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CORALT FAST NEUTRON CROSS SECTIONS-
MEASUREMENT AND EVALUATION

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PREFACE

This document presents results of recent experimental studies, develops a physical interpretation and makes use of these measured and calculated results, together with previously reported information, to deduce an evaluated data file in the ENDF format. The endeavor makes contemporary nuclear data promptly available in a format suitable for a wide range of applied neutronic calculations.

Argonne National Laboratory
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COBALT FAST NEUTRON CROSS SECTIONS - MEASUREMENT AND EVALUATION^{*}

by

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ABSTRACT

Elastic and inelastic scattering cross sections of cobalt are measured from incident energies of 1.8 to 4.0 MeV including those for the excitation of states at 1.10 ± 0.01 , 1.20 ± 0.01 , 1.30 ± 0.01 , 1.43 ± 0.01 , 1.46 ± 0.02 , 1.72 ± 0.02 , 2.06 ± 0.02 , 2.09 ± 0.02 , 2.16 ± 0.03 , 2.35 ± 0.05 and 2.50 ± 0.05 MeV. Total neutron cross sections are measured from ~ 2.0 to 4.5 MeV. From the experimental results, and previously reported values, an optical-statistical model is deduced providing a quantitative description of measured values to 20.0 MeV. The observed excited structures and cross sections are shown consistent with a nuclear structure model based upon a proton hole in the $f_{7/2}$ shell strongly coupled to a spherical core and a solution of previous ambiguities in J^π assignments is suggested. The available experimental information and the computational model are utilized to provide a comprehensive evaluated data file in the ENDF format suitable for use in fission reactor, fusion reactor and other applied neutronic calculations. This evaluated file is explicitly presented in the Appendix.

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I. INTRODUCTION

Cobalt is a constituent of many ferrous-based alloys finding wide use as structural materials in neutronic systems. In addition neutron induced processes in cobalt are the physical basis for a number of spectral-index and dosimetry methods. Basic nuclear properties of cobalt have been extensively studied using a number of nuclear reactions (1). More than forty states have been reported to excitations of ~ 3.5 MeV. Despite these efforts, the spins and parities of some low-lying excited states remain ambiguous. Cobalt, with 27 protons, is one proton short of a closed $f_{7/2}$ shell and its structure should reasonably be related to nuclear shell concepts. Thus fast neutron induced processes in cobalt are of interest from both the applied and basic points of view.

The major knowledge of elastic neutron scattering from cobalt at energies of ≤ 1.5 MeV results from the work of Smith et al. (2). Holmqvist and Wiedling (3) have reported elastic scattering measurements between ~ 1.5 and ~ 8.0 MeV at intervals of about 500 keV and Kinney and Perey (4) have reported results in the range ~ 5.0 to 8.0 MeV. Several other elastic scattering measurements have been reported in the interval 3.0 to 4.0 MeV (5,6,7) and, apparently, a single measurement at ~ 14.0 MeV (8). The total neutron cross section is known to fluctuate to energies of ~ 4.0 MeV and the elastic scattering can be perturbed by such effects. There have apparently been only two sets of direct measurements of inelastic neutron scattering from cobalt at energies of < 4.0 MeV for a total of only three incident energies and the excitation of only a few of the possible states (2,9). Several $(n,n'\gamma)$ studies have been reported (10,11,12). Results from these latter are not easily re-

lated to inelastic neutron scattering cross sections nor are they particularly consistent. Recent measurements have well defined the total neutron cross section of cobalt at energies of ~ 0.2 MeV (13,14) and from ~ 0.4 to 20.0 MeV (15). Good resolution measurements are apparently not available in the region ~ 0.2 to 0.4 MeV.

It was the objective of this study to: 1) verify the energy-averaged magnitudes of the reported total cross sections in the energy range ~ 2.0 to 5.0 MeV, 2) provide, together with previously reported work from this laboratory (2), a definitive knowledge of elastic neutron scattering to ~ 4.0 MeV, 3) improve the knowledge of excited structure and associated inelastic neutron scattering, 4) develop a comprehensive optical-statistical model descriptive of measured values and suitable for extrapolation up to 20.0 MeV, and 5) utilize the experimental and calculational knowledge to construct an evaluated data file in the ENDF format. Subsequent portions of this paper are addressed to these five objectives.

II. EXPERIMENTAL METHODS

All of the experimental measurements employed high-purity metal cylinders of natural cobalt. In the total cross section measurements neutrons were incident on the cylindrical base, and the sample thickness was selected to provide transmissions of 50% or greater. The scattering measurements employed 2.0 cm diameter and 2.0 cm high cylinders with neutrons incident on the lateral surface.

The total cross section results were deduced from the observed transmissions of approximately monoenergetic neutrons through the cobalt samples. The scattering measurements employed an unusual 10-angle fast neutron time-of-flight apparatus. The details of the apparatuses, the experimental procedures and the data handling and processing have been

amply described elsewhere and will not be reiterated here. Detailed descriptions can be found in Refs. 16 and 17.

III. EXPERIMENTAL RESULTS

1. Total Neutron Cross Sections

The total neutron cross sections were determined at energies of ~ 2.0 to 4.5 MeV. Fast neutron time-of-flight techniques were used to suppress the background and other experimental perturbations. The statistical accuracy of the measured values was $\sim 1\%$. The incident neutron energy resolutions of ~ 3.5 keV neither averaged the expected resonance structure nor fully resolved it. As a consequence the measured values fluctuated with energy. When averaged over ~ 50 keV energy intervals they were comparable with the measured neutron scattering cross sections, discussed below, and provided a test of the internal consistency of the various partial cross section measurements. The total neutron cross section results are summarized and compared with the results of Cierjacks et al. (15) in Fig. 1. The energy-averages of the two sets of measurements are in good agreement. However, the energy resolution of the present results was about a factor of three better than those of Ref. 15, (3.5 keV via 0.07 nsec/meter or ~ 10 keV at 3.0 MeV) thus may have been more sensitive to inherent cross section fluctuations.

2. Elastic Neutron Scattering Cross Sections

The neutron scattering cross sections were deduced from the observed neutron velocity spectra measured concurrently at 10 scattering angles. The incident neutron resolution was ~ 50 keV and the scattered neutron resolution ~ 0.4 nsec/meter. Measurements were made at ≤ 0.1 MeV incident neutron energy intervals from 1.8 to 4.0 MeV, generally in two angle sets resulting in a total of 16 to 20 differential cross sections at each

incident energy distributed over the angular range 20 to 155 degrees. The energy-dependent sensitivities of the detectors were experimentally determined from measurements of the $H(n,n)$ scattering process and the absolute magnitudes of all the scattering cross sections were determined relative to the $H(n,n)$ cross sections as given in Ref. 18. All the measured scattering results were corrected for flux attenuation, multiple event and angular resolution perturbations using a Monte-Carlo procedure (19).

The measured differential elastic scattering cross sections were least-square fitted with an expansion of Legendre polynomials from which the angle-integrated elastic scattering cross sections were deduced. Generally, the fitting procedures utilized only the measured data and resulted in zero-degree extrapolated cross sections exceeding "Wicks Limit" (20). In a few instances the model, described below, was used to introduce a cross section value at 180 degrees so as to assure a good behavior of the extrapolation of the polynomial fit to 180 degrees. The experimental elastic scattering cross sections and the corresponding Legendre fits are summarized in Fig. 2.

The statistical uncertainties of the individual differential elastic scattering values were in the range 1% to 10% with the larger value pertaining to the distribution minima. In addition there were systematic uncertainties associated with the correction procedures and normalization. The cumulative systematic error was estimated at 5% to 8% dependent on the quality of the particular measurement. Thus the total uncertainty in the differential values was $\sim$ 5% to 13%. The uncertainty in the angle-integrated values was estimated to be 5% to 8%. The consistency of the data taken over a two year period indicated that the above uncertainty estimates

are conservative.

The present elastic scattering results are in good agreement with those reported by Holmqvist and Wiedling (3) at 2.0, 2.4, 3.0, 3.4 and 4.0 MeV and with the 4.0 MeV results of Gorlov et al. (6). The agreement with the 3.2 MeV results of Ref. 5 and the 3.7 MeV results of Ref. 7 is less satisfactory. Representative comparisons are shown in Fig. 3. The present results reasonably extrapolate to the lower energy values previously reported from this laboratory by Smith et al. (2) as illustrated in Fig. 2.

3. Inelastic Neutron Scattering Cross Sections

Inelastic scattering cross sections were determined concurrently with the elastic scattering cross sections. The scattered-neutron energy resolutions were sufficient to resolve many of the reported ^{59}Co states to excitations of ~ 2.6 MeV. The observed excitation energies were determined from the known incident energies and the measured neutron flight-times and flight-paths and verified by observation of known inelastic neutron processes (e.g. the excitation of the 846 keV state of ^{56}Fe). The measured excitation energies were uncertain to ~ 10 keV and generally not as precise as those previously reported from (p;p') and (n;n' γ) studies (1,10,11,12). Therefore, the energy determinations of the latter were accepted as the more accurate.

The first four reported excited states (1.099, 1.190, 1.291 and 1.434 MeV) were clearly observed in the present experiments. An observed "state" at 1.465 MeV was attributed to the reported doublet of states at 1.460 and 1.481 MeV. Neutrons corresponding to the next three reported states (1.744, 2.061 and 2.087 MeV) were observed and neutrons due to a "state" at 2.16 MeV were attributed to the reported triplet of states at 2.153, 2.183 and 2.206 MeV. Neutrons corresponding to the reported state

at 2.397 MeV were evident and a broad neutron group was associated with the known states at 2.479, 2.541 and 2.585 MeV. These correlations of presently measured and previously reported structure are summarized in Table 1. Generally, the energies of the structure observed in the present experiments are consistent with those previously reported from other measurements.

The observed differential inelastic cross sections were nearly isotropic. The measured angular distributions were least-square fitted with low order ($\leq P_2$) Legendre polynomial expansions from which the angle-integrated cross sections values were deduced. The uncertainties associated with the angle-integrated values were subjectively estimated from the statistical error of the measurements, the systematic uncertainties and the experimental reproducibility. The combined uncertainties were generally in the range 10 to 20% or 10 mb, whichever was larger. These uncertainties rapidly increased as the neutron energies decreased below 500 keV and cross-section results were not accepted when they corresponded to neutron energies of less than 500 keV.

The measured angle-integrated inelastic neutron scattering cross sections for the excitation of the above states are summarized and compared with previously reported values in Fig. 4. The total inelastic scattering cross sections deduced from the present measurements are consistent with the above determinations of elastic scattering and total cross sections and are in good agreement with the neutron measurements made at this laboratory a decade ago (2), with those reported by Cranberg and Levin at 2.5 MeV (9) and with the extrapolation of the higher energy values of Kinney and Perey (4). The agreement with cross sections deduced from the observation of gamma-rays emitted following the scattering process is less satisfactory. Results reported from the $(n;n'\gamma)$ measurements of Refs. 10, 11 and 12 tend to be larger than those of the present

work and those obtained from other direct neutron measurements. This is not unexpected as the reported results are generally gamma-ray production cross sections, not simply related to the inelastic neutron scattering cross sections.

IV. INTERPRETATION

Optical-model (21) and compound-nucleus (22) concepts were employed with the objectives of: 1) providing a comprehensive physical model suitable for experimental extrapolation requisite to the provision of complete data sets for applied use and 2) improving the physical understanding of the excited structures of ^{59}Co .

1. The Optical Potential

The selection of the spherical optical potential was based upon comparisons of measured and calculated: 1) total neutron cross sections in the energy range 0.1 to 20.0 MeV, 2) energy-averaged differential elastic scattering cross sections in the energy range 0.3 to 8.0 MeV and 3) $l=0$ strength functions at the low-energy limit. The emphasis was essentially in the above order. The choice of the optical-potential was not influenced by consideration of inelastic neutron processes. A number of optical potentials were examined in the context of the above criteria including those of: Perey and Buck (23), Lambropoulos et al. (24), Agee and Rosen (25), Holmqvist and Wiedling (3) and Moldauer (26). The latter was found very suitable, when inclusive of the potential energy dependence of Engelbrecht and Fiedeldey (27), and was the basis for subsequent detailed parameter adjustments. These adjustments were based upon subjective judgements made in an essentially real-time computational environment. The finally "selected" parameters were

$$\begin{array}{lll}
 {}^0V_{\text{real}} = 46.0 \text{ MeV} & R_{\text{real}} = 5.118 \text{ F} & a_{\text{real}} = 0.65 \text{ F} \\
 {}^0W_{\text{imag.}} = 14.0 \text{ MeV} & R_{\text{imag.}} = 5.618 \text{ F} & b_{\text{imag.}} = 0.6 \text{ F}
 \end{array} \quad (1)$$

$$V = {}^0V - 0.33 E \text{ (MeV)}$$

$$V_{so} = 7.0 \text{ MeV}$$

$$W = {}^0W - 0.1 E \text{ (MeV)}$$

where the real potential is a Saxon-Woods form, the surface-imaginary potential a Gaussian form, and the spin-orbit potential a Thomas form (21).

The calculated total neutron cross sections are descriptive of the energy-averaged experimental values in the region of large fluctuations (i.e. $E \lesssim 2.0$ MeV) and at higher energies (to 20.0 MeV) differ from the measured values by no more than 2% as illustrated in Fig. 5. Below several MeV compound-elastic scattering contributions were appreciable and were calculated using the Hauser-Feshbach formula (22). Above about 5.0 MeV the elastic scattering should be essentially equivalent to "shape" scattering. Between the two extremes, compound-elastic contributions were not well defined due to uncertain inelastic-channel competition. In the present calculations, the compound-elastic contribution was linearly interpolated from the reasonably calculated value at 3.0 MeV to an assumed zero contribution at 5.0 MeV. The results of elastic scattering calculations using the above potential and procedures are compared with some of the present and previously reported experimental results in Fig. 3. At low energies ($\lesssim 1.0$ MeV) the agreement is good when the experimental results are considered in the context of a 100 keV energy-average of the evident fluctuations. As the energy increases from 1.5 to 4.0 MeV the fluctuations of the experimental elastic scattering cross sections decrease and the agreement of individual measured distributions with calculation becomes very good.

The calculated distributions are reasonably descriptive of the 6.0 and 8.0 MeV elastic scattering angular distributions reported by Holmqvist and Wiedling (3) and by Kinney and Perey (4). The angle-integrated magnitudes, the general shapes and the position of the diffraction minima are

well represented by the calculation. The magnitude of the calculated second maximum near 90 deg. is too large by 20% to 25%. Potentials explicitly selected to describe high-energy elastic scattering gave an improved agreement with experimental elastic angular distributions at energies from 5.0 to 8.0 MeV but were less satisfactory in the context of the broader scope objectives set forth above. The elastic scattering calculations were extended to 14.0 MeV where only a qualitative description of the magnitude and shape of the experimental values of St. Pierre et al. (8) was achieved. The calculated distribution at 14.0 MeV was characterized by a more clearly defined diffraction pattern than observed experimentally. Calculated elastic scattering polarizations were qualitatively consistent with those reported from experiment (28).

The potential of Eq. 1 is very similar to that proposed by Moldauer in that the absorption is centered somewhat outside the mean radius of the real potential. The Moldauer potential gives a good description of $l=0$ strength functions thus it is not surprising that Eq. 1 leads to an $S_0 = 3.06 \times 10^{-4}$, in good agreement with the value $3.0 \pm 1.0 (\times 10^{-4})$ deduced from low-energy resonance measurements (29).

Though other potentials gave a description of certain aspects of the neutron interaction with ^{59}Co (e.g. strength functions, total cross sections, or high-energy elastic cross sections) equal or superior to that obtained with Eq. 1 none were found as suitable in the broad reaction and energy scope of the present objectives.

2. Statistical Model, Excited Structure and Inelastic Scattering

The statistical model and the Hauser-Feshbach formula were employed in the interpretation of the inelastic neutron scattering cross sections (22). The above optical potential was used to determine the total reaction cross sections. The Hauser-Feshbach formula was not corrected for

fluctuation effects (30) since it was felt that other uncertainties often masked such effects (primarily uncertainties in level structure). As a consequence, the calculated results may have tended to overestimate the magnitudes of the processes, particularly near the reaction thresholds. The excited structure of cobalt is summarized in Ref. 1. This information was derived from the study of a number of reaction processes which tended to select low l -value processes and thus may not give a comprehensive view of the actual structure. In any event, above ~ 2.0 MeV knowledge of cobalt excited structure is largely confined to energetics and becomes increasingly uncertain with correspondingly questionable calculational results. Therefore, the present calculations were judged unreliable above ~ 3.0 MeV and were terminated at 4.0 MeV.

Cobalt has one proton hole in the $f_{7/2}$ shell; thus it is attractive to model its structure with a single nucleon hole strongly coupled to a spherical core in the manner of Mottelson and Nilsson (31) and as applied in the lighter mass region; for example by Litherland et al. (32). There are a number of indications that such a simple model is appropriate. The quadrupole moment (e.g. the deformation) rapidly increases as proton holes are introduced into the closed $f_{7/2}$ shell (33). Assuming a prolate deformation with eccentricities of > 0.15 , a sequence of negative parity states associated with $f_{7/2}$ ($7/2-[303]$), $f_{5/2}$ ($1/2-[310]$) and $p_{3/2}$ ($1/2-[312]$) single-particle states and corresponding rotational bands is predicted and is consistent with the observed preponderance of low-lying negative parity states in cobalt (31, 34). Positive parity states should occur at higher excitation energies commencing with a band based upon the $g_{1/2}$ ($1/2 + [440]$) particle state. This is consistent with the first observed positive parity ($1/2+$) state at 2.72 MeV. The excitation energies of the states in the above model are simply given by

$$E(J) = A[J(J+1) + a(-1)^{J+\frac{1}{2}}(J+\frac{1}{2})] + B[J(J+1) + a(-1)^{J+\frac{1}{2}}(J+\frac{1}{2})]^2 \quad (2)$$

where A is the band constant, "a" the decoupling parameter ($\neq$ zero in the $K=\frac{1}{2}$ band) and B is the vibrational-rotational interaction parameter (31). In the present application we assume the latter is negligible. Correlating results calculated from Eq. 2 with the measured values leads to the band structure and parameters given in Fig. 6. The calculated energies and J^π values are in agreement with the reported measured values to excitations of ~ 2.0 MeV. The A parameter is defined as $\hbar^2/2I$ (I=moment of inertia) and the A calculated from an estimated I value is qualitatively similar to that deduced from Eq. 2. and given in Fig. 6. This model particularly suggests that the J^π value of the 1.19 MeV state is $9/2^-$ in accord with one of the alternate choices deduced from previous work. Both the model and the comparable experimental values become increasingly unreliable and/or deficient as the excitation energies increase above ~ 2.0 MeV. Attempts to relate reported gamma-ray transitions with the model were not rewarding as the experimental evidence is neither comprehensive nor entirely consistent (1).

The inelastic neutron scattering cross sections were calculated using a "selected" level sequence consistent with the above model and with an "alternate" sequence assembled from the optional parameters reported in the literature (1). Above excitation energies of ~ 2.0 MeV the two sequences were essentially identical and taken from Ref. 1 with additional and speculative J^π assignments where necessary. Both of these calculational sequences are given in Table 1. The calculated results are compared with the measured values in Fig. 4 and summarized as follows.

