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COMPARATIVE ANALYSIS OF ILLICIT LIQUOR IN ANDAMAN AND NICOBAR ISLANDS

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Abstract : This study is based on the examination of different illicit liquor consumed by the citizens of Andaman and Nicobar and illegally smuggling in this territory. Comparative study of different illicit liquor samples was examined at Forensic Science Laboratory, Sri Vijaya Puram, Andaman and Nicobar Islands. A total of 100 samples of illicit liquor were analyzed to determine presence of ethanol concentration and also checked the presence of methanol. In this comparative analysis of illicit liquor there were two methods used for quantitative analysis, i.e. Alcolyzer method and the Pycnometer method. For qualitative analysis, some chemical tests were applied, including the Sulpho-molybdic Acid test, Iodoform test, and Chromotropic Acid test, which were employed to detect ethanol and methanol.

The findings reveal that several samples contained irregular alcohol concentrations which ranged from 4% v/v to 60% v/v.

KEYWORDS: Illicit liquor, ethanol methanol, Alcolyzer method, Pycnometer method

1. INTRODUCTION

1.1 What is Illicit liquor

Illicit liquor refers to alcoholic beverages that are produced, distributed, or sold illegally, often without regulatory oversight, taxation, or quality control. This type of liquor is commonly associated with health risks due to the possible presence of toxic substances such as methanol, which can cause blindness or death. Illicit liquor is frequently produced in unregulated environments, including homemade distilleries and underground markets, and is often referred to as "moonshine," "bootleg liquor," or "counterfeit alcohol.", (Matzopoulos *et al*., 2004).

Alcohol drinking can be broadly classified into recorded and unrecorded consumption. Recorded alcohol is typically comprised of alcoholic beverages that are legally sold and quality controlled. They are traceable via official statistics on alcohol consumption based on production, sales and/or trade data (Rehm, Klotsche, & Patra, 2007). The term ―unrecorded alcohol‖, on the other hand, carries with it multiple definitions, under four major categories (Lachenmeier *et al*., 2009): (1) illegally produced or smuggled alcohol, (2) surrogate alcohol, i.e. non-beverage alcohol not officially intended for human consumption, such as perfume, (3) alcohol not registered in the country where it is consumed, and (4) legal unregistered alcohol (e.g. homemade alcohol in countries where it is legal). Of course, there are various subcategories within these broad categories.

Illicit liquor is manufactured either in the home or in small, unlicensed breweries and is cheap, manufactured with the intent to evade taxes. Surrogate alcohol has a high ethanol content, but is not manufactured for human consumption, though it is used as a substitute for liquor. Generally, surrogate alcohol can be found in medicinal preparations, colognes, sprays, etc., that contain ethyl alcohol as one of the compounds (Punia *et al*., 2017).

1.2 TYPES OF ALCOHOL

India is the world‘s third-largest market for alcoholic beverages, with an estimated value of $35 billion. The spirit segment, which includes whisky and rum, is expected to grow to $41 billion by 2022.

Alcoholic beverages are broadly classified as beers, wines and spirits. The spirit segment in India, which includes whisky, brandy, rum and vodka, is expected to grow by **25 percent to Rs 2.92 lakh crore ($41 billion) by 2022**, according to **Euromonitor International**.

Indian Made Foreign Liquors [IMFL]- which are drinks made in India according to specification of internationals brands Eg- Whisky, Rum, Brandy, Vodka and Gin.

Beers of different strengths and wine.

Indian made country liquor (IMCL)- which are drinks made in India with government license.

Home brewed country liquor (HBCL)- which are illegally brewed but are consumed widely, like Toddy, Mahua and Chang.

Methanol is the most dangerous adulterant in Illicit liquor and is often the cause of life threatening – hooch tragedies.

Alcohol drinks are available in the various forms –

Distilled spirits or IMFL (Indian made foreign liquor such as whisky, brandy, rum, and gin contain 35% to 50% of alcohol, whereas

Beers ordinally contain 4 to 5% of alcohol.

Wines contain approximately of 12% of alcohol.

However, fortified liquor may contain about 20% of alcohol.

Undistilled Drinks-

Beer-

Beer is the most popular alcoholic beverage worldwide. In fact, after water and tea, beer is the most commonly-consumed drink in the world. Beer is also most likely the oldest alcoholic drink in history. A standard beer, whether it be a lager or an ale, has between 4% to 6% ABV, although some beers have higher or lower concentrations of alcohol. Beers are primarily categorized into two main types based on fermentation methods: ales and lagers.

- **Ales**: Utilize top-fermenting yeast at warmer temperatures, resulting in a wide range of flavors. Examples include:
  - **India Pale Ales (IPAs)**: Known for their hoppy and bitter profiles.
  - **Pale Ales**: Offer a balance of malt and hop flavors.
  - **Stouts and Porters**: Dark beers with rich, roasted flavors.
- **Lagers**: Employ bottom-fermenting yeast at cooler temperatures, producing clean and crisp flavors. Examples include:
  - **Pilsners**: Light-bodied with a pronounced hop bitterness.
  - **Bocks**: Stronger lagers with a malty sweetness. Other notable styles encompass:
- **Wheat Beers**: Light and often citrusy, ideal for warm weather.
- **Sour Beers**: Intentionally tart, achieved through specific fermentation techniques.
- **Belgian Ales**: Known for their complex, fruity, and spicy flavors. The Brewing Process of Beer

Brewing beer involves several key steps:

1. **Malting**: Grains are soaked, germinated, and dried to activate enzymes that convert starches into fermentable sugars.
2. **Mashing**: Malted grains are mixed with water and heated, allowing enzymes to break down starches into sugars, creating a sweet liquid called wort.
3. **Boiling**: The wort is boiled, and hops are added for bitterness, flavor, and aroma.
4. **Fermentation**: After cooling, yeast is introduced to the wort to ferment the sugars into alcohol and carbon dioxide.
5. **Conditioning**: The beer is aged to develop flavors and carbonation.
6. **Packaging**: The finished beer is bottled, canned, or kegged for distribution.

Wine-

Wine is another popular and ancient alcoholic beverage. Standard wine has less than 14% ABV. Champagne, the most well-known sparkling wine, has an alcohol concentration of about 10% to 12%. Some wines are ―fortified‖ with distilled alcohol. Port, Madeira, Marsala, Vermouth, and Sherry are examples of fortified wines. They usually have about 20% ABV.

Types of Wine:

1. Red Wine

Made from dark-colored grape varieties, red wine is fermented with the grape skins, which impart its color and tannins. Common types include Cabernet Sauvignon, Merlot, and Pinot Noir.

2. White Wine

Produced from green or yellowish grapes, white wine is fermented without the grape skins. Varieties include Chardonnay, Sauvignon Blanc, and Pinot Grigio.

3. Rosé Wine

A type of wine that incorporates some of the color from the grape skins but not enough to qualify it as red wine. It's typically made from red grape varieties and has a pink hue.

4. Sparkling Wine

This wine undergoes a secondary fermentation process to produce carbonation. Champagne, Prosecco, and Cava are popular examples.

Wine Production

1. **Harvesting**: Grapes are picked from vineyards, usually when they reach optimal ripeness.
2. **Crushing and Pressing**: Grapes are crushed to extract juice. For red wines, fermentation occurs with the skins; for white wines, the juice is separated from the skins.
3. **Fermentation**: Yeast is added to the juice to convert sugars into alcohol.
4. **Aging**: Wines are aged in various containers, such as stainless-steel tanks or oak barrels, to develop flavors.
5. **Bottling**: After aging, the wine is filtered and bottled for sale.

Hard Cider-

Hard cider is an alcoholic beverage made by fermenting apple juice. The fermentation process involves yeast converting the sugars in the juice into alcohol and carbon dioxide. While apples are the most common fruit used, other fruits can also be utilized to produce cider.

The alcohol by volume (ABV) of hard cider typically ranges from 4.5% to 7%, similar to many beers. However, some craft ciders can have higher ABVs, reaching up to 10% or more, especially if they undergo a second fermentation or if additional sugars are added.

Hard Cider Production

1. **Harvesting**: Apples are picked when ripe.
2. **Pressing**: The apples are crushed to extract the juice.
3. **Fermentation**: Yeast is added to the juice to ferment the sugars into alcohol.
4. **Aging**: The cider may be aged to develop flavors.
5. **Packaging**: The finished cider is filtered and bottled or canned for sale.

Mead-

Mead, often referred to as "honey wine," is an ancient alcoholic beverage crafted by fermenting honey with water, sometimes incorporating fruits, spices, grains, or hops. Its alcohol content varies widely, typically ranging from 3.5% to over 20% ABV, depending on the fermentation process and ingredients used.

Mead Production:

The basic ingredients for mead are honey, water, and yeast.

1. **Mixing**: Combining honey and water to create a must.
2. **Fermentation**: Adding yeast to the must, allowing it to ferment.
3. **Aging**: Letting the mead mature to develop its flavors.

Sake-

Sake is crafted from four primary ingredients: polished rice, water, yeast, and *koji* mold (*Aspergillus oryzae*). The *koji* mold plays a crucial role by breaking down the rice starches into fermentable sugars, facilitating the fermentation process. This method distinguishes sake from wine, which ferments the natural sugars found in grapes, and aligns it more closely with beer production techniques. Sake typically has an alcohol content ranging from 13% to 17% ABV

Sake Production:

1. **Rice Polishing**: The outer layers of the rice grains are milled away to remove proteins and oils, which can affect the flavor. The degree of polishing influences the sake's classification and taste.
2. **Washing and Soaking**: Polished rice is washed to remove residual bran and then soaked to achieve the desired moisture content.
3. **Steaming**: The soaked rice is steamed to gelatinize the starches, making them accessible for enzymatic action.
4. **Koji Making**: A portion of the steamed rice is inoculated with *koji* mold and incubated to develop enzymes that convert starches into sugars.
5. **Yeast Starter (Shubo)**: A mixture of steamed rice, water, *koji*, and yeast is prepared to cultivate a robust yeast population.
6. **Main Fermentation (Moromi)**: The yeast starter is combined with additional steamed rice, water, and *koji* in a fermentation tank. This mixture ferments over several weeks, during which the starches are converted into sugars and then into alcohol.
7. **Pressing, Filtration, and Pasteurization**: After fermentation, the mixture is pressed to separate the liquid from the solids. The liquid is then filtered and often pasteurized to stabilize the sake.
8. **Aging and Bottling**: The sake is aged for a period to develop its flavors before being bottled for consumption.

Distilled Drinks (Liquors and Spirits)-

Gin-

Gin is a distilled alcoholic beverage known for its predominant flavor of juniper berries. It is typically clear and ranges in alcohol content from 35% to 60% ABV (alcohol by volume).
Beyond juniper, gin is often infused with a variety of botanicals, including coriander, citrus peel, angelica root, and cardamom, contributing to its complex flavor profile.

Gin Production:

1. Base Spirit

Gin production begins with a neutral spirit, usually derived from grains like barley, corn, or rye. This base is distilled to a high purity level, ensuring a clean canvas for botanical infusion.

2. Botanical Infusion

The defining step in gin production is the infusion of botanicals. Juniper berries are mandatory, but distillers often include a mix of other botanicals to create unique flavor profiles. These botanicals can be added directly to the spirit or suspended in a basket within the still, allowing vapours to extract their essences during distillation.

3. Distillation Methods

- Distilled Gin: Produced by redistilling the base spirit with botanicals.
- Compound Gin: Made by adding botanical extracts or essences to the base spirit without redistillation.

Brandy-

Brandy is distilled wine. The concentration of alcohol in brandy ranges from 35% to 60%. For example, one famous brandy, Cognac, has 40% ABV. Brandy is a distilled spirit made by fermenting and distilling fruit juice, most commonly grapes. The term "brandy" originates from the Dutch word *brandewijn*, meaning "burned wine," referencing the heat-based distillation process. While grape-based brandy is the most prevalent, variations made from other fruits like apples, cherries, and pears are also popular and are typically labeled to indicate the specific fruit used.

Brandy Production:

1. **Fermentation**: Fruit juice is fermented to convert sugars into alcohol.

2. **Distillation**: The fermented liquid is heated to separate alcohol from water and other components, concentrating the alcohol content.
3. **Aging**: The distilled spirit is aged in wooden barrels, often oak, which imparts flavors and color to the brandy.
4. **Blending and Bottling**: After aging, brandies may be blended for consistency and then bottled.

Whiskey-

Whisky is produced by fermenting a mash of cereal grains—such as barley, corn, rye, or wheat—and distilling the resulting liquid. The distilled spirit is then aged in wooden barrels, often oak, which imparts color and complex flavors.

Whisky Production:

1. **Mashing & Fermentation**: Grains are milled and mixed with water to create a mash. Yeast is added to ferment the sugars into alcohol, producing a "distiller's beer" with an alcohol content of about 7–10% ABV.
2. **Distillation**: The fermented mash is distilled, concentrating the alcohol to around 70–80% ABV. This process removes impurities and concentrates flavors.
3. **Aging**: The distilled spirit is aged in wooden casks, which influence the whisky's flavour, aroma, and colour. The aging process allows the spirit to develop complexity over time.
4. **Bottling**: After aging, the whisky is diluted to the desired bottling strength, typically around 40% ABV, and then bottled for consumption.

Rum-

Rum, a distilled drink made from fermented sugarcane or molasses, has a typical alcohol concentration of 40% ABV. Some rum is ―overproof,‖ meaning that it has alcohol concentration of at least 57.5% ABV. Most overproof rum exceeds this minimum, usually reaching 75.5% ABV, which is equivalent to 151 proofs.

Rum Production:

1. **Fermentation**: The base ingredient—molasses or sugarcane juice—is mixed with water and yeast to ferment, converting sugars into alcohol. The fermentation process can vary in duration, influencing the flavour profile of the rum.
2. **Distillation**: The fermented liquid is distilled to concentrate the alcohol. Distillation methods include pot stills, which produce fuller-flavored rums, and column stills, which yield lighter spirits. For example, Kirk and Sweeney rum utilizes a 4-column distillation system to achieve its desired profile.
3. **Aging**: The distilled spirit is aged in barrels—often oak—to develop its flavor and color. Aging durations vary, with some rums aged for several years. The tropical climate in many rum-producing regions accelerates the aging process, leading to a faster development of flavors.
4. **Blending and Bottling**: After aging, rums may be blended to achieve a consistent flavor profile before being bottled. Some rums are filtered to remove color, while others may have caramel added for colouring.

Tequila-

Tequila is a type of liquor. The main ingredient of tequila is the Mexican agave plant. The alcohol concentration of tequila is typically about 40% ABV.

Tequila Production:

1. **Harvesting**: Agave plants are cultivated for 7–10 years until they mature. The heart of the plant, known as the *piña*, is harvested by skilled workers called *jimadores*.
2. **Cooking**: The *piñas* are cooked to convert complex carbohydrates into fermentable sugars. This is typically done in large ovens or autoclaves.
3. **Extraction**: After cooking, the agave is crushed to extract the sugary juice, which is then fermented.
4. **Fermentation**: The extracted juice ferments over several days, transforming sugars into alcohol.
5. **Distillation**: The fermented liquid is distilled, usually twice, to purify and concentrate the alcohol.

6. **Aging (if applicable)**: Depending on the desired type, tequila may be aged in wooden barrels to develop its flavour profile.

Vodka-

Vodka, a liquor usually made from fermented grains and potatoes, has a standard alcohol concentration of 40% ABV in the United States.

Vodka productions:

1. **Fermentation**: The chosen base ingredient—be it grains like wheat or rye, potatoes, or alternative sources such as sugar beets or fruits—is combined with water and yeast. The yeast ferments the sugars present, producing alcohol.
2. **Distillation**: The fermented liquid is distilled, often multiple times, to increase the alcohol content and remove impurities. This process typically yields a high-proof spirit around 95% alcohol by volume (ABV).
3. **Filtration**: Post-distillation, the spirit is filtered—commonly through activated charcoal—to further purify it and eliminate any remaining congeners or flavors, contributing to vodka's characteristic neutrality.
4. **Dilution**: The high-proof alcohol is then diluted with water to achieve the desired bottling strength, usually around 40% ABV (80 proof).

Absinthe-

Absinthe is a spirit made from a variety of leaves and herbs. There is no evidence for the idea that absinthe is a hallucinogen, but it does have a high alcohol concentration. Some forms of absinthe have about 40% ABV, while others have as much as 90% ABV.

Absinthe Formation:

1. **Maceration**: A blend of herbs—including wormwood, anise, fennel, hyssop, and lemon balm—is soaked in high-proof neutral alcohol to extract their flavours.
2. **Distillation**: The macerated mixture is then distilled to purify the spirit and concentrate its botanical essences.
3. **Coloration (optional)**: Some absinthes undergo a secondary maceration with additional herbs like petite wormwood and hyssop to impart a natural green colour.
4. **Bottling**: The final product is typically bottled at a high alcohol content, ranging from 45% to 74% ABV.

Everclear-

Everclear, a grain-based spirit, is another drink with a heavy concentration of alcohol. The minimum ABV of Everclear is 60%, but Everclear can also have 75.5% and 95% ABV. Everclear Preparation:

1. Ingredient Selection: Everclear is primarily made from corn, chosen for its high starch content, which is essential for alcohol production.

2. Saccharification: The corn undergoes saccharification, where enzymes convert starches into fermentable sugars.

3. Fermentation: Yeast is added to the sugar-rich mash, fermenting it into a low-alcohol "beer" with an ABV of approximately 5–21%.

4. **Distillation**: The fermented mash is distilled using industrial column stills. This process separates ethanol from water and impurities, increasing the alcohol concentration.

5. **Rectification**: Multiple distillations are performed to further purify the spirit, achieving up to 95.6% ABV—the maximum purity attainable through distillation alone.

6. **Quality Control**: Upon arrival at Luxco's facility, each batch is tested for proof, clarity, and purity before bottling.

1.3 TYPES OF LIQUOR CONSUME IN ANDAMAN AND NICOBAR ISLANDS

In the Andaman and Nicobar Islands, the most commonly consumed types of liquor include locally brewed beverages like "Handia" and "Toddy," alongside Indian Made Foreign Liquor (IMFL) such as whiskey, brandy, rum, and beer, with "Toddy" being particularly popular among the Nicobarese people; the preference for locally brewed drinks is significantly higher than commercially available options.

- **Locally brewed beverages:**
  - **Handia:** A traditional fermented drink, widely consumed.
  - **Toddy:** Primarily preferred by the Nicobarese community.
  - **Jungli liquor:** Another locally brewed beverage.
- **Indian Made Foreign Liquor (IMFL):**
  - Whiskey
  - Brandy
  - Rum
  - Vodka

Almost 62% of the alcohol consumers prefer locally brewed beverages in Andaman and Nicobar Islands (Handia: 26%, Toddy: 23%, and Jungli liquor:13%). The remaining (38%) prefer Indian- Made Foreign Liquor (IMFL) such as whiskey (20%), brandy (8.1%), rum (7%), vodka (1.6%), beer (1%), and gin (0.3%).

Jungli Liquor-

Jungli liquor refers to illicit or homemade alcoholic beverages, often brewed in rural or forested areas using traditional or unregulated methods. The term "Jungli" (meaning "wild" in Hindi and other South Asian languages) suggests that this type of liquor is produced in uncontrolled environments, outside government regulation, and often using unconventional or unsafe ingredients.

Characteristics of Jungli Liquor:

1. **Illegally Produced:** Made without licenses or quality control, often to evade taxes.
2. **Homemade Ingredients:** Usually distilled from molasses, jaggery, fruits, or grains using crude methods.
3. **Health Risks:** May contain **methanol** or other toxic substances, leading to poisoning, blindness, or death.

Jungle Daru is very famous in Katchal of Andaman and Nicobar Island, people prepare it from forest items, without proper distillation. And it is dangerous to health.

The alcohol content in Jungli liquor can range from 30% to 70% ABV (alcohol by volume), with some homemade or illicit varieties reaching even higher percentages.

Indian Made Foreign Liquor-

IMFL stands for Indian Made Foreign Liquor, which is a category of alcoholic beverages produced in India but designed to resemble or imitate foreign (imported) liquors such as whisky, rum, gin, vodka, and brandy. IMFL products are made with the same production processes used for international brands but are typically produced locally for the Indian market.

Production Process:

- IMFL is made by distilling fermented materials like grains, molasses, or fruits, followed by blending and aging processes (especially for whiskey and brandy) to enhance flavor and quality.
- These liquors are typically blended with high-quality ingredients and then bottled in similar packaging to international brands, often featuring the same label style.

Popular Varieties of IMFL:

- **Whisky** – Produced from fermented grains, it is one of the most popular IMFL varieties in India.
- **Rum** – Typically made from sugarcane molasses, it is also a widely consumed IMFL.
- **Brandy, Gin, and Vodka** – These spirits also fall under the IMFL category and are manufactured to cater to both domestic and export markets.

In the Andaman and Nicobar Islands, the consumption of Indian Made Foreign Liquor (IMFL) varies among the population. A study published in the *Indian Journal of Public Health* in 2017 found that among male alcohol consumers, 38% preferred IMFL.

The National Family Health Survey (NFHS) 2019-2021 reported that 42.1% of men and 2.2% of women aged 15 and above in the Andaman and Nicobar Islands consume alcohol.

Handia-

Handia is a traditional alcoholic beverage widely consumed in parts of India, particularly in rural areas and tribal communities. It is a type of fermented rice beer, and its preparation and consumption are often linked to cultural and social practices. Here's an overview of handia: **Ingredients and Preparation:**

- **Main Ingredients:** Handia is made from fermented rice, water, and herbal ingredients or yeast, which aid in the fermentation process.

- **Fermentation Process:** The rice is typically cooked and mixed with a culture made from previous batches of handia, which contains wild yeast. This mixture is then allowed to ferment for several days, typically ranging from 3 to 7 days, depending on the desired strength.

Handia generally has a low to moderate alcohol content, typically ranging from 4% to 8% ABV, but this can vary based on the fermentation period and the ingredients used.
Handia is often consumed during festivals, social gatherings, and rituals, especially among tribal communities in states like Jharkhand, Odisha, Chhattisgarh, Madhya Pradesh, and Andaman and

Nicobar Islands.
While there is no specific study detailing the exact percentage of Handia consumption in the Andaman and Nicobar Islands, research into alcohol consumption in the region suggests that traditional alcoholic beverages like Handia continue to be consumed alongside more mainstream alcoholic beverages, including IMFL.

According to available data, in the Andaman and Nicobar Islands, around 62% of alcohol consumers prefer locally brewed beverages like "Handia" (26%), "Toddy" (23%), and "Jungli" (13%), while the remaining 38% opt for Indian Made Foreign Liquor (IMFL) including whiskey (20%), brandy (8.1%), rum (7%), vodka (1.6%), beer (1%), and gin (0.3%).

Toddy-

In the Andaman and Nicobar Islands, toddy is a traditional, locally significant beverage made from the sap of palm trees—particularly the coconut palm and palmyra palm.

Ingredients and Preparation:

Tapping the Palm

- Sap is extracted from the inflorescence (flower stalk) of coconut or palmyra palms.
- The tip of the flower stalk is beaten or bruised to encourage sap flow.
- A clay pot or bamboo container is tied below the cut to collect the sap.

Collection Timing

- Collected usually early in the morning and late evening.
- Fresh sap is sweet and non-alcoholic if consumed immediately.

Fermentation

- Within 2–4 hours, natural yeasts in the air begin to ferment the sugar-rich sap.
- No added yeast or chemicals—completely natural fermentation.

Storage

- Typically stored in earthen pots or bamboo containers.
- Continuous fermentation makes it sour and alcoholic within a day.

Homebrews: Among alcohol consumers, a significant portion prefers locally brewed beverages. Specifically, 62% of male drinkers and 60% of female drinkers favor homebrews such as toddy, handia, and jungli liquor.

Indian Made Foreign Liquor (IMFL): The remaining 38% of male drinkers and 40% of femaledrinkers consume IMFL.

Figure 1: Andaman and Nicobar Police Team busts illegal liquor operation

1.4 Introduction of the Methods

In this study, two methods were employed to estimate the percentage of ethanol in illicit liquor: the pycnometer method and the Alcolyzer instrument method. In the pycnometer method, percentage of Ethanol is calculated by the principle of Specific Gravity and in Alcolyzer instrument, determination of percentage of Ethanol by using two different principles-based instruments first one densitometer and second is Narrow infrared spectrophotometer (NIR). Alcolyser gives rapid and accurate results to determine the percentage of Ethanol. Both methods were compared to assess their reliability and applicability for analyzing illicit alcoholic beverages.

Pycnometer

Determine the specific gravity of the distilled sample by specific gravity bottle and apply the bottle correction and temperature correction for 20 c as per the table showing weight in gram of the spirit of temperatures 610 to 1000 given under the instructions for ascertaining the real alcoholic strength of drugs chemicals, medicines dietetics and toilet preparations entered for test prepared by R.L. Jenks, F.I.C., Examiner for Customs and Excise, Calcutta (Central Board of Revenue) 1914-1928 Revised-1936 and find out the quantity of alcohol (% of proof spirit and % of alcohol V/V) from the table showing the relation between the specific gravity of spirits at 600/600 F and the percentage of ethyl alcohol by weight and by volume with the corresponding percentage of proof spirit issued under the authority of the Commissioner of Her Majesty‘s Customs and Excise, London, Her Majesty‘s stationery office 1955, Reprinted 1971 (Annexure I & II).

Alcolyzer

It is an instrument which is used to determine the percentage and density of alcohol. It gives accurate readings, and determines alcohol content of all liquors like beer, wine, ciders, etc. It is easy to use and takes approx. 5 min. to take for analysing one sample. In this study, samples were analysed by using Anton Paar DMA 4501 model alcolyzer.

The instrument measures the density by use of the oscillating U-tube oscillation method by which a norosil u tube 0.7 mm glassware is present, which has been first introduced on the market by Anton Paar in 1967. This cutting-edge digital density and concentration meter combines high precision with easy operation and robust design.

Alcolyzer 3001 determines the alcohol content of beer and other alcoholic beverages by a patented Near Infrared Rays analysis method which gives you an accurate percentage of ethanol present in the sample.

Figure 2: Alcolyzer DMA 4501

2. REVIEW OF LITERATURE

1. Ethanol and water are the main components of most alcoholic beverages, although in some very sweet liqueurs the sugar content can be higher than the ethanol content. Ethanol (CAS Reg. No. 64–17–5) is present in alcoholic beverages as a consequence of the fermentation of carbohydrates with yeast. It can also be manufactured from ethylene obtained from cracked petroleum hydrocarbons. The alcoholic beverage industry has generally agreed not to use synthetic ethanol manufactured from ethylene for the production of alcoholic beverages, due to the presence of impurities. In order to determine whether synthetic ethanol has been used to fortify products, the low ^{14}C content of synthetic ethanol, as compared to fermentation ethanol produced from carbohydrates, can be used as a marker in control analyses (Weeny et al., 1970). [1]

2. Beer, wine and spirits also contain volatile and nonvolatile flavor compounds. Although the term ‗volatile compound' is rather diffuse, most of the compounds that occur in alcoholic beverages can be grouped according to whether they are distilled with alcohol and steam, or not. Volatile compounds include aliphatic carbonyl compounds, alcohols, monocarboxylic acids and their esters, nitrogen- and Sulphur-containing compounds, hydrocarbons, terpenic compounds, and heterocyclic and aromatic compounds. Nonvolatile extracts of alcoholic beverages comprise unfermented sugars, di- and tribasic carboxylic acids, colouring substances, tannic and polyphenolic substances, and inorganic salts. The flavour composition of alcoholic beverages has been described in detail in several reviews (Suomalainen *et al.*, 1970, Amerine *et al.*, 1972), and a recent review on the compounds occurring in distilled alcoholic beverages is available (te Heide, 1986). The volatile compounds of alcoholic beverages and distillates generally originate from three sources: raw materials, fermentation and the wooden casks in which they are matured (Jouret et al., 1975).

3. During maturation, unpleasant flavours, probably caused by volatile sulphur compounds, disappear. Extensive investigations on the maturation of distillates in oak casks have shown that many compounds are liberated by alcohol from the walls of the casks (Jouret *et al*.,1975). Lignin plays an important role and is responsible for the occurrence of some aromatic aldehydes and phenolic compounds (Nykanen et al., 1984). These compounds are liberated from oak during the maturation process, together with monosaccharides (pentoses, quercitol), carboxylic acids and ‗whisky lactone' (5-butyl-4-methyldihydro-2(3*H*)- furanone). The occurrence of aromatic compounds has been considered a manifestation of the degradation (oxidation) of oak lignin.

4. There are numerous traditional alcoholic beverages which are locally produced and consumed among native peoples of many countries around the world. Such types of drinks are very commonly produced in a variety of ways as home-made beverages in many African countries (WHO, 2004). Home-brewed beverages have several names mostly reflecting the areas where they are produced but most of them are produced in almost similar ways by distillation and fermentation of grain cereals, fruits and/or vegetables (Shale *et al.*, 2014). Distillation is a more complex time-consuming method requiring specialized equipments to produce potent alcoholic beverages. Some of the most culturally important traditional beverages in Africa are: \`tella\` in Ethiopia (Shale et al., 2014) \` thobwa\` in Malawi (Matumba *et al*., 2011), \`burukutu\` in Nigeria (Sawadogo-Lingani et al., 2010) \`tonto\` in Uganda (Mwesigye *et al*., 1995) and \`muratina\` in Kenya (Aka *et al*., 2014). These drinks are very popular, perhaps the most widely consumed beverage types because of the nutritional, therapeutic, social and religious values attached to them (Solange, 2014). Indeed, studies also confirmed that fermented products in general can improve sensory

qualities and nutritional values by enriching the product with essential proteins and vitamins (Steinkraus, 1986).

5. The other concerning aspect in many African countries is, the rapidly changing drinking culture. In traditional African society drinking alcohol has been an occasional and communal activity, associated with particular communal festivals (Room, 2014; Room *et al*., 2002). People do not drink alone or for the sake of drinking only, but these days this values are changing due to expansions of urbanization together with income inequality, along with the tendency to drink excessively inexpensive illegal and/or homemade high alcoholic beverages to alleviate their stress and have good time (Room *et al*., 2002). According to the latest WHO (2014) global status report on alcohol consumption showed that about 30% of all alcohol consumed globally is unrecorded. This rate, however, is much higher in Eastern Mediterranean, South East Asia and Africa (56, 69 and 31%).

6. Traditional alcohol beverages are widely consumed among different ethnic groups of the country as a prominent part of the local traditions of major social events including public holidays, wedding, funerals and other forms of festivities. Some of the most widely consumed home-brewed beverages are Tella, Shamita, Tej, Borde, and Areki. Of these traditionally fermented beverages of Tej, Tella and Areki are the most preferred drinks for big festive occasions.

7. Methanol, as the most common and main alcohol type, is used in producing counterfeit and illegal alcoholic beverages instead of ethanol, i.e., due to its low cost (Lachenmeier *et al*.,2009). Moreover, it is produced during the non-standard procedure of alcoholic beverages production due to the fermentation of pectin and sugars. Accordingly, methanol poisoning is a frequent consequence of consuming illegal and counterfeit alcoholic drinks. Therefore, sporadic and epidemic methanol poisoning cases were reported world-wide, as a result of using illegal alcoholic products (Karadeniz *et al*., 2011). Thus, consuming illegal and homemade alcoholic beverages, especially in low-income individuals, is con considered as a potential source of methanol poisoning (Lachenmeier *et al*., 2008).

8. Alcoholic beverages, though widely consumed for recreational and social purposes, have become a major concern due to adulteration and contamination, especially in unregulated markets. The ingestion of alcoholic drinks containing nonqualified raw materials and toxic adulterants like **methanol, furfural, urea, and acetone** has led to numerous cases of poisoning across India and globally. These adulterants can result in **serious health consequences** such as metabolic issues, blindness, neurological damage, and even death.

9. Methanol, in particular, is a highly toxic alcohol often mistakenly ingested due to its similarity to ethanol. It is frequently used to illicitly increase alcohol content due to its lower cost. According to the **Bureau of Indian Standards (1986)**, ethanol levels in Indian-made foreign liquor (IMFL) should be 42.8% and 33.3% in country liquor. However, the lack of regulation and intentional adulteration often leads to significant deviations, rendering the liquor unsafe for consumption.

10. Illicitly produced alcoholic beverages remain a global concern due to their frequent contamination with toxic substances, particularly methanol. As highlighted by Arslan et al. (2015), methanol is often intentionally added or inadvertently formed during fermentation processes in unregulated settings, where safety standards are absent. Methanol toxicity arises not from methanol itself but from its toxic metabolites—formaldehyde and formic acid—which lead to metabolic acidosis, optic nerve damage, and death.

11. The study emphasizes the importance of both presumptive and confirmatory testing methods in forensic investigations. Color-based chemical tests like the **chromotropic acid test** and **Schiff's test** serve as quick screening tools, showing visible color changes in the presence of methanol. However, for precise quantification and confirmation, **UV-Visible (UV-Vis) spectroscopy** was used, with methanol detection occurring consistently in the 340–360 nm absorption range.

12. Liquor produced legally must adhere to standards set by the Bureau of Indian Standards (BIS), specifying that Indian-made foreign liquor (IMFL) like whisky, rum, and gin should contain 42.8% ethanol by volume, while country liquor should have 33.3%. However, clandestine production often exceeds these ethanol levels and introduces additional impurities, such as industrial methylated spirit and heavy metals.

13. Common adulterants include methanol, fusel oil, aldehydes, copper, urea, and even narcotic substances. Methanol, in particular, is frequently associated with fatal poisoning cases due to its toxicity (Lachenmeier et al., 2021; Rostrup et al., 2016). Adulterants such as copper and iron may leach from containers, while urea and furfural are by-products of fermentation or deliberate additives to enhance the alcoholic content (Spink & Moyer, 2011).

14. Illicit alcohol consumption in rural and semi-urban regions remains a persistent public health hazard, especially where local alcoholic beverages are produced without regulation. Methanol contamination is a recurrent and deadly issue, as its presence in locally brewed drinks can lead to acute toxicity, blindness, and death. According to Ray (2023), methanol is often detected in unregulated liquors such as Handia (rice beer), mahua, and toddy, which are commonly consumed in Jharkhand.

15. Controlling illicit liquor is a multifaceted challenge. Despite strict excise laws, enforcement is often weak, particularly in remote or under-resourced areas. Legal alcohol may be heavily taxed, creating price differentials that fuel illegal markets (Lachenmeier et al., 2008). Corruption, lack of surveillance, and insufficient public awareness further complicate the issue. Moreover, eradication efforts often face community resistance when illicit production is tied to livelihoods.

3. AIM AND OBJECTIVE

AIM-

To compare and analyze percentage of alcohol in illicit liquors of Andaman and Nicobar Islands.

OBJECTIVES-

- To collect the sample of Illicit liquor from different parts of Andaman and Nicobar Islands.
- To check the presence of ethanol and methanol.
- To estimate the density and percentage of alcohol in the Illicit liquor.
- To calculate the variation of different alcohol in the illicit liquor.
- To interpret the results of the following data.

4. MATERIALS REQUIRED

- Glass Beakers
- Pyknometer
- Thermometer
- Test Tubes
- Droppers
- Distillation Unit

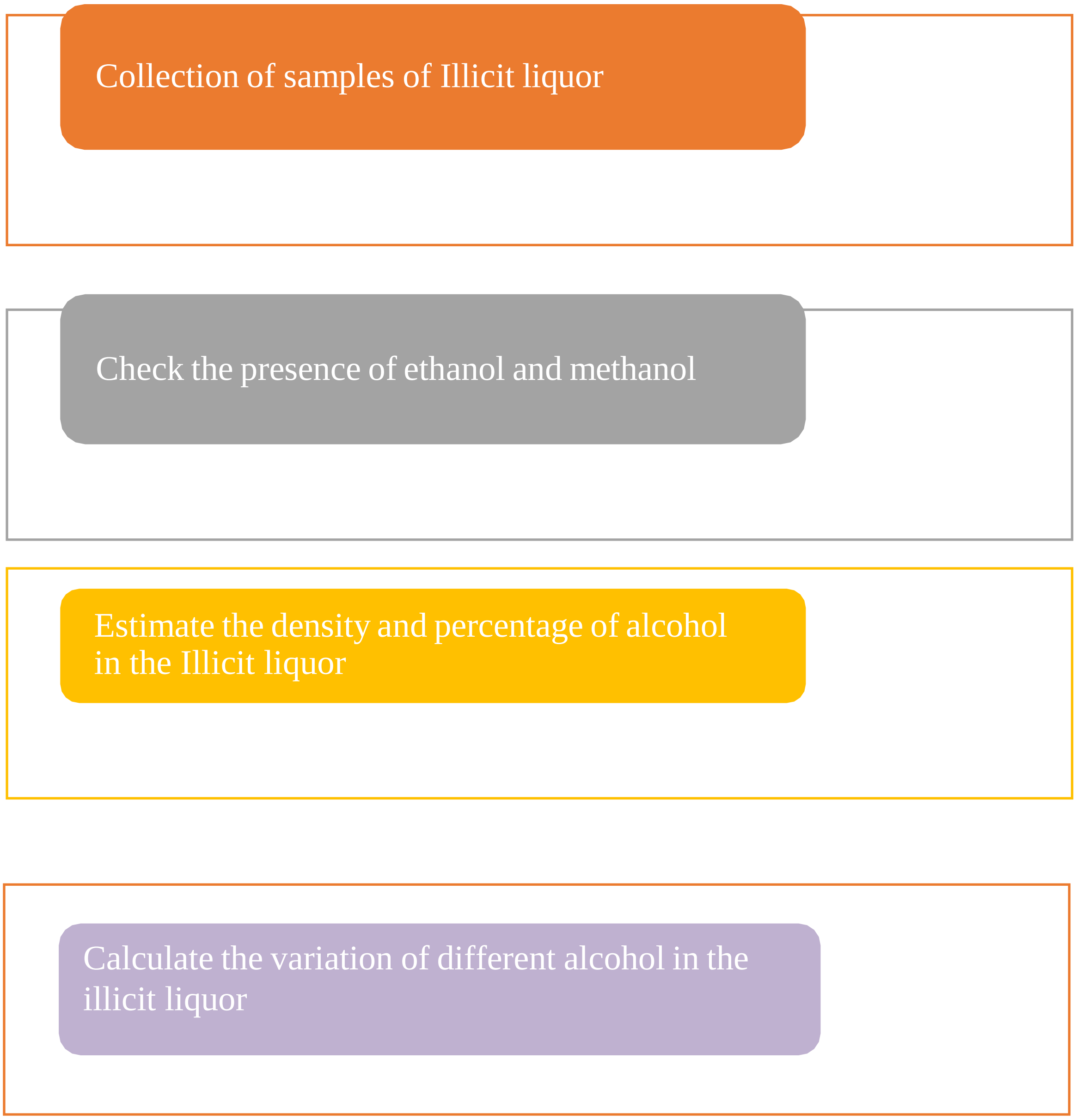
Instruments:

- Alcolyzer
- Digital Weighting Scale

Chemicals:

- Molybdic Acid
- Sulfuric Acid
- Sodium Hydroxide
- Potassium Iodide
- Iodine
- Potassium Permanganate
- Phosphoric Acid
- Sodium Bisulfite
- Chromotropic Acid

3. WORK FLOW


Collection of samples of Illicit liquor
Check the presence of ethanol and methanol
Estimate the density and percentage of alcohol in the Illicit liquor
Calculate the variation of different alcohol in the illicit liquor

4. METHODOLOGY

4.1 COLLECTION OF SAMPLES

Illicit liquor samples were collected from various regions across the Andaman and Nicobar Islands. A total of 100 sealed samples were obtained through Forensic Science Laboratory (FSL), Sri Vijaya Puram. These samples were analysed to determine the percentage of ethanol and to detect possible adulterants present in the illicit liquor using standardized chemical testing methods. Chemical tests were primarily employed to identify the presence of harmful or unauthorized substances in the alcohol. Prior to analysis, certain types of illicit liquor, such as *Handia*, were subjected to distillation using a Distillation Unit to ensure the removal of solid impurities and to obtain a homogeneous liquid sample suitable for testing.

We collected 100 samples in which 50 samples (S1 to S50) were done with alcolyzer method, another 50 samples (S51 to S100) done with pycnometer method.

Figure 3: Beakers containing IMFL

Figure 4: Beakers containing Junglee Liquor

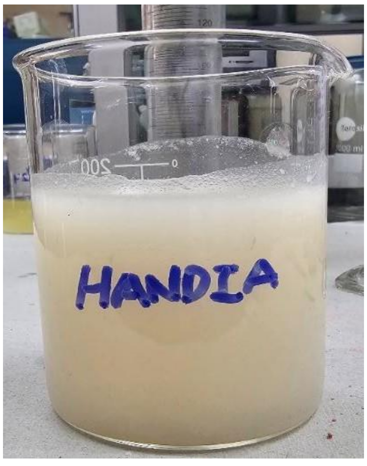


Figure 5: Beakers containing Handia

Figure 6: Beakers containing Tadi

DISTILLATION OF LIQUOR FOR PURE FORM –

Take 100ml of sample of illicit liquor and 30 ml of distilled water was added into the distillation unit to get the pure form of liquor to test.

