MELUHA INTERNATIONAL SCHOOL

HYDERABAD

SR MPC | **MAINS MODEL – GT -2** | **Date: 22-05-2020**

Time: 3 Hours | **Max Marks : 300**

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. Given that variance of 20 observations is 5,when each of those observation is multiplied by -2, then new variance is,

(A) 10 (B) 30 (C) -20 (D) 20

02. If the first and n^{th} term of a G.P are a and b respectively, and if P is the product of first n terms of such G.P. ,then $p^2 =$ _____

(A) $(ab)^n$ (B) $a^n b$ (C) ab^n (D) $(ab)^{n+1}$

03. The area of triangle formed by lines joining vertex of parabola $x^2 = 12y$ to the ends of its latusrectum is,

(A) 36 sq.units (B) 9 sq.units (C) 18 sq.units (D) 6 sq.units

04. The middle term in the expansion $(1+x)^{2n}$ is,

(A) $\frac{1.2.4.....(2n)}{n!}2^n x^n$ (B) $\frac{1.3.5.....(2n-1)}{n!}2^n x^n$

(C) $\frac{1.3.5.....(2n-1)}{(n-1)!}2^n x^{n-1}$ (D) $\frac{1.2.4.....(2n-1)}{n!}2^n x^n$

05. $\int \frac{x+3}{\sqrt{5-4x-x^2}}dx$ equals, (NOTE : C is constant of integration)

(A) $\sqrt{5-4x+x^2}+C$ (B) $-\sqrt{5-4x-x^2}-\cos^{-1}\left(\frac{x+2}{3}\right)+C$

(C) $-\sqrt{5-4x-x^2}-\sin^{-1}\left(\frac{x+2}{3}\right)+C$ (D) $\sqrt{5-4x-x^2}-\cos^{-1}\left(\frac{x+2}{3}\right)+C$

06. The contrapositive of "If you are born in India; then you are a citizen of India".

(A) If you are not a citizen of India, then you are not born in India.

(B) If you are not born in India, you are not a citizen of India.

(C) If you are born in India, you are not a citizen of India.

(D) If you are a citizen of India, you are born in India.

07. If a,b,c are in A.P then $\begin{vmatrix} 2y+4 & 5y+7 & 8y+a \\ 3y+5 & 6y+8 & 9y+b \\ 4y+6 & 7y+9 & 10y+c \end{vmatrix} =$

(A)8 (B) -8 (C)0 (D) 2

08. Value of $\int_{-1}^{3/2} |x\sin(\pi x)|dx$ is,

(A) $\frac{2}{\pi}+\frac{1}{\pi^2}$ (B) $\frac{3}{\pi}-\frac{1}{\pi^2}$ (C) $\frac{4}{\pi}+\frac{1}{\pi^2}$ (D) $\frac{3}{\pi}+\frac{1}{\pi^2}$

09. The general solution of $e^x dy + \left(ye^x + 2x\right)dx = 0$ is,

(A) $e^y x + x^2 = C$ (B) $xe^y + y^2 = C$ (C) $e^x y + x^2 = C$ (D) $ye^y + x^2 = C$

10. $\int \frac{\left(x^4 - x\right)^{\frac{1}{4}}}{x^5} dx =$ ……..(NOTE : C is constant of integration)

(A) $\frac{4}{5}\left(1 - \frac{1}{x^3}\right)^{5/4} + C$ (B) $\frac{4}{15}\left(1 - \frac{1}{x^3}\right)^{5/4} + C$

(C) $\frac{4}{15}\left(1 - \frac{1}{x^3}\right)^{3/4} + C$ (D) $\frac{4}{5}\left(1 - \frac{1}{x^3}\right)^{7/4} + C$

11. Let R be a relation on the set A of ordered pairs of positive integers defined by $(x, y)R(u, v) \Rightarrow xv = yu$ then R is

(A) Reflexive but not Symmetric (B) Symmetric but not transitive
(C) Equivalence (D) Anti-Symmetric

12. If $\bar{a} = \bar{i} + 4\bar{j} + 2\bar{k}$, $\bar{b} = 3\bar{i} - 2\bar{j} + 7\bar{k}$ and $\bar{c} = 2\bar{i} - \bar{j} + 4\bar{k}$ then the vector $\bar{d}$ which is perpendicular to both $\bar{a}$ and $\bar{b}$ (given $\bar{c}.\bar{d} = 15$) is,

(A) $\frac{1}{3}\left(160\bar{i} - 5\bar{j} - 70\bar{k}\right)$ (B) $\frac{1}{3}\left(60\bar{i} - 5\bar{j} + 70\bar{k}\right)$

(C) $\frac{1}{3}\left(60\bar{i} + 5\bar{j} - 70\bar{k}\right)$ (D) $\frac{1}{3}\left(60\bar{i} + 5\bar{j} + 70\bar{k}\right)$

13. If the line 2x-3y=5 and mx-5y=9 intersects the coordinate axis at concyclic points ,then the value of 'm' is,

(A) 9/2 (B) 11/2 (C) 13/2 (D) 15/2

14. If A and B are symmetric matrices then $AB - BA$ is

(A) Symmetric (B) Skew Symmetric (C) Nilpotent (D) Idempotent

15. The area of the region $\left\{(x, y) : y^2 \le 4x, 4x^2 + 4y^2 \le 9\right\}$ is,

(A) $\frac{9\pi}{8} - \frac{9}{4}\sin^{-1}\left(\frac{1}{3}\right) + \frac{1}{3\sqrt{2}}$ (B) $\frac{9\pi}{8} - \frac{9}{4}\sin^{-1}\left(\frac{1}{3}\right) + \frac{1}{2\sqrt{2}}$

