



MECH4620

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7ci fgY'8YHJ]`g

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Gi a a UfmcZh\Y'7ci fgY

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("`H\Y`UV])]mhc`]bYfdFYhWta di fU]cbU`fYgi`rg`UbX`hc`k`f]h`U fYdcfhWcbj Ym]b[`hY`fYgi`rg`cZ`hY`Wta di fU]cbU`UbU`mg]g"	D9' "%žD9' "" žD9' "*

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8YHJ]g.

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h'lg'Wci fgYžfYWbh]a dfcj Ya Ybng'fYgi`h]b['Zca`ghi XYbhZYXVUW_]bWi XY'hAY`]bfcXi W]cb'cZU'[fci d
dfc YW]c`YbWci fU[Y`Wc`UVcfU]j Y`YUfb]b['YI dYf]YbWg"5`gcžXYa cbgfU]c fg'UfY`bck`fYei]fYX`hc
dfcj]XY`a cfY`Wca dfY\Ybg]j Y`ZYXVUW_]cb`Ugg][ba YbhUW]j]h]Yg`Xi f]b[``UV`gYgg]cbg"

Gi Va]gg]cb'cZ5ggYgga YbhiHUg_g

5ggYgga Ybhigi Va]gg]cb'UbX'a Uf_]b['Wf]hYf]U

G\ci 'X'h\Y'Wci fgY'\Uj Y'Ubmbcb!Y'YVWfcb]WUggYgga Ybhigi Va]gg]cbž'h\YgY'g\ci 'X'\Uj Y'U'ghUbxUfX
GWkcc'Wcj Yf'g\YYH'

5`gi Va]gg]cbg'UfY'YI dYWYX'hc'VY'bYUhiUbX'WYUfmgYhici H'Mci f'fYgi 'hg'UfY'h\Y'd]bbUWY'cZU`mci f'\UfX
k cf_'UbX'g\ci 'X'VY'hYUhiX'k]h'Xi Y'fYgdYWf'DfYgYbh]b['fYgi 'hg'WYUfm[]j Yg'h\Y'a Uf_Yf'h\Y'VYghWUbxWY
cZi bXYfgUbx]b['mci f'a Yh\cX/Yj Yb']Zh\Y'bi a Yf]WU'fYgi 'hg'UfY']bVc'ffYWf'

A Uf_]b[[i]XY']bYg'Zcf'Ugg][ba Ybhigi Va]gg]cbg'k]`VY'dfcj]XYX'Uhih\Y'gUa Y'h]a Y'Ug'Ugg][ba YbhXYH]g
hc'Ugg]ghk]h'a YH]b['UggYggUV'Y'fYei]fYa Ybhg" Gi Va]gg]cbg'k]`VY'a Uf_YX'UWVc'fX]b['hc'h\Y'a Uf_]b[
[i]XY']bYg'dfcj]XYX"

@UHY'dc`]Wm

K cf_gi Va]hYX'UH'k]h\ci hUb'Uddfcj YX'YI hYbg]cb'Vmih\Y'Wci fgY'Wc'fX]bUhc'f'cf'XY'Y[UHYX'Ui h\cf]hm]g
gi VYWih'c'U'UH'dYbU'hmZ&\$'dYfW'bhf&\$i 'cZh\Y'a U]]a i a 'a Uf_'dcgg]V'Y'Zcf'hUhiUggYgga Ybh]hYa ž
dYf'WU'YbXUf'XUm'

H\Y'UH'dYbU'hm]g'Udd'YX'dYf'WU'YbXUf'XUm]bWi X]b['k YY_YbXg'UbX'di V]W\c'XUmg'c'hUhih\Y
UggYgga Ybh]g'c] YfXi Y'"H\YfY']g'bc'dfc!fUfU'cZh\Y'UH'dYbU'hm]Zcf'gi Va]gg]cbg'a UXY'dUfhk Umih\ci [\ 'U
XUm'

K cf_gi Va]hYX'UZf'h\Y'XYUX']bY'Zcf'UVgc'i h'ZU]']g'bc'hUWVW'dhYX'UbX'U'a Uf_'cZnYfc'k]`VY'Uk UfXYX
Zcf'hUhiUggYgga Ybh]hYa "

: cf'gca Y'UggYgga Ybh]hYa gžU'UH'dYbU'hmia UmibchVY'Uddfcdf]UH'" H\YgY'UfY'WYUfm]bX]WUhiX']b'h\Y
Wci fgY'ci h]bYž'UbX'gi W'UggYgga Ybhg'fYW'j Y'U'a Uf_'cZnYfc']ZbchWca d'YhX'Vmih\Y'gdYW]ZYX'XUH'"
9I Ua d'Yg']bWi XY.

