MELUHA INTERNATIONAL SCHOOL
HYDERABAD

SR MPC | **MAINS MODEL – GT 1** | **Date: 01-07-2020**
Time: 3 Hours | **Max Marks : 300**

JEE MAIN MODEL
MATHEMATICS

Section	Question type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 01 – 20)	Questions with Single Answer Type	4	-1	20	80
Sec – II(Q.N : 21 – 25)	Questions with Numerical Answer Type (+/ - Decimal Numbers)	4	0	5	20
Total				25	100

PHYSICS

Section	Question type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 26 – 45)	Questions with Single Answer Type	4	-1	20	80
Sec – II(Q.N : 46 – 50)	Questions with Numerical Answer Type (+/ - Decimal Numbers)	4	0	5	20
Total				25	100

CHEMISTRY

Section	Question type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 51 – 70)	Questions with Single Answer Type	4	-1	20	80
Sec – II(Q.N : 71 – 75)	Questions with Numerical Answer Type (+/ - Decimal Numbers)	4	0	5	20
Total				25	100

MATHS
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.

01. If $y(\alpha)=\sqrt{1+2\tan\alpha(\tan\alpha+\sec\alpha)}$, $\alpha\in\left(0,\frac{\pi}{2}\right)$ then $\frac{dy}{d\alpha}$ at $\alpha=\frac{\pi}{6}$ is

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

02. Which of the following is a tautology?

A) $(p\to q)\wedge(p)\to q$ B) $(p\to q)\vee(p)\to q$

C) $(p\to q)\wedge(\sim p)\to q$ D) $(p\to q)\wedge(\sim q)\to p$

03. The values of "a"to which one root of the equation $x^2-(a+1)x+a^2+a-8=0$ exceeds 2 and other is less than 2, are given by

A) $3<a<10$ B) $a>10$ C) $-2<a<3$ D) $a\le 2$

04. Let $f(x)=-1+|x-2|$ and $g(x)=1-|x|$ then the set of all points. where $fog(x)$ is discontinuous is

A) $\{0,2\}$ B) $\{0,1,2\}$ C) $\{0\}$ D) empty set

05. A tangent to the hyperbola $\frac{x^2}{4}-\frac{y^2}{2}=1$ meet x-axis at P and y –axis at Q, lines PR are QR are drawn such that OPRQ is a rectangle where O is origin then R lies on

A) $\frac{4}{x^2}+\frac{2}{y^2}=1$ B) $\frac{2}{x^2}-\frac{4}{y^2}=1$ C) $\frac{2}{x^2}+\frac{4}{y^2}=1$ D) $\frac{4}{x^2}-\frac{2}{y^2}=1$

06. The equation of the curve where it passing through origin and satisfying the differential equation $(1+x^2)\frac{dy}{dx}+2xy=4x^2$ is

A) $(1+x^2)y=x^3$ B) $3(1+x^2)y=2x^3$ C) $(1+x^2)y=3x^3$ D) $3(1+x^2)y=4x^3$

07. If P_1 and P_2 are two points on the ellipse $\frac{x^2}{4}+y^2=1$ at which the tangents are parallel to the chord joining the points $(0,1)$ and $(2,0)$ then the distance between P_1 and P_2 is

A) $\sqrt{10}$ B) $\sqrt{5}$ C) $2\sqrt{2}$ D) $2\sqrt{3}$

08. $\underset{x\to\infty}{Lt}\left(\frac{x^2+5x+3}{x^2+x+3}\right)^x=$

A) e^3 B) e^4 C) e^2 D) e

09. If $\frac{d}{dx}(G(x))=\frac{e^{\tan x}}{x}, x\in\left(0,\frac{\pi}{2}\right)$ then $\int_{\frac{1}{4}}^{\frac{1}{2}}\frac{2}{x}e^{\tan\pi x^2}\,dx$ is equal to

A) $G\left(\frac{\pi}{4}\right)-G\left(\frac{\pi}{16}\right)$ B) $2\left[G\left(\frac{\pi}{4}\right)-G\left(\frac{\pi}{16}\right)\right]$

C) $\pi\left[G\left(\frac{1}{2}\right)-G\left(\frac{1}{4}\right)\right]$ D) $G\left(\frac{1}{\sqrt{2}}\right)-G\left(\frac{1}{2}\right)$

10. $\int\frac{2x^{12}+5x^9}{\left(x^5+x^3+1\right)^3}dx=$

A) $\frac{-x^5}{\left(x^5+x^3+1\right)^2}+C$ B) $\frac{x^{10}}{2\left(x^5+x^3+1\right)^2}+C$

C) $\frac{x^5}{2\left(x^5+x^3+1\right)^2}+C$ D) $\frac{-x^{10}}{2\left(x^5+x^3+1\right)^2}+C$

11. If $\tan\left(\cos^{-1}x\right)=\sin\left(\cot^{-1}\frac{1}{2}\right)$, then x is equal to

A) $\pm\frac{5}{3}$ B) $\pm\frac{\sqrt{5}}{3}$ C) $\pm\frac{5}{\sqrt{3}}$ D) $\pm\frac{3}{\sqrt{5}}$

12. A seven digit number is formed by using all the digits 0, 1, 2, 3, 4, 8, 9 without repetition.Then the probability that it is divisible by 4 is

A) $\frac{53}{180}$ B) $\frac{53}{5(6!)}$ C) $\frac{53}{6(6!)}$ D) $\frac{53\times4!}{5\times6!}$

13. The equation of a plane containing the line $\frac{x+1}{-3}=\frac{y-3}{2}=\frac{z+2}{1}$ and (0, 7, -7) is

A) $x+y+z=0$ B) $x+2y+z=21$ C) $3x-2y+5z+35=0$ D) $3x+2y+5z+21=0$

14. Let S be the set of real values of λ for which the function $f(x)=x^3-3(2\lambda-1)x^2+6\lambda x$ has exactly one local maximum and exactly one local minimum, then S can be

A) (0, 6) B) (1, 4) C) $(-\infty,\ 0)$ D) $(0,\ \infty)$

15. A man has seven relative, 4 of them are ladies and 3 gentlemen, his wife also has 7 relative out of which 3 are ladies and 4 gentlemen. The number of ways in which they can invite a dinner party of 3 ladies and 3 gentlemen, so that there are 3 of the man's relative and 3 of the wife's relative, are

