wrfcvgf"Urtkpi"4244

Vjg"Dgtgp" Y tkvkpi "Egpvgt"dgnkgxgu"vjcv"vjg"dguv" y tkvkpi "eq o gu"htq o "c" y tkvgtøu"gpicig o gpv" y kvj qvjgt" y tkvgtu0" Yg"rtqxkf ukip"wr"xkc"qwt"qpnkpg"uejgfwnkpi"rtqitco0"Uvwfgpvu"ecp"ukip"wr"hqt"c"oczkowo"qh"vjtggvu"ecp"ukip"wr"hqt"c"oczkowo"qh"vjtggvu"ecp"ukip"wr"hqt"c"oczkowo"qh"vjtggvu"ecp"ukip"wr"hqt"c"oczkowo"qh"vjtggvu"ecp"ukip"wr"hqt"c"oczkowo"qh"vjtggvu"ecp"ukip"wr"hqt"c"oczkowo"qh"vjtggvu"ecp"ukip"wr"hqt"c"oczkowo"qh"vjtggvu"ecp"ukip"wr"hqt"c"oczkowo"qh"vjtggvu"ecp"ukip"wr"hqt"c"oczkowo"qh"vjtggvu"ecp"ukip"wr"hqt"c"oczkowo"qh"vjtggvu"ecp"ukip"wr"hqt"c"oczkowo"qh"vjtggvu"ecp"ukip"wr"hqt"c"oczkowo"qh"vjtggvu"ecp"ukip"wr"hqt"c"oczkowo"qh"vjtggvu"ecp"ukip"wr"hqt"c"oczkowo"qh"vjtggvu"ecp"ukip"wr"hqt"c"oczkowo"qh"vjtggvu"ecp"ukip"wr"hqt"c"oczkowo"qh"vjtggvu"ecp"ukip"wr"hqt"c"oczkowo"qh"vjtggvu"ecp"ukip"wr

 $uejqnctujkr0" Yg"v{ rkecm{"jcxg"5/7"uvchh" oggvkpiu" rgt"ug oguvgt" y kvj "xctkcdng"vk ogu"cpf"qrvkqpu hqt"tg oqvg" cvvgpfcpeg0$

 $\label{eq:product} Y jgp" \{qw"cttkxg"kp"vjg" Y tkvkp i "Egpvgt."ejgem"vjg"qpnkpg"uejgfwng"cv \\ y y y0 \{w0gfwl y tkvkp i / egpvgtuldgtgp vq"ugg"kh" \{qw" j cxg pg y "crrqkpv o gpvu0"Kh" \{qw" fqpøv" j cxg cp \{"uejgfwngf"crrqkpv o gpvu." \{qw" o kijv"dg"cumgf"vq" fq" cf o kpkuvtcvkxg" y qtm ô "rtgrctcvkqp qh" o cvgtkcnu"hqt"vtckpkp i." jgnr" y kvj "cfxgtvkukp i." rncppkp i "hqt" o ggvkp i u." uejgfwnkp i crrqkpv o gpvu." crrqkpv o gpvu." gve0$

 $Cpqvjgt"korqtvcpv"vcum"cv"vjg"gpf"qh"gcej"crrqkpvogpv"ku"vq"eqorngvg"c"õ ö qpnkpg0"Vq"eqorngvg"c"enkgpv"tgrqtv"hqto."enkem"qp"vjg"crrqkpvogpv"unqv0"C"pgy"ykpfqy"vjcv eqpvckpu"vjg"uejgfwnkpi"fgvcknu"qh" {qwt"crrqkpvogpv"ujqwnf"qrgp"kp" {qwt"dtqyugt0"Kp"vjg"pgy ykpfqy" {qw" yknn"ugg"c"ugevkqp"ncdgngf"õCfokpkuvtcvqt"Qpn {0ö"Vjku"ugevkqp" i kxgu" {qw"vjg"qrvkqp vq"ejgem"c"dqz"kh"vjg"crrqkpvogpv"ku" o kuugf"qt"vq"cff"qt"tgxkgy"c"enkgpv"tgrqtv"hqto0"Vq"cff"c enkgpv"tgrqtv"hqto"ngvgf"uguukqp."enkem"qp"vjg"nkpm"vjcv"tgcfu"õCff"Pgy0ö$

[qw"ctg"tgurqpukdng"hqt"mggrkpi"vtcem"qh"cm"qh"{qwt"jqwtu"yqtmgf."yjgvjgt"hqt"vwvqtkpi. vtckpkpi."qt"lwuv"eqxgtkpi"vjg"Egpvgt0"Chvgt"c"ujkhv"gpfu"qt"chvgt"c"uvchh" oggvkpi."{qw"ykm"tgeqtf {qwt"jqwtu"qpnkpg"cv"{w0gfwlmtqpqu0

