1. On the Celsius scale the absolute zero of temperature is at

(a) 0°*C* (b) – 32°*C*

(c) 100°*C* (d) – 273.15°*C*

2. Recently, the phenomenon of superconductivity has been observed at 95 *K*. This temperature is nearly equal to

(a) – 288°*F* (b) – 146°*F*

(c) – 368°*F* (d) +178°*F*

3. Absolute temperature can be calculated by

(a) Mean square velocity (b) Motion of the molecule

(c) Both (a) and (b) (d) None of the above

4. 'Stem Correction' in platinum resistance thermometers are eliminated by the use of

(a) Cells (b) Electrodes

(c) Compensating leads (d) None of the above

5. On which of the following scales of temperature, the temperature is never negative

(a) Celsius (b) Fahrenheit

(c) Reaumur (d) Kelvin

6. Two thermometers are used to record the temperature of a room. If the bulb of one is wrapped in wet hanky

(a) The temperature recorded by both will be same

(b) The temperature recorded by wet-bulb thermometer will be greater than that recorded by the other

(c) The temperature recorded by dry-bulb thermometer will be greater than that recorded by the other

(d) None of the above

7. At what temperature the centigrade (Celsius) and Fahrenheit, readings are the same

(a) – 40° (b) + 40°

(c) 36.6° (d) – 37°

8. A constant pressure air thermometer gave a reading of 47.5 units of volume when immersed in ice cold water, and 67 units in a boiling liquids. The boiling point of the liquid will be

(a) 135°*C* (b) 125°*C*

(c) 112°*C* (d) 100°*C*

9. When a rod is heated but prevented from expanding, the stress developed is independent of

(a) Material of the rod (b) Rise in temperature

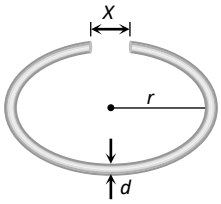
(c) Length of rod (d) None of above

10. If the length of a cylinder on heating increases by 2%, the area of its base will increase by

(a) 0.5% (b) 2%

(c) 1% (d) 4%

11. A cylindrical metal rod of length L_0 is shaped into a ring with a small gap as shown. On heating the system



(a) *x* decreases, *r* and *d* increase

(b) *x* and *r* increase, *d* decreases

(c) *x*, *r* and *d* all increase

(d) Data insufficient to arrive at a conclusion

12. An iron bar of length 10 *m* is heated from 0°*C* to 100°*C*. If the coefficient of linear thermal expansion of iron is 10×10^{-6} /°*C*, the increase in the length of bar is

(a) 0.5 *cm* (b) 1.0 *cm*

(c) 1.5 *cm* (d) 2.0 *cm*

13. Thermal coefficient of volume expansion at constant pressure for an ideal gas sample of n moles having pressure P_o, volume V_o and temperature T_o is

(a) $\frac{R}{P_0 V_0}$ (b) $\frac{P_0 V_0}{R}$ (c) $\frac{1}{T_0}$ (d) $\frac{1}{n T_0}$

14. If H_C, H_K and H_F are heat required to raise the temperature of one gram of water by one degree in Celsius, Kelvin and Fahrenheit temperature scales respectively then :
(a) $H_K > H_C > H_F$ (b) $H_F > H_C > H_K$

(c) $H_K = H_C > H_F$ (d) $H_K = H_C = H_F$

15. For a real gas, the force of interaction between molecules of a gas is different from force of interaction between molecules of the walls of the container and gas molecules (both gas and the container are in thermodynamic equilibrium). This indicates that:
(a) Pressure near the walls of the container is different from pressure inside the bulk of the gas but distribution of the molecules inside the container is uniform.

(b) Pressure is uniform throughout the container but distribution of the molecules is different for two regions.

(c) Both pressure and distribution of molecules is uniform throughout the container.

(d) Both pressure and distribution of molecules is different for the two regions.

