26-3-18

DOON UNIVERSITY, DEHRADUN
Mid Semester Examination, March, 2018
Department of Chemistry, School of Physical Sciences
Integrated M.Sc. Chemistry (II Semester)
Course: CYC−152: Physical Chemistry-II

Time Allowed: 2 Hours. *Maximum Marks: 30*

Note: Attempt All Questions

SECTION: A

Attempt All Questions.

(Marks: 6Q × 1= 6)

1. Six moles of an ideal gas expand isothermally and reversibly from a volume of 1 dm^3 to a volume of 10 dm^3 at 27 degrees centigrade. What is the maximum work done in joules?
2. Draw an energy level diagram for burning of petrol in air.
3. State the thermodynamic criteria for adiabatic irreversible process.
4. Give an example of an isoenthalpic process.
5. Establish the relationship between q_p and q_v in the Haber syntheses of ammonia assuming that the gaseous reactants and products are ideal.
6. What is the work done in irreversible isothermal expansion of real gas?

SECTION: B

Attempt All Questions.

(Marks:6Q × 2=12)

7. Let 1.00 kg of liquid water at 100°C be converted to steam at 100°C by boiling at standard atmospheric pressure (1 atm) as shown. The volume of that water changes from an initial value of $1.00 \times 10^{-3} m^3$ as a liquid to 1.671 m^3 as steam.
8. State Hess's law of constant heat summation and explain its applications.
9. Derive an expression for irreversible adiabatic expansion for ideal gases and calculate the final temperature of the gas under these conditions.
10. Define the enthalpy of combustion and enthalpy of formation. Calculate enthalpy of formation of glucose, given the enthalpy of formation values for carbon dioxide and water are -393.5 and -285.9 kJ/mol respectively.
11. Derive an expression for inversion temperature and use this expression to calculate the inversion temperature of hydrogen. Given a= 0.246 $dm^6 atm\ mol^{-2}$ and b= $2.67 \times 10^{-2}\ dm^3\ mol^{-1}$.

12. One mole of naphthalene was burnt in oxygen at constant volume to give carbon dioxide and liquid water at 25°C. The heat evolved was found to be 5138.8 kJ. Calculate the enthalpy of the reaction.

SECTION: C

Attempt All Questions.

(Marks:3 Q × 4=12)

13. Distinguish between isothermal and adiabatic processes. Drive the relation between temperature and volume and that between temperature and pressure in reversible expansion of an ideal gas.
14. Derive an expression for variation of enthalpy of reaction with temperature for conditions (a) T_2-$T_1 \leq$ 20°C and (b) T_2-T_1 = 300°C
15. What is Joule –Thomson effect. Derive an expression for Joule –Thomson coefficient and calculate its value for an ideal gas.