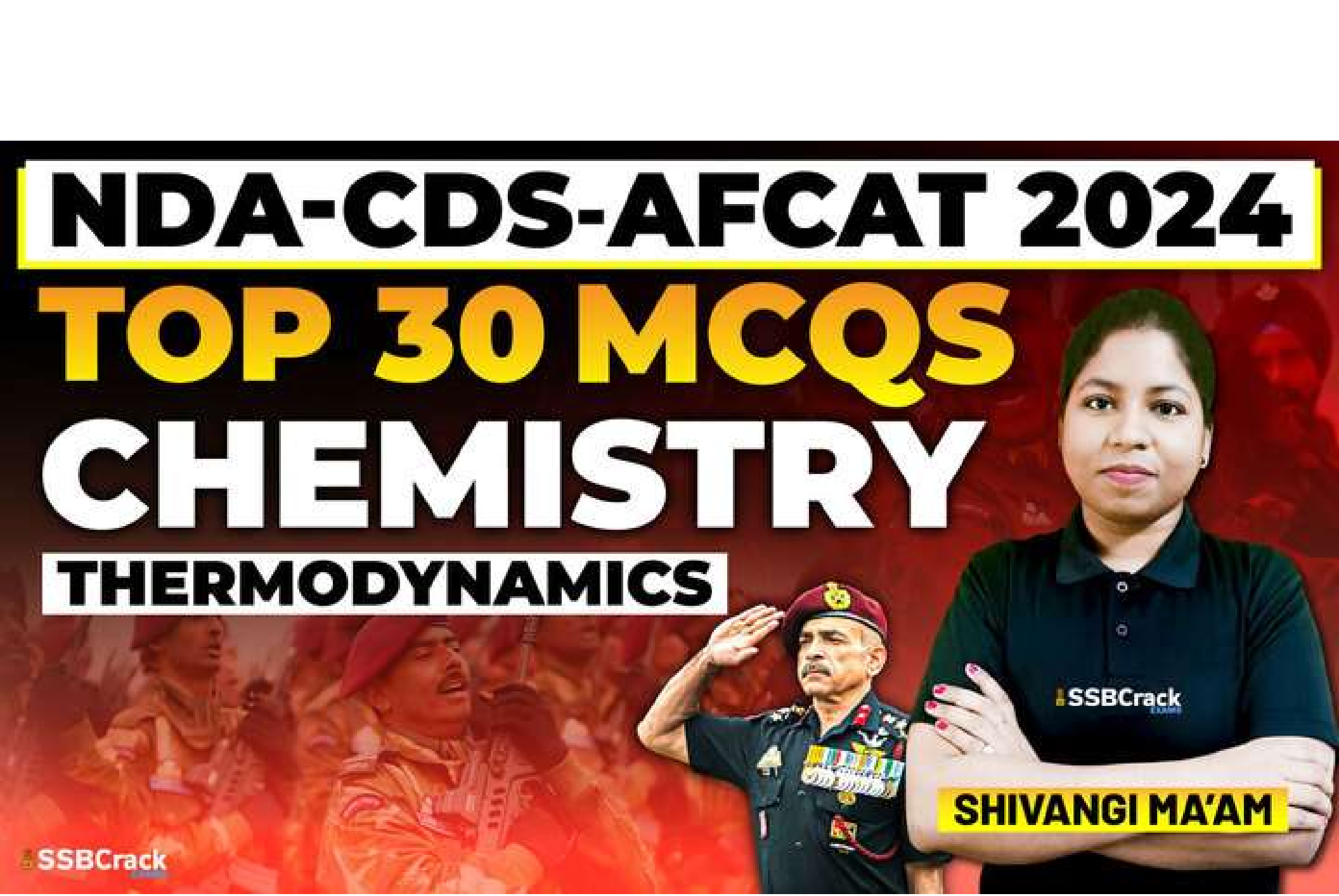
NDA-CDS-AFCAT 2024

TOP 30 MCQS

CHEMISTRY

THERMODYNAMICS



Heat And Work Are:

a) extensive properties

b) intensive properties

c) point function

d) path function

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- Heat and work, both are path functions; Their magnitude depends on the path followed during a process as well as the end state.

According To Which Law, "It Is Impossible To Reduce Any System To Absolute Zero In Temperature In A Finite Number Of Processes."

a) The second law of thermodynamics.

b) The first law of thermodynamics

c) The third law of thermodynamics

d) None of the above

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- The Third Law of Thermodynamics tells us about the entropy of a perfect crystal at absolute zero temperature.