16. Two cylinders A and B fitted with pistons contain equal amounts of an ideal diatomic gas at 300K. The piston A is free to move, while that of B is held fixed. The same amount of heat is given to the gas in each cylinder. If the rise in temperature of the gas in A is 30K, then the rise in temperature of the gas in B is.
(a) 30K (b) 18K (c) 50K (d) 42K

17. In a room where temperature is 30°C a body cools from 61°C to 59°C is 4 minutes. The time taken by the body to cool from 51°C to 49°C will be:
(a) 4 minutes (b) 6 minutes (c) 5 minutes (d) 8 minutes

18. The average translational energy and the rms speed of molecules in a sample of oxygen at 300K are 6.21×10^{-21}J and 484 m/s respectively. The corresponding values at 600K are nearly (assuming ideal gas behavior).
(a) 12.42×10^{-21}J, 968 m/s. (c) 6.21×10^{-21}J, 968 m/s

(b) 8.78×10^{-21}J, 684m/s (d) 12.42×10^{-21}J, 684 m/s

19. The pressure and volume of a given mass of gas at a given temperature are P and V respectively. Keeping temperature constant, the pressure is increased by 10% and then decreased by 10%. The volume how will be -
(a) Less than V

(b) More than V

(c) Equal to V

(d) Less than V for diatomic and more than V for monoatomic

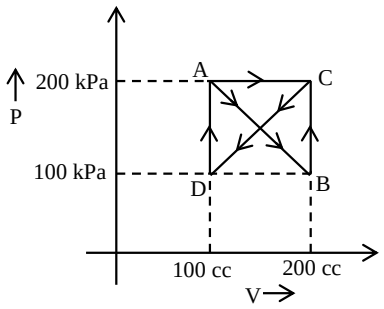
20. Which of the following is a FALSE statement?
(a) Heat is energy transferred into or out of a system as a result of a temperature difference between the system and its surroundings.

(b) The heat added to an ideal gas during the transition from state 1 to state 2 depends only on the initial and final states, 1 and 2, and not on the path by which the gas went from one to the other.

(c) When a gas goes from one state to another, the work done depends on the path followed

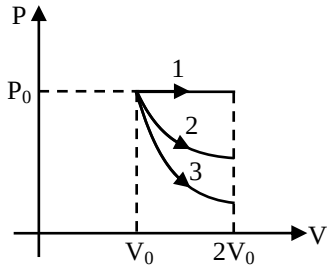
(d) It does not make sense to refer to "the amount of heat in a body".

21. A gas undergoes process ABCDAC. Work done by gas is –



(a) 5 kJ (b) 2.5 kJ (c) – 5 kJ (d) 7.5 kJ

22. A gas is expanded from volume V_0 to $2V_0$ under three different processes. Process 1 is isobaric, process 2 is isothermal and process 3 is isothermal and process 3 is adiabatic. Let ΔU_1, ΔU_2 and ΔU_3 be the change in internal energy of the gas in these three processes. Then –



(a) $\Delta U_1 > \Delta U_2 > \Delta U_3$ (b) $\Delta U_1 < \Delta U_2 < \Delta U_3$

(c) $\Delta U_2 < \Delta U_1 < \Delta U_3$ (d) $\Delta U_2 < \Delta U_3 < \Delta U_1$

23. An ideal gas at (P,V,T) is expanding adiabatically to 5.66 times the volume and half the temperature. The degree of freedom f of the gas and work done W by the gas –

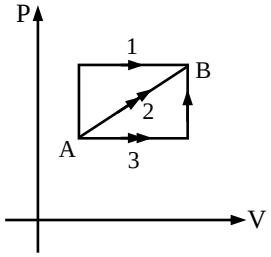
(a) W = 0, f = 5 (b) W = PV, f = 7

(c) W = $\frac{25}{23}$ P, f = 7 (d) W = $\frac{25}{23}$ PV, f = 5

24. The energy density U / V of an ideal monoatomic gas is related to its pressure P as -

(a) $\frac{U}{V}$ = 3P (b) $\frac{U}{V} = \frac{3}{2}$ P (c) $\frac{U}{V} = \frac{P}{3}$ (d) $\frac{U}{V} = \frac{5}{2}$ P