 $Vjg"tgncvkqpujkr"qh"c"vwvqt"vq"c"uvwfgpv"ecp"ugg o "c"dkv"c o dkiwqwu."kp"rctv"dgecwug" {qw"ctg uvwfgpvu"cu" y gnn"cu"vwvqtu0"Kp"cffkvkqp."c"vwvqtøu" rtqhguukqpcn"tqng"ku"c"htkgpfn {"qpg ô" jgnrkpi.uwrqtvkpi."cpf"gpeqwtcikpi0" Y jgp" {qw"ctg" y qtmkpi"kp"vjg" Y tkvkpi"Egpvgt." {qw" o wuv"mggr" {qwt tgncvkqpujkr" y kvj"uvwfgpvu"rtqhguukqpcn"cv"cm"vk o gu0"Kv"ku"k o rqtvcpv"vq"mggr"c"dkv"qh" fkuvcpeg dgv y ggp" {qwt"uvwfgpv"enkgpvu"cpf" {qwtugnh"vq"cxqkf"cp{"uvwfgpv"dgecwug"ujg"ku"ncvg"hqt"qt" qwt gepvkpwcm{" o kuugu"crrqkpv o gpvu."ugpf" jgt"cp" g o ckn0" Yg" fq"pqv" o ggv" y kvj"uvwfgpvu"hqt"vwvqtkp i$

qwvukfg"qh"qwt"uejgfwngf"Ytkvkpi"Egpvgt"jqwtu."cpf"yg"pgxgt"ytkvg"rcrgtu"hqt"qwt"uvwfgpvu0

 $Cnuq."y tkvkpi"vwvqtu" o wuv"cxqkf"gxcnwcvkpi"uvwfgpv" y tkvkpi."gkvjgt"rqukvkxgn{"qt"pgicvkxgn{0"Cxqkf uw i iguvkpi" y jcv" i tcfg" {qw"vjkpm"vjg"uvwfgpv" y knn"fgugtxg"qt" o cmkpi"qxgtcnn"lwfi o gpvu"cdqwv"vjg swcnkv{"qh"vjg" y qtm0"Kv"ku"vjg"vgcejgtøu"lqd"vq"gxcnwcvg"vjg"uvwfgpvøu" y tkvkpi."cpf" y tkvkpi "vwvqtu" fq pqv" y cpv"vq"kpvgthgtg" y kvj"vjg"vgcejkpi" rtqeguu0"Kv"ku"ceegrvcdng"vq"cempq y ng fig"cpf" fguetkdg urgekhke"ctgcu"qh"k o rtqxg o gpv"*g0i0"õ [qwt"vjguku"ku" o wej" o qtg"urgekhke"vjcp"kv" y cu"dghqtg"qwt fkuewuukqp0ö+."dwv"kv"ku"pqv" ceegrvcdng"vq"qnhgt"qxgtcnn"gxcnwcvkqpu"*g0i0"õVjku"rcrgt"ku"gzegnngpvö+0$

 $\label{eq:stress} Y j kng" y g"cnn" j cxg" g o g t i g pekgu."kv"ku"k o rqtvcpv"vq"tg o g o dgt"v j cv" {qwt" y qtm"kp"v j g" Y tkvkp i Egpvgt"ku" {qwt"lqd0"Rngcug"qpn {" o kuu" y qtm"dgecwug" {qw"ctg"knn"qt" j cxg"qv j gt"g o g t i g pe { ektew o uvcpegu0"Uvwf {kp i "hqt" o kfvgt o u." fkppgt" y kv j "htkgp fu."qt" o ggvkp i u" y kv j" {qwt" rtqhguuqtu" fq pqv" swcnkh {"cu"ceeg rvcdng" tgcuqpu"vq" o kuu" y qtm0$

Vjg" o clqtkv{"qh"uvw fgpvu" y g"ugg"cv"vjg" Y tkvkpi "Egpvgt"eq o g" y kvj" ftchvu0" Oquv"eq o g" y cpvkpi "vjg vwvqt"vq"õugg"kh"c"rcrgt"hnq y uö"cpf"vgm"vjg o " y jcv"pggfu"vq"dg" fqpg"vq"k o rtqxg"kv0"Kv"ku"k o rqtvcpv hqt"vjg"vwvqt"vq"tgukuv"uk o rn{"ujq y kpi"vjg"uvw fgpv" y jgtg"vjg"rcrgt"pggfu" y qtm0