A) 144 B) 340 C) 484 D) 485

16. The equation of a straight line passing through (3,2) and cutting an intercept of 2 units between the lines 3x+4y=11 and 3x+4y=1 is

A) $2x+y-8=0$ B) $3y-4x+6=0$ C) $3x+4y-17=0$ D) $2x-y-4=0$

17. If $\vec{a}=\hat{i}-\hat{j}-\hat{k}$ *and* $\vec{b}=\lambda\hat{i}-3\hat{j}+\hat{k}$ and orthogonal projection of $\vec{b}$ on $\vec{a}$ is $\frac{4}{3}\left(\hat{i}-\hat{j}-\hat{k}\right)$ then λ is equal to:

A) 0 B) 2 C) 12 D) -1

18. The length of longest interval in which Rolle's Theorem can be applied for the function $f(x)=|x^2-a^2|,(a>0)$ is

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

19. The value of $\left|3+\frac{9}{z}\right|^2+|3-z|^2$ *if* $|z|=3$ is

A) 18 B) 1 C) 3 D) 36

20. Let $A=\left[a_{ij}\right]$ and $B=\left[b_{ij}\right]$ be two 3 x 3 real matrices such that $b_{ij}=(4)^{(i+j)-2}a_{ji}$, where i, j = 1, 2, 3. If the determinant of B is 256, then the determinant of A is

A) 4 B) 1/4 C) 1/256 D) 1/16

SECTION-II
(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical value. If the numerical value has more than two decimal places, **round-off the value** of Two decimal places. Answer to each question will be evaluated according to the following marking scheme:
Marking scheme: +4 for correct answer, 0 in all other cases.

21. The system of linear equations $x_1+2x_2+3x_3=6$, $x_1+3x_2+5x_3=9$, $2x_1+5x_2+ax_3=b$ is consistent has infinite number of solutions, then the value of $a+b$ is

22. The area bounded by the curve $y=x^3, y=x+6$ and $x=0$ is.....(in square units)

23. The term independent of x in the expansion of $\left(\frac{1}{x^2}+\frac{1}{x}+1+x+x^2\right)^5$ is

24. For two data sets each of size 5. The variances are given by 4and 5 and the corresponding means are given to be 2 and 4 respectively. The variance of combined data is.

25. The difference between the fourth term and the first term of a increasing geometrical progression is 52. If the sum of first three terms is 26 then the sum of first six terms of the progression is

PHYSICS

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.

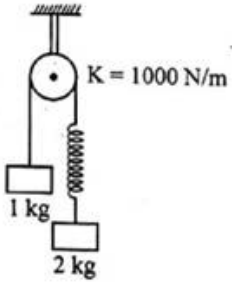
26. The volume of a liquid (V) that passes a given cross-section (area A) in a given time (t) depends on velocity of flow (u), as $V = u^aA^bt^c$.Find the correct relation

A) a = c B) a + c = 0 C) 2b + a = 1.5 D) 2b + a + 3 = 0

27. A balloon starts rising from the surface of the earth. The ascent rate is constant and equal to v_0. Due to wind the balloon gathers the horizontal velocity component V_x= Ay Where A is constant and 'y' is height of ascent, the horizontal drift of the balloon after an ascent 'y' is -

A) $\frac{Ay^2}{2v_0}$ B) $\frac{Ay}{v_0^2}$ C) $\frac{A}{v_0}$ D) $\frac{2Ay^2}{v_0}$

28. In the arrangement shown in the figure pulley is light and smooth. The extension in the spring is ($g=10\ m/s^2$)

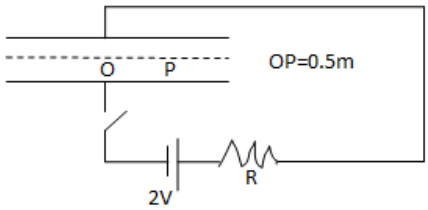


A) 1.33 cm B) 1.cm C) 1.67 cm D) 2 cm

29. A particle of mass m begins to slide down on a fixed smooth sphere from the top, when it breaks off the sphere, it's tangential acceleration will be

A) $2g/3$ B) g C) $\frac{\sqrt{5}}{3}g$ D) $\frac{g}{3}$

30. A parallel plate capacitor with circular plates of radius 1 m has a capacitance of 1 nF. At t = 0, it is connected for charging in series with a resistor R = 1 MΩ across a 2V battery as shown in fig. Calculate the magnetic field at a point P, halfway between the centre and the periphery of the plates, after $t = 10^{-3}$ s.(given $\frac{1}{e} = 0.37$)

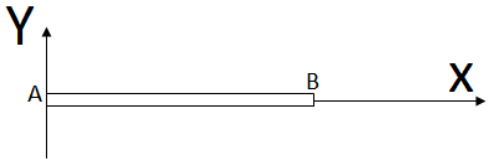


A) $8\times10^{-13}T$ B) $8.4\times10^{-14}T$ C) $7\times10^{-14}T$ D) $7.4\times10^{-14}T$

31. An object is projected with a speed 10 m/s at an angle of 30^o with the horizontal. The object breaks down into n equal fragments during its motion. One fragment is found to strike the ground at a distance of $\sqrt{3}$ m from the point of projection in the same azimuthal plane, in which the object is projected. If the centre of mass of the remaining fragments strikes the ground simultaneously at distance of $7\sqrt{3}$ m from the point of projection, then the value of n is (g=10 m/s^2)

A) 2 B) 3 C) 4 D) 5

32. On the rod at point B a force $\vec{F} = \left(3\hat{i} + 10\hat{j} + 5\hat{k}\right)N$ is applied then the ratio of torque about other end 'A' and about y – axis is ____Nm



A) $\sqrt{5}$ B) $\sqrt{10}$ C) 5 D) $\sqrt{15}$

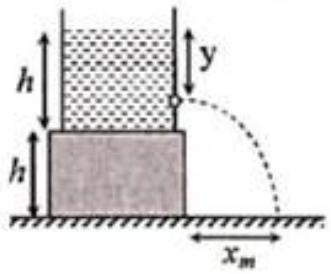
33. An artificial satellite is first taken to a height equal to half the radius of Earth. Let E_1 be the energy required. It is then given the appropriate orbital speed such that it goes in a circular orbit at that height. Let E_2 be the energy required. The ratio $\frac{E_1}{E_2}$ is