(C) $\frac{9\pi}{8} - \frac{9}{8}\sin^{-1}\left(\frac{1}{3}\right) + \frac{1}{3\sqrt{2}}$ (D) $\frac{9\pi}{8} - \frac{9}{4}\sin^{-1}\left(\frac{1}{3}\right) + \frac{1}{2\sqrt{2}}$

16. Vector equation of the plane passing through the intersection of planes $\bar{r}.\left(\bar{i} + \bar{j} + \bar{k}\right) = 6$ and $\bar{r}.\left(2\bar{i} + 3\bar{j} + 4\bar{k}\right) = -5$ and passing through $(1,1,1)$ is,

(A) $\bar{r}.\left(20\bar{i} - 23\bar{j} + 26\bar{k}\right) = 69$ (B) $\bar{r}.\left(20\bar{i} - 23\bar{j} - 26\bar{k}\right) = 49$

(C) $\bar{r}.\left(20\bar{i} + 23\bar{j} + 26\bar{k}\right) = 69$ (D) $\bar{r}.\left(\bar{i} + \bar{j} - \bar{k}\right) = 69$

17. The mean deviation about the median for $3, 3, 4, 5, 7, 9, 10, 12, 18, 19, 21$ is,

(A) 3.57 (B) 5.27 (C) 4.57 (D) 6.27

18. The value of $\int_0^1 \tan^{-1}\left(\frac{2x-1}{1+x-x^2}\right)dx$ is,

(A) 1 (B) 0 (C) -1 (D) $\frac{\pi}{4}$

19. General solution of $\left(\frac{e^{-2\sqrt{x}}}{\sqrt{x}} - \frac{y}{\sqrt{x}}\right)\frac{dx}{dy} = 1$ is,

(A) $ye^{2\sqrt{x}} = \sqrt{x} + c$ (B) $ye^{2\sqrt{x}} = 2\sqrt{x} + c$

(C) $ye^{2\sqrt{x}} = 3\sqrt{x} + c$ (D) $xe^{2\sqrt{x}} = \sqrt{x} + c$

20. If a machine is correctly set up, it produces 90% acceptable items. If it is incorrectly set up, it produces only 40% acceptable items. Past experience shows that 80% of the set ups are correctly done. If after a certain set up, the machine produces 2 acceptable items, then the probability that the machine is correctly set up is approximately,
(A) 0.90 (B) 0.95 (C) 0.76 (D) 0.98

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. Three vectors $\bar{a}, \bar{b}$ and $\bar{c}$ satisfy $\bar{a} + \bar{b} + \bar{c} = \bar{0}$. If $|\bar{a}| = 1, |\bar{b}| = 4$ and $|\bar{c}| = 2$ then the value of $\bar{a}.\bar{b} + \bar{b}.\bar{c} + \bar{c}.\bar{a}$, is,

22. The area common to the region $\{(x, y) : 0 \le y \le x^2 + 1, 0 \le y \le x + 1, 0 \le x \le 2\}$ is,

23. A and B throws a die alternatively till one of them gets a '6' and wins the game. If A starts game then the probability of winning of B is,

24. An equilateral triangle is inscribed in the parabola $y^2 = 4x$, where one vertex is at the vertex of the parabola, then the square of length of the side of the triangle is,

25. Distance of the point $(-1, -5, -10)$ from the point of intersection of the line $\bar{r} = 2\bar{i} - \bar{j} + 2\bar{k} + \lambda(3\bar{i} + 4\bar{j} + 2\bar{k})$ and the plane $\bar{r}.(\bar{i} - \bar{j} + \bar{k}) = 5$ 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.
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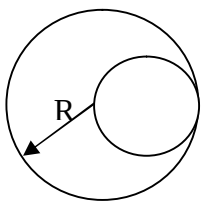
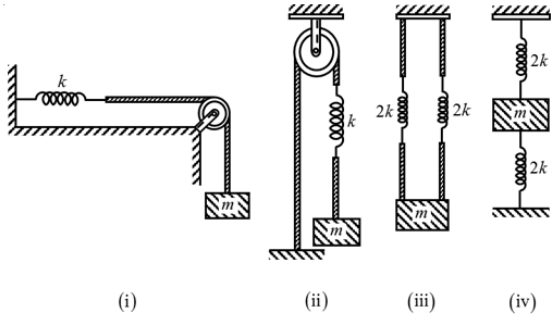
26. A planet revolves about the sun in an elliptical orbit. The areal velocity (dA/dt) of the planet is 4.0×10^{16} m^2 / s. The least distance between planet and the sun is 2×10^{12} m. Then the maximum speed of the planet in km/s is
A) 10 B) 20 C) 40 D) 80

27. A spherical hole of radius R/2 is made in a solid sphere of radius R. The mass of the sphere before hollowing was M. The gravitational field at the centre of the hole due to the remaining mass is



A) zero B) $\frac{GM}{8R^2}$ C) $\frac{GM}{2R^2}$ D) $\frac{GM}{R^2}$

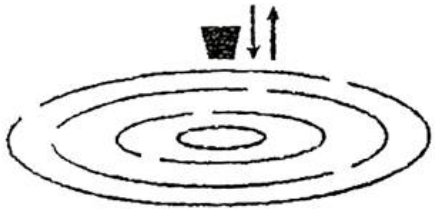
28. A block of mass *m* is suspended by different springs of force constant as shown in the figure.



