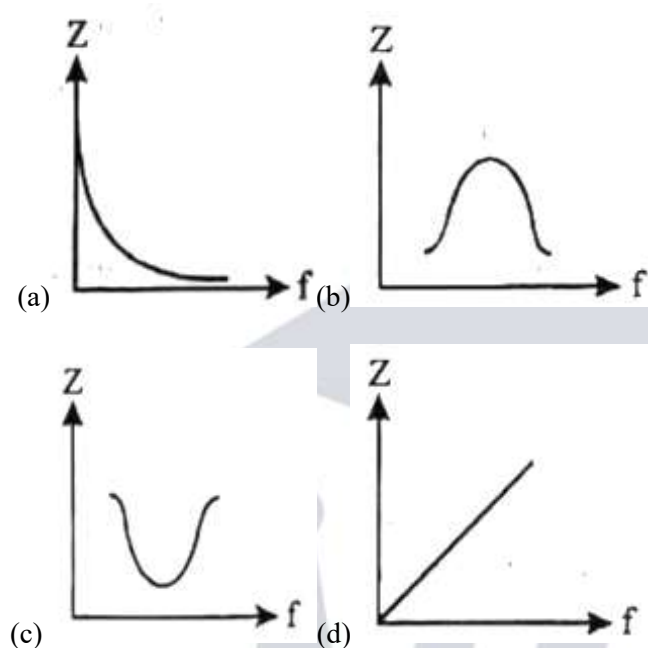


PART-I PHYSICS

1. Light of wavelength λ_A and λ_B falls on two identical metal plates A and B respectively. The maximum kinetic energy of photoelectrons is K_A and K_B respectively, then which one of the following relations is true ($\lambda_A = 2\lambda_B$)

- (a) $K_A < \frac{K_B}{2}$ (b) $2 K_A = K_B$
(c) $K_A = 2 K_B$ (d) $K_A > 2 K_B$

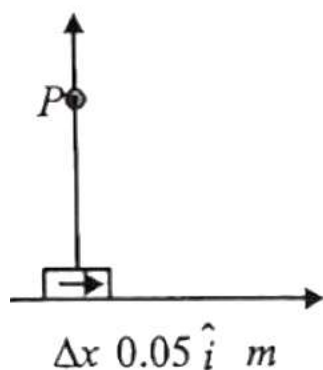
2. Which one of the following curves represents the variation of impedance (Z) with frequency f in series LCR circuit?



3. A Carnot engine takes 3×10^6 cal. of heat from a reservoir at 627°C , and gives it to a sink at 27°C . The work done by the engine is

- (a) 4.2×10^6 J (b) 8.4×10^6 J
(c) 16.8×10^6 J (d) zero

4. An element of 0.05m is placed at the origin as shown in figure which carries a large current of 10 (a) distance of 1m in perpendicular direction. The value of magnetic field is



- (a) $4.5 \times 10^{-8} \text{ T}$ (b) $5.5 \times 10^{-8} \text{ T}$
(c) $5.0 \times 10^{-8} \text{ T}$ (d) $7.5 \times 10^{-8} \text{ T}$

5. A sinusoidal voltage of amplitude 25 volt and frequency 50 Hz is applied to a half wave rectifier using P – n junction diode. No filter is used and the load resistor is 1000Ω . The forward resistance R_f of ideal diode is 10Ω . The percentage rectifier efficiency is

- (a) 40% (b) 20%
(c) 30% (d) 15%

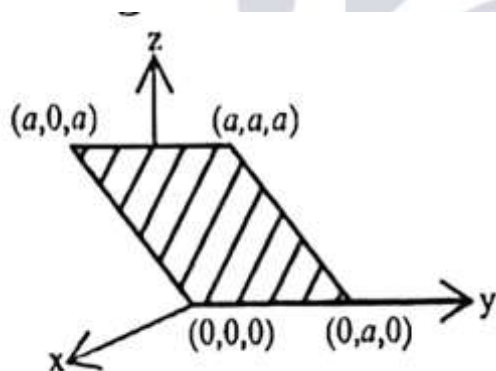
6. A flask contains a monoatomic and a diatomic gas in the ratio of 4: 1 by mass at a temperature of 300 K. The ratio of average kinetic energy per molecule of the two gases is

- (a) 1: 1 (b) 2: 1
(c) 4: 1 (d) 1: 4

7. The potential energy of a particle (U_x) executing S.H.M. is given by

- (a) $U_x = \frac{k}{2}(x - a)^2$ (b) $U_x = k_1x + k_2x^2 + k_3x^3$
(c) $U_x = Ae^{-bx}$ (d) $U_x = \text{a constant}$

8. Consider an electric field $\vec{E} = E_0\hat{x}$ where E_0 is a constant. The flux through the shaded area (as shown in the figure) due to this field is



- (a) $2E_0a^2$ (b) $\sqrt{2}E_0a^2$
(c) E_0a^2 (d) $\frac{E_0a^2}{\sqrt{2}}$

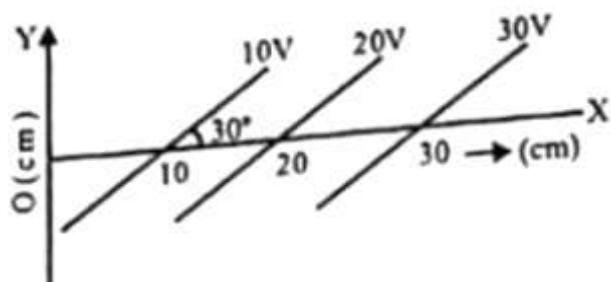
9. The equation of a wave on a string of linear mass density 0.04 kg m^{-1} is given by

$$y = 0.02(\text{m})\sin\left[2\pi\left(\frac{t}{0.04(\text{s})} - \frac{x}{0.50(\text{m})}\right)\right]$$

The tension in the string is

- (a) 4.0 N (b) 12.5 N
(c) 0.5 N (d) 6.25 N

10. Equipotential surfaces are shown in figure. Then the electric field strength will be



- (a) 100Vm^{-1} along X-axis
- (b) 100Vm^{-1} along Y-axis
- (c) 200Vm^{-1} at an angle 120° with X-axis
- (d) 50Vm^{-1} at an angle 120° with X-axis

