CHEMISTRY VOLUME - 2

Physical Chemistry

Quantum Success Mantraa: SCQ-NCERT Based

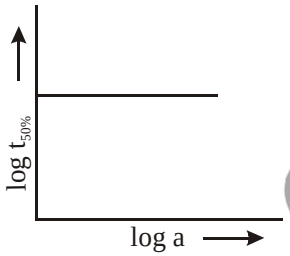
Choose the appropriate answer:

1. A graph plotted between log $t_{50\%}$ vs.log concentration is a straight line. What conclusion can you draw from the given graph?

(1) $n = 1, t_{1/2} = \frac{1}{K.a}$

(2) $n = 2, t_{1/2} = \frac{1}{a}$

(3) $n = 1, t_{1/2} = \frac{0.693}{K}$



(4) None of these

2. For the reaction 4A + B $\rightarrow$ 2C + 2D, which of the following statements is not correct :
   (1) Rate of disappearance of B is 1/4th of rate of disappearance of A
   (2) Rate of formation C is 1/2 the rate of consumption of A
   (3) Rate of appearance of D is 1/2 the rate of disappearance of B
   (4) Rate of formation of C and D are equal

3. Which of the following is correct for the equilibrium of the reaction $K_p << 1$

$$A_{(s)} + B_{(g)} \rightleftharpoons C_{(g)} + D_{(g)}$$

(1) $P_C \propto P_{B^o}$ (2) $P_C \propto \sqrt{P_{B^o}}$

(3) $P_C = (P_B)^2$ (4) None of these

4. A following mechanism has been proposed for a reaction 2A + B $\rightarrow$ D + E

A + B $\rightarrow$ C + D (slow)

A + C $\rightarrow$ E (fast)

The rate law expression for the reaction is

(1) $r = k[A]^2[B]$ (2) $r = k[A][B]$

(3) $r = k[A]^2$ (4) $r = k[A][C]$

5. Which statement is not correct?
   (1) For endothermic rections, heat of reaction is lesser than energy of activation.
   (2) For exothermic reactions, heat of reaction is more than energy of activation.
   (3) For exothermic reactions energy of activation is less in forward reation than in backward reaction.
   (4) For endothermic reactions energy of activation is more in forward reaction than in backward reaction.

6. In acidic medium the rate of reaction between $(BrO_3)^-$ and Br^- ions is given by the expression

$$-\frac{d[BrO_3^-]}{dt} = k[BrO_3^-][Br^-][H^+]^2$$

It means

(1) Unit of rate constant of overall reaction is sec^{-1}
(2) Rate of reaction is independent of the conc. of acid
(3) The change in pH of the solution will not affect the rate
(4) Doubling the conc. of H^+ ions will increase the reaction rate by 4 times.

7. The rate constant of nth order has units

(1) $litre^{1-n}\, mol^{1-n}\, sec^{-1}$ (2) $mol^{1-n} litre^{1-n}\, sec$

(3) $mol^{1-n}\, litre^{n}\, sec^{-1}$ (4) $mol^{1-n}\, litre^{n-1}\, sec^{-1}$

8. 99% of a first order reactions was completed in 32 min. When will 99.9% of the reaction complete?

(1) 50 min (2) 46 min

(3) 49 min (4) 48 min

9. The rate of reaction increases by the increase of temperature because
   (1) collision frequency is increased
   (2) energy of products decreases
   (3) fraction of molecules possessing energy $\geq E_T$ (threshold energy), increases
   (4) mechanism of a reaction is changed

10. The plot of log k vs $\frac{1}{T}$ helps to calculate
    (1) Energy of activation
    (2) Rate constant of the reaction
    (3) Order of the reaction
    (4) Energy of activation as well as the frequency factor

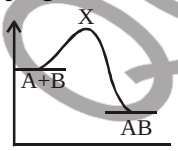
11. What specific name can be given to following sequence of steps
$Hg + hv \rightarrow Hg^*$
$Hg^* + H_2 \rightarrow H^*_2 + Hg$
$H_2^* \rightarrow 2H\ (g)$
(1) Fluorescence (2) Phosophorescence
(3) Photosensitisation (4) Chemiluminescence

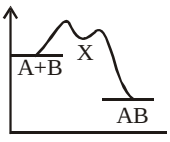
12. For a zero order reaction $A \rightarrow P$, $t_{1/2}$ is (k is rate constant)
(1) $\frac{[A]_0}{2k}$ (2) $\frac{\ln 2}{k}$
(3) $\frac{1}{k[A]_0}$ (4) $\frac{\ln 2}{[A]_0 k}$

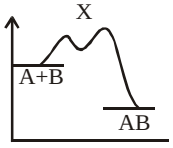
13. Which of the following statement regarding catalyst is not true ?
(1) A catalyst remains unchanged in composition and quantity at the end of the reaction
(2) A catalyst can initiate a reaction
(3) A catalyst does not alter the equilibrium in a reversible reaction
(4) Catalysts are sometimes very specific in respect of reaction

14. If a first order reaction, 75% of the reactants disappeared in 1.386 hr. What is the rate constant?
(1) $3.6 \times 10^{-3}\ s^{-1}$ (2) $2.7 \times 10^{-4}\ s^{-1}$
(3) $72 \times 10^{-3}\ s^{-1}$ (4) $1.8 \times 10^{-3}\ s^{-1}$

15. For a certain reaction, a plot of $\frac{[c_0 - c]}{c}$ against time t, yields a straight line. c_0 and c are concentrations of reactant at t = 0 and t = t respectively. The rate of reaction is
(1) 3 (2) 0
(3) 1 (4) 2

16. For an exothermic chemical process occurring in two steps as
(i) $A + B \rightarrow X$ (slow) (ii) $X \rightarrow AB$ (fast)
The progress of the reaction can be best described by
(1) 

(2) 

(3) 

(4) None of these

17. The rate constant is given by the equation $k = P.Ze^{-E/RT}$. Which factor should register a decrease for the reaction to proceed more rapidly?
(1) T (2) Z
(3) E (4) P

18. For a first order reaction, the plot of log k against 1/T is a straight line. The slope of the line is equal to
(1) $\frac{E_a}{R}$ (2) $\frac{2.303}{E_a \times R}$
(3) $\frac{E_a}{2.303}$ (4) $\frac{-E_a}{2.303\,R}$

19. For the reaction
$2A + B \rightarrow C + D$

Expt. No.	*Initial concentrations (M)*		*Initial Rate (Ms^{-1})*
	$[A]_0$	$[B]_0$	
I.	0.10	0.05	6.0×10^{-3}
II.	0.20	0.05	1.2×10^{-2}
III.	0.30	0.05	1.8×10^{-2}
IV.	0.20	0.15	1.1×10^{-1}

The rate law for the above reaction is
(1) rate = $k[A]_0[B]_0$ (2) rate = $k[A]_0\,[B]_0^2$
(3) rate = $k[B]_0^2$ (4) rate = $k[A]_0^2\,[B]$

20. A first order reaction requires 30 minutes at 27 °C to be 50% over. Its rate constant at 47 °C is 0.00115 sec^{-1}. The energy of activation for the reaction is
(1) 43.18 KJ $mole^{-1}$ (2) 34.18 KJ $mole^{-1}$
(3) 430.18 KJ $mole^{-1}$ (4) 0.4318 KJ $mole^{-1}$

21. For a reaction $pA + qB \rightarrow$ products, the rate law expression is $r = k[A]^1\,[B]^m$ then
(1) (p + 1) < (1 + m)
(2) (p + q) > (1 + m)
(3) (p+q) may or may not be equal to (1+m)
(4) (p+q) = (1 + m)

22. The dependence of rate constant K of a reaction on the activation energy E is expressed as ?
(1) $Ae^{-E/RT}$ (2) $Ae^{E/RT}$
(3) Ae^{ERT} (4) Ae^{-ERT}

23. Consider the chemical reaction,
$$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$$
The rate of this reaction can be expressed in terms of time derivative of concentration of $N_2(g)$, $H_2(g)$ and $NH_3(g)$. Identify the correct relationship amongst the rate expressions

