1. Out of boiling point (I), entropy (II), pH (III) and density (IV), intensive properties are

(A) I, II (B) I, II, III (C) I, III, IV (D) All of these

2. If work done by the system is 300 joule when 100 cal. heat is supplied to it. The change in internal energy during the process is :-

$q = \Delta U - w$

$w = q - \Delta U$

(A) – 200 Joule (B) 400 Joule

(C) 720 Joule (D) 120 Joule

3. One mole of a gas absorbs 200J of heat at constant volume. Its temperature rises from 298 K to 308 K. The change in internal energy is :-

(A) 200 J (B) –200 J (C) $200 \times \frac{308}{298}$ J (D) $200 \times \frac{298}{308}$ J

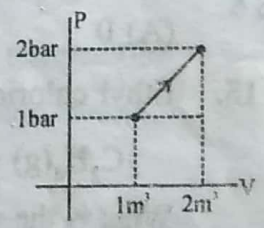
4. A system has internal energy equal to U_1, 450 J of heat is taken out of it and 600 J of work is done on it. The final energy of the system will be -

(A) $(U_1 + 150)$ (B) $(U_1 + 1050)$ (C) $(U_1 - 150)$ (D) None of these

5. The work done by a weightless piston in causing an expansion ΔV (at constant temperature), when the opposing pressure P is variable, is given by :

(A) $W = -\int PdV$ (B) $W = 0$ (C) $W = -P\Delta V$ (D) None

6. What is ΔU for the process described by figure. Heat supplied during the process q = 200 kJ.



(A) +50 kJ (B) –50 kJ

(C) –150 kJ (D) + 150 kJ

7. What is the change in internal energy when a gas is compressed from 377 ml of 177 ml under a constant pressure of 1520 torr, while at the same time being cooled by removing 124 J heat ?

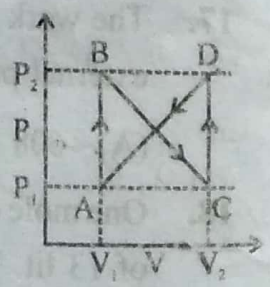
$q_p = \Delta H = 124$ J

[Take : (1L atm) = 100 J]

(A) –24 J (B) – 84 J

(C) – 164 J (D) – 248 J

8. An ideal gas is taken around the cycle ABCDA as shown in figure. The net work done during the cycle is equal to :-



(A) Zero

(B) Positive

(C) Negative

(D) We cannot predict

SBG STUDY

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9. A mixture of 2 moles of carbon monoxide and one mole of oxygen in a closed vessel is ignited to get carbon dioxide. If ΔH is the enthalpy change and ΔU is the change in internal energy, then :-

(A) $\Delta H > \Delta U$ (B) $\Delta H < \Delta U$ (C) $\Delta H = \Delta U$ (D) Not definite

10. For the reaction $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$, ΔH is -

(A) $\Delta U + 2RT$ (B) $\Delta U - 2RT$ (C) $\Delta U + RT$ (D) $\Delta U - RT$

11. According to first law of thermodynamics (where q = heat supplied to system & W → work done by the system)

(A) $\Delta U = q - W$ (B) $\Delta U = q + W$ (C) $\Delta U = \Delta q + \Delta W$ (D) $\Delta U = \Delta q + W$

12. For which reaction will $\Delta H = \Delta U$?

(A) $H_2(g) + Br_2(g) \rightarrow 2\,HBr(g)$ (B) $C(s) + 2\,H_2O(g) \rightarrow 2H_2(g) + CO_2(g)$

(C) $PCl_5(g) \rightarrow PCl_3(g) + Cl_2(g)$ (D) $2CO(g) + O_2(g) \rightarrow 2\,CO_2(g)$

13. For a reaction, $2X(s) + 2Y(s) \rightarrow 2C(\ell) + D(g)$

The q_p at 27°C is – 28 KCal. mol^{-1}. The q_v is ---------- K. Cal. mol^{-1} :-

(A) – 27.4 (B) + 27.4 (C) – 28.6 (D) 28.6

14. Consider the reaction at 300 K

$H_2(g) + Cl_2(g) \longrightarrow 2HCl(g)$ $\Delta H = -185 kJ/mol$

Calculate ΔU if 3 mole of H_2 completely react with 3 mole of Cl_2 to form HCl.

(A) 0 (B) –185 kJ (C) 555 kJ (D) None of these

15. Ethyl chloride (C_2H_5Cl), is prepared by reaction of ethylene with hydrogen chloride :

$C_2H_4(g) + HCl(g) \longrightarrow C_2H_5Cl(g)$ $\Delta H = -72.3$ kJ/mol

What is the value of ΔU (in kJ), if 70 g of ethylene and 73 g of HCl are allowed to react at 300 K

(A) –69.8 (B) –180.75

(C) –174.5 (D) –139.6

Isothermal, Adiabatic, polytropic & cyclic process

16. Two moles of an ideal gas expand spontaneously into vacuum. The work done is :-

(A) Zero (B) 2 J (C) 4 J (D) 8 J

17. The work done during the expansion of a gas from a volume of 4 dm^3 to 6 dm^3 against a constant external pressure of 3 atm is -

(A) –608 J (B) +304 J (C) –304 J (D) –6 J

18. One mole of a gas occupying 3dm^3 expands against a constant external pressure of 1 atm to a volume of 13 lit. The workdone is :-