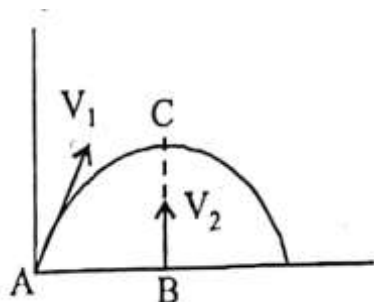
11. Water falls from a 40 m high dam at the rate of 9×10^4 kg per hour. Fifty percentage of gravitational potential energy can be converted into electrical energy. Using this hydro electric energy, number of 100 W lamps, that can be lit, is : (. Take $g = 10 \text{ ms}^{-2}$)

- (a) 25
- (b) 50
- (c) 100
- (d) 18

12. An electron (mass = 9×10^{-31} kg, charge = 1.6×10^{-19} C) moving with a velocity of 10^6 m/s enters a magnetic field (d) If it describes a circle of radius 0.1 m, then strength of magnetic field must be

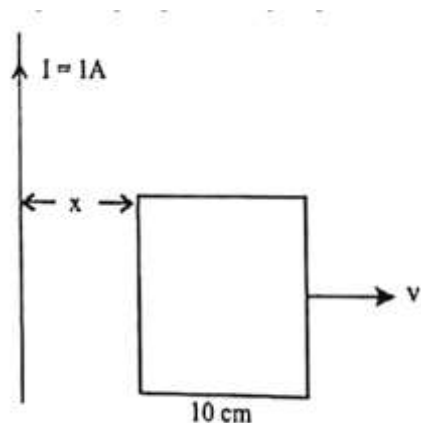
- (a) 4.5×10^{-5} T
- (b) 1.4×10^{-5} T
- (c) 5.5×10^{-5} T
- (d) 2.6×10^{-5} T

13. If V_1 is velocity of a body projected from the point A and V_2 is the velocity of a body projected from point B which is vertically below the highest point C. if both the bodies collide, then



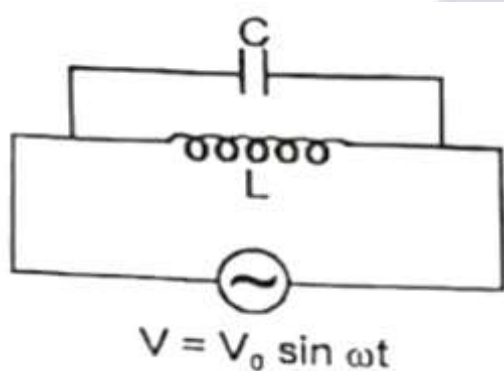
- (a) $V_1 = \frac{1}{2} V_2$
- (b) $V_2 = \frac{1}{2} V_1$
- (c) $V_1 = V_2$
- (d) $V_1 = 3 V_2$

14. A square frame of side 10 cm and a long straight wire carrying current 1 A are in the plane of the paper. Starting from close to the wire, the frame moves towards the right with a constant speed of 10 ms^{-1} (see figure). The e.m. induced at the time the left arm of the frame is at $x = 10$ cm from the wire is



- (a) $2\mu\text{V}$ (b) $1\mu\text{V}$
(c) $0.75\mu\text{V}$ (d) $0.5\mu\text{V}$

15. For the circuit shown in the fig., the current through the inductor is 0.9 A while the current through the condenser is 0.4 (a) Then

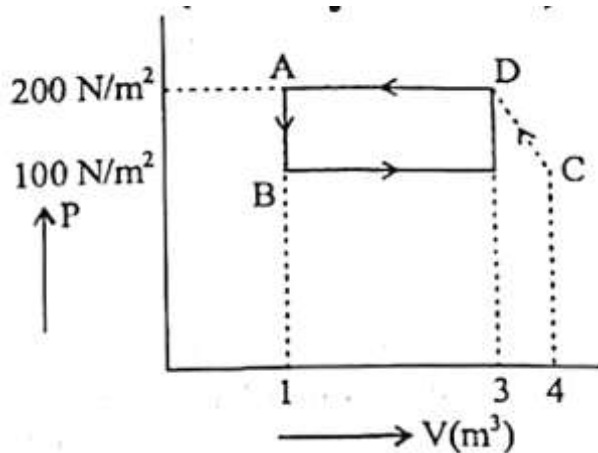


- (a) current drawn from source $I = 1.13\text{ A}$
(b) $\omega = 1/(1.5LC)$
(c) $I = 0.5\text{ A}$
(d) $I = 0.6\text{ A}$

16. The ozone layer in the atmosphere absorbs

- (a) only the radiowaves
(b) only the visible light
(c) only the γ -rays
(d) X-rays and ultraviolet rays

17. The P - V diagram of a diatomic ideal gas system going under cyclic process as shown in figure. The work done during an adiabatic process CD is (Use $\gamma = 1.4$):



- (a) -500 J (b) 200 J
 (c) -400 J (d) 400 J

18. In YDSE, how many maximas can be obtained on a screen including central maxima in both sides of the central fringe if $\lambda = 3000 \text{ \AA}$, $d = 5000 \text{ \AA}$

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

19. A and B are two metals with threshold frequencies $1.8 \times 10^{14} \text{ Hz}$ and $2.2 \times 10^{14} \text{ Hz}$. Two identical photons of energy 0.825 eV each are incident on them. Then photoelectrons are emitted in (Take $h = 6.6 \times 10^{-34} \text{ Js}$)

- (a) B alone (b) A alone
 (c) neither A nor B (d) both A and B

20. A sinusoidal voltage of amplitude 25 volt and frequency 50 Hz is applied to a half wave rectifier using P – n junction diode. No filter is used and the load resistor is 1000Ω . The forward resistance R_f of ideal diode is 10Ω . The percentage rectifier efficiency is

- (a) 40% (b) 20%
 (c) 30% (d) 15%

21. The force between two short bar magnets with magnetic moments M_1 and M_2 whose centres are r metres apart is 8 N when their axes are in same line. if the separation is increased to $2r$, the force between them is reduced to

- (a) 4 N (b) 2 N
 (c) 1 N (d) 0.5 N

22. In a Rutherford scattering experiment when a projectile of charge Z_1 and mass M_1 approaches a target nucleus of charge Z_2 and mass M_2 , the distance of closest approach is r_0 . The energy of the projectile is