% K YY_'micb']bY'hYgh'cf'UVcfUhc'fmik cf_'k cff'h'U'ga U'dfc'dcf]cb'cZh\Y'gi VYW'ia Uf_ž'cf
&" C b']bY'ei]nnYg'k \YfY'Ubgk Yfg'UfY'fY'YUgYX'hc'gfi XYbhg'cb'Wca d'Yh]cbž'cf
' " DfcZYgg]cbU'UggYgga Ybh]Ug_gžk \YfY'h\Y']bhYbh]cb]g'hc'WYUhi'Ub'Ui h\Ybh]WUggYgga Ybh'h\U
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UggYgga YbhdYfZcfa UbWžmci 'UfY'Y'[]V'Y'rc'Udd'mZcf'GdYWU'7 cbg]XYfUhc'b'df]cf'rc'gi Va]h]b['Ub
UggYgga Ybhcf'g]h]b['Ub'YI Ua "

I BGK 'bck '\Ug'U': [\]hrc'G\]h#Gi Va \]hfi_Yžk \\]W'a](#) YUbg'hUh]Zmci 'UthYa dhUb'YI Ua 'cf'gi Va]hU'd]YW'cZ
UggYgga Ybhž'mci 'UfY'XYWUf]b['mci fgY'Z]hYbci ['\rc'Xc'gc'UbX'Wbbch'Uhf'Udd'mZcf'GdYWU'
7 cbg]XYfUhc'b"

: cf'XYHU]g'cZUdd'm]b['Zcf'GdYWU'7 cbg]XYfUhc'b'UbX'WcbX]h]cbg'Zcf'hY'Uk UfX'cZgi dd'Ya YbhUfm
UggYgga Ybhž'd'YUg'gYY'hY'jbZcfa Uhc'b'cb'I BGK 'g'[GdYWU'7 cbg\]XYfUhc'b'dU\]Y"](#)

D'YUgY'bc'hY'hUhighi XYbhg'k]'bchVY'fYei]fYX'rc'dfcj]XY'UbmXcW'a YbhUfmYj]XYbW'rc
gi ddcfhUVgYbW'g'Zca 'UbmWUggYg'a]ggYX'

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

I BGK `Ug`Ub`cb[c]b[`Wca a]ha Ybhlc`ZcghYf]b[`U`W`h`fY`cZ`YUfb]b[`]bZcfa YX`VmiUWUXYa]W]bhY[f]m`5`
I BGK `gh`XYbhg`Uj`Y`U`fYgdcbg]V`]hmlc`UX`YfY`hc`h`g`df]bW]d`Y`cZUWUXYa]W]bhY[f]m`D`U[]Uf]ga
i bXYfa]bYg`UWUXYa]W]bhY[f]m]UbX`]g`bchlc`YfUH`X`UhI BGK "B`SY[Sde_ SfG@E|]e VWX` VW`Se ge[Y
fZWi`ad/e ad[VWSe aXafZWde S` V bSee[Y fZW_ aXSe kagdai ` ž

D`U[]Uf]ga `]g`U`hmdY`cZ]bhY`YW`i`U`h`YZ`h`#`h`W]b`h`U`_`Y`a`UbmiZcfa gžZca`XY`]VYfUH`WX`YU]b[`hc`UWUXYbH`U`m
W`dm]b[`Zca`U`gci`fW`k`]h`ci`h`UW`bck`YX[Ya`Ybh`I BGK `Ug`dfcXi`W`X`U`k`YVg]h`k`]h`U`k`YU`h`cZ
fYgci`fW`g`hc`gi`ddcfghi`XYbhg`hc`i`bXYfgHbX`UbX`Uj`c]X`d`U[]Uf]ga ž]]g]h`[gh`XYbh`i`bgk`"YXi`"Ui`#d`U\[\]Uf\]ga`"](#)
H`Y`@YUfb]b[`7`YbhY`Ugg]ghg`gh`XYbhg`k`]h`i`bXYfgHbX]b[`UWUXYa]W]bhY[f]m]UbX`ck`bchlc`d`U[]Uf]gY`
H`Y`mi`U`gc`lc`X`k`cf_g`l`cdg`UbX`W]b`Y`d`gh`XYbhg`cbY!cb!cbY"

