

JEE-ADVANCE-2011-P2-Model

Time: 03:00 Hr's

IMPORTANT INSTRUCTIONS

Max Marks: 240

CHEMISTRY

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I (Q.N : 1 – 8)	Questions with Single Correct Choice	3	-1	8	24
Sec – II (Q.N : 9 – 12)	Questions with Multiple Correct Choice	4	0	4	16
Sec – III (Q.N : 13 – 18)	Questions with Integer Answer Type	4	0	6	24
Sec – IV (Q.N : 19 – 20)	Matrix Matching Type	8	0	2	16
Total				20	80

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I (Q.N : 21 – 28)	Questions with Single Correct Choice	3	-1	8	24
Sec – II (Q.N : 29 – 32)	Questions with Multiple Correct Choice	4	0	4	16
Sec – III (Q.N : 33 – 38)	Questions with Integer Answer Type	4	0	6	24
Sec – IV (Q.N : 39 – 40)	Matrix Matching Type	8	0	2	16
Total				20	80

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I (Q.N : 41 – 48)	Questions with Single Correct Choice	3	-1	8	24
Sec – II (Q.N : 49 – 52)	Questions with Multiple Correct Choice	4	0	4	16
Sec – III (Q.N : 53 – 58)	Questions with Integer Answer Type	4	0	6	24
Sec – IV (Q.N : 59 – 60)	Matrix Matching Type	8	0	2	16
Total				20	80

SECTION-1
(SINGLE CORRECT CHOICE TYPE)

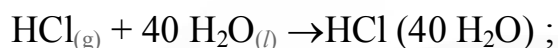
Section-I (Single Correct Answer Type, Total Marks: 24) contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**. For each question you will be awarded 3 marks if you darken **ONLY** the bubble corresponding to the correct answer and zero marks if no bubble is darkened. In all other cases, minus one (-1) mark will be awarded.

1. We consider a growing plant, limiting our system to the plant itself, to be an example of decreasing entropy. Small molecules, like carbon dioxide, (CO_2) and water (H_2O) are converted into complex but orderly arrangement of macromolecules. Which one of the following statements applies here ?
- A) The second law of thermodynamics, that the entropy of the universe is increasing, is being violated
- B) Plant growth is so complex that the laws of thermodynamics cannot be applied accurately
- C) The second law of thermodynamics is not being violated because the entropy of the plant's surroundings is increasing
- D) The second law of thermodynamics is not being violated because the entropy of the plant's surroundings is decreasing

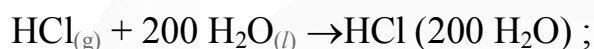
2. The factors that does not influence the heat of reaction are -
- A) The physical state of reactants and products
 - B) The temperature
 - C) The pressure or volume
 - D) The method by which the final products are obtained from same initial reactants
3. 20 litre of an ideal gas, present in a piston fitted cylinder at 10 atm is allowed to expand in a process in which P/V is a constant. If final volume of gas is 60 litre, then work done by gas is -
- A) 81.1 kJ B) – 81.1 kJ C) 40.56 kJ D) – 40.56 kJ
4. A gas is cooled such that it loses 400 J of heat into surroundings. If during cooling gas contracts against external pressure of 2 atm by a volume of 5 litre, then change in internal energy of gas is -
- A) 410 J B) – 390 J C) 390 J D) 613.25 J

5. At higher temperature molar heat capacity of gases (Assuming ideal behavior) increases because -
- A) K.E. of gas increases
 - B) Rotational and vibrational degrees of freedom also activate
 - C) P.E. of gas increases
 - D) Both (A) and (B)
6. One mole of an ideal gas at 300 K was first heated at constant volume to a new state (X) where the temperature is 400 K. In the second step, gas was expanded freely against vacuum to another state (Y) where volume was twice to the volume at X. Finally the gas was cooled adiabatically and reversibly to a new state(Z) where the temperature was 300 K and volume was twice to the volume at Y. ΔH for the entire process is -
- (given : $\ln 4/3 = 0.2876$; $\ln 2 = 0.693$)
- A) 0 J B) 2000 J C) - 2000 J D) None of these

