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TALEGAON, PUNE

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## MHT CET Sample Paper

- Physics & Chemistry paper will be of 50 marks each.
- Mathematics paper will be of 100 marks.

### Section - A

#### Physics

1. In a circus, motor cyclist moves in a spherical cage of radius 5m. The minimum velocity with which he must cross the highest point without losing contact is \_\_\_\_\_. ( $g = 9.8 \text{ m/s}^2$ )  
A) 3 m/s B) 5 m/s C) 6 m/s D) 7 m/s
2. If 'N' is the number of turns in a circular coil then the value of self inductance varies as  
A)  $N_0$  B) N C)  $N^2$  D)  $N^{-2}$
3. The buckling of a beam is found to be more if.  
(A) the breadth of the beam is large. (B) the beam material has large value of Young's modulus.  
(C) the length of the beam is small. (D) the depth of the beam is small.
4. If the light is incident on a transparent medium at a polarizing angle then the angle between the reflected and refracted rays is \_\_\_\_\_.  
A)  $30^\circ$  B)  $60^\circ$  C)  $90^\circ$  D)  $180^\circ$
5. In AM, the cent percent modulation is achieved when \_\_\_\_\_.  
(A) Carrier amplitude = signal amplitude (B) carrier amplitude  $\neq$  signal amplitude  
(C) Carrier frequency = signal frequency (D) carrier frequency  $\neq$  signal frequency
6. A body at rest starts sliding from top of a smooth inclined plane and requires 4 second to reach bottom. How much time does it take, starting from rest at top, to cover one-fourth of a distance?  
A) 1 second B) 2 second C) 3 second D) 4 second
7. In vertical circular motion. The ratio of kinetic energy to potential energy at the horizontal position is  
A) 5 : 2 B) 2 : 1 C) 3 : 2 D) 2 : 3
8. According to Huygen's principle,  
(A) Each point on the wave front is indifferent phase.  
(B) Each point on the wave front is centre of a new disturbance and emits secondary waves.  
(C) The tangent to wave front is the direction of the propagation of the wave.  
(D) The wave is transverse.
9. In electromagnetic spectrum, the frequencies of  $\gamma$ -rays, X-rays and ultraviolet rays are denoted by  $n_1$ ,  $n_2$  and  $n_3$  respectively then  
A)  $n_1 > n_2 > n_3$  B)  $n_1 < n_2 < n_3$  C)  $n_1 > n_2 < n_3$  D)  $n_1 < n_2 > n_3$
10. Gyromagnetic ratio is a ratio of magnetic dipole moment to  
(A) Mass of electron. (B) momentum of electron. (C) radius of electron. (D) angular momentum of electron.
11. If the wavelength of red light in air is  $7500 \text{ \AA}$ , then the frequency of light in air is \_\_\_\_\_.  
A)  $7.5 \times 10^{10} \text{ Hz}$  B)  $3 \times 10^{14} \text{ Hz}$  C)  $4 \times 10^{14} \text{ Hz}$  D)  $5 \times 10^{14} \text{ Hz}$
12. An air column, closed at one end and open at the other resonates with a tuning fork of frequency  $\nu$ , when its length is 45 cm, 99 cm and at two other lengths in between these values. The wavelength of sound in air column is