- (a) directly proportional to $Z_1 Z_2$
 (b) inversely proportional to Z_1

(c) directly proportional to mass M_1

(d) directly proportional to $M_1 \times M_2$

23. What will be the maximum speed of a car on a road turn of radius 30 m if the coefficient of friction between the tyres and the road is 0.4 (Take $g = 9.8 \text{ m/s}^2$)

(a) 10.84 m/s (b) 9.84 m/s

(c) 8.84 m/s (d) 6.84 m/s

24. A person aiming to reach the exactly opposite point on the bank of a stream is swimming with speed of 0.5 m/s at an angle of 120° with the direction of flow of water. The speed of water in the stream is

(a) 1 m/s (b) 0.5 m/s

(c) 0.25 m/s (d) 0.433 m/s

25. A car moves at a speed of 20 ms^{-1} on a banked track and describes an arc of a circle of radius $40\sqrt{3} \text{ m}$. The angle of banking is ($g = 10 \text{ ms}^{-2}$)

(a) 25° (b) 60°

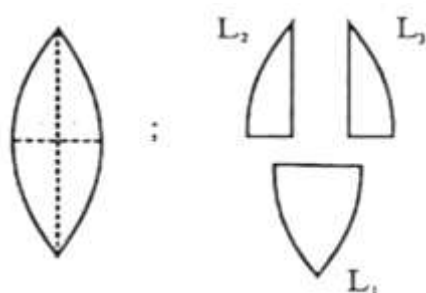
(c) 45° (d) 30°

26. A force $\vec{F} = \alpha\hat{i} + 3\hat{j} + 6\hat{k}$ is acting at a point $\vec{r} = 2\hat{i} - 6\hat{j} - 12\hat{k}$. The value of α for which angular momentum about origin is conserved is

(a) 2 (b) zero

(c) 1 (d) -1

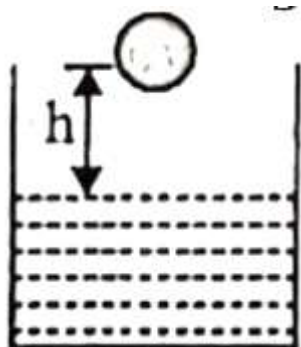
27. A convex lens has power P. It is cut into two halves along its principal axis. Further one piece (out of the two halves) is cut into two halves perpendicular to the principal axis (as shown in figure). Choose the incorrect option for the reported pieces.



(a) Power of $L_1 = \frac{P}{2}$ (b) Power of $L_2 = \frac{P}{2}$

(c) Power of $L_3 = \frac{P}{2}$ (d) Power of $L_4 = P$

28. A ball of radius r and density ρ falls freely under gravity through a distance h before entering water. Velocity of ball does not change even on entering water. If viscosity of water is η the value of h is given by



- (a) $\frac{2}{9} r^2 \left(\frac{1-\rho}{\eta} \right) g$ (b) $\frac{2}{81} r^2 \left(\frac{\rho-1}{\eta} \right) g$
(c) $\frac{2}{81} r^4 \left(\frac{\rho-1}{\eta} \right)^2 g$ (d) $\frac{2}{9} r^4 \left(\frac{\rho-1}{\eta} \right)^2 g$

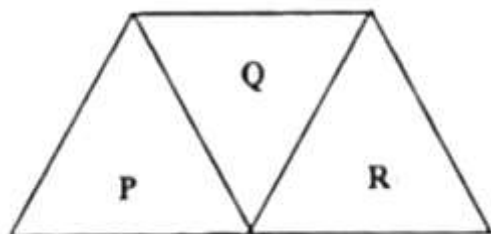
29. The pressure inside a tyre is 4 times that of atmosphere. If the tyre bursts suddenly at temperature 300 K, what will be the new temperature?

- (a) $300(4)^{7/2}$ (b) $300(4)^{2/7}$
(c) $300(2)^{7/2}$ (d) $300(4)^{-27}$

30. A parallel plate air capacitor of capacitance C is connected to a cell of emf V and then disconnected from it. A dielectric slab of dielectric constant K, which can just fill the air gap of the capacitor, is now inserted in it. Which of the following is incorrect?

- (a) The energy stored in the capacitor decreases K times.
(b) The change in energy stored is $\frac{1}{2} CV^2 \left(\frac{1}{K} - 1 \right)$.
(c) The charge on the capacitor is not conserve(d)
(d) The potential difference between the plates decreases K times.

31. A given ray of light suffers minimum deviation in an equilateral prism P. Additional prism Q and R of identical shape and of the same material as P are now added as shown in the figure. The ray will now suffer



- (a) greater deviation (b) no deviation
(c) same deviation as before (d) total internal reflection

32. If $\vec{m}$ is magnetic moment and $\vec{B}$ is the magnetic field, then the torque is given by

- (a) $\vec{m} \cdot \vec{B}$ (b) $\frac{|\vec{m}|}{|\vec{B}|}$

- (c) $\vec{m} \times \vec{B}$ (d) $|\vec{m}| \cdot |\vec{B}|$

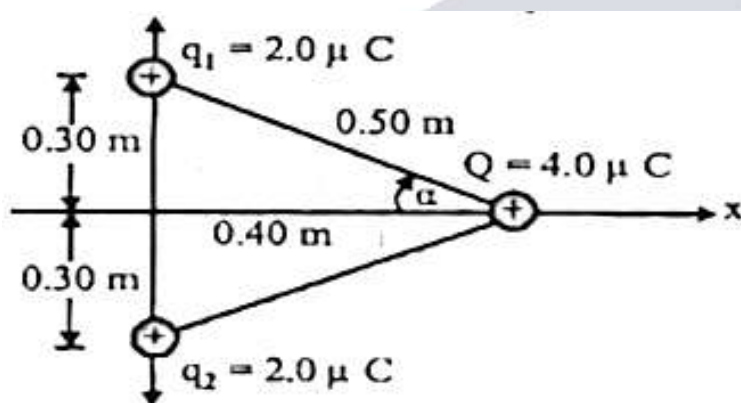
33. An α -particle of 10 MeV collides head-on with a copper nucleus ($Z = 29$) and is deflected back. Then, the minimum distance of approach between the centres of the two is:

- (a) 8.4×10^{-15} cm (b) 8.4×10^{-15} m
(c) 4.2×10^{-15} m (d) 4.2×10^{-15} cm

34. A planet in a distant solar system is 10 times more massive than the earth and its radius is 10 times smaller. Given that the escape velocity from the earth's surface is 11 km s^{-1} , the escape velocity from the surface of the planet would be

- (a) 1.1 km s^{-1} (b) 11 km s^{-1}
(c) 110 km s^{-1} (d) 0.11 km s^{-1}

35. In fig., two equal positive point charges $q_1 = q_2 = 2.0 \mu\text{C}$ interact with a third point charge $Q = 4.0 \mu\text{C}$. The magnitude, as well as direction, of the net force on Q is



- (a) 0.23 N in the +x-direction
(b) 0.46 N in the +x-direction
(c) 0.23 N in the -x-direction
(d) 0.46 N in the -x-direction

PART-II CHEMISTRY

36. Which of the following sets of quantum numbers is correct for an electron in 4 orbital?

- (a) $n = 4, l = 3, m = +1, s = +1/2$
(b) $n = 4, l = 4, m = -4, s = -1/2$
(c) $n = 4, l = 3, m = +4, s = +1/2$
(d) $n = 3, l = 2, m = -2, s = +1/2$

37. Arrange the following in increasing order of ionic radii? $\text{C}^4, \text{N}^3, \text{F}, \text{O}^{2-}$

- (a) $\text{C}^4 < \text{N}^{3-} < \text{O}^{2-} < \text{F}^-$ (b) $\text{N}^{3-} < \text{C}^4 < \text{O}^{2-} < \text{F}^-$



38. The bond dissociation energies of X_2 , Y_2 and XY are in the ratio of 1: 0.5: 1. ΔH for the formation of XY is -200 kJ mol^{-1} . The bond dissociation energy of X_2 will be

- (a) 200 kJ mol^{-1} (b) 100 kJ mol^{-1}
(c) 400 kJ mol^{-1} (d) 800 kJ mol^{-1}

39. Values of dissociation constant, K_a are given as follows.

Acid	K_a
HCN	6.2×10^{-10}
HF	7.2×10^{-4}
HNO_2	4.0×10^{-4}

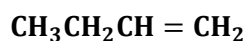
Correct order of increasing base strength of the base CN^- , F^- and NO_2^- will be:

- (a) $F < CN^- < NO_2^-$ (b) $NO_2^- < CN^- < F^-$
(c) $F < NO_2^- < CN^-$ (d) $NO_2^- < F^- < CN^-$

40. The product/s formed when diborane is hydrolysed is/are

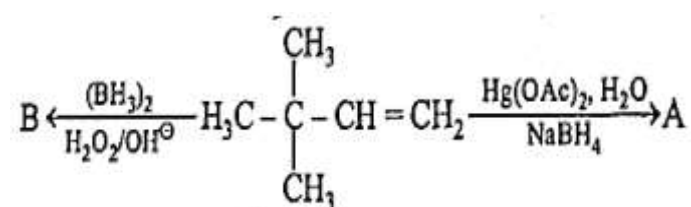
- (a) B_2O_3 and H_3BO_3 (b) B_2O_3 only
(c) H_3BO_3 and H_2 (d) H_3BO_3 only

41. The compounds $CH_3CH = CHCH_3$ and



- (a) are tautomers
(b) are position isomers
(c) contain same number of $sp^3 - sp^3$, $sp^3 - sp^2$ and $sp^2 - sp^2$ carbon-carbon bonds
(d) exist together in dynamic equilibrium

42. Choose the correct option for the following reactions.



- (a) 'A' and 'B' are both Markovnikov addition products.
(b) 'A' is Markovnikov product and 'B' is antiMarkovnikov product.
(c) 'A' and 'B' are both anti-Markovnikov products.
(d) 'B' is Markovnikov and 'A' is anti-Markovnikov product.

43. Which of the following has Frenkel defects?

- (a) Sodium chloride (b) Silver bromide
(c) Graphite (d) Diamond

44. An element X has a body centred cubic (bcc) structure with a cell edge of 200pm. The density of the element is 5gcm^{-3} . The number of atoms present in 300 g of the element X is Given: Avogadro Constant, $N_A = 6.0 \times 10^{23} \text{ mol}^{-1}$.

- (a) $5 N_A$ (b) $6 N_A$
(c) $15 N_A$ (d) $25 N_A$

45. On passing current through two cells, connected in series, containing solution of AgNO_3 and CuSO_4 , 0.18 g of Ag is deposited. The amount of the Cu deposited is:

- (a) 0.529 g (b) 10.623 g
(c) 0.0529 g (d) 1.2708 g

46. The limiting molar conductivities of HCl, CH_3COONa and NaCl are respectively 425, 90 and $125\text{mho cm}^2 \text{ mol}^{-1}$ at 25°C . The molar conductivity of 0.1M CH_3COOH solution is $7.8\text{mho cm}^2 \text{ mol}^{-1}$ at the same temperature. The degree of dissociation of 0.1M acetic acid solution at the same temperature is

- (a) 0.10 (b) 0.02
(c) 0.15 (d) 0.03

47. The rate law for a reaction between the substances A and B is given by $\text{Rate} = k[A]^n[B]^m$

On doubling the concentration of A and halving the concentration of B, the ratio of the new rate to the earlier rate of the reaction will be as

- (a) $(m + n)$ (b) $(n - m)$
(c) $2^{(n-m)}$ (d) $\frac{1}{2^{(m+n)}}$

48. In a reaction, the threshold energy is equal to

- (a) activation energy + normal energy of reactants
(b) activation energy - normal energy of reactants
(c) normal energy of reactants - activation energy
(d) average kinetic energy of molecules of reactants

49. Which property of white phosphorus is common to red phosphorous?

- (a) It burns when heated in air.
(b) It reacts with hot caustic soda solution to give phosphine.
(c) It shows chemiluminescence.

(d) It is soluble in carbon disulphide.

50. XeO_4 molecule is tetrahedral having:

- (a) Two $\text{p}\pi - \text{d}\pi$ bonds (b) One $\text{p}\pi - \text{d}\pi$ bonds
(c) Four $\text{p}\pi - \text{d}\pi$ bonds (d) Three $\text{p}\pi - \text{d}\pi$ bonds

51. Cuprous ion is colourless while cupric ion is coloured because

- (a) both have half filled p-and d-orbitals
(b) cuprous ion has incomplete d -orbital and cupric ion has a complete d -orbital
(c) both have unpaired electrons in the d -orbitals
(d) cuprous ion has complete d -orbital and cupric ion has an incomplete d -orbital.

