

Line 5a = line 5 from above; Line 7b = line 7 from below

<u>Page</u>	<u>Location</u>	<u>Reads</u>	<u>Should Read</u>
iv	Addendum	University of Puerto	University of Puerto Rico
iv	Addendum	Carlos Ramirez (no accent on “i”)	Carlos A. Ramírez (accent on “i”, and add middle initial)
12	fn 2, line 3	<i>Mathematica</i> (1687)	<i>Mathematica</i> , London (1687)
14	Table 1.1-1, col 3	gm	g
19	line 6b	of the lesser y	of lesser y
20	Fig 1.2-2(a), 2 nd figure	Delete the spurious arrowhead above the cylinder next to the y coordinate	
20	Fig 1.2-2(a), 3 rd figure	z -direction $(\pi/z) - \alpha$	$+z$ -direction $(\pi/2) - \alpha$
20	Fig 1.2-2(b) top figure	Add an arrow to indicate the theta-direction	
20	Fig.1.2-2(b)	Top dwg: θ -direction Middle dwg: ϕ -direction Bottom dwg: r -direction	$+\theta$ -direction $+\phi$ -direction $+r$ -direction
37	Qu. 12, line 1	about kinetic	about the kinetic
38	1B.1, line 4	for the Newtonian	for a Newtonian
39	1C.1(c), line 1	by	from
39	Prob 1C.3, line 4	...wall.	...wall, assuming specular reflections.
39	Fig 1D.2	\mathbf{f} (in drawing)	π_n
40	3b	<i>steady flow</i>	<i>steady, rectilinear</i>

[Thanks to Professor Chih-Hsin James Shih, Feng Chia University,
Taichung, Taiwan]

42	Item “a”	...condition.”	...condition.” See Problem 2D.3 for further ideas.
46	6 lines after Eq 2.2-23	regime	regimes
50	2 lines above Eq 2.3-14 [from Meshach Prasanna Heenatigala]	Appendix B.2	Appendix B.1
62	2A.3, line 4	lb/ft ³	lb _m /ft ³
62	2A.4, line 5	0.045 lb/ft ³	0.045 lb _m /ft ³
65	2B.8, line 1	lb/hr	lb _m /hr
66	1 line after 2B.9-2	$p_{\text{avg}} = \frac{1}{2}(p_0 - p_L)$.	$p_{\text{avg}} = \frac{1}{2}(p_0 - p_L)$, and ρ_{avg} is the average density calculated at p_{avg} .
67	line 2a	in the above equation	in Eq. 2B.10-1
67	line 2a	the equation becomes	it becomes
69	Figure caption [from Bahman Homayun]	The figure caption should read: “A possible particle trajectory. The particle that begins at $z = 0$, $x = B$ and ends at $x = -B$ may not necessarily travel the longest distance in the z -direction.”	
73	2C.7, ans. (c)	t_0	t_{rel}
74	Add Prob 2D.3	2D.3 The no-slip condition at solid walls Read S. Richardson, <i>J. Fluid Mech.</i> , 59 , 707-719 (1973), and discuss the physical meaning of the no-slip condition.	
81	1line above 3.3-1	...energy:	...energy for symmetrical τ (see Eq. 1.2-4):
92	Fig 3.6-3, caption	Fig. 3.5-4(b)	Fig. 3.6-4(b)
93	fn 5, line 4	...edition (2000).	...edition, Springer-Verlag,

			Berlin (2000).
104	3A.3, answer	... N/m^2	..., N/m^2 (if $\rho = \rho(p)$)
105	3A.5, line 4	hardens.	hardens (see Fig. 3.6-6).
105	Fig 3A.7	$T = 60'$	$D = 60'$
105	3B.1(a), line 6	exerted by the two	exerted on the fluid by the two
106	Eqs 3B.4-4, 5, 6	$\ln \cot$	$\ln \cot$
111	Prob 3C.2	example	Example
124	lines after 4.2-6	recognizing [to avoid splitting up $\cos \theta$]	noting
125	addn to fn 4	...760 (1969). A solution to the unsteady-state analog of Eq. 4.2-2 was obtained by F. Sy, J. W. Taunton, and E. N. Lightfoot, <i>AIChE Journal</i> , 16 , 386-391 (1970).	
132	Fig caption	$c[2/(2-\beta)]$	$c[2/(2-\beta)]$
133	Fig caption	...empty region.	...empty region, shaded gray.
140	Eq 4.4-35	$(1+f'^2)$	$(1-f'^2)$
142	Prob 4A.6(c)	of the plate	on the plate
142	4B.2, line 2	Example 4.1.1	Examples 4.1-1
144	line 4a	unit normal on	unit vector normal to
145	4C.1, line 4	$0 < x < L_e$	$0 \leq x \leq L_e$
145	Eq 4C.1-1	$0 < y < \delta$	$0 \leq y \leq \delta$
145	Eq 4C.1-2	$\delta < y < B$ (with roman B)	$\delta \leq y \leq B$ (with italic B)
146	1 line above 4C.1-3	$0 < x < L_e$	$0 \leq x \leq L_e$
148	Prob 4C.2(f)	ϕ°	$\phi^\circ(x)$

148	Prob 4C.2(j)	2500 gmcm ²	2500 g cm ²
148	Prob 4C.2(j)	$4 \times 10^6 \text{ dyn cm} \rho =$ $1 \text{ gm/cm}^3,$ $(a-1)R = 10^{-2} \text{ cm} .$	$4 \times 10^6 \text{ dyn cm}, \rho =$ $1 \text{ g/cm}^3,$ and $(a-1)R = 10^{-2} \text{ cm} .$
168	Eq 5.5-10	485	477
168	3 lines above ex.	Fig. 5.4-3	Eq. 5.4-3
169	Eq 5.6-8	at $z = \infty,$ $\bar{v}_z = 0$	as $z \rightarrow \infty,$ $\bar{v}_z \rightarrow 0$
173	last line of 5C.1	...for the fluid.	...for the fluid, and J is the total momentum flow defined analogously to Eq. 5.6-2.
174	line 1a	Eq. 5.4-2	Eq. 5.4-3
174	Prob 5C.1(j)	line $z = \text{constant}$	plane $z = \text{constant}$
175	line 4a	$r < br$ $r > br$	$r \leq br$ $r \geq br$
180	fn 1, line 1	$(\partial^2 / \partial \bar{z}^2) \mathbf{v}$	$(\partial^2 / \partial \bar{z}^2) \check{\mathbf{v}}$
180	fn 1, line 3	\mathbf{v}	$\check{\mathbf{v}}$
182	Eq. 6.2-13	$\log_{10} \text{Re} \sqrt{f}$	$\log_{10} (\text{Re} \sqrt{f})$
183	Ex 6.2-2, line 1	in pounds per hour	in lb _m /hr
185	line before 6.3-5	definition in Eq. 6.1-5,	definitions in Eq. 6.1-5 and Eq. 3.7-4,
185	Eq 6.3-5	$(-\left(\check{\mathcal{P}} - \check{\mathcal{P}}_0\right)_{\check{r}=1} \cos \theta)$	$(-\check{\mathcal{P}} _{\check{r}=1} \cos \theta)$
185	Eq 6.3-7	$\check{\mathcal{P}} - \check{\mathcal{P}}_0$	$\mathcal{P} - \mathcal{P}_0$
185	Eq 6.3-10	at $\check{r} = \infty,$ $\check{v}_z = 1$	as $\check{r} \rightarrow \infty,$ $\check{v}_z \rightarrow 1$

