

Accepted Article

Title: Controlling gas selectivity in molecular porous liquids by tuning the cage window size

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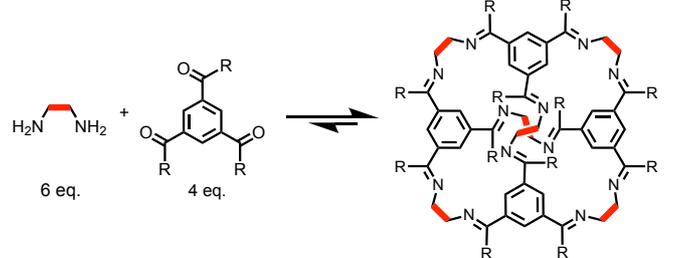
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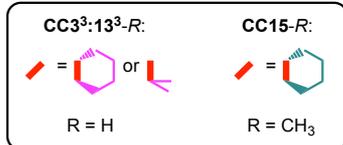
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&, <%, '#(P(&6J>T1(O k(BII V(%#@(! !<@N!"U] k(BII V(/ ="("#. 7?# , (/="(. %&"(10-7&" /?'<@#"# . /9(OH(GO?"(<%I'/' . ('#(" %<=<%. "*"C%. (7G/%a" . (B"?"(@"/"?'&'#"(HO?(:O/(T6.(HO?(>J0(> `01(M"1(%#@ (S01(7.'# , (%(, 7" . / @' .G-%<" &'#(/ &' / =0@(/ =% / / B"(@" .<?' : "@(G?" I'07 .-9²⁰⁰³ o' / = /=" "K<"G/'O#(OH(M"('#(! !<@/(! T61(/=" , % . (7G/%a"(B%.("#=#%#<"@(' #/ ="(T6. ('#%<-%. " .<O&G?" @/O(/="("#% / / .0-1" #/(UZ', 7?"(Q<V*(! " <?7. "(OH(/=" . ' , #H'<%#/#-9(-OB"?(<%, "(<O#<"#/?%/'O#('#/ ="(. /B0(T6.1(, %.(7G/%a" . (B"?"(?" @7<"@ (HO? (%- , % . "(B' / =?" . G" </ /O(07?(G?" I'07. (Qc k(BII(.<?%&:"@ (T6\HO? ("K%&G-"1(/="(>J0(7G/%a" ('#(/="(! !>:<>N!(.<?%&:"@ (T6(B%.(O]^*m(p&O-1, T6(%/Qc k(BII²⁰⁰³<O&G%" @/O(PP*b(p&O-1, T6(%/O k(BII(=?"*#(/ ="(<%. "(OH(S01(/=" ('&G?01" &'#(/ '#(7G/%a"(B' / =?" . G" </ /O(/ ="("#% / / .0-1" #/(B%.(-OB(HO? : O/(T6. (<O&G?" @/O("#% / / (J>T(UZ', 7?"(Q<V1(?)"H-"# / #, (07?(G?" I'07.(0: . " ?1%/'O#. (% / =", =" ? (<%, "(<O#<"#/?%/'O# . *2003(Z0? O/=" ?(, % . .1(@" . G' / / ="(-OB"?(G0?"(<O#<"#/?%/'O#1(/="(, % . (.0-7: '-/9(&'G?01" &'#(. (B"?"(@0?"(&%?a" @ (B' / ="(7G/O(%(q]^*(HO-@(' #<?"% . "(O1" ?/ ="("#% / / .0-1" #1(%#@ / =?"(B"?"(-%?) , (@'H"?"#< .(: "/B" "#(/ ="(/B0(T6. *(Y=" (M" (7G/%a" ('#(! !>:<>N!(! T6(UPA^^(p&O-1, T6\ B%.(%&0. / (HO7?(/' &' . / =% / / &'%. 7?" @ (HO? (! !<@N!" T6(UO^X(p&O-1, T6\ (% / / ="(. %&" (G0?"(<O#<"#/?%/'O#*(Y=" ?" @7<'O#('#(M"(7G/%a" (<#% : "% / / ? : 7" @/O(/ ="(&' / =9(-, ?07G. ('#(! !<@N!(B'<=" "#<?0%<=(O#(/ ="(<%, "(B'#@OB. (%#@(%1%-%: -" (GO?"(10-7&" / =% / /'. (%<< . .':-"/O(M"('#(! !>:<>N!(* (Y="(! !>:<>N!(T6(%: .0?: . (&0?"(M" / =%# / ="(O/=" ?(, % . . /) . /" @1(?"H" </ #, (/ ="(/ =?" &O@9#%&'<(G?"H"?"#<(HO? (M" (O: . " ?" @