(1) Rate $= \frac{-d[N_2]}{dt}$

$= -\frac{1}{3}\frac{d[H_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$

(2) Rate $= -\frac{d[N_2]}{dt}$

$= -\frac{3d[H_2]}{dt} = \frac{2d[NH_3]}{dt}$

(3) Rate $= \frac{d[N_2]}{dt}$

$= \frac{1}{3}\frac{d[H_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$

(4) Rate $= -\frac{d[N_2]}{dt}$

$= -\frac{d[H_2]}{dt} = \frac{d[NH_3]}{dt}$

24. If $[A]_0$ is the initial concentration and [A] is the concentration at time 't', then
(1) $[A] = [A]_0 e^{k/t}$ (2) $[A] = [A]_0 e^{-kt}$
(3) $[A]_0 = [A]e^{-kt}$ (4) $[A] = [A]_0 e^{k/t}$

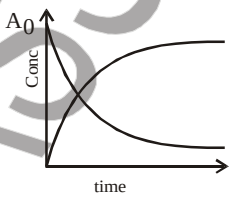
25. The acid catalyzed ionisation of γ-hydroxy butyric acid proceeds as a reversible reaction, which is 1st order in both the forward and backward steps : $\underset{\text{(Acid)}}{A} \underset{K_2}{\overset{K_1}{\rightleftharpoons}} \underset{\text{(Lactose)}}{B}$. The rate $\frac{-d[A]}{dt}$ is given by:
(1) $K_1[A]$ (2) $-K_2[B]$
(3) $K_1[A] - K_2[B]$ (4) $\frac{K_1[A]}{K_2[B]}$

26. For the reaction $N_2 + 3H_2 \rightarrow 2NH_3$, the rate $\frac{d[NH_3]}{dt} = 2\times10^{-4} Ms^{-1}$. Therefore the rate $\frac{-d[N_2]}{dt}$ is given as:
(1) 10^{-4} M sec^{-1} (2) 10^{4} M sec^{-1}
(3) 10^{-2} M sec^{-1} (4) 10^{-4} sec M^{-1}

27. Reactions of higher order are rare because :
(1) The change of effective collisions go on decreasing with increase in the number of molecules
(2) Activation energy of molecules increases
(3) Kinetic energy of reactant molecules decreases
(4) None of these

28. Given that for a reaction of *n*th order, the integrated rate equation is $K = \frac{1}{t(n-1)}\left[\frac{1}{C^{n-1}} - \frac{1}{C_0^{n-1}}\right]$, where C and C_0 are the concentration of reactant at time t and initially respectively. The $t_{3/4}$ and $t_{1/2}$ are related as ($t_{3/4}$ is time required for C_0 to become $C_{0/4}$) :
(1) $t_{3/4} = t_{1/2}[2^{n-1} + 1]$ (2) $t_{3/4} = t_{1/2}[2^{n-1} - 1]$
(3) $t_{3/4} = t_{1/2}[2^{n+1} + 1]$ (4) $t_{3/4} = t_{1/2}[2^{n+1} + 1]$

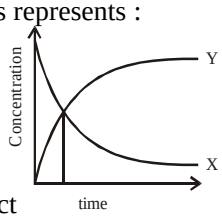
29. At the point of intersection of the two curves shown, the concentration of B is given by _____ for, $A \rightarrow nB$.



(1) $\frac{nA_0}{2}$ (2) $\frac{A_0}{n-1}$
(3) $\frac{nA_0}{n+1}$ (4) $\left(\frac{n-1}{n+1}\right)A_0$

30. For the reaction:
$[Cu(NH_3)_4]^{2+} + H_2O \rightleftharpoons [Cu(NH_3)_3H_2O]^{2+} + NH_3$
the net rate of reaction at any time is given by:
net rate $= 2.0\times10^{-4}[\{Cu(NH_3)_4\}^{2+}][H_2O] - 3.0\times10^{5}\left[[Cu(NH_3)_3H_2O]^{2+}\right][NH_3]$
Then correct statement is (are):
(1) Rate constant for forward reaction $= 2\times10^{-4}$
(2) Rate constant for backward reaction $= 3\times10^{5}$
(3) Equilibrium constant for the reaction $= 6.6\times10^{-10}$
(4) All of these

31. The accompanying figure depicts the change in concentration of species X and Y for the reaction $X \rightarrow Y$, as a function of time. The point of intersection of the two curves represents :
(1) $t_{1/2}$
(2) $t_{3/4}$
(3) $t_{2/3}$
(4) Data insufficient to predict



32. For the endothermic reaction where ΔH represents the enthalpy of the reaction in kJ/mol, the minimum value for the energy of activation will be :
(1) Less than ΔH (2) Zero
(3) More than ΔH (4) Equal to ΔH

33. The rate law for a reaction between the substances A and B is given by rate $= K[A]^n[B]^m$. On doubling the concentration of A and halving the concentration of B, the ratio of the new rate to the earlier rate of the reaction will be as

(1) $\left(\frac{1}{2}\right)^{m+n}$ (2) $(m+n)$

(3) $(n-m)$ (4) $2^{(n-m)}$

34. A reaction, $A_2 + B_2 \rightarrow 2AB$ occurs by the following mechanism :

$A_2 \rightarrow A + A$ ..... (slow)

$A + B_2 \rightarrow AB + B$ ..... (fast)

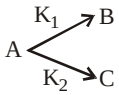
$A + B \rightarrow AB$ ..... (fast)

Its order would be :

(1) 3/2 (2) 1

(3) zero (4) 2

35. A substance undergoes first order decomposition. The decomposition follows two parallel first order reactions as:



and $K_1 = 1.26 \times 10^{-4}$ sec^{-1}

$K_2 = 3.8 \times 10^{-5}$ sec^{-1}

The percentage distribution of B and C are :

(1) 80% B and 20% C

(2) 76.83% B and 23.17% C

(3) 90% B and 10% C

(4) 60% B and 40% C

36. For the reaction,

$N_2O_5 \rightarrow 2NO_2 + \frac{1}{2}O_2$, Given, $-\frac{d[N_2O_5]}{dt} = K_1[N_2O_5]$

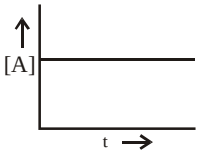
$\frac{d[NO_2]}{dt} = K_2[N_2O_5]$ and $\frac{d[O_2]}{dt} = K_3[N_2O_5]$

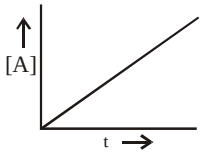
The relation between K_1, K_2 and K_3 is

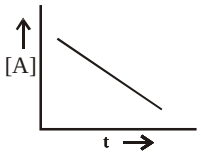
(1) $2K_1 = K_2 = 4K_3$ (2) $K_1 = K_2 = K_3$

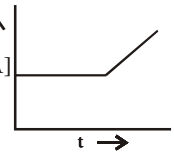
(3) $2K_1 = 4K_2 = K_3$ (4) None of these

37. Which curve represents zero order reaction:

(1) 

(2) 

(3) 

(4) 

38. The reaction $2NO + Br_2 \rightarrow 2NOBr$ obeys the following mechanism :

$NO + Br_2 \overset{\text{fast}}{\rightleftharpoons} NOBr_2$

$NOBr_2 + NO \xrightarrow{\text{slow}} 2NOBr$

The rate expression of the above reaction can be written as:

(1) $r = K[NO]^2[Br_2]$ (2) $r = K[NO][Br_2]$

(3) $r = K[NO][Br_2]^2$ (4) $r = K[NOBr_2]$

39. Hydrogen atom of vegetable ghee at 25 ^oC reduces pressure of H_2 from 2 atm of 1.2 atm in 50 minute. The rate of reaction in terms of molarity per second is :

(1) 1.09×10^{-6} (2) 1.09×10^{-5}

(3) 1.09×10^{-7} (4) 1.09×10^{-9}

40. Mathematical representation for $t_{1/4}$ life i.e., when 1/4th reaction is over is given by:

(1) $t_{1/4} = \frac{2.303}{K}\log 4$ (2) $t_{1/4} = \frac{2.303}{K}\log 3$

(3) $t_{1/4} = \frac{2.303}{K}\log\frac{4}{3}$ (4) $t_{1/4} = \frac{2.303}{K}\log\frac{3}{4}$

