

1. The Molarity of HNO_3 in a sample of concentrated nitric acid that contains 68% by weight of HNO_3 and has a density of 1.4 g/mL is :

(1) 1 M
(2) 10 M
(3) 15 M
(4) 20 M

2. **Assertion (A) :** Pressure of a gas is due to the impact of collisions of gas molecules against the walls of the container.

Reason (R) : The collisions between molecules depend on the temperature and are independent of the nature of the gas.

Choose the **correct** code.

- (1) Both (A) and (R) are individually true and (R) is the correct explanation of (A)
(2) Both (A) and (R) are individually true, but (R) is not the correct explanation of (A)
(3) (A) is true, but (R) is false
(4) Both (A) and (R) are false
3. Ideal gas particles :
- (A) move randomly
(B) have no Kinetic Energy
(C) have no mass
(D) repel each other at high pressure

Choose the **correct** answer from the options given below :

- (1) (A) and (C) only
(2) (A), (C) and (D) only
(3) (B) and (D) only
(4) (A), (B) and (C) only
4. A mixture of 0.5 mol of $\text{CH}_4(\text{g})$, 0.5 mol of $\text{H}_2(\text{g})$ and 0.5 mol of $\text{SO}_2(\text{g})$ is introduced into a 10.0 L container at 25°C . If the container has a pinhole leak, what describes the relationship between the partial pressures of the individual components in the container after 3 hours ?
- (1) $P_{\text{SO}_2} > P_{\text{CH}_4} > P_{\text{H}_2}$
(2) $P_{\text{SO}_2} < P_{\text{CH}_4} < P_{\text{H}_2}$
(3) $P_{\text{SO}_2} < P_{\text{CH}_4} > P_{\text{H}_2}$
(4) $P_{\text{H}_2} = P_{\text{CH}_4} = P_{\text{SO}_2}$

5. Which is a possible set of quantum numbers for a valence electron in a ground state atom of phosphorus ?

	n	l	m_l	m_s
(1)	2	1	0	$+\frac{1}{2}$
(2)	3	0	0	0
(3)	1	1	-1	$+\frac{1}{2}$
(4)	3	2	1	$-\frac{1}{2}$

6. Which species dissociates most completely in water solution ?

- (1) NH_4^+
- (2) H_2CO_3
- (3) HNO_3
- (4) HSO_4^-

7. The dissociation constant for a certain weak monoprotic acid is 9×10^{-5} . What is the $[\text{H}^+]$ of a 0.10 M solution of the weak acid that is 0.010 M in the sodium salt of the acid ?

- (1) 9.0×10^{-6}
- (2) 9.0×10^{-4}
- (3) 3.0×10^{-3}
- (4) 3.0×10^{-2}

8. According to the Bronsted - Lowry Theory, which of these species can be amphoteric ?

- (1) NH_4^+ (aq)
- (2) NH_3 (aq)
- (3) NH_2^- (aq)
- (4) NH^{2-} (aq)

9. Which of these solutions, appropriately combined, could be used to produce a buffer ?

- (1) HCl and NaOH
- (2) HNO_2 and NaNO_2
- (3) KI and KOH
- (4) HF and NaOH

10. The forward reaction of the autoionization equilibrium for H_2O



What will be the effect of increasing the temperature on the pH of water ?

- (1) The pH will increase and the solution will become basic.
- (2) The pH will decrease and the solution will become acidic.
- (3) The pH will increase, but the solution will remain neutral.
- (4) The pH will decrease, but the solution will remain neutral.

11. Which of these is not a characteristic of physisorption ?

- (1) It is specific
- (2) The amount of gas adsorbed by a solid depends on the nature of the gas
- (3) It is reversible
- (4) The extent of adsorption increases with increase of surface area of the adsorbent

