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Time: 3 Hour Total Marks: 450

BITSAT

Subjects : Physics, Chemistry, English Proficiency, Logical Reasoning, Mathematics

Section: I
Subject: Physics

1. Two container of equal volume contain the same gas at pressure P_1 and P_2 and absolute temperatures T_1 and T_2 respectively. On joining the vessels, the gas reaches a common pressure P and a common temperature T. The ratio P/T is equal to

(a) $\frac{P_1}{T_1}+\frac{P_2}{T_2}$ **(b)** $\frac{1}{2}\left[\frac{P_1}{T_1}+\frac{P_2}{T_2}\right]$

(c) $\frac{P_1T_2+P_2T_1}{T_1+T_2}$ **(d)** $\frac{P_1T_2-P_2T_1}{T_1-T_2}$

2. A diatomic ideal gas is heated at constant volume until its pressure is doubled. It is again heated at constant pressure until its volume is doubled. The molar heat capacity for the whole process is kR where k is

(a) 23/5 **(b)** 19/5

(c) 19/6 **(d)** 13/4

3. A body cools from 50° C to 40° C in 5 minutes. The surrounding temperature is 20°C. In what further time (in minutes) will it cool to 30°C?

(a) 5 **(b)** 15/2

(c) 25/3 **(d)** 10

4. A system undergoes a cyclic process in which it absorbs Q_1 heat and gives out Q_2 heat. The efficiency of the process in η and the work done is W. Then

(a) $W = Q_1 + Q_2$ **(b)** $\eta = W/Q_1$

(c) $\eta = Q_2/Q_1$ **(d)** $\eta = 1+\frac{Q_2}{Q_1}$

5. 50 gm of ice at 0°C is mixed with 50 gm of water at 20°C. The final temperature of the mixture would be

(a) -10^oC **(b)** -30^oC

(c) 0^oC **(d)** 10^oC

6. If the ratio of specific heat of a gas at constant pressure to that at constant volume is γ, the change in internal energy of the mass of gas, when the volume changes from V to 2V at constant pressure P, is

(a) $\frac{R}{\gamma-1}$ **(b)** PV

(c) $\frac{PV}{\gamma-1}$ **(d)** $\frac{\gamma PV}{\gamma-1}$

All The Best!!!

7. In kinetic theory of gases, a molecule of mass m of an ideal gas collides with a wall of vessel with velocity v. The change in the linear momentum of the molecule is

(a) 2 mv **(b)** mv

(c) $-mv$ **(d)** zero

8. In a thermodynamic process, pressure of a fixed mass of gas is changed in such a manner that the gas released 20 J of heat and 8 J of work has done on the gas. If the initial internal energy of the gas was 30 J, then the final internal energy will be

(a) 2 J **(b)** 18 J

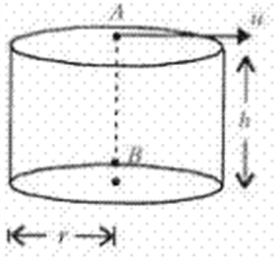
(c) 42 J **(d)** 58 J

9. Steam at 100°C is passed into 1.1 kg of water contained in a calorimeter of water equivalent 0.02 kg at 15°C till the temperature of the calorimeter rises to 80° C. The mass of steam condensed in kilogram is

(a) 0.13 **(b)** 0.065

(c) 0.260 **(d)** 0.135

10. A hollow vertical cylinder of radius r and height h has a smooth internal surface. A small particle is placed in contact with the inner side of the upper rim, at point A, and given a horizontal speed u, tangential of the rim. It leaves the lower rim at point B, vertically below A. If n is an integer then



(a) $\frac{u}{2\pi r}\sqrt{2h/g} = n$ **(b)** $\frac{h}{2\pi r} = n$

(c) $\frac{2\pi r}{h} = n$ **(d)** $\frac{u}{\sqrt{2gh}} = n$

11. A disc of mass m and radius R has a concentric hole of radius r. Its moment of inertia about an axis through its centre and perpendicular to its plane is

(a) $\frac{1}{2}m(R-r)^2$ **(b)** $\frac{1}{2}m(R^2-r^2)$

(c) $\frac{1}{2}m(R+r)^2$ **(d)** $\frac{1}{2}m(R^2+r^2)$

12. A rectangular block of mass m and area of cross section A floats in a liquid of density ρ. If it is given a small vertical displacement from equilibrium, it undergoes oscillation with a time period T, then

(a) $T \propto m$ **(b)** $T \propto \rho$

(c) $T \propto A$ **(d)** $T \propto \rho^2$

13. A spherical steel ball released at the top of a long column of glycerine of length L, falls through a distance L/2 with accelerated motion and the remaining distance L/2 with a uniform velocity. If t_1 and t_2 denote the time taken to cover the first and second half and W_1 and W_2 the work done against gravity in the two halves, then

(a) $t_1 < t_2$; $W_1 > W_2$ **(b)** $t_1 < t_2$; $W_1 < W_2$

(c) $t_1 = t_2$; $W_1 = W_2$ **(d)** $t_1 > t_2$; $W_1 = W_2$

14. Pushing force making an angle θ to the horizontal is applied in a block of weight W placed on a horizontal table. If the angle of friction is ϕ, the magnitude of force required to move the body is equal to

(a) $\frac{W\cos\theta}{\cos(\theta-\phi)}$ **(b)** $\frac{W\sin\phi}{\cos(\theta-\phi)}$

(c) $\frac{W\tan\phi}{\sin(\theta-\phi)}$ **(d)** $\frac{W\sin\phi}{\tan(\theta-\phi)}$

15. The torque $\vec{\tau}$ on a body about a given point is found to be equal to $\vec{A}\times\vec{L}$ where $\vec{A}$ is constant vector and $\vec{L}$ is the angular momentum of the body about that point. From this follows that

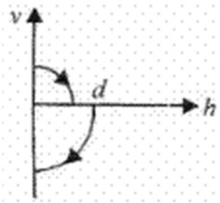
(a) $\frac{d\vec{L}}{dt}$ is parallel to $\vec{L}$ at some instants of time

(b) the component of $\vec{L}$ in the direction of $\vec{A}$ does not change with time

(c) The magnitude of $\vec{L}$ does change with time

(d) $\vec{L}$ does not change with time.