Both calculations gave essentially identical results for the excitation of the 1.099 MeV ($3/2^-$) state and both were in reasonable agreement with experiment considering the uncertainties of the measured values.

The excitation of the 1.19 MeV state calculated with the "selected" sequence ($J^\pi = 9/2^-$) was larger than the measured values and that calculated with the "alternate" sequence ($J^\pi = 5/2^-$) appreciably smaller. Fluctuation corrections tend to reduce both calculated results thus the "selected" sequence is to be preferred. This choice was more evident from comparison of calculated results with the composite measured values of 1.099 + 1.190 MeV states and 1.099 + 1.190 + 1.291 MeV states. Contributions from the 1.291 MeV state were small and consistent with both calculations and the composite values were better known due to reduced demands on experimental resolution.

The excitation of the 1.434 MeV state was observed but the cross section magnitudes were uncertain. The excitations of 1.460 and 1.481 MeV states were not individually resolved. Therefore, measured cross section magnitudes were only reliable in the context of the triplet of states (1.434, 1.460 and 1.481 MeV) and comparison with calculations was made on that basis. The two calculated results and the experimental values differ by very small amounts. Values of J^π for the 1.460 state $> 9/2^-$ and/or $< 5/2^-$ for the 1.481 state gave less acceptable results. Both calculations and the measured excitations of the 1.744 MeV were essentially identical.

The 2.061 and 2.098 MeV states were experimentally resolved at only one incident energy (2.9 MeV). The respective cross section ratio was $\sim 1:3$ in reasonable agreement with either calculation. The observed composite excitation of both states is best described by calculations based upon the "selected" sequence but the choice is marginal and does not clearly distinguish between alternate $5/2$ and $7/2$ spin options for the 2.061 MeV state.

Either calculation was consistent with the observed excitation of the 2.15 MeV (attributed to reported states at 2.15, 2.163 and 2.206 MeV) and of the 2.397 MeV states. A relatively large experimental uncertainty is associated with the excitation of the 2.5 MeV "state" and the contributing

structure is not well known. Therefore, comparisons of measured and calculated excitations are not particularly meaningful in this area.

Generally, the inelastic neutron scattering cross section calculations based upon the "selected" sequence of Table 1 and the above simple ellipsoidal structure model were descriptive of the observed values. The "alternate" sequence was less suitable for some excitations. In particular, comparison of calculation and experiment indicate that the J^π value of the 1.190 MeV state is $9/2^-$ rather than a previously reported alternative of $5/2^-$. Furthermore, the results tend to indicate J^π values for the 1.460 MeV state of $7/2^-$ or $9/2^-$ and for the 1.481 state of $5/2^-$ or $7/2^-$ thereby limiting previously suggested alternatives.

V. EVALUATION

1. Procedures, Practices and Scope

The objective was a contemporary and comprehensive evaluation of fast neutron processes in cobalt over the energy range 0.1 to 20.0 MeV and suitable for neutronic calculations in a wide range of applications. The ENDF/B, MAT-1118 (35) evaluated file was explicitly used to extend the present work from 0.1 MeV to essentially thermal energies. The present complete evaluated data file is given in the ENDF format in the Appendix.

The present evaluation considers the neutron-induced processes listed in Table 2. The respective Q-values were obtained directly from experimental measurements or from the mass tables of Wapstra and Gove (36) as judged most suitable. Primary emphasis was given to experimental cross section values. Theoretical calculations were used to verify the physical validity of and to extrapolate and interpolate the measured values. The selection and weighting of the experimental values were subjectively based upon a number of criteria pertinent to the particular

contexts (see subsequent discussion). Gamma-ray production cross sections were not included in this evaluation as experimental knowledge of the process in cobalt is fragmentary and theoretical estimates require a knowledge of the properties of highly excited states. The latter information is uncertain and as a consequence theoretical estimates of the gamma-ray production cross sections would not be in the quantitative spirit of the present evaluation endeavor.

Subsequent portions of this section deal with the specific evaluation of the processes listed in Table 2.

2. $\sigma_t(n)$, Total Neutron Cross Section

The present evaluation gives emphasis to both magnitude accuracy and structure resolution. With these criteria, the most suitable measured total cross sections in the range 0.1 to 0.12 MeV were judged to be those of Bilpuch et al. (13) and they were directly employed in this evaluation. Similarly, the results of Rainwater et al. (14) were utilized in the range 0.12 to 0.216 MeV. These two data sets provide the best resolution to $\sim$ 0.2 MeV and they are relatively consistent in the region of overlap.

From 0.36 to 20.0 MeV the present evaluation is based upon the measurements of Cierjacks et al. (15). The energy resolution of this data is generally unsurpassed and a careful comparison with the results of the present work (see Fig. 1) and with a number of lesser resolution values found in the literature (37-45) indicated that the energy-averaged cross section magnitudes of the Cierjacks et al. results were excellent. In the energy range of interest the Cierjacks et al. results consist of more than 6000 data points. This profusion of information cannot be easily handled in a practical evaluation and is more than necessary to define the observed structure. Therefore, the volume of these results was truncated by about a factor of five. The truncation was carried out by graphically

selecting experimental points in such a way as to provide a linearly-interpolated cross section essentially identical to that reported by the original authors. An alternate attempt to use spline fitting was judged to give no better results and was tedious and, therefore, was abandoned. The point selection was employed from the lowest energies of the set to 3.0 MeV. Above 3.0 MeV the experimental values fluctuate by small amounts, often within experimental uncertainty. Therefore above 3.0 MeV the experimental values were averaged over increasingly coarse energy increments to obtain the evaluated result. These "smoothed" values retained a good consistency with the basic data.

The interval ~ 0.21 to ~ 0.36 MeV was a problem as, apparently, no high resolution measurements have been made in this fluctuating region. At both higher and lower energies structure is grossly evident (14, 15). In the absence of suitable experimental information the theoretical statistical R-matrix method of Moldauer (46) was used to interpolate between 0.21 and 0.36 MeV. The calculations utilized the optical potential of Section IV to determine the average resonance properties. The latter, combined with the known statistics of resonance widths and spacings (47, 48), were applied in a random manner in an R-matrix calculation of the cross section. The "resolution" of the calculated cross section (0.1 keV) was a great deal better than obtainable experimentally at these energies. The calculated result was compared with the measured values of Cierjacks et al. as illustrated by the 0.50 to 0.55 MeV energy interval of Fig. 7. When the calculated result was averaged over an ~ 0.8 keV "resolution" function (similar to that of the experiment) it was remarkably statistically-similar to the measured results. This is visually evident in Fig. 7 and was verified by auto-correlation analysis. After the good comparison of measured and calculated results in the experimentally known region, the

calculational method was applied to the interpolation over the unknown region 0.216 to 0.360 MeV. Smoothly joined, the calculated and measured values blended very well.

In some special-application contexts, such as deep neutron penetration in bulk media, Fig. 7 has special interest. Though the 0.8 keV average of calculated values is very similar to the measured result, the "infinite" resolution cross section deduced by calculation is characterized by far deeper minima and larger maxima than shown by the best experiments. The calculated result should be more truly statistically representative of the resonance structure. An apparent consequence is far more transparent "windows" than indicated by experiment, or this evaluation. Applications sensitive to "window" and similar resonance effects should use measured and this evaluated data with caution. An "infinite" resolution evaluation is not realistic as neither measurements nor theory are sufficiently defined over the wide energy range needed for many applications.

The complete evaluated total cross section is illustrated in Fig. 8 together with the corresponding energy-averaged content of ENDF, MAT-1118. At energies of less than 0.2 MeV the two evaluations are essentially identical (by definition so below 0.1 MeV). Above 0.2 MeV, the latter shows none of the structure of the present evaluation. In addition the energy-averaged values of the two evaluations are discrepant in some energy ranges; notably near 1.0 MeV where the differences are 15% and more. From Fig. 8, it is difficult to distinguish the interpolated region theoretically deduced in the manner described above.

3. $\sigma(n;n)$, Elastic Neutron Scattering

Apparently the only comprehensive experimental data on neutron scattering at energies of < 0.3 MeV, are the total scattering cross sec-

tions reported by Langsdorf et al. (49). Therefore, in this low-energy region the evaluation relies on the model of Section IV, above, and total scattering results of Ref. 49 to obtain the relative energy-averaged elastic scattering cross sections. These evaluated results will not reproduce detailed resonance fluctuations. The comprehensive experimental results of Smith et al. (2) are available in the energy range 0.3 to 1.5 MeV. They are in good agreement with other reported experimental values (e.g. those of Cox (50) and Walt et al. (51) and the experimental resolution of ~ 20 keV is sufficient to define intermediate-resonance-structure effects. Therefore, the results of Smith et al. were explicitly employed in the evaluation. At energies of 1.5 to 4.0 MeV the present experimental results (see Section III) provide a comprehensive knowledge of elastic scattering and are consistent with previously reported experimental information. The present results were explicitly employed in this evaluation. The results of Kinney and Perey (4) defined the evaluation at ~ 5.0 MeV with extrapolation in angle using the model of Section IV as necessary. Kinney and Perey (4) and Holmqvist and Wiedling (3) have reported a number of measured elastic scattering results over the energy range ~ 6.0 to 8.0 MeV. Some of these distributions are shown in Fig. 3. The Kinney and Perey results emphasize forward angles. Those of Holmqvist and Wiedling extend over a wider angular range but are less definitive at forward angles. Generally, the two sets of results are in reasonable agreement (see Fig. 3) but the Kinney and Perey values tend to be a little larger at forward angles (as also noted in Ref. 4). This is a significant discrepancy since the angle-integrated cross sections are sensitive to the forward-angle values as are the legendre polynomial fits to the measured data. With no clear choice between the two sets of data and with rather unsatisfactory results from the averages of the two sets of values this evaluation em-

ployed, as an alternative, the model calculations described in Section IV and illustrated in Fig. 3. These calculational results have their shortcomings, as discussed in Section IV, but they tend to be in regions of low "importance". The calculated values, which are a good compromise between measured results at forward angles, reasonably extrapolate the measured values to large scattering angles and are physically licit; e.g. satisfy "Wicks Limit" (20). The model results were also used to extend the evaluation from 8.0 to 20.0 MeV. Within this region apparently only a single experimental measurement has been reported; the ~ 14.0 MeV angular distribution measured by St. Pierre et al. (8). The angle-integrated elastic scattering cross section given by the model was 1.47b, about 12% larger than the value deduced in Ref. 8 from measurements but not appreciably outside the estimated experimental uncertainty. The discrepancy is largely due to forward-angle values which dominate the determination of the angle-integrated quantity. There are only several measured differential values in this important region and they may not be particularly consistent. The calculated 14.0 MeV results show a more pronounced diffraction pattern than experiment but the angle-averaged values in the regions of small cross sections are similar. These various considerations lead to the acceptance of the calculated elastic scattering angular distributions for the high-energy (> 8.0 MeV) portion of the present evaluation.

The angular dependence of the differential elastic distributions was expressed in terms of f_ℓ coefficients defined by

$$\frac{d\sigma}{d\Omega} = \frac{\sigma}{2\pi} \sum_{\ell=0}^n \left[\frac{1}{2\ell+1} f_\ell P_\ell \right] \quad (3)$$

where P_ℓ are legendre polynomials and σ values were obtained from a least-square fit of Eq. 3 to the above measurements or, alternatively, from the

model calculations. In some instances calculated 180 degree values were added to the experimental results to assure a good behavior as described in Section IV. In regions of strong fluctuations and reasonably known inelastic scattering cross sections (i.e. $\lesssim 3.0$ MeV) the angle-integrated elastic cross sections were treated as free parameters adjusted so as to assure consistency between the evaluated total and partial cross sections. As a consequence, the evaluated elastic scattering cross sections reflected the structure of the high-resolution total cross sections. This is not necessarily a sound approach when non-elastic channels are open at higher energies. However, there was little pragmatic alternative as the structure was predominantly at low energies and was well beyond the resolution of the direct elastic scattering measurements. However, the energy-average of the evaluated elastic cross sections was reasonably consistent with experimental values obtained with lesser resolutions. In the "smooth" total cross section region ($E > 3.0$ MeV) the evaluated total and elastic scattering cross sections were used to deduce the non-elastic cross sections. The latter consisted of a number of reaction cross sections most of which made small contributions. A major contribution was the continuum inelastic scattering cross section. The latter was deduced from the non-elastic cross section by subtracting the other partial cross section contributions (see subsequent discussion). This procedure was judged reasonably reliable as the remaining partial cross sections were small, with the exception of the $(n;2n)$ cross section, and the latter is well known.

The evaluated differential elastic scattering cross sections are summarized in Fig. 9. The numerical values including cross sections, f_ℓ values, ν_ℓ , ξ and γ are given in the file of the Appendix. The present evaluated results are compared with those of ENDF/B, MAT-1118 in Fig. 10.

They differ in structure and in magnitude from those given in MAT-1118, over a wide energy range.

4. $\sigma(n;n')$, Inelastic Neutron Scattering Cross Sections

a. Discrete Excitation Cross Sections

The evaluated discrete excitation cross sections were largely based upon the results of direct neutron measurements. Theoretical calculations offered some guidance. Results of $(n;n'\gamma)$ measurements generally were not utilized as they are either ambiguous or somewhat inconsistent. Some of the observed cross sections were believed to consist of several unresolved components. In these cases theory was not used to give further definition as it was felt that such detail would be speculative, of little merit in most neutronic applications and not consistent with the objective of conciseness. The inelastic neutron processes considered in this evaluation are summarized in Table 2. The respective thresholds are taken from precise values found in the literature (1) or from the present measurements as appropriate. The Q-values are directly associated with those of Table 1 (e.g. the evaluation combines 1.434, 1.460 and 1.481 MeV states and 2.061 and 2.098 MeV states). Below 4.0 MeV the evaluation relies primarily upon the present work with the additional values of Smith et al. (2) at low energies and the $\sim$ 2.5 MeV results of Cranberg and Levin (9). Above 4.0 MeV the evaluation relies primarily upon the results of Kinney and Perey (4). The highest energy-threshold considered was 2.5 MeV and the upper energy limit of the discrete evaluation was 8.0 MeV. The spectra were assumed isotropic. This was a valid assumption at incident energies of less than 4.0 MeV as the measurements of the present work (Section III) showed only small deviation from isotropy. At higher energies (6.0 to 8.0 MeV) the work of Kinney and Perey (4) indicates that anisotropy can be appreciable. However, at these

energies the discrete cross section contributions are small therefore the effect of the uncertain assumption of isotropy should not be large in most applications. In special cases, at higher energies and where the angular distribution of the emitted neutron can be important this evaluation should be used with caution.

The evaluated results were subjectively deduced from the measured values considering experimental accuracies, consistency and theoretical guidance. They are summarized in Fig. 11 and compared with the experimental foundation in Fig. 4. The evaluation is, obviously, representative of the results obtained in direct neutron measurements. The discrete portion of the present evaluation is compared with that of ENDF, MAT-1118 in Fig. 12. For these comparisons the ENDF values were combined in such a way as to correspond to the energy definition of the present work. MAT-1118 is essentially a calculated result with excited state energetics very similar to those given in Table 1. In some areas the magnitudes of the two evaluations differ by a factor of two or more (notably in the excitation of the first few states). At higher energies MAT-1118 does not show the definition of the present results.

b. Continuum Inelastic Scattering Cross Sections

The magnitudes of the continuum inelastic cross sections were treated as essentially free parameters adjusted to assure consistency between partial reaction cross sections ($Q \neq 0.0$) and the non-elastic cross sections. The latter follow directly from the total and elastic cross sections as described above. The resulting evaluated continuum inelastic cross sections are shown in Figs. 11 and 13. The total inelastic cross section of the present evaluation is compared with values from ENDF, MAT-1118 in Fig. 10. The two evaluations differ by appreciable amounts. The effect of the onset of the large $(n,2n)$ cross section

at ~ 10.5 MeV is clearly evident in Fig. 13. In addition the present evaluated results increase slightly as 20.0 MeV is approached. This may be an artifact of the derivation but it is consistent with slowly increasing contributions from $(n;n',p)$ and $(n;n',\alpha)$ processes.

The continuum emission spectra were approximated with an evaporation distribution (52) given by

$$N \nu E \exp (-E/T) \quad (4)$$

where the "temperature" $T = \sqrt{\frac{E}{a}}$ and "a" is a level density parameter. This description is not particularly suitable in the present context as the measurements of Kinney and Perey (4) indicate appreciable structure in the evaporation spectrum even at incident energies above 8.0 MeV. This structure is due to residual and partly resolved excitations of discrete states and also, possibly, to persistent "clumping" of excited states in cobalt even at relatively high energies. The latter effect might be expected from single-particle and collective modes. In any event, the statistical assumptions underlying Eq. 4 are not strictly applicable to experimental interpretation in this instance. This should be recognized when the present evaluation is utilized in applications which may be sensitive to structure in the continuum emission spectrum.

The temperatures of Eq. 4 were deduced from the results of Tsukada et al. (53) and of Kinney and Perey (4). The latter authors have tabulated their results as detailed spectral distributions at incident energies of ~ 4.0 to 8.0 MeV. These were least-square fitted with Eq. 4 to obtain the respective temperatures using two procedures: 1) fitting all data reported by Kinney and Perey, and 2) fitting this data truncated to exclude high neutron energies where structure was most prominent. The temperatures resulting from the first of these fitting procedures are compared with the temperatures reported by Tsukada et al. in Fig. 14.

An additional 14.0 MeV value reported by Arnold and Bunyard (54) is included in the figure. The latter appears anomalous and was not used in the present evaluation. The results of Tsukada et al. and of Kinney and Perey have an appreciable common energy range in which the temperatures deduced from the two sets of measurements are similar. However, the energy dependence of the temperatures of the two sets of measurements is different ($a \approx 5.6 \text{ MeV}^{-1}$ of Ref. 4 and $a \approx 7.0 \text{ MeV}^{-1}$ of Ref. 53). In view of the evident structure and marginal validity of Eq. 4 in the present context, it was difficult to logically choose between the two sets of data. The discrepancy was not improved by using the more limited energy-scope of the second fitting procedure outlined above. Therefore, the level parameters "a" derived from the individual energy values of both sets of data were simply averaged (equal weighting) to obtain the $a = 6.4 \text{ MeV}^{-1}$ used in the present evaluation. The resulting energy dependent temperature is a reasonable compromise between the two sets of measurements as shown in Fig. 14. The present temperatures are slightly larger than those of ENDF, MAT-1118 which tend to be descriptive of the values given in Ref. 53.

The present evaluation assumes that the continuum emission spectrum is isotropic. It is recognized that at higher energies this is a crude assumption as direct processes certainly are contributing factors and will lead to anisotropy. Indeed, anisotropies of $\approx 25\%$ (increase of 30 deg. cross section above 90 deg. values) have been observed by Prud'Homme et al. (55). The assumption of isotropy employed in the present evaluation should not be a matter of concern in most neutronic applications.