52. The reason for greater range of oxidation states in actinoids is attributed to:

- (a) actinoid contraction
(b) 5f , 6d and 7s levels having comparable energies
(c) 4f and 5 d levels being close in energies
(d) the redioactive nature of actinoids

53. The geometry and magnetic behaviour of the complex $[\text{Ni}(\text{CO})_4]$ are

- (a) Square planar geometry and diamagnetic
(b) Tetrahedral geometry and diamagnetic
(c) Tetrahedral geometry and paramagnetic
(d) Square planar geometry and paramagnetic

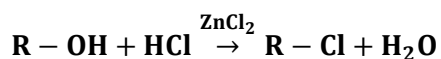
54. Indicate the complex ion which shows geometrical isomerism.

- (a) $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]^+$ (b) $[\text{Pt}(\text{NH}_3)_3\text{Cl}]^{2-}$
(c) $[\text{Co}(\text{NH}_3)_6]^{3-}$ (d) $[\text{Co}(\text{CN})_5(\text{NC})]^{3-}$

55. Reaction of $\text{C}_6\text{H}_5\text{CH}_2\text{Br}$ with aqueous sodium hydroxide follows

- (a) $\text{S}_{\text{N}}1$ mechanism
(b) $\text{S}_{\text{N}}2$ mechanism
(c) Any of the above two depending upon the temperature of reaction
(d) Saytzeff rule

56. What is the correct order of reactivity of alcohols in the following reaction?

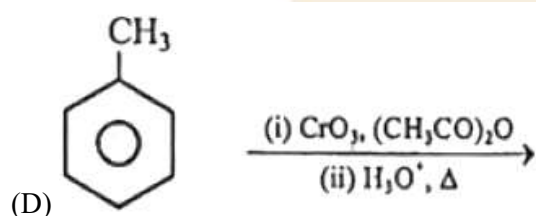
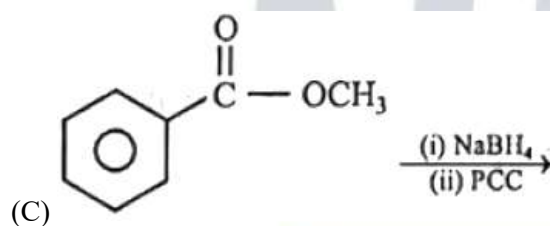
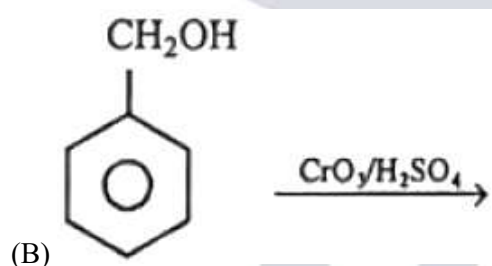
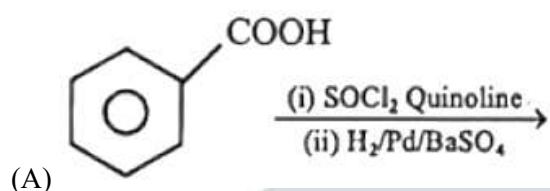


- (a) $1^\circ > 2^\circ > 3^\circ$ (b) $3^\circ > 2^\circ > 1^\circ$
 (c) $1^\circ < 2^\circ < 3^\circ$ (d) $3^\circ > 1^\circ > 2^\circ$

57. Which of the following cannot be made by using Williamson's synthesis?

- (a) Methoxybenzene
 (b) Benzyl p-nitrophenyl ether
 (c) Methyl tertiary butyl ether
 (d) Di-tert-butyl ether

58. Which of the following reactions will yield benzaldehyde as a product?



- (a) (B) and (C) (b) (C) and (D)
 (c) (A) and (D) (d) (A) and (C)

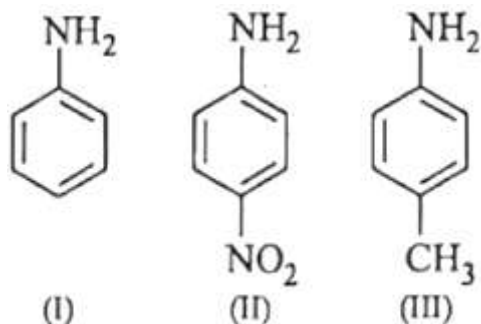
59. In Clemmensen reduction, carbonyl compounds is treated with

- (a) zinc amalgam +HCl
 (b) sodium amalgam +HCl

(c) zinc amalgam + nitric acid

(d) sodium amalgam + HNO_3

60. The correct increasing order of basic strength for the following compounds is



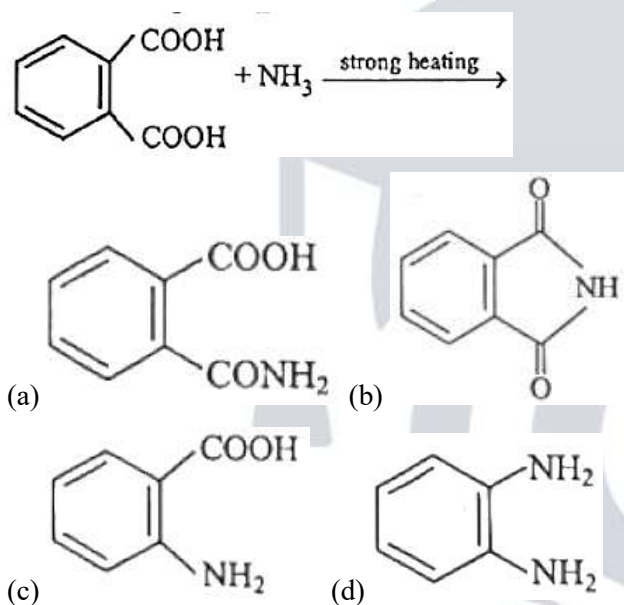
(a) $\text{II} < \text{III} < \text{I}$

(b) $\text{III} < \text{I} < \text{II}$

(c) $\text{III} < \text{II} < \text{I}$

(d) $\text{II} < \text{I} < \text{III}$

61. The major product of the following reaction is :



62. Blister copper is

(a) Impure Cu

(b) Cu alloy

(c) Pure Cu

(d) Cu having 1% impurity

63. P_A and P_B are the vapour pressure of pure liquid components, A and B, respectively of an ideal binary solution. If x_A represents the mole fraction of component A, the total pressure of the solution will be.