16. A ball is dropped vertically from a height d above the ground. It hits the ground and bounces up vertically to a height d/2. Neglecting subsequent motion and air resistance, its velocity v varies with height h above the ground as

(a)


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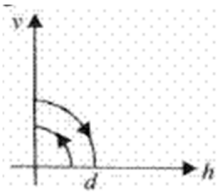

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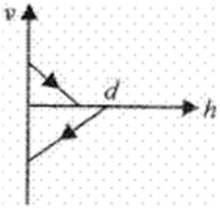

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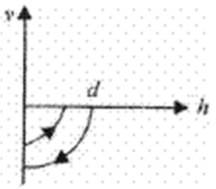
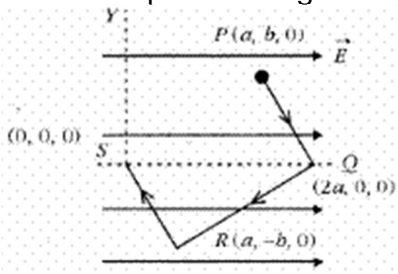


17. A point charge q moves from point P to point S along the path PQRS in a uniform electric field $\vec{E}$ pointing parallel to the positive direction of the x-axis. The coordinates of the points P, Q, R and S are (a, b, 0), (2a, 0, 0), $(a, -b, 0)$ and (0, 0, 0) respectively. The work done by the field in

the above process is given by the expression



(a) qaE

(b) $-qaE$

(c) $q\left(\sqrt{a^2+b^2}\right)E$

(d) $3qE\sqrt{a^2+b^2}$

18. A large solid sphere with uniformly distributed positive charge has a smooth narrow tunnel through its centre. A small particle with negative charge, initially at rest far from the sphere, approaches it along the line of the tunnel, reaches its surface with a speed v, and passes through the tunnel. Its speed at the centre of the sphere will be

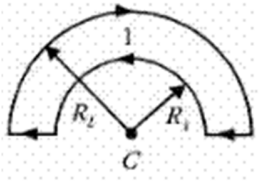
(a) 0

(b) v

(c) $\sqrt{2}\,v$

(d) $\sqrt{1.5}\,v$

19. The wire loop formed by joining two semicircular sections of radii R_1 and R_2, and centre C carries a current I, as shown. The magnetic field at C has magnitude



(a) $\frac{\mu_0 I}{2}\left(\frac{1}{R_1}+\frac{1}{R_2}\right)$

(b) $\frac{\mu_0 I}{4}\left(\frac{1}{R_1}+\frac{1}{R_2}\right)$

(c) $\frac{\mu_0 I}{2}\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$

(d) $\frac{\mu_0 I}{4}\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$

20. A flat coil of n turns, area A and carrying a current i is placed in a uniform magnetic field of magnitude B. The plane of the coil makes and angle θ with the direction of the field. The torque acting on the coil is

(a) $BinA\sin\theta$

(b) $\frac{nAi}{B}\sin\theta$

(c) $BinA\cos\theta$

(d) $Bin^2A\cos\theta$

21. A short bar magnet is placed in the tan A position 10 cm to the east of compass needle. The deflection produced in the needle is 45°. If H - 0.4 Tesla, magnetic moment of the magnet is

(a) 100×10^3

(b) 400×10^3

(c) 200×10^3

(d) 800×10^3

22. A charge q is placed at the centre of the joining of two equal charges Q. The system of three charges will be in equilibrium if q is equal to

(a) $-Q/2$

(b) $-Q/4$

(c) $-4Q$

(d) $+Q/2$

23. An electron moving in a circular orbit of radius r makes n rotations per second. The magnetic field produced at the centre has magnitude

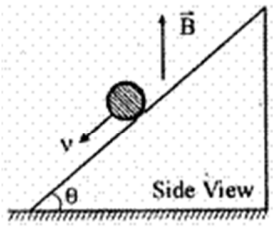
(a) $\frac{\mu_0 n^2 e}{2r}$

(b) $\frac{\mu_0 n e}{2r}$

(c) $\frac{\mu_0 n e}{2\pi r}$

(d) zero

24. A conducting rod of length l and mass m is moving down a smooth inclined plane of inclination θ with constant velocity v. A current I is flowing in the conductor in a direction perpendicular to paper inwards. A vertically upward magnetic field $\vec{B}$ exists in space. Then magnitude of magnetic field $\vec{B}$ is



(a) $\frac{mg}{il}\sin\theta$

(b) $\frac{mg}{il}\tan\theta$

(c) $\frac{mg\cos\theta}{il}$

(d) $\frac{mg}{il\sin\theta}$

25. P is a point on the axis of a concave mirror. The image of P, formed by the mirror, coincides with P. A rectangular glass slab of thickness t and refractive index μ is now introduced between P and the mirror. For the image of P to coincide with P again, the mirror must be moved.

(a) towards P by $(\mu-1)t$

(b) away from P by $(\mu-1)t$

(c) towards P by $t(1-1/\mu)$

(d) away from P by $t(1-1/\mu)$

26. A ray of light travels from an optically denser to rarer medium. The critical angle for the two media is c. The maximum possible deviation of the ray will be

(a) $\pi - c$

(b) $\pi - 2c$

(c) 2c

(d) $(\pi/2)c$

27. A short linear object of length b lies along the axis of a concave mirror of focal length f, at a distance u from the mirror. The size of the image is approximately

(a) $b\left(\frac{u-f}{f}\right)^{1/2}$

(b) $b\left(\frac{f}{u-f}\right)$

(c) $b\left(\frac{u-f}{f}\right)$

(d) $b\left(\frac{f}{u-f}\right)^2$

28. An astronomical telescope has an angular magnification of magnitude 5 for distant objects. The separation between the objective and the eyepiece is 36 cm. The final image is formed at infinity. The focal length f_o of the objective and f_e of the eyepiece are

(a) 45 cm and -9 cm respectively

(b) 50 cm and 10 cm respectively

(c) 7.2 cm and 5 cm respectively

(d) 30 cm and 6 cm respectively

29. Consider Fraunhofer diffraction pattern obtained with a single slit illuminated at normal incidence. At the angular position of the first diffraction minimum the phase difference (in radians) between the wavelets from the opposite edges of the slit is

(a) $\pi/4$

(b) $\pi/2$

(c) π

(d) 2π

30. With respect to air the critical angle in a medium for light of red colour λ_1 is θ. Other facts remaining the same critical angle for light of yellow light λ_2 will be

(a) θ

(b) more than θ

(c) less than θ

(d) $\frac{\theta\lambda_1}{\lambda_2}$

31. In Young's double slit experiment, 12 fringes are obtained to be formed in a certain segment of the screen when light of wavelength 600 nm is used. If the wavelength of light is changed to 400 nm, number of fringes observed in the same segment of the screen is given by

(a) 12

(b) 18

(c) 24

(d) 30

32. A giant telescope in an observatory has an objective of focal length 19 m and an eye-piece of focal length 1.0 cm. In normal adjustment, the telescope is used to view the moon. What is the diameter of the image of the moon formed by the objective ? The diameter of the moon is 3.5×10^6 m and the radius of the lunar orbit round the earth is 3.8×10^8 m.

