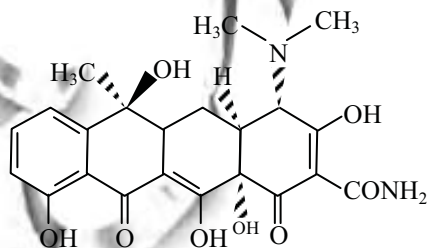


INDIAN ASSOCIATION OF CHEMISTRY TEACHERS
NATIONAL STANDARD EXAMINATION IN CHEMISTRY 2008-2009

This is question paper contains 100 multiple-choice question. Each correct answer carries 3 marks and 1 mark will be deducted for each wrong answer. No weightage II be given to unattempted question.

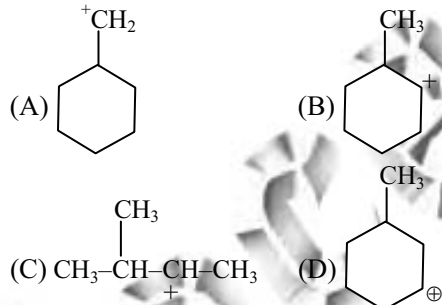
- Q.1** Salicylic acid is a stronger acid than p-hydroxybenzoic acid due to
 (A) Steric hindrance
 (B) Hydrogen bonding
 (C) Mesomeric effect
 (D) Solvation energy
- Q.2** To reduce a nitroaldehyde to a nitroalcohol the reducing agent of choice is
 (A) LiAlH_4 (B) NaBH_4
 (C) Molecular H_2 (D) SnCl_2
- Q.3** The product of reamer-teimann reaction is a
 (A) phenolic aldehyde (B) hydroxyamine
 (C) nitroaldehyde (D) nitroalcohol
- Q.4** In the Dumas method for the estimation of nitrogen, 0.0237 grams of an organic compound gave 2.21 mL of nitrogen at 754.32 mm of Hg pressure at 18°C . (Aqueous tension at 18°C is 15.4 mm of Hg.) Therefore the percentage of nitrogen in the compound is
 (A) 20.67% (B) 10.6% (C) 11.2% (D) 13.9%
- Q.5** Which one of the following compounds can be deprotonated by OH fastest?
 (A) HCOOH , $\text{pK}_a = 3.8$
 (B) H_2S , $\text{pK}_a = 7.0$
 (C) Toluene, $\text{pK}_a = 41$
 (D) CH_3NH_2 , $\text{pK}_a = 40$
- Q.6** How many chiral carbon atoms does Tetracycline A (a broad spectrum antibiotic) have?



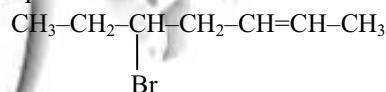
Tetracycline A

- (A) 3 (B) 4
 (C) 5 (D) 6

- Q.7** Which one of the following carbocations will not rearrange?



- Q.8** How many stereoisomers does the following compound have?



- (A) None (B) 2
 (C) 4 (D) 6

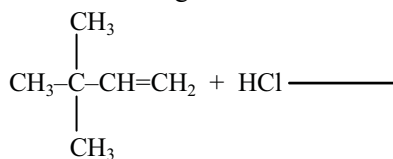
- Q.9** Which of the following is a "superacid"?

- (A) $(\text{HF} + \text{SbF}_5)$ in SO_2
 (B) $(\text{H}_2\text{SO}_4 + \text{SO}_3)$ in SO_2
 (C) $(\text{HNO}_3 + \text{BF}_3)$ in SO_2
 (D) $(\text{H}_3\text{PO}_4 + \text{PF}_5)$ in SO_2

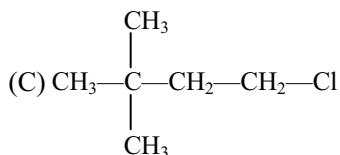
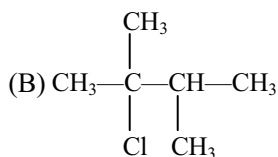
- Q.10** Which of the following series contains only nucleophiles?

- (A) NH_3 , H_2O , CN^- , I^-
 (B) AlCl_3 , NH_3 , H_2O , I^-
 (C) AlCl_3 , BF_3 , H_2O , NH_3
 (D) AlCl_3 , BF_3 , NO_2^+ , NH_3

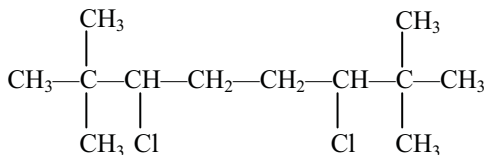
- Q.11** What is the major product that will be formed in the following reaction?



