

PRNC109

PRNC 109

PUERTO RICO NUCLEAR CENTER

Radioactive Decay

Correction Tables

October 1967

OPERATED BY UNIVERSITY OF PUERTO RICO UNDER CONTRACT

NO. AT (40-0=1833 FOR US. ATOMIC ENERGY COMMISSION)

---Page Break---

7

Radioactive Decay Correction Tabi

owen H. he

jer, Anne 5, Kay and J, Elisa Trabal

Puerto Rico Nuclear Center

Mayaguez, Puerto Rico

00708

october, 1967

---Page Break---

:

. Arsenic - 78 wee eg

caamiun 2070 = ee

Chiorine = 34 - .- - - - - Pe

---Page Break---

Zine- 69 = 5 =

tine- 7200-5

Appenesx,

T+ Fortran Program = =~

IT = Isotopes of Sinflar Half-liv

5

59

a

---Page Break---

?8

perRopueroN

The decay of a radioactive isotope is governed by the equation

$A_t = A_0 e^{-\lambda t}$

where A_0 is the initial activity, A_t the activity after time t and λ

is the decay constant,

the decay constant (λ) is related to the half-life ($T_{1/2}$) by the

equation

$\lambda = 0.693/T_{1/2}$

The radioactive decay correction tables give the fraction (A_t/A_0)

of activity remaining after various intervals of time. The data was

calculated on an IBM 1620 computer using a Fortran II program (see appendix).

The isotopes covered are those of moderately short half-life and do not

generally duplicate tables reported elsewhere (1,2,3).

The data bases

rounded to six significant figures, and the decimal

exponent, where necessary, is indicated after the number, Thus .100000 + OL

AndScates 1.00000 and 0.391457 - 02 inateates 0,00391457.

For intervals longer than those given in these tables, the fraction of remaining activity can be obtained by multiplying the factors for shorter time intervals, since if $t = t_1 + t_2$;

then $A_t/A_0 = (A_{t_1}/A_0) \times (A_{t_2}/A_0)$ gets,

For example, the fraction of silicon-31 remaining after 30 hours can

be found by multiplying the fractions for 24 hours and 6 hours

$$0.001746 \times 0.206 = 0.000359$$

or by squaring the fraction at 15 hours,

$$(0.01889)^2 = 0.000356$$

A number of other isotopes have half-lives similar to those reported

in the tables, while others have numerically similar half-lives with a

---Page Break---

-2-

aifferent unit of tine (hours instead of minutes or days instead of hourg)

These cases are tabulated in the appendix and permit the present tables

for 28 isotopes to be extended to 85 cat

REFERENCES ,

2, "Radtological Health Randbook,? Division of Radiological Health, .

U.S. Departzent of Health Education and Welfare, Washington, D. Coy

1960.

2. G. Pe Hunter and V, F, Mitchell, "Tables of Factors for Correcting

for Radioactive Decay," United Kingdon Atomic Energy Authority Report

Rke3T, 1963.

K, K, Falter, "Radioactive Decay Correction Factors," Division of

Radiological Health, U.S, Department of Health, Education and Welfare,

Washington, D.C., 1965.

---Page Break---

26

12.00 +269008-01 60,00 4140872-07 '

anette

707803-08

---Page Break---

A» 108640 st = 1,00 min Tmax = 320-00 min

Dy r 1 F

0,00 +200000+02 \$1.00 +457275-02

99748 52.00 Teraua3=02

2:00 Teossu7 53,00 Ta70186-02

S726383 suloo 1333074-02

te5s367 55100 {299683-02

1589665 56.00 t2es639-02

1530552, 57,00 {2u7608-02

tu77362 50.00 218286-02

1829508 59.00 196402-02

Sse6uu7 60.00 117671302

i3u7705 61.00 1158997-02

Sauzeu7 62.00 1183057-02

i2e14e4 59.00 1128716-02

1253265, 54.00 t115e12-02

227675, 55.00 T1o4201-02

1205030 86.00 1937550-08

S1eu75, 87.00 Tau3s60-03

OS . WS.

Atuninun = 2 Ties ese nin AI?

116598) 58.00 l1se9si-03

Siwgau2 69:00 {682901-03

tisua70 70,00 Teisuwo-03

1120893 71100 Tsszewi-03

[108779 72:00 tas7428-03

1978734-02, 73100 tau7551-03

e80615-01 74!00 {402683-03

1792332-01, 75100 {362526-03

712899-01 78:00 1325991-03

leuiuso-02 77.00 \$293310-03

1577126-01 78,00 1263905-03

1519268-01, 78.00 123784a-03

tue7211-01, 20.00 121364403,

\$u20372-02 £1.00 1152226209 |
1378229-01, 22,00 1272955203.
{340311-02 23100 1155616-03
1306108-02. 84,00 tiwoos-03
le7sese-on 85.00 1125978-03
\$247879-01 25.00 Tiis3u9-03
1223023-0 87200 1101985-03
\$200670-03, 82,00 1917613-04
1180552-01 89,00 1a75621-00
1162652-02 30.00 i7uzesi-o4
Siw6166-01 81.00 te68379-04
\$191522-02 52.00 1801373-08
1118328-01 83:00 iski08s-o8
106465-01, 94.00 Ingeauo-ou
tes7szi-02 28.00 Tuaeos4-ou
ie61888-02 96.00 {398120-08
lr7sue2-02 57.00 1354609-04
1897739-02 se.00 1319059-04
1627790-02 99,00 1287073-08
Tsewas3-02 200,00 1258203-08
1808226-02 10100 23230904

SEE |

---Page Break---

+209202~08

Theei3s-o8

1168277-04

11s2307-08

1137038-04

1223299-08

{110938-04

1898167-05

1898099-05

Teososs-os

Tratosu=05

Te5u166-05

1388585-05

lszas7e-05

1878487-05

ta28719-08

1385739-05

1347088-05

1312274-05

---Page Break---

-7e

Ancunony = 122 Tinenes Sb

-20000002 24.50 +292566-02

te83602 25.00 1205496-02

1780750 25.50 118157602

1639871 26.00 {18084102

?609573, 28.50 [141765-02

27200 1125264202

1475923 27.50 finose4-02

1420526 28.00 1978001-03

1371577 28.50 ?aeui62-03

1328325 23.00 1789574-03

iz90109 28.50 1874695-03

1256340 30.00 1596161-03

1226502

?200138

1178042

1156287

1136089

hizisse

1107798

1952500-02.

teei630-01

1743665-02,

1657103-01,

1580616-02

1519033-01,

t459315-01

1400551-02

1383827702

1912730-01

276328-01

{2uWi66-01

121574301,

1290831-02.