(a) 10 cm

(b) 12.5 cm

(c) 15 cm

(d) 17.5 cm

33. In Young's double slit experiment the fringe width with light of wavelength $6000\,\text{Å}$ is found to be 4.0 mm. What will be the fringe width of light of wavelength $4800\,\text{Å}$ is used ?

(a) 2.8 mm

(b) 3.2 mm

(c) 4.0 mm

(d) 4.8 mm

34. When a thin wedge-shaped film is illuminated by a parallel beam of light of wavelength $6000\,\text{Å}$, 7 fringes are observed in a certain region of the film. How many fringes will be observed in the same region of the film of light of wavelength $4200\,\text{Å}$ is used ?

(a) 6

(b) 10

(c) 14

(d) 18

35. Imagine an atom made up of a proton and a hypothetical particle of double the mass of the electron but having the same charge as the electron. Apply the Bohr atomic model and consider all possible transitions of this hypothetical particle to the first excited level. The longest wavelength of photon that will be emitted has wavelength λ (given in terms of the Rydberg constant R for hydrogen atom) equal to

(a) 9/(5R)

(b) 36/(5R)

(c) 18/(5R)

(d) 4/R

36. The classical physics relation between the magnetic moment $\vec{\mu}$ of the electron orbiting round the proton and its angular momentum $\vec{L}$ is

(a) $\vec{\mu} = \vec{L}$

(b) $\vec{\mu} = \frac{\vec{L}}{m}$

(c) $\vec{\mu} = \frac{e}{2m}\vec{L}$

(d) None

37. The wavelength of incident radiation is 10 cm. It lies in which of the following electromagnetic radiation?

(a) ultra-violet

(b) infra-red

(c) microwaves

(d) X-rays

38. The activity of a sample of radioactive material is A_1 at time t_1 and A_2 at time t_2 ($t_2 > t_1$). Its mean life is T. Then

(a) $A_1 t_1 = A_2 t_2$

(b) $\frac{A_1 - A_2}{t_2 - t_1} = \text{constant}$

(c) $A_2 = A_1 e^{(t_1 - t_2)/T}$

(d) $A_2 = A_1\, e^{t_1/t_2 T}$

39. The count rate from 100 cm^3 of radioactive liquid is c. Some this liquid is now discarded. The count rate of the remaining liquid is found to be c/10 after three half-lives. The volume of the remaining liquid in cm^3 is

(a) 20

(b) 40

(c) 60

(d) 80

40. In a Collidge tube, the potential difference across the tube is 20 kV, and 10 mA current flows through the voltage supply. Only 0.5% of the energy carried by the electrons striking the target is converted into X-rays. The X-ray beam carries a power of

(a) 0.1 W

(b) 1 W

(c) 2 W

(d) 10 W

Section: II
Subject: Chemistry

41. The mass defect of the nuclear reaction $^{8}_{5}B \longrightarrow {}^{8}_{4}Be + {}^{0}_{+1}e$ is

(a) Δm = atomic mass of $^{8}_{4}Be$ – atomic mass of $^{8}_{5}B$

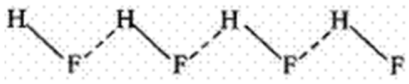
(b) Δm = atomic mass of $^{8}_{4}Be$ – atomic mass of $^{8}_{5}B$ + mass of one electron

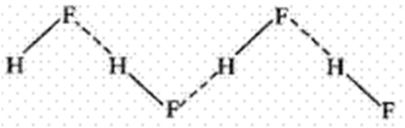
(c) Δm = atomic mass of $^{8}_{4}Be$ – atomic mass of $^{8}_{5}B$ + mass of one positron

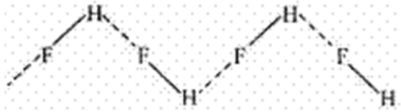
(d) Δm = atomic mass of $^{8}_{4}Be$ – atomic mass of $^{8}_{5}B$ + mass of two electron

42. The H-bonds in solid HF can be best represented as

(a) H — F - - - - H — F - - - - H — F

(b) 

(c) 

(d) 

43. A section of the periodic table is given below with elements A, B and X, Y in two groups. Which of the bonds given below is the least polar?

Group I	Group II
A	X
B	Y

(a) AX

(b) AY

(c) BX

(d) BY

44. Which of the following molecules will have a permanent dipole moment?

(a) SiF_4

(b) XeF_4

(c) SF_4

(d) BF_3

45. Which one of the following statements is not applicable to electricity conductors?

(a) new products show up at the electrodes

(b) ions are responsible for carrying the current

(c) show a positive temperature coefficient for conductance

(d) a single stream of electrons flows from cathode to anode

46. Consider the following data:

Element	Atomic weight
A	12
B	35.5

A and B combine to form a new substance X. If four moles of B combine with one mole of A to give one mole of X, then the weight of one mole of X is

(a) 166g

(b) 47.5g

(c) 83g

(d) 154g

47. At 400 K, energy of activation of a reaction is decreased by 0.8 Kcal is pressure of catalyst. Hence rate will be

(a) increased by 2.72 times

(b) increased by 1.18 times

(c) decreased by 2.72 times

(d) none of these

48. X-rays were sent through a crystal with $d = 1\,\text{Å}$. There were no reflection maximum. From this, we assume that

(a) the wavelength of X-rays used is greater than $1\,\text{Å}$

(b) the wavelength of X-rays used is greater than $2\,\text{Å}$

(c) With successive order of reflection, the angle of reflected beam weakens.

(d) ways are out of phase

49. The reaction given below, involving the gases is observed to be first order with rate constant $7.48 \times 10^{-3}\ \text{sec}^{-1}$. Calculate the time required for the total pressure of 0.1 atm to rise to 0.145 atm and also find the total pressure after 100 sec.