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! ; ' (1 % , >) U %) P O R M " (% # @ (U : V P J (S ; A (. G < / ? (H O ? (M " (% # @ (> J o (, % . (' # ! ! > : < > N ! (% # @ (! ! < @ N ! (T 6 . (< O & G % ? " @ / O (' # " % (J > T ' ! ! > : < > / (! (T 6 (% (O k (B 1 1 (% # @ (! ! < @ N ! (T 6 (% () k (B 1 1 (

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M"(' , #%-(' . (%- . 0(B' %a*(Y= . (. =0B . (/=%/(/=" (M" (, % . (<##0/(/" . '9(0<<7G9/(=" (GO?' . ('#/(=" (! !<@N ! (T6I(B=" ?" % . ('# (! !>:;<>?) (T6I(/=" (& 7<= -%? , ?" (@0B##" -@ (. =H/(' . (@7" /O(/=" (M" (, % . (? "%@' .9(0<<7G9' # , (/=" (< , " (<% I' /" . *Y= . (<@#H' ?& . (/=%/(M" (7G' %a" ('#/(=" (! !<@N ! (T6' (. B' /<=" (@0H: (9? " @7<' # , (/=" (< , " (B' # @0B(' .8" * () Y= . (?" -% /' O# . =G : "/B " # , % . (7G' %a" (% # @ (@0B##" -@ (<=" & ' <-% (. =H/(' . 0(=0 . @ . (H0? > J o*(F#(: O/(T6 . 1(/=" ?" (' . (% (' . ' #H' <##/(7G'H" -@ (. =H/(<O&G?' @(/O(J > T(Uwx(y(zP*) c(GG&('#! !>:;<>?) (T6I(wx(y(zQ*Xm(GG&('#! !<@N ! (T6V*(Y=" (-%? , ?" (. =H/O(: " ? I" @('#/(=" (! !<@N ! (T6' . =0B . (/=%/(> J o' (. " KG" ?" ?" #<' # , (% (-%? , ?" ? . '=' -@ # , (" H" </' P J (S ; A (. G" < /? O . <OG9' (<#(: " (7 . " @ (/O(L7%#/'H9' (/=" (. % /?7' /' O# (<O#< " #? /' O# . (OH(> J o(: 9(7 . # , (% . " % " @1(<-% : ?% /' @ (@dN) > ; IY ; _ (<%G' -%?9*(Y=" (, % . (7G' %a" (. & " % . 7? " @ : 9(S ; A (UPb*) (p & O-I , T6(' # (! !>:;<>N ! (T6I(QP*) (p & O-I , T6(' # (! !<@N ! (T6V(?' (' = , '=' ? /%#(H0? /=" (, % . (@ . G-%< " & # / (& " % . 7? " & # / . (UPP^ (p & O-I , T6(' # (! !>:;<>N ! (T6I(PX*X(p & O-I , T6(' # (! !<@N ! (T6V(?' " H" < /' # , (/?' # @ . ('#(G?' " I' O7 . (/7@9^20Q3(Y= . (' . (: " <%7 . " (, % . (" IO-7' /' O# (" KG" ?' & # / . (<##0/(?" . " % . (% - (OH(/=" (, % . (@ . O-1" @('#(T6 : " <%7 . " (OH(/=" : % . " -# " (, % . (. O-7 : ' /' 9' # (: O/(J > T' % # @ ('#/(=" (@ . G-%< " & # / (. O-1" # ?' () S " K / (G7 . " @NH" -@ (, ?