Let the time period of oscillation in these four positions be T_1, T_2, T_3 *and* T_4. Then

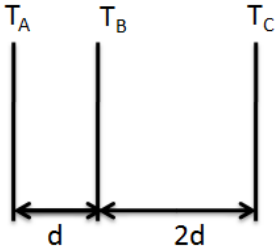
A) $T_1 = T_2 = T_4$ B) $T_1 = T_2$ *and* $T_3 = T_4$ C) $T_1 = T_2 = T_3$ D) $T_1 = T_3$ *and* $T_2 = T_4$

29. A piece of cork is floating on water in a small tank. The cork oscillates up and down vertically when small ripples pass over the surface of water. The velocity of the ripples being 0.21 m/s , wavelength 15 mm and amplitude 5 mm, the maximum velocity of the piece of cork is



A) 0.44 ms^{-1} B) 0.24 ms^{-1} C) 2.4 ms^{-1} D) 4.4 ms^{-1}

30. Two sheets of thickness of d and 2d and of same area are touching each other on their face. Temperatures T_A, T_B, T_C shown are in geometric progression with common ratio r = 2. Then ratio of thermal conductivity of thinner and thicker sheet are

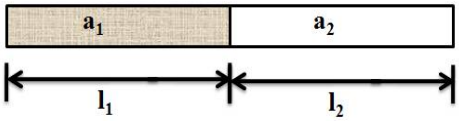


A) 1 B) 2 C) 0.5 D) 4

31. The following sets of values for C_v and C_p of a gas of identical molecules have been reported by different students. The units are cal $mole^{-1}$ K^{-1}. Which of these sets is most reliable ?

A) $C_v = 3$, $C_p = 5$ B) $C_v = 4$, $C_p = 6$ C) $C_v = 3$, $C_p = 2$ D) $C_v = 3$, $C_p = 4.2$

32. Two rods having lengths l_1 and l_2, made of materials with the linear expansion coefficients α_1 and α_2, were soldered together. The equivalent coefficients of linear expansion for the composite rod is



A) $\frac{l_1\alpha_2 + l_2\alpha_1}{l_1 + l_2}$ B) $\frac{l_1\alpha_1 + l_2\alpha_2}{\alpha_1 + \alpha_2}$ C) $\frac{l_1\alpha_1 + l_2\alpha_2}{l_1 + l_2}$ D) $\frac{l_2\alpha_1 + l_1\alpha_2}{\alpha_1 + \beta_2}$

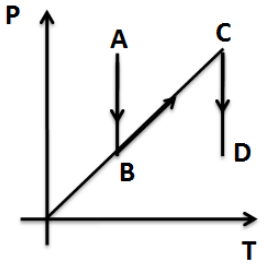
33. A black body calorimeter filled with hot water cools from 60° C to 50°C in 4 min and 40°C to 30° C in 8 min. Then the temperature of the surrounding is

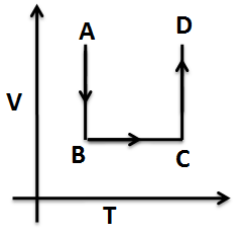
A) 10°C B) 15°C C) 20°C D) 25°C

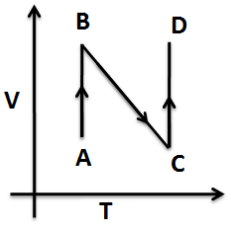
34. RMS speed of a gas is increased by 2 times. If the process is done adiabatically then the minimum ratio of initial volume to final volume will be

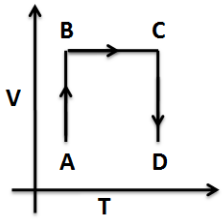
A) 4 B) $(4)^{2/3}$ C) $2^{3/2}$ D) 8

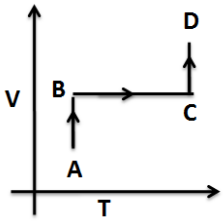
35. Pressure P versus temperature T diagram of a gas is as shown below. Then choose the corresponding volume V versus temperature T diagram.



A)


B)


C)


D)


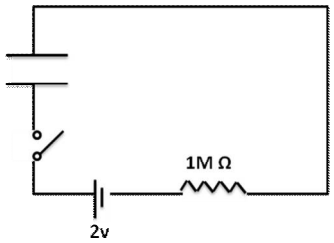
36. A metal ball immersed in water weighs W_1 at 0^oC and W_2 at 50^oC. The coefficient of cubical expansion of metal is less than that of water. Then

A) $W_1 > W_2$ B) $W_1 < W_2$ C) $W_1 = W_2$ D) Data is insuifficient

37. The efficiency of a Carnot engine at a particular source and sink temperature is 1/2. When the sink temperature is reduced by 100^OC the engine efficiency becomes 2/3. The source temperature is

A) 600 K B) 300 K C) 500 K D) 550 K

38. A parallel plate capacitor with circular plates of radius 0.5m 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 figure. The magnetic field at a point P, which is at a distance of 0.25 m form the axis of the plates, at t = 10^{-3} s is (approximately).



A) $1.48x10^{-13}$ T B) $0.74x10^{-13}$ T C) $0.74x10^{-7}$ T D) $1.48x10^{-7}$ T

39. When a metallic surface is illuminated with light of wavelength λ, the stopping potential is V. When the same surface is illuminated by light of wavelength 2 λ, the stopping potential is V/3. The threshold wavelength for the surface is

A) $\frac{4\lambda}{3}$ B) 4λ C) 6λ D) $\frac{8\lambda}{3}$

40. Consider the nuclear reaction

$X^{200} \rightarrow A^{110} + B^{90}$

If the binding energy per nucleon for X, A and B is 7.4 MeV, 8.2 MeV and 8.2 MeV respectively, what is the energy released?