- (A) 180 cm (B) 108 cm (C) 54 cm (D) 36 cm
13. In cyclotron, for a given magnet, radius of the semicircle traced by positive ion is directly Proportional to ( $v$  = velocity of positive ion)  
 A)  $v^{-2}$  B)  $v^{-1}$  C)  $v$  D)  $v^2$
14. Due to propagation of longitudinal wave in a medium, the following quantities also propagate in the same direction  
 (A) Energy, momentum and mass (B) Energy (C) Energy and mass (D) Energy and linear momentum
15. The height at which the acceleration due to gravity is 25% of that of the surface of earth is \_\_\_\_\_. ( $R$  = Radius of the earth)  
 A)  $h = 3R$  B)  $h = 2R$  C)  $h = R$  D)  $h = 2$
16. In a potentiometer experiment, a balance point is obtained, when  
 (A) The e.m.f of the battery becomes equal to the e.m.f of the experimental cell.  
 (B) The potential difference of the wire between the +ve end to jockey becomes equal to the e.m.f of the experimental cell.  
 (C) The potential difference of the wire between +ve point and jockey becomes equal to the e.m.f of the battery.  
 (D) The potential difference across the potentiometer wire becomes equal to the e.m.f of the battery
17. In insulators (C.B. is conduction band and V.B. is valence band)  
 A) V.B. is partially filled with electrons B) C.B. is partially filled with electrons  
 C) C.B. is empty and V.B. is filled with electrons D) C.B. is filled with electrons and V.B. is empty
18. According to de Broglie, wave is associated with matter  
 (A) When it is stationary. (B) when it is in motion with the velocity of light only.  
 (C) When it is in motion with any velocity. (D) None of the above
19. Monochromatic light of wavelength  $4500 \text{ \AA}$  falls on slit of width 'a'. In diffraction pattern second maxima deviates through  $30^\circ$ . The slit width is \_\_\_\_\_.  
 A)  $900 \text{ \AA}$  B)  $1800 \text{ \AA}$  C)  $13500 \text{ \AA}$  D)  $22500 \text{ \AA}$
20. The moment of inertia of a body does not depend upon  
 (A) The mass of the body. (B) the distribution of the mass in the body. (C) the axis of rotation of the body  
 (D) The angular velocity of the body.
21. The masses of three copper wires are in the ratio 1 : 3 : 5 and their lengths are in the ratio 5 : 3 : 1. The ratio of their resistance is  
 A) 25 : 1 : 125 B) 1 : 125 : 25 C) 125 : 1 : 25 D) 125 : 25 : 1
22. In conductors,  
 (A) The valence band is partially filled with electrons.  
 (B) The conduction band is partially filled with electrons.  
 (C) The conduction band is filled with electrons and valence band is empty.  
 (D) The conduction band and valence band is overlapping.
23. The bending of light near the edges of an obstacle and spreading into the region of geometrical shadow is called \_\_\_\_\_.  
 A) interference B) diffraction C) polarization D) Doppler effect
24. In an npn transistor circuit, the collector current is 10 mA. If 90% of the electrons emitted reach the collector, the emitter current (IE) and base current (IB) are given by  
 (A)  $IE = -1 \text{ mA}$ ,  $IB = 9 \text{ mA}$  (B)  $IE = 9 \text{ mA}$ ,  $IB = -1 \text{ mA}$   
 (C)  $IE = 1 \text{ mA}$ ,  $IB = 11 \text{ mA}$  (D)  $IE = 11 \text{ mA}$ ,  $IB = 1 \text{ mA}$
25. A body of mass 'm' is raised to a height '10 R' from the surface of earth, where 'R' is the radius of earth. The increase in potential energy is ( $G$  = universal constant of gravitation,  $M$  = mass of earth and  $g$  = acceleration due to gravity)  
 A)  $11RGMm$  B)  $10RGMm$  C)  $11GmgRD$  D)  $11R10GMm$
26. An alternating e.m.f,  $e = 300 \sin(100\pi t)$  volt is applied to a pure resistance of 100 ohm. Calculate r.m.s current through the circuit.  
 (A) 2.121 A (B) 3.121 A (C) 4.121 A (D) 1.121 A
27. When a dielectric slab is introduced between the two plates of condenser then its capacity\_\_\_\_\_.

- A) remains constant B) increases C) decreases D) may increase or decrease depending on the material of dielectric slab
28. When equal forces are applied at different points of objects of same material but of different shapes, the same strain is not produced because  
 (A) The external force causes different strains. (B) the property of matter at every point is not same.  
 (C) The coefficient of elasticity of the same material is not constant. (D) the nature of external force changes.
29. A small metal ball of mass 'm' is dropped in a liquid contained in a vessel, attains a terminal velocity 'v'. If a metal ball of same material but of mass '8m' is dropped in same liquid then the terminal velocity will be  
 A) v B) 2v C) 4v D) 8v
30. In Bohr's model of hydrogen atom, which of the following pairs of quantities are quantized?  
 (A) Energy and linear momentum. (B) Linear and angular momentum. (C) Energy and angular momentum.  
 (D) Energy but not the angular momentum.
31. To minimize the error due to contact resistance, in Wheatstone's meter bridge experiment\_\_\_\_\_.  
 A) The wire used must be uniform B) the wire used must be non-uniform  
 C) Null point is obtained near the middle of the wire  
 D) Interchange the positions of unknown resistance (X) and known resistance (R)
32. In remote controlled receivers, the sensor are,  
 (A) LEDs (B) Solar cells (C) Photodiodes (D) Zener diodes
33. A wooden block of mass 8 kg slides down an inclined plane of inclination  $30^\circ$  to the horizontal with constant acceleration  $0.4 \text{ m/s}^2$ . The force of friction between the block and inclined plane is ( $g = 10 \text{ m/s}^2$ )  
 A) 12.2 N B) 24.4 N C) 36.8 N D) 48.8 N
34. The potential energy of a particle executing S.H.M is 2.5 J, when its displacement is half of amplitude. The total energy of the particles  
 (A) 2.5 J (B) 10 J (C) 12 J (D) 20 J
35. If the length of simple pendulum is increased to four times then its period \_\_\_\_\_.  
 A) becomes doubled B) remains same C) becomes three times D) becomes four times
36. Which of the following metal is found exclusively in Free State?  
 (A) Iron (B) Platinum (C) Aluminum (D) Zinc
37. In electromagnetic wave, according to Maxwell, changing electric field gives  
 A) stationary magnetic field B) conduction current C) eddy current D) displacement current
38. A potentiometer wire of length 100 cm has a resistance of  $10 \Omega$ . It is connected in series with a resistance and an accumulator of e.m.f 2 V and of negligible internal resistance. A source of e.m.f 10 mV is balanced against a 40 cm length of the potentiometer wire. The value of the external resistance is  
 (A)  $395 \Omega$  (B)  $790 \Omega$  (C)  $405 \Omega$  (D)  $810 \Omega$
39. In cyclotron, radius of circular path traced by positive ions is \_\_\_\_\_.  
 A) directly proportional to velocity B) inversely proportional to velocity C) directly proportional to square root of velocity D) inversely proportional to square root of velocity
40. For stationary waves in the medium,  
 (A) Phase of SHM of particles at any time is same, between two successive nodes.  
 (B) Phase of SHM of particles increases as path increases.  
 (C) The amplitude of vibration is same for each point.  
 (D) Phase of all points between two successive antinodes is same.
41. An elevator is moving vertically up with acceleration 'a'. The force exerted on the floor by a Passenger of mass m is  
 a) mg b) ma c) mg-ma d) mg+ma
42. To increase the range of voltmeter the series resistance should be \_\_\_\_\_.  
 (A) Increased (B) decreased (C) constant (D) low
43. A particle is performing linear S.H.M. with period 6 S and amplitude 'a'. The minimum time taken by the particle to travel between two points situated at a distance a/2 on either sides of mean position is \_\_\_\_\_.  
 A) 1 s B) 1.5 s C) 3 s D) 6 s

