SRIGAYATRI EDUCATIONAL INSTITUTIONS

INDIA

SR MPC | **BITSAT MODEL CUM TEST-4** | **Date: 10-05-2020**

Time: 3 Hours | **Max. Marks: 450**

Instructions:

For each question, you will be awarded 3 marks if you darken the bubble corresponding to the correct answer ONLY and zero marks if no bubbles are darkened. In all other cases, minus one (-1) mark will be awarded in this section.

PHYSICS

1. Let l, r, c and v represent inductance, resistance, capacitance and voltage respectively. The dimension of $\frac{l}{rcv}$ in S.I units will be

a) $\left[L A^{-2}\right]$ b) $\left[A^{-1}\right]$ c) $\left[L\ T\ A\right]$ d) $\left[L\ T^{2}\right]$

2. A screw guage advance by 3mm in 6 rotations. There 50 divisions on circular scale. Find least count of screw guage?

a) $0.002cm$ **b)** $0.001cm$ **c)** $0.01cm$ **d)** $0.02cm$

3. A drunkard walking in a narrow lane takes 5 steps forward and 3 steps backward, followed again by 5 steps forward and 3 steps backward and so on each step is in long and requires 13. The time when he fall into pit 13m away from him is

a) 13sec **b) 37sec** **c) 40sec** **d) 42sec**

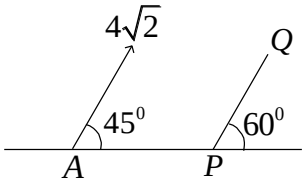
4. A particle moves according to law $x = a\cos\pi t$. The distance covered by it in 2.5sec is

a) 2a **b) 3a** **c) 4a** **d) 5a**

5. Which group of forces can give zero resultant

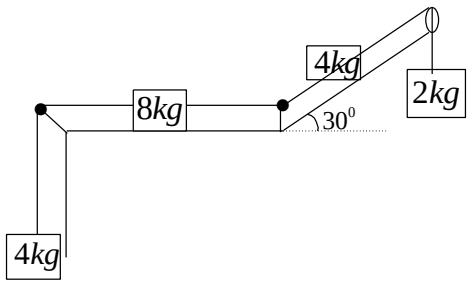
a) 5, 10, 166 **b) 5,8,14** **c) 6,9,15** **d) 10,20,31**

6. A particle is projected from point A with velocity $4\sqrt{2}$ at an angle of 45^0 with the horizontal it strikes the inclined plane PQ at right angle. The velocity of the particle at the time of collision is



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

7. In the device shown all the surfaces are smooth and pulley are light and smooth find the acceleration of the blocks

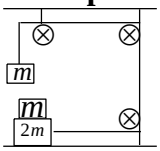


a) $\frac{2g}{9} m/\sec^2$ **b)** $\frac{g}{9} m/\sec^2$ **c)** $\frac{3g}{9} m/\sec^2$ **d)** $\frac{4g}{9} m/\sec^2$

8. In the arrangement, the coefficient of friction between m and 2m so that they more together is

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

9. A particle is delivered constant power, its displacement is proportional to

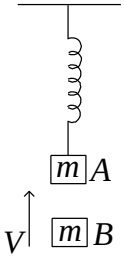


a) $t^{\frac{1}{2}}$ **b)** $t^{\frac{3}{2}}$ **c)** $t^{-\frac{3}{2}}$ **d)** $t^{-\frac{1}{2}}$

10. Potential energy of a particle is given by $U=(2x+3y+3z)J$ **. The force on the particle**

a) 8N **b)** $\sqrt{29}N$ **c)** 36 **d)** $45N$

11. Block A is having from a vertical spring and at rest block B strikes the block A with velocity and sticks to it. Then the value of v for which the spring just attains natural length is



a) $\sqrt{\frac{12mg^2}{k}}$ **b)** $\sqrt{\frac{6mg^2}{k}}$ **c)** $\sqrt{\frac{5mg^2}{k}}$ **d) none of these**

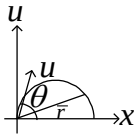
12. Two particles each of mass 0.10kg are moving with vertical 3m/sec along x-axis and 5m/sec along y-axis respectively. After an elastic collision one of the mass moves with a velocity $4i+4j$ **. The energy of other particle after collision is** $\frac{x}{10}$ **. Then x is**

a) 2 **b) 1** **c) 3** **d) 4**

13. (n-1) equal point masses each of mass m are placed at the vertices a regular n-polygon. The vacant vertex has a position vector a with respect to the centre of the polygon. The position of centre of mass is

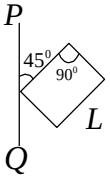
a) $-\frac{a}{(n-1)}$ **b)** $\frac{a}{(n+1)}$ **c)** $\frac{a}{n}$ **d)** $\frac{n}{a+1}$

14. A particle is projected from a point 'o' with a speed u at an angle θ **to the horizontal. Find torque of gravitational force on projectile about o at any time t. (x, y plane is vertical plane)**



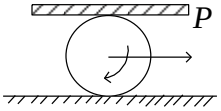
a) $mg(u\cos\theta t)$ **b)** $2mg(u\sin\theta t)$ **c)** $mg(\sin\theta t)$ **d)** $\frac{u\sin\theta t}{mg}$

15. A square is made by joining four roads each of mass M and Length L. Its moment of inertia about an axis PQ in its plane and passing through one of its corner is



a) $\frac{4}{3}ML^2$ **b)** $5ML^2$ **c)** $\frac{10}{3}ML^2$ **d)** $\frac{8}{3}ML^2$

16. A plank p is placed on a solid cylinder which rolls on horizontal surface. The two are of equal mass. There is no slipping at any of the surface in contact the ratio of the K.E of p to that of cylinder is

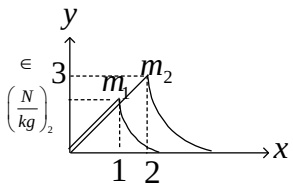


a) 1 : 1 **b) 2 : 1** **c) 1 : 2** **d) 3 : 3**

17. A stone is dropped from a height equal to 3R, above the earth surface. The velocity of stone on reaching the earth's surface is

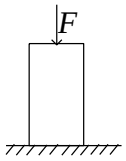
a) $\sqrt{\frac{gR}{2}}$ **b)** $\sqrt{2gR}$ **c)** $\sqrt{\frac{3gR}{2}}$ **d)** $\sqrt{gR}$

18. Two spherical bodies of mass m_1 **and** m_2 **have radii 1m and 2m respectively. The gravitational field of two bodies with the radial distance from centre is shown below the value of** $\frac{m_1}{m_2}$ **is**



a) $\frac{1}{6}$ **b)** $\frac{1}{3}$ **c)** $\frac{1}{2}$ **d)** $\frac{1}{4}$

19. A metal cylinder of length L is subjected to a uniform compressive force F as shown in the figure. The material f the cylinder has young's modulus y and poisson's ratio σ **. The change in volume of the cylinder is**



a) $\frac{\mu FL}{y}$ **b)** $\frac{(1-\sigma)FL}{y}$ **c)** $\frac{(1+2\sigma)FL}{y}$ **d)** $\frac{(1-2\sigma)FL}{y}$

20. A wire of length 1m and radius 1mm is subjected to a load. The extension is x, the wire is melted and then drawn into a wire of square cross section of side 1mm what is the extension under the same load

a) $\frac{\pi^2}{x}$ **b)** πx^2 **c)** $\pi^2 x$ **d)** πx

21. A body floats in a liquid with one fourth volume out of liquid. The same body floats in water with its one third volume of water. Find density of liquid

a) $880kg/m^3$ **b)** $780kg/m^3$ **c)** $889kg/m^3$ **d)** $989kg/m^3$

22. Two soap bubbles of radii R_1 **and** R_2 **are kept in vaccum at constant temperature. The ratio of masses of air inside then is**

a) $\frac{R_1}{R_2}$ **b)** $\frac{R_1^3}{R_2^3}$ **c)** $\frac{R_1^2}{R_2^2}$ **d)** $\frac{R_2^3}{R_1^3}$

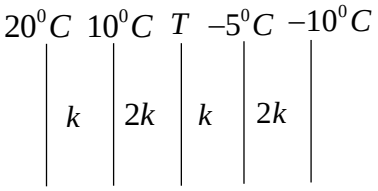
23. The volume of an air bubble becomes η **times when it rises from bottom of a water lake to its surface of the water barometer reads H. The depth of the lake is**

a) ηH **b)** $(\eta-1)H$ **c)** $\frac{H}{\eta}$ **d) none of these**

24. 6gm of steam at 100^0C **is mixed with 6gm of ice at** 0^0**C. Find the mass of steam lift uncondensed.**

a) 4gm **b) 5gm** **c) 6gm** **d) 3gm**

25. The figure shows the face and interface temperature of a composite slab containing of four layers of two materials have identical thickness. Under steady state condition the value of T is

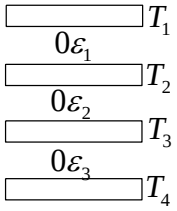


a) 5^0C **b)** 2^0C **c)** 4^0C **d)** 1^0C

26. A diatomic ideal gas is heated at constant volume until the pressure is doubled and again heated at constant volume is doubled. The average molar heat capacity for whole process is

a) $\frac{13R}{6}$ **b)** $\frac{19R}{6}$ **c)** $\frac{23R}{6}$ **d)** $\frac{17R}{6}$

27. Three carnot engine operate in series between a heat source at a temperature T_1 and a heat sink at temperature T_4 (see figure) there are two other reservoirs at temperature T_2 and T_3 as shown with $T_1 > T_2 > T_3 > T_4$. The three engines are equally efficient if



a) $T_2 = \left(T_1 T_4\right)^{\frac{1}{2}} : T_3 : \left(T_1^2 T_4\right)^{\frac{1}{3}}$ **b)** $T_2 = \left(T_1^2 T_4\right)^{\frac{1}{3}} : T_3 : \left(T_1\, T_4^2\right)^{\frac{1}{3}}$

c) $T_2 = \left(T_1\, T_4^2\right)^{\frac{1}{3}} : T_3 : \left(T_1^2 T_4\right)^{\frac{1}{3}}$ **d)** $T_2 = \left(T_1^3 T_4\right)^{\frac{1}{4}} : T_3 : \left(T_1\, T_4\right)^{\frac{1}{4}}$

28. For a gas $\frac{R}{C_V} = 0.67$ this gas is made up of molecules which are

a) diatomic **b) mixture of diatomic and polyatomic molecules**
c) monoatomic **d) polyatomic**

