1. Equal volumes of two solutions of pH= 2 and pH = 4 are mixed together. The pH of the resulting solution will be

   A) 2.0 B) 3.1 C) 4.2 D) 2.3

2. The molecule that has maximum covalent character

   A) NaH B) Na_2S C) $CaCl_2$ D) $SnCl_4$

3. A first order reaction is 20% complete in 600 s. The time required to complete 75% of the same reaction will be

   A) 3120 s B) 3720 s C) 4320 s D) 4920 s

4. The mode of expression in which the concentration remains independent of temperature is

   A) molarity B) normality C) formality D) molality

5. The vapour density of gas A is four times that of B. If the molecular mass of B is M then molecular mass of A is

   A) M B) 4M C) M/4 D) 2M

6. The enthalpy changes for the following reactions are

   $C_{diamond} + O_{2(g)} \rightarrow CO_{2(g)}$ $\Delta H = -395.3$ kJ mol^{-1}

   $C_{graphite} + O_{2(g)} \rightarrow CO_{2(g)}$ $\Delta H = -393.4$ kJ mol^{-1}

   The enthalpy change for the transition

   $C_{diamond} \longrightarrow C_{graphite}$ will be

   A) -3.8 kJ mol^{-1} B) +3.8 kJ mol^{-1} C) -1.9 kJ mol^{-1} D) +1.9 kJ mol^{-1}

7. Among the isomers of dimethylcylohexanes, the chiral ones are

   A) 1,2-trans and 1,3-cis B) 1,2-cis and 1,3-trans

   C) 1,3-trans and 1,4-trans D) 1,2-trans and 1,3-trans

8. The sequence of steps involved in aromatic nucleophilic substitution involving a benzyne intermediate is

   A) addition-elimination B) elimination-addition

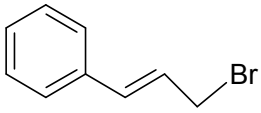
   C) addition-rearrangement D) elimination-rearrangement

9. The relative basic strengths of NH_3, CH_3NH_2 and NF_3 are in the order

   A) $CH_3NH_2 > NH_3 > NF_3$ B) $NH_3 > CH_3NH_2 > NF_3$

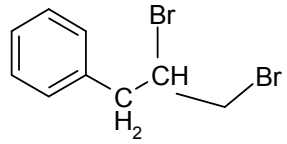
   C) $NF_3 > CH_3NH_2 > NH_3$ D) $CH_3NH_2 > NF_3 > NH_3$

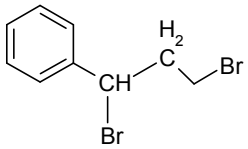
10.

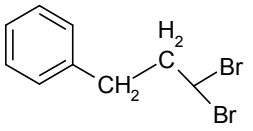


+ HBr ⟶ Product

The 'product' in the above reaction is :

A) 

B) 

C) 

D) This reaction cannot take place

11. The outermost electronic configuration of the most electronegative element is

A) ns^2,np^3 B) $ns^2,np^6(n-1)d^5$ C) ns^2,np^5 D) ns^2,np^6

12. The commercial name of calcium hydride is

A) lime B) hydrolyth C) slaked lime D) calgon

13. The conductivity of a metal decreases with increase in temperature because

A) the kinetic energy of the electrons increases

B) the movement of electrons becomes haphazard

C) the ions start vibrating

D) the metal becomes hot and starts emiting radiation.

14. The number of moles of $KMnO_4$ that will be needed to react completely with one mole of ferrous oxalate [$Fe(C_2O_4)$] in acidic solution is

A) 1 B) 2/5 C) 3/5 D) 4/5

15. The lanthanide compound which is used as a most poweful liquid laser after dissolving in selenium oxychloride is

A) Cerium oxide B) Neodynium oxide

C) Promethium sulphate D) Cerium sulphate

16. Protein and DNA being charged molecules, can be separated by

A) Electrophoresis B) Centrifugation

C) Filtration D) Spectrophotometry

17. The solubility of SrF_2 in water at 303 K is $9.55x10^{-5}$ mol.dm^{-3}. The solubility product of the salt is

A) $8.7x\ 10^{-17}$ B) $9.1x\ 10^{-11}$ C) $9.55x\ 10^{-5}$ D) $3.48x\ 10^{-12}$

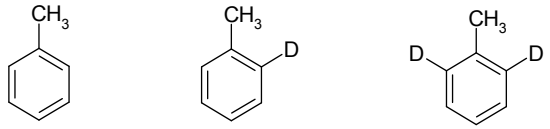
18. The biomolecule which does not have a secondary structure is

