

ARTS1540

⇒hfcXi Wcfm; fYY_5

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

7ci fgY'Cj Yfj]Yk

GHJZ7cbHJWh8YHJ]`g

7cbj Ybcfg

B Ua Y	9a U]`	5j U]`UV]`] m	@cWUh]cb	D\cbY
8f'9 <i>T</i> fcg]b] 8Y`][]Ubb]	Y"XY`][]Ubb]4 i bgk "YXi "Ui	,	A 6&+\$ fA cfj Yb 6fck bž@Yj Y` &Ł	f\$&£'-\$*) %-,'

GWXcc`7cbHJWh′±bZcfa Uh]cb

GWkcc``cZ<iaUb]h]Yg'UbX'@Ub[iU[Yg

@c\\U||cb. G\\cc`C\\Z|\\\ž\Acfj\b'6fck\b'6i]\X]b[\z'@\j\Y`\&z\&),

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D\cbY. 'Ž*%'&'-',)'%*,%

: UI . Ž*%'&'-',)', +\$)

9a U]`.'\<u>U`4 i bgk "YXi "Ui</u>

7ci fgY 8YW] g

7 fYX]hDc]bhg**

Gi a a UfmcZh\Y 7 ci fgY

H\Y'; fYY_``Ub[iU[Yž\ckYjYf`]bff]WlhYž]g'acfY'h\Ub`mYh`Ubch\Yf`ZcfY][b``Ub[iU[Y/]h]g'h\Y`_Ymhcibc\\Yf\ZcfY][b``Ub[iU[Y/]h]g'h\Y'_Ymhcibc\\Yb['`\down']b['`U'[fYUhW\hifty'h\Uh]g'h\Y'\VUW_VcbY'cZcif'acXYfb'W]j]]nUh]cb''`\down'h\]g'WcifgY'mci'UfY]bffcXiWX'hc'h\Y'; fYY_``Ub[iU[Y'UbX'mci'k]``VY[]b'hc'`YUfb'Z\bW]cbU'`; fYY_žk\]W\\Wb'VY'igYX']bYjYfmXUm`]ZY']b'; fYYW'''Nci'UfY'YIdcgYX'hc'h\Y'; fYY_`U'd\UVYhhc'aU_Y'fYUX]b['UbX'kf]h]b['dcgg]V`Y'UgZfca'h\Y'ZfghkYY_'cZWUggYg'''6Ug]W[fUaaUh]WU``UbX'gmbhUw]WU``UgdYWg'cZ; fYY_`UfY']bffcXiWXXhci[\'cfU`z`]ghYb]b['UbX'fYUX]b['UWMj]h]Yg'''H\Y'acfd\c`c[mUbX'gffiWifYcZh\Y'`Ub[iU[Y']g'dfYgYbhYX

5ggYgga Ybh

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K f]thYb HYgh	(\$1	&%#\$+#&\$&%`\$\$\$`5A	%ž [*] &
Cb`]bY'Dcfh7c`]c'	(\$1	Bch5dd`]WUV`Y	%ž'&ž'' ž'(
; fci d'DfYgYblUljcb'	&\$ı	\$(#\$,#&\$&%`\$\$\$`5A	%ž [.] ' ž [.] (

5ggYgga Ybh'8YHJ]`g

5ggYgga Ybh% K f]HYb HYgh

GhUfhXUhY. Bch5dd`]WUV`Y

8YHJ]`g.

H\Y'Xi fUhjcb'cZh\Y'hYgh']g'() 'a]bi hYg''

 $Gh XYbhg k] ``fYWY] j Y ZYYXVUW Vm]bX] j] Xi U ``Wca a Ybhg z [YbYfU ``X]gW gg]cb '] b `WUgg `UbX [fUXYg `cb 'h\Y] f hYgh'$

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

5ggYgga Ybh'& 'Cb`]bY'Dcfh\(\mathbb{Z}\c)]c

GhUfhXUhY. Bch5dd`]WUV`Y

8 YHJ] g.

Ghi XYbhgʻUfYʻYl dYWhYXʻhcʻgi Va]hih\Y]fʻUgg][ba Ybhgžk\]WXʻhYghih\YʻZci fʻa UWfc!g_]``gʻcZWca a i b]WUh]cb fl]ghYb]b[žgdYU_]b[žfYUX]b[ʻUbX`k f]h]b[ŁcbʻUʻk YY_`mVUg]g"ʻ

Gh XYbhg [Yhcfu UbX k f]hhYb ZYYXVUW flYl hYbg]j Y Wca a YbhgEhN Y k YY UZhYf gi Va]gg]cb"

