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SARDAR PATEL UNIVERSITY  
B.Sc. First semester (CBCS)  
Wednesday 24<sup>th</sup> November 2010  
US01CICV02 (Process calculations)

Time: 11:30 am to 1:30pm

Max Marks: 70

Note: 1. Answer of all the questions including multiple choice questions should be written in the provided answer sheet only.

2. Figures to the right indicate full marks.

Q-1 Answer the following:

(10)

1. Average molecular weight of gaseous mixture is
  - a. Moles of unit weight of gaseous mixture is
  - b. Weight of unit mole of gaseous mixture
  - c. Weight of total volume of gaseous mixture
  - d. Moles of total volume of gaseous mixture
2. Specific gravity of gases at existing condition of temp and pressure is the ratio of its density to
  - a. Density of water at existing condition
  - b. Density of air at existing condition
  - c. Density of water at standard condition
  - d. Density of air at standard condition
3. Normal boiling point of liquid is the temperature at which total vapor pressure exerted equals to
  - a. Atmospheric pressure
  - b. Standard atmospheric pressure
  - c. Absolute pressure
  - d. None of above
4. Material balance calculation are carried out on the basis of law of conservation of
  - a. Mass
  - b. Energy
  - c. Both mass and energy
5. Which of the following is the unit process?
  - a. Steam generation
  - b. Burning of fuel
  - c. Ice making
  - d. All of the above

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6. For the following reaction which is the excess reactant?



- a. Ethane                      b. oxygen                      c. both
7. Heat and work energy are known as energy
- Associate with mass
  - Not associate with mass
  - Stored energy and used as and when needed
8. Incomplete combustion is characterize by appearance of high percentage of -----  
----- in flue gas
- CO<sub>2</sub>
  - O<sub>2</sub>
  - CO
  - Smoke formation
9. For unsaturated water vapor-air mixture, the wet bulb temperature (WBT) is always ----- dry bulb temperature (DBT).
- Equal to
  - More than
  - Less than
  - None
10. Oxy gen percentage by weight in atmospheric air is
- 19
  - 21
  - 23
  - 29

Q-2

Attempt any ten of the following:

(20)

- State and write Dalton's law
- Define specific gravity of gaseous mixture
- Write industrial application of steam distillation
- Explain unit process giving examples
- State and write the basis of material balance calculation
- Give neat sketch of bypass operation
- Write energy balance equation
- Define standard heat of reaction
- State the forms of energies included in energy balance equation
- Define fuel gas and flue gas
- Define humidity and dew point temperature
- Write combustion reaction for methane and hydrogen

Q-3

- A. define average molecular weight and density of gaseous mixture (4)  
B. a mixture of hydrogen and oxygen contains 11.1 % hydrogen by weight. Calculate  
1. % composition by moles  
2. Average molecular weight and density of gas mixture at 303<sup>o</sup>K and 100 KPa (6)

OR

Q-3

- A. Discuss the phenomena of vaporization and vapor pressure (4)  
B. Explain effect of temperature on vapor pressure (6)

Q-4

- A. Define recycle ratio and purge ratio (4)  
B. Write short note on recycle operations (6)

OR

Q-4

- A. Write the steps followed in material balance calculations (4)  
B. Dilute acid containing 25% H<sub>2</sub>SO<sub>4</sub> is concentrated by commercial grade sulfuric acid containing 98% H<sub>2</sub>SO<sub>4</sub> to obtain desire acid containing 65% H<sub>2</sub>SO<sub>4</sub>. Find the quantities of the acids to make 1000 Kg desire acid. All % on Weight basis (6)

Q-5

- A. Derive the energy balance equation for batch processes (6)  
B. Discuss various forms of energy (4)

OR

Q-5

- A. Define heat capacity and its estimation for mixtures (5)  
B. Discuss effect of pressure on heat of reaction (5)

Q-6

- A. Define combustion, ignition temperature and percentage relative saturation. (4)  
B. Volume percentages of producer gas are H<sub>2</sub>- 14%, CH<sub>4</sub>-2%, CO-22%, CO<sub>2</sub>-5%, O<sub>2</sub>-2% and N<sub>2</sub>- 55%. Find the theoretical air required for perfect combustion for 100m<sup>3</sup> of the gas. (6)

OR

Q-6

- A. Explain the terms: Calorific value, Humidification and Dehumidification (4)  
B. Discuss theoretically calculations of air requirement for burning of fuels (6)

X=X=X

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