

SECTION - A

51. The plot of $\log k$ versus $\frac{1}{T}$ of the first order is linear with a:
- (1) Positive slope and zero intercept.
 - (2) Positive slope and non-zero intercept.
 - (3) Negative slope and non-zero intercept.
 - (4) Negative slope and zero intercept.
52. Which of the following pairs of a chemical reaction is certain to result in a spontaneous reaction?
- (1) Exothermic and increasing disorder
 - (2) Exothermic and decreasing disorder
 - (3) Endothermic and increasing disorder
 - (4) Endothermic and decreasing disorder
53. **Assertion:** Acid catalysed hydrolysis of esters is pseudo first order reaction.
Reason: Water is present in excess in given reaction.
- (1) Both Assertion and Reason are correct and Reason is the correct explanation for Assertion.
 - (2) Both Assertion and Reason are correct but Reason is not the correct explanation for Assertion.
 - (3) Assertion is correct but Reason is incorrect.
 - (4) Both Assertion and Reason are incorrect.
54. Gas constant (R) equals to:
- (1) $\frac{C_p}{C_v}$
 - (2) 1
 - (3) $C_v - C_p$
 - (4) $C_p - C_v$
55. For a certain reaction, the rate = $k [A]^2 [B]$, when the initial concentration of A is tripled keeping concentration of B constant, the initial rate would:
- (1) Increased by a factor of six
 - (2) Increased by a factor of nine
 - (3) Increased by a factor of three
 - (4) Decreased by a factor of nine
56. In thermodynamics, a process is called reversible when:
- (1) surroundings and system change into each other.
 - (2) there is no boundary between system and surroundings.
 - (3) the surroundings are always in equilibrium with the system.
 - (4) the system changes into surroundings spontaneously.

57. The half-life for a zero-order reaction having 0.02 M initial concentration of reactant is 100 s. The rate constant (in $\text{mol L}^{-1}\text{s}^{-1}$) for the reaction is:
- (1) 2.0×10^{-4}
 - (2) 2.0×10^{-3}
 - (3) 1.0×10^{-2}
 - (4) 1.0×10^{-4}
58. Which amongst the following options is the correct relation between change in enthalpy and change in internal energy?
- (1) $\Delta H = \Delta U + \Delta n_g RT$
 - (2) $\Delta H - \Delta U = \Delta RT$
 - (3) $\Delta H + \Delta U = \Delta nR$
 - (4) $\Delta H = \Delta U - \Delta n_g RT$
59. Chemical kinetics deals with:
- (1) rate of reaction
 - (2) factors affecting rate of reaction
 - (3) mechanism of the reaction
 - (4) All of these
60. A gaseous system changes from state A(P_1, V_1, T_1) to B(P_2, V_2, T_2) to C(P_3, V_3, T_3) and finally from C to A. The whole process may be called:
- (1) Reversible process
 - (2) Cyclic process
 - (3) Isobaric process
 - (4) Spontaneous process
61. Which of the following is known as rate law?
- (1) The representation of rate of a reaction in terms of concentration of the reactants.
 - (2) The representation of reaction quotient in terms of ratio of concentrations of products to concentration of reactants.
 - (3) The sum of powers of the concentration of the reactants in the rate law expression.
 - (4) The number of reacting species taking part in an elementary reaction, which must collide simultaneously in order to bring about a chemical reaction.
62. For adiabatic process, which is correct?
- (1) $\Delta T = 0$
 - (2) $q = 0$
 - (3) $\Delta S = 0$
 - (4) $\Delta H = 0$
63. Which of the following is not a correct statement regarding order of reaction?
- (1) It is the sum of power of concentration or pressure terms raised in the rate law expression.
 - (2) It may be 0, 1, 2, 3..... and even fractional or negative.
 - (3) It is determined experimentally.
 - (4) All are correct.