44. The moment of inertia of a sphere is  $20 \text{ kg-m}^2$  about the diameter. The moment of inertia about any tangent is  
 (A)  $25 \text{ kg-m}^2$  (B)  $50 \text{ kg-m}^2$  (C)  $70 \text{ kg-m}^2$  (D)  $80 \text{ kg-m}^2$
45. Electromagnets are made of soft iron because soft iron has  
 A) high susceptibility and low retentivity B) low susceptibility and high retentivity  
 C) low susceptibility and low retentivity D) high susceptibility and high retentivity
46. A uniform aluminum wire of length 3 m and area of cross-section  $2 \text{ mm}^2$  is extended through 12 mm the energy stored in the wire is \_\_\_\_\_. ( $Y_{Al} = 7 \times 10^{10} \text{ N/m}^2$ )  
 A) 336 J B) 33.6 J C) 3.36 J D) 0.336 J
47. In common base circuit of a transistor, current amplification factor is 0.95. Calculate the Emitter current if base current is 0.2 mA  
 A) 2 mA B) 4 mA C) 6 mA D) 8 mA
48. A piece of material moves slowly towards a pole of magnet. The material must be \_\_\_\_\_.  
 A) diamagnetic B) ferromagnetic C) paramagnetic D) ferromagnetic
49. Gases exert pressure on the walls of the container because the gas molecules  
 A) have finite volume B) obey Boyle's law C) possess momentum D) collide with one another
50. A glass tube of internal diameter 3.5 cm and thickness 0.5 cm is held vertically with its lower end immersed in water. The downward pull on the tube due to surface tension (S.T. of water =  $0.074 \text{ N/m}$ ) is  
 (A) 1.86 N (B)  $1.86 \times 10^{-1} \text{ N}$  (C)  $1.86 \times 10^{-2} \text{ N}$  (D)  $1.86 \times 10^{-3} \text{ N}$

## Chemistry

## Section – B

51. Which of the following is used as pickling agent \_\_\_\_\_?  
 A) Sulphuric acid B) Nitric Acid C) Phosphoric acid D) Hydrochloric acid
52. Which of the following ion is diamagnetic \_\_\_\_\_?  
 A)  $\text{Sc}^{3+}$  B)  $\text{V}^{3+}$  C)  $\text{Ni}^{2+}$  D)  $\text{Fe}^{2+}$
53. Consider the cell  $\text{Cr} | \text{Cr}^{3+}(1\text{M}) || \text{Fe}^{2+}(1\text{M}) | \text{Fe}$   $E^\circ_{\text{Cr}} = -0.740 \text{ V}$   $E^\circ_{\text{Fe}} = -0.440 \text{ V}$   $\Delta G^\circ$  for the Above cell is \_\_\_\_\_.  
 A) - 173.7 KJ B) - 17.37 KJ C) - 1.737 KJ D) - 0.1737 KJ
54. The purple colour of permanganate ion ( $\text{MnO}_4^-$ ) arises due to \_\_\_\_\_.  
 A)  $3d - 3d$  transition of electrons B)  $4f - 4f$  transition of electrons  
 C) Transfer of negative charge D)  $5f - 5f$  transition of electrons
55. Potassium permanganate is used \_\_\_\_\_.  
 A) As Baeyer's reagent B) In dyeing C) In the tanning of leather D) In the manufacture of pigment
56. In alkaline hydrolysis of t-butyl bromide the order of reaction with respect to nucleophile is  
 A) Zero B) First C) Pseudo D) Second
57. Which of following describe the hexagonal close packed structure of sphere \_\_\_\_\_.  
 A) AB AB B) ABC ABC C) ABCD D) AAAA
58. Which azobenzene gives orange dye \_\_\_\_\_.  
 A) P- aminoazobenzene B) P- (dimethyl amino) azobenzene C) P- Hydroxyazobenzene  
 D) Phenolazobenzene
59. For the reaction  $\text{CH}_3\text{CHO}_{(g)} \rightleftharpoons \text{CH}_4_{(g)} + \text{CO}_{(g)}$   
 $R = K [\text{CH}_3\text{CHO}]^{3/2}$  then the following molecularity and order of reaction are \_\_\_\_\_.  
 A) 1.5 and 1 B) 1 and 1 C) 1 and 1.5 D) 1.5 and 1.5
60. Enzymes required for phosphorylation are located in \_\_\_\_\_ of chloroplast.  
 A) Peristromium B) Plastidome C) Stroma D) Quantosome
61. How internal energy will change due to removal of heat and work from the system ?  
 A) Decrease B) Increase C) Remain same D) None
62. How many forms of liquids are there in nature ?  
 A) 1 B) 2 C) 3 D) 4
63. Thermite process is a process of \_\_\_\_\_.  
 A) Thermal decomposition of oxide of aluminium B) Reduction of metal oxide like  $\text{Cr}_2\text{O}_3$  or  $\text{Fe}_2\text{O}_3$  by aluminium  
 C) Obtaining iron from iron pyrite D) Purification of zinc

