

ARTS3821

 $\label{eq:hammer} $HY^*Dc^*]hWg^*cZ=XYbhJhm^*]b^*hY^*\&\%gh^7Ybh^*fm$



7ci fgY^{*}Cj Yfj]Yk

GHJZZ:7cbHJWh:8YHJ]`g

7cbj Ybcfg

BUa Y	9a U]`	5j U]`UV]`]lm	@cWUh]cb	D\cbY
8f'DYbbm; f]Z]b	gcgg4 i bgk "YXi "Ui	D`YUgY'Ya U]`hc UffUb[Y'Ub Uddc]bha Ybh'		
5bXfY`B Ugg]f]	gcgg4 i bgk "YXi "Ui	D`YUgY'Ya U]`hc UffUb[Y'Ub Uddc]bha Ybh'		

GWXcc`7cbHJWhi±bZcfa Uhjcb

GWXcc``cZGcWJU``GWJYbWYg

Fcca '%) -

A cfj Yb 6fck b 7 &\$

Ya U]`. 'gcgg4 i bgk "YXi "Ui

d\cbY. '\$&'-',) '% \$+

5W_bck `YX[Ya YbhcZ7ci bhfm

I BGK '5fhgž'8Yg][b'UbX'5fW]hYWhifY'?Ybg]b[hcb'UbX'DUXX]b[hcb'WUadigYg'UfY'Vi]hhcb'5Vcf][]bU`

7ci fgY 8YW] g

 $I b h c Z 7 f Y X h^*$

Gi a a UfmcZh\Y 7ci fgY

Gi VYWn5fYU. 'Dc`]h]Wg'UbX' +bhYfbUh]cbU``F Y`Uh]cbgž

7ci fgY @YUfb]b[Ci hWca Yg

- %" 8 Y g W f] V Y `U b X `Y I d`U] b `th, Y `dc`] r] W U `z 'g c W U ``U b X `W `ti f U ``X] a Y b g] c b g `c Z] X Y b r] r m] b `\ i a U b f Y `U r] c b g \] d g `U r i h \ Y `g r U f i c Z h \ Y `& g h W r b i f m '
- &" ⇒ YbhjZmiUbX`ci h`]bY`h\Y`WcbhYghYX`UbX`X]j YfgY`W\UfUWYf`cZ]XYbhjlmidc`]hjWg`Uh[`cVU`ž`cWU``UbX Yj YfmXUm`Yj Y`g`cZk cf`X`dc`]hjWg`
- ' " 9j U`i UHY`U`j Uf]YmicZUXj UbWYX`XYVUHYg`cb`UbX`UddfcUWXYg`hc`ei Ygh]cbg`cZ]XYbh]mi]b`k cf`X dc`]h]Wgž`]bZcfa YX`VmU`gY`ZfYZYI]j Y`Uk UfYbYgg`cZh\Y`fYUgcbYX`j]Yk g`cZch\Yfg`UbX`i g]b[`U j Uf]YmicZWcbWYdhgž'h\Ycf]Yg`UbX`WUHY[cf]Yg`cZUbU`mg]g"`
- ("@cWUHYždf]cf]hjgY`UbX`Udd`mUddfcdf]UHY`]bZcfa Uhjcb`]b`UbX`hc`Dc`]hjWg`]b`U`gcd\]ghjWUHYX`UbX dYfgi Ug]j Y`a UbbYfži g]b[`WYUf`UbX`YZZYWhj Y`]bXYdYbXYbhfYgYUfW.ž'Wf]hjWU``fYUgcb]b[`UbX gW.c`Uf`mk f]hjb[`g_]``g"`

HYUWX]b['GhfUhY[]Yg'