A) protein B) lipid C) DNA D) RNA

19. The amount of electricity required to deposit 1.0 mole of aluminium from a solution of AlCl3 will be

A) 1 faraday B) 3 faradays C) 0.33 faraday D) 1.33 faraday

20.



I II III

The rate of o-nitration of the above compounds, (I)toluene, (II) 2-D-toluene and (III) 2,6-D_2-tolueneare is in the following order

A) I> II > III B) II > I > III

C) III > I > II D) The rate is the same for all the three compounds

21. In the reaction, $2KClO_3 \rightarrow 2KCl + 3\ O_2$

when 36.75 g of $KClO_3$ is heated, the volume of oxygen evolved at N.T.P. will be

A) 9.74 dm^3 B) 8.92 dm^3 C) 10.08 dm^3 D) 22.4 dm^3

22. In which of the following reaction is Kp > Kc

A) $H_2 + I_2 \longrightarrow 2HI$ B) $N_2 + 3H_2 \longrightarrow 2NH_3$

C) $2SO_3 \longrightarrow 2SO_2 + O_2$ D) $PCl_3 + Cl_2 \longrightarrow PCl_5$

23. The pKa value in H_2O of picric acid, acetic acid and phenol are in the order

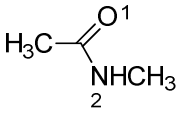
A) picric acid 0.4, acetic acid 4.75, phenol 10.0

B) acetic acid 0.4, picric acid 4.75, phenol 10.0

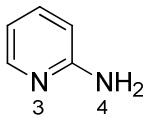
C) picric acid 0.4, phenol 4.75, acetic acid 10.0

D) phenol 0.4, acetic acid 4.75, picric acid 10.0

24. The preferred sites of protonation in the following compounds are



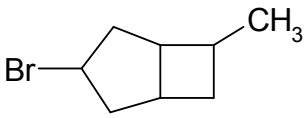
I



II

A) 1 and 3 B) 2 and 4 C) 1 and 4 D) 2 and 3

25. The correct IUPAC name of the following compound is



A) 2-Bromo-5-methylbicyclo[5:4:0]heptane B) 3-Bromo-7-methylbicyclo[3.2.0]heptane

C) 3-Bromo-6-methylbicyclo[3.2.0]heptane D) 2-Methyl-6-bromobicyclo[2.3.0]heptane

26. Which of the following vibrational modes show no IR absorption bands?

A) Symmetric CO_2 stretch B) Antisymmetric CO_2 stretch

C) Symmetric S=C=O stretch D) Antisymmetric S=C=O stretch

27. The first ionisation potential of Na, Mg, Al and Si are in the order

A) Na < Mg > Al < Si B) Na > Mg > Al > Si

C) Na < Mg < Al > Si D) Na > Mg > Al < Si

28. The crimson colour imparted to flame is due to a salt of

A) barium B) copper C) calcium D) strontium

29. The first four ionization energy values of a metal are 191,587,872 and 5962 kcal/mol. respectively. The number of valence electrons in the element is

A) 1 B) 2 C) 3 D) 5

30. Which of the following weighs less when weighed in magnetic field?

A) $ScCl_3$ B) $FeCl_3$ C) $TiCl_3$ D) VCl_3

31. An aqueous solution of a salt 'X' gives white precipitate with dilute H_2SO_4. The same solution with a few drops of aq. KI gives golden yellow precipitate which dissolves on heating. The salt 'X' is

A) $Ba(NO_3)_2$ B) $Sr(NO_3)_2$ C) $Pb(NO_3)_2$ D) $Zn(NO_3)_2$

32. Essential vitamin required for the production of RBCs is

A) Folic acid B) Nicotinic acid C) Pantothenic acid D) None of the above

33. The rate of the reaction $MnO_4^-{}_{(aq.)} + 8\,H^+{}_{(aq.)} + 5Fe^{2+}{}_{(aq.)} \longrightarrow Mn^{2+}{}_{(aq.)} + 5Fe^{3+}{}_{(aq.)} + 4H_2O$ can be best measured by monitoring colorimetrically the concentration of