64. Which of the following statements are correct?
 (A) ΔG is zero for a reversible reaction.
 (B) ΔG is positive for a spontaneous reaction.
 (C) ΔG is negative for a spontaneous reaction.
 (D) ΔG is positive for a non-spontaneous reaction.
 Choose the most appropriate answer from the options given below:

(1) A and B only (2) A, B and C only
 (3) A, C and D only (4) A, B, C and D

65. Molecularity of a reaction cannot be:

(1) 3 (2) 2
 (3) 1 (4) 0.5

66. The property, which can be classified as an intensive property, is:

(1) Volume (2) Mass
 (3) Heat capacity (4) Temperature

67. In a certain reaction $4A + 2B \rightarrow 3C$, if rate of formation of C is $9.6 \times 10^{-2} \text{ mol/L s}$, then what will be the rate of reaction?

(1) $9.6 \times 10^{-2} \text{ mol/L s}$
 (2) $2.4 \times 10^{-2} \text{ mol/L s}$
 (3) $3.2 \times 10^{-2} \text{ mol/L s}$
 (4) $4.8 \times 10^{-2} \text{ mol/L s}$

68. Two moles of an ideal gas undergo reversible isothermal expansion from 2.303 L to 23.03 L at 27°C . The change in entropy is: [$R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$]

(1) 4.6 J K^{-1} (2) 16.6 J K^{-1}
 (3) -4.6 J K^{-1} (4) 38.3 J K^{-1}

69. If the concentration is expressed in moles per litre, the unit of the rate constant for a first order reaction is

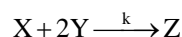
(1) $\text{mole litre}^{-1} \text{ sec}^{-1}$
 (2) mole litre^{-1}
 (3) sec^{-1}
 (4) $\text{mole}^{-1} \text{ litre}^{-1} \text{ sec}^{-1}$

70. **Assertion:** There is no change in internal energy for an ideal gas at constant temperature.

Reason: Internal energy of an ideal gas is a function of temperature only.

(1) Both Assertion and Reason are correct and Reason is the correct explanation for Assertion.
 (2) Both Assertion and Reason are correct but Reason is not the correct explanation for Assertion.
 (3) Assertion is correct but Reason is incorrect.
 (4) Both Assertion and Reason are incorrect.

71. For an elementary reaction



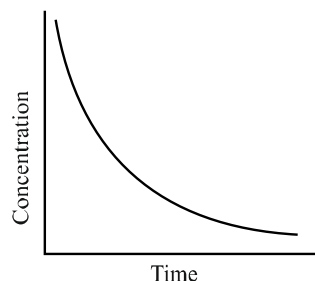
Rate law can be expressed as:

(1) $k[X]^1[Y]^2$ (2) $k[X]^1[Y]^{-2}$
 (3) $k[X]^{-1}[Y]^2$ (4) $k[X]^2[Y]^1$

72. When 6 moles of He gas at 27°C undergoes reversible isothermal expansion from 30 L to 60 L, then work done will be:

(1) -10.4 kJ (2) -4.5 kJ
 (3) $+4.5 \text{ kJ}$ (4) $+10.3 \text{ kJ}$

73. Certain reactions follow the reaction between concentrations of the reactant vs time as



What is the expected order for such reactions?

(1) 0 (2) 1
 (3) 2 (4) None of these

74. Match the column:

Column-I (Types of process)		Column-II (Features)	
(A)	Isothermal process	(P)	$\Delta Q = 0$
(B)	Isobaric process	(Q)	Volume constant
(C)	Isochoric process	(R)	Pressure constant
(D)	Adiabatic process	(S)	Temperature constant

A B C D

(1) P Q R S
 (2) S R Q P
 (3) S R P Q
 (4) Q P S R

75. Arrhenius equation is:

(1) $k = -Ae^{-E_a/RT}$ (2) $k = Ae^{-E_a/RT}$
 (3) $k = e^{-E_a/RT}$ (4) $k = Ae^{E_a/RT}$

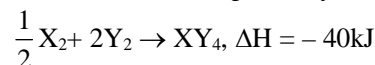
76. In an isobaric process, when temperature change from T_1 to T_2 , ΔS is equal to:

(1) $2.303 C_p \log (T_2/T_1)$
 (2) $2.303 C_p \ln (T_2/T_1)$
 (3) $C_p \ln(T_1/T_2)$
 (4) $C_v \ln(T_2/T_1)$

