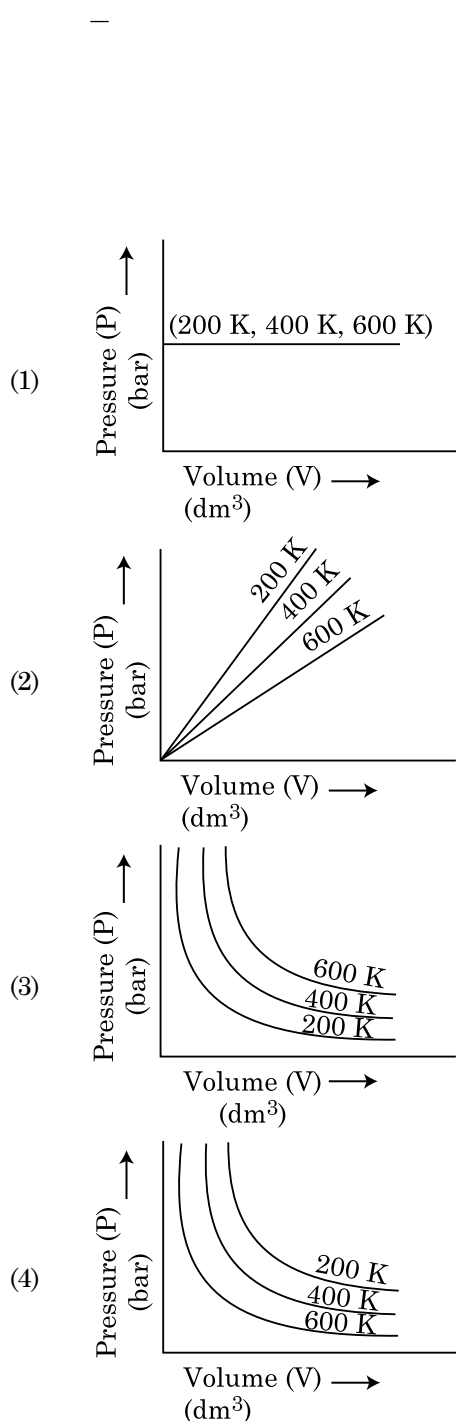


Section - A (Chemistry)

51. Choose the correct option for graphical representation of Boyle's law, which shows a graph of pressure vs. volume of a gas at different temperatures :



52. **Statement I :**

Acid strength increases in the order given as $\text{HF} \ll \text{HCl} \ll \text{HBr} \ll \text{HI}$.

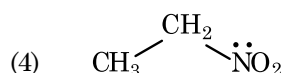
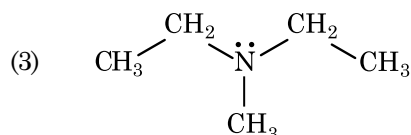
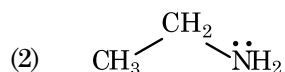
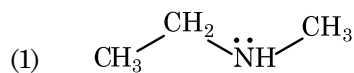
Statement II :

As the size of the elements F, Cl, Br, I increases down the group, the bond strength of HF, HCl, HBr and HI decreases and so the acid strength increases.

In the light of the above statements, choose the **correct** answer from the options given below.

- (1) Both **Statement I** and **Statement II** are false.
- (2) **Statement I** is correct but **Statement II** is false.
- (3) **Statement I** is incorrect but **Statement II** is true.
- (4) Both **Statement I** and **Statement II** are true.
53. Tritium, a radioactive isotope of hydrogen, emits which of the following particles ?
- (1) Alpha (α)
- (2) Gamma (γ)
- (3) Neutron (n)
- (4) Beta (β^-)
54. The maximum temperature that can be achieved in blast furnace is :
- (1) upto 2200 K
- (2) upto 1900 K
- (3) upto 5000 K
- (4) upto 1200 K
55. Noble gases are named because of their inertness towards reactivity. Identify an **incorrect** statement about them.
- (1) Noble gases have very high melting and boiling points.
- (2) Noble gases have weak dispersion forces.
- (3) Noble gases have large positive values of electron gain enthalpy.
- (4) Noble gases are sparingly soluble in water.