$2A(g) \longrightarrow 4B(g) + C(g)$

(a) 0.12 atm

(b) 0.18 atm

(c) 0.16 atm

(d) none of these

50. How many mole of HCl will be required to prepare one litre of buffer solution (containing NaCN + HCl) of pH 8.5 using 0.01 g formula weight of NaCN ?

$(K_{HCN} = 4.1 \times 10^{-10}.)$

(a) 6.85×10^{-3} mol

(b) 8.85×10^{-3} mol

(c) 7.65×10^{-3} mol

(d) 4.85×10^{-3} mol

51. ΔC_P for a reaction is given by 2.0 + 0.2T cal/deg. Its enthalpy of reaction at 100K in kcal will be

(a) −13.21

(b) −15.37

(c) 16.02

(d) 7.08

52. Formaldehyde polymerizes to form glucose according to the reaction : $6HCHO \rightleftharpoons C_6H_{12}O_6$. The theoretically computed equilibrium constant for this reaction is found to be 6×10^{22}. If 1 M solution of glucose dissociates according to the above equilibrium, the concentration of formaldehyde in the solution will be

(a) 1.6×10^{-2} M

(b) 1.6×10^{-4} M

(c) 1.6×10^{-6} M

(d) 1.6×10^{-8} M

53. K_a for HCN is 5×10^{-10} at 25°C. For maintaining a constant pH of 9, the volume of 5 M KCN solution required to be added to 10 ml of 2 M HCN solution is

(a) 4 ml

(b) 7.95 ml

(c) 2 ml

(d) 9.3 ml

54. For the given reaction :

$H_{2(g)} + Cl_{2(g)} \longrightarrow 2H^+_{(aq)} + 2Cl^-_{(aq)}$;

$\Delta G^\circ = -262.4\ \text{kJ}$

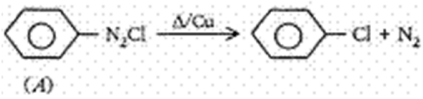
The value of free energy of formation (ΔG°_f) for the ion $Cl^-_{(aq)}$, therefore will be

(a) $-131.2\ kJ\ mol^{-1}$

(b) $-131.2\ kJ\ mol^{-1}$

(c) $-262.4\ kJ\ mol^{-1}$

(d) $+262.4\ kJ\ mol^{-1}$

55. 

Half-life is independent of concentration of A. After 10 minutes volume of N_2 gas is 10 L and after complete reaction 50 L. Hence rate constant is

(a) $\frac{2.303}{10}\log 5\ min^{-1}$

(b) $\frac{2.303}{10}\log 1.25\ min^{-1}$

(c) $\frac{2.303}{10}\log 2\ min^{-1}$

(d) $\frac{2.303}{10}\log 4\ min^{-1}$

56. For the following equilibrium $N_2O_4 \rightleftharpoons 2NO_4$ in gaseous phase, NO_2 is 50% of the total volume when equilibrium is set up. Hence percent dissociation of N_2O_4 is

(a) 50%

(b) 25%

(c) 66.66%

(d) 33.33%

57. If a certain mass of gas is made to undergo separately adiabatic and isothermal expansions to the same pressure, starting from the same initial conditions of temperature and pressure, then as compared to that isothermal expansion, in the case of adiabatic expansion, the final

(a) volume and temperature will be higher

(b) volume and temperature will be lower

(c) temperature will be lower but the final volume will be higher

(d) volume will be lower but the final temperature will be higher

58. Energy of activation of forward and backward reaction are equal in cases (numerical values) where

(a) $\Delta H = 0$

(b) no catalyst present

(c) $\Delta S = 0$

(d) stoichiometry is the mechanism

59. For $NH_4HS\ (S) \rightleftharpoons NH_3\ (g) + H_2S\ (g)$, if $K_p = 64\ atm^2$, equilibrium pressure of mixture is

(a) 8 atm

(b) 16 atm

(c) 64 atm

(d) none of these

60. The order of increasing lattice energy of the metallic compound is

(a) NaCl < CaO < NaI < BaO

(b) NaI < NaCl < BaO < CaO

(c) NaCl < NaI < BaO < CaO

(d) NaI < NaCl < CaO < BaO

61. The decreasing order of the second ionization potential of K, Ca and Ba is (At. NOs. K = 19, Ca = 20, Ba = 56)

(a) K > Ca > Ba

(b) Ca > Ba > K

(c) Ba > K > Ca

(d) K > Ba > Ca

62. Mac-Arthur process is used for

(a) Ag

(b) Fe

(c) Cl

(d) O_2

63. Potassium cyanide is used for separating

(a) Co^{2+} and Ni^{2+}

(b) Cu^{2+} and Cd^{2+}

(c) both (a) and (b)

(d) none of these

64. The compound formed when stannic chloride is treated with concentrated HCl is

(a) $SnCl_2$

(b) $(SnCl_5)^-$

(c) $(SnCl_4)^{2-}$

(d) $(SnCl_6)^{2-}$

65. If M is the element of actinide series, the degree of complex formation decreases in the order

(a) $M^{4+} > M^{3+} > MO_2^{2+} > MO_2^+$

(b) $MO_2^+ > MO_2^{2+} > M^{3+} > M^{4+}$

(c) $M^{4+} > MO_2^{2+} > M^{3+} > MO_2^+$

(d) $MO_2^{2+} > MO_2^+ > M^{4+} > M^{3+}$

66. The aqueous solution of which of the following salt will have the lowest pH?

(a) NaClO

(b) $NaClO_2$

(c) $NaClO_3$

(d) $NaClO_4$

67. Which metal is extracted by carbon reduction process?

(a) Na

(b) Al

(c) Fe

(d) Mg

68. Hydrogen will not reduce heated

(a) cupric oxide

(b) ferric oxide

(c) stannic oxide

(d) aluminium oxide

69. The material used in solar cells contains

(a) Cs

(b) Si

(c) Sn

(d) Ti

70. There is no $S-S$ bond in

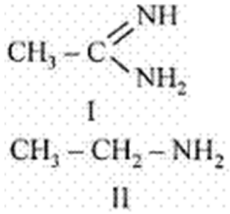
(a) $S_2O_4^{2-}$

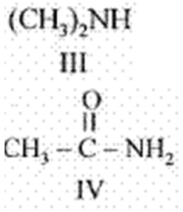
(b) $S_2O_5^{2-}$

(c) $S_2O_3^{2-}$

(d) $S_2O_7^{2-}$

71. The correct order of basicities of the following compound is





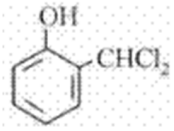
(a) II > I > III > IV

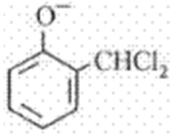
(b) I > III > II > IV

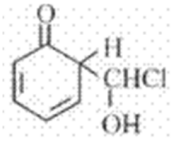
(c) III > I > II > IV

(d) I > II > III > IV

72. When phenol is reacted with $CHCl_3$ and NaOH followed by acidification, salicylaldehyde is obtained. Which of the following species are involved in the above mentioned reaction as intermediate