5. $\sigma(n;\gamma)$, The $(n;\gamma)$ Reaction

The cross sections for this process have been measured by activation and by prompt gamma-ray detection techniques. There is a metastable state

in the residual ^{60}Co nucleus but the isomer ratio has been determined at a number of incident energies by Paulsen (56) and thus the total (n,γ) cross section can be reasonably deduced using activation techniques. Johnsrud et al. (57) have determined the isomer activation cross section at a number of energies up to ~ 2.0 MeV. Their results have been corrected to obtain the total (n,γ) cross section using the isomer ratios of Paulsen. Paulsen has measured the (n,γ) cross sections at approximately 2.0, 6.0 and 14 MeV. The Johnsrud et al. and Paulsen measurements are in agreement in the region of overlap near 2.0 MeV. Rigaud et al. (58) determined a 14.8 MeV cross section from observation of prompt gamma-ray emission. Their value is only about half that of Paulsen but both are small ($< 2.5\text{mb}$).

The available experimental information is sparse but it does provide reasonable guidance for the present evaluation illustrated in Fig. 15. The evaluation follows the small structure near 0.5 MeV reported in Ref. 57. The interpolation from measurements at 6.0 to those at 14.0 MeV is essentially linear with little slope. The available experimental information seems to preclude any appreciable giant resonance behavior between 2.0 and 14.0 MeV. Above 14 MeV the evaluation slowly increases. Such a behavior is qualitatively consistent with a small contribution from direct capture. The evaluation compromises between measured results near 14.0 MeV. The evaluation has some uncertainties but the cross sections are generally small and as a consequence creditable errors will not seriously influence most applications.

The present (n,γ) evaluation is grossly different from that of ENDF, MAT-1118 as illustrated in Fig. 15. No experimental evidence justifying the ENDF result over much of the energy range could be found. Whether or not the ENDF result is suitable at energies below 0.1 MeV is not certain

and that energy region is beyond the energy-scope of the present evaluation.

6. $\sigma(n;2n)$, The $(n;2n)$ Reaction

The product nucleus, ^{58}Co , has an isomeric state which, fortunately, decays primarily by internal conversion. Thus, with reasonable care, activation methods have been used to give good results.

The available experimental information was divided into three sets. The first of these was judged most reliable by experimental error, detail and consistency, both internally and with other selected sets. In this first group were the results of Cabe et al. (59), Granger and Longneve (60), Bormann et al. (omitting the lowest energy points) (61), Wenusch et al. (62), Bormann et al. (63), Wenusch and Vonach (64), Paulsen and Liskien (65) and Goodwin and Carter (66). The second set of data was given less consideration in the evaluation and consisted of the results of Decowski et al. (67), Weigold et al. (68) and Jeronymo et al. (69). The third set of data, consisting of the results of Refs. 70 to 73, was not accepted for this evaluation due to large discrepancies with the body of available information and/or large uncertainties. In some instances the values of the third set were not reasonably consistent with systematics (74) and/or were obviously much too small. The experimental information of all three sets is summarized in Fig. 16.

Giving most weight to the first data group (above) and, particularly, that of Ref. 65 (as it is detailed and of high precision) a curve was constructed through the measured values. This curve is representative of experimental values as shown in Fig. 16 and was used in the present evaluation. The choice of this curve was subjective. However, more logical approaches may be deceptive in this instance as some data, reported with the highest precision, is obviously in error. Furthermore, some merit

should be given to demonstrated reliability of particular laboratories and/or methods. These are subjective judgements.

Apparently the energies of the emitted neutrons have not been measured. Therefore, we assume an evaporation distribution with a temperature somewhat "softer" than that of the $(n;n')$ process. The present evaluation and that of ENDF, MAT-1118 are compared in Fig. 16. There is not a great deal of difference though the present evaluation clearly is more descriptive of measurements at lower energies.

7. $\sigma(n;3n')$, The $(n;3n')$ Reaction

The threshold for the reaction is 19.35 MeV and empirical estimates by Pearlstein (75) indicate cross section values equivalent to or smaller than those of the $(n,2n)$ process over much of the energy range of interest. In view of the small cross section and high threshold the process was not included in the present evaluation.

8. $\sigma(n;p)$, The $(n;p)$ Reaction

The product nucleus ^{59}Fe decays by β^- emission to ^{59}Co with a 45 day half life. The subsequent and dominant gamma-rays have energies of ~ 1.1 and 1.29 MeV and no isomeric states are involved. Thus the (n,p) process can be reasonably studied using activation techniques. In view of these simple processes it is odd that there is such a paucity of experimental data.

The available experimental information is summarized in Fig. 17. Results of Allan (75), Storey et al. (77), Preiss and Fink (73) and Weigold (68) near 14.0 MeV are consistent. The result of H. Vonach and J. Munro (78) is somewhat lower. The emulsion results of Allan (79) and the direct particle detection results of Hassler and Peck (80) at 14.0 MeV are much lower than other values in this energy range. The direct particle detection technique probably is more uncertain than the activa-

tion method. Therefore, the values of Refs. 79 and 80 were not used for cross section determination. Near threshold only the recent measurements of Smith and Meadows (81) define the cross section. The results of Jeronimo et al. (69) extending from 13 to 20 MeV appear systematically in error by a factor of $\sim$ 8. In Fig. 17 they are renormalized to the 14 MeV values. There apparently is no experimental information in the range 6 to 13 MeV. Theoretical interpolation over this interval is of dubious merit as the results are dependent on unknown properties of highly excited states. However, some guidance can be obtained from an inspection of the (n,p) cross sections in similar nuclei, particularly $^{65}\text{Cu}(n,p)^{65}\text{Ni}$ and $^{60}\text{Ni}(n,p)^{60}\text{Co}$ (82,83). The thresholds are similar to that of $^{59}\text{Co}(n,p)$ and, when normalized to the 14 MeV $^{59}\text{Co}(n,p)$ values, the ^{65}Cu and ^{60}Ni cross sections are fairly consistent and reasonably extrapolate to the measured low-energy cobalt values. However, these normalized curves become increasingly higher than the results of Ref. 69 as the energy increases to 20 MeV. The magnitude of the results of Ref. 69 appear clearly in error and thus the relative energy dependence can be suspect. They are not accepted for this evaluation.

Following the above procedure a smooth curve was constructed through the measured $^{59}\text{Co}(n,p)$ values interpolated and extrapolated using the normalized $^{65}\text{Cu}(n,p)$ and $^{60}\text{Ni}(n,p)$ cross sections. This curve, shown in Fig. 17, was used for the present evaluation and is consistent with known systematics (84). For comparison, Fig. 17 also shows the ENDF, MAT-1118 $^{59}\text{Co}(n,p)$ cross sections. The ENDF evaluation differs appreciably from the present result, particularly in the region above $\sim$ 15 MeV where the ENDF result appears influenced by the uncertain values of Ref. 69.

The proton emission spectrum has been observed and is reasonably described as an evaporation distribution. Hassler and Peck (80) report a

proton "temperature" of 1.25 MeV including $(n;n'p)$ contributions.

Mohendra and Hans (85) report a temperature of 1.5 MeV. The results of Colli et al. (86) are consistent with both values. We assume a temperature of 1.25 MeV as a qualitative estimate of the emitted proton energy. It is further assumed that the proton emission is isotropic, certainly a simple approximation at higher energies. However, these proton emission properties apparently are not consistent with the present ENDF formats and thus were omitted from the numerical file.

9. $\sigma(n;n'p)$, The $(n;n'p)$ Reaction

This process has a higher energy threshold and its cross sections should be smaller than those of the (n,p) reaction. The latter assumption is supported by the ~ 11 mb cross section at 14.0 MeV measured by Hassler and Peck (80). Such a cross section, while small, is not negligible. However, because of the absence of quantitative experimental values, it was not explicitly included in the present evaluation. From the neutron point of view the emitted neutron will appear as a contribution to the continuum inelastic scattering cross sections. The omission of the recoil proton is not serious in view of the uncertainty in the (n,p) cross sections which will mask the small proton contribution from the $(n;n'p)$ reaction.

10. $\sigma(n;\alpha)$, The $(n;\alpha)$ Reaction

This reaction is easily studied using activation techniques. ^{56}Mn has no isomeric states and the half life is a convenient 2.58 hrs. The β^- decay to ^{56}Fe is well known with a subsequent prominent 0.846 MeV gamma-ray. There have been a number of measurements employing activation techniques. The results of Santry and Butler (87), Lauber and Malmsky (88), Preiss and Fink (73), Weigold et al. (68), Bormann et al. (excepting lowest energy values) (89), Jeronymo et al. (69), and Liskien and

Paulsen (90), are all in good agreement. The other reported results of Refs. 91 to 94 vary by $\sim 10\%$ to 20% or less from the main body of experimental information. Generally, this experimental information reasonably defines the (n,α) cross section to 20 MeV as illustrated in Fig. 18.

Breseti et al. (95) have evaluated the above experimental information. Simons and McElroy (96) extended the Breseti evaluation to lower energies using the results of macroscopic experiments to obtain cross sections as low as 4×10^{-4} mb at ~ 5.0 MeV. Such use of macroscopic results can be ambiguous but no comparable microscopic data is available in this low threshold region. The Breseti evaluation, as extended by Simons and McElroy, was judged in good agreement with experimental evidence as illustrated in Fig. 18. Therefore, it was accepted for this evaluation with a simple extrapolation from 17 to 20 MeV. The result differs only very slightly from the evaluation of ENDF, MAT-1118 as shown in Fig. 18. The present evaluation is in good agreement with systematic knowledge of (n,α) cross sections (97).

There is little experimental information dealing with the emitted alpha particles. We accept the nuclear temperature of 0.9 MeV reported by Patzak and Vonach (98) and assume isotropic emission. Both assumptions are only qualitatively accurate as there is some evidence for discrete alpha spectra and non-isotropic emission. In any event, the current ENDF format apparently is not inclusive of alpha-emission characteristics.

11. $\sigma(n;n',\alpha)$, The $(n;n',\alpha)$ Reaction

There have apparently been no experimental measurements of this reaction cross section. It should generally be smaller than the $(n;n',p)$ cross section and thus was not explicitly included in the present evaluation. The emitted neutron will appear as a contribution to the continuum

inelastic scattering cross sections.

12. $\sigma(n;d)$, The $(n;d)$ Reaction

Colli et al. (99) studied the $(n;d)$ process using particle detection and reported a cross section of 1.8 ± 0.6 mb at ~ 14.0 MeV. It is unlikely that the cross section is appreciably larger than this small value within the energy range of the present evaluation. Therefore, this evaluation assumes that the cross section rises from threshold to a value of 2 mb at 15 MeV and then remains constant to 20.0 MeV. This is a very qualitative estimate but these cross sections are of minor importance in most applications.

13. $\sigma(n;t)$, The $(n;t)$ Reaction

Khurana and Govil (94) have measured the cross section for this reaction at 14.8 MeV with a result of 2.1 ± 0.2 mb. Measurements at essentially the same energy by Poularikas and Gardener (100) give a result several orders of magnitude smaller. For the present evaluation a compromise of 1 mb at 15 MeV was assumed. This is a very approximate (and possibly large) estimate. The process is included in the evaluation largely for the sake of completeness and the user should view the respective cross sections with caution.

14. $\sigma(n;^3\text{He})$, The $(n;^3\text{He})$ Reaction

The $(n;^3\text{He})$ cross section has been measured by Kumabe et al. (101) to be in the range 1-3 mb at approximately 15.0 MeV. Later essentially the same group reported a value of less than 0.1 mb attributing the larger result of the previous measurement to sample impurities (102). Thus the cross sections for this process appear very small and therefore were not included in the present evaluation.

15. $\sigma(n;2p)$, The $(n;2p)$ Reaction

This process has apparently not been observed. The threshold is

high and the cross section magnitudes should be appreciably smaller than those of the (n;p) process and the latter are not large. In view of the threshold energy and the probable small cross sections this process was excluded from the present evaluation.

Throughout the above evaluation procedures considerable attention was given to conciseness. As a consequence the quantity of information has increased by only $\sim 10\%$ beyond that of ENDF, MAT-1118 while including a wealth of new detail.

VI. CONCLUSIONS

The present measurements of elastic scattering from cobalt, together with those previously reported from this laboratory (2), provide a good experimental understanding of the process from 0.3 to 4.0 MeV. The inelastic neutron scattering measurements lead to a much improved definition of this process to incident energies of 4.0 MeV. Total cross section measurements verify the cross section magnitudes of previously reported measurements and assure the internal consistency of the present elastic and inelastic neutron scattering studies. An optical-statistical model is deduced from the experimental foundation. It provides for a quantitative interpretation of the measured values and particularly suggests that the spin and parity of the 1.190 MeV state is $9/2^-$ and that those of the 1.460 and 1.481 states are $7/2^-$ or $9/2^-$ and $5/2^-$ or $7/2$, respectively. These suggested assignments tend to remove previous ambiguities in the understanding of the low lying excited structure of cobalt and are consistent with a nuclear-structure model based upon single-particle and collective concepts. The experimental and calculational results, together with previously available information, are utilized to provide a comprehensive evaluated nuclear data file in the ENDF format covering the energy range

0.1 to 20.0 MeV. Extension to essentially thermal energy is carried out by explicit inclusion of the ENDF, MAT-1118 evaluated file for energies of less than 0.1 MeV. The complete composite file is presented in numerical form.

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TABLE 1. Energies, spins and parities of states of ⁵⁹Co.

No.	E _x (MeV) ^a	Select J ^π	Alternate J ^π	Exp. E _x (MeV) ^b
1	0	7/2-	---- ^e	----
2	1.099	3/2-	----	1.10 ± 0.01
3	1.190	9/2-	5/2-	1.20 ± 0.01
4	1.291	3/2-	----	1.30 ± 0.01
5	1.434	1/2-	----	(1.43 ± 0.01) ^c
6	1.460	7/2-	9/2-	} 1.46 ± 0.02
7	1.481	5/2-	----	
8	1.744	7/2-	----	1.72 ± 0.02
9	2.061	(5/2-) ^d	7/2-	2.06 ± 0.02
10	2.087	(9/2-)	----	2.09 ± 0.02
11	2.153	(5/2-)	----	} 2.16 ± 0.03
12	2.183	(7/2-)	----	
13	2.206	(5/2-)	----	
14	2.397	(9/2-)	-	2.35 ± 0.05
15	2.479	(5/2-)	----	} 2.50 ± 0.05
16	2.541	(7/2-)	----	
17	2.585	(5/2-)	----	
18	2.712	(11/2-)	----	----
19	2.720	(1/2+)	----	----

a. Energies from Ref. 1 .

b. Experimental uncertainties pertain to mean excitation energies in MeV and do not necessarily reflect experimental resolution.

c. Corresponding cross sections are uncertain.

d. Bracketed J^π values are estimates based upon values of Ref. 1 and, in the absence of any information, are speculative estimates.

e. Where not otherwise specified "select" and "alternate" sequences are identical.

TABLE 2. Processes, Q-Values and Thresholds Considered in this Evaluation.

<u>NO.</u>	<u>Process</u>	<u>Q-Value(MeV)</u>	<u>Threshold(MeV)</u>
1.	$\sigma(n)$ (Total)	--	--
2.	$\sigma(n;n')$		
a.	Elastic	0.0	--
b.	$(n;n'_1)$	-1.099	1.117
c.	$(n;n'_2)$	-1.190	1.210
d.	$(n;n'_3)$	-1.291	1.313
e.	$(n;n'_4)$	-1.460	1.484
f.	$(n;n'_5)$	-1.744	1.773
g.	$(n;n'_6)$	-2.070	2.105
h.	$(n;n'_7)$	-2.160	2.196
i.	$(n;n'_8)$	-2.350	2.390
j.	$(n;n'_9)$	-2.500	2.542
k.	Continuum	-2.400	2.440
3.	$\sigma(n;\gamma)$	--	--
4.	$\sigma(n;2n')$	-10.461	10.637
5.	$\sigma(n;3n')$	-19.033	19.354
6.	$\sigma(n;p)$	-0.783	0.796
7.	$\sigma(n;n'_p)$	-7.370	7.495
8.	$\sigma(n;\alpha)$	+0.320	--
9.	$\sigma(n;n'_\alpha)$	-6.951	7.068
10.	$\sigma(n;d)$	-5.145	5.232
11.	$\sigma(n;t)$	-8.930	9.081
12.	$\sigma(n;^3\text{He})$	-11.476	11.669
13.	$\sigma(n;2p)$	-12.682	12.896

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FIGURE CAPTIONS

- Fig. 1. Total neutron cross sections of cobalt. The present results are indicated by O. The results of Cierjacks et al. (15) are represented by solid curve. Other illustrated results are: ||||| = Foster and Glasgow (39), Δ = Walt et al. (45) and X = Nereson and Darden (43).
- Fig. 2. Elastic neutron scattering cross sections of cobalt. Results at energies > 1.5 MeV are from the present measurements; those at energies < 1.5 MeV were previously reported from this laboratory (2). Measured values are indicated by datum points and curves illustrate the results of least-square fits of a legendre expansion to the experimental values as described in the text.
- Fig. 3. Comparison of measured differential elastic scattering cross sections (datum points) and results obtained from optical model calculations (curves). CE and SE refer, respectively, to compound-elastic and shape-elastic scattering. The data points are referenced as follows: O ($E > 1.5$ MeV) = present work, O ($E \leq 1.5$) = Ref. 2, $\triangleleft$ = Ref. 3, + = Ref. 103, X = Ref. 5, $\leftarrow$ = Ref. 7, $\triangleright$ = Ref. 6 and X = Ref. 4. Approximate incident energies are given with further definition when a data set differs appreciably from the mean. At lower incident energies distributions within an interval of ~ 0.1 MeV are plotted in an effort to average known energy-dependent fluctuations.
- Fig. 4. Inelastic neutron scattering cross sections of cobalt. Data points indicate measured values referenced as follows: $\square$ ($E > 1.5$ MeV) = This Work, $\square$ ($E \leq 1.5$ MeV) = Ref. 2, X = Ref. 4, + = Ref. 9, O = Ref. 10, Δ = Ref. 11, and $\diamond$ = Ref. 12. Excitation energies are indicated in MeV. The heavy solid curve is an "eye-guide" based upon measured values and is used in this evaluation. The dashed curve indicates the results of calculations based upon the "selected" level structure of Table 1 and the dotted curve those obtained with the "alternate" structure of Table 1 (see text for discussion).
- Fig. 5. Comparison of measured and calculated total neutron cross sections of cobalt. The solid curve indicates high resolution experimental results from Ref. 13 (0.1 - 0.12 MeV), Ref. 14 (0.12 - 0.21 MeV)

and Ref. 15 (0.37 - 20.0 MeV). Lesser resolution individual data points are referenced as follows: $\square$ = Ref. 38, X = Ref. 40, $\diamond$ = Ref. 44, + = Ref. 42, O = Ref. 45, |||| = Ref. 39, and * = Ref. 43. The heavy dashed curve indicates the results of optical model calculations as described in the text.