1168642-01

1148835-02,

fisisii-or

1116203-02

1102677-01

1907257-02

801653-02

170834102

1625990-02

1553037-02

tuses64-02

t¥31764-02

1381525-02

1337115-02

1287875-02

1263208-02

ee |

---Page Break---

7

Avsenic ~ 78 tineaa AS

A= 007815 at = 8.00min tL = 2440.00 ain

7 7 : r

. +100000001 384,00 +537098-01,

1580898 392.00 [s05355-01

1835200 400,00 ta7sue7-01,

. 1852968 408200 Taw7aes-02

1783730 416700 lwz09uu-01

trs7are 42400 {386066-02

1692636 432,00 1372658-01

1852829 440.00 1350633-01

Te16266 48,00 1329910-01

1577983 456.00 1310412-01

1543786 46400 1282086-02

tsiz6u7 472.00 1274805-02

iesis08 480,00 1258563-01,

1452956 468,00 1243282-01

t476186 49600 22890302,

{400997 508.00 1215375202

128/00 1377298 512,00 1202645-02

136.00 Issua99 520,00 1is0se9-02

4400 354028 528,00 li7swoo-02,

252,00 1524277 536.00 t1ee798-01

60.00 1258703 544.00 {1se821-02

is8.00 1278226 582,00 fiks435-02

178.00 261703 560,00 {is0803-02

ies.00 t24e3i1 568.00 tig2293-01

292,e0 231754 576.00 fi2ke 74-01

200.00 1216057 584.00 faimine-or

208.00 1205165 592.00 1110196-02

218,00 Tisso43 600,00 {103883-01,

224.00 Treiese 608.00 1975554-02

232200 ti70899 516.00 917897202

240,00 {180799 824.00 636ug=02

1151295 832,00 1812605-02

tis235u 840500 i764579-02

1 Tis3940 648,00 \$719391-02

3126024 856.00 1676874202

{hiss7s 684.00 1638870-02

. 11lises 672.00 1599230-02

1108974 680.00 156381502

{987701-01 688.00 {s30492-02

1929527-01, 636,00 1499139-02

1a76402-02 704.00 t869639-02

2724-01 732200 tauiee3-02

i77s089-01 720.00 {415767-02

i728345-01, 728.00 1392195-02

1685302-01 738.00 1368074-02

tesss00-01 Tee .00 1386321-02

1608691-01. 752.00 1325853-02

1570835-01 760,00 {306594-02

---Page Break---

PO

1000.00

1008.00

1016.00

102400

1032+00

Low0.00

Lowes00

Los6.00

Loss.00

1072.00

1080.00

1088-00

1098-00

Liow.o0

3112-00

2220.00

218,00

2136.00

aslo

2152,00

1160,00

isesoo

1175.00

Lie4.oo

i192,00

1200.00

428847402

1271425-02

1285383-02

\$240290-02

1226088-02

1212726-02

1200158-02

[198324-02

fi77194-02

1166722-02

Uisse6e-07

7597-02

6674-02

\$130686-02

la22guu-02

1115677-02

trosesi-02

1102408-02

1963556-03

?s06608-03

1e53026-03

{e02611-03

1755176-08

l720544-03

1668550-03

1629037-03

1591860-03

[5s6a80-03

1525968-03

{493002-03,

Teese6e-03

Tig6uu9-03

{w10858-03

1306308-03

1363548-03

Tau2061-03

ls2ig4s-o3

1302624-03

{2aK826-03

1268087-03

1252242-03

1237334-03,

\$223308-08

t210110-03

197692-03,

tiesoos-03

ta7s0is-03

tiese71-03

Tisus39-03

t1is782-03

[137166-03

[izs0ss-09

tiziusi-03

thi42s5-09

107502-03,

troiiss-03

1216.00

224,00

1232.00

1240.00

1248.00

1256.00

1268.00

1272.00

1280.00

288.00

1296.00,

1304700

1812100

1320.00

132800

3336.00

L344 00

2382,00

2360.00

2368.00

1376.00

1384.00

1392.00

1400.00

2408.00

1416.00

1424-00

1432-00

iswo.00

951705-08

1792740-08

i7s5e83-04

Irois0s-o4

1660327-08

1621301-08

Tseusai-ou

{s80032-08

ts27524-08

Thaesa7-0u

tuseiss-o8

{us1081-08

Twos603-04

Tae1632-08

\$a59077-048

t337855-08

{317887-04

T29s099-0u

i2eik22-08

{26u750-04

i2agio-04

i2auui6-08

1220861-04

1207526-04

t19s261-08

\$163720-08

ti72e62-04

---Page Break---

sae

Bo

partus = 139 tinzesem Ba

?_??_\$. \$\$

---Page Break---

f

1000.00

008,00

1018.00

1024-00

1032.00

1040.00

048,00

1056.00

106400

1072-00

1080.00

io8e.00

1096.00

1104, 00

212200

1120.00

1128200

1138700

Lisso0

2152200

1160;00

iisazo0

117600

aslo

ais2seo

00200

3208.00

3216.00

+190984-02

1178926-02

1187630-02

T3s70m6-02

tas7asi-02

{137842-02

tize130-02

Tx20986-02

{iisa4s-02

{106192-02

\$994872-03

\$932061-03

ta73216-03

18085-03,

I766435-03

Trisow7-03

1872713-08

1630241-03

Tsgousi-03

1353173-03

1528248-03

Ingss29-03

1w54675-03

1426156-03

399251-03

740NN 03

ts50829-03

1528505-03

1307577-03

1268158-03
1269966-038
1252923-09
1258953-03
i221993-03
1207978-03
Ti8ua07-03
tie2ses-03
1171020-03
t160223-03
{150107-03
{1s0630-03
{131752203
T123u33-03
T11s640-03
{i08340-03
Troisse-03
issosi4-04
ta90878-08
fes4633-08
l7ei930-08
732870-08
1686320-04
1682989-04
Te02a9u-08
156836208

1526731-08

Teos24a-0u

222,00

1232.00

1240.00,

1248.00

1256.00,

1264.00,

1272.00

1280.00

128.00

3256.00

1304.00

1312.00

41320,00

1326.00

1336.00

2344.00

1352700

1360.00

1368.00

1378200

1384.00

1392,00

1400.00

1808.00

is16,00

1424200,

1432.00

1440.00

+464076-08

1434776-08

{407327-08

381610-08

1357517-08

1334345-08

{a13799-04

t293987-04

1275826,04

1258037-04

T2u1 786-04

{226483-04

{212184-08

fiss7es-04

11e6238-00

fa7au79-04

Ties464-ou

Tassiu3-04

[1ugw75-04

Tigwui6-04

1125930-04

1117980-04

Trzosa1-04

1103553-04

970148-05

908698-05,

85151505,

1787754-05

---Page Break---

sas

Bromine = 80 tinsisain Br®

A= 098500 at 2,00 ain an #240 880

: r : ,

. +200000" 01 200,00 21279701,

1525890 102.00 1197027-01

1857272 204.00 1182425-01

. 1799739 406,00 t168906-01
t7skois 308,00 1i58388-01
te80451 210.00 {nuu7 98-01
680022 212,00 tisuos7-01
1589331 hialoo tizuisi-or
is40100 1114932701
{s0007% trossis-o1
tas30i3 120,00 1385280-02
1428698 122,00 1912260-02
386928 224,00, lauk653-02
1367512 1782055-02 |
1380275 \$724087-02 |
1315087 330,00 lerowse-02
{281709 132,00 1620788-02
270090 234200 1574 744-02
{250074 1532150-02
1232541, 1892712-02
ianuser 180,00 tus6197-02
Sigeuss 142,00 1822388-02
1183783 24400 1391085-02
ti7ores 1362102-02
1157552 iwssoo 1335266-02
1is5676 25000 1310420-02
1iss06s 152700 ize7uis-02
1225055 254.00 1266114-02
1115707 156200 1286392-02

1107206 358.00 i22m132-02 '

1992612-02 360,00 1211225-02

1919050-01 152200 1195571-02

1850939-02 264.00 tae1078-02

. 156.00 116765802

188,00 1155233-02

1675424-02 370,00 t1ua728-02

. 1625368-01 272,00 1133077202

1579022-01 74200 1123216202

1\$38110-01 178700 tiie08s-02

{496379-01 178,00 1105628=02

1459593-01 180,00 {97e003-03

1425532-01 182,00 \$903521-03

1393996-01 1B4200 fa36413-03

1364797-01 188,00 1176278-03

\$337762-01 188.00 l7ip74a-03

\$912730-02 390700 1665401-09,

1289554-01 392,00 1826162-03

1268095-01, ioss00 1570898-09

1246226-01, 196.00 1528219-03

1229830-01 1489072-03

i SSSSSSSSSSSFFeseF

---Page Break---

200.00

202.00

204.00

206,00

208.00

210,00

212,00

214,00

216,00

220.00

222,00

224.00

226,00

228200

230.00

232.00

234,00

235.00

238,00

240.00

1452827203

tw19268-03

Tagei96-03

1359627-03

1332790-08

1308126-03

1295281-03

126424803

{2aus72-03

t226847-03

\$209665-08

{194127-03

[179 740-03

tie6419-03

{158086-03

1182867-03

tas2094-03

1122304-03

11i3240-08

{ioke49-03

1970776-08

- ans

---Page Break---

= ase

ez

Bropine = 62 11/2 36 br Br

A = 01928 AT = 0,50 Br Tagg * 200,00 be

t r t r |

. 0.00 +100000+03 26.00 +530022

2:50 Vosowat 2050 623987

2100 Tesoss4 25100 Veieo10

. iso tonasas 25250 Veaz0si

2:00 1962232 26100 606227

250 tesa0us 26.50 Yeoo20

3:00 lonaess 27.00 598669

3:50 Toakens 27150 ?se6s73 |

Sl00 Ts2ses0 20200 Tsesasz

iso veizooa 26:50 Terma

5:00 ?06237 29.00 1572208

5:50 Tesssa7 25150 1566728

6100 Tes0s20 30:00 ?ssig00

6150 teez307 30:50 Tss5973

700 lerssse 31:00 ?ss0598

7150 Se0sses 31150 ?susa28

8100 157272 32:00, Tsuox00

| 880 Tausoso 32:50 Tss4927

300 . tasoa27 33:00 ?s2se03

9150 tas2872 33:50 Tsaurae

10,00 34200 {si9702

10:50 Telesss 34250 tsis724

aitoo ve0s267 35100 509793,

31:50 Leouis 35.50 ?sousi0

i2t00 Trs37a9 36:00, Tsooo7s

32150 {786238 36:50 ta9s233

ist00 t778608 37200 T3052

33150 iiss 37250 TMeseno

istoo t763761 36:00 Teele?

Tsenes 38150 ies79

Truss 39:00 1872012

i7a2023 39:50 tue7esi

T7sesus 0,00 tse3013

? lr7676 40150 Tase576

720903 81100 Tse1es

tnisse S110 iseoas

: iro7189 82200 Teess26

Iro03es W280 ywlzse

Tess676 83200 Ina7o0sa

?ee7032 83150 Thazens

Tosonsa oul00 Th2e6s9

Ye7ssa3 4150 Th2uso3

To67677 ts!00 ta20525

8550 tei6497

86200 iai2so8

sero iso8sse

87200 Teoweus

47250 tw00767

---Page Break---

+396928

1399126

1389360

[385631

381937

1378278

ia7a6ss

1371066

1367512

{363992

tasos0s

t3s7052

1353631

Taso2uu.

1346089

1383566

1340275

1337026

133378

133089

ts2742

1326287

iszien

isiei05

1315057

Ts12080

1309052

1308090

{303158

1300254

287378

290530

{291708

izessis

147

1203806

280891,

1278002

1275340

1272702

270090

1267503

1264940

1262403

1259809

1257400

i2suosu

i2s2u92

{250078

{207678

205308

1242958

1240629,

1238324

1236041

1233780

1231541

1229323,

1227126

1228950

1222786

1220662

1218548

216854

T2ause1

232528

1210298

1208273

{206288

?204308

{202352

{200w13

figsua3

tises9z

t1sw709

Trez60u

fi90996

1189167

S1e7ass,

1185560,

{183783

1182022

1180279

1378852

ta768u2

fa7sise

1373670

li7isos

fi7oiss

1168533

Tisesie

fiesais

1163736

162168

tie0614

1159076

1157552

tis6083

Tisusue.

