Time allowed: 1 hr   Maximum Marks: 20

Note: Attempt all questions.

1. The spent acid from nitrating process contains 35% HNO_3, 35% H_2SO_4 and 30% water by weight. This acid is to be strengthened by the addition of 95% H_2SO_4 and 76% HNO_3. The final acid mixture is to contain 42% HNO_3 and 40% H_2SO_4. Calculate the amount of spent acid and the concentrated acid that should be mixed together to give 1000 kg of the desired mixed acid. (9)

2. a) A 0.5 molar aqueous solution of sulfuric acid flows into the process unit at a rate of 1.25 m^3/min. The specific gravity of the solution is 1.03. Calculate (i) the mass concentration of H_2SO_4 in kg/m^3, (ii) the mass flow rate of H_2SO_4 in kg/s and (iii) the mass fraction of H_2SO_4.

b) A natural gas has the following composition by volume:

CH_4	94.1 %
C_2H_6	3.0 %
N_2	2.9 %

The gas is piped from the well at the temperature of 26°C and an absolute

pressure of 3.4 atm. It may be assumed that the ideal gas law is applicable.

Calculate:

i. Partial pressure of the Nitrogen in kPa

ii. Pure component volume of Nitrogen in m^3 if the volume of gas is 100 ft^3.

iii. Density of the mixture in lb/ft^3. (5,6)