41. For an elementary chemical reaction, $A \longrightarrow B$, the rate of reaction doubles when the concentration of A is increased four times. The order for this reaction with respect to A is

(1) 2 (2) 1

(3) 1/2 (4) zero

42. In Arrhenius equation $K = Ae^{-E_a/RT}$, the quantity $-E_a/RT$ is referred as:

(1) Boltzmann factor (2) Frequency factor

(3) Activation factor (4) None of these

43. In radioactive decay, the emitted electrons come from the

(1) innermost shell of the atom

(2) K shell of an atom

(3) outermost shell of the atom

(4) decay of neutrons in the nucleus

44. Which of the following nuclei are β^+ -emitters?

(1) Anti nutrino (2) Potassium-40

(3) Radon-222 (4) Chlorine-34

45. Ethanal and vinyl alcohol are isomer in a one litre container, at equilibrium amount of ethanal dominates over alcohols. Which of the following is correct at equilibrium.
(1) $Q_C > K_C$ (2) $K_C > Q_C$
(3) $Q_C = K_C$ (4) None of these

46. For stable nuclei, the average binding energy per nucleon lies between
(1) 7 and 9 MeV (2) 10 and 12 MeV
(3) 2 and 4 MeV (4) 5 and 7 MeV

47. For the reaction $AB_{(g)} \rightleftharpoons A_{(g)} + B_{(g)}$. AB is 33% dissociated at a total pressure of P. Then
(1) $P = K_P$ (2) $P = 4K_P$
(3) $P = 3K_P$ (4) $P = 8\ K_P$

48. The analysis of a rock shows that the relation of ^{206}Pb and ^{238}U atoms is Pb/U = 0.25. If $t_{1/2}$ for the reaction $^{238}U \rightarrow {}^{206}Pb$ is 4×10^9 years, the age of rock (in years) is
(1) $\frac{2.303}{0.693}\left(4\times10^9\right)\log\frac{5}{4}$ (2) $\frac{2.303}{0.693}\left(4\times10^9\right)\log\frac{1}{4}$
(3) $\frac{2.303}{0.693}\left(4\times10^9\right)\log 4$ (4) $\frac{2.303}{0.693}\left(4\times10^9\right)\log\frac{4}{5}$

49. A certain radioactive isotope $^{A}_{Z}X$ is kept in sealed vessel, how much helium will accumulate in 20 days? [$t_{1/2}$ = 10 days)
(1) 22.4 L (2) 11.2 L
(3) 16.8 L (4) 33.6 L

50. A freshly prepared radio element has a half-life of 2 hours. It emits radiation whose intensity is 64 times the permissible safe level. The minimum time after which it would be possible to work with this sample is
(1) 3 hours (2) 9 hours
(3) 24 hours (4) 12 hours

51. The half-life of a radioactive sample is 2n years. What fraction of a sample will remain undecayed after n years?
(1) $\frac{1}{2}$ (2) $\frac{1}{\sqrt{2}}$
(3) $\frac{1}{\sqrt{3}}$ (4) 2

52. A sample of a radioisotope ($t_{1/2}$ = 3 days) was taken. After 12 days, 3 g of the sample was left. What was the initial mass of the sample ?
(1) 112 g (2) 136 g
(3) 12 g (4) 48 g

53. The K_{SP} of $Mg(OH)_2$ is 1×10^{-12}, 0.01M $MgCl_2$ will precipitate at the limiting pH.
(1) 3 (2) 9
(3) 8 (4) None of these

54. The decay constant of a radioactive sample is 'λ'. The half-life and mean life of the sample are, respectively
(1) $1/\lambda$; $\ln 2/\lambda$ (2) $\ln 2/\lambda$; $1/\lambda$
(3) λ ln 2, $1/\lambda$ (4) λ / ln2; $1/\lambda$

55. A radioactive element has a half-life of 20 mins. How much time should elapse before the element is reduced to 1/8th of the original mass?
(1) 40 min (2) 60 min
(3) 80 min (4) 160 min

56. The rate of elementary reaction $A \longrightarrow B$, increases by 100 times when the concentration of A is increased ten folds. The order of the reaction with respect to A is
(1) 1 (2) 2
(3) 10 (4) 100

57. How much faster would a reaction proceed at 25 °C than at 0°C if the activation energy is 65 kJ?
(1) 2 times (2) 16 times
(3) 11 times (4) 6 times

58. The reaction : $^{2}_{1}D + {}^{3}_{1}T \rightarrow {}^{4}_{2}He + {}^{1}_{0}n$ is an example of
(1) nuclear fission
(2) Artificial radioactivity
(3) Radioacitivity disintegration
(4) Nuclear fusion

59. Half life period of a substance is 1600 minutes. How much fraction of the substance will remain after 6400 minutes?
(1) 1/16 (2) 1/4
(3) 1/8 (4) 1/2

60. A certain radioactive isotope has a half life of 50 days. Fraction of the material disintegrate after 100 days will be ?
(1) 50% (2) 75%
(3) 125% (4) 25%

61. Cyclotron is not capable of accelerating ?
(1) Neutrons (2) Protons
(3) Deuterons (4) α -particles

62. Which of the following is an (n, p) reaction ?
(1) $_5C^{13} + {}_1H^1 \rightarrow {}_6C^{14}$
(2) $_7N^{14} + {}_1H^1 \rightarrow {}_8O^{15}$
(3) $_{13}A^{27} + {}_0n^1 \rightarrow {}_{12}Mg^{27} + {}_1H^1$
(4) $_{92}U^{235} + {}_0n^1 \rightarrow {}_{54}Xe^{140} + {}_{38}Sr^{94} + {}_{30}n^1$

63. After the emission of one α-particle followed by one β-particle from the atom of $^{238}_{92}X$, the number of neutrons in the atom will be ?
(1) 144 (2) 143
(3) 142 (4) 146

64. The radioactive decay of $^{238}_{92}U$ to $^{206}_{82}Pb$ involves the loss of ?
(1) 2α and 2β particles (2) 6α and 8β particles
(3) 8α and 2β particles (4) 8α and 6β particles

65. $^{27}_{13}Al$ is a stable isotope $^{29}_{13}Al$ is expected to disintegrate by ?
(1) α-emission (2) β-emission
(3) positron (4) proton emission

66. Isodiaphers are atoms having
(1) $\frac{p}{n}$ constant (2) (p–n) constant
(3) (n–p) constant (4) (n–p) different

67. In a nuclear reactor, the function of moderator is ?
(1) to slow down the speed of neutron
(2) to increase the speed of neutron
(3) to produce more neutrons
(4) to stop the nuclear reaction

68. 1.0g of a radioactive isotope was found to reduce to 125 mg after 24 hours. The half-life of the isotope is?
(1) 8 hours (2) 24 hours
(3) 6 hours (4) 4 hours

69. In the nuclear reaction $^{7}_{3}Li + ^{1}_{1}H \rightarrow 2^{4}_{2}He$, the mass loss is nearly 0.02 amu. Hence the energy released in units of million kcal/mol in the process is approx?
(1) 400 (2) 200
(3) 100 (4) 50

70. The end product of (4n + 2) radioactive disintegration series is ?
(1) $_{82}Pb^{208}$ (2) $_{82}Pb^{206}$
(3) $_{82}Pb^{207}$ (4) $_{82}Pb^{210}$

71. Breeder reactors are nuclear reactors that are capable of converting non-radioactive isotopes, into radioactive fissionable isotopes which can be used for generating energy. U^{238} a non-radioactive isotope is thus, converted into radioactive
(1) U^{234} (2) Pu^{239}
(3) I^{131} (4) C^{13}

72. Which one of the following notations shows the product incorrectly?
(1) $_{98}Cm^{242}(\alpha,2n)_{97}Bk^{243}$ (2) $_{5}B^{10}(\alpha, n)\ _{7}N^{13}$
(3) $_{7}N^{14}(n, p)\ _{6}C^{14}$ (4) $_{14}Si^{28}(d, n)\ _{15}P^{29}$

73. A solution of 2 moles of hydrogen cyanide and one mole of sodium hydroxide are taken in 500 ml solution. If the volume of solution increased by 1000 times the new pH of the solution will be (PKb of HCN = 5)
(1) 5 (2) 6.99
(3) 4 (4) 12

74. 10^{-4}M of CH_3–COONa undergoes Kolbes electrolysis gives ethane the pH of solution after completion of the reaction is
(1) 4 (2) 10
(3) 8 (4) Data insufficient

75. The half-life period of a radioactive element is 140 days. After 560 days, one gram of the element will be reduced to ?
(1) 1/2 g (2) 1/4 g
(3) 1/8 g (4) 1/16 g

76. The half-life of $^{14}_{6}C$ having decay constant of $2.31 \times 10^{-4}\ yr^{-1}$ is
(1) 2.2×10^{2} yrs. (2) 3×10^{3} yrs.
(3) 3.3×10^{4} yrs. (4) 4×10^{3} yrs.