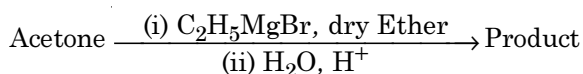
56. Identify the compound that will react with Hinsberg's reagent to give a solid which dissolves in alkali.



57. Among the following alkaline earth metal halides, one which is covalent and soluble in organic solvents is :

- (1) Strontium chloride
- (2) Magnesium chloride
- (3) Beryllium chloride
- (4) Calcium chloride

58. What is the IUPAC name of the organic compound formed in the following chemical reaction ?



- (1) pentan-2-ol
- (2) pentan-3-ol
- (3) 2-methyl butan-2-ol
- (4) 2-methyl propan-2-ol

59. BF_3 is planar and electron deficient compound. Hybridization and number of electrons around the central atom, respectively are :

- (1) sp^3 and 6
- (2) sp^2 and 6
- (3) sp^2 and 8
- (4) sp^3 and 4

60. The structures of beryllium chloride in solid state and vapour phase, are :

- (1) Linear in both
- (2) Dimer and Linear, respectively
- (3) Chain in both
- (4) Chain and dimer, respectively

61. The RBC deficiency is deficiency disease of :

- (1) Vitamin B_6
- (2) Vitamin B_1
- (3) Vitamin B_2
- (4) Vitamin B_{12}

62. The correct option for the number of body centred unit cells in all 14 types of Bravais lattice unit cells is :

- (1) 5
- (2) 2
- (3) 3
- (4) 7

63. The molar conductance of NaCl , HCl and CH_3COONa at infinite dilution are 126.45, 426.16 and $91.0 \text{ S cm}^2 \text{ mol}^{-1}$ respectively. The molar conductance of CH_3COOH at infinite dilution is. Choose the right option for your answer.

- (1) $390.71 \text{ S cm}^2 \text{ mol}^{-1}$
- (2) $698.28 \text{ S cm}^2 \text{ mol}^{-1}$
- (3) $540.48 \text{ S cm}^2 \text{ mol}^{-1}$
- (4) $201.28 \text{ S cm}^2 \text{ mol}^{-1}$

64. Which one of the following polymers is prepared by addition polymerisation ?

- (1) Nylon-66
- (2) Novolac
- (3) Dacron
- (4) Teflon

65. The pK_b of dimethylamine and pK_a of acetic acid are 3.27 and 4.77 respectively at T (K). The correct option for the pH of dimethylammonium acetate solution is :

- (1) 5.50
- (2) 7.75
- (3) 6.25
- (4) 8.50

66. A particular station of All India Radio, New Delhi, broadcasts on a frequency of 1,368 kHz (kilohertz). The wavelength of the electromagnetic radiation emitted by the transmitter is : [speed of light, $c = 3.0 \times 10^8 \text{ ms}^{-1}$]

- (1) 219.2 m
- (2) 2192 m
- (3) 21.92 cm
- (4) 219.3 m

67. Right option for the number of tetrahedral and octahedral voids in hexagonal primitive unit cell are :

- (1) 6, 12
- (2) 2, 1
- (3) 12, 6
- (4) 8, 4

68. The following solutions were prepared by dissolving 10 g of glucose ($C_6H_{12}O_6$) in 250 ml of water (P_1), 10 g of urea (CH_4N_2O) in 250 ml of water (P_2) and 10 g of sucrose ($C_{12}H_{22}O_{11}$) in 250 ml of water (P_3). The right option for the decreasing order of osmotic pressure of these solutions is :

- (1) $P_1 > P_2 > P_3$
- (2) $P_2 > P_3 > P_1$
- (3) $P_3 > P_1 > P_2$
- (4) $P_2 > P_1 > P_3$

69. Match List - I with List - II.

List - I	List - II
(a) PCl_5	(i) Square pyramidal
(b) SF_6	(ii) Trigonal planar
(c) BrF_5	(iii) Octahedral
(d) BF_3	(iv) Trigonal bipyramidal