1is3068

1151602

fisoikS

tawe7i2

1147287

finse76

---Page Break---

Cadmium - 107

A= ,103800

t

0,00

, 50

2.00

. 2380

2200

2150,

3100

3150

8.00

4250

5100

5150

6.00

6.50

Too

7150

20

8.50

3.00

9:50

10.00

10.50

inico

31150

32,00

12150

23:00

13.50

isloo

in!so

15.00

15.50

16:00

' 36150

17,00

17iso

. 18200

18,50

19.00

19150

20:00

20.50

20150

21100

2150

22100

22.50

\$\$

sare

t= 450 he

+2100000001

ro49624

{so1766

leses29

tazsie2

1772209,

1733300

1696382

1861265

1627947

1596307

1566262

1537729,

1510835

Tha4so6

2460473

1037272

twis299

1394317

ls7euue

tasse2

ta7u503

i2607K9

{207610

i23si34

223286

1212035

1201352

1191207

1181572

1172424

1163735

Tissues

1187652

{140212

tis3i47

1126438

1120088

11200

taisoie

1108273

{102617

1976369-02

TA/2 = 6.7 br

Taax

t

23,00

23250

28,00

24250

25.00

25:50

26.00,

25:50

27200

27250

28:00

28.50

23.00

23:50

30.00

0

31200,

31150

32.00

32:50

33200

33:50

38.00

34250

35.00

35.50

36.00

36.50

37.00

37250

38.00

39.00

39,50

40:00

40.50

42,00

41250

42.00

42250

43200

43750

48200

44250

45200

45.50

46.00

= 100.00

ca?

br

+927173~01

te80456-01

1836093-01

t793966-01

1783961-01

i735971-02

1679896-01

teus639-01

{613108-01

382215-01,

1552680-02.

1525022-01

tuges6e-01

ta7344 7-01

t4¥3592-01

t¥26939-01

{405427-01

{se4999-01

1385600-01,

1387179201

1529686-01

1313074-02

1297300-01,

282320-01

1268095-01

1254586-01

{28175901

1228877-01

?2ig010-02

\$207025-01

fis6so4-01.

S1g66e8-01

fa772e2-01,

Tises49-02.

1159867-02.

1151812-01

tise162-01

1136899-01

1130001-01

t1z3450-02

\$117230-01

{111323-01

11057,

fr003

1953296-02

1305263-02

1859650-02

---Page Break---

46.50

47,00

47,50

4900

alsa

4,00

49rs0

50,00

50.50

6

51,50

52.00,

52.50

53.00

53,50

\$6.00

54.50

35.00

35.50

56,00

56.50

57200

57.50

58.00

58.50

59.00

59.50

50.00

50.50,

61.00

61.50

82.00

82,50

63100

63150

84,00

84.50

85.00

65:50

8600

85.50

67.00

67.50

68.00

88.50

89,00

69.50

79200

70.50

mi00

7hiso

72,00

72:50

73.00

73150

78100

+826398-02

1775203-02

t7se144-02

1639052-02

1863830-02

\$630382-02

1598619-02

{s00457-02

1539818-02

1512615-02

the5786-02

tne2259-02

143896702

tu16650-02

Tagse45-02

1375901-02

{356961-02

1338975-02

1321895-02

1305676-02

\$290274-02

1275646-02

\$261759-02

{209570-02

i236046-02

tz2eis2-02

1212850-02

1202133-02

Tisisua-02

\$102277-02

t173092-02

Tieea73-02

{156089-02

{145224-02

1160756-02

Uis3e6s-02

1326925-02

1120833-02

{h1s460-02

{108693-02

\$103216-02

T980255-03

1330768-03

3870-03

39335-03

l7g7044=03

l7568a0-03

t71a748=03

1682533-03

Teuaie2-03

1615465-03

1584473-03

155s024-03

{527088-03

{s00s01-03

1n75283-03

oak

74.50

75.00

75.50

76.00

78150

17,00

1750

78,00

78.50

73,00

79150

80.00

81.00

81.50

82.00

23.00

93.50

84,00

84.50

25150

85.00

86.50

87,00

87,50

88.00

82.50

29,00

29.50

90.00

90.50

92.00

91.50

92.00

92.50

93.00

93150

94,00

94250

95.00

95,50

96,00

96.50

37.00

97.50

98.00

98.50,

99,00

99,50

100,00

+451335-03

{u2?594-03

{40839

?sees:

136702

1309525-03

1330964-03

1314288-03

1298852-03

i2e3814-03

T26s136-03

Tasss74=03

1242696-03

T2s0K68-03

i2isess-03

1207828-03

1197356-08

{2e7412-03

ti77969-03

t1e3002-03

Tisowe7-03

{152400-03

Tiui722-03

1137429-03

1180805-03

1173929-03

[117685-03

1121755-08

tio6326-03

\$100777-03

I9s8993-08

1908773-04

26 2924-08,

9501-04

\$778209-04

t7aes90-08

\$701763-08

Tesssou-o4

632826-04

Is00940-08

1570661-04

Tsh1g08-04

Ts1u603-04

1486674-0u

Twe8052-04

Tawos70-08

Teis466-08

Is973a1-04

1377358-08

Taseaus-o0

Tawoze9-04

1323143-04

---Page Break---

carbon = 12

A= .03380 at = 2 min

s 200000402

1934834

1873543

1816642

1763074

inisaes

1556577

?623005,

362282

1544221,

?soeeus

ta7s398

te84325,

twis262

taee136

1362765,

1339053,

{316890

256176

(276817

1258722

tawieaa

i226008

{211232

fis7424

1184520

1172658

tieiies

T1s0649

t1ko802

Sisis9s

1122598

t11u9s7

fi07e42

froowas

93855402,

1877208-01,

{819866-01

1756274-01

i7isis-01

186937

62562

ls0u726-01

lsu6503-01

{si0781-01

-a9-

ras

Trax = 240 min

{417023-01

rose Cl

+389766-01

{36u256-01

Tawow74-02

taig2i9-02

lastuie-or

1277977201

{2s9807-01

1242825-01

1226952-02

\$212117-01

\$198252-02

{1e5293-01

ti7siei-o1

iieiasi-o

t1si261-01

t1s1393-01,

1132150-01

1123512-01

T115u3e-02

1107883-01

lroos4o-01

fau2490-02

{880803-02

1823304-02

lreshse-02

i718190-02

167217902

1628242-02

158717602

1548795-02

\$s12923-02

1w79395-02

taugoss-02

1418771-02

Tasiage-02

taesei4-02

1341902-02

\$319554-02

{29e666-02

t279143-02

\$260897-02

tangeeu-o2

t227904-02

1213007-02

\$199084-02

{186070-02

1173908-02

1162540-02

---Page Break---

192.00

194.00

196.00

96.00

200.00

202.00

204.00

208.00

208.00

210.00

212,00

214.00

218.00

218.00

220.00

222.00

224.00

226.00

228.00

230.00

232,00

234,00

236.00

239.00

240.00

+182916-02

{1985-02

{132705-02

{1zm030-02

\$115923-02

T10@s45-02

\$101263-02

Teweuus-03

1884578-03

1626757-03

1772715-03

1722206-03

1674998-03

1630877-03

1589639-03

1552097-03

1s15074-03

Tweiko6-03

luug9s8-03

1367348-03.

1343336-03

1320894-03

i2a9si8-03

---Page Break---

ome

34

Chterine - $34 \frac{11}{2} = 99$ ain CI

A= 0.21000 At © 4,00min + 640,00 min

t r , r

0,00 +100000ç 01 +149956-02

, 4.00 6919832, +137874-02

8:00 lossase 1126766201

< 12100 Lorna Shiess2-01

16:00 trineas \$107162-01

20:00 les7ou7 v285260-02

24.00 Teouzes 1905897-07

28:00 Tssia7 3210-02

32100 ?sioeas i765803-02 }

36:00 tegsna 704104202 |

0,00 T3270 leu7a75z02

44to0 T336028 '895217-02

40100 Tense 1547361-09

32.00 Tasssus ?sosies-o2

56:00 T3ossi0 iweze2a-02

60:00 Taeaese sa2sa5e-02

4100 1280800 {39108s-02

88:00 239708 1389576-09

72100 {220n69 l3s0sos-02

78100 \$202708 ?303s6s-02 '

80,00 ie6a7s :279478-02

84100 inate :286961-02

88.00 1is7ss2 236258-02

92100 lates {217223703

36,00 ?issae? t195722-02

100;00, perrrsts \$183650-09
iow 00 fuzsso 304,00 ?iseese-09
ios .o9 hiossi9 lisszaszo2
112/00, v95i786-01 \$142726202
116100, 75102-03 [151227203
120,00, Teousss?01 [120850202
124200 l1ss77-a1 {110839202
128.00 ?e80168-01 lroases-o2
192100 Ye2sae-01 Tes7p75203
& 136100 Istusessor 1862220-03
YWo.00 [2067-01 1782752-03
nse TNeosu-01 lrtaseizes
19800 Tateso2-01 1670156209
152;00 Thioes6=02 Teieisa?o3
156200 is777s1201 issesi9-03
60:00, Tau7asa-0 \$520875~03
6:00 {519367-01 La7es0s?03
16800 {2saes6-0 teto3u=08
172/00 1269970-01 ?Mowee7=03
iel00 12¥e226-01 372229203
380:00 {226227-02 13h2039c03
164.00 209839-01 1314666-09
188.00 !192952-01 283313203
182/00 Ui7taeacon "2esosse3
196:00 \$163096-01 t24us72-03