7. Given :



$$\Delta_r H = -73 \text{ kJ/mol}$$



$$\Delta_r H = -74 \text{ kJ/mol}$$

By above data integral enthalpy of dilution of $\text{HCl}(40 \text{H}_2\text{O})$ into $\text{HCl}(200 \text{H}_2\text{O})$ is -

A) -74 kJ/mol B) -73 kJ/mol C) -1 kJ/mol D) $+1 \text{ kJ/mol}$

8. For a isothermal expansion of an ideal gas

$$\Delta S = nR \ln \frac{V_2}{V_1} \text{ for -}$$

A) Reversible process

B) For irreversible process

C) For free expansion

D) All A, B, C are correct

SECTION-2

(MORE THAN ONE TYPE)

Section - II (Multiple Correct Answers Type, Total Marks: 16) contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE or MORE may be correct. For each question you will be awarded 4 marks if you darken ALL the bubble(s) corresponding to the correct answer(s) ONLY and zero marks otherwise. There are no negative marks in this section.

9. In which of the following process entropy increases ?

A) Rusting of iron

B) Vaporizations of Camphor

C) Crystallisation of sugar from syrup

D) Atomizations of dihydrogen

- 10 Two moles of a monoatomic ideal gas ($C_V = 1.5R$) initially at 400 K in an isolated, 1.0 L, container piston is allowed to expand against a constant pressure of a 1.0 atm till the final volume reaches to 10 L. Which of the following conclusions regarding the above changes(s) is (are) true ?
- A) The final temperature of the gas is 363.5 K (approx)
- B) If the same process were carried out to the same final volume but under reversible conditions, final temperature would have been less than 363 K
- C) In the above process (Given in the question) the initial and final temperatures and volumes are related as $\left(\frac{T_1}{T_2}\right) = \left(\frac{V_2}{V_1}\right)^{\gamma-1}$
- D) Entropy change of a system (ΔS_{system}) is zero
11. Which of the following thermodynamic relation(s) is (are) correct ?
- A) In a cyclic process, $\oint dS = 0$ (at constant P)
- B) $\Delta G = -T\Delta S_{\text{univ}}$ (at any conditions of T & P)
- C) $\left(\frac{\partial G}{\partial T}\right)_p = -S$
- D) $\Delta G = \Delta G^\circ + RT \ln Q$, Q = reaction quotient

12. An ideal gas expands from volume V_1 to V_2 . This may be achieved by any of the three processes : isobaric, isothermal and adiabatic. Let ΔE be the change in internal energy of the gas, Q be the heat given to the system. Identify which of the following statements is not true for ΔE ?
- A) ΔE is the least in the adiabatic expansion
 - B) ΔE is the greatest in the adiabatic expansion
 - C) ΔE is greatest under isobaric process
 - D) ΔE in isothermal process lies in-between the values obtained under isobaric and adiabatic process

SECTION-3
[INTEGER TYPE]

Section-III (Integer Answer Type, Total Marks: 24) contains 6 questions. The answer to each of the questions is a single-digit integer, ranging from 0 to 9. The bubble corresponding to the correct answer is to be darkened in the ORS. For each question you will be awarded 4 marks if you darken ONLY the bubble corresponding to the correct answer and zero marks otherwise. There are no negative marks in this section.

13. At 25°C , the enthalpy change, ΔH° for the ionization of trichloroacetic acid is $+6.3\text{kJ mol}^{-1}$ and the entropy change, ΔS° is $+0.0084\text{kJ mol}^{-1}\text{K}^{-1}$. The $|pK_a|$ of trichloroacetic acid is x then ' x ' multiplied by 3.0303 is

14. For a reaction $M_2O(s) \rightarrow 2M(s) + \frac{1}{2}O_2(g)$; $\Delta H = 30 \text{ kJ mol}^{-1}$ and $\Delta S = 0.07 \text{ kJ mol}^{-1}$ at 1 atm . If the temperature at which reaction becomes non spontaneous is T then $\frac{T}{60}$ is