(a) 

(b) 

(c) 

(d) none of these

73. Phenol gives sym-tribromophenol when treated with bromine in aqueous solution but only o^- and p^- bromophenols in CCl_4 solution because

(a) in aqueous solution the bromine is ionised

(b) in aqueous solution the, phenol exists in equilibrium with phenoxide ion which has more activating effect.

(c) In CCl_4, the electrophilicity of Br_2 increases.

(d) In CCl_4, the other positions of benzene rings are blocked by the solvent.

74. Liebig method is used for the estimation of

(a) nitrogen

(b) sulphur

(c) carbon and hydrogen

(d) halogens

75. Which is the decreasing order of stability of the ions?

(i) $CH_3 - CH - CH_3$

(ii) $CH_3 - CH - OCH_3$

(iii) $CH_3 - CH - COCH_3$

(a) (i) > (iii) > (ii)

(b) (ii) > (iii) > (i)

(c) (iii) > (i) > (ii)

(d) (i) > (ii) > (iii)

76. A dihalogen derivative (A) of hydrocarbon having two carbon atoms reacts with alcoholic potash and forms another hydrocarbon which gives a red precipate with ammonical cuprous chloride. Compound A gives an aldehyde when treated with aqueous KOH. What is the original compound?

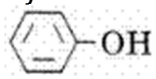
(a) (b) $CH_2Cl.CH_2Cl$ (c) both (a)

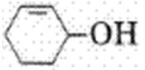
(b) $CH_2Cl.CH_2Cl$

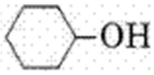
(c) both (a) and (b)

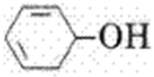
(d) none of these

77. Dehydration of the following in increasing order is

(I) 

(II) 

(III) 

(IV) 

(a) I < II < III < IV

(b) II < III < IV < I

(c) I < III < IV < II

(d) none of these

78. An organic compound with molecular formula, C_7H_8O dissolves in NaOH and gives a characteristic colour with $FeCl_3$. On treatment with bromine, it gives a tribromo derivative, $C_7H_5OBr_3$. The compound is

(a) benzyl alcohol

(b) o - cresol

(c) p - cresol

(d) none of these

79. Which of the following compounds will exhibit geometrical isomerism?

(a) 3-phenyl-1-butene

(b) 2-phenyl-1-butene

(c) 1, 1-diphenyl-1-propene

(d) 1-phenyl-2-butene

80. The pKa of acetylsalicylic acid (aspirin) is 3.5. The pH of gastric in human stomach is about 2-3 and pH in the small intestine is about 8. Aspirin will be

(a) unionised in the small intestine and in the stomach

(b) completely ionised in the stomach and almost unionized in the small intestine

(c) ionised in the stomach and almost unionised in the small intestine

(d) ionised in the small intestine and almost unionised in the stomach

Section: III(a)
Subject: English Proficiency

81. In the following question some alternatives are suggested for the idiom / phrase in bold in the sentence. Choose the one which best expresses the meaning of the idiom / phrase in bold.
The trade union's seemingly rightful demand only a **stalking horse** to blackmail management

(a) Pretence

(b) Suggestion

(c) Trick

(d) Proposal

82. Pick out the correct synonyms for the following words.
Cautiously

(a) Secretly

(b) Somewhat

(c) Genuinely

(d) Carefully

83. Pick out the correct synonyms for the following words.
Emulate

(a) Likely to be late

(b) Inspire to win

(c) Trying to do as well

(d) Enable

84. The following question, choose the alternative which can replace the word printed in bold without changing the meaning of the sentence.
Reading of poetry is not **congenial** to his taste.

(a) Helpful

(b) Preferable

(c) Suited

(d) Beneficial

85. The following question, choose the alternative which can replace the word printed in bold without changing the meaning of the sentence.
He had the **nerve** to suggest that I was cheating.

(a) Capacity

(b) Strength

(c) Courage

(d) Audacity

86. The following sentence, a word has been printed in bold. Out of the given alternatives, choose the one which is closest to the opposite in meaning of the bold word.
The plantation workers were on a **collision** course before the labour officer intervened.

(a) Conciliatory

(b) Perfunctory

(c) Circuitous

(d) Retaliatory

87. The following sentence, a word has been printed in bold. Out of the given alternatives, choose the one which is closest to the opposite in meaning of the bold word.
The minister was accused of indulging in **nepotism**.

(a) Condemnation

(b) Indifference

(c) Impartiality

(d) Hatred

88. (I) He did not **accede** to my request.
(II) The précis should not **exceed**150 words.

(a) If only sentence I is correct

(b) If only sentence II is correct

(c) If both the sentence I and II are correct

(d) If I as well II are incorrect, but both could be made correct by interchanging the bold words

(e) If neither I nor II is correct and the sentence could not be made correct by interchanging the bold words.

89. Out of the four alternatives, choose the one which can be substituted for the given words / sentences.
A sea abounding in islands

(a) Ocean

(b) Gulf

(c) Strait

(d) Archipelago

90. A word has been written in four different ways out of which only one is correctly spelt. Find the correctly spelt word.

(a) Cancellation

(b) Cancellasion

(c) Cancelation

(d) Cancelletion

91. Some words are given, one of which may be wrongly spelt. Find out that word where the spelling is wrong. If all the words are spelt correctly your answer is (e) i.e. all correct.

(a) Captious
(b) Capricious
(c) Coupious
(d) Cautious

92. The question are provided with the first and last parts of a sentence. The remaining sentence is broken into four parts labelled P, Q, R and S. Arrange these parts so as to form a complete meaningful sentence.
Athens
P. It was also at its height
Q. The first democracy in the world,
R. Was not only
S. An almost perfect democracy.