- Fig. 6. Comparison of the structure model with reported experimental values as defined in Ref. 1. The respective band structure, band constants (A) and decoupling parameters (a) are indicated together with the equation defining the excitation energies (31).
- Fig. 7. Comparison of statistical R-Matrix calculation with experimental measurements. The upper curve was obtained by statistical calculation at 0.1 keV intervals. This result was averaged over a "resolution function" of 0.8 keV to obtain the center curve. The lower curve is the experimental result taken from Ref. 15.
- Fig. 8. Comparison of the present evaluated total cross section of cobalt (light solid line) with that given in ENDF, MAT-1118 (heavy solid curve above 0.2 MeV, dashed curve at lower energies).
- Fig. 9. Elastic scattering angular distributions used in the present evaluation.
- Fig. 10. Comparison of present evaluated elastic scattering, total inelastic scattering and (n;2n) cross sections (light curves) with those given in ENDF, MAT-1118 (heavy curves).
- Fig. 11. Discrete, continuum and total inelastic scattering cross sections employed in the present evaluation.
- Fig. 12. Comparison of the evaluated discrete inelastic cross sections of the present work (A) with those given in ENDF, MAT-1118 (B).
- Fig. 13. Summary of partial reaction cross sections utilized in the present evaluation.
- Fig. 14. Inelastic neutron scattering "temperatures". Data points are referenced as follows: O = Ref. 53, $\diamond$ = Ref. 4, and $\square$ = Ref. 54. The present evaluated result is indicated by the solid curve.
- Fig. 15. Radiative capture cross sections of cobalt. Data points are referenced as follows: O = Ref. 56, X = Ref. 55 and Δ = 57. The present evaluation is indicated by the heavy solid curve, that of ENDF, MAT-1118, by the light curve.
- Fig. 16. Measured and evaluated (n;2n) cross sections of cobalt. Solid curve indicates the present evaluation, the dashed curve that of

ENDF, MAT-1118. Data points are referenced as follows: 0 = Ref. 59, Δ = Ref. 60, + = Ref. 61, $\times$ = Ref. 62, Σ = Ref. 63, $\downarrow$ = Ref. 64, ∇ = Ref. 65, $\%$ = Ref. 66, $\diamond$ = Ref. 67, $\uparrow$ = Ref. 68, $\square$ = Ref. 69, $\times$ = Ref. 70, γ = Ref. 71, $*$ = Ref. 72, and $\star$ = Ref. 73.

Fig.17. Measured and evaluated (n;p) cross sections of cobalt. Solid curve indicates the present evaluation, dashed curve that of ENDF, MAT-1118. Data points are referenced as follows: 0 = Ref. 80, Δ = Ref. 75, $\times$ = Ref. 77, $\diamond$ = Ref. 73, $\uparrow$ = Ref. 69, $\times$ = Ref. 81, Σ = Ref. 78, γ = Ref. 86, and $\square$ = Ref. 79.

Fig.18. Measured and evaluated (n; α) cross sections of cobalt. The present (solid curve) and ENDF, MAT-1118 (dashed curve) evaluations are indicated. Data points are referenced as follows: 0 = Ref. 87, Δ = Ref. 88, $\diamond$ = Ref. 73, $\uparrow$ = Ref. 68, γ = Ref. 89, $\square$ = Ref. 69, $*$ = Ref. 65, + = Ref. 91, $\times$ = Ref. 92 $\times$ = Ref. 93, Σ = Ref. 94, and Σ = Ref. 90.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

$$E(J) = A[J(J+1) + \alpha(-1)^{J+1/2}(J+1/2)]$$

Fig. 7

Fig. 8

Fig. 9

Fig. 10

Fig. 11

Fig. 12

Fig. 13

Fig. 14.

Fig. 15

Fig. 16

Fig. 17

Fig. 18

"APPENDIX, EVALUATED DATA FILE IN ENDF/B FORMAT"

2.70590+ 4 5.84269+ 1	1	0	0	429999	1451	1
0.00000+ 0 0.00000+ 0	1	0	07	099999	1451	2
***** C-59 *****				999999	1451	3
EVALUATION BY A.S. AND D.L. SMITH---AHL---JUNE 1973.				999999	1451	4
ABOVE 100 KEV ENTIRELY NEW DATA				999999	1451	5
DOCUMENTATION TO BE PROVIDED				999999	1451	6
BELOW 100 KEV DATA IS EXPLICITLY TAKEN FROM THE EVALUATION				999999	1451	7
OF T. STEPHENSON AND A. PRINCE AS GIVEN IN MAT-1118				999999	1451	8
*****				999999	1451	9
1	451	51		999999	1451	10
1	453	11		999999	1451	11
2	151	48		999999	1451	12
3	1	749		999999	1451	13
3	2	747		999999	1451	14
3	4	23		999999	1451	15
3	16	8		999999	1451	16
3	51	8		999999	1451	17
3	52	8		999999	1451	18
3	53	8		999999	1451	19
3	54	8		999999	1451	20
3	55	7		999999	1451	21
3	56	7		999999	1451	22
3	57	7		999999	1451	23
3	58	7		999999	1451	24
3	59	7		999999	1451	25
3	91	16		999999	1451	26
3	182	150		999999	1451	27
3	183	9		999999	1451	28
3	184	5		999999	1451	29
3	185	5		999999	1451	30
3	187	23		999999	1451	31
3	251	23		999999	1451	32
3	252	23		999999	1451	33
3	253	23		999999	1451	34
4	2	193		999999	1451	35
4	16	10		999999	1451	36
4	51	10		999999	1451	37
4	52	10		999999	1451	38
4	53	10		999999	1451	39
4	54	10		999999	1451	40
4	55	10		999999	1451	41
4	56	10		999999	1451	42
4	57	10		999999	1451	43
4	58	10		999999	1451	44
4	59	10		999999	1451	45
4	91	10		999999	1451	46
5	15	7		999999	1451	47
5	91	11		999999	1451	48
				999999	1 0	49
2.70590+ 4 5.84269+ 1	1	0	1	099999	1453	50
2.70590+ 4 5.84269+ 1	0	0	2	499999	1453	51
1.00000+ 0 2.00000+ 7				999999	1453	52
0.00000+ 0-1.00000+ 7	0	0	5	099999	1453	53
1.00000+ 1 2.70590+ 4 1.12990- 7 1.00000+ 0 1.00000+ 0				999999	1453	54
0.00000+ 0 7.00000+ 6	0	0	5	099999	1453	55
1.00000+ 2 2.70590+ 4 4.25340- 9 1.00000+ 0 1.00000+ 0				999999	1453	56
0.00000+ 0-7.00000+ 6	0	0	5	099999	1453	57
1.00000+ 2 2.70590+ 4 1.70100- 7 1.00000+ 0 1.00000+ 0				999999	1453	58
0.00000+ 0 3.17000+ 6	0	0	5	099999	1453	59

1.57000+	2	2.5356+	4	7.51790-	5	1.00330+	0	1.00000+	0	9999	1453	60
2.70590+	4	5.5426+	1		0					9999	1	61
2.70590+	4	1.5000+	0		0					9999	0	62
1.00200-	5	5.5000+	4		1					09999	2151	63
3.50000+	0	6.5000+	1		0					09999	2151	64
5.54269+	1	0.0000+	0		0					09999	2151	65
-4.00000+	2	3.5000+	0		0					379999	2151	66
-1.00000+	0	4.0000+	0		0					09999	2151	67
1.32000+	2	4.0000+	0		0					09999	2151	68
4.52200+	3	4.0000+	0		0					09999	2151	69
5.01500+	3	3.0000+	0		0					09999	2151	70
8.05000+	3	3.0000+	0		0					09999	2151	71
8.74080+	3	4.0000+	0		0					09999	2151	72
9.70000+	3	3.0000+	0		0					09999	2151	73
1.07000+	4	4.0000+	0		0					09999	2151	74
1.18500+	4	3.0000+	0		0					09999	2151	75
1.32800+	4	4.0000+	0		0					09999	2151	76
1.56600+	4	3.0000+	0		0					09999	2151	77
1.69200+	4	4.0000+	0		0					09999	2151	78
1.77500+	4	3.0000+	0		0					09999	2151	79
2.20700+	4	3.0000+	0		0					09999	2151	80
2.25100+	4	4.0000+	0		0					09999	2151	81
2.44200+	4	3.0000+	0		0					09999	2151	82
2.52000+	4	4.0000+	0		0					09999	2151	83
2.59500+	4	4.0000+	0		0					09999	2151	84
2.73500+	4	4.0000+	0		0					09999	2151	85
2.94100+	4	4.0000+	0		0					09999	2151	86
3.01100+	4	4.0000+	0		0					09999	2151	87
3.14400+	4	3.0000+	0		0					09999	2151	88
3.18500+	4	3.0000+	0		0					09999	2151	89
3.27500+	4	3.0000+	0		0					09999	2151	90
3.31000+	4	4.0000+	0		0					09999	2151	91
3.49000+	4	4.0000+	0		0					09999	2151	92
4.52600+	4	4.0000+	0		0					09999	2151	93
4.79800+	4	3.0000+	0		0					09999	2151	94
5.15000+	4	4.0000+	0		0					09999	2151	95
5.40500+	4	3.0000+	0		0					09999	2151	96
7.21000+	4	3.0000+	0		0					09999	2151	97
8.87000+	4	3.0000+	0		0					09999	2151	98
9.29000+	4	3.0000+	0		0					09999	2151	99
9.81000+	4	3.0000+	0		0					09999	2151	100
9.88000+	4	4.0000+	0		0					09999	2151	101
1.14870+	5	4.0000+	0		0					09999	2151	102
5.54269+	1	0.0000+	0		0					09999	2151	103
1.11000+	3	2.0000+	0		0					09999	2151	104
2.26400+	3	4.0000+	0		0					09999	2151	105
2.66600+	3	3.0000+	0		0					09999	2151	106
5.39000+	3	3.0000+	0		0					09999	2151	107
1.92000+	4	3.0000+	0		0					09999	2151	108
2.70590+	4	5.5426+	1		0					09999	2151	109
0.00000+	7	0.0000+	0		0					09999	2151	110
1.00000-	5	5.5426+	0		0					09999	2151	111
2.55000-	2	1.0000-	1		0					09999	2151	112
1.00000-	2	2.5450-	3		0					09999	2151	113
4.30000-	2	4.3000-	1		0					09999	2151	114
4.30000-	2	4.3000-	1		0					09999	2151	115
4.30000-	2	4.3000-	1		0					09999	2151	116
4.30000-	2	4.3000-	1		0					09999	2151	117
4.30000-	2	4.3000-	1		0					09999	2151	118
4.30000-	2	4.3000-	1		0					09999	2151	119

8.00000+	2	6.75000-	1	9.00000+	2	6.50000-	1	1.20000+	3	5.50000-	19999	3	1	120
1.60000+	3	5.50000-	1	1.70000+	3	5.00000-	1	1.50000+	3	5.00000-	19999	3	1	121
1.90000+	3	4.75000-	1	2.00000+	3	4.75000-	1	2.10000+	3	4.25000-	19999	3	1	122
2.20000+	3	4.00000-	1	2.30000+	3	3.75000-	1	2.35000+	3	3.50000-	19999	3	1	123
2.40000+	3	3.40000-	1	2.45000+	3	3.20000-	1	2.50000+	3	3.10000-	19999	3	1	124
2.55000+	3	2.80000-	1	2.60000+	3	2.65000-	1	2.65000+	3	2.20000-	19999	3	1	125
2.70000+	3	1.80000-	1	2.75000+	3	1.20000-	1	2.80000+	3	1.00000-	19999	3	1	126
2.80000+	3	0.00000-	0	1.75000+	4	0.00000-	0	1.77000+	4	-3.00000-	19999	3	1	127
1.78000+	4	-5.00000-	1	1.87000+	4	-5.00000-	1	1.89000+	4	-5.00000-	19999	3	1	128
1.90000+	4	-2.20000-	1	1.97000+	4	-2.20000-	1	1.99000+	4	0.00000+	09999	3	1	129
2.00000+	4	-3.50000-	1	2.01000+	4	-4.50000-	1	2.02000+	4	-5.00000-	19999	3	1	130
2.05000+	4	-4.75000-	1	2.04000+	4	-4.50000-	1	2.05000+	4	-4.00000-	19999	3	1	131
2.10000+	4	-2.75000-	1	2.07000+	4	-2.00000-	1	2.08000+	4	0.00000+	09999	3	1	132
2.15000+	4	3.00000-	1	2.12000+	4	7.00000-	1	2.13000+	4	1.20000+	09999	3	1	133
2.14000+	4	1.40000+	0	2.15000+	4	3.00000+	0	2.16000+	4	3.00000+	09999	3	1	134
2.17000+	4	5.00000+	0	2.18000+	4	9.00000+	0	2.19000+	4	1.50000+	19999	3	1	135
2.20000+	4	1.50000+	1	2.21000+	4	5.00000+	0	2.22000+	4	2.50000+	09999	3	1	136
2.23000+	4	0.00000+	0	2.29000+	4	0.00000+	0	2.30000+	4	-2.00000+	09999	3	1	137
2.32000+	4	-4.00000+	0	2.34000+	4	-3.70000+	0	2.36000+	4	-2.80000+	09999	3	1	138
2.38000+	4	-1.40000+	0	2.40000+	4	-5.00000-	1	2.41000+	4	-4.00000-	19999	3	1	139
2.42000+	4	0.00000+	0	2.50000+	4	0.00000+	0	2.51000+	4	1.40000+	19999	3	1	140
2.52000+	4	1.20000+	1	2.53000+	4	2.00000+	0	2.54000+	4	0.00000+	09999	3	1	141
2.55000+	4	-1.00000+	0	2.56000+	4	-3.00000+	0	2.57000+	4	-3.00000+	09999	3	1	142
2.58000+	4	-2.50000+	0	2.59000+	4	-1.00000+	0	2.60000+	4	0.00000+	09999	3	1	143
2.61000+	4	0.00000+	0	2.62000+	4	-2.00000+	0	2.67000+	4	-1.70000+	09999	3	1	144
2.68000+	4	-1.00000+	0	2.69000+	4	-4.00000+	1	2.70000+	4	-2.00000-	19999	3	1	145
2.71000+	4	0.00000+	0	2.76000+	4	0.00000+	0	2.75000+	4	-1.80000+	09999	3	1	146
2.80000+	4	-1.50000+	0	2.86000+	4	-1.50000+	0	2.88000+	4	-1.80000+	09999	3	1	147
2.90000+	4	-2.10000+	0	2.92000+	4	-2.00000+	0	2.94000+	4	-1.50000+	09999	3	1	148
2.95000+	4	0.00000+	0	3.20000+	4	0.00000+	0	3.22000+	4	-9.00000-	19999	3	1	149
3.24000+	4	-9.00000-	1	3.25000+	4	1.20000+	0	3.26000+	4	-5.00000-	19999	3	1	150
3.27000+	4	0.00000+	0	3.32000+	4	0.00000+	0	3.34000+	4	-1.40000+	09999	3	1	151
3.36000+	4	-1.20000+	0	3.38000+	4	-1.00000+	0	3.40000+	4	-1.10000+	09999	3	1	152
3.44000+	4	-1.10000+	0	3.49000+	4	-5.00000-	1	3.47500+	4	0.00000+	09999	3	1	153
3.49000+	4	2.00000+	3	3.50000+	4	5.00000+	3	3.50200+	4	1.20000+	29999	3	1	154
3.50400+	4	1.60000+	2	3.50500+	4	2.12000+	2	3.50800+	4	2.44000+	29999	3	1	155
3.51000+	4	2.71000+	2	3.51200+	4	2.98000+	2	3.51400+	4	3.13000+	29999	3	1	156
3.51500+	4	3.20000+	2	3.51800+	4	3.42000+	2	3.52000+	4	3.55000+	29999	3	1	157
3.52200+	4	3.67000+	2	3.52400+	4	3.78000+	2	3.52600+	4	3.67000+	29999	3	1	158
3.52800+	4	3.95000+	2	3.53000+	4	4.02000+	2	3.53200+	4	4.07000+	29999	3	1	159
3.53400+	4	4.10000+	2	3.53600+	4	-2.56730-	1	3.53800+	4	-5.54300-	19999	3	1	160
3.54000+	4	-6.53100-	1	3.54200+	4	-4.55540-	0	3.57000+	4	-5.15630-	09999	3	1	161
3.58000+	4	-5.65220-	0	3.59000+	4	-5.95570-	0	3.60000+	4	-5.35550-	09999	3	1	162
3.60000+	4	5.54230+	0	3.62000+	4	8.09520+	0	3.64000+	4	7.64500+	09999	3	1	163
3.66000+	4	7.24490+	0	3.67000+	4	7.24490+	0	3.68000+	4	1.03450+	19999	3	1	164
3.68500+	4	1.03450+	1	3.70000+	4	7.34450+	0	3.71000+	4	7.04440+	09999	3	1	165
3.72000+	4	6.74430+	0	3.74000+	4	6.44400+	0	3.76000+	4	6.04380+	09999	3	1	166
3.78000+	4	5.84370+	0	3.80000+	4	5.54360+	0	3.82000+	4	5.34350+	09999	3	1	167
3.84000+	4	5.14330+	0	3.86000+	4	5.04310+	0	3.88000+	4	4.99290+	09999	3	1	168
3.90000+	4	4.94230+	0	3.94000+	4	4.64220+	0	3.96000+	4	4.44240+	09999	3	1	169
3.98000+	4	4.04230+	0	3.99000+	4	3.84220+	0	4.00000+	4	3.44200+	09999	3	1	170
4.01000+	4	2.84190+	0	4.01500+	4	2.84190+	0	4.02000+	4	2.94190+	09999	3	1	171
4.03000+	4	7.54180+	0	4.04000+	4	6.74170+	0	4.05500+	4	4.34160+	09999	3	1	172
4.06000+	4	4.34160+	0	4.07000+	4	4.44150+	0	4.08000+	4	4.24140+	09999	3	1	173
4.10000+	4	3.84120+	0	4.12000+	4	3.19110+	0	4.13500+	4	2.54100+	09999	3	1	174
4.14000+	4	2.34090+	0	4.15750+	4	1.07410+	1	4.16000+	4	1.14410+	19999	3	1	175
4.16250+	4	1.07410+	1	4.17000+	4	7.34070+	0	4.18000+	4	4.94070+	09999	3	1	176
4.18000+	4	4.94070+	0	4.19000+	4	4.24050+	0	4.19500+	4	4.14050+	09999	3	1	177
4.20000+	4	3.44050+	0	4.22000+	4	3.44050+	0	4.24000+	4	3.21520+	09999	3	1	178
4.26000+	4	2.72000+	0	4.27000+	4	2.72000+	0	4.28000+	4	3.13000+	09999	3	1	179

