# **BITSAT Question Paper 2017**

## Duration: 3:00 Hrs

Exam		Total Questions				
BITSAT		180				
Marks for Correct Answer 3	Negative Marks 1	Physics 40	Chemistry 40	Mathematics 45	English 15	Logical Reasoning 10

#### **Physics**

1. Figure shows a capillary rise H. If the air is blown through the horizontal tube in the direction as shown then rise in capillary tube will be



(a) = H (b) > H (c) < H (d) zero

Correct: b

2. Consider an iceberg floating in sea water. The density of sea water is 1.03 g/cc and that of ice is 0.92 g/cc. The fraction of total volume of iceberg above the level of sea water is near by (a) 1.8%

- (b) 3%
- (c) 8%
- (d) 11%

Correct: d

3. In the formula  $X = 3YZ^2$ , X and Z have dimensions of capacitance and magnetic induction respectively. The dimensions of Y in MKSA system are :

(a)  $\left[\mathbf{M}^{-3}\mathbf{L}^{-2}\mathbf{T}^{-2}\mathbf{A}^{-4}\right]$ 

(b) 
$$\left[ ML^{-2} \right]$$
  
(c)  $\left[ M^{-3}L^{-2}A^{4}T^{8} \right]$   
(d)  $\left[ M^{-3}L^{2}A^{4}T^{4} \right]$ 

Correct: c

4. Figure here shows the vertical cross section of a vessel filled with a liquid of density  $\rho$ . The normal thrust per unit area on the walls of the vessel at the point P, as shown, will be



Correct: c

5. The approximate depth of an ocean is 2700 m. The compressibility of water is  $45.4 \times 10^{-11}$  Pa<sup>-1</sup> and density of water is  $103 \text{ kg/m}^2$ . What fractional compression of water will be obtained at the bottom of the ocean ?

(a)  $1.0 \ge 10^2$ (b)  $1.2 \ge 10^2$ (c)  $1.4 \ge 10^{-2}$ (d)  $0.8 \ge 10^{-2}$ 

Correct: b

6. In the circuit shown, the heat produced in  $5\Omega$  resistor is 10 cal/s. The heat produced per second in  $4\Omega$  resistor will be



7. During vapourisation

(a) change of state from liquid to vapour state occurs.

(b) temperature remains constant.

(c) both liquid and vapour states coexist in equilibrium.

(d) All of the above

Correct: d

8. Two spheres of different materials one with double the radius and one-fourth wall thickness of the other are filled with ice. If the time taken for complete melting of ice in the larger sphere is 25 minute and for smaller one is 16 minute, the ratio of thermal conductivities of the materials of larger spheres to that of smaller sphere is

(a) 4:5

(b) 5:4

(c) 25:8

(d) 8:25

## Correct: d

9. Two long parallel wires carry equal current i flowing in the same direction are at a distance 2d apart. The magnetic field B at a point lying on the perpendicular line joining the wires and at a distance x from the midpoint is -

(a)  $\frac{\mu_0 i d}{\pi (d^2 + x^2)}$ (b)  $\frac{\mu_0 j x}{\pi (d^2 - x^2)}$ (c)  $\frac{\mu_0 a}{(d^2 + x^2)}$ (d)  $\frac{\mu_0 i d}{(d^2 + x^2)}$ 

Correct: b

10. The wavelength of radiation emitted by a body depends upon

(a) the nature of its surface

(b) the area of its surface

(c) the temperature of its surface

(d) All of the above

Correct: d

11. In the following P-V diagram of an ideal gas, two adiabates cut two-isotherms at  $T_1 = 300$ K and  $T_2 = 200$ K. The value of  $V_A = 2$  unit,  $V_B = 8$  unit,  $V_C = 16$ . Find the value of VD



(a) 4 unit
(b) < 4 unit</li>
(c) > 5 unit
(d) 5 unit

Correct: a

12. A cyclic process ABCD is shown in the figure P-V diagram. Which of the following curves represent the same process?





Correct: a

13. A hunter aims his gun and fires a bullet directly at a monkey on a tree. At the instant the bullet leaves the barrel of the gun, the monkey drops. Pick the correct statement regarding the situation.

- (a) The bullet will never hit the monkey
- (b) The bullet will always hit the monkey
- (c) The bullet may or may not hit the monkey
- (d) Can't be predicted

Correct: b

14. Figure below shows two paths that may be taken by a gas to go from a state A to a state C



In process AB, 400 J of heat is added to the system and in process BC, 100 J of heat is added to the system. The heat absorbed by the system in the process AC will be

- (a) 500 J
- (b) 460 J
- (c) 300 J
- (d) 380 J

Correct: b

15. Block A of weight 100 kg rests on a block B and is tied with horizontal string to the wall at C. Block B is of 200 kg. The coefficient of friction between A and B is 0.25 and that between B and surface is <sup>1</sup>/<sub>3</sub>. The horizontal force F necessary to move the block B should be



(c) 120 N(d) None of the above

Correct: d

16. The ratio of the specific heats of a gas is  $\frac{C_p}{C_v}$  =1.66, then the gas may be

- (a) CO<sub>2</sub>
- (b) He
- (c) H<sub>2</sub>
- (d) NO<sub>2</sub>

Correct: b

17. The variation of magnetic susceptibility  $(\chi)$  with temperature for a diamagnetic substance is best represented by





18. The mass of  $m H_2$  molecule is  $3.32 imes 10^{-24}$ g. If  $10^{23}$  hydrogen molecules per second strike 2

cm of wall at an angle of 45° with the normal, while moving with a speed of 10 cm/s, the pressure exerted on the wall is nearly.

