

PACE IIT | MEDICAL | MHT-CET

MUMBAI / AKOLA / DELHI / KOLKATA / LUCKNOW / NASHIK / GOA / BOKARO / PUNE / NAGPUR

IIT – JEE: 2019

TW TEST (3 YRS.)MAIN

DATE: 14/09/18

TIME: 1 Hr.

TOPIC: FULL PHYSICAL CHEMISTRY

MARKS: 120

SECTION-I (SINGLE ANSWER CORRECT TYPE)

This section contains **30 Multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D) for its answer, out which **ONLY ONE** is correct. (+4, -1)

31. Pick out the incorrect statements

- (A) $\Psi_{1s(H)}$ and $\Psi_{2s(H)}$ are spherically symmetric around the nucleus
- (B) The degeneracy of the orbitals of the H-atom having energy $-\frac{R_H hc}{16}$ is 30.
- (C) 2s orbital has one radial node
- (D) 2p orbital has one angular node

32. A gas obeys $P(V - b) = RT$. Which of the following are correct about this gas?

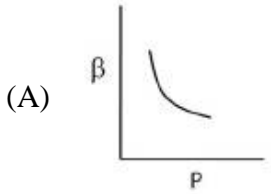
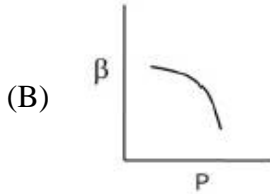
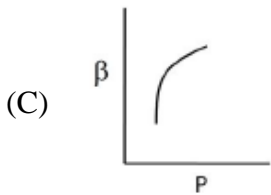
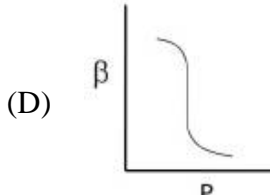
- (1) Isochoric curves have slope $= \frac{R}{V - b}$
- (2) Isobaric curves have slope $\frac{R}{P}$ and intercept b
- (3) For the gas compressibility factor $= 1 + \frac{Pb}{RT}$
- (4) The attraction forces are overcome by repulsive forces
- (A) 1, 2, 4 (B) 2, 3, 4 (C) 1, 2, 3 (D) 1, 2, 3, 4

33. Select the correct statements

- (A) The fraction of moles having speed in the range of u to $(u+du)$ of a gas of molar mass m at temperature T is the same as that of gas of molar mass $2m$ at temperature $T/2$
- (B) It is possible to liquefy an ideal gas
- (C) Vapour phase of a liquid exist above its critical temperature
- (D) The excluded volume b is approximately four times the actual volume occupied by the molecules.

34. Which of the following is/are TRUE of a real gas?

- (1) Its second virial coefficient is negligible.
- (2) Its compressibility factor is almost unity
- (3) It behaves almost like an ideal gas
- (4) It deviates remarkably from the ideal behavior when its temperature is far from the Boyle temperature
- (A) 1 and 2 (B) 4 only (C) 2 and 3 (D) 3 and 4

35. The average translational energy and the rms speed of molecules in a sample of O_2 at 300K are $6.21 \times 10^{-21} \text{J}$ and 484m/s respectively. Assuming ideal gas nature the corresponding values at 600K are respectively.
- (A) $12.42 \times 10^{-21} \text{J}$, 968 m/s (B) $8.78 \times 10^{-21} \text{J}$, 684 m/s
(C) $6.21 \times 10^{-21} \text{J}$, 968 m/s (D) $12.42 \times 10^{-21} \text{J}$, 684 m/s
36. Which of the following graphs correctly represents the variation of $\beta \left[\beta = - \left(\frac{dV}{dP} \right) / V \right]$ with P for an ideal gas at constant temperature?
- (A)  (B) 
- (C)  (D) 
37. A monoatomic ideal gas at temperature T_1 , is enclosed in a cylinder fitted with piston. The gas is allowed to expand adiabatically to a temperature T_2 by releasing the piston slowly. If L_1 and L_2 are lengths of the gas columns before and after expansion respectively, then T_1/T_2 is given by;
- (A) $\left(\frac{L_1}{L_2} \right)^{1/3}$ (B) $\frac{L_1}{L_2}$ (C) $\frac{L_2}{L_1}$ (D) $\left(\frac{L_2}{L_1} \right)^{2/3}$
38. The pressure-volume work for an ideal gas can be calculated by using the expression $W = \int_{V_i}^{V_f} P_{\text{ex}} dV$. The work can also be calculated from the PV-plot by using the area under the curve within the specified limits. When an ideal gas is compressed (i) reversibly or (ii) irreversibly from volume V_i to V_f . Choose the correct option. (Consider magnitude only)
- (A) $W_{\text{reversible}} = W_{\text{irreversible}}$ (B) $W_{\text{reversible}} < W_{\text{irreversible}}$
(C) $W_{\text{reversible}} > W_{\text{irreversible}}$ (D) $W_{\text{reversible}} = W_{\text{irreversible}} + P_{\text{ex}} \Delta V$
39. ΔH for solid to liquid transition for two substances A and B is $2.73 \text{ k cal mol}^{-1}$ and $3.0 \text{ k cal mol}^{-1}$ respectively. The melting points are 0°C and 30°C respectively. The entropy changes ΔS_A and ΔS_B at two transition temperatures are released as:
- (A) $\Delta S_A = \Delta S_B$ (B) $\Delta S_A < \Delta S_B$ (C) $\Delta S_A > \Delta S_B$ (D) $\Delta S_B = \frac{300 \Delta S_A}{273}$
40. For the process $H_2O(\ell) \longrightarrow H_2O(g)$ at $T = 100^\circ\text{C}$ and 1 atmosphere pressure, the correct choice is:
- (A) $\Delta S_{\text{system}} > 0$ and $\Delta S_{\text{surrounding}} > 0$ (B) $\Delta S_{\text{system}} > 0$ and $\Delta S_{\text{surrounding}} < 0$
(C) $\Delta S_{\text{system}} < 0$ and $\Delta S_{\text{surrounding}} > 0$ (D) $\Delta S_{\text{system}} < 0$ and $\Delta S_{\text{surrounding}} < 0$
41. 1 gram sample of NH_4NO_3 is decomposed in a bomb calorimeter. The temperature of the calorimeter increases by 6.12 K. The heat capacity of the system 1.23 kJ/g-deg. What is the molar heat of decomposition for NH_4NO_3 ?
- (A) -7.53 kJ/mol (B) -398.1 kJ/mol (C) -16.1 kJ/mol (D) -602 kJ/mol