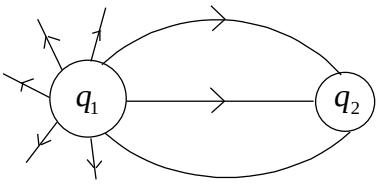
29. In a mixture of gases, the average number of degree of freedom per molecules is 6 the rms speed of the molecules of the gas is c. The velocity of sound in the gas is

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

30. A pipe of length 1m is closed at one end. The velocity of sound in air is 300m/sec. The air column in the pipe will not resonate for sound of frequency

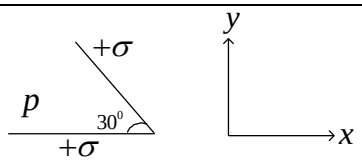
a) $75Hz$ **b)** $225Hz$ **c)** $300Hz$ **d)** $375Hz$

31. The field lines of two charges are shown in figure determine the ratio $\frac{q_1}{q_2}$



a) 2 **b) 3** **c) 4** **d) 1**

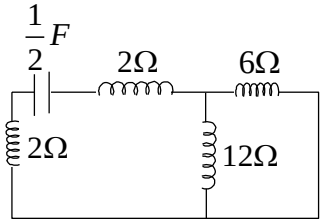
32. There are two infinite plane sheets each having uniform surface charge density $+\sigma\ c/m^2$. They are inclined to each other at an angle 30^0 as shown in the figure electric field at arbitrary point P is



a) $\frac{\sigma}{2\varepsilon_0}\left[\left(1-\frac{\sqrt{3}}{2}\right)\hat{y}-\frac{1}{2}x\right]$ **b)** $\frac{\sigma}{2\varepsilon_0}\left[\left(1+\frac{\sqrt{3}}{2}\right)\hat{y}-\frac{1}{2}\hat{x}\right]$

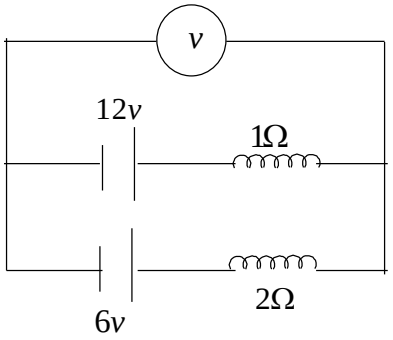
c) $\frac{\sigma}{2\varepsilon_0}\left[\left(1-\frac{\sqrt{3}}{2}\right)\hat{y}+\frac{1}{2}\hat{x}\right]$ **d)** $\frac{\sigma}{2\varepsilon_0}\left[\left(1+\frac{\sqrt{3}}{2}\right)\hat{y}+\frac{1}{2}\hat{x}\right]$

33. Find the time constant of the circuit shown in figure



a) 4sec **b) 5 sec** **c) 3sec** **d) 2 sec**

34. Two cells 12V, 1Ω and 6V, 2Ω are connected in parallel to a voltmeter V as shown find reading of voltmeter



a) 6V **b) 5V** **c) 7V** **d) 8V**

35. A line having a total resistance of 0.5Ω delivery 15kw at 240v to a small factory. The efficiency of transmission is nearly

a) 78% **b) 89%** **c) 68%** **d) 97%**

36. Electric field in space is given by $\in(t)=\in_0\left(\frac{i+j}{2}\right)\cos(\omega t+kz)$. A positively charges particle at $(0,0,\pi/k)$ is given velocity $v_0\hat{k}$ at $t=0$ direction of force acting on particle is

a) f = 0 **b) antiparallel to** $\frac{\bar{i}+\bar{j}}{2}$ **c) parallel to** $\frac{\bar{i}+\bar{j}}{\sqrt{2}}$ **d) k**

37. An electric in a circular orbit of radius r makes n rotations per second about z-axis in counter clockwise sene its magnetic moment

a) $-\pi r^2 ne\hat{k}$ **b)** $\pi r^2 ne\hat{k}$ **c)** $\frac{r^2 ne}{2\pi}\hat{i}$ **d)** $\frac{\pi}{2}r^2 ne\hat{j}$

38. When a coil carrying a steady current is short-circuited, the current in it decrease η times in time t_0, the time constant of the circuit is

a) $t_0 \ln n$ **b)** $\frac{t_0}{\ln n}$ **c)** $\frac{t_0}{2}$ **d)** $\frac{t_0}{\eta-1}$

39. If relative permittivity and relative permeability of a medium are 3 and $\frac{4}{3}$ respectively. The critical angle for this medium is

a) 45^0 **b) 60^0** **c) 30^0** **d) 15^0**

40. Three waves of same intensity (I_0) having initial phases $0, \frac{\pi}{4}, -\frac{\pi}{4}$ rad respectively interfere at a point. Find the resultant intensity

a) I_0 **b) 0** **c) $5.8I_0$** **d) $0.2I_0$**

CHEMISTRY

41. If the speed of electron in the Bohr's first orbit of hydrogen atom is x. The speed of the electron in the third orbit is

a) 9x **b) x/9** **c) x/3** **d) 3x**

42. Ionization energy of He^+ is $19.6\times10^{-18} J$ atom^{-1} the energy of the first stationary stable $(x = i)$ of Li^{2+} is

a) $8.82\times10^{-17} J/atom$ **b)** $4.41\times10^{-16} J/atom$

c) $-4.41\times10^{-17} J/atom$ **d)** $-2.2\times10^{-15} J/atom$

43. Which of the following species have the same bond order?

a) CN^- *and* CN^+ **b)** O_2^- *and* CN^-

c) NO^+ *and* CN^- **d)** CN^- *and* NO^+

44. The ratio of hybrid and unhybird orbitals involved in the bonding of a benzene molecule is

a) 3 : 2 **b) 1 : 1** **c) 3 : 1** **d) 1 : 3**

45. Air contains nitrogen and oxygen in the volume ratio of 4 : 1. The average molecular weight of air is

a) 30 **b) 28.8** **c) 28** **d) 14.4**

46. A 27^0C the ratio of the RMS velocity of ozone and oxygen molecule is

a) $\sqrt{\frac{3}{5}}$ **b)** $\sqrt{\frac{1}{4}}$ **c)** $\sqrt{\frac{4}{3}}$ **d)** $\sqrt{\frac{2}{3}}$

47. The frequency of the characteristic X-ray of K_α line of metal target M is 2500cm^{-1} and the graph between $\sqrt{V}$ vs Z is as follows then atomic number of M is

a) 49 **b) 50** **3) 51** **d) 25**

48. NaOH exhibits disproportionation reaction with

a) Al **b) HCl** **c)** H_2SO_4 **d)** Cl_2

49. The decreasing order of hydration enthalpies of alkaline earth metal ions is

a) $Be^{2+} > Mg^{+2} > Ca^{+2} > Sr^{+2} > Ba^{+2}$

b) $Be^{2+} > Ba^{+2} > Mg^{+2} > Ca^{+2} > Sr^{+2}$

c) $Ba^{2+} > Sr^{+2} > Ca^{+2} > Mg^{+2} > Be^{+2}$

d) $Be^{2+} > Ca^{+2} > Sr^{+2} > Mg^{+2} > Ba^{+2}$

50. In Al_2Cl_6, the covalency of aluminium is

a) 6 **b) 4** **c) 3** **d) 2**

51. Which of the following statement is not correct

a) CO_2 **is neither combustible nor supporter of combustion**

b) CO is a combustible gas

c) CO burns with a blue flame **d) CO_2 reduces CuO to Cu**

52. **Given that** $\frac{1}{2}S_{8(g)} + 6O_{2(g)} \rightarrow 4SO_{3(g)}; \Delta H^0 = -1590KJ$ **. The standard enthalpy of formation of** SO_3 **is**

a) $-1590KJ\ mole^{-1}$ **b)** $-397.5KJ\ mole^{-1}$

c) $-3.975KJ\ mole^{-1}$ **d)** $+397.5KJ\ mole^{-1}$

53. **The heat of atomisation of** PH_3 **is 228 K.Cal mole^{-1} and that of** $P_2H_{4(g)}$ **is 355** $K.Cal\ mole^{-1}$**. The energy of the p-p bond is**

a) 102 **b) 51** **c) 26** **d) 204**

54. **One mole of** $A_{(g)}$ **is heated to** 300^0C **in a closed one litre vessel till the following equilibrium is reached.**

$A_{(g)} \square B_{(g)}$

The equilibrium constant of the reaction at 300^0C **is 4. What is the concentration of B in mole litra^{-1} at equilibrium is**

a) 0.2 **b) 0.6** **c) 0.8** **d) 0.1**

55. **At some high temperature, KW of water is** 10^{-13} **then the pH of the water at the same temperature is**

a) 7.0 **b) 6.5** **c) 7.5** **d) 7.23**

56. **The substance which contains both sp and sp^3 hybridised carbon atom is**

a) x-butane **b) isobutene** **c) 2-butyne** **d) 1,3-butadiene**

57. **A mixture of Benzene and Toulene can be separated by**

a) Crystallisation **b) solubility** **c) distillation** **d) fractional distillation**

58. **Lassaigne's test gives a violet colourisation with sodium nitroprusside, it indicates**

a) N **b) S** **c) O** **d) Cl**

59. $C_2H_6 \xrightarrow[h\nu]{1mole\,chlorine} A \xrightarrow[KOH]{Alcoholic} B \xrightarrow[200^0C]{H_2/Ni} C$

The final product C is

a) C_2H_6 **b)** C_2H_5Cl **c)** C_2H_4 **d)** C_4H_{10}

60. **During ozonolysis of 1 mole of Benzene, number of moles of ozone consumed is**

a) 1 **b) 2** **c) 3** **d) 4**

61. **The latent heat of vaporization of water is 9700cal/mole and if the b.pt is 100^{0}C. The bullioscopic constant of water is**

a) 0.516^0C **b)** 1.026^0C **c)** 10.26^0C **d)** 1.832^0C

62. **In coagulating the colloidal solution of** Ar_2S_3 **. Which has the minimum coagulation value?**

a) NaCl **b) KCl** **c)** $BaCl_2$ **d)** $AlCl_3$

63. $I_2 + 2S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$ **, equivalent weight of iodine will be equal to**

a) M **b) M/2** **c) M/4** **d) 2M**

64. **The specific conductivity of 0.1N KCl solution is** $0.0129\Omega^{-1}Cm^{-1}$**. The resistance of the solution in the cell is** 100Ω**. The cell constant of the cell will be**

a) 1.10 **b) 1.29** **c) 0.56** **d) 2.80**

65. **Cu$^+$ ion is not stable is aqueous solution because of disproportionation reaction, E^0 value of disproportionation of Cu$^+$ is**

