

ARTS3123

Gc`c'DYfZcfa UbWY'A U_]b[

HYfa 'Hk c''#'&\$&%

7ci fgY'Cj Yfj]Yk

GHJZZ7cbHJWh8YHJ]`g

7cbj Ybcfg

| BUa Y | 9a U]` | 5j U]`UV]`]lm | @cWUh]cb | D∖cbY |
|-----------------------------|---------------------------|---------------------|---------------------------|---------|
| 6fmcb] ⁻ HfYn]gY | V"ffYn]gY4 i bgk "YXi "Ui | D`YUgY`Ya U]``Z fgh | K YVghYf | -',)()% |
| | | Zcf'Ub'Uddc]bha Ybh | 6i]`X]b[[·] ‰+ | |

Hi hcfg

| B Ua Y | 9a U]` | 5j U]`UV]`] m | @cWJhjcb | D\cbY |
|---------------------|-------------------------------|----------------------|----------|------------------|
| A Uf_'A]h/XY`` | a "a]h/XXY``4 i bgk "YXi "Ui | | € A mYfg | - ' ,) '(, * ' |
| DfcXi Wjcb'A UbU[Yf | | | H\YUlfY | |

GWXcc`7cbHJWhi±bZcfa Uhjcb

GWXcc`cZh\Y'5fhg'UbX'AYX]U

Fcca " %&ž@Yj Y`" žFcVYfhK YVghYf'6i]`X]b[ff %(Ł

D\cbY.'f\&\\'-',)'(,)*

9a U]` gUa 4 i bgk "YXi "Ui

K YVg]hY. k k k "Ufhq"i bqk "YXi "Ui #qUa

 $\label{eq:hamiltonian} $$HY'GW.cc``cZhY'5ftg'UbX'AYX]U'kci`X``]_Y'tc'FYgdYWM\cong \cong m5\Lock\`YX[Y'h\Y'HfUX]tjcbU``7i\gtcX]Ubg\cong h\Y'6YXY[U'`fP\Ybg]b[tcb'WJa\di\gt\cong \cong m5\Lock\`YX][U'`fP\Ybg]b[tcb'WJa\di\gt\cong \cong m5\Lock\`Y'B[i\bbUk\U'\dYcd'Y'fbi\gth\'Y'B[i\bbUk\U'\dYcd'Y'fbi\gth\'Y'\UW\\`WJa\di\g'\cong \cong \cong m5\Lock\Y'\UbXg'k\YfY'YUW\\`WJa\di\g'\cong \cong \cong\cong \cong \cong \cong \cong \cong \cong \cong \cong \cong \cong$

7ci fgY 8YHJ] g

7 fYX]h'Dc]bhg'*

Gi a a UfmcZh\Y 7ci fgY

GiVYWh5fYU.FZWSfdWS`VBWdAd_S`UWEfgV[We

5fY 'mci '`cc_]b['Zcf'U'WlfYYf'Ug'U'dYfZcfa Yf3'8 c'mci 'k Ubhhc'i gY'dYfZcfa UbW'hc'Yl dfYgg'mci f'ck b]XYUg3'H\]g'Wci fgY']g'Zcf'U```ghi XYbhg']bhYfYghYX']b'k cf_]b['k]h\'dfUWf]W'hc 'XYj Y`cd'U'dYfZcfa UbW'k cf_ Zcf'di V']WdfYgYbhUh]cb"'DYfZcfa UbW'hU_Yg'd'UWY']b'h\Y'\YfY'UbX'bck "'H]a Y'`cdYbg'i d'UbX'VcX]Ygž]a U[Yg'UbX'k cfXg'fYg\UdY'k\Uhh\Y'Z hi fY'Wlb'`cc_'`]_Y'''K\]'Y'XfUk]b['cb'ZfUa Yk cf_g'Zfca 'hfUX]h]cbg'cZ ']j Y'UfhUbX'dYfZcfa UbWYZYUW\ k YY_`mk cf_g\cd'k]``dfcj]XY'mci 'k]h\'hYW\b]ei Yg'Zcf'WfYUh]b['mci f'ck b dYfZcfa UbWY'''Nci 'k]``Yl d`cfY'U'k]XY'fUb[Y'cZUfh]gh]WdfUWf]WYgz'WfYUh]j Y'dfcWYggYg'UbX'Wf]h]WD''WcbhYl hg Zcf'a U_]b['mci f'k cf_'''Nci 'k]``k cf_'h\fci [\ci h\h\Y'Wci fgY'cb'dfUWf]WYzk\\Yh\Yf'mci 'UfY'a U_]b[dYfZcfa UbWY''mci fgY`Zcf'XYj Y`cd]b['mci f'XfUa Uhi f[]WD''ZYYXVUW_'g_]``g'cb'h\Y'dfcWygg"