(a) $P_A + x_A(P_B - P_A)$

(b) $P_B + x_A(P_B - P_A)$

(c) $P_A + x_A(P_A - P_B)$

(d) $P_B + x_A(P_A - P_B)$

64. Which of the following complex shows sp^3d^2 hybridization

(a) $[\text{Cr}(\text{NO}_2)_6]^{3-}$

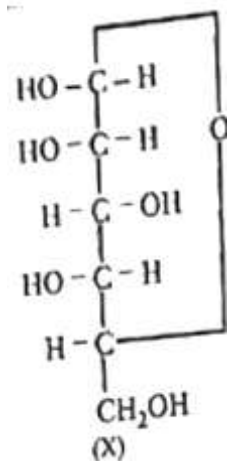
(b) $[\text{Fe}(\text{CN})_6]^{4-}$

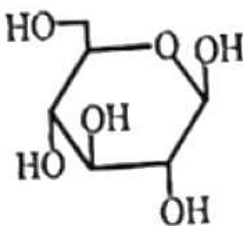
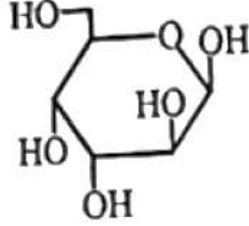
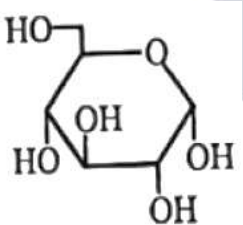
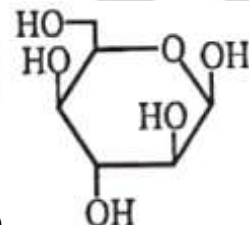
- (c) $[\text{CoF}_6]^{3-}$ (d) $[\text{Ni}(\text{CO})_4]$

65. 2-Pentene contains

- (a) 15σ - and one π - bond (b) 14σ - and one π - bond
(c) 15σ - and two π - bonds (d) 14σ - and two π - bonds

66. For the below given cyclic hemiacetal (X), the correct pyranose structure is :



- (a)  (b) 
(c)  (d) 

67. Sucrose which is dextrorotatory in nature after hydrolysis gives glucose and fructose, among which

- (i) Glucose is laevorotatory and fructose is dextrorotatory.
(ii) Glucose is dextrorotatory and fructose is laevorotatory
(iii) The mixture is laevorotatory.
(iv) Both are dextrorotatory.

- (a) (i) and (iii) (b) (iii) and (iv)
(c) (ii) and (iii) (d) (iii) only

68. Allyl cyanide molecule contains

- (a) 9 sigma bonds, 4 pi bonds and no lone pair
(b) 9 sigma bonds, 3 pi bonds and one lone pair

- (c) 8 sigma bonds, 5 pi bonds and one lone pair
(d) 8 sigma bonds, 3 pi bonds and two lone pairs

69. Which of the following pairs of compounds is isoelectronic and isostructural?

- (a) TeI_2 , XeF_2 (b) IBr_2^- , XeF_2
(c) IF_3 , XeF_4 (d) BeCl_2 , XeF_2

70. In which case change in entropy is negative?

- (a) Evaporation of water
(b) Expansion of a gas at constant temperature
(c) Sublimation of solid to gas
(d) $2\text{H}(\text{g}) \rightarrow \text{H}_2(\text{g})$

PART-III MATHEMATICS

71. The argument of the complex number $\left(\frac{1}{2} - \frac{2}{i}\right)$ is equal to

- (a) $\frac{\pi}{4}$ (b) $\frac{3\pi}{4}$
(c) $\frac{\pi}{12}$ (d) $\frac{\pi}{2}$

72. The lines $p(p^2 + 1)x - y + q = 0$ and $(p^2 + 1)^2 x + (p^2 + 1)y + 2q = 0$ are perpendicular to a common line for

- (a) exactly one value of p
(b) exactly two values of p
(c) more than two values of p
(d) no value of p

73. The probability that a card drawn from a pack of 52 cards will be a diamond or king is

- (a) $\frac{1}{52}$ (b) $\frac{2}{13}$
(c) $\frac{4}{13}$ (d) $\frac{1}{13}$

74. If $n(A) = 4$ and $n(B) = 7$, then the difference between maximum and minimum value of $n(A \cup B)$ is

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

75. The domain of the function $f(x) = \frac{1}{\sqrt{9-x^2}}$ is

- (a) $-3 \leq x \leq 3$ (b) $-3 < x < 3$

(c) $-9 \leq x \leq 9$ (d) $-9 < x < 9$

76. If $\sin x + \cos x = \frac{1}{5}$, then $\tan 2x$ is

- (a) $\frac{25}{17}$ (b) $\frac{7}{25}$
(c) $\frac{25}{7}$ (d) $\frac{24}{7}$

77. For binary operation $*$ defined on $\mathbb{R} - \{1\}$ such that $a * b = \frac{a}{b+1}$ is

- (a) not associative (b) commutative
(c) not commutative (d) both (a) and (b)

78. $\cos^{-1}\left(\frac{1}{2}\right) + \sin^{-1}(1) + \tan^{-1}\frac{1}{\sqrt{3}}$ is equal to

- (a) Π (b) $\frac{\pi}{3}$
(c) $\frac{4\pi}{3}$ (d) $\frac{3\pi}{4}$

79. If $A = \begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix}$, $B = \begin{bmatrix} x & 1 \\ y & -1 \end{bmatrix}$ and $(A + B)^2 = A^2 + B^2$, then $x + y =$