A) $MnO_4^-{}_{(aq.)}$ B) $Mn^{2+}{}_{(aq.)}$ C) $Fe^{2+}{}_{(aq.)}$ D) $Fe^{3+}{}_{(aq.)}$

34. For the reaction $NH_4^+ + NO_2^- \longrightarrow N_2 + 2H_2O$ the following data was recorded

Set	NH_4^+/M	NO_2^-/M	Rate/MS^{-1}
1	0.010	0.020	0.020
2	0.015	0.020	0.030
3	0.010	0.010	0.005

A) rate = $K[NH_4^+][NO_2^-]$ B) rate = $K[NH_4^+]^2[NO_2^-]$

C) rate = $K[NH_4^+][NO_2^-]^2$ D) rate = $K[NH_4^+]^2[NO_2^-]^2$

35. Which of the following observation indicates colligative properties?

I. A 0.5 M NaBr solution has a higher vapor pressure than 0.5 M $BaCl_2$

II. A 0.5 M NaOH solution freezes at a lower temperature than pure water.

III. Pure water freezes at a higher temperature than pure ethanol.

A) only I B) only II C) only III D) I and II

36. In a nitration experiment, 10.0g of benzene gave 13.2 g of nitrobenzene. The percentage yield is

A) 83.5 % B) 62.7% C) 88.9% D) 26.7%

37. A 500g toothpaste sample has 0.4g fluoride concentration. The fluoride concentration in terms of ppm will be:

A) 200 B) 400 C) 500 D) 800

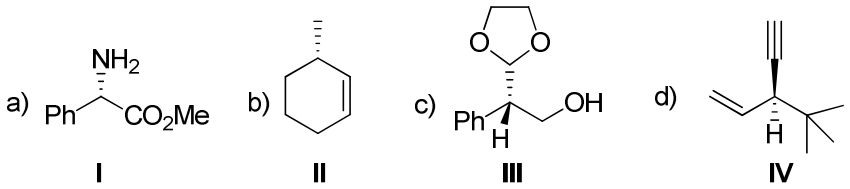
38. The rate constant of a reaction increases by 5% when the temperature is increased from 27^oC to 28^oC . Therefore, the Energy of activation of the reaction is

A) 36.6 kJ mol^{-1} B) 46.6 kJ mol^{-1} C) 16.6 kJ mol^{-1} D) 26.6 kJ mol^{-1}

39. Among the following carbon centered reactive intermediates, the carbon that has octet of electrons is

A) carbocation B) carbanion C) carbine D) radical

40. Which one of the following compounds has R configuration?



A) I B) II C) III D) IV

41. An electron releasing group will not stabilize which of the following groups?

A) Carbocation B) Carbanion C) free radical D) any of the above

42. The widest range over which electronic excitations in organic compounds occur, is

A) 200 nm – 780 nm B) 220 nm– 500nm

C) 250 nm– 700 nm D) 290 nm – 1000nm

43. The species in which the central atom uses sp^2 hybrid orbitals is

A) PH_3 B) NH_3 C) CH_3^+ D) SbH_3

44. The chemical formula of 'laughing gas' is

A) NO B) N_2O C) N_2O_4 D) N_2O_5

45. In which of the following ion/molecule , the '**S**' atom does not assume sp^3 hybridization?

A) SO_4^{2-} B) SF_4 C) SF_2 D) S_8

46. Phosphine is prepared by the reaction of

A) P and HNO_3, B) P and H_2SO_4 C) P and NaOH D) P and H_2S

47. Which of the following does not reduce Benedict's solution?

A) Glucose B) Fructose C) Sucrose D) Aldehyde

48. The genetic material of a cell is made of

A) nucleic acids B) proteins C) carbohydrates D) fats

49. Which of the following contain maximum number of electrons in the antibonding molecular orbitals

A) O_2^{2-} B) O_2 C) O_2^{-1} D) O_2^+

50. If the radius of the first Bohr orbit is **r**, then the deBroglie wavelength in the third Bohr orbit is

A) $2\pi r$ B) $9r$ C) $r/3$ D) $6\pi r$

51. In the Vander waal equation of state for a non ideal gas the term that accounts for intermolecular force is

A) (V- b) B) RT C) $(P + \frac{a}{v2})$ D) 1/RT

52. The maximum amount of CH_3Cl that can be prepared from 20g of CH_4 and 10g of Cl_2 by the following reaction, is

$CH_4 + Cl_2 \longrightarrow CH_3Cl + HCl$, (presume that **no other reaction** is taking place)