64. Tertiary structure of proteins represents \_\_\_\_\_.  
 A) Sequence of amino acids B) Shape of protein molecule C) Folding of polypeptide chains D) Association of acid chains
65. In the linear packing arrangement in one dimension, the coordination number is \_\_\_\_\_.  
 (A) 1 (B) 2 (C) 3 (D) 4
66. The atomic number of third member of the nitrogen family is \_\_\_\_\_.  
 (A) 23 (B) 15 (C) 33 (D) 43
67. The number of optically inactive isomers for  $C_5H_{11}Br$  is \_\_\_\_\_.  
 A) Two B) Three C) Four D) Six
68. Which of the following alkyl halide is more reactive towards nucleophilic substitution reaction?  
 A)  $H_3C-CH_2-F$  B)  $H_3C-CH_2-Cl$  C)  $H_3C-CH_2-Br$  D)  $H_3C-CH_2-I$
69. Nitric acid oxidizes cane sugar to give \_\_\_\_\_.  
 A) Succinic acid B) Oxalic acid C) Acetic acid D) Formic acid
70. The isomer of  $C_4H_9I$  is capable of producing but-2-ene with alc. KOH solution is \_\_\_\_\_.  
 A) 1-Iodobutane B) 2-Iodobutane C) 1-Iodo-2-Methyl Propane D) 2-Iodo-2-Methyl Propane
71. What is the geometry of molecule of bromine penta fluoride ?  
 A) square planar B) trigonal bipyramidal C) square pyramidal D) octahedral
72. The systematic name of  $K_3[Al(C_2O_4)_3]$  complex is \_\_\_\_\_.  
 A) Potassium trioxalato aluminate (I) B) Potassium trioxalato aluminate (III)  
 C) Potassium Aluminium trioxalato aluminate (I)  
 D) Potassium Aluminium trioxalato aluminate(III)
73. Oxidation number of nitrogen in which among the oxides of nitrogen is the lowest ?  
 A) Nitric oxide B) Nitrous oxide C) Nitrogen dioxide D) Nitrogen trioxide
74. The precipitate formed on passing  $H_2S$  gas through solution of  $[Cu(CN_4)]^{2-}$  and  $[Cd(CN)_4]^{2-}$   
 A)  $CuS$  B)  $CdS$  C)  $Cu_2O$  D)  $Cd_2O$
75. In hydrometallurgical extraction of copper from low grade ore, For reduction of  $Cu^{++}$  ions from their solution when one of the following is advisable and advantageous \_\_\_\_\_.  
 A)  $H_2$  B) zinc scrap C) Silver metal D) Iron scrap
76. Sea weeds are an important source of \_\_\_\_\_.  
 A) chlorine B) iodine C) copper D) bromine
77. In the cell  $Zn/Zn^{2+}(1M) || H^+(1M)/H_2(g)/Pt$  Zn electrode is replaced by Cu electrode. The cell potential will  
 A) Increase B) decrease C) remain the same D) become double
78. The drug used to control birth is \_\_\_\_\_.  
 A) Prontosil B) Tertnadine C) Alitame D) novestrol
79. Oxidation state of Nitrogen in  $N_2O_4$  is \_\_\_\_\_.  
 A) -4 B) +4 C) +5 D) +6
80. One mole of an ideal monoatomic gas initially at STP expand isothermally and reversible to 224 lit. Calculate  $\Delta S$ .  
 A) -2.303 R B) -23.03 R C) -0.2303 R D) -2303 R
81. The IUPAC name of  $CH_3-CO-(CH_2)_2-CH_3$  is \_\_\_\_\_.  
 A) Pentan-2-one B) Pentan-3-one C) 3-methyl butan-2-one D) 3-methyl pentanal
82. Butylated hydroxy toluene is used in  
 A) Preventing oxidative rancidity of fats B) preserving food grains  
 C) Killing bacteria in living tissues D) reducing stress and anxiety
83. The role of nitric oxide in a lead chamber manufacturing process of sulphuric acid is as a  
 A) Catalyst B) Reagent C) Oxidising agent D) Purifier
84. Pentan-3-one can be obtained by dry distillation of \_\_\_\_\_.  
 A) Ca-acetate and Ca-formate B) Ca-propionate C) Ca-acetate D) Ca-propionate and Ca-formate
85. During electrolysis of molten  $CaCl_2$  0.005 A current is passed through the cell for 200 s. The Mass of product formed at cathode (molar mass of Ca = 40 g mol<sup>-1</sup>) will be \_\_\_\_\_.