- (A)



(D)



Q.12 A nucleus with the following characteristics is NOT NMR active

- (A) even mass number and even atomic number
- (B) odd mass number and even or odd atomic number
- (C) even mass number and odd atomic number
- (D) None of these

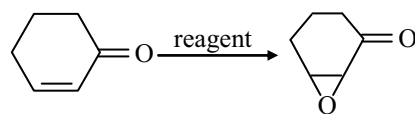
Q.13 The specific rotation of an optically active compound is dependent on

- (A) concentration of the sample
- (B) path length
- (C) wavelength of the circularly polarized light
- (D) all of the above

Q.14 For cyclohexane, which of the following factors does not make the boat conformation less stable than the chair conformation

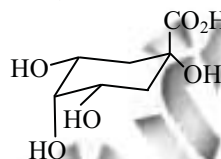
- (A) 1,3-diaxial interactions
- (B) flag pole interactions
- (C) angle strain
- (D) torsional strain

Q.15 Suggest the suitable reagent for the following transformation



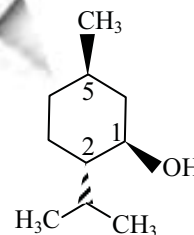
- (A) meta-chloroperbenzoic acid
- (B) ozone
- (C) potassium dichromate
- (D) alkaline hydrogen peroxide

Q.16 The following molecule has a



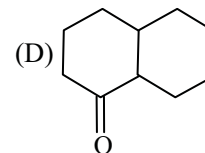
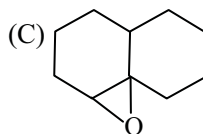
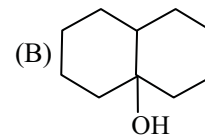
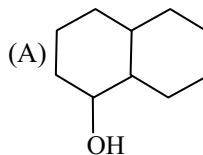
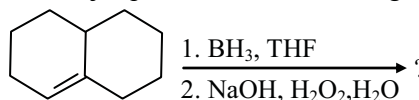
- (A) centre of symmetry
- (B) plane of symmetry
- (C) axis of symmetry
- (D) none of the above

Q.17 The absolute configurations of the chiral centres 1,2 and 5 in the following molecule are

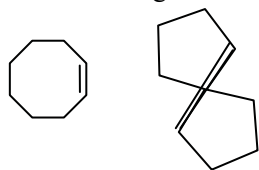


- (A) 1R, 2R, 5R
- (B) 1S, 2S, 5S
- (C) 1R, 2S, 5R
- (D) 1S, 2R, 5S

Q.18 The major product in the following reaction is



Q.19 The following structures are



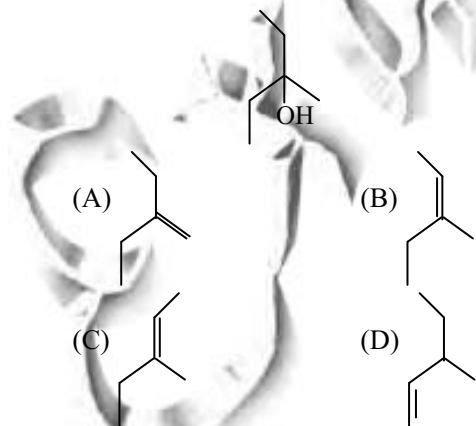
- (A) enantiomers (B) identical
(C) diastereomers (D) rotamers

Q.20 The major product in the following reaction is



- (A)
(B)
(C)
(D)

Q.21 Identify the alkene which will NOT provide the following alcohol upon oxymercuration-demercuration.