- (a) 2 (b) 3
(c) 4 (d) 5

80. The value of $\frac{-a^2}{ab} \cdot \frac{ab}{-b^2} \cdot \frac{ac}{bc}$ is:

- (a) 0 (b) abc
(c) $4a^2b^2c^2$ (d) None of these

81. If $A = \begin{bmatrix} \alpha & \beta \\ \gamma & \alpha \end{bmatrix}$, then $\text{Adj. } A$ is equal to:

- (a) $\begin{bmatrix} \delta & -\gamma \\ -\beta & \alpha \end{bmatrix}$ (b) $\begin{bmatrix} \delta & -\beta \\ -\gamma & \alpha \end{bmatrix}$
(c) $\begin{bmatrix} -\delta & \beta \\ \gamma & -\alpha \end{bmatrix}$ (d) $\begin{bmatrix} -\delta & -\beta \\ \gamma & \alpha \end{bmatrix}$

82. If $\sec\left(\frac{x-y}{x+y}\right) = a$, then $\frac{dy}{dx}$ is

- (a) $-\frac{y}{x}$ (b) $\frac{x}{y}$
(c) $-\frac{x}{y}$ (d) $\frac{y}{x}$

83. The number of non-zero terms in the expansion of $(1 + 3\sqrt{2}x)^9 + (1 - 3\sqrt{2}x)^9$ is

- (a) 2 (b) 3
(c) 4 (d) 5

84. If $\frac{a^n+b^n}{a^{n-1}+b^{n-1}}$ is the A.M. between a and b, then the value of n is

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

85. The sum of the series

$$\frac{1}{1+\sqrt{2}} + \frac{1}{\sqrt{2}+\sqrt{3}} + \frac{1}{\sqrt{3}+\sqrt{4}} + \dots$$

Up to 15 terms is

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

86. The equation of the circle with centre (0, 2) and radius 2 is $x^2 + y^2 - my = 0$. The value of m is

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

87. $\int x^x(1 + \log x)dx$ is equal to

- (a) $x^x + C$ (b) $x^{2x} + C$
(c) $x^x \log x + C$ (d) $1/2(1 + \log x)^2 + C$

88. $\int_0^{\pi/2} (\sqrt{\tan x} + \sqrt{\cot x})dx =$

- (a) $\frac{\pi}{\sqrt{2}}$ (b) $\pi\sqrt{2}$
(c) $\frac{\pi}{2}$ (d) $\frac{\sqrt{2}}{\pi}$

89. The area of the region bounded by the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ is

- (a) 12π (b) 3π
(c) 24π (d) π

90. If vertex of a parabola is (2, -1) and the equation of its directrix is $4x - 3y = 21$, then the length of its latus rectum is

- (a) 2 (b) 8
(c) 12 (d) 16

91. 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) $\sqrt{6/7}$

92. In $\triangle ABC$ the mid-point of the sides AB, BC and CA are respectively $(1, 0, 0)$, $(0, m, 0)$ and $(0, 0, n)$. Then, $\frac{AB^2+BC^2+CA^2}{1^2+m^2+n^2}$ is equal to

(a) 8 (b) 16

(c) 9 (d) 25

93. If $f(x) = \frac{x+|x|}{x}$, then the value of $\lim_{x \rightarrow 0} f(x)$ is

(a) 0 (b) 2

(c) does not exist (d) None of these

94. Negation of the Boolean expression $p \Leftrightarrow (q \Rightarrow p)$ is

(a) $(\sim p) \wedge q$ (b) $(p) \wedge (\sim q)$

(c) $(\sim p) \vee (\sim q)$ (d) $(\sim p) \wedge (\sim q)$

95. If $R = \{(x, y): x \text{ is exactly 7 cm taller than } y\}$, then R is

(a) not symmetric

(b) reflexive

(c) symmetric but not transitive

(d) an equivalence relation

96. The particular solution of $\log \frac{dy}{dx} = 3x + 4y, y(0) = 0$ is

(a) $e^{3x} + 3e^{-4y} = 4$ (b) $4e^{3x} - 3e^{-4y} = 3$

(c) $3e^{3x} + 4e^{4y} = 7$ (d) $4e^{3x} + 3e^{-4y} = 7$

97. $\tan^{-1} x + \tan^{-1} y = c$ is the general solution of the differential equation

(a) $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$

(b) $\frac{dy}{dx} = \frac{1+x^2}{1+y^2}$

(c) $(1+x^2)dy + (1+y^2)dx = 0$

(d) $(1+x^2)dx + (1+y^2)dy = 0$

98. If $|\vec{a}| = 3, |\vec{b}| = 4$, then a value of λ for which $\vec{a} + \lambda\vec{b}$ is perpendicular to $\vec{a} - \lambda\vec{b}$ is:

- (a) $\frac{9}{16}$ (b) $\frac{3}{4}$
(c) $\frac{3}{2}$ (d) $\frac{4}{3}$

99. The area of the parallelogram whose diagonals are $\frac{3}{2}\hat{i} + \frac{1}{2}\hat{j} - \hat{k}$ and $2\hat{i} - 6\hat{j} + 8\hat{k}$ is:

- (a) $5\sqrt{3}$ (b) $5\sqrt{2}$
(c) $25\sqrt{3}$ (d) $25\sqrt{2}$

100. Bag P contains 6 red and 4 blue balls and bag Q contains 5 red and 6 blue balls. A ball is transferred from bag P to bag Q and then a ball is drawn from bag Q. What is the probability that the ball drawn is blue?

- (a) $\frac{7}{15}$ (b) $\frac{8}{15}$
(c) $\frac{4}{19}$ (d) $\frac{8}{19}$

101. The mean and variance of a random variable X having binomial distribution are 4 and 2 respectively, then $P(X = 1)$ is

- (a) $\frac{1}{4}$ (b) $\frac{1}{32}$
(c) $\frac{1}{16}$ (d) $\frac{1}{8}$

102. The value of $\tan\left(\cos^{-1}\frac{4}{5} + \tan^{-1}\frac{2}{3}\right) =$

- (a) $\frac{6}{17}$ (b) $\frac{7}{16}$
(c) $\frac{16}{7}$ (d) None of these

103. If the function $f(x) = \begin{cases} 1, & x \leq 2 \\ ax + b, & 2 < x < 4 \\ 7, & x \geq 4 \end{cases}$

is continuous at $x = 2$ and 4 , then the values of a and b are.