- A) 0.0002073 g of Ca B) 0.0004145 g of Ca C) 0.0003678 g of Cl<sub>2</sub> D) 0.0007357 g of Cl<sub>2</sub>
86. Which of the following is biodegradable polymer?  
A) Polyhydroxy butyrate-co-hydroxy valerate B) Nylon-6 C) Bakelite D) Polythene
87. Which among the following group 16 elements exists in more than two allotropic states ?  
A) Polonium B) Tellurium C) Selenium D) Oxygen
88. Which of the following ion is diamagnetic \_\_\_\_\_?  
A) Sc<sup>3+</sup> B) V<sup>3+</sup> C) Ni<sup>2+</sup> D) Fe<sup>2+</sup>
89. What is the geometry of molecule of bromine penta fluoride ?  
A) square planar B) trigonal bipyramidal C) square pyramidal D) octahedral
90. Which among the following metals is employed to provide cathodic protection to iron?  
A) Zinc B) Nickel C) Tin D) Lead
91. Oxidation number of nitrogen in which among the oxides of nitrogen is the lowest?  
A) Nitric oxide B) Nitrous oxide C) Nitrogen dioxide D) Nitrogen trioxide
92. The volume of oxygen evolved at STP, by decomposition of 0.68 g '20 volume' hydrogen Peroxide solution, is.....  
A) 2.24 mL B) 22.4 mL C) 224 mL D) 2240 mL
93. What is the molality of a solution containing 200 mg of urea (molar mass 60 g mol<sup>-1</sup>) dissolved in 40 g of water ?  
A) 0.0825 B) 0.825 C) 0.498 D) 0.0013
94. Alkaline hydrolysis of which among the following compounds leads to the formation of a racemate ?  
A) 1-Bromo-1-phenylethane B) 1-Chloro-3-methylbutane C) Bromoethane D) 1-Chloropropane
95. Benzene can be conveniently converted into n-propyl benzene by  
A) Friedel – Craft alkylation with n-propyl chloride  
B) Friedel – Craft acylation with propionyl chloride followed by Wolff – Kishner reduction  
C) Friedel – Craft acylation with propionyl chloride followed by catalytic hydrogenation  
D) Friedel – Craft acylation with propionyl chloride followed by reduction with LiAlH<sub>4</sub>
96. Which statement is NOT correct about fullerene C<sub>60</sub> ?  
A) It contains 20 six membered rings and 12 five membered rings  
B) All carbon atoms undergo SP<sup>2</sup> hybridization  
C) A six membered ring is fused with six membered rings only  
D) A five membered ring is fused with six membered ring only
97. The product of molar concentrations of hydrogen ions and hydroxide ions in a 0.01 M Aqueous solution of sodium chloride is known as  
A) Hydrolysis constant of salt B) Dissociation constant of acid  
C) Dissociation constant of base D) Ionic product of water
98. Which among the following solids crystalizes as a face centered cube?  
A) Iron B) Rubidium C) Uranium D) Platinum
99. What is the pH of mill molar solution of ammonium hydroxide which is 20% dissociated?  
A) 3.699 B) 10.301 C) 4.691 D) 9.301
100. Deficiency of which vitamin causes degeneration of spinal cord?  
A) E B) K C) B<sub>12</sub> D) A

## Mathematics

- Q.1 The angle between the lines  $\vec{r} = 3\vec{i} + 2\vec{j} - 4\vec{k} + \lambda(\vec{i} + 2\vec{j} + 2\vec{k})$  and  $\vec{r} = 5\vec{i} - 2\vec{k} + m(3\vec{i} + 2\vec{j} + 6\vec{k})$  is  
A)  $\cos^{-1}\left(\frac{18}{21}\right)$  B)  $\cos^{-1}\left(\frac{19}{21}\right)$  C)  $\cos^{-1}\left(\frac{20}{21}\right)$  D)  $\cos^{-1}\left(\frac{17}{21}\right)$
- Q.2 Given  $X \sim N(10, 36)$  What is the variance of X?  
A) 10 B) 10 C) 36 D) 6

Q.3 Approximate value of  $\tan^{-1}(0.999)$  is

- A) 0.7847    B) 0.748    C) 0.787    D) 0.847

Q.4 If a normal to ellipse  $\frac{x^2}{18} + \frac{y^2}{8} = 1$  at  $(-3, -2)$  touches the parabola  $y^2 = 4ax$ , then value of a is

- A)  $\frac{15}{4}$     B) 15    C)  $\frac{15}{2}$     D)  $\frac{15}{-4}$

Q.5 A dealer wishes to purchase toys A and B. He has Rs. 580 and has space to store 40 items. A costs Rs. 75 and B costs Rs. 90. He can make profit of Rs. 10 and Rs. 15 by selling A and B respectively assuming that he can sell all the items that he can buy formulation of this as L.P.P. is

A) Maximize  $z = 10x + 15y$ ,

Subject to  $x + y \leq 40$ ,  $75x + 90y \leq 580$ ,  $x \geq 0$ ,  $y \geq 0$ .

