

# **MUSC4706**

Aig]W9bgYaV`Y

HYfa 'C bY''##'&\$%

# 7ci fgY'Cj Yfj ]Yk

### Ghuzz 7 cbhuWh8 Yhu]`g

#### '7cbj Ybcfg'

B Ua Y	9a U]`	5j U]`UV]`]m	@cWJhjcb	D\cbY
9a YfmGWXi VYfh	Y"gWiVYfh4 i bgk "YXi "Ui	-	%\$%*@YjY``% FcVYfh KYVghYf	Ž*%'&'-',) *,\$,

#### GWkcc~7cbhJWh~abZcfa Uh]cb

Fcca " &ž`Yj Y`" FcVYfhK YVghYf`6i ]`X]b[

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

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

K YVg]hY. \hdg.#gUa "Ufhg"i bgk "YXi "Ui

 $\label{thm:constraint} $$HY'GWKcc``cZhY'5ftg'UbX'AYX]U'kci`X``]_Y'hc'FYgdYWZI``m5W_bck`YX[Y'h\Y'HfUX]h]cbU``7ighcX]Ubgžh\Y'6YXY[U``fPYbg]b[hcb'WJadigłž; UX][U``fP]hmUbX'5fhV'8Yg][b'7UadigYgŁ'UbX'h\Y'B[ibbUkU`dYcd'Y'fbighfU`]Ub'8YZYbWY': cfWY'5WUXYam]b'7UbVYffUŁ'cZh\Y'`UbXg'k\YfY'YUWX'WJadig'cZIBGK']g`cWJhYX''$ 

# 7ci fgY<sup>.</sup>8YHJ]`g

## 5ggYgga Ybh

#### 5ggYgga YbhHUg\_g

5ggYgga Ybh'tUg_	K Y][ \h	8iY'8UhY	Gh XYbh@YUfb]b[ CihWcaYgʻ5ggYggYX
9bgYa V`Y`5`7cblf]Vi ljcb`UbX DUfli7\YW_]b[	' \$ı		%
9bgYa V`Y`6`7cblf]Vi ljcb`UbX DUffi7\YW_]b[`	' \$ı		%
Di V`]WDYfZcfa UbWF	&\$I	8YdYbXgʻcbʻh\YʻYbgYa VʻYg ʻc]bYX	%ž&
7 ca dufuhji Y Yj U i Uhjcb	&\$I	K YY_"%\$	ı

#### 5ggYgga Ybh8YlU]`g

5ggYgga Ybh% 9bgYa V Y 5 7cbff]Vi h]cb UbX DUfH7\YW]b[

GhUfhXUhY. Bch5dd`]WUV`Y

8 YHU]`g. `Ghi XYbhgfidUfh]WdUh]cb`UbX`Wcblf]Vi h]cb`hc`YbgYa V`Y`fY\YUfgU`g`k]```VY`UggYggYX`Zcfa Uh]j Y`mž`Vm h\Y`YbgYa V`Y`X]fYWcf`fY[i``Uf`ma cb]hcf]b[`ghi XYbhg`]b`fY\YUfgU`g`hc`Ybgi fY`h\Uh`YUfb]b[`]g`HU\_]b[d`UW\"`Gi a a Uh]j Y`UggYgga Ybh`]g`UXa ]b]ghYfYX`h\fci [\`U'dUfh\W\Y\\\_]b[`hYghUhh\Y`YbX`cZh\YgYgg]cb": YYXVU\\\_`8]fY\\HUbX`cb[c]b[`ZYYXVU\\\_Xi f]b[`fY\YUfgU`g`UbX`UZhYf`U'di V`]\WdYfZcfa Ub\\"

#### 5XX]h]cbU`XYhU]`g.

 $H\Y'dUfflWXYW_]b[\ 'hYghi gi U``m'lU_Yg'd`UW']b'h\Y'k YY__'UZhYf'h\Y'Z]bU``fY\YUfgU`*di V`]WdYfZcfa UbW' fK YY__'%$`cf'f%fl'''``8YhU]`g'cZh\Y'dUfflWXYW_]b[ 'hYghk ]``VY'Ubbci bWYX''``K \YfY'dcgg]V`Yž_YYd'U'WcdmcZU```a i g]WdUfflg#g\WcfYg'fY\YUfgYX'Xi f]b[ 'h\Y'hYfa 'UbX'Vf]b[ 'h\Ya 'hc'h\Y'dUffl\WXYW_]b[ 'hYgh'$ 