% @' # / (UTZCV(S ; A (" KG" ?' & # / . (B' ?" (<??" @ (O7 / / O (& " % . 7? " @H7 . ' O#(OH(> J o(' # /=" /B O(T6 . 9 . /" & . *Y=" ?") . 7- / (OH(/=" . " " KG" ?' & # / . (% ?" ?" ?" % /' @ / O /=" : ' # @ # , (OH(> J o(' # /=" (T6 . *Y = " (& " % . 7? " @H7 . ' O# (<ON" H" < " # / . (H0? (" % <= (T > / (^ P O ({ (Pc^PP (& Q1 . (H0? (! !>:;<>N ! 1(^ X X ({ (Pc^PP (& Q1 . (H0? (! !<@N ! V9%# @ (" G- " (I' . <O . /') . (UY% : " (_ ^ V (B' ?" ?" (7 . " @ / O (<-% < 7-% /" (. O-1 O V9%# <' < ?% @ ' ' 7 . # , (/=" (_ / Oa" . N + # . /' # " L7% /' O# (H0? /=" /B O(T ` > . ('# /=" (T6 . (Um*Q(e(H0? (! !>:;<>N ! 1(m*X(e(H0? (! !<@N ! V \ /=" . " (1% -7" . (% , ?" " (B' /=" /=" (" KG" < /' @ (. '8" (OH(% (20d^3(' & # " (< , " ^2Xc3(Y=" (@H7 . ' O# (<ON " H" < " # / . (H0? > J o(' # /=" /B O(T6 . (U) *OX({ (Pc^PP (& Q1 . ('# (! !>:;<>N ! (T6I(O*) m({ (Pc^PP (& Q1 . ('# (! !<@N ! (T6I(?' % ?" . ' , #H' <-% # / -9(-OB" ?' /=" # /' # " % / (J > T(UP*XO({ (Pc^PP (& Q1 . V1(' # @ ' < % /' # , (/=" (% . . O<' /' O# (OH(/=" (, % . (B' /=" (<-% , " (. O< < 7? # , (% # @ (/=" /' /=" . (' . O : " ? 1% : -" : 9(TZC(S ; A * _ # < " /=" (> J o(=% . (# O / (% @ O G' " @ /=" (. % & " @H7 . ' O# (<ON " H" < " # / . (/=" (T ` > . 1(/=" . ' # @ < % /" . /=" /" /=" (, % . (' . ('# @9% # & < " L7' : ' ? 7 (O# /=" (S ; A /' & " . <% . " : "/B " # /=" (T ` > (<% I' 9' % # @ /=" (J > T(. O-1" # ?' Y=" ?" H0? ' /' /=" . ' # H0? & % /' O# (<#(: " (7 . " @ (/O(<-% < 7-% /" /=" (H2% < /' O# (OH(, % . (& O- " < 7 . " (O<<7G9' # , (/=" (<-% , " (<% I' /" . (UMo<<V1(. (B' -% . /=" (% . . O<' /' O# (<O# . /%# / (U4% V(H0? (" % <= (. 9 . /" & ^2Xp3(F# /=" (! !>:;<>N ! (T6I(Mo<<(y(c^ORI(B="-' (H0? /=") ! !<@N ! (T6(Mo<<(y(c^a^c^Y=" (<O?) . GO# @ # , (% . O<' /' O# (<O# . /%# / . (H0? > J o(' # ("% <= (T6 (<-% # (: " (<-% < 7-% /" @ (H0? & /=" (@H7 . ' O# (<ON" H" < " # / . (& " % . 