H\Y'Wci fgY']g'Hui [\hih\fci [\'U'a] | hi fY'cZk YY_`mh\fYY'\ci f'gYa]bUfg'UbX'cb`]bY'`YUfb]b['UWjj]ljYg'''Mci k]``UXXfYgg'h\Y'`YUfb]b['ci lWca Yg'h\fci [\'cb`]bY'UbX'gYa]bUf'dfYdUfUjcb'UbX'dUffjWjdUfjcb'zd'i g'h\Y'hJa Y`mgi Va]gg]cb'cZWci fgY'Ugg][ba Ybhg'''H\Y'Wci fgY'\Ug'VYYb'XYg][bYX'hc'Yb[U[Y'mci ']b'U W ff]W\'i a 'cZ]bXYdYbXYbh'UbX'fYZYWjj Y'`YUfb]b['ZYbWci fU[]b['Wf]hJWJ''h\]b_]b['h\fci [\']bZcfa YX'gYa]bUf dfYdUfUjcb'UbX'X]gW gg]cb'VUgYX'cb'[i]XYX'fYUX]b['UbX']bXYdYbXYbh'UbX'X]fYWfYX'fYgYUfW.''GYa]bUfgz'cb']bY'UWjj]hJYg'UbX'UggYgga Ybhg'YbWci fU[Y'mci 'hc'XYYdYb'mci f'Wf]hJWJ''fYZYWjcb']b'UfYUg'cZdUffjW'Uf]bhYfyghk\]Y'h\Y']bhYfgYWjcbU'`bUhi fY'cZWci fgY'h\Ya Ygz'gYa]bUf'hcd]\wj'UbX'k YY_`mcb`]bY'UWjj]hJYg fYei]fYg'mci 'hc'VfcUXYb'mci f'Wf]hJWJ''WJdUWJmUWfcgg'Wci fgY'WcbhYbh'': YYXVUW_jg'dfcj]XYX'h\fci [\ci h h\Y'Xi fUh]cb'cZh\Y'Wci fgY']b'Ua YUb]b[\(\frac{1}{2} \) ``UbX'hja Y'ma UbbYf'''Nci f'UW\]Yj Ya YbhcZh\Y''YUfb]b[ci hWca Yg'cZh\]g'Wci fgY']g'WYUf'mXYa cbghfUhYX'h\fci [\'mci f'Yb[U[Ya Ybhik]h\'Wci fgY'a UhYf]U'z'h\Y ei U']hmcZh\Y'dfYgYbhUjcb'cZmci f']XYUg'UbX'X]gW gg]cb'UbX'mci f''Yj Y''cZUW\]Yj Ya Ybh']b'Wci fgY

UggYgga Ybh' 5```UggYgga Ybhg`]b`h\]g`Wci fgY`UfY`XYg][bYX`hc`gi ddcfhi\YgY``YUfb]b[`ci hWca Yg"'GYa]bUf X]gW gg]cbg`k]```VY`Vch\`ghi XYbh' UbX`YXi WUhcf! `YX`UbX`VUgYX`cb` WUfYZ\``dfYdUfUh]cbz`h\Y`Wca d`Yh]cb cZcb`]bY!ZUW]hUhYX`UWfj]h]YgžWcgY`fYUX]b[g`UbX`h\Y`UbU`mg]g`cZfY`Yj Ubhdf]a UfmiUbX`gYWcbXUfm gci fWfg"

H\Y`XYg][b`cZh\Y`hYUW\]b[`acXY`UbX`WcbhUWi\cifg`fYZYWiVch\`U`Wcaa]naYbhhc`ZUWY`hc`ZUWY`hYUW\]b[UbX`Yb[U[YaYbhk]h\`jUf]cig`UgdYWng`cZV`YbXYX``YUfb]b[ž`Ug`cih]bYX`]b`h\Y`IBGK`&\$&)`GhfUhY[mH\YaY`5&.`9XiWUn|cbU``9IWY``YbWY"

5ggYgga Ybh

 $5\label{eq:continuous} 5\label{eq:continuous} 5\label{eq:continuous} 5\label{eq:continuous} fix f]hhyb'' uggYgga Ybhg'']b'5F HG', &%a i gh'VY'Zcfa UhhyX'UVWcfX]b['hkY'
- Ufj UfX'gmghYa 'cZ fYZYfYbW]b['z'Ug'Zci bX']b'hkY'[i]XY''bHyg']b'hkY'GWkcc``cZ'GcW]U''GW]YbWffg'FYZYfYbW]b['; i]XY'''H\]g']g Uj'UV'Y'Uh$

\htdg.#k k k "Uffg"i bgk "YXi "Ui #g]hYg#XYZUi `h#Z]Yg#XcWi a Ybfg#GcGGSF YZYfYbW]b[S: i]XYS&\$% "dXZ" \display [gc cb h\Y A ccX`Y dU[Y \Zcf 5F HG', &%\UbX \g\ci `X`VY \Wcbgi `hYX \Zcf \U``fYZ\fYb\W]b['ei Yf]Yg"