(a) 1350 N<sub>m<sup>2</sup></sub>
(b) 2350
(c) 3320 Nm
(d) 1660 Nm

Correct: b

19. A balloon contains  $1500m^3$ . of helium at 27°C and 4 atmospheric pressure. The volume of helium at - 3°C temperature and 2 atmospheric pressure will

(a)  $1500 m^3$ (b)  $1700 m^3$ (c)  $1900 m^3$ 

(d) 1700  $m^3$ 

Correct: d

20. Five gas molecules chosen arina comarc found to have speeds of 500, 600, 700, 800 and 900 m/s. Then which of the following statements is correct?

(a) The root mean square speed and the average speed are the same.

(b) The root mean square speed is 14 m/s higher than the average speed.

(c) The root mean square speed is 14 m/s lower than the average speed.

(d) The root mean square speed is  $\sqrt{14}$  m/s higher than the average speed.

Correct: b

21. A square loop of wire of side 5 cm is lying on a horizontal table. An electro-magnet wave, above and to one side of the loop is turned on causing a uniform magnetic field downward at an angle of 60° to the vertical as shown in the figure The magnetic induction is 0.50 T. The average induced emf in the loop, if the field increases from zero to its final value in 0.2 s is



Correct: b

22. Two oscillators are started simultaneously in same phase. After 50 oscillations of one, they get out of phase by  $\overline{\Lambda}$ , that is half oscillation. The percentage difference of frequencies of

the two oscillators is nearest to (a) 2% (b) 1% (c) 0.5% (d) 0.25%

Correct: b

23. A load of mass m falls from a height h on to the scale pan hung from the spring as shown in the figure. If the spring constant is k and mass of the scale pan is zero and the mass m does not bounce relative to the pan, then the amplitude of vibration is



Correct: b

24. An elasticized conducting band is around a spherical balloon. Its plane through the centre of balloon. A uniform magnetic field of magnitude 0.04 T is directed perpendicular to the plane of band. Air is let out of the balloon at 100 cm3/s at an instant when the radius of the balloon is 10 cm. The induced emf in the band is



Correct: a

25. A body of mass 1 kg is executing S.H.M. Its displacement y (cm) at t seconds is given by

 $y = 6 \sin\left(100t + \frac{\pi}{4}\right)$ Its maximum kinetic energy is (a) 6 J (b) 18 J (c) 24 J (d) 36 J

Correct: b

26. The wavelength of two waves are 50 and 51 cm respectively. If the temperature of the room is  $20^{\circ}$ C then what will be the number of beats produced per second by these waves, when the speed of sound at  $0^{\circ}$ C is 332 m/s?

(a) 24

(b) 14

(c) 10

(d) None of these

Correct: b

27. 10 forks are arranged in increasing order of frequency in such a way that any two nearest tuning forks produce 4 beats/sec. The highest frequency is twice of the lowest. Possible highest and the lowest frequencies (in Hz) are

(a) 80 and 40

(b) 100 and 50

(c) 44 and 22

(d) 72 and 36

Correct: d

28. In the circuit shown, the symbols have their usual meanings. The cell has emf E. X is initially joined to Y for a long time. Then, X is joined to Z. The maximum charge on C at any later time will be



Correct: d

29. A transverse wave propagating on a stretched string of linear density  $3 \times 10^{-4} \rm kgm^{-1}$  is represented by the equation

Y = 0.2 sin ( 1.5x + 60t ) where, x in metres and t is in seconds. The tension in the string (in Newton) is

(a) 0.24

- (b) 0.48
- (c) 1.20
- (d) 1.80

Correct: b

30. A satellite of mass m is circulating around the Earth with constant angular velocity. If the radius of the orbit is R and mass of the Earth is M, the angular momentum of satellite about the centre of Earth is



Correct: b

31. The dipole moment of the given charge distribution is



Correct: b

32. ABC is an equilateral triangle. Charges +q are placed at each corner as shown in fig. The electric field intensity at centre O will be



(a)  $\frac{1}{4\pi\epsilon_0} \frac{q}{r}$ (b)  $\frac{1}{4\pi\epsilon_0} \frac{q}{r^2}$ (c)  $\frac{1}{4\pi\epsilon_0} \frac{3q}{r^2}$ (d) zero

Correct: d

33. Which of the following electromagnetic radiations has the smallest wavelength?

- (a) Ultraviolet rays
- (b) X-rays
- (c) y-rays
- (d) Microwaves

Correct: c

34. A test charge  $q_0$  is placed at the centre of a spherical conductor of radius R. A charge Q is placed on the spherical conductor. What will be the electrostatic force on the charge Q due to  $q_0$ ?

(a) zero

(b)  $\frac{1}{4\pi\varepsilon_0} \cdot \frac{Qq_0}{R^2}$ (c)  $\frac{1}{4\pi\varepsilon_0} \cdot \frac{Qq_0}{2R^2}$ (d)  $\frac{1}{4\pi\varepsilon_0} \cdot \frac{Qq_0}{4R^2}$ 

Correct: a

35. The surface charge density of a thin charged disc of radius R is  $\sigma$ . The value of the electric field at the centre of the disc is  $\frac{\sigma}{2\epsilon_0}$ . With respect to the field at the centre, the electric field along the axis at a distance R from the centre of the disc

(a) reduces by 70.7%

- (b) reduces by 29.3%
- (c) reduces by 9.7%
- (d) reduces by 14.6%

Correct: a

36. A plane electromagnetic wave is incident on a material surface. If the wave delivers momentum p and energy E, then

(a) p = 0, E = 0(b)  $p \neq 0, E \neq 0$ (c)  $p \neq 0, E = 0$ (d)  $p = 0, E \neq 0$ 

Correct: b

37. Electric potential at any point is V =  $-5x + 3y + \sqrt{15}z$ , then the magnitude of the electric field is:

(a)  $3\sqrt{2}$ (b)  $4\sqrt{2}$ (c)  $5\sqrt{2}$ (d) 7

Correct: d

38. In an electron gun, the potential difference between the filament and plate is 3000 V. What will be the velocity of electron emitting from the gun?