185	Eq 6.3-11	at $\check{r} = \infty$, $\mathcal{P} = 0$	as $\check{r} \rightarrow \infty$, $\mathcal{P} \rightarrow 0$
193	6A.2(b)	drop is	drop (pump outlet to reservoir) is
193	6A.6, line 6	lb/min	lb _m /min
194	6A.8, line 4	lb/ft ³	lb _m /ft ³
196	6C.3-2	- μ	+ μ
203	Fig 7.3-1, side view	Delete: r_2	Add: \mathbf{r}_2 as label to the vertical arrow just above the vertical arrow for \mathbf{u}_2
203	Fig 7.3-1, top view	r_1	\mathbf{r}_1
205	last line of §7.4	Eq. 7.4-10	Eq. 7.4-11
207	Eq 7.5-10	$g(z_2 - z_1)$	$g(h_2 - h_1)$
212	line 1 of solution	3-in. pipe	4-in. pipe
212	Eq 7.6-18	(3×2.54)	(4×2.54)
212	Eq 7.6-18	3×10^6	2.3×10^6
213	Eqs 7.6-27 & 28	$\frac{(120)^2}{2(0.049)(32.2)}$	$\frac{(120)^2}{60(0.049)(32.2)}$
213	Eq 7.6-27 line 3	(144)	(114)
217	Lines 1a and 2a	At time $t = 0$	For all times $t > 0$
218	Eq 7.7-7	$\sqrt{2gH}$	$-\sqrt{2gH}$
224	7A.1, line 2	0.0384 [Thanks to Jack Guidarelli at Iowa State University]	0.0284
225	Fig 7A.6	Internal diameter of all pipe is 5"	Internal diameter of all pipe segments is 5"

226	line 4a	7.5-6	7.5-7
226	Prob 7B.2, add to end of problem:	See pp. 14 and 15 of reference to R. B. Bird on p. 70.	
236	line 3a	...direction).	...directions).
257	1 line after 8.6-15	...quadratic in $\dot{\epsilon}$ from	...quadratic in $\dot{\epsilon}$, from
258	8A.2 line 6	the mass flow rate	the total mass flow rate
267	3 lines after 9.1-2a	T [=] C	T [=] °C
269	Table 9.1-1, rows 2, 4, and 5	C F	°C °F
271	Table 9.1-4, 5 th col	Prandtl number ^c	Prandtl number
288	9A.10, line 2	predict thermal	predict the thermal
292	Eq 10.2-2 [from Eric A. Pohl, Columbia University]	$(2\pi r L)q_r _r$	$(2\pi r L)(q_r _r)$
298	below 10.3-21	“To find the maximum, etc.” needs to be moved down, by applying a “return” command.	
307	Figure	Change the directions of the y and x arrows	
308	fn 2, line 1	the <i>Biot</i>	a <i>Biot</i>
309	Ex 10.7-1, lines 5,6	F	°F
310	after Eq 10.7-19	10 F°	10 °F
313	Line 1a	The $\mu(\partial v_z / \partial r)^2$	The term $\mu(\partial v_z / \partial r)^2$
323	10B.7 line 4	$z > 0$	$z \geq 0$
324	10B.8(iii) line 1	Heat loss	The heat flux
326	after Eq 10B.13-1	$k_{z,\text{eff}}$	$\kappa_{z,z,\text{eff}}$
326	Figure	The symbol “ r ” with no subscript should be removed	

329	10C.1(a), line 3	position dependent	position-dependent
331	fn 5, line 3	223-227	223-227).
347	Fig. caption	...body of fluid.	...body of fluid at temperature T_1 .
348	Eq 11.4-48	$\eta \rightarrow \infty$	$\eta \rightarrow \pm\infty$
352	Fig 11.4-5	λ_1	λ
352	Figure	530 R	530 ° R
356	5 lines above 11.5-10	at $x =$	as $x \rightarrow$
356	11.5-12	at	as
357	Figure, part (a)	System II	System I
360	Example, line 3	tank surface temperature	bulk liquid temperature
362	11A.4 answer	sec	s
362	11A.5(a)	initial	upstream
362	11A.5, ans (b)	888 R	888 ° R
363	1 line after 11B.2-2	for all z	for all $z > 0$
365	11B.7, tabulation	lb	lb _m (twice)
365	11B.7, tabulation	F	°F (twice)
366	11B.9(e)	sec	s
367	Eq 11B.12-1	$(\exp \theta_0 - \exp \theta)$	$(\exp \Theta_0 - \exp \Theta)$
371	Eq. 11C.6-5	The 2 lower-case pi's here should be boldface and should look exactly like the pi to the right side of the equals sign in Eq 1.7-2	
372	11C.7(a), line 4	on system	on the
389	Eq 12.4-15	$\Delta < 1$	$\Delta \leq 1$