77. In the nuclear reaction $^{9}_{4}Be\ (p, \alpha)\ X$, X is ?
(1) $^{4}_{2}He$ (2) $^{6}_{3}Li$
(3) $^{7}_{3}Li$ (4) $^{8}_{4}Be$

78. The constituents of cathode rays are
(1) α-particles (2) β-particles
(3) γ-rays (4) He particles

79. Which of the following can be used to convert $_{7}N^{14}$ into $_{8}O^{17}$?
(1) Deutron (2) Proton
(3) α-particles (4) Neutron

80. The age of most ancient geological formation is estimated by
(1) Potassium-argon method
(2) Uranium-lead method
(3) C^{14} dating method
(4) Ra-Si method

81. In the chain reaction, $^{238}_{92}U \rightarrow Ba + Kr + 3^{1}_{0}n$ + energy (E) At the *n*th step, neutrons and energy produced will be
(1) $3, 3^{27}$ (2) $3^{n-1}, 3^{n}$
(3) $n^3, 3n$ (4) $3^{n}, 3^{n-1}$

82. $^{m}_{Z}X\,(t_{1/2} = 10\text{ days}) \rightarrow {}^{m-8}_{Z-4}Y$ Starting with one mole of X in a closed vessel at S.T.P, helium gas that would be collected after 30 days is :
(1) 39.2 L (2) 19.6 L
(4) 33.6 L (4) 0.875 mol

83. For the reaction, $2HI \rightleftharpoons H_2 + I_2$ the equilibrium constant K at 440°C is 0.022. The equilibrium constant for $I_2 + H_2 \rightleftharpoons 2HI$ is
(1) 0.022 (2) 45.45
(3) 0.050 (4) None of these

84. In a chemical reaction equilibrium is said to be established when the ?
(1) Concentration of reactants and products are equal
(2) Opposing reactions cease
(3) Velocities of opposing reactions become equal
(4) Temperature of opposing reaction are equal

85. In the absence of catalyst, if the equilibrium constant be K, then on using catalyst, it will be?
(1) K (2) greater than K
(3) less than K (4) any one of these

86. For a gaseous reaction $xA + yB \rightleftharpoons lC + mD$
(1) $K_p = K_c$
(2) $K_p = (K_c)^{1+m}$
(3) $K_p = K_c\,(RT)^{\{(1+m)-(x+y)\}}$
(4) $K_p = 1/K_c$

87. Effect of pressure on the melting point of ice can be predicted by the application of ?
(1) law of mass action (2) Le Chatelier's principle
(3) Both (1) and (2) (4) Laws of fusion

88. One mole of solid NH_4SH decomposes as $NH_4SH_{(s)} \rightleftharpoons NH_{3(g)} + H_2S_{(g)}$. At equilibrium NH_3 gas is added till the partial pressure of NH_3 becomes equal to 2 times of initial equilibrium pressure. The ratio of equilibrium constant now to initial equilibrium constant is
(1) $\frac{31}{27}$ (2) $\frac{17}{4}$
(3) $\frac{4}{17}$ (4) 1

89. Eight mole of a gas AB_3 attain equilibrium in a closed container of volume 1 dm^3 as, $2AB_3 \rightleftharpoons A_2(g) + 3B_2(g)$. If at equilibrium 2 mole of A_2 are present then, equilibrium constant is
(1) 72 $mol^2\,L^{-2}$ (2) 36 $mol^2\,L^{-2}$
(3) 3 $mol^2\,L^{-2}$ (4) 27 $mol^2\,L^{-2}$

90. 10.2 gms. of ammonia is present in a vessel of volume 3 litres. Active mass of ammonia is ?
(1) 0.1 mole/lit (2) 0.2 mole/lit
(3) 0.3 mole/lit (4) 0.5 mole/lit

91. The equilibrium constant K for the reaction $AB + C \rightleftharpoons AC + B$ is 10. The rate constant of forward reaction is 10^4. The rate constant of the backward reaction is ?
(1) 10^4 (2) 10^3
(3) 10^5 (4) 10^6

92. At a certain temperature, $2HI \rightleftharpoons H_2 + I_2$ only 50% HI is dissociated at equilibrium. The equilibrium constant is
(1) 1.0 (2) 3.0
(3) 0.5 (4) 0.25

93. In which of the following reaction, the forward reaction is favoured by use of high pressure ?
(1) $H_2(g) + I_2(g) \rightleftharpoons 2HI\,(g)$
(2) $N_2(g) + O_2(g) \rightleftharpoons 2NO\,(g)$
(3) $2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g)$
(4) $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

94. Unit of equilibrium constant for the reaction
$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ is ?
(1) moles/litre (2) litres/mole
(3) $(\text{moles/litre})^2$ (4) K has no unit

95. Equilibrium constant for the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$ is 16. For the reaction, $NH_3 \rightleftharpoons (1/2)\,N_2 + (3/2)\,H_2$ its value will be?
(1) 0.25 (2) 0.4
(3) 0.50 (4) 4.0

96. (i) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$
(ii) $\frac{1}{2}N_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons NO(g)$
If K_1 and K_2 are equilibrium constants for reactions (i) and (ii) respectively. then the relation between K_1 and K_2 is ?
(1) $K_1 = K_2$ (2) $K_2 = \sqrt{K_1}$
(3) $K_1 = 2K_2$ (4) $K_1 = \frac{1}{2}K_2$

97. If the equilibrium constant of the reaction $2HI \rightleftharpoons H_2 + I_2$ is 0.25, the equilibrium constant of the reaction: $H_2 + I_2 \rightleftharpoons 2HI$ would be?
(1) 1.0 (2) 2.0
(3) 3.0 (4) 4.0

98. Which of the following oxides of nitrogen will be the most stable one ?
(1) $2NO_2(g) \rightleftharpoons N_2(g) + 2O_2(g)$, $K = 6.7\times10^{16}$ mol L^{-1}
(2) $2NO(g) \rightleftharpoons N_2(g) + O_2(g)$, $K = 2.2 \times 10^{30}$
(3) $2N_2O_5(g) \rightleftharpoons 2N_2(g) + 5O_2(g)$, $K = 1.2 \times 10^{24}$ mol^5 L^{-5}
(4) $2NO_2(g) \rightleftharpoons 2N_2(g) + O_2(g)$, $K = 3.5 \times 10^{33}$ mol L^{-1}

99. The K_p of the reaction $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ was found to be 11.45 kP_a at 298 K. Its K_a would be?
(1) 4.62×10^{12} (2) 4.62×10^{-3} M
(3) 4.62×10^{-4} (4) 4.62×10^{-5} M

100. At 500°C, the equilibrium constant for the reaction, $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ is 6.02×10^{-2} $litre^2$ mol^{-2}. The K_p at this temperature is?
(1) 1.49×10^{-5} atm^{-2} (2) 2.98×10^{-5} atm^{-2}
(3) 2.01×10^{-5} atm^{-2} (4) 3.42×10^{-5} atm^{-2}

101. The reaction, $A + 2B \rightleftharpoons 2C + D$ was studied using an initial concentration of B which was 1.5 times that of A. But the equilibrium concentration of A and C were found to be equal. Then the K_c for the equilibrium is
(1) 4 (2) 8
(3) 6 (4) 0.32

102. For $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ + heat
(1) $K_p = K_c$ (2) $K_p = K_cRT$
(3) $K_p = K_c(RT)^{-2}$ (4) $K_p = K_c (RT)^{-1}$