$\left[E^0Cu^{2+}/Cu^+ = 0.15V,\ E^0\ Cu^{+2}/Cu = 0.34V\right]$

a) -0.38V **b) +0.19V** **c) -0.49V** **d) +0.38V**

66. **20mg of C-14 has a half lift of 5760 years. 100mg of sample containing C-14 is reduced to 25mg in**

a) 57600 **b) 1440** **c) 17280** **d) 11520**

67. **In a borax bead test. The brown colour is due to**

a) Cr **b) Co** **c) Mn** **d) Fe**

68. H_2O_2 **reduces** $K_3[Fe(CN)_6]$ **in**

a) neutral solution **b) acidic solution** **c) non-polar medium** **d) alkaline medium**

69. Anhydrone a drying agent is

a) $Mg(ClO_4)_2$ **b)** $Sr(ClO_4)_2$ **c)** $Ca(ClO_4)_2$ **d)** $Ba(ClO_4)_2$

70. Among the following pair of oxides, which pair cannot be reduced by carbon to give the respective metals?

a) Fe_2O_3, ZnO **b)** CaO, K_2O **c)** PbO, Fe_3O_4 **d)** Cu_2O, SnO_2

71. The rate of a reaction becomes 4 times when temp. is raised from 293K to 313K. The activation energy for such reaction would be

a) $50.85\,KJ/Mole$ **b)** $52.84\,KJ/Mole$ **c)** $54.85\,KJ/Mole$ **d)** $56.85\,KJ/Mole$

72. The composition of the common glass is

a) $Na_2O.CaO.6SiO_2$ **b)** $Na_2O.Al_2O_3.2SiO_2$

c) $CaO.Al_2O_3.2SiO_2$ **d)** $Na_2O.CaO.Al_2O_3.6SiO_2$

73. One of the products of reaction between solid $KMnO_4$ **and** $Conc.HCl$ **is**

a) a red liquid **b)** MnO_2 **c) a greenish yellow gas** **d) HCl**

74. The one which has got the highest boiling point is

a) HCl **b) HF** **c) HBr** **d) HI**

75. Asbestos fiber has formula

a) $\left(Mg, Fe^{+2}\right)_7 Si_8O_{22}(OH)_2$ **b)** $\left(Mg, Fe^{+2}\right)_5 Si_8O_{22}OH$

c) $\left(Mg, Fe^{+2}\right)_6 Si_8O_{22}(OH)_3$ **d)** $\left(Mg, Fe^{+3}\right)_7 Si_8O_{22}(OH)_2$

76. The number of atoms in 100g of a FCC crystal with density 10g cm^{-3} and cell edges as 200pm is equal to

a) 3×10^{25} **b)** 1×10^{25} **c)** 5×10^{24} **d)** 2×10^{25}

77. When electric current is passed thorough acidified water for 1930s, 1120ml of H_2 **gas is collected (at STP) at the cathode. What is the current passed in amperes?**

a) 0.05 **b) 0.50** **c) 5.0** **d) 50**

78. Which cannot be stored in glass vessel?

a) XeF_2 **b)** XeF_4 **c)** XeF_6 **d) All of these**

79. The correct formula of Zeisse's salt is

a) $\left[PtCl_3.C_2H_6\right]^- K^+$ **b)** $\left[PtCl_2.(CH_2)_2\right]^- K^+$ **c)** $K^+\left[PtCl_3.C_2H_4\right]^-$ **d)** $\left[PtCl_3.C_6H_6\right]K^+$

80. Which of the following is paramagnetic

a) $K_4[Fe(CN)_6]$ **b)** $K_3[Fe(CN)_6]$ **c)** $Ni(CO)_4$ **d)** $[CO(NH_3)_6]Cl_3$

ENGLISH

81. Choose the word, which is most nearly the SAME in meaning as the word given in bold.
He wrote SCATHING review of the prise-winning novel

a) biased **b) scornful** **c) unbalanced** **d) subjective**

82. Choose the word, which is most OPPOSITE in meaning as the word given in bold.
I liked the poem for its LITERAL meaning.

a) deep **b) complex** **c) fictitious** **d) figurative**

83. Choose the alternative which can most appropriately replace the group of words italicized in the sentence.
The advertisement assured the public that the medicine would give back to the users, their youthful vigour and appearance

a) rejuvenate **b) restore** **c) replenish** **d) render**

84. Choose the alternative which best expresses the meaning of the given idiom /phrase
To pour oil in troubled water.

a) To foment trouble **b) to add to the trouble**

c) to instigate **d) to calm quarrel with soothing words**

85. Choose the correct sequence to arrange the parts which are labelled P, Q, R, S. So as to produce the sentence.

The broker said that

a person (*P*) **should shop carefully** (*Q*) **who buys a house** (*R*) **for the lowest interest rate** (*S*)

The proper sequence should be :

a) S P R Q b) P R Q S c) S P Q R d) P S R Q

Directions: In each of the following questions, a sentence has been given in active or passive voice. Out of the four alternatives suggested select the one which best expresses the same sentence in passive or active voice.

86. I saw him leaving the house.

a) He had been seen leaving the house
b) He was seen to be leaving the house
c) Leaving the house he was seen by me
d) He was seen leaving the house by me

87. Darjeeling grows tea.

a) Tea grows in Darjeeling
b) Tea is grown in Darjeeling
c) Let the tea be grown in Darjeeling
d) Tea is being grown in Darjeeling

Directions : Complete the sentences with suitable alternatives.

88. The police presume that neena ……there at the time of murder.

a) might have been **b) can have been**
c) should have been **d) shall have been**

89. She ……alone as it is raining heavily.

a) must not leave **b) must not have left** **c) should not have left** **d) should not left**

90. While you were young, you ……..cultivated good habits.

a) ought to **b) ought to have** **c) should have** **d) must have**

Directions : Sentences are given with blanks to be filled in with an appropriate and suitable word. Four alternatives are suggested for each question. Choose the correct alternative out of the four.

91. Are you really desirous ……..visiting Japan.

a) of **b) in** **c) to** **d) about**

92. She is very popular …….. her friends and relatives.

a) among **b) with** **c) in** **d) between**

93. Everybody complaints …….callous treatment of the police.

a) against **b) of** **c) with** **d) to**

Directions : Choose the correct conjunction from the given alternatives to complete the sentences.

94. I doubt ……..my father will help you.

a) that **b) if** **c) and** **d) unless**

95. He cannot see clearly …….he wears glasses.

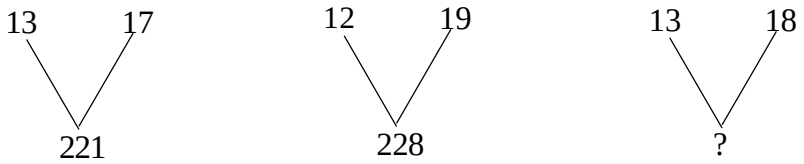
a) unless **b) but** **c) yet** **d) so**

LOGICAL REASONING

96. In a certain code TELEPHONE is written as LETHPEENO. How ALIGATORE written in that code?

a) ROTAGILAE **b) ROTAGAILE** **c) ILATAGERO** **d) ROTEGIAEL**

97. Find the missing number from the given responses



a) 31 **b) 229** **c) 234** **d) 312**

98. Find the next two letters in the given series. EFHKO?

a) T, Z **b) Z, T** **c) S, Z** **d) T,Y**

99.

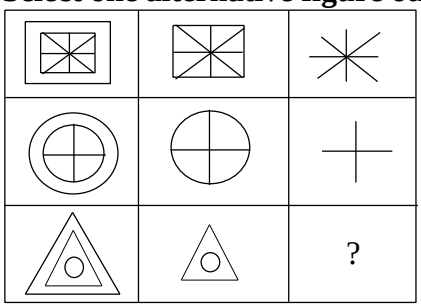
a) 127 **b) 142** **c) 158** **d) 198**

100. In the following questions, one number is missing in the series. You have to understand the pattern of the series and insert the number

83, 82, 81,……69, 60, 33.

a) 73 **b) 80** **c) 77** **d) 70**

101. Select one alternative figure out of (a), (b), (c) and (d) which completes the given matrix.



a)  b)  c)  d) 

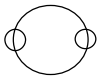
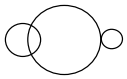
102. Kilogram is related to Quintal in the same way as paisa is related to

a) Rupee **b) coin** **c) wealth** **d) money**

103. 2,3,13,5,7,74, 11, 13 ?

a) 88 **b) 185** **c) 99** **d) 290**

104. Which represents carrot, food, vegetable?

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

105. Which one number is wrong in the given series?

5, 10, 17, 24, 37

a) 10 **b) 17** **c) 24** **d) 37**

MATHEMATICS

106. The value of $\lim_{n\to\infty}\frac{1.2+2.3+3.4+.....+n(n+1)}{n^3}$ **is**

a) -1 **b) -1** **c)** $-\frac{1}{3}$ **d)** $\frac{1}{3}$

107. If $f''(x)$ **be continuous at x = 0,** $f(0)\neq 0, f'(0)\neq 0$ **and** $\lim_{x\to 0}\frac{2f(x)-3af(2x)+bf(8x)}{\sin^2 x}$, **exists then the values of a and b are**

a) $a=\frac{7}{9}, b=\frac{1}{3}$ **b)** $a=1, b=1$ **c)** $a=b=-1$ **d)** $a=-1, b=1$

108. If $f(x+y+z)=f(x)f(y)f(z)$ **for all x, y, z and** $f(2)=4$, $f'(0)=\ln 2$ **then** $f'(2)$ **equals**

a) ln 2 **b) ln 4** **c) ln 8** **d) ln 16**

109. If $p(x)=ax^3+bx^2+cx+d$ **and** $p(O)=4, p'(O)=3, p''(O)=4, p'''(O)=6$ **then arrange the value of a, b, c, d in the descending order of their values**

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

110. At the point (2, 3) on the curve $y=x^3-2x+1$**, the gradient of the curve increases**

a) 6 times as fast as x **b) 10 times as fast as x**

c) 8 times as fast as x **d) 12 times as fast as x**

111. The tangent at the point (2, -2) to the curve $x^2y^2-2x=4(1-y)$ does not pass through the point

a) $\left(4,\frac{1}{3}\right)$ **b)** $(8,5)$ **c)** $(-4,-9)$ **d)** $(-2,-7)$

112. Let $f:[0,4]\to R$ be a differentiable function. There exist α and β in the open interval $(0,2)$ such that $\int_0^4 f(t)dt =$

a) $2[\alpha f(\alpha)+\beta f(\beta)]$ **b)** $2\left[\alpha^2 f(\alpha)+\beta^2 f(\beta)\right]$

c) $2\left[\beta^2 f(\alpha^2)+\alpha^2 f(\beta^2)\right]$ **d)** $2\left[\alpha f(\alpha^2)+\beta f(\beta^2)\right]$

