CJEE
TEST on Thermodynamics and Basic Concepts

Time 1 hr **Full Marks 50**

Note: **Each question carries 2 Marks.** ***Some of the questions have multiple correct answers. In questions having multiple correct answers, only two correct answers will fetch 1 mark and all four will fetch full marks. However, a wrong answer will deduct two marks for that question only. No cumulative negative marking is there.***

Some constants : R = 8.314 J mol^{-1} K^{-1}, 0.0821 L atm mol^{-1} K^{-1} ; 1 L = 1000 ml, h= 6.62607004 × 10^{-34} joule·second, R = 1.097 x 10^{7} m^{-1}, N_A = 6.023 x 10^{23}, c = 3.0 x 10^{10} cm sec^{-1}; At wt of Pb = 207, At wt of Cl = 35.5

Q1 Convert each of the following into energy is J

i) 100 m^3 Pa of pV work
ii) 100 L atm of pV work

a) 1000, 0.503 x 10^6
b) 100, 0.503 x 10^4
c) 100, 1.0127 x 10^4
d) 10, 5.03x 10^5

Q2 Assign the sign of work done (based on SI convention) given in the options (given in the sequence of the reactions given)for the following chemical changes taking place against external atmospheric pressure

i) N_2 (g) + $3H_2$ (g) → 2 NH_3 (g)
ii) C(s) + CO_2 → 2CO (g)

a) + , -
b) - , 0
c) + , 0
d) +,+

Q3. For the following process at constant volume, ***H_2(g) → 2H(g)***, the process absorbs 436 kJ $mole^{-1}$. Thus,

a) internal energy of the system is 436 kJ $mole^{-1}$
b) change in internal energy is 436 kJ $mole^{-1}$
c) internal energy of the system is 218 kJ $mole^{-1}$
d) change in internal energy of the system is 218 kJ $mole^{-1}$

Q4. 8 gram of O_2 gas at STP is expanded so that volume is doubled. Thus, the work done is

a) 22.4 L atm
b) 11.2 L atm
c) 5.6 L atm
d) - 5.6 L atm

Q5. 56 grams of iron reacts with dilute H_2SO_4 at 27^0C. The work done in calories in **(a)**closed vessel of fixed volume and **(b)** and open vessel is

a) 0,0
b) 600,600

c) -600. 600
d) 0,-600

Q6. Select the intensive properties

a) boiling point
b) entropy
c) pH
d) surface tension

Q7.Consider the following properties and find out the state functions

a) enthalpy
b) free energy
c) Irreversible expansion work
d) reversible expansion work

Q8. Bond energy of N-H bond is ***x*** $kJmol^{-1}$ under standard state. Thus, change in internal energy in the following process; NH_3 (g) ***→ N(g) + 3H (g)*** is

a) + ***x*** $kJmol^{-1}$
b) + ***3x*** $kJmol^{-1}$
c) **-** ***x*** $kJmol^{-1}$
d) **-** ***3x*** $kJmol^{-1}$

Q9. Temperature of 1 mole of He gas is increased by 2^0C. Thus, increase in internal energy is a) 6 cal
b) 12 cal
c) 3 calorie
d) 1.5 calorie

Q10. The internal energy change when a system goes from state A to state B is 40KJ mol^{-1}. If a system goes from A to B by a reversible path and returns to state A by an irreversible path, what would be the net change in internal energy?

a) 40 kJ
b) >40 kJ
c) < 40 kJ
d) zero

Q11. The following diagram represents the ***pV*** changes of a gas

select the isochoric changes

a) when pressure changes from p_1 to p_2

b)when pressure changes from p_2 to p_3
c)when pressure changes from p_1 to p_3
d) when pressure changes from p_3 to p_1

Q12 From the ***figure of Q11,*** the $|W_{Total}|$ done is
a) $p_2 (V_2-V_1) + p_3 (V_3-V_2)$
b) $p_1 (V_2-V_1) + p_3 (V_3-V_2)$
c) $p_2(V_3-V_1) + p_3(V_2-V_1)$
d) ***none of the above***