A) 200 MeV B) 160 MeV C) 110 MeV D) 90 MeV

41. A γ – ray photon is emitted

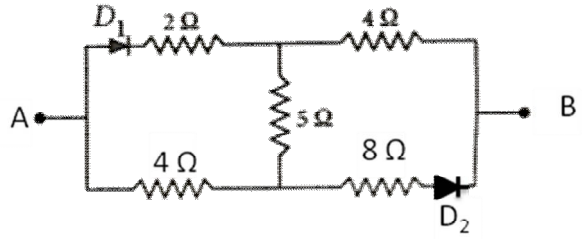
A) after ionization of an atom

B) due to conversion of a neutron into a proton in the nucleus

C) after de-excitation of a nucleus

D) due to conversion of a proton into a neutron in the nucleus

42. The equivalent resistance of the circuit across AB is given by



A) 4 Ω B) 13 Ω C) 4 Ω or 13 Ω D) 4 Ω or zero

43. Regarding a transistor the **incorrect** statement is

A) For transistor to act as an amplifier, EB junction should be forward biased and CB junction should be reverse biased

B) $l_E = l_B + l_C$ in any configuration and for any transistor

C) $\alpha = \frac{\beta}{1+\beta}$ where α and β are transistor parameters

D) $\beta = \frac{\alpha}{1+\alpha}$

44. The radio waves of frequency 30 MHz to 300 MHz belong to

A) High frequency band B) very high frequency band

C) ultra high frequency band D) super high frequency band

45. An optical instrument uses a 25 D objective and 20 D eyepiece with a tube length of 25 cm when eye is least strained.

A) The instrument is a telescope with angular magnification 20.

B) The instrument is a microscope with angular magnification 20.

C) The instrument is a telescope with angular magnification 24.

D) The instrument is a microscope with angular magnification 24.

SECTION-II
(Numerical Value Answer Type)

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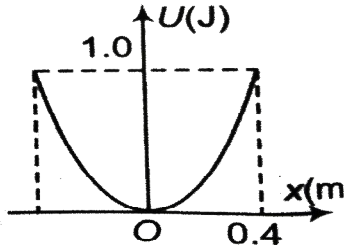
46. A target element A is bombarded with electrons and the wavelengths of the characteristic spectrum are measured. A second characteristic spectrum is also obtained, because of an impurity in the target. The wavelengths of the K_α lines are 196 pm for the element A and 169 pm for the impurity. If atomic number of the impurity is z = (10 λ-1) s find the value of λ. (atomic number of element A is 27)

47. A person speaking normally producers a sound intensity of 40 dB at a distance of 1m. if the threshold intensity for reasonable audibility is 20 dB, the maximum distance at which person can be heard clearly is x meter. Find the value of x.

48. A particle of mass 2 kg moves in simple harmonic motion and its potential energy U varies with position x as shown. The period of oscillation of the particle in seconds is (take $\pi = 3.14$)



49. A small magnet of moment 8 Am^2 is oriented along x-axis at the origin. A point P is a distance of 2m from the centre of magnet and angle between OP and x-axis is $\tan^{-1}\sqrt{2}$. If $\mu o = 4\pi x10^{-7}$ SI units the magnetic induction at P in tesla is n times 10^{-8}. Then n is (take $\sqrt{2} = 1.414$)

50. A parallel beam of light of wavelength 6000 $\overset{o}{A}$ passes through a slit of width 0.1mm. The angular width of central maximum in radians is

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. For standardizing Mohr's salt solution, which of the following is used as primary standard?
A) sodium dichromate B) potassium permanganate
C) oxalic acid D) potassium dichromate

52. $\left[Co\left(NH_3\right)_2\left(H_2O\right)_2ClBr\right]^+$ has 'n' number of optically active isomers. The spin only magnetic moment and crystal field stabilization energy of $\left[NiF_6\right]^{n-}$, respectively, are :
A) $2.84BM, -2.4\Delta_0$ B) $4.89BM, -0.4\Delta_0$
C) $0BM, -2.4\Delta_0$ D) $2.84BM, -1.2\Delta_0$

53. The number of S-S bonds and $d_\pi - P_\pi$ bonds in cyclic trimeric SO_3, respectively, are :
A) 3, 6 B) 6,6 C) 0, 3 D) 0, 6

54. Brown ring formed in the test of nitrate ion is of:
A) $\left[Fe(H_2O)_6\right]SO_4$ B) $\left[Fe(NO)(CN)_5\right]SO_4$
C) $\left[Fe(NO)(H_2O)_5\right]SO_4$ D) $\left[Fe(NO)_5(H_2O)\right]SO_4$

55. MnO_4^{2-} disproportionatein presence of acid to produce
A) Mn^{2+}, MnO_4^- B) MnO_2, MnO_4^- C) MnO_4^-, Mn^{3+} D) Mn_2O_7, Mn^{3+}

56. Which of the following statementregarding smog is false?
A) photochemical smog is oxidising in nature

B) classical smog is reducing in nature

C) classical smog contains high concentration of NO_2

D) photochemical smog is formed in dry and sunny climate.