Ocp{"vwvqtu"nkmg"vq"jcxg"uvwfgpvu"dtkghn{"fguetkdg"yjcv"vjg{"jcxg"ytkvvgp"dghqtg"cevwcm{"tgcfkpi cp{"qh"vjg"ftchv0"Fqkpi"uq"igvu"uvwfgpvu"vcnmkpi"cdqwv"vjgkt"ytkvkpi."cpf"yjgp"vjg{"vcnm"cdqwv vjgkt"rcrgtu."uvwfgpvu"yjq"lwuv"ycpv"vjgkt"rcrgtu"õhkzgfö"qhvgp"fkueqxgt"hqt"vjgougnxgu"yjgtg"vjg rcrgtøu"rtqdngou"ctg0"Kp"cffkvkqp."vjgtg"ecp"dg"c"fkuetgrcpe{ ô "uqogvkogu"c"jwig"qpg ô dgvyggp yjcv"vjg"uvwfgpv ujg"jcu"ytkvgp"cpf"yjcv"ujg jcu ytkvgp0"Ocp{"uvwfgpvu"ctg oqtg"ctvkewncvg"cdqwv"vjgkt"kfgcu"yjgp"vjg{"urgcm"vjcp"qp"vjg"ytkvgp"rcig."cpf"vjgtghqtg"c"swkem kpvgtxkgy"ecp"htgswgpvn{"vgnn"{qw"yjcv"vjg"uvwfgpv"tgcm{"ycpvgf"vq"uc{0"Vjg"vwqt."yqtmkpi"cu"c okttqt."ecp"cnuq"rqkpv"qwv"rtqdngo"ctgcu"ujg"jgtu"kp"c"uvwfgpvøu"fguetkrvkqp"d{"uc{kpi."hqt gzcorng<"õKv"uqwpfu"vq" og"nkmg"{qw"jcxgpøv"hqwpf"c"engct"hqewu"{gv0"Ecp"{qw"vgnn"og"gzcevn{"yjcv"vjg"uvwfkp" qwt"vjguku"ku"qt"rqkpv"kv"qwv"kp"{qwt"rcrgtAö

 $Vjg"\tilde{o}Dcuke" I wkfgnkpgu"vq"Eqphgtgpegu"qp"Ftchvuö"qwvnkpgu"uq o g"wughwn"uvtcvg i kgu"hqt" i gvvkp i uvw fgpvu"kpxqnxgf"kp"tgcfkp i "vjg"ftchv0"Qpg"pqv" o gpvkqpgf"vjgtg."jq y gxgt."ku"tgcfkp i "vjg"rcrgt qwv"nqwf"vq"vjg"uvw fgpv."qt"jcxkp i "vjg"uvw fgpv"tgcf"kv"qwv"nqwf"vq" {qw0"Uvw fgpvu"ecp"qhvgp"jgct rtqdng o u"kp"vjgkt" y tkvkp i "vjcv"vjg {"ecppqv"ugg0"Qeecukqpcnn {.c"wughwn"qwveq o g"qh"vjg"uvw fgpv tgcfkp i "cnqwf"ku"c" fkuetgrcpe {"dgv y ggp" y jcv"ujg"uc {u"cpf" y jcv"ujg"jcu" y tkvvgp0"Qhvgp."vjg" y c {vjg"uvw fgpv"tgcfu"yjg"rcrgt"ku"jq y "ujg"kpvgpfgf"vq" y tkvglkv0$

Vk og"rgt o kvvkpi."kv"ku"rtghgttgf"vq"jcxg"vjg"uvwfgpv"tgcf"vjg"gpvktg"ftchv"vq"{qw"dghqtg"qhhgtkpi cp{"uw i iguvkqpu"qt"eq o ogpvu0"Kh"vjg"uvwfgpv"hkpfu"gttqtu"jgtugh"vjcv"ujg"ycpvu"vq"eqttgev."cnnq y jgt"vq"fq"uq"cu"ujg"tgcfu."cpf"tghtckp"htq o "qhhgtkpi"eqttgevkqpu"qt"uw i iguvkqpu"yjkng"vjg"uvwfgpv ku"tgcfkpi0"Kh"vjg"ftchv"ku"xgt{"nqpi"cpf"{qw"ctg"eqpegtpgf"vjcv"{qw" oc{"pqv"jcxg"vk og"vq"jgct"vjg gpvktg"guuc{"tgcf"cnqwf."{qw" oc{"cum"vjg"uvwfgpv"vq"tgcf"cnqwf"vjg"kpvtqfwevkqp."uw o octk|g"jgt $o\ ckp"\ rqkpvu."cpf"\ tgcf"\ cnqw\ f"\ jgt"\ eqpenwukqp0"Cf\ fkvkqpcnn\ \{."cv"v\ jg"\ dg\ ikppkp\ i"\ qh"v\ jg"\ uguukqp."\ \{qwo\ c\ "cum"v\ jg"\ uguukqp"\ vq"\ o\ cmg"\ pqvcvkqpu"\ qp"\ jgt"\ fchv"\ qh"k\ o\ rqtvcpv"\ rcuuc\ igu"\ vq"\ y\ jke\ jvq"\ tgvwtp"\ ncvgt0"Cumkp\ i"\ rg\ to\ kuukqp"\ ku"\ ko\ rqtvcpv"\ vq"\ vq"\ vq"\ y\ jke\ j"\ gpvgt"\ f\ pc\ o\ ke\ "dgecwug"\ kv"\ cnnq\ yu$

