DPP SOLUTION

- **Subject – Physical Chemistry**
- **Chapter –** Thermodynamics and Thermochemistry

DPP No.- 02

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Question-

If 400 kJ work is done by the system and 150 kJ heat is given to system then what will be effect on internal energy?

1. Increases by 250 kJ
2. Decreases by 250 kJ
3. Increases by 600 kJ
4. Increases by 600 kJ

$w = -400\ kJ$

$q = +150\ kJ$

$\Delta U = q + w = 150 - 400 = -250\ kJ$

Ans. (2)

Question-

In Isobaric process

1. Pressure is constant
2. Temperature is constant
3. No heat is exchanged
4. Volume is constant

Ans. (1)

Question-

For an adiabatic process which of the relations is correct

1. $P\Delta V = 0$
2. $P\Delta V = 0$
3. $q = 0$
4. $q = +W$

Ans. (3)

Question-

Under isothermal condition, a gas at 300 K expands from 0.1 L to 0.25 L against a constant external pressure of 2 bar. The work done by the gas is (Given that 1 L bar = 100 J

1. −30 J
2. 5 kJ
3. 25 J
4. 30 J

$\Delta T = 0$

$T = 300\,K$

Expansion

$V_1 = 0.1\,L$ $\quad V_2 = 0.25\,L$

$P_{ext} = 2$ bar

$W = -P_{ext}\,\Delta V$

$= -2(0.25 - 0.1)$

$= -2 \times 0.15 = -0.3$ L bar

$= -0.3 \times 100$ J

$= -30$ J

Ans. (1)

Question-

A gas is allowed to expand in a well insulated container against a constant external pressure of 2.5 atm from an initial volume of 2.50 L to a final volume of 4.50 L. The change in internal ΔU energy of the gas in joules will be:

1. −500 J
2. −505 J
3. +505 J
4. 1136.25 J

gas expansion $q = 0$

$P_{ext.} = 2.5$ atm

$V_1 = 2.5$ L

$V_2 = 4.5$ L

$\Delta U = q + w$

$\Delta U = w = -P_{ext.} \Delta V$

$= -2.5(4.5 - 2.5) = -2.5 \times 2 = -5$ Latm

1 Latm = 101.3 J

$w = -5 \times 101.3$ J

$= -506.5$ J

Ans. (2)

Question-

A gas expands from 3.0 L to 3.5 L against an external pressure of 1 atm. Calculate the PV work done.

1. −0.5 L – atm
2. −1 L – atm
3. −100 J
4. −200 J

$V_1 = 3\,L$

$V_2 = 3.5\,L$

$P_{ext} = 1\,atm$

$w = -P_{ext}\,\Delta V$

$= -1(3.5 - 3)$

$w = -0.5\,L\,atm$

Ans. (1)

Question-

When 1 mole of a gas is heated at constant volume, temperature is raised from 280 to 308 K. If heat supplied to the gas is then which statement is correct?

1. $q = w = 500\ J, \Delta U = 0$
2. $q = \Delta U = 500\ J, w = 0$
3. $q = -w = 500\ J, \Delta U = 0$
4. $\Delta U = 0, q = w = -500\ J$

$n = 1 \quad \Delta V = 0 \Rightarrow w = -P\Delta V = 0$

$T_1 = 280\ K$

$T_2 = 308\ K \quad \Delta U = q + w$

$\Delta U = q = 500\ J, \quad w = 0$

$q = m s \Delta T$

$= \frac{m}{M} \times 8 \times M \Delta T$

$= n C_m \Delta T$

Ans. (2)

Question-

A system is provided 50 J of heat and work done on the system is 10 J. The change in internal energy during the process is

1. 40 J
2. 60 J
3. 80 J
4. 50 J

$q = +50$ J

$w = 10$ J

$\Delta U = q + w$

$= 50 + 10 = 60$ J

Ans. (2)

Question-

The first law of thermodynamics is represented by the equation:

$\Delta U = q + w$

1. $\Delta E = Q + W$
2. $\Delta E = Q - W$
3. $\Delta E = Q$
4. $Q = W - \Delta E$

Ans. (1)

Question-

The net internal energy change in reversible cyclic process is:

$\Delta U = 0$

1. 3/2 RT
2. Zero
3. Greater than zero
4. Less than zero

Ans. (2)

Question-

A system absorbs 600 J of heat and does work equivalent to 300 J on its surroundings. The change in internal energy is

1. 200 J
2. 300 J
3. 400 J
4. 600 J

$q = +600$ J

$w = -300$ J

$\Delta U = q + w$

$= 600 - 300$

$= 300$ J

Ans. (2)

Question-

A piston filled with 0.04 mol of an ideal gas expands reversibly from 50.0 mL to 375 mL at a constant temperature of 37.0°C. As it does so, it absorbs 208 J of heat. The values of *q* and *w* for the process will be (R = 8.314 J/molK, In 7.5 = 2.01)

1. q = +208 J, w = +208 J
2. q = +208 J, w = −208 J
3. q = −208 J, w = −208 J
4. q = −208 J, w = +208 J

$n = 0.04$ Rev. exp. Isothermal

$V_1 = 50\,mL$, $V_2 = 375\,mL$

$T = 37^\circ C = 310\,K$

$q = +208\,J$

$$w = -nRT \ln \frac{V_2}{V_1}$$

$$= -0.04 \times 25 \times 310 \ln \frac{375}{50} \quad 7.5$$

$$\simeq -\frac{0.04}{100} \times 25 \times 103 \times 2.01$$

$$w \simeq -208\,J$$

Ans. (2)

Question-

Which of the following is correct option for free expansion of an ideal gas under adiabatic condition?

$q = 0$

$w = -P_{ext}\,\Delta V$

$w = 0$

$\Delta U = 0$

$\Delta T = 0$

1. $q = 0, \Delta T < 0, w \neq 0$
2. $q = 0, \Delta T \neq 0, w = 0$
3. $q \neq 0, \Delta T = 0, w = 0$
4. $q = 0, \Delta T = 0, w = 0$

Ans. (4)

Question-

Which one of the following equation does not correctly represent the first law of thermodynamics for the given process?

$\Delta U = q + w$

1. Isothermal process: $q = -w$ $\quad q = -w$

   $\Delta T = 0 \Rightarrow \Delta U = 0$

2. Cyclic process: $q = -w$

   $\Delta U = 0$

3. Isochoric process: $\Delta E = q$

   $\Delta U = 0 \Rightarrow w = 0$

4. Adiabatic process: $\Delta E = -w$

   $q = 0$

   $\Delta U = w$

Ans. (4)

Question-

ΔE is always positive when

$\Delta U = q + w$

1. System absorbs heat and work is done on it
2. System emits heat and work is done on it
3. System emits heat and no work is done on it
4. System absorbs heat and work is done by it

Ans. (1)

Question-

Out of the following, the correct statement is:

1. *w* is a state function
2. $\Delta E = q + w$ for every thermodynamic system at rest in the absence of external field
3. $q = 0$ for every cyclic process
4. $\Delta E = 0$ for every cyclic process

Ans. (4)

Question-

In an isothermal expansion of an ideal gas

$\Delta T = 0 \Rightarrow \Delta U = 0$

1. $q = 0$
2. $\Delta V = 0$
3. $\Delta U = 0$
4. $w = 0$

Ans. (3)

Thank You...