57. Among the following the diamagnetic complexes is (are)

(i) $Ni(CO)_4$ (ii) $[Ni(PPh_3)_2Cl_2]$

(iii) $(NH_4)_2[PtCl_4]$ (iv) $[Pd(PPh_3)_2Cl_2]$

A) i, iii only B) ii, iii only C) i, iii, iv only D) all

58. Treatment with lime can remove hardness of water caused by

A) $CaCl_2$ B) $CaSO_4$ C) $Ca(HCO_3)_2$ D) $CaCO_3$

59. Among the reactions (i) – (iv) the reaction(s) that does (or) do not occur in reverberatory furnace during extraction of copper is(are):

(i) $CuFeS_2 + O_2 \longrightarrow Cu_2S + FeO + SO_2$

(ii) $2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2$

(iii) $2Cu_2O + Cu_2S \longrightarrow 6Cu + SO_2$

(iv) $FeO + SiO_2 \longrightarrow FeSiO_3$

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

60. In qualitaive analysis when H_2S is passed through an aqueous solution of salt acidified with dil. HCl, a black ppt is obtained. On boiling the ppt with dil. HNO_3, it forms a solution of blue color. Addition of excess of aqueous solution ammonia to this solution gives:

A) deep blue ppt of $Cu(OH)_2$ B) deep blue solution of $[Cu(NH_3)_4]^{2+}$

C) deep blue solution of $Cu(NO_3)_2$ D) deep ppt solution of $Cu(NO_3)_2.Cu(OH)_2$

61. Frenkel defect is observed in:

A) ZnS, KCl B) AgI, ZnS C) AgBr, CsCl D) all of these

62. Consider the following statements:

i) reduction of D-glucose with $NaBH_4$ results in optically active glucitol

ii) D-glucose on oxidation with HNO_3 produces gluconic acid

iii) D-glucose and D-fructose form same osazone on reaction with $PhNHNH_2$

iv) D-glucose and D-fructose form same product with $[Ag(NH_3)_2]OH$.

Select the correct statement(s):

A) i, ii, iii only B) ii, iii, iv only C) i, iii, iv only D) all

63. Consider the following compounds

(I) methoxy methane

(II) propanal

(III) acetone

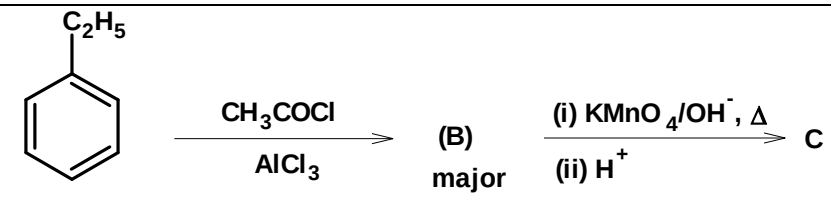
(IV) propan-1-ol

The correct boiling point order of these compounds is:

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

64.

$$H_2C{=}CH_2 \xrightarrow[0^0\,C]{KMnO_4/OH^-} (A)$$



Which of the following correctly represents 'D' and the type of polymerization ?

A) glyptal, chain growth polymerisation

B) dacron, step growth polymerisation

C) dacron, chain growth polymerisation

D) glyptal, step growth polymerisation

65. In which of the following compounds presence of nitrogen cannot be identified by Lassaigne's test ?

(i) hydrazine

(ii) 2,4- DNP

(iii) Urea

(iv) Azobenzene

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

66. Which of the following polymers involve cross linkages?

(i) bakelite (ii) polythene (iii) melmac (iv) vulcanized rubber

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

67. A solid is hard and brittle. It is an insulator in solid but conducts electricity in molten state. The solid is a

A) molecular solid B) ionic solid C) metallic solid D) covalent solid

68. The correct match between List (I) and List (II) is:

List-I (drug)	List-II (test)
i) chloroxylenol	p) carbylamines test
ii) norethindrone	q) sodium bicarbonate test
iii) sulphapyridine	r) ferric chloride test
iv) penicillin	s) Baeyer's test

A) i-r, ii-p, iii-s, iv-q B) i-q, ii-s, iii-p, iv-q C) i-r, ii-s, iii-p, iv-q D) i-q, ii-p, iii-s, iv-s

69. The correct statement is:

A) aniline is a froth stabliser B) zincite is a carbonate ore

C) Sodium cyanide cannot be used in metallurgy of gold

D) zone refining process is used for refining of zirconium

70. Among the following metals, the strongest reducing agent is

A) Ni B) Cu C) Zn D) Fe

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. Number of sp^3 hybridized carbon atoms in alitame is:

72. Number of milli moles of potassium permanganate required to react with 10 mL of 0.1 M hydrogen peroxide infaintly alkaline medium is:

73. The percentage of copper in blue vitriol is:
(Given atomic weight of Cu = 63.5, S = 32, O = 16, H = 1)

74. At 70 K, the adsorption of N_2 gas at iron surface obeys Freundlich adsorption isotherm. The experimental data is:

P (bar)	4	25	64
$\frac{x}{m}$	0.2	0.5	0.8

Where $\frac{x}{m}$ is the mass of N_2 in gram, adsorbed per gram of iron at P bar pressure. The mass N_2 gas in g adsorbed by 5g of Fe at 36 bar and 70 K is:

75. 200 mL of a colloidal solution is completely precipitated by 10 mL of 1 M NaCl solution. Calculate the coagulating value of NaCl.

MELUHA INTERNATIONAL SCHOOL

HYDERABAD

SR MPC | **MAINS MODEL – GT 2** | **Date: 22-05-2020**

Time: 3 Hours | **Max Marks : 300**

KEY SHEET

MATHS

1) **D**	2) **A**	3) **C**	4) **B**	5) **B**	6) **A**	7) **C**	8) **D**	9) **C**	10) **B**
11) **C**	12) **A**	13) **D**	14) **B**	15) **A**	16) **C**	17) **B**	18) **B**	19) **B**	20) **B**
21) **-10.5**	22) **3.83**	23) **0.45**	24) **192**	25) **13**					

PHYSICS

26) **C**	27) **C**	28) **B**	29) **A**	30) **A**	31) **A**	32) **C**	33) **B**	34) **D**	35) **D**
36) **B**	37) **A**	38) **A**	39) **B**	40) **B**	41) **C**	42) **C**	43) **D**	44) **B**	45) **B**
46) **3**	47) **10**	48) **2.51**	49) **14.14**	50) **0.01**					