Carnot Cycle Consists Of

a) two constant volumes and two isentropic processes

b) two isothermal and two isentropic processes

c) two constant pressures and two isentropic processes

d) one constant volume, one constant pressure and two isentropic processes

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a) two constant volumes and two isentropic processes

b) two isothermal and two isentropic processes

c) two constant pressures and two isentropic processes

d) one constant volume, one constant pressure and two isentropic processes

- An isothermal process is a very slow process and the adiabatic process is a very fast process and the combination of a slow process and fast process are very difficult.

The Third Law Of Thermodynamics:

a) introduces the principle of increase of entropy

b) throws light on concepts of internal energy

c) establishes a concept of temperature

d) defines the absolute zero of entropy

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A Well Stoppered Thermos Flask Contains Some Ice Cubes. This Is An Example Of

(a) Closed system

(b) Open system

(c) Isolated system

(d) Non thermodynamics system

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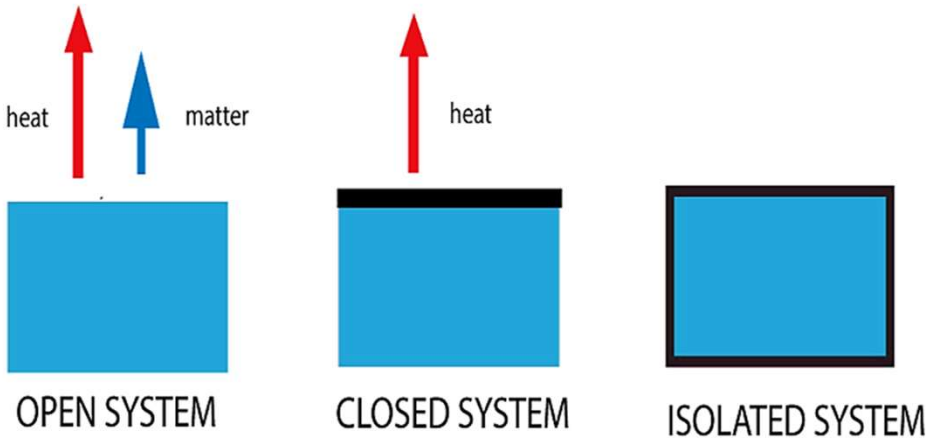

For The Reaction C(s) + O2(g) → Co2(g)

a) $\triangle H > \triangle U$

b) $\triangle H < \triangle U$

c) $\triangle H = \triangle U$

d) None of these

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- Here $\triangle ng\ RT = 0$, because reactant and product contain same number of gaseous molecules. So that $\triangle H = \triangle U + \triangle ng\ RT \Rightarrow \triangle H = \triangle U$

For An Ideal Gas, CV And CP Are Related As :

(a) $CV - CP = R$

(b) $CV + CP = R$

(c) $CP - Cv = RT$

(d) $CP - Cv = R$

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The Least Random State Of The Water System Is:

(a) ice

(b) liquid water

(c) steam

(d) randomness is same

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- The least random state of the water system is ice.

Considering Entropy(s) Thermodynamic Parameters The Criteria For The Spontaneity Of Any Process Is:

(a) $\triangle S$ system + $\triangle S$ surroundings > 0

(b) $\triangle S$ system – $\triangle S$ surroundings < 0

(c) $\triangle S$ system > 0

(d) $\triangle S$ surroundings > 0

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The Enthalpy Change In A Reaction Does Not Depend Upon

(a) the state of reactions and products

(b) the nature of the reactants and products

(c) different intermediate steps in the reaction

(d) initial and final enthalpy of the reaction

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- The enthalpy change is a state function so it doesn't depend on different intermediate steps in the reaction.

What Is The Entropy Change (In JK-1 Mol-1) When 1 Mole Of Ice Is Converted Into Water At 0℃? (The Enthalpy Change For The Conversion Of Ice To Liquid Water Is 6.0 Kj Mol-1 At 0℃)

(a) 20.13

(b) 2.013

(c) 2.198

(d) 21.98

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- The entropy change; ds = dqrev /T ⇒ ds = 6000J mol-1 / 273K
- ⇒ ds = 21.978JK-1 mol-1

If Liquids A And B Form An Ideal Solution

(a) the entropy of mixing is zero

(b) the free energy of mixing is zero

(c) the free energy as well as the entropy of mixing are zero

(d) the enthalpy of mixing is zero

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When Water Is Added To Quick Lime The Reaction Is

(a) Explosive

(b) endothermic

(c) exothermic

(d) photochemical

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- When water is added to quick lime the reaction is exothermic
- $CaO + H_2O \rightarrow Ca(OH)_2$ $\triangle H$ = -ve

Which Of The Following Statement Is/Are Correct Regarding The Second Law Of Thermodynamics?