7 ci fgY @YUfb]b[Ci hWca Yg

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%" gmbh\Yg]gY`Wca d`YI`a UhYf]U`g`Zfca `fYUX]b[gž`WUgg`YI YfVJgYgž`dYYfg`UbX`gY`ZXYj Y`cda Ybh`]bhc`U Wc\Yg]j Y`)`a]bi hY`gY`ZXYj]gYX`dYfZcfa UbVW`Zcf`di V`]WdfYgYbhUh]cb

Y # Tay Vizid Tob b YK Abd Y 1 d YM 7 Zoch f Y Children Y F Hub Ver Went for the Year Viven from the Year

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5ggYgga Ybh HUg_g

| 5ggYgga Ybh'hUg_ | K Y][\h | 8i Y'8UhY | Gh XYbh@YUfb]b[Ci hWca Yg 5ggYggYX |
|---|---------|---------------|--|
| 8 Yj Y`cd]b['dfUW¶W' dfYgYbHJh]cbg' | &\$ı | Bch5dd`]WUV`Y | &ž (ž) |
| A U^cf'dYfZcfa UbW\' | ()। | | |
| | | | |

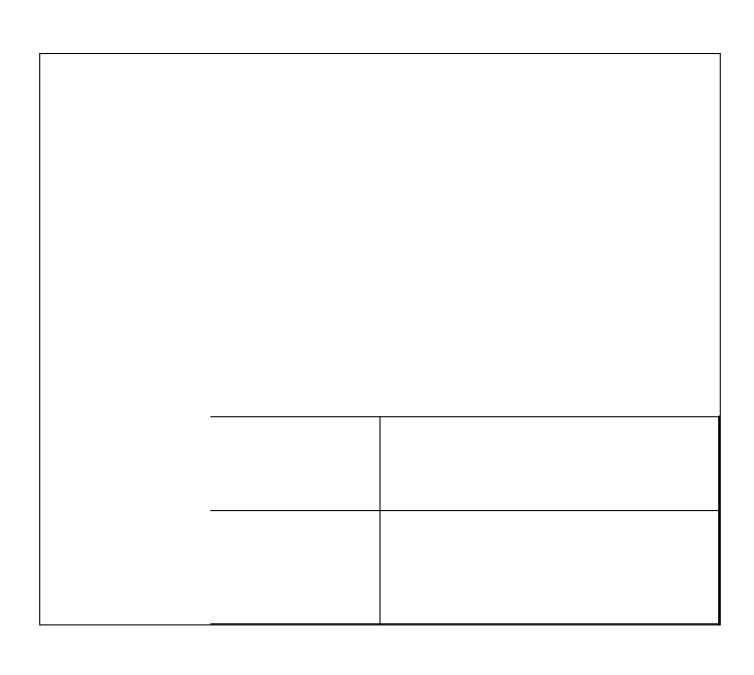
 $\label{eq:higher_high_substitution} \mbox{Hi fb]h]b "gYhh]b[."H\]g"]g"bchU"Hi fb]h]b"Ugg][\ ba\ Ybh$

5ggYgga Ybh' . FYZYWhjj Y'5bU'mg]g

8YHJ]`g.

FiVf]WzWcaaYbhUfmiUbX^[fUXY

 $\label{thm:condition} \mbox{Hi fb]h]b"gYh]b" Low Ybh"]g"gi Va]hhYX"h\fci [\h]b" Low X"ghi XYbhg"Xc"bchigYY" Hi fb]h]b g]a]"Uf]hmfYdcfhg" \mbox{Hi fb]h]b" Low Ybh"]g"gi Va]hhYX"h\fci [\h]b" Low X"ghi XYbhg"Xc"bchigYY" Hi fb]h]b Low Ybh"]g"gi Va]hhYX"h\fci [\h]b" Low Ybh"]g"g [\h]b" Low Ybh"]g"g [\h]b" Low Ybh"]g"g [\h]b" Low Ybh"]g"g [\h]b" Low$



FYgci fWyg

DfYgWf]VYX F Ygci fWYg

F YUX]b[g'Uj U]`UV`Y']b'@Y[Ubhc"

FYWca a YbXYX FYgci fWfg

D`YUgY`gYY`fhY`WcifgY`AccX`Y`Zcf`Ub`YIfYbg]jY``]ghcZfYUX]b[g`UbX`X][]fU``fYgcifWYg''

7 ci fgY 9j U'i Uh]cb UbX 8 Yj Y'cda Ybh

H\]g`Wci fgY`]g`fci h]bY`m`]a dfcj YX`cb`h\Y`VUg]g`cZ]bZcfa U``ZYYXVUW_[]j Yb`Vmgh XYbhg`hc`hYUW\Yfg`Ug`k Y``Ug`h\fci [\`Zcfa U``a YW\Ub]ga g`gi W\`Ug`A m9I dYf]YbW`]b`h\Y`Z]bU``k YY_g`cZh\Y`Wci fgY''`

