

Section - A (Chemistry)

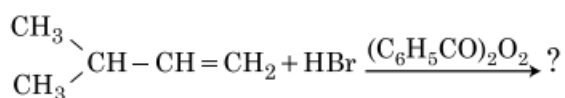
51. Dihedral angle of least stable conformer of ethane is :

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

52. Noble gases are named because of their inertness towards reactivity. Identify an **incorrect** statement about them.

- (1) Noble gases are sparingly soluble in water.
- (2) Noble gases have very high melting and boiling points.
- (3) Noble gases have weak dispersion forces.
- (4) Noble gases have large positive values of electron gain enthalpy.

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



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

CH_3

54. 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) 219.3 m
- (2) 219.2 m
- (3) 2192 m
- (4) 21.92 cm

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

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

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

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

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

- (1) $\text{CH}_3-\text{CH}_2-\ddot{\text{N}}\text{O}_2$
- (2) $\text{CH}_3-\text{CH}_2-\ddot{\text{N}}\text{H}-\text{CH}_3$
- (3) $\text{CH}_3-\text{CH}_2-\ddot{\text{N}}\text{H}_2$
- (4) $\text{CH}_3-\text{CH}_2-\ddot{\text{N}}(\text{CH}_3)-\text{CH}_2-\text{CH}_3$

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

- (1) $2\text{KClO}_3 \xrightarrow{\Delta} 2\text{KCl} + 3\text{O}_2$
- (2) $\text{Cr}_2\text{O}_3 + 2\text{Al} \xrightarrow{\Delta} \text{Al}_2\text{O}_3 + 2\text{Cr}$
- (3) $\text{Fe} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2 \uparrow$
- (4) $2\text{Pb}(\text{NO}_3)_2 \rightarrow 2\text{PbO} + 4\text{NO}_2 + \text{O}_2 \uparrow$

59. Given below are two statements :

Statement I :

Aspirin and Paracetamol belong to the class of narcotic analgesics.

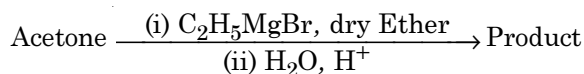
Statement II :

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 true.
- (2) Both **Statement I** and **Statement II** are false.
- (3) **Statement I** is correct but **Statement II** is false.
- (4) **Statement I** is incorrect but **Statement II** is true.

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



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

61. **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 true.
- (2) Both **Statement I** and **Statement II** are false.
- (3) **Statement I** is correct but **Statement II** is false.
- (4) **Statement I** is incorrect but **Statement II** is true.

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

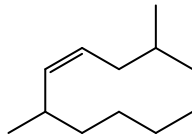
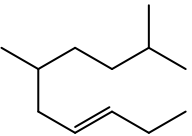
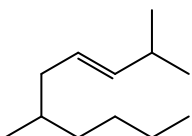
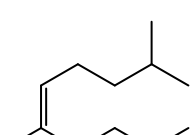
- (1) $C_P + C_V = R$
- (2) $C_P - C_V = R$
- (3) $C_P = RC_V$
- (4) $C_V = RC_P$

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

64. 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) $P_2 > P_1 > P_3$
 - (2) $P_1 > P_2 > P_3$
 - (3) $P_2 > P_3 > P_1$
 - (4) $P_3 > P_1 > P_2$
65. Which one of the following methods can be used to obtain highly pure metal which is liquid at room temperature ?
- (1) Electrolysis
 - (2) Chromatography
 - (3) Distillation
 - (4) Zone refining
66. Tritium, a radioactive isotope of hydrogen, emits which of the following particles ?
- (1) Beta (β^-)
 - (2) Alpha (α)
 - (3) Gamma (γ)
 - (4) Neutron (n)
67. The correct option for the number of body centred unit cells in all 14 types of Bravais lattice unit cells is :
- (1) 7
 - (2) 5
 - (3) 2
 - (4) 3
68. The major product formed in dehydrohalogenation reaction of 2-Bromo pentane is Pent-2-ene. This product formation is based on ?
- (1) Saytzeff's Rule
 - (2) Hund's Rule
 - (3) Hofmann Rule
 - (4) Huckel's Rule
69. The maximum temperature that can be achieved in blast furnace is :
- (1) upto 1200 K
 - (2) upto 2200 K
 - (3) upto 1900 K
 - (4) upto 5000 K
70. 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) $201.28 \text{ S cm}^2 \text{ mol}^{-1}$
 - (2) $390.71 \text{ S cm}^2 \text{ mol}^{-1}$
 - (3) $698.28 \text{ S cm}^2 \text{ mol}^{-1}$
 - (4) $540.48 \text{ S cm}^2 \text{ mol}^{-1}$
71. Ethylene diaminetetraacetate (EDTA) ion is :
- (1) Hexadentate ligand with four "O" and two "N" donor atoms
 - (2) Unidentate ligand
 - (3) Bidentate ligand with two "N" donor atoms
 - (4) Tridentate ligand with three "N" donor atoms
72. The structures of beryllium chloride in solid state and vapour phase, are :
- (1) Chain and dimer, respectively
 - (2) Linear in both
 - (3) Dimer and Linear, respectively
 - (4) Chain in both
73. The correct structure of 2,6-Dimethyl-dec-4-ene is :
- (1) 
 - (2) 
 - (3) 
 - (4) 
74. The right option for the statement "Tyndall effect is exhibited by", is :
- (1) NaCl solution
 - (2) Glucose solution
 - (3) Starch solution
 - (4) Urea solution

