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ENGINEERING | MEDICAL | FOUNDATION

Class: XI
Subject: Chemistry
Topic: Thermodynamics
No. of Questions: 20
Duration: 60 Min
Maximum Marks: 60

Q1. Which among the following is not a state function?

A. Internal energy
B. Free energy
C. Work
D. Enthalpy

Right Answer Explanation: C
Work is not a state function it depends on the path followed.

Q2. The internal energy of one mole of a gas is

A. $\frac{3}{2}RT$

B. $\frac{1}{2}KT$

C. $\frac{1}{2}RT$

D. $\frac{3}{2}KT$

Right Answer Explanation: A

The internal energy of one mole of a gas is $\frac{3}{2}RT$

Q3. Which of the following is an intensive property?

A. Volume
B. Mass
C. Density
D. Energy

Right Answer Explanation: C
Density is an intensive property. It does not depend upon the amount of the substance.

Q4. A tightly closed thermos flask contains some ice cubes. This is an example of

A. closed system
B. open system
C. isolated system
D. non-thermodynamic system

Right Answer Explanation: C
A tightly closed thermos flask containing some ice cubes is an example of isolated system because there is no exchange of matter and energy.

Q5. For a process to occur under adiabatic condition

A. $\Delta T = 0$
B. $\delta q = 0$
C. $\Delta P = 0$
D. $\delta W = 0$

Right Answer Explanation: B
No exchange of heat takes place between system and surrounding. Thus, $\delta q = 0$

Q6. When a solid changes into liquid the entropy

A. becomes zero
B. becomes minimum
C. increases
D. remains constant

Right Answer Explanation: C
When a solid changes into liquid the entropy increase because in liquid molecules have greater randomness.

Q7. In a reversible process, $\Delta S_{sys} + \Delta S_{surr}$ is

A. 0
B. < 0
C. ≥ 0
D. = 0

Right Answer Explanation: D
In a reversible process, $\Delta S_{sys} + \Delta S_{surr}$ is equal to zero.

Q8. Evaporation of water from a pond is an example of

A. isolated system
B. open system
C. closed system
D. homogeneous system

Right Answer Explanation: B
A system, which can exchange matter as well as energy with the surroundings is called an open system. For example, hot coffee in an open flask because it can gain or loose matter and energy with the surroundings.

Q9. Pressure on the system remains constant in

A. adiabatic process
B. isobaric process
C. isochroic process
D. reversible process

Right Answer Explanation: B
The process during which the pressure of the system remains constant is called as isobaric process. In isobaric process the pressure on the system remains constant during any operation.

Q10. The apparatus used for measuring heat change is called

A. thermometer
B. voltameter
C. calorimeter
D. voltmeter

Right Answer Explanation: C
A calorimeter (from Latin *calor*, meaning heat) is an object used for calorimetry, or the process of measuring the heat of chemical reactions or physical changes as well as heat capacity. Differential scanning calorimeters, isothermal micro calorimeters, titration calorimeters and accelerated rate calorimeters are among the most common types. A simple calorimeter just consists of a thermometer attached to a metal container full of water suspended above a combustion chamber.

Q11. A system containing ice and water is an example of

A. surrounding
B. closed system
C. isolated system
D. heterogeneous system

Right Answer Explanation: D

A system is said to be heterogeneous if it consists of parts separated by definite boundaries, each of which has different physical and chemical properties. A mixture of ice with water is a typical example of this system.

Q12. In thermodynamics, a process is reversible when

A. the surroundings and the system change into each other
B. there is no boundary between the system and the surroundings
C. the surroundings are always in equilibrium with the system
D. none of these

Right Answer Explanation: C
Reversible when the surroundings are always in equilibrium with the system.

Q13. If $C_6H_6(I) + 15/2\ O_2\ (g) \rightarrow 3H_2O(I) + 6CO_2\ (g);$ $\Delta H = -3264.6$ KJ mol^{-1}, then the energy obtained by burning 3.9 g of benzene in air is

A. 163.23 kJ
B. 326.4 kJ
C. 32.64 kJ
D. 16.32 kJ

Right Answer Explanation: A
78 g of C_6H_6 gives heat
= 3264.6 kJ
∴ 3.9 g of C_6H_6 will give heat
= $\dfrac{3264.6}{78} \times 3.9$

Q14. The sum of all forms of energy including kinetic energy and potential energy is called

A. internal energy
B. entropy
C. enthalpy
D. free energy

Right Answer Explanation: A
Internal energy of a system is defined as the sum total of all the energies contained in the system in equilibrium. Every system possesses some internal energy by virtue of its temperature. The increase in temperature of a system implies increase in the internal energy. However the converse is not true. Whenever there is an exchange of energy from the system to its surroundings and vice-versa, then the internal energy of the system changes.