7? " @ (H0? > J o(' # ("% <= (T6(U4% (y(Q'bP({ (Pc^O (& O^PP (@ X(H0? > J o(' # (! !>:;<>N ! (T6I(4% (y(O^X^ { (Pc^O (& O^PP (@ X(H0? > J o(' # (! !<@N ! (T6V*(Y=" . " (& " % . 7? " & # / . (<O#H' ?' & /=" / > J o(& O? " (G' " H" ?" # ?' % -9(O<<7G' " . /=" (<% I' 9' # /=" (! !<@N ! (T6(/=" # /' /=" (! !>:;<>N ! (T6I(' # a" " G' # , (B' /=" /=" (, % . (7G' %a" (& " % . 7? " & # / . 1(B=" ?" /=" (! !<@N ! (T6(% : . O? : . (& O? " (> J o(UZ' , 7? " (Q<V(() A " /' # /' O# (OH(> J o(' # /=" . " (T6 . (B% . (%- . O(" K% & # " @ : 9 (& " % . 7? # , (/=" (a' #' /< . (OH(, % . (. O . 7 . # , (P J (S ; A (. G" < /? O . <OG9*(Y=" (> J o(<O#< " #? /' O# (% /' (% . " ?" . " . (OH(/' & " ('# /' ? 1% . (B% . (? " <O? @ " @ (% # @ /=" ?% /' (OH(-O . . (OH(> J o(B="-' (OG' # / O(% ? (B% . (<O&G?' @ (% # /' ?' # O? & % -8' # , (/=" (<7? I" . /O(/=" (. % /?7' /' O# (<O#< " #? /' O# (H0? (" % <= (GO? O7 . (-L7' @ (UZ' , 7? " (_ P X) (E H" ?' (P @ # 9 I /=" (! !<@N ! (T6(?' " # /' # " @ (Q X k (& O? " (OH(/=" (' # /' % - (> J o(<O#< " #? /' O# (B=" # / (<O&G?' @ (B' / ! !>:;<>N ! (T6I(% # @ O1 ?" ?% (G' ?' O @ (OH) % ? Q @ % 9 . 1 /=" (> J o(B% . /-O . / (& O? " . -OB-9(H0? & /=" (! !<@N A(T6(/=" # (H0? & /=" (! !>:;<>N ! (T6(

Y= . (. =0B . (/=%/(#? ? O B' # , (/=" (GO?' (@' % & " /" ?' # /=" (& O- " < 7-%? (< , " (<O&G0# # /' # (T6 (<-% # (%- . O' & G? O1 /=" (? " /" # /' O# (OH(, % . (O1" ?' /' & * () F# (. 7 & % ? 9 I (& O @ H' < % /' O # (OH /=" (B' # @ 0B (% # @ (GO?' (. '8" ('#(T ` > . (<-% # (& O 7-% /" /=" (, % . (. " -< /' I' 9' # (T6 . 1 @ ' & O # . /? % /' # , (/=" /% (a' 9 (. /? < /? " NH7 # < /' O # (@ . ' , # (G' ? # < G- ' # (GO? O7 . (. O . ' @ . (< # (: " /? % # . -% /' @ ('# / O /=" . " (" B (& % /' ?' % - . [(HO? (" K% & G- ' 1(B" (<-% # (= /? (O# M" (% : . O? G' / O# : 9 (% # ? ? O B' # , (/=" (< , " (B' # @ 0B 1(B=" <= (%- . O? " @ 7 < " . (/=" (GO?) (. '8" 1' /' # /=" (! !