After distillation the pure form of sample was extracted and was stored in low temperature of 20 °C in the cold storage unit.

4.2 DETERMINATION OF ETHANOL

4.2.1 Sulphur Molybdic Acid Test Preparation of Molybdic acid solution:

0.2 gram of molybdic acid is diluted with 10 ml of Sulfuric acid, to prepare 10ml of Sulphur molybdic solution.

Procedure:

- A small quantity of the illicit liquor sample was transferred into a clean test tube.
- Addition of Reagents this is Sulphur Molybdic which is already made.
- The reaction mixture was gently swirled and observed for the development of a color change.
- The formation of a **bluish coloration** indicated the presence of ethanol.

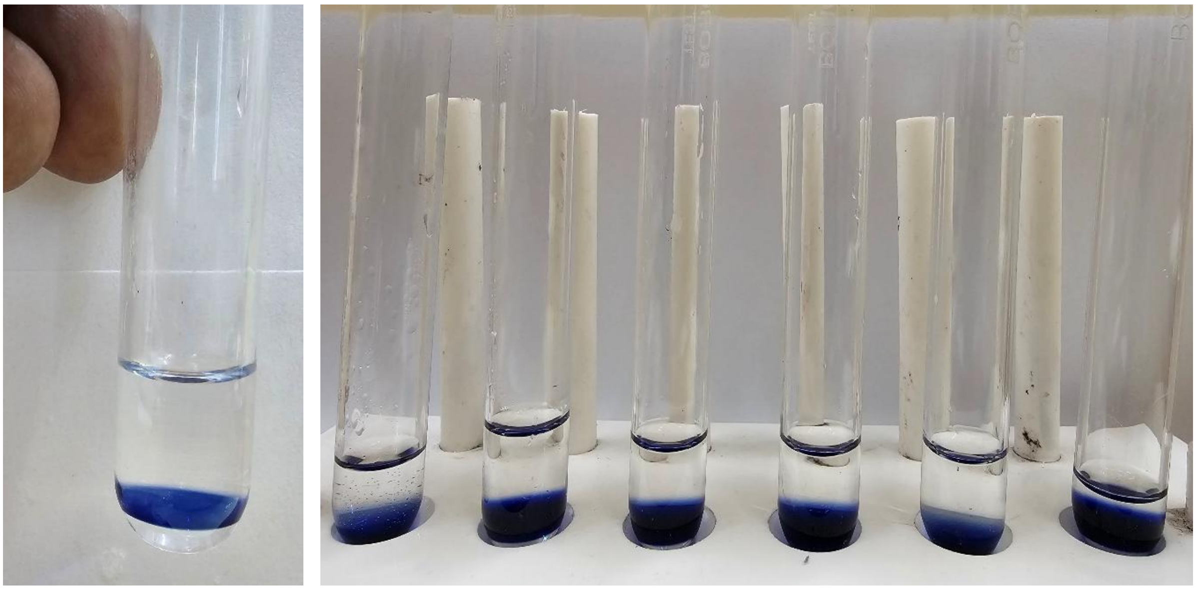


Figure 7: Formation of a bluish coloration indicated the presence of ethanol

4.2.2 Iodoform Test Procedure:

- A small quantity of the illicit liquor sample was transferred into a clean test tube.
- Add **1 ml of 5% sodium hydroxide (NaOH)** solution to the test sample.
- Prepare iodine solution by dissolving **20 g of potassium iodide (KI)** and **10 g of iodine (I_2)**

in **100 ml of distilled water**.

- Add the iodine solution **drop-wise** to the sample while **continuously shaking** the test tube.
- Continue adding iodine solution until the solution turns a **persistent dark brown**.
- Allow the solution to stand for **2–3 minutes**.
- If the brown color disappears, **add more iodine solution drop-wise** until a **stable brown coloration** is observed.
- Add a **few drops of dilute sodium hydroxide solution** to remove any excess iodine, just until the brown color lightens slightly.
- Add an **equal volume of distilled water** to the reaction mixture.
- Allow the mixture to stand undisturbed for **10 minutes**.
- The formation of a **yellow crystalline precipitate** indicates a **positive test for the presence of ethanol**.

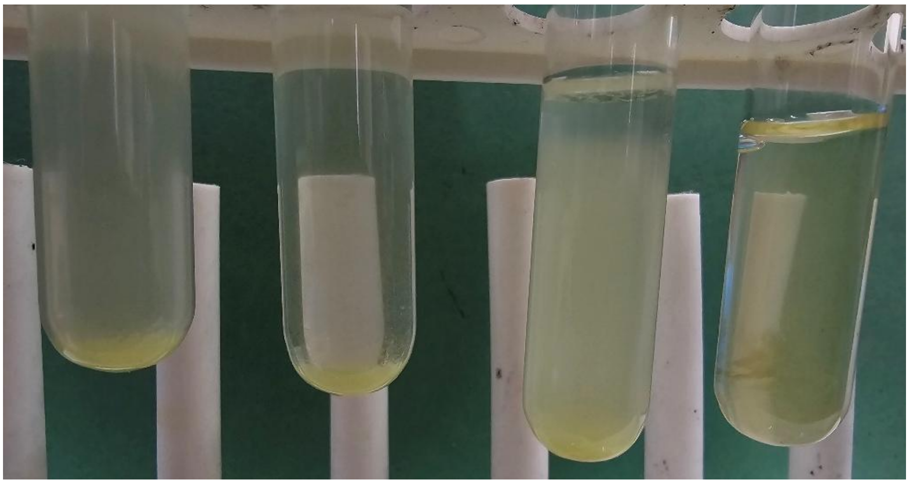


Figure 8: Formation of a yellow crystalline precipitate indicated the presence of ethanol

4.3 DETERMINATION OF METHANOL (Chromotropic Acid Test) Procedure:

- A small quantity of the illicit liquor sample was transferred into a clean test tube.
- Prepare the potassium permanganate reagent by dissolving **3 g of potassium permanganate ($KMnO_4$)** and **15 ml of phosphoric acid (H_3PO_4 or ortho-phosphoric acid)** in **100 mL of distilled water**.
- Add **2 ml** of this solution to the test sample and **shake well**.
- Add a **few crystals of sodium bisulphite** to the mixture with continuous shaking.
- Continue shaking until the **purple color of potassium permanganate disappears** completely.
- Add **1 ml** of **5% aqueous solution of chromotropic acid (sodium salt)** to the decolorized solution.
- Slowly add **15 mL of concentrated sulfuric acid (H_2SO_4) along the inner wall of the test tube** to form a separate layer.
- Observe the reaction interface for **color development**.
- The **appearance of a violet or purple color** at the junction of the two layers indicates a **positive test for the presence of methanol.**

4.4 QUANTITATIVE ANALYSIS OF LIQUOR

4.4.1 Pyknometer Method

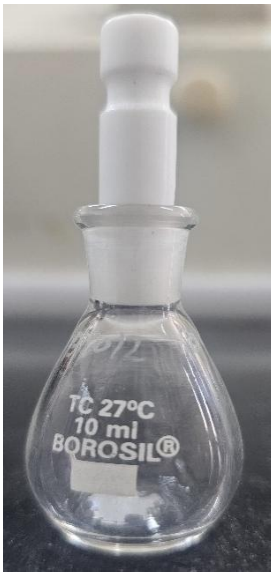
This method determines the ethanol concentration in liquor based on its density, measured using a pycnometer. Ethanol content is then inferred by comparing the measured density with standard ethanol-water density tables at a controlled temperature.

Procedure:

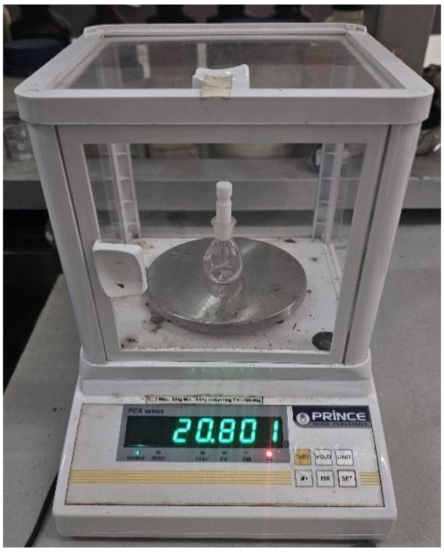
- Clean and dry the pyknometer thoroughly.
- Weigh the empty pycnometer, and note down the weight.
- Fill the pycnometer completely with **distilled water (it should be maintained in 20°C).**

- Ensure no air bubbles are present and wipe the outside dry.
- Weigh the pycnometer filled with distilled water, and note down the weight.
- Again, empty and dry the pycnometer.
- Fill it with the **liquor sample** (ensure homogeneous mixing; distill if necessary for cloudy samples).
- Wipe off any spills and weigh the pycnometer **filled with liquor (it should be maintained in 20°C)**, and note down the weight.
- Then after we refer Indian Standard tables for alcoholometry, by these we can get the percentage of liquor with the density at specific temperature of 20°**C.**

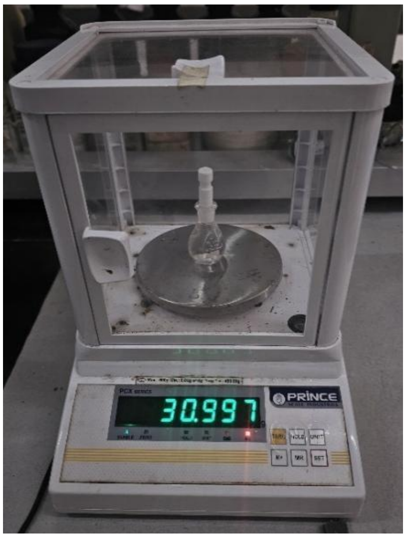
Step 1: **Calibrate the weighting scale**



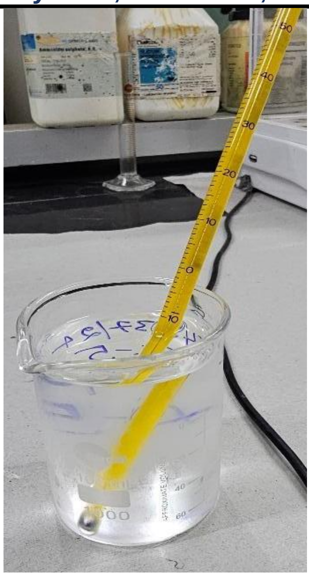
Step 2: Clean and dry the pyknometer thoroughly



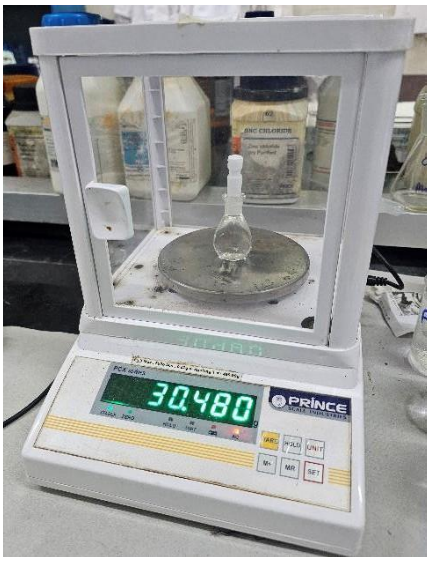
Step 3: Weigh the empty pycnometer



Step 4: Weigh the pycnometer filled with distilled water



Step 5: Maintain the sample temperature at 20°C



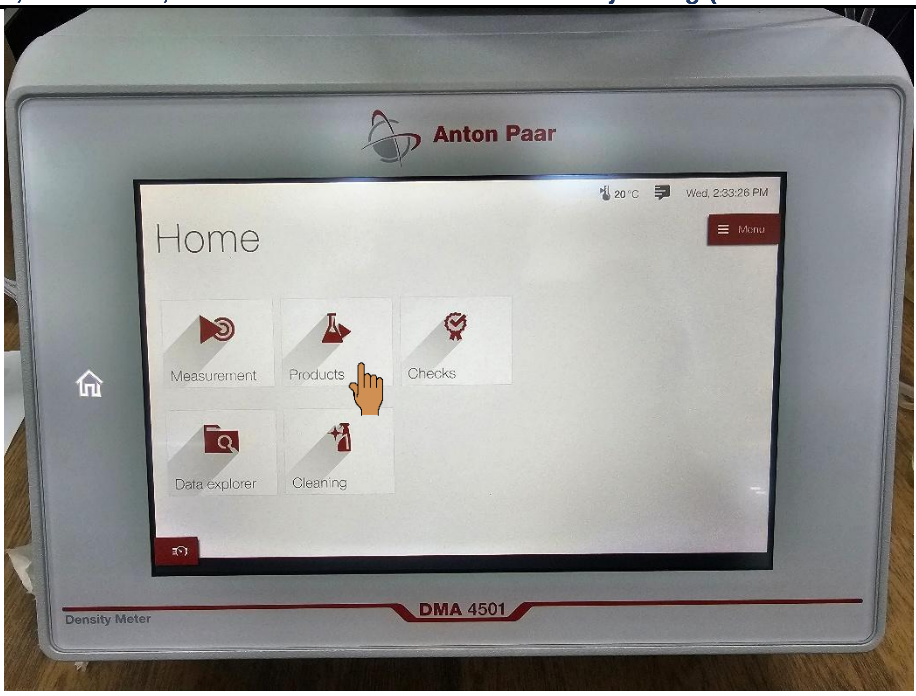
Step 6: Weigh the pycnometer filled with sample

4.4.2 Alcolyzer Method

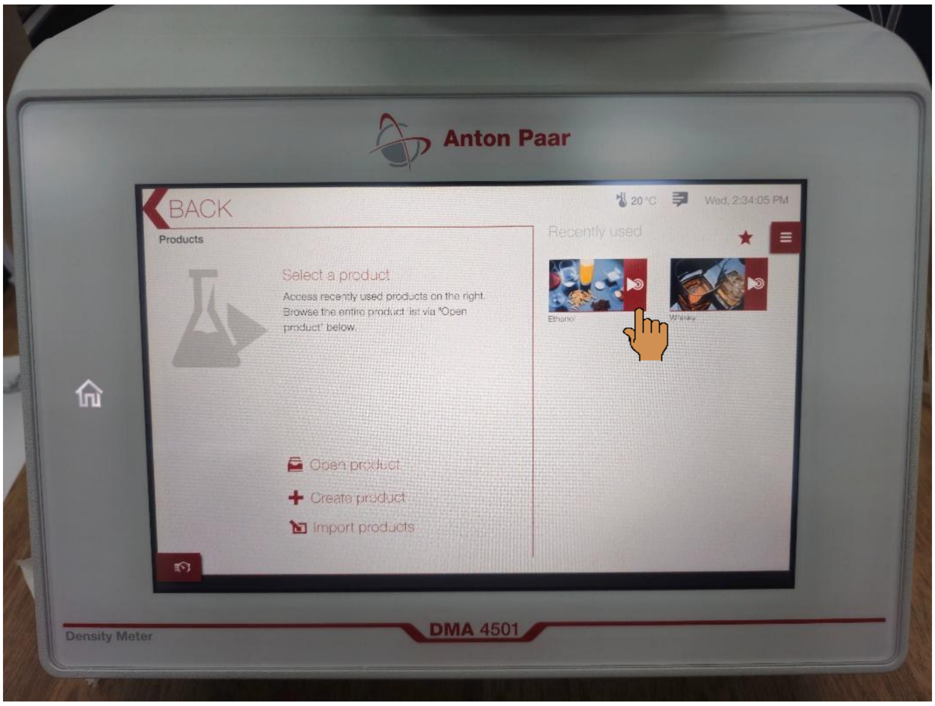
The Anton Paar Alcolyzer 4501 is a high-precision instrument designed to determine the alcohol content (% v/v) and density of alcoholic beverages using NIR (Near-Infrared) spectroscopy and a vibrating U-tube density meter. It provides direct digital readouts without the need for external calculations or density tables.

Procedure:

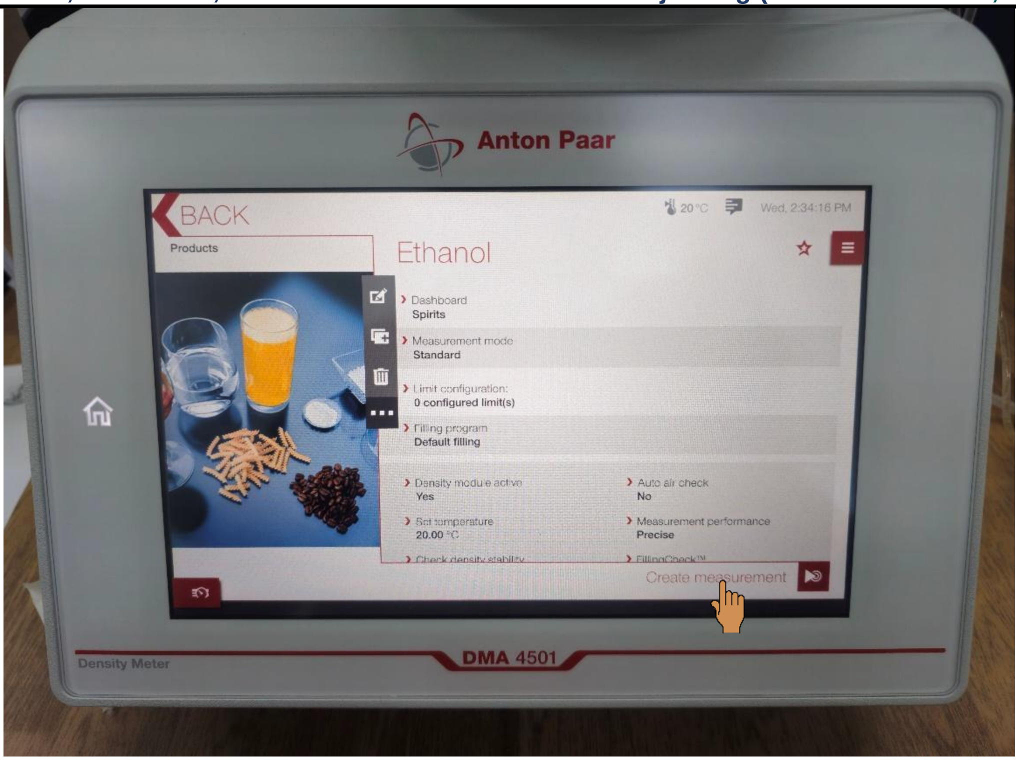
- Switch on the Alcolyzer and allow it to warm up.
- Calibrate the instrument using **distilled water** and **ethanol reference standards** as per the manufacturer's instructions.
- Ensure the system shows correct temperature (usually 20.00 ± 0.05 °C).
- Filter or **distill the liquor sample** if it is cloudy, viscous, or contains particulates (e.g., traditional or illicit liquors like *handia*).
- Load the sample into the Alcolyzer using an attached peristaltic pump.
- Avoid air bubbles during sample loading.
- Select the product which is used to measure i.e ethanol on the system.
- Then rinse the measuring cell with sample which is used to measure.
- After that press **measure** option on the screen.
- The device will automatically measure **alcohol content (% v/v)**, **density**, and **temperature**.



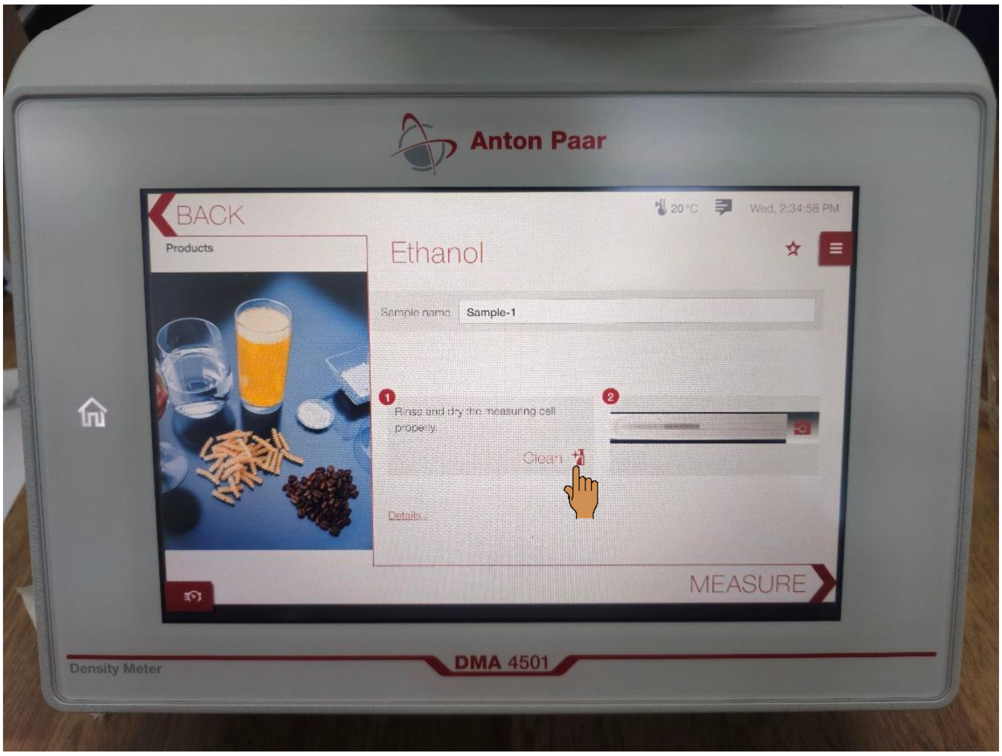
Step 1: Select the Products option from the home screen



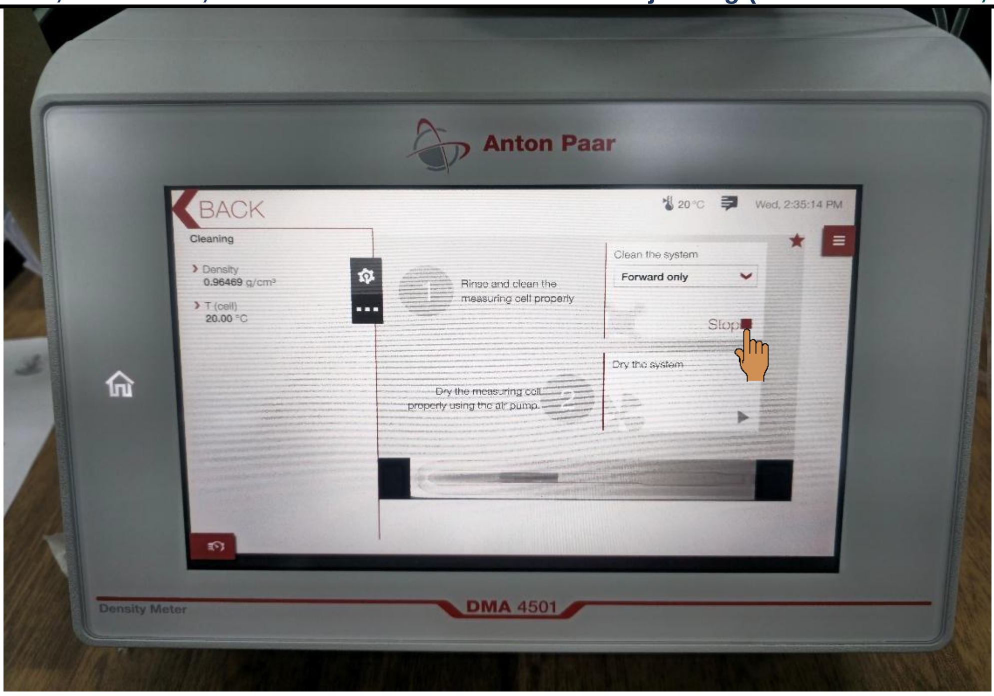
Step 2: Select the Ethanol option



Step 3: Select the Create Measurement option



Step 4: Enter the sample name and after that select clean option



Step 5: Select the Play option after rinsing the measurement cell select the Stop option

Step 6: Select the measurement option from the screen

Step 7: After that sample will be collected through the probe and the system will start measures

Step 8: After the measurement the result are automatically shown on display

5. RESULTS AND DISCUSSION

The color test is was conducted on all 100 samples of suspected illicit liquor, labeled S1 to S100. The test results indicate that **ethanol was present in every sample**, confirming the presence of alcohol across the entire dataset. Importantly, **no traces of methanol were detected** in any of the samples tested. This suggests that, based on the color test, the liquor samples did not contain methanol—a toxic compound often associated with adulterated or hazardous alcoholic.

Table 1: Shows results of color test for illicit liquors

Sample No.	Name of Illicit Liquor	Test for Ethanol	Test for Methanol
1	Handia	Positive	Negative
2	Junglee Liquor	Positive	Negative
3	Junglee Liquor	Positive	Negative
4	IMFL	Positive	Negative
5	IMFL	Positive	Negative
6	IMFL	Positive	Negative
7	IMFL	Positive	Negative
8	IMFL	Positive	Negative
9	IMFL	Positive	Negative
10	Junglee Liquor	Positive	Negative
11	Junglee Liquor	Positive	Negative
12	IMFL	Positive	Negative
13	IMFL	Positive	Negative
14	IMFL	Positive	Negative
15	Junglee Liquor	Positive	Negative
16	IMFL	Positive	Negative
17	IMFL	Positive	Negative
18	Handia	Positive	Negative
19	Junglee Liquor	Positive	Negative
20	Junglee Liquor	Positive	Negative
21	Junglee Liquor	Positive	Negative
22	IMFL	Positive	Negative
23	IMFL	Positive	Negative
24	IMFL	Positive	Negative
25	Junglee Liquor	Positive	Negative
26	Junglee Liquor	Positive	Negative
27	Junglee Liquor	Positive	Negative
28	Junglee Liquor	Positive	Negative
29	IMFL	Positive	Negative
30	Junglee Liquor	Positive	Negative
31	Junglee Liquor	Positive	Negative
32	IMFL	Positive	Negative
33	IMFL	Positive	Negative
34	Handia	Positive	Negative
35	Handia	Positive	Negative
36	Junglee Liquor	Positive	Negative
37	Junglee Liquor	Positive	Negative
38	Handia	Positive	Negative
39	Junglee Liquor	Positive	Negative
40	Junglee Liquor	Positive	Negative
41	IMFL	Positive	Negative
42	Handia	Positive	Negative
43	Handia	Positive	Negative

44	Junglee Liquor	Positive	Negative
45	Junglee Liquor	Positive	Negative
46	Junglee Liquor	Positive	Negative
47	Toddy	Positive	Negative
48	Toddy	Positive	Negative
49	Toddy	Positive	Negative
50	Toddy	Positive	Negative
51	Junglee Liquor	Positive	Negative
52	Junglee Liquor	Positive	Negative
53	Junglee Liquor	Positive	Negative
54	Junglee Liquor	Positive	Negative
55	Junglee Liquor	Positive	Negative
56	Junglee Liquor	Positive	Negative
57	Junglee Liquor	Positive	Negative
58	Handia	Positive	Negative
59	Handia	Positive	Negative
60	Handia	Positive	Negative
61	Handia	Positive	Negative
62	Handia	Positive	Negative
63	Handia	Positive	Negative
64	Handia	Positive	Negative
65	Junglee Liquor	Positive	Negative
66	Junglee Liquor	Positive	Negative
67	Junglee Liquor	Positive	Negative
68	IMFL	Positive	Negative
69	IMFL	Positive	Negative
70	IMFL	Positive	Negative
71	IMFL	Positive	Negative
72	IMFL	Positive	Negative
73	IMFL	Positive	Negative
74	IMFL	Positive	Negative
75	IMFL	Positive	Negative
76	IMFL	Positive	Negative
77	IMFL	Positive	Negative
78	IMFL	Positive	Negative
79	Junglee Liquor	Positive	Negative
80	IMFL	Positive	Negative
81	IMFL	Positive	Negative
82	IMFL	Positive	Negative
83	IMFL	Positive	Negative
84	IMFL	Positive	Negative
85	IMFL	Positive	Negative
86	Handia	Positive	Negative
87	Handia	Positive	Negative
88	Handia	Positive	Negative
89	Handia	Positive	Negative
90	Handia	Positive	Negative
91	Handia	Positive	Negative
92	Handia	Positive	Negative
93	Handia	Positive	Negative
94	Handia	Positive	Negative
95	Handia	Positive	Negative
96	Handia	Positive	Negative

97	Handia	Positive	Negative
98	Handia	Positive	Negative
99	Handia	Positive	Negative
100	Junglee Liquor	Positive	Negative

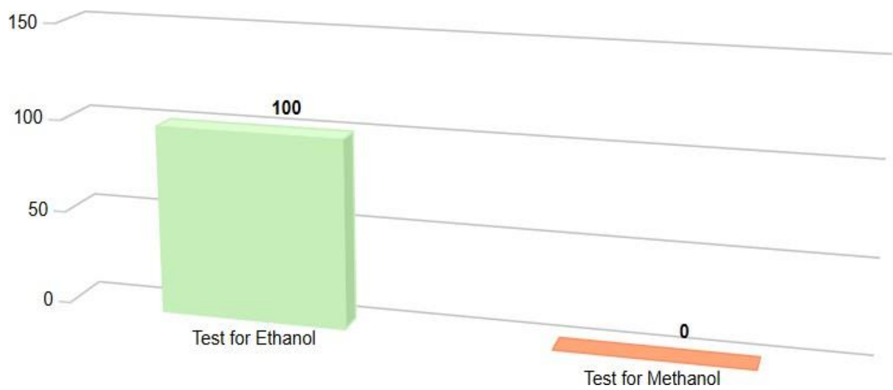


Figure 9: Bar graph showing results of color test for illicit liquors

The result from **alcolyzer shows the density and percentage** of illicit liquor and give a result that Junglee liquor contains 4.50 % v/v to 55.89 % v/v, IMFL contains
27.79 % v/v to 42.69 % v/v, Handia contains 03.88 % v/v to 15.14 % v/v and Tadi contains 5.44 % v/v to 8.51 % v/v. Alcolyzer gives an accurate result by using NIR (Near-Infrared) spectroscopy and a vibrating U-tube density meter.

Table 2: Shows the alcohol(%v/v) and density values of illicit liquors samples observed through alcolyzer

Sample Name	Density	Percentage of Sample
S1	0.99001 g/cm^3	12.49 % v/v
S2	0.94086 g/cm^3	44.19 % v/v
S3	0.97063 g/cm^3	22.93 % v/v
S4	0.94424 g/cm^3	42.47 % v/v
S5	0.94720 g/cm^3	40.74 % v/v
S6	0.94504 g/cm^3	42.01 % v/v
S7	0.94451 g/cm^3	41.56 % v/v
S8	0.96469 g/cm^3	27.79 % v/v
S9	0.96466 g/cm^3	28.07 % v/v
S10	0.95509 g/cm^3	35.30 % v/v
S11	0.95140 g/cm^3	37.75 % v/v
S12	0.94449 g/cm^3	42.15 % v/v
S13	0.94583 g/cm^3	41.42 % v/v
S14	0.94362 g/cm^3	42.32 % v/v
S15	0.93962 g/cm^3	44.89 % v/v
S16	0.94565 g/cm^3	41.54 % v/v
S17	0.94651 g/cm^3	41.00 % v/v
S18	0.99048 g/cm^3	15.14 % v/v
S19	0.95704 g/cm^3	33.84 % v/v
S20	0.96409 g/cm^3	28.51 % v/v
S21	0.98114 g/cm^3	17.91 % v/v
S22	0.96029 g/cm^3	32.18 % v/v
S23	0.94674 g/cm^3	39.77 % v/v
S24	0.94374 g/cm^3	42.69 % v/v
S25	0.97095 g/cm^3	22.45 % v/v
S26	0.97095 g/cm^3	22.45 % v/v
S27	0.98580 g/cm^3	9.41 % v/v

S28	0.98011 g/cm³	14.33 % v/v
S29	0.95006 g/cm³	41.69 % v/v
S30	0.98194 g/cm³	12.81 % v/v
S31	0.98967 g/cm³	6.34 % v/v
S32	0.95440 g/cm³	36.08 % v/v
S33	0.95516 g/cm³	35.34 % v/v
S34	0.99861 g/cm³	3.88 % v/v
S35	0.99671 g/cm³	5.11 % v/v
S36	0.91782 g/cm³	55.99 % v/v
S37	0.95836 g/cm³	33.09 % v/v
S38	0.99556 g/cm³	6.70 % v/v
S39	0.95224 g/cm³	37.34 % v/v
S40	0.99189 g/cm³	4.59 % v/v
S41	0.94455 g/cm³	42.29 % v/v
S42	0.99061 g/cm³	15.04 % v/v
S43	0.99532 g/cm³	6.36 % v/v
S44	0.94626 g/cm³	41.17 % v/v
S45	0.92250 g/cm³	53.73 % v/v
S46	0.94791 g/cm³	40.16 % v/v
S47	0.94791 g/cm³	40.16 % v/v
S48	1.00253 g/cm³	5.44 % v/v
S49	1.00100 g/cm³	5.48 % v/v
S50	0.99733 g/cm³	8.51 % v/v

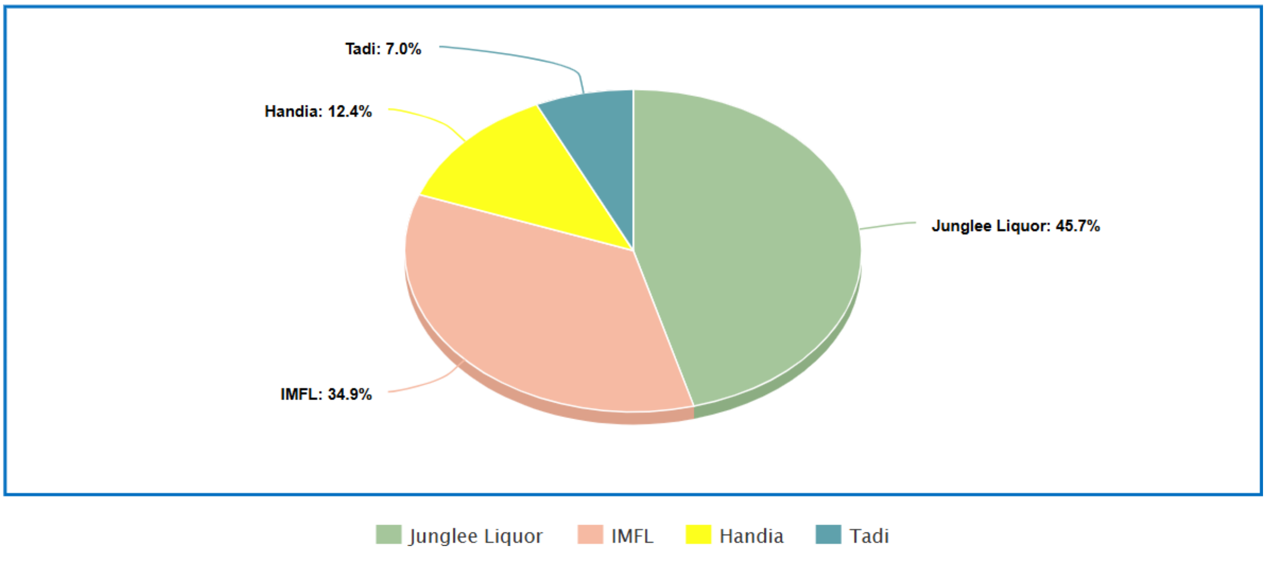


Figure 10: Pie chart showing results of percentage of ethanol by alcolyzer method

The result from **pycnometer method shows the density and percentage** of illicit liquor and give a result that Junglee liquor contains 12.0 % v/v to 41.2 % v/v, IMFL contains 34.2 % v/v to 44.8 % v/v and Handia contains 5.4 % v/v to 26.4 % v/v.

Formula used for the calculation of specific gravity

$$\text{Specific Gravity} = \frac{\text{Weight of specific gravity bottle with sample- Weight of empty SG bottle}}{\text{Weight of specific gravity bottle with distilled water- Weight of empty SG bottle}}$$

Table 3: Shows the alcohol (%v/v) and specific gravity values of illicit liquors samples observed through pycnometer method

Sample name	Weight of empty SG bottle	Weight of SG bottle with Dist. Water	Weight of SG bottle with sample	Weight of sample	Weight of Distilled water	Specific Gravity	Percentage of Sample
S51	20.800 g	30.983 g	30.651 g	9.851 g	10.183 g	0.9673 g	27.2% v/v
S52	20.800 g	30.983 g	30.432 g	9.652 g	10.183 g	0.9478 g	41.2% v/v
S53	20.800 g	30.983 g	30.587 g	9.787 g	10.183 g	0.9611 g	32.2% v/v
S54	20.800 g	30.983 g	30.590 g	9.790 g	10.183 g	0.9614 g	32.0% v/v
S55	20.800 g	30.983 g	30.666 g	9.866 g	10.183 g	0.9688 g	25.8% v/v
S56	20.800 g	30.983 g	30.475 g	9.675 g	10.183 g	0.9501 g	39.8% v/v
S57	20.800 g	30.983 g	30.647 g	9.847 g	10.183 g	0.9670 g	27.4% v/v
S58	20.800 g	30.970 g	30.772 g	9.972 g	10.170 g	0.9805 g	15.2% v/v
S59	20.800 g	30.970 g	30.771 g	9.971 g	10.170 g	0.9804 g	15.2% v/v
S60	20.800 g	30.970 g	30.766 g	9.966 g	10.170 g	0.9799 g	15.8% v/v
S61	20.800 g	30.970 g	30.753 g	9.953 g	10.170 g	0.9786 g	17.0% v/v
S62	20.800 g	30.970 g	30.694 g	9.894 g	10.170 g	0.9728 g	22.2% v/v
S63	20.800 g	30.970 g	30.860 g	10.06 g	10.170 g	0.9891 g	07.8% v/v
S64	20.800 g	30.970 g	30.798 g	9.998 g	10.170 g	0.9830 g	12.8% v/v
S65	20.800 g	30.970 g	30.808 g	10.008 g	10.170 g	0.9840 g	12.0% v/v
S66	20.800 g	30.970 g	30.621 g	9.821 g	10.170 g	0.9656 g	28.6% v/v
S67	20.800 g	30.970 g	30.621 g	9.821 g	10.170 g	0.9656 g	28.6% v/v
S68	20.800 g	30.985 g	30.399 g	9.590 g	10.185 g	0.9415 g	44.8% v/v
S69	20.800 g	30.985 g	30.426 g	9.626 g	10.185 g	0.9451 g	42.8% v/v

S70	20.800 g	30.985 g	30.412 g	9.612 g	10.185 g	0.9437 g	42.8% v/v
S71	20.800 g	30.985 g	30.426 g	9.626 g	10.185 g	0.9451 g	42.8% v/v
S72	20.800 g	30.985 g	30.429 g	9.629 g	10.185 g	0.9454 g	42.6% v/v
S73	20.800 g	30.985 g	30.432 g	9.632 g	10.185 g	0.9457 g	42.4% v/v
S74	20.800 g	30.985 g	30.435 g	9.635 g	10.185 g	0.9459 g	42.4% v/v
S75	20.800 g	30.985 g	30.438 g	9.638 g	10.185 g	0.9462 g	42.2% v/v
S76	20.802 g	30.978 g	30.429 g	9.627 g	10.176 g	0.9464 g	42.2% v/v
S77	20.802 g	30.978 g	30.517 g	9.715 g	10.176 g	0.9546 g	36.8% v/v
S78	20.802 g	30.978 g	30.525 g	9.723 g	10.176 g	0.9554 g	36.2% v/v
S79	20.802 g	30.978 g	30.705 g	9.903 g	10.176 g	0.9731 g	22.0% v/v
S80	20.802 g	30.978 g	30.554 g	9.752 g	10.176 g	0.9583 g	34.2% v/v
S81	20.802 g	30.978 g	30.483 g	9.681 g	10.176 g	0.9513 g	39.0% v/v
S82	20.802 g	30.978 g	30.490 g	9.688 g	10.176 g	0.9520 g	38.4% v/v
S83	20.802 g	30.978 g	30.463 g	9.661 g	10.176 g	0.9493 g	40.2% v/v
S84	20.802 g	30.978 g	30.481 g	9.679 g	10.176 g	0.9511 g	39.0% v/v
S85	20.802 g	30.978 g	30.503 g	9.701 g	10.176 g	0.9533 g	37.6% v/v
S86	20.799 g	31.000 g	30.920 g	10.121 g	10.201 g	0.9921 g	05.6% v/v
S87	20.799 g	31.000 g	30.675 g	9.876 g	10.201 g	0.9681 g	26.4% v/v
S88	20.799 g	31.000 g	30.746 g	9.947 g	10.201 g	0.9751 g	20.0% v/v
S89	20.799 g	31.000 g	30.921 g	10.122 g	10.201 g	0.9922 g	05.4% v/v
S90	20.799 g	31.000 g	30.820 g	10.021 g	10.201 g	0.9823 g	13.6% v/v
S91	20.799 g	31.000 g	30.846 g	10.047 g	10.201 g	0.9849 g	11.4% v/v
S92	20.799 g	31.000 g	30.791 g	9.992 g	10.201 g	0.9795 g	16.2% v/v

S93	20.809 g	30.967 g	30.817 g	10.008 g	10.158 g	0.9852 g	11.0% v/v
S94	20.809 g	30.967 g	30.701 g	9.892 g	10.158 g	0.9738 g	21.4% v/v
S95	20.809 g	30.967 g	30.695 g	9.886 g	10.158 g	0.9732 g	22.8% v/v
S96	20.809 g	30.967 g	30.729 g	9.920 g	10.158 g	0.9765 g	18.8% v/v
S97	20.809 g	30.967 g	30.837 g	10.028 g	10.158 g	0.9872 g	09.4% v/v
S98	20.809 g	30.967 g	30.881 g	10.072 g	10.158 g	0.9915 g	06.0% v/v
S99	20.809 g	30.967 g	30.615 g	9.806 g	10.158 g	0.9653 g	20.8% v/v
S100	20.809 g	30.967 g	30.529 g	9.720 g	10.158 g	0.9568 g	35.2% v/v

Note: The weight of empty specific gravity bottle and distilled water was show variation every time, because of every time for the calculation of specific gravity, the sample was taken the Weight of empty SG bottle and distilled water.