4.29000+	4	3.53990+	0	4.29500+	4	3.53990+	0	4.36000+	4	3.13990+	09999	3	1	180
4.30500+	4	2.75990+	0	4.32000+	4	2.43980+	0	4.34000+	4	1.88980+	09999	3	1	181
4.35000+	4	1.63980+	0	4.37000+	4	2.65970+	0	4.37500+	4	2.83960+	09999	3	1	182
4.36000+	4	2.63980+	0	4.41000+	4	1.65940+	0	4.44000+	4	1.24910+	09999	3	1	183
4.40000+	4	1.03900+	0	4.49500+	4	2.38890+	0	4.50500+	4	3.91850+	09999	3	1	184
4.52000+	4	1.96390+	1	4.52600+	4	2.60390+	1	4.52600+	4	2.81390+	19999	3	1	185
4.55000+	4	2.73620+	0	4.57000+	4	0.40300+	1	4.59900+	4	2.79380+	19999	3	1	186
4.60100+	4	2.63680+	1	4.63000+	4	1.00390+	1	4.68000+	4	6.43780+	09999	3	1	187
4.70000+	4	5.13770+	0	4.71000+	4	4.63760+	0	4.72500+	4	2.43740+	09999	3	1	188
4.73000+	4	1.00370+	1	4.73500+	4	1.02370+	1	4.74000+	4	9.63730+	09999	3	1	189
4.76000+	4	6.73710+	0	4.78000+	4	5.13710+	0	4.80000+	4	4.53700+	09999	3	1	190
4.84000+	4	4.63660+	0	4.86000+	4	3.73570+	0	4.88000+	4	3.43640+	09999	3	1	191
4.90000+	4	3.13630+	0	4.92000+	4	2.65620+	0	4.94000+	4	2.33610+	09999	3	1	192
4.95500+	4	3.13600+	0	4.96500+	4	3.14600+	0	5.00000+	4	1.53590+	09999	3	1	193
5.01250+	4	1.41000+	0	5.02500+	4	1.41000+	0	5.05120+	4	1.07560+	19999	3	1	194
5.05650+	4	1.00360+	1	5.07500+	4	3.93550+	0	5.10000+	4	3.63540+	09999	3	1	195
5.11250+	4	4.03530+	0	5.12500+	4	3.03510+	0	5.15000+	4	2.43530+	19999	3	1	196
5.16120+	4	2.56350+	1	5.16250+	4	2.50350+	1	5.22500+	4	9.73470+	09999	3	1	197
5.25000+	4	6.63450+	0	5.27500+	4	3.73440+	0	5.29000+	4	2.50930+	09999	3	1	198
5.31000+	4	1.14340+	1	5.35000+	4	6.63410+	0	5.36250+	4	7.53400+	09999	3	1	199
5.37500+	4	9.43400+	0	5.40000+	4	2.23340+	1	5.40620+	4	2.25340+	19999	3	1	200
5.41250+	4	2.26340+	1	5.43750+	4	7.53360+	0	5.50000+	4	6.73370+	09999	3	1	201
5.52500+	4	6.13350+	0	5.55000+	4	5.33330+	0	5.57500+	4	4.53320+	09999	3	1	202
5.58750+	4	4.03320+	0	5.60000+	4	3.13310+	0	5.61250+	4	3.03310+	09999	3	1	203
5.62500+	4	4.13300+	0	5.65000+	4	1.40330+	1	5.65620+	4	1.50330+	19999	3	1	204
5.66250+	4	1.40330+	1	5.67500+	4	9.03290+	0	5.70000+	4	6.93290+	09999	3	1	205
5.75000+	4	5.33250+	0	5.77500+	4	4.63240+	0	5.79400+	4	5.03230+	09999	3	1	206
5.80000+	4	4.93230+	0	5.81250+	4	3.83220+	0	5.82500+	4	3.43220+	09999	3	1	207
5.85000+	4	2.68200+	0	5.87500+	4	2.13220+	0	5.91200+	4	1.33320+	19999	3	1	208
5.92000+	4	1.75320+	1	5.92500+	4	1.72320+	1	5.93000+	4	1.60320+	19999	3	1	209
5.96250+	4	6.03160+	0	5.97000+	4	7.73150+	0	5.97500+	4	7.93150+	09999	3	1	210
6.00000+	4	1.30320+	1	6.05620+	4	1.33310+	1	6.01250+	4	1.35810+	19999	3	1	211
6.02500+	4	9.03140+	0	6.03000+	4	8.33140+	0	6.05000+	4	7.13130+	09999	3	1	212
6.07500+	4	5.53120+	0	6.09500+	4	4.23110+	0	6.10000+	4	4.10110+	09999	3	1	213
6.11000+	4	4.19110+	0	6.11250+	4	4.63110+	0	6.12500+	4	5.03100+	09999	3	1	214
6.13000+	4	1.05310+	1	6.13500+	4	1.07310+	1	6.14000+	4	1.05310+	19999	3	1	215
6.15000+	4	8.23090+	0	6.17500+	4	6.13090+	0	6.20000+	4	5.43080+	09999	3	1	216
6.21250+	4	5.23070+	0	6.22500+	4	5.16170+	0	6.23750+	4	5.13060+	09999	3	1	217
6.25000+	4	4.73050+	0	6.26250+	4	4.03040+	0	6.27500+	4	3.43030+	09999	3	1	218
6.31000+	4	7.23030+	0	6.31250+	4	7.33020+	0	6.31500+	4	7.23020+	09999	3	1	219
6.36250+	4	4.23010+	0	6.38750+	4	4.63000+	0	6.39000+	4	4.63000+	09999	3	1	220
6.42500+	4	4.22990+	0	6.45000+	4	3.77930+	0	6.47500+	4	3.47930+	09999	3	1	221
6.50000+	4	3.32970+	0	6.52500+	4	3.22950+	0	6.55000+	4	3.12950+	09999	3	1	222
6.56250+	4	2.97950+	0	6.57500+	4	2.72940+	0	6.60000+	4	2.12930+	09999	3	1	223
6.63750+	4	7.02920+	0	6.64000+	4	7.52920+	0	6.64500+	4	7.42920+	09999	3	1	224
6.65000+	4	7.32920+	0	6.67000+	4	4.22910+	0	6.68750+	4	3.62900+	09999	3	1	225
6.70000+	4	3.37900+	0	6.72500+	4	3.02900+	0	6.75000+	4	2.92880+	09999	3	1	226
6.75630+	4	2.90860+	0	6.76250+	4	2.92880+	0	6.77500+	4	3.12880+	09999	3	1	227
6.78000+	4	3.27870+	0	6.78500+	4	3.02870+	0	6.79000+	4	3.27870+	09999	3	1	228
6.80000+	4	2.77570+	0	6.81250+	4	2.52860+	0	6.82500+	4	2.37560+	09999	3	1	229
6.83750+	4	2.27550+	0	6.85000+	4	2.25850+	0	6.86250+	4	2.32550+	09999	3	1	230
6.87500+	4	2.52840+	0	6.88000+	4	2.56840+	0	6.88500+	4	2.57840+	09999	3	1	231
6.90000+	4	2.56840+	0	6.90000+	4	2.27830+	0	6.92500+	4	1.67830+	09999	3	1	232
6.93750+	4	1.57820+	0	6.95000+	4	1.54820+	0	6.96250+	4	1.53810+	09999	3	1	233
6.97500+	4	1.54810+	0	6.97500+	4	1.92800+	0	7.02500+	4	1.02800+	19999	3	1	234
7.03000+	4	1.10280+	1	7.03500+	4	1.12280+	1	7.04000+	4	1.10280+	19999	3	1	235
7.05000+	4	9.52790+	0	7.07500+	4	5.72780+	0	7.10000+	4	4.32780+	09999	3	1	236
7.12500+	4	3.42770+	0	7.13750+	4	3.02770+	0	7.14000+	4	3.02770+	09999	3	1	237
7.15000+	4	3.12770+	0	7.21250+	4	1.10280+	1	7.22000+	4	1.12280+	19999	3	1	238
7.22500+	4	1.02280+	1	7.23750+	4	2.62730+	0	7.24000+	4	2.77750+	09999	3	1	239

7.25000	4	5.32748	0	7.27000	4	1.13270	1	7.27250	4	1.14270	19999	3	1	240	
7.27000	4	1.13270	1	7.30000	4	5.12720	0	7.35000	4	4.72720	09999	3	1	241	
7.30250	4	4.02720	0	7.37000	4	4.67720	0	7.38750	4	4.52710	09999	3	1	242	
7.40000	4	4.02710	0	7.42000	4	3.42710	0	7.43750	4	3.22700	09999	3	1	243	
7.45000	4	3.14700	0	7.46250	4	3.12700	0	7.49000	4	4.12690	09999	3	1	244	
7.49000	4	4.15590	0	7.50000	4	3.07590	0	7.54500	4	2.57600	09999	3	1	245	
7.55000	4	2.55590	0	7.55000	4	2.57600	0	7.58000	4	2.92670	09999	3	1	246	
7.59000	4	3.02670	0	7.59500	4	2.92670	0	7.65000	4	1.67660	09999	3	1	247	
7.67000	4	1.62650	0	7.67500	4	1.42600	0	7.72500	4	1.00260	19999	3	1	248	
7.72500	4	1.02260	1	7.73000	4	1.20260	1	7.82500	4	4.07630	09999	3	1	249	
7.85000	4	3.52650	0	7.87500	4	2.77620	0	7.96000	4	2.33610	09999	3	1	250	
7.91250	4	2.24610	0	7.92500	4	2.27610	0	7.94250	4	1.05260	19999	3	1	251	
7.97000	4	1.05260	1	7.97500	4	1.04260	1	8.00000	4	6.32600	09999	3	1	252	
8.01250	4	4.62500	0	8.02500	4	4.07590	0	8.05000	4	3.12590	09999	3	1	253	
8.06250	4	2.67590	0	8.07500	4	2.16590	0	8.08750	4	1.67590	09999	3	1	254	
8.10000	4	1.37590	0	8.11250	4	1.32590	0	8.12500	4	1.42570	09999	3	1	255	
8.15000	4	3.32570	0	8.15000	4	9.62590	0	8.19500	4	9.72560	09999	3	1	256	
8.20000	4	8.02560	0	8.22500	4	4.52550	0	8.25000	4	3.02540	09999	3	1	257	
8.27500	4	2.17540	0	8.28750	4	1.87540	0	8.30000	4	1.91530	09999	3	1	258	
8.31000	4	1.72530	0	8.31250	4	1.82530	0	8.35000	4	5.62520	09999	3	1	259	
8.35000	4	6.22520	0	8.35000	4	6.32520	0	8.37500	4	5.72520	09999	3	1	260	
8.38750	4	5.32510	0	8.40000	4	5.42510	0	8.44500	4	9.82500	09999	3	1	261	
8.45000	4	1.00240	1	8.45500	4	9.82500	0	8.47500	4	4.72500	09999	3	1	262	
8.50000	4	4.72490	0	8.52500	4	3.97490	0	8.53750	4	3.14400	09999	3	1	263	
8.55000	4	2.72490	0	8.57500	4	1.92400	0	8.58750	4	1.52470	09999	3	1	264	
8.60000	4	1.57470	0	8.62000	4	1.77470	0	8.62500	4	1.77470	09999	3	1	265	
8.63750	4	1.67470	0	8.65000	4	1.57460	0	8.67500	4	1.50460	09999	3	1	266	
8.69750	4	1.55460	0	8.70000	4	1.46450	0	8.71250	4	1.37450	09999	3	1	267	
8.72500	4	1.14450	0	8.73750	4	1.09350	0	8.75000	4	1.15440	09999	3	1	268	
8.82500	4	9.22430	0	8.85000	4	9.22430	0	8.87500	4	9.32430	09999	3	1	269	
8.85000	4	1.19240	1	8.86250	4	1.35240	1	8.87500	4	1.45240	19999	3	1	270	
8.86750	4	1.55240	1	8.89500	4	1.55240	1	8.90000	4	1.57240	19999	3	1	271	
8.91000	4	1.55240	1	8.91250	4	1.50240	1	8.92500	4	1.30240	19999	3	1	272	
9.07500	4	2.67390	0	9.08750	4	2.47390	0	9.09000	4	2.42390	09999	3	1	273	
9.10000	4	2.44390	0	9.12500	4	2.97390	0	9.13750	4	3.32380	09999	3	1	274	
9.15000	4	3.62390	0	9.16250	4	3.92370	0	9.17500	4	4.17370	09999	3	1	275	
9.18750	4	4.53370	0	9.21000	4	4.42370	0	9.21250	4	4.60370	09999	3	1	276	
9.22500	4	5.12360	0	9.25000	4	7.62360	0	9.27500	4	1.10240	19999	3	1	277	
9.30000	4	1.90240	1	9.31250	4	2.10230	1	9.32500	4	1.90230	19999	3	1	278	
9.37500	4	1.10230	1	9.38750	4	1.05230	1	9.40000	4	1.06230	19999	3	1	279	
9.41250	4	1.10230	1	9.42500	4	1.10230	1	9.43000	4	1.20230	19999	3	1	280	
9.43750	4	1.10230	1	9.45000	4	1.10230	1	9.46250	4	9.92320	09999	3	1	281	
9.47500	4	9.52320	0	9.48750	4	9.92310	0	9.50000	4	1.12230	19999	3	1	282	
9.52500	4	1.42230	1	9.53500	4	1.50230	1	9.53750	4	1.51230	19999	3	1	283	
9.54000	4	1.50230	1	9.55000	4	1.40230	1	9.65000	4	2.37290	09999	3	1	284	
9.62500	4	1.44290	0	9.67500	4	1.71290	0	9.68750	4	1.44290	09999	3	1	285	
9.70000	4	1.71290	0	9.71000	4	1.72280	0	9.71250	4	1.62290	09999	3	1	286	
9.72500	4	2.22280	0	9.81250	4	1.30230	1	9.82500	4	1.57230	19999	3	1	287	
9.83750	4	1.72230	1	9.85000	4	1.55230	1	9.86250	4	1.70230	19999	3	1	288	
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.47180E	05	.42700E	01	.47400E	06	.53100E	01	.47490E	06	.52000E	019999	3	1	557
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.48200E	06	.37900E	01	.48290E	06	.27600E	01	.48320E	06	.23400E	019999	3	1	561
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.50030E	06	.25600E	01	.50100E	06	.36000E	01	.50130E	06	.40300E	019999	3	1	571
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.53640E	06	.32100E	01	.53640E	06	.33700E	01	.53750E	05	.30500E	019999	3	1	588
.53890E	05	.36200E	01	.53960E	06	.41100E	01	.54000E	06	.41200E	019999	3	1	589
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.54600E	05	.22000E	01	.54640E	06	.25000E	01	.54720E	05	.40000E	019999	3	1	593
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.80670E	06	.34500E	01	.80740E	06	.34300E	01	.80840E	06	.36300E	019999	3	1	683
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.11500E	08	.29960E	01	.11570E	08	.29870E	01	.12000E	08	.29260E	019999	3	1	851
.12100E	08	.29120E	01	.12560E	08	.28650E	01	.12630E	08	.28500E	019999	3	1	852
.13000E	08	.28000E	01	.13150E	08	.27800E	01	.13500E	08	.27420E	019999	3	1	853
.13690E	08	.27220E	01	.14000E	08	.26690E	01	.14220E	08	.26660E	019999	3	1	854
.14200E	08	.26320E	01	.14750E	08	.26030E	01	.15000E	08	.25890E	019999	3	1	855
.15290E	08	.25660E	01	.15530E	08	.25520E	01	.15820E	08	.25270E	019999	3	1	856
.15000E	08	.25160E	01	.16300E	08	.24940E	01	.16500E	08	.24850E	019999	3	1	857
.16900E	08	.24590E	01	.17000E	08	.24550E	01	.17440E	08	.24350E	019999	3	1	858
.17500E	08	.24330E	01	.17990E	08	.24170E	01	.18000E	08	.24170E	019999	3	1	859
.18540E	08	.23950E	01	.19000E	08	.23770E	01	.19100E	08	.23730E	019999	3	1	860
.19660E	08	.23580E	01	.20000E	08	.23560E	01				9999	3	1	861
											9999	3	0	862
2.70590+	4	5.84269+	1		0		99	0			09999	3	2	863
0.00000+	0	0.00000+	0		0		0	3			22319999	3	2	864
	136		3		519		5	2231			29999	3	2	865
1.00000+	5	0.00000+	0	3.00000+	2	0.00000+	0	3.50000+	2	3.50000+	19999	3	2	866
4.00000+	2	4.00000+	1	5.00000+	2	7.00000+	1	7.00000+	2	7.00000+	19999	3	2	867
8.00000+	2	6.75000+	1	9.00000+	2	6.50000+	1	1.20000+	3	5.50000+	19999	3	2	868
1.60000+	3	5.50000+	1	1.70000+	3	5.00000+	1	1.80000+	3	5.00000+	19999	3	2	869
1.90000+	3	4.75000+	1	2.00000+	3	4.75000+	1	2.10000+	3	4.25000+	19999	3	2	870
2.20000+	3	4.00000+	1	2.30000+	3	3.75000+	1	2.35000+	3	3.50000+	19999	3	2	871
2.40000+	3	3.40000+	1	2.45000+	3	3.20000+	1	2.50000+	3	3.10000+	19999	3	2	872
2.50000+	3	2.80000+	1	2.60000+	3	2.65000+	1	2.65000+	3	2.20000+	19999	3	2	873
2.70000+	3	1.80000+	1	2.75000+	3	1.20000+	1	2.80000+	3	1.00000+	19999	3	2	874
2.86000+	3	0.00000+	0	1.76000+	4	0.00000+	0	1.77000+	4	3.00000+	19999	3	2	875
1.78000+	4	5.00000+	1	1.87000+	4	5.00000+	1	1.89000+	4	5.00000+	19999	3	2	876
1.90000+	4	2.20000+	1	1.97000+	4	2.20000+	1	1.99000+	4	0.00000+	09999	3	2	877
2.00000+	4	3.50000+	1	2.01000+	4	4.50000+	1	2.02000+	4	5.70000+	19999	3	2	878
2.05000+	4	4.75000+	1	2.04000+	4	4.50000+	1	2.05000+	4	4.00000+	19999	3	2	879
2.06000+	4	2.75000+	1	2.07000+	4	2.00000+	1	2.08000+	4	0.00000+	09999	3	2	880
2.10000+	4	3.00000+	1	2.12000+	4	7.00000+	1	2.13000+	4	1.20000+	09999	3	2	881
2.14000+	4	1.40000+	0	2.15000+	4	3.00000+	0	2.16000+	4	3.00000+	09999	3	2	882
2.17000+	4	5.00000+	0	2.18000+	4	9.00000+	0	2.19000+	4	1.50000+	19999	3	2	883
2.20000+	4	1.50000+	1	2.21000+	4	6.50000+	0	2.22000+	4	2.50000+	09999	3	2	884
2.23000+	4	0.00000+	0	2.29000+	4	0.00000+	0	2.30000+	4	2.00000+	09999	3	2	885
2.32000+	4	4.00000+	0	2.34000+	4	3.70000+	0	2.36000+	4	2.80000+	09999	3	2	886
2.38000+	4	1.40000+	0	2.40000+	4	5.00000+	1	2.41000+	4	4.00000+	19999	3	2	887
2.42000+	4	0.00000+	0	2.50000+	4	0.00000+	0	2.51000+	4	1.40000+	19999	3	2	888
2.52000+	4	1.20000+	1	2.53000+	4	2.00000+	0	2.54000+	4	0.00000+	09999	3	2	889
2.55000+	4	1.00000+	0	2.56000+	4	3.00000+	0	2.57000+	4	3.00000+	09999	3	2	890
2.58000+	4	2.50000+	0	2.59000+	4	1.00000+	0	2.60000+	4	0.00000+	09999	3	2	891
2.61000+	4	0.00000+	0	2.62000+	4	2.00000+	0	2.67000+	4	1.70000+	09999	3	2	892
2.68000+	4	1.00000+	0	2.69000+	4	4.00000+	1	2.70000+	4	2.00000+	19999	3	2	893
2.71000+	4	0.00000+	0	2.76000+	4	0.00000+	0	2.78000+	4	1.81000+	09999	3	2	894
2.80000+	4	1.50000+	0	2.85000+	4	1.50000+	0	2.86000+	4	1.50000+	09999	3	2	895
2.90000+	4	2.10000+	0	2.92000+	4	2.00000+	0	2.94000+	4	1.50000+	09999	3	2	896
2.95000+	4	0.00000+	0	3.00000+	4	0.00000+	0	3.22000+	4	9.00000+	19999	3	2	897
3.24000+	4	9.00000+	1	3.25000+	4	1.20000+	0	3.26000+	4	5.00000+	19999	3	2	898
3.27000+	4	0.00000+	0	3.32000+	4	0.00000+	0	3.34000+	4	1.40000+	09999	3	2	899