103. One mole of hydrogen iodide is heated in a closed container of 2 litres. At equilibrium half a mole of hydrogen iodide has dissociated. The equilibrium constant is ?
(1) 1.0 (2) 0.5
(3) 0.25 (4) 0.75

104. Dissociation of $NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g)$. If K_p for this equilibrium has the value 0.108 atm^2 at a certain temperature, what is the partial pressure of NH_3 under equilibrium ?
(1) 0.108 atm (2) 0.012 atm
(3) 0.329 atm (4) 0.216 atm

105. One mole of ethyl alcohol was treated with one mole of acetic acid at 25°C. Two-third of the acid changes into ester at equilibrium. The equilibrium constant for the reaction will be?
(1) 1 (2) 2
(3) 3 (4) 4

106. Consider the equilibrium at 500°C
$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$
4.0 moles of PCl_5 are taken in a 2 litre flask and at equilibrium, the flask is found to contain 0.80 mole of Cl_2. What is the equilibrium constant
(1) 1.0 (2) 1.0×10^{-1}
(3) 1.0×10^{-3} (4) 1.0×10^{-2}

107. K_c for $A + B \rightleftharpoons C + D$ is 10 at 25°C. If a container contains 1, 2, 3 and 4 moles of A, B, C and D respectively at 25°C, the reaction shall
(1) proceed from left to right
(2) proceed from right to left
(3) be at equilibrium
(4) None of these

108. The equilibrium constant (K_c) for the reaction,
$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$
at room temperature T is 4×10^{-4}. The value of K_c for $NO(g) \rightleftharpoons \frac{1}{2}N_2(g) + \frac{1}{2}O_2(g)$ at the same T is
(1) 0.02 (2) 50
(3) 4×10^{-4} (4) 2.5×10^{-2}

109. In a chemical equilibrium $A + B \rightleftharpoons C + D$ when one mole each of the two reactants are mixed, 0.6 mole each of the products are formed. The equilibrium constant is?
(1) 1 (2) 0.36
(3) 2.25 (4) 4/9

110. The partial pressures of PCl_3, Cl_2 and PCl_5 and 0.1, 0.2 and 0.008 atmosphere respectively for the reaction,
$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$. The value of K_p is
(1) 2.5 (2) 5.0
(3) 0.25 (4) 25

111. In the reaction, $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ at t°C., the ratio of number of moles of SO_2, O_2 and SO_3 in the equilibrium mixture is 2 : 3 : 5. If the equilibrium pressure be 3 atms., then K_p is
(1) 5.4 (2) 6.94
(3) 12.2 (4) 14.3

112. A + B $\rightleftharpoons$ AB (in gaseous state) is a reversible reaction. It appears in equilibrium that 0.4 mole of AB is formed when each A and B are taken one mole. How much percentage of A changes into AB.
(1) 20 (2) 40
(3) 60 (4) 4

113. The following reaction : A $\rightleftharpoons$ 2B is taking place in a vessel of 2L. If the degree of dissociation is 0.4, then the value of equilibrium constant will be
(1) 0.53 (2) 106
(3) 2 (4) 0.2

114. 3.2 moles of HI were heated in a sealed bulb at 444°C. till the equilibrium was reached. Its degree of dissociation was found to be 25%. Total number of moles of HI, present at equilibrium point will be
(1) 1.8 (2) 2
(3) 2.4 (4) 1.92

115. Two moles of PCl_5 were heated in a closed vessel of 2 litres. At equilibrium, 40% of PCl_5 dissociates into PCl_3 and Cl_2. The value of equilibrium constant is ?
(1) 0.267 (2) 0.53
(3) 2.63 (4) 5.3

116. At 180°C., PCl_5 is 40% dissociated, if K_p = 0.4, then at equilibrium total pressure in the vessel will be atmospheres
(1) 1.5 atm (2) 2.1 atm
(3) 2.4 atm (4) 3 atm

117. At 100°C, the vapour density of N_2O_4 is 25. Degree of dissociation at this temperature is
(1) 0.7 (2) 0.84
(3) 0.52 (4) 0.9

118. When PCl_5 is heated, it dissociates into PCl_3 and Cl_2. The density of the gas mixture at 250 °C is 57.9. Percentage dissociation is
(1) 40 (2) 55
(3) 64 (4) 80

119. For the reaction 2A + B $\rightleftharpoons$ 2C + D, on doubling the concentration of C, the value of K_c would ?
(1) Double (2) Halve
(3) Increase by 2 (4) Not change

120. For the reaction $I_2(g) \rightleftharpoons 2I(g)$, $K_c = 37.6 \times 10^{-6}$ at 1000 K. If 1.0 mole of I_2 is introduced into a 1.0 litre flask at 1000 K at equilibrium ?
(1) The concentration of $I_2(g)$ is more than that of I(g)
(2) The concentration of $I_2(g)$ is less than that of I(g)
(3) $[I_2] = [I]$
(4) $[I_2] = 1/2[I]$

121. For the reversible reaction $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$; $\Delta G = -93.7$ k.J., the equilibrium will shift in the forward direction if concentration of ?
(1) N_2 is decreased
(2) N_2 is increased
(3) NH_3 is increased
(4) Temperature is kept constant

122. At temperature T, a compound $AB_2(g)$ dissociates according to the reaction $2AB_2(g) \rightleftharpoons 2AB(g) + B_2(g)$ with a degree of dissociation x, which is small compared with unity. The expression for K_p, in terms of x and the total pressure P, is
(1) $\frac{Px^3}{2}$ (2) $\frac{Px^2}{3}$
(3) $\frac{Px^3}{3}$ (4) $\frac{Px^2}{2}$

123. The reaction, $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$, is in equilibrium in a cylinder fitted with a movable piston. Compression will cause
(1) more dissociation of PCl_5
(2) less dissociation of PCl_5
(3) more formation of PCl_3
(4) more formation of Cl_2

124. Which of the following reactions give more products as a result of increase in pressure ?
(1) $H_2O(g) + CO(g) \rightleftharpoons H_2(g) + CO_2(g)$
(2) $H_2(g) + Br_2(g) \rightleftharpoons 2HBr(g)$
(3) $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$
(4) $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$

125. 40% of a mixture of 0.2 mole of N_2 and 0.6 mole of H_2 react to give NH_3 according to the equation, $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ at constant temperature and pressure. Then the ratio of the final volume to the initial volume of gases are
(1) 4 : 5 (2) 5 : 4
(3) 7 : 10 (4) 8 : 5

126. Solids $CaCO_3$ and CaO and gaseous CO_2 are placed in a vessel and allowed to reach equilibrium
$CaO(s) + CO_2(g) \rightleftharpoons CaCO_3(s)$
$\Delta H = -180$ kJ mol^{-1}
The quantity of CaO in the vessel could be increased by
(1) adding more of $CaCO_3$

(2) removing some of CO_2
(3) lowering the temperature
(4) reducing the volume of the vessel

127. According to Le Chatelier's solubility of NH_3 in water _____ with in temperature
(1) increases (2) decreases
(3) remain unchanged (4) None of these

128. For an equilibrium reaction
$A(g) + B(g) \rightleftharpoons C(g) + D(g)$ ΔH = –ve an increase in temperature would cause
(1) an increase in the value of K_{eq}
(2) a decrease in the value of K_{eq}
(3) no change in the value of K_{eq}
(4) a change in Keq which cannot be qualitatively predicted

129. The equilibrium constant for a reaction; $A + B \rightleftharpoons C + D$ is 1×10^{-2} at 298 K and is 2 at 373 K. The chemical process resulting in the formation of C and D is
(1) exothermic
(2) endothermic
(3) unpredictable
(4) There is no relationship between K and ΔH

130. For the reaction $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$
$K^o_c = 66.9$ at 350°C and $K^o_c = 50.0$ at 448°C. The reaction has
(1) ΔH = +ve
(2) ΔH = –ve
(3) ΔH = zero
(4) ΔH whose sign cannot be predicted

131. For a reaction: $A(g) + 3B(g) \rightleftharpoons 2C(g)$; $\Delta H = -90\ KJmol^{-1}$
The K_p for the reaction at 600 K is 4.62×10^{-3}, then the K_p at 800 K would be:
(1) 5.3×10^{-2} (2) 5.05×10^{-5}
(3) 4.62×10^{-3} (4) 8.7×10^{-1}