25. If the amount of heat supplied to change the state from A to B via path 1, 2 and 3 are Q_1, Q_2 and Q_3 respectively, then the correct option is -



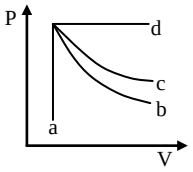
(a) $Q_1 > Q_2 > Q_3$ (b) $Q_1 < Q_2 < Q_3$

(c) $Q_1 = Q_2 = Q_3$ (d) Data insufficient

26. If 150 J of heat is added to a system and work done by the system is 110 J, then change in internal energy will be –

(a) 40 J (b) 110 J (c) 150 J (d) 260 J

27. In the indicator diagram four different curves are shown. Match the curve with the process. The processes are adiabatic, isochoric, isobaric and isothermal.



(a) a, b, c, d (b) b, a, d, c (c) b, d, a, c (d) a, d, b, c

28. The temperature of a gas is raised while its volume remains constant, the pressure exerted by a gas on the walls of the container increases because its molecules

(a) Lose more kinetic energy to the wall

(b) Are in contact with the wall for a shorter time

(c) Strike the wall more often with higher velocities

(d) Collide with each other less frequency

29. Two containers of equal volume contain the same gas at pressures 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 common temperature T. The ratio P/T is equal to

(a) $\frac{P_1}{T_1} + \frac{P_2}{T_2}$ (b) $\frac{P_1T_1 + P_2T_2}{(T_1 + T_2)^2}$

(c) $\frac{P_1T_2 + P_2T_1}{(T_1 + T_2)^2}$ (d) $\frac{P_1}{2T_1} + \frac{P_2}{2T_2}$

30. Cooking gas containers are kept in a lorry moving with uniform speed. The temperature of the gas molecules inside will

(a) Increase

(b) Decrease

(c) Remain same

(d) Decrease for some, while increase for others

31. Hydrogen gas is filled in a balloon at 20°C. If temperature is made 40°C, pressure remaining same, what fraction of hydrogen will come out

(a) 0.07 (b) 0.25 (c) 0.5 (d) 0.75

32. The density of a polyatomic gas is standard conditions is 0.795 kgm^{-3}. The specific heat of the gas at constant volume is

(a) 930 $J\text{-}kg^{-1}K^{-1}$ (b) 1400 $J\text{-}kg^{-1}K^{-1}$

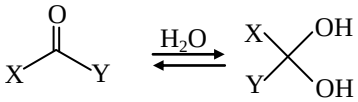
(c) 1120 $J\text{-}kg^{-1}K^{-1}$ (d) 925 $J\text{-}kg^{-1}K^{-1}$

33. For the reaction $AB(g) \rightleftharpoons A(g) + B(g)$, *AB* is 33% dissociated at a total pressure of *P*. Then

(a) $P = K_p$ (b) $P = 4K_p$

(c) $P = 3K_p$ (d) $p = 8K_p$

34. Mark out the correct statement for the following conversion



Reaction is usually catalysed by acid or base -

(a)If X = CH_3 and Y = H, the equilibrium constant, $K_c > 1$

(b)If X = H and Y = H, $K_c = 1$ and hydrate is isolable.

(c)If X = CCl_3 and Y = H, $K_c > 1$ and hydrate is not isolable

(d)If X = CCl_3 and Y = H, $K_c > 1$ and hydrate is isolable

35. In a closed system : A (s) $\rightleftharpoons$ 2B (g) + 3C (g), if the partial pressure of C is doubled, then partial pressure of B will be