A) 4:1 B) 3:1 C) 1:1 D) 1:2

34. The maximum force on a body of mass m executing SHM is p and the maximum kinetic energy of the body is q. Then its time period is

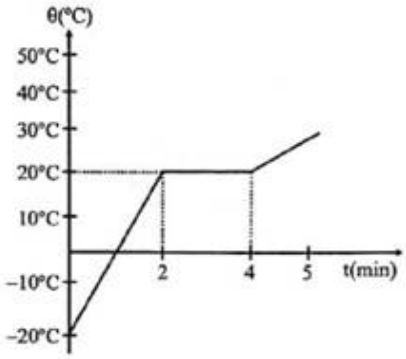
A) $\frac{2\pi}{p}\sqrt{2mq}$ B) $\frac{2\pi}{q}\sqrt{2mp}$ C) $\frac{\pi}{p}\sqrt{2mq}$ D) $\frac{\pi}{q}\sqrt{2mp}$

35. A tank is filled upto a height h with a liquid and is placed on a platform of height h from the ground. To get maximum range x_m a small hole is punched at distance of y from the free surface of the liquid. Then



A) $y = 0.25h$ B) $y = 0.5h$ C) $y = h$ D) $y = 0.75h$

36. Heat is supplied to 2kg of solid (initially at -20°C) at the constant rate of 5kJ/min. Temperature is plotted as a function of time as shown in the figure. Latent heat of fusion for solid is –



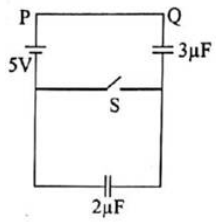
A) 10 kJ/kg B) 2.5 kJ/kg C) 5 kJ/kg D) 7.5 kJ/kg

37. A l cm long string fixed at both ends, sustains a standing wave such that the adjacent points on the string having displacement amplitude 1 mm (less than maximum amplitude) are separated by d cm. The string is oscillating in its third overtone then

A) $\frac{l}{d} = 2$ B) $\frac{l}{d} = 3$ C) $\frac{l}{d} = 6$ D) $\frac{l}{d} = 8$

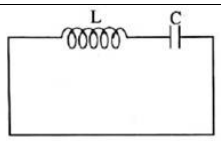
38. Choose the INCORRECT STATEMENT.
A) Gauss' law can be derived from Coulomb's law.
B) Gauss' law states that the net number of field lines crossing any closed surface in an outward direction is proportional to the net charge enclosed within the surface.
C) Coulomb's law can be derived from Gauss' law and symmetry.
D) According to Gauss' law, if a closed surface encloses no charge, then the electrostatic field must vanish everywhere on the surface.

39. The charge flown from P to Q when the switch S is closed is –



A) 3μC B) 6μC C) 9μC D) 15μC

40. In an LC circuit initially the capacitor has maximum charge q_0.Then the value of $\left(\frac{dI}{dt}\right)_{max}$ is



A) $\frac{q_0}{LC}$ B) $\frac{q_0}{\sqrt{LC}}$ C) $\frac{q_0}{LC}-1$ D) $\frac{q_0}{LC}+1$

41. A coil of inductance 0.12 H and resistance 5Ω is connected to an AC – source of 13 V, $\frac{50}{\pi}$Hz. The power factor of this circuit is

A) $\frac{12}{5}$ B) $\frac{12}{13}$ C) 5 D) $\frac{5}{13}$

42. A long solenoid with 10 turns/cm and a radius of 7 cm carries a current of $\frac{20}{\pi}$mA. A charge of $10\mu C$ move along central axis of solenoid. the magnetic force on charge is

A) 8πN B) 11.3 N C) 11.3×10^{-3}N D) Zero

43. The distance between object and screen is 96 cm. The ratio of length of two images formed by a convex lens placed between them is 4.84. The focal length f is nearly_

A) 22 cm B) 20.6 cm C) 34 cm D) 24.2 cm

44. In a screw gauge, there are 100 divisions in circular scale and each main scale division is of 1 mm. when there is no gap between the jaws, 97th division coincides with the main scale zero and zero of main scale is not visible. While measuring the diameter of a ball, the circular scale is between 3mm mark and 4 mm mark such that the 76th division of circular scale coincides with the reference line. Select the correct alternative.

A) The least count of the micrometer is 0.01 cm

B) The zero error is -0.04 mm

C) The diameter of ball is 3.79 cm

D) The main scale reading is 4 mm

45. The binding energies of nuclei X and Y are E_1 and E_2 respectively. Two atoms of X fuse to give one atom of Y and an energy Q is released. Then:

A) $Q=2E_1-E_2$ B) $Q=E_2-2E_1$ C) $Q=2E_1-E_2$ D) $Q=2E_2-E_1$

SECTION-II
(Numerical Value Answer Type)

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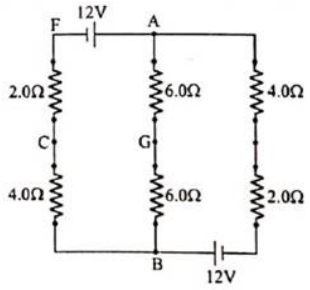
46. A transmitting antenna at the top of a tower has a height 32 m and the height of the receiving antenna is 50 m. What is the maximum distance (in km) between them for satisfactory communication in LOS mode? Given radius of earth $6.4\times10^6 m$. $\left(\text{take}\sqrt{10}=3\right)$

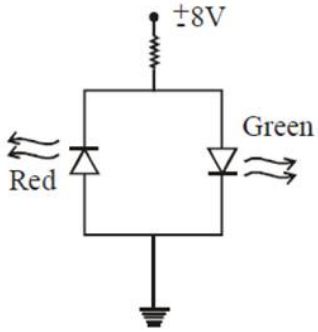
47. In the network shown in the figure, the potential difference (in Volt) across points A and B is



48. An ac source of angular frequency ω is connected across a resistance R and a capacitor C in series. The current registered is *i*. If now the angular frequency of source is changed to $\frac{\omega}{3}$ the current in the circuit is found to be halved. Then ratio of capacitive reactance to resistance at the original frequency is $\sqrt{\frac{n}{5}}$. Find value of n.