12. When reacted with water, the insecticide DDT decomposes with a half-life of 10 years. Approximately how many years will it take for 99% of a given sample to decompose once exposed to water in the surroundings ?
- (1) 50 years
 - (2) 70 years
 - (3) 500 years
 - (4) 700 years
13. Which property, if decreased, will cause an increase in the rate of reaction involving a solid ?
- (1) Temperature
 - (2) Pressure
 - (3) Concentration
 - (4) Particle size
14. Which reaction characteristics change by the addition of a catalyst to a reaction at constant temperature ?
- (A) Activation energy
 - (B) Equilibrium concentrations
 - (C) Reaction Enthalpy
- Choose the **correct** answer from the options given below :
- (1) (A) only
 - (2) (C) only
 - (3) (A) and (B) only
 - (4) (A), (B) and (C)
15. What is the oxidizing agent in the unbalanced equation ?
- $$\text{HAsO}_2(\text{aq}) + \text{Sn}^{2+}(\text{aq}) + \text{H}^+(\text{aq}) \rightarrow \text{As}(\text{s}) + \text{Sn}^{4+}(\text{aq}) + \text{H}_2\text{O}(\text{l})$$
- (1) $\text{HAsO}_2(\text{aq})$
 - (2) $\text{Sn}^{2+}(\text{aq})$
 - (3) $\text{H}^+(\text{aq})$
 - (4) $\text{Sn}^{4+}(\text{aq})$
16. What can be calculated if the mole fraction and density of an aqueous solution of HCl are known ?
- (A) Molality
 - (B) Molarity
 - (C) Percent by Weight
- Choose the **correct** answer from the options given below :
- (1) (A) only
 - (2) (C) only
 - (3) (A) and (B) only
 - (4) (A), (B) and (C)

17. Which species has the same general shape as SO_3^{2-} ?
- (1) SO_3
 - (2) NO_3^-
 - (3) NH_3
 - (4) CO_3^{2-}
18. Resonance structures describe molecules that have :
- (1) hybrid orbitals
 - (2) rapid equilibria
 - (3) electrons that are resonating
 - (4) no suitable single Lewis electronic dot formula
19. According to the Lewis structure for HNNH , how many σ bonds, π bonds and lone pairs of electrons are present ?
- | | σ bonds | π bonds | lone pairs |
|-----|----------------|-------------|------------|
| (1) | 2 | 2 | 2 |
| (2) | 3 | 2 | 0 |
| (3) | 3 | 1 | 2 |
| (4) | 3 | 0 | 1 |
20. In the Lewis structure for the BrF_4^- ion, how many lone pairs of electrons are placed around the central atom ?
- (1) 0
 - (2) 1
 - (3) 2
 - (4) 3
21. What term is used for the measure of the atomic attraction for the electrons that constitute a covalent bond ?
- (1) Ionization energy
 - (2) Bond dissociation energy
 - (3) Electron affinity
 - (4) Electronegativity
22. All of the following reactions involve an increase in entropy except :
- (1) $\text{N}_2\text{O}_4(\text{g}) \rightarrow 2 \text{NO}_2(\text{g})$
 - (2) $\text{C}_6\text{H}_6(\text{l}) \rightarrow \text{C}_6\text{H}_6(\text{g})$
 - (3) $2 \text{KClO}_3(\text{s}) \rightarrow 3 \text{O}_2(\text{g}) + 2 \text{KCl}(\text{s})$
 - (4) $3 \text{Fe}(\text{s}) + 2 \text{O}_2(\text{g}) \rightarrow \text{Fe}_3\text{O}_4(\text{s})$

23. For the burning of propane, $\text{C}_3\text{H}_8(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 3\text{CO}_2(\text{g}) + 4\text{H}_2\text{O}(\text{g})$, which of the following is true at any temperature ?

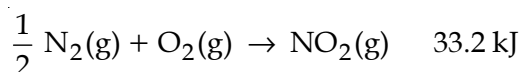
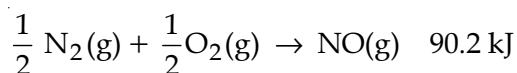
- (A) $\Delta G < 0$
- (B) $\Delta S > 0$
- (C) $\Delta H < 0$

Choose the **correct** answer from the options given below :

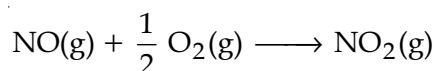
- (1) (A) only
- (2) (C) only
- (3) (A) and (B) only
- (4) (B) and (C) only

24. Reaction

ΔH°

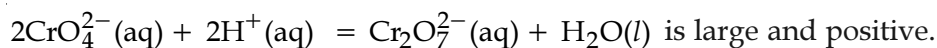


Use these data to calculate ΔH° for the reaction.



- (1) -57.0 kJ
- (2) -28.5 kJ
- (3) $+28.5 \text{ kJ}$
- (4) $+57.0 \text{ kJ}$

25. **Assertion (A) :** The entropy change for the reaction



Reason (R) : During the reaction, water from the solvation shells of the ions is released.