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

- (1) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)
- (2) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)
- (3) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)
- (4) (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)

70. Ethylene diaminetetraacetate (EDTA) ion is :

- (1) Unidentate ligand
- (2) Bidentate ligand with two "N" donor atoms
- (3) Tridentate ligand with three "N" donor atoms
- (4) Hexadentate ligand with four "O" and two "N" donor atoms

71. The right option for the statement "Tyndall effect is exhibited by", is :

- (1) Glucose solution
- (2) Starch solution
- (3) Urea solution
- (4) NaCl solution

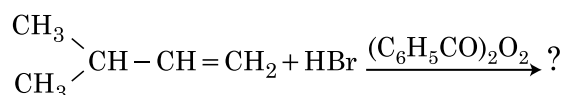
72. The major product formed in dehydrohalogenation reaction of 2-Bromo pentane is Pent-2-ene. This product formation is based on ?

- (1) Hund's Rule
- (2) Hofmann Rule
- (3) Huckel's Rule
- (4) Saytzeff's Rule

73. Dihedral angle of least stable conformer of ethane is :

- (1) 180°
- (2) 60°
- (3) 0°
- (4) 120°

74. The major product of the following chemical reaction is :



- (1) $\begin{array}{c} \text{CH}_3 \\ \diagdown \\ \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{O} - \text{COC}_6\text{H}_5 \\ \diagup \\ \text{CH}_3 \end{array}$
- (2) $\begin{array}{c} \text{CH}_3 \\ \diagdown \\ \text{CH} - \text{CH} - \text{CH}_3 \\ \diagup \quad | \\ \text{CH}_3 \quad \text{Br} \end{array}$
- (3) $\begin{array}{c} \text{CH}_3 \\ \diagdown \\ \text{CBr} - \text{CH}_2 - \text{CH}_3 \\ \diagup \\ \text{CH}_3 \end{array}$
- (4) $\begin{array}{c} \text{CH}_3 \\ \diagdown \\ \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{Br} \\ \diagup \\ \text{CH}_3 \end{array}$

75. The correct structure of 2,6-Dimethyl-dec-4-ene is :

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

76. Zr ($Z = 40$) and Hf ($Z = 72$) have similar atomic and ionic radii because of :

- (1) diagonal relationship
- (2) lanthanoid contraction
- (3) having similar chemical properties
- (4) belonging to same group

77. Given below are two statements :

Statement I :

Aspirin and Paracetamol belong to the class of narcotic analgesics.

Statement II :

Morphine and Heroin are non-narcotic analgesics.

In the light of the above statements, choose the **correct** answer from the options given below.

- (1) Both **Statement I** and **Statement II** are false.
 - (2) **Statement I** is correct but **Statement II** is false.
 - (3) **Statement I** is incorrect but **Statement II** is true.
 - (4) Both **Statement I** and **Statement II** are true.
78. Which one of the following methods can be used to obtain highly pure metal which is liquid at room temperature ?
- (1) Chromatography
 - (2) Distillation
 - (3) Zone refining
 - (4) Electrolysis

79. The compound which shows metamerism is :

- (1) C_3H_8O
- (2) C_3H_6O
- (3) $C_4H_{10}O$
- (4) C_5H_{12}

80. Which of the following reactions is the metal displacement reaction ? Choose the right option.

- (1) $Cr_2O_3 + 2Al \xrightarrow{\Delta} Al_2O_3 + 2Cr$
- (2) $Fe + 2HCl \rightarrow FeCl_2 + H_2 \uparrow$
- (3) $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2 \uparrow$
- (4) $2KClO_3 \xrightarrow{\Delta} 2KCl + 3O_2$

81. The **incorrect** statement among the following is :

- (1) Most of the trivalent Lanthanoid ions are colorless in the solid state.
- (2) Lanthanoids are good conductors of heat and electricity.
- (3) Actinoids are highly reactive metals, especially when finely divided.
- (4) Actinoid contraction is greater for element to element than Lanthanoid contraction.