132. At a certain temperature, K_p for the dissociation of $CaCO_3$ is 4×10^{-2} atm and for the reaction $C_{(s)} + CO_{2(g)} \rightleftharpoons 2CO_{(g)}$ it is 2 atm respectively. The pressure of CO at this temperature when solid carbon, CaO and $CaCO_3$ are mixed and allowed to attain equilibrium is
(1) 0.82 atm (2) 1 atm
(3) 0.28 atm (4) None of these

133. The oxidation of SO_2 by O_2 to SO_3 is an exothermic reaction. The yield of SO_2 will be maximum if
(1) Temperature is increased and pressure is kept constant
(2) Temperature is reduced and pressure is increased
(3) Both temperature and pressure are increased
(4) Both temperature and pressure are decreased

134. For the reaction $PCl_{3(g)} + Cl_{2(g)} \rightleftharpoons PCl_{5(g)}$. If K_C at 250°C is 26, K_P at 250°C will be
(1) 0.5 (2) 0.4
(3) 0.3 (4) 0.6

135. For the gas phase reaction
$2NO(g) \rightleftharpoons N_2(g) + O_2(g)$,
$\Delta H = -43.5\ kcal\ mol^{-1}$, which one of the statement is true for
$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$
(1) K is independent of T
(2) K increases as T decreases
(3) K decreases as T decreases
(4) K varies with the addition of NO

136. The equilibrium concentrations of X, Y and XY_2 are 4, 2 and 2 respectively for the equilibrium $2X + Y \rightleftharpoons YX_2$. The value of equilibrium constant K_c is?
(1) 0.0625 (2) 0.625
(3) 6.25 (4) None of these

137. The equilibrium constant for the reaction
$H_2O(g) + CO(g) \rightleftharpoons H_2(g) + CO_2(g)$
is 0.44 at 1260 K. The equilibrium constant for the reaction
$2H_2(g) + 2\ CO_2\ (g) \rightleftharpoons 2CO(g) + 2H_2O(g)$ at 1260 K is equal to
(1) 0.44 (2) 0.88
(3) 516 (4) 126

138. In the equilibrium reaction involving the dissociation of $CaCO_3$
$CaCO_3(s) \rightleftharpoons CaO\ (s) + CO_2\ (g)$
the equilibrium constant is given by
(1) $\frac{P_{CaO} \times P_{CO_2}}{P_{CaCO_3}}$ (2) $C_{CaO} \times \frac{P_{CO_2}}{C_{CaCO_3}}$
(3) P_{CaO} / P_{CaCO_3} (4) P_{CO_2}

139. In a reversible reaction, two substance are in equilibrium. If the concentration of each one is doubled, the equilibrium constant will be
(1) doubled (2) halved
(3) constant (4) tripled

140. At a given temperature, the equilibrium constant for the reaction,
$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$
is 2.4×10^{-3}. At the same temperature the equilibrium constant for the reaction,
$PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g)$ will be roughly
(1) 2.4×10^{3} (2) 4.2×10^{2}
(3) -2.4×10^{-3} (4) 4.8×10^{-2}

141. According to Le-Chatelier's principle, adding heat to a solid and liquid in equilibrium will cause the
(1) temperature to increase
(2) temperature to decrease
(3) amount of liquid to decrease
(4) amount of solid to decrease

142. The pH of a 10^{-10} HCl solution is approximately
(1) 10 (2) 7
(3) 1 (4) 14

143. 0.2 M solution of a weak acid HA is 1% ionised at 25^0C. K_a for the acid is equal to
(1) $\frac{0.002 \times 0.002}{0.198}$ (2) $\frac{0.02 \times 0.02}{0.18}$
(3) $\frac{0.1 \times 0.1}{0.19}$ (4) $\frac{0.19}{0.01 \times 0.01}$

144. Solution of equal pH and pOH is called ?
(1) Dilute solution (2) Protonic solution
(3) Neutral solution (4) Buffer solution

145. The pH of boiling water (373 K) is ?
(Given K_w at 373 K = 10^{-12})
(1) 12 (2) 8
(3) 6 (4) 2

146. Ionic product of water increases if ?
(1) Pressure is reduced
(2) H^+ ion is added
(3) OH^- ion is added
(4) Temperature is increased

147. If the ionic product of water is x then in pure water, molar concentration of H^+ ions will be
(1) x/2 (2) x^2
(3) $x^{1/2}$ (4) 2x

148. If some water is added to the solution of a base, the pH value of the solution will
(1) become 7 (2) increase
(3) decrease (4) remain unchanged

149. Ionic product of water at 80^oC is 10^{-12}. A solution with H^+ ion concentration of 10^{-4} at that temperature is?
(1) Acidic (2) Basic
(3) Neutral (4) Highly basic

150. Which one of the following mixtures will not form a buffer solution ?
(1) A weak acid and sodium or potassium salt of the weak acid
(2) A weak base and chloride or bromide salt of the weak base
(3) A strong acid and a strong base
(4) Mixture of amino acids

151. Which of the following combinations does not form a buffer ?
(1) NaCl + NaOH (2) $(NH_4)CO_3 + NH_4OH$
(3) $NH_4Cl + NH_4OH$ (4) $(NH_4)_2SO_4 + NH_4OH$

152. A buffer solution of sodium acetate and acetic acid is diluted with water. Its pH will ?
(1) Become 7 (2) Decrease
(3) Increase (4) Not change

153. When 1.0 ml of dilute HCl is added to 100 ml of a buffer solution of pH 4, the pH of the solution
(1) Becomes 7.0 (2) Almost remains same
(3) Becomes 2.0 (4) Becomes 10.0

154. In an acidic buffer solution containing acetic acid and sodium acetate, if some NaOH is added, its pH will
(1) increase a little
(2) decrease a little
(3) remain constant
(4) change but cannot be predicted

155. Equation of calculating pH of a solution containing weak acid and its salt is ?
(1) $pH = pK_a + \log \frac{[Salt]}{[Acid]}$
(2) $pH = pK_a - \log \frac{[Salt]}{[Acid]}$
(3) $pH = pK_a + \log \frac{[Acid]}{[Salt]}$
(4) $pH = K_b - \log \frac{[Acid]}{[Salt]}$

156. pH of buffer solution prepared by dissolving C_1 moles of acetic acid and C_2 moles of potassium acetate is given by
(1) $pH = \log C_1/C_2$
(2) $pH = pKa + \log C_2/C_1$
(3) $pH = -pKa + \log C_1/C_2$
(4) $pH = -\log C_1$

157. An acid type indicator, HIn differs in colour from its conjugate base (In^-). The human eye is senstive to colour differences only when the ratio $\frac{[In^-]}{[HIn]}$ is greater than 10 or smaller than 0.1. What should be the minimum change in the pH of the solution to observe a complete colour change $\left(K_a = 1.0\times10^{-5}\right)$?
(1) 4 (2) 2
(3) 6 (4) 1

158. Hydrolysis is regarded as interaction between
(1) H^+ and OH^- ions
(2) Acid and base
(3) Ions of acid with ions of base
(4) Ions of salt with ions of water

159. Degree of hydrolysis (h) of a salt of weak acid and a strong base is given by
(1) $h = \sqrt{K_h/c}$ (2) $h = \sqrt{K_h}$
(3) $h = \sqrt{c/K_h}$ (4) $h = \sqrt{K_w/K_b}$

160. The rate of reaction is doubled for 10^o rise in temperature. The increase in reaction rate as a result of temperature rise from 10^oC to 100^oC is (Considering activation energy to be constant)
(1) 1024 times (2) 512 times
(3) 64 times (4) 100 times

161. The indicator employed for the determination of approximate pH of a solution by calorimetric method is
(1) Adsorption indicator (2) Universal indictor
(3) Mixed indictor (4) Metal ion indicator

162. Which of the following indicator is absorbed by the precipitate at the equivalence point?
(1) Acid-base indictor (2) Redox indictor
(3) Adsorption indicator (4) Precipitation indicator

163. Fluorescein, tatrazine, rhodamine and chromotrope are examples of
(1) Acid base indicators (2) Adsorption indicators
(3) Mixed indicators (4) Extractive indicators