Gi Va]gg]cb bchYg. 9bX cZYUWX k YY_

Hi fb]h]b gYh]b[. H\]g]g bchU Hi fb]h]b Ugg][ba Ybh

5ggYgga Ybh' .; fci d DfYgYbhJh]cb

GhUfhXUhY. Bch5dd`]WUV`Y

8 YW] g.

Ghi XYbhik cf_']b'[fci dg'cZ&!("'H\Y``Yb[h\'cZh\Y'dfYgYbhUh]cb'\WJbbchYl \\YYX'&\$'a]bi hYg"

Ghi XYbhg'k]``'fY\\]j Y'\\alpha a Ybhg'f][\h\\Zh\f'h\Y'dfYgYbhUh]cb'\UbX'h\Y]f'[fUXY'\Uhih\Y'YbX'cZh\Y'\\alpha i fgY"

H\]g']g'h\Y'\Z|bU``\UggYgga Ybh\Zcf'\UhiYbX\Ub\\'di fdcgYg"

 $\label{eq:higher} \mbox{Hi fb]h]b"gYh]b"[."H\]g"Ugg][ba Ybh]g"gi Va]hhYX"h\fci [\ \ 'Hi fb]h]b"UbX"ghi XYbhg"Xc"bchgYY"Hi fb]h]b"g]a]`Uf]hmfYdcfhg"$

5 https://bxubwww.Fyei]fYaYbhg

 $\hbox{Ghi XYbhg'UfY'ghfcb[`m'YbWc'i fU[YX'hc'UhhYbX'U```WUggYg'UbX'fYj]Yk'``YWhfY'fY'WcfX]b[g''' } \\$

7ci fgY GWX YXi `Y

J]Yk 'WUgg'h]a YhUV'Y

H]a YtUV`Y

8UHY	Hmd Y	7cbhYbh
K YY_'%'' %'A Um!'('>i bY	@YWhifY	+blfcXi Wfcfm@Yggcb. h\Y U`d\UVYhfUgmbW\fcbci gŁ
	Hi lcf]U`	; fYY_'U`d\UVYhž'UVW\bhgmgh\a ždfcbi bW]Uh]cb fgmb\%fcbci gž'cb`]bYŁ
K YY_'&.'+'>i bY'!'%	@YWn fY	⇒hfcXi Wh]cbg fUgmbWkfcbci gŁ
>i bY	Hi kcf]U`	; fYYh]b[g/@cb[Yf]bhfcXi Wh]cbgfgmbWkfcbcigUbXcb]bYŁ
		; fYYhjb[gžZjfgh]bhfcXi Whjcbg
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>i bY	Hi hcf]U`	A mZJfghWcbj YfgUhJcbg fgmbWkfcbci g UbX cb`]bYŁ
		:]fgh'Wcbj YfgUhjcbg. k cf_ž'bUhjcbU`]hmž``Ub[i U[Yž a Uf]hU``ghUhi g`
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K YY_^(.^&%'>i bY^!^&)	@YWhi fY	<ca :=""]`mfugmbwkfcbci="" gł<="" td="" ua="" y7=""></ca>
>i bY	Hi hcf]U`	A mZUa]`mfgmbW\fcbci gžcb`]bYŁ
K YY_') . '&, '>i bY'! '&'>i `m	@YWhifY	<pre><ci 5="" a="" cxuh]cb="" fugmbw.fcbci="" gy="" gł<="" pre="" wwca=""></ci></pre>
	Hi hcf]U`	A m'\ca Y'fgmbW\fcbci gž'cb']bYŁ
K YY_'*.')	C b`]bY'5Wf]j]lm	F Yj]g]cb
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	Hi hcf]U`	A mg\cdd]b['fgmb\W\fcbci gž'cb`]bYŁ

F Ygci fWyg

DfYgWf]VYX F Ygci fWfg

 $Bc "g]b["Y"hYI"hVcc_"k"]^"VY"i" gYX""F Yei"]fYX"fYUX]b["g"UbX"UXX]h]cbU"a UhYf]U"k"]^"VY"i" d"cUXYX"cb"A ccX"Y U"k"YY_"]b"UXj UbVV""$

.