?_?_?_

---Page Break---

+224967-03

1206750-03

tiseos2-03

\$17777703

t1e069s-03

1187748-03

1isseeu-03

1124900-03

1114837-03

1105584-03

1570776-08

le92562-04

Te2o6ua-on

l7sus30-00

1693739208

1537085-04

Tse6455-04

1539208-04

1895762-04

tasse19-04

Tu19098-04

?ses326-04

1356283-04

132573904

{299494-04

1275364-08

1253179-04

1232780-04

{214026408

1196782-08

t180927-0u

T166350-08

Titzeue-ou

f1w0625e04

1129298-08

tizes7e-ou

\$109300-04

Troowss-ou

1923971-05

ie49sze-o5

\$761082-05

1718152-05

1660291-05

1607092-05

1558180-05

1513208-05

{u71959-05

{w33842-05

ia9e9e0-05

{366750205

{337201-08

£910034-05

{26s055-05

Srez08e-05

{2N0972-05

2

+221587-05

1203706-05

[1e7298-05

1172208205

1156330-05

1145573-05

1133845-05

1223061-05

1113186-05

\$10¥030-05

Seseus6-06

187342306

Teoeses-06

i7u3u23-06

1683527-06

1828456-08

1577822-06

1533268-08

Tess¥eu-o6

tuys109-06

Tu12925-08

1379656-06

1349068-06

1320944-06

1298086-06

iz7isil-o6

1249452-06

1229354-06

1210875-06

1193885-06

li7e264-06

f1es901-08

1150696-08

1138555-06

liz7392-08

1117128-06

3107691-06

1990168-07

191037007

1837022-07

{769508-07

707580-07

1650571-07

\$398156-07

\$\$49963-07

1505653-07

1464913-07

1427856-07

{393016-07

361351-07

1392238-07

1308470-07

1280888-07

1258230-07

i237425-07

1218296-07

---Page Break---

Chlorine - 38

A= .016580

22000

1ee.00

- 23

aT = 4,00 min

F

+100000402

28375,

1361879

1300147

i72e36

1689530

680235

isoua7e

1581805

1512282

1475590

leuas2s

Teos901

Tseose2

1359285

?327981

Taouues

i2e2680

1262433,

243636

226185,

?209985

Tigeo4s

{180982

tisao19

1155980,

tiennen?

Tiswo

fi2ear0

Ive,

fno7s7,

S7e2845-01,

1888710-03,

163938-01

1593885-02

1581069-01

1511599-01,

{a 74955301

{480936-01

{wo93s4-o1

\$380034-02

taszeis?o2

13275¥3-02

\$30¥083-01

TAs? = 37.3 min c*

Tay 7 820600 min

max

t

192,00

198-00

200,00

204,00

208.00

212.00

216,00

220,00

224.00,

228.00

232.00

236.00

240,00,

24900

249,00

252,00

256200

60.00

264.00

348.00

352,00

356.00

360,00

364,00

368,00

372.00

376.00

380.00

Fr

282303201

1262083-01

{243312-01

{225884-01

'203705-01

fisw6s4-01

{1e07so-02.

1187795-01

1158776-02

iise619-02

1138260-01

ir2ueuu01

t11s7i6-01

1107428-02

19973394-02

'925999-02

58581-02

i798023-02

1740855202

\$687791-02

1638528-02

1592793-02

{ss0334-02

510016-02

1474321-02

tewo3ue-02

?eoae08-02

1379527-02

i3szau3-02

'327106-02

\$303677-02

128192602

1261733-02

1242906-02

122558202

'209825-02

t19ku 25-02

t1e0u99-02

1167571-02

{115562-02

1107285-02

{996003-03

le2us6u-03

1858435-03

---Page Break---

388,00

388.00

392,00

386,00

00,00

wowsoo

Mos.00

412/00.

416,00

420.00

424,00

428,00

432,00

436,00

440.00

aw, 00

448,00

452,00

456.00

480,00

464,00

469.00

472,00

476,00

480,00

44.00

488,00

492,00

496,00

500,00

504.00

508.00

\$12.00

518,00

520.00

524.00,

528,00

532.00

536.00

540,00

548200

54800

552.00

586.00

560.00

56400

568,00

572.00

576,00

580,00

00

588,00

392,00

596,00

600,00

+796949~03

1739867403

1686074-03

1637676-03

1592002-09

1589600-03,

1510235-03,

ts7368

1379021203

1351873-03

1326670-03

1303272603

i2e15s0-03

1261384-03

T2u2662-03

1225281-03

1209146-03

ligui6s-03

1180258-09

1167347-03

1155362-03

{1s4233-03

tia1g02-03

tizwaii-03

{11sw09=03

tio7asa-03

1994675-04

23431-08

les72e9-ce

1795886-04

l7aese0-08

{685957-08

leace7"-0u

67-08

Tso9ssu-ou

1473057-08

3874-04

{no7719-08

1378815-04

{35104-04

1326234-08

1302868-04

{2e1275-04

\$262035-08

1202938-08

224981-04

ieo018-o%

1167124-08

Tissis4-o4

Tiswowi-08

=e

-133724-048

{azeak6-ou

1115254-04

t1o6998-04

1993346-05

1922199-05

TA56146 -05

l7sue24-05

l73780u-05

feasou2-05

1635976-05

Tssou2u-05

Tswe134-05

{soea74-05

1n72426-05

t¥38588-05

1807174=05

1378010-05

1350935-05

1325799-05

1302463-05

1280799-05

260687-05

1242015-05

1224681-05

\$208588-05

Tiss64e-05

1179778-05

fis6s02-05

1154947-05

Tissa4s-o5

1193545-05

1123980-05

{115100-05

t106e56-05

1992022-08

{920968-06

a5500u-06

1793764-06

736910-06

24128-06

635127-06

ls89626-06

1547403-08

1508195-06

1871796-08

{438003-06

{806631-06

1377506-06

135086706

Tezsaeu=06

1302060-06

i2e0425-08

1260339-08

241692-06

---Page Break---

Cobalt - 60 4

Ae

t

+06600

at = 2,00 min

+100000402

1a76302

767978

1873007

{589769

1516851

tusz93ç

396928

1347868

Taaui02

1208153

179784

i1s75s2

i1ae0ss

1120896

fios034

1929215-01.

te1us09-01

1723613-02

1825368-02
1368036-01,
'480266-01
1420877-02.
i36ee32-02
1323222701
1283253-01
1298226-01
1217831201,
1190831-01
1167058-02
tiwewoo-02.
1128296-01
1112431-01
?985280-02
863441-02
1756669-02
1863100-02
1s81102-02
150924302
446271202
391085-02
1302724-02
1300343-02
+263203-02
1230656-02

- ase

11/2 = 10.5 sin

Tyax 7 20-00 nin

Co*?

+202139-02

1177137-02

1185233-02

1136037-02

tiie2is-02

{108473-02

\$915537-09

1802522-03

\$703108-03

1616162-03

1539968-03

1473196-03.

tuis6e1-09

1363802-03

---Page Break---

copper -

A =,13590

t

0.00

0.50

1.00

isso

2100

2iso

3:00

3:50

loo

4i50

5,00

5.50

6.00

8.50

7100

750

8:00

8:50

3200

9150

10,00

10.50

iitoo

Lusso

32:00

22250

13!00

13150

14.00

Lato

15,00

15.50

17,00

i750

18,00

18.50

19,00

13150

20.00

20.50

21,00

21.50

22.00

22.80

33.00

23,50

86

-27-

Tas? = 5.1 min

ap 450 mtn Tyag * 60-00 ain

r t

+100000401

1934307

1872930

1815585

1762007

i7iisae

1665178

veziwer

sseo6s

562509

1506870

1473873

tau 2k62

1013398,

1386239

1380865

1337189

1315020

?zauai6

t274982

{256017

T2mooKo

224271

209538

1195773

{182912

1170896

1iss663

lawsiso

tiasaso

tisoz2s

hiziees

tiise76

1106209

1992315-02

1927127-01

1866221-01

0837-01,

1756150-01

1706877-01

1680066-01

1616708-02.