Gi Va ]gg]cb bchYg.GYY 5XX]h]cbU XYhU] g

5ggYgga Ybh& 9bgYa V`Y 6 7cbff]Vi h]cb UbX DUffl 7\YW\_]b[

GhUfhXUhY. Bch5dd`\WUV`Y

8 YHU]`g. `Ghi XYbhgfidUfh]WdUh]cb`UbX`Wcblf]Vi h]cb`hc`YbgYa V`Y`fY\YUfgU`g`k]```VY`UggYggYX`Zcfa Uh]j Y`mž`Vm h\Y`YbgYa V`Y`X]fYWcf`fY[i``Uf`ma cb]hcf]b[ `ghi XYbhg`]b`fY\YUfgU`g`hc`Ybgi fY`h\Uh`YUfb]b[ `]g`HU\_]b[ d`UW\"`Gi a a Uh]j Y`UggYgga Ybh`]g`UXa ]b]ghYfYX`h\fci [\`U'dUfh\W\Y\\\_]b[ `hYghUhh\Y`YbX`cZh\Y gYgg]cb": YYXVU\\\_.`8]fY\\HUbX`cb[c]b[ `ZYYXVU\\\_Xi f]b[ `fY\YUfgU`g``UbX`UZhYf`U'di V`]\WdYfZcfa Ub\\"

#### 5XX]h]cbU`XYhU]`g.

H\Y`dUfh\W\YW\_]b[`'hYghi gi U``mhU\_Yg`d`U\W`]b`h\Y`k\YY\_`'UZhYf`h\Y`Z]bU``fY\YUfgU`#di V`]\WdYfZcfa Ub\W\f\X\Y\_\'\\%\cf`f\\\Y\\]b[`'hYghi ]```VY`Ubbci b\W\X\"``K\\YfY`dcgg]\V`\Yž\_\YYd`U`\\cdot dmcZ\U```a i g]\WdUfhg\#g\\cfYg`fY\\YUfgYX`Xi f]b[`'h\Y`h\fa `UbX`Vf]b[`h\Ya 'hc'\h\Y`dUfh\\\\Y\\\_]b[`'h\Yh\fa `UbX`Vf]b[`'h\Ya 'hc'\h\Y`dUfh\\\\Y\\\_]b[`'h\Ygh'

Gi Va ]gg]cb bchYg.GYY 5XX]hJcbU`XYhU]`g

5ggYgga Ybh' . Di V`]WDYfZcfa UbW

GhUfhXUhY. Bch5dd`]WUV`Y

**8 YHJ]`g.** `Ghi XYbhg`UfY`fYei ]fYX`hc`dUfh]WjdUhY`]b`di V`]WdYfZcfa UbWYg`cZh\Y]f`W\cgYb`YbgYa V`Ygžk\]W\k ]```VY`UggYggYX`Vmh\Y`YbgYa V`Y`X]fYWhcf"': YYXVUW\_.`[]j Yb`]b`k f]h]b[`UZhYf`h\Y`di V`]WdYfZcfa UbWY"'H\]g ]g`h\Y`Z]bU``UggYgga YbhHUg\_"

5XX]h]cbU``XYhU]`g.

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

9bgYa V`Y`dUff]WdUbhg`a i ghUhYbX`U```fY\YUfgU`g`UbX`di V`]WdYfZcfa UbWYg"

?YYd']b'a ]bX'h\Uh

f%EGca Y.YbgYa V.Yg.d%cg[dWSgV[f[a`e'df]cf'hc'k YY\_\_'%"

f&EGYj YfU`fYei ]fY mci hc ZShWS` [`efcq\_ W hih Uhmci WUb d`Um'

fl  $EGca Y' \ Uj Y' \ [fSf[a] e [ ] g_ TWdaXbWabWk \ C'WUb' VY' UWWYdhYX"]$ 

f(ŁBgT (U bWokad\_S`UWe S`V SVV[f[a`S^dWZWSceSre ScWdWcg[dW agfe[VWfZWdWYgrSdcWZWSceSrf[\_WežGh XYbhgra i ghYbgi fYrh\Uhih\ygY'UXX]h]cbU`fY\YUfgU`g'Xc'bchWUg\k]h\ch\Yf'Wci fgYg#YbgYa V`Yg"

8 YHJ] YX`]bZcfa UH]cb`UVci hYUWX`YbgYa V`Y`]g``]gHYX`<u>\YfY</u>"``A i g]W9bgYa V`Y'H]a YHJV`Y`Zcf`5@'YbgYa V`Yg ]g`<u>\YfY</u>"``C b`mYbgYa V`Yg`&]bYX`]b'H\Y'W ffYbhHYfa `WJb`VY`i gYX`Zcf`Wci fgY`UggYgga YbH'

FYYj Ubh]bZcfa Uh]cb'UVci hYUW. YbgYa VY']g'i gi U`mi dXUhYX'VmC!K YY\_'UbX'ghi XYbhg'g\ci `X'W\YW\_'Zcf Ubmi dXUhYg'Uhh\]g'h]a Yž'UbX']ZZ fh\Yf']bZcfa Uh]cb']g'fYei ]fYXž'dY`UgY'WcbhUWh\Y'GW\cc`'cZ5fhg'UbX A YX]U'C ZZW. \hdg.##qUa "Ufha"i bgk "YXi "Ui #\cbhU\Mi a