395	12A.1, ans (b)	sec	s
396	12A.6(b), line 2	sec	s
396	12.B-1, table	$T(\text{C})$	$T(^{\circ}\text{C})$
397	fig caption	a film falling down	a liquid film flowing down
398	12B.4-5	$T = T_0$ $y = \infty$	$T \rightarrow T_0$ $y \rightarrow \infty$
398	2lines after 12B.4-6	at $y = \infty$	as $y \rightarrow \infty$
398	12B.4(f)	flux to	flux from the wall to
398	12B.5, line 2	For time $t > 0$	For all times $t > 0$
401	12C.3, line 2	For time $\underline{t} \geq 0$	For all times $t > 0$
401	Fig 12C.3 (left)	$t < 0$	$t \leq 0$
402	after Eq 12C.4-5	$\bar{T} - \bar{T}_0$	$\bar{T} - T_0$
406	Line after 12D.7-3	$\Gamma(a, x) = \int_0^{\infty} t^{a-1} e^{-t} dt$	$\Gamma(a, x) = \int_x^{\infty} t^{a-1} e^{-t} dt$
406	after Eq 12D.7-3	gamma functions.	gamma functions. ¹³
406	above Eq 12D.8-1	for $\Delta > 1$ is ¹³	for $\Delta \geq 1$ is ¹⁴
406	footnotes	¹³ H. Schlichting... ¹⁴ M. Abramowitz... [[Then put the footnotes in the proper order]]	¹⁴ H. Schlichting... ¹³ M. Abramowitz...
415	Eq 13.5-7	at $r = \infty$, $\Theta = 0$	as $r \rightarrow \infty$, $\Theta \rightarrow 0$
417	fn 3	<i>AIChE Journal</i> (to be submitted).	(unpublished).
421	13D.1(b)	in laminar developed flow	in fully developed laminar flow
434	Eq 14.3-7	$0 \leq \bar{r} \leq \frac{1}{2}$	$0 \leq \bar{r} < \frac{1}{2}$

437	Eq 14.3-18])
446	Figure 14.7-1	Remove the horizontal line to the right of the origin of coordinates. Remove the horizontal line just above the T_d	
450	14A.1 line 2	pounds per	pounds mass per
450	14A.2 line 2	pounds per	pounds mass per
451	14B.5, line 2	15.4-2	15.4-1
451	line 3a, left col	$T(^{\circ}\text{C})$	$T(^{\circ}\text{C})$
452	below 14D.1-5	A.7-13 and 14	A.7-14 and 15
457	Fig caption, line 3	ruled	lightly shaded
459	Fig 15.3-1	sec^{-1}	s^{-1}
459	line 2a, Ex 15.3-1	sec	s
459	1 line below 15.3-1	R	$^{\circ}\text{R}$
464	line 5b	100 psi	100 psia
470	lines 1a & 2a	<	\leq
470	1 line above 15.5-18	<	\leq
476	15A.7(b)(iv)	inner pipe surface area	inner surface area of the inner pipe
477	above 15B.2-2	Eq. 6.2-13	Eq. 6.2-12
478	15B.3(c), line 3	“mass velocity”	mass flux
480	15B.6(d), line 1	fluid velocity	the fluid velocity
480	15B.6 answer	ft sec^{-1}	ft s^{-1}
480	Fig 15B.7(b)	Label the horizontal line as T_{g_0} , and move the label $T(t)$ to the left of the vertical dotted line $t = t_1$	
483	15C.1, last line	heat-exchange surface	heat-transfer area

485	line 2a	$\mathcal{G}_{s,\text{tot}}$	$\mathcal{G}_{S,\text{tot}}$
496	Eq 16.3-13	10,400 R	10,400 ° R
508	16A.2, line 5	heat energy	energy
509	16A.4(a)	constants.	constants (see §16.6).
509	16B.5, line 4	body at	body initially at
509	16B.5, line 7	T of the black body as a function of time	$T(t)$ of the black body
509	16B.6(c), line 2	values of T_0 and	value of T_0 for
509	16C.1, line 1	Integration	Evaluation
509	16C.1, line 1	integral	integrals
524	Eq 17.2-10	g-mol	g-mole
525	Fig 17.3-1	The lower-left sphere should not be shaded and its circumference should be dotted. It should be drawn the same as in Fig. 1.4-1 on p. 24.	
529	2 lines above 17.4-3	β_{AB} (b.f. beta)	β_{AB} (l.f. beta, as in line 3a)
529	2 lines above 17.4-4	β_{AB} (b.f. beta)	β_{AB} (l.f. beta, as in line 3a)
534	table, LHS of (P)	∇x_α	∇x_α
534	table, LHS of (Q)	$\nabla \omega_\alpha$	$\nabla \omega_\alpha$
537	Table 17.8-1, (U)	\mathbf{n}_α	\mathbf{n}_α
539	17A.2(c)	17.3-12 and 15	17.3-12, 14, and 15
539	17A.3, line 2	with viscosity	with its viscosity
540	17A.6(a)	chlorine-air	chlorine (A)-air (B)
540	Prob 17A.8, lines 2 and 5	g-mol	g-mole

540	line after 17A.9-1	as about	to be about
540	17A.9(b)	for Lennard-Jones	for the Lennard-Jones
541	17B.4 (b)	folowing	following
541	17C.1 after 17C.1-2	mass flux with	mass flux of species α with
542	1 line after 17C.2-1	mass flux with	mass flux of species α with
546	Fig., right drawing	Insert a zero (“0”) directly below 1.0 on the x_B axis, near z_2	
553	Eq 18.3-14	Move (k_1 large) one-half inch to the right	
562	6a	$0 < z < L$	$0 \leq z \leq L$
568	18A.1, line 8	Density of	Density of liquid
569	line 1b	for the measure of	for the measurement of
570	18.A-17, ans	g-mol (twice)	g-mole (twice)
571	18B.4(b)	be of the sum	be the sum
572	Fig caption	The stirrers ... maintain	The stirrers maintain
573	18B.8-8, lines 7 & 8	tube, in terms the	tube in terms of the
573	18B.8-8, line 8	of the helium in	of helium in
574	18B.8-10, line 6	60 F	60 ° F
574	18B.8-10, 2 lines below table	lines 2 and 3	rows II and III
574	18B.8-10, 2 lines below table	calculate A	calculate LA
575	Fig 18B.11, caption	P neglected.	P may be neglected
576	Eq 18B.13-1	c_0	c_0
576	2b	Most such reactions are,	Most of these are, however,