49. A light beam of power 12 watt and wavelength $6000A^o$ falls normally on a partially reflecting plate absorb 80% of light falling on it then force exerted on the plate is $4.8\lambda \times 10^{-n}$ Newton. Find the value of $\lambda + n$.

50. If the figure shown are 2 LEDs that can be used as a polarity detector. Apply a positive source voltage and a green light results. Negative supplies result in a red light. Packages of such combination are commercially available. Find maximum value of resistance R to ensure a current of 20mA through the ON diode for the configuration. Both diodes have reverse voltage of 3V and average turn ON voltage of 2V.



CHEMISTRY

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.

51. i) $XeF_4 + O_2F_2 \rightarrow$

ii) $XeF_4 + H_2O_{(excess)} \rightarrow$

iii) $XeF_2 + H_2O \rightarrow$

iv) $XeF_6 + H_2O \rightarrow$

The reaction in which oxygen gas is liberated

A) i and iv B) iii and iv C) ii and iv D) i, ii and iii

52. Read the following statements

i) Among the transition elements the metals of 2^{nd} and 3^{rd} transition series have greater enthalpies of atomisation than 1^{st} series

ii) The radii of the 3^{rd} transition series (5d) are virtually the same as those of the corresponding members of 2^{nd} series,

iii) Ionization enthalpy of Mn^{+} is higher than Cr^{+}

iv) Due to the lanthanide contraction the 2^{nd} and 3^{rd} series exhibit similar radii

Which of the following is the correct as per the above 4- statements

A) Statements i, ii, iii are correct , iv is incorrect

B) Statement i, ii, iv are correct , iii is incorrect

C) Statement ii,iv,iii are correct , i is incorrect

D) All the four are correct statements

53. An inorganic compound "X" undergo disproportionation gives the compounds Nitric acid, water and Nitric oxide, X is

A) Nitrous Acid B) Nitric Acid C) Hypo nitric Acid D) Per Nitric Acid

54. $[Ma_3b_3]$ type of complex [a, b are monodentate ligands] can exhibit two geometrical isomers, facial and meridional. The correct statement about the complex is

A) Both the complexes are optically active

B) Facial isomer have no plane of symmetry

C) Meridional isomer has plane of symmetry

D) Both are homoleptic complexes

55. The correct statement is

i) The common oxidation state of Lanthanides is +3

ii) Ce^{+4} is good oxidising agent

iii) Ce^{+4} compounds are colourless due to f^{0} configuration

iv) Tripositive Lanthanides can readily form complexes compared tri positive transition elements

A) i & iv B) i, ii, iii & iv C) i, ii and iv D) i and ii

56. In case of ore containing ZnS and PbS to separate them depressants is used. The correct statements is

A) $CuSO_4$ is used as depressant

B) The depressant selectively prevents PbS from coming to froth

C) The depressant selectively prevents ZnS from coming to froth

D) Depressant prevents ZnS and PbS coming to froth

57. Sodium carbonate generally prepared by solvay process. In this process, advantage is taken of

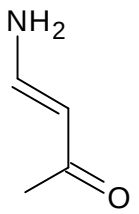
A) High solubility of sodium hydrogen carbonate

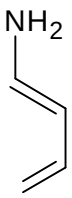
B) Low solubility of sodium hydrogen carbonate

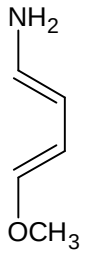
C) Low solubility of sodium carbonate

D) High solubility of sodium carbonate

58. Correct order of C—N bond length in the given compounds is

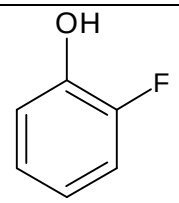
(i) 

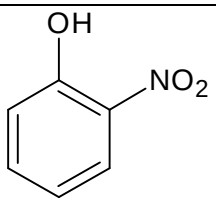
(ii) 

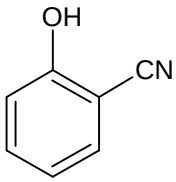
(iii) 

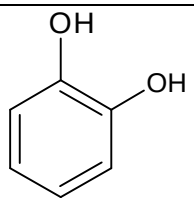
A) i>ii>iii B) iii>ii>i C) ii>iii>i D) ii>i>iii

59. Which one of the following do not show intramolecular hydrogen bonding?

A) 

B) 

C) 

D) 

60. In 1980 atmospheric scientists working in the Antarctica reported about depletion of ozone layer commonly known as ozone hole over the south pole. During this study they observed different reactions in different seasons. Among the following incorrect match is

A) $Cl\dot{O}_{(g)} + NO_{2(g)} \rightarrow ClONO_{2(g)}$ - summer

B) $\dot{Cl}_{(g)} + CH_{4(g)} \rightarrow \dot{C}H_{3(g)} + HCl_{(g)}$ - Summer

C) $ClONO_{2(g)} + H_2O_{(g)} \rightarrow HOCl_{(g)} + HNO_3$ - Winter

D) $HOCl_{(g)} \rightarrow \dot{O}H_{(g)} + \dot{Cl}_{(g)}$ - Winter

61. Zaitzev's rule is violated in the dehydrohalogenation of

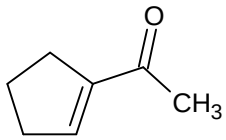
A) 2-methyl-2-chloropentane using EtOK

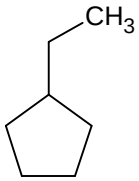
B) 2-methyl-2-chloropentane using MeOK

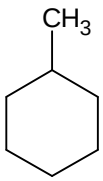
C) 2-methyl-2-chloropentane using t-BuOK

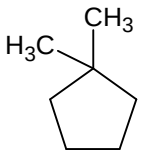
D) 2-methyl-2-chloropentane using alc.KOH

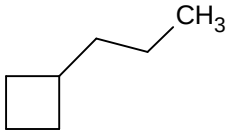
62.

