^{-x} f(x) = \frac{3}{e^2} + 4e^{-x} \int_2^x \sqrt{2t^2 + 6t + 5}\, dt\ \forall x \in R$ and let $g(x) = f^{-1}(x)$ then $\left[\left|g''(3)\right|\right]$ is equal to ________ (where [.] denote the greatest integer function and $f^{-1}(x)$ is the inverse function of $f(x)$).

90. Let a function f defined from $R \to R$ as $f(x) = \begin{cases} x + p^2, & for\ x \le 2 \\ px + 5, & for\ x > 2 \end{cases}$. If the function is surjective, then find the sum of all possible integral values of $'p'$ in $[-100, 100]$.