Q.22 If the energy of a reaction is twice RT , its rate constant k is related to frequency factor A by the relation :

- (A) $k = 0.135 A$ (B) $k = 1.35 A$
(C) $k = 0.0135A$ (D) $k = 2.303A$

Q.23 A solution of urea was found to be isotonic with a solution of salt XY of molecular weight 74.6. If 0.15 moles of urea are dissolved in a certain volume V mL of the isotonic solution, the amount of salt in the solution will be

- (A) 22.4g (B) 5.6 g
(C) 11.2 g (D) 7.46 g

Q.24 The pH of 0.1 M NH_4OH ($K_b = 1.8 \times 10^{-5}$) is

- (A) 1 (B) 13 (C) 5.7 (D) 11.1

Q.25 The pH of mixture of 100 ml of 0.25 N HCl and 100 ml of 0.125N NaOH is

- (A) 1.20 (B) 0.90 (C) 0.70 (D) 0.42

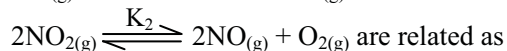
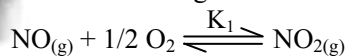
Q.26 For the reaction $P + Q \rightarrow R$ the following data was obtained

Set	[P]	[Q]	Rate
I	0.125M	0.250M	0.01
II	0.250M	0.250M	0.04
III	0.250M	1.00M	0.08

The order of reaction is

- (A) 1 (B) 2
(C) 3 (D) 2.5

Q.27 At a given temperature the equilibrium constants of the gaseous reactions



- are related as
(A) $K_1 = 2K_2$ (B) $K_1 = 1/K_2$
(C) $K_1 = \sqrt{K_2}$ (D) $K_1 = \sqrt{1} K_2$

Q.28 The degree of freedom for $\text{NH}_4\text{Cl}_{(s)} \rightleftharpoons \text{NH}_4\text{Cl}_{(g)} \rightleftharpoons \text{NH}_{3(g)} + \text{HCl}_{(g)}$ will be

- (A) 4 (B) 3
(C) 2 (D) 1

Q.29 The root mean square velocity of SO_2 is equal to that of oxygen at 27°C when the temperature is

- (A) 327°C (B) 127°C
(C) 227°C (D) 600°C

Q.30 The temperature of a sample of sulfur dioxide is increased from 27°C to 327°C . The average kinetic energy of the gas molecules

- (A) is doubled
(B) increases by the factor 327/27
(C) is halved
(D) remains same

- Q.31** A gas shows positive joule-thomson effect below
 (A) Critical temperature
 (B) Boyle temperature
 (C) Transition temperature
 (D) Inversion temperature
- Q.32** Under high pressure conditions, van der waals' equation for a real gas reduces to
 (A) $PV = RT$
 (B) $PV + a/V = RT$
 (C) $PV - Pb = RT$
 (D) $(P + a/V^2)(V - b) = RT$
- Q.33** When an aqueous solution of Na_2SO_4 was electrolyzed, 1440 ml of hydrogen was liberated at the cathode. The volume of oxygen liberated at anode would be :
 (A) 540 mL (B) 720 mL
 (C) 1440 mL (D) 2880 mL
- Q.34** A reversible adiabatic expansion is an
 (A) isothermal process
 (B) isobaric process
 (C) isoentropic process
 (D) isochoric process
- Q.35** The desalination of sea water involves the phenomenon of
 (A) Sedimentation
 (B) Distillation
 (C) Precipitation
 (D) Reverse osmosis
- Q.36** CaF_2 (Mol. Wt. = 78) has a solubility of $1.6 \times 10^{-2} \text{ g dm}^{-3}$ at 293K. The solubility product of CaF_2 is
 (A) 3.45×10^{-11} (B) 4.20×10^{-8}
 (C) 2.56×10^{-4} (D) 4.69×10^{-9}
- Q.37** Raman's scattering of visible light is shown by
 (A) Polar molecules
 (B) Non-polar molecules
 (C) Molecules with permanent dipole moment
 (D) Ions
- Q.38** The Bohr radius of the first orbit of hydrogen atom is 0.530 Å units. The radius of the third orbit will be
 (A) 1.06 Å (B) 4.77 Å
 (C) 2.12 Å (D) 1.59 Å
- Q.39** If the bond energies are as follows
 (i) C-H = 413.8 kJ
 (ii) Cl-Cl = 238.0 kJ
 (iii) C-Cl = 327.2 kJ
 (iv) H-Cl = 429.8 kJ
 the enthalpy of the reaction :
 $\text{CH}_4 + 2\text{Cl}_2 \rightarrow \text{CH}_2\text{Cl}_2 + 2\text{HCl}$ will be
 (A) +202.6 kJ (B) -202.6 kJ
 (C) +220.1 kJ (D) +870 kJ
- Q.40** Oxalic acid, $\text{H}_2\text{C}_2\text{O}_4$, reacts with permanganate ion according to the balanced equation given below :
 $5\text{H}_2\text{C}_2\text{O}_4(\text{aq}) + 2\text{MnO}_4^-(\text{aq}) + 6\text{H}^+(\text{aq}) \rightarrow 2\text{Mn}^{2+}(\text{aq}) + 10\text{CO}_2(\text{g}) + 8\text{H}_2\text{O}(\text{l})$
 How many mL of 0.0154 M KMnO_4 solution are required to react with 25.0 mL of 0.0208 M $\text{H}_2\text{C}_2\text{O}_4$ solution ?
 (A) 13.5 mL (B) 18.5 mL
 (C) 33.8 mL (D) 84.4 mL
- Q.41** Which of these mixtures constitute buffer solutions ?
Mixture 1 : 25 mL of 0.10 M HNO_3 and 25 mL of 0.10 M NaNO_3
Mixture 2 : 25 mL of 0.10 M $\text{HC}_2\text{H}_3\text{O}_2$ and 25 mL of 0.10 M NaOH
 (A) 1 only (B) 2 only
 (C) both 1 and 2 (D) neither 1 nor 2
- Q.42** Nickel metal is added to a solution containing 1.0 M $\text{Pb}^{2+}(\text{aq})$ and 1.0 M $\text{Cd}^{2+}(\text{aq})$. Use the standard reduction potential to determine which of the following reaction (s) will occur.
Reaction 1 : $\text{Ni}(\text{s}) + \text{Pb}^{2+}(\text{aq}) \rightarrow \text{Pb}(\text{s}) + \text{Ni}^{2+}(\text{aq})$
Reaction 2 : $\text{Ni}(\text{s}) + \text{Cd}^{2+}(\text{aq}) \rightarrow \text{Cd}(\text{s}) + \text{Ni}^{2+}(\text{aq})$
Reactions :
 $\text{Pb}^{2+}(\text{aq}) + 2\text{e} = \text{Pb}(\text{s}) \quad E^\circ = -0.13 \text{ V}$
 $\text{Ni}^{2+}(\text{aq}) + 2\text{e} = \text{Ni}(\text{s}) \quad E^\circ = -0.23 \text{ V}$
 $\text{Cd}^{2+}(\text{aq}) + 2\text{e} = \text{Cd}(\text{s}) \quad E^\circ = -0.40 \text{ V}$
 (A) 1 only (B) 2 only
 (C) both 1 and 2 (D) neither 1 nor 2