Q13 Assuming that water vapour is an ideal gas, the ΔU change when 1 mole of water is vaporized at 1 bar pressure and 100^0 C will be (*given molar enthalpy of vaporization of water at 1 bar and 373 K is 41 kJmol^{-1})*
a) 4.1 *kJmol^{-1}*
b) 3.79 *kJmol^{-1}*
c) 37.904 *kJmol^{-1}*
d) 41.00 *kJmol^{-1}*

Q14. 1 mole of a diatomic gas is contained in a piston. It gains 50 joule of energy and work is done on the surrounding by the system is 100 joule . Thus,
a) the gas will cool by 2.41^0
b) the gas will heat by 2.41^0
c) the gas will cool by 3.61^0
d) the gas will heat by 3.61^0

Q15. The heat capacity ratio was determined for cyanogen as 1.777. Thus,C_p for this gas is
a) 55.3 *JK^{-1} mole^{-1}*
b) 33.2 6 *JK^{-1} mole^{-}*
c) 8.314 *JK^{-1} mole^{-}*
d) 24.9 4 *JK^{-1} mole^{-}*

Q16. Given for $N_2(g) + 3\,H_2(g) \rightarrow 2\,NH_3(g)$ at 1000K; $\Delta_r H$ = -123.77kJ. Choose the correct option
a) $\Delta_f H^0$ is - 61.885 kJ mol^{-1} at 1000K
b) $\Delta_f U^0$ is – 53.571 kJ mol^{-1} at 1000K
c) $\Delta_{system} S > 0$
d) $\Delta_{system} S < 0$

Q17. Show the complete combustion of Ethanol $C_2H_5OH(l) + 3O_2 \rightarrow 2CO_2(g) + 3\,H_2O(l)$, the amount of heat produced as measured in Bomb calorimeter is 1364. 470 KJ mol $^{-1}$ at 25^0 C Assuming ideality, the enthalpy of combustion $\Delta_c H^0$ for the reaction will be (R = 8.314 kJ mol^{-1}).

a)- 1366.95
b) - 1361.95
c) - 1460.50
d) - 1350.50

Q18. Suppose the elements X and Y combine to form two compounds XY_2 and X_3Y_2 . When 0.1 mole of XY_2 weighs 10g and 0.05 mole of X_3Y_2 weighs 9g, the atomic weights of X and Y are –
a) 40,30
b) 60,40
c) 20,30
d) 30,20

Q19. Haemoglobin contains 0.334% of iron by weight. The molecular weight of haemoglobin is approximately 67200. The number of iron atoms (Atomic weight of Fe is 56) present in one molecule haemoglobin is . –

a) 4
b) 6
c) 3
d) 2

Q20. How many moles of lead (II) chloride will be formed from a reaction between 6.5 g of PbO and 3.2 g HCl ?

a) 0.011
b) 0.029
c) 0.044
d) 0.333

Q21. The number of gram molecules of oxygen in 6.02×10^{24} CO molecules is –

a) 10 g molecules
b) 5 g molecules
c) 1 g molecules
d) 0.5 g molecules

Q22. The number of atoms in 0.1 mol of a triatomic gas is ($N_A = 6.02 \times 10^{23}$ mol^{-1}). –

a) 6.026×10^{22}
b) 1.806×10^{23}
c) 3.600×10^{23}
d) 1.800×10^{22}

Q23. The molecular weight of O_2 and SO_2 are 32 and 64 respectively . At 15ºC and 150 mmHg pressure, one litre of O_2 contains 'N'molecules. The number of molecules in two litres of SO_2 under the same conditions of temperature and pressure will be –

a) N/2
b) N
c) 2N
d) 4N

Q24. In the reaction, - **$4NH_3(g)+5O_2(g) \rightarrow 4NO(g)+ 6H_2O(l)$.** When 1 mole of ammonia and 1 mole of O_2 are made to react to completion :

a) All the oxygen will be consumed.
b) 1.0 mole of NO will be produced
c) 1.0 mole of H_2O is produced
d) All the ammonia will be consumed.

Q25. Molarity of liquid HCl, if density of solution is 1.17g/cc is –

a) 36.5
b) 18.25
c) 32.05
d) 42.10