164. Phenolpthalein is suitable indicator in the titration of
(1) weak acid and strong base
(2) strong acid and weak base
(3) weak acid and weak base
(4) None of these above

165. When phenolphthalein indicator is added to an acid solution, the solution attains
(1) Pink colour (2) Yellow colour
(3) Red colour (4) No colour

166. Carbonates can be titrated with strong acids using ..... as indicator
(1) phenolphthalein (2) methyl orange
(3) Litmus (4) None of these

167. Indicator used in the titration of $KMnO_4$ against Fe^{2+} ions is ?
(1) Phenolphthalein (2) Methyl red
(3) Methyl orange (4) Self indicator

168. The hydroxyl ion concentration in a solution having pH value 3 will be
(1) 10^{-11} (2) 10^{-7}
(3) 10^{-3} (4) 10^{-14}

169. The pH of a solution is 4. What should be the change in the hydrogen ion concentration of the solution if pH is to be increased to 5?
(1) Halved
(2) Doubled
(3) Decreased by 10 times
(4) Decreased to half to its original value of concentration

170. The pH of a 1×10^{-8} M aqueous solution of HCl is slightly less than 7 because
(1) The ionization of HCl is incomplete
(2) The ionization of water is negligible
(3) The ionization of water at such a low concentration of HCl is significant
(4) The ionization of both HCl and water are negligible

171. A solution is prepared by dissolving one mole of sulphuric acid in one litre of water. If all sulphuric acid molecules are completely dissociated, the pH of the solution will be:
(1) 0 (2) 2
(3) –2 (4) –0.3

172. How many grams of KOH must be dissolved in a litre of the solution to give it a pH value 12?
(1) 5.6 gm (2) 0.56 gm
(3) 0.056 gm (4) 2.8 gm

173. Four grams of NaOH solid is dissolved in just enough water to make 1 litre of solution. What is the $[H^+]$ of the solution ?
(1) 10^{-2} moles/litre (2) 10^{-1} moles/litre
(3) 10^{-12} moles/litre (4) 10^{-13} moles/litre

174. If $[OH^-]$ is 1×10^{-8} ions/litre. It pH is ?
(1) 6 (2) 7
(3) 3 (4) 8

175. The hydrogen ion concentration of 0.001 N–NaOH solution is
(1) 1×10^{-3} mole/litre (2) 1×10^{-11} mole/litre
(3) 1×10^{-14} mole/litre (4) 1×10^{-12} mole/litre

176. Which of the following has the maximum pH:
(1) $\frac{M}{4}Ba(OH)_2$ solution (2) $\frac{M}{4}$ NaOH solution
(3) $\frac{M}{4}NH_4OH$ solution (4) $\frac{M}{4}$ KOH solution

177. The pH of a 0.01 N solution of monobasic acid is four. Then the acid involved will be
(1) Weak (2) Strong
(3) Strong or weak (4) Cannot be predicted

178. An acid HA is dissociated to an extent of 60% in 0.2 M solution. The concentration of H^+ is :
(1) 0.60 M (2) 0.12 M
(3) 0.2 M (4) None of these

179. Given that pKa for acetic acid = 4.75, what is the pH for 0.01 M acetic acid solution ?
(1) 6.75 (2) 5.07
(3) 3.38 (4) 2.75

180. Which of the following would be an acidic solution?
(1) Solution having hydrogen ion concentration of 10^{-7} M
(2) Solution having hydrogen ion concentration of 10^{-13} M
(3) Solution having hydrogen ion concentration of 10^{-2} M
(4) Solution having hydrogen ion concentration of 10^{-12} M

181. 10 mL of a solution contains 0.1 M NH_4Cl + 0.01 M NH_4OH. Which addition would not change the pH of the solution?
(1) Adding 1 mL water
(2) Adding 5 mL of 0.1 M NH_4Cl
(3) Adding 5 mL of 0.1 M NH_4OH
(4) Adding 10 mL of 0.1 M NH_4Cl

182. If 15 c.c. of $\frac{M}{1000}$ HCl is added to 15 c.c. of $\frac{M}{1000}$ HCl, the pH of the mixture is
(1) 1 (2) 2
(3) 3 (4) 4

183. Equal volumes of N/10 H_2SO_4 and N/10 HNO_3 are mixed together in a beaker. Hydrogen ion concentration of the resulting solution
(1) 0.2 mole/lit (2) 0.1 mole/lit
(3) 0.2 mole/lit (4) 0.4 mole/lit

184. Which of the following when added to 25 c.c. of a 1.0 M solution of sodium hydroxide would cause the largest change in pH :
(1) 25 c.c. of 1.0 M hydrochloric acid
(2) 25 c.c. of of 2.0 M hydrochloric acid
(3) 25 c.c. of 0.5 M hydrochloric acid
(4) 25 c.c. of distilled water

185. When 20 mL of N/20 NaOH are added to 10 mL of N/10 HCl, the resulting solution ?
(1) Turns blue litmus red
(2) Turns phenolphthalein solution pink
(3) Turns methyl orange solution red
(4) Will have no effect on either red or blue litmus solution

186. The pH of a buffer solution containing 0.1 mole of acetic acid and 0.15 mole of sodium acetate is (K_a for acetic acid = 1.75×10^{-5})
(1) 4.9 (2) 3.0
(3) 4.2 (4) 5.4

187. Solution prepared by dissolving equal number of moles of HOCl (Ka = 3.2×10^{-8}) and NaOH is a buffer of pH?
(1) 8.0 (2) 3.2
(3) 7.5 (4) 4.8

188. One litre of a buffer solution containing 0.01 M NH_4Cl and 0.1 M NH_4OH having pK_b of 5 has pH of ?
(1) 9 (2) 10
(3) 6 (4) 4

189. In a mixture of NH_4Cl and NH_4OH the ratio concentration of salt to acid is increased 10 times. The pOH of the solution?
(1) Decreases 10 times
(2) Increases 10 times
(3) Decreases by one
(4) Increase by one

190. The pH of a buffer solution containing 25 ml of 1 M CH_3COONa and 25 ml of 1M CH_3COOH will be appreciably affected by 5 ml of:
(1) 1M – CH_3COOH (2) 5M – CH_3COOH
(3) 5M – HCl (4) 1M – NH_4OH

191. Degree of hydrolysis in a decimolar solution of NH_4Cl is 10^{-4}. pH value of the solution is
(1) 3 (2) 4
(3) 5 (4) slightly greater than 7

192. If K_b for NH_4OH is 1.8×10^{-5}, then degree of hydrolysis of ammonium chloride in its 0.01 M solution will be
(1) 5.6×10^{-7} (2) 2×10^{-8}
(3) 2.35×10^{-4} (4) 2×10^{-6}

193. The pH of a saturated solution of $Mg(OH)_2$ $\left[K_{sp} \text{ of } Mg(OH)_2 = 8.9 \times 10^{-12}\right]$ is
(1) 10.4168 (2) 9.4168
(3) 11.4168 (4) 7.0

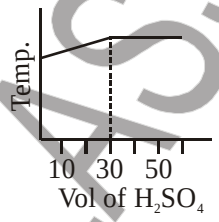
194. The aqueous solution of $CuSO_4$ is :
(1) Acidic (2) Neutral
(3) Basic (4) Amphoteric

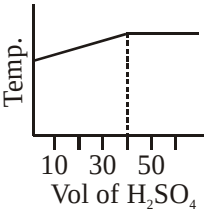
195. 0.1 millimole of $CdSO_4$ are present in 10 mL acid solution of 0.08 N HCl. Now H_2S is passed to precipitate all the Cd^{2+} ions. The pH of the solution after filtering off precipitate, boiling of H_2S and making the solution 100 mL by adding H_2O is
(1) 2 (2) 4
(3) 6 (4) 8

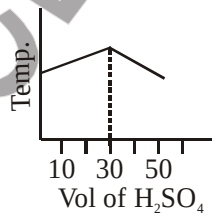
196. The $[H^+]$ ion concentration in 0.001 M acetic acid is 1.34×10^{-4} g ion/litre. The $[H^+]$ ion concentration of 0.164g of CH_3COONa is added to a litre of 0.001 M CH_3COOH will be
(1) 9×10^{-6} (2) 18×10^{-6}
(3) 4.5×10^{-6} (4) 5×10^{-6}

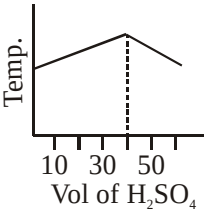
197. Solution of $NaHCO_3$ is alkaline because ?
(1) $NaHCO_3$ is alkaline
(2) Contains sodium
(3) It forms ions
(4) Forms OH^- ions in solution

198. In an experiment to determine the enthalpy of neutratlization of sodium hydroxide with sulphuric acid, 50 cm^3 of 0.4 M sodium hydroxide were titrated thermometrically with 0.25 M sulphuric acid. Which of the following plots gives the correct representation?