? $\xrightarrow[\text{ii) } 20\%H_3PO_4/\Delta \\ \text{iii) } O_3 \\ \text{iv) } Me_2S/H_2O \\ \text{v) dil.NaOH}/\Delta]{\text{i) } KMnO_4}$ 

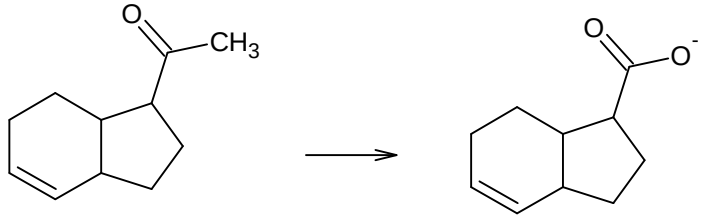
A) 

B) 

C) 

D) 

63. Which reagent is used for given reaction?

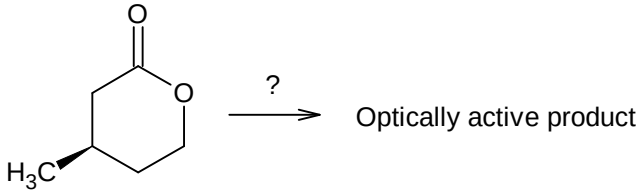


A) Hot alkaline $KMnO_4$

B) aq. $CuSO_4$ / Alkaline sodium potassium tartarate

C) Cl_2 / NaOH

D) PDC

64. 

i) $LiAlH_4$ ii) CH_3MgBr

iii) $DIBAL - H\ at - 78^0C$ iv) $Na / EtOH$

A) ii only B) iii only C) ii and iii D) ii and iv

65. For the hypothetical reaction: $A + B \rightleftharpoons C + D$, the equilibrium constant, K, is less than 1.0 at $25°C$ and decreases by 35% on changing the temperature to $45°C$. What must be true according to this information?

A) The $\Delta H°$ for the reaction is positive

B) The $\Delta S°$ for the reaction is negative

C) The $\Delta G°$ for the reaction at $25°C$ is negative

D) The $\Delta G°$ for the reaction at $45°C$ is zero

66. Which of the following statements are correct?

I. Larger is the value of $\frac{T_c}{P_c}$ for a gas larger would be its excluded volume

II. Larger is the excluded volume of gas, more will be its critical volume

III. The slope for an isochore obtained for a gas showing P (V – b) = RT is $\left[\frac{R}{V-b}\right]$

IV. The excluded volume for He is more than H_2

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

67. Among the following statements (a) to (e), correct important feature of quantum mechanical model of atom are ?

a) The energy of electrons in atoms is quantized

b) The existence of quantized electronic energy levels is a direct result of the wave like properties of electrons and are allowed solutions of Schrodinger wave equation.

c) Both the exact position and exact velocity of an electron in an atom cannot be determined simultaneously (Heisenberg uncertainty principle). The path of an electron in an atom therefore can never be determined or known accurately. That is why, as you shall see later on, one talks of only probability of finding the electron at different points in an atom.

d) An atomic orbital is the square of wave function Ψ for an electron in an atom.

e) The probability of finding an electron at a point within an atom is proportional to the square of the orbital wave function i.e., $|\Psi|^2$ at that point. $|\Psi|^2$ is known as probability density and is always positive. From, the value of $|\Psi|^2$ at different points within an atom, it is possible to predict the region around the nucleus where electron will most probably be found.

A) a, b and e only B)a, b, c and e only C) a, b, d and e only D) b, d and e only

68. Among the following statements (a) to (d), correct statements are ?

a) the catalyst ZSM-5 converts alcohols directly into gasoline (petrol)

b) charge on Lyophilic colloids depends on pH of medium

c) The charged colloidal particles of the sol formed by addition of $FeCl_3$ in excess $NaOH(aq)$. Move towards cathode during electrophoresis

d) '1' g of activated charcoal adsorbs more ammonia than sulphur dioxide

A) a and b B) a and c C) a, b and c D) a and d

69. The following pairs of solution are mixed in equal volume. Which combination does not produce a buffer solution ?

A) 0.5M HCOOH and 0.4M NaOH B) 0.1M NH_4OH and 0.1M HCl

C) 0.2M HCOONa and 0.1M HNO_3 D) 0.2M HCOOH and 0.4M HCOONa

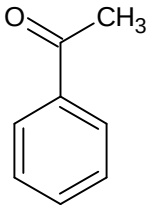
70. In novestrol structure number of six membered and five membered rings are respectively
A) 1, 3 B) 2, 2 C) 3,1 D) 4, 0

SECTION-II
(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical value. If the numerical value has more than two decimal places, **round-off the value** of Two decimal places. Answer to each question will be evaluated according to the following marking scheme:
Marking scheme: +4 for correct answer, 0 in all other cases.

71. Reaction of ammonia with diborane gives initially a product 'X' which is formulated as $\left[BH_X\left(NH_3\right)_2\right]\left[BH_y\right]$. The x+y value is

72. In the following reaction sequence, the amount of D (in g) formed from 10 moles of acetophenone is
(Atomic weights in g mol^{-1}; H = 1, C=12, N=14, O=16, Br =80. The yield (%) corresponding to the product in each step is given in the parenthesis)



$\xrightarrow[\text{ii) } H_3O^+]{\text{i) NaOBr}}$ A (60%) $\xrightarrow[\Delta]{NH_3}$ B (50%) $\xrightarrow{Br_2/KOH}$ C (50%) $\xrightarrow[AcOH]{Br_2(3eq)}$ D (100%)

73. The specific rotation of 'invert sugar' is $X°$, (given: specific rotations of $(+)-\text{sucrose}, (+)-\text{maltose}, \text{L}-(-)\text{glucose and L}(+)-\text{fructose}$ in aqueous solution are **+66°, +140°, -52° and +92°**, respectively). The value of X is

74. The following galvanic cell was $Zn_{(s)}\left|Zn\left(NO_3\right)_2(aq.)\right|\left|Cu\left(NO_3\right)_2(aq.)\right|Cu_{(s)}$
$\underset{1L,1M}{}$ $\underset{1L,1M}{}$
operated as an electrolytic cell using Cu as anode and Zn as cathode when current of 16 ampere was passed for 2.68 hours. Now the cell was allowed to function as galvanic cell. What would be the emf of the cell in Volts at $25°C$? Given $E^0_{Cu^{2+}/Cu} = +0.34V$ and $E^0_{Zn/Zn^{2+}} = +0.76V$, (2.303RT/F=0.06V, log3=0.48)