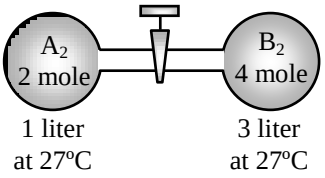
(a)two times the original pressure

(b)one half of its original value

(c) $\frac{1}{2\sqrt{2}}$ times to the original value

(d)$2\sqrt{2}$ times to the original value

36. The gas A_2 in the left flask allowed to react with gas B_2 present in right flask as



$A_2(g) + B_2(g) \rightleftharpoons 2\,AB(g)$; $K_C = 4$ at 27ºC

What is the concentration of AB when equilibrium is established -

(a)1.33M (b)2.66M (c)0.66M (d)0.33M

37. The kinetic energy of 2.8 g of nitrogen gas at 127°C is nearly -

(a)249.3 J (b)200.4 J (c)2.5 J (d)20.5 J

38. In a chemical reaction, the rate constant for the backward reaction is 7.5×10^{-4} and the equilibrium constant is 1.5. The rate constant for the forward reaction is -

(a)5×10^{-4} (b)2×10^{-3}

(c)1.125×10^{-3} (d)9.0×10^{-4}

39. The conjugate acid of PO_4^{3-} is

(a) H_3PO_4 (b) $H_2PO_4^-$ (c) $HPO^{2-}{}_4$ is (d) $HPO^{1-}{}_3$

40. The concentration of hydrogen ion in a solution left after mixing 100 ml of 0.1 $MgCl_2$ and 100 ml of 0.2 M NaOH. $[K_{SP}[Mg(OH)2] = 12 \times 10^{-11}]$ is

(a) 2.8×10^{-3} (b) 2.8×10^{-2}

(c) 2.8×10^{-4} (d) 2.8×10^{-5}

41. For an aqueous solution to be neutral it must have

(a) $pH = 7$ (b) $[H^+] = [OH^-]$

(c) $[H^+] = \sqrt{K_W}$ (d) $[H^+] < [OH^-]$

42. pH of $Ba(OH)_2$ solution is 12. Its solubility product is

(a) $10^{-6}M^3$ (b) $4 \times 10^{-6}M^3$

(c) $0.5 \times 10^{-7}M^3$ (d) $5 \times 10^{-7}M^3$

43. Ammoniacal solution of Ag^+ + Acidified solution of $N_2H_4 \rightarrow$ ppt of (X)

(a) (X) is Ag (b) (X) is Ag_2O

(c) (X) is $AgNH_2$ (d) (X) is Ag_2SO_4

44. The equilibrium constant for the given reaction is approximately 10^{-3}

$HPO_4^{2-}(aq) + HCO_3^-(aq) \rightleftharpoons$

$H_2PO_4^-(aq) + CO_3^{2-}(aq)$

Which is strongest conjugate base in the given reaction ?

(a) $HPO_4^{2-}(aq)$ (b) $HCO_3^-(aq)$

45. At 27°C one mole of an ideal gas is compressed isothermally and reversibly from a pressure of 2 atm to 10 atm. The values of ΔE and q are (R = 2)

(a) 0, –965.84 cal

(b) – 965.84 cal, + 965.84 cal

(c) + 865.58 cal, –865.58 cal

(d) –865.58 cal, –865.58 cal

46. The standard entropies of $CO_2(g), C(s)$ and $O_2(g)$ are 213.5, 5.690 and 205 JK^{-1} respectively. The standard entropy of formation of CO_2 (g) is

(a) 1.86 JK^{-1} (b) 1.96 JK^{-1}

(c) 2.81 JK^{-1} (d) 2.86 JK^{-1}

47. The heat of formations of $CO(g)$ and $CO_2(g)$ are –26.4 kcal and -94.0 kcal respectively. The heat of combustion of carbon monoxide will be

(a) + 26.4 kcal (b) – 67.6 kcal

(c) –120.6 kcal (d) + 52.8 kcal

48. The enthalpy of formation of $H_2O(l)$ is – 285.77 kJ mol^{-1} and enthalpy of neutralisation of strong acid and strong base is –56.07 kJ mol^{-1}, what is the enthalpy of formation of OH^- ion

(a) + 229.70kJ (b) –229.70kJ

(c) +226.70kJ (d) –22.670kJ

49. The heat of combustion of sucrose, $C_{12}H_{22}O_{11}(s)$ at constant volume is – 1348.9 kcal mol^{-1} at 25°C, then the heat of reaction at constant pressure, when steam is produced , is