77. 50% of a first order reaction completes in 20 minute. 100% of same reaction shall complete in:

(1) 5 minute (2) 40 minute
(3) 20 minute (4) Infinite time

78. Standard entropy of X_2 , Y_2 and XY_4 are 30, 60 and 110 J/K mol respectively. For the reaction



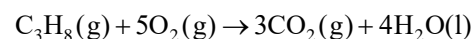
To be at equilibrium, the temperature will be:

(1) 800 K (2) 1600 K
(3) 750 K (4) 1800 K

79. The activation energy for a reaction that doubles the rate when the temperature is raised from 300 K to 310 K is: ($\log 2 = 0.3$)

(1) 50.6 kJ mol⁻¹ (2) 75.45 kJ mol⁻¹
(3) 45.5 kJ mol⁻¹ (4) 53.4 kJ mol⁻¹

80. For the reaction:



Constant temperature, $\Delta H - \Delta U$ is:

(1) 3 RT (2) +RT
(3) -RT (4) -3 RT

81. For the reaction, $A(g) \rightarrow B(g) + C(g)$

The initial pressure was P_0 while pressure after time 't' was P_t . The rate constant k will be given by:

(1) $k = \frac{2.303}{t} \log \frac{P_0}{P_t}$
(2) $k = \frac{2.303}{t} \log \frac{P_0}{P_0 - 2P_t}$
(3) $k = \frac{2.303}{t} \log \frac{P_0}{2P_0 - P_t}$
(4) $k = \frac{2.303}{t} \log \frac{P_0}{P_0 - P_t}$

82. A diatomic gas at pressure P, compressed adiabatically to half of its volume, what is the final pressure?

(1) $(2)^{1.4} P$ (2) $P/(2)^{1.4}$
(3) $(2)^{5/3} P$ (4) $P/(2)^{5/3}$

83. Match the following:

Rate Equation		Units of K	
(A)	rate = K[A]	(P)	mole lit ⁻¹ sec ⁻¹
(B)	rate = K[A][B]	(Q)	lit ² mole ⁻² sec ⁻¹
(C)	rate = K[A][B] ²	(R)	sec ⁻¹
(D)	rate = K	(S)	lit mole ⁻¹ sec ⁻¹

The correct matching is

(1) A→S; B→R; C→P; D→Q
(2) A→R; B→S; C→Q; D→P
(3) A→P; B→Q; C→R; D→S
(4) A→Q; B→P; C→S; D→R

84. In which reaction ΔS is positive:

(1) $H_2O(l) \rightarrow H_2O(s)$
(2) $3O_{2(g)} \rightarrow 2O_{3(g)}$
(3) $H_2O(l) \rightarrow H_2O(g)$
(4) $N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$

85. If k_1 is the rate constant at temperature T_1 and k_2 is the rate constant at temperature T_2 for a first order reaction, then which of the following is correct: (E_a = activation energy, $T_2 > T_1$)

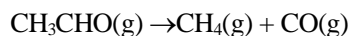
(1) $\log \frac{k_1}{k_2} = \frac{2.303E_a}{R} \left(\frac{T_2 - T_1}{T_1 T_2} \right)$
(2) $\log \frac{k_2}{k_1} = \frac{E_a}{2.303R} \left(\frac{T_2 - T_1}{T_1 T_2} \right)$
(3) $\log \frac{k_2}{k_1} = \frac{E_a}{2.303R} \left(\frac{T_2 T_1}{T_2 - T_1} \right)$
(4) $\log \frac{k_1}{k_2} = \frac{E_a}{2.303R} \left(\frac{T_2 T_1}{T_2 - T_1} \right)$

SECTION - B

86. Which of the following statements is incorrect as per IUPAC sign convention?

(1) The work done by the system on the surrounding is negative.
(2) The work done by the surrounding on the system is positive.
(3) The heat absorbed by the system from the surrounding is positive.
(4) The heat absorbed by the surrounding from the system is positive.