(a)  $3 \times 10^8 \text{m/s}$ (b)  $3.18 \times 10^7 \text{m/s}$ (c)  $3.52 \times 10^7 \text{m/s}$ (d)  $3.26 \times 10^7 \text{m/s}$ 

Correct: d

39. What is equivalent capacitance of circuit between points A and B?



Correct: b

40. The load versus elongation graph for four wires is shown. The thinnest wire is



(a) P

(b) Q

(c) R

(d) S

Correct: d

## Chemistry

41. 100 ml  $O_2$  and  $H_2$  kept at same temperature and pressure. What is true about their number of molecules ?

 $\begin{array}{l} \text{(a) } \mathrm{NO}_2 > \mathrm{NH}_2 \\ \text{(b) } \mathrm{NO}_2 < \mathrm{NH}_2 \\ \text{(c) } \mathrm{NO}_2 = \mathrm{NH}_2 \\ \text{(d) } \mathrm{NO}_2 + \mathrm{NH}_2 = 1 \\ \end{array}$ 

Correct: c

42. Identify the structure of water in the gaseous phase. (a)  $H - \ddot{O} - H$  (b)



(C)



(d) None of these

Correct: c

43. Which of the following relation represents correct relation between standard electrode potential and equilibrium constant?

I.  $\log K = \frac{nFE^{\circ}}{2.303RT}$ II.  $K = e^{\frac{nFE^{\circ}}{RT}}$ III.  $\log K = \frac{-nFE^{\circ}}{2.303RT}$ IV.  $\log K = 0.4342 \frac{nFE^{\circ}}{RT}$ Choose the correct statement(s). (a) I, II and III are correct (b) II and III are correct (c) I, II and IV are correct (d) I and IV are correct

Correct: c

44. When same amount of zinc is treated separately with excess of sulphuric acid and excess of sodium hydroxide solution, the ratio of volumes of hydrogen evolved is:

(a) 1:1

(b) 1:2

(c) 2:1

(d) 9:4

Correct: a

45. The normality of 26% (wt/vol) solution of ammonia (density=0.855) is approximately:

(a) 1.5

(b) 0.4

(c) 15.3

(d) 4

Correct: c

46. Following are colours shown by some alkaline earth metals in flame test. Which of the following are not correctly matched ?

MetalColours(i)Calcium- Apple green(ii)Strontium - Crimson

- (iii) Barium Brick Red
- (a) (i) and (iii)
- (b) (i) only
- (c) (i) and (iii)
- (d) (ii) and (iii)

Correct: a

47. For an endothermic reaction where AH represent the enthalpy of reaction in kJ/mol, the minimum value for energy of activation (for forward reaction) will be

- (a) less than H
- (b) zero
- (c) more than H
- (d) equal to H

Correct: c

48. Dead burnt plaster is (a)  $CaSO_42H_2O$ (b)  $MgSO_4 \cdot 7H_2O$ (c)  $CaSO_4 \cdot 1/2H_2O$ (d)  $CasO_4$ 

## Correct: d

49. Which of the following is not present in Portland cement ? (a)  $Ca_2SiO_4$ (b)  $Ca_3siO_5$ (c)  $Ca_3(PO_4)_2$ (d)  $C_{a_3Al_2O_6}$ 

Correct: c

50. The energy of an electron in second Bohr orbit of hydrogen atom is : (a)  $-5.44 \times 10^{-19} eV$ (b)  $-5.44 \times 10^{-19} cal$ (c)  $-5.44 \times 10^{-19} kJ$ (d)  $-5.44 \times 10^{-19} J$ 

Correct: d

51. An element X occurs in short period having configuration  $ns^2np^1$ . The formula and nature of its oxide is (a) XO<sub>3</sub> basic (b) XO<sub>3</sub> acidic (c) X<sub>2</sub>O<sub>3</sub> amphoteric (d) X<sub>2</sub>O<sub>3</sub> basic

Correct: c

52. The rate of reaction between two reactants A and B decreases by a factor of 4 if the concentration of reactant B is doubled. The order of this reaction with respect to reactant B is:

(a) 2

(b) -2

(c) 1

(d) -1

Correct: b

- 53. Ordinary glass is:
- (a) Sodium silicate
- (b) Calcium silicate
- (c) Sodium and calcium silicate
- (d) Mixed salt of Na and Ca

Correct: c

54. Which of the following is the most basic oxide?

 $\begin{array}{l} \text{(a)} \ Sb_2O_3\\ \text{(b)} \ Bi_2O_3\\ \text{(c)} \ SeO_2\\ \text{(d)} \ Al_2O_3 \end{array}$ 

Correct: b

55. The first emission line in the atomic spectrum of hydrogen in the Balmer series appears at (a)  $\frac{9R}{400}$  cm<sup>-1</sup>

(a)  $\frac{9R}{400}$  cm<sup>-1</sup> (b)  $\frac{7R}{144}$  cm<sup>-1</sup> (c)  $\frac{3R}{4}$  cm<sup>-1</sup> (d)  $\frac{5R}{36}$  cm<sup>-1</sup>

Correct: d

56. Which of the following is strongest nucleophile

(a) Br (b) : OH<sup>-</sup> (c) : CN<sup>-</sup> (d)  $C_2H_5\overline{O}$ 

Correct: c

57. Which of the following ionic substances will be most effective in precipitating the sulphur sol?

(a) KCl (b)  $BaCl_2$ (c)  $Fe_2(SO_4)_3$ (d)  $Na_3PO_4$ 

Correct: c

58. Which of the following will have a meso-isomer also?

- (a) 2,3-Dichloropentane
- (b) 2,3-Dichlorobutane
- (c) 2-Chlorobutane
- (d) 2-Hydroxypropanoic acid