CHEMISTRY

51) **D**	52) **D**	53) **D**	54) **C**	55) **B**	56) **C**	57) **C**	58) **C**	59) **B**	60) **B**
61) **B**	62) **C**	63) **B**	64) **B**	65) **C**	66) **A**	67) **B**	68) **C**	69) **A**	70) **C**
71) **11**	72) **0.67**	73) **25.45**	74) **3**	75) **50**					

HINTS & SOLUTIONS

MATHEMATICS

01. Variance $\left(\sigma^2\right)=\frac{1}{n}\sum_{i=1}^{n}\left(x_i-\bar{x}\right)^2$

02. $t_n=ar^{n-1}=b$

$p=a.ar.ar^2------ar^{n-1}$

$p^2=\left(a^n\right)^2\left(1.r.r^2----r^{n-1}\right)^2=a^n\left(ar^{n-1}\right)^n$

$\Rightarrow p^2=a^nb^n$

03. Parabola $x^2=12y$

Vertex $(0,0)$

Ends of latus rectum $(\pm 2a,a)$

04. As 2n is even, the middle term $\left(\frac{2n}{2}+1\right)=(n+1)^{th}$ term

$T_{n+1}={}^{2n}C_n(1)^{2n-n}(x)^n$.

05. $px+q=A\frac{d}{dx}\left(ax^2+bx+c\right)+B$

06. Conceptual

07. Use row operations and $2b = a + c$

08. $\int_{-1}^{3/2} |x \sin \pi x| dx = \int_{-1}^{1} x \sin \pi x dx - \int_{+1}^{3/2} x \sin \pi x dx$

And use by parts rule.

09. $\Rightarrow e^x dy + y e^x dx + 2x dx = 0$

$\Rightarrow d\left(ye^x\right) + d\left(x^2\right) = 0$

$\Rightarrow ye^x + x^2 = C$

10. $\int \frac{\left(x^4 - x\right)^{1/4}}{x^5} dx = \int \frac{x\left(1 - \frac{1}{x^3}\right)^{1/4}}{x^5} dx$

$= \int \frac{\left(1 - \frac{1}{x^3}\right)^{1/4}}{x^4} dx$

Put $1 - \frac{1}{x^3} = t$

11. Conceptual

12. Take $\bar{d} = k\left(\bar{a} \times \bar{b}\right)$

13. Conceptual

14. $A^T = A, B^T = B$

$\left(AB - BA\right)^T = -\left(AB - BA\right)$

15. Conceptual

16. Required equation of the plane is $\pi_1 + \lambda \pi_2 = 0$ and passing through $(1,1,1)$

17. $M.D = \sum_{i=1}^{11} |x_i - M|$, where M is median

18. $\int_0^1 \tan^{-1}\left(\frac{2x-1}{1+x-x^2}\right) dx = \int_0^1 \tan^{-1}\left(\frac{x-(1-x)}{1+x(1-x)}\right) dx$

19. Linear equation $\frac{dy}{dx} + p(x)y = Q(x)$ method

20. Conceptual

21. Since $\bar{a} + \bar{b} + \bar{c} = \bar{0}$

$\bar{a}.\left(\bar{a} + \bar{b} + \bar{c}\right) = \bar{0}$

$\bar{a}.\bar{b} + \bar{a}.\bar{c} = -1$

Similarly $\bar{a}.\bar{c} + \bar{b}.\bar{c} = -4, \bar{a}.\bar{b} + \bar{b}.\bar{c} = -16$

Now $2\left(\bar{a}.\bar{b} + \bar{b}.\bar{c} + \bar{c}.\bar{a}\right) = -21$

$\Rightarrow \left(\bar{a}.\bar{b} + \bar{b}.\bar{c} + \bar{c}.\bar{a}\right) = -\frac{21}{2}$

22. $\text{Area} = \int_0^1 \left(x^2 + 1\right) dx + \int_1^2 (x+1) dx$

23. $P(5) = \frac{1}{6}, P(F) = \frac{5}{6}$

$$P(A\,wins)=\frac{1}{6}+\frac{5}{6}\frac{5}{6}\frac{1}{6}+\left(\frac{5}{6}\right)^4\frac{1}{6}+....=\frac{\frac{1}{6}}{1-\frac{25}{36}}=\frac{6}{11}$$

$$P(B\,wins)=1-\frac{6}{11}=\frac{5}{11}$$

24. Conceptual

25. Line is $\frac{x-2}{3}=\frac{y+1}{4}=\frac{z-2}{2}=\lambda$

Plane is $x-y+z-5=0$

PHYSICS

26. $\frac{dA}{dt}=\frac{L}{2m}=\frac{mvr}{2m}=\frac{vr}{2}\ \therefore\quad v=\frac{2(dA/dt)}{r}=\frac{2x40x10^{16}}{2x10^{12}}$

$= 4 \times 10^4$ m/s**= 40 km/s**

27. From the principal of superposition of fields,

$E = E_1 + E_2$

Here, E = net field at the centre of hole due to entire mass

E_1 = field due to remaining mass

and E_2 = field due to mass in hole = 0

$\therefore\ E_1 = E\ =\frac{GM}{R^3}r \quad (where\ \ r=R/2) \qquad E=\frac{GM}{2R^2}$

28. Effective force constant in case (iii) and (iv) is

$K_{eff} = 2\ k + 2\ k = 4\ k$

Therefore, $T_1 = T_2 = 2\pi\sqrt{\frac{m}{k}}$ and $T_3 = T_4 = 2\pi\sqrt{\frac{m}{4k}}=\pi\sqrt{\frac{m}{k}}$

29. $v = \frac{\omega}{k}=\frac{\omega}{(2\pi/\lambda)}\ \therefore\quad \omega=\frac{2\pi v}{\lambda}$