5 bm]bZcfa Uh]cb 'Wca a i b]WUhYX X]fYWhmhc 'mci 'h\fci [\'Ya U]\'k]\'`VY 'gYbhhc 'mci f'I b]j Yfg]hmYa U]\'UW\'ci bh' \din i]g 'UX XfYgg" 'D`YUgY fYUX \hdg.#ghi XYbh'i bgk "YXi "Ui #/a U]\!fi `Yg'UbX 'WcbhU\hi BGK \din H f\hdg.#k k k "a mh'i bgk "YXi "Ui #yfj]\wg#ghi XYbhg\'z]\mathred{Zmci 'UfY i b\wYUf'cb'i g]b['cf'fYX]fY\wh]b['mci f'Ya U]\'''

K Y`k]```gdYbX`gca Y`h]a Y`]b`WUgg`hc[Yh\Yf`X]gWigg]b[`UbX`d`Ubb]b[`mci f`**UggYgga Ybhg**`]b`5F HG', &%" H\]g`]g`dUfhmk\mUhYbXUbWi]b`h\]g`Wci fgY`]g`gc`]a dcffUbh'``

8c'd`YUgY'a U_Y'gi fY'mci '\Uj Y'a UXY'mci fgY`ZZ\``mUk UfY'cZU```fY`Yj Ubh'dc`]W]Yg'WcbWffb]b['fYZYfYbW]b[ž UWUXYa]W\cbYghm'UbX'd`U[]Uf]ga ž'UbX'h\Y'`UhY'gi Va]gg]cb'cZk cf_'f<u>\htdg.#gh XYbh'i bgk "YXi "Ui #dc`]Wh</u>t"

5ggYgga Ybh'tUg_	K Y][\h	8iY'8UHY	7 ci fgY @YUfb]b[Ci HWca Yg 5ggYggYX
%" ⁻ 9ggUmD`Ub	(\$1	\$+#%\$#&\$&&`%%) - `DA	&
&"'F YgYUfWX'9ggUm	* \$1	&%#%#&\$&&`%%) - `DA	%ž'' ž'(

5ggYgga Ybh'% '9ggUm'D`Ub

5ggYgga Ybh`Yb[h\. %) \$\$ k cfXg 8i Y XUhY. \$+#\\$#&\$&&\%) - DA

%) \$\$`k cfX`YggUmd`Ub"`Mci `k]```fYWY]j Y`k f]hhYb`ZYYXVUW_ž'U`Wca d`YhYX`fi Vf]WZ'UbX`U`bi a Yf]WU``[fUXY h\fci [\`A ccX`Y`k]h\]b`hk c`k YY_g`cZgi Va]gg]cb`cZh\]g`Ugg][ba Ybh'

H\]g`Ugg][ba Ybh]g`gi Va]hhYX`h\fci [\`Hi fb]h]b`UbX`gh XYbhg`Wb`gYY`Hi fb]h]b`g]a]`Uf]hmfYdcfhg"

5XX]h]cbU`XYhU]`g

cfih.]giUggYgga Ybhimci a i ghdfcj]XYiUfYgYUfWk ei Ygh]cbiUbXiYggUmd`Ub"iMci fid`Uba i ghVYibc a cfYih.Ub'%2) \$\$ k cfXgiUbXa i ghci h]bYih.Yighfi Whi fYiUbXi]bX]WUhYih.YiWcbhYbhcZmci fif YgYUfWk 9ggUmdiMci fid`Uba i ghgdYWJZmUbi]bX]WUhjj YiV]Vi]c[fUd\mcZhYbifYiYj UbhUbX:Uddfcdf]UhYidYf! fYj]Yk YXiUWUXYa]Wgci fWrg"iH\YiU]a icZh,]giYl YfW]gYi]gihciYbWci fU[Yimci ihciVY[]bih,]b_]b[iuVci hUbX diUbb]b[ih,Yih,YcfYh]WUiUbXiYa d]f]WUiZci bXUh]cbgicZmci fif YgYUfWki9ggUmik \]YiYb[U[]b[ik]hh fYiYj UbhUWXYa]Wi]hYfUhi fY": i ```[i]XYi]bYgicbih,YiZcfa UhUbXigi Va]gg]cbicZh,YiUggYgga YbhUfY Uj U]iUVYicbih,Yi5F HG', &%A ccXYidU[Y"