82. Which one among the following is the correct option for right relationship between C_P and C_V for one mole of ideal gas ?

- (1) $C_P - C_V = R$
- (2) $C_P = RC_V$
- (3) $C_V = RC_P$
- (4) $C_P + C_V = R$

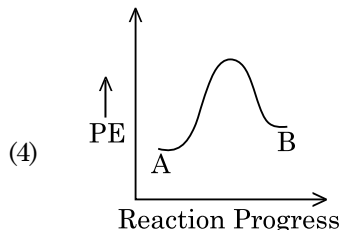
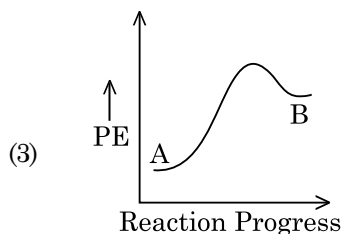
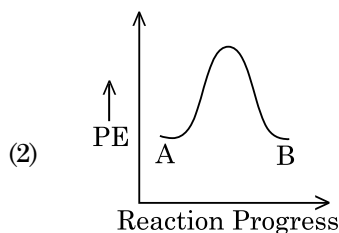
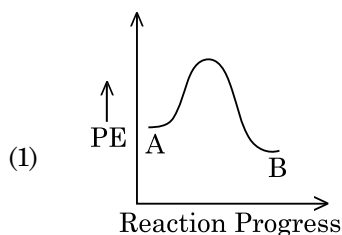
83. The correct sequence of bond enthalpy of 'C-X' bond is :

- (1) $CH_3 - F > CH_3 - Cl > CH_3 - Br > CH_3 - I$
- (2) $CH_3 - F < CH_3 - Cl > CH_3 - Br > CH_3 - I$
- (3) $CH_3 - Cl > CH_3 - F > CH_3 - Br > CH_3 - I$
- (4) $CH_3 - F < CH_3 - Cl < CH_3 - Br < CH_3 - I$

84. An organic compound contains 78% (by wt.) carbon and remaining percentage of hydrogen. The right option for the empirical formula of this compound is : [Atomic wt. of C is 12, H is 1]

- (1) CH_2
- (2) CH_3
- (3) CH_4
- (4) CH

85. For a reaction $A \rightarrow B$, enthalpy of reaction is -4.2 kJ mol^{-1} and enthalpy of activation is 9.6 kJ mol^{-1} . The correct potential energy profile for the reaction is shown in option.

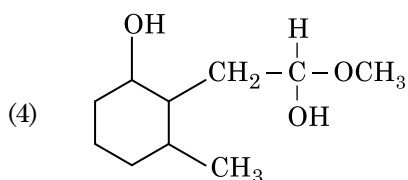
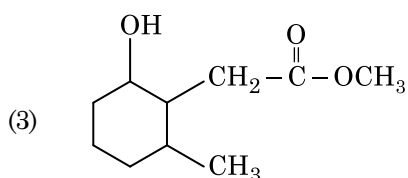
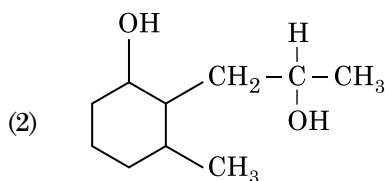
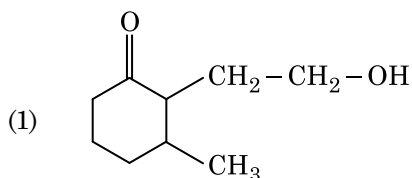
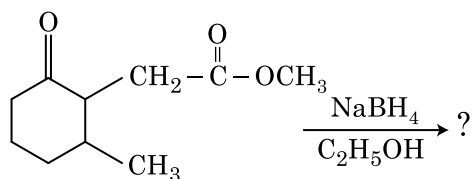


Section - B (Chemistry)