Maximum velocity = $\omega A = =\frac{2\pi vA}{\lambda}$

Substituting the values we have, Maximum velocity $=\frac{2\pi vA}{\lambda}$

$=\frac{(2\pi)(0.21)(5x10^{-3})}{(15x10^{-3})}$ **= 0.44 m/s**

30. Let, $T_A = T$, $T_B = 2T$ and $T_C = 4T$

$H_{CB} = H_{BA}$ (H = heat current)

$\therefore\quad \frac{4T-2T}{(2d/K_{CB}A)}=\frac{2T-T}{(d/K_{BA}A)}$

$\therefore\quad \frac{K_{BA}}{K_{CB}}=1$

31. For a gas $C_P = C_V + R$

$1+2/f = C_p/C_v$

R must be equal to 2 and f must be either 3 or 5 or 6 (mono, di and polyatomic gasses) as the gas is not a mixture of gases.

32. $(l_1+l_2)\alpha_{eq}\Delta\theta=l_1\alpha_1\Delta\theta+l_2\alpha_2\Delta\theta$

$\alpha_{eq} \frac{l_1 \alpha_1 + l_2 \alpha_2}{l_1 + l_2}$

33. $\frac{\theta_1 - \theta_2}{t} = \alpha \left[\frac{\theta_1 + \theta_2}{2} - \theta_0 \right]$

Here, θ_0 is the temperature of surroundings. Substituting the values we have

$\frac{60-50}{4} = \alpha \left[\frac{60+50}{2} - \theta_0 \right]$ and $\frac{40-30}{8} = \alpha \left[\frac{40+30}{2} - \theta_0 \right]$

Solving these two equations we get $\theta_0 = 15^{O}C$

34. $V_{rms} \propto \sqrt{T}$

V_{rms} is increased by 2 times, it means its temperature is increased by 4 times.

In adiabatic process

$TV^{\gamma-1} =$ constant

$\therefore \left(\frac{V_i}{V_f} \right) = \left(\frac{T_f}{T_i} \right)^{\frac{1}{\gamma-1}}$ for minimum ratio γ must be maximum That means the gas must be monoatomic.

For monatomic gas $\gamma = \frac{5}{3}$

$\therefore \frac{V_i}{V_f} = (4)^{3/2} = 8$

35. AB process is isothermal process

Therefore T = constant and $p \propto \frac{1}{V}$

Pressure is decreasing. Therefore volume should increase in process BC:

$p \propto T$, therefore V = constant

Further, p and T both are increasing.

CD, process is identical to AB process

36. Apparent weight W_a = Actual weight (w) – upthrust (F)

Here, F = $V_{PW} g$ (ρ w = density of water)

i.e. $F_{0^O C=} V_{0^O C=} (\rho_w)_{0^O C} g$

and $F_{50^O C=} V_{50^O C=} (\rho_w)_{50^O C} g$

$\therefore \frac{F_{50^O C=} V_{50^O C=} (\rho_w)_{50^O C}}{F_{0^O C=} V_{0^O C=} (\rho_w)_{0^O C}} = \frac{(1+\gamma_m \Delta\theta)}{(1+\gamma_w \Delta\theta)}$

Given that $\gamma_m < \gamma_w$ $\therefore F_{50^O C} < F_{0^O C}$

Or apparent weight at $50^{O}C$ will be more

37. $1 - \frac{T_2}{T_1} = \frac{1}{2}$ $\Rightarrow \frac{T_2}{T_1} = \frac{1}{2}$

Further, $1 - \frac{(T_2 - 100)}{T_1} = \frac{2}{3}$

or $\frac{T_2 - 100}{T_1} = \frac{1}{3}$

Solving Eqs. (i) and (ii), we get $T_1 = 600K$

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

q (t) = CV [1-exp (-t/τ)]

= $2x10^{-9}$ [1-exp(-t/10^{-3})]

The electric field in between the plates at time t is

$E = \frac{q(t)}{\varepsilon_0 A}$, A = π $(0.5)^2$ m^2 = area of the plates.

Consider now a circular loop of radius (1/4)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 through this loop is given by

$$\Phi = E\ \pi\left(\frac{1}{4}\right)^2 = \frac{\pi E}{18}$$

The displacement current

$i_d = \varepsilon_0 \frac{d\Phi}{dt} = \frac{1}{4}\frac{dq}{dt} = 0.5x10^{-6} \exp(-1)$at t= 10^{-3} s. Now,

Applying Ampere-Maxwell law to the loop, we get

$$B \text{ x } 2\pi \text{ x}\left(\frac{1}{4}\right) = \mu_0\left(i_c + i_d\right) = \mu_0(0 + i_d)$$

= $0.5x10^{-16}\ \mu_0 \exp(-1)$

Or B = $1.48x10^{-13}$T

39. $eV = \frac{hc}{\lambda} - \frac{hc}{\lambda_0}$

e $\frac{V}{3} = \frac{hc}{2\lambda} - \frac{hc}{\lambda_0}$ Solving these two equations we get $\lambda_0 = 4\lambda$

40. Energy released = Final binding energy
- initial binding energy

= 110x8.2+90x8.2-200x7.4

= 160 MeV

41. Excited nucleus will emit γ

42. If $V_A > V_B$, both the junction diodes are forward biased and the given circuit diagram becomes a balanced Wheatstone bridge. The equivalent resistance in this case becomes 4 Ω if $V_A < V_B$, the diodes are reverse biased in that case 4 Ω , 5 Ω and 4 Ω are in series.