1. No process is possible whose sole result is the absorption of heat from a reservoir and complete conversion of the heat into work.

2. No process is possible whose sole result is the transfer of heat from a colder object to a hotter object.

a) 1 only

b) 2 only

c) Both 1 and 2

d) More than one of the above

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The _____ Of Thermodynamics States That, No Process Is Possible Whose Sole Result Is The Transfer Of Heat From A Colder Object To A Hotter Object.

a) First Law

b) Zeroth Law

c) Second Law

d) Third Law

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Spot The Odd One Out

a) Specific enthalpy

b) Kinetic Energy

c) Work

d) Pressure

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a) Specific enthalpy

b) Kinetic Energy

c) Work

d) Pressure

- The thermodynamic properties which depend on the end states, as well as the path followed, are known as path function like heat and work.

Which Of The Following Is An Intensive Property?

a) Temperature

b) Pressure

c) Volume

d) Both temperature and pressure

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a) Temperature

b) Pressure

c) Volume

d) Both temperature and pressure

Which Of The Following Is NOT A Point Function?

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b) Pressure

c) Temperature

d) Volume

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b) Pressure

c) Temperature

d) Volume

- The thermodynamic properties which depend on the end states, as well as the path followed, are known as path function like heat and work.

The Heat Taken From A Sink Is Based On-

a) First law of thermodynamics

b) Second law of thermodynamics

c) Third law of thermodynamics

d) Zeroth law of thermodynamics

The Heat Taken From A Sink Is Based On-

a) First law of thermodynamics

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- The part of the Carnot engine in which an extra amount of heat is rejected by the engine is called a heat sink.

When 20 J of work is done on a gas, 40 J of heat energy is released. If the initial internal energy of the gas was 70 J, what is the final internal energy?

a) –150 J

b) 50 J

c) 90 J

d) More than one of the above

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a) –150 J

b) 50 J

c) 90 J

d) More than one of the above

Given: Initial internal energy of the gas ($U_{initial}$) = 70 J, Work done (W) = -20 J (work done on the system), and Heat (Q) = -40 J (energy released in the system)
According to first law of thermodynamics
$\Rightarrow Q = W + \Delta U$
$\Rightarrow \Delta U = Q - W = -40 + 20 = -20$ J
$\Rightarrow \Delta U = U_{final} - U_{initial} = Q - W = -40 + 20 = -20$ J
$\Rightarrow$ Ufinal - 70 = -20
$\Rightarrow$ Ufinal = 50 J

_____ of thermodynamics is used to understand the concept of energy conservation.

a) Zeroth law

b) First law

c) Second law

d) None of the above

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c) Second law

d) None of the above

- As explained above according to the **first law** of thermodynamics **energy cannot be created or destroyed in an isolated system, energy can only be transferred or changed from one form to another.**
- This is the ideal statement which is used in thermodynamics for explaining the concept of **energy conservation** among systems and surrounding.

In Which Thermodynamic Process Is There No Flow Of Heat Between The System And The Surroundings?

a) Isobaric

b) Isochoric

c) Adiabatic

d) Isothermal

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b) Isochoric

c) Adiabatic

d) Isothermal

- The thermodynamic process in a system, during which **no heat transfer occurs between thermodynamic systems and surrounding** is called an adiabatic process.
- In an adiabatic process, no heat flows between the system and surroundings.

In Thermodynamics _____ Is Not A State Variable.

a) density

b) internal energy

c) enthalpy

d) Heat

In Thermodynamics _____ Is Not A State Variable.

a) density

b) internal energy

c) enthalpy

d) Heat

- State variables are defined as the thermodynamical variables which depend only on the initial and final state of a thermodynamical system.
- These variables don't depend on how the thermodynamical system changed itself from the initial to the final state.
- Temperature, Pressure, Internal energy, and Density are the examples of state variables.
- State variables are also known as state functions.
- Path variables are defined as the thermodynamical variables which depend on the way in which the thermodynamical system achieved the initial and final states.
- Heat, Work is examples of Path variables

The Heat Given To An Ideal Gas In Isothermal Conditions Is Used To:

a) increase temperature

b) do external work

c) increase temperature and in doing external work

d) increase internal energy

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•When a thermodynamic system undergoes a physical change in such a way that its **temperature remains constant**, then the change is known as an **isothermal process**.
•As we know that, the **internal energy of the system is a function of temperature alone**, so in the isothermal process, the change in internal energy is zero.
$\Rightarrow \Delta Q = 0 + \Delta W = \Delta W$
•Therefore, the heat given to an ideal gas in **isothermal conditions** is used **to do external work**.
Hence option 2 is correct.