5ggYgga Ybh& FYgYUfW 9ggUm

' ž\$\$\$`k cfX`YggUm'`Mci `k]```fYWY]j Y`k f]thYb`ZYYXVUW_žU`Wca d`YhYX`fi Vf]WžUbX`U`bi a Yf]WU``[fUXY`th\fci [\ A ccX`Y`k]th\]b`tk c`k YY_g`cZqi Va]qq]cb"`H\]q`]q`th\Y`Z[bU``UqqYqqa YbticZth\Y`Wci fqY"

H\]g`Ugg][ba Ybh]g`gi Va]h\YX`h\fci [\`Hi fb]h\b`UbX`gh XYbhg`Wb`gYY`Hi fb]h\b`g]a]`Uf]hmfYdcfhg"

5XX]h]cbU`XYhJ]`q

cfih]gʻUggYgga Ybhžmci a i gh]XYbh]ZmʻUbʻYa d]f]WUʻcfih YcfYh]WUʻʻUfYUʻcZʻ]bhYfYghžXYj]gYʻUʻgi]hUVʻYʻfYgYUfW. ei Ygh]cbʻffYj]g]b[ʻ]bʻʻ]bYʻk]h ZYYXVUW_cbʻmci fʻ9ggUmDʻUbŁʻUbXʻdfcXi WʻUʻWc\YfYbhʻUbX dYfgi Ug]j YʻUf[i a YbhcZʻ Z\$\$\$k cfXgʻh UhYb[U[Ygʻk]h ThYYʻWcfYʻh Ya YgʻUbXʻ]ggi YgʻcZ5F HGʻ, &%" Mci k]``VYʻUggYggYXʻcbʻmci fʻUV]`]mhcʻXYa cbghfUhYʻfYgYUfWkʻg_]``gʻfh YʻUV]`]mhcʻdfcj]XYʻUWW fUhY UbXʻXYhJ]`YX']bZcfa UhJcbʻUVci hmci fʻWkcgYbʻhcd]WUbXʻfYʻYj UbhWUgYʻghi X]YgŁZcbʻgmbh Yg]gʻUbX 'dYfgi Ug]j YʻUf[i a Ybhf]bʻVf]b[jb[ihc[Yh\Yf]XYUgʻUbX`XUhUʻZca 'gYj YfU`ʻgci fWYgŁZcbʻh YcfYh]WUʻi bXYfghUbX]b[zcbʻei Uʻ]mhcZdfYgYbhUh]cbʻf]bWi X]b['UWW fUhYʻfYZYfYbW]b[ŁUbXʻcbʻh\YʻWUf]mhcZmci f k f]h]b['':i ```[i]XY`]bYgʻcbʻh\YʻZcfa UhUbXʻgi Va]gg]cbʻcZh\YʻUggYgga YbhUfYʻUj U]`UVʻYʻcbʻh\Y 5F HGʻ, &%A ccX'YʻdU[Y''

5 hmy b X Ub WY F Yei] f Ya Yb hg

 $\label{eq:hamman} \mbox{H\Y'I b]j Yfg] \mbox{hmfg' Dc']Whicb'5 hhybXUbW'']g'Uj~Uj'UV'Y'Uh'\underline{\mbox{hmdg.} \#gh XYbh'i bgk "YXi "Ui $\mu \mbox{hmybXUbW}$}$

K YY_`%\$.`%(`Bcj Ya VYf !`% `Bcj Ya VYf	GYa]bUf	>i ghjwy Ubx F ywt[b]hjcb	
	5ggYgga Ybh	K YY_`‰f&‰ghBcj Ya VYfŁ'5ggYgga Ybh&. F YgYUfVX '9ggUm	

FYgci fWyg

DfYgWf]VYX F Ygci fWYg

5 "fYei] fYX UbX fYWca a YbXYX fYUX]b[g Zcf 5F HG', &% UfY Uj U] UV Y cb h\Y Wci fgY A ccX Y dU[Y"

FYWca a YbXYX FYgci fW/g

D`YUgY`gYY`AccX`Y`Zcf`U`Z````]ghcZU```fYei]fYX`UbX`fYWcaaYbXYX`fYUX]b[g"`FY`YjUbhiWcifgYfYgcifWYg`UbX`giVYWh[i]XYg`WUb`U`gc`VY`UWWYggYX`h\fci[\`h\Y`IBGK`@]VfUfmffhhdg.#giVYWf[i]XYg"`]VfUfmfibgk "YXi"Ui#WcifgYfYgcifWYg`]ghg#UW`h]Yg#Ugg\z"`Mci`g\ci`X`Wcbgi`hh\Y@]VfUfmfY[i`Uf`mZcf`U``XUhUVUgYžY`cifbU``UbX`giVYWh[i]XY`]bei]f]Yg"`