113. The distance between the foci of the hyperbola $x^2-3y^2-4x-6y-11=0$

a) 4 **b) 6** **c) 8** **d) 10**

114. If the length of the major axis of an ellipse is three times the length of the minor axis then, e =

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

115. $\int e^x\left[\frac{x+4}{(x+6)^3}\right]dx =$

a) $\frac{e^x}{(x+6)^2}+c$ **b)** $e^x\frac{1}{(x+4)^2}+c$ **c)** $e^x\frac{x}{x+6}+c$ **d)** $e^x\frac{x}{(x+6)^2}+c$

116. If $I_n=\int_0^{\frac{\pi}{4}}\tan^n x\,dx$, then $\frac{1}{I_2+I_4},\frac{1}{I_3+I_5},\frac{1}{I_4+I_6},\ldots\ldots$ form

a) an A.P **b) a G.P** **c) a H.P** **d) a G.P**

117. If the area enclosed between the curves $y=Kx^2$ and $x=Ky^2$ (K>0) is 1 sq.units then K =

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

118. If $y(x)$ is the solution of the differential equation $(x+2)\frac{dy}{dx}=x^2+4x-9, x\neq -2$ and $y(0)=0$, then $y(-4)=$

a) 0 **b) 1** **c) 2** **d) -1**

119. The D.E. having solution $y=a\cos x+b\sin x+x\sin x$ is

a) $y_2+y=\cos x$ **b)** $y_2+y=\sin x$ **c)** $y_2+y=2\sin x$ **d)** $y_2+y=2\cos x$

120. A stationary value of $f(x)=x(\log x)^2$ is

a) $2e^{-2}$ **b)** $4e^{-2}$ **c)** $4e^2$ **d)** $2e^2$

121. The equation of the plane through the straight line $\frac{x-1}{2}=\frac{y+2}{-3}=\frac{z}{5}$ and perpendicular to the plane $x-y+z+2=0$ is

a) $2x-3y+5z+7=0$ **b)** $2x+3y+z+4=0$ **c)** $x-3y+z+4=0$ **d)** $2x-3y+z-4=0$

122. The equation of the line bisecting perpendicularly the segment joining the points (-4, 6) and (8, 8) is

a) $6x+y-19=0$ **b)** $y=7$ **c)** $6x+2y-19=0$ **d)** $x+2y-7=0$

123. The distance between the pair of parallel lines $x^2+y^2+2xy-8ax-8ay-9a^2=0$ is

a) $2a\sqrt{2}$ **b)** $a\sqrt{2}$ **c)** $10a\sqrt{2}$ **d)** $5a\sqrt{2}$

124. If the axes are rotated through an angle $\frac{\pi}{2}$ in the positive direction, the new coordinates of (x, y) are

a) $(-x,-y)$ **b)** $(x,-y)$ **c)** (y,x) **d)** $(y,-x)$

125. Locus represented by $x=a(\cosh\theta+\sinh\theta)$, $y=b(\cosh\theta-\sinh\theta)$ is

a) a hyperbola **b) a parabola** **c) an ellipse** **d) a straight line**

126. The points $(-4,-1),(-2,-4),(4,0),(2,3)$ taken in order are the vertices of a

a) parallelogram **b) rhombus** **c) rectangle** **d) square**

127. If the x-coordinate of P on the join of Q(2,2,1) and R(5,1,-2) is 4, then Z coordinate of P is

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

128. The d.r's of the line $x=ay+b, z=cy+d$ are

a) 1, a, c **b) a, 1, c** **c) b, 1, c** **d) c, a, 1**

129. Let n be a fixed positive integer such that $\sin\frac{\pi}{2n}+\cos\frac{\pi}{2n}=\frac{\sqrt{n}}{2}$ then

a) n = 4 **b) n = 5** **c) n = 6** **d) n = 2**

130. The value of $\tan^{-1}(1)+\cos^{-1}\left(-\frac{1}{2}\right)+\sin^{-1}\left(-\frac{1}{2}\right)$ is equal to

a) $\frac{\pi}{4}$ **b)** $\frac{5\pi}{12}$ **c)** $\frac{3\pi}{4}$ **d)** $\frac{13\pi}{12}$

131. If A+B+C=180^0 then $\frac{\cot A+\cot B+\cot C}{\cot A\cot B\cot C}$ is equal to

a) 1 **b) cotA.cotB.cotC** **c) -1** **d) 0**

132. In ΔABC. $a=2,b=3$ and $\sin A=\frac{2}{3}$. Then cosC is equal to

a) $\frac{1}{2}$ **b)** $\frac{2}{3}$ **c)** $\frac{2}{\sqrt{13}}$ **d)** $\frac{1}{\sqrt{13}}$

133. The work done by a force $4\bar{i}-3\bar{j}+2\bar{k}$ in moving a particle along a straight line from the point (3, 2, -1) to (2, -1, 4) is

a) 0 units **b) 4 units** **c) 15 units** **d) 19 units**

134. If $A=\begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix}$ and $I=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$ then the correct statement is

a) $A^2+5A-7I=0$ **b)** $-A^2+5A+7I=0$ **c)** $A^2-5A+7I=0$ **d)** $A^2+5A+7I=0$

135. If $(1+x)^n=C_0+C_1x+C_2x^2+....+C_nx^n$ is $C_0-C_1+C_2-C_3+.....+(-1)^nC_n$ is equal to

a) 3^n **b)** 2^n **c) 1** **d) 0**

136. A ladder rests against a wall so that its top touches the roof of the house. If the ladder makes an angle of 60^0 with the horizontal and height of the house be $6\sqrt{3}m$ then the length of the ladder is

a) $12\sqrt{3}m$ **b) 12m** **c)** $\frac{12}{\sqrt{3}}m$ **d)** $\frac{12}{\sqrt{2}}m$

137. Let $f:R\to R, g:R\to R$ be two functions given by $f(x)=2x-3, g(x)=x^3+5$. Then $(fog)^{-1}$ is equal to

a) $\left(\frac{x+7}{2}\right)^{\frac{1}{3}}$ **b)** $\left(x-\frac{7}{2}\right)^{\frac{1}{3}}$ **c)** $\left(\frac{x-2}{7}\right)^{\frac{1}{3}}$ **d)** $\left(\frac{x-7}{2}\right)^{\frac{1}{3}}$

138. The least value of n for which $\left(\frac{1+i}{1-i}\right)^n = 1$ is

a) 4 **b) 3** **c) -4** **d) 1**

139. If the sum of the roots of the equation $ax^2 + 2x + 3a = 0$ is equal to their product then value of a is

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

140. ${}^{n-2}C_r + 2^{n-2}C_{r-1} + {}^{n-2}C_{r-2}$ is equals

a) ${}^{n+1}C_r$ **b) ${}^{n}C_r$** **c) ${}^{n}C_{r+1}$** **d) ${}^{n-1}C_r$**

141. If $n(v) = 700, n(A) = 200, n(B) = 300$, $n(A \cap B) = 100$ then $n(A' \cap B')$ is equal to

a) 300 **b) 350** **c) 400** **d) 500**

142. The cubic equation whose roots are thrice to each of the roots of $x^3 + 2x^2 - 4x + 1 = 0$ is

a) $x^3 - 6x^2 + 36x + 27 = 0$ **b)** $x^3 + 6x^2 + 36x + 27 = 0$

c) $x^3 - 6x^2 - 36x + 27 = 0$ **d)** $x^3 + 6x^2 - 36x + 27 = 0$

143. Sum of the infinite series $1 + \frac{2}{3}.\frac{1}{2} + \frac{2}{3}.\frac{5}{6}.\frac{1}{2^2} + \frac{2}{3}.\frac{5}{6}.\frac{8}{9}.\frac{1}{2^3} + ... + \infty$ is

a) $2^{\frac{1}{3}}$ **b)** $4^{\frac{1}{3}}$ **c)** $8^{\frac{1}{3}}$ **d)** $2^{\frac{1}{5}}$

144. The amplitude of $\frac{1+i\sqrt{3}}{\sqrt{3}+i}$ is

a) $\frac{\pi}{3}$ **b) $\frac{\pi}{4}$** **c) $\frac{2\pi}{3}$** **d) $\frac{\pi}{6}$**

145. Let the homogeneous system of linear equations $px + y + z = 0$, $x + qy + z = 0$ and $x + y + rz = 0$ where $p, q, r \neq 1$ have a non-zero solutions then the value of

$\frac{1}{1-p} + \frac{1}{1-q} + \frac{1}{1-r}$ **is**

a) -1 **b) 0** **c) 2** **d) 1**

146. Range of the function $f(x) = \frac{x^2}{x^2+1}$ is

a) $(-1, 0)$ **b)** $(-1, 1)$ **c)** $(0, 1]$ **d)** $(1, 1)$

147. The number of ways four boys can be seated around a round table in four chairs of different colours is

a) 24 **b) 12** **c) 23** **d) 64**

148. If $\sin\theta = \frac{1}{2}, \tan\theta = \frac{1}{\sqrt{3}}$ $\forall n \in I$, then most general values of θ is

a) $2n\pi + \frac{\pi}{6}$ $\forall n \in I$ **b)** $2n\pi + \frac{\pi}{4}$ $\forall n \in I$ **c)** $2n\pi + \frac{\pi}{3}$ $\forall n \in I$ **d)** $2n\pi + \frac{\pi}{3}$ $\forall n \in I$

149. If $\bar{r}.\bar{a} = 0, \bar{r}.\bar{b} = 0$ and $\bar{r}.\bar{c} = 0$ for some non-zero vector $\bar{r}$ then the value of $\left[\bar{a}\ \bar{b}\ \bar{c}\right]$ is

a) 0 **b) $\frac{1}{2}$** **c) 1** **d) 2**

150. If $\alpha + \beta = -2$ and $\alpha^3 + \beta^3 = -56$ then the quadratic equation whose roots are α and β is

a) $x^2 + 2x - 16 = 0$ **b)** $x^2 + 2x + 15 = 0$ **c)** $x^2 + 2x - 12 = 0$ **d)** $x^2 + 2x - 8 = 0$