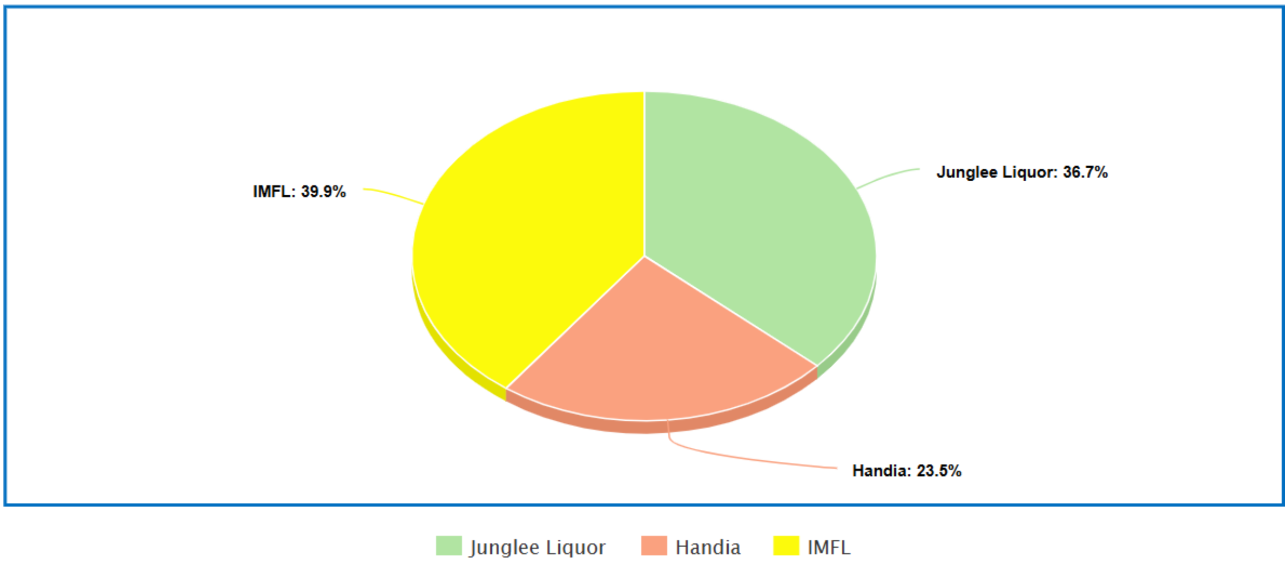


Figure 11: Pie chart showing results of percentage of ethanol by pyknometer method

6. CONCLUSION

The comprehensive analysis of 100 suspected illicit liquor samples, using both presumptive and instrumental methods to detect ethanol and methanol. The colour tests preliminary indicated that the presence of ethanol in all samples while detecting no methanol, indicating an absence of this highly toxic adulterant across the dataset. This suggests that, from a methanol toxicity perspective, the tested liquors may not pose an immediate chemical hazard related to adulteration.

Quantitative analysis through advanced instrumentation further revealed a wide variability in ethanol concentration across different liquor types. The Alcolyzer, employing Near-Infrared (NIR) spectroscopy and a vibrating U-tube density meter, demonstrated that Junglee liquor had the broadest ethanol range (4.50% v/v to 55.89% v/v), followed by IMFL (27.79% v/v to 42.69% v/v), Handia (3.88% v/v to 15.14% v/v), and Tadi (5.44% v/v to 8.51% v/v). Results obtained via the pycnometer method corroborated the presence of ethanol but with differing ranges: Junglee liquor (12.0% v/v to 41.2% v/v), IMFL (34.2% v/v to 44.8% v/v), and Handia (5.4% v/v to 26.4% v/v).

These findings highlight not only the heterogeneity of alcohol content within illicit liquor types but also the reliability of the Alcolyzer in providing consistent and accurate measurements. The absence of methanol and the quantifiable ethanol concentrations emphasize the need for continuous monitoring of illicit liquors to prevent health risks and support regulatory actions. Future research should include toxicological assessments and trace impurity analysis to further evaluate the safety and compliance of such beverages.

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6. APPENDIX

Indian Standard tables for alcoholometry (Pyknometer Method)

Table 1 Apparent Relative Densities of Aqueous Ethanol at Various Temperatures

(*Clauses* 0.4, 1.1, 3.0, 3.3.5, 5.3.1, 5.3.2, 5.3.2.1, 5.3.2.3, 5.3.2.4, 5.4, 6, 6.1 *and* 6.2)

Temperature °C	Percentages of Volume at 20°C									
	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8
10	1.000 00	0.999 70	0.999 39	0.999 09	0.998 78	0.998 48	0.998 19	0.997 90	0.997 60	0.997 31
11	1.000 00	0.999 70	0.999 40	0.999 09	0.998 79	0.998 49	0.998 20	0.997 90	0.997 61	0.997 31
12	1.000 00	0.999 70	0.999 40	0.999 09	0.998 79	0.998 49	0.998 20	0.997 91	0.997 61	0.997 32
13	1.000 00	0.99970	0.999 40	0.999 09	0.998 79	0.998 49	0.998 20	0.997 91	0.997 61	0.997 32
14	1.000 00	0.999 70	0.999 40	0.999 09	0.998 79	0.998 49	0.998 20	0.997 90	0.997 61	0.997 31
15	1.000 00	0.999 70	0.999 40	0.999 09	0.998 79	0.998 49	0.998 19	0.997 90	0.997 60	0.997 31
16	1.000 00	0.999 70	0.999 40	0.999 09	0.998 79	0.998 49	0.998 20	0.997 90	0.997 61	0.997 31
17	1.000 00	0.999 70	0.999 40	0.999 09	0.998 79	0.998 49	0.998 20	0.997 90	0.997 61	0.997 31
18	1.000 00	0.999 70	0.999 40	0.999 10	0.998 80	0.998 50	0.998 20	0.997 91	0.997 61	0.997 32
19	1.000 00	0.999 70	0.999 40	0.999 10	0.998 80	0.998 50	0.998 20	0.997 91	0.997 61	0.997 32
20	1.000 00	0.999 70	0.999 40	0.999 10	0.998 80	0.998 50	0.998 20	0.997 91	0.997 61	0.997 32
21	1.000 00	0.999 70	0.999 40	0.999 10	0.998 80	0.998 50	0.998 20	0.997 91	0.997 61	0.997 32
22	1.000 00	0.999 70	0.999 40	0.999 09	0.998 79	0.998 49	0.998 20	0.997 90	0.997 61	0.997 31
23	1.000 00	0.999 70	0.999 39	0.999 09	0.998 78	0.998 48	0.998 19	0.997 90	0.997 60	0.997 31
24	1.000 00	0.999 70	0.999 40	0.999 09	0.998 79	0.998 49	0.998 20	0.997 90	0.997 61	0.997 31
25	1.000 00	0.999 70	0.999 40	0.999 09	0.998 79	0.998 49	0.998 20	0.997 90	0.997 61	0.997 31
26	1.000 00	0.999 70	0.999 40	0.999 09	0.998 79	0.998 49	0.998 20	0.997 90	0.997 61	0.997 31
27	1.000 00	0.999 70	0.999 40	0.999 09	0.998 79	0.998 49	0.998 20	0.997 90	0.997 61	0.997 31
28	1.000 00	0.999 70	0.999 40	0.999 09	0.998 79	0.998 49	0.998 19	0.997 90	0.997 60	0.997 31
29	1.000 00	0.999 70	0.999 40	0.999 09	0.998 79	0.998 49	0.998 19	0.997 89	0.997 60	0.997 30
30	1.000 00	0.999 70	0.999 39	0.999 09	0.998 78	0.998 48	0.998 18	0.997 88	0.997 59	0.997 29
31	1.000 00	0.999 70	0.999 39	0.999 09	0.999 78	0.998 48	0.998 18	0.997 88	0.997 59	0.997 29
32	1.000 00	0.999 70	0.999 39	0.999 09	0.998 78	0.998 48	0.998 18	0.997 88	0.997 59	0.997 29
33	1.000 00	0.999 69	0.999 39	0.999 08	0.998 78	0.998 47	0.998 17	0.997 87	0.997 58	0.997 28
34	1.000 00	0.999 69	0.999 39	0.999 08	0.998 78	0.998 47	0.998 17	0.997 87	0.997 57	0.997 27
35	1.000 00	0.999 69	0.999 38	0.999 08	0.998 77	0.998 46	0.998 16	0.997 86	0.997 57	0.997 27
36	1.000 00	0.999 69	0.999 38	0.999 08	0.998 77	0.998 46	0.998 16	0.997 86	0.997 56	0.997 26
37	1.000 00	0.999 69	0.999 38	0.999 07	0.998 76	0.998 45	0.998 15	0.997 85	0.997 55	0.997 25
38	1.000 00	0.999 69	0.999 38	0.999 07	0.998 76	0.998 45	0.998 15	0.997 85	0.997 54	0.997 24
39	1.000 00	0.999 69	0.999 38	0.999 07	0.998 76	0.998 45	0.998 14	0.997 84	0.997 53	0.997 23
40	1.000 00	0.999 69	0.999 38	0.999 06	0.998 75	0.998 44	0.998 13	0.997 83	0.997 52	0.997 22

(Continued)

Table 1 Apparent Relative Densities of Aqueous Ethanol at Various Temperatures —*Contd*

Temperature °C	Percentages of Volume at 20°C									
	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8
10	0.997 02	0.996 73	0.996 45	0.996 16	0.995 88	0.995 59	0.995 32	0.995 04	0.994 77	0.994 49
11	0.997 02	0.996 74	0.99645	0.996 17	0.995 88	0.995 60	0.995 33	0.995 05	0.994 78	0.994 50
12	0.997 03	0.996 74	0.996 46	0.996 17	0.995 89	0.995 60	0.995 33	0.995 05	0.994 78	0.994 50
13	0.997 03	0.996 74	0.996 46	0.996 17	0.995 89	0.995 60	0.995 32	0.995 05	0.994 77	0.994 50
14	0.997 02	0.996 74	0.996 45	0.996 17	0.995 88	0.995 60	0.995 32	0.995 05	0.994 77	0.994 50
15	0.997 01	0.996 73	0.996 44	0.996 16	0.995 87	0.995 59	0.995 31	0.995 04	0.994 76	0.994 49
16	0.997 02	0.996 74	0.996 45	0.996 17	0.995 88	0.995 60	0.995 32	0.995 04	0.994 77	0.994 49
17	0.997 02	0.996 74	0.996 45	0.996 17	0.995 88	0.995 60	0.995 32	0.995 04	0.994 77	0.994 49
18	0.997 02	0.996 74	0.996 45	0.996 17	0.995 88	0.995 60	0.995 32	0.995 04	0.994 77	0.994 49
19	0.997 02	0.996 74	0.996 45	0.996 17	0.995 88	0.995 60	0.995 32	0.995 04	0.994 76	0.994 48
20	0.997 02	0.996 74	0.996 45	0.996 17	0.995 88	0.995 60	0.995 32	0.995 04	0.994 75	0.994 47
21	0.997 02	0.996 73	0.996 45	0.996 16	0.995 88	0.995 59	0.995 31	0.995 03	0.994 75	0.994 47
22	0.997 02	0.996 73	0.996 45	0.996 16	0.995 88	0.995 59	0.995 31	0.995 03	0.994 74	0.994 46
23	0.997 02	0.996 73	0.996 44	0.996 16	0.995 87	0.995 58	0.995 30	0.995 02	0.994 74	0.994 46
24	0.997 02	0.996 73	0.996 44	0.996 16	0.995 87	0.995 58	0.995 30	0.995 02	0.994 74	0.994 46
25	0.997 02	0.996 73	0.996 44	0.996 16	0.995 87	0.995 58	0.995 30	0.995 02	0.994 73	0.994 45
26	0.997 02	0.996 73	0.996 44	0.996 15	0.995 86	0.995 57	0.995 29	0.995 01	0.994 73	0.994 45
27	0.997 02	0.996 73	0.996 44	0.996 15	0.995 86	0.995 57	0.995 29	0.995 00	0.994 72	0.994 43
28	0.997 01	0.996 72	0.996 43	0.996 14	0.995 85	0.995 56	0.995 28	0.994 99	0.994 71	0.994 42
29	0.997 00	0.996 71	0.996 42	0.996 14	0.995 85	0.995 56	0.995 27	0.994 99	0.994 70	0.994 42
30	0.996 99	0.996 70	0.996 41	0.996 12	0.995 83	0.995 54	0.995 26	0.994 97	0.994 69	0.994 40
31	0.996 99	0.996 70	0.996 41	0.996 11	0.995 82	0.995 53	0.995 25	0.994 96	0.994 68	0.994 39
32	0.996 99	0.996 70	0.996 41	0.996 11	0.995 82	0.995 53	0.995 24	0.994 96	0.994 67	0.994 39
33	0.996 98	0.996 69	0.996 40	0.996 10	0.995 81	0.995 52	0.995 23	0.994 94	0.994 66	0.994 37
34	0.996 97	0.996 68	0.996 39	0.996 09	0.995 80	0.995 51	0.995 22	0.994 93	0.994 65	0.994 36
35	0.99 97	0.996 68	0.996 38	0.996 09	0.995 79	0995 50	0.995 21	0.994 92	0.994 64	0.994 35
36	0.996 96	0.996 67	0.996 37	0.996 08	0.995 78	0.995 49	0.995 20	0.994 91	0.994 63	0.994 34
37	0.996 95	0.996 65	0.996 36	0.996 06	0.995 77	0.995 47	0.995 18	0.994 89	0.994 60	0.994 31
38	0.996 94	0.996 64	0.996 34	0.996 05	0.995 75	0.995 45	0.995 16	0.994 87	0.994 59	0.994 30
39	0.996 92	0.996 62	0.996 33	0.996 03	0.995 74	0.995 44	0.995 15	0.994 86	0.994 57	0.994 28
40	0.996 91	0.996 61	0.996 32	0.996 02	0.995 73	0.995 43	0.995 14	0.994 85	0.994 55	0.994 26

Temperature °C	Percentages of Volume at 20°C									
	4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.4	5.6	5.8
10	0.994 22	0.993 96	0.993 69	0.993 43	0.993 16	0.992 90	0.992 64	0.992 38	0.992 13	0.991 87
11	0.994 23	0.993 96	0.993 70	0.993 43	0.993 17	0.992 90	0.992 64	0.992 38	0.992 13	0.991 87
12	0.994 23	0.993 96	0.993 69	0.993 43	0.993 16	0.992 89	0.992 63	0.992 37	0.992 12	0.991 86
13	0.994 22	0.993 95	0.993 69	0.993 42	0.993 16	0.992 89	0.992 63	0.992 37	0.992 11	0.991 85
14	0.994 22	0.993 95	0.993 68	0.993 42	0.993 15	0.992 88	0.992 62	0.992 36	0.992 09	0.991 83
15	0.994 21	0.993 94	0.993 67	0.993 41	0.993 14	0.992 87	0.992 61	0.992 34	0.992 08	0.991 81
16	0.994 21	0.993 94	0.993 67	0.993 41	0.993 14	0.992 87	0.992 61	0.992 34	0.992 08	0.991 81
17	0.994 21	0.993 94	0.993 67	0.993 39	0.993 12	0.992 85	0.992 59	0.992 33	0.992 06	0.991 80
18	0.994 21	0.993 94	0.993 67	0.993 39	0.993 12	0.992 85	0.992 59	0.992 32	0.992 06	0.991 79
19	0.994 20	0.993 93	0.993 66	0.993 38	0.993 11	0.992 84	0.992 58	0.992 31	0.992 05	0.991 78
20	0.994 19	0.993 92	0.993 65	0.993 38	0.993 11	0.992 84	0.992 57	0.992 31	0.992 04	0.991 78
21	0.994 19	0.993 92	0.993 65	0.993 37	0.993 10	0.992 83	0.992 56	0.992 29	0.992 03	0.991 76
22	0.994 18	0.993 91	0.993 64	0.993 36	0.993 09	0.992 82	0.992 55	0.992 28	0.992 01	0.991 74
23	0.994 18	0.993 90	0.993 63	0.993 35	0.993 08	0.992 80	0.992 53	0.992 26	0.992 00	0.991 73
24	0.994 18	0.993 90	0.993 63	0.993 35	0.993 08	0.992 80	0.992 53	0.992 26	0.991 99	0.991 72
25	0.994 17	0.993 89	0.993 62	0.993 34	0.993 07	0.992 79	0.992 52	0.992 25	0.991 98	0.991 71
26	0.994 17	0.993 89	0.993 61	0.993 34	0.993 06	0.992 78	0.992 51	0.992 24	0.991 96	0.991 69
27	0.994 15	0.993 87	0.993 60	0.993 32	0.993 05	0.992 77	0.992 50	0.992 22	0.991 95	0.991 67
28	0.994 14	0.993 86	0.993 59	0.993 31	0.993 04	0.992 76	0.992 49	0.992 21	0.991 94	0.991 66
29	0.994 13	0.993 85	0.993 57	0.993 30	0.993 02	0.992 74	0.992 47	0.992 19	0.991 92	0.991 64
30	0.994 12	0.993 84	0.993 56	0.993 28	0.993 00	0.992 72	0.992 44	0.992 17	0.991 89	0.991 62
31	0.994 11	0.993 83	0.993 55	0.993 27	0.992 99	0.992 71	0.992 43	0.992 16	0.991 88	0.991 61
32	0.994 10	0.993 82	0.993 54	0.993 26	0.992 98	0.992 70	0.992 42	0.992 15	0.991 87	0.991 60
33	0.994 08	0.993 80	0.993 52	0.993 23	0.992 95	0.992 67	0.992 39	0.992 12	0.991 84	0.991 57
34	0.994 07	0.993 79	0.993 51	0.993 22	0.992 94	0.992 66	0.992 38	0.992 10	0.991 83	0.991 55
35	0.994 06	0.993 78	0.993 49	0.993 21	0.992 92	0.992 64	0.992 36	0.992 08	0.991 81	0.991 53
36	0.994 05	0.993 77	0.993 48	0.993 20	0.992 91	0.992 63	0.992 35	0.992 07	0.991 79	0.991 51
37	0.994 02	0.993 74	0.993 45	0.993 17	0.992 88	0.992 60	0.992 32	0.992 04	0.991 76	0.991 48
38	0.994 01	0.993 72	0.993 44	0.993 15	0.992 87	0.992 58	0.992 30	0.992 02	0.991 75	0.991 47
39	0.993 99	0.993 71	0.993 42	0.993 14	0.992 85	0.992 57	0.992 29	0.992 01	0.991 72	0.991 44
40	0.993 97	0.993 68	0.993 40	0.993 11	0.992 83	0.992 54	0.992 26	0.991 98	0.991 69	0.991 41

(Continued)

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Table 1 Apparent Relative Densities of Aqueous Ethanol at Various Temperatures -*Contd*

Temperature ·C	Percentages of Volume at 20•c									
	6.0	6.2	**6.4**	**6.6**	***6.8***	7.0	7.Z	**7.4**	7.6	7,JJ
10	0.991 61	0.991 36	0.991 11	0.990 87	0.990 62	0.990 37	0.990 1.3	0.989 89	0.989 64	0.989 40
11	0.991 61	0.991 36	0.991 11	0.990 86	0.990 61	0.990 36	0.990 11	0.989 87	0.989 62	0.989 38
12	0.991 60	0.991 35	0.991 10	0.990 84	0.990 59	0.990 34	0.990 00	0.989 85	0.989 60	0.989 36
13	0.991 59	0.991 34	0.991 08	0.990 83	0.990 *51*	0.990 32	0.990 07	0.989 83	0.989 58	0.989 34
14	0.991 57	0.991 32	0.991 06	0.990 81	0.990 *SS*	0.990 30	0.990 05	0.989 81	0.989 56	0.989 32
15	0.991 *55*	0.991 30	0.991 04	0.990 79	-0.990 53	0.990 28	0.990 03	0.989 78	0.989 54	0.989 29
16	0.991 *55*	0.991 29	0.991 04	0.990 78	0.990 53	0.990 27	0.990 02	o.989 *n*	0.989 53	0.989 28
17	0.99154	0.991 28.	0.991 03	o.990 *n*	0.990 52	0.990 26	0.990 01	0.989 76	0.989 51	0.989 26
18	0.991 53	0.991 27	0.991 01	0.990 76	0.990 50	0.990 24	**0.989 99**	0.989 74	0.989 48	0.989 23
19	0.991 52	0.991 26	0.991 00	0.990 74	0.990 48	0.990 22	0.989 97	0.989 72	0.989 46	0.989 21
20	0.991 51	0.991 25	0.990 99	0.990 72	0.990 46	0.990 20	0.989 *9S*	0.989 69	0.989 44	0.989 18
21	0.991 49	0.991 23	0.990 97	0.990 70	0.990 44	0.990 18	0.989 93	0.989 67	0.989 42	0.989 16
22	0.991 47	0.991 21	0.990 95	0.990 69	0.990 43	0.990 17	0.989 91	0.989 65	0.989 40	0.989 14
23	0.991 46	0.991 20	0.990 94	0.990 67	0.990 41	0:990 15	0.989 89	0.989 63	0.989 37	0.989 11
24	0.991 45	0.991 19	0.990 92	0.990 66	0.990 39	0.990 13	0.989 87	0.989 61	0.989 36	0.989 10
25	0.991 44	0.991 17	0.990 91	0.990 64	0.990 38	0.990 11	**0.989 85**	0.989 59	0.989 33	0.989 07
26	0.991 42	0.991 15	0.990 89	0.990 62	0.990 36	0.990 *Q()*	0.989 83	0.989 57	0.989 30	0.989 04
27	0.991 40	0.991 13	0.990 86	0.990 60	0.990 33	0.990 06	0.989 80	0.989 54	0.989 28	0.989 02
28	0.991 39	0.991 12	0.990 85	0.990 58	0.990 31	0.990 04	0.989 78	0.989 52	0.989 25	0.988 99
29	0.991 37	0.991 10	0.990 83	0.990 57	0,990 30	0.9990 03	0.989 76	0.989 50	0.989 23	0.988 97
30	0.991 34	0.991 07	0.990 80	0.990 54	0.990 *Zl*	0.990 00	0.989 73	0.989 47	0.989 20	0.988 94
31	0.991 33	0.991 06	0.990 79	0.990 51	0.990 24	0.989 97	0.989 71	0.989 44	0.989 18	0.988 91
32	0.991 32 .	0.991 05	0.990 78	0.990 50	0.990 23	0.989 96	0.989 69	0.989 42	0.989 16	0.988 89
33	0;991 29	0.991 02	0.990 75	0.990 47	0.990 20	0.989 93	0.989 66	0.989 39	0.989 13	0.988 86
34	0.991 27	0.991 00	0.990 72	0.990 45	0.990 17	0.989 90	0.989 63	0.989 36	0.989 O'J	0.988 82
35	0.991 25	0.990 98	0.990 70	0.990 43	0.990 15	0.989 88	0.989 61	0.989 34	0.989 07	0.988 SO
36	0.991 23	0.990 96	0.990 68	0.990 41	0.990 13	0.989 86	0.989 *59*	0.989 32	0.989 04	0.988 77
31	0.991 20	0.990 92	0.990 65	0.990" 37	0.990 10	0.989 82	0.989 *55*	0.989 28	0.989 00	0.988 73
38	0.991 19	0.990 91	0.990 64	0.990 36	0.990 09	8.989 81	0.989 54	0.989 26	0.988 99	0.988 71
39	0.991 16	0.990 88	0.990 60	0.990 33	0.990 05	o.989 *n*	0.989 50	0.989 22	0.988 *95*	0.988 67
40	0.991 13	0.990 85	0.990 58	0.990 30	0.990 03	0.989 75	0.989 48	0.989 20	0.988 93	0.988 65

Temperature °C	Percentages of Volume at 20°C									
	8.0	8.2	8.4	8.6	8.8	9.0	9.2	9.4	9.6	9.8
10	0.989 16	0.988 92	0.988 69	0.988 45	0.988 22	0.987 98	0.987 75	0.987 52	0.987 30	0.987 07
11	0.989 13	0.988 89	0.988 66	0.988 42	0.988 19	0.987 95	0.987 72	0.987 49	0.987 27	0.987 04
12	0.989 11	0.988 87	0.988 64	0.988 40	0.988 17	0.987 93	0.987 70	0.987 47	0.987 24	0.987 01
13	0.989 09	0.988 85	0.988 61	0.988 38	0.988 14	0.987 90	0.987 67	0.987 44	0.987 20	0.986 97
14	0.989 07	0.988 83	0.988 59	0.988 35	0.988 11	0.987 87	0.987 64	0.987 40	0.987 17	0.986 93
15	0.989 04	0.988 80	0.988 56	0.988 32	0.988 08	0.987 84	0.987 60	0.987 36	0.987 13	0.986 89
16	0.989 03	0.988 78	0.988 54	0.988 29	0.988 05	0.987 80	0.98756	0.987 33	0.987 09	0.986 86
17	0.989 01	0.988 76	0.988 52	0.988 27	0.988 03	0.987 78	0.987 54	0.987 30	0.987 07	0.986 83
18	0.988 98	0.988 73	0.988 49	0.988 24	0.988 00	0.987 75	0.987 51	0.987 27	0.987 03	0.986 79
19	0.988 96	0.988 71	0.988 46	0.988 22	0.987 97	0.987 72	0.987 48	0.987 24	0.986 99	0.986 75
20	0.988 93	0.988 68	0.988 43	0.988 19	0.987 94	0.987 69	0.987 45	0.987 20	0.986 96	0.986 71
21	0.988 91	0.988 66	0.988 41	0.988 15	0.987 90	0.987 65	0.987 41	0.987 16	0.986 92	0.986 67
22	0.988 88	0.988 63	0.988 38	0.988 12	0.987 87	0.987 62	0.987 38	0.987 13	0.986 89	0.986 64
23	0.988 85	0.988 60	0.988 35	0.988 09	0.987 84	0.987 59	0.987 34	0.987 09	0.986 85	0.986 60
24	0.988 84	0.988 58	0.988 33	0.988 07	0.987 82	0.987 56	0.987 31	0.987 06	0.986 82	0.986 57
25	0.988 81	0.988 55	0.988 30	0.988 04	0.987 79	0.987 53	0.987 28	0.987 03	0.986 78	0.986 53
26	0.988 78	0.988 52	0.988 27	0.988 01	0.987 76	0.987 50	0.987 25	0.987 00	0.986 74	0.986 49
27	0.988 76	0.988 50	0.988 24	0.987 98	0.987 72	0.987 46	0.987 21	0.986 96	0.986 70	0.986 45
28	0.988 73	0.988 47	0.988 21	0.987 95	0.987 69	0.987 43	0.987 17	0.986 92	0.986 66	0.986 41
29	0.988 70	0.988 44	0.988 18	0.987 93	0.987 67	0.987 41	0.987 15	0.986 89	0.986 64	0.986 38
30	0.988 67	0.988 41	0.988 15	0,987 88	0.987 62	0.987 36	0.987 10	0.986 84	0.986 58	0.986 32
31	0.988 65	0.988 39	0.988 12	0.987 86	0.987 59	0.987 33	0.987 07	0.986 81	0.986 55	0.986 29
32	0.988 62	0.988 36	0.988 09	0.987 83	0.987 56	0.987 30	0.987 04	0.986 78	0.986 52	0.986 26
33	0.988 59	0.988 32	0.988 06	0.987 79	0.987 53	0.987 26	0.987 00	0.986 74	0.986 47	0.986 21
34	0.988 55	0.988 28	0.988 02	0.987 75	0.987 49	0.987 22	0.986 96	0.986 70	0.986 43	0.986 17
35	0.988 53	0.988 26	0.987 99	0.987 73	0.987 46	0.987 19	0.986 93	0.986 66	0.986 40	0.986 13
36	0.988 50	0.988 23	0.987 96	0.987 70	0.987 43	0.987 16	0.986 90	0.986 63	0.986 37	0.986 10
37	0.988 46	0.988 19	0.987 92	0.987 66	0.987 39	0.987 12	0.986 85	0.986 58	0.986 32	0.986 05
38	0.988 44	0.988 17	0.987 90	0.987 63	0.987 36	0.987 09	0.986 82	0.986 55	0.986 29	0.986 02
39	0.988 40	0.988 13	0.987 86	0.987 59	0.987 32	0.987 05	0.986 78	0.986 51	0.986 25	0.985 98
40	0.988 38	0.988 11	0.987 84	0.987 56	0.987 29	0.987 02	0.986 75	0.986 48	0.986 21	0.985 94

(Continued)

Table 1 Apparent Relative Densities or Aqueous Ethanol at Various Temperatures -*Contd*

Temperature ·C	Percentages of Volume at 20•c									
	10.0	10.2	**10.4**	)0.6	**10.8**	**11.0**	11.2	UA'	**11.6**	11.8
10	0.986 84	0.986 62	0.986 40	0.986 18	0.985"96	0.985 74	0.985 53	0.985 31	0.985 10	0.984 88
11	0.986 81	0.98 *59*	0.986 37	0.986 14	0.985 92	0.985 70	0.985 48	0.985 27	0.985 05	0.984 84
12.	0.986 78	0.986 56	0.986 33	0.986 11	0.985 88	0.985 66	0.985 44	0.985 22	0.985 01	0.984 79
13	0.986 74	0.986 51	0.986 29	0.986 06	0.985 84	0.985 61	0.985 39	0.985 17	0.984 94	0.984 72
14	0.986 70	0.986 47	0.986 24	·o.986 01	0.985 78	0.985 *55*	0.985 33	0.98J 11	0.984 88	0.984 66
15	0.986 65	0.986 42	0.986 19	· o.9 _5 f77	0.985 74	0.985 51	0.985 29	0.985 06	0.984·84	0.984 61
16	0.986 62	0.986 39	0.986 16	0.985 92	0.985 69	0.985 46	0.985 24	0.985 01	0.984 79	0.984 *56*
17	0.986 *59*	0.986 36	0.986 12	0.985 89	0.985 *65*	0.985 42	0.985 19 .	0.984-96	0.984 73	0.984 50
18	0.986 *55*	0.986 31	0.986 OJ	0.985 84	0.985 61	0.985 37	0.985 14	0.984 91	0.984 68	0.984 45
19	0.986 51	0.986 *Tl*	0.986 04	0.985 80	0.985 57	0.985 33	0.985 10	0.984 *frl*	0.984 63	0.984 40
20	0.986 47	0.986 23	0.985 99	0.985 76	0.985 52	0.985 28	0.985 04	0.984 81	0.984 *57*	0.984 34
21	0.986 43	0.986 19	0.985 95	0.985 71	0.985 47	0.985 23	0.984 99 . ·	0.984 *16*..·.'..	0.984 52	0.984 29
22	0.986 40	0.986 16	0.985 91	0:985 67·	0.985 42	0.985 18	0.984 9(.'	0.984 71-	0.984 47	0.984 24
23	0.986 35	0.986 11	0.985 87	0.985 62	0.985 38	0.985 14	0.984 90	0.984.66	. 0.984 41	0.98,117
24	0.986 32	o.986 *en*	0.985 83	0.985 58	0.985 34	0.985 *OJ*	0.984 115	0.984 61	0.984 37	0.984 13-
25	0.986 28	0.986 03	0.985 78	0.985 54	0.985 29	0.985 04	0.984_80.	0.984 56	0.984 31	0.984 *f.11*
26	0.986 24	0.985 99	0.985 74	0.985 50	0.985 25	0.985 00	0.984 75	0.984 51	0.984 26	0.98402
27	0.986 20	0.985 *95*	0.985 70	0.985 45	0.985 20	0.984 *95*	0.984 70	0.984 46	0.984 21	0.983 97
28	0.986 15	0.985 90	0.985 65	0.985 40	0.985 15	0.984 90	0.984 *65*	0.984 40	0.984 16	0.983 91
29	0.986 12	0.985 87	0.985 61	0.985 36	0.985 10	0.984 *85*	0.984 60	0.984 35	0.984 11	0.983 86
30	0.986 06	0.985 81	0.985 *56*	0.985 30	0.985 05	0.984 80	0.984 *55*	0.984 30	0.984 04	0.983 79
31	0.986 03	0.985 77	0.985 52	0.985 26	0.985 01	0.984 75	0.984,50 .	0,984.25	0.983 99	0.983 74
32	0.986 00	0.985 74	0.985 48	0.985 23	0.984 97	0.984 71	0.984 46	0.984 20	0.983 *95*	0.983 69
33	0.985 95	**0.985 69**	0.985 43	0.985 18	0.984 92	0.984 66	**0.984 40**	0.984 14	0.983 89.	0.983 63.
34	0.985 91	0.985 *65*	0.985 39	0.985 13	0.984 87	0.984 61	0.984 35	0.984 09	0.983 84	0.983 58
35	0.985 87	0.985 61	0.985 *35*	0.985 08	0..984 82	0.984 56	0.984 30	0,98,l_n.t	0.983 78	0.983 *52*
36	0.985 84	0.985 58	0.985 31	0.985 05	0.984 8	0.984 52	0.984. 26	0.984 00	0.983 73	0.983 47
37	0.985 78	0.985 52	0.985 25	0.984 99	0.984 72	0.984 46	0.984 20	0.983 *94*	0.983 67	0.983 41
38	0.9:85 75	0.985 48	0.985 22	0.984 95	0.984 69	0.984 42	0.984 16	0.983 89	0.983 63	0.983 36
39	0.985 71	0.98S 44	0.985 18	0.984 91	0.984 *65*	0.984 38	0.984 11	0.983 85	0.983 58	0.983 32
40	*0.985* 67	0.985 40	.0.985 13	0.984 87	0.984 60	0.984 33	0.984 06	0.983 80	0.983 53	0.983 27

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Temperature ·C	Percentages of·Volume at 20•c									
	11.8	11.1	11.4	11.6	**12.8**	13.0 ·	13.2	13.4	13.6	13.8
10	0.984 67	0.984 46	0.984 *25*	0.984 *OS*	0.983 84	0.983 63	0.983 43	0.983 23	0.983 02	0.982 82
11	0.984 62	0.984 41	0.984 20	0.983 *99*	0.983 78	0.983 57	0.983 36	0.983 16	0.982 95.	0.982 75
12	0.984 57	0.984 36	0.984 14	0.983 93	0.983 71	0.983 *SO*	0.983 29	0.983 08	0.982 88	0.982 67
13	0.984 SO	0.984 29	0.984 07	0.983 86	0.983 64	0.983 43	0.983 22	0.983 01	0.982 80	0.982 59
14	0.984 **44**	0.984 22	0.984 01	0.983 79	0.983 58	0.983 36	0.983 15	0.982 94	0.982 72	0.982 51
15	0.984 39	0.984 17	0.983 95	0.983 73	0.983 51	0.983 29 ·	0.983 08	0.982 86	0.982 65	0.982 43
16	0.984 34	0.984 12	0.983 89	0.983 67	0.983 44	0.983 22	0.983 00	0.982 79	0.982 57	0.982 36
17	0.984 *'1:1*	0.984 *OS*	0.983 83	0.983 *60*	0.983 38	0.983 16	0.982 94	0.982,72	0.982 50	0.982 28
18	0.984 22	0.984 00	0.983 77	0.983 *55*	0.983 32	0.983 10	0.982 88	0.982 66	0.982 43	0.982 21
19	0.984-17	0.983 94	0.983 71	0.983 49	0.983 26	0.983 03	0.982 81	0.982 58	0.982 36	0.982 13
20	0.984 10	0.983 87	0.983 64	0.983 42	0.983 19	0.9. 82 96	0.982 73	0.982 51	0.982 28	0.982 **06**
21	0.984 05	0.983 82	0.983 *59*·	0.983 36	0.98313	0.982 90	0.982 67	0.982 44	0.982 21	0.981 98
22	0.984 00	0.983 76	0.983 53	0.983 *29*	0.983 06	· 0.982 82	0.982 59	0.982 36	0.982 13	0.981 90
23	0.983 93	0.983 70	0.983 46	0.983 23	0.982 *99*	0.982 76	0.982 53	0.982 30	0.982 06	0.981 83
24	**0.983 89**	0.983 6S	0.983 41	0.983 18	0.982 94	0.982 70	0.982 46	0.982 23	0.981 99	'0.981 76
25	0.983 83	0.983 59	0.983 35	0.983 11	0.982 87	0.982 63	0.982 39·	0.982 16	0.981 92	0.981 *fD*
26	0.983 77	0.983 53	0.983 29	0.983 05	0.982 81	0.982-57,	0.982 33	0.982 O'J	0.981 85	0.981 61
27	0.983 72	0.983 48.	0.983 23	0.982 99	0.982 74	0.982 SO	0.982 26	0.982 02	0.981 78	0.981 54
28	0.983 66	0.983 42	· 0.983 17	0.982 93	0.982 68	0.982 44	0.982 20	0.981 *9S* ·	0.981 71	0.981 46
29	0.983 61'	0.983 36.	0.983 11	0.982 87	0.982 62	0.982 *31*	0.982 12	0.981 88	0.981 63	0.981 39
30	0.983 54	0.983 *29*	0.983 04	0.982 79	0.982 54.	0.982 *29*	0.982 04	0.981 80	0.981 ***SS***	0.981 31
31	0.983 49	0.983 24	0:982 99,	0.982 73	0.982 48	0.982 23	0.981 98	0.981 73	l>.981 49	0.981 24
32	-0.983 44	0.983 19	0.982 93	0.982 68	0.982 42	0.982 17	0.981 92	0.981 67	0.981 42	0.981 17
33	0.983-37	0.983 12	0.982 87	0.982 61	0.982 36	0.982 11	0.981 86	0.981 00	0.981 35	0.981 O'J
34	0.983 32	0.983 06	0.982 81	0.982 *55*	0.982 30	0.982 04	0.981 78	0.981 53	0.981 *'1:1*	0.981 02
35	0.983 26	0.983 00	0.982 74	0.982 49	0.982 23	0.981 97.	0.981 71	0.981 46	0.981 20	0.980 *9S*
36	0.983 21	0.982 *9S*	0,982 *fD*	0.982 44	0.982 18	0.981 92.	0.981 66	0.981 40	0.981 15	0.980 89
37	0.983 15	0.982 8§·	0.982 63	0.982 37	0.982 11	0.981 85	0.981 59	0.981·33	0.981 07	0.980 81
38	0.983 10	0.982 84	0.982 58	0.982 31	0.982 05	0.981 79	0.981 53	0.981 *'1:1*	0.981 00	0.980'74
39	0.983 *OS*	0.982 79	0.982 52	0.982 26	0.981 *99*	0.981 73	0.981 47	0.981 20	0.980 94	0.980 67
40	0.983 00	0.982 73	0.982 47	0.982 20	0.981 94	0.981 67	0.981 41	0.981 14	0.980 88	0.980 61

(Conl1nued)

3506 : 1989

Table 1 Apparent Relative Densities of Aqueous Ethanol at Various Temperatures-Coned