however, much

576	fn 11, line 1	Diffusion, <i>Academic Press</i>	<i>Diffusion</i> , Academic Press
577	18B.14, last line	§18.6	§18.7
577	18B.15, line 2	perimeter P , is in	perimeter P is in
577	Fig 18B.15(b)	The label on the left arrow should be:	
		$n_{Az} _z = -\rho \mathcal{D}_{AB} \left. \frac{d\omega_\alpha}{dz} \right _z$	
577	Fig 18B.15(b)	The label on the right arrow should be:	
		$n_{Az} _{z+\Delta z} = -\rho \mathcal{D}_{AB} \left. \frac{d\omega_\alpha}{dz} \right _{z+\Delta z}$	
578	18B.18, last line	$x_{A1} = 1$ $x_{A2} = 1$	$x_{A1} = 0$ $x_{A2} = 0$
580	Eq 18C.1-4	at $s = \infty$, $c_A = 0$	as $s \rightarrow \infty$, $c_A \rightarrow 0$
580	Eq 18C.2-1	$0 < r < \kappa R$	$0 \leq r < \kappa R$
580	Eq 18C.2-2	$\kappa R < r < R$	$\kappa R \leq r \leq R$
580	2b, 1b	integrals	The integrals may integrals, which may
581	fn 13, add on	See also T. K. Sherwood and R. L. Pigford, <i>Absorption and Extraction</i> , 2 nd edition, McGraw-Hill, New York (1952), p. 42.	
589	2 lines above Eq 19.2-3	term)	term, where we set $\rho = \bar{\rho}$)
589	Eq 19.2-3, left side	ρ	$\bar{\rho}$
594	2 lines before 19.4-10	quantities are	indicates quantities
599	1 line after 19.5-3	$\alpha = k/\rho \tilde{C}_p$	$\alpha = k/\rho \hat{C}_p$
601	Eq 19.5-17	at	as

601	Eq 19.5-17	=	→	(2 times)
603	Fig caption line 7	(ω_{w1}, T_1)	(T_1, ω_{w1})	
604	Fig caption line 6	all time	all times	
604	19.5-22 to 24	<	≤	(8 times)
606	line 4a	at the end of Example 19.4-1	below Eq. 19.4-9	
607	19B.4(b)	$0 < z < \delta(t)$	$0 \leq z \leq \delta(t)$	
608	19D.1, replace	Use... Eq. 19.1-6.	Use the Gauss divergence theorem to obtain Eq. 19.1-6.	
608	19D.1(b)	with local	with the local	
608	Add to fn 2	See also O. T. Hanna, <i>AIChE Journal</i> , 8 , 278-279 (1962).		
610	19D.3(a)	Shows that	Show that	
611	line 2a	as =	at →	(2 times)
611	line 3b	higher terms	higher-order terms	
616	horizontal axis in Fig. 20.1-1	D_{AB}	\mathcal{D}_{AB}	
618	Fig, ordinate	gm-mol	g-mole	
618	Fig, curve labels	sec	s	(3 times)
620	line before 20.1-59	k'''	k_1'''	
621	Fig, left dwg	Extend arrow down to the liquid-solid interface. Label the interface as $z = 0$.		
621	Fig, left dwg	Remove the curved arrow from “ $c_A = 0$ at $t = 0$ ”		
625	Fig, left end of plate	Install arrows x and y to indicate the coordinate system, exactly as was done on p. 389		
626	Eq 20.2-15	$\Delta < 1$	$\Delta \leq 1$	

627	Fig 20.2-2	Transition region	Transition region*
628	Eq 20.2-24	or y	or as y
628	Eq 20.2-24	=	→ (four times)
628	Eq 20.2-31	=	→ (two times)
628	Eq 20.2-31	or y	or as y
628	Eq 20.2-35	at	as
628	Eq 20.2-35	=	→ (two times)
629	Eq 20.2-40	at	as
629	Eq 20.2-40	=	→ (two times)
636	Line 2 of Solution	x and z as follows in	x and z in
643	Figure	Remove the arrow below “Parabolic velocity profile in a circular tube”	
643	fn 2	P. C. Chatwin...(1985);	H. B. Fisher, <i>Ann. Rev. Fluid Mech.</i> , 5 , 59-78 (1973)
646	Fig, ordinate label	$Pé$ D	$Pé_{AB}$ R
646	Fig, lower RH corner	Taylor solution	Taylor’s solution
646	2 lines below Fig	$Pé$	$Pé_{AB}$
649	20A.4, 3 rd par	liquid water to	liquid water at
650	20B.4, line 3	The solution may be	The solution for the concentration $\rho_A(r, t)$ (r = radial position in spherical coordinates, t = time) may be
652	Before 20B.9-1	at $z =$	as $z \rightarrow$
652	20B.9-1	=	→ (2 times)

653	20C.2-2	$r(t)$	$r_s(t)$
654	Prob 20C.5, line 5	equations to	equations of change to
654	line after Eq 20D.1-1	funcions	fractions
655	Eq 20D.2-7 & 8	at =	as → (2 times) (4 times)
655	20D.3 line 6	creation	production
655	5 lines before 20D.3-2	pipe	pipe diameter
656	Eq 20D.4-2	$[L - \langle v_z \rangle (t - t')]^2$	$[L - \langle \bar{v}_z \rangle (t - t')]^2$
656	20D.4-3	$0 < t < t_0$	$0 \leq t \leq t_0$
661	1 line after 21.4-12	Damkohler	Damköhler
662	2 lines before 21.4-1	Damkohler	Damköhler
662	21.4-1 caption	Damkohler	Damköhler
663	line 1a	Damkohler	Damköhler
663	line 11a	Damkohler	Damköhler
669	Eq 21B.2-2	$\frac{v_z}{\langle v_z \rangle}$	$\frac{\bar{v}_z}{\langle \bar{v}_z \rangle}$
669	Eq 21B.2-3	$(v_z / \langle v_z \rangle)$	$(\bar{v}_z / \langle \bar{v}_z \rangle)$
669	Prob 21B.3	$v_z / \langle v_z \rangle$	$\bar{v}_z / \langle \bar{v}_z \rangle$
669	Prob 21B.3	$\omega_A = \omega_{A0}$	$\bar{\omega}_A = \omega_{A0}$
669	Prob 21B.3	$\omega_A = \omega_{Ab}$	$\bar{\omega}_A = \bar{\omega}_{Ab}$
673	Fig 22.1-4	The r coordinate should be indicated by an arrow whose arrowhead ends within the light shaded region.	
678	7 lines after 22.2-8	0.6415	0.6515

