

SARDAR PATEL UNIVERSITY
B Sc (I Semester) Examination
Wednesday, 5th December 2012
2.30 – 4.30 pm

US01CICV02 : Industrial Chemistry Vocational (Process Calculations)

Total Marks: 70

Q. 1 Select and write the correct option among the given options for each of the following questions. (10)

- (1) Relationship of total pressure of gaseous mixture and partial pressure of respective components is the statement of
 - (a) Roul't's Law
 - (b) Dalton's Law
 - (c) Amagat's Law
 - (d) Henry's Law
- (2) _____ hydrometer is used in industries to measure specific gravity of aqueous solution.
 - (a) Degree Baume
 - (b) Degree Brix
 - (c) Degree API
- (3) Absolute pressure of gaseous mixture is equal to _____.
 - (a) gage pressure + atmospheric pressure
 - (b) gage pressure + standard atmospheric pressure
 - (c) gage pressure + barometric pressure
 - (d) None of above
- (4) Which of the following is Unit Operation?
 - (a) Calculation
 - (b) Alkylation
 - (c) Filtration
 - (d) Nitration
- (5) For the reaction $\text{CO} + 4\text{H}_2 = \text{CH}_3\text{OH}$, which is the excess reactant?
 - (a) Methane
 - (b) Hydrogen
 - (c) None
- (6) Recycle ratio is _____.
 - (a) $\frac{R}{F}$
 - (b) $\frac{F}{R}$
 - (c) $F \times R$
- (7) Energy associated with mass of the system is _____ energy.
 - (a) Potential
 - (b) Kinetic
 - (c) Internal
 - (d) All the above
- (8) Heat of reaction gets affected by changing _____.
 - (a) temperature only
 - (b) pressure only
 - (c) both (a) & (b)
- (9) Combustion is _____ reaction.
 - (a) oxidation
 - (b) reduction
 - (c) polymetization
- (10) Humidity of air is defined as
 - (a) kg water vapor per kg dry air
 - (b) K_{mole} water vapor per K_{mole} dry air
 - (c) K_{mole} water vapor per kg dry air

Q. 2 Answer the following: **(Any Ten)** (20)

- (1) List the units to express the composition of mixtures and solutions.
- (2) Define : Pure component volume, Boiling Point.
- (3) State and explain Roul't's law.
- (4) List industrially practiced common unit operations and unit processes.
- (5) Explain batch and continuous processes with examples.
- (6) Explain limiting and excess reactants with examples.
- (7) List various forms of energy and unit of energy in MKS and SI units.

- (8) Write : Complete energy balance equation.
(9) Define : Combustion, Calorific Value.
(10) Explain : Dew point temperature and Wet bulb temperature.

- Q. 3 (a) Prove that for gaseous mixture, the mole percentage composition is equal to volume percentage composition. (06)
(b) Explain average molecular weight and density of gaseous mixture. (04)

OR

- Q. 3 (a) Discuss the phenomenon of Vapor pressure of the liquids. (04)
(b) A natural gas has the following compositions by volume. (06)
CH₄ – 82%, C₂H₆ – 12%, N₂ – 6%
Calculate the density of gas at 288 K and 101.32 KPa and composition in weight percent.

- Q. 4 (a) Explain the concept of material balance and material balance calculations. List the steps followed in material balance calculation. (04)
(b) The dilute acid containing 25% H₂SO₄ is concentrated by commercial grade Sulfuric acid containing 98% H₂SO₄ to obtain desired acid containing 65% H₂SO₄. Find the quantities of the acids required to make 1000 kg of desired acid. (06)

OR

- Q. 4 (a) Write short note on: Recycle Operation (06)
(b) Explain : (1) Material Balance Problems (04)
(2) Process and Process Variables

- Q. 5 Write statement of law of conservation of energy. Derive the equation $\Delta U = Q - W$ assuming usual notations. (10)

OR

- Q. 5 Explain effect of temperature on heat of reaction. (10)

- Q. 6 (a) Give classification of fuels. (04)
(b) Discuss combustion reactions for burning of fuels. (06)

OR

- Q. 6 Write short note on:
(a) Calorific Value (06)
(b) Units to express composition of vapor bearing gaseous mixture (04)