75. If atoms of element B form hcp lattice and those of the element A occupy 1/4th of tetrahedral voids. When 1 g of the formed compound (assume ionic and completely ionised) dissolved in 20 g of Benzene (K_f=5K kg mol^{-1}) lowers the freezing point by 2.5 K, whereas atoms of element B forms ccp lattice in another crystallisation and those of the element A occupy 1/4th of octahedral voids. When 1 g of the formed compound (assume ionic and completely ionised) dissolved in 20 g of unknown solvent (K_b=2.7 K kg mol^{-1}) elevates the boiling point by 1.5 K. Calculate the sum of the atomic masses of A & B?

MELUHA INTERNATIONAL SCHOOL HYDERABAD

SR MPC | **MAINS MODEL – GT 1** | **Date: 01-07-2020**
Time: 3 Hours | **Max Marks : 300**

KEY SHEET

MATHS

1) **B**	2) **A**	3) **C**	4) **D**	5) **D**	6) **D**	7) **A**	8) **B**	9) **A**	10) **B**
11) **B**	12) **A**	13) **A**	14) **C**	15) **D**	16) **B**	17) **B**	18) **A**	19) **D**	20) **D**
21) **23**	22) **10**	23) **381**	24) **5.5**	25) **728**					

PHYSICS

26) **A**	27) **A**	28) **A**	29) **C**	30) **D**	31) **B**	32) **A**	33) **C**	34) **A**	35) **C**
36) **C**	37) **D**	38) **D**	39) **C**	40) **A**	41) **D**	42) **D**	43) **C**	44) **C**	45) **B**
46) **42.2**	47) **0**	48) **3**	49) **9**	50) **300**					

CHEMISTRY

51) **D**	52) **B**	53) **A**	54) **C**	55) **D**	56) **C**	57) **B**	58) **B**	59) **C**	60) **D**
61) **C**	62) **B**	63) **C**	64) **C**	65) **B**	66) **A**	67) **B**	68) **A**	69) **B**	70) **C**
71) **6**	72) **495**	73) **-20**	74) **1.13**	75) **225**					

HINTS & SOLUTIONS

MATHEMATICS

01. $y(\alpha) = \sec\alpha + \tan\alpha$

$\frac{dy}{d\alpha} = \sec\alpha \tan\alpha + \sec^2\alpha$

$\left(\frac{dy}{d\alpha}\right)_{\alpha=\frac{\pi}{6}} = 2$

03. $D > 0 \quad (a+1)^2 - 4(a^2+a-8) > 0$

$a^2 + 2a + 1 - 4a^2 - 4a + 32 > 0$

$-3a^2 - 2a + 33 > 0$

$3a^2 + 2a - 33 < 0$

$3a^2 + 11a - 9a - 33 < 0$

$a(3a+11) - 3(3a+11) < 0$

$\frac{-11}{3} < a < 3$

04. $fog(x) = -1 + |1x| + 1|$

$fog(x)$ *is Continuous for all real numbers*

05. equation of tangent at θ is

$$\frac{x\sec\theta}{2}-\frac{y\tan\theta}{\sqrt{2}}=1$$

$$P=(2\cos\theta,0),Q=\left(0,-\sqrt{2}\cot\theta\right)$$

$$h=2\cos\theta \qquad k=-\sqrt{2}\cot\theta$$

Eliminating θ we get $\frac{4}{x^2}-\frac{2}{y^2}=1$

06.

$$IF=1+x^2, y\left(1+x^2\right)=\frac{4x^3}{3}+c$$

07. Equation of the chord is

$$y=\frac{-1}{2}x+\sqrt{2}$$

Solving this equation with eqn of ellipse

$$x=\sqrt{2}\ or-\sqrt{2}$$

$$y=\frac{1}{\sqrt{2}}, or\frac{-1}{\sqrt{2}}$$

$$PQ=\sqrt{10}$$

08. given limit = $e^{\underset{x\to\infty}{Lt}\left(\frac{x^2+5x+3}{x^2+x+3}-1\right)x}=e^4$

09.

$$I=\int_{1/4}^{1/2}\frac{2\pi x}{\pi x^2}e^{tam\,\pi x^2}dx$$

$$\pi x^2=t\ ,\ \ 2\pi x\,dx=dt$$

$$I=\int_{\pi/16}^{1/4}\frac{e^{\tan t}}{t}dt=G(t)\Big]_{\pi/16}^{\pi/4}$$

$$=G\left(\frac{\pi}{4}\right)-G\left(\frac{\pi}{16}\right)$$

10.

$$I=\int\frac{2x^{12}+5x^9}{(x^5+x^3+1)^3}dx=$$

$$\int\frac{\frac{2}{x^3}+\frac{5}{x^6}}{(1+\frac{1}{x^2}+\frac{1}{x^3})^3}du=\frac{1}{2}\frac{x^{10}}{\left(x^5+x^3+1\right)^2}+c$$

I =

11.

$$\tan\left(\tan^{-1}\frac{\sqrt{1-x^2}}{x}\right)=\sin\left(\sin^{-1}\frac{2}{\sqrt{5}}\right), 9x^2=5, x=\pm\frac{\sqrt{5}}{3}$$

12. $n(E)=53\times4!, n(S)=7!-6!=6(6!)$

$$P(E)=\frac{53\times(4!)}{6(6!)}=\frac{53}{180}$$

13. $-3a+2b+c=0$

$a+4b-5c=0$

$$\frac{a}{1}=\frac{b}{1}=\frac{c}{1}$$

15.