87. The rate equation for the following reaction is, rate = $k[CH_3CHO]^{3/2}$



The order of reaction is:

(1) 3 (2) 2
(3) 1.5 (4) 2.5

88. For a first order reaction, $A \rightarrow \text{Products}$, initial concentration of A is 0.1 M, which becomes 0.001 M after 5 minutes. Rate constant for the reaction in min⁻¹ is:

(1) 0.4606 (2) 0.2303
(3) 0.9212 (4) 1.3818

89. Calculate change in internal energy, if $\Delta H = -92.2$ kJ, $P = 40$ atm and $\Delta V = -1$ L.

(1) -42 kJ (2) -88 kJ
(3) +88 kJ (4) +42 kJ

90. The rate of a reaction at different times are given below

Time (in min)	Rate
0	2.8×10^{-2}
10	2.8×10^{-2}
20	2.8×10^{-2}
30	2.8×10^{-2}

The order of the reaction is:

- (1) 2nd order (2) Zero order
(3) 3rd order (4) 1st order
91. Which of the following statements is/are correct?
- (A) If a reaction occurs in a sequence of steps, the fastest step is called the rate determining step.
(B) For most of the reactions, the rate of reaction becomes almost two times for 10° rise in temperature.
(C) All colliding molecules having energy more than threshold energy result into the formation of products.
(D) Half life period of a first order reaction is independent of initial concentration of the reactants.
- Choose the most appropriate answer from the options given below:
- (1) A and B only (2) A, B and D only
(3) B and D only (4) A, B, C and D
92. An ideal gas expands isothermally from 10^{-3} m^3 to 10^{-2} m^3 at 300K against a constant pressure of 10^5 Nm^{-2} . The work done by the gas is:
- (1) +270 kJ (2) -900 J
(3) +900 kJ (4) -900 kJ
93. Unit of entropy is:
- (1) $\text{JK}^{-1} \text{ mol}^{-1}$ (2) J mol^{-1}
(3) $\text{J}^{-1} \text{ mol}^{-1}$ (4) JK mol^{-1}
94. For a first order reaction the rate constant is 6.909 min^{-1} . The time taken for 75% conversion in minutes is:
- (1) $\frac{3}{2} \log 2$ (2) $\frac{2}{3} \log 3$
(3) $\frac{2}{3} \log 2$ (4) $\frac{3}{2} \log \frac{3}{4}$
95. Energy of activation of forward reaction for an endothermic process is 50 kJ. If enthalpy change for forward reaction is 20 kJ, then activation energy for backward reaction will be:
- (1) 30 kJ (2) 20 kJ
(3) 70 kJ (4) 50 kJ

96. A gas is allowed to expand in a well insulated container against a constant external pressure of 2.5 atm from an initial volume of 2.50 L to a final volume of 4.50 L. The change in internal energy ΔU of the gas in joules will be:

- (1) -500 J (2) -505 J
(3) +505 J (4) 1136.25 J

97. The rate of reaction, $X + Y \rightarrow \text{Products}$ is given by the equation, $r = k[X] [Y]$. If Y is taken in large excess, the order of the reaction would be:

- (1) 0 (2) 1
(3) 2 (4) Can't be predicted

98. **Assertion:** Mass and volume are extensive properties.

Reason: Mass/volume is also an extensive property.

- (1) Both Assertion and Reason are correct and Reason is the correct explanation for Assertion.
(2) Both Assertion and Reason are correct but Reason is not the correct explanation for Assertion.
(3) Assertion is correct but Reason is incorrect.
(4) Both Assertion and Reason are incorrect.

99. The half time of a second order reaction is:

- (1) Inversely proportional to the square of the initial concentration of the reactants.
(2) Inversely proportional to the initial concentration of the reactants.
(3) Directly proportional to the initial concentration of reactants.
(4) Independent of the initial concentration of reactants.

100. A system suffers an increase in internal energy of 80 J and at the same time has 50 J of work done on it. What is the heat change of the system?

