University of Melbourne

Department of Chemical Engineering

CHEN20010 MATERIAL AND ENERGY BALANCES

NUMERICAL ANSWERS TO EXERCISE SHEET A

Note the number of significant figures to which each answer is given. Giving an answer to too many figures suggests an accuracy that is not usually warranted. Also note that the units of the answer should be specified.

1. 11.6 mol % H_2SO_4, 7.0 mol % HNO_3 and 81.5 mol % H_2O. Av. MW = 30.40

2. 66.8 mol % methanol, 9.4 mol % ethanol, 5.4 mol % 1-propanol, 6.2 mol % 2-propanol, 12.2 mol water. Av. MW = 34.91

3. 2.8 mol % CH_3OH, 46.2 mol % H_2, 33.8 mol % CO_2, 17.2 mol % CO.

4. 5.7% $^w/_w$ He, 49.0% $^w/_w$ N_2 and 45.3% $^w/_w$ Ar.

5. Av. MW = 43.23 partial pressure of N2 = 25.0 Pa

6. 67.6% w/w CH_4, 4.8% $^w/_w$ C_2H_6, 1.2% $^w/_w$ C_3H_8, 20.6% $^w/_w$ N_2, 5.8% $^w/_w$ CO_2.
Av. MW = 18.98

7. 71.3% $^w/_w$ N_2, 2.1% $^w/_w$ O_2, 22.9% $^w/_w$ CO_2, 3.7% $^w/_w$ CO.

8. 0.208 mol % $CoCl_2$, 0.0623 mol % $MnCl_2$ and 99.7 mol % H_2O.

9. 44.2

10. 0.0766

11. 26.5% $^w/_w$ benzene, 16.1% $^w/_w$ toluene, 21.0% $^w/_w$ xylene, 6.1% $^w/_w$ cumene and 30.2% $^w/_w$ naphthalene.

12.

a. i) 2.60 kg

ii) 43.3 mol

b. i) 619 g/L

ii) 0.436

iii) 10.3 mol/L

iv) 0.773

v) 2.57

13. 8.9 mol % CH_3OH, 24.3 mol % C_2H_5OH, 14.3 mol % C_3H_7OH and 52.5 mol % H_2O.

14.

a. 2.43 mol

b. 0.299

15. 11.03 mol % HCOOH, 16.84 mol % CH_3COOH, 20.86 mol % C_2H_5COOH, 9.08 % H_2 and 42.19 mol % CO Av. MW = 42.65

16.

a. 72.3 kg

b. 72.5 L

c. 40.0% $^w/_w$ nitrobenzene, 33.0% $^w/_w$ glycerol, 27.0% $^w/_w$ acetone.

d. 28.3 mol % nitrobenzene, 31.2 mol % glycerol, 40.5 mol % acetone.

M17. Av MW = 88.1

1.4% $^w/_w$ CH_3OH, 29.8% $^w/_w$ HI, 61.0% $^w/_w$ CH_3I and 7.7% $^w/_w$ H_2O.