JEE-ADVANCED-2011-P1-Model

Time: 3:00 Hrs.   IMPORTANT INSTRUCTIONS   Max Marks: 240

CHEMISTRY

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I (Q.N : 1 – 7)	Questions with Single Correct Choice	3	-1	7	21
Sec – II(Q.N : 8 – 11)	Questions with Multiple Correct Choice	4	0	4	16
Sec – III(Q.N : 12 – 16)	Questions with Comprehension Type (2 Comprehensions – 2 + 3 = 5Q)	3	-1	5	15
Sec – IV(Q.N : 17 – 23)	Questions with Integer Answer Type	4	0	7	28
	Total			23	80

PHYSICS

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 24 – 30)	Questions with Single Correct Choice	3	-1	7	21
Sec – II(Q.N : 31 – 34)	Questions with Multiple Correct Choice	4	0	4	16
Sec – III(Q.N : 35 – 39)	Questions with Comprehension Type (2 Comprehensions – 2 + 3 = 5Q)	3	-1	5	15
Sec – IV(Q.N : 40 – 46)	Questions with Integer Answer Type	4	0	7	28
	Total			23	80

MATHEMATICS

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 47 – 53)	Questions with Single Correct Choice	3	-1	7	21
Sec – II(Q.N : 54 – 57)	Questions with Multiple Correct Choice	4	0	4	16
Sec – III(Q.N : 58 – 62)	Questions with Comprehension Type (2 Comprehensions – 2 + 3 = 5Q)	3	-1	5	15
Sec – IV(Q.N : 63 – 69)	Questions with Integer Answer Type	4	0	7	28
	Total			23	80

CHEMISTRY   **Max. Marks: 80**

SECTION – I
(SINGLE CORRECT CHOICE TYPE)

This section contains **7 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** is correct

1. The bond enthalpy (in kJ/mol) of each three centre two electron bond in

    $B_2H_6 \left\{ B-H-B \rightarrow 2B_{(g)} + H_{(g)} \right\}$ from the given data $\Delta H_f^0 \left[BH_{3(g)} \right] = 100 KJ/mol$ is,

    $\Delta H_{atm} \left[B_{(s)} \right] = 565 KJ/mol$

    $\Delta H_f^0 \left[B_2H_{6(g)} \right] = 36 kJ/mol$

    $\Delta H_{atm} \left[H_{2(g)} \right] = 436 kJ/mol$

    A) 498   B) 455   C) 320   D) 550

2. When equal masses of two substances, A & B absorb same amount of energy,

    The increase in temperature of A is found to be 4 degrees and that of B is 8

    degrees. Which of the following statement is correct?

    A) the specific heat of A is double that of B.

    B) the specific heat of B is double that of A.

    C) the specific heat of B is negative.

    D) the specific heat of B is triple that of A

3.   The enthalpy of combustion of methane gas in terms of given data is. Bond

energy (kJ/mol) of $\underset{X_1}{e_{C-H}}, \underset{X_2}{e_{O-H}}, \underset{X_3}{e_{C=O}}, \underset{X_4}{e_{O=O}}$

Resonance energy of CO_2 is Y kJ/mol (Y is a positive quantity)

$\Delta H_{Vaporization}(H_2O,l) = Z \, kJ/mol$

A) $4X_1 + 2X_4 - 2X_3 - 4X_2 + Y + 2Z$ B) $4X_1 + 2X_4 - 2X_3 - 4X_2 + Y - 2Z$

C) $4X_1 + 2X_4 - 2X_3 - 4X_2 - Y + 2Z$ D) $4X_1 + 2X_4 - 2X_3 - 4X_2 - Y - 2Z$

4. ΔC_p for a reaction is given by 2.0+0.2Tcal / K. Its enthalpy of reaction at 10K is

-14. 2 Kcal/mol. Its enthalpy of reaction at 100 K in Kcal/mol will be

A) -13.03   B) -16.02   C) -15.3   D) 7.08

5.   Entropy change for the transition will be approximately

$H_2O(l,1atm,100°C) \rightarrow H_2O(g,1atm,110°C)$ given $\Delta H_{VaP} = 40KJ/mol \cdot \left(\log \frac{383}{373} = 0.01148 \right)$

$C_{P(l)} = 75J/mol/K$

$C_{P(g)} = 35J/mol/K$

A) $108.16KJ/K/mol$ B) $150KJ/K/mol$

C) $89KJ/K/mol$ D) $243KJ/K/mol$

6. Enthalpy of neutralisation of a weak monobasic acid HA in 1M solution with a strong base is -56.1 kJmol^{-1} whereas the enthalpy of ionisation of the acid is 1.5 kJ. If the enthalpy of neutralisation of strong acid and strong base is -57.3 kJ, what will be the % ionisation of the weak acid?

