**CASE 1.**

**Prepare 2 liters of 70% alcohol from 96.5% available in the pharmacy.**

**Option 1.**

**To calculate the amount of 96.5% alcohol, use the volume dilution formula (1):**

X = 2000 = 1450.77 ≈ 1451 ml of alcohol 96.5%

***Option 2.***

**To calculate the amount of 96.5% alcohol, we use the “rule of the cross” (5):**

96.5 ↘ ↗ 70 - 0 = 70 ml 96.5% alcohol

 70

0 ↗ ↘ 96.5 - 70 = 26.5 ml of water

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Σ = 96.5 ml 70% alcohol (excluding contraction)

From the available data, we compose the proportion:

70 ml of 96.5% alcohol is required to make 96.5 ml of 70% alcohol

X ml 96.5% - 2000 ml 70% alcohol,

X == 1450.77 ≈ **1451 ml** 96.5% alcohol

When mixing alcohol and water, the mixture heats up and decreases in volume. This phenomenon is called contraction. Therefore, according to the first and second calculation options, the volume of water cannot be calculated arithmetically by subtraction from the total volume (2000 ml) of the obtained volume of strong alcohol (2000 ml - 1451 ml). In this case, the solution is prepared by bringing in the cylinder to the required volume, i.e. 1451 ml of 96.5% alcohol are measured with a cylinder and brought to 2000 ml with water.

To calculate the volume of water, you can use the Fertman table, which shows the content of anhydrous alcohol and water in 100 liters of a water-alcohol mixture.

1) Find the water content in 2 liters of 70% alcohol:

 100 l of 70% alcohol contains 33.360 l of water

and in 2 l - X

X = 0.6672 liters of water in 2 liters of 70% alcohol;

2) Find the water content in 1.451 liters of 96.5% alcohol:

In Fertman's table there is no data on the water content in 96.5% alcohol, but data are given for 96 and 97% alcohol. Interpolation needed:

96.5% - X

100 l of 96% alcohol contains 4.985 l of water

in 100 l of 97% alcohol - 3.780 l of water

 (97 - 96) 1% - 1.205 L (4.985 - 3.780)

(97 - 96.5) 0.5% - X

X = 0.6025 l

therefore, 100 liters of 96.5% alcohol contains water:

3.780 + 0.6025 = 4.3825 l

if 100 liters of 96.5% alcohol contains 4.3825 liters of water

then in 1.1451 l - X

X = 0.0502 l of water.

3) Calculate the amount of water required to dilute 96.5% alcohol to 70% concentration.

Since in 1.451 liters of 96.5% alcohol contains 0.0502 liters water, then to obtain 2 liters of 70% alcohol, it must be taken in an amount of

0.6672 - 0.0502 = 0.617 liters, i.e. 617 ml.

***Answer: To prepare 2 liters of 70% alcohol, add 0.617 liters of water to 1.451 liters of 96.5% alcohol.***

**Option 3. Calculations using alcoholometric tables.**

Given that the concentration of the diluted alcohol is 96.5%, it is advisable to use the table. 5 RPh XIV.

To prepare 1 liter of 70% alcohol, 725.4 ml of 96.5% alcohol is required

and for 2 l - X

X = 1450.8 ≈ 1451 ml of 96.5% alcohol.

To prepare 1 liter of 70% alcohol, 301.8 ml of water is required

and for 2 l - X

X = 603.6 ≈ 603 ml of water

When mixing the calculated amounts of alcohol and water, a total volume of 2054.4 ml is obtained, while the actual volume will be 2000 ml. The **contraction** will be 2054.4 ml - 2000 ml = 54.4 ml.

**Alcohol accounting in pharmacies is** conducted by mass. If it becomes necessary to convert volume units to weight units and vice versa, you can use the following formulas:

(1) and

(2)

where P is the mass of the alcohol solution in g;

V is the volume of the alcohol solution in ml;

ρ is the density of the alcohol solution in kg / m³.

In order to determine the content of strong alcohol in alcohol solutions, you can use various techniques. Let's consider one of the possible options - calculations through absolute alcohol.

**CASE 2. For the manufacture of the dosage form, 50 ml of 70% ethanol was used. It is necessary to make a record (registration) of alcohol**

**Decision:**

1. Find the absolute alcohol content in 50 ml of 70% ethanol. From the definition of the volumetric concentration of alcohol it follows that

100 ml of 70% alcohol solution contains 70 ml of 100% alcohol, then

50 ml of 70% alcohol solution will contain X ml of 100% alcohol

X = 35 ml of absolute alcohol

2. If the accounting is carried out on 96% alcohol, we find in what volume of 96% alcohol 35 ml of absolute alcohol will be contained

100 ml of 96% alcohol solution contains 96 ml of 100% alcohol

X ml - 35 ml of 100% alcohol

X = 36.45 ml 96% alcohol

3. Since the accounting is carried out by weight, it is necessary to convert the volumetric units to weight units. To do this, use the formula 2. The density value of 96% alcohol is taken from table 2 of STANDARD (Tables for determining the content of ethyl alcohol in water-alcohol solutions) or from the alcoholometric table 1 RPh XIV (ρ₉₆% = 0.80748)

P 96% = 36.45 x 0.80748 = 29.43 g 96% alcohol

In the event that small amounts of alcohol are recorded, it is convenient to make calculations using the tables given in "Appendix 12" "Instructions for the manufacture of liquid dosage forms in pharmacies" , in which corresponds to the volumes (ml) of ethyl alcohol of various concentrations to the mass (g) of alcohol 95; 96; 96.1-96.9% at 20 ºС. So, according to the table, it is found that 50 ml of 70% alcohol contains 29.45 g of 96% alcohol. Regardless of the version of the calculation, values ​​are obtained that differ very slightly.

In the event that it is necessary to record large amounts of alcohol, the use of the tables of "Appendix 12" will lead to significant deviations in the calculations, moreover, the larger the volume of alcohol considered, the more error. Therefore, in this case, it is more expedient to carry out calculations using the density of an alcohol solution.