

JEE previous year questions:

1. 200 mL of 0.2 M HCl is mixed with 300 mL of 0.1 M NaOH. The molar heat of neutralization of this reaction is  $-57.1$  kJ. The increase in temperature in  $^{\circ}\text{C}$  of the system on mixing is  $x \times 10^{-2}$ . The value of  $x$  is \_\_\_\_\_ . (Nearest integer)  
[Assume no volume change on mixing] (JEE Mains'21)

**Ans: 82**

Explanation:

$$\text{Millimoles of HCl} = 200 \times 0.2 = 40$$

$$\text{Millimoles of NaOH} = 300 \times 0.1 = 30$$

$$\text{Heat released} = (30/1000) \times 57.1 \times 1000 = 1713 \text{ J}$$

$$\text{Mass of solution} = 500 \text{ ml} \times 1 \text{ gm/ml} = 500 \text{ gm}$$

$$\Delta T = q / (m \times c) = 1713 \text{ J} / (500 \text{ g} \times 4.18 \text{ J g}^{-1} \text{ K}^{-1}) = 0.8196 \text{ K}$$

$$= 81.96 \times 10^{-2} \text{ K}$$

2. At constant volume, 4 mol of an ideal gas when heated from 300 K to 500 K changes its internal energy by 5000 J. The molar heat capacity at constant volume is \_\_\_\_\_. (JEE Mains'20)

**Ans: 6.25**

Explanation:

$$\Delta U = nC_v\Delta T$$

$$5000 = 4 \times C_v(500 - 300)$$

$$C_v = 6.25 \text{ JK}^{-1}\text{mol}^{-1}$$

3. For one mole of an ideal gas, which of these statements must be true?
- (a)  $U$  and  $H$  each depends only on temperature
  - (b) Compressibility factor  $z$  is not equal to 1
  - (c)  $C_{p,m} - C_{v,m} = R$
  - (d)  $dU = C_v dT$  for any process
- A) (a), (c) and (d)  
B) (a) and (c)  
C) (c) and (d)  
D) (b), (c) and (d) (JEE Mains'20)

**Ans: A) (a), (c) and (d)**

Explanation:

For 1 mole of ideal gas :

1. Both internal energy (U) and Enthalpy (H) depends on temperature
  2. Compressibility factor  $Z = 1$
  3.  $C_{P, m} - C_{V, m} = R$
  4.  $dU = C_V dT$  for all process
4. A gas undergoes change from state A to state B. In this process, the heat absorbed and work done by the gas is 5 J and 8 J, respectively. Now gas is brought back to A by another process during which 3 J of heat is evolved. In this reverse process of B to A:
- A) 10 J of work will be done by the gas.
  - B) 6 J of work will be done by the gas.
  - C) 10 J of work will be done by the surroundings on the gas.
  - D) 6 J of work will be done by the surroundings on the gas.

(JEE Mains'17)

Ans: D)