   A) 10 B) 20 C) 25 D) 80

7. Certain mass of a gas is expanded from (1L, 10 atm.) to (4L, 5 atm.) against a constant external pressure of 1 atm. If initial temperature of gas is 300K and heat capacity is 50 J per degree, then internal energy change in kJ during the process will be (1Latm = 100 J)

   A) 15 B) 15.7 C) 14.4 D) 14.7

SECTION – II
(MORE THAN ONE TYPE)

This section contains 4 **multiple choice questions.** Each question has four choices a), b), c), d) out of which **ONE OR MORE** may be correct.

8. Which of the following statements are CORRECT ?

   A) $\left|\left(W_{rev}\right)_{isothermal}\right|_{exp.} > \left|\left(W_{irr}\right)_{isothermal}\right|_{exp.}$

   B) ΔG^{o} is always zero at equilibrium

   C) ΔG and ΔS_{total} are always zero at equilibrium

   D) All reversible adiabatic processes are isentropic

9.   Which of the following is/are TRUE in case of reversible isothermal expansion of an ideal gas?

A) W is +ve   B) $\Delta H = 0$ C) $\Delta S_{gas} > 0$ D) $\Delta G > 0$

10.   Which of the following is/are always negative ?

A) enthalpy of fusion   B) enthalpy of neutralisation

C) enthalpy of hydrogenation   D) enthalpy of solution

11.   Which of the following is/are correct ?

A) For an isothermal process, $\Delta H = 0$, $\Delta E = 0$ but W_{exp} or $W_{comp} \neq 0$ for ideal gases

B) For an adiabatic reversible process, q=0, $\Delta S_{sys} = \Delta S_{surr} = 0$, however work is done

by the system at the expense of internal energy.

C) In case of cyclic processes change in state function = 0

D) Adiabatic irreversible process is an isoentropic process

SECTION – III
(PARAGRAPH TYPE)

This section contains 2 **paragraphs.** Each of these questions has four choices a), b), c) and d) out of which ONLY ONE is correct

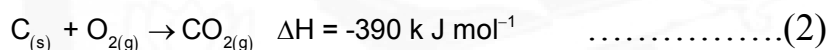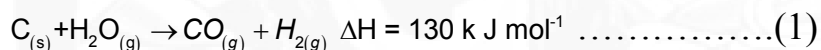**Paragraph for Questions Nos. 12 to 14**

The enthalpy of formation of a compound is the enthalpy change, ΔH_f when one

mole of a compound at its standard state is formed from its elements in their

standard states. For elements in their standard states ΔH_f is taken to be zero.

Enthalpy of combustion of a compound is the enthalpy change, ΔH when one mole of a compound is burnt in excess of oxygen at constant pressure. Enthalpy of a reaction, ΔH is similarly defined) The basis of such calculations is Hess's law. If a reaction occurs in several steps, then the total enthalpy change $\Delta H = \sum_i \Delta H_i$ where,

ΔH_i is the enthalpy change in the ith step

12. Consider the two reactions undergone by carbon:

$C_{(s)} + H_2O_{(g)} \to CO_{(g)} + H_{2(g)}$ $\Delta H = 130 \text{ k J mol}^{-1}$ ……………(1)

$C_{(s)} + O_{2(g)} \to CO_{2(g)}$ $\Delta H = -390 \text{ k J mol}^{-1}$ ……………(2)

Assume that both reactions are conducted in such a way that the endothermicity of (1) is just balanced by the exothermicity of (2). Neglecting heat losses and all other possible reactions such as $C_{(s)} + \frac{1}{2}O_{2(g)} \to CO_{(g)}$ or $CO_{(g)} + \frac{1}{2}O_{2(g)} \to CO_{2(g)}$ etc)