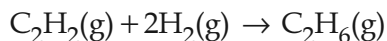
In the light of the above statements, choose the **most appropriate** answer from the options given below :

- (1) Both (A) and (R) are correct and (R) is the correct explanation of (A)
- (2) Both (A) and (R) are correct but (R) is **not** the correct explanation of (A)
- (3) (A) is correct but (R) is not correct
- (4) (A) is not correct but (R) is correct

26. Which halogen in its standard state has the greatest absolute entropy per mole ?

- (1) $\text{F}_2(\text{g})$
- (2) $\text{Cl}_2(\text{g})$
- (3) $\text{Br}_2(\text{g})$
- (4) $\text{I}_2(\text{g})$

27. Calculate ΔH° for the reaction :



Molecule	$\Delta H_{\text{comb}}/(\text{kJ/mol})$
$\text{C}_2\text{H}_2(\text{g})$	-1300
$\text{H}_2(\text{g})$	-286
$\text{C}_2\text{H}_6(\text{g})$	-1560

(1) -212 kJ

(2) -26 kJ

(3) +26 kJ

(4) +312 kJ

28. What are the signs for ΔH , ΔS and ΔG for the freezing of liquid water at -10°C ?

	ΔH	ΔS	ΔG
(1)	+	-	+
(2)	-	-	0
(3)	-	+	-
(4)	-	-	-

29. Which statement about work and heat is **true** ?

(1) A given quantity of heat can be completely converted to work

(2) Heat and work are both state functions

(3) Some heat is always produced when work is done

(4) Work is a state function, whereas heat is not

30. For which reaction do you expect ΔS to be negative ?

(1) $2\text{C}(\text{s}) + \text{O}_3(\text{g}) \rightarrow 2\text{CO}_2(\text{g})$ (2) $\text{Br}_2(\text{s}) \rightarrow \text{Br}_2(\text{l})$ (3) $\text{H}_2\text{O}(\text{l}, 25^\circ\text{C}) \rightarrow \text{H}_2\text{O}(\text{l}, 50^\circ\text{C})$ (4) $\text{Cl}_2(\text{g}) + 2\text{HI}(\text{g}) \rightarrow \text{I}_2(\text{s}) + 2\text{HCl}(\text{g})$

31. The empirical formula for a compound with a cubic close-packed arrangement of anions and with cations occupying the octahedral holes is :

(1) AB

(2) A_2B (3) AB_2 (4) AB_3

32. Which element has the highest second ionization energy ?

(1) Be

(2) Li

(3) B

(4) C

33. Which element has the greatest electronegativity ?

- (1) As
- (2) Ge
- (3) P
- (4) Sb

34. Which element has the highest melting point ?

- (1) Al
- (2) Si
- (3) P
- (4) S

35. Which hydride is the most stable ?

- (1) AsH_3
- (2) SbH_3
- (3) PH_3
- (4) NH_3

36. Which one is a neutral oxide ?

- (1) CO
- (2) SnO_2
- (3) ZnO
- (4) SiO_2

37. Which one is not a Borane ?

- (1) B_5H_9
- (2) B_5H_{10}
- (3) B_5H_{11}
- (4) B_6H_{10}

38. Which of the following chlorides is covalent ?

- (1) NaCl
- (2) BeCl_2
- (3) CaCl_2
- (4) BaCl_2

39. In which of the following molecules/ions are all the bonds not equal ?

- (1) SiF_4
- (2) XeF_4
- (3) BF_4^-
- (4) SF_4

40. In solid phase, PBr_5 exists as :

- (1) PBr_4^- , PBr_6^-
- (2) PBr_4^+ , Br^-
- (3) PBr_5
- (4) PBr_3 , Br_2

41. Which one of the following species is **not** a pseudo halide ?

- (1) CNO^-
- (2) RCOO^-
- (3) OCN^-
- (4) NNN^-

42. The chemical composition of rust is :

- (1) $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$
- (2) $\text{Fe}_3\text{O}_4 \cdot x\text{H}_2\text{O}$
- (3) Fe_2O_3
- (4) Fe_3O_4