86. The molar conductivity of 0.007 M acetic acid is $20 \text{ S cm}^2 \text{ mol}^{-1}$. What is the dissociation constant of acetic acid? Choose the correct option.

$$\left[\begin{array}{l} \Lambda^\circ_{\text{H}^+} = 350 \text{ S cm}^2 \text{ mol}^{-1} \\ \Lambda^\circ_{\text{CH}_3\text{COO}^-} = 50 \text{ S cm}^2 \text{ mol}^{-1} \end{array} \right]$$

- (1) $2.50 \times 10^{-4} \text{ mol L}^{-1}$
 (2) $1.75 \times 10^{-5} \text{ mol L}^{-1}$
 (3) $2.50 \times 10^{-5} \text{ mol L}^{-1}$
 (4) $1.75 \times 10^{-4} \text{ mol L}^{-1}$
87. The product formed in the following chemical reaction is :



88. Match List - I with List - II.

List - I	List - II
(a) $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{SO}_3(\text{g})$	(i) Acid rain
(b) $\text{HOCl}(\text{g}) \xrightarrow{h\nu} \cdot\text{OH} + \cdot\text{Cl}$	(ii) Smog
(c) $\text{CaCO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{CaSO}_4 + \text{H}_2\text{O} + \text{CO}_2$	(iii) Ozone depletion
(d) $\text{NO}_2(\text{g}) \xrightarrow{h\nu} \text{NO}(\text{g}) + \text{O}(\text{g})$	(iv) Tropospheric pollution

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

- (1) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)
 (2) (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)
 (3) (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)
 (4) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)

89. Match List - I with List - II.

List - I	List - II
(a) $\xrightarrow[\text{CuCl}]{\text{CO, HCl, Anhyd. AlCl}_3}$	(i) Hell-Volhard-Zelinsky reaction
(b) $\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3 + \text{NaOX} \longrightarrow$	(ii) Gattermann-Koch reaction
(c) $\text{R}-\text{CH}_2-\text{OH} + \text{R}'\text{COOH} \xrightarrow{\text{Conc. H}_2\text{SO}_4}$	(iii) Haloform reaction
(d) $\text{R}-\text{CH}_2\text{COOH} \xrightarrow[\text{(ii) H}_2\text{O}]{\text{(i) X}_2/\text{Red P}}$	(iv) Esterification

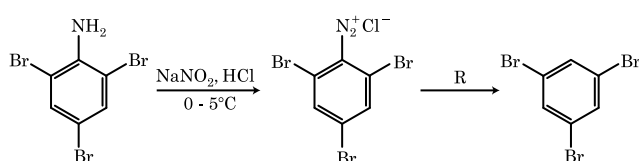
Choose the **correct** answer from the options given below.

- (1) (a)-(iii), (b)-(ii), (c)-(i), (d)-(iv)
 (2) (a)-(i), (b)-(iv), (c)-(iii), (d)-(ii)
 (3) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)
 (4) (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)

90. In which one of the following arrangements the given sequence is not strictly according to the properties indicated against it?

- (1) $\text{H}_2\text{O} < \text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te}$: Increasing pK_a values
 (2) $\text{NH}_3 < \text{PH}_3 < \text{AsH}_3 < \text{SbH}_3$: Increasing acidic character
 (3) $\text{CO}_2 < \text{SiO}_2 < \text{SnO}_2 < \text{PbO}_2$: Increasing oxidizing power
 (4) $\text{HF} < \text{HCl} < \text{HBr} < \text{HI}$: Increasing acidic strength

91. The reagent 'R' in the given sequence of chemical reaction is :



- (1) $\text{CH}_3\text{CH}_2\text{OH}$
 (2) HI
 (3) CuCN/KCN
 (4) H_2O

92. For irreversible expansion of an ideal gas under isothermal condition, the correct option is :

- (1) $\Delta U \neq 0, \Delta S_{\text{total}} \neq 0$
 (2) $\Delta U = 0, \Delta S_{\text{total}} \neq 0$
 (3) $\Delta U \neq 0, \Delta S_{\text{total}} = 0$
 (4) $\Delta U = 0, \Delta S_{\text{total}} = 0$