- (1) +130 J (2) +30 J
(3) -130 J (4) - 30 J

Solution

51. (3)

$$\log k = \log A - \frac{E_a}{2.303 RT}$$

$y = C + mx$ (straight line graph)

$m = \text{slope} = \text{negative}$

$C = \log A = \text{positive}$

(NCERT – Class 12th, Page 78 – 81)

52. (1)

Measure of disorder of a system is nothing but entropy. For a spontaneous reaction, $\Delta G < 0$. As per Gibbs Helmholtz equation,

$$\Delta G = \Delta H - T\Delta S$$

Thus ΔG is –ve only

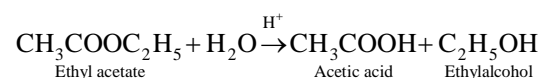
when $\Delta H = -ve$ (exothermic)

and $\Delta S = +ve$ (increasing disorder)

(NCERT – Class 11th, Page 157 – 161)

53. (1)

Hydrolysis of ethyl acetate can be seen as,



Rate of reaction is as follow,

$$\text{Rate} = k[\text{CH}_3\text{COOC}_2\text{H}_5][\text{H}_2\text{O}]$$

Since water is in excess in this reaction, the rate of reaction only depends upon concentration of ethyl acetate. So, this reaction is a pseudo first order reaction.

(NCERT – Class 12th, Page 78)

54. (4)

$$C_p - C_v = R$$

Where C_p and C_v are the molar specific heats of gas at constant pressure and constant volume respectively.

(NCERT – Class 11th, Page 145)

55. (2)

$$\text{Rate} = k[A]^2[B]$$

If $[A]$ is tripled and $[B]$ is kept constant

$$r' = k[3A]^2[B]$$

$$r' = 9k[A]^2[B]$$

$$r' = 9r$$

Increased by a factor of nine.

(NCERT – Class 12th, Page 66 – 71)

56. (3)

A process is called reversible in thermodynamics when the surrounding is always in equilibrium with the system.

(NCERT – Class 11th, Page 141)

57. (4)

For zero order reaction

$$t_{1/2} = \frac{a}{2k}$$

$$k = \frac{a}{2t_{1/2}}$$

$$k = \frac{0.02}{2 \times 100}$$

$$= 1 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$$

(NCERT – Class 12th, Page 78 – 81)

58. (1)

$$\Delta H = \Delta U + \Delta n_g RT$$

(NCERT – Class 11th, Page 143)

59. (4)

Chemical kinetics deals with:

(1) rate of reaction.

(2) factors affecting rate of reaction

(3) mechanism of the reaction.

(NCERT – Class 12th, Page 61 – 62)

60. (2)

A thermodynamic process that returns a system to its initial state is a cyclic process.

61. (1)

The representation of rate of a reaction in terms of concentration of the reactants is known as rate law (NCERT – Class 12th, Page 67)

62. (2)

During an adiabatic process, there is no exchange of energy between system and its surrounding.

Thus, $q = 0$

Entropy change is zero in only those adiabatic process, which is also reversible.

(NCERT – Class 11th, Page 138)

63. (4)

Order of a reaction:

(1) is the sum of power of concentration or pressure terms raised in the rate law expression.

(2) may be 0, 1, 2, 3, ... and even fractional or negative.

(3) is determined experimentally.

(NCERT – Class 12th, Page 67 – 69)

64. (3)

A, C and D are correct statements.

(NCERT – Class 11th, Page 157 – 162)

65. (4)

Molecularity of a reaction cannot be zero, fractional or more than 3.

(NCERT – Class 12th, Page 69 – 71)

66. (4)
Intensive property is that which is independent of the amount of the substance present in the system e.g. density, temperature, concentration etc. Extensive property depends upon the amount of the substance present in the system, e.g., volume, mass etc.

(NCERT – Class 11th, Page 144)

67. (3)
For the given reaction;



Rate in terms of C is:

$$\text{Rate} = \frac{d[C]}{dt} \times \frac{1}{3}$$

$$= 3.2 \times 10^{-2} \text{ mol/Ls}$$

((NCERT – Class 12th, Page 62 – 65)

68. (4)
For isothermal and reversible expansion of gas:

$$\Delta S = 2.303 nR \log \frac{V_2}{V_1}$$

$$= 2.303 \times 2 \times 8.314 \times \log \frac{23.03}{2.303}$$

$$= 2.303 \times 2 \times 8.314 \times \log 10$$

$$= 2.303 \times 2 \times 8.314 \times 1$$

$$= 38.29 \text{ J K}^{-1}$$

$$= 38.3 \text{ J K}^{-1}$$

(NCERT – Class 11th, Page 158 - 160)