[s76192-01,

ts38340-01

1s02875-01

1469933-01

1439062-01

tw20219-01

cu

+383270-02

13s8092-01

1334568-02

132258902

t282054-01

1272869-01

izsuau3-01

1238i95-01

1222547-03

1207928-01

1198 268-01

t1e1506-02

t169583-01

Sisewu2-01

Tissos4-01

{138303-01

1229223-01

1120734-01

taz2e03-01

1105392-01

Toewee9-02

's20002-02

59564-02

3097-02

1750339-02

tro1047-02

iesua9u-02

611965-02

ø573763-02

's30203-02

{439108-02

{866322-02

Tn35628-02

{407068-02

1380325-02

1355340-02

1331997-02

{310187-02

1289810-02

1270771-02

1252384-02

1236365-02

\$220837-02

1206330-02

1192775-02

+180111-02

1168279-02

1157225-02

---Page Break---

+286896-02

1137248-02

{119808-02

{211936-02

[104582-02

1977121-03

1932931-03

1052958-03

t196925-03

1744573-03

teas660-08

t6u3960-03

1607262-03

1567369-03

153009703,

1095278203

1462738-03

1432339-03,

{403938-03

1377402-03

1352609-03

1329445-03"

1307803-03

1287583-03

=e

---Page Break---

oe

8

Fiurine = 28 Tia * uzain F

A= ,00687 ar = 5 nin = 480 nin

t F ?

9.00 +190000 -01 226529

: 5100 Toe9ss9 t2is62s

10:00 Tatoos S2iz939

15/00 Teanga Toeus2

20:00 les3e09 preset

25.00 ase6e3 Tiseoes

30:00 te30597 Sipeass

35.00 {205296 Siszu2s

o.oo T1e0768 hires6

45.00 t756963 tinu7s
50:00 Irsse28 Sise25s
35:00 tnase7 ?isiie1
60:00 3692 ?156261
65:00 {688077 1151520
70:00 Teusso2 Tisesos
75.00 Te2e7as fis2na0
20:00 tosses Sise0a1
85.00 ?ss1026 si33605
30-00 {573023 1128808
95.00 1358868 125852
100.00 Tsseeus iizz018
ios:00 1522236 iiteso2
119.00 {506378 lhiness
115.00 ?esos0s ?izzo8
120.00 ie7s951 1207817
12:00 Teoanss Sowsaa
130.00 su7396 Troaaue
tasso0 Th33768 {98261301 |
1No.00 ts20555 S9szeei-01
1ns.00 to778 S923661-01
150.00 tgsa8 95525-01 |
' 155.00 Taeaze2 8246-01
ie0.00 1372608 1798-01
ies.00 {380287 81615@01
- 370,00 Sowsai2 s751295-01

175.00 Tosee72 sremisiot
180.00 Ta2eass i7w3e20-01
185.00 Taieass iraiies-01
190,00 Ta0eess se3si9s-o1
95.00 tas0253 577697-01
200.00 {290138 Ses7247-02
205.00 {281300 63722701
210-00 Taa7aa sea7ere-or
215,00 1254423 s98996-01
220,00 1256368 ?seo7so-o1
225,00 V2eesss Sses0ss-01
230,00 {260987 ?545908-01
238/00 t253607 12827801
13i5156-01

ee

---Page Break---

Calliue - 70

Ae

+033000

sae

at = 2,00 min

F

100000401,

1936132

876302

20370

1767973

i7ies24

1673007

1830022

isa9783

iss2aas

1516852,

teases

1452938

{424009

1396928

{371577

tau 7846

1325628

{308830

{265362

\$267335,

1250078

1234102

1219150

1205153

1192050

1179784

168301

1157552

Tis7eas

t1seose

1129251,

1120996

1113268

106033,

}92612-01

1929215-01

3613-01

8035-01,

1625368-01

585426-01

iswe0s6-02

TA/2 2 21 min

1,

t

90.00

92:00

94 00

96.00

98:00,

100.00

102-00

10400

106.00

108.00

110,00

ii2t00

114200

116,00

118:00

120.00

= 120.00 nin

Ga?

+\$19033-01

{860266-02

1449592-01,

1420877-02,

1393996-01,

1388832-01

1385275-01,

1828222-01

1302578-01

\$283253-01

\$265162-01.

12¥8226-01

\$232372-01

\$217531-01,

\$203637-01

\$190631-01

---Page Break---

A= 00e4s0 ar =

t Fr t r

75

Gernantun -75 tinsean Ge

. 100000401 4+380474-02

1938634 1318219-01

. 187354) t297W18-01

vare4aa 1277978-02

763076 t2s9807-01

1713195 Sauz625-02

1666577 \$226952-01

1623005 \$232117-01

1582282 \$198252-01

154221 \$185283-03

1508667 ti7aiei-01

00 1875399 1161861-01

36. Taeus25 1isi2e1-01

10400 tais2a1 t1u1393-01

12:00 [388138 taazaso-01

120.00 1362765 \$123812-01

128:00 1339053 triswas-o2

0 ian6a90 1107893-01

isu s00 {296176 Troewo-o1

152,00 {276817 {982490-02

160,00 1258722 g0Rgu-02

168,00 tzeieii 2330N-02

100 t226005 {769488-02

ios 00 i2in232 i719190-02

19200 hiemae 1672379-02

1184520, 1628242-02

1172458 1587176-02

tieiis5 1588795-02

tiso649 1512923-02

1140802 1479395-02

1is1s98 leweos9-02

1122996 {#18773-02

thiwos7 1391398-02

? fro7u42 1365824-02

hoosi9 1361902-02

. 1938554-02 1319554-02

1877208 -02 1298666-02

1819866-01 127914302

1766274-01, 1260897-02

t716186-01 {2u3843-02

1669372-01. 1227904-02

328100 1625618-02 1213007-02

336.00 1586724-02 ii99084-02

34400 s¥6503-01 1186070-02

352,00 1310781-01 t173908-02

360.00 +477393-02 +162540-02

368,00 ?ayeiss-o1 1151916-02

378.00 {817023-02. {iNiges-02

384700 \$389768-01 t1a2708-02

+368286-01

|

---Page Break---

100.00

308,00

815.00

824,00

832.00

1038,00

2024-00

2032.00

Low0%00

1056.00

Lo64 00

1072.00

1080.00

iogs:00

1098+00

L104,00

3112-00

1120,00

3128/00

3136, 00

Li4s 00

3152-00

1160-00

L1s8,00

3176,00

Lisasoo

iig2o0

1200.00,

1208.00,

1216:00

1224-00

1232700

3240.00

24800

+115929-02

{108345-02

\$101263-02

{94644303

4578-03,

1826757-03

1772718-03

1722208-03

1674999-03

\$630877-03

Tsa9639-03

1551097-03

{s15074-03

1481406-03

tuus938-03

1420528-03

139304003,

1367348-03

\$343336-03

1320898-03

?299918-03

?2e03i4-03

'261991-03

S2uwe66-03

1226860-09

121390003

1199919-03

Siesesi-03

1174637-03

1163222-03

1152553-03

1182581-03

1133261-03

1128550-03

118409-03

{108800-03

tio1698-03

95041204

288-04

feg022404

1775956-04

1725235-04

1877829-04

1633523-04

1392112-08

lsssko8-04

1517234-08

Tweaw2s-ou

1451825-08

Tuz2281-04

Tagueae-o4

1368889-04

13ua776-04

i32z240-04

301176-04

T2eieso-o4

1263090-08

- He

1256.00

1264.00

1272700

1280, 00

1288.00

1296.00,

1304-00

3312.00

1320.00

1328700

1336;00

1344.00

1352200

1360.00

1368.00

1376.00

1388.00

3392/00

1so0.00

1408-00

418,00

2424200

143200

iwio,00

+265093-04

\$229820-08

{21W798-04

\$200757-04

1187634-08

1175370208

\$163908-04

1153193-08

1143179-04

\$133820-04

1125073-04

\$116897-04

{108256-ou

1102115-0u

tasu396-05

tes2013-05

{e33705-05

\$779210-05

\$720276-05

1680672-05

636178-05

is9us9s-05

1555723-05

1519803-05

---Page Break---

-38-

28

todine © 08 a

t r ' :

+100000%01

Towe06s

895046

846775

Taoz208

t7s7903,

1717028

1678358

2641773,

1607162

ts74aa7

lsu3uae

Tsiki30

twa6402

{us0170

1435352

tuaie73

1389860

T360645

1345764

1329985

312160

1295325

1279397

264329

{25007

1236587

{223827

1211756

{200336

t1e9s32

1179310

1169639,

tio,

fisie3s

Tis36u6

fisse99

1128570

la2i636

1115076

1108870

1102889

Is74u37-01

«66202801

1625360-01

{s91641-01

1559733-01

1529546-01

1500987-01

1873968-01

{s8a407-01

1424223-01

{so1345-02

1379700-01

1359222-01

\$780629-01,

t738529-03

---Page Break---

27

agnestua = 27 tinssain Mg

* 36,00 +723529-01 84,00 +218137-02

ioo8 ?ansauacor ssce nieces

??\$ \$\$

---Page Break---

|

=e

95,00 1908969-09

87.00 ens020-03

98.00 t795571-03

| 99.00 \$730308-03

t 100,00 1678925-03

' 101/00 veauz61-03

102,00 1586757-03

1103-00 1505877-03

04200 1\$07201-03

205,00 {w72625-03 .

10600 1438259-03

{807426-03 .

1378763=03

1352116-03

ta273e4e03

Ts0ua14-03

1262908-03

1263002-03

T2uue99-03

1227293-03

! 1211307-03

Tig6uui-03

| iisz62i-03

1169773-03

120,00 1157828-03

---Page Break---

-39-

56

Mangeneſe - 56 taneasens Mn

Nerisecot ?Tocossces

??2_\$\$

---Page Break---

?suszaeo2

14452

Hates

+129681-02

1121259-02

t1as3e3-02

{108020-02

1991343-03

1926960-03

'266759-03

10467-03,

t1s7e31-03

trop6a4-03

Te62s93-03

1619561-03

ls79323-03

is4i639-03

{506518-03

{u73622-03

1942863-08

tuisioi-03

1387207-03

1362060-03

T338546-03

laisesse-03

\$296000-03

\$276777-03

{2se901-03

{2ei993-03

1226277-03

t211502-03

t197ew0-03

t1eu992-03

1172977-03

T161743-03

Tisi239e03.