(a) RQPS
(b) PSRQ
(c) QRPS
(d) QRSP

93. Rearrange the given five sentences A, B, C, D and E in the proper sequence so as to form a meaningful paragraph and then answer the question below.
A. Marie Curie's discovery of radium led to much improved treatment for cancer.
B. It has helped man to live a more comfortable life.
C. However, its how we use a thing that makes it 'good' or 'bad'.
D. The benefits conferred on the world in general by science have been manifold and varied.
E. But the eventual discovery of the full properties of radium and uranium has brought great destruction in its train.
F. No educated man would deny this but many would point out that it has brought evils as well as blessings.
Which of the following will be the last sentence?

(a) A
(b) B
(c) C
(d) D
(e) E

94. Rearrange the given five sentences A, B, C, D and E in the proper sequence so as to form a meaningful paragraph and then answer the question below.
A. What is clear is that no one has yet provided evidence for it to be conclusively rejected or validated.
B. To some people such a notion seems perfectly reasonable; to others it seems quite ludicrous.
C. Most of the people have curiosity and also possess some knowledge of astrology.
D. Much of the evidence offering support for this fundamental notion is far from clear cut.
E. They appreciate that astrology attempts to relate human behaviour to the movements of stars and planets.
Which sentence should come third in the paragraph?

(a) A
(b) B
(c) C
(d) D
(e) E

95. Rearrange the given five sentences A, B, C, D and E in the proper sequence so as to form a meaningful paragraph and then answer the question below.

A. Many consider it wrong to blight youngsters by recruiting them into armed forces at a young age.
B. It is very difficult to have an agreement on an issue when emotions run high.
C. The debate has again come up whether this is right or wrong.
D. In many countries military service is compulsory for all.
E. Some of these detractors of compulsory draft are even very angry.
Which sentence should come fourth in the paragraph?

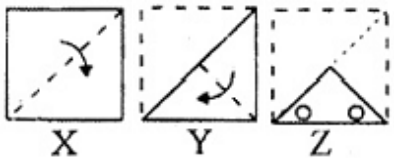
(a) A **(b)** B

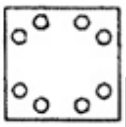
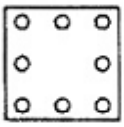
(c) C **(d)** D

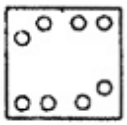
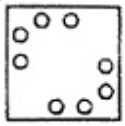
(e) E

Section: III(b)
Subject: Logical Reasoning

96. The question that follow contain a set of three figure X, Y and X showing a sequence of folding of a piece of paper. Fig. (Z) shows the manner in which the folded paper has been cut. These three figures are followed by four answer figures from which you have to choose a figure which would most closely resemble the unfolded form of fig. (Z).



(a)  **(b)** 

(c)  **(d)** 

97. In the following question, there is a certain relationship between given words, choose the correct alternative.
Fear : Threat :: Anger : ?

(a) Compulsion **(b)** Panic

(c) Provocation **(d)** Force

98. In the following question, there is a certain relationship between given words, choose the correct alternative.
Flower : Bud :: Plant : ?

(a) Seed **(b)** Taste

(c) Flower **(d)** Twig

99. In the following question, there is a certain relationship between given words, choose the correct alternative.
Harp : Drum :: Flute : ?

(a) Violin **(b)** Bugle

(c) Harmonium **(d)** Piano

100. In the given question, five words have been given. Choose out the odd one.

(a) Venus

(b) Saturn

(c) Earth

(d) Mercury

(e) Neptune

101. Choose the odd numeral pair/group in the following question :

(a) 57-69

(b) 42-29

(c) 47-59

(d) 73-61

102. In given the question, a matrix carrying certain characters, is given. These characters follow a certain trend, row wise or column wise. Find out this trend and choose the missing character accordingly.

28	60	48
5	6	7
14	39	27
7	?	16

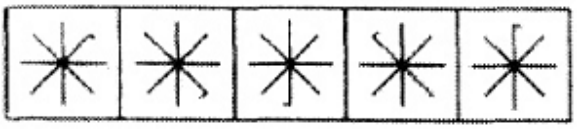
(a) 18

(b) 23

(c) 24

(d) 27

103. The following question consists of figures marked A, B, C, D and E. select a figure from options which will continue the same series.



A B C D E

(a) 

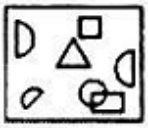
(b) 

(c) 

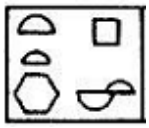
(d) 

(e) 

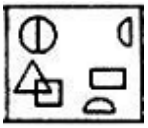
104. In which of the answer figures the specified components of the key figure (X) are found?

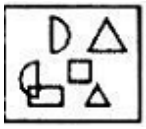


(X)

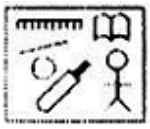
(a) 

(b) 

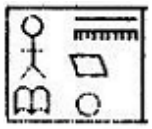
(c) 

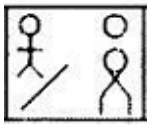
(d) 

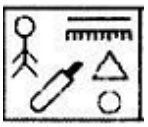
105. In which of the answer figures the specified components of the key figure (X) are found?

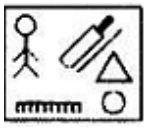


(X)

(a) 

(b) 

(c) 

(d) 

Section: IV
Subject: Mathematics

106. The number of real solution of
$1+|e^x-1|=e^x(e^x-2)$ is

(a) 0 **(b)** 1

(c) 2 **(d)** 4

107. The smallest positive integral value of n for which
$\left(\frac{1-i}{1+i}\right)^n$ is purely imaginary with positive imaginary part, is

(a) 1 **(b)** 3

(c) 5 **(d)** none of these

108. The value of $\sum_{r=1}^{10} r \cdot {}^{r}P_{r}$ is

(a) ${}^{11}P_{11}$ **(b)** ${}^{11}P_{11}-1$

(c) ${}^{11}P_{11}+1$ **(d)** none of these

109. The number of positive integral solutions of $x + y + z = n$, $n \in N$, $n \geq 3$, is

(a) ${}^{n-1}C_2$ **(b)** ${}^{n-1}P_2$

(c) $n(n-1)$ **(d)** none of these

110. If the third term in the expansion of $\left[\frac{1}{x}+x^{\log_{10}x}\right]^5$, $(x>1)$ is 1000, then x is equal to