Q.43 An electrochemical cell constructed for the reaction :

$\text{Cu}^{2+}_{(\text{aq})} + \text{M}_{(\text{s})} \rightarrow \text{Cu}_{(\text{s})} + \text{M}^{2+}_{(\text{aq})}$ has an $E^\circ = 0.75 \text{ V}$. The standard reduction potential for $\text{Cu}^{2+}_{(\text{aq})}$ is 0.34 V . What is the standard reduction potential for $\text{M}^{2+}_{(\text{aq})}$?

- (A) 1.09 V (B) 0.410 V
(C) -0.410 V (D) -1.09 V

Q.44 A 0.200 g sample of benzoic acid, $\text{C}_6\text{H}_5\text{COOH}$, is titrated with a 0.120 M $\text{Ba}(\text{OH})_2$ solution. What volume of the $\text{Ba}(\text{OH})_2$ solution is required to reach the equivalence point ?

[$\text{C}_6\text{H}_5\text{COOH}$, Molar Mass = $122.1 \text{ g}\cdot\text{mol}^{-1}$]

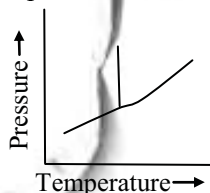
- (A) 6.82 mL (B) 13.6 mL
(C) 17.6 mL (D) 35.2 mL

Q.45 The amount of sodium hydrogen carbonate, NaHCO_3 , in an antacid tablet is to be determined by dissolving the tablet in water and then titrating the resulting solution with hydrochloric acid. Which indicator is the most appropriate for this titration ?

Acid	K_a
H_2CO_3	2.5×10^{-4}
HCO_3^-	2.4×10^{-8}

- (A) methyl orange, $pK_{in} = 3.7$
(B) bromothymol blue, $pK_{in} = 7.0$
(C) phenolphthalein, $pK_{in} = 9.3$
(D) alizarin yellow, $pK_{in} = 12.5$

Q.46 According to this phase diagram, which phases can exist at pressures lower than the triple point pressure ?