Ghi XYbhgʻgY`YWhlb[`h\Y]fʻhk cʻYbgYa V`YgʻZcfʻh\]gʻWci fgY`Xcʻgcʻcbʻh\Yʻi bXYfghUbX]b[`h\Uhih\Ym`\Uj Y`fYUX UbX`i bXYfghccX`h\]gʻ]bZcfa Uh]cb"

### 7ci fgY GWX YXi `Y

J]Yk 'WUgg'ha YhUV'Y

#### H]a YHJV`Y

8UHY	HmdY	7 cbhYbh
K YY_"% "% ": YVfi Ufm"! "&(		7 ci fgY gWkYXi `Y`]bZcfa Uh]cb'j Uf]Yg XYdYbX]b[ 'cb
: YVfi Ufm		h\Y`YbgYa V`Yg`W\cgYb"

Fygci fWyg

DfYgWf]VYX F Ygci fWYg

Bch'Udd`]WUV`Y"

FYWca a YbXYX FYgci fWYg

BchUj U]`UV`Y

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

8] fYW h ub X cb [c] b [2YYXV uw Xi f] b [2YYX

Gi Va ]gg]cb cZ5ggYgga YbhHUg\_g Gi Va ]gg]cb cZ5ggYgga YbhHUg\_g Hi fb]h]b Gi Va ]gg]cb

#### 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`hYl h'cf']XYU'k ]h\ci h'UW\_bck `YX[]b['h\Y gci fW'cf'i g]b['ei chUh]cb'a Uf\_g"'H\]g'U`gc'Udd`]Yg'hc']a U[Ygž'Ufh'UbX'XYg][b'dfcYWhgž'Ug'k Y``'Ug dfYgYbhUh]cbg'k \YfY'gca YcbY'dfYgYbhg'Ubch\Yf'g']XYUg'cf'k cfXg'k ]h\ci h'WfYX]h'

⇒ Uddfcdf]UhY 'dUfUd\fUg]b[. '7\Ub[]b['U'ZYk'k cfXg'UbX'd\fUgYg'k\]Y 'a cghmfYhU]b]b['h\Y'cf][]bU`ghi Wh fY 'UbX#cf'dfc[fYgg]cb'cZ]XYUg'cZh\Y'cf][]bU`žUbX']bZcfa Uh]cb'k]h\ci hUW\_bck`YX[Ya Ybh'H\]g'U`gc Udd`]Yg']b'dfYgYbhUh]cbg'k\YfY'gca YcbY'dUfUd\fUgYg'Ubch\Yf'g']XYUg'cf'k cfXg'k]h\ci h'WfYX]h'UbX'hc d]YW]b['hc[Yh\Yf'ei chYg'UbX'dUfUd\fUgYg']bhc'U'bYk'k\c`Yžk]h\ci h'Uddfcdf]UhY'fYZYfYbW]b['"

7 c``i g]cb.'k cf\_jb['k]h\ch\Yfg'Vi hdUgg]b['cZZh\Y'k cf\_'Ug'U'dYfgcb'g']bX]j ]Xi U``k cf\_"'7 c``i g]cb'U`gc ]bWi XYg'dfcj ]X]b['mci f'k cf\_'hc'Ubch\Yf'ghi XYbhVYZcfY'h\Y'Xi Y'XUhYžcf'Zcf'h\Y'di fdcgY'cZh\Ya d`U[]Uf]g]b['UhiUbmh]a Yž'dUm]b['Ubch\Yf'dYfgcb'hc'dYfZcfa 'Ub'UWUXYa ]WhUg\_ž'ghYU']b['cf'UWei]f]b[ Ubch\Yf'dYfgcb'g'UWUXYa ]Wk cf\_'UbX'Wcdm]b[']hz'cZYf]b['hc'Wca d'YhY'Ubch\Yf'dYfgcb'g'k cf\_'cf'gYY\_]b[ dUma YbhZcf'Wca d'Yh]b['UWUXYa ]Wk cf\_"

±bUddfcdf]UhY`W]hUh]cb.`7]h]b[`gcifWrg`k\]W\`\UjY`bchVYYb`fYUXžk]h\cihUW\_bck`YX[]b[`h\Y`´gYWcbXUfm´gcifWrZfca`k\]W\`\_bck`YX[Y`cZh\Ya`\Ug`VYYb`cVhU]bYX"

8 i d`]\WUh]cb`ffgY`Zd`U[]\Uf]ga "Ł gi Va]\h]b[`mci f`ck b`k cf\_ž]b`k \c`Y`cf`]b`dUfhžk \YfY`]h\Ug`dfYj]ci g`m VYYb`dfYdUfYX`cf`gi Va]\hYX`Zcf`Ubch\Yf`UggYgga Ybhcf\Wci fgY`UhI BGK `cf`Ubch\Yf`i b]j Yfg]\m'

7 cffYWnfYZYfYbWlb[ 'dfUWnWyg.

• DUfUd\fug]b[ z'gi a a Uf]q]b[ z'YggUmk f]hb[ 'UbX'ha Y'a UbU[ Ya Ybh