B) Maximize  $z = 10x + 15y$ ,

Subject to  $x + y \geq 40$ ,  $x \geq 0$ ,  $y \geq 0$ ,  $75x + 90y \geq 580$

C) Maximize  $z = 15x + 10y$ ,

Subject to  $x + y \leq 40$ ,  $75x + 90y \leq 580$ ,  $x \geq 0$ ,  $y \geq 0$

D) Maximize  $z = 10x + 15y$ ,

Subject to  $x + y \geq 40$ ,  $75x + 90y \leq 580$ ,  $x \geq 0$ ,  $y \geq 0$

Q6. The value of  $\cos^{-1}\left(\cos\frac{7\pi}{6}\right) =$

- A)  $\frac{7\pi}{6}$     B)  $\frac{5\pi}{6}$     C)  $\frac{\pi}{3}$     D)  $\frac{\pi}{6}$

Q7. The particular solution of differential equation  $\log\left(\frac{dy}{dx}\right) = 3x + 4y$  is, When  $y = 0 = x$

A)  $4e^{3x} + 3e^{-4y} + 7 = 0$     B)  $4e^{3x} - 3e^{-4y} - 7 = 0$

C)  $4e^{3x} + 3e^{-4y} - 7 = 0$     D)  $4e^{3x} - 3e^{-4y} - 7 = 0$

Q8.  $Z = 10x + 25y$  subject to  $0 \leq x \leq 3$  and  $0 \leq y \leq 3$ ,  $x + y \leq 5$  then the maximum value of z is

- A) 80    B) 95    C) 30    D) 75

Q9. The differential equation of family of circles having centre on line  $y = 10$  and touching x-axis is

A)  $y'' - 5y' + 6y = 0$     B)  $x^2 y'' + y' + y = 0$

C)  $8(y')^3 - 27y = 0$     D)  $(y - 10)^2 (y')^2 + y^2 - 20y = 0$

Q10. Area bounded by the curve  $f(x) = \cos x$  which is bounded by the lines  $x = 0$  and  $x = \pi$  is

- A)  $4(\text{Unit})^2$     B)  $1(\text{Unit})^2$     C)  $2(\text{Unit})^2$     D)  $3(\text{Unit})^2$

Q11. Equation of normal to the circle  $x = 6 \cos \theta$ ,  $y = 6 \sin \theta$  at  $p\left(\frac{2\pi}{3}\right)$  is

A)  $\sqrt{3}x - y = 0$     B)  $\sqrt{3}x + y = 0$

C)  $x + \sqrt{3}y = 0$     D)  $x - \sqrt{3}y = 0$

Q12. If the equation  $kxy + 10x + 6y + 4 = 0$  represents a pair of lines then value of k is

- A) 0    B) 15    C) -15    D)  $\frac{1}{15}$

Q13. If  $a = 16$ ,  $b = 24$ ,  $c = 20$  then  $\cos\left(\frac{b}{2}\right) =$

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

Q14. The direction cosine of a line which is perpendicular to both the lines whose direction ratios are  $-1, 2, 2$  and  $0, 2, 1$  are

A)  $-2/3, 1/3, 2/3$     B)  $2/3, -1/3, 2/3$     C)  $2/3, 1/3, -2/3$     D)  $2/3, -1/3, -2/3$

Q15. The perimeter of a triangle is 10 cm. If one of the side is 4 cm. Then lengths of remaining sides when area of triangle is minimum are

A) 4 cm, 2 cm    B) 3 cm, 3 cm    C) 1 cm, 5 cm    D) 4 cm, 3 cm

Q16. The joint equation of pair of lines through origin each of which makes an angle of  $60^\circ$  with the y-axis is

A)  $X^2 - 3y^2 = 0$     B)  $x^2 + 3y^2 = 0$     C)  $3x^2 - y^2 = 0$     D)  $3x^2 + y^2 = 0$

Q17. If  $\text{cov}(x,y) = 6$  and  $u = (x-1)/2$ ,  $v = (y-2)/3$  then  $\text{cov}(u,v) =$

A) 6    B) 3    C) 2    D) 1

Q18. The equation of plane passing through (2, 1, 0) and line of intersection of planes  $x - 2y + 3z = 4$  and  $x - y + z = 3$  is

A)  $x + y - z + 4 = 0$     B)  $2x + y + z + 1 = 0$     C)  $x - z = 2$     D)  $x + y + z + 1 = 0$

Q19. If  $xy = 1 + \log y$  and  $k \cdot y' + y^2 = 0$  then  $k$  is

A)  $1 + xy$     B)  $1/(xy - 1)$     C)  $xy - 1$     D)  $1 - 2xy$

Q20. Let  $p$  : A triangle is equilateral,  $q$  : A triangle is equiangular then inverse of  $q \rightarrow p$  is

- A) If a triangle is not equilateral then it is not equiangular
- B) If a triangle is not equiangular then it is not equilateral
- C) If a triangle is equiangular then it is not equilateral
- D) If a triangle is equiangular then it is equilateral

Q21. The mean of the numbers  $a, b, 8, 5, 10$  is 6 and the variance is 6.80. Then which one of the following gives possible values  $a$  and  $b$ ?