Mci`U`fY`U`gc`fYa`]bXYX`h`UhWUfYZ`h`a`Y`a`UbU[Ya`Ybh]g`Ub`ja`dcfHbhdUfhcZghi`XmiUbX`cbY`cZ`h`Y
]X`Ybh]Z`Y`X`W]i`gYg`cZ`d`U[]Uf]ga `]g`d`ccf`h`a`Y`a`UbU[Ya`Ybh`G`h`XYbhg`g`l`ci`X`U`ck`gi`Z`W]Y`bh`h`a`Y`Z`c`f
fYgYUfW`X`Z`X`f`U`Z]b[`UbX`h`Y`dfcdYf`fY`Z`fY`b`W]b[`cZ`gci`fW`g`]b`dfY`d`Uf]b[`U`UggYgga`YbhH`g_g`"

žd`U[]Uf]ga `]g`Zci`bX`]b`mci`f`k`cf`_`k`Y`b`mci`U`fY`]b`Z`fghmY`Ufž`mci`f`Y`W`h`fY`f`k`]`c`Z`Y`f`mci`Ugg]ghU`b`W`h`c
]a`dfcj`Y`mci`f`UWUXYa]Wg_]`g`H`Y`ma`UmUg_]`mci`hc`cc_]`Uh`gca`Y`cb`]bY`fYgci`fW`gž`U`h`Y`b`X`h`Y`@YUfb]b[
7`YbhY`Z`c`f`gca`Y`h`a`Yg`fYgi`Va`]h`mci`f`k`cf`_`k`]h`h`Y`dfcV`Ya`Z]`YX`<ck`Yj`Yf`a`cfY`gYf]ci`g`]bgH`U`b`W`g`]b`Z`fgh
mY`Ufž`gi`W`Ug`gh`U`]b[`Ubch`Y`f`gh`XYbhg`k`cf`_`cf`d`U]b[`gca`YcbY`hc`Xc`mci`f`k`cf`_`ž`a`UmVY`]bj`Ygh[]UH`X
i`bXYf`h`Y`G`h`XYbhA]gW`b`Xi`W`h`D`fc`W`Xi`fYg`"

F`Yd`Y`UH`X`d`U[]Uf]ga`fYj`Yb`]b`Z`fghmY`Ufž`d`U[]Uf]ga`U`Z`Y`f`Z`fghmY`Ufž`c`f`gYf]ci`g`]bgH`U`b`W`gž`a`UmU`gc`V`Y
]bj`Ygh[]UH`X`i`bXYf`h`Y`G`h`XYbhA]gW`b`Xi`W`h`D`fc`W`Xi`fYg`H`Y`d`Y`b`U`h`Y`g`i`bXYf`h`Y`dfc`W`Xi`fYg`W]b`]b`W`i`XY
U`fY`Xi`W`h`c`b`]b`a`Uf_gž`Z]`]b[`U`W`i`fgY`c`f`Z`c`f`h`Y`a`cghgYf]ci`g`a`U`h`Y`fg`f]l`_`Y`d`U[]Uf]ga`]b`Ub`l`cbci`fg
h`Y`g]g`L`Yj`Yb`gi`gdYbg]cb`Zca`h`Y`i`b]`Yfg]m`H`Y`G`h`XYbhA]gW`b`Xi`W`h`D`fc`W`Xi`fYg`UfY`Uj`U]UV`Y`Y`fY`.

[k`k`k`"\[g`i`bgk`"YXi`"Ui`#d`U\[\]Uf\]ga`\]W`#`c`W`a`Ybhg`gh`XYbhA \]gW`b`Xi`W`h`D`fc`W`Xi`fYg`dXZ`"](#)

5 WUXYa]W=Zcfa Uh]cb

7 fYX]hdc]bhg

7 ci fgY`WYX]hg`W`W`UH`X`]b`I` b]hg!C Z 7 fYX]hfl C 7 E`H`Y`bcfa U`k cf`cUX`YI dYWUh]cb`Zf`cbY`I C 7