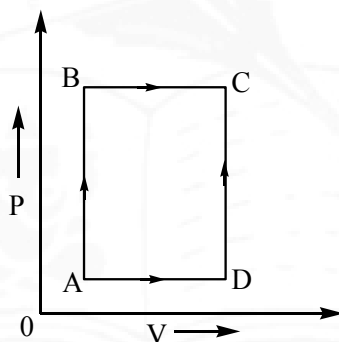
15. For the reaction,
 $4C(\text{graphite}) + 5H_2(g) \longrightarrow n - C_4H_{10}(g)$;
 $\Delta H^0 = -124.73 \text{ kJ mol}^{-1}$
 $\Delta S^0 = -365.8 \text{ J K}^{-1} \text{ mol}^{-1}$
 $4C(\text{graphite}) + 5H_2(g) \longrightarrow \text{iso} - C_4H_{10}(g)$
 $\Delta H^0 = -131.6 \text{ kJ mol}^{-1}$
 $\Delta S^0 = -381.079 \text{ J K}^{-1} \text{ mol}^{-1}$

Indicate whether normal butane can be spontaneously converted to iso-butane or not (Mark 3 for YES and 5 for NO)

16. From the following data, if the heat of solution of KI is x then $\left(\frac{x+7}{10}\right)$ is

Lattice energy (kJ/mole)	<i>NaCl</i> 788	<i>NaI</i> 696	<i>KCl</i> 699	<i>KI</i> 632
Heat of solution (kJ/mole)	4.0	5.0	17.0	?

17. The bond energy of H_2 is $104.3 \text{ kcal mol}^{-1}$. Then how many of the following statements are true. (N_A = avagadro's number)
- A) 104.3 kcal heat is required to break N_A bonds in N_A molecules of H_2
 - B) 104.3 kcal heat is required to break up N_A molecules to $2 N_A$ atoms of H
 - C) 104.3 kcal heat is evolved during combination of $2 N_A$ atoms of H to form N_A molecules of H_2
 - D) Heat of formation of H -atom $= \frac{1}{2} \times$ Bond energy of $H-H$
18. A thermodynamic process is shown in the following figure. The pressure and volume corresponding to some point in the figure are:
 $P_A = 3 \times 10^4 \text{ Pa}$; $P_B = 8 \times 10^4 \text{ Pa}$; $V_A = 2 \times 10^3 \text{ cm}^3$; $V_D = 5 \times 10^3 \text{ cm}^3$ in the pressure AB, 600J of heat is added to the system and in BC, 200J of heat is added to the system. If the change in internal energy of the system in the process AC is Z: then $\frac{Z}{80}$ is



SECTION-4**[Matrix Matching Type]**

Section-IV (Matrix-Match Type, Total Marks: 16) contains 2 questions. Each question has four statements (A, B, C and D) given in Column I and five statements (p, q, r, s and t) in Column II. Any given statement in Column I can have correct matching with ONE or MORE statement(s) given in Column II. For example, if for a given question, statement B matches with the statements given in q and r, then for the particular question, against statement B, darken the bubbles corresponding to q and r in the ORS. For each question you will be awarded 2 marks for each row in which you have darkened ALL the bubble(s) corresponding to the correct answer(s) ONLY and zero marks otherwise. Thus, each question in this section carries a maximum of 8 marks. There are no negative marks in this section.

19. Match the columns :**Column-I**

- A) dE
- B) dH
- C) dS (1 mole)
- D) dG

Column-II

- P) $C_V \frac{dT}{T} + R \frac{dV}{V}$
- Q) $V dP - S dT$
- R) $dq + V dP$
- S) $dq - PdV$

20. Column-I

- A) Ideal gas expands in Vacuum isothermally
- B) Real gas expands in vacuum adiabatically
- C) Ideal gas expands reversibly and isothermally
- D) Ideal gas expands reversibly and adiabatically

Column-II

- P) $\Delta S_{sys} = 0$
- Q) $\Delta S_{sur} = 0$
- R) $\Delta S_{total} = 0$
- S) $\Delta S_{total} = +Ve$