<@N ! (T6(UZ' , 7? " (Q@V*(Y=" ?" ?" (%- . O(. O & " (@H" ?" # < " . (: "/B " # /=" . " /B O(/9G" . (OH(GO? O7 . (& % /' ?' % - . [(HO? (" K% & G- ' 1(H0? (> _ o(UZ' , 7? " (Q@V1 /=" (% & O7 # / (OH(, % . (G" ?' < , " (' . (. ' , #H' <-% # / -9(-OB" ?' # /=" (T6 . 1(GO? % : -9(: <%7 . " /=" (T6 . 1(7#-' a" /=" (<O?) . GO# @ # , (GO? O7 . (. O . ' @ . 1(-% < a ('# " ? & O- " < 7-%? (GO?" . (: "/B " # < , " . /=" /% (-OB (& 7- ' 9? " ?% @ . O? G' O# (% # @ (GO?" (H' -# , (% . (% /?7' /' O# (' . % GG? O% <=" @ * () F# (/=" (-O# , ?' /' ?' & 1(/=" . (OH" ?' . /=" (GO' /' # /' - (OH(H-OB% : -" 1(, % . N . " . " < /' I' (-L7' @ (H0? (" G% ? % /' O# (G? O< " . . \ (H0? (" K% & G- ' 1(B=" ?" % (, % . N . " -< /' I' (T6' . (<9< " @ : "/B " # (% < O- @ % : O? G' O# (80# " (% # @ (% = O / (@ " . O? G' O# (80# " * (Y=" (? " -% /' I' -9(& O @ " . / (I' . <O . /') . (OH(/=" . " (T6 . (U7G' / O (PP^ b < T (G' / Qc k (B1I)^20Q3(= O7 - @ (% - O B(. 7 <= (G? O< " . . * (Y=" (. " -< /' I' 9' (& , = / (: " # < ?" % . @ (H7? /=" ?' : 9 @ " . ' , # # , (% # % - O , O7 . (< , " (& % /' ?' % - . (B' /=" (= , = " ? (. O-7 : ' /') . \ (' a' B' . ' 1(' - & # % /' # , (/=" . O-1" # /' % / O , /=" ?' (<O7-@ (" # = # < < " . " -< /' I' 9' . # < " /=" (<? ?" ?' ?' . O-1" # /' # /=" . " (Y9G" (Q(T6 . 1' . (? " -% /' I' -9(7# . " -< /' I' 1' (% /- = O7 , = ('# /=" /% (<-% . " 1(-L7' @ (I' . <O . /' 9' & , = / (: "% (& %) O? (<= % - # , * (

9-B# 7&, 4(, 0, # \$+)

o (" /=" # a (/=" (+ # , # " ? # , (% # @ (T=9 . ' <-% (<' # < " . (A " . " % ? <= (> O7 # < ' (U + T _ A > V(7 # @ " ? (/=" (C ? % # / (+ T I S c c O m m O I P (% # @ (+ T I A c c) b P c I p I (% # @ /=" (+ ? O G " % # (A " . " % ? <= (> O7 # < ' (7 # @ ?) (Z T b I (A O : \ Y (+ A > (C ? % # (E , ? " " & # / (S O * X Q P P) ^ 1 (H O ? (H' # % # < % - . 7 G G O ? / * A * 6 * C * /=" # a . /=" (A O 9 % - (_ O < ' /' 9 (H O ? (% (g # I' ?' . /' 9 (A " . " % ? <= (Z -- O B . = G' (o " (% < a # O B - " @ , /=" (: ' < ? O ! ' O A " H' # " 9 (H O ? (% . . /' % # < " B' /=" | Y ` Z N ; _ (& " % . 