KEY SHEET
PHYSICS

1) **b** 2) **b** 3) **b** 4) **d** 5) **c** 6) **c** 7) **a** 8) **a** 9) **b** 10) **b**

11) **b** 12) **b** 13) **a** 14) **a** 15) **d** 16) **d** 17) **c** 18) **a** 19) **d** 20) **c**

21) **c** 22) **c** 23) **b** 24) **a** 25) **a** 26) **b** 27) **b** 28) **c** 29) **c** 30) **c**

31) **b** 32) **a** 33) **a** 34) **a** 35) **b** 36) **b** 37) **a** 38) **b** 39) **c** 40) **c**

CHEMISTRY

41) **c** 42) **c** 43) **c** 44) **a** 45) **b** 46) **d** 47) **c** 48) **d** 49) **a** 50) **b**

51) **d** 52) **b** 53) **b** 54) **c** 55) **b** 56) **c** 57) **d** 58) **b** 59) **a** 60) **c**

61) **a** 62) **c** 63) **a** 64) **d** 65) **b** 66) **d** 67) **d** 68) **d** 69) **a** 70) **b**

71) **b** 72) **a** 73) **c** 74) **b** 75) **a** 76) **c** 77) **c** 78) **c** 79) **c** 80) **b**

ENGLISH & LOGICAL REASONING

81) **b** 82) **d** 83) **a** 84) **d** 85) **b** 86) **d** 87) **b** 88) **a** 89) **a** 90) **c**

91) **a** 92) **b** 93) **b** 94) **b** 95) **a** 96) **c** 97) **c** 98) **a** 99) **b** 100) **c**

101) **d** 102) **a** 103) **d** 104) **a** 105) **c**

MATHEMATICS

106) **d** 107) **a** 108) **d** 109) **c** 110) **d** 111) **d** 112) **d** 113) **c** 114) **d** 115) **a**

116) **a** 117) **d** 118) **a** 119) **d** 120) **b** 121) **b** 122) **a** 123) **d** 124) **d** 125) **a**

126) **c** 127) **c** 128) **b** 129) **c** 130) **c** 131) **a** 132) **b** 133) **c** 134) **c** 135) **d**

136) **b** 137) **d** 138) **a** 139) **a** 140) **b** 141) **a** 142) **d** 143) **b** 144) **d** 145) **d**

146) **c** 147) **a** 148) **a** 149) **a** 150) **d**

HINTS AND SOLUTIONS

PHYSICS

1. $\frac{C}{R}=T$

   $CV=q=[AT]$

   $\frac{L}{RCV}=\frac{T}{AT}=\left[A^{-1}\right]$

2. Pitch = $\frac{3}{6}=0.5mm$

   $L.C=\frac{0.5mm}{50}=\frac{1}{100}mm=0.001cm$

3. The time taken to move net 2 steps (5 steps forward and 3 steps backward) is 8s and so for 8 steps he take 32sec in last 5 steps he will take 5sec full in to pit

   $\therefore T=32+5=37\sec$

4. $x=a\cos\pi t$ represent periodic motion with a period $T=\frac{2\pi}{w}=\frac{2\pi}{\pi}=2\sec$. Thus in 0.5sec it covers a distance a. So in 2.5sec it covers a distance 5sec.

5. If using $|\bar{A}-\bar{B}|\leq|\bar{C}|\leq|\bar{A}+\bar{B}|$

   In option 3) let A= 6 and B = 9

   Then $\left(\bar{A}-\bar{B}\right)=3$ and $\left(\bar{A}+\bar{B}\right)=6+9=15$

   As $|\bar{C}|=15$ lies from 3 to 15

   Therefore option 3 is correct

6. If V is the required velocity, then its horizontal component of when it hits the plane is vcos30^0, so $v\cos30^0=4\sqrt{2}\cos45^0$

   $v\frac{\sqrt{3}}{2}=4\sqrt{2}\times\frac{1}{\sqrt{2}}$

   $v=\frac{2u}{\sqrt{3}}$

7. $a=\frac{unbaned\ load}{total\ mass}$

   $a=\frac{\left(4g+4g\sin30^0\right)-29}{4+8+4+2}=\frac{49}{18}=\frac{25}{9}m/\sec^2$

8. If μ the COF between the blocks then acceleration of these blocks can be μ_g

   $mg-T=m(\mu g)$ …….1)

   $T=3m\mu g$ ……..2)

   Solve 1) and 2) then $\mu=\frac{1}{4}$

9. $P=M\,L^2\,T^{-3}$

   $L\propto T^{\frac{3}{2}}$

10. $\bar{F}=-\left(\frac{du}{dx}\bar{i}+\frac{du}{dy}\bar{j}+\frac{du}{dz}\bar{k}\right)$

11. The initial extension on in spring $x_0=\frac{mg}{k}$. Tust ofter collision the speed of combined mass becomes $\frac{v}{2}$

Using conservation of $M \in$ we have

$$\left(\frac{1}{2}\right)(2m)\left(\frac{v}{2}\right)^2+\frac{1}{2}k\left(\frac{mg}{k}\right)^2=2mg\left(\frac{mg}{k}\right)$$

$$v=\sqrt{\frac{6mg^2}{k}}$$

12. for elastic collision $k.\in_i = k.\in_f$

$$\frac{1}{2}m\times 25+\frac{1}{2}m\times 9=\frac{1}{2}m\times 32+\frac{1}{2}mv^2$$

$$34=32+v^2$$

$$k.e=\frac{1}{2}\times 0.1\times 2=0.1J=\frac{1}{10}$$

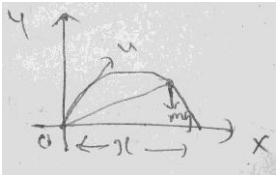
$$x=1$$

13. Centre of mass of whole system lies at the centre so

$$r_{cm}=\frac{nm\times 0-mg}{nm-m}=\frac{-ma}{m(n-1)}=\frac{-a}{n-1}$$

14. $T=mgx$

$$=mg\left(u\cos\theta t\right)$$



15. $$I=2\left(\frac{2M(\sqrt{2}L)^2}{3}\right)=\frac{8}{3}ML^2$$

16. If V is the velocity of CM then

$$K_{plank}=\frac{1}{2}m(2v)^2 = 2mv^2$$

And $k_{cylinder}=\frac{3}{4}mv^2$

Ratio $\frac{k_{plank}}{k_{cylinder}}=\frac{2mv^2}{\frac{3}{4}mv^2}=\frac{8}{3}$

17. using $\frac{mgh}{\left(1+\frac{h}{R}\right)}=\frac{1}{2}mv^2$

$$\frac{mg(3R)}{\left(1+\frac{3R}{R}\right)}=\frac{1}{2}mv^2$$

$$\frac{3gR}{4}=\frac{1}{2}v^2$$

$$v=\sqrt{\frac{3gR}{2}}$$

18. $4=\frac{Gm_2}{2^2}$.....1) from the dig.

$$2=\frac{Gm_1}{1^2}.....2)$$

$$\frac{3}{2}=\frac{1}{4}\frac{m_2}{m_1}$$

$$\frac{m_1}{m_2}=\frac{1}{6}$$

19. using $\frac{\Delta V}{V}=\frac{\Delta L}{L}(1-2\sigma)$

$$\Delta L=\frac{FL}{AY}$$

$$\frac{\Delta V}{V}=\frac{F}{AY}(1-2\sigma)$$

$$\Delta V=(1-2\sigma)\frac{FL}{Y}$$

20. $\pi(1)^2\times 1=1^2\times l\Rightarrow l=\pi$

Using $\Delta l=\frac{Fl}{AY}$

$$\frac{\Delta l_1}{\Delta l_2}=\frac{l_1}{l_2}\times\frac{A_2}{A_1}=\frac{1}{\pi}\times\frac{1}{\pi(l)^2}$$

$$\Delta l_1=\frac{1}{\pi^2}\Delta l_2$$

$$\Delta l_2=\pi^2 x$$

21. density of body $\rho_b=\frac{3}{4}\rho_1$

And $l_b=\frac{2\rho_w}{3}=\frac{2000}{3}kg/m^3$

$$\rho_l=\frac{4}{3}l_b=\frac{4}{3}\times\frac{2000}{3}=889\,kg/m^3$$

22. using $PV=nRT=\frac{m}{M}RT$

$$\frac{M_1}{M_2}=\frac{P_1V_1}{P_2V_2}\frac{\left(\frac{4T}{R_1}\right)\times\frac{4}{3}\pi R_1^3}{\left(\frac{4T}{R_2}\right)\times\frac{4}{3}\pi R_2^3}$$

$$\frac{M_1}{M_2}=\frac{R_1^2}{R_2^2}$$

23. using $P_1V_1=P_2V_2$

$$(H+h)v=H\times(\eta v)$$

$$h=(\eta-1)H$$

24. using heat lost = heat gained

$$m\times 540=6\times 80+6\times 1\times(100-0)$$

$$m=2gm$$

Mass of steam left uncondensed = 6.2 = 49m

25. For first two layers

$$H_1=H_2$$

$$\frac{kA(20-10)}{l}=\frac{2kA(10-T)}{l}$$

$T = 5^0 C$

26. $\Delta Q = C_V \Delta T + C_P \Delta T$

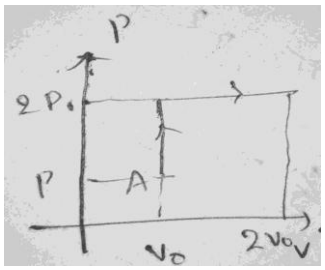
$= \frac{5R}{2}(2T_0 - T_0) + \frac{7R}{2}(4T_0 - 2T_0)$

$= \frac{19}{2} RT_0$

Total change in temperature from A to C

$\Delta T = 4T_0 - T_0 = 3T_0$

$C = \frac{\Delta Q}{\Delta T} = \frac{\frac{19}{2} RT_0}{3T_0} = \frac{19}{6} R$



27. According to equation $\eta_1 = \eta_2 = \eta_3$

$1 - \frac{T_2}{T_1} = 1 - \frac{T_3}{T_2} = 1 - \frac{T_4}{T_3}$

$\frac{T_2}{T_1} = \frac{T_3}{T_2} = \frac{T_4}{T_3}$

$T_2 = \sqrt{T_1 T_3} = \sqrt{T_1 \sqrt{T_2 T_4}}$

$T_3 = \sqrt{T_2 T_4}$

$T_2^{3/4} = \sqrt{T_1^{\frac{1}{2}} T_4^{\frac{1}{3}}}$

28. $\frac{R}{CV} = 0.67,\ CV = \frac{R}{0.67} = \frac{3R}{2}$

They gas is monoatomic.