42. For a reaction $\Delta C_p = 2.0 + 0.2T \text{ cal/}^\circ\text{C}$ and enthalpy of reaction at 10 K is -14.2 Kcal . The enthalpy of this reaction at 100 K in kcal is:
 (A) -13.21 (B) -16.02 (C) -15.3 (D) 7.08
43. The standard enthalpies of formation of $\text{CO}_2(\text{g})$, $\text{H}_2\text{O}(\ell)$ and glucose(s) at 25°C are -400 kJ/mol , -300 kJ/mol and -1300 kJ/mol , respectively. The standard enthalpy of combustion per gram of glucose at 25°C is :
 (A) $+2900 \text{ kJ}$ (B) -2900 kJ (C) -16.11 kJ (D) $+16.11 \text{ kJ}$
44. Two solids A and B shows the following equilibrium in a vessel:

$$\text{A}(\text{s}) \rightleftharpoons \text{X}(\text{g}) + 2\text{Y}(\text{g}); \quad K_{p_1} = 9 \times 10^{-3}$$

$$\text{B}(\text{s}) \rightleftharpoons \text{Z}(\text{g}) + 2\text{Y}(\text{g}); \quad K_{p_2} = 4.5 \times 10^{-3}$$
 What will be the total pressure over a mixture of A and B in atm?
 (A) 0.45 (B) 0.60 (C) 0.35 (D) 0.75
45. How many mole of glycerine should be added to 1 litre of $1\text{M H}_3\text{BO}_3$ so that 80% of Boric acid produce boric acid-glycerine complex.

$$\text{H}_3\text{BO}_3 + \text{Glycerine} \rightleftharpoons \text{Complex}; K_c = 0.9$$
 (A) 4.52 (B) 5.24 (C) 2.54 (D) 3.24
46. The value of ΔU° for the reaction $2\text{A}(\text{g}) + \text{B}(\text{g}) \rightleftharpoons \text{A}_2\text{B}(\text{g})$ for which $K_p = 1.0 \times 10^{-10} \text{ atm}^{-2}$ and $\Delta S^\circ = 5 \text{ JK}^{-1}$ and $T = 300 \text{ K}$, is
 (A) 53.93 kJ (B) 63.93 kJ (C) 56.24 kJ (D) 68.24 kJ
47. An acid type indicator, HIn differs in colour from its conjugate base (In^-). The human eye is sensitive to color differences only when the ratio $[\text{In}^-]/[\text{HIn}]$ 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 ($K_a = 1.0 \times 10^{-5}$)?
 (A) 5 (B) 2 (C) 6 (D) 1
48. 0.1 mole of CH_3NH_2 ($K_b = 5 \times 10^{-4}$) is mixed with 0.08 mole of HCl and diluted to one litre. The $[\text{H}^+]$ in solution is:
 (A) $8 \times 10^{-2} \text{ M}$ (B) $8 \times 10^{-11} \text{ M}$ (C) $1.6 \times 10^{-11} \text{ M}$ (D) $8 \times 10^{-5} \text{ M}$
49. $\text{Ca}_3(\text{PO}_4)_2$ is insoluble in water. On adding a few drops of HCl to solid $\text{Ca}_3(\text{PO}_4)_2$ in contact with water, the solid dissolves. The reason is:
 (A) The solvent becomes more polar on adding HCl
 (B) $\text{Ca}_3(\text{PO}_4)_2$ combines with HCl to form soluble CaCl_2
 (C) $\text{Ca}(\text{H}_2\text{PO}_4)_2$ is formed, which dissolves in water
 (D) H_3PO_4 , a weak acid is formed and the solubility product of $\text{Ca}_3(\text{PO}_4)_2$ decreases
50. The degree of hydrolysis of a salt of weak acid and weak base in its 0.1M solution is found to be 50%. If the molarity of the solution is 0.2M, the percentage hydrolysis of the salt should be:
 (A) 100% (B) 50% (C) 25% (D) 10%
51. The solubility of lithium sodium hexafluoroaluminate, $\text{Li}_3\text{Na}_3(\text{AlF}_6)_2$ is $s \text{ mol litre}^{-1}$. Its solubility product is equal to:
 (A) s^8 (B) $12s^3$ (C) $18s^3$ (D) $2916s^8$