Tiei4i7-03

1132232-09

{123686=03

{115616-03

t1os108-03

troioss-03

Tousis9-o4

1883813-04

1a264i4-04

1772742-08

1722556-08

\$675630-04

631751-04

1s90722-0u

s52358-08

lsieuss?o8

1882941-08

185157704

{422249-04

394826-04

Taesi64-04

{345207608

1322788-04

38.75

39.00

39.25

39.50

39.75

40,00

woras

40,50

40.75

42100

preery

8150

reer

82:00

42.28

42.50

42075

43.00

43.25

43150

4317s

44500

425

44250

44275,

45.00

45.25

45.50

45.75

46.00

4e.25

46.50

48.75

47,00

87.25

47250

87278

42.00

+301824-08

1282222-04

l263993-0u

{2u6755-00

1280729-0u

1215745-08

1201733-08

1188632-04

1176381-08

T164926-04

Tiswais-ou

Tinwies-o4

Vaguass-ou

\$126077-00

ti17a89-04

{110233-04

1203074-04

1963797-05

1301203-05

1eu2674-05

1107967-05

736774-05

88924-05

Teeei82-05

1602345-05

1565226-05

1526647-05

Ing2uuu-o5,

ta60462-05

1430587-05

Two2ses-o5

1376448-05

1352000-05

1329139-05

1307763-05

1287775-05

{269086-05

{251610-05

---Page Break---

wae

765

Nickel = 65 tis 2sear Nj

A = 0.2707 fs 2s ae Teag 2 2H Ke

t r : r

-100000+03 12.25 «362618-01

Tagetiae 12150 1337920201

lersare airs Inisrancor

lalsore 18100 298i08-01

Treaeie 1338 L29s77e02

peers 13150 125992302

Beet aairs Reritrae

leaagsz ince U23s0su-02

seises iis ?ahoaaa-0:

perere ini3o ?gesas-o3

isopees lela Steséea202

meets istoo liniese-or

iassas isles [ie08e7-02

meee 35:50 iNseaz-02

leraze isos ?ieaes02

nitty 16l00 ?inoeee-o2

lagaze0 Seles ?taasuecor

lateoss 18:50 Sne302203

loasane ie.9s Moeeseo2

lto2s 17200 ?saei72-07

launoer ines lada7eezo2

Uloso anise leniees-02

Tasso ins 1hse2-02

pesetirs 1el00 ?a6hae2-03

Herts tess [Alase-02

leseas ?e6u760-02

liner isblaiecoz

ieosan is.a0 'seosai-o2

iiseaie isles lstauga-o2

Retsen isiso s0e9s7-02

Mateos ints rere

Beret 20.00 rtanis-o2

stnrry 2ol3 Te1s3ia202

Hesse boise pet

r2S8eag-02 bole perses

: Tsdaeas-o1 23100 Ssa7eaiso2

Tenaneocor Riles 1315808202

: Taissescor 2ils0 lashese-oz

raistacr 21s a7ssan-02

i712008-02 200 [257u76202

Toesseecos ales 12hosos-02

relsescot 22150 laaueueso2

*Serosacoa 2338 Tatoniacog

rSgyetzcoa 33100 Sieseass-02

Sgege7m2 bias ?aasue3-02

forage 23180 Ute

etied Bins ?eo2ue-o2

seaeaag-st 2400 Sive7ueces

Taeese7-03

?_??\$. \$\$

---Page Break---

13

Nitrogen = 13 ti2s.iconin N

A= 06830 ape aatn ote 20 ain

? r , r

000 +100000+01 +359222-01

100 lessour '335171-01

2100 lerosre 1312730201

3100 31220 lesineaso

slog lyst503, Uoapsscol

too Tronise L2sno7-01

aoa lesseu2 1237039-03

Too Tenses 12211se-01

ale isn {20eau3-01
300 isasesa 11s2s26-01
30200 lsoo07s li7sea7-01
reer isesg2 liereiono
i2leo iessasz
13!00 ieeez08 Tsei720
inloo 1278007 lipereesor
istoo Tas36a1 1a27082-03
ielo0 Tazaess Siiesa7-or
i710 Tao7ees {1lossi-or
ialoo 2er2si S1031e7-01
18100 Tassos Toea7ei-02
t2s0078 1seaia-02
21:00 lasaa80 8301 74-02
22,00 laine l7a20ss-02
23100 {bosise [25680202
2400 Meesae Tenosse-02
25100 linea Teasase-02
2600 les002 lss2722-00
27200 Tisasse 1ss30a7-02
28200 league 's16010-02
28100 [jakozs tMatwesco3
30:00 l2s08s iins226=02
31:00 lisee2 Thieius-o2
32500 Trose70 T3siess-o2
33:00 trouser {36usoi-02

3600 1907797-02 ?atonea=o2

35.00, Teeuass-o1 Taarere=09

36200 leasio-o1 l2s6uos-o2

37,00 Tyesees-01 laresseso2

3600 T2snoe3-02

38500 [huoree-02

toro laaugue=o2

siloo 1208608-02

t2l00 T2suunaizo2 95873-02

t3l00 Tso7s79-03 l1e2077202

aloo Sa7as6e-01

Ssto0 inaagsz0r

6,00 T412625-01 Sisezes?02

ano S138300-02

---Page Break---

+129040-02

{1z0401-02

{312839-03

[i048i8-02

1978003-03

\$912521-03

'251024-03

V794419-03

I742230-03

1691602-03

1e85297-03

ts02092-03

1561780-03

1524267-08

1489072-03

1856327-08

1425775-03,

1397288-03

1370869-03

1345852-03

1322696-03

101090-03

\$280991-03

1262122-08

Tau572-09

---Page Break---

= use

6

3 Selenium - @1 tinsisen Se

Ae 03700 at sa nin Tyan £120 nin

7 F 1

0.00 -200000ç02 vaseess

i00 aease7 ieores j

. 2100 Tezai15 hiswass |

Bie ietsuae iHsaes j

7 seo iesiae? thane, |

\$400 829859 #136498 |

ico lasers 1is5u2

703 Srroo "bese

leo lgoe iiseae

| sco iiiiiss ?afsae

s 20108 tates iitase

: iiteo ?esses iNones

12100 ?esaieo Hosen

13100 ielenss Hoare

| ielo0 Seana "ss008s-01

isles isnines Tasazer-o

isioe ives Sauaeesoy

En!o0 "Sona Teasozecot

inion ?Shoaas Tazaisco1

is100 iazae Tapisescot

2o100 ioredeo [reisoscer

2ilo8 iheees ?eassca

22100 ious? ?raeeioco1

23100 seaeosa Morniece:

paloo Shossze Teedeoaco

25100 Tasases Tesenvoroy

Zeros Uonsiss ieagvaaaz

2ri08 Sae277 ?eoseascer

pores Uasie0s SSersoacez
Fst00 13soas iSegnooce
. gor00 Uaneeoe [Susoen-oy
avea lateeve isesior-or
s2ie0 Ssosite Soseo1-03
: 33t00 Lasz030 iaersyecoy
. 281938 46953401,
: Bst00 Unies ieSzanacor
deroa uae iaspeaces
a7:00 losis iigezeco:
. beroe Uozaus nownssco2
3er00 L2aau7e Taesee7-02
foros inne ianesai-02
Sites Ualeee ?3ease7-02
aloo oeysel ?anesoe=02
S3i08 Yona ?3asenoco2
Silos ieee Uazasse-01
ws.00 linesse Tanisia-0:
teres Hisezo ?aoso7-01
aries ttre UBesige-e2

96.00

97,00

98.00

99.00

100-00

201.00

102,00

03:00

104.00

105.00

106.00

107.00

308-00

109-00

110-00

312.00

112-00

113/00

114.00

115.00

216.00

127.00

2is.00

iis.00

120.00

+278534-01

1268336-01.

1258512-02

{249087-01

1239928-01

128124401

1222681-01

1214528-01

1206674-01.