110 Joule Of Heat Is Added To A Gaseous System, Whose Internal Energy Is 40 J. Then The Amount Of External Work Done Is

a) 150 J

b) 70 J

c) 110 J

d) 40 J

110 Joule Of Heat Is Added To A Gaseous System, Whose Internal Energy Is 40 J. Then The Amount Of External Work Done Is

a) 150 J

b) 70 J

c) 110 J

d) 40 J

Given that, $\Delta Q = 110$ J, $\Delta U = 40$ J
According to the **first law of thermodynamics**:
$\mathbf{\Delta Q = \Delta W + \Delta U}$
$\Delta U = \Delta Q - \Delta W$
$40 \text{ J} = 110 \text{ J} - \Delta W$
$\Delta W = 110 - 40 = 70$ J
Then the amount of external work done is 70 J.

The First Law Of Thermodynamics Is Based On The Law Of Conservation Of

a) energy

b) mass

c) momentum

d) More than one of the above

The First Law Of Thermodynamics Is Based On The Law Of Conservation Of

a) **energy**

b) mass

c) momentum

d) More than one of the above

- The first law of thermodynamics is a restatement of the law of conservation of energy.
- It states that energy cannot be created or destroyed in an isolated system; energy can only be transferred or changed from one form to another.
- When heat energy is supplied to a thermodynamic system or any machine: Two things may occur:
- The internal energy of the system or machine may change.
- The system may do some external work.
- According to the first law of Thermodynamics:

- $\Delta Q = \Delta W + \Delta U$

- Where ΔQ = Heat supplied to the system, ΔW = work done by the system, ΔU = change in internal energy of the system

The Direction Of A Natural Process Is Dictated By The _____ Law Of Thermodynamics.

a) Zeroth

b) third

c) first

d) second

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a) Zeroth

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c) first

d) second

- **Second law of thermodynamics –** The entropy of an isolated system not in equilibrium will tend to increase over time, approaching a maximum value at equilibrium.
- $\Delta S = \Delta Q/T$
- $\Delta S_{Total} = \Delta S_{System} + \Delta S_{surrounding}$
- **The second law of thermodynamics introduces the concept of entropy.**
- The second law of thermodynamics **deals with the direction taken by natural or spontaneous processes.**

The heat transfer in a cyclic process are 20 kJ, -28 kJ, -2 kJ and 40 kJ. Determine the total work for this cycle process.

a) 30 kJ

b) 45 kJ

c) 40 kJ

d) 60 kJ

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a) **30 kJ**

b) 45 kJ

c) 40 kJ

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- Q1 = 20 kJ, Q2 = - 28 kJ, Q3 = - 2 kJ, Q4 = 40 kJ
- Net work done in the cycle = Net heat in the cycle
- Wnet = Q1 + Q2 + Q3 + Q4
- = 20 - 28 - 2 + 40
- = **30 kJ**
- **The total work for this cycle process is 30 kJ.**

At Triple Point For Water, Which Of The Following Term Is Not Equal To Zero?

a) Enthalpy

b) Entropy

c) Internal energy

d) None of these

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a) **Enthalpy**

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d) None of these

- The properties like internal energy, enthalpy and entropy of a system cannot be directly measured. They are related to change in the energy of the system.
- Hence, we can determine Δu, Δh, Δs but not the absolute values of these properties.
- ⇒ Therefore, It is necessary to choose a reference state to which, these properties are arbitrary assigned some numerical values.
- So for water, **the triple point (T = 0.01°C & P = 611 Pa) is selected as reference a state, where the "Internal energy" (u) and "Entropy" (s) of saturated liquid are assigned a zero value.**
- #Note: h = u + Pv
- At triple point, u = 0, but p × v ≠ 0
- Therefore **h ≠ 0 at triple point.**

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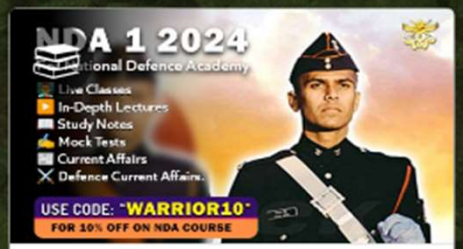

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