A) 3.625 mole B) 0.141 mole C) 1.41 mole D) 0.365 mole

53. The most effective electrolyte to cause the flocculation of a negatively charged arsenium sulphide colloid is:

A) NaCl B) $BaCl_2$ C) $K_3Fe(CN)_6$ D) $AlCl_3$

54. The electronegativities of acetylene, ethylene and ethane are in the order

A) ethylene > acetylene > ethane B) acetylene > ethylene > ethane

C) ethane > acetylene > ethylene C) acetylene > ethane > ethylene

55. The number of transition states in a unimolecular nucleophilic substitution ($\mathbf{S_N^1}$) reaction is

A) 0 B) 1 C) 2 D) 3

56. Which of the following information is **not provided** by a reaction mechanism?

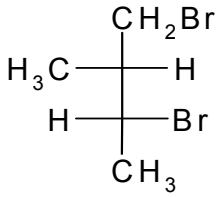
A) Which bonds are formed and which bonds are broken

B) Which intermediates and transition states are formed

C) Energy content of the reacting species

D) Which is the slowest step

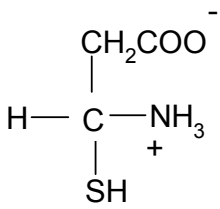
57. The R/S designation for the following stereoisomer of 1,3-dibromo-2-methylbutane is

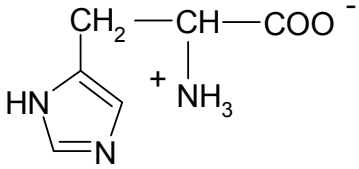


A) 2R, 3R B) 2R, 3S C) 2S, 3R D) 2S, 3S

58. The amino acid that cannot be obtained by hydrolysis of proteins is

A) $HOOCCH_2CH(\overset{+}{N}H_3)COO^-$

B) 

C) 

D) $\overset{+}{N}H_3\ (CH_2)_4CH(NH_2)COO^-$

59. The quantum numbers for the 19th electron of Cr (Z=24) are

A) n = 3, l = 0, m = 0, s = +½ B) n = 4, l = 0, m = 0, s = +½

C) n = 3, l = 2, m = 2, s = +½ D) n = 4, l = 2, m = 2, s = +½

60. Which of the following ion is colourless

A) Mn^{2+} B) Cu^{+} C) Cr^{3+} D) Fe^{2+}

61. The bond order for a species with the configuration

$\sigma 1s^2\ \ \sigma^* 1s^2\ \sigma 2s^2\ \sigma^* 2s^2\ \ \sigma p_x^1$ will be

A) 1 B) ½ C) Zero D) 3/2

62. Which of the following compounds has the least tendency to form hydrogen bonds between molecules?

A) NH_3 B) H_2NOH C) HF D) CH_3F

63. α-D(+) glucose and β-D(+) glucose are

A) Enantiomers B) Geometrical isomers C) Epimers D) Anomers

64. The enzyme which hydrolyses triglycerides to fatty acids and glycerol is

A) lipase B) maltase C) pepsin D) zymase

65. The most stable free radical which can be isolated is

A) Trityl radical B) Diphenyl methyl radical

C) 2,4,6-Tri-ter-butylphenoxy radical D) tert-butyl radical

66. Pheromones are chemical substances which are

A) formed by fermentation process of fungi B) secreted by endocrine glands of man

C) secreted by insects D) plant growth hormones.

67. The inorganic precipitate which acts as a semipermeable membrane is

A) Calcium phosphate B) Nickel phosphate

C) Plaster of paris D) Copper ferrocyanide

68. Lanthanide contraction is caused due to

A) the appreciable shielding on outer electrons by *4f* electrons from the nuclear charge

B) the appreciable shielding on outer electrons by *5d* electrons from the nuclear charge

C) the same effective nuclear charge from Ce to Lu.