(a) 10 **(b)** 100

(c) 1000 **(d)** 10000

111. If p, q and r are any real numbers, then

(a) max (p, q) < max (p, q, r) **(b)** $\min(p,q)=\frac{1}{2}(p+q-|p-q|)$

(c) min (p, q) < min (p, q, r) **(d)** none of these

112. The sum to n terms of the series $\left(\frac{2n+1}{2n-1}\right)+3\left(\frac{2n+1}{2n-1}\right)^2+5\left(\frac{2n+1}{2n-1}\right)^3+\ldots\ldots$ is

(a) n^2+4n **(b)** n^2+n

(c) $2n^2$ **(d)** none of these

113. The minimum number of times a fair coin must be tossed so that the probability of getting at least one head is at least 0.8 is

(a) 7 **(b)** 6

(c) 5 **(d)** none of these

114. The number of different numbers, which are smaller than $2\cdot10^8$ can be written by means of the digits 1 and 2 is

(a) 720 **(b)** 120

(c) 766 **(d)** none of these

115. All the real values of m such that both roots of the equation $x^2-2mx+m^2-1=0$ are greater than -2 and less than 4 lies in

(a) $(-2, 4)$ **(b)** $(-1, 2)$

(c) $(-1, 3)$ **(d)** none of these

116. The largest interval in which $x^{12}-x^9+x^4-x+1>0$ is

(a) $[0,\infty)$ **(b)** $(-\infty, 0]$

(c) $(-\infty,\infty)$ **(d)** none of these

117. If $0^0<\theta<180^0$ then $\sqrt{2+\sqrt{2+\sqrt{2+\ldots.+\sqrt{2(1+\cos\theta)}}}}$ there being n number of 2's, is equal to

(a) $2\cos\frac{\theta}{2^n}$ **(b)** $2\cos\frac{\theta}{2^{n-1}}$

(c) $2\cos\frac{\theta}{2^{n+1}}$ **(d)** none of these

118. Let $a = \cos A + \cos B - \cos(A+B)$ and $b = 4\sin\frac{A}{2}\sin\frac{B}{2}\cos\frac{A+B}{2}$. Then $a-b$ is equal to

(a) 1 **(b)** 0

(c) -1 **(d)** none of these

119. The number of solutions of $\cos\theta + \sqrt{3}\sin\theta = 5, \quad 0 \le \theta \le 5\pi$ is

(a) 4 **(b)** 0

(c) 5 **(d)** none of these

120. If $\cos^{-1}\lambda + \cos^{-1}\mu + \cos^{-1}\nu = 3\pi$ then $\lambda\mu + \mu\nu + \nu\lambda$ is equal to

(a) -3 **(b)** 0

(c) 3 **(d)** -1

121. In a $\Delta ABC, (c+a+b)(a+b-c) = ab$ The measure of $\angle C$ is

(a) $\frac{\pi}{3}$ **(b)** $\frac{\pi}{6}$

(c) $\frac{2\pi}{3}$ **(d)** none of these

122. In a triangle ABC, cos A + cos B + cos C = $\frac{3}{2}$, then the triangle is

(a) isosceles **(b)** right angled

(c) equilateral **(d)** none of these

123. The value of $\frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2} + \frac{1}{r^2}$ is

(a) 0 **(b)** $\frac{a^2+b^2+c^2}{\Delta^2}$

(c) $\frac{\Delta^2}{a^2+b^2+c^2}$ **(d)** $\frac{a^2+b^2+c^2}{\Delta}$

124. If $5\cos 2\theta + 2\cos^2\frac{\theta}{2} + 1 = 0, \quad -\pi < \theta < \pi$, then $\theta =$

(a) $\frac{\pi}{3}$ **(b)** $\frac{\pi}{3}, \cos^{-1}\left(\frac{3}{5}\right)$

(c) $\cos^{-1}\left(\frac{3}{5}\right)$ **(d)** $\frac{\pi}{3}, \pi - \cos^{-1}\left(\frac{3}{5}\right)$

125. In a ΔABC, a, c, A are given and b_1, b_2 are two values of the third side b such that $b_2 = 2b_1$. Then sin A =

(a) $\sqrt{\frac{9a^2-c^2}{8a^2}}$ **(b)** $\sqrt{\frac{9a^2-c^2}{8c^2}}$

(c) $\sqrt{\frac{9a^2+c^2}{8a^2}}$ **(d)** none of these

126. $\cos(x-y)-2\sin x+2\sin y=3$ is

(a) sin x = sin y **(b)** $x+y=2n\pi,\quad x-y=(2k-1)\frac{\pi}{2}$

(c) $x=2k\pi-\frac{\pi}{2},\quad y=2n\pi+\frac{\pi}{2}$ **(d)** $\cos(x-y)=-1\,(n,k\in I)$

127. $\underset{x\to 0}{\text{Lt}}\frac{1}{x}\left(\int_y^a e^{\sin^2 t}\,dt-\int_{x+y}^a e^{\sin^2 t}\,dt\right)$, where a is a constant equals

(a) $e^{\sin^2 y}$ **(b)** $\sin 2y\, e^{\sin^2 y}$

(c) $2\sin y\, e^{\sin^2 y}$ **(d)** none of these

128. The integral $\int_{-10}^{0}\left|\frac{2[x]}{3x-[x]}\right|\frac{2[x]}{3x-[x]}\,dx$ (where [x] is greatest integral function) equals.