Temperature ·C	Percentages of Volume at 20·c									
	14.0	**14.2**	14.4	**14.6**	**14.8**	**15.0**	**15.2**	**15.4**	**15.6**	**15.8**
10	0.982 62	0.982 42	0.982 22	0.982 03	0.981 83	0.981 63	0.981 44	0.981 24	0.981 05	0.980 *85*
11	0.982 54	0.982 34	0.982 14	0.981 93	0.981 73	0.981 53	0.981 34	0.981 14	0.980 *95*	0.980 75
12	0.982 46	0.982 26	0.982 06	0.981 85	0.981 65	0.981 45	0.981 25	0.981 05	0.980 85	0.980 *65*
13	0.982 38	0.982 18	0.981°97	0.981 77	0.981 *56*	0.981 36	0.981 16	0.980 96	0.980 76	0.980 56
14	0.982 30	0.982 09	0.981 88	0.981 68	0.981 47	0.981 26	0.981 05	0.980 85	0.980 64	0.980 44
15	0.982 22	0.982 01	0.981 80	0.981 58	0.981 37	0.981 16	0.980 9S	0.980 74	0.980 **54**	0.980 33
16	0.982 14	0.981 93	0.981 71	0.981 50	**0.981 28**	0.981 07	0.980 86	0.980 65	0.980 45	0.980 24
17	0.982 06	0.981 85	0.981 63	0.981 42	0.981 20	0.980 **99**	0.980 78	0.980 56	0.980 35	0.980 13
18	0.981 99	0.981 77	0.981 *55*	0.981 33	0.981 11	0.980 89	0.980 68	0.980 46	0.980 25	0.980 03
· 19	0.981 91	0.981 69	0.981 47	0.981 25	0.981 03	0.980 81	0.980 *59*	0.980 37	0.980 16	0.979 94
20	0.981 83	0.981 61	0.981 39	0.981 16	0.980 94	0.980 72	0.980 50	0.980 28	0.980 OS	0.979 83
21	0,981 75	0.981 52	0.981 30	0.981 07.	0.980 85	0.980 62	0.980 40	0.980 18	0.979 95	0.979 73
22	0.981 67	0.981 44	0.981 22	0.980 99	0.980 77	0.980 54	0.980 31	0.980 (JI)	0.979 86	0.979 **64**
23	0.981 60	0.981 37	0.981 14	0.980 **90**	0.980 67	0.980 **44**	0.980 21	0.979 99	0.979 76	0.979 54
24	0.981 52	0.981 *19*	0.981 06	0.980 83	0.980 60	0.980 37	0.980 14	0.979 91	0.979 67	0.979 44
25	0.981 45	0.981 21	0.980 98	0.980 74	0.980 51	0.980 27	0.980 04	0.979 81	0.979 58	0.979 35
26	0.981 37	0.981 13	0.980 90	0.980 **66**	0.980 43	0.980 19	0.979 95	0.979 72	0.979 48	0.979 25
27	0.981 30	0.981 06	0.980 82	0.980 58	0.980 34	0.980 10	0.979 86	0.979 62	0.979 39	0.979 15
28	0.981 22	0.980 98	0.980 74	0.980 49	0.980 25	0.980 01	0.979 77	0.979 53	0.979 30	0.979 06
29	0.981 14	0.980 90 ·	0.980 66	· o.980 41	0.980 17	0.979 93	0.979 69	0.979 45	0.979 20	0.978 96
30	0.981 06	0.980 81	0.98Q57	0.980 32	0.980 08	0.979 83	0.979 *59*	0.979 34	0.979 IO	0.978 85
31	0.980 99	0.980 74	0.980 49	0.980 25	0.980 00	0.979 75	0.979 50	0.979 26	0.979 01	0.978 77
32	0.980 92	0.980 67	0.980 42	0.980 17	0.979 92	0.979 67	0.979 42	0.979 17	0.978 93	0.978 68
33	0.980 84	0.980 59	0.980 34	0.980 08	0.979 83	0.979 58	0.979 33	0.979 08	0.978 83	0.978 58
34	0.980 76	0.980 SI	0.980 25	0.980 00	0.979 74	0.979 49	0.979 24	0.978 99	0.978 73	0.978 48
35	0.980 69	0.980 44	0.980 18	0.979 93	0.979 67	0.979 42	0.979 16	0.978 91	0.978 6S	0.978 40
36	0.980 63	0.980 37	0.980 11	0.979 86	0.979 60	0.979 34	0.979 08	0.978 82	0.978 *57*	0.978 31
37	0.980 *55*	0.980 29	0.980 03	0.979 77	0.979 51	0.979 2S	0.978 99	0.978 73	0.978 47	0.978 21
38	0.980 48	0.980 22	0.979 96	0.979 69	0.979 43	0.979 17	0.978 91	0.978 65	0.978 38	0.978 12
39	0.980 41	0.980 15	0.979 88	0.979 62	0.979 35	0.979 09	0.978 83	0.978 56	0.978 30	0.978 03
40	0.980 35	0.980 08	0.979 81	0.979 *55*	0.979 28	0.979 01	0.978 74	0.978 48	0.978 21	0.977 95

Temperature °C	Percentages of Volume at 20°C									
	16.0	16.2	16.4	16.6	16.8	17.0	17.2	17.4	17.6	17.8
10	0.980 66	0.980 47	0.980 28	0.980 09	0.979 90	0.979 71	0.979 52	0.979 34	0.979 15	0.978 97
11	0.980 56	0.980 37	0.980 17	0.979 98	0.979 78	0.979 59	0.979 40	0.979 21	0.979 03	0.978 84
12	0.980 45	0.980 26	0.980 06	0.979 87	0.979 67	0.979 48	0.979 29	0.979 09	0.978 90	0.978 70
13	0.980 36	0.980 16	0.979 96	0.979 76	0.979 56	0.979 36	0.979 16	0.978 96	0.978 77	0.978 57
14	0.980 23	0.980 03	0.979 83	0.979 63	0.979 43	0.979 23	0.979 03	0.978 83	0.978 63	0.978 43
15	0.980 12	0.979 92	0.979 71	0.979 51	0.979 30	0.979 10	0.978 90	0.978 70	0.978 50	0.978 30
16	0.980 03	0.979 82	0.979 61	0.979 41	0.979 20	0.978 99	0.978 78	0.978 58	0.978 37	0.978 17
17	0.979 92	0.979 71	0.979 50	0.979 29	0.979 08	0.978 87	0.978 66	0.978 45	0.978 25	0.978 04
18	0.979 82	0.979 61	0.979 40	0.979 18	0.978 97	0.978 76	0.978 55	0.978 34	0.978 13	0.977 92
19	0.979 72	0.979 50	0.979 29	0.979 07	0.978 86	0.978 64	0.978 43	0.978 21	0.978 00	0.977 78
20	0.979 61	0.979 39	0.979 18	0.978 96	0.978 75	0.978 53	0.978 31	0.978 10	0.977 88	0.977 67
21	0.979 51	0.979 29	0.979 07	0.978 84	0.978 62	0.978 40	0.978 18	0.977 96	0.977 75	0.977 53
22	0.979 41	0.979 19	0.978 96	0.978 74	0.978 51	0.978 29	0.978 07	0.977 85	0.977 63	0.977 41
23	0.979 31	0.979 08	0.978 85	0.978 63	0.978 40	0.978 17	0.977 95	0.977 72	0.977 50	0.977 27
24	0.979 21	0.978 98	0.978 75	0.978 53	0.978 30	0.978 07	0.977 84	0.977 61	0.977 39	0.977 16
25	0.979 12	0.978 89	0.978 66	0.978 42	0.978 19	0.977 96	0.977 73	0.977 50	0.977 27	0.977 04
26	0.979 01	0.978 78	0.978 55	0.978 31	0.978 08	0.977 85	0.977 62	0.977 38	0.977 15	0.976 91
27	0.978 91	0.978 67	0.978 44	0.978 20	0.977 97	0.977 73	0.977 49	0.977 26	0.977 02	0.976 79
28	0.978 82	0.978 58	0.978 34	0.978 10	0.977 86	0.977 62	0.977 38	0.977 15	0.976 91	0.976 68
29	0.978 72	0.978 48	0.978 24	0.978 00	0.977 76	0.977 52	0.977 28	0.977 04	0.976 79	0.976 55
30	0.978 61	0.978 37	0.978 13	0.977 88	0.977 64	0.977 40	0.977 16	0.976 91	0.976 67	0.976 42
31	0.978 52	0.978 27	0.978 03	0.977 78	0.977 54	0.977 29	0.977 04	0.976 80	0.976 55	0.976 31
32	0.978 43	0.978 18	0.977 93	0.977 69	0.977 44	0.977 19	0.976 94	0.976 69	0.976 45	0.976 20
33	0.978 33	0.978 08	0.977 83	0.977 57	0.977 32	0.977 07	0.976 82	0.976 57	0.976 33	0.976 08
34	0.978 23	0.977 98	0.977 73	0.977 47	0.977 22	0.976 97	0.976 72	0.976 47	0.976 21	0.975 96
35	0.978 14	0.977 89	0.977 63	0.977 38	0.977 12	0.976 87	0.976 61	0.976 36	0.976 10	0.975 85
36	0.978 05	0.977 79	0.977 53	0.977 28	0.977 02	0.976 76	0.976 50	0.976 24	0.975 99	0.975 73
37	0.977 95	0.977 69	0.977 43	0.977 17	0.976 91	0.976 65	0.976 39	0.976 13	0.975 87	0.975 61
38	0.977 86	0.977 60	0.977 34	0.977 07	0.976 81	0.976 55	0.976 29	0.976 03	0.975 76	0.975 50
39	0.977 77	0.977 51	0.977 24	0.976 98	0.976 71	0.976 45	0.976 19	0.975 92	0.975 66	0.975 39
40	0.977 68	0.977 41	0.977 15	0.976 88	0.976 62	0.976 35	0.976 08	0.975 81	0.975 55	0.975 28

(Continued)

Table 1 **Apparent** Relative Densities or Aqueous Ethanol at Various **Temperatures** -*Contd*

Temperature ·C	Percentages of Volume at 20·c									
	18.0	**18.2**	**,18.4**	**18.6**	**18.8**	**19.0**	**19.2**	**19.4**	**19.6**	**19.8**
10	0.978 78	0.978 60	0.978 41	0.978 23	0.978 04	0.977 86	0.977 68	0.977 50	0.977 31	0.977 13
11	0.978 65	0.978 46	0.978 27	0.978 09	0.977 90	0.977 71	0.977 52	0.977 34	0.977 *15*	0.976 97
12	0.978 51	0.978 32	0.978 13	0.977 94	0.977 *75*	0.977 56	0.977 37	0.977 18	0.976 98	0.976 79
13	0.978 37	0.978 18	0.977 98	0.977 79	0.977 *59*	0.977 40	0.977 21	0.977 01	0.976 82	0.976 62
14	0.978 23	0.978 03	0.977 84	0.977 64	0.977 45	0.977 25	0.977 05	0.976 86	0.976 66	0.976 47
15	0.978 10	0.977 90	0.977 70	0.977 49	0.977 29	0.977 09	0.976 89	0.976 69	0.976 49	0.976 29
16	0.977 96	0.977 76	0.977 *55*	0.977 35	0.977 14	0.976 94	0.976 74	0.976 54	0.976 33	0.976 13
17	0.977 83	0.977 62	0.977 42	0.977 21	0.977 01	0.976 80	0.976 *59*	0.976 38	0.976 18	0.975 97
18	0.977 71	0.977 50	0.977 29	0.977 ITT	0.976 86	0.976 *65*	0,976 **44**	0.976 23	0.976 03	0.975 82
19	0.977 *57*	0.977 36	0.977 15	0.976 93	0.976 72	0.976 51	0.976 30	0.976 **09**	0.975 87	0.975 **66**
20	0.977 45	0.977 23	0.977 01	0.976 **80**	0.976 58	0.976 36	0.976 15	0.975 93	0.975 72	0.975 50
21	0.977 31	0.977 09	0.976 87	0.976 **66**	0.976 44	0.976 22	0.976 00	0.975 78	0.975 56	0.975 34
22	0.977 19	0.976 97	0.976 74	0.976 52	0.976 29	0.976 07	0.975 85	0.975 63	0.975 41	0.975 **19**
23	0.977 05	0.976 83	0.976 61	0.976 38	0.976 16	0.975 94	0.975 71	0.975 49	0.975 26	0.975 04
24	0.976 93	0.976 70	0.976 48	0.976 25	0.976 03	0.975 80	0.975 *57*	0.975 34	0.975 12	0.974 89
25	0.976 81	0.976 *58*	0.976 35	0.976 12	0.975 89	0.975 66	0.975 43	0.975 20	0.974 97	0.974 74
26	0.976 68	0.976 45	0.976 22	0.975 98	0.975 75	0.975 52	0.975 29	0.975 *05*	0.974 82	0.974 58
27	0.976 *55*	0.976 32	0.976 08	0.975 85	0.975 61	0.975 38	0.975 14	0.974 91	0.974 67	0.974 44
28	0.976 44	0.976 20	0.975 96	0.975 72	0.975 48	0.975 24	0.975 00	0.974 77	0.974 53	0.974 30
29	0.976 31	0.976 07	0.975 83	0.975 *59*	0.975 35	0.975 11	0.974 87	0.974 63	0.974 39	0.974 15
30	0.976 18	0.975 94	0.975 70	0.975 45	0.975 21	0.974 97	0.974 73	0.974 48	0.974 24	0.973 **99**
31	0.976 06	0.975 82	0.975 *51*	0.975 33	0.975 08	0.974 84	0.974 59	0.974 34	0.974 *10*	0.973 85
32	0.975 95	0.975 70	0.975 *45*	0.975 21	0.974 96	0.974 71	0.974 46	0.974 21	0.973 96	0.973 71
33	0.975 83	0.975 58	0.975 33	0.975 07	0.974 82	0.974 *57*	0.974 32	0.974 07	0.973 81	0.973 *56*
34	0.975 71	0.975 46	0.975 20	0.974 95	0.974 69	0.974 44	0.974 18	0.973 93	0.973 67	0.973 42
35	0.975 .59	0.975 33	0.975 Ol!	0.974 82	0.974 57	0.974 31	0.974 05	0.973 79	0.973 54	0.973 28
36	0.975 47	0.975 21	0.974 *95*	0.974 70	0.974 44	0.974 18	0.973 92	0.973 66	0.973 40	b.973 14
37	0.975 35	0.975 09	0.974 83'	0.974 56	0.974 30	0.974 04	0.973 78	0.973 52	0.973 *25*	0.972 99
38	0.975 24	0.974 98	0.974 71	0.974 45	0.974 18	0.973 92	0.973 66	0.973 39	0.973 13	0.972 86
39	0.975 13	0.974 86	0.974 *59*	0.974 33	0.974 06	0.973 79	0.973 52	0.973 26	0.972 99	0.972 73
40	0.975 01	0.974 74	0.974 47	0.974 21	0.973 94	0.973 67	0.973 40	0.973 13	0.972 86	0.972 59

Temperature ·C	Percentages of Volume at 20·c									
	20.0	20.1	**20.4**	**20.6**	**20.8**	**21.0**	**21.2**	**21.4**	**21.6**	**21.8**
10	0.976 95	0.976 77	0.976 59	0.97640	0.97622	0.97604	0.975 86	0.975 68	0.975 49	. 0.975 31
11	0.976 78	0.97659	0.976 41	0.976 22	0.97604	0.975 85	0.975 66	0.975 48	0.975 29	·0.975 11
12	0.976 60	0.97641	0.976 22	0.97604	0.975 85	0.975 66	0.975 47	0.97528	0.975 09	0.97490
13	0.97643	0.97624	0.976 05	0.975 85	0.975 66	0.975 47	0.975 28	0.97509	0.974 89	0.974 70
14	0.976·27'	0.97607'	• 0.975 88	0.975'68	0.97549	0.975 29	0.975 09	0.974 89	0.97470	0.974 50
15	0.9.76 *(JC)*	0.975 89	0.975 69	0.975 49	0.975 29	0.975 09	0.974 89	0.974 69	0.97449	0.974 29
16	0.975 93	0.975.73	0.975 53 .	0.975 32	0.975 12	0.97492	0.974 72	0.974 51	0.974 31	0.97410
17	0.975 76	0.975 56 ·	0.97S35	0.97515	0.97494	0.974 74	0.974 53	0.97432	0.974 12	0.973 91
18"	0.975 61	, 0:975 40	0.975.19	**0.974 98**	0.974 77	0.97456	0.974 35	**0.97414**	0.973 93	0.973 72
19	0.975 45	*0.r]5* 24	0_.975 02	0.974 81	0.97459	0.974 38	0.974 17	0.973 96	0.973 74	0.973 53
20	0.975 29	0.975 07	0.974_86	**0.974 64**	0.97443	0.974 21	0.973 99	0.973 77	0.97356	0.973 34
21	0.97512	0.974 90	0.974 68	0.97447	0.97425	0.97403	0.973 81	0.973 59	0.973 38	0.973 16
22	0.97497	.0.974 75	'0.974 53·	0.974 30	0.974 08	0.973 86	0.973 64	0.97341	0.973 19	0.97296
23	0.974 81	0.97459	0.974 36	0.974 14	0.973 91	0.973 69	0.973 46	0.97323	0.973 01	0.972 78
24	**0.97466**	0.974;43	0.974 20	0.973 98	0.973 75	0.973 52	0.973 29	0.97306	0.97284	0.972 61
.25	**0.974 51**	0.974Z8	0.9-7405	0.973 81	0.973 58	0.973 35	0.973 12	0.97289	0.97266	0.97243
26	0.97435	0.97412	0.973 89	0.973 65	0.97342	0.973 19	0.972 95	0.972 72	0.97248	0.972 25
27	0.97420	0.973 96.	0.97373	0.973 49	0.973 26	0.973 02	0.972 78	0.97254	0.972 31	0.97207
28	0.97406	0.973!!2	d.973 58	0.973 34	0.973 lO	0.972 86	0.972 62	0.97238	0.97213	0.97189
29	0.973 91	0.973 67	0.973 42	0.97318	0.97293	0.97269	0.97245	0.97220	0.97196	0.971 71
30	0.973 75	0.973 50	0.973 26	0.973 01	0.97277	0.97252	0.97227	0.97203	0.971 78	0.97154
31	0.973 60	0.973 35	0.973 10	0.972 86	0.972 61	0.97236	0.97211	0.97186	0.971 62	0.971 37
32	0.97346	0.973 21 ·	0·_972 96	0.972 70	0.97245	0.97220	0.971 95	0.971 70	0.97145	0.971 20
33	0.973 31	0.97306	0.972·80	0.97255	0.972 29	0.97204	0.971 78	0.97153	0.97127	0.97102
34	0.973 16	0.97290	0.972 65	0.972 39	0.97214	0.97188	0.971 62	0.97136	0.97110	0.97084
35	0.97302	0.972 76	0.972 50	0.97224	0.971 98	0.971 72	0.97146	0.97120	0.97093	0.97067
36	0.972 88	0.97262	0.972 36	0.97209	0.97183	0.97157	0.971 31	0.971 04	0.97078	0.970 51
37	0.972 73	0.97247	0.972 20	0.97194	0.97167	0.97141	0.971 14	0.97087	0.97061	0.97034
38	0.97260	0.972 33	0.97206	0.97180	0.97153	0.971 26	0.97099	0.97072	0.97045	0.970 18
39	0.97246	0.97219	0.97192	0.97165	o. 11 38	0.97111	0.970 83	0.97056	0.97028	0.970 01
40	0.97232	0.97205	0.971 77	0.971 50	0.971 22	0.97095	0.97067	0.97040	0.970 12	0.969 85

(ConJinued)

Table 1 Apparent Relative Densities of Aqueous Ethanol at Various Temperatures -*Contd*

Temperature ·C	Percentages or Volume at 20·c									
	22.0	22.2	22.4	**22.6**	22.8	23.0	23.2	**23.4**	23.6	**23.8**
10	0.97513	0.974 95	0.974 77	0.974 58	0.97440	0.974 22	0.97403	0.973 85	0.973 66	0.97r48
11	0.97492	0.974 73	0.974 54	0.974 36	0.97417	0.973 98	0.973 79	0.973 60	0.973 42	0.973 23
12	0.974 71	0.97452	0.97433	0.97414	0.973 *95*	0.973 76	0.973 57	0.973 38	0.973 18	0.97299
13	0.974 51	0.974 32	0.97412	0.97393	0.973 73	0.973 54	0.973 34	0.973 **14**	0.97295	0.972 75
14	0.974 30	0.974 10	0.973 90	0.973 71	0.973 51	0.973 31	0.973 **11**	0.972 **91**	0.972 71	0.972 51
15	0.97409	0.973 89	0.973 69	0.973 49	0.973 29	0.973 09	0.97289	0.972 68	0.97248	0.97227
16	0.973 90	0.973 69	Q.97349	0.973 28	0.97308	0.972 87.	0.972 66	0.97246	0.972 25	0.97205
17	0.97370	0.973 49	0.973 28	0.973 08	0.972 87	0.972 66	0.97245	0.97224	0.97203	0.97182
18	0.973 51	0.973 30	0.97309	0.97287	0.972 66	0.97245	**0.972 24**	0.97202	0.971 81	0.971 59
19	0.973 32	0.973 11	0.97289	**0.97268**	0.97246	0.972 25	0.97203	0.971 81	0.97159	0.97137
20	0.97312	0.972 90	0.972 68	0.97247	0.972 25	0.97203	0.971 81	0.97159	0.97137	0.97115
21	0.972 94	0.972 72	0.97249	0.972 27	0.97204	0.971 82	0.971 60	0.97138	0.971 15	0.97093
22	0.972 74	0.97252	0.97229	0.972 07	0.971 84	0.97162	0.97139	0.97116	0.97094	0.97071
23	0.97255	0.97232	0.97210	0.971 87	0.971 65	0.971 42	0.971 19	0.97096	0.97073	**0.97050**
24	0.97238	0.97215	0.97192	0.971 68	0.97145	0.971 22	0.97099	0.97076	0.97052	0.97029
25	0.972 20	0.97196	0.971 73	0.97149	0.971 26	0.97102	0.97078	0.97055	0.97031	0.97008
26	0.972 01	0.971 77	0.97154	0.97130	0.971 07	0.97083	0.97059	0.97035	0.97010	0.969 86
27	0.971 83	0.971 *59*	0.97135	0.97111	0.97087	0.97063	0.97039	0.970 14	0.969 90	0.969 65
28	0.971 65	0.97141	0.97116	0.970 92	0.97067	0.97043	0.97018	0.96994	0.969 69	0.96945
29	0.97147	0.97122	0.97098	0.97073	0.97049	0.9702A	0.969 99	0.969 74	0.96949	0.969 24
30	0.97129	0.97104	0.97079	0.97054	0.97029	0.97004	0.969 79	0.96954	0.96928	0.96903
31	0.97112	0.970 87	0.97061	0.97036	0.970 lO	0.969 85	0.969 60	0.96934	0.96909	0.968 83
32	0.97095	0.97069	0.97044	0.970 18	0.96993.	0.969 67	0.96941	0.96915	0.968 90	0.968 64
33	0.97076	0.97050	0.97025	0.96999	0.969 74	0.96948	0.96922	0.968 96	0.968 69	0.96843
34	0.97058	0.97032	0.97006	0.96981	0.969 *55*	0.96929	0.96903	0.968 76	0.968 *50*	0.968 23
35	0.97041	0.97015	0.%988	0.96962	0.9693S	0.96909	0.968 82	0.96856	0.968 29	0.96803
36	0.97025	0.96998	0.969 71	0.96945	0.96918	0.96891	0.968 64	0.96837	0.968 10	0.967 83
37	0.97007	0.96980	0.969 *53*	0.96926	0.968 99	*0.968* 72	0.968 *4S*	0.968 18	0.967 90	0.967 63
38	0.969 91	0.969 64	0.969 37	0.96909	0.968 82	0.968 .55	0.968 27	0.96800	0.967 72	0.967 *45*
39	0.969 73	0.96946	0.96918	0.968 91	0.968 63	0.968 36	0.968 08	0.967 80	0.967 53	0.967 25
40	0.969 57	0.96929	0.969 01	0.968 74	0.96846	0.968 18	0.967 90	0.96762	0.96734	0.967 06

Temperature ·C	Percentages of Volume at 20"C									
	24.0	24.2	24.4	24.6	24.8	2S.O	2S.2	25.4	25.6	25.8
10	0.973 29	0.973 10	0.972 91	0.972 73	0.972 54	0.97235	0.97216	0.97197	0.97,1 78	0.971 59
11	0.97304	0.972 85	0.97266	0.97247	0.972 28	0.97209	0.97190	0.971 70	0.971 51	0.971 31
12	0.972 80	0.972 61	0.97241	0.972 22	0.972 02	0.97183	0.97163	0.97143	0.971 23	0.971 03
13	0.97255	0.972 35	0.972 15	0.97196	0.971 7fJ	0.97156	0.971 36	0.971 16	0970 95	0.970 75
14	0.972 31	0.97211	0.971 91	0.971 70	0.971 50	0.97130	0.97110	0.970 89	0.97069	0.97048
15	0.97207.	0.97186	0.97166	0.971 45	0.97] 25	0.971 04	0.970 83	0.97062	0.97041	0.970 20
16	0.97184	0.971.63	0.97142	0.97121	0.971 00	0.97079	0.97058	0.97037	0.97015	0.969 94
17	0.9716)	0.97140	0.97118	0.97097	0.970 75	0.97054	0.97032	0.970 11	0.96989	0.969 68
18	0.97138	0.97116	0.97095	0.97073	0.970 52	0.97030	0.97008	0.969 86	0.969 63	0.969 41
19 .	0.97115	0.97093	0.970 71	0.97049	0.97027	0.97005	0.969 83	0.969 61	0.969 38	0.969 16
20	0.97093	0.97071	0.97048	0.97026	0.97003	0.969 81	0.96958	0.969 36	0.96913	0.968 91
21	0.97071	0.97048	0.97025	0.97003	0.969 80	0.969 57	0.96934	0.969 11	0.968 88	0.968 65
22	0.97048	0.97-0 25	0.97002	0;969 79	0.969 56	0.969 33	0.96910	0.968 87	0.968 63	0.96840
23	0.97027	0.97004	0.96980	0.969 57	0.96933	0.969 10	0.968 86	0.968 62	0.968 39	·0.968 15
24	0.97-006	0.969 82	0.969 58	0.969 35	0.96911	0.968 87	0.96863	0.968 39	0.968 15	0.967 91
25	. 0.969 84	0.969 60	0.969 36	0.969 12	0.968 88	0.968 64	0.968 40	0.968 15	0.967 91	0.967 66
26	0;969 62	0,96938	0.96914	0.968 89	0.968 65	0.968 41	0.96816	0.967 92	0.967 67	0.967 43
27	0.96941	· 0.96917	0.968 92	0.968 68	0.96843	0.968 19	0.967 94	0.967 69	0.967 43	0.96718
28	0.96920	0.96895	0.968 70	0.96846	0.968 21	0.967 96	0.967 71	0.967 45	0.967 20	0.966 94
29	0.96899	0.968 74	0.96849	0.96824	0.967 99	0.967 74	0.967 48	0.967 23	0.96697	0.96672
30	0.968 78	0.96852	0.968 27	0.968 01	0.967 76	0.967 50	0.967 24	0.966 98	0.96673	0.96647
31	0.96858	0.968 32	0.96806	0.967 80	0.967 54	0.967 28	0.967 02	0.966 76	0.96650	0.96624
32	0.968 33	0.968 12	0.967 86	0.967 59	0.967 33	0.967 07	0.966 80	0.96654	0.966 27	0.966 01
33	0.96817	0.967 91	0.967 64	0.967 38	0.96711	0.966 85	0.966 58	0.966 31	0.96605	0.965 78
34	0.96797	0.96770	0.96743	0.96717	0.966 90	0.966 63	0.966 36	0.96609	0.965 82	0.965 55
35	0.967 76	0.967 49	0.967 22	0.96695	0.966 68	0.966 41	0.966 14	0.965 86	0.965 59	0.965 31
36	0.967 56	0.967 29	0.96702	0.966 74	0.96647	0.966 20	0.96592	0.965 65	0.965 37	0.965 10
37	0.967 36	0.967 08	0.966 81	0.966 53	0.96626	0.965 98	0.965 70.	0.965 42	0.965 15	0.964 87
38	0.96717	0.966 89	0.966 61	0.966 33	0.96605	0.965 77	0.965 49	0.965 21	0.964 92	0.964 64
39	0.96697	0.966 69	0.96641	0.96613	0.965 85	0.965 57	0.96.528	0.965 00	0.964 71	0.964 43
40	0.966 78	0.96649	0.966 21	0.965 92	0.965 64	0.965 35	0.965 06	0.964 77	0.96449	0.964 20

(Con.tmued)

Table 1 Apparent Relative Densities of Aqueous Ethanol at Various Temperatures-Contd

Temperature ·C	Percentages of Volume at l0°C									
	26.0	26.2	**26.4**	**26.6**	**26.8**	**27.0**	27.2	**27.4**	**27.6**	**27.8**
10	0.97140	0.971 21	0.971 02	0.970 82	0.97063	0.97044	0.97024	0.97004	0.96984	0.969 64
11	0.971 12	0.970 92	0.970 72	0.97053	0.97033	0.97013	0.96993	0.969 73	0.969 52	0.969 32
12	0.97083	0.970 63	0.97043	0.97022	0.97002	0.969 82	0.969 61	0.96941	0.969'20	0.969 00
13	0.97055	0.970 35	0.97014	0.96994	0.969 73	0.969 53	0.96932	0.96911	0.968 89	0.968 68
14	· 0.97028	0.97007	0.969 86	0.96964	0.96943	0.969 22	0.969 01	0.968 79	0.968 58	0.968 36
15	0.96999	0.96978	0.969 57	0.96935	0.96914	0.968 93	0.968 71	0.96849	0.968 28	0.968 06
16	0.96973	0.969 51	0.96929	0.96908	0.968 86	0.968 **64** ,·	0.96842	0.968 20	0.96797	0.967 75
17	0.96946	0.96924	0.96902	0.968 80	0.968 ss	**0.968 36**	**0.968 14**	0.967 91	0.967 69	0.96746
18	**0.96919**	0.968 97	0.968 75	0.968 52	**0.96830**	**0.968 08**	0.967 85	0.96762	0.967 39	0.967,16
19	**0;96894**	0.968 71	0.968 48	0.96825	0.968 02	0.96779	0.967 56	0.967 33	0.96710	0.96687.
20	**0.96868**	**0.96845**	0.968 22	0.96798	0.967 75	0.967 52	0.967 28	0.967 05	0.966 81	**0.966 58**
21	0.96842	0.968 19	0.967 95	0.967 72	0.967 48	. 0.967 25	0.967 01	0.966 77	0.966 54	0.966 30
22	**0.968 17**	0.967 93	0.967 69	0.967 45	0.967 21	0.966 97	.0.96673	0.96649	0.96625	0 96601
23	0.96791	0.967 67	0.967 43	0.96718	0.96694	o.9'6610	0.96646	0.966 21	0.965 97	0.965 72
24	0.967 67	0.96743	0.967 18	0.96694	0.966 69	0.96645	0.96620	**0.96595**	0.965 71	**0.96546**
25	0.96742	0.967 17	0.96692	0.96668	0.966 3	0.966 18	0.965 93	**0.96568**	0.96542	0.965 17
26	0.96718.	0.96693	0.966 68	0.96642	**0.966 17**	0.965 92	0.965 67	0.965 41	0.965 16	**0.964 90**
27	0.96693	0.966 68	0.96642	0.966 17	0.965 91	0.965 66	0.96540	0.965 14	0.96489	0.964 63
28	0.96669	·o.96643	0.966 17	0.965 92	0.965 66	0.96540	0.965 14	**0.964 88**	0.964 62	0.96436
29	0.966°46	0.96620	0.96594	0.965 67	0.965 41	0.96515	0.964 89	0.964 63	**0.96436**	0.964 JO
30	**0.9'6°621**	0.965 95	0.965 68	0.96542	**0.96515**	0.96489	0.964 62	0.96435	0.964 09	0.963 82
31	**0.96598**	0.965 71 ·	0.96545	0.96518	0.96492	0.964 65	0.96438	0.964 11	0.963 83	**0.963 56**
32	0.96574	0.96547	0.965 21	0.96494	0.964 68	0.96441	0.96414	0.963 86	0.963 *59*	0.963 31
33	0.965 51	().965 24	0.96497	0.964 69	0.96442	0.96415	0.963 87	0.963 60	0.963 32	0.963 05
34	0.96528	0.965 00	0.964 73	0.96445	0.96418	0.963 90	0.963 62	0.963 34	0.96307	0.962 79
35	0.965 04	0.964 76	0.964 49	0.964 21	0.963 94	0.963 66	0.963 38	09631,0	0.962 81,	0.96253
36	0.96482	0.964 54	0.964 26	0.96398	0.963 70	0.963 42	0.963 13	0.96285	0.962 56	0.962 28
37	0.96459	0.964 31'	0.964 02	0.963 74	0.96345	0.963 17	0.962 88	0.962 *59*	. 0.962 31	0.96202
38	0.964 36	0.96407	0.963 79·	0.963 50	0.963 22	0.96293	0.96264	0.962 '.)5	, 0.96206	0.961 77
39	0.96414	0.963 85	0.963 56	0.963 27	0.96298	0.962 69	0.96240	0.96210	0.961 81	0.961 51
40	0.963 91	0.963 62	0.963 33	0.963 04	0.962 75	0.96246	0.962 16	0.961 &7	0.961 57	0.961 28

Temperature ·C	Percentages of Volume at 20°C									
	28.0	28.1	**28.4**	**28.6**	28.8	**29.0**	29.2	29.4	29.6	**29.8**
10	0.?6944	0.96924	0.96903	0.968 83	0.968 62	0.96842	0.968 21	0.968 00	. 0.967 80	0.967 59
11	0.969 12	0.968 91·	0.968 70	0.96849	0.968 28	0.968 07	0.967 86	0.967 64	0.967 43	0.967 21
12	0.968 79	0.968 58·	0.96837	0.96815	0.967 94	0.967 73	0;967 51	0.967 30	0.967 08	0.966 87
13	0.96847 ·	··o:968 26	0.96804	0.967 83	0.967 61	0.967 40	0.967 18	0.966 95	0.966 73	0.96650
14	0.968.15 ·	··o.96793	0.96771	0.967 so	0.967 28	0.967 06	0.966 83	0.966 61	0.966 38	0.96616
15	0.96784	0.967 62	0.967 40	0.967 17	0.96695	0.966 73	0.96650	0.96627	0.966 03	0.965 80
16	o:961·53	0.967 30	0.967 08	0.96685	0.966 63 .	0.96640	0.96617	0.965 94	0.965 70	0.96547
17	0,967 24	0.967 01	0.966 78	0.966 54	0.966 31	0.96608	0.965 84	0.965 61	0.965 37	0.965 14
18	0.96693	0.966 70	0.96647	0.966 23	0.96600	0.965 77	0.965 53	0.965 29	0.96504	0.964 80
19	0,966 64	0.96640	0.96616	0.96593	0.965 69	0.965 45	0.965 21	0.96497	0.964 72	0.964 48
20	0.96634	0.96610.	0.965 86	· 0.965 62	0.!?65 38	0.965 14	0.964 89	0.964 65	0.96440	0.964 16
21	0.96606	0.965 81	0.965 57	0.965 32	0.965 08	0.964 83 ·	0.96458	0.964 33	0.96408	0.963 83
22	0.965 77	0.965 *52*	0.96527	0.96502	0.964 77	0.96452	0.964 27	0.964 02	0.963 76	0.963 51
23	0.96548,	0.96523	0.96498	0.964 72	0.96447	0.964 22	. 0.96396	0.963 71	0.963 45	0.963 20
24	0.965 21	o. 6495	0.964 70	·0.96444	0.964 19	0.963 93	0.963 67	0.Q63 41	0.963 16	0.962 90
25	0.96492 ·	**0.96466**	0.964 40	0.96415	0.963 89	0.963 63·.	0.963 37	0.963 11	0.96285	0.962 59
26	0.964 65	0.96439	0.96413	0.9.63 86	0.963 60	· 0.963 34	0.963 08	0.962 81	0.962 *55*	0.96228
27	0.964 37	0.96411	0.96384	0.963 58	0.963 31	0.963 05	0.962 78·	0.962 52	0.96225	0.96199
28	0.96410	0.963 83	0.963 57	0.963 30	0.963 04	0.962 77	0.96250	0.962 23	0.961 *95*	0;96168
29	0.963 84 ·	0.963 *S.1*	0.963 30	0.963 08	0.962 76	0.96249	0.962 21	0.96194	0.961 66	0.96139
30	0.96355	0.963 28	0.963 01	0.962 74	0.96247	0.96220	0.96192	0.961 64	0.96137	0.96109
31	0.96329	o. 63 01	0.962 74	0.96246	0.962 19	0.961 91	0.96163	0.961 35	0.96107	0.96079
32	0.96304	0.962 76	0.96248	0.96220	0.96192	0.96164	0.961 36	0.961 08	Q.96079	0.96051
33	0.96277	0.96249	0.962'·21	0.96193	0.961 *65*	0.96137	0.96108	0.96080	0.960 51	0.96023
34	0.96251	0.96223	0.96194	0.96166	0.961 37	0.961 *o')*	0.96080	0.960 51	0.96022.	0.959 93
35	0.96225	0.96196	0.961 68	0.961 39	0.961 11	0.960 82	0.96053	0.96024	0.959 94	0.959 65
36	0.96199	0.961 70	0.96141	0.96112	0.96083	0.960 54	"0.96025	0.95995	0.959 66	0.959 36
37	0.961 73	0.96144	0.96115	0.96085	0.96056	0.96027	0.959 97	0.959 67	0.959 38	0.959 08
38	0.96148	0.96119	0.96089	0.96060	0.96030	0.96001	0.959 71	0.959 41	0.95910	0.958 80
39	0.96122	0.96092	0.96063	0.96033	0.96004	0.959 74	0.95944	0.959 14	0.958 83	0.958 53
40	0.96098	0.96068	0.96038	0.96007	0.959 77	0.95947	0.95917	0.958 86	0.958 56	0.958 25

(ConJinued)

Table 1 Apparent Relative Densities of Aqueous Ethanol at Various Temperatures -*Contd*

Temperature ·c	Percentages or Volume at 10·c									
	30.0	**30.2**	30.4	30.6	**30.8**	**31.0**	**31.2**	31.4	**31.6**	**31.8**
10	0.967 38	0.967 16	0.96694	0.966 73	0.966 51	0..966 29	0.966 07	0.965 84	0.965 62	0.965 39
11	0.967 00	0.966 78	--0.966 56	0.966 35	0.966 13	0.965 91	0.965 **68**	0.96545	0.965 23	0.965 00
12	0.966 *65*	0.966 43	0.966 20	0.965 98	0.965 75	0.965 53	0.965 30	0.96507	0.96483	0.964 60
13	0.966 28	0.966 05	0.965 83	0.965 60	0.965 38	0.965 15	0.964 91	0.964 68	0.96444	0.964 21
14	0.965 93	0.965 70	0.965 47	0.965 24	0.96501	0.964 78	0.964 54	0.964 30	0.96406	0.963 82
15	0.965 57	0.965 34	0.96510	0.964 87	0.964 63	0.96440	0.964 16	0.963 92	0.963 67	0.963 43
16	0.96524	0.965 00	0.964 76	0.964 52	0.964 28	0.96404	0.963 80	0.96355	0.963 31	0.96306
17	0.96490	0.96466	0.964 42	0.96417	0.963 93	0.963 69	0.963'4	0.963 19	0.96294	0.962 69
18	0.96456	0.964 32	0.96407	0.963 83	0.963 *58*	0.963 34	**0.96,'5 09**	**0.96284**	0.962 58	0.962 33
19.	.0.964 24	0.963 99	0.963 74	0.96349	0.963 24	0.96299	0.962 73	0.96248	0.96222	0.961 97
20	0.963 91	0.963 66	. 0.963 40	0.963 15	0.962 89	0.962 **64**	0.962 38	0.96212	0.961 87	0.96161
21	0.963 58	0.963 33	0.963 07	0.962 82	0.962 *56*	0.962 31	0.96i0-'	0.961 78	0.961 52	0.961 25
22	0.963 26	0.963 00	0.962 74	0.96249	0.962 23	0.96197	0.961'70	0.96144	0.961 17	0.96091
23	0.96294	0.962 68	0.96242	0.962 16	0.96190	0.961 64	o.961 n	0.961 JO	0.960 83	0.96056
24	0.96264	0.962 37	0.96211	0.96184	0.96158	0.961 31	0.96104	0.96077	0.960 50	0.96023
25	0.96233	0.962 06	0.96179	0.96152	0.961 25	0.9609&	0.9607\	0.96044	0.96016	0.959 89
26	0.96202	0.961 75	0.961 48	0.961 20	0.96093	0.960 66	0.96Q38	0.96011	0.959 83	0.959 56
27	0.961 72	0.961 44	0.961 17	0.96089	0.96062	0.960 34	0.96006 ·	0.959 78	0.959 50	0.959 22
28	0.961 41	0.961 13	0.960 86	0.960 58	0.960 31	0.96003	0.959 75	0.95946	0.959 18	0.958 89
29	0.961 11	0.960 83	0.96055	0.96027	0.95999	0.959 71	0.95942	0.959 14	0.958 85	0.958 57
30	0.960 81	0.96053·	0.960 24	0.959 96	0.95967	0.959 39	0,95910	0.958 8)	0.958 52	0.958 23
31	0.960 51	0.96023	0.959 94	0.959 66	0.95937	0.95900	0.958 80	Q.958 51	0.958 21	0.957 92
32	0.96023	0.95994	0.959 65	0.959 36	0.959 07	0.958 78	**0.95849**	0.958 19	0.957 90	0.957 60
33	0.959 94	0.959 *65*	0.959 36	0.959 06	o.958n	**0.95848**	**0,958 18**	**0.957 88**	0.957 *59*	0.957 29
34	0.959 64	0.959 35	0.95905	0.958 76	0.95846	0.95817	0.957 87	0.957 57	0.957 27	0.95697
35	0.959 36	0.959 06	0.958 76	0_958 47	0.958 17	0.957 87	0.957 57	0.957 27	0.956 96	0.956 66
36	0.959 07	0.958 77	0.958 47	0.95818	0.957 88	0.957 58	0.957 27	0.9 97	0.956 66	0.956 36
37	0.958 78	0.958 48	0.958 18	0.957 87	0.957 57	0.9571:1	0.956 96	0.956 66	0.956 *35*	0.956 05
38	0.958 50	0.958 20	0.957 89	0.957 59	0.957 28	0.95698	0.956 67	0.95636	0.956 05	0.955 74
39	0.958 23	0.957 92	0.957 61	0.957 31	0.957 00	0.95669	0.956 38	· 0.956 07	0.955 75	0.95544
40	0.957 95	0.957 64	0.957 33	0.957 01	0.956 70	0.956 39	0.95608	0.955 76	0.955 45	0.955 13