A m9I dYf]YbWY ZYYXVUW_`]g`j]hU``hc`gi ghU]b]b['h\Y``]ZY`cZ'h\]g`Wci fgY"`K Y`YbXYUj ci f`hc`a U_Y`h\Y dfYW]ci g`gdUWY`cZh\]g`dYfZcfa UbWY``UVcfUhcfmUg`]bbcj Uhjj Yž`Zi]X`UbX`f][cfci g`Ug`dcgg]V`Yž`gc`d`YUgY dfcj]XY`mci f`ZYYXVUW_`k\Yb`kY`fYei Ygh`]h'

±0`&\$&%k Y`UfY`VUW_ik cf_]b[ik]th`dYfZcfa UbWY`]b`U`g\UfYX`UbX`Wc``UVcfUt]j Y`ZUWY`tb`ZUWY`Ybj]fcba Ybti' K Y``YUfbYX`U``ch`UVci hdYfZcfa UbWY`]b`&\$&\$`k\Yb`k Y`XY`]j YfYX`th]g`Wci fgY`cb`]bY`UbX`gca Y`cZth\cgY]bg][\tg`\Uj Y``YX`tb`bYk 'WUgY`gti X]YgžYI dYf]a Ybtg`UbX`]XYUg`UVci hik\Uhk Y`WUb`Xc`k]th`dYfZcfa UbWY`]b th]g`Wci fgY"'

Gi Va]gg]cb cZ5ggYgga YbhHUg_g

Hi fb]h]b Gi Va]gg]cb

Image: Ybwei bhyfu'dfcv'ya k \yb'uhhya dhjb['hc'gi va]hmci f'Ugg][ba Ybhh\fci [\ 'Hi fb]h]bž'd'YUgY

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\ci fg'UfY', .\$\$Ua '-'%\$.\$\$da 'cb'k YY_XUmg'UbX'-.\$\$Ua '-').\$\$da 'cb'k YY_YbXg'fl *) 'XUmg'U'mYUft'''=Z'mci
UfY'i bUV'Y'hc'gi va]hmci f'Ugg][ba YbhXi Y'hc'U'ZJi 'hk]h\ 'Hi fb]h]b'mci 'a Um'Udd'mZcf'Ub'Y! hy'bg]cbž'Vi hmci
a i ghfYhJ]b'mci f'h]W_Yhbi a VYf'Zfca '9! hy'fbU''Gi ddcfhfU'cb['k]h\ 'Ubmch\Yf'fy'Yj UbhXcW a Ybhgt'hc
]bWi XY'Ug'Yj]XYbW' hc'gi ddcfhmci f'Y! hy'bg]cb'Udd']WUh]cb"'=Zmci 'Ya U]''9! hy'fbU''Gi ddcfhmci 'k]'`
Ui hca Uh]WJ'`mfYW']j Y'U'h]W_Yhbi a VYfZ'Vi h]Zmci 'hY'Yd\cbY'mci 'k]``bYYX'hc'gdYW]Z]WJ'`mUg_'Zcf'cbY''
Hi fb]h]b'U'gc'dfcj]XYg'i dXUhy'g'cb'h\Y]f'gmghYa 'ghUh' g'cb'Hk]hyf''

; YbYfU`mž'UggYgga YbhiHug_g'a i ghVY'gi Va]hhYX'Y`YVWfcb]\WJ``mij]U'Y]h\Yf'Hi fb]h]b'cf'U'A ccX`Y Ugg][ba Ybh''=b']bgHJb\W'g'k \YfY'h\]g']g'bchdcgg]V`Yž']hk]```VY'gHJhYX'cb'mci f'\\circ i fgY'g'A ccX`Y'g]hY'k]h\U`hYfbUh]j Y'gi Va]gg]cb'XYHJ]`g"

cfi]bZcfa Uhjcbicbi\ckihcigi Va]hUgg][ba Ybhgicbi]bYij]UiA ccXiY.i\hdg.#gh XYbhi bgk "YXi "Ui #\ck! gi Va]hUgg][ba Ybha ccXiY

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=hWJbihU_Yia Ubm Zcfa gžZfca iXYi]VYfUhYiWXYUh]b[ihciUWW]XYbhU`mWcdm]b[iZfca iUigci fWYik]h\ci hiUW_bck iYX[Ya Ybh'

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

• i bXYfgHJbX'mci f'f][\hg'UbX'fYgdcbg]V]`]h]Yg'Ug'U'gh XYbh'Uhil BGK