(1) 

(2) 

(3) 

(4) 

199. The following 1 M solution will have maximum pOH value
(1) $Ca(OH)_2$ (2) $Ba(OH)_2$
(3) $Zn(OH)_2$ (4) $Be(OH)_2$

200. 1 M aqueous solution of which of the following substances has the highest pH value ?
(1) $Al(OH)_3$ (2) NaOH
(3) K_2CO_3 (4) NH_4OH

SUBJECTIVE QUESTIONS

1. When 0.80 moles of iodine and 0.80 moles of hydrogen are heated at 444 ^{o}C until equilibrium is established, 0.60 moles of hydriodic acid are formed. Find out the equilibrium constant.
2. Radioactivity is a first order process. Radioactive carbon in wood sample decays with a half life of 5770 years. What fraction would remain after 11540 years?
3. A rate of reaction R = K $[A]^2$ $[B]^{-1/2}$. If the value of R at 40°C is 1.8×10^3 mole /l/s. What will be the rate if the concentration of A is doubled, concentration of B is quadrapled at 70°C. Given temperature coefficient of the given reaction is 2.
4. For an equilibrium $Ag(CN)^-_2$ $\rightleftharpoons$ $Ag^+ + 2CN^-$ the equilibrium constant at 25° is 10^{-20}. Calculate the Ag^+ concentration in a solution which was originally formed by mixing. 0.1 M KCN and 0.03 M $AgNO_3$.
5. Calculate the pH of decimolar solution of acetic acid which is 1.3 % ionised
6. Calculate the hydroxyl ion concentration in moles/litre of a solution whose pH is 4.70. Also determine the weight of NaOH required to produce these ions in 1 litre of the solution.
7. A certain buffer solution contains equal concentration of X^- and HX. Determine the pH of the buffer, K_a for HX is 10^{-8}.
8. In the reaction $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

   the equilibrium concentrations of PCl_5 and PCl_3 are 0.4 and 0.2 mole/litre respectively. If the value of KC is 0.5, what is the concentration of Cl_2 in mole/litre?
9. 0.1M each of ethyl alcohol and acetic acid are allowed to react and at equilibrium the acid was exactly neutralised by 100 mL of 0.85 N NaOH. Find the equilibrium constant.
10. What will be the change in free energy for a reaction whose equilibrium constant is 1×10^{10} at 300 K.
11. The thorium decay series produces one atom of 208 Pb as the final disintegration product of an atom of ^{232}Th. $t_{1/2}$ of ^{232}Th is 1.39×10^{10} years. At certain time rock is found to have mass ratio of ^{205}Pb and ^{232}Th as 14 : 1. Find the time taken.
12. Calculate the binding energy per nucleon (in MeV) in He atom ^4_2He which has mass of 4.00260 amu. Mass of one neutron is 1.008665 amu & mass of 1 hydrogen atom = 1.007825 amu.
13. The rate law for a reaction between the substances A and B is given by Rate $= k[A]^n[B]^m$. On doubling the concentration of A and having the concentration of B what will be the ratio of the new rate to the earlier rate of reaction.
14. Calculate the pH value of the mixture containing 50 c.c. M HCl and 30 c.c. M NaOH solution assuming both to be completely ionised.
15. A first order reaction was started with a decimolar solution of the reactant. After 8 minutes and 20 seconds, its concentration was found to be M/100. Determine the rate constant of the reaction.
16. Calculate the weight of HCl to be dissolved per litre of the solution so that its pH value is 1.301.
17. The half-life time for the decomposition of a substance dissolved in CCl_4 is 2.5 hours at 30^{o}C. How much of the substance will be left after 10 hours if the initial weight of the substance is 160 gm?
18. Determine the number of moles of $Ca(OH)_2$ required to prepare 250 ml of solution of pH 14.
19. N_2O_4 is dissociated to 33% and 40% at total pressure P_1 and P_2 atom respectively. what is ratio of P_1/P_2?
20. What is percentage of dissociation of NH_2COONH_4. The observed density ammonium carbonate (NH_2COONH_4) is 26.

ANSWERS

Quantum Success Mantraa: SCQ-NCERT Based

VOLUME - 2

1.	(3)	41.	(3)	81.	(4)	121.	(2)	161.	(2)
2.	(3)	42.	(1)	82.	(1)	122.	(1)	162.	(3)
3.	(2)	43.	(4)	83.	(2)	123.	(2)	163.	(3)
4.	(2)	44.	(2)	84.	(3)	124.	(3)	164.	(1)
5.	(2)	45.	(3)	85.	(1)	125.	(1)	165.	(4)
6.	(4)	46.	(1)	86.	(3)	126.	(1)	166.	(2)
7.	(4)	47.	(4)	87.	(2)	127.	(3)	167.	(4)
8.	(4)	48.	(1)	88.	(4)	128.	(2)	168.	(1)
9.	(3)	49.	(3)	89.	(4)	129.	(2)	169.	(3)
10.	(4)	50.	(4)	90.	(2)	130.	(2)	170.	(3)
11.	(3)	51.	(2)	91.	(2)	131.	(2)	171.	(1)
12.	(1)	52.	(4)	92.	(3)	132.	(3)	172.	(2)
13.	(2)	53.	(4)	93.	(4)	133.	(2)	173.	(4)
14.	(2)	54.	(2)	94.	(1)	134.	(4)	174.	(1)
15.	(4)	55.	(2)	95.	(1)	135.	(3)	175.	(2)
16.	(2)	56.	(2)	96.	(2)	136.	(1)	176.	(1)
17.	(3)	57.	(3)	97.	(4)	137.	(1)	177.	(1)
18.	(4)	58.	(4)	98.	(1)	138.	(4)	178.	(2)
19.	(2)	59.	(1)	99.	(2)	139.	(3)	179.	(3)
20.	(1)	60.	(2)	100.	(1)	140.	(2)	180.	(3)
21.	(3)	61.	(1)	101.	(4)	141.	(4)	181.	(1)
22.	(1)	62.	(3)	102.	(3)	142.	(2)	182.	(3)
23.	(1)	63.	(2)	103.	(2)	143.	(1)	183.	(2)
24.	(2)	64.	(4)	104.	(3)	144.	(3)	184.	(2)
25.	(3)	65.	(2)	105.	(4)	145.	(3)	185.	(4)
26.	(1)	66.	(2)	106.	(2)	146.	(4)	186.	(1)
27.	(1)	67.	(1)	107.	(1)	147.	(3)	187.	(3)
28.	(1)	68.	(1)	108.	(2)	148.	(3)	188.	(2)
29.	(1)	69.	(1)	109.	(3)	149.	(1)	189.	(4)
30.	(4)	70.	(2)	110.	(1)	150.	(3)	190.	(3)
31.	(1)	71.	(2)	111.	(2)	151.	(1)	191.	(2)
32.	(3)	72.	(1)	112.	(2)	152.	(4)	192.	(3)
33.	(4)	73.	(1)	113.	(1)	153.	(2)	193.	(1)
34.	(2)	74.	(2)	114.	(3)	154.	(3)	194.	(1)
35.	(2)	75.	(4)	115.	(1)	155.	(1)	195.	(1)
36.	(1)	76.	(2)	116.	(2)	156.	(2)	196.	(1)
37.	(3)	77.	(2)	117.	(2)	157.	(2)	197.	(4)
38.	(1)	78.	(2)	118.	(2)	158.	(4)	198.	(2)
39.	(2)	79.	(3)	119.	(4)	159.	(1)	199.	(3)
40.	(3)	80.	(2)	120.	(1)	160.	(2)	200.	(2)