69. (3)
Unit of $k = (\text{mol L}^{-1})^{(1-n)} \text{ s}^{-1}$

If $n = 1$ (order)

$$k = (\text{mol L}^{-1})^{1-1} \text{ s}^{-1}$$

$$= \text{s}^{-1}$$

(NCERT – Class 12th, Page 69)

70. (1)
Internal energy for an ideal gas is a function of temperature.

$$\Delta U = nC_v \Delta T$$

At constant temperature, change in internal energy will be 0.

(NCERT – Class 11th, Page 142)

71. (1)
For Elementary reaction
Molecularity = order



$$\text{Rate law} \Rightarrow \text{Rate} = K[X]^1[Y]^2$$

(NCERT – Class 12th, Page 67 – 69)

72. (1)
$$W_{\text{rev}} = -2.303 nRT \log \frac{V_2}{V_1}$$

$$= -2.303 \times 6 \times 8.314 \times 300 \times \log \frac{60}{30}$$

$$= -2.303 \times 6 \times 8.314 \times 300 \times \log 2$$

$$= -2.303 \times 6 \times 8.314 \times 300 \times 0.301$$

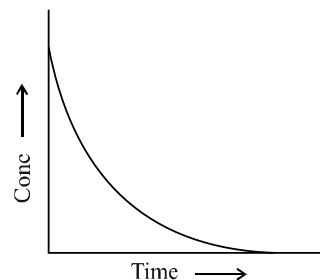
$$= -10373.9 \text{ J}$$

$$= -10.37 \text{ kJ}$$

$$= -10.4 \text{ kJ}$$

(NCERT – Class 11th, Page 142)

73. (2)
For first order reaction $A_t = A_0 e^{-kt}$



(NCERT – Class 12th, Page 72 – 74)

74. (2)
Isothermal process – Temperature constant
Isobaric process – Pressure constant
Isochoric process – Volume constant
Adiabatic process - $\Delta Q = 0$
(NCERT – Class 11th, Page 138 - 142)

75. (2)
Arrhenius equation is as follows,
$$k = Ae^{-E_a/RT}$$

(NCERT – Class 12th, Page 78 – 81)

76. (1)
The entropy change for a process, when T and P are the variable is given by

$$\Delta S = C_p \ln \frac{T_2}{T_1} - R \ln \frac{P_2}{P_1}$$

For an isobaric process $P_1 = P_2$. Hence the above equation reduces to

$$C_p \ln \frac{T_2}{T_1} = \Delta S$$

$$\text{Or } \Delta S = 2.303 C_p \log(T_2/T_1)$$

(NCERT – Class 11th, Page 158 - 160)

77. (4)
The reaction never goes to completion.
(NCERT – Class 12th, Page 72 – 74)