Correct: b

59. A compound of molecular formula of  $\mathrm{C}_{7}\mathrm{H}_{16}$  shows optical isomerism, compound will be

(a) 2,3-Dimethylpentane

(b) 2,2-Dimethylbutane

- (c) 3-Methylhexane
- (d) None of the above

Correct: a

 $\begin{array}{l} \mbox{60. Which of the following order is wrong?} \\ \mbox{(a) } NH_3 < PH_3 < AsH_3-acidic \\ \mbox{(b) } Li < Be < B < C-IE_1 \\ \mbox{(c) } Al_2O_3 < MgO < Na_2O < K_2O-basic \\ \mbox{(d) } Li^+ < Na^+ < K^+ < Cs^+-\mbox{ionic radius} \\ \end{array}$ 

Correct: b

61. In a set of reactions, ethylbenzene yielded a product D .



Correct: d

62. The element, with atomic number 118, will be

- (a) alkali
- (b) noble gas
- (c) lanthanide
- (d) transition element

Correct: b

63. Which of the following on reductive ozonolysis gives only glyoxal?

- (a) Ethene
- (b) Acetylene
- (c) Benzene
- (d) Both (b) and (c)

Correct: d

64. According to molecular orbital theory which of the following statement about the magnetic character and bond order is correct regarding  $\rm O_2^+$ 

- (a) Paramagnetic and Bond order  $< O_{\rm 2}$
- (b) Paramagnetic and Bond order  $> O_2$ ,
- (c) Diamagnetic and Bond order  $< 0_2$
- (d) Diamagnetic and Bond order  $>O_2$

Correct: b

65. An organic compound A  $(C_4H_9Cl)$  on reaction with Na/diethyl ether gives a hydrocarbon which on monochlorination gives only one chloro derivative then A is

- (a) tert-butyl chloride
- (b) sec-butyl chloride
- (c) isobutyl chloride
- (d) n-butyl chloride

# Correct: a

- 66. Identify the incorrect statement from the following:
- (a) Ozone absorbs the intense ultraviolet radiation of the sun.
- (b) Depletion of ozone layer is because of its chemical reactions with chlorofluoro alkanes.
- (c) Ozone absorbs infrared radiation atmosphere.
- (d) Oxides of nitrogen in the atmosphere can cause the depletion of ozone layer.

Correct: c

67. If V is the volume of one molecule of gas under given conditions, the van der Waal's constant b is (a) 4V

(b)  $\frac{4V}{N_0}$ (c)  $\frac{N_0}{4V}$ (d)  $4VN_0$ 

Correct: d

68. Which of the following pollutants is main product of automobiles exhaust?

(a) CO
(b) CO<sub>2</sub>
(c) NO

(d) Hydrocarbons

Correct: c

69. The disease caused the high concentration of hydrocarbon pollutants in atmosphere is/are

(a) silicosis

(b) TB

(c) cancer

(d) asthma

Correct: c

70. The average kinetic energy of an ideal gas per molecule in SI unit at 25° C will be (a)  $6.17 \times 10^{-21}$ kJ (b)  $6.17 \times 10^{-21}$ J (c)  $6.17 \times 10^{-20}$ J (d)  $7.16 \times 10^{-20}$ J

Correct: b

71. Each edge of a cubic unit cell is 400 pm long. If atomic mass of the element is 120 and its density is  $6.25g/cm^3$ , the crystal lattice is : (use  $N_A=6\times 10^{23}mol^{-1})$ 

(a) primitive

- (b) body centered
- (c) face centered
- (d) end centered

Correct: b

72. The number of atoms per unit cell of bcc structure is

(a) 1

(b) 2

(c) 4

(d) 6

Correct: b

73. For vaporization of water at 1 atmospheric pressure, the values of  $\Delta H$  and  $\Delta S$  are 40.63 kJmol<sup>-1</sup> and 108.8JK<sup>-1</sup>mol<sup>-1</sup> respectively. The temperature when Gibbs energy change ( $\Delta G$ ) for this transformation will be zero, is:

(a) 293.4K

(b) 273.4K

(c) 393.4K

(d) 373.4K

Correct: d

74. The non stoichiometric compound  $Fe_{0.94}O$  is formed when x% of  $Fe^{2+}$  ions are replaced by as many  $\frac{2}{3}Fe^{3+}$  ions, x is (a) 18 (b) 12 (c) 15 (d) 6 Correct: a

75. Graphite is a

(a) molecular solid

(b) covalent solid

(c) ionic solid

(d) metallic solid

Correct: b

76. For a particular reversible reaction at temperature T,  $\Delta H$  and  $T > T_e$  were found to be both +ve. If  $T_e$  is the temperature at equilibrium, the reaction would be spontaneous when (a)  $T_e > T$  (b)  $T > T_e$  (c)  $T_e$  is 5 times T (d)  $T = T_e$ 

Correct: b

77. pH of a 0.1 M monobasic acid is found to be 2. Hence, its osmotic pressure at a given temperature TK is
(a) 0.1 RT
(b) 0.11 RT
(c) 1.1 RT
(d) 0.01 RT

Correct: b

78. Raoult's law becomes a special case of Henry's law when

(a)  $K_{H} = p_{1}^{\circ}$ (b)  $K_{H} > p_{1}^{\circ}$ (c)  $K_{H} < p_{1}^{\circ}$ (d)  $K_{H} \ge p_{1}^{\circ}$ 