683	line 4a	g-moles	g-mole
683	Eq 22.3-30	g-mol	g-mole
691	above 22.4-20	$0 < r < R$	$0 \leq r \leq R$
692	1 line after 22.4-35	transferred...interface,	remaining in the sphere at time t ,
695	Eq 22.5-7	$\frac{Vk_c}{A\mathcal{D}_{AB}}$	$\frac{Vk_c}{A\mathcal{D}_{AB}} = \text{Sh}$
696	Fig, ordinate	$\frac{Vk_c}{A\mathcal{D}_{AB}}$	delete
715	3 lines after 22.8-52	upstream surface	upstream membrane surface
716	Arrow in figure for “a priori prediction” should point to the lower solid curve		
718	4 lines above 22.9-6	values, so will...however	values, so that the subscript “ref” will not be needed; however
719	5 lines before Eq 22.9-17	Eq. 21.1-10	Eq. 22.1-10
720	1 line after 22.9-23	$[\tilde{k}_\omega]$ The symbol above the letter should be a “klitschka”	$[\mathbf{k}_\omega]$
722	22B.1, line 2	at pressure	at a pressure
723	below 22B.3-2	Eqs.,	Eqs.
723	Fig 22B.7	log	\log_{10}
723	Fig 22B.7, axis label	C	°C
723	Fig caption, line 2	DELETE: “under its own vapor”	
724	Below partial ans.	The term in	The term containing
724	Line 10b	$\rho(s)$	$\rho^{(s)}$ (Superscript cap-ess)

724	Line 6b	with	, with
724	line 6b	$0.224 \rho_p$	$0.224 \rho_p,$
732	line 2a	only	but
732	1 line after 23.1-31	with respect to z	with respect to x
732	Eq 23.1-35	$\frac{d^2v}{dz^2} = \frac{1}{z^2(1-z^2)}$	$\frac{d^2v}{dx^2} = \frac{1}{x^2(1-x^2)}$
733	Eq 23.1-36	$v = (2z-1)\ln\left(\frac{z}{1-z}\right) - 2$ $+ C_1z + C_2$	$v = (2x-1)\ln\left(\frac{x}{1-x}\right) - 2$ $+ C_1x + C_2$
733	Eq 23.1-37	$v = (2z-1)\ln\left(\frac{z}{1-z}\right)$	$v = (2x-1)\ln\left(\frac{x}{1-x}\right)$
733	1 line after 23.1-37	$v(1-z) = v(z)$	$v(1-x) = v(x)$
733	1 line after 23.1-37	$v'(1-z) = -v'(z)$	$v'(1-x) = -v'(x)$
733	2 lines after 23.1-35	$v(z)$	$v(x)$
733	4 lines after 23.1-35	$v(z)$	$v(x)$
747	Fig 23.5-6	$0.1 < x < 0.9$	$0.1 \leq x \leq 0.9$
	Fig 23.5.6 caption	$0.1 < x < 0.9$	$0.1 \leq x \leq 0.9$
748	Fig 23.5-7	$0.1 < x < 0.9$	$0.1 \leq x \leq 0.9$
	Fig 23.5-7 caption	$0.1 < x < 0.9$	$0.1 \leq x \leq 0.9$
749	Fig 23.5-8	$0.1 < x < 0.9$	$0.1 \leq x \leq 0.9$
	Fig 23.5-8 caption	$0.1 < x < 0.9$	$0.1 \leq x \leq 0.9$
754	2 line above 23.6-10	Eq. 22.1-3	Eq. 23.1-3
754	line 4b	c_{As}	c_{As}
758	1 line above 23.6-43	finally ³	finally
759	23A.1, line 4	F.	°F).

759	Prob 23A.2 line 5	lb-mol	lb-moles
759	Prob 23A.2(d) line 1 Prob 23A.2(d) line 2	moles moles	lb-moles lb-moles
760	line 7a	gm-mol	g-mole
760	Prob 23B.4, line 5	sec ⁻¹	s ⁻¹
760	Prob 23B.5, line 2	Btu/lb	Btu/lb _m
760	above 22B.5-3	Btu/lb	Btu/lb _m
760	below 22B.5-3	Btu/lb	Btu/lb _m
760	Prob 23B.5, ans	36.5 lbs	36.5 lb _m
760	Lines 1b & 2b	Use 10 ... 0.1.	The bottoms composition corresponds to a mole fraction $x_0 = x_W = 0.1$. (???)
761	23C.1(a)	balance for the tank	balance on solute A over the tank
768	1 line above 24.2-6	w get	we get
768	6 lines after 24.2-6	can usually be	is often
770	Eq 24.2-10	$x_A \nabla \ln x_A$	$x_A (\nabla \ln x_A)_{T,p}$
774	Eq 24.3-1	$x_A \nabla \ln x_A$	$x_A (\nabla \ln x_A)_{T,p}$
775	1 and 2 lines above 24.4-1	given (Eqs. 24.2-8 or 9):	given by Eqs. 24.2-8 or 9:
777	24.4-6	$\left(1 + \frac{\partial \ln \gamma_p}{\partial \ln x_p}\right)$	$\left(1 + \frac{\partial \ln \gamma_p}{\partial \ln x_p}\right)_{T,p}$
777	24.4-7, line 1	$\left(1 + \frac{\partial \ln \gamma_p}{\partial \ln x_p}\right)$	$\left(1 + \frac{\partial \ln \gamma_p}{\partial \ln x_p}\right)_{T,p}$