Kv"ku" i gpgtcm { "c" i qqf"kfgc"vq"cum"vjg"uvwfgpv"vq" fguetkdg"vjg" y tkvkp i "cuuk i p o gpv"cpf"vq"gz rnckp"vq {qw" y j cv"vjg"cuuk i p o gpv"kpxqnxgu0"Kp"vjg" rtqeguu"qh"gz rnckpkp i "vjg"cuuk i p o gpv0"Hqt"kpuvcpeg. ujg" o c { "pqv"mpq y "egtvckp"vgt o u."qt" y j cv"gz cevn { "vjg"kpuvtwevqt" o gcpu"d { "õdg"urgekhke.ö"õnkvgtct { cpcn { uku.ö"õengct"vjguku.ö"õtgcuqpg f" fghgpug.ö"qt"õeqjgtgpv"ct i w o gpv0ö"C" fkuewuukqp"qh" y j cv"vjg uvw fgpv"ku"dgkp i "cumg f"vq" fq"ecp"ngc f"gcukn { "kpvq"c"eqpxgtucvkqp"cdqwv" j q "vjg"uvw fgpv" o ki jv dg i kp"vq"vj kpm"cdqwv"cpu y gtkp i "vjg" swguvkqp" rqug f" d { "vjg"cuuk i p o gpv." y j gtg"ujg" y cpvu"vjg"guuc { vq" i q. "qt" y j cv" o cvgtkcn" y knn"dg"etwekcn"vq" j gt"ct i w o gpv0"Kh"ujg" j cu"dtqw i jv"kp"c"hwnn" ftchv."uwej"c

 $\begin{aligned} & \text{Kv}^*\text{ku}^*\text{rquukdng}^*\text{vj}\text{cv}^* \{ qw^*\text{cp}^*\text{vj}\text{g}^*\text{uv}\text{fgpv}^*\text{oc} \{ \text{fkueqxgt}^*\text{vj}\text{cv}^*\text{vj}\text{g}^*\text{cuukip}\text{ogpv}^*\text{ku}\text{uph}^*\text{ku}^*\text{wpengct}^*\text{Kh}^* \{ qw \text{vj}\text{kpm}^* \{ qw^*\text{ccp}^*\text{j}\text{g}^*\text{uv}\text{fgpv}^*\text{ocmg}^*\text{ugpug}^*\text{qh}^*\text{cp}^*\text{cuukip}\text{ogpv}^*, \text{fq}^*\text{uq}, \text{dwv}^*\text{kh}^* \{ qw^*\text{ctg}^*\text{wpengct}^*\text{cdqwv} \text{yj} \text{cv}^*\text{ku} \text{yj} \text{cv}^*\text{vj}\text{g}^*\text{cuukip}\text{ogpv}^*\text{up}^*\text{cg}^*\text{vj}^*\text{g}^*\text{uv}^*\text{sp}^*\text{cdqwv}^*\text{up}^*\text{cdqwv}^*\text{up}^*\text{sp}^*\text{u}^*\text{sp}^*\text{u}^*\text{sp}^*\text{u}^*\text{sp}^*\text{u}^*\text{u}^*\text{sp}^*\text{u}^*\text$

50" J q y "fqgu"vjku"cuuk i p o gpv"hkv"kpvq"vjg"eqpvgzv"qh"vjg"eqwtugA"Ku"vjg"uvwfgpv"gzrgevgf"vqwug"vjg"eqwtug"eqpvgpv"cpf" o cvgtkcnuA" J q y A"Ujqwnf"ujg"wug"qwvukfg"uqwt<u>A</u>"Kh"uq." y j cvmkpfA

60"Y jcv"umknnu"qt"rtqegfwtgu"fqgu"vjg"uvwfgpv"pggf"vq"rtqfweg"jgt"y tkvkpiA"70"Y jcv"mkpf"qh vgzv"ku"ujg"gzrgevgf"vq"rtqfwegA"C"uwooct{A"Rqukvkqp"rcrgtA"Nkvgtct{"cpcn{ukuA"Ujqtv"uvqt{A Ncd"tgrqtvA