3.36000+	4-1.20000+	0	3.35000+	4-1.00000+	0	3.40000+	4-1.10000+	09999	3	2	900
3.44000+	4-1.10000+	0	3.45000+	4-5.00000+	1	3.47500+	4 0.60000+	09999	3	2	901
3.49900+	4 0.00000+	0	3.50000+	4 0.00000+	0	3.50200+	4 0.00000+	09999	3	2	902
3.50400+	4 0.00000+	0	3.50500+	4 0.00000+	0	3.50800+	4 0.00000+	09999	3	2	903
3.51000+	4 0.00000+	0	3.51200+	4 0.00000+	0	3.51400+	4 0.00000+	09999	3	2	904
3.51600+	4 0.00000+	0	3.51800+	4 0.00000+	0	3.52000+	4 0.00000+	09999	3	2	905
3.52200+	4 0.00000+	0	3.52400+	4 0.00000+	0	3.52600+	4 0.00000+	09999	3	2	906
3.52800+	4 0.00000+	0	3.53000+	4 0.00000+	0	3.53200+	4 0.00000+	09999	3	2	907
3.53400+	4 0.00000+	0	3.53600+	4-3.00000+	1	3.53800+	4-6.00000+	19999	3	2	908
3.54000+	4-7.00000+	1	3.56000+	4-4.60000+	0	3.57000+	4-5.20000+	09999	3	2	909
3.58000+	4-5.70000+	0	3.59000+	4-6.00000+	0	3.60000+	4-5.40000+	09999	3	2	910
3.60000+	4 8.50000+	0	3.62000+	4 8.05000+	0	3.64000+	4 7.60000+	09999	3	2	911
3.66000+	4 7.20000+	0	3.67000+	4 7.20000+	0	3.68000+	4 1.00000+	19999	3	2	912
3.68800+	4 1.03000+	1	3.70000+	4 7.30000+	0	3.71000+	4 7.00000+	09999	3	2	913
3.72000+	4 6.70000+	0	3.74000+	4 6.40000+	0	3.76000+	4 6.00000+	09999	3	2	914
3.78000+	4 5.30000+	0	3.80000+	4 5.50000+	0	3.82000+	4 5.30000+	09999	3	2	915
3.84000+	4 5.10000+	0	3.86000+	4 5.00000+	0	3.88000+	4 4.90000+	09999	3	2	916
3.90000+	4 4.90000+	0	3.94000+	4 4.60000+	0	3.96000+	4 4.40000+	09999	3	2	917
3.98000+	4 4.00000+	0	3.99000+	4 3.80000+	0	4.00000+	4 3.40000+	09999	3	2	918
4.01000+	4 2.80000+	0	4.01500+	4 2.60000+	0	4.02000+	4 2.50000+	09999	3	2	919
4.03000+	4 7.50000+	0	4.04000+	4 6.70000+	0	4.05500+	4 4.30000+	09999	3	2	920
4.06000+	4 4.35000+	0	4.07000+	4 4.40000+	0	4.08000+	4 4.35000+	09999	3	2	921
4.10000+	4 3.80000+	0	4.12000+	4 3.15000+	0	4.13500+	4 2.50000+	09999	3	2	922
4.14000+	4 2.50000+	0	4.15750+	4 1.07500+	1	4.16000+	4 1.10000+	19999	3	2	923
4.16250+	4 1.07500+	1	4.17000+	4 7.80000+	0	4.18000+	4 4.90000+	09999	3	2	924
4.18500+	4 4.50000+	0	4.19000+	4 4.20000+	0	4.19500+	4 4.00000+	09999	3	2	925
4.20000+	4 3.35000+	0	4.22000+	4 3.37500+	0	4.24000+	4 3.17500+	09999	3	2	926
4.26000+	4 2.80000+	0	4.27000+	4 2.80000+	0	4.28000+	4 3.00000+	09999	3	2	927
4.29000+	4 3.50000+	0	4.23500+	4 3.50000+	0	4.30000+	4 3.10000+	09999	3	2	928
4.30500+	4 2.70000+	0	4.32800+	4 2.40000+	0	4.34000+	4 1.65000+	09999	3	2	929
4.35000+	4 1.60000+	0	4.37000+	4 2.82000+	0	4.37500+	4 2.80000+	09999	3	2	930
4.38000+	4 2.65000+	0	4.41000+	4 1.65000+	0	4.44000+	4 1.25000+	09999	3	2	931
4.48000+	4 1.00000+	0	4.49500+	4 2.35000+	0	4.50500+	4 3.80000+	09999	3	2	932
4.52000+	4 1.96000+	1	4.52600+	4 2.80000+	1	4.52800+	4 2.81000+	19999	3	2	933
4.56000+	4 6.70000+	0	4.57000+	4 8.40000+	1	4.59900+	4 2.79000+	19999	3	2	934
4.60100+	4 2.80000+	1	4.65000+	4 1.00000+	1	4.68000+	4 6.40000+	09999	3	2	935
4.70000+	4 5.10000+	0	4.71000+	4 4.60000+	0	4.72500+	4 8.60000+	09999	3	2	936
4.75000+	4 1.00000+	1	4.75500+	4 1.02000+	1	4.74000+	4 9.40000+	09999	3	2	937
4.76000+	4 6.70000+	0	4.78000+	4 5.10000+	0	4.80000+	4 4.50000+	09999	3	2	938
4.84000+	4 4.00000+	0	4.85500+	4 3.70000+	0	4.88000+	4 3.40000+	09999	3	2	939
4.90000+	4 3.10000+	0	4.92000+	4 2.65000+	0	4.94000+	4 2.35000+	09999	3	2	940
4.95500+	4 3.10000+	0	4.96500+	4 3.11000+	0	5.00000+	4 1.50000+	09999	3	2	941
5.01250+	4 1.37500+	0	5.02500+	4 1.37500+	0	5.05120+	4 1.07500+	19999	3	2	942
5.05500+	4 1.05000+	1	5.08750+	4 3.90000+	0	5.10000+	4 3.50000+	09999	3	2	943
5.11250+	4 4.00000+	0	5.12500+	4 8.00000+	0	5.15000+	4 2.45000+	19999	3	2	944
5.16120+	4 2.56000+	1	5.16250+	4 2.50000+	1	5.22500+	4 9.70000+	09999	3	2	945
5.25000+	4 6.60000+	0	5.27500+	4 3.70000+	0	5.29000+	4 2.47500+	09999	3	2	946
5.31000+	4 1.14000+	1	5.35000+	4 6.60000+	0	5.36250+	4 7.50000+	09999	3	2	947
5.37500+	4 9.40000+	0	5.40000+	4 2.20000+	1	5.40620+	4 2.25000+	19999	3	2	948
5.41250+	4 2.26000+	1	5.48750+	4 7.50000+	0	5.50000+	4 6.70000+	09999	3	2	949
5.52500+	4 6.10000+	0	5.55000+	4 5.30000+	0	5.57500+	4 4.50000+	09999	3	2	950
5.58750+	4 4.00000+	0	5.60000+	4 3.10000+	0	5.61250+	4 3.00000+	09999	3	2	951
5.62500+	4 4.10000+	0	5.65000+	4 1.40000+	1	5.65620+	4 1.50000+	19999	3	2	952
5.66250+	4 1.40000+	1	5.67500+	4 9.00000+	0	5.70000+	4 6.90000+	09999	3	2	953
5.75000+	4 5.30000+	0	5.77500+	4 4.40000+	0	5.79400+	4 5.00000+	09999	3	2	954
5.80000+	4 4.90000+	0	5.81250+	4 3.60000+	0	5.82500+	4 3.40000+	09999	3	2	955
5.85000+	4 2.65000+	0	5.87500+	4 2.10000+	0	5.91200+	4 1.30000+	19999	3	2	956
5.92000+	4 1.75000+	1	5.92500+	4 1.72000+	1	5.93000+	4 1.40000+	19999	3	2	957
5.96250+	4 8.00000+	0	5.97000+	4 7.70000+	0	5.97500+	4 7.90000+	09999	3	2	958
6.00000+	4 1.50000+	1	6.00620+	4 1.30000+	1	6.01250+	4 1.35000+	19999	3	2	959

6.02500+	4	9.00000+	0	6.03000+	4	6.30000+	0	6.05000+	4	7.10000+	09999	3	2	960
6.07500+	4	5.50000+	0	6.07500+	4	4.20000+	0	6.10000+	4	4.15000+	09999	3	2	961
6.11000+	4	4.16000+	0	6.11250+	4	4.50000+	0	6.12500+	4	3.20000+	09999	3	2	962
6.13000+	4	1.05000+	1	6.13500+	4	1.07000+	1	6.14000+	4	1.05000+	19999	3	2	963
6.15000+	4	6.20000+	0	6.17500+	4	6.10000+	0	6.20000+	4	5.40000+	09999	3	2	964
6.21250+	4	5.25000+	0	6.22500+	4	5.25000+	0	6.23750+	4	3.10000+	09999	3	2	965
6.25000+	4	4.70000+	0	6.25250+	4	4.60000+	0	6.27500+	4	3.40000+	09999	3	2	966
6.31000+	4	7.20000+	0	6.31250+	4	7.30000+	0	6.31500+	4	7.20000+	09999	3	2	967
6.36250+	4	4.20000+	0	6.38750+	4	4.50000+	0	6.39000+	4	4.50000+	09999	3	2	968
6.42500+	4	4.20000+	0	6.45000+	4	3.75000+	0	6.47500+	4	3.45000+	09999	3	2	969
6.50000+	4	3.30000+	0	6.52500+	4	3.20000+	0	6.55000+	4	3.10000+	09999	3	2	970
6.56250+	4	2.95000+	0	6.57500+	4	2.70000+	0	6.60000+	4	2.10000+	09999	3	2	971
6.63750+	4	7.00000+	0	6.64000+	4	7.50000+	0	6.64500+	4	7.40000+	09999	3	2	972
6.65000+	4	7.30000+	0	6.67000+	4	4.20000+	0	6.69750+	4	3.60000+	09999	3	2	973
6.70000+	4	3.35000+	0	6.72500+	4	3.00000+	0	6.75000+	4	2.90000+	09999	3	2	974
6.75600+	4	2.60000+	0	6.76250+	4	2.90000+	0	6.77500+	4	3.10000+	09999	3	2	975
6.78000+	4	3.25000+	0	6.78500+	4	3.00000+	0	6.79000+	4	3.25000+	09999	3	2	976
6.80000+	4	2.75000+	0	6.81250+	4	2.50000+	0	6.82500+	4	2.35000+	09999	3	2	977
6.83750+	4	2.25000+	0	6.85000+	4	2.22500+	0	6.86250+	4	2.30000+	09999	3	2	978
6.87500+	4	2.50000+	0	6.88000+	4	2.54000+	0	6.88500+	4	2.35000+	09999	3	2	979
6.89000+	4	2.54000+	0	6.90000+	4	2.25000+	0	6.92500+	4	1.65000+	09999	3	2	980
6.93750+	4	1.55000+	0	6.95000+	4	1.52000+	0	6.96250+	4	1.51000+	09999	3	2	981
6.97500+	4	1.62000+	0	6.98750+	4	1.90000+	0	7.02500+	4	1.02000+	19999	3	2	982
7.03000+	4	1.10000+	1	7.03500+	4	1.12000+	1	7.04000+	4	1.10000+	19999	3	2	983
7.05000+	4	9.50000+	0	7.07500+	4	5.70000+	0	7.10000+	4	4.30000+	09999	3	2	984
7.12500+	4	3.40000+	0	7.13750+	4	3.00000+	0	7.14000+	4	3.00000+	09999	3	2	985
7.15000+	4	3.10000+	0	7.21250+	4	1.10000+	1	7.22000+	4	1.11000+	19999	3	2	986
7.22500+	4	1.05000+	1	7.23750+	4	8.80000+	0	7.24000+	4	8.75000+	09999	3	2	987
7.25000+	4	8.80000+	0	7.27000+	4	1.13000+	1	7.27250+	4	1.14000+	19999	3	2	988
7.27500+	4	1.13000+	1	7.35300+	4	5.10000+	0	7.35800+	4	4.90000+	09999	3	2	989
7.36250+	4	4.80000+	0	7.37500+	4	4.65000+	0	7.38750+	4	4.50000+	09999	3	2	990
7.40000+	4	3.90000+	0	7.42500+	4	3.40000+	0	7.43750+	4	3.20000+	09999	3	2	991
7.45000+	4	3.12000+	0	7.46250+	4	3.10000+	0	7.49000+	4	4.10000+	09999	3	2	992
7.49500+	4	4.13000+	0	7.50000+	4	3.05000+	0	7.54500+	4	2.35000+	09999	3	2	993
7.55000+	4	2.94000+	0	7.56000+	4	2.55000+	0	7.58000+	4	2.90000+	09999	3	2	994
7.59000+	4	3.00000+	0	7.59500+	4	2.50000+	0	7.65000+	4	1.65000+	09999	3	2	995
7.67000+	4	1.30000+	0	7.67500+	4	1.40000+	0	7.72500+	4	1.00000+	19999	3	2	996
7.72550+	4	1.19000+	1	7.73000+	4	1.20000+	1	7.82500+	4	4.05000+	09999	3	2	997
7.85000+	4	3.30000+	0	7.87500+	4	2.75000+	0	7.90000+	4	2.36000+	09999	3	2	998
7.91250+	4	2.22000+	0	7.92500+	4	2.25000+	0	7.96250+	4	1.05000+	19999	3	2	999
7.97000+	4	1.05000+	1	7.97500+	4	1.04000+	1	8.00000+	4	6.30000+	09999	3	2	1000
8.01250+	4	4.80000+	0	8.02500+	4	4.05000+	0	8.05000+	4	3.10000+	09999	3	2	1001
8.06250+	4	2.65000+	0	8.07500+	4	2.14000+	0	8.08750+	4	1.45000+	09999	3	2	1002
8.10000+	4	1.35000+	0	8.11250+	4	1.30000+	0	8.12500+	4	1.40000+	09999	3	2	1003
8.15000+	4	3.30000+	0	8.16500+	4	9.50000+	0	8.19500+	4	9.70000+	09999	3	2	1004
8.20000+	4	8.00000+	0	8.22500+	4	4.50000+	0	8.25000+	4	3.00000+	09999	3	2	1005
8.27500+	4	2.15000+	0	8.28750+	4	1.85000+	0	8.30000+	4	1.79000+	09999	3	2	1006
8.31000+	4	1.70000+	0	8.31250+	4	1.80000+	0	8.35000+	4	5.60000+	09999	3	2	1007
8.35500+	4	6.20000+	0	8.36000+	4	6.30000+	0	8.37500+	4	5.70000+	09999	3	2	1008
8.38750+	4	5.30000+	0	8.45000+	4	5.40000+	0	8.44500+	4	9.80000+	09999	3	2	1009
8.45000+	4	1.00000+	1	8.45500+	4	9.80000+	0	8.47500+	4	6.70000+	09999	3	2	1010
8.50000+	4	4.70000+	0	8.52500+	4	3.55000+	0	8.53750+	4	3.12000+	09999	3	2	1011
8.55000+	4	2.70000+	0	8.57500+	4	1.90000+	0	8.58750+	4	1.50000+	09999	3	2	1012
8.60000+	4	1.55000+	0	8.62500+	4	1.75000+	0	8.62500+	4	1.75000+	09999	3	2	1013
8.63750+	4	1.55000+	0	8.65000+	4	1.55000+	0	8.67500+	4	1.54000+	09999	3	2	1014
8.68750+	4	1.55000+	0	8.70000+	4	1.45000+	0	8.71250+	4	1.35000+	09999	3	2	1015
8.72500+	4	1.12000+	0	8.73750+	4	1.07500+	0	8.75000+	4	1.13000+	09999	3	2	1016
8.82500+	4	7.50000+	0	8.83500+	4	9.20000+	0	8.83750+	4	9.90000+	09999	3	2	1017
8.85000+	4	1.10000+	1	8.85250+	4	1.35000+	1	8.87500+	4	1.45000+	19999	3	2	1018
8.88750+	4	1.55000+	1	8.89500+	4	1.55000+	1	8.90000+	4	1.57000+	19999	3	2	1019