Temperature °C	Percentages of Volume at 20°C									
	32.0	32.2	**32.4**	**32.6**	**32.8**	33.0	33.2	33.4	33.6	33.8
10	0.96517	0.96494	0.964 71	0.96448	0.96425	0.96402	0.963 78	0.963 54	0.963 31	0.963 07
11	0.964 77	0.96454	0.96,i'JO	0.96407	0.963 83	0.963 60	0.963 36	0.963 12	0.962 87	0.962 63
12	0.96437	0.964 13	0.963 89	0.963 66	0.963 42	0.96318	0.96293	0.962 69	0.96244	0.962 20
13	0.96397	0.963 73	0.96349	0.963 25	0.963 01	0.962 77	0.96252	0.962 27	0.96202	0.96177
14	**0.96358**	0.963 33	0.963 09	0.96284	0.962 60	0.96235	0.96210	0.961 85	0.961 59	0.961 34
15	**0.96319**	0.96294	0.96269	0.96245	0.962 20	0.961 95	0.961 69	0.96143	0.961 18	0.96092
16	**0.96282**	0.962 57	0.96232	0.96206	0.96181	0.961 56	0.96130	0.96104	0.96078	0.96052
17	**0.96244**	0.96219	0.96193	**0.96168**	0.96142	0.96117	0.96091	0.96064	0.96038	0.96011
18	**0.96208**	0.96182	0.961 56	0.96130	0.961 04	0.9607	0.960 51	0.96025	0.95998	0.959 72
19	0.961 71	**0.96145**	0.961 19	0.96093	0.96067	0.96041	0.96014	0.959 87	0.959 59	0.95932
20	**0.96135**	0.961 ()I)	0.96082	0.96056	0.96029	0.96003	0.959 76	0.95948	0.959 21	0.958 93
21	**0.96099**	0.960 72	0.96046	0.96019	0.959 93	0.959 66	0.95938	0.959 10	0.958 83	0.958 SS
22	**0.96064**	0.96037	0.96010	0.959 83	0.959 56	0.959 29	0.959 01	0.958 73	0.958 45	0.958 17
23	**0.96029**	0.960 O'l	0.959 74	0.95947	0.959 19	0.95892	0.958 64	0.958 36	0.958 07	0.95779
24	**0.95996**	**0.959 68**	0.95940	0.95912	0.958 84	0.95856	0.958 28	0.95800	0.957 71	0.957 43
25	**0.95962**	0.95934	0.95906	0.95877	0.95849	0.958 21	0.95792'	0.957 64	0.957 35	0.95707
26	0.959 28	0.95900	0.958 71	0.95843	0.958 14	0.957 86	0.957 57	0.957 28	0.95698	0.956 69
27	0.958 94	0.958 65	0.95837	0.95808	0.957 80	0.957 51	0.957 22	0.95692	0.956 63	0.956 33
28	**0.958 61**	0.95832	0.95803	0.95774	0.957 45	0.957 16	0.956 87	0.95657	0.956 28	0.95598
29	**0.958 28**	0.95799	0.95770	0.95740	0.957 ll	0.95682	0.95652	0.95622	0.955 93	0.955 63
30	0.957 94	0.957	0.957 36	0.95706	0.95677	0.95648	0.956 18	*0.955* 88	0.955 *57*	*0.955* 27
31	0.957 63	0.95733	0.95703	0.95674	0.95644	0.95614	0.955 84	0.955 53	0.955 23	0.95492
32	0.95731	0.95701	0.95671	0.95641	0.95611	*0.955* 81	0.95550	0.955 20	0.95489	0.95459
33	**0.95699**	0.956 *(I)*	0.95639	0.95608	0.955 78	0.95548	0.95517	0.95486	0.95455	0.954 24
34	**0.95667**	0.95637	0.95606	0.955 76	0.95545	0.955 15	0.954 84	0.954 53	0.954 21	0.953 90
35	0.95636	J.95605	0.955 74	0.95544	0.955_13	0.95482	0.95451	0.95419	0.953 88	0.953 56
36	0.95605	0.955 74	0.95543	Q.9 551 2	0.954 81	0.95450	0.95418	0.953 86	0.953 *55*	0.953 23
37	0.955 74	0.955 43	0.95511	0;95480	0.95448	0.954 17	0.953 85	0.953 53	0.953 21	0.952 89
38	0.95543	0.95512	0.95480	0.95449	0.95417	0.953 86	0.95354	0.953 22	0.952 89	0.952 57
39	0.95513	0.95481	0.95449	0.95418	0.953 86	0.953 54	0.953 22	0.95289	0.952 57	0.952 24
40	0.95482	0.95450	0.954 18	0.953 87	0.953 *55*	0.953 23	0.95290	0.95258	0.952 25	0.951 93

(Conlinu.ed)

Table 1 Apparent Relative Densities of Aqueous 'Ethanol at Various Temperatures -*Contd*

Temperature ·C	**Percentages of Volume at 20℃**									
	34.0	34.2	**34.4**	**34.6**	34.8	**3S.0**	3S.2	35.4	***35.6***	**35.8**
10	0.962 83	0.962 58	0.962 33	0.96209	0.961 84	0.96159	0.96134	0.961 08	0.960 83	0.96057
11	0.96239	0.96214	0.961 89	0.961 63	0.961 38	0.96113	0.96087	0.960 61	0.96036	0.96010
12	0.961 95	0.961 70	0.96144	0.961 19	0.96093	**0.96068**	0.96042	0.96016	0.959 89	0.959 63
13	0.96152	0.96126	0.96100	0.960 75	0.96049	0.96023	0.95996	0.959 70	0.95943	0.959 17
14	0.96109	0.96083	0.96057	0.96031	0.96005	0.95979	0.95952	0.959 25	0.95899	0.958 72
15	0.96066	0.96040	**0.96014**	0.959 87	0.959 61	0.95935	0.95908	0.958 81	0.958 53	0.958 26
16	0.96026	0.95999	0.95972	0.95946	0.95919	0.958 92	P.958 *65*	0.958 37	0.958 10	0.957 82
17	0.95985	0.959 *58*	0.95931	0.95905	0.95878	0.958 51	0.958 23	0.95795	0.957 67	0.95739
18	0.95945	0.95918	**0.958 91**	0.95863	0.95836	**0.95809**	0.957 81	0.957 52	0.957 24	**0.95695**
19	0.95905	0.958 77	**0.958 50**	**0.958 22**	0.95795	**0.957 67**	0.957 39	0.95710	0.956 82	**0.95653**
20	0.958 66	0.958 38	0.958 10	0.957 83	0.957 *55*	0.957 27	0.95698	0.956 69	0.95640	0.95611
21	0.958 27	0.957 99	0.957 71	0.95742	0.95714	0.956 86	0.95657	0.956 28	0.955 99	0.955 70
22	0.957 89	0.957 61	·0.957 32	0.957 04	0.956 75	0.95647	0.95618	0.955 88	0.955 59	0.95529
23	0.957 51	0.957 22	0.956 93	0.956 65	0.956 36	0.95607	0.955 77	*0.955* 48	0.955 18	**0.95489**
24	0.957 15	0.956 86	0.95656	0.956 27	0.955 97	0.955 68	0.955 38	0.955 09	0.954 79	0.95450
25	0.95678	0.95648	0.95619	0.955 89	0.955 60	0.955 30	0.95500	0.954 70	0.95440	0.95410
26	0.95640	0.95610	0.955 81	0.955 51	0.955 22	0.954 92	0.95462	0.954 31	0.95401	0.953 70
27	0.95604	0.955 74	0.955 44	0.955 14	0.954 84	0.95454	0.954 24	0.953 93	0.953 63	0.95256
28	0.955 69	0.955 39	0.955 08	0.954 78	0.95447	0.95417	0.953 86	0.953 *55*	0.953 24	0.9S293
29	0.955 33	0.95502	0.954 72	0.95441	0.95411	R953 80	0.953 49	0.953 18	0.95287	**0.952S6**
30	0.95497	0.95466	0.954 35	0.954 05	0.953 74	0.95343	0.95312	0.952 80	0.95249	0.95217
31	0.954 62	0.954 31	0.95400	0.953 69	0.953 38	0.95307	0.952 75	0.95244	0.95212	**0.95181**
32	0.95428	0.953 97	0.953 66	0.953 34	0.953 03	0.952 72	0.95240	0.95208	0.951 77	0.95145
33	0.95393	0.953 62	0.953 30	0.95299	o. 5267	0.95236	0.95204	0.95172	0.951 39	0.9S107
34	0.9S3 *59*	0.953 27	0.95295	0.952 64	0.95232	0.95200	0.95168	0.9S1 36	0.951 03	0.950 71
3S	0.95325	·· 0.95293	0.952 61	0.952 29	0.95197	0.95165	0.951 32	0.95100	0.95067	0.95035
36	0.952 91	0.95259	0.952V	0.951 *95*	0.951 63	0.95131	0.95098	0.95065	0.95033	0.95000
37	0.95257	0.95225	0.95192	0.951 60	0.95127	0.95095	0.95062	0.95029	0.94997	0.94964
38	0.95225	0.95192	0.951 60	0.95127	0.95095	0.95062	0.95029	0.94996	0.94962	0.94929
39	0.95192	0.951 9	0.95126	0.95094	0.950 61	0.95028	0.949 *95*	0.949 61	0.94928	0.948 94
40	0.951 60	0.951 27	0.95094	0.950 61	0.95028	0.949 *95*	0.94961	0.949 27	0.948 94	0.948 60

Temperature °C	Percentages of Volume at 20°C									
	36.0	**36.2**	36.4	36.6	**36.8**	37.0	37.2	**37.4**	37.6	**37.8**
10	0.96032	0.96006	0.959 79	0.959 53	0.95926	0.95900	0.958 72	0.95845	0.958 17	0.957 90
11	0.959 84	0.95957	0.95930	0.95904	0.958 77	0.95850.	0.958 22	0.957 95	0.957 67	0.957 40
12	0.95937	0.95910	0.958 83	0.95855	0.958 28	•0.958 01	0.957 73	0.957 45	0.957 17	0.956 89
13	0.958 90	0.958 63	0.958 35	0.958 08	0.957 80	0.957 53	0.957 25	0.95697	0.956 68	0.95640
14	0.95845	0.95817	0.957 89	0.957 61	0.957 33	0.95705	0.956 77	0.956 48	0.956 20	0.955 91
15	0.957 *99*	0.95771	0.957 43	0.957 15	0.956 87	0.95659	0.956 30	0.956 01	0.955 72	0.95543
16	*0.95155*	0.957 27	0.95698	0.9J6 70	0.956 41	0.95613	0.955 84	*0.955 55*	0.955 25	0.95496
17	0.95711	0.956 82	0.95654	0.95625	0.955 97	*0.955* 68	*0.955* 39	0.955 09	0.954 80	0.95450
18	0.956 67	0.95638.	0.95609	0.955 81	0.955 52	0.955 23	0.95493	0.954 64	0.954 34	0.954 05
19	0.956 *25*	0.95596	*0.955* 67	0.955 37	0.955 08	0.954 79	0.95449	0.95419	0.953 90	0.953 60
20	0.955 82	0.955 53	0.95524	0.95494	0.954 65	0.95436	0.954 06	0.953 76	0.95345	0.953 15
21	0.95541	0.95511	0.954 81	0.954 52	0.954 22	0.95392	0.953 61	0.953 31	0.953 00	0.95210
22	0.95500	0.954 70	0.95440	0.954·10	0.953 80	0.953 *50*	0.953 19	0.952 88	0.952 58	0.95227
23	0.95459	0.95429	0.95399	0.953 68	0.953 38	0.953 08	0.952 77	0.95246	0.95214	0.951 83
24	**0.95420**	0.953 89	0.953 *59*	0.953 28	0.95298	0.952 67	0.952 36	0.952 05	0.95173	0.95142
25	0.953 80	0.95349	0.95318	0.952 88	0.95257	0.952 26	0.951 94	0.951 63	0.951 31	0.95100
26	0.953 40	0.953 00	0.952 78	o:95246	0.95215	0.951 84	0.95152	0.95121	0.95089	0.95058
27	0.953 02	0.952 71	0.95239	0.95208	0.951 76	0.951 45	0.951 13	0.950 81	0.95048	0.95016
28	0.95262	0.95 30	0.95199	0.951 67	0.95136	·0.951 04	0.95072	0.95040	0.95008	0.949 76
:i9	0.95225	0.95193	0.95161	0.951 30	0.95098	0.95066	0.95033	0.950 01	0.94968	0.949 36
30	0.95186	0.95154	0.95122	0.95090	0.95058	0.95026	0.949 93	0.949 60	0.949 28	0.94895
31	0.95149	0.95117	0.95084	0.950 52	0 .9, 5019	0.94987	0.949 54	0.949 21	0.948 88	0.94855
32	0.951·13	0.950 80	0.95048	0.950 15·,	0.94983	0.94950	0.949 17	0.94884	0.948 50	0.94817
33	0.95075	0.95042	0.95010	0.94977	0.94945	0.94912	0.948 79	0.94845	0.94812	0.94778
34	0.95039	0.95006	0.94973	0.94940	0.94907	0.948 74	0.94840	0.94807	0.947 73	0.94740
35	0.95002	0.949 69	0.949 36	0.94903	0.948 70	0.948 37	0.948 03	0.94769	0.947 36	0.94702
36	0.949 67·	0.94934	0.949 00	0.948 67	0.948 33	0.948 00	0.947 66	0.94732	0.946 97	0.946 63
37	0.949 31	0.94897	Q.948 64	0.948 30	0.947 97	0.947 63	0.947 29	0.94694	0.946 60	0.94625
38	0.94896	0.948 62	0.948 28	0.947 94	0.947 60	0.94726	0.94692	0.94358	0.946 23	0.945 89
39	0.948 61	0.948 27	0.94793	0.947 58	0.947 24	0.94690	0.94656	0.94621	0.945 87	0.945 52
40	0.948 26	0.94792	0.947 58	0.947 23	0.946 89	0.946 *55*	0.94620	0.945 *85*	0.945 51	0.945 16

(Continued)

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Table 1 Apparent Relative Densities or Aqueous Ethanol at Various Temperatures -*Contd*

Temperature ·C	Percentages or Volume at 20°C									
	38.0	**38.2**	38.4	**38.6**	**38.8**	**39.0**	**39.2**	39.4	**39.6**	**39.8**
10	0.957 62	0.957 34	0.957 06	0.95677	0.95649	0.956 21	0.955 92	0.955 63	0.955 34	0.955 05
11	0.957 12	0.956 84	0.956 55	0.95627	0.95598	0.955 70	0.95540	0.955 11	0.954 81	0.954 52
12	0.956 61	0.956 32	0.95604	0.955 75	0.955 47	0.95518	0.954 88	0.95458	0.95429	0.953 99
13	o:95612	0.955 83	0.955 54	095524	0.954 95	0.95466	0.95436	0.95406	0.953 77	0.953 47
14	0.955 63	0.955 34	0.955 04	0.954 75	0.95445	0.954 16	0.953 86	0.953 55	0.953 25	0.952 94
15	0.955 14	0.954 84	0.954 55	0.954 25	0.953 96	0.953 66	0.953 36	0.953 05	0.952 75	0.95244
16	0.954 67	0.95437	0.954 07	0.953 78	0,95348	0.953 18	0.95287	0.95256	0.95226	0.95195
17	0.954 21	0.953 91	0.953 61	0.953 30	0.953 00	0.952 70	0.952 39	0.952 08	0.951 77	0.951 46
18	0.953 75	0.95344	0.953 14	0.95283	0.952 53	0.95222	0.95191	0.951 60	0.951 28	0.95097
19	0.953 30	0.95299	0.952 68	0.95237	0.95206	0.951 75	0.95144	0.95112	0.950 81	0.95049
20	0.952 85	0.952 54	0.952 23	0.951 91	0.95160	0.951 29	0.95097	0.950 66	0.95034	0.95003
21	0.95239	0.95208	0.95177	0.95145	0.95114	0.95.0 83	0.950 51	0.95019	0.949 88	0.949 56
22	0.951 96	0.951 64	0.951 33	0.951 01	0.95070	0.95038	0:95006	0.949 73	0.949 41	0.94908
23	0.95152	0.951 20	0.95088	0.95057	0.95025	0.94993	0.94961	0.94928	0.94896	0.948 63
24	0.951 11	0.95079	0.95047	0.95014	0.94982	0.94950	0.94917	0.948 84	0.94852	0.948 19
25	0.950 68	0.950 36	0.95004	0.949 71	0.949 39	0.949 07	o. 48 74	0.948 41	0.94808	0.947 75
26	0.95026	0.949 93	0.949 61	0.949 28	0.948 96	0.948 63	0.948 30	0.94797	0.947 63	0.947 30
27	0.949 84	0.949 51	0.949 19	0.948 86	0.94854	0.94821	0.947 88	0.947 54	0.947 21	0.946 87
28	0.94944	0.949 11	0.948 78	0.948 45	0.948 12	0.947 79	0.947 45	0.947 11	0.946 78	0.94644
29	0.949 03	0.94870	0.948 37	0.948 03	0.947 70	0.947 37	0.947 03	0.946 69	0.946 35	0.94601
30	0.948 62	0.948'19	0.947 95	0.947 62	0.947 28	0.94695	0.946 61	0.946 27	0.94592	0.94558
31	0.948 22	0.947 89	0.947 55	0.94722	0.946 88	0.94655	0.946 21	0.945 86	0.945 52	0.945 17
32	0.947 84	0.947 SO	0.947 16	0.946 83	0.94649	0.94615	0.945 80	0.94546	0.94511	0.944 77
33	0.947 45	0.94711	0.946 77	0.94642	0.946 08	0.945·74	0.945 39	0.94504	0.944 70	0.94435
34	0.94706	0.946 72	0.946 38	0.946 03	0.945 69	0.945 35	0.945 00	0.944 65	0.94429	.0.943 94
35	0.94668	0.94633	0.945 99	0.945 **64**	0.945 30	0.944 95	0.944 60	0.94425	0.943 8_9	0.943 54
36	0.946 '19	0.945 94	0.945 60	0.945 25	0.94491	0.94456	0.944 21	0.943 86	0.94350	0.943 15
37	0.945 91	0.945 56	0.945 21	0.944 87	0.944 52	0.94417	0.943 82	0.943 46	0.943 11	0.942 75
38	0.945 55	0.945 20	0.944 85	0.944 50	0.94415	0.943 80	0.94344	0.943 08	0.942 73	0.94237
39	0.945 18	0.94483	0.944 47	0.94412	0.94376	0.94341	0.943 05	0.942 70	0.94234	0.94199
40	0.944 81	0.94446	0.94410	0.943 75	0.943 39	0.943 04	0.942 68	0.942 32	0.94196	0.94160

Temperature ·C	Percentages or Volume at 2o·c									
	40.0	40.2	**40.4**	**40.6**	40.8	**41.0**	41.2	41.4	**41.6**	41.8
10	0.954 76	0.95446	0.95416	0.953 86	0.953 56	0.953 26	0.95295	0.952 64	0.952 33	0.95202
11	0.95422	0.953 92	0.953 61	0.953 31	0.95300	0.952 70	0.95239	0.952 08	0.951 76	0.951 45
12	.. 0.953 *(f)*	0.953 39	0.953 08	0.952 78	0.95247	0.952 17	0.951 85	0.95154	0.95122	0.95091
13	0.953 17	0.95286	0.95255	0.95225	0.951 94	0.951 63	0.951 31	0.95099	0.95068	0.95036
14	0.952 64	0.952 33	0.95202	0.951 71	0.95140	0.951 09	0.950 77	0.95045	0.95014	0.949 82
15	0.95214	0.95182	0.951 51	0.951 19	0.95088	0.95056	0.95024	0.949 92	0.94960	0.949 28
16	0.951 **64**	0.95132	0.95101	0.95069	0.95038	0.95006	0.949 73	0.9494)	0.94908	0.948 76
17	0.95115	0.95083	0.95051	0.95020	0.949 88	0.949 56	0.94923	0.948 90	0.948 58	0.948 25
18	0.95066	0.95034	0.95002	0.94970	0.94938	0.94906	0.948 73	0.948 40	0.948 07	0.947 74
19	0.95018	**0.94986**	0.949 53	0.949 21	0.948 88	0.948 56	0.948 23	0.947 90	0.947 56	0.947 23
20	0.949 71	0.94938	0.94905	0.948 73	0.94840	0.94807	0.947 74	0.947 41	0.947 07	0.946 74
21	0.949 24	0.948 91	0.948 58	0.948 25	0.94792	0.947 59	0.947 26	0.946 92	0.946 59	0.946 25
22	0.948 76	**0.94843**	0.94810	0.947 78	0.947 45	0.947 12	0.946 78	0.94644	0.94610	0.945 76
23	0.948 31	0.94798	0.947 64	0.947 31	0.94697	0.946 64	0.946 30	0.945 96	0.945 63	0.945 29
24	0.947 86	0.94753	0.94719	0.946 86	0.946 52	0.94619	0.945 85	0.945 51	0.94516	0.944 82
25	0.94742	0.947 (I!	0.946 74	0.946 41	0.94607	0.945 73	0.945 39	0.945 04	0.944 70	0.94435'
26	0.946 97	0.94663	0.94629	0.945 96	0.945 62	0.945 28	0.94493	0.944 58	0.944 24	0.943 89
27	**0.946 54**	0.94620	0.945 86	0.945 51	0.94517	0.944 83	0.94448	0.94413	0.943 78	0.943 43
28	**0.94610**	**0.945 76.**	**0.94541**	0.945 07	0.944 72	0.94438	0.94403	0.943 68	0.943 33	0.94298
29	**0.945 67**	0.945 32	**0.94498**	0.944 63	0.944 29	0.94394	0.943 59	0.943 24	0.942 89	0.94254
30	**0.945 24**	**0.9"489**	**0.94455**	0.944 20	0.943 86	0.943 51	0.943 16	0.942 80	0.94245	0.943 09
31	**0.944 83**	0.944 48	0.94413	0.943 79	0.94344	0.94300	0.942 73	0.942 37	0.94202	0.941 66
32	**0.944 42,**	0.944 07	0.943 72	0.943 36	0.943 01	0.942 66	0.942 30	0.941 94	0.94159	0.94123
33	0.944 00	0.943 65	0.943 29	0.94294	0.94258	0.94223	0.941 87	0.941 51	0.941 16	0.94080
34	0.943 '9	0.943 24	0.942 88	0.94253	0.94217	0.94182	0.94146	0.94110	0.940 73	0.94037
35	0.94319	0.942 83	0.94248	0.94212	0.941 77	0.94141	0.941 05	0.94069	0.94032	0.93996
36	0.942 80	0.94244	0.94208	0.941 73	0.94137	0.94101	0.940 64	0.94028	0.939 91	0.9239 55
37·	0.94240	0.-94204	0.94168	0.94131	0.94095	0.94059	0.94022	0.939 86	0.93949	0.93913
38	0.942 01	0.94165	0.94129	0.94092	0.94056	0.94020	0.939 83	0.93946	0.93910	0.938 73
39	0.941 63	0.94126	0.94090	0.94053	0.94017	0.939 80	0.93943	0.939 06	0.938 70	0.938 33
40	0.94124	0.94088	0.940 51	0.94015	0.93978	0.93942	0.93905	0.938 68	0.93830	0.937 93

(ConJinued)

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Table 1 Apparent Relative Densities of Aqueous Ethanol at Various Temperature-s-*Contd*

VJ

Temperature ·C	Percentages of Volume at 20"C									
	42.0	42.2	42.4	42.6	**42.8**	43.0	43.2	43.4	43.6	**43.8**
IO	0.951 71	0.95139	0.951 07	0.95075	0.95043	0.950 11	0.94978	0.94946	0.94913	0.948 81
11	0.951 14	0.95082	0.95050	0.95018	0.949 86	0.949 54	0.949 21	**0.94888**	0.948 *55*	**0.948** 22
12	0.95059	0.950 27	0.949 94	0.949 62	0.94929	0.948 97	0.948 64	0.948 31	0.94797	0.947 64
13	0.95004	0.949 71	0.949 39	0.94906	0.948 74	0.948 41	0.948 08	0.94774.	0.947 41	0.94707
14	0.94950	0.949 17	0.948 84	0.948 52	0.948 19	0.947 86	0.947 52	0.94718	0.94685	0.946 51
15	0.948 96	0.948 63	0.94830	0.94797	0.947 64	0.947 31	0.94697	0.946 63	0.94629	0.94595
16	**0.94843**	0.948 10	0.947 77	0.94744	0.94711	0.946 78	**0.946 44**	0.94610	0.945 75·	0.945 41
17	0.94792	0.947 59	0.94725	0.94692	0.94658	0.94625	0.945 91	0.945 *56*	0.945 22	**0.94487**
18	• 0.947 41	0.947 *(17*	0.94674	0.94640	0.94607	0.945 73	0.945 38	0.945 04	**0.94469**	0.94435
19	0.94690	0.946 56	0.946 22	0.945 89	0.945 *55*	0.945 21	0.944 86	0.94451	0.94417	0.943 82
20	0.946 41	0.946 07	0.945 73	0.945 38	0.945 04	0.944 70	0.944 35	0.94400	0.943 66	0.943 31
21	0.945 92	0.945 58	0.945 23	0.944 89	0.944 54	0.944 20	0.943 85	0.943 50	0.943 14	0.942 79
22	0.945 42	0.945 08	0.944 73	0.944 39	0.94404	0.943 70	0.943 35	0.942 99	0.942 **64**	0.94228
23	0.944 95	0.944 60	0.944 25	0.943 90	0.943 *55*	0.943 20	0.942 85	0.94250	0.942 14	0.941 79
24	0.94448	0.94413	0.943 78	0.94343	0.943 08	0.942 73	0.94237	0.94202	0.941 66	0.941 31
25	0.94401	0.943 66	0.943 31	0.94295	0.942 60	0.942 25	0.941 89	0.94153	0.941 18	0.94082
26	0.943	0.943 19	0.94283	0.94248	0.942 12	0.941 77	0.94i 41	0.941 OS	0.940 69	0.94033
27	0.943 08	0.942 72	0.94237	0.94201	0.941 66	0.941 30	0.94094	0.94058	0.94022	0.939 86
28	0.94263	. 0.942 27	0.94192	0.94156	0.941 21	0.940 85	0.94049	0.94012 .	0.93976	0.939 39
29	0.94219	0.941 83	0.94147	0.94111	0.94075	0.94039	0.94002	0.93966	0.939 29	0.93893
30	0.941 74	0.941 38	0.941 02	0.94065	0.94029	0.93993	0.939 56	• 0.93920	0.938 83	0.93847
31	0.941 30	0.94094	0.940 58	0.94021	0.939 85	0.93949	0.939 12	0.938 75·	0.938 38	0.938 01
32•	0.94087	0.94051	0.940 14	0.939 78	0.939 41	0.939 05	0.938 68	0.938 31	0.937 93	0.937 56
33	0.94044	0.94007	0.939 71	0.939 34	0.93898	0.9-38 61	0.938 24	0.937 87	0.937 49	0.93712
34	0.940 01	,. 0.939 64	· 0.93928	0.938 91	0.938 *55*	0.93818	0.937 81	6.93743	0.937 06	0.936 68
35	0.93960	0.939 23	0.93 8 86	0.938 48	0.938 11	0.9:}.7 74	0.937 37	0.93699	0.936 62	0.93624
36	IF.J39 18	0.938 81	0.938 44	0.93806	0.937 69	0.937 32	0.93694	0.93656	0.93619	0.935 81
37	0.938 76	·o.938 39	0.938 01	0.937 64	0.937 26	• 0.936 89	0.93651	0.93613	0.935 76	0.935 38
38	0.938 36	0 37 99	0.937 61	0.937 24	0.936 86	0.93649	0.93611	0.935 73	0.935 35	0.93497
39	0.93796	0.937 58	0.'937 21	0.936 83	0.93646	0.936 08	0.935 70	0.935 31	0.934 93	0.934 54
40	0.937 56	0.937 18	0.936 80	0.936 43	0.93605	0.935 67	0.935 29	0.934 91	0.93452	0.93414

(Conlinued)

Temperature ·C	Percentages ol Volume at 2o·c									
	44.0	44.2	**44.4**	**44.6**	44.8	**4S.0**	45.2	45.4	**45.6**	**45.8**
10	0.94848	0.94814	0.947 81	0.947 47	0.947 14	0.946 80	0.94646	0.94611	0.945 77	0.945 42
11	0.947 89	0.947 *55*	0.947 21	0.946 88	0.94654	0.94620	0.945 85	0.945 51	0.945 16	0.944 82
12	0.94731	0.946.97	0.94663	0.946 30	0.945 96	0.945 62	0.945 27	0.944 92	0.944 57	0.94422
13	0.946 74	,0.94640	0.94606	0.945 71	0.945 37	0.945 03	0.94468	0.94433	0.943 98	0.943 63
14	0.946 17	0.945 83	0.94548	0.945 14	0.944 79	0.94445	0.94410	0.943 75	0.94340	0.943 0 .
15	0.945 61	0.945 26	0.94492	0.944 57	0.94423	0.943 88	0.94353	0.943 17	0.94282	0.94246
16	0.945 07	0.944 72	0.94437	0.94403	0.943 68	0.943 33	0.94297	0.94262	0.942 26	0.941 91
17	0.94453	**0.94418**	0.943 83	0.94348	0.943 13	0.942 78	0.94242	0.94207	0.941 71	0.941 36
18	**0.94400**	0.94365	0.94330	0.94294	0.94259	0.94224	0.941 88	0.941 52	0.9'41 16	0.94080
19	0.94347	0.94312	0.942 77	0.94241	-0.942 06	0.941 71	0.94135	0.94099	0.94062	0.94026
20	0.94296	0.942 60	0.94224	0.94189	0.941 53	0.941 17	0.94081	0.94045	0.940 08	0.93972
21	0.94244	0.94208	0.941 72	0.941 37	0.941 01	0.940 *65*	0.94028	Q.939 92	0.93955	0.939 19
22	·0.94193	0.94157	0.94121	0.94085	0.94049	0.94013	0.939 76	0.93940	0.939 03	0.938 67
23	0.94144	**0.94108**	0.94072	0.94035	0.93999	0.939 63	0.939 26	0.938 89	0.93852	0.938 15
24	0.94095	**0.94059**	0.94022	0.93986	0.93949	0.93913	0.938 76	0.938 39	0.938 01	0.937 64
25	0.94046	**0.94009**	0.93973	0.939 36	0.939 00	0.93863	0.938 26	0.937 89	0.937 51	0.937 14
26	0.93997	0.939 60	0.93924	0.938 87	0.938 51	0.938 14	0.937 77	0.937 39	0.93702	0.936 **64**
27	0.939 50	0.93913	0.93876	0.938 39	0.93802	0.937 65	0.937 28	0.936 90	0.93658	0.93615
28	0.93903	**0.93866**	0.93829	0.937 91	0.937 54	0.937 17	0.93679	0.93642	0.93604	0.935 67
29	0.938 *56*	0.93819	0.93782	0.937 44	0.937 07	0.93670	0.93632	0.935 94	0.935 57	0.935 19
30	0.93810	0.93773	0.93735	0.936 98	0.936 60	0.936 23	0.935 85	0.93547	0.935 09	0.934 71
31	0.937 64	0.93726	**0.93689**	0.93651	0.93614	0.935 76	0.93538	0.935 00	0.93461	0.934 23
32	0.93719	0.936 81	**0.93644**	0.93606	0.935 69	0.935 31	0.93493	0.934 54	0.93416	0.933 77
33	0.936 75	0.93637	0.93599	0.935 61	0.935 23	0.93485	0.93446	0.93408	0.933 69	0.933 31
34	0.936 31	0.935 93	0.935 *55*	0.93516	0.934 78	0.93440	0.93401	0.933 63	0.933 24	0.932 86
35	0.935 87	0.935 49	0.93511	0.934 72	0.93434	0.933 96	0.933 57	0.933 18	0.93280	0.93241
36	0.93543	0.935 05	0.93467	0.934 28	0.933 90	0.933 52	0.933 13	0.932 74	0.93236	0.931 97
37	0.935 00	0.93462	0.93423	0.933 *85*	0.933 46	0.93308	0.932 69	0.93230	0.93191	0.93152
38	0.93459	0.934 20	0.933 82	0.933 43	J.933 05	0.932 66	0.93227	0.931 88	0.93148	0.93109
39	0.93416	0.933 77	0.933 39	0.933 00	0.932 62	0.93223	0.931 84	0.93144	0.931 05	0.93065
40	0.933 76	0.933 37	0.93298	0.93259	0.932 20	0.931 81	0.93142	0.931 02	0.93063	0.93023

(Con11nued)

Table 1 Apparent Relative Densities of Aqueous Ethanol at Various Temperatures -*Contd*

Temperature ·C	Percentages of Volume lit 20"C									
	46.0	**46.2**	46.4	**46.6**	**46.8**	**47.0**	47.2	47.4	47.6	47.8
10	0.945 08	0.944 72	0.944 37	0.94401	0.943 66	0.943 30	0.94294	0.942 58	0.942 22	0.941 86
11	0.94447	0.944 i2	0.943 76	0.943 41	0.943 05	0.942 70	0.942 34	0.94197	0.941 61	0.94124
12	0.943 87	0.943 51	0.943 16	0.94280	0.942 45	0.942 09	0.941 73	0.94136	0941 00	0.94063
13	0.943 28	0.942 92	0.94256	0.942 20	0.941 84	0.94148	0.94112	0.94075	0.940 39	0.94002
14	0.942 70	0.942 34	0.941 98	0.941 61	0.941 25	0.94089	0.94052	0.940 15	0.939 79	0.93942
15	0.942 11	0.941 75	0.94139	0.94102	0.94066	0.94030	0.93993	0.939 *56*	0.93920	0.938 83
16	0.941 *55*	0.94119	0.940 82	0.94046	0.94009	0.93973	0.93936	0.938 99	0.938 62	0.938 25
17	0.94100	0.940 63	0.94026	0.939 90	0.939 53	0.939 16	0.93879	0.93842	0.938 05	0.93768
18	0.94044	0.94007	0.93971	0.939 34	0.938 98	0.938 61	0.938 24	0.937 86	0.937 49	0.937 11
19	0.93990	0.93953	0.93916	0.938 80	0.93843	0.938 06	0.937 68	0.937 30	0.93693	0.936 *55*
20	0.93936	0.938 99	0.938 62	0.938 24	0.937 87	0.937 50	0.93712	0.936 75	0.93637	0.93600
21	0.938 82	0.938 45	0.938 08	0.937 71	0.937 34	0.936 97	0.93659	0.93621	0.935 83	0.935 45
22	0.938 30	0.937 93	0.937 *55*	0.937 18	0.936 80	0.93643	0.93605	0.935-67	0.935 29	0.934 91
23	0.937 78	0.937 41	0.937 03	0.93666	0.93628	0.935 91	0.935 53	0.935 15	0.934 76	0.93438
24	0.937 27	0.936 89	0.936 52	0.936 14	0.935 77	0.935 39	0.935 01	0.934 62	0.93424	. 0.933 85
25	0.936 77	0.936 39	0.936 01	0.935 64	0.935 26	0.934 88	0.93449	0.93411	0.933 72	0.933 34
26	0.936 27	0.935 89	0.935 51	0.935 13	0.934 75	0.93437	0.933 98	0.933 59	0.933 21	0.932 82
27	0.935 78	0.93540	0,93502	0.934 63	0.93425	0.933 87	0.933 48	0.933 **09**	0.932 70	0.932 31
28	0.935 29	0.934 91	0.934 52	0.934 14	0.933 75	0.933 37	0.93298	0.93259	0.93220	0.931 81
29	0.934 81	0.93442	0.93404	0.933 65	0.933 27	0.932 88	0.93249	0.93210	0.931 71	0.93132
30	0.934 33	0.933 94	0.933 *55*	0.933 17	0.932 78	0.932 39	0.93200	0.93160	0.931 21	0.930 81
31	0.933 85	0.933 46	0.933 07	0.932 69	0.932 30	0.93191	0.93152	0.931 13	0.93073	0.93034
32	0.933 39	0.933 00	0.932 61	0.932 23	0.931 84	**0.93145**	0.931 05	0.93066	0.93026	0.92987
33	0.93292	0.93253	0.932 14	0.931 75	0.931 36	0.93097	0.93057	0.93018	0.929 78	0.92939
34	0.93247	0.93208	0.931 69	0.931 29	0.93090	0.930 51	0.93011	0.929 71	0.929 32	0.92892
35	0.93202	0.931 63	0.931 23	0.930 84	0.93044	Q.93005	0.929 65	0.92925	0.928 86	0.928 46
36	0.931 58	0.931 18	0.93079	0.930 39	0.93000	0.929 60	0.929 20	0.928 80	0.928 40	0.928 00
37	0.931 13	0.93073	0.93033	0.929 94	0.929 54	0.92914	0.928 74	0.928 34	0.927 94	0.927 54
38	0.93070	0.93030	0.929 90	0.929 50	0.929 10	0.928 70	0.928 30	0.927 90	0.927 50	0.92710
39	0.93026	0.929 86	0.92946	0.92906	0.928 66	0.928 26	0.927 86	0.92746	0.927 05	0.926 65
40	0.929 84	0.929 44	0.929 04	0.928 63	0.928 23	0.927 83	0.92742	0.927 02	0.926 61	0.92621

"o 0 C \C

Temperature ·C	Percentages of Volume at lOT									
	48.0	48.2	*48:4*	***48.6***	48.8	**49.0**	49.2	49.4	49.(i	**49.8**
10	0.94150	0.94113	0.94076	0.94040	0.94003	0.939 66	0.939 28	0.93&91	0.938 53	0.93816
11	0.940 88	0.940 51	0.94014	0.939 77	0.93940	0.93903	0.938 65	0.938 27	0.93790	0.937 52
12	0.9401.7	0.93990	0.939 *52*	0.93915	0.938 77	0.93840	0.938 02	0.937 64	0.937 27	0.936 89
13	0.939 66	0.93919	0.938 91	0.938 54	0.93816	0.93779	0.937 41	0.937 03	0.936 64	0.93626
14	0.93905	0.938 68	0.938 30	0.937 93	0.937 *55*	0.93718	0.936 80	0.93642	0.93603	0.935 65
15	0.93846	0.938 08	0.937 71	0.937 33	0.936 96	0.936 58	0.936 20	0.935 81	0.935 43	0.935 04
16	0.937 88	0.937 50	0.937 12	0.936 75	0.93637	0.93599	0.935 60	0.935 22	0.934 83	0.93445
17	0.93731	. 0.93693	0.93655	0.93616	0.935 78	0.93540	0.935 02	0.93463	0.934 *25*	0.933 86
18	0.93674·	0.93636	0.935 98	0.935 *59*	0.935 21	0.934 83	0.93444	0.93406	0.933 67	0.933 29
19	0.93617	0.935 79	0.935 41	0.935 03	0.93465	0.93427	0.933 88	0.933 49	0.93310	0.932 71
20	0.935 62	0.935 24	0.93485	0.93447	0.934 08	0.933 70	0.933 31	0.93292	0.93253	0.932 14
21	0.935 07	0.934 69	0.93430	0.933 92	0.933 53	0.933 15	0.932 76	0.932 37	0.93197	0.931 58
22	0.934 53	0.93414	0.933 76 ·	0.933 *YI*	0.932 99	0.93260	0.932 21	0.931 81	0.93142	0.93102
23	0.93400	0.933 61	0.933 22	0.932 83	0.93244	0.93205	0.931 66	0.931 26	0.93087	0.93047
	0.933 47	0.933 08	0.93269	0.932 30	0.931 91	0.931 52	0.931 13	0.93073	0.93034	0.929 94
25	0.93295	0.93256	0.93217	0.931 77	0.931 38	0.93099	0.93059	0.93020	0.92980	0.929 41
26	0.93243	0.93204	0.93165	0.93i 25	0.930 86	0.93047.	0.93007	0.929 67	0.929 28	0.928 88
27	0.931 92	0.93153	o. 3113	0.93074	0.930 34	0.929 *95*	0.929 *55*	0.929 15	0.928 75	0.92835
28	0.93142	0.931 03	0.93063	0.93024	0.929 84	0.92945	0.929 05	0.928 *65*	0.928 24	0.927 84
29	**0.93093**	0.93053	0.93014	0.92974	0.92935	0.928 95	0.928 *55*	0.928 14	0.92774	0.927 33
30	0.93042	0.93002	0.929 62	0.92923	0.928 83	0.92843	0.928 03	0.927 63	0.927 22	0.926 82
31	0.929 *95*	0.92955	0.92915	0.928 75	0.928 35	0.927 95	0.927 54	0.927 14	0.926 73	0.92633
32	0.92947	0.929(!1	0.928 67	0.928 26	0.927 86	0.92746	0.927 05	0.926 *65*	0.92624	0.925 84
33	0.928 99	0.928 *59*	0.92819	0.927 78	0.927 38	0.92698	0.926 57	0.92616	0.925 76	0.92535
34	0.928 52	0.928 12	0.927 71	0.927 31	0.92690	0.92650	0.92609	0.925 68	0.925 28	0.924 87
35	0.928 06	0.927 *65*	0.92725	0.926 84	0.92644	0.92603	0.925 62	0.925 21	0.924 80	0.92439
36	0.927 60	0.92719	0.92678	0.926 38	0.925 97	0.925 56	0.925 15	0.924 74	0.924 33	0.92392
37	0.927 14	0.926 73	0.92632	0.925 92	0.925 51	0.92510	0.924 69	0.92428	0.923 86	0.92345
38	0.926 70	0.92679	0.925 88	0.92547	0.925 06	0.92465	0.924 24	0.923 82	0.923 41	0.92299
39	0.926 25	0.925 84	0.925 43	0.925 02	0.924 61	0.92420	0.923 78	0.923 37	0.92295	0.922 54
40	0.925 80	0.925 39	0.92498	0.924 57	0.92416	0.923 75	0.923 33	0.92292	0.92250	0.922 09