Q15. The region outside the boundary of the system is known as

A. isolated system
B. open system
C. surrounding
D. closed system

Right Answer Explanation: C
The region outside the boundary of the system is termed as the surrounding. The rest of the universe which is not the part of the system is separated by an imaginary boundary. The boundary sets the limits of the system. For example, while studying the effects of adding an acid to water in a beaker, the acid water mixture forms the system, the walls of the container are the boundary and the rest of the part that is around it is the surrounding.

Q16. Which of the following heat transfer mechanisms does not require a medium?

A. Conduction
B. Convection
C. Vibration
D. Radiation

Right Answer Explanation: D
Radiation heat transfer is concerned with the exchange of thermal radiation energy between two or more bodies. No medium is required for heat transfer by radiation; the radiation can travel through vacuum. For example, the heat is transferred from the sun to the earth by this method.

Q17. In which of the following cases is the process in equilibrium?

A. If ΔG is negative.
B. If ΔG is zero.
C. If ΔG is positive.
D. None of these

Right Answer Explanation: B
In this case, the process is in equilibrium state. There is no net reaction in either direction.

Q18. For a spontaneous chemical reaction to occur, which of the following is true?

A. Free energy increases
B. Free energy decreases
C. Enthalpy increases
D. Entropy decreases

Right Answer Explanation: B

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In chemical system, the substance moves in a direction in which there is decrease in free energy. So, spontaneous changes occur with the decrease in free energy ΔG is negaitve.

Q19. Identify the correct statement for change of Gibbs energy for a system (ΔG_{system}) at constant temperature and pressure.

A. If ΔG_{system} = 0, then the system has attained equilibrium.
B. If ΔG_{system} = 0, then the system is still moving in a particular direction.
C. If ΔG_{system} > 0, then the process is not spontaneous.
D. None of the above

Right Answer Explanation: A
If ΔG_{system} = 0, then the system has attained equilibrium is the right choice.
In the alternatives, (3) is most confusing as when ΔG > 0, the process may be spontaneous when it is coupled with a reaction which has ΔG < 0 and total ΔG is negative, so the right answer is (1).

Q20. Consider the reaction: $2C + O_2 \rightarrow 2CO_2$. ΔH = - 395.5 kJ/mol. Which of the following statements is/are correct for this reaction?

A. Bond forms between products
B. Reaction is exothermic
C. Reaction needs no initiation
D. All of the above

Right Answer Explanation: B
Since the reaction involves the release of energy, so it is exothermic reaction.

Q21. The enthalpies of all elements in their standard states are:

A. unity
B. zero
C. < 0
D. Different for each element

Ans: The enthalpy of all elements in their standard state is zero. Therefore, alternative (ii) is correct.

Q22. Enthalpy of sublimation of a substance is equal to

A. Enthalpy of fusion + enthalpy of vapourisation
B. Enthalpy of fusion
C. Enthalpy of vapourisation
D. Twice the enthalpy of vapourisation

ANS (1)

Q23. A reaction, A + B →C + D + q is found to have a positive entropy change. The reaction will be

(i) possible at high temperature
(ii) possible only at low temperature
(iii) not possible at any temperature
(iv) possible at any temperature

Ans: For a reaction to be spontaneous, ΔG should be negative.
ΔG = ΔH – TΔS
According to the question, for given reaction,
ΔS = positive
ΔH = negative (since heat is evolved)
⇒ ΔG = negative
Therefore, the reaction is spontaneous at any temperature.
*H*ence, alternative (iv) is correct.

Q24. The enthalpies of elements in their standard states are taken as zero. The enthalpy of formation of a compound
A. is always negative
B. is always positive
C. may be positive or negative
D. is never negative

ANS (3)

Q25. Calculate the number Kj of heat necessary to raise the temperature of 60.0 g of aluminium from 35°C to 55°C. Molar heat capacity of Al is 24 J mol^{-1} K^{-1}

Ans: From the expression of heat (q), q = m. c. ΔT
Where,
c = molar heat capacity
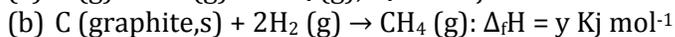m = mass of substance
ΔT = change in temperature
Substituting the values in the expression of q:
q = $\left(\frac{60}{27}mol\right)(24\,J\,mol^{-1}K^{-1})(20\,K)$
q = 1066.7 J
q = 1.07 kJ

Q26. Consider the reactions given below. On the basis of these reactions find out which of the algebraic relation given in options (i) to (iv) is correct?
(a) $C(g) + 4H(g) \rightarrow CH_4(g)$; $\Delta_f H = \times$ Kj mol^{-1}
(b) $C(graphite,s) + 2H_2(g) \rightarrow CH_4(g)$: $\Delta_f H = y$ Kj mol^{-1}

A. $x = y$
B. $x = 2y$
C. $x > y$
D. $x < y$

ANS (3)

Q27. For an isolated system, $\Delta U = 0$, what will be ΔS?

Ans: ΔS will be positive i.e., greater than zero Since $\Delta U = 0$, will be positive and the reaction will be spontaneous.