

Universal Gas Constant (R) =  $8.314 \text{ JK}^{-1}\text{mol}^{-1}$   
Avogadro Number ( $N_A$ ) =  $6.022 \times 10^{23} \text{ mol}^{-1}$   
Planck Constant (h) =  $6.626 \times 10^{-34} \text{ Js}$   
Velocity of Sound (C) =  $3.0 \times 10^8 \text{ ms}^{-1}$

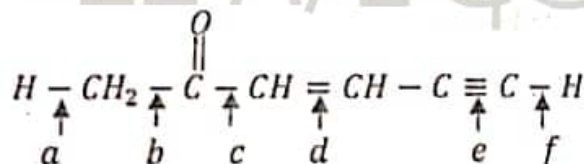
01. Select the correct answer regarding scientist related with following statements respectively.  
(a) Nuclear positive charge increases by one unit of electrons.  
(b) Discovery of positive charged particles of matter.

1. William Aston and Ernest Rutherford
2. Jefry Mosely and Eugen Goldstein
3. Jefry Mosely and Ernest Rutherford
4. Eugen Goldstein and Ernest Rutherford
5. Robert Millikan and Eugen Goldstein

02. A set of quantum numbers of last electron of Cr (Z=24) is,

1.  $(4, 0, 0, +\frac{1}{2})$
2.  $(5, 0, 0, +\frac{1}{2})$
3.  $(4, 1, 0, +\frac{1}{2})$
4.  $(5, 1, 0, +\frac{1}{2})$
5.  $(4, 2, 1, +\frac{1}{2})$

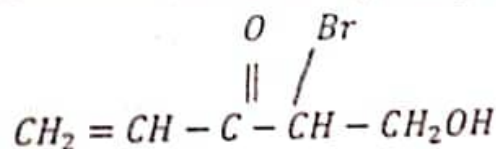
03. Consider molecule given below,



Correct increasing order of bond lengths a, b, c, d, e and f is,

1.  $b < c < d < e < a < f$
2.  $e < d < c < b < f < a$
3.  $c < b < d < e < a < f$
4.  $f < a < e < d < c < b$
5.  $a < f < e < c < d < b$

04. IUPAC name of the compound given below is,



1. 4-bromo-5-hydroxypent-1-en-3-one
2. 2-bromo-1-hydroxypent-4-en-3-one
3. 5-hydroxy-4-bromopent-1-en-3-one
4. 2-bromo-3-oxopent-4-en-1-ol
5. 2-bromo -3- oxopent-4-ene-1-ol

05. Correct statement regarding  $\text{NO}_3^-$ ,  $\text{NO}_2^+$  and  $\text{NO}_2^-$  is,
1.  $\text{NO}_2^+$  and  $\text{NO}_2^-$  are angular in shape while  $\text{NO}_3^-$  is trigonal planar in shape.
  2. All species N is in same hybridization.  $\times$
  3. Hybridization of N in both  $\text{NO}_3^-$  and  $\text{NO}_2^-$  is  $\text{sp}^2$ .  $\checkmark$
  4.  $\text{NO}_2^+$  has two N-O bond with different bond length.
  5.  $\text{NO}_3^-$  is trigonal pyramidal in shape while  $\text{NO}_2^+$  is angular in shape.

06. Correct increasing order of thermal stability is,

1.  $\text{Na}_2\text{CO}_3 < \text{MgCO}_3 < \text{NaHCO}_3 < \text{Mg}(\text{HCO}_3)_2$
2.  $\text{MgCO}_3 < \text{Na}_2\text{CO}_3 < \text{NaHCO}_3 < \text{Mg}(\text{HCO}_3)_2$
3.  $\text{Mg}(\text{HCO}_3)_2 < \text{MgCO}_3 < \text{NaHCO}_3 < \text{Na}_2\text{CO}_3$
4.  $\text{MgCO}_3 < \text{Na}_2\text{CO}_3 < \text{Mg}(\text{HCO}_3)_2 < \text{NaHCO}_3$
5.  $\text{MgCO}_3 < \text{Mg}(\text{HCO}_3)_2 < \text{Na}_2\text{CO}_3 < \text{NaHCO}_3$