(3)	(4)	(4)	(3)
A	B	C	D
0	3	3	0
1	2	2	1
2	1	1	2
3	0	0	3

Required number of ways = 485

16. Distance between the parallel lines =2
Required line = 3y-4x+6=0

17.

$$\frac{\left(\bar{b}.\bar{a}\right)\bar{a}}{|a|^2}=\frac{4}{3}\left(\bar{i}-\bar{j}-\bar{k}\right)$$

$$(\lambda+2)\left(\bar{i}-\bar{j}-\bar{k}\right)=4\left(\bar{i}-\bar{j}-\bar{k}\right)$$

$$\lambda=2$$ 44

18. it is clear from the graph f(x) it is non-differentiable at x=+ a
The length of longest interval = 2a

19.

$$|z|^2=9,\quad z\bar{z}=9$$

$$\left|3+\frac{9}{z}\right|^2+|3-z|^2=\left|3+\frac{9\bar{z}}{9}\right|^2+|3-2|^2$$

$$=\left|3+\bar{z}\right|^2+\left|3-\bar{z}\right|^2=2(9+|z|^2)$$

$$=36$$

20. $$|B|=\begin{pmatrix} a_{11} & 4a_{21} & 16a_{31} \\ 4a_{12} & 16a_{22} & 64a_{32} \\ 16a_{13} & 64a_{23} & 256a_{33}\end{pmatrix} \quad =46\begin{pmatrix} a_{11} & a_{21} & a_{31} \\ a_{12} & a_{22} & a_{32} \\ a_{13} & a_{23} & a_{33}\end{pmatrix}=4^6|A|$$

$$|A|=\frac{256}{4^6}=\frac{1}{16}$$

21.

$$A=\begin{pmatrix}1 & 2 & 3\\ 1 & 3 & 5\\ 2 & 5 & a\end{pmatrix}\quad B=\begin{pmatrix}6\\9\\b\end{pmatrix}$$

$$(adjA)B=0$$

$$\begin{pmatrix}3a-25 & 15-2a & 1\\ 10-a & a-6 & -2\\ -1 & -1 & 1\end{pmatrix}\begin{pmatrix}6\\9\\b\end{pmatrix}=\begin{pmatrix}0\\0\\0\end{pmatrix}$$

$$a=8,\quad b=15$$

22. Sol: $x^3-x-6=0$
$x=2$

$A=\int_0^2\left(x+6-x^3\right)dx=10\ sq\ units$

23. sol $\left(\frac{1}{x^2}+\frac{1}{x}+1+x+x^2\right)^5=\frac{1}{x^{10}}\left(1-x^5\right)^5\left(1-x\right)^{-5}$

= coefficient $x^{10}\ in\ \left(1-x^5\right)^5\left(1-x\right)^5$ =381

24. $n_1=n_2=5,\ \sigma_1^2=4,\ \sigma_2^2=5,\ \overline{x_1}=4\quad\overline{x_2}=4$

$\frac{11}{2}=5.5$

Combined varience =

25. $a, ar, ar^2, ar^3, ar^4, ar^5$

$ar^3-a=4,\qquad a\left(r^3-1\right)=52$

$a+ar+ar^2=26$

Required value $=a\left(1+r+r^2+r^3+r^4+r^5\right)$

$=a\left(1+r^3\right)\left(1+r+r^2\right)$

$=2\left(1+3+9\right)\quad\left(1+27\right)$ =728

PHYSICS

26. $V=u^aA^bt^c$

Dimensionally

$L^3=\left(LT^{-1}\right)^a\left(L^2\right)^b\left(T\right)^c$

$\Rightarrow a+2b=3$

$c-a=0$

27. ϑ_o const

$\Rightarrow y=\vartheta_0 t$

$\vartheta_x=Ay$

$dx=A\vartheta_0 t\,dt$

$\Rightarrow x=\frac{A\vartheta_0}{2}t^2$

$\Rightarrow x=\frac{A\vartheta_0}{2}\frac{y^2}{\vartheta_0^2}$

$\Rightarrow x=\frac{Ay^2}{2\vartheta_0}$

28. $2g-T=2a$

$T-g=a$

$\Rightarrow 2g-T=2\left(T-g\right)$

$3T=4g$

$T=\frac{4g}{3}$

$1000\times x=\frac{4\times10}{3}$

$\Rightarrow x=\frac{4}{3}cm$

29. The body loses contact at angle $'\theta'$ with vertical given by $\cos\theta = \frac{2}{3}$

$\Rightarrow$ Tangential acceleration $a = g\sin\theta = \frac{\sqrt{5}g}{3}$

30. The time constant of the CR circuit is $\pi = CR = 10^{-3}$ s. then, we have

$q(t) = CV[1 - \exp(-t/\pi)]$

$= 210^{-9}[1 - \exp(-t/10^{-3})]$

The electric field in between the plates at time t is

$E = \frac{q(t)}{\varepsilon_0 A} = \frac{q}{\pi\varepsilon_0}; A = \pi[1]^2 m^2 = \text{area of the plates.}$

Consider now a circular loop of radius (1/2) m parallel to the plates passing through P. The magnetic field B at all points on the loop is along the loop and of the same value. The flux Φ_E through this loop is

$\Phi_E = \pi \times \left(\frac{1}{2}\right)^2 = \frac{\pi E}{4} = \frac{q}{4\varepsilon_0}$

The flux

The displacement current

$i_d = \varepsilon_0 \frac{d\Phi_E}{dt} = \frac{1}{4}\frac{dq}{dt} = 0.5\times10^{-6}e^{-1}$

At $t = 10^{-3}s$. Now,applying ampere-maxwell law to the loop. We get

$B \times 2\pi \times \left(\frac{1}{2}\right) = \mu_0(i_d) = 0.5\times10^{-6}\,e^{-1}$

$B = 0.74\times10^{-13}T$

31. $\frac{m(\sqrt{3}) + (n-1)mT\sqrt{3}}{nm} = \frac{u^2\sin 2\theta}{g}$

$\Rightarrow \frac{\sqrt{2} + (n-1)7\sqrt{3}}{n} = \frac{100}{10}\times\frac{\sqrt{3}}{2}$

$\Rightarrow 1 + (n-1)7 = 5n$

$1 + 7n - 7 = 5n$

$2n = 6$

$n = 3$

$= \frac{\sqrt{(5l)^2 + (10l)^2}}{5l} = \sqrt{5}$

32. Ratio .

33. $E_1 = GMm\left(\frac{1}{R} - \frac{1}{R+h}\right) = \frac{GMmh}{R(R+h)} = \frac{gR^2mR/2}{R3R/2} = \frac{mgR}{3}$