A)  $a = 1, b = 6$     B)  $a = 3, b = 4$     C)  $a = 0, b = 7$     D)  $a = 5, b = 2$

Q22. The line passing through the points (5, 1,  $a$ ) and (3,  $b$ , 1) crosses the yz-plane at the point (0,  $17/2, -13/2$ ). Then

A)  $a = 6, b = 4$     B)  $a = 8, b = 2$     C)  $a = 2, b = 8$     D)  $a = 4, b = 6$

Q23. If the straight lines  $(x-1)/k = (y-2)/2 = (z-3)/3$  and  $(x-2)/3 = (y-3)/k = (z-1)/2$  intersect at a point, then the integer  $k$  is equal to

A) 2    B) -2    C) -5    D) 5

Q24. The quadratic equations  $x^2 - 6ax = 0$  and  $x^2 - cx + 6 = 0$  and have one root in common. The other roots of the first and second equations are integers in the ratio 4 : 3. Then the common root is

A) 3    B) 2    C) 1    D) 4

Q25. The area of the plane region bounded by the curve  $x + 3y^2$  and  $3y^2 = 1$  is equal to

A)  $2/3$     B)  $4/3$     C)  $5/3$     D)  $1/3$

Q26. All letters of the word 'CEASE' are arranged randomly in a row then the probability that two E are found together is ::

A)  $7/5$     B)  $3/5$     C)  $2/5$     D)  $1/5$

Q27. Three numbers are selected randomly between 1 to 20. Then The probability that they are consecutive numbers will be : A)  $7/190$     B)  $3/190$     C)  $5/190$     D)  $1/3$



Q28. If the four positive integers are selected randomly from the set of positive integers then the probability that the number 1,3,7,9 are in the product of 4 digits selected is :

- A)  $7/625$       B)  $2/5$       C)  $5/625$       D)  $16/625$

Q29. If  $A$  and  $B$  are points on one bank of a straight river and  $C, D$  are two other points on the other bank of river. If direction from  $A$  to  $B$  is same as that from  $C$  to  $D$  and  $AB = \alpha$ ,  $\angle CAD = \alpha$ ,  $\angle DAB = \beta$ ,  $\angle CBA = \gamma$ , then  $CD$  is equal to:

- (a)  $\frac{\alpha \sin \beta \sin \gamma}{\sin \alpha \sin(\alpha+\beta+\gamma)}$   
 (b)  $\frac{\alpha \sin \alpha \sin \gamma}{\sin \beta \sin(\alpha+\beta+\gamma)}$   
 (c)  $\frac{\alpha \sin \alpha \sin \beta}{\sin \gamma \sin(\alpha+\beta+\gamma)}$   
 (d) None of these

Q30. If  $1, \omega, \omega^2$  are the cube roots of unity, then

$$\Delta = \begin{vmatrix} 1 & \omega & \omega^{2n} \\ \omega^n & \omega^{2n} & 1 \\ \omega^{2n} & 1 & \omega^n \end{vmatrix}$$

is equal to:

- (a) 0      (b) 1      (c)  $\omega$       (d)  $\omega^2$

Q31. If  $x$  is positive, the first negative term in the expression of  $(1+x)^{27/5}$  is

- (a) 7th term      (b) 5th term      (c) 8th term      (d) 6th term

Q32. Rational roots of the equation  $2x^4+x^3-11x^2+x+2=0$  are:

- a.  $\frac{1}{2}$  and 2      b)  $\frac{1}{2}, 2, \frac{3}{4}, -2$       c)  $\frac{1}{2}, 2, 3, 4$       d)  $\frac{1}{2}, 2, \frac{3}{4}, -2$

Q33. The general solution of

$\frac{dy}{dx} = \frac{2x-y}{x+2y}$  is      a)  $x^2-xy+y^2=c$       b)  $x^2-xy-y^2=c$       c)  $x^2+xy-y^2=c$       d)  $x^2+xy^2=c$

Q34. The line  $\frac{x}{a} - \frac{y}{b} = 1$  cuts the  $x$ -axis at  $P$ . The equation of the line through  $P$  perpendicular to the given line is:

- a.  $x+y=ab$       b)  $x+y=a+b$       c)  $ax+by=a^2$       d)  $bx+ay=b^2$

Q35. If the function  $f(x) = \frac{2x - \sin^{-1}x}{2x + \tan^{-1}x}$ ,  $x \neq 0$  is continuous at each point of its domain, then the value of  $f(0)$  is:

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

Q36. If orthocentre and circumcentre of triangle are respectively  $(1, 1)$  and  $(3, 2)$ , then the co-ordinates of its centroid are:

- (a)  $(\frac{7}{3}, \frac{5}{3})$       b)  $(\frac{5}{3}, \frac{7}{3})$       c)  $(7, 5)$       d) None of these

Q37. The minimum value of  $[x^2 + \frac{1}{1+x^2}]$  is, at:

- a)  $x = 0$       b)  $x = 1$       c)  $x = 4$       d)  $x = 3$

Q38. The centre of gravity  $G$  of three particles of equal mass placed at the three vertices of a right angled isosceles triangle whose hypotenuse is equal to 8 unit is on the median through  $A$  such that  $AG$  is

- a)  $\frac{4}{3}$  unit      b)  $\frac{8}{3}$  unit      c)  $\frac{5}{3}$  unit      d)  $\frac{10}{3}$  unit

Q39.  $\int \sqrt{\frac{1+x}{1-x}} dx$  is equal to

- a)  $-\sin^{-1} x - \sqrt{1-x^2} + c$       c)  $\sin^{-1} x - \sqrt{1-x^2} + c$   
 b)  $\sin^{-1} x + \sqrt{1-x^2} + c$       d)  $-\sin^{-1} x - \sqrt{x^2-1} + c$

Q40.  $2^{3n} - 7n - 1$  is divisible by :

- a) 49      b) 36      c) 64      d) 25

Q41. In a triangle  $ABC$ ,  $a : b : c = 4 : 5 : 6$ . The ratio of the radius of the circumcircle to that of the in circle is:

- a) 16/9      b) 16/7      c) 11/7      d) 7/16

Q42. Derivative of  $x^6 + 6^x$  with respect to  $x$  is:

- a)  $12x$       b)  $x+4$       c)  $6x^{5+} 6^x \log 6$       d)  $6x^5 + x6^{x-1}$

Q43. For the matrix  $A = \begin{pmatrix} 1 & 1 & 0 \\ 1 & 2 & 1 \\ 2 & 1 & 0 \end{pmatrix}$

- a)  $2A^3 + 3A^2 - I = 0$       b)  $A^3 + 3A^2 - I = 0$       c)  $A^3 + 2A^2 - I = 0$       d)  $A^3 + A^2 - I = 0$

Q44. The equation of the plane passing through  $(1, 1, 1)$  and  $(1, -1, -1)$  and perpendicular to  $2x - y + z + 5 = 0$  is:

- a)  $2x + 5y + z - 8 = 0$       b)  $x + y - z - 1 = 0$       c)  $2x + 5y + z + 4 = 0$       d)  $x - y + z - 1 = 0$

Q45. Domain of the function  $f(x) = \sqrt{\sin^{-1}(2x) + \frac{\pi}{6}}$  is:

- a)  $[\frac{-1}{4}, \frac{1}{2}]$       b)  $[\frac{-1}{2}, \frac{1}{2}]$       c)  $[\frac{-1}{2}, \frac{1}{9}]$       d)  $[\frac{-1}{4}, \frac{1}{4}]$

Q46. Suppose that a die (with faces marked 1 to 6) is loaded in such a manner that for  $K = 1, 2, 3, \dots, 6$  the probability of the face marked  $K$  turning up when die is tossed is proportional to  $K$ . The probability of the event that the outcome of a toss of the die will be an even number, is equal to:

- a)  $\frac{1}{2}$       b)  $\frac{4}{7}$       c)  $\frac{2}{5}$       d)  $\frac{1}{21}$

Q47. If the tangent to the parabola  $y^2 = ax$  makes an angle of  $45^\circ$  with  $x$  axis, then the point of contact is:

- a)  $(\frac{a}{2}, \frac{a}{2})$       b)  $(\frac{a}{4}, \frac{a}{4})$       c)  $(\frac{a}{2}, \frac{a}{4})$       d)  $(\frac{a}{4}, \frac{a}{2})$

Q48. If  $w$  is an imaginary cube root of unity, then  $(1 + w - w^2)^7$  equals

- a)  $128w$       b)  $-128w$       c)  $128w^2$       d)  $-128w^2$

Q49. If  $y(t)$  is a solution of  $(1+t)\frac{dy}{dt} - ty = 1$  and  $y(0) = -1$  then  $y(1)$  is equal to :

- a)  $\frac{-1}{2}$       b)  $e + \frac{1}{2}$       c)  $e - \frac{1}{2}$       d)  $\frac{1}{2}$

Q50. The number of solutions of the inequality

$$2^{1/\sin^2 \alpha_2} \cdot 3^{1/\sin^2 \alpha_3} \dots n^{1/\sin^2 \alpha_n} \leq n !$$

Where  $\alpha_i \in (-\pi, 2\pi)$  for  $i = 2, 3, \dots, n$  is:

a) 0

b)  $2^{n-1}$

c)  $3^{n-1}$

d) None of these