07. Select incorrect statement regarding electronegativity.

1. Electronegativity of C increases as  $\text{C}_2\text{H}_6 < \text{C}_2\text{H}_4 < \text{C}_2\text{H}_2$   $\checkmark$
2. Electronegativity of N increases as  $\text{NH}_2^- < \text{NH}_3 < \text{NH}_4^+$ .  $\checkmark$
3. Electronegativity of increases as  $\text{SO}_3^{2-} < \text{SO}_4^{2-} < \text{H}_2\text{S}$
4. Electronegativity of an atom inversely proportional to the atomic radius.  $\checkmark$
5. O has the 2<sup>nd</sup> most highest electronegativity from the electronegativity of elements in the periodic table.  $\checkmark$

08. following properties are shown by aqueous X

I. Adding  $\text{BaCl}_2$  solution to X given white precipitate which dissolves in dil HCl

II. Adding  $\text{H}_2\text{O}_2$  to the aqueous solution of X and then  $\text{BaCl}_2$  solutions gives white precipitate which insoluble in dil HCl

Anion X is,

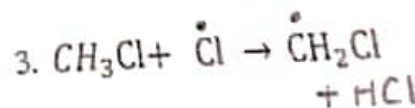
1.  $\text{CO}_3^{2-}$
2.  $\text{CrO}_4^{2-}$
3.  $\text{NO}_3^-$
4.  $\text{SO}_3^{2-}$
5.  $\text{SO}_4^{2-}$   $\times$

09. Mass of iron nail increases by 20% due to corrosion. Formula of corroded ion is  $\text{Fe}_2\text{O}_3$ . Find percentage that get corroded with respect to mass of total iron. (Relative atomic mass of Fe is 56)

1. 23.3%
2. 46.6%
3. 20%
4. 4.25%
5. 40%

10. Select incorrect step of the mechanism of chlorination of alkene.

1.  $\text{Cl}_3\text{CH} + \text{Cl}_2 \rightarrow \text{CCl}_4 + \dot{\text{Cl}}$
2.  $\text{CH}_4 + \dot{\text{Cl}} \rightarrow \text{H}_3\dot{\text{C}} + \text{HCl}$
4.  $\text{Cl}_2\text{HC} + \text{Cl}_2 \rightarrow \text{CHCl}_3 + \dot{\text{Cl}}$
5.  $\text{CH}_3 + \dot{\text{Cl}} \rightarrow \text{CH}_3\text{Cl}$





11.  $X^{2+}$  ion oxidizes into  $X^{n+}$  by  $MnO_4^-$  in acidic medium.  $2 \times 10^{-3} \text{ mol}$  of  $MnO_4^-$  needed to oxidize  $50 \text{ cm}^3$  of  $0.1 \text{ mol dm}^{-3} X^{2+}$  ions. What is the value of 'n' ?
1. 1                      2. 2                      3. 3                      4. 4                      5. 5
12. A set of molecule/ ion which have four atoms in the same plane is,
1.  $BCl_3, SO_3^{2-}$                       2.  $XeOF_2, SO_3$                       3.  $NO_3^-, NH_3$  ✗
4.  $SO_3^{2-}, XeOF_2$  ✗                      5.  $SO_3, HCHO$  ✗
13. The concentration of  $K^+$  in a  $K_2SO_4$  solution is  $0.02 \text{ mol dm}^{-3}$ . Find the composition of  $K_2SO_4$  in, ( $K = 39, S = 32, O = 16$ )
1. 1560                      2. 870                      3. 1724                      4. 1740                      5. 3480
14. The products formed when excess  $S$  and  $NaOH$  reacted,
1.  $Na_2S, Na_2SO_3, H_2O$     2.  $Na_2S_2O_3, Na_2S, H_2O$  ✗    3.  $Na_2S, SO_2, H_2O$     4.  $Na_2SO_3, Na_2S_2O_3, H_2O$     5.  $Na_2S_2O_3, SO_2, H_2O$
15.  $0.48 \text{ g}$  of sample of  $MnO_2$  was dissolved in dil.  $H_2SO_4$  and excess  $1.9 \text{ g}$  of  $FeSO_4$  was added to it. The volume of  $0.1 \text{ mol dm}^{-3} KMnO_4$  necessary to titrate with this solution was  $15 \text{ cm}^3$ . Mass percentage of  $MnO_2$  in the sample is, ( $Mn = 55, O = 16, S = 32$ )
1. 30%                      2. 45%                      3. 50%                      4. 60%                      5. 66%
16. What is the cation that gives,
- I. Gives yellow brown solution with excess  $NH_3$
- II. Gives blue coloured solution with conc.  $HCl$
- III. Does not give precipitate when  $H_2S$  gas is passed in the acidic medium,
1.  $Cu^{2+}$  ✗                      2.  $Ni^{2+}$  ✗                      3.  $Co^{2+}$                       4.  $Fe^{2+}$  ✗                      5.  $Mn^{2+}$
17. Pressure of  $1.6 \text{ g}$  of  $CH_4(g)$  gas included in a vessel with  $V$  volume is  $1 \times 10^5 \text{ Pa}$ .  $N_2$  gas is included to same vessel until pressure become  $4 \times 10^5 \text{ Pa}$ . The number of moles of  $N_2$  gas that included to the vessel is,
1. 0.30                      2. 0.25                      3. 0.20                      4. 0.15                      5. 0.10
18. Butane ( $C_4H_{10}$ ) is used as a fuel in domestic gas cylinders. The mass of  $O_2$  has to be used to generate energy by complete combustion of  $1 \text{ kg}$  of butane is, ( $C = 12, H = 1, O = 16$ )
1. 3.20 kg                      2. 3.40 kg                      3. 3.51 kg                      4. 3.82 kg                      5. 3.60 kg