(a) – 1342.344 kcal (b) + 1342.344 kcal

(c) + 1250 kcal (d) None

50. The heat of transition for carbon from the following is

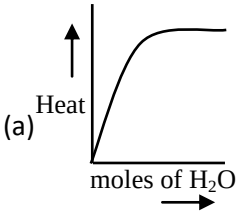
$C_{Diamond} + O_2(g) \longrightarrow CO_2(g) \quad \Delta H = -94.3$ kcal

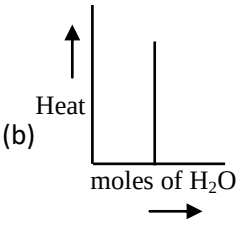
$C_{Amorphous} + O_2(g) \longrightarrow CO_2(g) \quad \Delta H = -97.6$ kcal

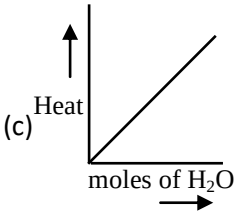
(a) 3.3 kJ / mol (b) 3.3 kcal / mol

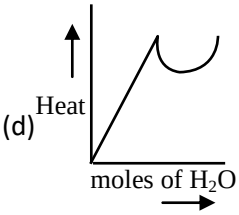
(c) –3.3 kJ / mol (d) – 3.3 kcal / mol

51. Which of the following curve shows variation of heat of solution of NaCl with dilution ?

(a) 

(b) 

(c) 

(d) 

52. Which of the following is/are correct ?

(a) For the incompressible liquid $\left(\frac{dH}{dP}\right)_T$ is approximately equal to volume of liquid

(b) For ideal gas $\left(\frac{dH}{dP}\right)_T$ is equal to zero

(c) For real gas if $\left(\frac{dE}{dV}\right)_T = 0$ then not necessarily $\left(\frac{dH}{dP}\right)_T$ is equal to zero

(d) All of the above are correct

53. The heat of combustion of yellow phosphorus and red phosphorus are – 9.91 KJ/mol and – 8.78 KJ/mol respectively. The heat of transition from yellow phosphorus to red phosphorus is -

(a) – 1.13 KJ (b) – 18.69 KJ

(c) + 18.69 KJ (d) + 1.13 KJ

54. Which of the following is/are correct ?

(a) When 1 mole of Zn is dissolved in excess HCl the work done is approximately equal to –2.46 kJ in open beaker at 300 K and 1 atm.

(b) When 1 mole of Zn is dissolved in excess HCl work done is equal to zero in closed beaker

(c) Both (a) and (b) are correct

(d) Neither (a) and nor (b) are correct

55. Hydrogen molecule differs from chlorine molecule in the following respect :

(a) Hydrogen molecule is non-polar but chlorine molecule is polar.

(b) Hydrogen molecule is polar while chlorine molecule is non-polar.

(c) Hydrogen molecule can form intermolecular hydrogen bonds but chlorine molecule does not.

(d) Hydrogen molecule cannot participate in co-ordinate bond formation but chlorine molecule can.

56. Which of the following groups represents the saline hydrides ?

(a) NaH, KaH, CaH_2 (b) NaH, SiH_4, CaH_2

(c) NH_3, BH_3, AlH_3 (d) None of these

57. Water is said to be permanently hard when it contains:

(a) Chloride and sulphates of Mg and Ca.

(b) Bicarbonates of Na and K.

(c) Carbonates of Na and K.

(d) Phosphate of Na and K.

58. Moist hydrogen peroxide can not be dried over conc. H_2SO_4 because:

(a) It can catch fire. (b) It is reduced by H_2SO_4.

(c) It is oxidised by H_2SO_4. (d) None of these

59. One of the following is an incorrect statement. Point out the incorrect one.

(a) H_2O_2 decomposes rapidly in presence of MnO_2.

(b) Ice at its melting point is lighter than water because ice crystals have hollow hexagonal arrangement of H_2O molecules.

(c) D_2O will have maximum density at 11.5^0C.