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

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

76. The RBC deficiency is deficiency disease of :

- (1) Vitamin B₁₂
- (2) Vitamin B₆
- (3) Vitamin B₁
- (4) Vitamin B₂

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

- (1) $\text{CH}_3-\text{F} < \text{CH}_3-\text{Cl} < \text{CH}_3-\text{Br} < \text{CH}_3-\text{I}$
- (2) $\text{CH}_3-\text{F} > \text{CH}_3-\text{Cl} > \text{CH}_3-\text{Br} > \text{CH}_3-\text{I}$
- (3) $\text{CH}_3-\text{F} < \text{CH}_3-\text{Cl} > \text{CH}_3-\text{Br} > \text{CH}_3-\text{I}$
- (4) $\text{CH}_3-\text{Cl} > \text{CH}_3-\text{F} > \text{CH}_3-\text{Br} > \text{CH}_3-\text{I}$

78. 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) CH₂
- (3) CH₃
- (4) CH₄

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

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

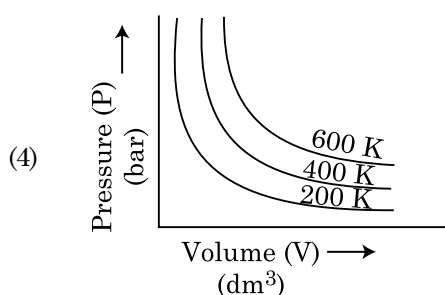
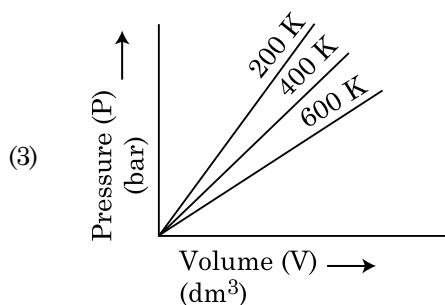
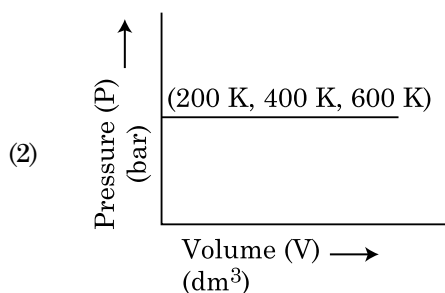
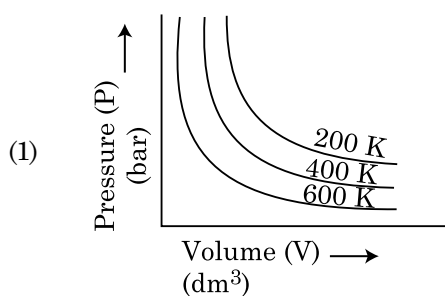
80. BF₃ is planar and electron deficient compound. Hybridization and number of electrons around the central atom, respectively are :

- (1) sp³ and 4
- (2) sp³ and 6
- (3) sp² and 6
- (4) sp² and 8

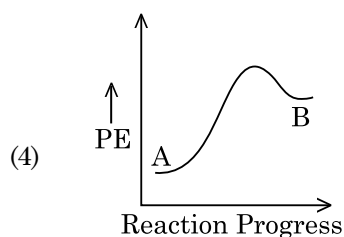
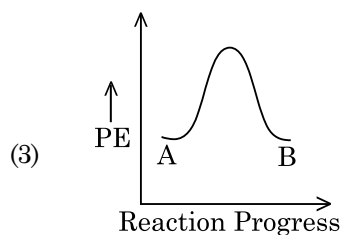
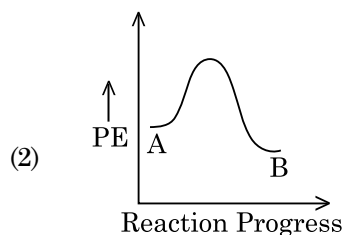
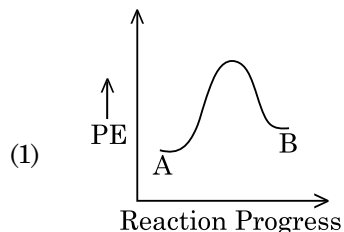
81. The pK_b of dimethylamine and pK_a of acetic acid are 3.27 and 4.77 respectively at T (K). The correct option for the pH of dimethylammonium acetate solution is :

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

82. 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 :



83. 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.