The temperature rise when  $100\text{cm}^3$  of  $1\text{mol dm}^{-3}$   $\text{NaOH}_{(\text{aq})}$  and  $100\text{cm}^3$  of  $1\text{mol dm}^{-3}$   $\text{HCl}$  are mixed together in a thermostat beaker is. (Ignore the heat absorbed by the container)

Enthalphy of neutralization of  $\text{NaOH}/\text{HCl} = -57\text{KJ mol}^{-1}$

Specific heat capacity of the solution  $= 4.2\text{J g}^{-1}\text{K}^{-1}$

Density of solution  $= 1\text{g cm}^{-3}$

1.  $3^\circ\text{C}$       2.  $4.2^\circ\text{C}$       3.  $5.6^\circ\text{C}$       4.  $6.8^\circ\text{C}$       5.  $20^\circ\text{C}$

20. In Correct statement regarding compound formed by element nitrogen N is,

A) Sodium forms  $\text{Na}_3\text{N}$  when it reacts with  $\text{N}_2$  ✗

B) All ammonium salts evolve  $\text{NH}_3$  when adding base.

C) Chloride of  $\text{N}_2$  gives  $\text{HCl}$  and  $\text{NH}_3$  when it undergoes hydrolysis. ✗

1. A and C correct

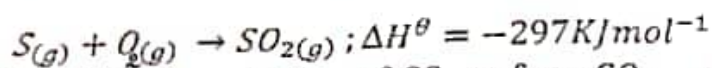
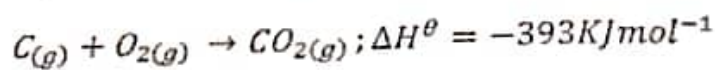
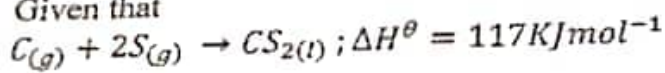
2. A and B correct

3. C and B correct

4. All correct

5. Only C correct

21. Given that



The heat of combustion of  $\text{CS}_{(\text{l})}$  to form  $\text{CO}_{2(\text{g})}$  and  $\text{SO}_{2(\text{g})}$  is,

1.  $-1104\text{KJ mol}^{-1}$

2.  ~~$+1104\text{KJ mol}^{-1}$~~

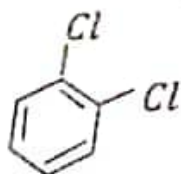
3.  $+807\text{KJ mol}^{-1}$

4.  $-807\text{KJ mol}^{-1}$

5.  $+1041\text{KJ mol}^{-1}$

22. Select the molecules having dipole moment ( $\mu$ ),

1.