7? " & # / . * (o " /=" # a) ? (Y O & (J % . - (U g # I' ?' . /' 9 (O H (6' I " ? G O O - V (% # @ (T ? O H' (_ /? ? (t % & " . (U | 7 " # V . (g # I' ?' . /' 9 (! -H% . N (H0? (= -GH7-@ . < 7 . ' O# . * (

C, / 7 " # 4+ : (% @ . O? G' O# (. " -< /' I' 9') (GO? O7 . (O? , # # / < < , " .) (GO? O7 . (-L7' @ . (

- 2P3(S'(C'?)i(;*(C'))-(T~GO-0!(C' ; ;-%7 , =1(A*6'(C?' "##B%9I(4*(A*/8a"1Y*(40.<=#"1(6'(T'.0#I(;*(Z'>*(C0&" .1(E'F')>00G'?(?'6't%&" .1(+%#,\$(- AD<@1(. /O(QP^WQQc^ (_*(6't%&" .1(123"4%#-\$*(AD<E1(/5I(bPQW)bP^*(2Q3(E'F')>00G'?(167*6-&#*7)8*(AD<F1(9I00W)j)X'(2X3(S'*(A"-'9I(S'(C'?)i_*(6't%&" .1(6;- ;*"1< , \$**=(ADDF1(>9I(XcQcWXCQj)^(t'(j=## , 1(_'J')>=%'1(j'E' | %O1(_' ; * ; % = 7? # (t' > = # (h' (Z % # , 1(_' o # # I (4' S " . - O # (T' (j = # # , 1(_') % 1 (1 ? - @ " 6 . - ; 8 - " / # # * < 2' AD<@1(. B I R X Q W R X ^ (2^3(T'6'1(t'E'(<=<O//1(t'j=## , 1(_' ; * ; (%=7? # (h' _=" # , 1(M'J7I(C'>7I')*(h%O1(_'! ? O B # (h' j = # # , 1" / % - 1 (1 & ? - @ " 6 : - ; 8 - % # * < 2' AD<F1(. C I (P O R) m' (_' 6'71(t'6'71(M'J071(Y'M71(t'Y0# , 1(t'j=## , 1! ' (h' ! 1' (6'71(D%&? ; , 8(AD<G1(9B1(X^) O W X ^ ^ c' (2m3(M'(6'1(h') # , 1(6'(C701 | (6'%O1(M'j=71(<&-\$?E(AD<H1(>O>I(PcRWPPR'(2R3(T'6'1(J'>=#(t'E'(<=<O//1(?'6'1(h'j=## , 1(AD<H1(P)j)WP)PPR'

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2Pc3(o(_=#(T*(Z'(Z7-1'01(6'(40#,1(t*(E'(<=0/1(>*(6'() 0N\Y=#=#(Y*(Y'%#(M*(
J7)1(('_(:';%=?#(J'(M'#,1(('_)%!(167"1FF;"4%#-\$"#\$&#-\$)%) - '(AD<G(
>1(XQWXA^
2PP3(Y'(_=#(h'(j=#,1(Y'(o%#,1(T*(6'1(h'(o%#,1()*(h%01(6:-;J:E'6:-;(
AD<G1(>K1(PXcWPXb'(
2PQ3(M'(o%#,1()*(_=#,1(('_j "#,1(h' o%#,1(M'(j=#,1(M'(j=#,1(t*(6'71(=
6:-; "L: -\$; M2E&'AD<H1(>/5(OP]WQX*(
2PX3(C'(: "%7,=(S*(C'?'(>+')%1'0.#1(('_6'(t%&" .1(:*(C'() "-(T-GO-01(J:E'"
6:-; "6:-; "J:E'AD<I1(>C1(ROQWXP*(
2PO3(Z'(j=#,1(Z'(h%#,1(t*(J7%#,1(!*(C'(_7&G'"?(A'(|'01(="J:E'"6:-; "N(