FYWca a YbXYX FYgci fWyg

• HYI hVcc_g

 $8 \text{ "'Hc`]Ug'Yh'U`"f\&\$\%\&"? gY_]bcbhUg'fGhUff]b[\text{ 'C Z\&"}5h\Ybg.'<Y``Yb]W5a Yf]WUb'l b]cb'fk]h\'' 'Ul X]c'78g\&fUj U]`UV`Y'Uh'l BGK '`]VfUfm'UbX'l BGK 'Vcc_g\cd\&"$

K YVg]hYg

Zffbe,!!i i i žZSgžYd1[/YdWW] Ž'S`YgSYWŽbdaYdS_ žW žZa_ W

fh(Y) cZ(M)U(Y) ff(Y) cZ(h(Y) < Y(Y)) ff(Y) ff

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fth\Y'VYghicb`]bY'WcifgY'Zcf'AcXYfb'; fYY_'VY[]bbYfg'dfcj]XYX'Vmih\Y'+bgh]hihY'Zcf'@Ub[iU[Y'UbX'GdYYW\DfcWfgg]b[L

Zffb,!!i i i ZYdWW] ZSYWZYdYdWW] $>SY!_aVWdQYdWW$]![VW] $ZZf_^$

fh\Y`a cghWca dfY\Ybg]j Y`fYZYfYbWY`[i]XY`Zcf`A cXYfb`; fYY_Ł

.

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

H\]g`Wci fgY`]g`dYf]cX]\WJ``mfYj]Yk YX`UbX`ghi XYbhg`'ZYYXVU\W_`]g`i gYX`hc`]a dfcj Y`h\Ya "': YYXVU\W_`]g [Uh\YfYX`Zfca `ghi XYbhg`i g]b[`a m9I dYf]Yb\W''`#i]g`Yb\Wci fU[YX`ghi XYbhg`Wca d`YhY`h\Y]f`gi fj Ymg`Vm

 $\label{eq:continuity} UWW gg]b[\ ^th Y \cdot dY fgcbU \cdot]gYX \cdot k \ YV \cdot ^t]b_ \cdot j \]U \cdot th Y \cdot A \ ccX \cdot Y \cdot Wci \ fgY \cdot g]tY''$

Gi Va]gg]cb cZ5ggYgga YbhHUg_g

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

Image: Ybwci bhYf'U'dfcV'Ya k \Yb'UhYa dhjb['hc'gi Va]hmci f'Ugg][ba Ybhh\fci [\'Hi fb]h]bz'd'YUgY

HY'Yd\cbY'9| hYfbU''Gi ddcfhcb'-',) "''' %cf'Ya U]''h\Ya 'cb'Y! hYfbU'hY'hgi ddcfh4 i bgk "YXi "Ui ""Gi ddcfh
\ci fg'UfY', .\$\$Ua '-'%\$.\$\$da 'cb'k YY_XUmg'UbX'-.\$\$Ua '-').\$\$da 'cb'k YY_YbXg'fl *) 'XUmg'U'mYUft'''=\mathred{Image: Wa Jhmci f'Ugg][ba YbhXi Y'hc'U'ZJi 'hk]h\'Hi fb]h]b'mci 'a UmUdd'm\mathred{Image: Wa Jhmci f'Ugg][ba YbhXi Y'hc'U'ZJi 'hk]h\'Hi fb]h]b'mci 'a UmUdd'm\mathred{Image: Wa Jhmci f'Ugg][ba YbhXi Y'hc'U'ZJi 'hk]h\'Hi fb]h]b'mci 'a UmUdd'm\mathred{Image: Wa Jhmci f'Ub'Y! hYbg]cb\mathred{Image: Wa Jhmci h\Yf'f'Y'j UbhXcW a Ybhg\mathred{Image: Wa Uj''9! hYfbU''Gi ddcfhmci 'k]'`

JbWi XY'Ug'Yj]XYbW' hc'gi ddcfhmci f'Y! hYbg]cb'Udd']\wUh]cb"'\mathred{Image: Wa Uj''9! hYfbU''Gi ddcfhmci 'k]'`

Ui hca Uh]\wU'`mfYW']j Y'U'h]\w_Yhbi a VYf\mathred{Image: hY'Yd\cbY'mci 'k]\tag{Y}\wu''mug_'\mathred{Image: Wa'\mathred{Image: hY}\wu''mug_'\mathred{Image: hY}\wu''mug_'\mathred{Image: hY}\wu''mug_'\mathred{Image: hY'Yd\cbY''mci 'k]\tag{Y}\wu''mug_'\mathred{Image: hY'\mathred{Image: hY'\mathred{I

; YbYfU``mž'UggYgga YbhiHug_g'a i ghVY'gi Va]hhYX'Y`YVWfcb]\W)``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`hYfbUhjj 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