2. cis-1, 2 - dibromoethene

3.  $\text{H}_2\text{O}_2$

4.  $\text{XeF}_4$

5.  $\text{XeOF}_4$

23. Select the correct order of electronegativity of central atom of the ions/ molecules given below

1.  $\text{NH}_2^- < \text{NH}_4^+ < \text{CF}_4 < \text{CCl}_4$  ✗

2.  $\text{NH}_4^+ < \text{CF}_4 < \text{CCl}_4 < \text{NH}_2^-$  ✗

3.  $\text{CF}_4 < \text{CCl}_4 < \text{NH}_2^- < \text{NH}_4^+$

4.  $\text{CCl}_4 < \text{CF}_4 < \text{NH}_2^- < \text{NH}_4^+$

5.  $\text{CCl}_4 < \text{CF}_4 < \text{NH}_4^+ < \text{NH}_2^-$  ✗



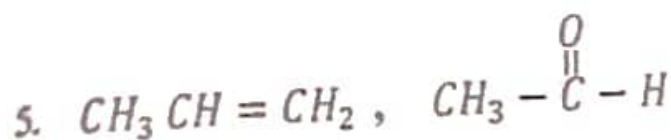
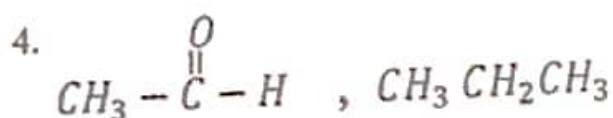
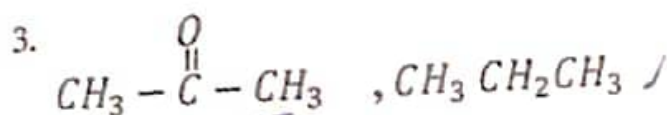
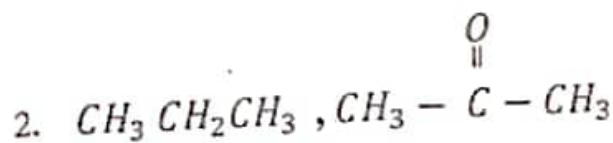
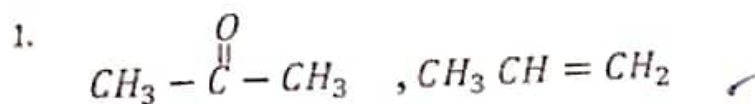
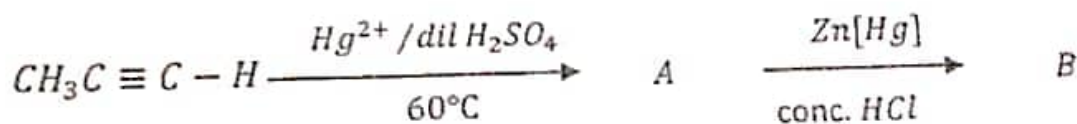
incorrect statement regarding gases is,

1. Compressibility factor  $Z$ , is the ratio of actual molar volume of a gas to the molar volume of it if it behave as an ideal gas at that temperature and pressure.
2. In Vander Wall's equation  $\frac{an^2}{y^2}$   $a$  is a constant related to the magnitude of attractive forces and is independent of temperature and pressure.
3. The kinetic energy of a gas depends only on the Kelvin temperature.
4. The more gas particles, the greater the frequency of collisions with the walls of the container, the lower the pressure.
5. The lowest hypothetical or imaginary temperature at which gases are supposed to occupy zero volume is called absolute zero.

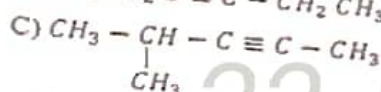
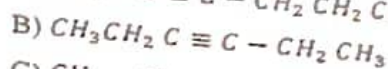
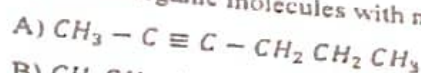
25. Select correct statement regarding  $s$  - block elements.

1.  $BH_3$  can be prepared when  $B$  react with  $H_2$  at high temperature and  $BH_3$  is stable.
2. Only Group 1 elements form their peroxides.
3. Lithium forms unstable nitride when  $Li$  reacts with  $N_2$
4.  $Mg$  has the lowest melting point from the all group 2 elements.
5.  $Li$  reacts with water vigorously with ignition.

26. Consider reaction chain given below select  $A$  and  $B$ ,



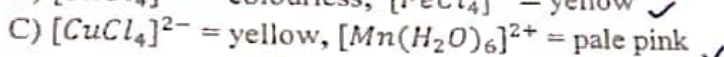
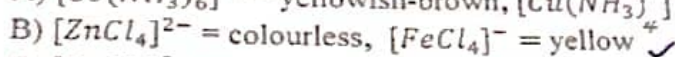
27. Consider organic molecules with molecular formula  $C_5H_{10}$ ,



Select correct answer.