Correct: a

79. Identify the correct order of solubility of  $Na_2S$  CuS and ZnS in aqueous medium (a)  $CuS>ZnS>Na_2S$  (b)  $ZnS>Na_2S>CuS$  (c)  $Na_2S>CuS>ZnS$  (d)  $Na_2S>ZnS>CuS$ 

Correct: d

80. For the reaction taking place at certain temperature if equilibrium pressure is 3X bar then  $NH_2COONH_4(s) \Rightarrow 2NH_3(g) + CO_2(g)$  would be (a)  $-RT \ln 9 - 3RT \ln X$ (b)  $RT\ln 4 - 3RT \ln X$ (c)  $-3RT \ln X$ (d) None of these

Correct: d

#### **Mathematics**

81. A straight the through a fixed point (2, 3) intersects the coordinate axes at distinct points P and Q. If O is the origin and the rectangle OPRO is completed, then the locus of R is
(a) 2x+3y = xy
(b) 3x+2y = xy
(c) 3x+2y=6xy
(d) 3x+2y=6

Correct: b

82. If a system of equation 1 - ax + y + z = 0 has a non-zero solution then x - by + z = 0; x + y - cz = 0  $(a, b, c \neq -1)$ (a) 0 (b) 1 (c) 2 (d) 3

## Correct: b

83. Given the system of straight lines a(2x + y-3) + 6(3x + 2y-5)=0, the line of the system situated farthest from the point (4, -3) has the equation . (a) 4x + 11y-15=0(b) 7x+y-8=0(c) 4x+3y-7=0(d) 3x - 4y+1=0

Correct: d

84. Two equal sides of an isosceles triangle are 7x-y+3 = 0 and x+y=3=0 and its third side passes through the point (1,-10). find the equation of the third side (a) x - 3y = -31(b) x - 3y = 31(c) x + 3y = 31(d) x + 3y = -31

Correct: b

 $\begin{cases} f(x) = \sin x, \text{ when } x \text{ is rational} \\ = \cos x, \text{ when } x \text{ is imational} \end{cases}$ Then the function is
(a) discontinuous at  $x = n\pi + \pi/4$ (b) continuous at  $x = n\pi + \pi/4$ (c) discontinuous at all x
(d) none of these

Correct: b

86. The locus of the point of intersection of the lines at  $x = a\left(\frac{1-t^2}{1+t^2}\right)$  and  $y = \frac{2at}{1+t^2}$  represent (t being a parameter) (a) circle (b) parabola (c) ellipse (d) hyperbola

Correct: a

87. If  $y = \frac{x}{x+1} + \frac{x+1}{x}$  then  $\frac{d^2y}{dx^2}$  at x = 1 is equal to (a) 7/4 (b) 7/8 (c) 1/3 (d) 2/3

#### Correct: a

88. Eccentricity of ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  if it passes through point (9,5) and (12,4) is (a)  $\sqrt{3/4}$ (b)  $\sqrt{4/5}$ (c)  $\sqrt{5/6}$ (d)  $\sqrt{6/7}$ 

Correct: d

89. If  $f(x) = x^x$  then f(x) is increasing in interval : (a) [0, e](b)  $\left[0, \frac{1}{e}\right]$ (c) [0, 1](d) None of these

Correct: b

90. If p and p' denotes the lengths of the perpendicular from a focus and the center of an ellipse with semi-major axis of length a, respectively, on a tangent to the ellipse and r denotes the focal distance of the point, then

(a) ap = rp'(b) rp = ap'(c)  $p^2 < 8q^2$ (d) ap' + rp=1

Correct: a

91. The value of  $\lim_{n\to\infty} \frac{1+2+3+\ldots n}{n^2+100}$  is equal to (a)  $\infty$ (b) 1/2 (c) 2 (d) 0

Correct: b

92. Line joining the points (0, 3) and (5, - 2) is a tangent to the curve  $y = \frac{ax}{1+x}$ , then (a)  $a = 1 \pm \sqrt{3}$ (b)  $a \in \phi$ (c)  $a = -1 \pm \sqrt{3}$ 

(d)  $a = -2 \pm 2\sqrt{3}$ 

Correct: b

93. The value of  $\lim_{x\to\infty} \left(\frac{a_1^{1/x} + a_2^{1/x} + \dots + a_n^{1/x}}{n}\right)^{nx}$  $a_i > 0, i = 1, 2, \dots, n$  is (a)  $a_1 + a_2 + \dots + a_n$ (b)  $e^{a_1 + a_2 + \dots + a_n}$ (c)  $\frac{a_1 + a_2 + \dots + a_n}{n}$ (d)  $a_1 a_2 a_3, \dots + a_n$ 

Correct: d

94.  $\lim_{n\to\infty} \sin\left(\pi\sqrt{n^2+1}\right)$  is equal to (a)  $\infty$ (b) 0 (c) does not exist (d) none of these

Correct: b

95. The value of the integral  $\int_a^b \frac{\sqrt{x}dx}{\sqrt{x}+\sqrt{a+b-x}}$  is (a)  $\pi$ (b)  $\frac{1}{2}(b-a)$ (c)  $\pi/2$ (d) b-a

Correct: b

96. In the truth table for the statement  $(p \land q) o (q \lor \sim p)$ , the last column has the truth value in the following order is

(a) TTFF

- (b) FTTT
- (c) TFTT
- (d) TTTT

Correct: d

- 97. Negation of "Paris in France and London is in England" is
- (a) Paris is in England and London is in France
- (b) Paris is not in France or London is not in England
- (c) Paris is in England or London is in France
- (d) None of these

Correct: b

98. If  $\int_0^a f(2a-x)dx = m$  and  $\int_0^a f(x)dx = n$  then  $\int_0^{2a} f(x)dx$  is equal to (a) 2 m + n (b) m + 2n(c) m - n(d) m + n

