**Activity oriented Lesson plan 3 T**

1. Preliminary Details

Name of the Teacher : Shanavas K.E Standard : XI Science

Name of the Institution : JHSS Thandekkad Time : 45 Minutes

Subject : Chemistry

Unit : VI

Chapter : Thermodynamics

Topic : measurement of internal energy changes isothermal expansion

of gas, Enthalpy H

1. Types of knowledge
2. Factual knowledge

Terms : internal energy change isothermal expansion of gas, Enthalpy H.

Facts : 1) The heat evolved or absorbed at constant volume is the internal

energy change.

2) The heat evolved or absorbed at constant pressure is the enthalpy

change.

1. Conceptual knowledge

Concepts : Internal energy change Enthalpy H, enthalpy change

Definitions : 1) The change in internal energy of a system is equal to heat evolved or absorbed at constant temperature and volume**. v**

2) Enthalpy H is the sum total of internal energy and pressure-volume change (work) of the system.

3) The enthalpy change is the heat evolved or absorbed at constant temperature and pressure. **p**

1. Procedural Knowledge

Internal energy change and its measurement using Bomb calorimeter

Steps

1. Write the equation of Ist law of T.D
2. If work is pressure volume change and is done on the system. w = p
3. If process is carried out at constant volume **v (**from 1st law of T.D .
4. Displaying Bomb calorimeter diagram.
5. Discussing the measurement of
6. Meta Cognitive knowledge

The student can acquire the awareness of knowledge, thinking and learning strategies in above-mentioned facts and Concepts.

III Instructional Objectives and learning Outcomes

The students will be able to choose, define, explains, solves, draws, applies, suggest, generate, infer, assess and create the above-mentioned facts and concepts.

IV Previous knowledge.

The students have the knowledge about Enthalpy H and Enthalpy change ΔH.

V Learning Aids

1. Definition, equation of U, and work done in isothermal expansion or compression of gas (chart)
2. Photo of measurement of (internal energy change.)

**Constructivist learning Design**

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| Activity | Student response with Assessment |
| **Phase 1 Situation**  Can you give the first thermodynamic function and first law of T.D  **Phase II Grouping**  The students are grouped into 2 groups on the basis of first (Internal energy, U) and second thermodynamic function (Enthalpy, H)  **Phase III Bridging**  Assume the work is only pressure-volume change and is done on the system. That is if w = pv. what happens to change in internal energy of the system by applying the first law of T.D if process is carried out constant volume  How will you define internal energy change | Students share their experiences. Internal energy U. First law of T.D  The students are grouped as internal energy group and Enthalpy group.  The internal energy group solves using first law of T.D  since w = p  p  **v**  since  The internal energy change ∆U is defined as the heat evolved or absorbed at constant volume. |
| **Factual knowledge**  The students recognize the internal energy change | |
| **Phase IV Question**  How will you measure using Bomb calorimeter.  What is Bomb calorimeter? | The internal energy group shows the photo of measurement of using Bomb calorimeter.  The group Leader presents their finding after discussion.   * The temperature of water in calorimeter is noted. * Then the substance is taken in a platinum cup and ignited. * The heat evolved and the temperature is again noted. * Amount of heat evolved on combustion   Where C is heat capacity of calorimeter.  is the rise in temperature.  Bomb calorimeter is a steel lined vessel which can withstand high pressure. |
| **Procedural knowledge**  The students will be able to measure internal energy change using Bomb calorimeter. | |
| How will you calculate work done in reversible isothermal expansion of a gas ? | The enthalpy group hang the chart of work done in reversible isothermal expansion of n gas.  Expansion of gas infinitesimal slowly reversible process is given in the diagram.  gas  Pex = Pin- dp |
| What is the work done in reversible compression of a gas  Can you give the name of second Thermodynamic function. That is energy changes occurring at constant pressure not simply internal energy alone but also include expansion or contraction of P-V work.  Write equation for Enthalpy  Can you define Enthalpy change  Give the relation between and qp. | Wrev = - = = - )dv  since dp is very small. For a on mole of an ideal gas Pin = RT/v  Wrev = = **-** RT In  Wrev = **-** 2.303RT log  From Boyle’slaw P1V1 = P2V2.  That is =  Wrev = -2.303RT log  Wrev = +2.303RT log  The student group give the answer  Enthalpy, H  H = U + PV  at constant pressure  From 1st law of T.D  since w = -p  p - P  qp =  Comparing equation (1) and (2)  = qp  That is enthalpy change is heat evolved or absorbed at constant pressure. |
| **Conceptual knowledge**  The students will be able to define internal energy change and Enthalpy change. | |
| **Phase V Exhibit**  Give the relation between and in terms of  Give the relation between qp and qv  in terms of  **Phase VI Reflection**  Can you give the work done during irreversible expansion and contraction  **Follow up activities**  Problem  The enthalpy changes for a reaction  N2(g)+3H2(g) → 2NH3(g) is -93.0 KJ at 300K calculate the value of ∆U  (R= 8.314 JK-1mol-1) | Enthalpy group mutually interact and give the derivation and exhibit for others.  = at constant P  Ideal gas equation  P V = nRT  P=  Substitute in equation (1)  ∴  Since qp and= qv  ∴qp = qv +  Two groups share their experiences  Wirr = -Pex(expansion)  Wirr = +Pex  (contraction)  Students solves and analyses the problem.  ∴ = -93.0 –2 (8.31410-3300K)  = - 88.014 KJmol-1 |
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| **Meta cognitive knowledge**  The students can acquire the awareness of knowledge, thinking and learning strategies in measurement of using bomb calorimeter, work done in reversible isothermal expansion of gas and second thermodynamic function Enthalpy, H. | |