D) the imperfect shielding on outer electrons by *4f* electrons from the nuclear charge

69. Lattice energy for an ionic compound is calculated by using

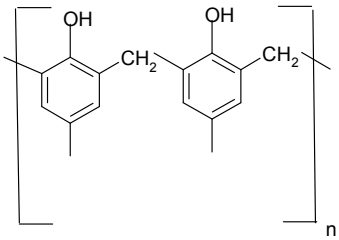
A) Kirchoff's equation B) Markownikoff's rule C) Born Haber cycle D) Carnot cycle

70. The IUPAC name of $[Co(ONO)(NH_3)_5Cl_2]$ is

A) pentamminenitrocobalt(II)chloride B) pentamminenitrosocobalt(III)chloride

C) pentamminenitritocobalt(III)chloride D) pentammineoxo-nitrocobalt(III)chloride

71. The structure given below represents



A) Isoprene Rubber B) Bakelite C) PVC D) Nylon 6,6

72. Which isomer of xylene can give three different monochloroderivatives?

A) o-xylene B) m-xylene

C) p-xylene D) xylene cannot give a monochloro derivative

73. Carbocations, carbanions, free radicals and radical cation are reactive carbon intermediates. Their hybrid orbitals respectively are

A) sp^2, sp^2, sp^3, sp B) sp^2, sp^2, sp, sp^3 C) sp^2, sp^3, sp^2, sp D) sp^3, sp^2, sp ,sp^2

74. A catalyst accelerates a reaction primarily by stabilizing the

A) substrate B) product C) intermediate D] transition state

75. The dipole moments of halo compounds are in the order

A) $CHCl_3 > CCl_4 > CHCl_2 >$ cis-CHCl=CHCl B) cis-CHCl=CHCl > $CHCl_3 > CH_2Cl_2 > CCl_4$

C) cis-CHCl=CHCl > $CH_2Cl_2 > CHCl_3 > CCl_4$ D) $CHCl_3 > CHCl_2 >$ cis-CHCl=CHCl > CCl_4

76. Tollen's reagent is

A) Cu_2O B) $[Cu(OH)_4]^{2-}$ C) Ag_2O D) $[Ag(NH_3)_2]^+$

77. The bond energy of B-F bond in BF_3 is 646 kJ .mol^{-1} , while that of N-F bond in NF_3 is 280 kJ .mol^{-1}. this is because

A) **N** is more electronegative than **B**

B) The atomic mass of **N** is higher than that of **B**

C) The **B-F** bond gets a partial double bond character due to p-p overlap

D) **N** has a lone pair of electrons while **B** does not nave

78. When equal volumes of the following solutions are mixed precipitation of AgCl ($K_{sp} = 1.8 \times 10^{-10}$) will occur only with