777	1 line above 24.4-11	Eqs. 24.4-7, 8, 10, and 11	Eqs. 24.4-7, 8, 10a, and 10b
778	24.4-14	$-c_p v_{\text{migr}}$	$-v_{\text{migr}} \frac{\partial c_p}{\partial r}$
778	1 line above 24.4-18	Eqs. 24.4-6, 9, and 10	Eqs. 24.4-6, 10a, and 10b
778	24.4-18	$\left(1 + \frac{\partial \ln \gamma_p}{\partial \ln x_p}\right)$	$\left(1 + \frac{\partial \ln \gamma_p}{\partial \ln x_p}\right)_{T,p}$
780	Eq. 24.4-25	$N_{M^+} = N_{X^-} = N_S$	$\mathbf{N}_{M^+} = \mathbf{N}_{X^-} = \mathbf{N}_S$
780	After 24.4-5	...that of the salt S , which is conventionally defined in terms of the molar concentrations of salt and water as $c_S/(c_S + c_W)$.	
781	line 1a	Eqs. 24.4-5 and 24	Eqs. 24.4- 24 and 25
781	24.4-26	$x_{M^+} \nabla \ln a_{M^+}$	$x_{M^+} (\nabla \ln a_{M^+})_{T,p}$
781	24.4-27	$x_{X^-} \nabla \ln a_{X^-}$	$x_{X^-} (\nabla \ln a_{X^-})_{T,p}$
781	24.4-28	$\left(\frac{\partial \ln a_{M^+}}{\partial \ln x_S}\right)$	$\left(\frac{\partial \ln a_{M^+}}{\partial \ln x_S}\right)_{T,p}$
781	24.4-29	$\left(\frac{\partial \ln a_{X^-}}{\partial \ln x_S}\right)$	$\left(\frac{\partial \ln a_{X^-}}{\partial \ln x_S}\right)_{T,p}$
781	24.4-30	$\left(\frac{\partial \ln(a_{M^+} a_{X^-})}{\partial \ln x_S}\right)$	$\left(\frac{\partial \ln(a_{M^+} a_{X^-})}{\partial \ln x_S}\right)_{T,p}$
781	24.4-33	$\gamma_S = \sqrt{\gamma_{M^+} \gamma_{X^-}}$	$\gamma_S = \gamma_{\pm}$
782	line 1a	Delete line (it duplicates line at bottom of previous page)	
783	24.4-45	$-\frac{q_e}{\lambda}$	$\frac{q_e \lambda}{\varepsilon}$
783	24.4-46	$-\frac{dp}{dr} + \rho_e E_z$	$-\frac{dp}{dz} + \rho_e E_z$

783	24.4-47	$\frac{\partial \phi}{\partial z}$	$-\frac{\partial \phi}{\partial z}$
783	line above 24.4-48	Eq. 24.4-36	Eq. 24.4-38
783	Eq 24.4-48	$+\varepsilon$	$-\varepsilon$
783	24.4-49	$\left(\frac{q_e \lambda}{\varepsilon}\right)$	$-\left(\frac{q_e \lambda}{\varepsilon}\right)$
785	fn 9, line 2	241-258	21 , 241-258
786	line 1a	matrix m	membrane M
786	before 24.5-2	matrix	membrane (i.e., the “matrix” m of Eq. 24.4-5)
786	Eq 24.5-2	v_m	\mathbf{v}_M
786	1 line after 24.5-2	v_m	\mathbf{v}_M
786	1 line after 24.5-2	matrix	membrane
786	1 line after 24.5-3	matrix m	membrane M
786	3 lines before 24.5-4	matrix must be considered to be one	membrane must be considered as one
786	24.5-4	$x_\alpha \nabla_{T,p} \ln a_\alpha$	$x_\alpha (\nabla \ln a_\alpha)_{T,p}$
786	4 lines above 24.5-5	of the matrix	of the membrane
786	24.5-6	$a_{\alpha m} \quad p_m \quad \phi_m$	$a_{\alpha M} \quad p_M \quad \phi_M$
787	line 1a	m	M
787	24.5-7	p_m	p_M (2 times)
787	line 4b (main text) line 3b (main text)	matrix matrix-free	“matrix” “matrix-free”
788	3 line above 24.5-8	first law for this system.	first law for this system. For

simplicity, we omit the directional index, z , on the velocities and fluxes.

788	6 lines after 24.5-9	with the matrix	with the membrane
788	7 lines after 24.5-9	occurring	that would occur
788	8 lines after 24.5-9	membrane matrix	membrane
788	Fig 24.5-1	Add labels $z = 0$ and $z = \delta$ to the left and right edges of the “membrane” in the figure, respectively	
789	Eq 24.5-12	$c_{Ae} = K_D c_{Am}$	$c_{AM} = K_D c_{Ae}$
789	2 lines after 24.5-15	of the membrane.	of the membrane (see Fig. 24.5-1).
790	24.5-16	$x_S (\nabla_{T,p} RT \ln a_S)$	$x_S (\nabla RT \ln a_S)_{T,p}$
790	24.5-17	$x_W (\nabla_{T,p} RT \ln a_W)$	$x_W (\nabla RT \ln a_W)_{T,p}$
790	24.5-20	∇p_m	∇p_M
790	1 line after 24.5-20	subscript m	subscript M
790	24.5-22	$p_e - p_m = \frac{RT}{\bar{V}_S} \ln \frac{a_{Sm}}{a_{Se}} = \pi_e - \pi_m$	$p_e - p_M = \frac{RT}{\bar{V}_S} \ln \frac{a_{SM}}{a_{Se}} = \pi_e - \pi_M$
791	line after 24.5-23	where...	(omitting the directional subscript, z) where...
791	24.5-24	$\Delta \pi_{\text{eff}} = (\pi_{e0} - \pi_{e\delta}) - (\pi_{m0} - \pi_{m\delta})$	$\Delta \pi_{\text{eff}} = (\pi_{e0} - \pi_{e\delta}) - (\pi_{M0} - \pi_{M\delta})$
791	24.5-25	$\left(1 + \frac{\partial \ln \gamma_S}{\partial \ln x_S} \right) \frac{dx_S}{dz}$	$\left(1 + \frac{\partial \ln \gamma_S}{\partial \ln x_S} \right)_{T,p} \frac{dx_S}{dz}$
792	24.5-27	$\ln \frac{a_{We}}{a_{Wm}} = \frac{\bar{V}_W}{RT} (p_m - p_e) = \frac{\bar{V}_W}{RT} \Delta \pi$	

$$\ln \frac{a_{We}}{a_{WM}} = \frac{\bar{V}_W}{RT} (p_M - p_e) = \frac{\bar{V}_W}{RT} (\pi_M - \pi_e) = \frac{\bar{V}_W}{RT} \Delta\pi$$