The ratio in which one mole of carbon is consumed in reactions (1) and (2) is

A) 3 : 2   B) 3 : 1   C) 1 : 1   D) 2 : 1

13.   Given $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$ ΔH = -90 k cal mol^{-1} and

$C_{(s)} + \frac{1}{2}O_{2(g)} \rightarrow CO_{(g)}$ ΔH = -30 k cal mol^{-1}; in a certain experiment utilizing a limited

quantity of oxygen only 60k.cal energy is released per mole of carbon oxidized.
The mole fraction of CO_2 is.
A) 0.41   B) 0.51   C) 0.50   D) 0.46

14.   Given $\Delta_f H$ values of $CO_{(g)}$ and $CO_{2(g)}$ are respectively -30 k cal mol^{-1} and

-90 k cal mol^{-1} at 298K, The ratio $\dfrac{-\Delta H}{n_{O_2}}$ i.e., $\dfrac{\text{heat liberated(Kcal)}}{\text{no of moles of } O_2 \text{ consumed}}$ when one

mole of carbon is oxidized and 0.25 mole of carbon forms $CO_{(g)}$, is

A) 85.71   B) 73.8   C) 63.7   D) 67.3

Paragraph for Questions Nos. 15 to 16

One mole of a monoatomic gas is subjected to the following three steps:
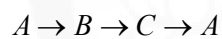
$A \rightarrow B \rightarrow C \rightarrow A$

$\overline{C_V} = 12.5J$
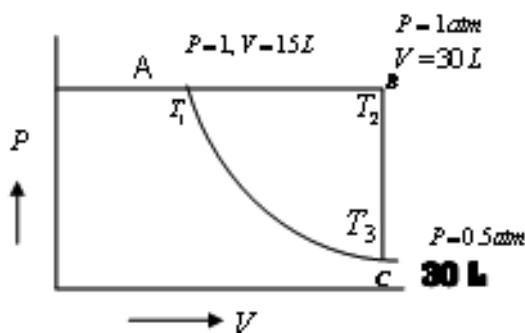
15. ΔU of the process $(B \rightarrow C)$

A) $7.07kJ$ B) $-2.28kJ$ C) $+6.08kJ$ D) Zero

16. ΔS for the over all process $(A \rightarrow B \rightarrow C \rightarrow A)$

A) $1218 J/K$ B) $609 J/K$ C) Zero   D) $-5.86 J/K$

SECTION – IV
INTEGER TYPE

(This section contains **7 questions.** The answer to each question is a single digit integer ranging from 0 to 9. The correct digit below the question number in the ORS is to be bubbled)

17.   How many of the following properties belongs to intensive properties

I) temperature   II) Mass   III) Energy   IV) Density

V) Refractive index   VI) Entropy   VII) Electro motive force

18.   One mole of helium gas changes its state from (10atm, 100k) to (1atm,1000k).

The change in entropy is $(2.3)X$ $cal\,K^{-1}$. What is 'X' (R= 2 cal/mol K)

19.   When 100ml of 1 M H_3PO_3 is neutralized completely by 1M NaOH the heat

liberated is 10.668 KJ. If enthalpy of neutralization of HCl by $NaOH$ is -55.84 KJ

mol^{-1}. The ΔH ionization of H_3PO_3 is _____ KJ/mole.

20. When a system is taken from state A to B along path ACB, as shown in the figure, 8J of heat flows into system and system does 3J of work. How much heat flows into the system along the path ADB, if the work done by the system is 4J
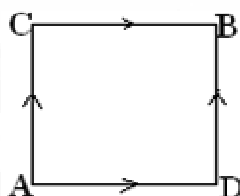
21. At 500 Kbar pressure density of diamond and graphite are 3gm /cc and 2 gm / cc respectively at a certain temperature T. $|\Delta H - \Delta U|$ (in KJ / mol) for the conversion of 1 mole of graphite to 1 mole of diamond at 500 Kbar pressure [Given 1 bar = 10^5 N / m^2] is 10^X. The value of 'X' is

22. 10 gm of Helium gas is subjected to reversible compression from 10 litres to 5 liters at 27°C. What is change in internal energy

23. A constant engine operates between temperatures 800 K and 600 K .It absorbs 80 Cal of heat from the source. If heat rejected to the sink is '10x' , value of 'x' is