52. Polyethylene can be produced from calcium carbide according to the following sequence of reactions:
 $\text{CaC}_2 + \text{H}_2\text{O} \rightarrow \text{CaO} + \text{HC}\equiv\text{CH}$
 $n(\text{HC}\equiv\text{CH}) + n\text{H}_2 \rightarrow -(\text{CH}_2 - \text{CH}_2)_n$
 The mass of polyethylene which can be produced from 20.0 kg of pure CaC_2 is:
 (A) 6.75 kg (B) 7.75 kg (C) 8.75 kg (D) 9.75 kg
53. An inorganic compound $\text{YBa}_2\text{Cu}_3\text{O}_7$ is used as semiconductor. It is prepared from Y_2O_3 , BaO_2 and CuO . The ratio of their mole in one mole of $\text{YBa}_2\text{Cu}_3\text{O}_7$ is :
 (A) 1:2:3 (B) 1:2:4 (C) 3:2:1 (D) 1:4:6
54. The molecular formula of a commercial resin used for exchanging ions in water softening is $\text{C}_8\text{O}_7\text{SO}_3\text{Na}$ (Mol. Wt. 206). What would be the maximum uptake of Ca^{2+} ions by the resin when expressed in mole per gram resin?
 (A) $\frac{1}{103}$ (B) $\frac{1}{206}$ (C) $\frac{2}{309}$ (D) $\frac{1}{412}$
55. One gram of mixture of Na_2CO_3 and NaHCO_3 consumes y equivalent of HCl for complete neutralization. One gram of the mixture is strongly heated, then cooled and the residue treated with HCl . How many equivalent of HCl would be required for complete neutralization?
 (A) $2y$ equivalent (B) y equivalent (C) $3y/4$ equivalent (D) $3y/2$ equivalent
56. The equivalent mass of HCl in the given redox change is:
 $\text{K}_2\text{Cr}_2\text{O}_7 + 14\text{HCl} \rightarrow 2\text{KCl} + 2\text{CrCl}_3 + 3\text{Cl}_2 + \text{H}_2\text{O}$
 (A) 85.1 (B) 36.5 (C) 73.0 (D) 35.5
57. Two mole of FeSO_4 are oxidized by x mole of KMnO_4 in acid medium, whereas 3 mole of $\text{Fe}_2(\text{C}_2\text{O}_4)_3$ are oxidized completely by y mole of $\text{K}_2\text{Cr}_2\text{O}_7$ in acid medium. The value of $\frac{x}{y}$ is :
 (A) $\frac{6}{5}$ (B) $\frac{2}{15}$ (C) $\frac{18}{15}$ (D) $\frac{3}{5}$
58. For the electrons of oxygen atom, which of the following statements is correct?
 (A) Z_{eff} for an electron in a 2s orbital is the same as Z_{eff} for an electron in a 2p orbital
 (B) An electron in the 2s orbital has the same energy as an electron in the 2p orbital
 (C) Z_{eff} for an electron in 1s orbital is the same as Z_{eff} for an electron in a 2s orbital
 (D) The two electrons present in the 2s orbital have spin quantum numbers, m_s but of opposite sign
59. The potential energy of the electron present in the ground state of Li^{2+} on is represented by:
 (A) $+\frac{3e^2}{4\pi\epsilon_0 r}$ (B) $-\frac{3e}{4\pi\epsilon_0 r}$ (C) $-\frac{3e^2}{4\pi\epsilon_0 r^2}$ (D) $-\frac{3e^2}{4\pi\epsilon_0 r}$
60. If the nitrogen atom had electronic configuration $1s^7$, it would have energy lower than that of the normal ground state configuration $1s^2 2s^2 2p^3$, because the electrons would be close to the nucleus. Yet $1s^7$ is not observed because it violates:
 (A) Heisenberg's uncertainty principle (B) Hund's rule
 (C) Pauli's exclusion principle (D) Bohr postulate of stationary orbits

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TW TEST (3 YRS.) MAIN

DATE: 14/09/18

TOPIC: FULL PHYSICAL CHEMISTRY

ANSWER KEY

31. (B)	32. (D)	33. (D)	34. (B)	35. (D)
36. (A)	37. (D)	38. (B)	39. (C)	40. (B)
41. (D)	42. (A)	43. (C)	44. (A)	45. (B)
46. (A)	47. (B)	48. (B)	49. (B)	50. (B)
51. (D)	52. (C)	53. (D)	54. (D)	55. (B)
56. (A)	57. (B)	58. (D)	59. (D)	60. (C)