29. using $r = 1 + \frac{2}{f} = 1 + \frac{2}{6} = \frac{4}{3}$

$C = \sqrt{\frac{3p}{\rho}}$ *and* $V = \sqrt{\frac{rp}{\rho}}$

$V = c\sqrt{\frac{r}{3}} = c\sqrt{\frac{4/3}{3}} = \frac{2c}{3}$

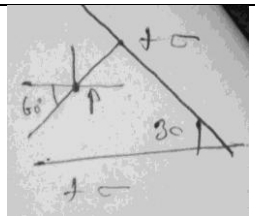
30. $f = \frac{v}{2l} = \frac{300}{4 \times 1} = 75Hz$

The resonance frequencies are in the ratio 1 : 3 : 5.

31. The field lines emerge from q_1 are 12 which terminating towards q_2 are is so $\frac{q_1}{q_2} = \frac{12}{4} = 3$

32. $\bar{\in} = \frac{\sigma}{2\varepsilon_0} \cos 60(-\hat{x}) + \left[\frac{\sigma}{2\varepsilon_0} - \frac{\sigma}{2\varepsilon_0} \cos 60\right] \hat{y}$

$\bar{\in} = \frac{\sigma}{2\varepsilon_0} \left(\left(1 - \frac{\sqrt{3}}{2}\right) \hat{y} - \frac{1}{2} \hat{x} \right)$



33. $R_{net} = \frac{6\times12}{6+12} + 2 + 2 = 8\Omega$

$T_{net} = R_{net}C_{net}$

$= 8\times\frac{1}{2} = 4\text{sec}$

34. Using $V = \frac{\varepsilon_1 r_2 - \varepsilon_2 r_1}{r_1 + r_2} = \frac{12\times2 - 6\times1}{2+1}$

$= \frac{24-6}{3} = \frac{18}{3} = 6v$

35. power loss $= i^2R = (62.5)^2 \times 0.5 = 2\times10^3 w$

Power produced = 12 +2 = 17kw

Efficiency $= \frac{p_{out}}{p_{in}}\times100 = \frac{15}{17}\times100 = 89\%$

36. Force due to electric field in direction

$-\left(\frac{\bar{i}+\bar{j}}{\sqrt{2}}\right)$

Because at t = 0 $\in = -\left(\frac{\bar{i}+\bar{j}}{\sqrt{2}}\right)\in_0$

Force due to magnetic field is in direction $q(\bar{V}\times\bar{B})$ *and* $\bar{V} \| \bar{K}$ *it is*$\|$ *el to* $\in$

Net force is antiparallel to $\left(\frac{\bar{i}+\bar{j}}{\sqrt{2}}\right)$

37. $i = \frac{e}{T} = ne$

$\bar{\mu} = iA = ne(nr^2)(-k)$

38. using $i = i_0e^{-t/\tau}$

$\frac{i_0}{\eta} = i_0\ e^{-t/\tau}$

$to = \tau\ln\eta$

$\tau = \frac{t_0}{\ln 2}$

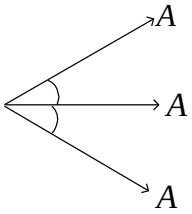
39. $V = \frac{1}{\sqrt{\mu\varepsilon}}$

$\eta = \sqrt{\mu_r\varepsilon_r} = 2$

$Smc = \frac{1}{2}$

$c = 30^0$

40.



$A_R = \left(\sqrt{2}+1\right)A$

$I_R = \left(\sqrt{2}+1\right)^2 I_0$

$= \left(3+2\sqrt{2}\right)I_0$

$= 5.8I_0$

CHEMISTRY

41. $V_x = \dfrac{2.18\times10^8}{n}(Z)cm\sec^{-1}$

$\therefore \dfrac{V_1}{V_2} = \dfrac{n_2}{n_1}$

$\dfrac{x}{V_2} = \dfrac{3}{1}$

$\therefore\ V_2 = \dfrac{x}{3}$

42. $E_n = \dfrac{-2.18\times10^{-18}}{x^2}(Z)/atom$

$$\frac{(I.E)_{Li^{+2}}}{(I.E)He^+} = \frac{\dfrac{-2.18\times10^{-18}}{x^2}(Z)^2}{\dfrac{-2.18\times10^{-18}}{x^2}(Z)^2} = \frac{3^2}{2^2} = \frac{1}{4}$$

$(I.E)_{Li^{+2}} = \dfrac{2}{4}\times(I.E)_{He^+}$

$(I.E)_{Li^{+2}} = \dfrac{9}{4}\times19.6\times10^{-18}\,J/atom$

$= 45.6\times10^{-18}\,J/atom$

$= 4.56\times10^{-17}\,J/atom$

43. $NO^+ = \dfrac{10-4}{2} = \dfrac{6}{2} = 3$

$CN^- = \dfrac{10-4}{2} = \dfrac{6}{2} = 3$

44. Benzene (C_6H_6)

Hybrid orbitals : unhybrid orbitals

$6\times(3)_{sp^2} : 6_{(H)} + 6_{(\pi i)}$

18 : 12

3 : 2

45. Average molecular weight = $\frac{(4\times 28)+(1\times 32)}{4+1}$

$=\frac{112+32}{5}=\frac{144}{5}=28.8$

46. $C=\sqrt{\frac{3RT}{M}}$

$\frac{C_1}{C_2}=\sqrt{\frac{M_2}{M_1}}=\sqrt{\frac{32}{48}}=\sqrt{\frac{2}{3}}$

47. $\sqrt{\nu}=a(Z-b)$

$\sqrt{2500}=(Z-1)$

$\left[\because OA=1\right]$

$\left[a=b=1\right]$

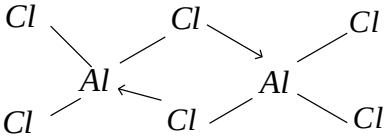
$50=Z-1$

$\therefore Z=50+1=51$

48. $2NaOH_{(dil)}+Cl_2^{O}\rightarrow NaCl^{-1}+NaOCl^{+1}+H_2O$

49. Hydration enthalpies decreases from top to bottom in Alkaline earth metals.

50. Al_2Cl_6 exists as Dimer



51. Conceptual

52. $\Delta H_f=\frac{-1590}{4}=-397.5\ KJ/mole^{-1}$ of 1 mole of SO_3

53. P – H bond energy in PH_3 = $\frac{228}{3}=76$

The energy of P-P bond in P_2H_4

$=total\ heat+4(P-H)$

$=355-4(76)=51$

54. $A_{(g)} \rightleftharpoons B_{(g)}$

1 0

1-x x

0.2 0.8 mol lit^{-1}

$K=\frac{[B]}{[A]}$

$4=\frac{x}{1-x}$

$\therefore 4-4x=x$

$4=5x$

$x=\frac{4}{5}=0.8 mole\ lit^{-1}$

55. $Kw=\left[H^+\right]\left[OH^-\right]$

$\left[H^+\right]=\left[OH^-\right]=6.5$

$pH=6.5$

56.

$$\overset{1}{H_3C}-\overset{2}{C}\equiv\overset{3}{C}-\overset{4}{CH_3}$$

$2-Butyne$

1, 4 – carbons – sp^3

2, 3 – carbons – sp

57. Benzene B.P is 78^0C

ToluneB.P is 110^0C

The difference of B.P is less than 40^0C use fractional distillation process for separation

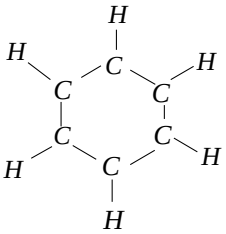
58. conceptual

59.

$$C_2H_6 \xrightarrow{Cl_2} C_2H_5Cl \xrightarrow[KOH]{Alcoholic} C_2H_4 \xrightarrow[200^0C]{H_2/Ni} C_2H_6$$

$$(-HCL)\ (H_2C=CH_2)\ \ (CH_3-CH_3)$$

60. Benzene contains three alternate double bonds. Three double bonds can break by using three moles of Ozone to form three moles of Glyoxal.



$$+3O_3 \xrightarrow{H_2O/Zn} \begin{matrix} CHO \\ | \\ CHO \end{matrix} +3H_2O_2$$

61. $$K_b=\frac{R.T_b^2}{1000.L_V}=\frac{2\times373\times373\times18}{1000\times9700}$$

$$=0.516^0C$$

62. Conceptual

63.

$$\overset{0}{I_2}+2\overset{-2}{S_2}\overset{-1}{O_3}\rightarrow 2\overset{-2}{I^-}+\overset{}{S_4O_+}$$

Decrease in O.N of iodine per molecule

= 2 x 1 = 2

Equivalent weight = $\frac{M}{2}$

64. $K=\frac{1}{R}\times Cell$ constant

$Cell$ constant=K×R = $0.0129\times100=1.29$

65. $$E^0\ Cu^+/Cu^{+2},Cu=E^0\ Cu^+/Cu^{+2}+E^0_{Cu^{+2}}/Cu$$

$$=E^0\ Cu^{+2}/Cu^+ + E^0_{Cu^{+2}}/Cu$$

$$=0.15+0.34=0.19V$$

66. $$N=N_0\left(\frac{1}{2}\right)^{\frac{t}{tr_{12}}}$$

$$\frac{25}{100}=\left(\frac{1}{2}\right)^{\frac{t}{5760}}$$

$$\left(\frac{1}{2}\right)^2=\left(\frac{1}{2}\right)^{\frac{t}{5760}}$$

$t = 2 \times 5760 = 11520$ *years*

67. conceptual
68. conceptual
69. Magnesium perchlorate is also called anhydrone
70. Conceptual
71. $\log \frac{K_2}{K_1} = \frac{E_a}{2.303}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$

$\log \frac{4}{1} = \frac{E_a}{2.303 \times 8.314}\left[\frac{313-293}{293 \times 313}\right]$

$E_9 = 52848.6\ J/mole$

$= 52.84\ KJ/mole$

72. conceptual
73. Conceptual
74. conceptual
75. conceptual
76. $d = \frac{Z.M}{n.a^3}$

$n = \frac{Z.M}{da^3} = \frac{4 \times 100}{10 \times \left(200 \times 10^{-10}\right)^3} = \frac{40}{8 \times 10^{-24}} = 5 \times 10^{24}$

77. $2H^+ 2O^O \rightarrow H_2$

No.of moles of hydrogen collected = $\frac{1120 \times 10^{-3}}{22.4} = 0.05$

1 mole of hydrogen is deposited by $= 2$ *moles of* e^-

0.05 mole ……?