78. (2)
- $$\frac{1}{2}X_2 + 2Y_2 \rightarrow XY_4, \Delta H = -40 \text{ kJ}$$
- $$\Delta S = (S_m^0)_{XY_4} - \left[\frac{1}{2}(S_m^0)_{X_2} + 2(S_m^0)_{Y_2} \right]$$
- $$S_m^0 = \text{Standard molar entropy}$$
- $$\Delta S = 110 - \left[\frac{1}{2} \times 30 + 2 \times 60 \right]$$
- $$= -25 \text{ J / K}$$
- At equilibrium, $\Delta G = 0$
- $$\Delta H = T\Delta S$$
- $$T = \frac{-40 \times 1000 \text{ J}}{-25 \text{ J / K}} = 1600 \text{ K}$$
- (NCERT – Class 11th, Page 157 – 162)
79. (4)
- $$\log \left(\frac{k_2}{k_1} \right) = \frac{E_a}{2.303R} \left[\frac{1}{T_1} - \frac{1}{T_2} \right]$$
- $$\log \left(\frac{2k_1}{k_1} \right) = \frac{E_a}{2.303 \times 8.314} \left[\frac{1}{300} - \frac{1}{310} \right]$$
- $$E_a = 53420.52 \text{ J}$$
- $$E_a = 53.42 \text{ KJ / mol}$$
- NCERT – Class 12th, Page 78 – 81)
80. (4)
- For the reaction:
- $$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$$
- $$\Delta n_g = 3 - 6 = -3$$
- Hence,
- $$\Delta H = \Delta U + \Delta n_g RT$$
- $$\Delta H = \Delta U + (-3)RT$$
- $$\Delta H = \Delta U - 3RT$$
- $$\Delta H - \Delta U = -3RT$$
- (NCERT – Class 11th, Page 143)
81. (3)
- $$A_{(g)} \rightarrow B_{(g)} + C_{(g)}$$
- $$P_0 \quad \quad \quad \bar{P} \quad \quad \quad \bar{P}$$
- $$P_0 - P \quad \bar{P} \quad \bar{P}$$
- Now, $P_t = P_0 - P + P + P = P_0 + P$
- $$P = P_t - P_0$$
- Now, put $P = P_t - P_0$ in $(P_0 - P)$
- $$P_0 - P = 2P_0 - P_t$$
- $$k = \frac{2.303}{t} \log \frac{P_0}{P_0 - P}$$
- $$k = \frac{2.303}{t} \log \frac{P_0}{2P_0 - P_t}$$
- (NCERT – Class 12th, Page 72 – 76)

82. (1)
- For adiabatic conditions, $PV^\gamma = \text{Constant}$
- $$P_1 V_1^\gamma = P_2 V_2^\gamma; V_2 = \frac{1}{2} V_1$$
- $$P_2 = P_1 \left(\frac{V_1}{V_2} \right)^\gamma \quad [\text{For diatomic gas, } \gamma = 1.4]$$
- $$P_2 = P_1 \left(\frac{V_1 \times 2}{V_1} \right)^{1.4}$$
- $$P_2 = P_1 (2)^{1.4} = (2)^{1.4} P$$
- (NCERT – Class 11th, Page 138)
83. (2)
- (A) rate = $K[A]^1$
First order reaction.
Unit of $K = \text{sec}^{-1}$
- (B) rate = $K[A]^1[B]^1$.
Second order reaction
Unit of $K = \text{lit mol}^{-1} \text{sec}^{-1}$
- (C) rate = $K[A]^1[B]^2$
Third order reaction.
Unit of $K = \text{lit}^2 \text{mole}^{-2} \text{sec}^{-1}$
- (D) rate = K
Zero order reaction
Unit of $K = \text{mole lit}^{-1} \text{sec}^{-1}$
- (NCERT – Class 12th, Page 69)
84. (3)
- $$\Delta n_{(g)} > 0$$
- $$\Delta S = +ve$$
- (NCERT – Class 11th, Page 158 – 160)
85. (2)
- Formula will be as,
- $$\log \frac{k_2}{k_1} = \frac{E_a}{2.303R} \left(\frac{T_2 - T_1}{T_1 T_2} \right)$$
- (NCERT – Class 12th, Page 78 – 81)
86. (4)
- If energy enters the system, its sign is positive. If energy leaves the system, its sign is negative. If work is done on the system, its sign is positive. If work is done by the system, its sign is negative.
- (NCERT – Class 11th, Page 138 – 139)
87. (3)
- From the given rate equation, rate = $k[\text{CH}_3\text{CHO}]^{3/2}$
- Order of the reaction = $3/2 = 1.5$
- NCERT – Class 12th, Page 68 – 69)
88. (3)
- $$k = \frac{2.303}{t} \log \frac{a}{a-x}$$

$$\begin{aligned}
 &= \frac{2.303}{5 \text{ min}} \log \frac{0.1 \text{ M}}{0.001 \text{ M}} \\
 &= \frac{2.303}{5} \times \log \frac{10^{-1}}{10^{-3}} \text{ min}^{-1} \\
 &= \frac{2.303}{5} \times \log 10^2 \text{ min}^{-1} \\
 &= 0.4606 \times 2 \log 10 \text{ min}^{-1} \\
 &= 0.4606 \times 2 \text{ min}^{-1} \\
 &= 0.9212 \text{ min}^{-1}
 \end{aligned}$$