(Conimued)

Table 1 Apparent Relative Densities of Aqueous Ethanol at Various Temperatures -*Contd*

Temperature ·C	Percentages of Volume_at 20·c									
	50.0	50.2	**50.4**	50.6	**50.8**	**51.0**	**51.2**	**51.4**	**51.6**	**51.8**
10	0.937 78	0.937 40	0.937 01	0.936 63	0.93624	0.935 86	0.935 47	0.935 08	0.934 69	0.93430
11	0.93714	0.936 76	0:936 37	0.935 99	0.935 60	0.935 22	0.934 83	0.93444	0.93404	0.933 65
12	0.936 51	0.93612	0.935 74	0.93535	0.93497	0.93458	0.93419	0.933 80	0.933 40	0.933 01
13	0.935 88	0.93549	0.935 11	0.934 72	0.93434	0.933 95	0.933 56	0.93316	0.932 77	0.932 37
14	0.93527	0.934 88	0.93449	0.93411	0.933 72	0.933 33	0.93293	0.932 54	0.93214	0.931 75
- 15	0.934 66	0.934 27	0.933 88	0.93349	0.933 10	0.932 71	0.932 31	0.931 92	0.93152	0.931 13
16	0.93406	0.933 67	0.933 28	0.93289	0.93250	0.93211	0.931 71	0.931 31	0.93091	0.93051
17	0.933 48	0.933 0IJ	0.932 69	0.93230	0.931 90	0.931 51	0.931 11	0.930 71	0.93032	0.92992
1-8	0.93290	0.93250	0.932 11	0.931 71	0.93132	0.93092	0.93052	0.93012	0.92973	0.92933
19	0.93232	··b.931'92	0.93153	0.931 13	0.93074	0.93034	0.92994	0,929 54	0.929]3	0.928 73
20	0.9 3 ! ,75	0.93135.	0.93095	0.930 56	0.93016	0.929 76	0.92936	0.928 96	0.928 55	0.928 15
21	0.9311 -	0,9'30 79 ·	0.93039	0.929 99	0.929 59	0.92919	0.928 79	0.92839	0.927 98	0.927 58
22	0.930 63	0.93023 ··	0.929 83	0.929 44	· 0.929 04	0.928 64	0.928 23	0.927 83	0.92742	0.927 02
23	0.93008	0.929 68	0.92928	0.928 88	0.92848	0.92808	0.927 67	0.927 26	0.926 86	0.92645
24	**0.9Jli55**	0.929 15	0.928 75	0.928 34	0.927 94	0.927 54	0.927 13	0.926 72	0.92632	0.925 91
25	0.929 01	0.928 61	0.928 21.	0.927 80	0.927 40	0.927 00	0.926 59	0.92618	0.92577	0.925 36
26	0.928 48	0.928 08	0.927 67	0.927 27	0.926 86	0.92646	0.92605	0.925 64	0.92523	0.924 82
27	0.927 95	0.927 54	0.927 14·	0.926 73	.. 0.926 33	0.925 92	0.925 51	0.925 10	0.924 70	0.924 29
28	0.927 44	0.927 03	0.926 62	0.926 22	0.925 th	0.925 40	0.9 499	0.92458	0.92416	0.923 75
29	0.92693	0.926 52	0.92611	0.925 71	0.92530	0.92489	0.92448	0.92407	0.923 65	0.92324
30	0.92642 ·	0.926 01..	0.925 60	, 0.925 19	0.924 78	0.92437	0.923 96	0.923 54	0.92313	0.922 71
31	0.92592	0.925 51	0.925 IO	0.924 69	0.92428	0.923 87	0.92345	0.923 04	0.92262	0.922 21
32	0.925 43	0.925 .	0.924 61	0.92420	0.923 79	0.923 38	0.92296	0.92254	0.92213	0,9Zl 71
33	0.92494	0.924 53	0.92412	0.923 70	0.92329	0.92288	0.92246	0.92204	0.92163	0.92121
34	0.92446	0.92404	0.923 63	0.923 21	0.922 80	0.92238	0.92196	0.92154	0.92113	0.92071
35	0.923 98	0.92356	0.923 15	0.922 73	0.92232	0.921 90	0.921 48	0.921 06	0.92064	0.92022
36-	0.923 51	0.923 0IJ	0.922 67	0.922 26	0.921 84	0.92142	0.92100	0.920 58	0.92016	0.919 74
37.	0.923 04	0.922 62	0.922 20	0.921 79	0.92137	0.92095	0.92053	0.92010	0.919 68	0.91925
38	0.92258	0.922 16	0.921 74	0.921 33	0.920 91	0.92049	0.92006	0.919 64	0.919 21	0.918 79
39	0.922 12	0.92170	0.921.28	0.92086	0.92044	0.92002	0.919 60	0.919 17	0.918 75	0.918 32
40	0.921 67	0.921 25	0.92083	0.920 40	0.919 98	0.919 56	0.91913	0.918 71	0.918 28	0.917 86

Temperature ·C	Percentages of V lume at 20'C									
	52.0	**52.2**	**52.4**	**52.6**	**52.8**	**53.0**	**53.2**	**S3.4**	**53.6**	**53.8**
10	0.933 91	0.933 51	0.933 12	0.932 72	0.93233	0.93193	0.931 53	0.93112	0.93072	0.93031
11	0.933 26	0.932 86	. 0.93246	0.93207	0.931 67	0.931 27	0.930 87	0.93046	0.93006	0.929 **65**
12	0.932 62	0.932 22	0.931 82	0.93142	0.931 02	0.93062	0.930 21	0.929 81	0.929 40.	0.929 00
13	0.93198	0.93158	0.931 18	0.93078	0.930 38	0.929 98	0.929 57	0.929 17	0.928 76	0.928 36
14	0.93135	0.93095	0.93055	0.93014	0.929 74	0.929 34	0.92893	0.928 52	0.928 12	0.927 71
15	0.930 73	0.93033	0.92992	0.92952	0.929 11	0.928 71	0.928 30	0.92789	0.927 4	0.92708
16	0.93011	0.929 71	0.929 31	0.928 90	0.928 50	0.92810	0.927 69	0.92728	0.926 86	0.92645
17	0.929 *52*	0.929 12 •	0.928 71	0.928 31	0.927 90	0.927 50	0.92709	0.92668	0.92626	0.925 85
18	0.928 93	0.928 52	0.928 11	0.927 71	0.927 30	0.926 89	0.92648	0.92607	0.925 66	0.925 25
19	0.928 33	0.927 92	0.927 52	0.927 11	0.926 71	0.926 30	0.925 89	0.925 47	0.92506	0.924 **64**
20	0.927 75	0.927 34	0.926 93	0.926 53	0 .92612	0.925 71	0.925 30	0.924 88	0.92447	0.92405
21	0.927 18	0.926 77	0.926 36	0.925 *95*	0.925 54	0.925 13	0.924 72	0.924.30	0.923 89	0.92347
22	0.926 61'	0.926 20	0.925 79	0.925 37	0.924 96	0.924 *55*	0.92414	0.923 72	0.923 31	0.922 89
23	0.926 04	0.925 63	0.925 22·	0.924 80	0.92439	0.923 98	0.923 56	0.923 15	0.92273	0.92232
24	0.925 50	0.925 09	0.924 67	0.92426	0.9i3 84	0.92343	0.923 01	0.922 60	0.92218	0.921 77
25	0.924 *95*	0.924 54	0.924 12	0.923 71.·	0.923 29	0.922 88	0.92246	0.92204	0.921 62	0.921_20
26	0.92441	0.923 **99**	0.92358	0.923 16	0.922 75	0.922 33	0.92191	0.92149	0.92107	0.920 65
27	0.923 88	0.923 46	0.923 04	0.922 63	0.92221	0.921 79	0.921 37	0.92095	0.92053	0.92011
28	0.923 34	0.92292	0.92250	0.922 09	0.97,.l 67	0.921 25	0.92083	0.92041	0.919 98	0.919 56
29	0.92283	0.92241	0.921 99	0.9il 57 •	0.92115	0.92073	0.92030	0.919 88	0.919 *45*	0.919 03
30	0.92230	0.921 88	0.92146	0.921 04	0.92062	. 0.920 20	0.919 77	0.919 35	0.918 92	0.91850
31	0.921 79	0.92137	0.92095	0.920 52	0.92010	0.919 68	0.919 25	0.918 83	0.91840	0.917 98
32	0.92129	0.92087	0.92044	0.920 02.	0.91959	0.91917	0.918 74	0.918 32	0.917 89	0.917 47
33	0.92079	0.92036	. 0.919 94	0.919 51	0.919 *OCJ*	0.918 66	0.918 23	0.917 81	0.917 38	**0.91696**
34	0.92029	0.919 86	0.919 44	0.919 01	0.918 *59*	0.91816	0.917 73	0.917 30	0.916 88	0.91645
35	091_9 80	0.919 37	0.918 *95*	0.918 52	0.918 10	0.917 67,	0.91724	0.916 81	0.91638	0915 *95*
36	0.919 32	0.918 89	0.918 46	0.918 04	0.917 61	0.917 18	0.916 75	0.916 32	0.915 88	0.91545
37	0.918 83	0.91840	0.917 97	0.917 *55*	0.91712	0.916 69	0.916 26	0.915 83	0.915 39	0.914 96
38	0.918 36	0.917 93	0.917 50	0.917 07	0.916 64	0.916 21	0.915 78	0.915 35	0.91491	0.914 48
39	0.917 90	0.917 47	0.917 04	0.916 60	0.91617	0.915 74	0.915 31	0.914 87	0.91444	0.914 00
4fl	0.917 43	0.917 00	0.916 57	0.916 13	0.915 70	0.915 27	0.914 83	0.914 40	0.913 96	0.913 53

(Continued)

Table 1 Apparent Relative Densities of Aqueous Ethanol at Various Temperatures-Contd

Temperature •C	Percentages of Volume at 20•c									
	54.0	**54.2**	**54.4**	**54.6**	**54.8**	**55.0**	*55.2*	**55.4**	**55.6**	**55.8**
10	0.929 91	0.92950	0.929 09	0.928 68	0.928 27	0.927 86	0.927 45	0.92703	0.926 62	0.926 20
11	0.92925	0.928 84	0.928 43	0.928 02	0.927 61	0.927 20	0.926 78	0.92636	0.925 95	0.925 53
12	0.92859	0.92818	0.927 77	0.927 36	0.92695	0.926 54	0.92612	0.925 70	0.925 29	0.924 87
13	0.92795	0.927 54	0.927 13	0.926 71	0.926 30	0.935 89	0.925 47	0.925 05	0.924 63	0.924 21
14	0.927 30	0.92689	0.92648	0.92606	0.925 65	0.925 24	0.924 82	0.92440	0.923 98	0.923 56
15	0.92667	0.92625	0.925 84	0.925 42	0.925 01	0.92459	0.924 17	0.923 75	0.923 34	0.92292
16	**0.92604**	0.925 63	0.925 21	0.92480	0.92438	0.92397	0.923 55	0.92313	0.922 71	0.92229
17	0.925 44	0.925 02	0.924 61	0.92419	0.923 78	0.923 36	0.922 94	0.922 51	0.92209	0.921 66
18	**0.92484**	0.92442	0.92400	0.923 58	0.92316	0.922 74	0.92232	0.92190	0.92147	0.921 05
19	0.92423	0.92381	0.923 39	0.92297	0.92255	0.92213	0.921 71	0.92129	0.920 86	0.92044
20	0.923 64	0.923 22	0.922 80	0.92238	0.92196	0.92154	0.921 11	0.92069	0.920 26	0.919 84
21	0.923 06	0.92264	0.922 22	0.921 79	0.92137	0.92095	0.92052	0.92010	0.919 67	0.919 25
22	0.92248	0.92206	0.92163	0.921 21	0.92078	0.92036	0.919 93	0.919 51	0.919 08	0.918 66
23	**0.92190**	0.92148	0.92106	0.92063	0.92021	0.919 79	0.919 36	0.918 93	0.918 *50*	0.918 07
24	**0.92135**	0.92093	0.92050	0.92008	0.919 *65*	0.919 23	0.918 80	0.918 37	0.91794	0.917 51
25	0.92078	0.92035	0.919 93	0.919 50	0.919 08	0.918 65	0.918 22	0.917 79	0.917 37	0.916 94
26	0.92023	0.919 80	0.919 38	0.918 95	0.918 53	0.918 JO	0.917 67	0.917 24	0.916 80	0.916 37
27	0.919 <*D*	0.919 26	0.918 83	0.918 41	0.917 98	0.917 55	0.917 12	0.916 69	0.91625	0.915 82
28	0.91914	0.918 71	0.918 28	0.917 86	0.917 43	0.917 00	0.916 57	0.916 14	0.915 70	0.915 27
29	**0.918 60**	0.918 17	0.917 74	0.917 32	0.916 89	0.91646	0.916 03	0.915 59	0.91516	0.914 72
30	0.918 07	**0.917 64**	0.917 21	0.91679	0.916 36	0.915 93	0.915 49	0.915 06	0.914 62	0.914 19
31	0.917 *55*	0.91712	0.916 69	0.916 26	0.915 83	0.915 40	0.914 96	0.914 53	0.914 09	0.913 66
32	0.917 04	0.916 61	0.916 18	0.915 74	0.915 31	0.914 88	0.91444	0.914 00	0.913 57	0.913 13
33	0.916 53	0.91610	0.915 66	0.915 23	0.914 79	0.914 36	0.913 92	0.913 48	0.913 05	0.912 61
34	0.91602	0.915 59	0.915 15	(t914 72	0.91428	0.913 85	0.91341	0.912 97	0.912 53	0.91209
35	0.91552	0.915 08	0.914 65	0.914 21	0.913 78	0.913 34	0.912 90	0.912 46	0.912 02 •	0.91158
36	0.915 02	0.914 58	0.91415	0.913 71	0.913 28	0,912 84	0.912 40	0.91196	0.91151	0.91107
37	0.91453	0.914 0)I)	0.913 65	0.913 22	0.912 78	0.912 34	0.91190	0.91146	0.911 01	0.91057
38	**0.914 05**	0.913 61	0.913 17	0.912 74	0.912 30	0.911 86	0.91142	0.910 97	0.91053	0.91008
39	0.913 57	0.91313	0.912 69	0.912 25	0.91181	0.91137	0.910 92	0,910 48	0.910 03	0.909 59
40	0.913 09	0.912 65	0.912 21	0.911 76	0.91132	· 0.910 88	0.91043	0.909 99	0.909 54	0.90910

Temperature ·C	Percentages of Volume at 20°C									
	56.0	56.2	56.4	56.6	56.8	57.0	S7.2	57.4	57.6	S7.8
10	0.925 79	0.925 37	0.924 Y5	0.92452	0.92410	0.923 68	0.923 25	0.92282	0.92240	0.92197
11	0.925 11	0.924 69	0.924 27	0.923 85	0.92343	0.923 01	0.92258	0.92215	0.921 73	0.921 30
12	0.92445	0.924 03	0.923 61	0.923 18	0.92276	0.92234	0.921 91	0.92148	0.921 06	0.920 63
13	0.923 79	0.923 37	0.922 94	0.922 52	0.92209	0.921 67	0.921 24	0.920 81	0.920 39	0.919 96
14	0.923 14	0.922 72	0.922 29	0.92187	0.92144	0.921 02	0.92059	0.92016	0.919 72	0.919 29
15	0.92250	0.922 07	0.921 65	0.92122	0.92080	0.92037	0.919 94	0.919 51	0.919 07	0.918 64
16	0.921 87	0.921 44	0.92101	0.92059	0.920 **16**	0.919 73	0.919 30	0.918 87	0.918 44	0.918 01
17	0.921 24	0.920 81	0.92039	0.919 96	0.919 54	0.919 11	**0.918 68**	0.918 24	0.917 81	0.917 37
18	0.92063	0.920 20	0.919 77	0.919 35	0.918 92	0.918 49	0.918 05	0.917 62	0.917 18	0.916 75
19	0.92002	0.919 59	0.919 16	0.918 73	0.918 30	0.917 87	0.917 44	0.917 00	0.916 57	0.91613
20	0.91941	0.918 98	0.918 55	0.918 13	0.917 70	0.917 27	0.916 83	0.916 40	0.915 96	0.915 53
21	0.918 82	0.918 39	0.917 96	0.917 53	0.917 10	0.916 67	0.916 23	0.915 79	0.915 36	0.914 92
22	0.918 23	0.917 80	0.917 37	0.916 93	0.916 50	0.916 07	0.915 63	0.915 20	0.914 76	0.914 33
23	0.917 64	0.917 21	0.916 78	0.916 34	0.915 91	0.915 48	0.915 04	0.914 60	0.91417	0.913 73
24	0.917 08	0.916 65	0.916 21	0.915 78	0.915 34	0.914 91	0.91447	0.91403	0.913 59	0.91315
25	0.916 51	0.916 08	0.915 64	0.915 21	0.914 77	0.914 34	0.913 90	0.91346	0.913 02	0.912 58
26	0.915 94	0.915 50	0.915 07	0.914 63	0.914 20	0.913 76	0.913 32	0.912 88	0.912 44	0.91200
27	0.915 39	0.914 95	0.914 52	0.914 08	0.913 65	0.913 21	0.912 77	0.912 33	0.911 88	0.91144
28	0.914 84.	0.914 40	0.913 96	0.913 53	0.913 09	0.912 65	0.912 21	0.91177	0.911 32	0.91088
29	0.914 29	0.913 85	0.913 41	0.91298	0.912 54	**0.91210**	0.911 66	0.911 21	0.91077	0.91032
30	0.913 75	0.913 31	0.912 87	0.91243	0.91199	0.91155	0.91111	0.910 66	0.91022	0.90077
31	0.913 22	0.912 78	0.912 34	0.91189	**0.91145**	0.911 01	**0.91057**	0.91012	**0.900 68**	0.90023
32	0.912 69	0.912 25	0.911 81	0.91137	0.91093	**0.91049**	**0.91004**	0.90960	0.909 15	0.908 71
33	0.912 17	0.911 73	0.911 29	0.910 84	0.91040	**0.90996**	**0.909 51**	0.90906	0.908 61	0.908 16
34	0.91165	0.911 21	0.910 77	0.910 32	**0.90988**	**0.90044**	0.908 99	0.908 54	0.908 09	0.907 64
35	0.911 14	0.910 69	0.910 25	0.909 80	0.909 36	0.90891	0.90846	0.908 01	0.907 57	0.90712
36	0.91063	0.910 19	0.909 74	0.90930	0.908 85	0.90841	0.90796	0.907 51	0.907 06	0.906 61
37	0.91013	0.909 68	0.909 23	0.908 79	0.908 34	0.907 89	0.907 44	0.906 99	0.906 53	0.90608
38	0.909 64	0.90919	0.908 74	0.908 30	0.907 85	0.90740	0.90695	0.90649	0.906 04	0.905 58
39	0.909 14	0.908 69	0.908 24	0.907 80	0.907 35	0.90690	0.90645	0.905 99	0.905 54	0.905 08
40	0.908 65	0.908 20	0.907 75	0.907 30	0.906 85	0.90640	0.90595	0.905 49	0.905 04	0.904 58

(Col'llmued)

Table 1 **Apparent** Relative Densities or Aqueous Ethanol at Vario1,1s Temperatures -*Contd*

Temperature ·C	Percentages of Volume at 20•c									
	58.0	.58.l	58.4	58.6	S8.8	59.0	S9.2	59.4	59.6	59.8
10	0.92154	0.92110	0.92067	0.92023	0.919 80	0.919 36	0.91892	0.918 49	0.918 05	0.91'7 62
11	0.92087	0.92043	0.919 99	0.919 56	0.91912	0.918 68	0.918 24	0.917 80	0.917 37	0.916 93
12	0.92020	0.91976	0.91932	0.918 8&	0.91844	0.91800	0.917 56	0.91712	0.916 69	0.916 25
13	0.919 53	\0.919 09 .;	0.918 65	0.918 21	0.917 77	0.917 33	0.916 89	0.91645	0.91602	0.915 58
14	0.918 86	**0.91842**	0.917 98	0.917 55	0.917 11	0.916 67	0.916 23	0.915 79	0.915 35	0.914 91
15	0.918 21	0.91777	0.91733	0.91690	0.91646	0.916 02	0.915 58	0.91513	0.91469	0.914 24
16	0.917 58	0.91714	0.91670	0.91625	0.915 81	0.915 37	0.91493	0.91449	0.914 04	0.913 60
17	**0.91694**	**0.91650**	0.916 06	0.915 62	0.91518	0.914 74	0.91430	0.913 85	0.91341	0.91296
18	0.916 31	**0.915 87**	0.915 43	0.91499	0.914 55	0.91411	0.91366	0.913 22	, 0.912 77	0.91233
19	0.915 70	0.91526	0.914 81	0.91437	0.91392	0.913 48	0.913 04	0.912 60	0.912 15	0.911 71
20	0.915 09	**0.91464**	0.91420	0.913 75	0.913 31	0.912 86	0.91242	0.91197	0.91153	0.911 08
21	0.91448	0.91403	0.913 59	0.913 14	0.912 70	0.91225	0.911 81	0.911 36	0.91092	0.91047
22	0.913 89	0.91344	0.91299	0.912 55	0.91210	0.911 65	0.911 20	0.910 76	0.910 31	0.909 87
23	0.91329	0.912 84	0.91240	0.91195	0.911 51	0.91106	0.91061	0.910 16	0.909 72	0.909 27
24	0.912 71	0.91226	0.91181	0.911 37	0.91092	0.91047	0.91002	0.90958	0.90913	0.908 69
25	0.91214	**0.91169**	0.911 24	0.91079	0.91034	,0.909 89	0.909 44	,0.90899	0.90855	0.90810
26	0.91156	0.91111	0.91066	0.91021	0.909 76	0.909 31	0.908 86	0.90841	0.90796	0.907 51
27	**0.91100**	0.91055	0.91010	0.909 65	0.90920	0.908 75	0.908 30	0.907 85	0.907 39	Q.90694
28	**0.91044**	**0.90999**	0.90954	0.90908	0.908 63	0.908 18	0.907 73	0.90728	0.906 82	0.90637
29	**0.909 88**	0.90943	0.908 98	0.908 52	0.90807	0.907 62	0.90717	0.90672	0.90626	0.905 81
30	..·g·,909.33	**0.908 88**	0.90842	0.90797	0.907 51	0.907 06	0.90661	0.90616	0.905 70	0.905 25
31	0.90 -	0.90834	0.907 88	0.90743	0.906 97	0.906 52	0.90606	0.905 61	0.905 15	0.904 70
32	0.908 26 ..	0.907 80	0.907 35	0.906 89	0.90644	0.90598	0.905 52	0.90507	0.904 61	0.90416
33	0.907 71	· _.0.907	0.90680	0.90635	0.905 89	0.90544	0.90498	0.90453	0.90407	0.903 62
34	0.90719	0.90673	0.90628	0.905 82	· 0.905 37	0.904 91	0.90445	0.903 99	0.90354	0.903 08
35	0.906 67	0.90621 •	0.905 75	-9P5 30 ...	0.9_04 84	0.904 38 -	0.90392	0.90346	0.90301	0.90255
36	0.90616	.0.90570	0.905 24	0.904 78	0.904 32	0.903 86	0.90340	0.90294	0.90249	0.90203
37	0.905 63	0.90517	0.904 71	0.90425	0.903 79	0.903 33	0.902 87	0.90241	0.901 96	0.90150
38	0.90513	0.904 67	0.90421	0.903 75	0.903 29	0.902 83	0.90237	0.90191	0.90145	0.90099
39	0.904 63	0.90417	0.903 71	0.90324	0.90278	0.90232	0.90186	0.90140	0.90093	0.90047
40	0.904 13	0.903 67	0.903 20	0.90274	0.90227	0.90) 81	0.901 35	0.90089	0.90042	0.899 96

Temperature ·C	Percentages of Volume at 20°C									
	60.0	**60.2**	60.4	**60.6**	60.8	6U	**61.2**	**61.4**	**6).6**	**61.8**
10	0.91718	0.916 74	0.916 30	0.915 85	0.915 41	0.914 97	0.91452	0.914 07	0.913 63	0.913 18
11	0.916 49	0.916 05	0.915 61	0.91516	0.914 72	Q.914 28	0.913 83	0.913 38	0.91293	0.912 48
12	0.91581	0.915 37-	0.914 92	0.91448	0.914 03	0.913 59	0.913 14	0.912 69	0.912 24	0.911 79
13	0.915 14	0.91469	0.914 25	0.913 80	0.913 36	0.912 91	0.91246	0.9120f	0.91156	0.91111
14	0.914 47	0.914 02	0.913 58	0.91313	0.912 69.	0.912 24	0.911 79	0.911 34	0.91089	0.91044
15	0.913 80	0.913 36	0.912 91	0.912 47	0.912 02	0.91158	0.911 13	0.910 67	0.910 22	0.90976
16	0.913 16	0.912 71	0.912 26	0.911 82	0.91137	0.91092	0.91047	0.91002	0.90957	0.90912
17	0.912 52	0.912 07	0.911 63	0.911 18	0.910 74	0.91029	0.909 84	0.90938	0.908 93	0.90847
18	0.911 88	0.91143	0.91099	0.91054	0.91010	0.909 65	0.909 19	0.908 74	0.908 28	0.907 83
19	,0.911 27	0.91082	0.91037	0.909 91	0.909 46	0.90901	0.908 56	0.90810	0.907 65	0.90719
20	0.910 64	0.910 19	0.90974	0.909 29	0.908 84	0.908 39	0.90793	0.907 **48**	0.90702	0.90657
21	0.91003	0.909 58	0.909 13	0.908 67	0.908 22	0.907 77	0.907 31	0.90686	0.90640	0.905 95
22	0.90942	0.90897	0.908 52	0.90807	0.907 62	0.907 17	0.90671	0.906 25	0.905 80	0.90534
23	0.908 82	0.908 37	0.907 91	0.907 46	0.907 00	0.906 55	0.90609	0.905 64	0.905 18	0.904 73
24	0.90824	0.907 79	0.907 33	0.906 88	0.90642	0.905 97	0.90551	0.905 05	0.904 60	0.90414
25	0.907 65 ·	0.907 19	0.906 74	0.90628	0.905 83	0.905 37	0.90491.	0.90445	0.90400	0.903 54
26	0.907 06	0.906 61	0.906 15	0.905 70	0.905 24	0.904 79	0.90433	0.903 87	0.90341 .	0.90295
27	0.90649	0.90603	0.905 58	0.90512	0.904 67	0.901- 21	0.903 75 .	0. 329	0.90283	o.90237
28	0.905 92	0.905 46	0.905 01	0.90455	0.90410	0.903 64	0.903 18	0.902 72	0.90226	0.901 80
.29	0.905 36	0.904 90	0.90445	0.903 99	0.903 54	0.903 08	0.90262	0.90215	0.90169	0.90122
30	0.90480	0.90434	0.903 88	0.903 42	0.902 96	0.90250	.0.90204	0.901 58	0.90111	0.90065
31	0.90424	0.903 78	0.903 32	0.902 87	0.90241	0.90195	0.90149	0.90102	0.90056	0,90009
32	0.903 70	0.903 24	0.902 78	0.90233	0.901 87	0.90141	0.90094.	0.90048	0.90001	0.89955
33	0.90316	0.902 70	0.90224	0.901 77	0.90131	0.90085	9.90039	0.899 92	0.89946	0.89899
34	0.90262	0.9021'6	0.901 70	0.90124	0.90078	o.90032 .	0.899 85	0.89938	0.89892	0.89845
35	0.902 09	0.901 63	0.90117	0.900 70	0.90024	0.8 78 ·."	0.899 31	0.898 84 -	0.898 38	0.897 91
36	0.90157	0.90111	0.90064	0.90018	0.89971	0.89925	0.89878	0.898 3i	0.897'84	0.897 37
37	0.90104	0.900 57	0.90011	0.899·64	0.89918	0.898 71	0.89824	0.897 77	0.89731	0.89684
38	0.90053	0.90006	0.899 60	0.89913	0.898 67	0.898 20	0.89773	0.897 26	0.89679	0.89632
39	0.90001	0.899 54	0.89908	0.898 61	0.898 15	0.897 68	0.89721	0.896 74	0.89627	0.895 80
40	0.89950	0.89903	0.898 56	0.898 10	0.897 63 ,	0.89716	0.89669	0.896 22	0.89574	0.895 27

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Table 1 Apparent Relative Densities or Aqueous Ethanol at Various Temperatures -*Contd*

Temperature •C	Percentages of Volume at 20•c									
	62.0	**62.2**	**62.4**	**62.6**	**62.8**	**63.0**	63.2	63.4	**63.6**	**63.8**
10	0.912 73	0.91228	0.91183	0.911 37	0.910 92	0.910 47	0.91001	0.909 55	0.90910	0.908 64
11	0.91203	0.911 58	0.91113	0.910 67	0.910 22	0.90977	0.909 31	0.908 85	0.90840	0.90794
12	0.911 34	0.91089	0.91044	0.909 98	0.90953	0.90908	0.908 62	0.908 16	0.907 70	0.907 24
13	0.910 66	0.91021	0.909 75	0.909 30	0.908 84	0.908 39	0.907 93	0.907 47	0.907 01	0.906 *55*
u	**0.90999**	0.90953	0.909 08	0.908 62	0.90817	0.907 71	0.907 25	0.90679	0.906 33	0.905 87
15	0.90931	0.908 86	0.908 40	0.907 95	0.907 49	0.90704	0.90658	0.906 12	0.905 66	0.905 20
16	0.908 67	0.908 2i	*0.90115*	0.907 30	0.90684	0.906 38	0.905 92	0.905 46	0.90499	0.904 53
17	0.90802	0.907 *56*	0.90710	0.906 65	0.90619	0.905 73	0.905 27	0.904 81	0.904 34	0.903 88
18	0.90131	0.90691	0.90646	0.906 00	0.905 *55*	0.905 09	0.90463	0.90416	0.903 70	0.903 23
19	***0.90614***	**0.90628**	0.905 82	0.905 37	0.9049)	0.90445	0.903 99	0.903 52	0.903 06	0.902 59
20	0.90611	0.905 65	0.90519	*0.90414*	0.904 28	0.903 82	0.903 35	0.902 89	0.90242	0.90196
21	**0.90549**	0.90503	0.90457	0.904 11	0.903 65	0.903 19	0.902 73	0.902 26	0.901 80	0.901 33
22	**0.90488**	**0.90442**	0.903 96	0.90349	0.903 03	0.902 57	0.902 10	0.901 64	0.901 17	0.900 71
	0.904 *Tl*	0.903 81	0.903 35	0.902 88	0.90242	0.90196	0.90149	0.901 03	0.90056	0.90010
24	**0.903 68**	**0.903** 22	0.902 75	0.902 29	0.901 82	0.90136	0.900 89	0.90042	0.899 96	0.89949
lS	**0.90308**	**0.90262**	0.90215	0.901 69	0.90122	0.90076	0.90029	0.899 82	0.899 36	0.898 89
26	**0.90249**	0.90203,	0.90156	0.901 IO	0.90063	0.90017	0.899 70	0.899 23	0.898 76	0.898 29
27	**0.90191**	0.90145	**0.90098**	0.90052	0.900 *05*	0.899 59	0.89912	0.898 *65*	0.898 17	0.897 70
28	**0.90134**	0.90087	0.90040	0.89994	0.89947	0.89900	0.898 53	0.898 06	0.897 59	0.897 12
29	**0.90076**	**0.90029**	**0.899** 83	0.89936	0.89890	0.89843	0.897 96	0.897 49	0.897 01	0.89654
30	**0.90019**	**0.89972**	**0.89925**	0.898 79	0.898 32	0.897 *85*	0.897 38	0.896 91	0.896 43	0.895 96
31	**0.899 63**	**0.89916**	0.898 69.	0.898 23	0.897 76	0.8972?	0.896 82	0.896 34	0.895 87	0.895 39
32	**0.899**	**0.898 61**	0.89814	0.897 68	0.89 1 .	0.896 74	0.896 26	0.895 79	0.895 31	0.894 84
33	**0.898 53**	**0.898 06**	0.897 *59*	0.89712	0.8 65	0.89618	0.895 71	0.895 23	0.894 76	0.89428
34	**0.89798**	0.89751	0.89704	0.89656	0.896 09	0.895 62	0.895 15	0.894 67	0.89420	0.893 72
35	**0.89744**	0.89697	0.89650	0.896 02	0.895 *55*	0.895 08	0.894 60	0.89413	0.893 65	0.893 18
36	**0.89690**	0.89643	0.895 96	0.895 48	0.895 01	0.894 54	0.894 06	0.893 59	0.893 11	0.89264
37	0.896 37	0.895 90	0.89542	0.89495	0.89447	0.894 00	0.893 52	0.893 04	0.89257	0.892 09
38	**0.895 85**	0.895 37	0.89490	0.89442	0.893 95	0.89347	0.892 99	0.892 51	0.89204	0.89156
39	**0.89533**	0.894 85	0.89438	0.893 90	0.893 43	0.89295	0.89247	0.891 99	0.891 51	0.891 03
40	0.89480	0.89432	0.893 85	0.893 37	0.89290	0.89242	0.89194	0.89146	0.89098	0.890 50

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Temperature ·C	Percentages of Volume at 20•c									
	64.0	64.2	**64.4**	**64.6**	**64.8**	**65.0**	65.2	65.4	**65.6**	65.8
10	0.908 18	0.907 72	0.907 25	0.906 79	0.90632	0.90586	0.905 39	0.904 92	0.90446	0.90399
11	0.907 48	0.907 01	0.906 55	0.90608	0.905 62	0.90515	0.904 68	0.904 21	0.903 75	. 0,903 28
12	0.906 78	0.906 32	0.905 85	0.905 39	.0.904 92	0.90446	0.903 99	0.903 52	0.903 05	0.902 58
13	0.906 09	0.905 63	0.905 16	0.904 70	0.90423	0.903 77	0.903 30	0.902 83	0.90236	0.901 89
14	0.905 41	0.90494	0.90448	0.90401	. 0.90355	0.90308	0.902 61	0.90214	0.90166	0.901 19
15	0.904 74	0.90427	0.90380	0.903 34	0.902 87	0.90240	0.901 93	0.901 46	0.90099	0.90052
16	0.904 07	0.903 60	0.903 13	0.902 67	·o.90220	0.901 73	0.90126	0.90079	0.90032	0.899 85
17	0.903 42	0.90295	0.90248	0.90202	**0.90155**	0.90108	0.90061	0.90014	0.89966	0.89919
18	0.902 77	0.90230	0.90183	0.90137	**0.90090**	0.90043	0.89996	0.89948	0.899 01	0.898 53
19	0.902 13	0.901 66	0.90119	0.90073	0.90026	0.89979	0.899 31	0.898 84	0.898 36	0.897 89
20	0.90149	o.901 m·	0.90055	0.90008	0.89961	0.89914	0.898 67	0.89819	0.89772	0.897 24
21	0.900 87	0.90040	0.899 93	0.899 45	0;89898	0.898 51	0.898 03	0.897 56	0.897 08	0.896 61
22	0.90024	0.899 77	0.899 30	0.898 83	0.89836	0.897 89	0.897 41	0.89694	0.89646	0.895 99
23	0.899 63	0.899 16	0.898 69	0.898 21	0.897 74	0.89727	0.896 79	0.896 31	0.89584	0.895 36
24	0.899 O'l	0.898 55	0.898 08	0.897 60	0.89713	0.89666	0.896 18	0.895 70	0.89523	0.894 75
25	0.898 42	0.897 95	0.897 47	0.897 00	0.896 52	0.89605	0.895 57	0.895 **09**	0.894 62	0.89414
26	0.897 82	0.897 35	089687	0.89640	0.89592	0.89545	0.894 97	0.89449	0.89402	0.893 54
27	0.897 23	0.896 76	0.896 28	0.895 81	0.895 33	0.89486	0.894 38	0.893 90	0.89342	0.89294
28	0.896 65	0.89617	0.895 70	0.895 22	0.894 75	0.89427	0.893 79	0.893 31	0.89283	0.89235
29	0.896 07	0.895 59	0.895 12	0.894 64	0.89417	0.89369	0.893 21	0.892 73	0.89225	0.891 77
30	0.89549	0.895 01	0.894 53	**0.89406**	0.893 58	0.89310	0.89262	0.89214	0.89166	0.89118
31	0.894 92	0.89444	0.893 97	0.89349	0.893 02	0.89254	0.89206	0.89157	0.89109	0.89060
32	0.894 36	0.893 88	0.893 41	0.89293	**0.89246**	0.89198	0.89150	0.891 01	0.89053	0.89004
33	0.893 81	0.893 33	0.892 85	0.892 37	**0.89189**	0.89141	0.89093	0.89044	0.889 96	0.88947
34	0.893 25	0.89277	0.892 29	0.89181	0.89133	**0.89085**	0.89037	0.889 88	0.88940	0.888 91
35	0.892 70	0.89222	0.891 74	0.89126	0.89078	0.89030	0.889 81	0.88933	o.88184	0.888 36
36	0.89216	0.891 68	0.891 20	0.89071	0.89023	0.88975	0.889 26	0.888 78	0.888 29	0.887 81
37	0.891 61	0.89113	0.890 65	0.890 16	**0.889 68**	**0.88920**	0.888 71	'0.888 23	0.88774	0.88726
38	0.89108	0.890 60	0.89011	0.889 63	0.889 14	**0.88866**	0.888 17	0.887 68	0.88720	0.88'6 71
39	0.89055	0.89006	0.889 58	0.889 09	**0.888 61**	0.88812	0.887 63	0.88714	0.886 66	0.88617
40	0.89002	0.889 53	0.889 05	0.888 56	**0.88808**	0.887 59	0.88710	0.886 61	0.88613	0.885 64

(Conlinued)

Table 1 Apparc.nt Relative Densities or Aqueous Ethanol at Various Temperatures.-*Contd*

