(A) ODD-NUMBERED EXERCISES

Chapter 1

3 (i) 27.8 kg/kmol, (ii) 299 J/kg K, (iii) 127 ppm by mass

5 (i) 0.340, 0.646, 0.014; 68.9 kPa, 130.9 kPa, 2.84 kPa; 0.252, 0.746, 0.0012, (ii) 24.24 kg/kmol, 343 J/kg K, (iii) 0.984 kg/m^3, 4.06x10^{-2} kmol/m^3, (iv) 0.248 kg/m^3, 0.734 kg/m^3, 0.0012 kg/m^3; 1.38x10^{-2} kmol/m^3, 2.62x10^{-2} kmol/m^3, 5.7x10^{-4} kmol/m^3

7 (i) 3.21x10^{-5}; 1.804x10^{-5}, (ii) 10.56x10^{-4}; 4.32x10^{-4}, (iii) 2.53x10^{-3}; 1.340x10^{-3}, (iv) 0.25; 0.26

9 2.51x10^{-4} m^3

11 1.15x10^{-7} kg/s

13 7.81x10^{-12} kmol/s

15 5.9 m^3/day

17 (i) 3.34 h, (ii) 13.4 h, (iii) 1331 K

19 2.79x10^{-5} kmol

21 140 h

23 2.11x10^7 s (8 months)

25 (iii) 0.15 mm, (iv) -19.2 μm/s, (v) 13.6 s

27 0.571

29 2.28x10^{-5} kg/s

31 1.94x10^3 s (32 min)

33 8.92x10^{-8} kmol/s; ≈0.1 mm

35 (i) 21.9 s, (ii) 1.20 m, (iii) 20.7%

37 1.08 mg/h

41 (i) 9850 W, (ii) 51,300 W

43 (i) 174 W, (ii) 970 W, (iii) 174 W

45 0.0346

47 0.0772

49 (i) 85.9 kW; 262 kW; 210 kW, (ii) 60.2 kW; 179 kW; 185 kW

51 1.59x10^{-3} kg/m^2 s

53 (i) 302.5 K; 9.16x10^{-4} kg/m^2 s, (ii) 302.7 K, 1.27x10^{-3} kg/m^2 s

59 (ii) 114 min

61 Yes

63 4.43x10^{-3} kg/m^2 s

65 (i) 8.01x10^{-3} s, (ii) ~0.8 mm

69 7.98x10^{-5} kg/s

73 (i) 7.6%, (ii) 1.37%

75 5.18x10^{-5} kmol/m^3

77 (i) 7.49 m/s, (ii) diffusion controlled

81 1.83x10^{-5} kg/m s; 2.67x10^{-2} W/m K

83 (i) 70.6x10^{-6} m^2/s, (ii) 22.0x10^{-6} m^2/s, (iii) 7.54x10^{-6} m^2/s

85 (i) 1.84x10^{-9} m^2/s; 1.72x10^{-9} m^2/s, (ii) 1.24x10^{-9} m^2/s; 1.16x10^{-9} m^2/s

87 9.63x10^{-5} m^2/s, 9.65x10^{-7} m^2/s, 9.79x10^{-9} m^2/s

89 2.46x10^{12} particles/m^3

91 3.79x10^{-11} m^2/s

Chapter 2

3 (i) 6 m/s; 9.21 m/s, (ii) for H_2: 0.596 kg/m^2 s; 0.238 kg/m^2 s; 0.298 kmol/m^2 s, 0.0235 kmol/m^2 s

5 At 290 K: 0.01895; 3.52×10^{-6} kg/m^2 s; 3.47×10^{-6} kg/m^2 s; 0.9905, etc.

7 0.483

9 0.060 s

15 (i) 358.5 K, (ii) 358.5 K, (iii) 358.5 K

17 1.53 s

19 (i) 10 g, (ii) 0.0185 m, (iii) 2.3×10^{-12} kmol, (iv) 0.18 h at 400 K, etc.

21 q_{conv} = 251 W/m^2, q_{evap} = 12,600 W/m^2 K

23 2.25×10^{-3}kg/m^{2}s

27 293.8 K

29 (i) 0.0334 kg/m^2 s; 344.8 K, (ii) 0.0309 kg/m^2 s; 346.1 K

31 (i) 0.00525 kg/m^2 s; 344.8 K, (ii) 0.0450 kg/,^{2} s; 345.3 K

33 87.6 s

35 1.44 kg/m^2 s

37 5.47×10^{-2} kg/m^2 s; 8.58×10^{-2} kg/m^2 s

39 175.0 K; 1.108×10^{-2} kg/m^2 s

41 2.16×10^{-6} m^2/s at 10 m/s, etc.

43 3.11×10^{-2} kg/m^2 s for $m_{air,e} = 4.17\times10^{-3}$, etc.

47 (i) 4.61×10^{-2} kg/m^2 s, (ii) 290.0 K

53 0.010 kg/m^{2}s

57 (i) 4.28 g/day, (ii)-2.75×10^{-6} Pa

59 (i) 6.27×10^{-7} kmol/s (ii) -28.8 Pa

61 (i)86.1 g/day (ii) 1.87 Pa

Chapter 3

1 (ii) 3.4×10^{-5} kmol/s; 1.77×10^{-4} kmol/s; 6.69×10^{-4} kmol/s; 1.06×10^{-4} kmol/s, 1.42×10^{-4} kmol/s, (iii) 5.29×10^{-7} kmol/s

3 (ii) 1.15 kmol/h; 0.575 kmol/h; 1.15kmol/h; 2.16 kmol/h, (iii) 2.46×10^{-4}

5 (ii) 1.20 kg/s, (iii) 2.4 kg/s

7 $6(1-e^{t/6})$ μg/m^3 for t in minutes; 6 μg/m^3

9 (i) 4.61, (ii) 7.07×10^{-2} kg/m^2 s, (iii) 2.61 m^2, (iv) 14.1×10^{-2} m, (v) 1.034×10^{-3}; 1.034×10^{-5}

11 2.73 cm

13 D = 14 cm, L = 23.5 cm, ΔP = 901Pa

15 3.8 cm

19 0.702; 7.80×10^{-3} kmol/m^3

21 (i) 6.08%, (ii) 0.370%, (iii) 0.184%, (iv) 4.29%

25 29.4 cm

29 (i) 1.37, (ii) cannot deduce

31 0.00631; 89.5%

33 (i) 0.660 kmol/kmol air, (ii) 1.54

39 W = 0.55 m, H = 1.09 m, L = 0.91 m

43 5710 W/m^2 K; 0.12 K

59 (i) 24.7°C

61 1.30m

63 (i) 18.008°C, (ii) 217W

65 9.7m