**Activity oriented lesson plan -2 T**

1. Preliminary details

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

Name of the Institution : JHSS Thandakkad. Time : 45 Minutes

Subject : Chemistry

Unit : IV

Chapter 6 : Thermodynamics

Topic : Internal energy, first law of thermodynamics extensive and

intensive properties

1. Types of knowledge
2. **Factual knowledge**

Terms : Internal energy, heat and work, 1st law of thermodynamics

extensive and intensive properties.

Facts : 1.Internal energy is the total energy contained in a system

2.The energy of an isolated system is constant. First law of Thermodynamics.

1. **Conceptual knowledge**

Concepts : Internal energies 1st law of thermodynamics, extensive and

intensive properties.

Definitions : 1. The total energy contained in a system is called internal

energy. The internal energy is the heat evolved or absorbed at constant volume.

2. The 1st law of thermodynamics states that energy can neither be

created nor destroyed. It can be transferred from one form

to another. The total energy of the universe (system + surroundings) remains constant.

3. The extensive properties are the properties which depend upon

the size of mass present in the system.

4. The intensive properties are the properties which does not

depend upon the size of mass present in the system.

1. **Procedural knowledge**
2. First thermodynamics function, internal energy and first law of thermodynamics.

Steps

a) Experiment: A balloon is fitted on the month of a bottle and placed in hot water.

b) Asking questions: What happens to the balloon? what happens to the system?

c) Write the equation of the above experiment.

d) Then define internal energy.

1. **Meta cognitive knowledge.**

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

1. **Instructional objectives and learning outcomes.**

The students will be able to recall, state, define explains, solves, draws, analyses, evaluate and create the above-mentioned facts and concepts.

1. **Previous knowledge**

The student has knowledge about different forms of energy, heat and work.

1. **Learning aids**
2. Definition and equation of internal energy U and first law of T.D (chart).
3. Balloon bottle, steel vessel, hot water (For experiment of 1st law of T.D)

**Constructivist Learning Design**

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| Activity | Student response with Assessment | | |
| **Phase I Situation**  What type of energy stored in molecules?  What type of energy in motion of electrons in atoms or molecules?  Can you give different forms of kinetic energy when atoms combine to form molecules?  What is Translational kinetic energy?  **Phase II Grouping**  The students are grouped into three groups on the basis of different forms of kinetic energy.  **Phase III Bridging**  Then can you define internal energy? | Student share their experiences.  Potential energy and chemical energy stored in chemical bonds  Kinetic energy.  Vibrational kinetic energy, rotational kinetic energy and Translational kinetic energy.  Translational kinetic energy depends on the atom's motion through space from one point to the other.  The students responded the name of group as  vibrational, rotational and translational groups.  Vibrational group hang the chart of definition of Internal energy. The total energy (vibrational, rotational, translational kinetic energy) contained in a system is called Internal Energy. The latest notation of Internal energy is U | | |
| **Factual knowledge**  The students recognize the internal energy | | | |
| The pictures of system and surroundings is given to three groups.  What are the sign conventions of Heat (q) and Work (W)  Predict Sign convention of heat and work from following statement.  Heat added to the system.  Heat given out from the system  Work done on the System  Work done by the system  Work done on the Surrounding  **Phase IV Question**  Ask the rotational group to perform the experiment. The balloon is fitted at the mouth of a bottle and placed in hot water contained steel vessel.  What happens to the system and balloon?  Can you give the equation of this experiment.  Then define First law of Thermodynamics | The three student groups assessing the pictures given  Heat added Heat evolved    Surrounding  System  work on the system work done by the system    q = +ve  q = +ve  w = +ve  w = –ve  w = –ve  Translational group give the answer. Heat q supplied to the system, the balloon expands, work dose by the system.  **ΔU = q – w**  Where ΔU is change in internal energy.  + q is heat added to the system  –w is Work done by the system.  Vibrational group share their equation  **ΔU = q + w** where +w is work done on the system.  Rotational group hang the chart of definition of first law of thermodynamics | | |
| **Procedural knowledge**  The students perform experiments and draws the equation of first law of thermodynamics | | | |
| Is Internal energy U being an Extensive  or Intensive property?  Define Extensive property  Which property can be divided Extensive or Intensive properties.  Define Intensive properties with examples. | | | Translational group is given the answer (Chart)  Extensive property  Extensive property is a property depend upon the mass or size of matter present in the system.  All Thermodynamic function ∆U, ∆H. ∆S and ∆G  Extensive property can be divided m/2, v/2, E/2 (mass, volume and energy)  Intensive property is independent of size or mass of the system. Eg: Temperature, Concentration, Viscosity, Surface tension, melting point, Boiling point (physical properties), specific heat, molar volume (specific properties). |
| **Conceptual Knowledge**  The students define first law of Thermodynamics, Extensive and intensive properties | | | |
| **Phase V Exhibit**  For an isothermal process iinvolving ideal gas, the temperature is Constant.What happens to change in internal energy.  What happened to the System if ∆ U = 0 by applying First law of Thermodynamics.  **Phase VI Reflections**  Classify the following properties into extensive and intensive properties given (Thermal Conductivity, Specific entropy, Gibbs free energy G, Enthalpy H | | | ∆U = 0  There is no change in internal energy of the system.  Translational group is given the answer (Chart) and exhibit for others.  ∆U = q + w First law of Thermodynamics  0 = q + w Since ∆U = 0  That is, q = w Work done by the system is equal to heat absorbed on the system.  The three Students group write their reflection on the chart.  Extensive properties: Gibbs free energy G, Enthalpy, H and Intensive properties: Thermal conductivity, Specific entropy |
| **Meta Cognitive knowledge**  The students can acquire the awareness of knowledge, thinking, learning strategies in Internal energy, First law of Thermodynamics, Extensive and Intensive properties. | | | |
| **Follow up Activities**  Can you give the Limitation of First law of Thermodynamics? | | The three students present their findings on the chart.  It does not provide any information about spontaneity or feasibility of a reaction. It does not tell us anything about the extent and direction of convertibility of one form into another. | |