43. Conceptual

44. Conceptual

45. $f_e = \frac{1}{20} = 0.05m = 5cm$

$f_0 = \frac{1}{25} = 0.04 = 4cm$

Since $f_e > f_0$ thus the optical instrument is microscope. When the eye is least strained, then it means the image is formed at infinity.

V_O = 25-5 = 20cm

$$\frac{1}{u_o} = \frac{1}{V_o} - \frac{1}{t_o} = \frac{1}{20} - \frac{1}{4} = -\frac{1}{5}$$

U_o = -5cm

Angular magnification, $m = -\frac{v_o}{u_o} x \frac{D}{t_e}$

$= \frac{-20}{-5} x \frac{25}{5} = 20$

46. Using Moseley's law

$\sqrt{v} = a(Z-1)$, we have

$\sqrt{\frac{C}{\lambda_A}} = a(Z_A - 1)$

and $\sqrt{\frac{C}{\lambda_x}} = a(Z_x - 1)$

$\therefore \sqrt{\frac{\lambda_A}{\lambda_X}} = \frac{Z_X - 1}{Z_A - 1}$

$\Rightarrow Z_x = 29$

$\therefore \lambda = 3$

47. $L = 10 \log_{10}\left(\frac{I}{I_0}\right)$; where $I_0 = 10^{-12}$ Wm $^{-2}$

Since $40 = 10 \log_{10}\left(\frac{I_1}{I_0}\right)$

$\Rightarrow \left(\frac{I_1}{I_0}\right) = 10^4$ ……(1)

Also $20 = 10 \log_{10}\left(\frac{I_2}{I_0}\right)$

$\Rightarrow \frac{I_2}{I_0} = 10^2$ ……(2)

$\Rightarrow \frac{I_2}{I_1} = 10^2 = \frac{r_1^2}{r_2^2} \quad \Rightarrow \quad r_2^2 = 100 r_1^2$

$\Rightarrow r_2 = 10m \quad (\because r_1 = 1m)$

48. $\frac{1}{2} KA^2 = 1.0J$

$K = \frac{2}{A^2} = \frac{2}{(0.4)^2}\frac{25}{2} N/m$

$T = 2\pi\sqrt{\frac{m}{K}} = 2\pi\sqrt{\frac{2}{(25/2)}} = \frac{4\pi}{5} S$

= 2.51 s

49. Resolve the dipole along OP and perpendicular to OP. Find the fields due to these two and add vectorially.

50. $a \sin\theta = \lambda \quad \theta = \lambda/a$ and 2θ is angular width

CHEMISTRY

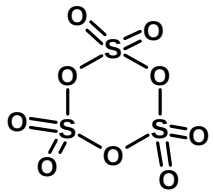
51. oxidising agents should be used and $KMnO_4$, $Na_2Cr_2O_7$ are not primary standards

52. $n = 4 \quad [NiF_6]^{4-}$

$CFSE = -6 \times 0.4\Delta_0$

$= -2.4\Delta_0$

53.



54. The formula of brown ring is $[Fe(NO)(H_2O)_5]SO_4$

55. $3Mn^{VI}O_4^{2-} + 4H^+ \rightarrow 2Mn^{VII}O_4^- + Mn^{IV}O_2 + 2H_2O$

56. classical smog contains SO_2 gas.

58. Lime removes only temporary hardness.

59. The following reactions occur in Bessemer converter

$2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2$ $2Cu_2O + Cu_2O \longrightarrow 6Cu + SO_2$

60. $Cu^{2+} + H_2S \longrightarrow CuS \xrightarrow{HNO_3} S + NO + Cu(NO_3)_2$

$Cu(NO_3)_2 \xrightarrow{NH_3} [Cu(NH_3)_4]SO_4$

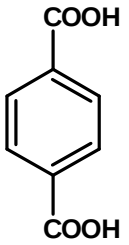
61. KCl, NaCl, CsCl, AgBr schottkey
ZnS, AgBr, AgCl, AgI Frenkel

62. glucose is oxidised to glucaric acid with HNO_3

63. More the polarity, more is the bp

64.

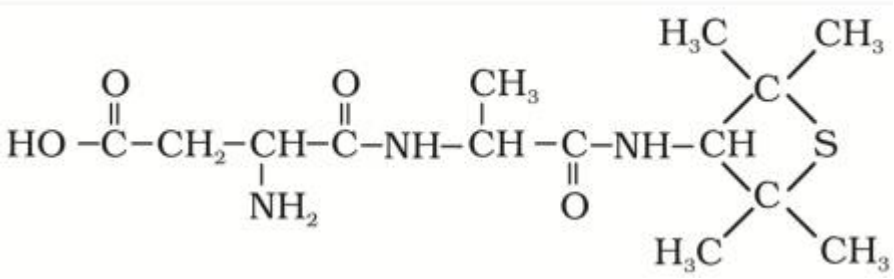
A = 

C = 

D = dacron

65. hydrazine does not contain C & azobenzene lose N_2.

71.



72. $2MnO_4^- + 3H_2O_2 \longrightarrow 2MnO_2 + 3O_2 + 2OH^-$

73. $\%Cu = \dfrac{63.5}{249.5} \times 100$

74. $\dfrac{x}{m} = kP^{\frac{1}{n}}$

$0.2 = k(4)^{\frac{1}{n}}$

$0.5 = k(25)^{\frac{1}{n}}$

$$\frac{5}{2}=\left(\frac{25}{4}\right)^{\frac{1}{n}}$$

$$2.5=(6.25)^{\frac{1}{n}}$$

$$n=2$$

$$\therefore k=\frac{0.2}{2}=0.1\,\frac{x}{5}=0.1(36)^{\frac{1}{2}}=0.1\times 6=0.6$$

75. $\text{coagulation value}=\dfrac{10\times 1\times 1000}{200}$