(a) 10 **(b)** −10

(c) $10+\frac{2}{3}$ **(d)** none of these

129. The number of points where the function $f(x)=$ maximum of $\{\text{sgn}(x),-\sqrt{9-x^2},x^3\}$ is not continuous is

(a) 1 **(b)** 2

(c) 3 **(d)** none of these

130. The maximum value of $\cos\left(\int_{2x}^{x^2}(e^t\sin t)\,dt\right)$ is

(a) 0 **(b)** 1/2

(c) 3/4 **(d)** 1

131. If $f(t)$ is an odd function then $\int_a^x f(t)\,dt$ is

(a) necessarily an odd function **(b)** an even function

(c) an even function if $\int_0^a f(t)\,dt=0$ **(d)** none of these

132. The equation $e^{x-1}+x-2=0$ has

(a) one real root **(b)** two real roots

(c) three real roots **(d)** four real roots

133. The domain of $f(x)=\log_{[x+1/2]}(x^2-x-2)$ ([ ] denotes integral part, is

(a) $[3/2\infty)$

(b) $[3/2\infty) \sim [2]$

(c) $(2,\infty)$

(d) $[1/2,\infty) \sim \{2\}$

134. The value of $\lim_{x\to 1^-} \frac{\int_1^x |t-1|\,dt}{\sin(x-1)}$, is

(a) 0

(b) $-1/2$

(c) 1/2

(d) 1

135. For given points A(200°), B(50°) on an ellipse, if $P(\theta)$ is the point such that area of ΔPAB is maximum, then the value of θ is

(a) $75^0 + k\pi,\ k \in I$

(b) $75^0 (2k+1)\pi, k \in I$

(c) $75^0 + 2k\pi, k \in I$

(d) none of these

136. If $[2\vec{a}+4\vec{b}, \vec{c}, \vec{d}] = \lambda[\vec{a}, \vec{c}, \vec{d}]+\mu[\vec{b}, \vec{c}, \vec{d}]$, then $\lambda + \mu =$

(a) 6

(b) -6

(c) 10

(d) 8

137. The number of vectors of unit length perpendicular to the vectors a = (1, 1, 0) and b = (0, 1, 1) is

(a) one

(b) two

(c) three

(d) infinite

138. Let $b = 4i + 3j$ and c be two vectors perpendicular to each other in the xy-plane. All vectors in the same plane having projections 1 and 2 along b and c respectively, are given by

(a) $2i-j, -\frac{2}{5}i + \frac{11}{5}j$

(b) $2i+j, i+j$

(c) $i-j, i+j+k$

(d) $i+j+k, i-k$

139. A unit vector perpendicular to each of the vectors $-3\hat{i} + 4\hat{j} + 2\hat{k}$ and $4\hat{i} + 3\hat{j} + \hat{k}$ forming a right handed system is

(a) $-2\hat{i} + 11\hat{j} - 25\hat{k}$

(b) $\frac{1}{\sqrt{750}}(-2\hat{i} + 11\hat{j} - 25\hat{k}$

(c) $-\frac{1}{\sqrt{750}}(2\hat{i} - 11\hat{j} + 25\hat{k}$

(d) $2\hat{i} - 11\hat{j} + 25\hat{k}$

140. A vector of magnitude $\sqrt{51}$ making equal angles with the vectors $\vec{a} = \frac{1}{3}\left(\hat{i} - 2\hat{j} + 2\hat{k}\right)$, $\vec{b} = \frac{1}{5}\left(-4\hat{i} - 3\hat{k},\right)$ and $\vec{c} = \hat{j}$ is

(a) $\pm\left(\hat{i} - \hat{j} + 7\hat{k}\right)$

(b) $\pm\left(5\hat{i} - \hat{j} - 5\hat{k}\right)$

(c) $\pm\left(\hat{i}+5\hat{j}-5\hat{k}\right)$ **(d)** $\pm\left(7\hat{i}+\hat{j}-\hat{k}\right)$

141. A circle is given by $x^2+y^2+4x-7y+12=0$. The points P (0, 0) and Q $(-2, 4)$ are such that

(a) both lie inside the circle **(b)** both lie outside the circle

(c) one lies inside and the other outside the circle **(d)** one lies on the circle and the other is outside the circle

142. A point on the ellipse $\frac{x^2}{16}-\frac{y^2}{9}=1$ at a distance equal to the mean of the lengths of the semi major axis and semi minor axis from the centre is

(a) $\left(\frac{2\sqrt{91}}{7},\frac{3\sqrt{105}}{14}\right)$ **(b)** $\left(-\frac{2\sqrt{91}}{7},-\frac{3\sqrt{105}}{14}\right)$

(c) $\left(\frac{2\sqrt{105}}{7},\frac{3\sqrt{91}}{14}\right)$ **(d)** $\left(\frac{2\sqrt{105}}{7},\frac{3\sqrt{91}}{7}\right)$

143. A straight line touches the rectangular hyperbola $9x^2-9y^2=8$ and the parabola $y^2=32x$. An equation of the line is

(a) $9x+3y-8=0$ **(b)** $9x-3y+8=0$

(c) $9x-3y+4=0$ **(d)** $9x-3y-8=0$

144. If α, β, γ are the angles which a half ray makes with the positive directions of the axes, then $\sin^2\alpha+\sin^2\beta+\sin^2\gamma$ is equal to

(a) 1 **(b)** 2

(c) 0 **(d)** -1

145. A square is inscribed in the circle $x^2+y^2-2x+4y+3=0$ and its sides are parallel to the co-ordinate axes. Then one vertex of the square is

(a) $(1+\sqrt{2},-2)$ **(b)** $(1-\sqrt{2},-2)$

(c) $(1,-2+\sqrt{2})$ **(d)** none of these

146. The two parabolas $y^2=4x$ and $x^2=4y$ intersect at a point P, whose abcissae is not zero, such that

(a) they both touch each other at P **(b)** they cut at right angles at P

(c) the tangents to each curve at P make complementary angles with the x-axis **(d)** none of these

147. AB , AC are tangents to a parabola $y^2=4ax$ and p_1, p_2, p_3 are the lengths of the perpendiculars from A, B, C on any tangent to the curve. Then p_2, p_1, p_3 are in

(a) A. P **(b)** G. P

(c) H.P **(d)** none of these

148. The equation to common tangents to the two hyperbolas $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$

(a) $y = \pm x \pm \sqrt{b^2 - a^2}$ **(b)** $y = \pm x \pm \sqrt{a^2 - b^2}$

(c) $y = \pm x \pm (a^2 - b^2)$ **(d)** $y = \pm x \pm \sqrt{a^2 + b^2}$

149. The points P (a, b + c), Q (b, c + a) and R (c, a + b) are such that PQ = QR if

(a) a, b, c are in A.P **(b)** a, b, c are in G.P.

(c) a, b, c are in H.P **(d)** none of these

150. A line which makes an acute angle θ with the positive direction of x-axis is drawn through the point P (3, 4) to meet the line x = 6 at R and y = 8 at S, then

(a) PR = $3\sec\theta$ **(b)** PS= $\operatorname{cosec}\theta$

(c) PR + PS = $\frac{(3\sin\theta + 4\cos\theta)}{\sin 2\theta}$ **(d)** $\frac{9}{(PR)^2} + \frac{16}{(PS)^2} = 2$