7 ci fgY 9j U'i Uhcb UbX 8Yj Y'cda Ybh

Gh XYbhYj U'i Uhj Y ZYYXVUW_']g'[Uh\YfYX'Zcfa U``mi g]b['I BGK fij A m9I dYf]YbW'gi fj Ym a YW\Ub]ga 'f\hdg.#gh XYbh'i bgk "YXi "Ui #a mYI dYf]YbW'\L" Mci 'UfY'U`gc'j Yfmk Y`Wca Y'UbX'YbWci fU[YX'hc dfcj]XY'ZYYXVUW_']bZcfa U``mžX]fYWhmhc'mci f'5FHG', &%7 ci fgY'7 cbj Ybcf" 'Mci f'Wcbghfi Whj Y'ZYYXVUW_']g]bWfYX]V`m]a dcfhUbhžVch\'Xi f]b['h\Y'Wci fgY'UbX'UZhYf']h]g'Wca d`YhYXžUbX']g'i gYX'hc'[i]XY'h\Y'XYg][bžfYj]Yk 'UbX']a d`Ya YbhU]cb'cZ5FHG', &%'UhU``ghU[Yg"'D`YUgY'Xc'fYa Ya VYf'k \Yb'dfcj]X]b['ZYYXVUW_'hcghUZUhI BGK 'h\Uhmci 'UfY'gdYU_]b['hc \i a Ub'VY]b[g'UbX'h\Uhmci f'k cfXg`\Uj Y'Ub']a dUWf'

5 WUXYa]W<cbYghmUbX D`U[]Uf]ga

D`U[]Uf]ga i]gii g]b[ih\Yik cfXgicfi]XYUgicZch\YfgiUbXidfYgYbh]b[ih\Ya iUgimci fick b"i±i\WbihU_Yia Ubm Zcfa gžZfca iXYi]VYfUhYiW\YUh]b[ihciU\W]XYbhU`m\Wcdm]b[iZfca iUigci f\Wik]h\ci hiU\w_bck iYX[Ya Ybh'

IBGK [fcidg'd'U[]Uf]ga]bhc'h\Y'Zc``ck]b['WUhY[cf]Yg.

- 7 cdm]b[.'I g]b['h\Y'gUa Y'cf'j Yfmg]a]'Uf'k cfXg'hc'h\Y'cf][]bU'hYI hcf']XYU'k]h\ci hUW_bck 'YX[]b[h\Y'gci fW'cf'i g]b['ei chUh]cb'a Uf_g"'H\]g']bWi XYg'Wcdm]b['a UhYf]U'gž]XYUg'cf'WcbW'dhg'Zfca 'U Vcc_ž'Ufh]WYž'fYdcfhcf'ch\Yf'k f]hHYb'XcW a Ybhž'dfYgYbhUh]cbž'Wca dcg]h]cbž'Uffk cf_ž'XYg][bž XfUk]b['z'W]fWi]hfmž'Wca di hYf'dfc[fUa 'cf'gcZhk UfYž'k YVg]hYž']bhYfbYhž'ch\Yf'Y'YWfcb]WfYgci fWYž'cf Ubch\Yf'dYfgcbfq'Uqq][ba Ybhk]h\ci hUddfcdf]UhY'UW_bck 'YX[Ya Ybh'
- \pm 0Uddfcdf]UhY dUfUd\fUg]b[. '7\Ub[]b['U'ZYk 'k cfXg'UbX'd\fUgYg'k\]Y'a cghmfYhU]b]b['h\Y

5 WUXYa]W + DZcfa Uh]cb

8 i Y'hc'Yj c'j]b['UXj]WY'VmBGK '<YU'h\z'ghi XYbhg'a i ghW\Y<u>W</u>'Zcf'i dXUhYX']bZcfa Uh]cb'fY[UfX]b['cb`]bY 'YUfb]b['Zcf'U``'5fhgz'8Yg][b'UbX'5fW\]hYWi fY'Wci fgYg'h\]g'hYfa 'fJ]U'A ccX`Y'cf'Wci fgY']bZcfa Uh]cb dfcj]XYXŁ"

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 $\label{eq:def-weight-def-weight$

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