- (a) $a = 3, b = -5$ (b) $a = -5, b = 3$
(c) $a = -3, b = 5$ (d) $a = 5, b = -3$

104. The derivative of $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ with respect to $\cos^{-1}\left[\frac{1-x^2}{1+x^2}\right]$ is equal to:

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

105. The number of distinct real roots of the equation $x^7 - 7x - 2 = 0$ is

- (a) 5 (b) 7

- (c) 1 (d) 3

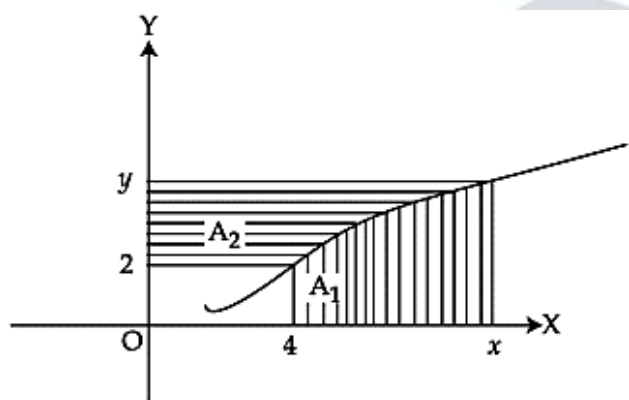
106. The minimum value of the function $y = x^4 - 2x^2 + 1$ in the interval $\left[\frac{1}{2}, 2\right]$ is

- (a) 0 (b) 2
(c) 8 (d) 9

107. $\int \frac{\sin^2 x - \cos^2 x}{\sin^2 x \cos^2 x} dx =$

- (a) $\tan x + \cot x + c$ (b) $\operatorname{cosec} x + \sec x + c$
(c) $\tan x + \sec x + c$ (d) $\tan x + \operatorname{cosec} x + c$

108. Consider a curve $y = y(x)$ in the first quadrant as shown in the figure. Let the area A_1 is twice the area A_2 . Then the normal to the curve perpendicular to the line $2x - 12y = 15$ does NOT pass through the point.



- (a) (6, 21) (b) (8, 9)
(c) (10, -4) (d) (12, -15)

109. The shortest distance between the lines $x = y + 2 = 6z - 6$ and $x + 1 = 2y = -12z$ is

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

110. The angle between two lines $\frac{x+1}{2} = \frac{y+3}{2} = \frac{z-4}{-1}$ and $\frac{x-4}{1} = \frac{y+4}{2} = \frac{z+1}{2}$ is:

- (a) $\cos^{-1}\left(\frac{1}{9}\right)$ (b) $\cos^{-1}\left(\frac{4}{9}\right)$
(c) $\cos^{-1}\left(\frac{2}{9}\right)$ (d) $\cos^{-1}\left(\frac{3}{9}\right)$

PART-IV APTITUDE

111. What is the approximate percentage increase in the production of Monopoly form 1993 to 1995?

- (a) 10 (b) 20
(c) 30 (d) 25

112. For which toy category there has been a continuous increase in the production over the years?

- (a) Ludo (b) Chess
(c) Monopoly (d) Carrom

113. What is the percentage drop in the production of Ludo from 1992 to 1994?

- (a) 30 (b) 50
(c) 20 (d) 10

114. 285, 253, 221, 189,?

- (a) 150 (b) 182
(c) 157 (d) 156

115. In a certain code language PRESENTATION is written as ENESTAITPRON. How would INTELLIGENCE be written in that code language?

- (a) TETGLLTNENCE (b) LUENLINTETG
(c) LLKKTGTTEEBTB (d) LLTEIGENINCE

116. Ram moves from a point X to 20 metres towards North. Then he moves 40 metres towards West. Then he moves 20 metres North. Then he moves 40 metres towards East and then 10 metres towards right and he reaches to a point Y. Find the distance and direction of Y from X ?

- (a) 30 metres, North (b) 40 metres, North
(c) 30 metres, South (d) 40 metres, South

117. If the 5th date of a month is Tuesday, what date will be 3 days after the 3rd Friday in the month?

- (a) 17 (b) 22
(c) 19 (d) 18

118. Statements:

- (I) Some cats are dogs.
(II) No dog is a toy.

Conclusions:

- (I) Some dogs are cats.
(II) Some toys are cats.
(III) Some cats are not toys.
(IV) All toys are cats.

- (a) Only Conclusions I and either II or III.
(b) Only Conclusions II and III follow

- (c) Only Conclusions I and II follow
(d) Only Conclusion I follows

119. How is H related to B ?

(I) H is married to P. P is the mother of T. T is married to D. D is the father of B.

(II) B is the daughter of T. T is the sister of N. H is the father of N.

(a) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.

(b) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.

(c) if the data in Statement I alone or in Statement II alone are sufficient to answer the question.

(d) if the data in both the Statements I and II together are not sufficient to answer the question.

120. Among five persons D, E, F, G and H each of whom having different height, who is the second tallest?

(I) D is taller than only G and E. F is not the tallest.

(II) H is taller than F. G is taller than E but shorter than D.

(a) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.

(b) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.

(c) if the data in Statement I alone or in Statement II alone are sufficient to answer the question.

(d) if the data in both the Statements I and II together are not sufficient to answer the question.

(e) if the data in both the Statements I and II together are necessary to answer the question.

PART-V ENGLISH

121. If someone else's opinion makes us angry, it means that

- (a) we are subconsciously aware of having no good reason for becoming angry
(b) there may be good reasons for his opinion but we are not consciously aware of them
(c) our own opinion is not based on good reason and we know this subconsciously
(d) we are not consciously aware of any reason for our own opinion

122. "Your own contrary conviction" refers to

- (a) the fact that you feel pity rather than anger
(b) the opinion that two and two are four and that Iceland is a long way from the Equator
(c) the opinion that two and two are five and that Iceland is on the Equator
(d) the fact that you know so little about arithmetic or geography

123. Conviction means

- (a) persuasion (b) disbelief
(c) strong belief (d) ignorance

124. The writer says if someone maintains that two and two are five you feel pity because you

- (a) have sympathy
- (b) don't agree with him
- (c) want to help the person
- (d) feel sorry for his ignorance

125. The second sentence in the passage

- (a) builds up the argument of the first sentence by restating it from the opposite point of view
- (b) makes the main point which has only been introduced by the first sentence
- (c) simply adds, a further point to the argument already stated in the first sentence
- (d) illustrates the point made in the first sentence