1199107-01

tisie17-01

tise79u-02,

1178028-01

ti7isi0-02

1165230-01

1issiei-o2

1155353-01

1147738201

t1a7aie-02

1152098-01,

1127261701

fiisii3-01

[113788-01

-46-

22602-01"

---Page Break---

-47e

;3

Silicon = 31 tisaerer. Si

a en

: r : r

+200000+02 175, 1446433-01

1935990 12:00 417857-01

? 1876078 a2i25 t3e1ii1-01

?820001 12:50 \$366076-02

767513 22,75 1382643-01,

718385 13/00 1320711-01

1672401 33125 1300182-01

1629361 13:50 *280968-02

1588076 13.75 \$262983-02

1551370 18200 124615001

1516077 aslas 1230394-01,

t4s3043 1850 1215646-02

{452123 isis ?zo1eu3-01

tw23203 15:00 {1se923-01

1396095 15125 1176830-01

1370742 25250 1165s11-01

i3u7o1l 1si7s 1156917-03

1320798 16.00 {14s001-01

1304008 16.25 1135720-01

1284549 18250 1127032-02

1266335 is.75 {iieso1-02

1249287 17,00 121129001

1239330 Arias ?1016-01

1218395 17:50 {97%988-02

{208816 A775 \$912580-02

1192331 1854166-02

t179084 {79989102

tis7622 7uaaie-02

1158892 S700817-02

fisses9 1655583-02

f1a7e49, 19.25 1613520-02

1128651 19!50 1574342-02

* 1120416 19.75 1537579-02

t1i2703 20.00 150316902

1105894 20.25 S¥70961-02

. \$987415-01 20.50 {4yo815-02

4211-01 20.75 £412599-02

. 5053-02 23,00 1386188-02

?809661-02 ails i3e1869-09

: 175785402 21:50 1338331-02

10:00 {70934401 21.75 1316675-02

1072s 1863938-01 22.00 1296405-02

10.50 te2i41-01 22125 1277432-02

1o17s 1581662-02, 22:50 125967402

iivoa 15444 30-01, 22.75 +243052-02

ilias 1509582-01 23200, 1227494-02

1liso 14 76964-02 23125 1212933-02

eT

---Page Break---

= une

23.50 4299303-02

23.75 1186545-02

24,00 Ti7ab08-02

---Page Break---

?TMtaniue - 51

s

siisseo

- 49

ats 1,00 mtn

+200000+02,

tas7364

1787435

te9e728

{620022

Tsso1as

tseozas

1933228

taeuu27

3uan27

1302708

1268008

i2sease

1212508

1187683,

hressua

1187706,

fisinas

1116366

1103260

1916297-01

{813089-01

1721508-01

{680238-02

1568124-01

1504133-02.

tau7350-01

1396962-01

1352260-03

\$312573-02

1277367-01

1246128-01

{218403-02

1193803-01

\$171073-01

152603-02,

1i3s424-01

3120162-01

\$108627-01

t986173-02

1839600-02

745031-02

1661113-02

{58664802

1520571-02

+461996-02

1#09905-02

1363735-02

TAs? = 5.8 min

Taax = 120.00 ein

1

48,00

49,00

50,00

51,00

52.00

53,00

58,00

55100

56.00

59,00

60,00

81,00

62.00

83,00

54.00

85.00

65.00

87.00

68.00

69.00

70.00

71100

72.00

73.00

74200

15100

76.00

77,00

78,00

79,00

80.00

81,00

82,00

83,00

84.00

85.00

88.00

87,00

88,00

89.00

30,00,

91:00

92.00

93.00

34200

95.00

Ti*

+322765-02

{2e6u20-02

£25W150-02

t2zss2u-02

\$200122-02

\$177801-02

1157579-02

t139830-02

{17s080-02

{110108-02

\$977025-03

1866975-03

\$769323-03

1682669-03

1605776-03

1537500=03

1476997-03

1428270-03

1375595-03

1333289-03

1295749203

1262437-03

\$232877-03

206647-03

t1e3371-03

1162717-03

Tasuga9-03

1128125-03

1113698-03.

Trows2

62552

1555071-08

1092550-0u

1437071-08

Tae7e4i-04

Tanwzs6-o4

305292-04,

t270996-08

1240470-04

1213384-08

1189350-04

168022-04

+189097-04

1132303-08

{117801-04

---Page Break---

100,00

101,00

102+00

103:00

108.00

108,00

106+ 00

107700

108.00

109.00

11000

Liaioo

212,00

113h00

11¥100

115,00

118,00

319,00

120,00

+108277-08

924433-05,

tezosa9-a5

72791205,

645923-05

1873169-05

1508610-05

1451322-05

s00487-05

1958377-08

{315349-08

t279830-05

T2eeia-05

\$220362-05

ti9ss23-05

{173500-05

1153958-05

1136617-05

1221228-05

1107874-05

1s5u575-06

84705506

751846-06

68 6

1892857-06

---Page Break---

soe

52

Vanadiua - 52 11/2 = 9.77 min V

A= .183000 At = 1,00 ain Trax 7 220.00 min

t r Fr

: +100000002 +106220-03

332768 4565-08

, 3503 1736637-04

1877527 Terauua-ou

th80988 {s10860-04

{400827 1w25426-04

1333537 Tasu283-0u

(277789 i298035-0H

231309 Tause96-04
\$192627 ?2on6o8-o4
Tieoway 1170391-08
1139887 Tiwze96-04
\$112247 {11e167-04
1926432-02. Toe eos4-o5
1771503-01" leiskes-05
4283-01 264-05,
535039-01, 1568318-05
45864-02 1473277-05
ø72051-01 ls98130-05
309000-01 tazezi9-05
\$257325-01 1273930-05
121429201 1227621-05
11 78456-02 1189555-05
> {is9612-01 1157856-05
: 112375901 fisi4s7-05
{10306301 t1o9u73-05
88276-02 is12659-06
1714745-02 1759200-06
1895217-02 1832238-06
1495677-02 1526508-08
{e12784-02 tu30459-06
1389754-02 1365138-06
. 1286267-02 1308072-06
: {238394-02 1253222-08

\$198527-02 \$220875-06

+ 1165327-02 1175610-06

1137679-02 1186242-06

14655-02 1121786-08

4808-02 Troisi9-08

1795134-03 leuwsa0-07

6262-03, 703307207

issis20-03 1805725-07

tss9211-03 1807773-07

1382417-03 1806202-07

1318864-03 1338272-07

1265207-03 \$201702-07

1220856-03 1234593-07

\$183922-03. [195361-07

1153164-03 [162651207

112755003 Uiaswew-07

\$\$ \$\$ \$\$

---Page Break---

110.00

312,00

112,00

113:00

214,00

11s;00

Lis.00

117,00

21800

iisoo

120,00

+112826-07

?sagsasuo8

1782485-08

lesi603?

{su2638?

lusieas=¢

1376319-08

3913386-08

1180722-08

1i25516-08

1108526-08

la704ss=1

1724891-09

1603666-09

1302714-09

Ture660-09

Tawesss-09

{290331-08

= 52 -

---Page Break---

69

tines69 ransszem ZN

Ae oiss2 ate asoenin 4, « amav0d ata

: ' : r

+100000 02 4599287-02

1538686-02

tueu2i3-02

1438249202

1391235-02

1351673-02

1316111702

{2aiius-02

\$255012-02

1383095 +229584-02

1388356 1208368-02

1309834 195800-02

1278233 1166742202

3250098 1149880-02

1224907 1184724202

102074 tiziz01-02

tieiess 1108855-02

1163272 78470-03,

1146762 73525-03,

sisr921, 1790586-03

12i8s01 1710840-03,

1106590 3879-03,

1988112-02. is7424208,

1861225-01 1516122-08

1774137202 146393009

1695054-01 {417017-08

1625898-03, 137¥887-03

+562237-01 336942-03,

1505383202 1302870-03

1656278202, 1272243-03.

te08340-01 124u713-03

'3ç70N8-02 1219967-03

1929931-02 1187724-03

1296568-02 £177728-03

1266578-0 1159757-03

:239621-01. 1283802-03

1218390201, \$129081-03

1193610-01

11 74031-01

1156833-01

?iso614-02, ie42684-04

1126395-01 1757470704

inissassor ?e00873-04

344,00 102125-02 1612022-04

352,00 917978-02 +550133-04

360.00 1825150-02 1494502-08

368,00 '741709-02 tauuus7-04

376,00 708-02 760.00 139984908

ee |

---Page Break---

1000.00

L024,00

1032.00

1080.00

064-00

2072.00

1204.00

1122/00

1120.00

1128,00

1136,00

2144.00

1152:00

21160,00

115800

1276.00

1184,00

1192,00

120000

435914508

1322026204

1234862-04

1220753-08

Brrirery

[170285-08

tiss06s-o4

1137587-08

Ti23674-08

iiiiise-o4

1999252205

9824-05,

07385-05

1725781-05

1652352-05

1s86385-05

1527089-05

1n73788-05

1425878-05

{se2812-05

Vauwi01-05

1309305-05

1278028-05

i2as913-05

122464205

\$201925-08

t1e1s06-05

{163152-05

11H6653-05

Titze26-05.

iiie4ss-05

1108521-05

Tas74ou-o6

?86089006

1773565-06

1e95341-06

1625026-08

1561022-08

{sosi0s06

vus3982-08

{s08039-06

1366777-08

1329688-06

1296349-08

1266382-06

T2agues-o6

t21szai-06

\$193667-08

1173903-08

1156318-06

1180510-06

1126302-06

1113530-06

1208.00

1216:00,

1224.00

1232100

1240.00

1248.00

1256.00

1264.00

1272.00

1280.00

1288.00

1296.00

2308200

312,00

320,00

1328.00,

1336.00

1244-00

1352/00

1360.00

1388,00

1376.00

1384200

1392.00

1400.00

iwo8,00

aaais,00

1424.00

1432.00

1440, 00

+202048-08

1917300-07

824541-07

\$741162-07

1666214-07

1s98845-07

1s38289-07

1s83056-07

1434927-07

tas0987-07

1351413-07

1315878-07

t2e3935-07

1255223-07

1229415-07

\$206216-07

\$165363-07

{166618-07

t1u9770-07

{138625-07

tuzn011-07

t108774-07

{977748-08

1a78876~1

1790002-08

{720126-08

1638307-08

---Page Break---

Bine= 71

A= 4177700

?