- (A) gas only
(B) solid and gas only
(C) liquid only
(D) solid and liquid only

Q.47 What is the Na^+ ion concentration in the solution formed by mixing 20 mL of 0.10 M Na_2SO_4 solution with 50 mL of 0.30 M Na_3PO_4 solution ?

- (A) 0.15 M (B) 0.24 M
(C) 0.48 (D) 0.70

Q.48 Ultra violet light absorption occurring in protein is due to the presence of

- (A) Alanine (B) Cysteine
(C) Glutamic acid (D) Tryptophan

Q.49 The amino acid proline allows bending of a polypeptide in secondary structure of protein. This is possible due to

- (A) Presence of peptide bond
(B) Absence of hydrogen bond
(C) Presence of hydrogen bond
(D) Steric hindrance

Q.50 Which of the amino acid stabilizes tertiary structure of protein through formation of covalent bond ?

- (A) Tyrosine (B) Methionine
(C) Cysteine (D) Valine

Q.51 Reversible binding of oxygen occurs through

- (A) Fe (B) Cu (C) Mg (D) Ca

Q.52 A mixture of three amino acids glycine (Gly), lysine (Lys) and glutamic acid (Glu) was separated by an anion exchange chromatography process. The order of elution of amino acids from the column is

- (A) Glu, Lys, Gly (B) Lys, Glu, Gly
(C) Gly, Lys, Glu (D) Glu, Gly, Lys

Q.53 The negative charge of the cell membrane is due to presence of

- (A) Phospholipid (B) Protein
(C) Glycolipid (D) Glycoprotein

Q.54 Ten DNA molecules undergo replication 2 times. The total number DNA molecules produced are

- (A) 10 (B) 20 (C) 30 (D) 40

Q.55 Enzymatic hydrolysis of starch leads to release of

- (A) Fructose (B) Mannose
(C) Glucose (D) Xylose

- Q.56** The template on which protein synthesis occurs during translation is
 (A) Protein (B) m RNA
 (C) DNA (D) t RNA
- Q.57** The biomolecule which does not have a secondary structure is
 (A) Lipid (B) Protein
 (C) DNA (D) RNA
- Q.58** A currency counting machine counts 60 million notes per day. A bank has as many notes as number of oxygen atoms in 24.8 g of $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ (M.W. = 248)
 How many days would be required to count these notes ?
 (A) 9.33×10^{17} (B) 7.03×10^{10}
 (C) 8.03×10^{15} (D) 6.66×10^{12}
- Q.59** What volume of water should be added to 1600 ml of a 0.205 N solution so that the resulting solution will be 0.2 N ?
 (A) 40 mL (B) 50 mL
 (C) 100 mL (D) 20 mL
- Q.60** Which of the following equations represented an oxidation-reduction reaction ?
 (A) $\text{H}_2\text{SO}_4 + 2\text{NH}_3 \rightarrow (\text{NH}_4)_2\text{SO}_4$
 (B) $\text{H}_2\text{SO}_4 + \text{Na}_2\text{CO}_3 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O} + \text{CO}_2$
 (C) $2\text{K}_2\text{CrO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{Cr}_2\text{O}_7 + \text{K}_2\text{SO}_4 + \text{H}_2\text{O}$
 (D) $2\text{H}_2\text{SO}_4 + \text{Cu} \rightarrow \text{CuSO}_4 + 2\text{H}_2\text{O} + \text{SO}_2$
- Q.61** Sapphire is a mineral of
 (A) Cu (B) Zn (C) Al (D) Mg
- Q.62** Which of these ion is expected to be colored in aqueous solution ?
 [I] Fe^{3+} [II] Zn^{2+} [III] Al^{3+} [IV] Sc^{3+}
 (A) [I] only (B) [III] only
 (C) [I] and [II] only (D) [I], [II] and [III]
- Q.63** How many unpaired electrons are in a Fe^{2+} ion in the ground state ?
 (A) 0 (B) 2 (C) 4 (D) 6
- Q.64** For the atoms Li, Be, B and Na, the correct order of increasing atomic radius is :
 (A) B, Be, Li, Na (B) Li, Be, B, Na
 (C) Be, Li, B, Na (D) Be, B, Li, Na
- Q.65** How many nearest neighbors surround each ion in a face-centered cubic lattice of an ionic crystal ?
 (A) 4 (B) 6 (C) 8 (D) 12
- Q.66** Methyl-t-butyl ether, $\text{C}_5\text{H}_{12}\text{O}$, is added to gasoline to promote cleaner burning. How many moles of oxygen gas, O_2 are required to burn 1.0 mol of this compound completely to form carbon dioxide and water ?
 (A) 4.5 mol (B) 6.0 mol
 (C) 7.5 mol (D) 8.0 mol
- Q.67** 1 mL of concentrated aqueous ammonia is added dropwise to 1 mL of a dilute aqueous solution of Cu(II). What observations can be made during this process ?
 (A) The colorless Cu(II) nitrate solution turns blue and yields a dark blue precipitate
 (B) The colorless copper (II) nitrate solution yields a white precipitate which turns dark blue upon standing.
 (C) The light blue copper (II) nitrate solution yields a white precipitate which redissolves to form a dark blue solution.
 (D) The light blue copper (II) nitrate solution turns dark
- Q.68** Two white solids, lead (II) chloride and silver chloride can be distinguished from each other by -
 (A) adding cold water to each : the silver chloride will dissolve.
 (B) adding hot water to each : the lead (II) chloride will dissolve.
 (C) adding sodium chloride solution to each : the lead (II) chloride will become warm and release chlorine gas.
 (D) adding zinc chloride solution to each : the silver chloride will change to metallic silver.
- Q.69** A catalyst speeds up a chemical reaction by
 (A) shifting the equilibrium
 (B) increasing the activation energy
 (C) initiating the reaction
 (D) decreasing energy of activation