80"Ecp"vjg"uvwfgpv"hkpf"c" oqfgn"qh"c"uwe<u>O</u>wn"tgurqpug"vq"vjku"v{rg"qh"cuukipogpvA 90"Jqy"nqpi"ujqwnf"vjg"vgzv"dgA

:0"Y jcv"ctg"vjg"fgcfnkpgu"hqt" y tkvkp i "vjg"xctkqwu"ftchvu"qh"vjg"vgzvA"Y jgtg"ecp"vjg"uvwfgpv igv"hggfO Yknn"vjgtg"dg"vk o g"hqt"rggt"tgxkg y A"Fqgu"vjg"vgceO y cpv"vq"ugg"c"ftchv"hqt eq o ogpvuA

jgnrkpi"vjgo"tgeqipk|g" y jcv"vjg{" o c{"qpn{"kpvwkv." y qtm"qwv" j wpejgu."vtceg"kpvgtguvkpi"ngcfu. tgcttcpig" y jcv"vjg{"fq"mpqy."cpf"tckug"ejckpu"qh" swguvkqpu"vq"cpu y gt0"Vwvqtu"qhvgp"hkpf"vjgug uguukqpu"gzjknctcvkpi."dwv"vjg{"ecp"cnuq"dg"c"dkv"dg y knfgtkpi0"Uq o gvk o gu"c"uvwfgpv"gzrgtkgpegu vjg"õnki jv"dwnd"ghhgevö"cpf"ngcxgu"vjg" Y tkvkpi"Egpvgt"engctn{"hggnkpi"eqphkfgpv"cpf"tgcf{"vq" y tkvg= qvjgt"vk o gu."gurgekcnn{" y kvj" o qtg"tgvkegpv"uvwfgpvu."vjg"uguukqp" o c{"ugg o "vq" j cxg"ceeq o rnkujgf tgncvkxgn{" nkvvng." rgt j cru"qpn{" c"vtkemng"qh"kfgcu0"V j qw i j"nguu" ftc o cvke."vjku"cejkgxg o gpv"ecp"dg"cu k o rqtvcpv"cu"vjg"õnk i jv"dwnd"ghhgevö"dgecwug"vjg"uvwfgpv"ngcxgu"hggnkpi "cv"ncuv"gpcdngf"vq" y tkvg. cpf" o c{" j cxg"ngctpgf"uq o gvjkpi "xcnwcdng"cdqwv"vjg"gctn{"uvcigu"qh"vjg" y tkvkpi " rtqeguu0"Wpnguu vjcv"uvwfgpv"tgvwtpu"vq" y qtm" y kvj" { qw"ci ckp." j q y gxgt."kv"ku" fkhhkewnv"hqt"vjg"vwvqt"qh"cp"õkfgcu eqphgtgpegö"vq"mpq y "vjg" swcnkv{" qh"vjg"hkpcn" rcrgt"qt"guuc{0

 $Uvwfgpvu" y tkvkpi"tgugctej"rcrgtu"uq o gvk o gu"eq o g"vq"vjg" Y tkvkpi"Egpvgt"nqqmkpi"hqt" y c {u"vq"vwtp c" o qwpf"qh" fcvc"qt"c" o qwpvckp"qh"pqvg/ectfu"kpvq"c"rcrgt0" Ocp{"qh"vjg"uvwfgpvu" y g"ugg" y qtmkpi qp"vjgkt"ugpkqt"vjgugu"xkukv"vjg" Y tkvkpi"Egpvgt"cv"vjku"uvcig"kp"vjg" y tkvkpi"rtqeguu."cpf" {qw"ecp gpeqwtcig"vjg o "vq"ukip"wr" y kvj"c"tgi wnct"vwvqt"kh"vjg{"jcxgpøv"cntgcf{"fqpg"uq0"Vjgug"uvwfgpvu i gpgtcm{"pggf"jgnr"qticpk|kpi"cpf"hqewukpi"vjgkt" o cvgtkcn."cpf" fkueqxgtkpi" y jcv"kv"ku"vjg{" y cpv vq"uc{"cdqwv"cm"vjg"kphqt o cvkqp"vjg{øxg"c o cuugf0"C" i qqf"rnceg"vq"dgi kp" y kvj"uwej"c"eqphgtgpeg ku"vq"gpeqwtcig"vjg"uvwfgpv"ujgt" y jcv"jgt"tgugctej"ku"cdqwv." y jcv"ujg" y cpvu"jgt"rcrgt"vq ceeq o rnkuj."cpf" y jcv"kfgcu"ujg"jcu"hqt"jgt"vjgku0$