43. The titanium compound that does not exist is :

- (1) K_2TiO_4
- (2) TiO
- (3) K_2TiF_6
- (4) TiCl_3

44. Which of the following will not give positive chromyl chloride test ?

- (1) CuCl_2
- (2) HgCl_2
- (3) ZnCl_2
- (4) $\text{C}_6\text{H}_5\text{N}^+\text{H}_3\text{Cl}^-$

45. Formula for dichlorobis (urea) copper (II) is :

- (1) $\text{Cu} \{ \text{O}=\text{C}(\text{NH}_2)_2 \}_2 \text{Cl}_2$
- (2) $[\text{CuCl}_2 \{ \text{O}=\text{C}(\text{NH}_2)_2 \}]$
- (3) $[\text{Cu} \{ \text{O}=\text{C}(\text{NH}_2)_2 \} \text{Cl}] \text{Cl}$
- (4) $[\text{CuCl}_2 \{ \text{O}=\text{C}(\text{NH}_2)_2 \}_2]$

46. Which among the following will show zero crystal field stabilization energy (CFSE) ?

- (1) $[\text{Mn}(\text{H}_2\text{O})_6]^{3+}$
- (2) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$
- (3) $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$
- (4) $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$

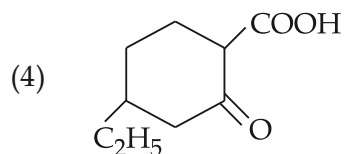
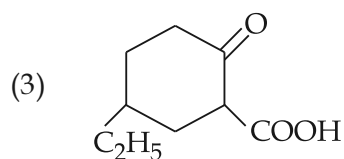
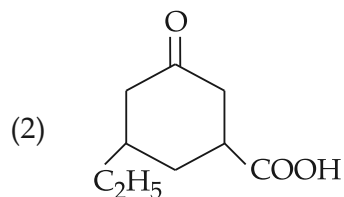
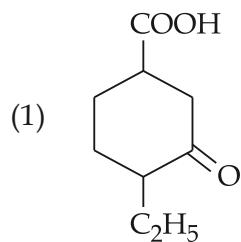
47. Which of the following ligands forms a chelate ?

- (1) Acetate
- (2) Oxalate
- (3) Cyanide
- (4) Ammonia

48. Wilkinson's catalyst is :

- (1) Ni
- (2) PtCl_6
- (3) CuCO_3
- (4) $[(\text{C}_6\text{H}_5)_3\text{P}]_3 \text{RhCl}$

49. 5-ethyl-3-Oxo Cyclohexan-1-oic acid in the following compounds is :



50. Carbenes can be generated by :

- (1) Diazomethane
- (2) Ketene
- (3) Chloroform
- (4) All the above

51. Internal compensation is found in :

- (1) Racemic mixture
- (2) Meso compound
- (3) Dextrorotatory compound
- (4) Levorotatory compound

52. Lactic acid can be made optically inactive by :

- (1) Replacing its OH by H
- (2) Replacing its OH by Cl
- (3) Replacing its OH by Br
- (4) Replacing its OH by I

53. The correct order of C – H bond length is :

- (1) $C_{sp^3}-H > C_{sp^2}-H < C_{sp}-H$
- (2) $C_{sp}-H > C_{sp^2}-H > C_{sp^3}-H$
- (3) $C_{sp^2}-H > C_{sp^3}-H > C_{sp}-H$
- (4) $C_{sp}-H < C_{sp^2}-H < C_{sp^3}-H$

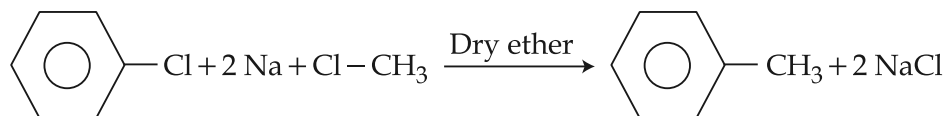
54. Freon – 12 is :

- (1) CH_2ClF
- (2) CCl_3F
- (3) CCl_2F_2
- (4) $CHCl_2F$

55. Chlorobenzene is used as :

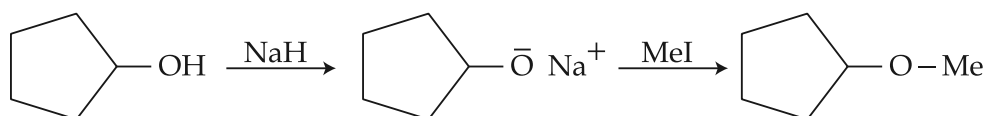
- (1) Insecticide
- (2) Herbicide
- (3) Preservative
- (4) Fuel