(A) – 10 atm dm^3 (B) – 20 atm dm^3 (C) – 39 atm dm^3 (D) – 48 atm dm^3

19. One mole of an ideal monoatomic gas expanded irreversibly in two stage expansion.

State-1 (8.0 bar, 4.0 litre, 300 K)
State-2 (2.0 bar, 16litre, 300 K)
State-3 (1.0 bar, 32 litre, 300 K)

Total heat absorbed by the gas in the process is :

(A) 116J (B) 40 J
(C) 4000 J (D) None of these

20. The temperature of an ideal gas increase in an -

(A) Adiabatic compression (B) Adiabatic expansion
(C) Isothermal expansion (D) Isothermal compression

21. One mole of ideal gas is allowed to expand reversibly and adiabatically from a temperature of 27°C. If the work done by the gas in the process is 3 kJ, the final temperature will be equal to (C_V = 20 J/K mol)

(A) 100 K (B) 450 K (C) 150 K (D) 400 K

22. For an adiabatic process which of the following relations must be correct -

(A) $\Delta U = 0$ (B) $P\Delta V = 0$ (C) $q = 0$ (D) $q = +W$

23. A system is expanded under adiabatic process

(A) Temperature increases (B) Internal energy decreases
(C) Internal energy increases (D) None of these

24. When a gas is compressed adiabatically and reversibly, the final temperature is-

(A) Higher than the initial temperature (B) Lower than the initial temperature
(C) The same as initial temperature (D) Dependent upon the rate of compression

25. A gas $\left(C_{v,m} = \frac{5}{2}R\right)$ behaving ideally was allowed to expand reversibly and adiabatically from 1 litre to 32 litre. It's initial temperature was 327° C. The molar enthalpy change (in J/mole) for the process is :-

(A) –1125 R (B) – 575 R (C) –1575 R (D) None of these

26. Two moles of an ideal gas ($C_V = \frac{5}{2}R$) was compressed adiabatically against constant pressure of 2 atm. which was initially at 350 K and 1 atm pressure. The work involve in the process is equal to ?

(A) 250 R (B) 300 R (C) 400 R (D) 500 R

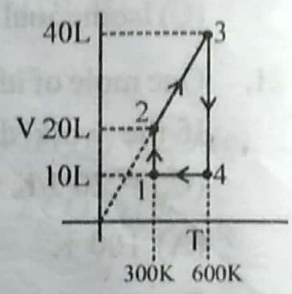
27. A diatomic ideal gas initially at 273 K is given 100 cal heat due to which system did 209 J work, Molar heat capacity (C_m) of gas for the process is :-

(A) $\frac{3}{2}R$ (B) $\frac{5}{2}R$ (C) $\frac{5}{4}R$ (D) 5R

28. For an ideal monoatomic gas during any process T = kV, find out the molar heat capacity of the gas during the process. (Assume vibrational degree of freedom to be active)

(A) $\frac{5}{2}R$ (B) 3R (C) $\frac{7}{2}$ (D) 4R

29. What is the net work done when 1 mole of monoatomic ideal gas undergoes in a process described by 1, 2, 3, 4 in given V–T graph



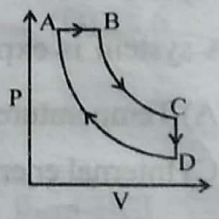
Use : R = 2cal/mole K

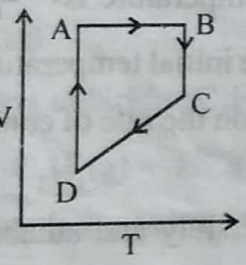
ln 2= 0.7

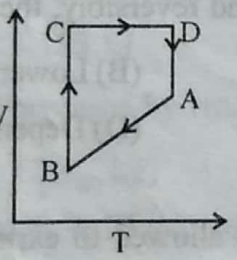
(A) –600 cal (B) – 660 cal

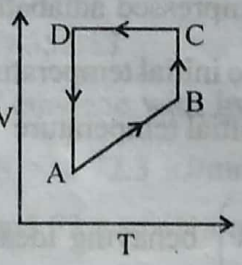
(C) + 660 cal (D) + 600 cal

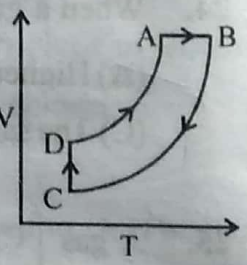
30. A cyclic process ABCD is shown in PV diagram for an ideal gas. which of the followig diagram represents the same process ?



(A) 

(B) 

(C) 

(D) 

(27) $TV^{\gamma-1} = k$

$PV^{\gamma} = k$

$P = kT^{n}$, $n = 0$

$C_m = C_{vm} + \frac{k}{T}$

(29) $-(1)(R)(300)\ln\left(\frac{20}{10}\right) - (1)R(600-300) - (1)R(600)$

$\left(\frac{10}{10}\right) = 0$

$R = 2$ $\ln 2 = 0.7$

$-600 \times 0.7 \times \frac{20}{10}$

(27) $q = nC_{vm}\Delta T = 100 \times 4.18$

$q + w = \Delta U$

$418 - 209 = nC_{vm}\Delta T$

$407 = \frac{209}{C_{vm}} = \frac{209}{\frac{5}{2}R}$

(30) $q + w = 0 = \Delta U \Rightarrow \Delta U = 0$

$\Delta U_1 + \Delta U_2 = 0$ / $n_1C_{vm}(T - T_1) + n_2C_{vm}(T - T_2) = 0$

$T = \frac{n_1T_1 + n_2T_2}{n_1 + n_2}$

$n_1 = \frac{P_1V_1}{RT_1}$