Correct: d

- 99. Which of the following is a statement?
- (a) May you live long!
- (b) May God bless you!
- (c) The sun is a star
- (d) Hurrah! we have won the match

Correct: c

- 100. Which of the following is not a proposition
- (a)  $\sqrt{3}$  is a prime
- (b)  $\sqrt{2}$  is irrational
- (c) Mathematics is interesting
- (d) 5 is an even integer

### Correct: c

Marks	No. of	Marks	No. of
10 - 20	2	60-70	12
20 - 30	3	70-80	14
30 - 40	4	80 - 90	10
40 - 50	5	90 - 100	4
50 - 60	6		

101. The marks obtained by 60 students in a certain test are given below :

Median of the above data is

- (a) 68.33
- (b) 70
- (c) 68.11
- (d) None of these

## Correct: a

102. The area under the curve  $y = |\cos x - \sin x| \ 0 \le x \le \frac{\pi}{2}$  above x-axis is (a)  $2\sqrt{2}$ (b)  $2\sqrt{2} - 2$ (c)  $2\sqrt{2} + 2$ (d) 0 Correct: b

103. If a variable takes value 0, 1, 2, ...,n with frequencies  $q^n$ ,  $C_1q^{n-1}p$ ,  $C_2q^{n-2}p^2$ , ...,  $C_np^n + 6$  where p+q=1, then the mean is (a) np (b) nq (c) n(p+q) (d) None of these

Correct: a

104. If the mean and standard deviation of 10 observations  $x_1, x_2, \ldots, x_{10}$  are 2 and 3 respectively, then the mean of  $(x_1 + 1)^2, (x_2 + 1)^2, \ldots, (x_{10} + 1)^2$  is equal to (a) 18 (b) 13.5 (c) 14.4 (d) 16

Correct: a

105. Number of solution for the system of inequalities  $egin{cases} 2x+1 < x+2 \ x-1 > 2x \end{cases}$ 

- (a) 1
- (b) 2
- (c) 3
- (d) 0

Correct: d

106. The probability of getting 10 in a single throw of three fair dice is :

- (a) 1/6
- (b) 1/8
- (c) 1/9
- (d) 1/5

Correct: b

107. If the papers of 4 students can be checked by anyone of the 7 teachers then the probability that all the 4 papers are checked by exactly 2 teachers, is equal to (a) 12/49

(b) 6/49

- (c) 9/49
- (d) 15/49

Correct: b

108. The number of ways in which first, second and third prizes can be given to 5 competitors

is ?

- (a) 10
- (b) 60
- (c) 15
- (d) 125

Correct: b

109. Let a, b and c be three vectors satisfying then equals
(a) 1
(b) -1
(c) 2
(d) -4

Correct: d

110. A bag contains 5 brown and 4 white socks. A man pulls out 2 socks. Find the probability that they are of the same colour.

(a) 4/9 (b) 2/9

(c) 5/9

(d) 7/9

# Correct: a

111. Let f and g be functions from R to R defined as

$$f(x) = \left\{egin{array}{c} 7x^2 + x - 8, x \leq 1 \ 4x + 5, 1 < x \leq 7, g(x) = \left\{egin{array}{c} 0, -3 \leq x < 2 \ x^2 + 4, x \geq 2 \end{array}
ight.
ight.$$

Then

(a) (fog) (-3)=8
(b) (fog)(9)=683
(c) (gof)(0)=-8
(d) (gof) (6)=427

# Correct: b

112. If  $\sum_{r=0}^{n} (-1)^{r} \frac{{}^{n}C_{r}}{r+3C_{r}} = \frac{3}{a+3}$  then a-n is equal to (a) 0 (b) 1 (c) 2 (d) None of these

#### Correct: a

113. If  $ho=\{(x,y)|x^2+y^2=1;x,y\in R\}$  then ho is (a) reflexive (b) symmetric (c) transitive (d) anti-symmetric

Correct: b

114. If A, B, C are the angles of a triangle and  $e^{iA}$ ,  $e^{iB}$ ,  $e^{ic}$  are in A.P. Then the triangle must be (a) right angled

(b) isosceles

(c) equilateral

(d) None of these

Correct: c

115. Let  $f : R \to R$  be a function defined by  $f(x) = \frac{x-m}{x-n}$ , where  $m \neq n$  then (a) f is one-one onto (b) f is one-one into (c) f is many-one onto (d) f is many-one into

Correct: b

116. After striking the floor a certain ball rebounds 4/5th of its height from which it has fallen. The total distance that the ball travels before coming to rest if it is gently released from a height of 120m is

- (a) 960m
- (6) 1000m
- (c) 1080m
- (d) Infinite

Correct: c

117. The domain of the function  $f(x) = \sin^{-1} \left\{ \log_2 \left( rac{1}{2} x^2 
ight) 
ight\}$  is

 $\begin{array}{l} \text{(a)} \ [-2,-1)\cup [1,2] \\ \text{(b)} \ (-2,-1]\cup [1,2] \\ \text{(c)} \ [-2,-1]\cup [1,2] \\ \text{(d)} \ (-2,-1)\cup (1,2) \end{array}$ 