(NCERT – Class 12th, Page 72 – 74)

89. (2)

$$\Delta H = \Delta U + P\Delta V$$

$$\Delta U = \Delta H - P\Delta V$$

$$\begin{aligned}
 \Delta U &= -92.2 - 40 \times (-1) \times 101 \times 10^{-3} \\
 &= -92.2 + 4.04 = -88.16 \text{ kJ} = -88 \text{ kJ}
 \end{aligned}$$

(NCERT – Class 11th, Page 143)

90. (2)

For zero order reactions, the rate of the reaction does not change with time

(NCERT – Class 12th, Page 71 – 72)

91. (3)

Slowest step is known as rate determining step.

For most of the reactions, the rate of reaction becomes almost two times for 10° rise in temperature.

It is a true statement.

All colliding molecules having energy more than threshold energy result into the formation of products.

It is a wrong statement.

Half-life period of a first order reaction is independent of initial concentration of the reactants.

It is a true statement.

(NCERT – Class 12th, Page 78 – 83)

92. (2)

$$w = -PdV = -P(V_2 - V_1)$$

$$= -10^5 \text{ Nm}^{-2} (10^{-2} - 10^{-3}) \text{ m}^3$$

$$= -10^5 \text{ Nm}^{-2} (9 \times 10^{-3}) \text{ m}^3$$

$$= -9 \times 10^2 \text{ Nm} = -900 \text{ J} \quad (\because 1 \text{ J} = 1 \text{ Nm})$$

(NCERT – Class 11th, Page 142)

93. (1)

Entropy change (ΔS) is given by $\Delta S = \frac{q_{\text{rev}}}{T}$

\therefore Unit of entropy = $\text{JK}^{-1} \text{ mol}^{-1}$

(NCERT – Class 11th, Page 158 – 160)

94. (3)

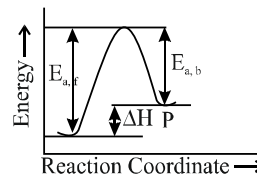
$$k = \frac{2.303}{t} \log \frac{R_o}{R}$$

$$t = \frac{2.303}{6.909} \log \frac{100}{25} = \frac{1}{3} \log 4$$

$$t = \frac{1}{3} \log 2^2 \Rightarrow \frac{2}{3} \log 2$$

(NCERT – Class 12th, Page 72 – 74)

95. (1)



For endothermic reaction,

$$E_{a,b} = E_{a,f} - \Delta H^\circ = 50 \text{ kJ} - 20 \text{ kJ} = 30 \text{ kJ}$$

(NCERT – Class 12th, Page 78 – 80)

96. (2)

$$w = -P_{\text{ext}} \Delta V = -2.5(4.50 - 2.50)$$

$$= -5 \text{ L atm} = -5 \times 101.325 \text{ J} = -506.625 \text{ J}$$

$$\Delta U = q + w$$

As, the container is insulated, thus, $q = 0$

$$\text{Hence, } \Delta U = w = -506.625 \text{ J}$$

(NCERT – Class 11th, Page 142)

97. (2)

In the given rate law; $r = k [X]^1 [Y]^1$, when Y is taken in large excess, then rate law will become,

$$r = k[X]^1 [Y]^0$$

$$\text{Hence, order of reaction} = 1 + 0 = 1$$

(NCERT – Class 12th, Page 78)

98. (3)

The properties of a system which depend upon quantity of matter contained in it are called extensive properties,

e.g., mass, volume, heat capacity etc.

But mass / volume = density is an intensive property as density does not depend upon quantity of matter in a system.

(NCERT – Class 11th, Page 144)

99. (2)

$$\text{For } 2^{\text{nd}} \text{ order reaction, } t_{1/2} = \frac{1}{k[A]_0}$$

(NCERT – Class 12th, Page 71 – 77)

100. (2)

Change in internal energy, $\Delta U = +80 \text{ J}$

Work done on the system, $w = +50 \text{ J}$

So, $\Delta U = q + w$

$$q = \Delta U - w = 80 - 50$$

$$q = 30 \text{ J}$$

(NCERT – Class 11th, Page 142)