- 555

+200000003,

1956547

914983

1875224

tes7193

te00835

786018

1732732

700893

1670837

fe4i305

Te1d899

1586783

ts61266

1536896

1513567

tuoi252,

tas9905

Tanouss

1429955

{811272

1393402,

1376307,

1359955

Tauesay

1329353

1325082

1302352

?2eezse

{275732

1263751

1282290

i2¥a3z8

i2a0eea

?220812

t2iazis

1202038

1193259

Tieess2

litse2e

Tresias

161795

115k765

irke040

t1wi607

1135454

ti29868

Tie = 38h

Tmax 2 60000 8

Zn"

1123938

tnuass2

t1i3801

1108473

1103760

1992513-02

lou93e6-01

1908133-01

68672-01,

30926-01,

794820-01

760283-01

1727246-01

25646-02

65418-01

1686504-01,

1s08846-02
1582390-01
155708401
1532877-01
1509722-02,
1487573-01
t466387-01
t446221-01
1826736-01,
{408193-02.
1390856-02
1373490-01
1357261-01
1381737202
1326887-01
{312683-01
1299096-01
1286100-01
1273668-01.
1261776-01
\$250¥01-02,
\$239521-01
\$229113-02
\$219157-02
{209634-02
\$200525-02

ti91812-02,

\$183477-02,

1175505-0

1167878-02.

[160564-01.

---Page Break---

+159606-01

\$1¥6931-02

t1kos67=01

lissa4onon

1128538-01

1323020-01

1117665-01

1112852-01,

{1o7664-02

1102983-01

1985083-02

1982278-02

ts0i334-02

62186-02

4705-02

788969-02

1754591-02

72180202

{680837=02

1660436-02

1631738-02

808288-02

1578030-02

1552913-02

1505906-02

1ue3923-02

1423541-02

{405137-02

1387533-02

1370693-02

135usa6-02

1339178-02

1324440202

{310342202

29

1217517-02

?20806:

M9s02

\$190376-02

118210302

fa7si91-02

1166622-02

+159381-02

1152458-02

11¥5a31-02

Tisgs9K-02

tisse33-02

1127635-02

-56-

+122089-02

tane7eu-02

1111709-02

ti0585s-07

1102212402

1977707-03

193822303,

'394586-03

55713-03

1818530-03

782963-03

t7He941-03

lm6398-03

{6es268-03

1655492-03

1627009-03

is9976u-03,

1573702-03,

1548773-03

152492603,

1502118-03

1680300-03,

{us98 29-03

{439866-09,

1420370-08

{wozi04-03

isekea1-03

1367918-03

1951931-03

1336639-03

1322011-03

{308018-03

t294638-03

{201832-03

t269585-03

t2s7e71-03

1246666-03

1238948-03,

1225695-03

1215a89-03,

120650703

119753403

118895103,

1180740-03

1172886-03,

ties374-03

i15s1s6-03

t1sisi4?03

1186739-03

1188450-03

t1a2436-03

1126679-03

1121175-03

{11s920-03,

1110873-03

{i0805s-03,

froiss7-03,

---Page Break---

\$2.00

52.25

52.50

52.75

53200

53.25

53,50

53.75

54.00

54.25

54.50

54.75

55,00

55.25

55.50

55.75

56.00

56.25

56.50

56.75

57,00

57.25

57.50

87.75

58.00

58.25

58.50

58,75

59.00

59.25

1869307-08

Tanzs02-04

t777101-08

i7ag334=04

1721034-08

{880138-08

1650584-04

1622818-08

1595273-08

\$s63407-04

Tsuwe5s?08

1520998-0

tuge359-04

1476708-04

1455990-08

1436176-04

1817223-08

ts99093-04

1381752-08

1365264-08

1389296-048

isa4ii8-04

ls19600-04

{g0s713-04

\$292428-04

1279722208

1267567-08

---Page Break---

- 59 e

APPENDDC T

FORTRAN PROGRAM,

BPOMNMIAL FUNCTION

DDGNSION TITLE(20),

90 READ 10, (TIPLE(I),2=21,20)

+10 FORWAT(20A4)

PUNCH 20, (t1TLE(1),1=1,20)

20 romwar(//e0ah//)

READ 30,. A, DD TAL

30 Forou (3710.6)

PUNK 0, A,Dn, TAK

40, Pow (5k, = FL0.6,5X,4HDE =F10.5,5X,6H9WAX =F10.11//9X, 1HT6X, 2H

1,

TO,

1100 FEKR(-AçT)

PINCH 30, 747,

50 rorwian(rio.4,6x,xi4.8)

IF(T-TMAX)200, 300,999

200 ator

{0 70 100

300 PUNCH 310.

io rowan (75%, 1%9)

9 10:50

999 StoP

=D

---Page Break---

- ee

ADPryDTx tr

ISOTOPES OF SINTLAP WALT Livts

sotope 212 Sinitar teotope_ tap

Americium= 246 25m Toline-128 25m

Antimony-120 2.0m caritun-70 210m

Arsenic= 70 s2n 2inen69 52m

Araense= 74 ase Prenine-20 380

Bardun-241 ion Rronine= 80 Lon

Blemuth-199 25m Toline-128 25m

Bromine-70" oon Hiupdnun= 29 6.56"

cadmium-115 238 Aluminun= 26 2.30

Cadniun-119 om trogen-13 Lom
californiun-244 25m Todine-128 25m
cariforniun-247 2.58 Nteker-65 2.56
cergun-141 32.54 chiorine-34 33m
Certun-143 33h chorine-36 39m
cestun-128 vanadtun-§2 3.778
Cesiun-132 Atuninun-29 6.588
cestun-139 9.58 Magnestun-27 9.5m
Copper-62 9.98 Mitregen-13 don
Curiun-238 265h nieker-65 2.56n
Tinsteiniun-248 250 Todine-128 25m
Finateiniun=251 asa Bronine-82 asa
Eineteiniun-254 asd Bronine=82 asa
Europiun-144 don Promine=60 er,
Gadolinium-159 ash Bronine=80 en
Gadoiintun-262 3.78 vanadgun-52 3.778
Germaniun-66 2.5h wiekel-65 2.56%
Heimiun-161 2.5h Mieke1-65 258m

---Page Break---

DT

\<2 -

|

ractope ap sinitar tsotope 1a

Motafun-166 26.78 chlorine-28 37.38

! Holmium-159 33m Chlorine-34 33m

rnétun-222 20a pnt dmony-122 ane

Indium-112 20,78 Carbon-11 20.50 ,

Todine-132 2.3b Aluminun-26 2.38 *

redine-199 20.8 caiatune70 21.0%

Tedine-i30 s2.58 zine-69 sen

Todina-135 em cagntun-107 6.7

tanthanua-i34 6.58 Atuninun-29 6.8

Lanthanun-196 o.sm | Magnensune27 ose

| kamchanen-aa zine=71 seb

! Lead-196 atm Chlorine-38 37.8m

i 10.68 cobalt-60H 20,5

176 gene zinc-70 sen

i ange calcium-70 21.08

aise 21,08

2.188 pnt molybdenum-122 2a

Neodymium-109 a chlorine-28 2.868

| Mendelevium-239 2.358 Aluminum, 2.3m

| Helium-7 aise strontium-82 aise

| Niobium-92 210,08 Nitrogen-13 10m *.

Niobium-92 6.68 Actinium-29 6.560

oxygen-190% 9.58 Magnesium-27 9.50

! Osmium-195 6.50 Aluminum-29 6.56m

Palladium-106 aise Actinium-26 aise

Platinum-186 2.58 Nickel-65 2.56h

---Page Break---

+ 62

taoteps say Sintier Taotope ean

Platinun-197 20h carbone22 20.58

Prassodysiun-ihs s.9h Titaniun-s1 5.8m

Poloniun-201, ten Promine-80 Le

Poloniun=208 a.8h nine=?1 38h

Piutonsun-239 20m carbon-22 20.5

Pronethiun-262 20n carbon-1i 20.5

Protactiniume229 nse Rronine-82 asa

Protactinfun-206 6.66 cadniun-107 6.7m

Radon-222 asm toaine-128 250

Rheniue-2e6" 18.78 Setentun-e2 38.6

Rhandun-it0 aon Atuninun-28 2.30

Rhod fun-105 ase Bromine-#2 aise

Rubiaiun-oun 21m Gariun-70 21.0

Rubiaiun-06 10.78 Seteniun-e2 18.6

Rubidfun-o8 10m Bronine-60 1s

Ruthentun-97 288 Antimony-122 ave

Senariun-iss 25m todine-128 25m

Seandiun-n6 ase Bariun-199 osm

Seieniun-23 25 Togine=128 25m

Sitver-208 2.4m Atuninun-26 2am

siiver=215 Garniuea70 2am

Strontiun-s1 Magnestun-27 9.50

suphur-27 copper-66 Sam

Tantaiva-163 5.24 copper-66 Sam

Tantalun-196

Technet ium-105

Thultun-168

cobaie-60m

Nitrogens13

Barium-139

---Page Break---

Tin-109

Tine125"

Xenon-125

Yeerius-93

Yetriun-96

Yetriun-o4

= ous

ndtrogen-13

cobait-60m

zine=71

roe,

10.58

3.8b

---Page Break---