	Type of isomer	Example
1.	Chain isomer	A, B ✓
2.	Functional group isomer	A, C ✓
3.	Position isomer	A, B ✓
4.	Chain isomer	B, C
5.	Position isomer	A, C ✓

28. Select correct colour given for each complex in each group.



1. A, B

2. B, C

3. C, D

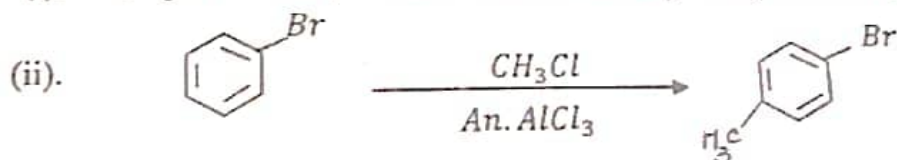
4. Only B

5. yellow C

29. Consider reactions (i), (ii) and (iii) given below and find correct their reaction types respectively.



$A_E$  = Electrophilic addition



$S_E$  = Electrophilic substitution

$S_N$  = Nucleophilic substitution

$A_N$  = Nucleophilic addition



1.  $A_E, S_E, A_N$

2.  $A_E, A_N, S_N$  ✗

3.  $A_E, S_E, S_N$

4.  $S_E, A_E, S_N$  ✓

5.  $S_N, A_E, S_N$  ✗

30. When a concentrated solution of  $K_2Cr_2O_7$  is treated with conc.  $H_2SO_4$ , the bright red acidic oxide X of chromium is precipitated. On heating X, the green amphoteric oxide Y is obtained. Y could also be obtained on heating  $(NH_4)_2Cr_2O_7$ . X and Y can be,

1.  $Cr_2O_3, CrO_3$

2.  $CrO_3, Cr_2O_3$  ✓

3.  $Cr_2O_5, Cr_2O_3$  ✓

4.  $CrO_3, Cr_2O_5$

5.  $CrO_2, Cr_2O_3$  ✓



❖ For each of the questions 31 to 40, one or more responses out of the four responses (a), (b), (c) and (d) given is/are correct. Select the correct response / responses. In accordance with the instructions given on your answer sheet, mark

- (1) if only (a) and (b) are correct.
- (2) if only (b) and (c) are correct.
- (3) if only (c) and (d) are correct.
- (4) if only (d) and (a) are correct.
- (5) if any other number or combination of responses is correct.

**Summary of above Instructions**

(1)	(2)	(3)	(4)	(5)
Only (a) and (b) are correct	Only (b) and (c) are correct	Only (c) and (d) are correct	Only (d) and (a) are correct	Any other number or combination of responses is correct

31. Select correct statement/ statements of simple covalent compound with oxygen and nitrogen.

- a.  $H_2O_2$  acts as both oxidizing agent and as reducing agent. ✓
- b.  $NH_3$  acts only as a base not as an acid. ✗
- c. Bond angle  $NF_3$  is greater than bond angle of  $NH_3$ . ✗
- d.  $SO_2$  acts as both oxidizing agent as well as reducing agent. ✓

(4)

32. Select correct statement/ statements regarding alkynes.

- a. All alkynes make carbonyl compounds when react with  $Hg^{2+}$  and dil  $H_2SO_4$ .
- b. Alkynes those with terminal hydrogen release  $H_2$  when it reacts with  $N_2$ . ✓
- c. Alkyne makes alkene when it reacts with  $\frac{H_2}{Pd}$ ,  $BaSO_4$ , quinoline. ✓
- d. All alkynes make alkene magnesium halides when react with Grignard reagent. ✗

(4)

33. When any reaction occurs spontaneously at constant temperature and pressure.

- a. Enthalpy of the system decreases. ✓
- b. Entropy of system increases. ✓
- c. No change in entropy of the system. ✗
- d. Increases the enthalpy of the system.

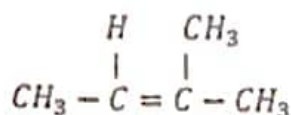
(2)

34. Correct statement/ statements regarding 3d- block elements and their compounds is/ are,

- a. All compounds formed by  $Ti$  are colourless. ✓
- b.  $Ni(OH)_2$  insoluble in excess ammonia solution. ✗
- c. All d- block elements except  $Zn$  are transition metal. ✗
- d. Colour of  $[CoCl_4]^{2-}$  is blue in colour and during dilution it converts to  $[Co(H_2O)_6]^{2+}$  pink solution. ✓

(4)

35. Correct statement regarding products formed by compound  $P$  given below by adding  $HBr$  is/are,



$[P]$

- a. Main product formed is tertiary alkyl halide. ✓
- b. Reaction is electrophilic addition. ✓
- c. Main product is given via secondary carbonation. ✗
- d. Product given by  $P$  with  $HBr$  in the presence of peroxide shows stereoisomerism. ✗