$= 2 \times 0.05 = 0.10$

$Q = nF = 0.1 \times 96500$

$Q = jt$

$0.1 \times 96500 = i \times 1930$

$i = \frac{9650}{1930} = 5A$

78. XeF_6 reacts with silica of glass and produces $XeOF_4$
79. Conceptual
80. $K_3\left[Fe(CN)_6\right]$ has an U.P.e$^-$ in Fe-atom

LOGICAL REASONING

HINTS

96.

$T\ E\ L\ E\ P\ H\ O\ N\ E$

$L\ E\ T\ H\ P\ E\ E\ N\ O$

Similarly

$A\ L\ I\ G\ A\ T\ O\ R\ E$

$I\ L\ A\ T\ A\ G\ E\ R\ O$

97.

$13 \times 17 = 221$

$12 \times 19 = 228$

similarly $13 \times 18 = 234$

98. The pattern of the series is

E F H K O T Z
+1 +2 +3 +4 +5 +6

99. $(101+15)-(43+35)=116-78=38$

$\therefore (48+184)-(34+56)=232-90=142$

100. Series is written in reverse order with a difference of $1^2,1^3,2^2,2^3,3^2,3^3$
i.e. 1, 1, 4, 8, 9, 27.

101. Missing figure should be the inner part of the second figure in the third row.
i.e. a small circle

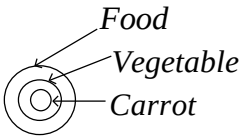
102. Second is a bigger unit than the first, though both are used to measure the same quantity.

103. $2^2+3^2=13$

$5^2+7^2=74$

$11^2+13^2=290$

104.



105. The pattern of the series is

26

5 10 17 24 37

2^2+1 3^2+1 4^2+1 5^2+1 6^2+1

MATHS

106. $\underset{n\to\infty}{Lim}\dfrac{\sum_{r=1}^{n} r(r+1)}{n^3}$

$=\underset{n\to\infty}{Lim}\dfrac{\frac{n(n+1)(2n+1)}{6}+\frac{n(n+1)}{2}}{n^3}$

$=\underset{n\to\infty}{Lim}\dfrac{n(n+1)(n+2)}{3n^3}=\dfrac{1}{3}$

107. As $x\to 0$, denominator $\to 0$

$\therefore \lim_{x\to 0} 2f(x)-3a\,f(2x)+bf(8x)=0$

$\Rightarrow 2-3a+b=0$

$\Rightarrow 3a-b-2=0$ .....1)

$\lim_{x\to 0} 2f'(x)-6af'(2x)+8bf'(8x)=0$

$\Rightarrow 2-6a+8b=0$

$\Rightarrow 3a-4b-1=0$ .....2)

From 1) and 2)

$a=\dfrac{7}{9}, b=\dfrac{1}{3}$

108. $f(x+y+z)=f(x)f(y)f(z)$

Put x = 0, y = 0, z = 0

$f(0+0+0)=f(0)f(0)f'(0)$

$f(0)\left[1-(f(0))^2\right]=0$

$\Rightarrow f(0)=1$

Given $f(2)=4, f'(0)=\ln 2$

$\Rightarrow f(2) = 2^x$

$f'(x) = 2^x \ln 2$

$f'(2) = 2^2 \ln 2 = \ln 16$

109. $p(x) = ax^3 + bx^2 + cx + d$

$p(0) = 4 \Rightarrow d = 4$

$p'(x) = 3ax^2 + 2bx + c$

$p'(0) = 3 \Rightarrow c = 3$

$p''(x) = 6ax + 2b$

$p''(0) = 4 \Rightarrow 2b = 4 \Rightarrow b = 2$

$p'''(0) = 6 \Rightarrow 6a = 6 \Rightarrow a = 1$

Descending order d, c, b, a

110. gradient $m = \frac{dy}{dx} = 3x^2 - 2$

$\frac{dm}{dt} = 6x\frac{dx}{dt}$

$\left(\frac{dm}{dt}\right)_{(2,3)} = 12\frac{dx}{dt}$

111. $S = x^2y^2 - 2x - 4 + 4y$

$\frac{dy}{dx} = \frac{-\frac{\partial s}{\partial x}}{\frac{\partial s}{\partial y}} = \frac{-\left(2xy^2 - 2\right)}{\left(2x^2y + 4\right)}$

$m = \left(\frac{dy}{dx}\right)_{(2,-2)} = \frac{-(14)}{-12} = \frac{7}{6}$

Equation of tangent $y + 2 = \frac{7}{6}(x - 2)$

$6y + 12 = 7x - 14$

$7x - 6y = 26$

Option 4) does not satisfy.

112. Let $f(x) = \int_0^{x^2} f(t)\,dt \quad for\, x \in [0,2]$

F(x) is continuous and differentiable on $[0,2]$

And $F'(x) = 2xf(x^2)$

Using LMVT for $f(x)$ on [0, 1] and [1, 2] there exist $\alpha \in (0,1)$ and $\beta \in (1,2)$ such that

$F'(\alpha) = \frac{F(1) - F(0)}{1 - 0}$

$F'(\alpha) = F(1) - F(0)$.....1)

And $F'(\beta) = \frac{F(2) - F(1)}{2 - 1}$

$F'(\beta) = F(2) - F(1)$.....2)

Adding 1) and 2)

$F(2) - F(0) = F'(\alpha) + F'(\beta)$

$= 2\alpha f(\alpha^2) + 2\beta f\left(\beta^2\right)$

$= 2\left(\alpha f\left(\alpha^2\right) + \beta f\left(\beta^2\right)\right)$

113. $x^2-4x-3y^2-6y-11=0$

$x^2-4x-3(y^2+2y)-11=0$

$(x-2)^2-4-3\left((y+1)^2-1\right)-11=0$

$(x-2)^2-3(y+1)^2=12$

$\frac{(x-2)^2}{12}-\frac{(y+1)^2}{4}=1$

$a^2=12\Rightarrow a=2\sqrt{3}$

$b^2=4\Rightarrow b=2$

$e=\sqrt{\frac{12+4}{12}}=\sqrt{\frac{16}{12}}=\sqrt{\frac{4}{3}}=\frac{2}{\sqrt{3}}$

Distance between foci = 2ae

$=2\left(2\sqrt{3}\right)\frac{2}{\sqrt{3}}=8$

114. $2a=3(2b)$

$a=3b$

$a^2=9b^2$

$a^2=9a^2(1-e^2)$

$1-e^2=\frac{1}{9}\Rightarrow e^2=\frac{8}{9}\Rightarrow e=\frac{2\sqrt{2}}{3}$

115. $\int e^x\left[\frac{x+6-2}{(x+6)^3}\right]dx=\int e^x\left(\frac{1}{(x+6)^2}-\frac{2}{(x+6)^3}\right)dx$

$=\frac{e^x}{(x+6)^2}+c$

116. $I_n+I_{n+2}=\frac{1}{n+1}$

$I_2+I_4=\frac{1}{3}\Rightarrow\frac{1}{I_2+I_4}=3$

$I_3+I_5=\frac{1}{4}$

$I_4+I_6=\frac{1}{5}$

117. area enclosed between the curves $y^2=4ax$ and $x^2=4by$ is $\frac{16ab}{3}$

$\therefore\frac{16\left(\frac{1}{4K}\right)\left(\frac{1}{4K}\right)}{3}=1$

$\Rightarrow K^2=\frac{1}{3}\Rightarrow K=\frac{1}{\sqrt{3}}$

118. $\frac{dy}{dx}=\frac{(x+2)^2-13}{x+2}$

$dy=\left[(x+2)-\frac{13}{x+2}\right]dx$

$y=\frac{x^2}{2}+2x-13\log|(x+2)|+c\ldots\ldots\ldots1)$

Given $y(0)=0$

$\Rightarrow 0+0-13\log 2+c=0$

$\Rightarrow c=13\log 2$

Sub. In 1)

$y(x)=\frac{x^2}{2}+2x-13\log|(x+2)|+13\log^2$

$y(-4)=\frac{16}{2}-8-13\log 2+13\log 2$

$y(-4)=0$

119. $y_1=-a\sin x+b\cos x+x\cos x+\sin x$

$y_2=-a\cos x-a\sin x-x\sin x+\cos x+\cos x$

$y_2=-y+2\cos x$

$y_2+y=2\cos x$

120. $f'(x)=x.(2\log x).\frac{1}{x}+(\log x)^2$

$\Rightarrow(\log x)(2+\log x)=0$

$\Rightarrow \log x=0,\log x=-2$

$\Rightarrow x=1,x=e^{-2}$

$f(e^{-2})=e^{-2}\left(\log e^{-2}\right)^2=4e^{-2}$

121. Let the equation of the plane through the line be $a(x-1)+b(y+2)+cz=0$ .....1)

Then $2a-3b+5c=0$ .....2)

And $a-b+c=0$ .....3)

From 2) and 3)

$\frac{a}{2}=\frac{b}{3}=\frac{c}{1}$

Required plane is

$2(x-1)+3(y+2)+z=0$

$2x+3y+z+4=0$

122. $let\ A=(-4,6),B=(8,8)$

Midpoint = $=\left(\frac{-4+8}{2},\frac{6+8}{2}\right)=(2,7)$

Slope of AB = $\frac{8-6}{8+4}=\frac{2}{12}=\frac{1}{6}$

Slope of perpendicular line = -6

Equation of required line is $6x+y-19=0$

123. $h=1,g=-4a,f=-4a,c=-9a^2$

$a=1,b=1$

$dis\tan ce=2\sqrt{\frac{g^2-ac}{a(a+b)}}$

$=2\sqrt{\frac{16a^2+9a^2}{1(1+1)}}=5a\sqrt{2}$

124. $X=x\cos\frac{\pi}{2}+y\sin\frac{\pi}{2}$

$X=y$

$Y = -x\sin\frac{\pi}{2} + y\cos\frac{\pi}{2}$

$Y = -x$

125. $xy = ab\left(\cosh^2\theta - \sinh^2\theta\right)$

$xy = ab$

126. $AB = \sqrt{13}, BC = \sqrt{52}$

Slope of AB = $-\frac{3}{2}$

Slope of $BC = \frac{2}{3}$

$AC = BD = \sqrt{65}$

127. using $\frac{x_1 - x_2}{x_2 - x_3} = \frac{z_1 - z_2}{z_2 - z_3}$

$\Rightarrow \frac{4-2}{2-5} = \frac{z_1 - 1}{1+2}$

$\Rightarrow \frac{2}{-3} = \frac{z_1 - 1}{3}$

$\Rightarrow z_1 - 1 = -2$

$\Rightarrow z_1 = -1$

128. $x = ay + b \Rightarrow \frac{x-b}{a} = y$ .....1)

$z = cy + d \Rightarrow \frac{z-d}{c} = y$ .....2)

From 1 and 2

$\frac{x-b}{a} = \frac{y-0}{1} = \frac{z-d}{c}$

D.r's are (a, 1, c)

129. $\sin\frac{\pi}{2n} + \cos\frac{\pi}{2n} = \sqrt{2}\sin\left(\frac{\pi}{4} + \frac{\pi}{2n}\right)$

$\Rightarrow \frac{\sqrt{n}}{2} = \sqrt{2}\sin\left(\frac{\pi}{4} + \frac{\pi}{2n}\right)$

So far n > 1,

$\frac{\sqrt{n}}{2\sqrt{2}} = \sin\left(\frac{\pi}{4} + \frac{\pi}{2n}\right) > \sin\frac{\pi}{4} = \frac{1}{\sqrt{2}}$

Or n > 4

Since $\sin\left(\frac{\pi}{4} + \frac{\pi}{2n}\right) < 1$ *for all* $n > 2$

We get $\frac{\sqrt{n}}{2\sqrt{2}} < 1$ *as* $n < 8$

So that $4 < n < 8$. By actual verification we find that only n = 6 satisfies the given relations.