56. The following reaction is :



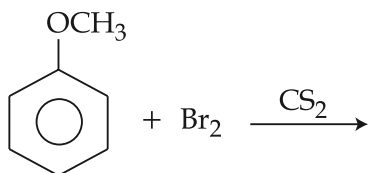
- (1) Fittig reaction
- (2) Wurtz - Fittig reaction
- (3) Wurtz reaction
- (4) Haloform reaction

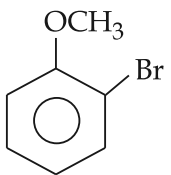
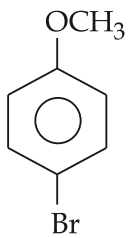
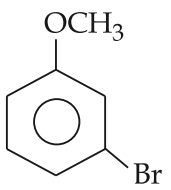
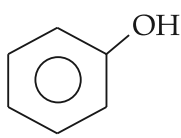
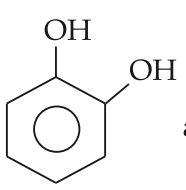
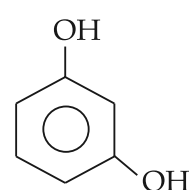
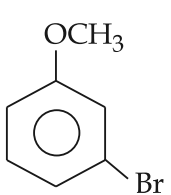
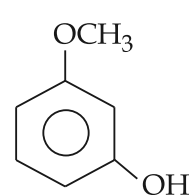
57. The following reaction is :



- (1) Dehydration reaction
- (2) Williamson alcohol synthesis reaction
- (3) Williamson ether synthesis reaction
- (4) Alcohol formation reaction

58. Products of following reaction are :

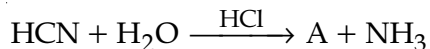


- (1)  and 
- (2)  and 
- (3)  and 
- (4)  and 

59. The reactivity of Hydrogen halides towards alcohols will follow the order :

- (1) $\text{HCl} > \text{HBr} > \text{HI}$
- (2) $\text{HCl} > \text{HI} > \text{HBr}$
- (3) $\text{HI} > \text{HCl} > \text{HBr}$
- (4) $\text{HI} > \text{HBr} > \text{HCl}$

60. A in the following reaction is :



- (1) HCOOH
- (2) HCHO
- (3) $\text{H}_3\text{C}-\text{CN}$
- (4) CH_3-Cl

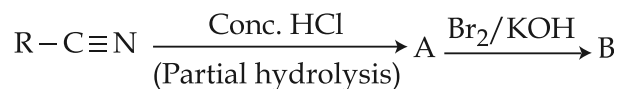
61. The oxidation of Toluene to benzaldehyde by chromyl chloride is called :

- (1) Etard reaction
- (2) Riemer-Tiemann reaction
- (3) Wurtz reaction
- (4) Cannizzaro reaction

62. CH_3CHO and $\text{C}_6\text{H}_5-\text{CH}_2\text{CHO}$ can be distinguished by :

- (1) Benedict's test
- (2) Iodoform test
- (3) Tollen's Reagent test
- (4) Fehling's solution test

63. A and B in the following reaction, respectively are :



- (1) Amide and amine
- (2) Ketone and carboxylic acid
- (3) Aldehyde and ketone
- (4) Ketone and Aldehyde

64. The correct order of basicity of the following is :

Ammonia	Methylamine	Dimethylamine	Trimethylamine
(I)	(II)	(III)	(IV)

- (1) (III) > (II) > (IV) > (I)
- (2) (II) > (III) > (IV) > (I)
- (3) (II) > (III) > (I) > (IV)
- (4) (I) > (II) > (III) > (IV)

65. Which among the following is not correctly matched ?

- (1) Nylon 6 - Caprolactum
- (2) Acrilan - Vinyl Cyanide
- (3) Neoprene - Chloroprene
- (4) Nylon 610 - Adipic acid

66. If $N_1, N_2, N_3, \dots, N_i$ are the number of molecules with molecular masses $M_1, M_2, M_3, \dots, M_i$ respectively, then the number average molecular mass $\left(\bar{M}_n\right)$ is given by :

