Time: 3 Hours   **Marks: 80**

N.B 1. Question number **one** is compulsory.
2. Attempt any three of the remaining questions.
3. Each question carries equal marks.
4. Figures to the right indicate marks.
5. Make suitable assumptions when required.

1 (a) Define the following:- Normality ,yield, calorificvalue, conversion and heat of formation   10

(b) Dry air has the following composition by volume.O_2-21.%,N_2-78%,Ar-1%.The total pressure is 760mm Hg. Calculate the partial pressure of each component in kPa.   05

(c) Prove that mole%=volume%=pressure% for a gaseous mixture.   05

2 (a) How many moles of NaOH will contain 64kg of oxygen?   05

(b) How many kilograms of methanol are there in 2500 moles of it?   05

(c) Calculate the nitrogen content of an aqueous solution which contains 25% ammonium sulphate,20% ammonium nitrate and 30% urea.   10

3 (a) An autoclave is maintained at a vacuum of 800 torr. Find the absolute pressure in the autoclave in mmHg, kPa, bar& psi.   05

(b) An object weighing 500lb occupies a volume of 29.25litres.Calculate the density of the material of the object in kg/dm^3.   05

(c) Calculate the density of oxygen gas at 503K &15.2MPa using ideal gas law. What is Dalton's law?   10

4 (a) Calculate the heat of formation of methane gas at 298K. Given that the heat of combustion(kJ/mol) of H_2,C(graphite) and CH_4 are -285.8,-393.5& -890.4 respectively.   10

(b) What do you understand by equation of state? Give an example and state its application   05

(c) Temperature of oxygen is raised from350K to 1500K.Calculate the amount of heat that must be supplied for raising the temperature of 1 kmol oxygen for the same. C_p (J/mol K)=$a+bT+cT^2+dT^3$data is given as following:-   05

a	$b \times 10^3$	$c \times 10^6$	$d \times 10^9$
26.0257	11.7551	-2.3426	-0.5623

5 (a) Ethylene oxide is produced by the oxidation of ethylene .100kmol of ethylene is fed to a reactor and the product is found to contain 80 kmol ethylene oxide and 10kmol CO_2.Calculate the percent conversion of ethylene and the yield of ethylene oxide.   10

(b) PNG containing 32kg of methane (neglect the presence of other trace materials in it) undergoes complete combustion. It reacts with 60% excess air. Compute the product composition.   10

6 (a) Explain recycling and bypass operations. What is the purpose of these operations?   10

(b) Write the stepwise procedure to perform material balance over an absorption column. What is the significance of tie component in material balance calculation?   10

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