Temperature ·C	Percentages of Volume at 20°C									
	66.0	66.2	**66.4**	**66.6**	66.8	**67.0**	67.2	67.4	67.6	**67.8**
10	0.903 52	0.9030S	0.90258	0.90210	0.901 63	0.90116	0.90068	0.90020	0.89972	0.89924
11	0.902 81	0.90234	0.90187	0.901 39	0.900 92	0.90045	0.899 97	0.89949	0.89901	0.898 53
12	0.90211	0.90163	0.90116	0.90068	0.90021	0.89973	0.89925	0.898°77	0.89830	0.897 82
13	0.90142	0.90094	0.90047	0.89999	0.89952	0.89904	0.898 56	0.89808	0.89760	0.897 12
14	0.90072	0.90025	0.89977	0.89930	0.898 82	0.89811	0.897 87	0.897 39'	0.89690	0.896 42
15	0.90005	0.89957	0.899 09	0.89862	0.89814	0.897 66	0.89718	0.896 70	0.896 22	0.895 74
16	0.89938	**0.89890**	0.89842	0.89795	0.89747	0.89699	0.896 51	0.89603	0.895 54	0.895 06
17	0.898 72	0.89824	0.897 76	0.89728	0.89680	0.89632	0.895 84	0.89536	0.89487	0.89439
18	0.898 06	0.897 58	0.89710	0.89662	0.89614	• 0.895 66	0.895 18	0;894 70	0.894 21	0.893 73
19	0.897 41	**0.89693**	0.89645	0.89598	0.895 SO	0.893 02	0.894 54	0.89405	0.893 57	0.893 08
20	0.89677	0.89629	0.895 81	0.89533	0.89485	0.89437	0.893 89	0.89 340	0.89292	0.89243
21	0.89613	0.895 *65*	0.895 17	0.894 70	0.89422	0.893 74	0.893 25	0.89277	0.89228	0.89180
22	0.895 51	0.895 03	0.894 55	0.89406	0.893 58	0.89310	0.892 61	0.89213	0.89164	0.891 16
23	**0.89488**	0.89440	0.89392	0.89343	0.89295	o: 9247	0.891 99	0.'891 50	0.89102	0.89053
24	0.8941:1	0.893 79	0.89331	0.892 82	0.89234	0.891 86	0.891 37	0.89089	0.89040	0.88992
25	0.893 66	0.893 18	0.892 70	0.892 22	0.891 74	0.89126	0.890 77	0.89028	0.88979	0.889 30
26	0.893 06	0.89258	0.89209	0.891 61	0.891 12	0.89064	0.890 15	0.88966	0.88917	0.888 68
27	0.89246	0.89198	0.89149	0.89101	0.890 52	0.89004	0.889 55	0.88906	0.88857	0.888 08
28	0.891 87	0.89139	0.89090	0.89042	0.889 93	0.88945	0.88896	0.88847	0.88798	0.88749
29	0.89129	0.890 80	0.890 31	0.88983	0.889 34	0.888 85	0.888 36	0.887 87	0.887 38	0.88689
30	0.89070	0.89021	0.88973	0.88924	0.888 76	0.888 27	0.887 78	0.887 28	0.886 79	0.88629
31	0.89012	0.889 63	0.88915	0.88866	0.888 18	0.887 69	0.88720	0.886 71	0.886 21	0.885 72
32	**0.88956**	0.889(11	0.888 58	0.888 10	0.887 61	0.88712	0.886 63	0.88614	0.885 64	0.885 15
33	**0.8889')**	**0.888 50**	0.888 01	0.887 53	0.887 04	0.88655	0.88606	0.885 56	0.88507	0.88457
34	**0.88843**	0.88794	0.887 45	0.88696	0.88647	0.885 98	0.88549	0.884 9'J	0.88450	0.884 00
35	0.887 87	0.887 38	0.88689	0.88640	0.885 91	0.88542	0.884 92	0.88443	0.88393	0.88344
36	0.887 32	0.886 83	0.88634	0.88S 84	0.885 35	0.884 86	0.88436	0.883 87	0.88337	0.882 88
37	o.886n	0.88628	0.885 79	0.885 'Jf)	0.884 80	0.88431	0.883 81	0.883 31	0.88282	0.88232
38	0.886 22	0.885 73	0.885 24	0.884 74	0.884 25	0.883 76	0.883 26	0.88277	0.88227	0.881 78
39	0.885 68	0.885 19	0.884 69	0.88420	0.883 70	0.883 21	0.88271	0.882 21	0.881 72	0.88122
40	o.8851s	0.884 65	0.88416	0.883 66	0.883 17	0.8812 67	0.88217	0.88167	0.881 18	0.88068

Temperature •C	Percentages of Volume at 20•c									
	68.0	68.2	**68.4**	**68.6**	**68.8**	**69.0**	**69.2**	**69.4**	***69.6***	**69.8**
10	0.898 76	0.898 28	0.897 79	0.897 31	0.89682	0.896 34	0.895 85	0.895 36	0.894 88	0.89439
11	0.898 05	0.897 57	0.897 08	0.896 60	0.89611	0.895 63	0.89514	0.89:465	0.894 16	0.893 67
12	0.897 34	C 896 86	0.896 37	0.895 89	0.89540	0.89492	0.89443	0.893 94	0.89344	0.89295
13	0.89664	0.89615	0.895 67	0.895 }8	0.894 70	0.89421	0.893 72	0.893 23	0.892 74	0.89225
14	0.895 94	0.89545	0.894 97	0.89448	0.89400	0.893 51	0.893 02	0.89253	0.892 03	0.89154
15	0.895 26	o.894 *n*	0.894 28	0.89380	0.893 31	0.89282	0.89233	0.89184	0.89134	0.89085
16	0.894 58	0.89409	0.893 60	0.89312	0.89263	0.89214	0.891 65	0.89116	0.89066	0.890 17
17	0.893 91	0.89342	0.892 93	0.89245	0.89196	0.89147	0.89098	0.89()49	0.88999	0.889 50
18	0.893 25	0.89276	0.892 27	0.891 78	0.89129	0.890 80	0.890 31	0.88982	0.889 32	0.888 83
19	0.89260	0.89211	0.891 62	0.89113	0.89064	0.89015	0.889 65	0.88916	0.888 66	0.888 17
20	0.891 95	0.89146	0.890 97	0.89048	**0.88999**	0.889 50	0.88900	0.888 51	0.88801	0.887 52
21	0.89131	0.89082	0:890 33	0.889 83	0.88934	0.888 85	0.888 35	0.887 86	0.88736	0.886 87
22	0.89067	0.89018.	0.889 69	0.88919	• 0.888 70	0.888 21	0.887 71	0.887 22	0.88672	0.886 23
23	0.89005	0.889 56	0.88906	0.888 56	0.888 07	0.887 58	0.88708	0.88659	0.88609	0.885 60
24	0.88943	0.888 94	0.88845	0.88795	0.88746	0.88697	0.886 47	0.88597	0.88548	0.884 98
25	0.888 81	0.888 32	0.887 83	0.887 33	0.886 84	0.886 35	0.885 85	0.885 35	0.884 85	0.88435
26	0.88819	0.887 70	0.887 21	0.886 71	0.886 22	0.885 73	0.885 23	0.884 73	0.884 23	0.883 73
-,27	0.887 59	0.887 10	0.88660	0.88611	0.885 61	0.885 12	0.884 62	0.88412	0.883 62	0.883 12
28	0.88700	0.886 50	0.88600	0.885 51	0.88501	0.88451	0.884 01	0.883 51	0.883 01	0.88251
29	0.88640	0.885 91	0.885 41	0.88492	0.88442	0.88393	0.88343	0.88293	0.88242	0.881 92
30	0.88580	0.885 30	0.884 81	0.884 31	0.883 82	0.883 32	0.88282	0.882 32	0.88182	0.88132
31	0.88523	0.884 73	0.88423	0.883 74	0.88324	0.882 74	0.88224	0.88174	0.88123	0.88073
32	0.884"66	0.884 16	0.883 66	**0.88316**	0.88266	0.88216	0.88166	0.88116	0.88065	0.88015
33	0.88408	0.883 58	0.883 08	0.88259	**0.882 (ll)**	0.881 59	0.88108	0.88058	0.88007	0.879 57
34	0.883 51	0.883 01	0.88251	0.88202	0.88152	0.88102	0.880 51	0.88001	0.87950	0.879 00
35	0.88294	0.88244	0.88194	0.88144	0.88094	0.88044	0.87994	0.87943	0.878 93	0.87842
36	0.88238	0.88188	0.88138	0.88089	0.88039	0.879 89	0.879 38	0.878 88	0.878 37	0.877 87
37	0.88182	0.88132	0.88082	0.88032	0.879 82	0.879 32	0.878 81	0.878 31	0.877 80	0.877 30
38	0.881 28	0.88078	0.88028	o.879n	0.879 27	o.878n	0.878 26	0.87775	.877 25	0.876 74
39	0.88072	0.88022	0.879 72	0.879 21	0.878 71	0.878 21	0.877 70	0.87720	0.876 69	0.87619
40	0.88018	0.879 68	0.87918	0.87867	0.87817	0.877 67	0:87716	0.87665	0.87615	0.875 64

(Continued)

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Table 1 Apparent Relative Densities of Aqueous Ethanol at Various Temperatures -*Contd*

Temperature •C	Percentages of Volume at 20•c									
	70.0	70.2	**70.4**	70.6	**70.8**	**71.0**	71.2	71.4	71.6	**71.S**
10	0.893 90	0.893 40	0.392 91	0.892 41	0.891 92	0.891 42	0.890 92	0.890 42	0.889 92	0.889 42
11	0.893 18	0.892 68	0.892 19	0.891 69	0.891 20	0.890 70	0.890 20	0.889 70	0.889 20	0.888 70
12	0.892 **46**	0.891 96	0.891 47	0.890 97	0.890 48	0.889 98	0.889 48	0.888 98	0.888 48	0.887 98
13	0.891 76	0.891 26	0.890 77	0.890 27	0.889 78	0.889 28	0.888 78	0.888 27	0.887 77	0.887 26
. 14	0.891 05	0.890 *55*	0.890 06	0.889 *56*	0.889 *(fl*	0.888 57	0.888 CJ7	0.887 56	0.887 06	0.886 *55*
15	0.890 36	0.889 86	0.889 36	0.888 87	0.888 37	0.887 87	0.887 37	0.886 86	0.886 36	0.885 85
16	**0.889 68**	0.889 18	0.888 68	0.888 18	0.887 68	0.887 18	0.886 68	0.886 18	0.885 67	0.885 17
17	0.889 01	0.888 51	0.888 01	0.887 51	0.887 01	0.886 51	0.886 01	0.885 50	0.885 00	0.884 49
18	0.888 34	0.887 84	0.887 34	0.886 84	0.886 34	0.885 84	0.885 33	0.884 83	0.884 32	0.883 82
19	0.887 67	0.887 17	0.886 67	0.886 18	0.885 68	0.885 18	0.884 67	0.884 16	0.883 66	0.883 15
20	0.887 02	0.886 52	0.886 02	0.885 51	0.885 01	0.884 51	0.884 00	0.883 50	0.882 99	0.882 49
21	**0.886** 37	**0.885 87**	0.885 37	0.884 87	0.884 37	0,883 87	0.883 36	0.882 85	0.882 35	0.881 84
22	**0.885** 73	**0.885** 23	**0.884** 73	0.884 22	0.883 72	0.883 22	0.882 71	0.882 20	0.881 70	0.881 19
23	**0.885** 10	**o:884 60**	**0.884 ()CJ**	0.883 59	0.883 08	0.882 58	0.882 00	0.881 56	0.881 06	0.880°55
24	**0.884 48**	0.883 98	0.883 47	0.882 97	0.882 46	0.881 96	0.881 45	0.880 94	0.880 43	0.879 92
25	**0.883** ***85***	0.883 *35*	0.882 84	0.882 34	0.881 83	0.881 33	0.880 82	0.880 31	0.879 81	0.879 30
26	0.883 23	0.882 73	0.882 *22*	0.881 72	0.881 21	0.880 71	0.880 20	0.879 69	0.879 18	0.878 67
27	**0.882 62**	0.882 12	0.881 61	0.881 11	0.880 60	0.880 10	0.879 *59*	0.879 08	0.878 57	0.878 06
28	0.882 01	0.881 51	0.881 00	0.880 50	0.879 99	0.879 49	0.878 98	0.878 47	0.877 *95*	0.877 44
29	**0.881 42**	0.880 91	0.880 40	0.879 90	0.9879 39	0.878 88	0.878 37	0.877 86	0.877 35	0.876 84
30	**0.880 82**	0.880 31	0.879 &O	0.879 30	0.878 79	0.878 28	o.877 *n*	0.877 26	0.876 74	0.876 23
31	**0.880** 23	0.879 72	0.879 21	0.878 71	0.878 20	0.877 69	0.877 18	0.876 67	0.876 '15	0.875 64
32	**0.879** ***6S***	0.879 14	0.878 63	0.878 13	0.877 62	0.877 11	0.876 60	0.876 08	0.875 57	0.875 05
33	0.879 06	0.878 55	0.878 05	0.877 54	0.877 **04**	0.876 53	0.876 01	0.875 50	0.874 98	0.874 47
34	0.878 49	0.877 98	0.877 47	0.876 96	0.876 45	0.875 94	0.875 43	0.874 91	0.874 40	0.873 88
35	0.877 92	0.877 41	0.876 90	0.876 39	0.875 88	0.875 37	0.874 85	0.874 34	0.873 82	0.873 31
36	0.877 36	0.876 85	0.876 34	0.875 82	0.875 31	0.874 80	0.874 28	o.813 *n*	0.873 25	0.872 74
37	**0.876 79**	0.876 *28*	0.875 77	0.875 *25*	0.874 74	0.874 23	0.873 71	0.873 20	0.872 68	0.872 17
38	**0.876** 23	0.875 72	0.875 21	0.874 69	0.874 18	0.873 67	0.873 15	0.872 64	0.8J2 12	0.871 61
39	0.875 68	0.875 17	0.874 66	0.874 14	0.873 63	0.873 12	0.872 60	0.872 08	0.871 57	0.871 05
40	0.875 13	0.874 61	0.874 IO	0.873 *58*	0.873 00	0.872 *55*	0.872 03	0.871 51	0.871 00	0.870 48

Temperature ·C	Percentages m Volume at 20·c									
	72.0	72.2	**72.4**	**72.6**	72.8	**73.0**	**73'.l**	**73.4**	73,6	73.8
10	0.888 *92*	0.888 42	0.887 91	0.887 41	0.886 90	0.886 40	0.885 89	0.885 37	0.884 86	0.884 34
11	0.888 20	0.887 69	0.887 19	0.886 68	0.886 18	**0.885.67**	**0,885 16**	0.884 64	0.884 13	0.883 61
12	0.887 48	0.886 97	0.886 46	0.885 *96*	0.885 45	0.884 94	0.88-4 43	0.883 92	0.883 40	0.882 89
13	0.886 76	0.886 25	0.885 75	0.885 24	0.884 74	0.884 23	0.883 71	0.883 20	0.882 68	0.882 17
14	0.886 05	0.885 54	0.885 03	0.884 53	0.884 *O'l*	0.883 51	0.883	0.882 48	0.881 97	0.881 45
15	0.885 35	0.884 84	0.884 33	o.&83 82	0.883 31	0.882 80	0.882 29	0.881 78	0.881 26	0.880 75
16	0.884 67	0.884 16	0.883 *65*	0.883 14	0.882 63	0.882 12	0;881 *tiO*	0.881 09	0.880 57	0.880 06
17	0.883 99	0.883 48	0.882 97	0.882 45	0.881 94	0.881 43	0.880 92	0.880 40	0.879 89	0.879 37
18	0.883 31	0.882 80	0.882 *'19*	0.881 78	0.881 1.7	0.880 76	0.880 24	0.879 72	0.879 21	0.878 69
19	0.882 64	0.882 13	0.881 62	0.881 10	0.880 59	0.880 08	0.879 56	0.879 05	0.878 53	0.878 *O'l*
20	0.881 98	0.881 47	0.880 96	0.880.45	0.879 94	0.879 43	0.878 9J	0.878 39	0.877 87	0.877 35
21	0.88] 33	0.880 82	0.880 31	0.879 79,	0.879 28	0.878 77	0.878 25	0.877 73	0.877 21	0.876 69
22	0.880 68	0.880 17	0.879 *65*	0.879 14	0.878 62	0.878 11	0.877 59	0.877 07	0.876 56	0.876 04
23	0.880 04	0.879 53	0.879 01	0.878 50	0.877 98	0.877 47	0.876 95	0.876 43	0.875 91	0.875 39
24	0.879 41	0.878 90	0.878 38	0.877 87	0.877 35	0.876 84	0.876 32	0.875 80	0.875 28	0.874 76
25	0.878 79	0.878 27	0.877 75	0.877 24	0.876 72	0.876 20	0.875 68	0.875 16	0.874 64	0.874 12
26	0.878 16	0.877 64	0.877 13	0.876 61	0.876 10	0.875 58	0.875 **06**	0.874 54	0.874 01	0.873 49
27	0.877 *55*	0.877 03	0.876 51	0.876 00	0.875 48	0.874 96	0.874 **44**	0.873 92	0.873 39	0.872 87
28	0.876 93	0.876 41	0.875 90	0.875 38	0.874 87	0.874 35	0.873 83	0.873 30	0.872 78	0.872 25
29	0.876 33	0.875 81	0.875 *'19*	0.874 78	0.874 26	0.873 74	0.873 22	0.872 69	0.872 17	0.871 64
30	0.875 72	0.875 20	0.874 68	0.874 17	0.873 65	0.873 13	0.872 61	0.872 08	0.871 *56*	0.871 03
31	0.875 13	0.874 61	0.874 09	0.873 57	0.873 05	0.872 53	·o.sn 01	0.87148	0.870 96	0.870 43
32	0.874 54	0.874 02	0.873 50	0.872 99	0.872 47	0.871 95	0.871 42	, 0.870 90	0.870 37	0.869 85
33	0.873 95	0.873 43	0.872 91	0.872 39	0.871 87	0.871 35	0..870 83	0.870 30	0.869 78	0.869 25
34	0.873 37	0.872 85	0.872 33	0.871 81	0.871 *'19*	0.810 *n*	0,870 **2'**	0.869 72	0.869 19	0.868 67
35	0.872 79	0.872 27	0.871 75	0.871 23	0.870 71	0.870 19	0.869 **66**	0.869 13	0.868 61	0.868 08
36	0.872 22	0.871 70	0.871 18	0.870 65	0.870 13	0.869 61	0.869 08	0.868 56	0.868 03	0.867 51
37	0.871 65	0.871 13	0.870 61	0.87008	0.869 56	0.869 **04**	***D.868* 51**	0.867 98	0.867 **46**	0.866 93
38	0.871 09	0.870 57	0.870 05	0.869 52	0.869 **00**	0.868 **48**	0.867 95	0.867 42	0.866 90	0.866 37
39	0.870 53	0.870 00	0.869 48	0.868 *95*	0.868 43	0.867 90	o.867 n	0.866 84	0.866. 32	0.865 79
40	0.869 96	0.869 44	0.868 92	0.868 39	0.867 87	0.867 35	0.866 82	0.866 29	o.865 *n*	0.865 24

(Conlmued)

Table 1 Apparent Relative Densities of Aqueous Ethanol at Various Temperatures --*Contd*

Temperature °C	Percentages or Volume a_t 20°C									
	74.0	74.2	**74.4**	**74.6**	74.8	75.0	75.2	75.4	75.6	75.8
10	0.883 83	0.883 31	0.882 80	0.882 28	0.881 77	0.881 25	0.880 73	0.880 20	0.879 68	0.879 15
11	0.883 10	0.882 58	0.882 06	0.881 55	0,881 03	0.880 51	0.879 98	0.879 46	0.878 93	0.878 41
12	0.882 38	0.881 86	0.881 34	0.880 82	0.880 30	0.879 78	0.87 25	0.878 73	0.878 20	0.877 68
13	0.881 65	0.881 13	0.880 61	0.88010	0.879 58	0.879 06	0.878 53	0.878 00	0.877 48	0.876 95
14	0.880 94	0.880 42	0.879 90	0.879 38	0.878 86	0.878 34	0.877 81	0.877 29	0.876 76	0.876 24
15	0.880 24	0.879 72	0.879 20	0.878 67	0.878 15	0.877 63	0.877 10	0.876 58	0.876 05	0.875 53
16	0.879 54	0.879 02	0.878 50	0.877 97	o. 77 45	0.876 93	0.876 40	0.875 88	0.875 35	0.874 83
17	0.878 86	0.878 34	0.877 82	0.877 '19	0.876 77	0.876 25	0.875 72	0.875 19	0.874 66	0.874 13
18	0.878 17	0.877 65	0.877 13	0.876 61	0.876 O'J	0.875 57	0.875 Of	0.874 51	0.873 98	0.873 45
19	0.877 50	0.876 98	0.876 46	0.875 93	0.875 41	0.874 89	0.874 36	0.873 83	0.873 30	0.872 77
20	**0.876 83**	0.876 31.	0.875 78	0.875 26	0.874 73	0.874 21	0.873 68	0.873 15	0.872 63	0.872 10
21	0.876 17	0.875 65	0.875 12	0.874 60	o.874 m	0.873 5_5	0.873 02	0.872 49	0.871 96	0.871 43
22	0.875 52	0.874 99	0.874 47	0.873 94	0.873 42	0.872 89	0.872 36	0.871 83	0.871 30	0.870 77
23	0.874 87	0.874 34	0.873 82	0.873 '19	0.872 77	0.872 24	0871 71	0.871 18	0.870 64	0.870 11
24	0.874 24	0.873 71	0.873 19	0.872 66	0.872 14	0.871 61	0.871 08	0.870 55	0.870 01	0.869 48
25	0.873 60	0.873 07	0.872 55	0.872 02	0.871 50	0.870 97	0.870 44	0.869 **90**	0.869 37	0.868 83
26	0.872 97	0.872 44	0.871 92	0.871 39	0.870 87	0.870 34	0.869 81	0.869 28	0.868 74	0.868 21
27	0.872 35	0.871 82	0.871 '19	0.870 77	0.870 24	0.869 71	0.869 18	0.868 65	0.868 11	0.867 58
28	0.871 73	0.871 20	0.870 67	0.870 15	0.869 62	0.869 00	0.868 56	0.868 02	0.867 49	0,866 95
29	0.871 12	0.870 59	0.870 06	0.869 54	0.869 01	0.868 48	0.867 95	0.867 41	o.866 ss·	·o:s66"34
30	0.870 51	0.869 98	0.869 45	0.868 93	0.868 40	0.867 87	0.867 33	0.866 79	0.866 76	0.865. 72
31	0.869 91	0.869 38	0.868 85	0.868 32	0.867 79	0.867 26	0.866 72	0.866 19	0.865 65	0.86 12-
32	0.869 32	0.868 79	0.868 26	0.867 73	0.867 20	0.866 67	0.866 13	0.865 59	0.865 06-	0.864 '52
33	0.868 73,	0.868 20	0.867 67	0.867 13	0.866 60	0.866 07	0.865 53	0.864 99	0.864 46	0.863 92
34	0.868 14	0.867 61	0.867 08	.9.866 54	0.866 01	0.865 48	0.864 94	0.864 40	0.863 87	0.863 33
35	0.867 55	0.867 02	0.866 49	0.865 95	0.865 42	0.864 89	0.864 35	0.863 81	0.863.28	0.8 62 74
36	0.866·98	0.866 45	0.865 91	0.865 38	0.864 84	0.864 31	0.863 77	0;863 23	0:862 70	0.862 16
37	0.866 40	-0.865 87	'0.865 33	0.864 80	0.864 26	0.863 73	0.863 19	0.862 65 -	0:862 12	0.861 58
38	0.865 84	0.865 30	0.864 77	0.864 23	0.863 70	0.863 16	0.862 62	0.862 08	0.861 54	0.861 00
39	0.865 26	0.864 73	0.864 19	0.863 66	0.863 12	0.862 59	0.862 05	0.861 51	0.860 98	0.860 44
40	0.864 71	0.864 17	0.863 64	0.863 10	0.862 57	0.862 03	0.861 49	0.860 95	0.860 41	0.859 87

Temperature °C	Percentages of Volume at 20°C									
	76.0	76.2.c.	**76.4**	116	**76.8**	**77.0**	77.2	77.4	77.6	77.8
10	0.878 63	0.878 10	0.877 57	0.877 03	0.876 50	0.875 97	0.875 43	0.874 90	0.874 36	0.873 83
11	0.877 88	0.877 35	0.876 82	0.876 29	0.875 76	0.875 23	0.874 69	0.874 16	0.873 62	0.873 **09**
12	0.877 15	0.876 62	0.87609	0.875 56	0.875 03	0.874 50	0.873 96	0.873 42	0.872 89	0.872 35
13	0.876 42	0.875 89	0.875 36	0.874 83	0.874 30	0.873 77	0.873 23	0.872 69	0.872 15	0.871 61
14	0.875 71	o.875 is	0.874 **64**	0.874 11	0.873 57	0.873 04	0.872 50	0.871 96	0.871 43	0.870 89
15	0.875 00	0.874 47	0.873 93	0.873 40	0.872 86	0.872 33	0.871 79	0.871 25	0.870 71	0.870 17
16	0.874 30	0.873 77	0.873 23	0.872 70	0.872 16	0.871 63	0.871 09	0.870 *55*	0.870 00	0.869 46
17-	0.873 60	0.873 07	().872 54	0.872 00 ·	0.871 47	0.870 94	0.870 40	0.869 86	0.869 31	0.868 77
18	0.872 92	0.872 38	0.871 85	0.871 31	0.870 78	0.870 24	0.869 70	0.869 16	0.868 62	0.868 08
19	0.872 24	0.871 71	0.871 17	0.870 64	0.870 10	0.869 57	0.869 03	0.868 49	0.867 94	0.867 40
20	0.871 57	0.871 03.	0.870 50	0.869 96	0.869 43	**0.868 89**	0.868 35	0.867 81	0.867 16	0.866 72
21	0:870 90	0.870 36	0.869.83.	0.869 29	0.868 76	0.868 22	0.867 68	0.867 13	0.866 59'	0.866 04
22	0.870 24	0.869 70	0.869 17	0.868 63	0.868 10	0.867 56	0.867 02	0.866 47	0.865 93	0.865 38
23	0.869 58	0.869 04	0.8'68 50	0.867 97	0.867 43	0.866 89	0.866 35	0.865 80	0.865 26	0.864 71
24	0.868 95	0.868 41	0.867 87	0.867 34	0.866 80	0.866 26	0.865 72	0.865 17	0.864 63	0.864 08
25	0.868 30	0.867 76	0.867 22	0.866 69	0.866 15	0.865 61	0.865 07	0.864 52	0.863 98	0.863 43
26	0.867 6.8	0.867 14	o. 6 60	0.866 05	0.865 51	0.864 97	,0,864 42	0.863 88	0.863 33	0.862 79
27	0.867 05	0.866 51	0.865 97	0.865 43	0.864 89	0.864 35	0.863 80	0.863 25	0.862 71	0.862 16
28	0.866 42	0.865 88.	0.865-34	0.864 79	0.864 25	0.863 71	0.863 16	0.862 62	0.862 07	0.861 53
29	0.865 .81	0.865 27	0.864 73.	0.864 18	0.863	0.863 10	0.862 *55*	0.862 01	0.861 46	0.860 92
30	0.86 18	0.864 "64	· 0.864 10.	0.863 56	0.863 02	· 0.862 48	0.861 93	0.861 38	0.860 84	0.860 29
31	0.864 58	0.864 04	0.863 50	0.862 95	0.862 41	0.861 87	0.8_132	0.860 77	0.860 23	0.859 68
32	0.863 98	0.863 44.	0.8(>2 90	0.862 35	0.861 81	0.861 27	0.860 72	0.860 17	0.859 63	0.859 08
33	0.863 38	0.862 M,	0.862 30	0.861 75	0.861 21	0.860 67	0.860 12	0.859, 57	0.859 02	0.858 47
34	· 0.862 79	0.862 25	0.861 71	0.861 16	0.860 62	0.860 08	0.859 53	0.858 98	0.858 43	0.857 88
35	0.862 20	0.861 6.6	0.861 11	0.860 *57*	0.860 02	.0.859 48	0.858 93	0.858 38	0.857 83	0.857 28
36	0.861 62	0.861 08	0.860 53	0.859 90	0.859 44	0.858 90	0.858 35	'0.857 80	0.857 24	0.856 69
37	0.861 04	0.860 49	0.859 *95*	0.859 40	0.858 86	0.858 31	0.857 76	0.857 21	0.856 66	o.856 u·
38	0.860 46	0.859 92	0.859 37	0.858 83·	0.858 28	0.857 74	0.857 19	0.856 64	0.856 08	0.855 53
39	0.859 90	0.859 35	0.858 80	0.858 26	0.857 71	0.857 16	0.856 61	0.856 06	0.855 50	0.854 95
40	0.859 33	0.858 78	0.858 23	0.857 69	0.857 14	0.856 *59*	0.856 04	0.855 48	0.854 93	0.854 37

(Continued)

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Table 1 Apparent Relative Densities of Aqueous Ethanol at Various Temperatures -*Contd*

Temperature ·C	Percentages of Volume at 20°C									
	'78.0	78.2	78.4	78,(i	78.8	79.0	79.2	79.4	79.6	79.8
10	0.873 29	0.872 75	0.872 21	0.871 66	0.871 12	0.870 58	0.870 03	0.869 48	0.868 92	0.868 37
n	0.872 SS	0.872 00	0.871 46	0.870 91	0.870 37	0.869 82	0.869 27	0.868 72	0.868 17	0.867 62
12	0.871 81	0.871 27	0.870 72	0.870 18	0.869 63	0.869 09	0.868 54	0.867 99	0.867 43	0.866 88
13	0.871 '11	0.870 53	0.869 98 .	0.869 44	0.868 89	0.868 35	0.867 80	0.867 2S	0.866 70	0.866 15
14	0.870 3S	0.869 80	0.869 26	0.868 71	0.868 17	0.867 62	0.867 07	0.866 52	0.865 96	0.865 41
lS	0.869	0.869 08	0.868 54	0.867 99	0.867 45	0.866 90	0.866 35	0.865 80	0.865 24	0.864 69
16	0.868 92	0.868 38	0.867 83	0.867 29	0.866 74	0.866 20	0.865 64	0.865 09	0.864 53	0.863 98
17	0.868 23	0.867 68	0.867 13	0.866 59	0.866 04	0.865 49	0.864 94	0.864 39	0.863 83	0.863 28
18	0.867 54	0.866 99	0.866 44	0.865 90	0.865 35	0.864 80	0.864 2S	0.863 69	0.863 14	0.862 58
19	0.866 86	0.866 31	0.865 76	0.865 21	0.864 66	0.864 II	0.863 55	0.863 00	0.862 44	0.861 89
20	0.866 18	0.865 63	0.865 08	0.864 53	0.863 98	0.863 43	0.862 87	0.862 32	0.861 76	0.861 21
21	0.865 50	0.864 95	0.864 40	0.863 86	0.863 31	0.862 76	0.862 20	0.861 64	0.861 09	0.860 53
22	0.864 84	0.864 29	0.863 74	0.863 19	0.862 64	0.862 09	0.861 53	0.860 98	0.860 42	0.859 87
23	0.864 17	0.863 62	0.863 07	0.862 52	0.861 97	0.861 42	0.860 87	0.860 31	0.859 76	0.859 20
24	0.863 54	0.862 99	0.862 44	0.861 88	0.861 33	0.860 78	0.860 22	0.859 66	0.859 11	0.858 55
25	0.862 89	0.862 34	0.861 79	0.861 23	0.860 68	0.860 13	0.859 57	0.859 01	0.858 46	0.857 90
26	0.862 24	0.861 flJ	0.861 14	0.860 59	0.860 04	0.859 49	0.858 93	0.858 37	0.857 81	0.857 25
27	0.861 61	0.861 06	0.860 51	0.859 95	0.859 40	0.858 85	0.858 29	0.857 73	0.857 18	0.856 62
28	0.860 98	0.860 43	0.859 88	0.859 32	0.858 77	0.858 22	0.857 66	0.857 10	0.856 54	0.855 98
29	0.860 37	0.859 81	0.859 26	0.858 70	0.858 15	0.857 59	0.857 03	0.856 47	0.855 91	0.855 35
30	0.859 74	0.859 19	0.858 63	0.858 08	0.857 52	0.856 97	0.856 41	0.855 85	0.855 28	0.854 72
31	0.859 13	0.858 S8	0.858 02	0.857 47	0.856 91	0.856 36	0.855 80	0.855 24	0.854 68	0.854 12
32	0.858 53	0.85791	. 0.857 42	0.856 86	0.856 31	0.855 75	0.85? 19	0.854 63	0.854 06	0.853 50
33	0.857 92			0.856 25	0.855 70	0.855 14	0.854 58	0.854 02	0.853 45	0.852 89
	0.857 33	0.857 36	0.856 81							
34	0.856 73	0.856 77	0.856 21	0.855 66	0.855 10	0.854 54	0.853 98	0.853 42	0.852 85	0.852 29
35		0.856 17	0.855 62	0.855 06	0.854 51	0.853 95	0.853 39	0.852 82	0.852 26	0.851 69..
	0.856 14									
36	0.855 56	0.855 58	0.853 02	0.854 47	0.853 91	0.853 35	0.852 79	0.852 22	0.851 66	0.851 09
37	0.854 9S	0.855 00	0.854 44	0.853 88	0.853 32	0.852 76	0.852 20	0.851 63	0.851 07	0.850 50
38	0.854 40	0.854 42	0.853 86	0.853 31	0.852 75	0.852 19	0.851 62	0.851 05	0.850 49	0.849 92
39	0.853 82	0.853 84	0.853 28	0.852 73	0.852 17	0.851 61	0.851 04	0.850 47	0.849 91	0.849 34
40		0.853 26	0.852 70	0.852 14	0.851 58	0.851 02	0.850 45	0.849 89	0.849 32	0.848 76

Temperature ·C	Percentages of Volume at 20°C									
	80.0	80.2	**80.4**	**80.6**	**80.8**	**81.0**	**81.2**	**81.4**	**81.6**	**81.8**
IO	0.867 **82**	0.867 26	0.866 70	0.866 15	0.865 59	0.865 03	0.864 47	0.863 90	0.863 34	0.862 77
11	0.867 *'17*	0.866 51	0.865 *95*	0.865 40	0.864 84	0.864 28	0.863 71	0.863 15	0.862 58	0.862 02
12	0.866 33	0..865 77	0.865 21	0.864 66	0.864 10	0.863 54	0.862 97	0.862 40	0.861 84	0.861. 27
13	0.865 60	0.865 04	0.864 48	0.863 91	0.863 35	0.862 79	0.862 23	0.861 66	0.86110	0.860 53
14	0.864 **86**	0.864 30	0.863 74	0.863 18	0.862 62	0.862 06	0.861 49	0.860 93	0.860 36.	0.859 80
15	0.864 14	0.863 58	0.863 02	0.862 45	0.861 89	0.861 33	0.860 76	0.860 20	0.859 63	0.859 07
16	0.863 42	0.862 86	0.862 30	0.861 75	0.861 19	0.860 63	0.860 06	0.859 49	0.858 92	0.858 35
17	0.862 73	0.862 17	0.861 61	0.861 04	0.860 48	0.859 92	0.859 35	0.858 78	0.858 22	0.857 65
18	0.862 03	0.861 47	0.860 91	0.860 34	0.859 78	0.859 22	0.858 65	0.858 08	0.857 52	0.856 *95*
19	0.861 33	0.860 77	0.860 21	0.859 65	0.859 *0I}*	0.858 53	0.857 96	0.857 39	0.856 82	0.856 25
20	0.860 65	0.860 ()C)	0.859 53	0.858 96	0.858 40	0.857 84	0.857 27	0.856 70	0.856 13	0.855 56
21	0.859 97	0.859 41	0.858 85	0.858 28	0.857 72	0.857 16	0.856 59	0.856 02	0.855 45	0.854 88
22	0.859 31	0.858 75	0.858 18	0.857 62	0.857 05	0.856 49	0.855 92	0.855 35	0.854 77	0.854 20
23	0.858 65	0.858 08	0.857 52	0.856 95	0.856 39	0.855 82	0.855 25	0.854 68	0.854 11	0.853 54
24	0.857 99	0.857 43	**0.856 86**	0.856 30	0.855 73	0.855 17	0.854 60	0.854 03	0.853 45	0.852 88
25	0.857 34	0.856 78	0.856 21	0.855 65	0.855 08	0.854 52	0.853 95	0.853 37	0.852 80	0.852 22
26	0.856 *fl)*	0.856 13	0.855 *56*	0.855 00	0.854 43	0.853 87	0.853 30	0.852 72	0.852 15	0.851 57
27	0.856 06	0.855 49	0.854 93	0.854 36	0.853 80	0.853 23	0.852 *65*	0.852 08	0.851 50	0.850 93
28	0.855 42	0.854 85	0.854 29	0.853 72	0.853 16	0.852 *59*	0.852 02	0.851 44	0.850 87	0.850 29
29	0.854 79	0.854 22	0.853 65	0.853 *0I}*	0.852 52	0.851 95	0.851 38	0.850 80	0.850 23	0.849 65
30	0.854 16	0.853 59	0.853 03 -	0.852 46	0.851 90	0.851 33	0.850 75	0.850 18	0.849 60	0.849 03
31	0.853 56	0.852 99	0.852 42	0.851 85	0.851 28	0.850 71	0.850 13	0.849 *56*	0.848 98	0.848 41
32	0.852 94	0.852 37	0.851 80	0.851 24	0.850 67	0.850 10	0.849 52	0.848 *95*	0.848 37	0.847 80
33	0.852 33	0.851 76	0.851 19	0.850 63	0.850 06	0.849 49	0.848 91	0.848 33	0.847 76	0.847 18
34	0.851 73	0.851 16	0.850 *59*	0.850 01	0.849 44	0.848 87	0.848 29	0.947 72	0.847 14	0.846 57
35	0.851 13	0.850 56	0.849 99	0.849 42	0.848 85	0.848 28	0.847 70	0.847 12	0.846 *55*	0.845 97
36	0.850 53	0.849 96	0.849 39	0.848 82	0.848 25	0.847 68	0.847 10	0.846 52	0.845 95	0.845 37
37	0.849 94	0.849 37	0.848 80	0.848 22	0.847 65	0.847 08	0.846 SO	0.845 92	0.845 35	0.844 77
38	0.849 35	0.848 78	0.848 21	0.847 64	0.847 07	0.846 50	0.845 92	0.845 34	0.844 76	0.844 18
39	0.848 77	0.848 20	0.847 63	0.847 05	0.846 48	0.845 91	0.845 33	0.844 75	0.844 16	0.843 58
40	0.848 19	0.847 62	0.847 04	0.846 47	0.845 89	0.845 32	0.844 74	0.844 16	0.843 *58*	0.843 00

(Con1inued)

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Table 1 Apparent **Relative** Densities Or **Aqueous** Ethanol **at Various Temperatures** -*Contd*

Temperature ·C	Percentages of Volume at 20·C									
	82.0	82.1	82.4	82.6	82.8	83.0	83.2	83.4	83.6	83.8
10	0.862 21	0.861 64	0.861 06	0.860 49	0.859 91	0.859 34	0.858 76	0.858 18	0.857 59	0.857 01
11	0.861 45	0.860 88	0.860 31	0.859 73	0.859 16	0.858 59	0.858 01	0.857 42	0.856 84	0.856 25
12	0.860 70	0.860 13	0.859 55	0.858 98	0.858 40	0.857 83	0.857 25	0.856 67	0.856 08	0.855 50
13	0.859 97	0.859 39	0.858 82	0.858 24	0.857 67	0.857 09	0.856 51	0.855 93	0.855 34	0.854 76
14	0.859 23.	0.858 65	O.B58 08	0.857 50	0.856 93	0.856 35	0.855 77	0.855 19	0.854 60	0.854 02
15	0.858 50	0.857 92	0.857 35	0.856 77	0.856 20	0.855 62	0.855 04	0:854 45	0.853 87	0.853 28
16	0.857 78	0.857 21	0.856 63	0.856 06	0.855 48	0.854 91	0.8:54 32	0.853 74	0.853 15	0.852 57
17	0.857 08	0.856 50	0.855 93	0.855 35	0.854 78	0.854 20	0.853 61	'0.853 03	0.852 44	0.851 86
18	0.856 38	0.855 80	0.855 22	0.854 65	0.854 07	0.853 49	0.85i. 90	0.852 32	0.851 73	0.851 15
19	0.855 68	0.855 10	0.854 52	0.853 95'•	0.853 3?	0.852 79	0.852 20	0.851 62	0.851 03	0.850 45
20	0.854 99	0.854 41	0.853 83	0,853 26	0:852 68	0.852 10	0.851 51	0.850 93	0.850 34	0.849 76
21	0.854 31	0.853 73	0.853 15	0.852 58	0.852 00	0.851 42	0.850 83	0.850 25	0.849 66	0.849 08
22	0.853 63	0.853 05	0.852 47	0.851 90	0.851 32	0.850 74	o:850 15	0.849 56	0.848 98	0.848 39
23	0.852 97	0.852 39	0.851 81	0.851 23	0.850 65	0.850 07	0.849 48	0.848 89	0.848 30	0.847 71
24	0.852 31	0.851 73	0.851 15	0.850 57	0.849 99	0.849 41	0.848 82	0.848 23	0.847 65	0.847 06
25	0.851 65	0.851 07	0.850 49	0.849 92	0.849 34	0.848 76	0.848 17	0.847 58	0.846 98	0.846 39
26	0.851 00	0.850 42	0.849 84	0.849 25	0.848 67	0.848 09	0.847 50	0.846 91	0.846 33	0.845 74
27	0.850 35	0.849 77	0.849 19	0.848 61	0.848 03	0.847 45	0.846 86	0.846 27	0.845 69	0.845 10
28	0.849 72	0.849 14	0.848 56	0.847 97	0.847 39	0.846 81	0.846 22	0.845 63	0.845 04	0.844 45
29	0.849 08	0.848 50	0.847 92	0.847 34	0.846 76	0.846 18	0.845 59	0.845 00	0.844 40	0.843 81
30	0.848 45	0.847 87	0.847 29	0.846 70	0.846 12	0.845 54	0.844 95	0.844 36	0.843 76	0.843 17
31	0.847 83	0.847 25	0.846 67	0.846 08	0.845 50	0.844 92	0.844 33	0.843 74	0.843 14	0.842 55
32	0.847 22	0.846 64	0.846 05	0.845 47	0.844 88	0.844 30	0.843 71	0.843 11	0.842 52	0.841 92
33	0.846 60	0.846 02	0.845 43	0.844 85	0.844 26	0.843 68	0.843 09	0.842 50	0.841 90	0.841 31
34	0.845 99	0.845 40	0.844 82	0.844 23	0.843 65	0.843 06	0.842 47	0.841 88	0.841 28	0.840 69
35	0.845 39	0.844 80	0.844 22	0.843 63	0.843 05	0.842 46	0.841 86	0.841 27	0.840 67	0.840 08
36	0.84419	0.844 20	0.843 62	0.843 03	0.842 45	0.841 86	0.841 26	0.840 67	0.840 07	0.839 48
37	0.844 19	0.843 60	0.843 01	0.842 43	0.841 84	0.&41 25	0.840 65	0.840 06	0.839 46	0.838 87
38	0.843 60	0.843 01	0.842 42	0.841 84	0.841 25	0.840 66	0.840 06	0.839 47	0.838 87	0.838 28
39	0.843 00	0.842 41	0.841 83	0.841 24	0.840 66	0.840 07	0.839 47	0.838 87	0.838 28	0.837 68
40	0.842 42	0.841 83	0.841 24	0.840 65	0.840 06	0.839 47	0.838 88	0.838 28	0.837 69	0.837 09