36. Correct statement/ statements regarding real gases that used to correction factor for the ideal gas equation is/ are,

- a. Lowering pressure of a real gas is due to intermolecular interactions. ✓
- b. effective volume of molecular movement of real gas at high pressure increase. ✗
- c. Volume of ideal gas at high pressure is lower than the volume of a real gas at high pressure. ✗
- d. Pressure exerted by real gas is lower than pressure exerted by ideal gas at same conditions. ✓

37. Correct statement/ statements regarding elements in 18<sup>th</sup> group of the periodic table.

- a. All element have positive enthalpy of element gain. ✗
- b.  $Xe$  has oxidation numbers +2, +4, +6 and +8. ✓
- c. Electron pair geometry of  $XeF_2$  is tetrahedral. ✗
- d.  $He$  has the highest enthalpy of gain. ✗

38. Correct statement/ statements is/ are,

- a. Line spectrum of hydrogen confirms the quantization of energy. ✓
- b. All atomic orbitals have same energy. ✗
- c.  $\Delta E$  volume of emission spectrum, is positive. ✗
- d. Shape of atomic orbitals is decided by azimuthal quantum number. ✓

39. Correct statement/ statements regarding nitrogen containing compounds,

- a.  $NCl_3$  is an ionic compound. ✗
- b.  $NCl_3$  make an acid and a base by reacting it with  $H_2O$ . ✓
- c. Thermal decomposition of  $NH_4NO_2$  release  $N_2$  gas. ✓
- d.  $NH_4^+$  salts releases  $H_2$  when reacts with a base. ✗

40. Boiling point of  $Br_2$  is lower than boiling point of  $ICl$ . Correct statement/ statements is/ are,

- a. Both  $Br_2$  and  $ICl$  are isoelectronic species. ✓
- b.  $Br_2$  molecules are non-polar and molecules  $ICl$  are polar. ✓
- c. Inter molecular interactions of  $ICl$  are greater than the intermolecular interactions of  $Br_2$ . ✓
- d. Considerable amount of energy needed to for the boiling of any chemical species having strong dipole-dipole interactions. ✓



❖ In question Nos. 41 to 50, two statements are given in respect of each question. From the Table given below, select the response, out of the responses (1), (2), (3), (4) and (5), that best fits the two statements and mark appropriately on your answer sheet.

Response	First Statement	Second Statement
(1)	True	True, and correctly explains the first statement
(2)	True	True, but does not explain the first statement correctly
(3)	True	False
(4)	False	True
(5)	False	False

	1 <sup>st</sup> statement	2 <sup>nd</sup> statement
41	The most stable oxide of Mn is $MnO_2$ ✓	Oxidation number of Mn affects the acidity or basicity of their oxides. ✓ - (1)
42	There are equal number of moles for the any gases with same volume at constant temperature and pressure. ✓	Molar volume of an ideal gas at $0^\circ C$ and 1atm pressure is $22.4 dm^3$ ✓ (1)
43	Alkyhydrogen sulfate make alkene reacts with cold conc. $H_2SO_4$ ✓	Electrophilic addition reactions occur via intermediate carbocation. ✓
44	$\Delta S$ of the reaction $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ is negative value. Higher temperature are favorable for the reaction. ✓	Entropy of a reaction decreases due to lower number of gaseous products. ✓ - (2)
45	Water solubility of group I carbonates increases down the group. ✗	Only lattice energy affects the solubility of salt. ✗
46	$NH_3$ evolves when $NaNH_2$ reacts with $H-C \equiv C-H$ (Acetylene) ✗ ✓	Electronegativity of C with triple bonds in alkynes higher due to sp hybridization when compared to other hydrocarbons. ✓ - (2)
47	Boiling point of HF is grater than other hydrogen halides. ✓	H atom when join with electronegative atoms can make Hydrogen bonds. ✗
48	Boiling point of pentane is lower than 2,2-dimethylpropane. ✗	Secondary interaction forces strength decreases when increasing surface area of molecules. ✗ - (5)
49	Few atoms are having positive electron gain energy.	Electron-repulsion forces are prominent when gaining electrons to the atom of the most stable electron configuration. ✓ - (1)
50	The reaction, $N_{2(g)} + 2O_{2(g)} \rightarrow 2NO_{2(g)}$ ✓ Occurs when gaining external energy.	$N_2$ is an inert gas towards reactions. ✓ - (2)



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