- Q.70** Evidence for the electron arrangement in atoms has been obtained primarily from the study of
 (A) isotopes (B) radioactivity
 (C) stoichiometry (D) atomic spectra
- Q.71** In which of the following pairs are both molecules polar ?
 (A) O₂ and H₂O (B) BF₃ and PCl₃
 (C) SO₂ and SCl₂ (D) CS₂ and NO₂
- Q.72** In which of the following transition metal ion complexes, the colour is not due to d-d transition ?
 (A) [Ti(H₂O)₆]³⁺ and [CoF₆]³⁻
 (B) [Ti(H₂O)₆]³⁺ and [MnO₄]²⁻
 (C) [CoF₆]³⁻ and [CrO₄]²⁻
 (D) [MnO₄]²⁻ and [CrO₄]²⁻
- Q.73** The hydrated salt Na₂SO₄·nH₂O loses all water of crystallization on heating and is reduced to 44.1% of its original weight. Therefore, the value n is
 (A) 5 (B) 10 (C) 6 (D) 7
- Q.74** A match box exhibits
 (A) Cubic geometry
 (B) Monoclinic geometry
 (C) Tetragonal geometry
 (D) Orthorhombic geometry
- Q.75** The noble gas was first time discovered by
 (A) Cavendish (B) William Ramsay
 (C) Rayleigh (D) Frankland
- Q.76** The maximum possible number of hydrogen bonds a water molecule can form is
 (A) 2 (B) 4 (C) 3 (D) 1
- Q.77** CuSO₄ reacts with KCN to form water insoluble CuCN. This insoluble precipitate dissolves in excess of KCN, due to formation of the following complex
 (A) K₂[Cu(CN)₄] (B) K₃[Cu(CN)₄]
 (C) Cu(CN)₂ (D) Cu[KCu(CN)₄]
- Q.78** An impossible arrangement of the set of quantum number is :

	n	ℓ	m	s
(A)	3	2	-2	1/2
(B)	4	0	0	1/2
(C)	3	2	-3	1/2
(D)	1	0	0	-1/2

- Q.79** Which of the following has the highest bond order ?
 (A) O₂ (B) O₂⁺
 (C) O₂ (D) O₂²⁻
- Q.80** The simplest formula of a compound containing 50% of element 'A' (Atomic weight = 10) and 50% of element 'B' (Atomic weight = 20) is
 (A) AB (B) A₂B
 (C) A₂B₂ (D) A₂B₃

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Ans.	B	B	A	B	A	C	D	C	A	A	B	A	D	A	D	B	C	A	C	B	D	A	B	D	A
Que.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Ans.	D	D	D	A	A	D	C	B	C	D	A	B	B	B	A	D	A	C	A	A	B	D	D	B	C
Que.	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans.	A	D	A	D	C	B	A	C	A	D	C	A	C	A	D	C	C	B	D	D	C	D	B	D	B
Que.	76	77	78	79	80																				
Ans.	B	B	C	B	B																				