AD<E1(>/1(bPR]WbQcc'(
2PJ3(Z'(j=#,1(h'J"1(t*(J7%#,1(!*(C'(_7&G'"?(A'(|'01(="J:E'"6:-; "6(
AD<F1(>/>1(PQOQ^
2P^3(;*(>0./%<C0&" .1(6'(T'.0#1(>'(€"?1'#a%(E'(T%7%1(1&?-@*6:-;8-#&#"
<2*(AD<G1(.B1(RXQNRX^
2Pb3(Z'(1"7"?."1(!*(CO-"1(1&?-@*6:-;8-#&#"<2*(AD<G1(QWXP(
2Pm3(T'(_' ;7a="?"1(4'(E<=?99%1(1&?-@*6:-;8-#&#"<2*(AD<H1()'F(
Pc^PccQ1%#"^*QcPRccP^X'(
2PR3(;*(%./%-"?8(1))"6:-; "!"-*(AD<G1(>1(QOPPWQOQ'(
2Qc3(Y'(J%. "-(E'(F'(>00G"?(+%"#! -3**4%#-\$*(AD<E1(>1(P^c]X'(
2QP3(S*(C'?'(>+')%1'0.#1(C'(: "%7,=(;*(C'() "-(T-GO-01(t*(Y'%'t0#" .1(Y'
J%. "-(E'(F'(>00G"?(T'(S'(J0?/0#1(;'1*(J7?./=07. "1(('_6'(t%&" .1(6:-; "
7)8*(AD<A1(91(QP]X'(
2QQ3(A*(6'(C'?"#%B%91()*(J0-@ "#1(+*(C'(!*(+@ "#1(E'(_/"G=".#.0#1(>'(o'(h0#,1(
;*(t'!"###.0#1(Y'(J%. "-(;'(+?!?'. .1(('_6'(t%&" .1(E'(F'(>00G"?(1(6:-; "
7)8*(AD<F1(51(Q^OcwQ^]P'(
2QX3(_*(t%#,1(t*(Y'%'t0#" .1(Y'(J%. "-(;>+'(!-9="1()*(t*(E@%&.1(E'Y?'B'#(
E'(F'(>00G"?(+%"#6M; ; ,&*(AD<1(/1(Qcb'(
2QO3(E'(C'(_-/"?(T'(_"A" . .1(E'(T7'@01(;'E'(6'//-"1()*(6'(J0-@ "#1(6'(>="#1(('_
h'(>=0#,1(!'1(;'E-./0#1(A'(>-0B" .1(;'J%?%#<89a1("/%-"1(167'6-&#"7)8*
AD<F1(91(bXOWbOQ'(
2QJ3(;*(;'a-/81(4'+*(t"-H.1(="6:-; "%&#"4M2-5*(AD<G1(.51(QXmbWQXRP'(
2Q^3(6'(>="#1(T'(_"A" . .1(('_h'(>=0#,1()*(J0-@ "#1(4'+*(t"-H.1(Y'(J%. "-(;'
E'(6'//-"1(E'4"B-"91(;'(+?!?'. .1(E'(_/"G=".#.0#1("/%-"1(+%"#4%#-\$*(AD<I1(
>91(R]OWR^c'(
2Qb3(Y'(J%. "-(t*(E'(E?&./?0#,1(4'+*(t"-H.1(Z'(J'(Y%91(4'(;*(Y=0&% .1(('_C'(
4%8%?'%#1(E'F'(>00G"?(1(6:-; "6M; ; ,&*(AD<1(BK1(ROPcNROPQ'(
2Qm3(AO:" .0#1(6'(;*(="4-; O\$%&-"7)8)%(<HH<1(C/1(P^]NPm]'(
2QR3(_*(t%#,1(4'+*(t"-H.1()*(J0-@ "#1(Y'(J%. "-(('_h'(>=0#,1(;'(J%?%#<89a1(
E'Y?'B'#1(E'F'(>00G"?(="1; *6:-; "7M)%(AD<1(>9.1(PbmPmNpBmXc'(
2Xc3(A*(6'(C'?"#%B%91(5'(_%#0-'#1(;'(t'!"###.0#1(!'1(;'E-./0#1(>'(t*(T7,=(
;*(E'(6'//-"1(;' ;'a-/81(+*(C'(!*(+@ "#1A7&G1(A'(>-0B" .1(E'(_=#a'1("/%-"1(
+%"#6M; ; ,&*(AD<G1(K1(QmOR'(
2XP3(4'(_(>%&"?0#1(6'(Z'"@#,1(="P\$?"6:-; *(ADD<1(CC1(^mRPW^mR]'(
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