Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_\_

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**End Semester Examination – Nov/Dec– 2018**

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| **Code :** | **12BT219** | **Duration :** | **3hrs** |
| **Sub. Name :** | **BIOPROCESS CALCULATIONS** | **Max. marks :** | **100** |

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| **Q. No.** | **Questions** | **Marks** |
| **PART-A(10X1=10 MARKS)** | | |
| 1. | 1 cm2 = \_\_\_\_\_\_\_\_\_\_\_\_\_ m2. | 1 |
| 2. | Molecular weight of H2SO4 = \_\_\_\_\_\_\_\_\_\_\_\_\_.  a) 98 b) 49 c) 40 d) 54.75 | 1 |
| 3. | \_\_\_\_\_\_\_\_\_\_\_\_\_ process, liquid mixture is converted into distillate and bottom product  a).Distillation b).Evaporation c).Mixing d).Filtration | 1 |
| 4. | Overall material balance for evaporation process is \_\_\_\_\_\_\_\_\_\_\_\_\_. | 1 |
| 5. | Yield = \_\_\_\_\_\_\_\_\_\_\_\_\_. | 1 |
| 6. | % conversion = \_\_\_\_\_\_\_\_\_\_\_\_\_. | 1 |
| 7. | Kinetic energy is defined as \_\_\_\_\_\_\_\_\_\_\_\_\_. | 1 |
| 8. | Heat = \_\_\_\_\_\_\_\_\_\_\_\_\_. | 1 |
| 9. | Work = \_\_\_\_\_\_\_\_\_\_\_\_\_.. | 1 |
| 10. | Calorie is defined as \_\_\_\_\_\_\_\_\_\_\_\_\_. | 1 |
|  | **PART – B (5 x 3 = 15 MARKS)** |  |
| 11 | Convert a volumetric flow rate of 2 m3/s to l/s. | 3 |
| 12 | What is the average molecular weight of air and its composition by weight? | 3 |
| 13 | Define Stoichiometric equation. | 3 |
| 14 | Short notes on Hess’s law of constant heat summation. | 3 |
| 15 | Define Heat of formation. | 3 |
|  | **PART – C (5 x 15 = 75 MARKS)**  ( Sub Division Allowed) |  |
| 16 | Explain a) Ideal gas law b) Dalton’s law c) Amagat’s law | 15 |
|  | OR |  |
| 17 | Explain the concentration of a solution  a) Normality b) Molality c) Molarity | 15 |
|  |  |  |
| 18 | Draw the symbols for the following unit operations  a) Evaporator b) Distillation column c) Dryer | 15 |
|  | (OR) |  |
| 19 | A single effect evaporator is fed with 10,000 kg/h of weak liquor containing 15% caustic by weight and is concentrated to get thick liquor containing 40% by weight caustic. Calculate a). kg/h of water evaporated and b). kg/h of thick liquor obtained. | 15 |
|  |  |  |
| 20 | In production of Sulphur trioxide, 100 kmol of SO2 and 100 kmol of O2 are fed to a reactor. If the percent conversion of SO2 is 80, calculate the composition of the product steam on mole basis. | 15 |
|  | (OR) |  |
| 21 | Ethylene oxide is produced by oxidation of ethylene. 100 kmol of ethylene are fed to a reactor and the product is found to contain 80 kmol ethylene oxide and 10 kmol CO2calculate a) the percent conversion of ethylene and b). the percent yield of ethylene oxide. | 15 |
|  |  |  |
| 22 | Methane gas is heated from 303 K to 523K at atmospheric pressure. Calculate the heat added per kmolmethane,using the heat capacity data given below:  Cp = a+bT+cT2+dT3 , kJ/(kmol.K)   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Gas | a | b x103 | c x106 | d x109 | | Methane | 19.2494 | 52.1135 | 11.973 | -11.3173 | | 15 |
|  | (OR) |  |
| 23 | Toluene is to be heated from 290K to 350K at the rate of 250gm/sec. Calculate the heat to be supplied to toluene using the heat capacity data given below  Cp = a+bT+cT2+dT3 , kJ/(kmol.K)   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Gas | a | b x103 | c x106 | d x109 | | Toluene | 1.8083 | 812.223 | -151.67 | 1630.01 | | 15 |
|  |  |  |
| 24 | When liquid benzene is completely burned to carbon dioxide and liquid water, the standard heat of combustion is – 3267.6 kJ/mol. The standard heat of combustion of hydrogen to liquid water is – 285.83 kJ/mol and that of carbon to carbon dioxide gas is – 393.51 kJ/mol. Calculate the standard heat of formation of liquid benzene. | 15 |
|  | (OR) |  |
| 25 | Calculate the heat of formation of phenol crystals at 298.15 K from its elements using the following data: standard heat of formation of carbon dioxide is -393.51 kJ/mol, standard heat of formation of water is -285.83 kJ/mol and heat of combustion of phenol crystals at 298.15 K is -3053.15 kJ/mol | 15 |