(d) Water gas contains greater proportion of CO than that of H_2

60. Alkali metals are not characterised by :

(a) Good conductor of heat and electricity

(b) High oxidation potentials

(c) High melting points

(d) Solubility in liquid ammonia

61. Alkaline earth metal salts are :

(a) Paramagnetic (b) Diamagnetic

(c) Ferromagnetic (d) all

62. Acid rains are produced by :

(a) Excess NO_2 and SO_2 from burning fossil fuels

(b) Excess production of NH_3 by industry and coal gas

(c) Excess release of carbon monoxide by incomplete combustion

(d) Excess formation of CO_2 by combustion and animal respiration.

63. Which causes water pollution ?

(a) Pathogens (b) Automobile exhausts

(c) PCBs (d) (a) and (c)

64. Domestic waste mostly constitutes :

(a) Non-biodegradable pollution

(b) Biodegradable pollution

(c) Effluents

(d) Air pollution

65. In stratosphere, which of the following radical retards the formation of O_3 ?

(a) $\dot{C}H_3$ (b) $\dot{C}l$ (c) $\dot{F}$ (d) Cl_2

66. Ozone in the stratosphere is deleted by :

(a) CF_2Cl_2 (b) C_7F_{16} (c) $C_6H_6Cl_6$ (d) C_6F_6

67. Area of a square inscribed in the incircle of an equilateral triangle of side a is–

(a) $3a^2$ (b) $\frac{a^2}{2}$ (c) $\frac{a^2}{6}$ (d) $6a^2$

68. Consider the locus of a moving point P(x, y) in the plane which satisfies the condition
$2x^2 = r^2 + r^4$, where $r^2 = x^2 + y^2$

Then, only one of the following statement is true-

(a) For every $0 < r < 1$, there are exactly four points on the curve

(b) For every $0 < r \leq 1$, there are exactly four points on the curve

(c) The locus is a pair of straight lines

(d) None of these

69. The line $y = 3x/4$ meet the lines $x – y + 1 = 0$ and $2x – y – 5 = 0$ at points A and B respectively. If P on the line $y = 3x/4$ which satisfies the condition $PA \cdot PB = 25$ then number of possible coordinate of P is-

(a) 3 (b) 2 (c) 1 (d) None of these

70. The liens $y = mx$ bisects the angle between the lines $ax^2 + 2hxy + by^2 = 0$ if -

(a) $h(1 + m^2) = m(a + b)$ (b) $h(1 – m^2) = m(a – b)$

(c) $h(1 + m^2) = m(a – b)$ (d) None of these

71. The equation of the straight line passing through the point (3, 2) and perpendicular to the line $y = x$ is

(a) $x – y = 5$ (b) $x + y = 5$

(c) $x + y = 1$ (d) $x – y = 1$

72. A straight line through the point (1, 1) meets the x-axis at 'A' and the y-axis at 'B'. The locus of the mid-point of AB is

(a) $2xy + x + y = 0$ (b) $x + y – 2xy = 0$

(c) $x + y + 2 = 0$ (d) $x + y – 2 = 0$

73. The straight line $x + 2y – 9 = 0$, $3x + 5y – 5 = 0$ and $ax + by – 1 = 0$ are concurrent, if the straight line $35x – 22y + 1 = 0$ passes through the point –

(a) (a, b) (b) (b, a) (c) (– a,– b) (d) None of these

74. A line makes p and q as intercepts on axes and a is the length of perpendicular from the origin to the line then-

(a) $a = p + q$ (b) $a^2 = p^2 + q^2$

(c) $\frac{1}{a^2} = \frac{1}{p^2} + \frac{1}{q^2}$ (d) None of these

75. A straight line L is perpendicular to the line $5x – y = 1$. If the area of the triangle formed by the line L and the co-ordinate axis is 5 then the equation of line L is –

(a) $x + 3y \pm 3\sqrt{2} = 0$ (b) $x + 2y \pm \sqrt{2} = 0$

(c) $x + 5y \pm 5\sqrt{2} = 0$ (d) None of these

76. The intercepts on the straight line $y = mx$ by the lines $y = 2$ and $y = 6$ is less than 5, then m belongs to -

(a) $\left]-\frac{4}{3}, \frac{4}{3}\right[$ (b) $\left]\frac{4}{3}, \frac{3}{8}\right[$