Hqt"vjg"uvwfgpv" yjq"jcu"dgeqog"gpitquugf"kp"eqnngevkpi" fcvc."tgcfkpi."cpf"pqvg/vcmkpi."vjg ejcpeg"vq"ugv"vjqug" ocvgtkcnu"cukfg"cpf"vcnm"cdqwv" yjcv"kpvgtguvu"jgt"kp"jgt"vqrke."jgt"hkpfkpiu. cpf"jgt"tgcevkqpu"vq"jgt"tgcfkpiu."cnnqyu"jgt"vq"gpvgt"jgt"uwdlgev"ctgcøu"uejqnctn{"fkcnqiwg0"Kv"ku eqooqp"hqt"uvwfgpvu"vq"hggn"qxgtyjgnogf"cpf"ukngpegf"d{"yjcv"vjg{"jcxg"dggp"tgcfkpi"cpf $\label{eq:spectral_spectrum} Uvwfgpvu"fq"pqv"qhvgp"dtkpi"itcfgf"rcrgtu"vq"vjg"Ytkvkpi"Egpvgt."dwv" yjgp"vjg{"fq"kv"ku"igpgtcm{dgecwug"vjg{"jcxg"pqv"dggp"cdng"vq"wpfgtuvcpf"cp"kpuvtwevqtøu"eq o ogpvu0"Rngcug"dgikp"d{gpeqwtcikpi"vjg"uvwfgpv"vq"vcnm"qxgt"jgt"rcrgt."qt"rgtjcru."c"ftchv"qh"jgt"pgzv"rcrgt."ykvj"jgt rtqhguuqt0" [qw"ecp"jgnr"c"uvwfgpv"c"nqv"d{"rtgrctkpi"jgt"vq"jcxg"cp"ctvkewncvg"fkuewuukqp"cdqwvjgt" ytkvkpi" ykvj"cp"kpuvtwevqt0$

Kh"vjg"uvwfgpv"ku"uvknn"kpvgtguvgf"kp"{qwt"eqoogpvu."eqpukfgt"{qwt"vcum"vq"kpvgtrtgv."cpf"vjgtgd{ enctkh{."vjg"rtqhguuqtøu"eqoogpvu0" [qw"okijv"dgikp"d{"cumkpi"cdqwv"vjg"cuukipogpv"htqo"vjg uvwfgpv0"Kv"ecp"cnuq"dg"wughwn"vq"cum"vjg"uvwfgpv"jqy" ygm"ujg"vjqwijv"ujg"jcf"fqpg"qp"vjg"rcrgt yjgp"ujg"jcpfgf"kv"kpôygtg"vjgtg"rctvu"vjcv"ujg"hgnv"wpgcu{"cdqwvA" [qw"oc{"cnuq" ycpv"vq kpswktg"cdqwv"jqy"ujg"cevwcm{"ytqvg"vjg"rcrgt0"Vjgug"uqtvu"qh"swguvkqpu" yknn"jgnr"vjg"uvwfgpv dgeqog"oqtg"cyctg"qh"jgt"pgzv"rcrgt0

 $Vwvqtu"igpgtcm{"jcxg"c"hcktn{"gcu{"vk og"wpfgtuvcpfkpi"eq o ogpvu"qp"c"itcfgf"rcrgt."cpf nctign{"hkpf"vjg{"qpn{"jcxg"vq"gncdqtcvg"qp"cp"cddtgxkcvgf"tg octm"*k0g0"õc y m0.ö"õwpeqpxkpekpi.ö õgxkfgpeg"pggfgf.ö"õugswgpeg"rtqdu0ö+0" Y jcv" y g"uvtkxg"hqt" jgtg"ku"vq"vgcej "vjg"uvwfgpv"vq wpfgtuvcpf"vjgug"eq o ogpvu"uq"vjcv"ujg"ecp"urqv"vjgug"rtqdng o u"kp"uwdugswgpv" rcrgtu0"Cu"kp"c ftchv"eqphgtgpeg."{qw" oc{"cnuq" y cpv"vq"pgiqvkcvg" y kvj"vjg"uvwfgpv"vq"hqewu"qp"qpg"qh"vjg k o rqtvcpv"qt"tgewttkpi"rtqdng o u"cpf"vq" fkuewuu" jqy"vq"cxqkf"vjku"rtqdng o "kp"hwvwtg"rcrgtu0$