93. The correct option for the value of vapour pressure of a solution at 45°C with benzene to octane in molar ratio 3 : 2 is :

[At 45°C vapour pressure of benzene is 280 mm Hg and that of octane is 420 mm Hg. Assume Ideal gas]

- (1) 168 mm of Hg
 (2) 336 mm of Hg
 (3) 350 mm of Hg
 (4) 160 mm of Hg

94. Match List - I with List - II.

List - I		List - II	
(a)	$[\text{Fe}(\text{CN})_6]^{3-}$	(i)	5.92 BM
(b)	$[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$	(ii)	0 BM
(c)	$[\text{Fe}(\text{CN})_6]^{4-}$	(iii)	4.90 BM
(d)	$[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$	(iv)	1.73 BM

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

- (1) (a)-(ii), (b)-(iv), (c)-(iii), (d)-(i)
 (2) (a)-(i), (b)-(iii), (c)-(iv), (d)-(ii)
 (3) (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)
 (4) (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)

95. The slope of Arrhenius Plot $\left(\ln k \text{ v/s } \frac{1}{T}\right)$ of first order reaction is $-5 \times 10^3 \text{ K}$. The value of E_a of the reaction is. Choose the correct option for your answer.

[Given $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$]

- (1) 83.0 kJ mol^{-1}
 (2) 166 kJ mol^{-1}
 (3) -83 kJ mol^{-1}
 (4) 41.5 kJ mol^{-1}

96. From the following pairs of ions which one is not an iso-electronic pair?

- (1) $\text{Na}^+, \text{Mg}^{2+}$
 (2) $\text{Mn}^{2+}, \text{Fe}^{3+}$
 (3) $\text{Fe}^{2+}, \text{Mn}^{2+}$
 (4) $\text{O}^{2-}, \text{F}^-$

97. Choose the correct option for the total pressure (in atm.) in a mixture of 4 g O_2 and 2 g H_2 confined in a total volume of one litre at 0°C is :

[Given $R = 0.082 \text{ L atm mol}^{-1} \text{ K}^{-1}$, $T = 273 \text{ K}$]

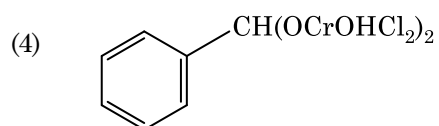
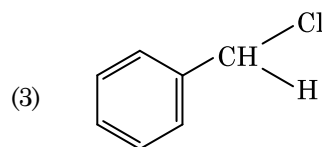
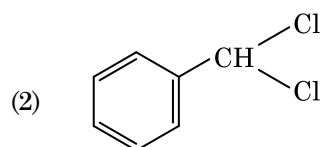
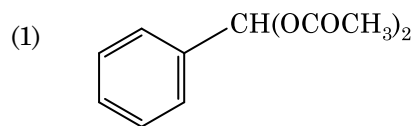
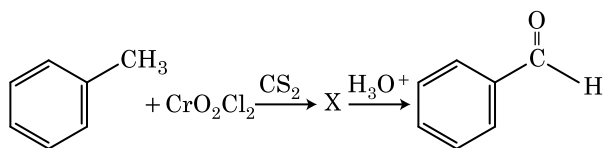
- (1) 2.602
 (2) 25.18
 (3) 26.02
 (4) 2.518

98. $\text{CH}_3\text{CH}_2\text{COO}^- \text{Na}^+ + \frac{\text{NaOH, + ?}}{\text{Heat}} \rightarrow \text{CH}_3\text{CH}_3 + \text{Na}_2\text{CO}_3$.

Consider the above reaction and identify the missing reagent/chemical.

- (1) Red Phosphorus
 (2) CaO
 (3) DIBAL-H
 (4) B_2H_6

99. The intermediate compound 'X' in the following chemical reaction is :



100. Which of the following molecules is non-polar in nature ?

- (1) CH_2O
- (2) SbCl_5
- (3) NO_2
- (4) POCl_3