8.91000+	4	1.54900+	1	8.91250+	4	1.50300+	1	8.92500+	4	1.30000+	19999	3	2	1020
9.07500+	4	2.64000+	0	9.08750+	4	2.45300+	0	9.09000+	4	2.40000+	09999	3	2	1021
9.10000+	4	2.42000+	0	9.12500+	4	2.99000+	0	9.13750+	4	3.30000+	09999	3	2	1022
9.15000+	4	3.43000+	0	9.16250+	4	3.90000+	0	9.17500+	4	4.15000+	09999	3	2	1023
9.18750+	4	4.25000+	0	9.21000+	4	4.40000+	0	9.21250+	4	4.50000+	09999	3	2	1024
9.22500+	4	5.10000+	0	9.25000+	4	7.00000+	0	9.27500+	4	1.10000+	19999	3	2	1025
9.30000+	4	1.43000+	1	9.31250+	4	2.10000+	1	9.32500+	4	1.90000+	19999	3	2	1026
9.37500+	4	2.10000+	1	9.38750+	4	1.85000+	1	9.40000+	4	1.60000+	19999	3	2	1027
9.41250+	4	1.10000+	1	9.42500+	4	1.10000+	1	9.43000+	4	1.20000+	19999	3	2	1028
9.43750+	4	1.10000+	0	9.45000+	4	1.10000+	1	9.46250+	4	9.91000+	09999	3	2	1029
9.47500+	4	9.63000+	0	9.48750+	4	9.90000+	0	9.50000+	4	1.12000+	19999	3	2	1030
9.52500+	4	1.42000+	1	9.53000+	4	1.50000+	1	9.53750+	4	1.51000+	19999	3	2	1031
9.54000+	4	1.50000+	1	9.55000+	4	1.40000+	1	9.65000+	4	2.35000+	09999	3	2	1032
9.66250+	4	1.40000+	0	9.67500+	4	1.69000+	0	9.68750+	4	1.64000+	09999	3	2	1033
9.70000+	4	1.69000+	0	9.71000+	4	1.70000+	0	9.71250+	4	1.60000+	09999	3	2	1034
9.72500+	4	2.20000+	0	9.81250+	4	1.30000+	1	9.82500+	4	1.50000+	19999	3	2	1035
9.83750+	4	1.72000+	1	9.85000+	4	1.85000+	1	9.86250+	4	1.90000+	19999	3	2	1036
9.87500+	4	1.93000+	1	9.90000+	4	1.95000+	1	9.92500+	4	1.90000+	19999	3	2	1037
9.95000+	4	1.77000+	1	9.97500+	4	1.58000+	1	9.98750+	4	1.20000+	19999	3	2	1038
1.00000E	06	.99775E	01	.10030E	06	.13678E	02	.10050E	06	.13578E	029999	3	2	1039
1.00000E	06	.99278E	02	.10100E	06	.12275E	02	.10130E	06	.10378E	029999	3	2	1040
1.01500E	06	.92278E	01	.10150E	06	.10778E	02	.10200E	06	.13378E	029999	3	2	1041
1.02500E	06	.11578E	02	.10250E	06	.10678E	02	.10250E	06	.11278E	029999	3	2	1042
1.03000E	06	.10478E	02	.10330E	06	.10578E	02	.10350E	06	.085078E	019999	3	2	1043
1.03800E	06	.082178E	01	.10400E	06	.07678E	01	.10430E	06	.06978E	019999	3	2	1044
1.04500E	06	.063378E	01	.10450E	06	.059779E	01	.10500E	06	.049679E	019999	3	2	1045
1.05300E	06	.065779E	01	.10550E	06	.054579E	01	.10580E	06	.054579E	019999	3	2	1046
1.06000E	06	.061779E	01	.10630E	06	.042480E	01	.10650E	06	.071580E	019999	3	2	1047
1.06800E	06	.085480E	01	.10700E	06	.090780E	01	.10720E	06	.065280E	019999	3	2	1048
1.07500E	06	.09381E	01	.10770E	06	.052631E	01	.10800E	06	.055281E	019999	3	2	1049
1.08200E	06	.035781E	01	.10850E	06	.041431E	01	.10870E	06	.039382E	019999	3	2	1050
1.09000E	06	.07582E	01	.10920E	06	.072232E	01	.10950E	06	.06782E	019999	3	2	1051
1.09700E	06	.062032E	01	.11000E	06	.062033E	01	.11020E	06	.072683E	019999	3	2	1052
1.10500E	06	.072683E	01	.11070E	06	.066633E	01	.11100E	06	.071183E	019999	3	2	1053
1.11200E	06	.073683E	01	.11150E	06	.069384E	01	.11170E	06	.044384E	019999	3	2	1054
1.12000E	06	.035784E	01	.11220E	06	.056234E	01	.11250E	06	.037984E	019999	3	2	1055
1.12700E	06	.047684E	01	.11300E	06	.037783E	01	.11320E	06	.060885E	019999	3	2	1056
1.13500E	06	.057285E	01	.11370E	06	.034885E	01	.11400E	06	.042786E	019999	3	2	1057
1.14200E	06	.047986E	01	.11450E	06	.038286E	01	.11470E	06	.061786E	019999	3	2	1058
1.15000E	06	.084286E	01	.11520E	06	.066186E	01	.11550E	06	.089587E	019999	3	2	1059
1.15700E	06	.051687E	01	.11600E	06	.059787E	01	.11620E	06	.065587E	019999	3	2	1060
1.16500E	06	.055587E	01	.11670E	06	.052688E	01	.11700E	06	.051888E	019999	3	2	1061
1.17200E	06	.053288E	01	.11730E	06	.061089E	01	.11770E	06	.083588E	019999	3	2	1062
1.18000E	06	.061489E	01	.11820E	06	.083689E	01	.11850E	06	.074789E	019999	3	2	1063
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1.19500E	06	.010979E	02	.11970E	06	.012579E	02	.12000E	06	.012579E	029999	3	2	1065
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1.21000E	06	.090791E	01	.12120E	06	.063591E	01	.12150E	06	.063491E	019999	3	2	1067
1.21700E	06	.072291E	01	.12200E	06	.057692E	01	.12260E	06	.044492E	019999	3	2	1068
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.16100E	05	.30521E	01	.16150E	06	.34021E	01	.16270E	05	.47222E	019999	3	2	1086
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.18130E	06	.20936E	01	.18240E	06	.24737E	01	.18350E	06	.31638E	019999	3	2	1093
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.19830E	06	.21049E	01	.19960E	06	.24750E	01	.20080E	06	.34750E	019999	3	2	1098
.20080E	06	.54750E	01	.20200E	06	.78950E	01	.20330E	06	.81251E	019999	3	2	1099
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.23140E	06	.42898E	01	.23180E	06	.63015E	01	.23220E	06	.35218E	019999	3	2	1117
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.69500E	06	.42620E	01	.69590E	06	.34120E	01	.69750E	06	.34020E	019999	3	2	1403
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2.70590+	4	5.54259+	1				99				0	99999	3	4	1611
0.00000+	3	-1.09900+	6				0				1	599999	3	4	1612
												9999	3	4	1613
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.12000E 08	.70400E 00	.13000E 08	.59400E 00	.13500E 08	.51400E 00	009999 3	4	1629
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.19000E 08	.33500E 00	.20000E 08	.33500E 00			9999 3	0	1633
						9999 3	0	1634
2.70590+ 4	5.84269+ 1	0	99	0	0	09999 3	16	1635
0.00000+ 0	-1.04610+ 7	0	0	1	1	149999 3	16	1636
	14	2				9999 3	16	1637
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.16000E 08	.75000E 00	.17000E 08	.76000E 00	.18000E 08	.80000E 00	009999 3	16	1641
.19000E 08	.81000E 00	.20000E 08	.80000E 00			9999 3	16	1642
						9999 3	0	1643
2.70590+ 4	5.84269+ 1	0	1	0	0	09999 3	51	1644
0.00000+ 0	-1.09900+ 6	0	0	1	1	159999 3	51	1645
	15	2				9999 3	51	1646
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						9999 3	0	1652
2.70590+ 4	5.84269+ 1	0	2	0	0	09999 3	52	1653
0.00000+ 0	-1.19000+ 6	0	0	1	1	159999 3	52	1654
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						9999 3	0	1661
2.70590+ 4	5.84269+ 1	0	3	0	0	09999 3	53	1662
0.00000+ 0	-1.29100+ 6	0	0	1	1	149999 3	53	1663
	14	2				9999 3	53	1664
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						9999 3	0	1670
2.70590+ 4	5.84269+ 1	0	4	0	0	09999 3	54	1671
0.00000+ 0	-1.46000+ 6	0	0	1	1	139999 3	54	1672
	13	2				9999 3	54	1673
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.25000E 07	.32000E 00	.30000E 07	.27000E 00	.35000E 07	.21000E 00	009999 3	54	1676
.40000E 07	.15000E 00	.50000E 07	.70000E-01	.60000E 07	.39000E-01	019999 3	54	1677
.80000E 07	.00000E 00					9999 3	54	1678
						9999 3	0	1679

2,70590+ 4 5,84269+ 1	.0	5	0	09999	3 55 1680
0,00000+ 0-1,7400+ 6	0	0	1	119999	3 55 1681
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.35000E 07 .11000E 00 .40000E 07 .35000E-01 .50000E 07 .43000E-019999				3 55 1685	
.00000E 07 .23000E-01 .80000E 07 .00000E 00				9999	3 55 1686
				9999	3 0 1687
2,70590+ 4 5,84269+ 1	0	6	0	09999	3 56 1688
0,00000+ 0-2,07000+ 6	0	0	1	109999	3 56 1689
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.80000E 07 .03000E 00				9999	3 56 1694
				9999	3 0 1695
2,70590+ 4 5,84269+ 1	0	7	0	09999	3 57 1696
0,00000+ 0-2,15000+ 6	0	0	1	119999	3 57 1697
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.35000E 07 .17500E 00 .40000E 07 .15500E 00 .50000E 07 .90000E-019999				3 57 1701	
.60000E 07 .40000E-01 .80000E 07 .00000E 00				9999	3 57 1702
				9999	3 0 1703
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0,00000+ 0-2,35000+ 6	0	0	1	129999	3 58 1705
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				9999	3 0 1711
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0,00000+ 0-2,50000+ 6	0	0	1	109999	3 59 1713
10 2				9999	3 59 1714
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.80000E 07 .03000E 00				9999	3 59 1718
				9999	3 0 1719
2,70590+ 4 5,84269+ 1	0	99	0	09999	3 91 1720
0,00000+ 0 0,00000+ 0	0	0	1	399999	3 91 1721
33 2				9999	3 91 1722
.24400E 07 .00000E 00 .25000E 07 .50000E-02 .28000E 07 .20000E-019999				3 91 1723	
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.17000E 03 .34400E 00 .17500E 08 .34000E 00 .18000E 03 .33500E 009999				3 91 1734	
.19000E 03 .33500E 00 .20000E 08 .33500E 00				9999	3 91 1735
				9999	3 0 1736
2,70590+ 4 5,84269+ 1	0	99	0	09999	3102 1737
0,00000+ 0 7,49800+ 6	0	0	3	4419999	3102 1738
7 5	441	2		9999	3102 1739

5.96250+	4	3.15950+	2	5.97400+	4	3.15640+	2	5.97500+	4	3.15420+	29999	3102	1800
6.00000+	4	3.15000+	2	6.00620+	4	3.14600+	2	6.01250+	4	3.14600+	29999	3102	1801
6.02500+	4	3.14000+	2	6.03000+	4	3.13300+	2	6.03500+	4	3.13000+	29999	3102	1802
6.07500+	4	3.12000+	2	6.09500+	4	3.11300+	2	6.10000+	4	3.11000+	29999	3102	1803
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6.15000+	4	3.08000+	2	6.17500+	4	3.06500+	2	6.20000+	4	3.06000+	29999	3102	1806
6.21250+	4	3.07250+	2	6.22500+	4	3.06500+	2	6.23750+	4	3.05750+	29999	3102	1807
6.25000+	4	3.05000+	2	6.26250+	4	3.04800+	2	6.27500+	4	3.03000+	29999	3102	1808
6.31000+	4	3.02000+	2	6.31250+	4	3.02500+	2	6.31500+	4	3.02400+	29999	3102	1809
6.36250+	4	3.01250+	2	6.35750+	4	3.00400+	2	6.39000+	4	3.00350+	29999	3102	1810
6.42500+	4	2.97100+	2	6.45000+	4	2.96350+	2	6.47500+	4	2.97500+	29999	3102	1811
6.50000+	4	2.95000+	2	6.52500+	4	2.95500+	2	6.55000+	4	2.95000+	29999	3102	1812
6.56250+	4	2.94000+	2	6.57500+	4	2.94200+	2	6.60000+	4	2.93350+	29999	3102	1813
6.63750+	4	2.92100+	2	6.64000+	4	2.92000+	2	6.64500+	4	2.91850+	29999	3102	1814
6.65000+	4	2.91700+	2	6.67500+	4	2.91000+	2	6.68750+	4	2.90400+	29999	3102	1815
6.70000+	4	2.90000+	2	6.72500+	4	2.89200+	2	6.75000+	4	2.88350+	29999	3102	1816
6.75000+	4	2.88150+	2	6.76250+	4	2.87450+	2	6.77500+	4	2.87550+	29999	3102	1817
6.76000+	4	2.87400+	2	6.78500+	4	2.87200+	2	6.79000+	4	2.87020+	29999	3102	1818
6.80000+	4	2.86700+	2	6.81250+	4	2.86200+	2	6.82500+	4	2.85800+	29999	3102	1819
6.83750+	4	2.85440+	2	6.85000+	4	2.85000+	2	6.86250+	4	2.84600+	29999	3102	1820
6.87500+	4	2.84160+	2	6.89000+	4	2.84000+	2	6.88500+	4	2.83800+	29999	3102	1821
6.89000+	4	2.83600+	2	6.90600+	4	2.83350+	2	6.92500+	4	2.82510+	29999	3102	1822
6.93750+	4	2.82000+	2	6.95000+	4	2.81500+	2	6.96250+	4	2.81260+	29999	3102	1823
6.97500+	4	2.80840+	2	6.98750+	4	2.80420+	2	7.02500+	4	2.79440+	29999	3102	1824
7.00000+	4	2.79330+	2	7.03500+	4	2.79220+	2	7.04000+	4	2.79110+	29999	3102	1825
7.05000+	4	2.78500+	2	7.07500+	4	2.78350+	2	7.10000+	4	2.77780+	29999	3102	1826
7.12500+	4	2.77220+	2	7.13750+	4	2.76940+	2	7.14000+	4	2.76890+	29999	3102	1827
7.15000+	4	2.76670+	2	7.17250+	4	2.75200+	2	7.22000+	4	2.75110+	29999	3102	1828
7.22500+	4	2.74000+	2	7.23750+	4	2.74730+	2	7.24000+	4	2.74670+	29999	3102	1829
7.25000+	4	2.74450+	2	7.27000+	4	2.74000+	2	7.27250+	4	2.73950+	29999	3102	1830
7.27500+	4	2.73900+	2	7.35300+	4	2.72150+	2	7.35800+	4	2.72050+	29999	3102	1831
7.36250+	4	2.71950+	2	7.37500+	4	2.71570+	2	7.38750+	4	2.71400+	29999	3102	1832
7.40000+	4	2.71110+	2	7.42500+	4	2.70750+	2	7.43750+	4	2.70290+	29999	3102	1833
7.45000+	4	2.70000+	2	7.46250+	4	2.69750+	2	7.49000+	4	2.69200+	29999	3102	1834
7.49500+	4	2.69100+	2	7.50000+	4	2.69000+	2	7.54500+	4	2.68400+	29999	3102	1835
7.55000+	4	2.68000+	2	7.56000+	4	2.67800+	2	7.58000+	4	2.67400+	29999	3102	1836
7.59000+	4	2.67200+	2	7.59500+	4	2.67100+	2	7.65000+	4	2.64000+	29999	3102	1837
7.67000+	4	2.65500+	2	7.67500+	4	2.65500+	2	7.72500+	4	2.64580+	29999	3102	1838
7.72550+	4	2.64570+	2	7.73000+	4	2.64500+	2	7.82500+	4	2.62920+	29999	3102	1839
7.85000+	4	2.62500+	2	7.87500+	4	2.62150+	2	7.90000+	4	2.61000+	29999	3102	1840
7.91250+	4	2.60870+	2	7.92500+	4	2.60750+	2	7.96250+	4	2.60370+	29999	3102	1841
7.97000+	4	2.60300+	2	7.97500+	4	2.60250+	2	8.00000+	4	2.60000+	29999	3102	1842
8.01250+	4	2.59720+	2	8.02500+	4	2.59450+	2	8.05000+	4	2.59900+	29999	3102	1843
8.06250+	4	2.58620+	2	8.07500+	4	2.58350+	2	8.08750+	4	2.58050+	29999	3102	1844
8.10000+	4	2.57600+	2	8.11250+	4	2.57520+	2	8.12500+	4	2.57250+	29999	3102	1845
8.15000+	4	2.56700+	2	8.18500+	4	2.55950+	2	8.19500+	4	2.55710+	29999	3102	1846
8.20000+	4	2.55700+	2	8.22500+	4	2.55000+	2	8.25000+	4	2.54500+	29999	3102	1847
8.27500+	4	2.53950+	2	8.26750+	4	2.53670+	2	8.30000+	4	2.53400+	29999	3102	1848
8.31000+	4	2.53190+	2	8.31250+	4	2.53110+	2	8.35000+	4	2.52300+	29999	3102	1849
8.35500+	4	2.52190+	2	8.35600+	4	2.52000+	2	8.37500+	4	2.51750+	29999	3102	1850
8.38750+	4	2.51470+	2	8.40000+	4	2.51200+	2	8.44500+	4	2.50200+	29999	3102	1851
8.45000+	4	2.50100+	2	8.45500+	4	2.50000+	2	8.47500+	4	2.49550+	29999	3102	1852
8.50000+	4	2.49000+	2	8.52500+	4	2.48500+	2	8.53750+	4	2.48330+	29999	3102	1853
8.55000+	4	2.48100+	2	8.57500+	4	2.47650+	2	8.58750+	4	2.47430+	29999	3102	1854
8.60000+	4	2.47200+	2	8.62000+	4	2.46540+	2	8.62500+	4	2.46750+	29999	3102	1855
8.65750+	4	2.46520+	2	8.65000+	4	2.46300+	2	8.67500+	4	2.46550+	29999	3102	1856
8.72500+	4	2.45450+	2	8.73750+	4	2.45470+	2	8.75000+	4	2.45170+	29999	3102	1857
8.82500+	4	2.44150+	2	8.83500+	4	2.44370+	2	8.83750+	4	2.44500+	29999	3102	1858
8.92500+	4	2.43150+	2	8.93500+	4	2.43370+	2	8.93750+	4	2.43450+	29999	3102	1859