 $Uq o gvk o gu."dwv"pqv"xgt{"qhvgp."c"uvw fgpv"eq o gu"vq"vjg" Y tkvkpi "Egpvgt" y kvj"c"itcfgf"rcrgt dgecwug"ujg"vjkpmu"ujg"jcu"dggp"wphcktn{"itcfgf0"Gxgp"kh"{qw"citgg"vjcv"c"itcfgf"ku"rctvkewnctn{jctuj."pqvjkpi"y km"dg"ickpgf"d{"ukfkpi"y kvj"vjg"uvw fgpv"kp"eq o rnckpvu"cickpuv"vjg"kpuvtwevqt0 Kpuvgcf."{qw" o kijv"uc{"uq o gvjkpi"nkmg."õ{gu."K"ecp"ugg"vjcv"{qw"hggn"c"÷Fø"ku"c"nqy"itcfg="{qw qw i jv"vq" fkuewuu"vjg"rcrgt" y kvj" (qwt"rtqhguuqt"uq"vjcv"{qw"ecp"hkpf"qwv" o qtg"urgekhkecm{"y j cv jg"gzrgevu"kp"{qwt"pgzv"rcrgtu0"Kh"{qwdgg"vkp"vgp0"Ujgøm"dg"kp"vjg"dguv"rqukvkqp"vq"ngv"{qw"mpqy" y j cv ujg"gzrgevu"kp"{qwt"pgzv"rcrgtu0"Kh"{qwdgg"vkp"vg"gfdcem"ujg"icxg"{qw00"Oquv"qhvgp."y jgp"cuvfgpv"ku"wrugv"cdqwv"c"itcfgf"rcrgt."c" o kuwpfgtuvcpfkpi"dgv ggp"vjg"uvfgpv"cpf"vjg kpuvtwevqt ô cdqwv"vjg"cuukip o gpv."cdqwv"itcfkpi"etkvgtkc."gve0 ô jcu"qeewttgf0"Kh"{qw"ecp"fvjg"uvfgpv"kp"qw o ggvu"kpi"{qw"ruff"qw"ecp" o ggvu"ctg"cdtcukxg"qt dgnkvnkpi."{qw"o c{"cum"kh"{qwecp" o cmg"c"eqr{"qhvjg"rcrgt"y kvj" y j cv"}$

 $\label{eq:wweighted} Wuwcm\{."kh"vjg"uvwfgpv"ecp"uvqr"qduguukpi"cdqwv"vjg"itcfg"tgegkxgf."cnn"uqtvu"qh"htwkvhwn y tkvkpi"kuuwgu"ecp"dg"fkuewuugf"d{"vjg"vyq"qh"{qw<"kuuwgu"qh"cwfkgpeg."ctiwogpv."cpf qticpk|cvkqp."cpf"uvtcvgikgu"hqt"crrtqcejkpi"vjg"pgzv"rcrgt0$

 $Vwvqtu"ecp"eqcej"c"uvwfgpv"cdqwv"rtqdngou"ykvj"itcooct"cpf"uv{ng"cpf"vgcej"rtqqhtgcfkpillereproduction of the second se$

œ

Gzrgtkgpegf" y tkvkpi "vgcejgtu"ctg"qhvgp"cdng"vq" fkcipqug" rtqdng o u"kp"c"uvw fgpvøu"guuc { "xgt { swkemn {0" Y jkng"vjcv" o c { "ugg o "nkmg" o cike."kp"hcev."vjg { øxg"kpvgtpcnk | gf"c"uecng"qh"eqpegtpu vjcv"dg ikpu" y kvj "vjg" inqdcn"cpf" o qxgu"vq y ctf"vjg"nqecn."cpf"vjg { "mpq y "uvw fgpvu"pggf"vq dg ikp"vq"tgxkug"d { "cfftguukp i " inqdcn" rtqdng o u"hktuv0"Vjg" o quv" inqdcn"eqpegtp"ku = "chvgt vjcv"eq o gu ."vjgp ."cpf"hkpcnn { 0

Gzrgtkgpegf" y tkvkpi "vgcejgtu"cpf" vwvqtu" cnuq" mpq y "vjcv" uvw fgpv" guuc {u"qhvgp" jcxg" rtg fkevcdng rcvvgtpu" qh" rtqdng o u0"V jg" hqnnq y kpi "ejctv." cfcrvg f" htq o "Mgtt {"Ycnmøu" õV { rgu" qh" Rtqdng o cvke Rcrgtu.ö" qwvnkpgu" c" hg y "v { rgu" qh" rtqdng o cvke" guuc { u." o quv" qh" y jkej " jcxg" vtqwdng" y kvj" v jg