(c) $\left]-\infty, -\frac{4}{3}\right[\cup \left]\frac{4}{3}, \infty\right[$ (d) $\left]\frac{4}{3}, \infty\right[$

77. A circle of radius 5 units touches both the axes and lies in first quadrant. If the circle makes one complete roll on *x*-axis along the positive direction of *x*-axis, then its equation in the new position is

(a) $x^2 + y^2 + 20\pi x – 10y + 100\pi^2 = 0$

(b) $x^2 + y^2 + 20\pi x + 10y + 100\pi^2 = 0$

(c) $x^2 + y^2 – 20\pi x – 10y + 100\pi^2 = 0$

(d) None of these

78. If the distances from the origin to the centres of three circles $x^2+y^2+2\lambda_i x-c^2=0$ $(i=1,2,3)$ are in *G.P.* then the lengths of the tangents drawn to them from any point on the circle $x^2+y^2=c^2$ are in

(a)*A.P.* (b)*G.P.* (c)*H.P.* (d) None of these

79. In the co-axial system of circle $x^2+y^2+2gx+c=0$ where *g* is a parameter, if *c*> 0. Then the circles are

(a) Orthogonal (b) Touching type

(c) Intersecting type (d) Non intersecting type

80. The number of common tangents that can be drawn to the circles $x^2+y^2-4x-6y-3=0$ and $x^2+y^2+2x+2y+1=0$ is

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

81. If $\tanh^2 x=\tan^2\theta$, then $\cosh 2x$ is equal to

(a) $-\sin 2\theta$ (b) $\sec 2\theta$ (c) $\cos 3\theta$ (d) $\cos 2\theta$

82. $\cos ix+i\sin ix$ equals

(a) e^{ix} (b) e^{-ix} (c) e^{x} (d) e^{-x}

83. $\operatorname{sech}(\pi i)+\operatorname{cosech}\left(\frac{\pi}{2}i\right)$ equals

(a) $1-i$ (b) $-1+i$ (c) $-1-i$ (d) $1+i$

84. If $\cosh^{-1}x=\log(2+\sqrt{3})$, then $x=$

(a) 2 (b) 1 (c) 3 (d) 5

85. $\sinh^{-1}(2^{3/2})$ is

(a) $\log(2+\sqrt{18})$ (b) $\log(3+\sqrt{8})$

(c) $\log(3-\sqrt{8})$ (d) $\log(\sqrt{8}+\sqrt{27})$

86. $\cosh 2+\sinh 2=$

(a) $\frac{1}{e}$ (b) e (c) $\frac{1}{e^2}$ (d) e^2

87. The value of $\cosh^{-1}(\sec x)$ is

(a) $\log\left(\frac{1+\sin x}{\cos x}\right)$ (b) $\log\left(\frac{1-\sin x}{\cos x}\right)$

(c) $\log\left(\frac{1+\cos x}{\sin x}\right)$ (d) $\log\left(\frac{1-\cos x}{\sin x}\right)$

88. If $\cos\alpha\cosh\beta=1$, then β is equal to

(a) $\log\sec\left(\frac{\alpha}{2}\right)$ (b) $\log\tan\alpha$

(c) $\log(\sec\alpha+\tan\alpha)$ (d) $\log\sin\left(\frac{\alpha}{2}\right)$

89. Find real part of $\tan^{-1}(1+i)$

(a) $-\frac{1}{2}\tan^{-1}(2)$ (b) $\frac{1}{2}\tan^{-1}(2)$

(c) $-\frac{1}{2}\tan^{-1}\left(\frac{1}{2}\right)$ (d) 0

90. Find imaginary part of $\sin^{-1}\left(\frac{5\sqrt{7}-9i}{16}\right)$

(a) $\log 2$ (b) $-\log 2$ (c) 0 (d) None of these