[05] No. of printed pages : 2

SARDAR PATEL UNIVERSITY
B.Sc. (I SEM.) (CBCS) EXAMINATION
2013
Friday, 4th January
10.30 am to 12.30 pm
US01CICV02 : Process Calculations

Total Marks: 70

Note: Figures to the right indicate full marks to the questions.

Q.1 Select and write the correct option from among the given below the following questions. [10]

(1) Average molecular weight of gaseous mixture is defined as weight of unit _____ quantity of gaseous mixture.
(a) Volume (2) Weight (3) Molal

(2) At standard conditions 1 kgmole of gaseous substance occupies _____ volume.
(a) 22.4 liter (b) 22.4 cubic meter (3) None

(3) Which of the following is an unit processe?
(a) Reduction (b) Halogenation
(c) Sulfonation (d) All the above

(4) Stream that bled off to remove an accumulation of inerts or unwanted from recycle stream is known as
(a) Purge stream (b) By pass stream (c) None

(5) For the reaction $2SO_2+3O_2 = 2SO_3$, oxygen is excess reactant and is supplied in _____ excess.
(a) 100% (b) 150% (c) 200%

(6) In continuous process _____ exchange is observed between the system and surroundings.
(a) Mass (b) Energy (c) both (a) and (b)

(7) Heat of reaction gets affected by change in _____.
(a) Temperature only (b) Pressure only (c) both (a) and (b)

(8) Pick out correct one
(a) 1 kcal=427 kJ (b) 1 kcal=4.18 kJ (c) 1 kcal=1 kJ

(9) Incomplete combustion of fuel is characterized by appearance of _____.
(a) CO (b) CO & CO_2 (c) O_2

(10) Temperature of air recorded by a thermometer when it gets affected by moisture present is called _____.
(a) Wet bulb temperature
(b) Dry bulb temperature
(c) None

Q.2 Answer the following questions. **(ANY TEN)** [20]

(1) Define partial pressure and Dalton's law.
(2) Explain ideal gas equation. State standard conditions of temperature and pressure.
(3) Define density and specific gravity of gaseous substances.
(4) Explain steam distillation.
(5) Write complete material balance equation.

(6) Distinguish between Unit operations and Unit processes.
(7) Sketch Recycle Operation.
(8) State various forms of energy to be taken into account for energy balance calculation.
(9) Define: combustion, calorific value.
(10) Explain combustion of solid and liquid fuels.
(11) Explain: Humidity, Dew Point temperature.
(12) What is meant by internal energy?

Q.3
(a) List the units to express the composition of mixtures and solutions. Discuss in brief. [05]
(b) Explain calculation of average molecular weight and density of gaseous mixture. [05]

OR

Q.3
(a) Write short not on: Vapor pressure of immiscible liquid system. [05]
(b) The analysis of a gas sample is given below on molal basis.
CH_4 - 66%, CO_2 - 30%, NH_3 - 4%. Find average molecular weight and density of gas at 308 K and 303.9 kPa. [05]

Q.4 Explain giving examples- [10]
(i) Batch and continuous process.
(ii) Steady state and unsteady state process.
(iii) Limiting and excess reactants.

OR

Q.4
(a) Explain concept of material balance and material balance calculation stating it significance. [05]
(b) It is desired to make 1000 kg of solution containing 35 % salt by weight. For this, two solutions are available. One contains 15% salt and other contains 60% salt by wt. Calculate kg of each solution to be mixed for preparing above solution. [05]

Q.5
(a) State [05]
(i) Basis for energy balance calculation.
(ii) Energy balance equation.
(b) Discuss about phase change operations. [05]

OR

Q.5
(a) Derive the equation $\Delta \mathbf{H} = \mathbf{Q} - \mathbf{W_s}$ assuming usual notations. [05]
(b) Write short note on Heat Capacity. [05]
Q.6 Discuss combustion reactions and theoretical air requirement for burning of solid and liquid fuels. [10]

OR

Q.6 Discuss various units to express composition of saturated and unsaturated water vapor-air mixtures. [10]

☺ ☺ ☺ ☺