Correct: c

118. If  $\sin^{-1}x + \sin^{-1}y + \sin^{-1}z = \frac{3\pi}{2}$  and  $f(1) = 2 f(p+q) = f(p) \cdot f(q), \forall p, q \in R$ , then  $x^{f(1)} + y^{f(2)} + z^{f(3)} - \frac{(x+y+z)}{x^{f(1)} + y^{f(2)} + z^{f(3)}}$  is equal to (a) 0 (b) 1 (c) 2 (d) 3 Correct: c 119.  $\sin^{-1}\left(\frac{2a}{1+a^2}\right) - \cos^{-1}\left(\frac{1-b^2}{1+b^2}\right) = \tan^{-1}\left(\frac{2x}{1-x^2}\right)$  then what is the value of x? (a) a/b (b) ab. (c) b/a (d)  $\frac{a-b}{1+ab}$ Correct: d 120. If  $\cos^{-1}x - \cos^{-1}rac{y}{2} = lpha$  then  $4x^2 - 4xy\coslpha + y^2$  is equal to (a)  $2\sin 2\alpha$ (b) 4 (c)  $4\sin^2\alpha$ (d)  $-4\sin^2\alpha$ Correct: c 121. If  $A = \frac{1}{3} \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ a & 2 & b \end{bmatrix}$  is an orthogonal matrix, then (a) a = -2, b = -1

(b) a=2, b= 1 (c) a=2,b=-1 (d) a=-2, b=1

Correct: a

122. If 
$$R(t) = \begin{bmatrix} \cos t & \sin t \\ -\sin t & \cos t \end{bmatrix}$$
 then  $R(s)R(t)$  equals  
(a) R (s+t)  
(b) R (s-t)  
(c) R(s)+R(t)  
(d) None of these

Correct: a

123. If  $\begin{bmatrix} \alpha & \beta \\ \gamma & -\alpha \end{bmatrix}$  is square root of identity matrix of order 2 then (a)  $1 + \alpha^2 + \beta y = 0$ (b)  $1 + \alpha^2 - \beta y = 0$ (c)  $1 - \alpha^2 + \beta y = 0$ (d)  $\alpha^2 + \beta y = 1$ 

Correct: d

124. The matrix  $A^2 + 4A - 5I$ , where I is identity matrix and  $A = \begin{bmatrix} 1 & 2 \\ 4 & -3 \end{bmatrix}$  equals (a)  $4 \begin{bmatrix} 2 & 1 \\ 2 & 0 \end{bmatrix}$ (b)  $4 \begin{bmatrix} 0 & -1 \\ 2 & 2 \end{bmatrix}$ (c)  $32 \begin{bmatrix} 2 & 1 \\ 2 & 0 \end{bmatrix}$ (d)  $32 \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$ 

Correct: a

125. If 
$$A = \begin{bmatrix} 1 & 3 \\ 3 & 2 \\ 2 & 5 \end{bmatrix}$$
 and  $B = \begin{bmatrix} -1 & -2 \\ 0 & 5 \\ 3 & 1 \end{bmatrix}$  and A+B-D=0 (zero matrix), then D matrix will  
be  
(a)  $\begin{bmatrix} 0 & 2 \\ 3 & 7 \\ 6 & 5 \end{bmatrix}$   
(b)  $\begin{bmatrix} 0 & 2 \\ 3 & 7 \\ 5 & 6 \end{bmatrix}$   
(c)  $\begin{bmatrix} 0 & 1 \\ 3 & 7 \\ 5 & 6 \end{bmatrix}$   
(d)  $\begin{bmatrix} 0 & -2 \\ -3 & -7 \\ -5 & -6 \end{bmatrix}$ 



126. Out of the four alternatives, choose the one which express the correct meaning of the word, AUGMENT

- (a) Increase
- (b) Decrease
- (c) Save
- (d) Mention

Correct: d

127. Choose the word opposite in meaning to the given word, EXODUS

- (a) Influx
- (b) Home-coming
- (c) Return
- (d) Restoration

Correct: a

128. Choose the word which is most opposite in meaning to the word 'Drowsy'.

- (a) Sleepy
- (b) Nodding
- (c) Yawning
- (d) Wakeful

Correct: d

129. Choose the word which is the exact OPPOSITE of the given word, ARROGANT

- (a) Humble
- (b) Cowardly
- (c) Egotistic
- (d) Gentlemanly

Correct: a

130. Read each sentence to find out whether there is any grammatical error in it. The error, if any will be in one part of the sentence. The letter of that part is the answer. If there is no error, the answer is d.

- (a) We discussed about the problem so thoroughly
- (b) on the eve of the examination
- (c) that I found it very easy to work it out.
- (d) No error.

## Correct: a

131. In the following question, out of the four alternatives, choose the one which best

expresses the meaning of the given word, LOQUACIOUS

- (a) Talkative
- (b) Slow
- (c) Content
- (d) Unclear

## Correct: a

132. Read the following passage carefully and answer the questions given below it. The likelihood of at least 600,000 deaths being caused annually in India by fine particulate matter pollution in the air is cause for worry, even if the data released by the World Health Organisation are only a modelled estimate. The conclusion that so many deaths could be attributed to particulate matter 2.5 micrometres a or less in size is, of course, caveated, sincero comprehensive measurement of PM2.5 is not yet being n done and the linkages between pollution, disease and in deaths need further study. What is not in doubt is that 1 residents in many urban areas are forced to breathe unhealthy levels of particulates, and the smallest of these - PM10 and less - can penetrate and get lodged deep in the lungs. The WHO Global Burden of Disease study has been working to estimate pollution-linked health impacts, such as stroke and ischaemic heart disease, acute lower respiratory infection and chronic obstructive pulmonary disease. Data on fine particulates in India show that in several locations the pollutants come from burning of biomass, such as coal, fuel wood, farm litter and cow dung cakes. In highly built-up areas, construction debris, road dust and vehicular exhaust add to the problem. The Prime Minister launched an Air Quality Index last year aimed at improving pollution control. The new data, which the WHO says provide the best evidence available on the terrible toll taken by particulates, should lead to intensified action. A neglected aspect of urban air pollution control is the virtual discarding of the Construction and Demolition 3 Waste Management Rules, notified to sustainably manage debris that is dumped in the cities, creating severe particulate pollution.