130. $\tan^{-1}(1) + \cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\left(-\frac{1}{2}\right)$

$= \frac{\pi}{4} + \frac{2\pi}{3} - \frac{\pi}{6} = \frac{3\pi}{4}$

131. since $A + B + C = 180^0$

$$\cot(A+B+C)=\frac{\sum\cot A\cot B-1}{\cot A\cot B\cot C-\sum\cot A}=\frac{1}{0}$$

$$\Rightarrow \cot A\cot B\cot C-\sum\cot A=0$$

$$\frac{\cot A+\cot B+\cot C}{\cot A\cot B\cot C}=1$$

132. $a=2, b=3, \sin A=\frac{2}{3}$

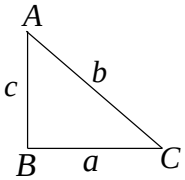
$$\Rightarrow \sin^2 A=\frac{4}{9}$$

$$\cos^2 A=1-\sin^2 A=\frac{5}{9}$$

$$\cos A=\frac{\sqrt{5}}{3}$$

By sine rule, $\frac{\sin A}{a}=\frac{\sin B}{b}$

$$\Rightarrow \frac{2}{3}\times\frac{1}{2}=\frac{\sin B}{3}$$



$\sin B=1\Rightarrow B=90^0$

In ΔABC, $\cos C=\frac{a}{b}=\frac{2}{3}$

133. Workdone = (force.displacement)

$$=\left(3\bar{i}-34\bar{j}+2\bar{k}\right)\left\{\left(2\bar{i}-\bar{j}+4\bar{k}\right)-\left(3\bar{i}+2\bar{j}-\bar{k}\right)\right\}$$

$$=\left(4\bar{i}-3\bar{j}+2\bar{k}\right).\left(-\bar{i}-3\bar{j}+5\bar{k}\right)$$

$$=\left(-4+9+10\right)=15 units$$

134. $A^2=\begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix}\begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix}=\begin{bmatrix}8 & 5\\ -5 & 3\end{bmatrix}$

$A^2-5A+7I=$

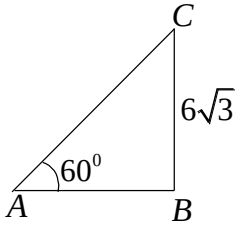
$$\begin{bmatrix}8 & 5\\ -5 & 3\end{bmatrix}-\begin{bmatrix}15 & 5\\ -5 & 10\end{bmatrix}+\begin{bmatrix}7 & 0\\ 0 & 7\end{bmatrix}=\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}$$

135. Given $(1+x)^n=C_0+C_1x+C_2x^2+.....+C_nx^n$

Put x = -1 we get

$C_0-C_1+C_2-.....+(-1)^nC_n=0$

136. Length of ladder $AC=\frac{6\sqrt{3}}{\sin 60^0}=12m$



137. $f(x)=2x-3$

$f(x)=y$

$2x-3=y$

$x=\frac{y+3}{2}$

$f^{-1}(y)=\frac{y+3}{2}$

$f^{-1}(x)=\frac{x+3}{2}$

Llly $g^{-1}(x)=(x-5)^{\frac{1}{3}}$

$(fog)^{-1}(x)=(g^{-1}of^{-1})(x)$

$=g^{-1}(f^{-1}(x))$

$=g^{-1}\left(\frac{x+3}{2}\right)$

$=\left(\frac{x+3}{2}-5\right)^{\frac{1}{3}}=\left(\frac{x-7}{2}\right)^{\frac{1}{3}}$

138. $\frac{1+i}{1-i}=\frac{1+i}{1-i}\times\frac{1+i}{1+i}$

$=\frac{(1+i)^2}{1-i^2}=\frac{1+2i+i^2}{1-i^2}=\frac{1+2i-1}{1+1}=i$

$\left(\frac{1+i}{1-i}\right)^n=1\Rightarrow i^n=1$

i^n will be equal to 1 if n = 1

139. Sum of the roots = $-\frac{2}{a}$

And product of the roots = $\frac{3a}{a}=3$

Given $-\frac{2}{a}=3\Rightarrow a=-\frac{2}{3}$

140. ${}^{n-2}C_r+2.{}^{n-2}C_{r-1}+{}^{n-2}C_{r-2}$

$=({}^{n-2}C_r+2.{}^{n-2}C_{r-1})+({}^{n-2}C_{r-1}+{}^{n-2}C_{r-2})$

${}^{n-1}C_r+{}^{n-1}C_{r-1}={}^{n}C_r$

141. $n(A'\cap B')=n(A\cup B)'$

$=n(\cup)-n(A\cup B)$

$=n(\cup)-n(A)-n(B)-n(A\cap B)$

$=700-200-300+100=300$

142. $f(x)=x^3+2x^2-4x+1=0$

$f\left(\frac{x}{3}\right)=\left(\frac{x}{3}\right)^3+2\left(\frac{x}{3}\right)^2-4\left(\frac{x}{3}\right)+1=0$

$=\frac{x^3+6x^2-36x+27}{27}=0$

$x^3+6x^2-36x+27=0$

143. $1+\frac{2}{3}.\frac{1}{2}+\frac{2}{3}.\frac{5}{6}.\frac{1}{2^2}+\frac{2}{3}.\frac{5}{6}.\frac{8}{9}.\frac{1}{2^3}+...$

$1+\frac{2}{1!}\left(\frac{1}{6}\right)+\frac{2(2+3)}{2!}\left(\frac{1}{6}\right)^2+...$

$(1-x)^{-p/q}=1+\frac{p}{1!}\left(\frac{x}{q}\right)+\frac{p(p+q)}{2!}\left(\frac{x}{q}\right)^2+.....$

$p=2,q=3,\frac{x}{q}=\frac{1}{6}$

$\Rightarrow \frac{x}{3}=\frac{1}{6}\Rightarrow x=\frac{1}{2}$

Sum of series

$(1-x)^{-\frac{p}{q}}$

$=\left(1-\frac{1}{2}\right)^{-\frac{2}{3}}$

$=\left(\frac{1}{2}\right)^{-\frac{2}{3}}=2^{\frac{2}{3}}=4^{\frac{1}{3}}$

144. $Z=\frac{1+i\sqrt{3}}{\sqrt{3}+i}=\frac{1+i\sqrt{3}}{\left(\sqrt{3}+i\right)}\times\frac{\left(\sqrt{3}-i\right)}{\left(\sqrt{3}-i\right)}$

$=\frac{\sqrt{3}-i+3i+\sqrt{3}}{3+1}=\frac{\sqrt{3}+i}{2}$

Amp(Z)= $\tan^{-1}\left(\frac{1}{\sqrt{3}}\right)=\frac{\pi}{6}$

145. $\begin{vmatrix} p & 1 & 1 \\ 1 & q & 1 \\ 1 & 1 & r \end{vmatrix}=0$

$c_2\to c_2-c_1, c_3\to c_3-c_2$

$$(1-p)(1-q)(1-r)\begin{vmatrix} \frac{p}{1-p} & 1 & 0 \\ \frac{1}{1-q} & -1 & 1 \\ \frac{1}{1-r} & 0 & -1 \end{vmatrix}=0$$

$\Rightarrow (1-p)(1-q)(1-r)\left[\frac{p}{1-p}(1)-1\left[-\frac{1}{1-q}-\frac{1}{1-r}\right]\right]=0$ $\qquad$ $\frac{p}{1-p}+\frac{1}{1-q}+\frac{1}{1-r}=0$

146. Given $f(x)=\frac{x^2}{x^2+1}$

Since it is an even function therefore its values is always greater than equal to O and we know

$x^2<x^2+1$ *or* $\frac{x^2}{x^2+1}<1$

Required range is $[0,1)$

147. Required number of ways = 4! = 24

148. $\sin\theta = \frac{1}{2} = \sin\frac{\pi}{6}$

$\theta = \frac{\pi}{6}, \pi - \frac{\pi}{6}$

$\tan\theta = \frac{1}{V_3} = \tan\frac{\pi}{6} \Rightarrow \theta = \frac{\pi}{6}, \pi + \frac{\pi}{6}$

Common value of θ is $\frac{\pi}{6}$

General value of θ is $2n\pi + \frac{\pi}{6}\ \forall n \in I$

149. The given condition mean that $\bar{r}$ is perpendicular to all three vectors $\bar{a}, \bar{b}$ and $\bar{c}$. This is possible if they are coplanar only.

$\therefore \left[\bar{a}\ \bar{b}\ \bar{c}\right] = 0$

150. $\alpha + \beta = -2$ and $\alpha^3 + \beta^3 = -56$

$(\alpha + \beta)(\alpha^2 + \beta^2 - \alpha\beta) = -56$

$\alpha^2 + \beta^2 - 2\beta = 28$, *now* $(\alpha + \beta)^2 = (-2)^2$

$\alpha^2 + \beta^2 + 2\alpha\beta = 4 \Rightarrow 28 + 3\alpha\beta = 4$

$\Rightarrow \alpha\beta = -8$

Req. equation is $x - (-2)x - 8 = 0 \Rightarrow x^2 + 2x - 8 = 0$