792 line after 24.5-27 subscripts e and m subscripts e and M

$$\frac{a_{Se}}{a_{Sm}} = \frac{x_{M^+e} x_{X^-e} \gamma_{Se}}{x_{M^+m} x_{X^-m} \gamma_{Sm}} = \exp\left(\frac{\bar{V}_S}{RT} \Delta\pi\right)$$

$$\frac{a_{Se}}{a_{SM}} = \frac{x_{M^+e} x_{X^-e}}{x_{M^+M} x_{X^-M}} \left(\frac{\gamma_{Se}}{\gamma_{SM}}\right)^2 = \exp\left(\frac{\bar{V}_S}{RT} \Delta\pi\right)$$

$$\frac{c_{M^+e} c_{X^-e}}{c_{M^+m} c_{X^-m}} = K_D = \left(\frac{\gamma_{Sm} c_m}{\gamma_{Se} c_e}\right)^2 \exp\left(\frac{\bar{V}_S}{RT} \Delta\pi\right)$$

$$\frac{c_{M^+e} c_{X^-e}}{c_{M^+M} c_{X^-M}} = K = \frac{\gamma_{SM}}{\gamma_{Se}} \left(\frac{c_e}{c_M}\right)^2 \exp\left(\frac{\bar{V}_S}{RT} \Delta\pi\right)$$

$$792 \quad 24.5-30 \quad c_{Sm}^2 + c_{Sm} c_{X^-m} = \frac{1}{K_D} c_{Se}^2 \quad c_{SM}^2 + c_{SM} c_{X^-M} = \frac{1}{K} c_{Se}^2$$

792 after 24.5-30 ...solution. ...solution (K is of order unity for monovalent ions).

$$792 \quad 24.5-31 \quad \phi_m - \phi_e = \left(\frac{z_{M^+} F}{RT}\right) \ln \frac{x_{M^+m}}{x_{M^+e}}$$

$$\phi_M - \phi_e = -\left(\frac{RT}{z_{M^+} F}\right) \ln \frac{x_{M^+M}}{x_{M^+e}}$$

$$795^* \quad \text{above 24.6-10} \quad \psi = p_N/p_0 \quad \psi_N = p_N/p_0$$

796* Fig 24.6-1 Dimensionless pressure ψ Dimensionless total
ordinate label pressure $\psi = \psi_N + \psi_H$

796* after 24.6-13 The results are The results for
 $\psi_{N_2} + \psi_{H_2}$ and
 $\psi_{N_1} + \psi_{H_1}$

$$796^* \quad \text{Eq 24.6-13} \quad \psi_{H_2} = \frac{1}{2}(1 + e^{-7.48\tau}) \quad \psi_{H_2} = \frac{1}{2}(1 - e^{-7.48\tau})$$

$$796^* \quad \text{Eq 24.6-13} \quad \psi_{H_1} = \frac{1}{2}(1 - e^{-7.48\tau}) \quad \psi_{H_1} = \frac{1}{2}(1 + e^{-7.48\tau})$$

797	Table, cols 2 & 3	Delete superscripts a and b	
798	24.6-18	$\mathcal{D}_{AB}^{\text{ext}} = \mathcal{D}_{AB}^{\text{ext}} \left(1 + \frac{\partial \ln \gamma_A}{\partial \ln x_A} \right)$	$\mathcal{D}_{AB}^{\text{ext}} = \mathcal{D}_{AB}^{\text{ext}} \left(1 + \frac{\partial \ln \gamma_A}{\partial \ln x_A} \right)_{T,p}$
799	24A.3	$F = 96,500$	$F \doteq 96,500$
799	Prob 24B.1 line 2	Eq. 25.4-50	Eq. 24.4-50
799	line 1b	estimate junction	estimate the junction
800	Above 24B.3-1	Calculate the distribution coefficient of	Calculation the equilibrium constant for the distribution of temperature,
800	Eq 24B.3-1	K_D	K
800	24B.3 Ans	0.633	0.64
800	24B.4, line3	pure water,	pure water at room temperature,
800	Prob 24B.6 line 3	of the transport to the	of the transport due to the
800	Prob 24B.6 line 4	24.6-3	24.6-1
800	Eq 24B.6-1	∇p	∇p_A
800	Eq 24B.6-2	$\frac{\varepsilon a}{\tau}$	$\frac{1}{1-\varepsilon} \frac{\varepsilon a}{\tau}$
801	line 4a	Eq. 24.2-9, and also the auxiliary	Eq. 24.2-9. The auxiliary
801	2 lines above 24C.3-1	dilution) are	dilution) for Na^+ and Cl^- are
802	24C.4-2	$\frac{F}{\varepsilon}$	$-\frac{F}{\varepsilon}$
802	fn 4	(1991), p. 256.	(1991).

803	line 3a	The field	The potential field
803	24C.7, line 1	cellophane	cellophane membrane
803	Prob 24C.7 line 2	assume glucose	assume the glucose
803	24C.7, listing	\bar{V}_s	\bar{V}_g
803	Prob 24C.8 line 1	of the hypothetical	of a hypothetical
803	24C.8, line 2	1.0	0.1
803	24C.7, answer	0.00242	0.00234
803	24C.8, ans	product solute concentration	solute mole fraction in the filtrate
803	Fig 24C.9	Remove the word “Distance” from the figure, and add $z = 0$ next to the vertical line just to the left of “Membrane” and add $z = \delta$ next to the vertical line just to the right of “Membrane”. These additions should be put in the space where the word “Distance” was deleted.	
814	Ex 2(d)	$(\delta_1 \cdot \mathbf{v})$	$(\delta_x \cdot \mathbf{v})$
	Ex 2(e)	$[\delta_1 \times \mathbf{w}]$	$[\delta_x \times \mathbf{w}]$
819	Ex 1(f)	$[\boldsymbol{\tau} \cdot \delta_1]$	$[\boldsymbol{\tau} \cdot \delta_x]$
822	Eq A.4-32	$\sum_i \sum_j$	$\sum_i \sum_j$
825	Ex 4, line 1	ε_{ijk} (wrong font)	ε_{ijk} (lightface)
827	Fig A.6-2	δ_r δ_θ	δ_r δ_θ
827	3 lines after A.615	i.e., v	i.e., \mathbf{v} (boldface Roman)
828	Ex 1, 1 st equation	0 (boldface)	0 (lightface)