8.85000+	4	2.42700-	2	8.85250+	4	2.42470-	2	8.87500+	4	2.42250-	29999	3102	1860
8.88750+	4	2.42430-	2	8.89000+	4	2.41910-	2	8.90000+	4	2.41800-	29999	3102	1861
8.91000+	4	2.41620-	2	8.91250+	4	2.41570-	2	8.92500+	4	2.41350-	29999	3102	1862
9.07500+	4	2.39000-	2	9.08750+	4	2.38730-	2	9.09000+	4	2.38740-	29999	3102	1863
9.10000+	4	2.38500-	2	9.12500+	4	2.38150-	2	9.13750+	4	2.37930-	29999	3102	1864
9.15000+	4	2.37720-	2	9.16250+	4	2.37500-	2	9.17500+	4	2.37290-	29999	3102	1865
9.18750+	4	2.37130-	2	9.21000+	4	2.36590-	2	9.21250+	4	2.36440-	29999	3102	1866
9.22500+	4	2.35440-	2	9.25000+	4	2.35000-	2	9.27500+	4	2.35580-	29999	3102	1867
9.30000+	4	2.35150-	2	9.31250+	4	2.34890-	2	9.32500+	4	2.34630-	29999	3102	1868
9.37500+	4	2.33610-	2	9.38750+	4	2.33350-	2	9.40000+	4	2.33090-	29999	3102	1869
9.41250+	4	2.32330-	2	9.42500+	4	2.32570-	2	9.43000+	4	2.32470-	29999	3102	1870
9.43750+	4	2.32310-	2	9.45000+	4	2.32050-	2	9.46250+	4	2.31810-	29999	3102	1871
9.47500+	4	2.31550-	2	9.48750+	4	2.31290-	2	9.50000+	4	2.31030-	29999	3102	1872
9.52500+	4	2.30510-	2	9.53000+	4	2.30410-	2	9.53750+	4	2.30260-	29999	3102	1873
9.54000+	4	2.30200-	2	9.55000+	4	2.30000-	2	9.55000+	4	2.29890-	29999	3102	1874
9.66250+	4	2.28750-	2	9.67500+	4	2.28610-	2	9.68750+	4	2.28470-	29999	3102	1875
9.70000+	4	2.28330-	2	9.71000+	4	2.28220-	2	9.71250+	4	2.28200-	29999	3102	1876
9.72500+	4	2.28060-	2	9.81250+	4	2.27030-	2	9.82500+	4	2.26950-	29999	3102	1877
9.83750+	4	2.26810-	2	9.85000+	4	2.26670-	2	9.86250+	4	2.26550-	29999	3102	1878
9.87500+	4	2.26400-	2	9.90000+	4	2.26120-	2	9.92500+	4	2.25840-	29999	3102	1879
9.95000+	4	2.25560-	2	9.97500+	4	2.25280-	2	9.98750+	4	2.25140-	29999	3102	1880
.10000E 06	.22500E-01	.20000E 06	.15000E-01	.30000E 06	.12500E-01	.09999	3102	1881					
.50000E 06	.90000E-02	.60000E 06	.80000E-02	.70000E 06	.80000E-02	.09999	3102	1882					
.80000E 06	.80000E-02	.90000E 06	.84000E-02	.12500E 07	.76000E-02	.09999	3102	1883					
.15000E 07	.62500E-02	.17500E 07	.46000E-02	.20000E 07	.40000E-02	.09999	3102	1884					
.25000E 07	.33000E-02	.40000E 07	.25000E-02	.60000E 07	.20000E-02	.09999	3102	1885					
.10000E 08	.17000E-02	.14000E 08	.15000E-02	.20000E 08	.15000E-02	.09999	3102	1886					
2.70590+	4	5.84269+	1	0	99	0	09999	3103	1887				
0.00000+	4	7.83000+	5	0	0	1	18999	3103	1888				
.79600E 06	.00000E-00	.20000E 07	.16000E-02	.30000E 07	.27000E-02	.09999	3103	1889					
.40000E 07	.50000E-02	.50000E 07	.92000E-02	.60000E 07	.16000E-01	.09999	3103	1890					
.70000E 07	.30000E-01	.80000E 07	.51000E-01	.90000E 07	.70000E-01	.09999	3103	1891					
.10000E 08	.81000E-01	.11000E 08	.84000E-01	.12000E 08	.86000E-01	.09999	3103	1892					
.13000E 08	.84500E-01	.14000E 08	.81500E-01	.15000E 08	.75500E-01	.09999	3103	1893					
.16000E 08	.67500E-01	.18000E 08	.54000E-01	.20000E 08	.42000E-01	.09999	3103	1894					
2.70590+	4	5.84269+	1	0	99	0	09999	3104	1895				
0.00000+	4	5.14500000	5	0	0	1	49999	3104	1896				
.52620E 07	.00000E-00	.10000E 08	.15000E-02	.15000E 08	.20000E-02	.09999	3104	1897					
.20000E 08	.20000E-02	.10000E 08	.15000E-02	.15000E 08	.20000E-02	.09999	3104	1898					
2.70590+	4	5.84269+	1	0	99	0	09999	3105	1900				
0.00000+	4	6.93000+	6	0	0	1	49999	3105	1901				
.90810E 07	.00000E-00	.12000E 08	.70000E-03	.15000E 08	.10000E-02	.09999	3105	1902					
.25000E 08	.10000E-02	.10000E 08	.70000E-03	.15000E 08	.10000E-02	.09999	3105	1903					
2.70590+	4	5.84269+	1	0	99	0	09999	3106	1904				
0.00000+	4	6.93000+	6	0	0	1	49999	3106	1905				
.90810E 07	.00000E-00	.12000E 08	.70000E-03	.15000E 08	.10000E-02	.09999	3106	1906					
.25000E 08	.10000E-02	.10000E 08	.70000E-03	.15000E 08	.10000E-02	.09999	3106	1907					
2.70590+	4	5.84269+	1	0	99	0	09999	3107	1908				
0.00000+	4	6.93000+	6	0	0	1	49999	3107	1909				
.90810E 07	.00000E-00	.12000E 08	.70000E-03	.15000E 08	.10000E-02	.09999	3107	1910					
.25000E 08	.10000E-02	.10000E 08	.70000E-03	.15000E 08	.10000E-02	.09999	3107	1911					
.49000E 07	.00000E-00	.50000E 07	.40000E-04	.51000E 07	.12000E-03	.09999	3107	1912					
.52000E 07	.20000E-03	.53000E 07	.29000E-03	.54000E 07	.36000E-03	.09999	3107	1913					
.55000E 07	.45000E-03	.56000E 07	.56000E-03	.57000E 07	.78000E-03	.09999	3107	1914					
.58000E 07	.62000E-03	.59000E 07	.94000E-03	.60000E 07	.11000E-02	.09999	3107	1915					
.61000E 07	.13000E-02	.62000E 07	.15000E-02	.63000E 07	.17000E-02	.09999	3107	1916					
.64000E 07	.19000E-02	.65000E 07	.21000E-02	.66000E 07	.24000E-02	.09999	3107	1917					
.67000E 07	.25000E-02	.68000E 07	.31000E-02	.69000E 07	.34000E-02	.09999	3107	1918					
.70000E 07	.30000E-02	.71000E 07	.36000E-02	.72000E 07	.40000E-02	.09999	3107	1919					

73000E 07	35950E-02	71000E 07	39430E-02	72000E 07	42350E-02	3197 1920
73000E 07	47350E-02	74000E 07	52500E-02	73000E 07	57500E-02	3197 1921
74000E 07	61600E-02	77000E 07	64500E-02	73000E 07	68200E-02	3107 1922
74000E 07	72770E-02	80000E 07	77540E-02	61000E 07	82310E-02	3107 1923
75000E 07	87000E-02	83000E 07	91850E-02	84000E 07	95620E-02	3107 1924
75000E 07	10120E-01	90000E 07	12250E-01	95000E 07	14110E-01	3107 1925
10000E 06	15940E-01	10000E 06	17760E-01	11000E 06	19590E-01	3107 1926
11000E 06	21420E-01	12000E 06	23930E-01	12500E 06	26440E-01	3107 1927
11000E 06	27770E-01	13000E 06	26930E-01	14000E 06	29100E-01	3107 1928
14000E 06	28310E-01	15000E 06	27640E-01	15500E 06	26240E-01	3107 1929
16000E 06	24620E-01	16000E 06	22520E-01	17000E 06	28960E-01	3107 1930
17000E 06	18580E-01	18000E 06	17630E-01	19000E 06	13330E-01	3107 1931
20000E 06	11430E-01	10000E 04	11412E-01	10000E 06	30241E-01	3107 1932
27000E 04	5.84269+ 1	0 0	0 0	0 0	09999	3 0 1933
0.00000+ 0	0.00000+ 0	0 0	0 0	1 1	589999	3251 1934
10000E-04	11412E-01	10000E 04	11412E-01	10000E 06	30241E-01	3251 1936
20000E 06	62764E-01	30000E 06	1092E 00	35000E 06	79677E-01	3251 1937
40000E 06	12341E 00	45000E 06	10292E 00	50000E 06	10408E 00	3251 1938
70000E 06	13931E 00	60000E 06	13441E 00	65000E 06	14035E 00	3251 1939
70000E 06	12150E 00	75000E 06	17049E 00	80000E 06	14035E 00	3251 1940
80000E 06	15385E 00	90000E 06	12154E 00	95000E 06	16315E 00	3251 1941
10000E 07	16226E 00	10500E 07	16113E 00	11000E 07	21585E 00	3251 1942
11000E 07	12973E 00	12000E 07	18574E 00	12500E 07	19970E 00	3251 1943
13000E 07	19490E 00	13500E 07	18030E 00	14000E 07	21051E 00	3251 1944
14000E 07	21982E 00	15000E 07	20516E 00	16000E 07	33233E 00	3251 1945
15000E 07	37064E 00	20000E 07	38611E 00	21000E 07	40777E 00	3251 1946
22000E 07	42342E 00	23000E 07	43222E 00	24000E 07	44136E 00	3251 1947
25000E 07	44143E 00	26000E 07	48951E 00	27000E 07	55435E 00	3251 1948
26000E 07	52237E 00	29000E 07	53555E 00	30000E 07	54304E 00	3251 1949
31000E 07	58534E 00	32000E 07	51175E 00	33000E 07	57074E 00	3251 1950
34000E 07	58799E 00	35000E 07	60075E 00	36000E 07	58228E 00	3251 1951
35000E 07	62347E 00	40000E 07	65033E 00	50000E 07	71489E 00	3251 1952
60000E 07	77714E 00	60000E 07	81124E 00	10000E 06	80842E 00	3251 1953
12000E 06	78549E 00	14000E 06	75660E 00	16000E 06	72851E 00	3251 1954
20000E 06	71527E 00	10000E 04	10000E 06	10000E 06	9999	3251 1955
27000E 04	5.84269+ 1	0 0	0 0	0 0	9999	3 0 1957
0.00000+ 0	0.00000+ 0	0 0	0 0	1 1	589999	3252 1958
10000E-04	33850E-01	10000E 04	33650E-01	10000E 06	32965E-01	3252 1959
20000E 06	32092E-01	30000E 06	30477E-01	35000E 06	31513E-01	3252 1960
40000E 06	30015E-01	45000E 06	30717E-01	50000E 06	30677E-01	3252 1961
70000E 06	29505E-01	60000E 06	29638E-01	65000E 06	29240E-01	3252 1962
70000E 06	30081E-01	75000E 06	28403E-01	80000E 06	29434E-01	3252 1963
75000E 06	25973E-01	90000E 06	30079E-01	95000E 06	28554E-01	3252 1964
10000E 07	25884E-01	10500E 07	26724E-01	11000E 07	26850E-01	3252 1965
11000E 07	29799E-01	12000E 07	27606E-01	12500E 07	27403E-01	3252 1966
13000E 07	27565E-01	13500E 07	28065E-01	14000E 07	27033E-01	3252 1967
14000E 07	27022E-01	15000E 07	25564E-01	16000E 07	22361E-01	3252 1968
19000E 07	21550E-01	20000E 07	21020E-01	21000E 07	22278E-01	3252 1969
22000E 07	19537E-01	23000E 07	19441E-01	24000E 07	19128E-01	3252 1970
25000E 07	17553E-01	26000E 07	17450E-01	27000E 07	15259E-01	3252 1971
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31000E 07	22423E-01	32000E 07	16717E-01	35000E 07	14495E-01	3252 1973
34000E 07	14141E-01	35000E 07	13663E-01	36000E 07	14693E-01	3252 1974
35000E 07	27213E-01	40000E 07	20233E-01	50000E 07	95251E-01	3252 1975
60000E 07	71500E-02	60000E 07	54632E-02	10000E 06	65526E-02	3252 1976
12000E 06	71467E-02	14000E 06	53520E-02	16000E 06	92958E-02	3252 1977
20000E 06	71467E-02	10000E 04	15000E 06	10000E 06	92958E-02	3252 1978
27000E 04	5.84269+ 1	0 0	0 0	0 0	9999	3 0 1979
0.00000+ 0	0.00000+ 0	0 0	0 0	1 1	589999	3252 1980
10000E-04	33850E-01	10000E 04	33650E-01	10000E 06	32965E-01	3252 1981
20000E 06	32092E-01	30000E 06	30477E-01	35000E 06	31513E-01	3252 1982
40000E 06	30015E-01	45000E 06	30717E-01	50000E 06	30677E-01	3252 1983
70000E 06	29505E-01	60000E 06	29638E-01	65000E 06	29240E-01	3252 1984
70000E 06	30081E-01	75000E 06	28403E-01	80000E 06	29434E-01	3252 1985
75000E 06	25973E-01	90000E 06	30079E-01	95000E 06	28554E-01	3252 1986
10000E 07	25884E-01	10500E 07	26724E-01	11000E 07	26850E-01	3252 1987
11000E 07	29799E-01	12000E 07	27606E-01	12500E 07	27403E-01	3252 1988
13000E 07	27565E-01	13500E 07	28065E-01	14000E 07	27033E-01	3252 1989
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0.00000+	0	1.31300+	6	0	0	1	9999	4	52	2231	
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0.00000+	0	8.00000+	6	0	0	1	9999	4	0	2233	
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2.70590+	4	5.84269+	1	0	2	0	09999	4	53	2235	
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0.00000+	0	0.00000+	0	0	0	1	9999	4	53	2237	
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0.00000+	0	8.00000+	6	0	0	1	9999	4	53	2240	
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2.70590+	4	5.84269+	1	0	2	0	9999	4	53	2242	
0.00000+	0	5.84269+	1	0	2	0	9999	4	53	2243	
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0.00000+	0	1.48400+	6	0	0	1	09999	4	54	2245	
-1.00000+	0	5.00000-	1	1.00000+	0	5.00000-	1	09999	4	54	2246
0.00000+	0	8.00000+	6	0	0	1	29999	4	54	2247	
-1.00000+	0	5.00000-	1	1.00000+	0	5.00000-	1	9999	4	54	2248
2.70590+	4	5.84269+	1	0	2	0	29999	4	54	2249	
0.00000+	0	5.84269+	1	0	2	0	9999	4	54	2250	
0.00000+	0	0.00000+	0	0	0	1	9999	4	54	2251	
0.00000+	0	1.77300+	6	0	0	1	29999	4	54	2252	
-1.00000+	0	5.00000-	1	1.00000+	0	5.00000-	1	9999	4	54	2253
0.00000+	0	8.00000+	6	0	0	1	9999	4	54	2254	
-1.00000+	0	5.00000-	1	1.00000+	0	5.00000-	1	9999	4	0	2255
2.70590+	4	5.84269+	1	0	2	0	09999	4	55	2256	
0.00000+	0	5.84269+	1	0	2	0	09999	4	55	2257	
0.00000+	0	0.00000+	0	0	0	1	29999	4	55	2258	
0.00000+	0	1.77300+	6	0	0	1	9999	4	55	2259	
-1.00000+	0	5.00000-	1	1.00000+	0	5.00000-	1	29999	4	55	2260
0.00000+	0	8.00000+	6	0	0	1	9999	4	55	2261	
-1.00000+	0	5.00000-	1	1.00000+	0	5.00000-	1	9999	4	55	2262
2.70590+	4	5.84269+	1	0	2	0	29999	4	55	2263	
0.00000+	0	5.84269+	1	0	2	0	9999	4	55	2264	
0.00000+	0	0.00000+	0	0	0	1	9999	4	55	2265	
0.00000+	0	2.10500+	6	0	0	1	9999	4	0	2266	
-1.00000+	0	5.00000-	1	1.00000+	0	5.00000-	1	09999	4	56	2267
0.00000+	0	8.00000+	6	0	0	1	09999	4	56	2268	
-1.00000+	0	5.00000-	1	1.00000+	0	5.00000-	1	29999	4	56	2269
2.70590+	4	5.84269+	1	0	2	0	9999	4	56	2270	
0.00000+	0	5.84269+	1	0	2	0	29999	4	56	2271	
0.00000+	0	0.00000+	0	0	0	1	9999	4	56	2272	
0.00000+	0	2.10500+	6	0	0	1	9999	4	56	2273	
-1.00000+	0	5.00000-	1	1.00000+	0	5.00000-	1	29999	4	56	2274
0.00000+	0	8.00000+	6	0	0	1	9999	4	56	2275	
-1.00000+	0	5.00000-	1	1.00000+	0	5.00000-	1	9999	4	56	2276
2.70590+	4	5.84269+	1	0	2	0	9999	4	0	2277	
0.00000+	0	5.84269+	1	0	2	0	09999	4	57	2278	
							09999	4	57	2279	

0.00000+ 0	0.00000+ 0	0	0	1	29999 4 57 2280
2	2				9999 4 57 2281
0.00000+ 0	2.19600+ 6	0	0	1	29999 4 57 2282
2	2				9999 4 57 2283
-1.00000+ 0	5.00000- 1	1.00000+ 0	5.00000- 1		9999 4 57 2284
0.00000+ 0	5.00000+ 6	0	0	1	29999 4 57 2285
2	2				9999 4 57 2286
-1.00000+ 0	5.00000- 1	1.00000+ 0	5.00000- 1		9999 4 57 2287
					9999 4 0 2288
2.70590+ 4	5.84269+ 1	0	2	0	09999 4 58 2289
0.00000+ 0	5.84269+ 1	0	2	0	09999 4 58 2290
0.00000+ 0	0.00000+ 0	0	0	1	29999 4 58 2291
2	2				9999 4 58 2292
0.00000+ 0	2.36900+ 6	0	0	1	29999 4 58 2293
2	2				9999 4 58 2294
-1.00000+ 0	5.00000- 1	1.00000+ 0	5.00000- 1		9999 4 58 2295
0.00000+ 0	5.00000+ 6	0	0	1	29999 4 58 2296
2	2				9999 4 58 2297
-1.00000+ 0	5.00000- 1	1.00000+ 0	5.00000- 1		9999 4 58 2298
					9999 4 0 2299
2.70590+ 4	5.84269+ 1	0	2	0	09999 4 59 2300
0.00000+ 0	5.84269+ 1	0	2	0	09999 4 59 2301
0.00000+ 0	0.00000+ 0	0	0	1	29999 4 59 2302
2	2				9999 4 59 2303
0.00000+ 0	2.54200+ 6	0	0	1	29999 4 59 2304
2	2				9999 4 59 2305
-1.00000+ 0	5.00000- 1	1.00000+ 0	5.00000- 1		9999 4 59 2306
0.00000+ 0	5.00000+ 6	0	0	1	29999 4 59 2307
2	2				9999 4 59 2308
-1.00000+ 0	5.00000- 1	1.00000+ 0	5.00000- 1		9999 4 59 2309
					9999 4 0 2310
2.70590+ 4	5.84269+ 1	0	2	0	09999 4 91 2311
0.00000+ 0	5.84269+ 1	0	2	0	09999 4 91 2312
0.00000+ 0	0.00000+ 0	0	0	1	29999 4 91 2313
2	2				9999 4 91 2314
0.00000+ 0	2.44000+ 6	0	0	1	29999 4 91 2315
2	2				9999 4 91 2316
-1.00000+ 0	5.00000- 1	1.00000+ 0	5.00000- 1		9999 4 91 2317
0.00000+ 0	2.00000+ 7	0	0	1	29999 4 91 2318
2	2				9999 4 91 2319
-1.00000+ 0	5.00000- 1	1.00000+ 0	5.00000- 1		9999 4 91 2320
					9999 4 0 2321
					9999 0 0 2322
2.7059 + 4	5.84269+ 1	0	0	1	09999 5 16 2323
1.0637 + 7	0.0 + 0	0	9	1	29999 5 16 2324
2	2				9999 5 16 2325
1.0637 + 7	1.0 + 0	2.0 + 7	1.0 + 0		9999 5 16 2326
0.0 + 0	0.0 + 0	0	0	1	39999 5 16 2327
3	5				9999 5 16 2328
1.0637 + 7	8.0 + 5	1.50000+ 7	1.40000+ 6	2.00000+ 7	1.74000+ 6
					9999 5 0 2333
2.7059 + 4	5.84269+ 1	0	0	1	09999 5 91 2331
2.44000+ 6	0.00000+ 0	0	9	1	29999 5 91 2332
2	2				9999 5 91 2333
2.44000+ 6	1.00000+ 0	2.00000+ 7	1.00000+ 0		9999 5 91 2334
0.00000+ 0	1.00000+ 0	0	0	1	149999 5 91 2335
1	5				9999 5 91 2336
2.44000+ 6	5.00000+ 5	2.50000+ 6	6.10000+ 5	3.00000+ 6	6.60000+ 5
					9999 5 91 2337
4.00000+ 6	7.70000+ 5	5.00000+ 6	6.70000+ 5	6.00000+ 4	9.50000+ 5
					9999 5 91 2338
7.00000+ 6	1.00000+ 6	6.00000+ 5	1.20000+ 6	9.00000+ 5	1.32000+ 6
					9999 5 91 2339

1.00000+ 7	1.40000+ 6	1.20000+ 7	1.74000+ 6	1.40000+ 7	1.95000+ 6	9999 5 91 2340
1.50000+ 7	2.20000+ 6	2.00000+ 7	2.60000+ 6			9999 5 91 2341
						9999 5 0 2342
						9999 0 0 2343