A) 10^{-4} M Ag^+ and 10^{-4} M Cl^- B) 10^{-5} M Ag^+ and 10^{-5} M Cl^-

C) 10^{-6} M Ag^+ and 10^{-6} M Cl^- D) 10^{-10}M Ag^+ and 10^{-10} M Cl^-

79. The oxidation of SO_2 by O_2 to SO_3 is an exothermic reaction. The yield of SO_3 can be maximized if

A) temperature is increased and pressure is kept constant

B) temperature is decreased and pressure is increased

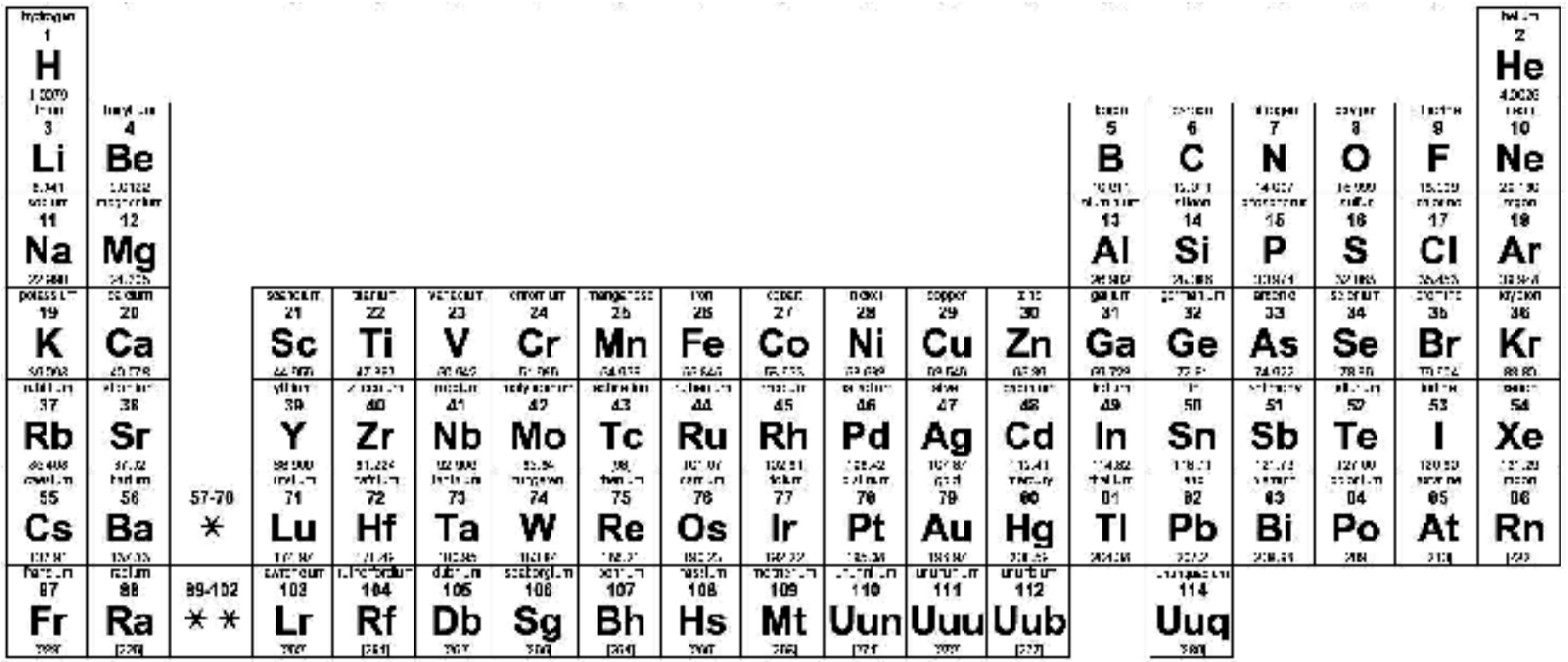
C) both temperature and pressure are increased

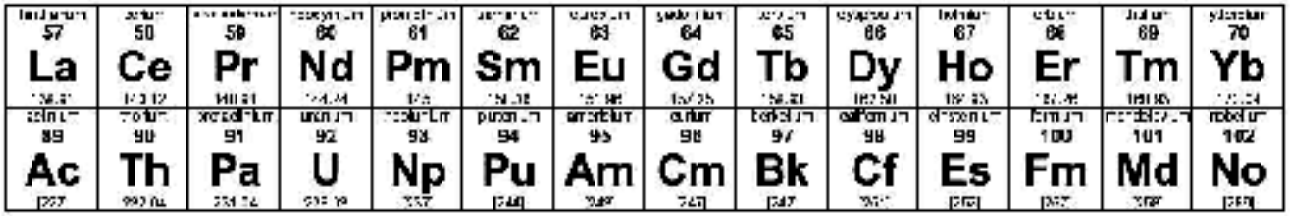
D) both temperature and pressure are decreased

80. Which of the following has a positive entropy change?

A) $H_2O_{(g)} \longrightarrow H_2O_{(l)}$ B) $BF_{3(g)} + NH_3(g) \longrightarrow F_3B{\cdot}NH_{3\,(s)}$

C) $2SO_{2\,(g)} + O_{2(g)} \longrightarrow 2SO_{3(g)}$ D) $2\,NH_4NO_{3(s)} \longrightarrow 2N_{2(g)} + 4H_2O_{(l)} + O_{2(g)}$





*Lanthanide series

x x Actinide series

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