$E_2 = \frac{1}{2}mv^2 = \frac{1}{2}m\left(\sqrt{\frac{gR^2}{R+\frac{R}{2}}}\right)^2 = \frac{1}{2}m\frac{gR^2}{3R}2 = \frac{mgR}{3}$

$$\Rightarrow \frac{E_1}{E_2} = 1$$

34. $p = mA\omega^2$

$$q = \frac{1}{2}mA^2\omega^2$$

$$\Rightarrow q = \frac{1}{2}m\omega^2 \frac{p^2}{m^2\omega^4}$$

$$\Rightarrow \omega^2 = \frac{p^2}{2mq}$$

$$\Rightarrow \frac{4\pi^2}{T^2} = \frac{p^2}{2mq} \Rightarrow T = \frac{2\pi}{p}\sqrt{2mq}$$

35. $x = \sqrt{2gy}\sqrt{2\frac{(2h-y)}{g}}$

$$\Rightarrow x = \sqrt{4\left(2hy - y^2\right)}$$

$$\frac{d}{dy}\left(2hy - y^2\right) = 0$$

X is maximum if

i.e y=h.

36. Change of state takes place at 20oC.

$$\Rightarrow mL = pt$$

$$2L = (5kJ)2$$

$$\Rightarrow L = 2kJ/kg$$

37. $l = 2\lambda$

$$\lambda = 4d$$

$$\Rightarrow \frac{l}{d} = 8$$

38. Theoretical concept.

39. $q_i \text{ on } 3\mu F = 6\mu c$

$$q_f \text{ on } 3\mu f = 15\mu c$$

40. $q = q_o \cos wt$

$$i = \frac{-dq}{dt} = q_o\omega \sin wt$$

$$\frac{di}{dt} = q_o\omega^2 \cos wt$$

$$\left(\frac{di}{dt}\right)_{max} = q_o\omega^2$$

41. Power factor

$$\frac{R}{Z} = \frac{R}{\sqrt{R^2 + (\omega L)^2}} = \frac{5}{\sqrt{5^2 + \left(2\pi\frac{50}{\pi} \times 0.12\right)^2}} = \frac{5}{13}$$

42. Theoretical concept.

43. D = 96 cm

If lens displacement is 'L'

$$\Rightarrow m_1 = \frac{D+L}{D-L}, m_2 = \frac{D-L}{D+L}$$

$$\Rightarrow \left(\frac{D+L}{D-L}\right)^2 = 4.84$$

$$\frac{D+L}{D-L} = 2.2 = \frac{11}{5}$$

$$5D + 5L = 11D - 11L$$

$$6D = 16L$$

$$3D = 8L$$

$$\Rightarrow f = \frac{D^2 - L^2}{4D}$$

$$= \frac{D^2 - L^2}{4D}$$

$$= \frac{55D}{64 \times 4} = \frac{55 \times 96}{64 \times 4} = 20.6cm$$

44. $\text{Least count} = \dfrac{\text{Pitch}}{\text{Number of divisions on circular scale}}$

$$= \frac{1\text{mm}}{100} = 0.01\text{mm} = 0.001\text{cm}$$

Zero error = -0.33 mm

Measurement = 3.76-(-0.03)=3.79 mm

45. $Q = (BE)_p - (BE)_R$

46. $dm = \sqrt{2 \times 64 \times 10^5 \times 32} + \sqrt{2 \times 64 \times 10^5 \times 32}\ \text{m}$

$$= 64 \times 10^2 \times \sqrt{10} + 8 \times 10^3 \times \sqrt{10}\ \text{m}$$

$$= 144 \times 10^2 \times \sqrt{10}\ \text{m} = 43.2\ \text{km}$$

47. Use kirchoff's laws. & symmetry

48. $$i = \frac{E}{\sqrt{R^2 + X_C^2}}$$

$$\frac{i}{2} = \frac{E}{\sqrt{R^2 + 9X_C^2}}$$

$$2 = \frac{\sqrt{R^2 + 9X_C^2}}{\sqrt{R^2 + X_C^2}}$$

$$\Rightarrow 4R^2 + 4X_C^2 = R^2 + 9X_C^2$$

$$3R^2 = 5X_C^2$$

$$\Rightarrow \frac{X_c}{R} = \sqrt{\frac{3}{5}}$$

49. $P=\frac{F}{A}=\left[2\times(0.2)+0.8\right]\frac{I}{C}.$

$F=\frac{(1.2)P}{C}=\frac{1.2\times12}{3\times10^{8}}=4.8\times10^{-8}$

$\Rightarrow \lambda=1, n=8$

$\Rightarrow \lambda+n=9$

50. $\frac{8-2}{R}=2\times10^{-2}$

$\Rightarrow R=300\Omega$

CHEMISTRY

53. $3HNO_2\rightarrow HNO_3+H_2O+2NO$ compound "X" is a

65. $\Delta G^\circ=\Delta H^\circ-T\Delta S^\circ$

$+ve=-ve-T(-ve)$

66. $T_c=\frac{8a}{27Rb}, T_c=\frac{a}{27b^2}, V_c=3b$

67. quantum mechanical model postulates NCERT PAGE NO

68. Amino acid charge varies with PH of medium, More Tc gas will be adsorbed more

69. WA+ WA SALT WITH SB
WA+SB(excess)
WB+WB SALT WITH SA
WB+SA(excess)
(WA+WB) SALT

70. Conceptual

74. No. Of equivalents = 1.6F $\Rightarrow$ 0.8 moles change takes place in both compartments

$\rightarrow E_{cell}=1.1-\frac{0.06}{2}\log\frac{\left[Zn^{2+}\right]}{\left[Cu^{2+}\right]}$

$E_{cell}=1.1-\frac{0.06}{2}\log\frac{0.2}{1.8}$

= 1.13 V

75. For AB_2

$\Delta T_f=i\,K_f m$

$2.5=3\times5\times\frac{50}{Mw_{AB_2}}\Rightarrow Mw_{AB_2}=300$

For AB_4,

$1.5=2.7\times5\times\frac{50}{Mw_{AB_4}}\Rightarrow Mw_{AB_4}=450$