(1) $\frac{\sum N_i M_i^2}{\sum N_i M_i}$

(2) $\frac{\sum N_i M_i}{\sum N_i}$

(3) $\frac{\sum M_i^2}{N_i}$

(4) $\frac{\sum N_i M_i}{\sum M_i}$

67. Starch consists of :

- (1) 50% Amylose and 50% Amylopectin
- (2) 10% Amylose and 90% Amylopectin
- (3) 20% Amylose and 80% Amylopectin
- (4) 80% Amylose and 20% Amylopectin

68. Which one of the following is not correctly matched ?

- (1) Cellulose - $(\text{Glucose})_n$
- (2) Sucrose - Glucose and fructose
- (3) Maltose - $(\text{Glucose})_n$
- (4) Lactose - $(\text{Galactose})_n$

69. Correctly matched in the following is :

- (1) Vitamin B_3 - Pantothenic acid
- (2) Vitamin B_6 - Riboflavin
- (3) Vitamin B_2 - Adermin
- (4) Vitamin B_{12} - Thiamin

70. Match **List - I** with **List - II** and select the correct answer using the codes given below the list :

List - I

- (A) Vitamin A
- (B) Vitamin B₁
- (C) Vitamin K
- (D) Vitamin H

List - II

- (i) Dermatitis
- (ii) Haemorrhage
- (iii) Beri beri
- (iv) Night blindness

Choose the **correct** answer from the options given below :

- (1) (A) - (iii), (B) - (iv), (C) - (ii), (D) - (i)
- (2) (A) - (iv), (B) - (iii), (C) - (ii), (D) - (i)
- (3) (A) - (iv), (B) - (iii), (C) - (i), (D) - (ii)
- (4) (A) - (iv), (B) - (ii), (C) - (iii), (D) - (i)

71. Water soluble vitamins are :

- (i) Vitamin K (ii) Vitamin C (iii) Vitamin B₁ (iv) Vitamin B₁₂
- (1) (i) and (ii)
- (2) (ii) and (iii)
- (3) (ii), (iii) and (iv)
- (4) (iii) and (iv)

72. Barbituric acid and its derivatives are well known as :

- (1) Tranquilizers
- (2) Antiseptics
- (3) Analgesics
- (4) Antipyretics

73. Which one is a broad spectrum antibiotic ?

- (1) Chloramphenicol
- (2) Plasmoquin
- (3) Xylocaine
- (4) Antiseptic

74. Which of the following is added to butter to increase its shelf life ?

- (1) Sodium benzoate
- (2) Butylated hydroxy anisole
- (3) Sulphur dioxide
- (4) Citric acid

75. Marsh gas is :

- (1) Methane
- (2) Ethane
- (3) 50% Methane and 50% Ethane
- (4) 20% Methane and 80% Ethane

76. The decreasing order of stability in the following cycloalkanes is :

Cyclopropane

Cyclobutane

Cyclopentane

Cyclohexane

(I)

(II)

(III)

(IV)

- (1) (I) > (II) > (IV) > (III)
(2) (II) > (I) > (III) > (IV)
(3) (I) > (II) > (III) > (IV)
(4) (IV) > (III) > (II) > (I)
77. In Demjanov rearrangement if amino group is directly bonded with the ring carbon of a cycloalkane, then there is :
(1) Ring contraction
(2) Ring expansion
(3) Formation of alcohol
(4) Formation of carboxylic acid
78. In which family of elements does the melting point increase with increasing atomic number ?
(A) Alkali metals
(B) Halogens
(1) (A) only
(2) (B) only
(3) Both (A) and (B)
(4) Neither (A) nor (B)
79. **Assertion (A) :** PCl_5 exists but NCl_5 does not exist.
Reason (R) : Phosphorus is more electro negative than nitrogen.
In the light of the above statements, choose the most appropriate answer from the options given below :
(1) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(2) Both (A) and (R) are correct, but (R) is not the correct explanation of (A).
(3) (A) is correct but (R) is not correct
(4) (A) is not correct but (R) is correct
80. Consider the following statements about amino acids :
(A) At the isoelectric point, an amino acid does not migrate under the influence of an electric field.
(B) The solubility of an amino acid is highest at its isoelectric point.
(C) Amino acids exist as dipolar ions.
Which of these statements are **true** ?
(1) (A) and (B) only
(2) (B) and (C) only
(3) (A) and (C) only
(4) (A), (B) and (C)