84. The compound which shows metamerism is :

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

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

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

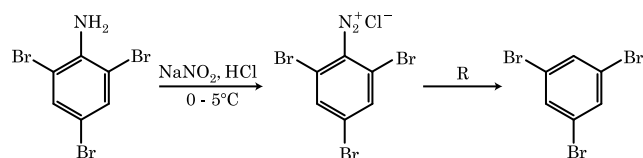
Section - B (Chemistry)

86. 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)-(iv), (b)-(ii), (c)-(i), (d)-(iii)
 - (2) (a)-(ii), (b)-(iv), (c)-(iii), (d)-(i)
 - (3) (a)-(i), (b)-(iii), (c)-(iv), (d)-(ii)
 - (4) (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)
87. The reagent 'R' in the given sequence of chemical reaction is :



- (1) H_2O
 - (2) $\text{CH}_3\text{CH}_2\text{OH}$
 - (3) HI
 - (4) CuCN/KCN
88. From the following pairs of ions which one is not an iso-electronic pair ?
- (1) O^{2-} , F^-
 - (2) Na^+ , Mg^{2+}
 - (3) Mn^{2+} , Fe^{3+}
 - (4) Fe^{2+} , Mn^{2+}

89. 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.

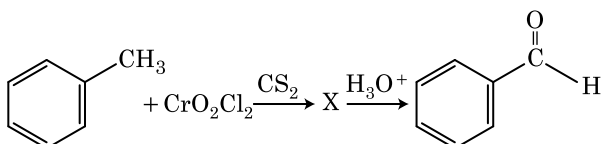
[Given $R = 8.314 \text{ JK}^{-1}\text{mol}^{-1}$]

- (1) 41.5 kJ mol^{-1}
 - (2) 83.0 kJ mol^{-1}
 - (3) 166 kJ mol^{-1}
 - (4) -83 kJ mol^{-1}
90. For irreversible expansion of an ideal gas under isothermal condition, the correct option is :
- (1) $\Delta U = 0$, $\Delta S_{\text{total}} = 0$
 - (2) $\Delta U \neq 0$, $\Delta S_{\text{total}} \neq 0$
 - (3) $\Delta U = 0$, $\Delta S_{\text{total}} \neq 0$
 - (4) $\Delta U \neq 0$, $\Delta S_{\text{total}} = 0$

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

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

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



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

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

94. 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.

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

- (1) $1.75 \times 10^{-4} \text{ mol L}^{-1}$
- (2) $2.50 \times 10^{-4} \text{ mol L}^{-1}$
- (3) $1.75 \times 10^{-5} \text{ mol L}^{-1}$
- (4) $2.50 \times 10^{-5} \text{ mol L}^{-1}$

95. $\text{CH}_3\text{CH}_2\text{COO}^- \text{Na}^+ + \xrightarrow[\text{Heat}]{\text{NaOH, + ?}} \text{CH}_3\text{CH}_3 + \text{Na}_2\text{CO}_3$.

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

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

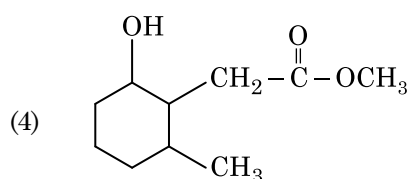
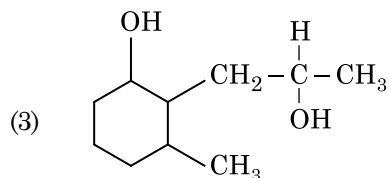
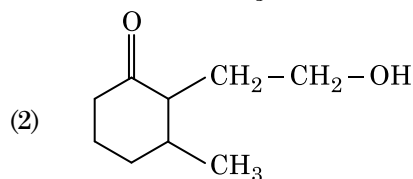
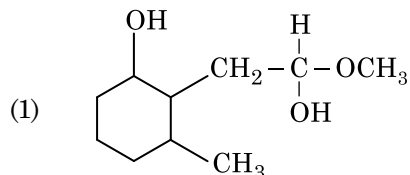
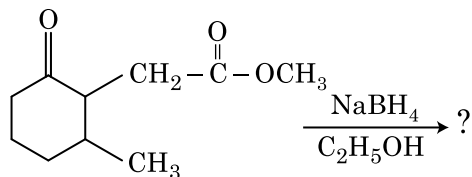
96. Match List - I with List - II.

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

97. The product formed in the following chemical reaction is :



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

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

99. 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) $\text{HOCl}(\text{g}) \xrightarrow{h\nu} \overset{\cdot}{\text{O}}\text{H} + \overset{\cdot}{\text{Cl}}$ | (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)-(i), (b)-(ii), (c)-(iii), (d)-(iv)
 (2) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)
 (3) (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)
 (4) (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)

100. 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) 2.518
 (2) 2.602
 (3) 25.18
 (4) 26.02