838	Line 1a	∇v	$\nabla \mathbf{v}$
838	Eq A.7-24 (rt side)	$[\dots]$	$[\dots]_r$
838	Eq A.7-27 (rt side)	$\frac{1}{r \sin \phi}$	$\frac{1}{r \sin \theta}$
841	Eq A.8-8	$\sin \theta d\theta$	$d\theta$
845	fn to Table B.2	\mathbf{q}	$-k\nabla T$
847	Eq B.5-8	$[\dots] + \rho g_\theta$	$[\dots] + \rho g_\theta$
849	Table B.7, title	Φv	Φ_v
851	Table B.11, title	Both ω and ρ should be light face	
851	Table B.11, last line of fn	$x_B R_A - x_A R_\beta$	$x_B R_A - x_A R_B$
856	Fig C.5-1	In both drawings, the x -axis and y -axis should be labeled.	
856	Fig C.5-1, right dwg	$\coth \theta = 1 / \coth \theta$	$\coth \theta = 1 / \tanh \theta$
864	Table heading col 9	μ_c ($\text{g/cm} \cdot \text{s} \times 10^6$)	$\mu_c \times 10^6$ ($\text{g/cm} \cdot \text{s}$)
864	Table heading col 10	k_c ($\text{cal/cm} \cdot \text{s} \cdot \text{K} \times 10^6$)	$k_c \times 10^6$ ($\text{cal/cm} \cdot \text{s} \cdot \text{K}$)
865	fn h	h Values	h Values
878	Damköhler	626	626, 661
879	Hanna	431	429
893	Tensor, unit	817	19, 817
Back cover, top diagram:		$\$_{AB}$	\mathcal{D}_{AB}

	$\frac{dy}{d\omega_A}$	$\frac{d\omega_A}{dy}$
Back cover, middle diagram:	$\frac{dy}{dv_x}$	$\frac{dv_x}{dy}$
Back cover, bottom diagram:	$\frac{dy}{dT}$	$\frac{dT}{dy}$

MISPRINTS:

25	fn 2, line 6	edition 1970),	edition (1970),
32	fn 3, line 1	Vol. 1,	Vol. 1
32	fn 4, line 1	Vol. 1,	Vol. 1
37	fn 1, line 1	<i>Revs.</i>	<i>Revs.</i> ,
38	fn 2, line 1	<i>Chem.</i>	<i>Chem.</i> ,
70	fn 6, line 2	(1965)	(1965);
96	fn 6, line 2	Vol. 1.,	Vol. 1,
110	3C.1, line 1	(Fig. 3C.-1)	(Fig. 3C.1)
122	fn 3, line 6	386-391	386-391 (1970)
125	fn 4	<i>Mech.</i> (twice)	<i>Mech.</i> , (twice)
135	fn 1, line 8	<i>Mechanics,</i> "	<i>Mechanics,</i>
140	fn 9, line 3	... <i>Theory</i> , Springer...	... <i>Theory</i> , 8 th edition, Springer...
142	4B.2, line 2	4.1.1	4.1-1
149	fn 6	McGraw-Hill (1937)	McGraw-Hill, New York (1937)
153	fn 2, line 2	McGraw-Hill (1961)	McGraw-Hill, New York (1961)

166	fig capt, last line	(1950)}.	(1950)].
182	fig capt, line 1	6.1-3.	6.1-3).
187	fig capt, line 3	<i>Handbook,</i>	<i>Handbook</i>
196	3 lines below 6C.3-2	baffles,	baffles
196	fn 8, line 2	Press, (1967),	Press (1967),
232	fn 1, line 2	Vol. 1.,	Vol. 1,
235	fn 5, line 1	<i>Sci.</i>	<i>Sci.,</i>
235	fn 5, line 3	<i>Rheol.</i>	<i>Rheol.,</i>
235	fn 6, line 2	<i>Mech.</i>	<i>Mech.,</i>
235	fn 6, line 3	(1985), 102-105.	(1985), pp. 102-105.
242	fn 4, line 2	<i>Vol. 1.</i>	<i>Vol. 1,</i>
245	fn 1	<i>Restitutiva</i> (1678)	<i>Restitutiva</i> , London (1678)
274	fn 1, line 5	edition (2000).	edition, Oxford University Press (2000).
289	fn 7, line 4	corrections (1964).	corrections, Wiley, New York (1964).
311	Fig 10.8-1, left side, #2	2	2.
326	line 1b	r_1 respectively and	r_1 , respectively, and
349	fn 4, line 1	Malabar Fla.	Malabar, Fla.
353	fig caption	wave, for helium	wave for helium
353	fig caption	p. 333]	p. 333.]
372	fn 14	<i>Chem.</i>	<i>Chem.,</i>
385	fn 15, line2	et seq;	et seq.; (style??)
400	fn 4	Co., (1946),	Co. (1946),

404	Table 12D.2, fn a	McGraw-Hill (New York).	3 rd edition, McGraw-Hill, New York (1998).
428	fn 1, line 2	New York, (1977),	New York (1977),
428	fn 1, line 3	74 , (35)	74 (35),
428	fn 1, line 4	75 , (1),	75 (1),
437	Eq 14.3-18	10,000}	10,000)
446	Fig 14.7-1	Remove horizontal line just above T_d	
450	Col 1, line 3	$T(\text{C})$	$T(^{\circ}\text{C})$
482	fn 2, line 5	Fla., (1983),	Fla. (1983),
488	fn 3, line 4	edition,	edition
493	fn 1, line 1	edition,	edition
495	fig capt, line 6	(1901).	(1901).]
500	Fig 16.4-4, caption	McAdams	McAdams,
505	fn 2, line1	Ed.	ed.
514	fn 1, line 2	<i>Reson.</i>	<i>Reson.</i> ,
519	fn 7, line 1	<i>Rev.</i>	<i>Rev.</i> ,
523	fn 5	B. A. Ivakin, P. E. Suetin	B. A. Ivakin and P. E. Suetin
527	fn 7, line 3	<i>Phys.</i>	<i>Phys.</i> ,
529	fn 9, line 4	<i>Phys.</i>	<i>Phys.</i> ,
540	17A.9(a),, line 3	for $(c\mathcal{D}_{AA^*})_c$	for $(c\mathcal{D}_{AA^*})_c$. (add period after formula)
570	Prob 18A.6(b)	Eq. 17-2-1	Eq. 17.2-1
611	fn 10, line 1	Spalding ed.),	Spalding, ed.),
621	fn 11, line 2	Cliffs N.J.	Cliffs, N.J.

638	Fig caption	AIChE Journal	<i>AIChE Journal</i>
647	fn 13	<i>Chromatog.</i> 589	<i>Chromatog.</i> , 589
648	fn 1	<i>Chem.</i> 42 ,	<i>Chem.</i> , 42 ,
685	fn 3, line 2	New York,	New York
764	fn 1, line 1	<i>Wien</i>	<i>Wien</i> ,
793	fn 1 (a)	Vols. 1 and 2 Oxford	Vols. 1 and 2, Oxford
854	2 nd equation	C.2.3	C.2-3