Hcnnu"kpvq"vyq" ockp v{rgu."kp"yjkej *3+"vjg"enck ou"ctg dcugf"qp"c okutgcfkpi"qt rtgeqpegrvkqp= *4+"vjg"enck ou"ctg uqwpf"dwv wpuwduvcpvkcvgf= cp{"gxkfgpeg"ku kpuwhhkekgpvn{ cpcn{ gf0	Wprgtuwcukxg rcrgtu"rnc{"hcuv"cpf nqqug"ykvj"gxkfgpeg cpflqt"hckn"vq cpcn{ g"vjg gxkfgpeg uwhhkekgpvn{."k0g0. eqppgev"kv"vq"vjg enck o 0	Rtq o rv"vjg" y tkvgt"vq tg"gzc o kpg"dqvj enck o u"cpf"gxkfgpeg d{"cumkpi< Y jgtgøu"vjg gxkfgpeg"vq"uwrrqtv gcej"enck o A J q y "fq"{qw ceeqwpv"hqt eqwpvgt/gxkfgpegA J q y "ecp"{qw cpcn{ g"vjg gxkfgpeg"uq"vjcv"vjg tgcfgt"uggu" y jcv {qw"uggA
Wuwcm{"gzjkdkvu"vjg u{orvqou"qh"qpg"qt oqtg"qh"vjg"cdqxg rcrgt"v{rgu."dwv cnuq"jcu"jctf vq/tgcf"ugpvgpegu. qhvgp"gkvjgt"jkijn{ cduvtcev"qt ukornkuvke0	Eqpegrvwcn rtqdng o u"ctg eq o rqwpfgf"d{ rtqdng o u" y kvj"uv{ng cpf"cwfkgpeg0"Vjg eqpvqtvgf" y tkvgtu dgnkgxg"vjcv ~~~0!8_c\@ cecfg o ke" y tkvkp i "ku kphncvgf="vjg uk o rnkuvke" y tkvgtu jcxg"nkvvng gzrgtkgpeg" y tkvkp i kp"cp"cecfg o ke eqpvgzv0	Cum"vjg"eqpvqtvgf y tkvgtu"vq"nkuvgp"vq vjgkt"ftchv"cnqwf cpf" y qtm"vq" o cmg y tkvvgp"ugpvgpegu cu"engct"cu"urqmgp Dufpgu0" J gnr"vjg uk o rnkuvke y tkvgtu"rcvvgtp"vjgkt ugpvgpegu"chvgt i qqf" o qfgnu0

 $vwvqtkpi"uvchh0"Kh" \{qw"dgnkgxg"c"uvwfgpv" yqwnf"dgpghkv"htqo"GUN/urgekhke"vwvqtkpi."iwkfg" jgt" kprovense (and an and a straight a straight$ ceeguukpi"vjg"GUN"uejgfwng"vjcv"ku"cxckncdng"xkc"vjg"ftqrOvwgf

nqqmkpi"vqigvjgt"cv"vjg"enkgpvøu" y tkvkpi."tgurqpf"hktuv"vq"vjg"eqpvgpv."qticpk|cvkqp."ctiw o gpv."cpf tgngxcpeg"vq"vjg"kpuvtwevqtøu"cuukip o gpv0"Kv"ku"wprtqfwevkxg"vq" y qtm"hktuv" y kvj"itc o o cvkecn"gttqtu kp"ugpvgpegu"vjcv" o kijv" fkucrrgct"qpeg"vjg"uvw fgpv"dgvvgt"wp fgtuvcpfu"vjg"eqpxgpvkqpu"qh ctiw o gpv0"Rc{"urgekcn"cvvgpvkqp"vq" y jcv"vjg"uvw fgpvu" y cpv"vq"uc{"kp"vjgkt" y tkvkpi0"Kv"ku"ceegrvcdng vq"ejcnngpig"vjg o "cpf"cum"vjg o "swguvkqpu"vq"uvtgpivjgp"vjgkt"ctiw o gpv."dwv"cxqkf"vcmkpi"qxgt"vjg ctiw o gpv0"Uq o gvk o gu"GUN vq"vcnm"vq"qpg"cpqvjgt"kp"Gpinkuj0"

 $j cxg"vq"vgcej"vjg"uvwfgpv"vjgug"hgy"itcoocvkecn"qt"tjgvqtkecn"eqpegrvu"kpuvgcf"qh"vcemnkpi"gxgt {rtqdngo"qpg"d{"qpg0}} \\$

GUN"kuuwgu"ctg"coqpi"vjg" oquv"ejcmgpikpi"hqt" y tkvkpi"vwvqtu."dwv" y qtmkpi" y kvj uvw fgpvu" y jqug"hktuv"ncpi wcig"ku"pqv"Gpinkuj "ecp"dg"qpg"qh"vjg" oquv"tg y ctfkpi"qh"vwvqtkpi gzrgtkgpegu0"Kh" {qw"mggr"vjgug"crrtqcejgu"vq"vgcejkpi"kp" okpf" y jgp" {qw"ctg" y qtmkpi" y kvj "GUN uvw fgpvu." {qw"ecp" ocmg"vjg"vcum"nguu" fcwpvkpi0