The Environment Ministry has highlighted the role that debris can play as a resource. Municipal and government contracts are, under the rules, required to utilise up to 20 per cent materials made from construction and demolition waste, and local authorities must place containers to hold debris. This is is dumped in the cities ,creating severe particulate pollution. must be implemented without delay. Providing cleaner fuels and scientifically designed cookstoves to those who have no option but to burn biomass, would have a big impact on reducing particulate matter in the northern and eastern States, which are the worst-hit during winter, when biomass is also used for heating. Greening the cities could be made a mission, involving civil society, with a focus on landscaping open spaces and paving all public areas to reduce dust. These measures can result in lower PM10 and PM2.5 levels. measurement of these particulates is currently absent in many cities, a lacuna that needs to be addressed. According to the WHO Global Burden of Disease study which of the following is/are pollution linked health impacts?

(I) Infection of the lower respiratory system

- (II) Chronic obstructive pulmonary disease
- (III) Stroke and ischaemic heart disease
- (a) Only (I)
- (b) Only (III)

(c) Both (I) and (II)(d) All of the above

Correct: d

133. In the following question, out of the four alternatives, choose the one which best expresses the meaning of the given word, INDICT

(a) Condemn

- (b) Reprimand
- (c) Accuse
- (d) Allege

Correct: c

134. Choose the word which best expresses the meaning of the underlined word in the sentence.

Decay is an *immutable* factor of human life.

(a) important

(b) unique

- (c) unchangeable
- (d) awful

Correct: c

135. Choose the word which best expresses the meaning of the underlined word in the sentence.

It was an <u>ignominious</u> defect for the team.

- (a) shameful
- (b) admirable

(c) unaccountable

(d) worthy

Correct: a

136. Choose the word which best expresses the meaning of the underlined word in the sentence.

The attitude of western countries towards the third world countries is rather <u>callous</u> to say the least.

- (a) cursed
- (d) unkend
- (c) unfeeling
- (d) passive

Correct: c

137. In each of the following questions choose the alternative which can be substituted for the

given words/sentence.

Elderly woman in charge of a girl on social occasions.

- (a) Spinster
- (b) Matron
- (c) Chaperon
- (d) Chandler

Correct: c

138. Choose the word which is closest to the opposite in meaning of the underlined word in the sentence.

The Gupta rulers patronised all cultural activities and thus Gupta period was called the golden era in Indian History.

- (a) criticised
- (b) rejected
- (c) opposed
- (d) spurned

Correct: c

139. Choose the word which is closest to the opposite in meaning of the underlined word in the sentence.

The General Manager is quete tactful and handles the workers union very effectively.

- (a) incautious
- (b) discreet
- (c) strict
- (d) disciplined

Correct: a

140. In each of the following questions, out of the four alternatives, choose the one which can be substituted for the given words/sentence.

A person who does not believe in any religion.

- (a) Philatelist
- (b) Rationalist
- (c) Atheist
- (d) Pagan

Correct: c

## Logical Reasoning

coded as -(a) ODONHCR (b) ODDOHCR (c) ODQHNCR (d) ODQHNRC

Correct: d

142. If 5#6=121 and 10#8 = 324, then find the value of 23 # 14=? (a) 1369 (b) 1349 (c) 1331 (d) 725

Correct: b

143. Select the related letter/word/ number from the given alternatives.

Distance: Odometer :: ? : Barometer

(a) Humidity

(b) Pressure

(c) Thickness

(d) Wind

Correct: d

144. Choose the correct alternatives from the given ones that will complete the series.

L\_NO\_\_MLLM\_OO\_ML

(a) MNNNO(b) MONNO(c) MONON

(d) MONNN

Correct: c

145. Choose the correct alternatives from the given ones that will complete the series.. 22, 26, 53, 69, 194, ?

(a) 230

(b) 260

(c) 250

(d) 245

Correct: b

146. In these series, you will be looking at both the letter pattern and the number pattern. Fill in the blank in the middle of the series or end of the series. QAR, RAS, SAT, TAU, \_

(a) UAV(b) UAT(c) TAS(d) TAT

Correct: b

147. In these series, you will be looking at both the letter pattern and the number pattern. Fill in the blank in the middle of the series or end of the series.

DEF, DEF2, DE2F2, \_, D2E2F3

(a) DEF3

(b) DзEFз

(c) D2E3F

(d) D2E2F2

Correct: d

148. In each question below are given two statements followed by two conclusions numbered I and II. You have to take the given two statements to be true even if they seem to be at variance from commonly known facts. Read the conclusion and then decide which of the given conclusions logically follows from the two given statements, disregarding commonly known facts.

Statements : Raman is always successful. No fool is always successful. Conclusions :

I. Raman is a fool.

II. Raman is not a fool.

Give answer:

- (a) If only conclusion I follows
- (b) If only conclusion II follows
- (c) If neither I nor II follows and

(d) If both I and II follow.

Correct: d

149. In each question below are given two statements followed by two conclusions numbered I and II. You have to take the given two statements to be true even if they seem to be at variance from commonly known facts. Read the conclusion and then decide which of the given conclusions logically follows from the two given statements, disregarding commonly known facts.

Statements : Statements : Some desks are caps. No cap is red.

Conclusions :

I. Some caps are desks.

II. No desk is red.

Give answer:

- (a) If only conclusion I follows
- (b) If only conclusion II follows
- (c) If neither I nor II follows and

(d) If both I and II follow.

Correct: a

150. Complete the series by replaning '? mark G4T,J9R, M20P, P43N, S90L,?
(a) S90L
(b) V185J
(c) M20P
(d) P43N

Correct: b