Temperature ·C	Percentages or Volume at 20°C									
	84.0	84.2	84.4	84.6	84.8	85.0	85.2	85.4	85.6	85.8
10	0.856 43	0.855 84	0.855 25	0.854 65	0.854 06	0.853 47	0.852 87	0.852 27	0.851 67	0.851 07
11	0.855 67	0.855 08	0.854 49	0.853 90	0.853 31	0.852 72	0.852 12	0.851 51	0.850 91	0.850 30
12	0.854 92	0.854 33	0.853 74	0.853 14	0.852 *55*	0.851 96	0.851 36	0.850 76	0.850 16	0.849 56
13	0.854 18	0.853 *59*	0.852 99	0.852 40	0.851 80	0.851 21	0.850 61	0.850 01	0.849 40	0.848 80
14	0.853 44	0.852 85	0.852 25	0.851 **66**	0.851 06	0.850 47	0.849 87	0.849 27	0.848 66	0.848 06
15	0.852 70	Q.852 11	0.851 52	0.850 92	0.850 33	0.849 74	0.849 14	0.848 53	0.847 93	0.847 32
16	0.851 98	0.851 39	0.850 79	0.850 20	0.849 60	0.849 01	0.848 41	0.847 81	0.847 20	0.846 60
17	0.851 27	0.85Q 68	0.850 09	0.849 49	0.848 90	0.848 31	0.847 70	0.847 10	0.846 49	0.845 89
18	0.850 56	0.849 97	0.849 38	0.&48 78	0.848 19	0.847 60	0.846 99	0.846 39	0.845 78	0.845 18
19	0.849 86	0.849 27	0.848 68	0.848 08	0.847 49	"""0;846 90	0.84619	0.845 69	0.845 08	0.844 48
20	0.849 17	0.848.57	0.847 98	0.847 38	0.846 79	0.846 19	0.845 59	0.44 98	0.844 38	0.843 77
21	0.848 49	0.847 89	0.847 30	0.846 70	0.846 11	0.845 51	0.844 90	0.844 30	0.843 69	0.843 09
22	0,847 80	0.847 20	0.846 61	0.846 01	0.845 42	0.844 82	0.844 21	0.843 61	0.843 **00**	0.842 40
23	0.847 12	0.846 52	0.845 93	0.845 33	0.844 74	0.844 14	0.843 53	0.842 93	0.842 32	0.841 72
24	0.846.47	0.845 87	0.845 27	0.844 68	0.844 08	0.843 48	0. 42 87	0.842 27	0.841 66	0.841 06
25	0 5 80	0.845 20	0.844 61	0.844 01	0.843 42	0.842·82	0.842 21	0'.841 61	0.841 00	0.840 40
26	0.845 15.	0.844 55	0.843 96	0.843 36	0.842 77	0.842 17	0.841 56	0.840 *95*	0.840 34	0.839 73
27	0.84451 ,-	0.843 91	0.843 31	0.842 71	0.842 11	0.841 51	0.840 90	0.840 30	0.839 69	0.839 09
28	0.843 86	0.843 26	0.842 66	0.842 tl6	0.841 46	0.840 86	0.840 25	0.839 65	0.839 04	0.838 44
19	0.843 22	0.84,2 62	0.842 02	0.841 43	0.840 83	0.840	0.839 62	0.839 01	0.838 40	0.837 79
30	0.842 *58*	0.841 98	0.841 38	0.840 79	0.840 19	0.839 *59*	0.838 98	0.838 37	0.837 76	0.837 15
31	0.841 96'	0.841 36	0.840 76	0.840 16	0.839 56	0.838 96	0.838 35	0.837 74	0.837 13	0.836 52
32	0.841 33	0.840 73	0.840 13	0.839 54	0.838 94	0.838 34	0.837 73	0.837 12	0.836 51	0.835 90
33	0.840 72	0.840 12	0.839 52	-0.838 91	0.838 31	0.837 71	0.837 10	0.836 49	0.835 88	0.835 27
34	0.840 10	0.839 50	0.838 90	0.838 *19*	0.837 69	0.837 09	0.836 48	0.835 87	0.835 25	0.834 64
35	0.839 48	0.838 88	0.838 28	0.837 7	0.837 ITT	0.836 4 7	0.§.35 86	0.835 25	0.834 64	0.834 03
36	0.838 88	0.838 28	0.837 68	0.@31 07	0.836 47	0.835 87	0.835 26	0.834 65	0.834 03	0.833 42
37	0.838 27	0.837 67	0.837 07	0.836 46	0.835 86	0;835 26-	0.834 65	0.834 04	0.833 42	0.832 81
38	0.837 68	0.837 08	0.836 47	0.835 87	0.835 26	0.834 66	0.834 OS	0.833 44	0.832 82	0.832 21
39	0.837 08	0.836 48	0.835 87	0.835 27	0.834 66	0.834 06	0.833 45	0.832 83	0.832 22	0.831 60
40	0.836 50	0.835 89	0.835 28	0.834 68	0.834 07	0.833 46	0.832 85	0.832 23	0.831 62	0.831 00

(Conlinued)

Table l **Apparent** Relative Densities of Aqueous Ethanol at Various Temperatures-Contd

Temperature ·C	**Percentages of** Volume at 20"C									
	86.0	86.l	**86.4**	86.6	86.8	87.0	87.2	87.4	87.6	87.8
10	0.850 47	*0.849* 86	0.849 25	0.848 63	0.848 *O'l*	0.847 41	0.846 79	0.846 16	0.845 S4	0.844 91
11	0.849 70	0.849 09	0.848 48	0.847 87	0.847 26	0.846 *6S*	0.846 02	0.845 40	o.844 *n*	0.844 15
12	0.848 96	0.848 *35*	0.847 73	0.847 12	0.846 50	0.845 89	0.845 27	0.844 64	0.844 *O'l*	0.843 39
13	0.848 20	0.847 59	0.846 97	0.846 36	0.845 74	0.845 13	0.844 *51*	0.843 88	0.843 *U,*	0.842 63
14	0.847 46	0.846 *85*	0.846 23	0.845 62	0.845 00	0.844 *39*	0.843 76	0.843 14	0.842 51	0.841 89
15	0.846 72	0.846 11	0.845 49	0.844 88	0.844 26	0.843 *6S*	0.843 02	0.842 40	0.841 77	0.841 *15*
16	0.846 00	0.845 39	0.844 77	0.844 16	0.843 S4	0.842 93	0.842 30	0.841 67	0.841 05	0.840 42
17	0.845 28	0.844 67	0.844 OS	0.843 44	0.842 82	0.842 21	0.841 *58*	0.840 *95*	0.840 33	0.839 70
18	0.844 *51*	0.843 96	0.843 34	0.842 73	0.842 11	0.841 50	0.840 87	0.840 24	0.839 62	0.838 99
19	0.843 87	0.843 25	0.842 64	0.842 *O'l*	0.841 41	0.840 79	0.840 16	0.83'9 54	0.838 91	0.838 29
20	. 0.843 17	0.842 *56*	0.841 94	0.841 33	0.840 71	0.840 10	0.839 47	0.838 84	0.838 22	0.837 59
21	0.842 48	0.841 86	0.841 *25*	0.840 63	0.840 *O'l*	0.839 40	0.838 77	0.838 14	0.837 52	0.836 89
22	0.841 79	0.841 17 ·	0.840 *56*	0.839 94	0.839 33	0.838 71	0.838 08	0.837 45	0.836 83	0.836 20
23	0.841 11	0.840 49	0.839 88	0.839 26	0.838 *65*	0.838 03	0.837 40	0.836 77	0.836 15	0.835 *52*
24	0.84045	0.839 83	0.839 22	0.838 60	0.837 99	0.837 37	0.836 74	0.836 11	0.835 49	0.834 86
25	0.839 79	0.839 17	0.838 *55*	0.837 94	0.837 32	0.836 70	0.836 07	0.835 44	0.834 81	0.8_34 18
26	0.839 12	0.838 50	0.837 89	0.837 27	0.836 66	0.836 04	0.835 41	0.834 78	0.834 16	0.833 53
27	0.838 48	0.837 86	0.837 24	0.836 62	0.836 00	0.835 38	0.834 75	0.834 12	0.833 *50*	0.832 87
28	0.837 83	0.837 21	0.836 59	0.835 98	0.835 36	0.834 74	0.834 11	0.833 48	0.832 84	0.832 21
29	0.837 18 .	0.836 *56*	0.835 94	0.835 33	0.834 71	0.834 09	0.833 46	0.832 83	0.832 20	0.831 57
30	0.836 54	0.835 92	0.835 30	0.834 68	0.834 06	0.833 44	0.832 81	0.832 18	0.831 *56*	0.830 93
31	0.835 91	0.835 29	0.834 67	0.834 05	0.833 43	0.832 81	0.832 18	0.831 *55*	0.830 92	0.830 29
32	**0.835 29**	**0.834 67**	**0.834** 05	0.833 43	0.832 81	0.832 19	0.831 56	0.830 93 ·	0.830 29	0.829 66
33	**0.834 66**	**0.834 04**	0.833 42	0.832 79	0.832 17	0.831 *55*	0.830 92	0.830 29	0.829 66	0.829 03
34	0.834 03	**0.833 41**	0.832 79	0.832 17	0.831 *55*	0.830 93	0.830 30	0.829 67	0.829 03	0.828 40
35	0.833 42	**0.832 80**	0.832 18	0.831 *55*	0_.830 93	0.830 31	0.829 68	0.829 05	0.828 41	0.82718
36	0.832 81	**0.832 19**	0.831 57	0,830 94	0.830 32	0.829 70	0.829 07	0.828 43	0.827 80	0.827 16
37	0.832 20	0.831 *58*	0.830 *95*	0.830 33	0.829 70	0.829 08	0.828 *45*	0.827 82	0.827 18	0.826 *55*
38	0.831 60	0.830 98	0.830 35	0.829 73	0.829 10	0.828 48	0.827 85	0.827 21	0.826 58	0.825 94
39	0.830 99	0.830 37	0.829 75	0.829 12	0.828 *50*	0.827 88	0.827 24	0.826 61	0.825 97	0.825 34
40	0.830 39	0.829 77	0.829 14	0.828 *52*	0.827 89	0.827 27	0.826 64	0.826 00	0.825 37	0.824 73

Temperature ·C	Percentages of Volume at 20"C									
	88.0	88.2	**88.4**	**88.6**	88.8	**89.0**	**89.2**	**89.4**	**89.6**	**89.8**
10	0.844 29	0.843 65	0.843 01	0.842 38	0.841 74	0.841 10	0.840 45	0.839 79	0.839 14	0.838 48
11	0.843 52	0.842 88	0.842 24	0.841 61	0.840 97	0.840 33	0.839 68	0.839 03	0.838 37	0.837 72
12	0.842 77	0.842 13	0.841 49	0.840 85	0.840 21	0.839 57	0.838 92	0.838 27	0.837 61	0.836 96
13	0.842 01	0.841 37	0.840 73	0.840 10	0.839 46	0.838 82	0.838 17	0.837 51	0.836 86	0.836 20
14	0.841 26	0.840 62	0.839 98	0.839 35	0.838 71	0.838 07	0.837 42	0.836 76	0.836 11	0.835 45
15	0.840 52	0.839 88	0.839 24	0.838 **60**	0.837 96	0.837 32	0.836 67	0.836 02	0.835 36	0.834 71
16	0.839 79	0.839 15	0.838 51	0.837 88	0.837 24	0.836 60	0.835 95	0.835 *'19*	0.834 64	0.833 98
17	0.839 07	0.838 43	0.837 79	0.837 16	0.836 52	0.835_88	0.835 23	0.834 57	0.833 92	0.833 26
18	0.838 36	0.837 72	0.837 08	0.836 45	0.835 81	0.835 17	0.834 51	0.833 86	0.833 20	0.832 55
19	0.837 **66**	0.837 02	0.836 38	0.835 73	0.835 *o')*	0.834 45	0.833 80	0.833 14	0.832 49	0.831 83
20	0.836 96	0.836 32	0.835 68	0.835 **04**	0.834 40	0.833 76	0.833 10	0.832 45	0.831 79	0.831 14
21	0.836 26	0.835 62	0.834 98	0.834 34	0.833 70	0.833 06	0.832 40	0.831 75	0.831 09	0.830 44
22	0.835 57	0.834 93	0.834 *'19*	0.833 65	0.833 01	0.832 37	0.831 71	0.831 06	0.830 40	0.829 75
23	0.834 89	0.834 25	0.833 61	0.832 97	0.832 33	0.831 69	0.831 03	0.830 38	0.829 72	0.829 07
24	0.834 23	0.833 59	0.832 *95*	0.832 30	0.831 66	0.831 02	0.830 36	0.829 71	0.829 05	0.828 40
25	0.833 *55*	0.832 91	0.832 27	0.831 63	0.830 **99**	0.830 35	0.829@	0.829 04	0.828 38	0.827 73
26	0.832 **90**	0.832 26	0.831 61	0.830 97	0.830 32	0.829 68	0.829 02	0.828 37	0.827 71	0.827 06
27	0.832 24	0.831 60	0.830 96	0.830 31	0.829 67	0.829 03	0.828 37	0.827 71	0.827 06	0.826 40
28	0.831 58	0.830 94	0.830 30	0.829 65	0.829 01	0.828 37	0.827 71	0.827 06	0.826 40	0.825 75
29	0.830 94	0.830 30	0.829 65	0.829 01	0.828 36	0.827 72	0.827 06	0.826 41	0.825 75	0.825 10
30	0.830 30	0.829 66	0.829 01	0.828 37	0.82772	0.827 08	0.826 42	0.825 76	0.825 11	0.824 45
31	0.829 66	0.829 02	0.828 37	0.827 73	0.827 **08**	0.826 44	0.825 78	0.825 12	0.824 47	0.823 81
32	0.829 03	0.828 39	0.827 74	0.827 10	0.826 45	0.825 81	0.825 15	0.824 49	0.823 84	0.823 18
33	0.828 40	0.827 76	0.827 11	0.826 47	0.825 82	0.825 18	0.824 52	0.823 86	0.823 21	0.822 55
34	0.827 77	0.827 13	0.826 48	0.825 84	0.825 19	0.824 *55*	0.823 89	0.823 23	0.822 58	0.821 92
35	0.827 15	0.826 51	0.825 86	0.825 22	0.824 57	0.823 93	0.823 *Tl*	0.822 61	0.821 96	0.82) 3fl
36	0.826 53	0.825 89	0.825 24	0.824 60	0.823 *95*	0.823 31	0.822 *65*	0.821 99	0.821 34	0.820 68
37	0.825 92	0.825 27	0.824 63	0.823 98	0.823 34	0.822@	0.822 03	0.821 37	0.820 72	0.820 06
38	0.825 31	0.824 66	0.824 02	0.823 37	0.822 73	0.822 08	0.821 42	0.820 76	0.820 11	0.819 45
39	0.824 70	0.824 05	0.823 41	0.822 76	0.822 12	0.821 47	0.820 81	0.820 15	0.819 49	0.818 83
40	0.824 10	0.823 45	0.822 81	0.822 16	0.821 52	0.820 87	0.820 21	0.819 *55*	0.818 89	0.818 23

(onJinued)

Table 1 **Apparent** Relative Densities of Aqueous Ethanol at Various Temperatures --*Contd*

Temperature ·C	Percentaps fl Volume.at ZO•C									
	9&.0	90.1	90A	90.6	90.S	91.0	91.2 '	91.4	91.6	91.8
10	0.837 83	0.837 16	0.836 49	0.835 8;i	0.835 16	0.834 49	0.833 80	0.833 11	0.832 42	0.831 73
11	0.837 07	0.836 40	0.835 73	0.835 **06**	0.834 39	0.833 72	0.833 03	0.832 34	0.831 66	0.830 97
12	0.836 31	0.835 64	0.834 97.	0.834 30	0.833 63	0.832 96	0.83211	0.831 58	0.830 90	0.830 21
13	0.835 *55*	0.834 88	0.834 21	0.833 54	0.832 87	0.832 20	0.831 51	o.,3o 82	0.830 13	0.829 44
14	0.834 80	0.834 13	0.833 46	0.832 79	0.832 12	0.831 45	0.830 7	0.830 07	0.829 38	0.828 *69*
15	**0.834 06**	0.833 39	0.832 72	0.832 04	0.831 37	0.830 70	0.830 01	0.829 32	0.828 63	0.827 94
16	0.833 33	0.832 66	0.831 *9!>*	0.831 31	0.830 64	0.829 97	0.829 28	0.828 *59*	0.827 91	0.827 22
17	0.832'.61	0.831 94	0.131 27	0.830	0.829 92	0.829 25	0.828 56	0,827 87	0.827 18	0.826 49
18	0.831 89									
19	0.831 18									
20	**0.830 48**	***0.829* 81**	0.829 14	0.828 46	0.827 79	0.827 12	0.826 43	0.825 74	0.825 *05*	0.824 36
21	0.829 78	0.829 11	· 0.828 44	0.827 76	0.827 09	0.826 42	:_ 0.825 73	0.825 04	0.824 35	0.823 66
22	**0.829 09**	**0.828 42**	0.827 75	0.827 *C17*	0.826 40	0.825 73	0.825 04	0.824 35	0.823 66	0.822 97
' 23	**0.828** 41	*0.82114*	0.827 *(fl*	0.826 39	0.825 72	0.825 05	0.824 36	0.823 67	0.822 98	0.822 29
24	0.82774	0.827ff1	**0.826 40**	0.825 72	0.825	0.824 38	0.823 *69*	0.823 00	0.822 3i	0.821 62
2S	0.121 *en*	**0.826 40**	0.825 72	0.825 *05*	0.824 '37	0.823 70	-0.823 01	0.822 32	0.821 63	0.820 94
26	**0.826·40**	0.825 73	0.825 06	0.824 38	0.823 71	0.823 04	0.822 3.5	0.821 66	0.820 97	0.820 28
'11	0.825 74	0.825 00	0.824 40	0.823 72	0.823 05	0.822 38	0.821 *69*	0.821 00	0.820 31	0.819 62
28	**0.825 09**	· 0.824 42	0.823 74	0.823 07	0.822 39	0.821 72	0.821 03	0.820 34	0.819 66	0.818 97
29	0.824 **44**	0.823 77	0.823 10	0.822 42	0.821 75	0.821 08	0.820 39	0.819 70 ·	0.819 (JO	0.818 31
30	0.62379	0.82312	0.822 44	0.821 TI	0.821 09	0.820 42	0.819 73	0.819 04	0.818 35	0.817 66
31	0.823 15	0.822 48	0.821 81	0.821 13	0.820 46	0.819 79	0.819 10	0.818 41	0.817 71	0.817 02
32	0.822 *52*	0.821 85	0.821 18	0.820 *SO*	0.819 83	. 0.819 16	0.818 47	0.817 78	0.817 09	0.816 40
33	0.821 89	0.821 22	0.820 *55*	0.819 87	0.819 20	0.818 53	0.817 S4	0.817 15	0.816 46	0.815 77
34	0.821 26	0.820 *59*	0.819 92	0.819 24	0.818 57	0.817 90	0.817 21	0.816 52	0.815 82	0.815 13
35	**0.820 *64***	**0.819** 97	0.819 29	0.818 *61*	0.817 94	0.817 27	0.816 *58*	0.815 *89*	0.815 20	0.814 51
36	0.82002	0.819 35.	0.818 67	0.818 00	0.817 32	0.816 65	0.815 96	0.815 *'Z1*	0.814 *59*	0.813 90
37	0.819 40	0.818 73	0.818 05	0.817 38	0.816 70	0.816 03	0.815 34	0.814 *65*	0.813 97	·o.sn 28
38	0.818 79	0.818 12-	0.817 45	0.816 77	0.816 10	0.815 43	0.814 74	0.814 05	0.813 36	0.812 6·7
39	0.818 17	0.817 *SO*	0.816 83	0.816 16	0.815 49	0.814 82	0.81413	0.813 44	0.812 75	0.812 06 ·
-40	0.817 57	. 0.816 90	0.816 23	0.815 *55*	0.814 88	0.814 21	0.813 52	0.812 83	0.812 14	0.811 45

Tempenture ·C	Percentages cl Volume at 20·c									
	92.0	92.2	**92.4**.	92.6	91.8	**93.0**	93.2	**93A**	**93.6**	**93.8**
10	0.831 04	0.&30 33	0.829 62	0.828 91	0.828 21	0.827 50	0.826 77	0.826 03	0.825 30	0.824 56
11	0.830 28	0.829 57	0.828 86	0.828 15	0.827 *44*	0.826 73	0.826 00	0.825 26	0.824 53	0.823 79.
12	0.829 52	0.828 81	0.828 10	0.827 38	0.826 67	0.825 96	0.825 23	0.824 49	0.823 76	0.823 02
13	0.828 75	0.828 04	0.827 33	0.826 63	0.825 92	0.825 21	0.824 47	0.823 74	0.823 00	0.822 *Tl*
14	0.828 00	0.827 29	0.826 58	0.825 87	0.825 16	0.824 45	o.823 *n*	0.82_2 98	0.822 25	0.821 51
15	0.827 25	0.826 *54*	0.825 83	0.825 13	0.824 42	0.823 71	0.822 97	0.822 24	0.821 50	0.820 77
16	0.826 53	0.825 82	0.825 11	0.824 40	0.823 *ffJ*	0.822 98	0.822 24	0.821 51	0.820 77	0.820 04
17	0.825 80	0.825 00	0.824 38	0.823 67	0.822 *96*	0.822 25	0.821 52	0.820 78	0.820 *05*	0.819 31
18	0.825 00	0.824 38	0.823 67	0.822 9S	0.822 24	0.821 53	0.820 79	0.820 06	0.819 32	0.818 59
19	0.824 38	0.823 67	0.822 96	0.822 24	0.821 53	0.820 82	0.820 00	0.819 *35*	0.818 62	0.817 88
20	0.823 67	0.822 96"	0.822 25	0.821 *54*	0.820 83	0.820 12	0.819 38	0.818 65	0.817 91	0;817 18
21	0.822 97	0.822 26	0.821 *55*	0.820 84	0.820 13	0.819 42	0.818 68	0.817 9S	0.817 21	0.816 48
22	0.822 28	0.821 57	0.820 86	0.820 15	0.819 44	0.818 73	0.818 00	0.817 26	0.816 53	0.815 79
23	0.821 60	0.820 89	0.820 18	0.819 46	0.818 75	0.818 04	0.817 30	0.816 57	0.815 83	0.815 10
24	0.82093	0.820 22	0.819 51	0.818 79	0.818 08	0.817 37	0.816 63	0.815 90	0.815 16	0:.814 43
25	0.820 25.	0.819 *54*	0.818 83	0.818 12	0.817 41	0.816 70	0.815 .96	0.815 23	0.814 49	0.813 76
26	0.819 59	0.818 88	0.818 17	0.817 45	0.816 74	0.816 03	0.815 30	0.814 561	0.813 83	0.813 00
Tl	0.818 93	0.818 22	0.817 51	0.816 79	0.816 08	0.815 37	0.814 64	0.813 90	0.813 17	0.812 43
28	**0.818 28**	0.817 *57*	0.816 86	0.816 14	0.815 43	0.814 72	0.813 98	0.813 25	0.812 51	0.811 78
29	0.817 62	0.816 91	0.816 20	0.815 49	0.814 78	0.814 *<J1*	0.813 33	0.812 60	0.811 86	0.811 13
30	0.816 97	0.816 26	0.815 *55*	0.814 83	0.814 12	0.813 41	0.812 68	0.811 94	0.811 21	0.810 47
31	0.816 33	0.815 62	0.814 91	0.814 20	0.813 49	0.812 78	0.812 *05*	0.811 31	0.810 58	0.800.84
32	0.815 71	0.815 00	0.814 29	0.813 57	0.812 86	0.812 15	0.811 42	0.810 *fD*	0.800 95	0.800 22
33	0.815 tJl	0.814 37	0.813 66	0.812 9S	0.812 24	0.811 53	0.810 80	0.810 06	0.800 33	0.808 59
34	0.814 44	0.813 73	0.813 02	0.812 32	0.811 61	0.810 90	0.810 17	0.800 43	0.808 70	0.807 *96*
35	.813 82	0.813 11	0.812 40	0.811 70	0.810 99	0.810 28	0.800 *55*	0.808 81	0.808 (JI	0.807 34
36	0.813 21	0.812 50	0.811 79	0.811 tJl	0.810 37	0.809 66	0.808 93	0.808 20	0.807 46	0.806 73
37	0.812 59	0.811 88	0.811 17	0.810 *46*	0.809 75	0.809 04	0.808 31	0.807 58.	**0.806 *85***	0.806 12
38	0.811 98	0.811 *Tl*	0.810 56	0.8()1) 85	0.809 14	0.808 43	0.8<Jl 70	0.806 97	0.806 24	0.805 51
39	0.81) 37	0.810 66	0.800 95	O.8 25	0.808 *54*	0.807 83	*0.8<Jl* 10	0.806 37	0.805 *65*	0.804 92
40	0.810 76	0.810 *05*	0.800 35	0.808 64	0.807 94	0.807 23	0.806 50.	0.805 77	0.805 *05*	0.804 32

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Table·1 Apparent Relative Densities or Aqueous Ethanol at Various Temperatures -*Contd*

Temperature ·C	Percentages or Volume at 20·c									
	94.0	94.1	**94.4**	94.6	94.8	**95.0**	95.2	95.4	95.6	9S.8
10	0.823 83	0.823 (f1	0.822 31	0.821 54	0.820 78	0.820 02	0.819 23	0.818 43	0.817 64	0.816 84
.11	0.823·()6	0.822 30	0.821 54	o.820 *n*	0.820 01	0.819 *25*	0.818 46	0.817 66	0.816 87	0.816 07
12	0.822 29	0.821 53	0.820 *n*	0.820 00	0.819 *2A*	0.818 48	0.817 69	0.816 89	0.816 10	0.815 30
13	0.821 53	0.820 *n*	0.820 01	0.819 *25*	0.818 49	0.817 73	0.816 93	0.816 14	0.815 34	0.814 55
14	0.820 78	0.820 02	0.819 26	0.818 49	0.817 7;3	0.816 97	0.816 17	0.815 38	0.814 58	0.813 79
15	0.820 03	0.819 27	0.818 51	0.817 74	0.816 98	0.816 22	0.815 .43	0.814 63	0.813 84	0.813 04
16	**0.819 30**	**0.818 54**	0.817 78	0.817 01	0.816 25	0.815 49	0.814 69	0.813 90	0.813 10	0.812 31
17	**0.818 58**	0.817 82	0.817 05	0.816 29	0.815 52	0.814 76	0.813 97	0.813 17	0.81238	0.811 58
18	0.817 85	0.817 ()l)	0.816 33	0.815 *56*	0.814 80	0.814 04	0.813 *25*	0.812 45	0.811 66	0.810 86
19	0.817 15	0.816 39	0.815 63	0.814 86	0.814 10	0.813 34	0.812 54	0.811 75	0.810 95	0.810 16
20	**0.816 44**	0.815 68	0.814 92	0.814 15	0.813 39	0.812 63	0.811 84	0.811 04	0.810 *25*	0.809 45
21	**0.815** 74	0.814 98	0.814 22	0.813 45	0.812 69	0.811 93	0.811 13	0.810 34	0.809 54	0.808 75
22	0.815 06									0.808 06
23	0.814 36									0.807 38
24	0.813 *(fJ*	0.812 93	0.812 17	0.811 41	0.810 *65*	0.809 89	0.809 ()l)	0.808 30	0.807 50	0.806 71
25	0.813 02	0.812 26	0.811 50	0.810 73	0.809 97	0.809 21	0.808 42	0.807 62	0.806 83	0.806 03
26	0.812 36	0.811 tiO	0.810 83	0.810 rn	0.8@ 30	0.808 54	0.807 75	0.806 96	0.80616	0.805 37.
21	0.811 70	0.810 94	0.810 18	0.809 41	0.808 *65*	0.807 89	0.807 10	0.806 30	0.805 51	0.804 71
28	0.811 04	0.810 28	0.809 52	0.808 75	0.807 99	0.807 23	0.806 44	0.805 65	0.804 85	0.804 06
29	0.810 39	0.8@ 63	0.808 87	0.808 11	0.807 35	0.806 59	0.805 80	0.805 01	0.804 21	0.803 42
30	0.800 74	**0.808 98**	0.808 22	0.807 46	0.806 70	0.805 94	0.805 15	0.804 36	0.803 56	0.802 77
31 ·	**0.8@** 11	**0.808** 35	0.807 *59*	0.806 83	0.806 *(f1*	0.805 31	0.804 52	0.803 73	0.802 94	0.802 15
32	0.808 49	0.807 73	0.806 97	0.806 20	0.805 44	0.804 68	0.803 89	0.803 10	0.802 31	0.801 52
33	0.807 86	0.807 10	0.806 34	0.805 58	0.804 82	0.804 06	0.803 27	0.802 48	0.801 69	0.800 90
34	0.807 23	0.806 47	0.805 71	0.804 96	0.804 20	0.803 44	0.802 *65*	0.801 86	0.801 07	0.800 28
35	0.806 61	0.805 *85*	0.805 10	0.804 34	0.803 59	0.802 83	0.802 04	0.801 25	0.800 46	·*0.199* 67
36	Q.806 00	0.805 24	0.804 48	0.803 73	0.802 97	0.802 21	0.801 42	0.800 64	0.799 85	0.799 07
37	0.805 39	0.804 63	0.803 88	0.803 12	0.802 37	0.801 61	0.800 82	0.800 03	0.799 *25*	0.798 46
38	0.804 78	0.804 03	0.803 27	0.802 52	0.801 76	0.801 01	0.800 22	0.799 44	0.798 65	0.797 87
39	0.804- 19	0.803 43 ·	0.802 68	0.801 92	0.801 17	0.800 41	0.799 63	0.798 84	0.798 06	0.797 27
40	0.803 59	0.802 83	0.802 08	0.801 32	0.800 57	0.799 81	0.799 03	0.798 25	0.797 46	0.796 68

Temperature ·C	Percentages *ol* Volume at 2Cl"C									
	96.0	96.2	**96.4**	**96.6**	**96.8**	**97.0**	**97.2**	**97.4**	**97.6**	97.8
10	· 0.816 05	0.815 22	0.814 39	0.813 56	0.812 73	0.811 90	0.811 02	0.810 14	0.809 26	0.808 38
11	0.815 28	0.814 45	0.813 62	0.812 78	0.811 95	0.811 12	0.810 *2A*	0.809 36	0.808 49	0.807 61
12	0.814 51	0.813 68	0.812 85	0.812 02	0.811 19	0.810 36	0.809 48	0.808 60	0.807 72	0.806 84
13	0.813 75	0.812 92	0.812 09	0.811 25	0.810 42	0.809 59	0.808 71	0.807 83	0.806 96	0.806 08
14	0.812 99	0.812 16	0.811 33	0.810 SO	0.809 67	0.808 84	0.807 96	0.807 08	0.806 21	0.805 33
15	0.812 25	0.811 42	0.810 59	0.809 75	0.808 92	0.808 09	0.807 21	0.806 33	0.805 46	0.804 58
16	0.811 51	0.810 68	0.809 85	0.809 02	0.808 19	0.807 36	0.806 48	0.805 60	0.804 73	0.803 85
17	0.810 79	0.809 96	0.809 13	0.808 29	0.807 46	0.806 63	0.805 75	0.804 87	0.804 00	0.803 12
18	0.810 07	0.809 *2A*	0.808 41	0.807 57	0.806 74	0.805 91	0.805 03	0.804 15	0.803 28	0.802 40
19	0.809 36	0.808 53	0.807 70	0.806 87	0.806 04	0.805 21	0.804 33	0.803 45	0.802 57	0.801 69
20	0.808 66	0.807 83	0.806 99	0.806 16	0.805 32	0.804 49	0.803 61	0.802 74	0.801 86	0.800 99
21	0.807 95	0.807 12	0.806 29	0.805 46	0.804 63	0.803 80	0.802 92	0.802 05	0.801 17	0.800 30
22	0.807 27	0.806 44	0.805 61	o.804 *n*	0.803 94	0.803 11	0.802 23	0.801 35	0.800 48	0.799 60
23	0.806 58	0.805.75	0.804 92	0.804 09	0.803 26	0.802 43	0.801 55	0.800 67	0.799 80	0.798 92
2A	0.805 91	0.805 08	0.804 25	0.803 42	0.802 59	0.801 76	0.800 88	0.800 01	0.799 13	0.798 26
25	0.805 *2A*	0.804 41	0.803 58	0.802 74	0.801 91	0.801 08	0.800 21	0.799 33	0.798 46	0.797 58
26	0.804 58	0.803 75	0.802 92	0.802 09	0.801 26	0.800 43	0.799 *55*	0.798 68	0.797 80	0.796 93
27	0.803 92	0.803 09	0.802 26	0.801 43	0.800 60	0.799 TI	0.798 89	0.798 02	0.797 14	0.796 *T1*
28	0.803 27	0.802 44	0.801 61	0.800 78	0.799 95	0.799 12	0.798 25	0.797 37	0.796 50	0.795 62
29	0.802 63	0.801 80	0.800 97	0.800 14	0.799 31	0.798 48	0.797 61	0.796 73	0.795 86	0.794 98
30	0.801 98	0.801 15	0.800 32	0.799 50	0.798 67	0.799 84	0.796 97	0.796 09	0.795 22	0.794 34
31	0.801 36	0.800 53	0.799 70	0.798 87	0.798 **04**	0.797 21	0.796 34 ·	0.795 47	0.794 59	0.793 72
32	0.800 73	0.799 90	0.799 08	0.798 25	0.797 43	0.796 60	0.795 73	0.794 85	0.793 98	0.793 10
33	0.800 11	0.799 28	0.798 46	0.797 63	0.796 81	0.795 98	0.795 11	0.794 23	0.793 36	0.792 48
34	0.799 49	0.798 66	0.797 84	0.797 01	0.796 19	0.795 36	0.794 49	0.793 62	0.792 74	0.791 87
35	0.798 88	0.798 05	0.797 23	0.796 40	0.795 58	0.794 75	0.£23 88	0.793 01	0.792 14	0.791 27
36	0.798 28	0.797 45	0.796 63	0.795 80	0.794 98	0.794 15	0.793 28	0.792 41	0.791 54	0.790 67 ·
37	0.797 67	0.796 85	0.796 02	0.795 20	0.794 37	0.793 *55*	0.792 68	0.791 81	0.790 94	0.790 07
38	0.797 08	0.796 26	0.795 44	0.794 61	0.793 79	0.792 97	0.792 10	0.791 23	0.790 36	0.789 49
39	0.796 49	0.795 67	0.794 85	0.794 02	0.793 20	0.792 38	0.791 51	0.790 64	o.789 *n*	0.788 90
40	0.795 90	0.795 08	0.794 26	0.793 43	0.792 61	0.791 79	0.790 92	0.790 05	0.789 19	0.788 32

(Con11nued)

Table 1 Apparent Relative Densities of Aqueous Ethanol at Various Temperatures — *Contd*

Temperature °C	Percentages of Volume at 20°C										
	98.0	98.2	98.4	98.6	98.8	99.0	99.2	99.4	99.6	99.8	100.0
10	0.807 50	0.806 57	0.805 63	0.804 70	0.803 76	0.802 83	0.801 82	0.800 81	0.799 79	0.798 78	0.797 77
11	0.806 73	0.805 79	0.804 86	0.803 92	0.802 99	0.802 05	0.801 04	0.800 03	0.799 02	0.798 01	0.797 00
12	0.805 96	0.805 03	0.804 09	0.803 16	0.802 22	0.801 29	0.800 28	0.799 27	0.798 25	0.797 24	0.796 23
13	0.805 20	0.804 27	0.803 33	0.802 40	0.801 46	0.800 53	0.799 52	0.798 51	0.797 50	0.796 49	0.795 48
14	0.804 45	0.803 52	0.802 58	0.801 65	0.800 71	0.799 78	0.798 77	0.797 76	0.796 75	0.795 74	0.794 73
15	0.803 70	0.802 77	0.801 83	0.800 90	0.799 96	0.799 03	0.798 02	0.797 01	0.796 01	0.795 00	0.793 99
16	0.802 97	0.802 04	0.801 10	0.800 17	0.799 23	0.798 30	0.797 29	0.796 28	0.795 28	0.794 27	0.793 26
17	0.802 24	0.801 31	0.800 38	0.799 44	0.798 51	0.797 58	0.796 57	0.795 56	0.794 56	0.793 55	0.792 54
18	0.801 52	0.800 59	0.799 66	0.798 72	0.797 79	0.796 86	0.795 85	0.794 85	0.793 84	0.792 84	0.791 83
19	0.800 81	0.799 88	0.798 95	0.798 01	0.797 08	0.796 15	0.795 14	0.794 14	0.793 13	0.792 13	0.791 12
20	0.800 11	0.799 18	0.798 25	0.797 31	0.796 38	0.795 45	0.794 44	0.793 44	0.792 43	0.791 43	0.790 42
21	0.799 42	0.798 49	0.797 55	0.796 62	0.795 68	0.794 75	0.793 75	0.792 74	0.791 74	0.790 73	0.789 73
22	0.798 72	0.797 79	0.796 86	0.795 93	0.795 00	0.794 07	0.793 07	0.792 06	0.791 06	0.790 05	0.789 05
23	0.798 04	0.797 11	0.796 18	0.795 25	0.794 32	0.793 39	0.792 39	0.791 38	0.790 38	0.789 37	0.788 37
24	0.797 38	0.796 45	0.795 52	0.794 58	0.793 65	0.792 72	0.791 72	0.790 71	0.789 71	0.788 70	0.787 70
25	0.796 71	0.795 78	0.794 85	0.793 92	0.792 99	0.792 06	0.791 06	0.790 05	0.789 05	0.788 04	0.787 04
26	0.796 05	0.795 12	0.794 19	0.793 25	0.792 32	0.791 39	0.790 39	0.789 39	0.788 38	0.787 38	0.786 38
27	0.795 39	0.794 46	0.793 53	0.792 60	0.791 67	0.790 74	0.789 74	0.788 74	0.787 73	0.786 73	0.785 73
28	0.794 75	0.793 82	0.792 89	0.791 96	0.791 03	0.790 10	0.789 10	0.788 10	0.787 09	0.786 09	0.785 09
29	0.794 11	0.793 18	0.792 25	0.791 32	0.790 39	0.789 46	0.788 46	0.787 46	0.786 45	0.785 45	0.784 45
30	0.793 47	0.792 54	0.791 61	0.790 68	0.789 75	0.788 82	0.787 82	0.786 82	0.785 81	0.784 81	0.783 81
31	0.792 85	0.791 92	0.790 99	0.790 06	0.789 13	0.788 20	0.787 20	0.786 19	0.785 19	0.784 18	0.783 18
32	0.792 23	0.791 30	0.790 37	0.789 44	0.788 51	0.787 58	0.786 58	0.785 58	0.784 57	0.783 57	0.782 57
33	0.791 61	0.790 68	0.789 75	0.788 83	0.787 90	0.786 97	0.785 97	0.784 96	0.783 96	0.782 95	0.781 95
34	0.791 00	0.790 07	0.789 14	0.788 21	0.787 28	0.786 35	0.785 35	0.784 34	0.783 34	0.782 33	0.781 33
35	0.790 40	0.789 47	0.788 54	0.787 61	0.786 68	0.785 75	0.784 74	0.783 74	0.782 73	0.781 73	0.780 72
36	0.789 80	0.788 87	0.787 94	0.787 02	0.786 09	0.785 16	0.784 15	0.783 14	0.782 14	0.781 13	0.780 12
37	0.789 20	0.788 27	0787 34	0.786 42	0.785 49	0.784 56	0.783 55	0.782 54	0.781 54	0.780 53	0.779 52
38	0.788 62	0.787 69	0.786 76	0.785 83	0.784 90	0.783 97	0.782 96	0.781 95	0.780 94	0.779 93	0.778 92
39	0.788 03	0.787 10	0.786 17	0.785 25	0.784 32	0.783 39	0.782 38	0.781 37	0.780 35	0.779 34	0.778 33
40	0.787 45	0.786 52	0.785 59	0.784 66	0.783 73	0.782 80	0.781 79	0.780 78	0.779 76	0.778 75	0.777 74