LABORATORY GUIDE IN MARKET MILK

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BY

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PREFACE

The production and handling of clean milk is based on scientific principles. It is true that many of these principles are simple in their application and oftentimes on account of their simplicity they are overlooked and neglected. It is the purpose of this laboratory guide to enable the student to better understand the application of science to clean milk production, and to impress on his mind the necessity for attention to detail in this branch of Dairy Industry.

Our ideas concerning the best methods of clean milk production are constantly changing. The Author recognizes that this will necessitate frequent revision of this book and an effort will be made to keep this laboratory guide thoroughly up-to-date.

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It is generally accepted that clean milk means milk which is free from microorganisms or the products of their action. It is possible to conceive of milk being impure from something other than microorganisms or their products, such as the addition of some poisonous substance to milk. The possibility of such contamination is, however, so rare and so remote that the words "impure milk," have come to mean that which is affected by the action of microorganisms.

For this reason all operations and experiments performed in a laboratory should be done in such a way as to prevent bacterial contamination, and all dairy utensils with which the milk comes in contact should be rendered sterile so far as possible. This can be done by thoroughly scalding all dairy apparatus, or better still by exposing them to live steam for not less than one hour. If the dairy utensils are scalded by means of hot water, the temperature of the water should be not less than 180°F. and it should be as near the boiling point as possible.

Dippers and other dairy utensils in which milk is handled, or which comes in contact with the milk in any way, should not be laid on the floor and then placed in the milk. Care should be taken not to touch the surfaces of dairy utensils, such as coolers, bottle fillers and so forth, with the hands. Water even in small amounts, may, if allowed to enter milk, cause it to putrefy.

Cleaning Dairy Utensils

Dairy utensils must be thoroughly cleaned if milk is to be handled in a sanitary manner. The proper way in which to clean a dairy utensil is to first rinse it with cold or luke-warm water, preferably the latter. This removes most of the milk from the utensil and prevents later cooking of the albumen of the milk on to the apparatus, when it is scalded or sterilized. The utensil should next be thoroughly washed by means of a brush and hot water in which there has been dissolved some good washing powder. An excessive amount of powder is not necessary, a tablespoonful to a pail of hot water is usually sufficient. The utensil should then be scalded in hot water, and if possible, exposed to the action of live steam for not less than one hour, thereby rendering the utensil as sterile as possible. It should be kept in a place where it will not become recontaminated.

EXPLANATION OF EXERCISE I

In studying any dairy utensil, it should be noted whether the utensil is so arranged and constructed as to best fulfill the purpose for which it is intended. All dairy utensils should be as simple as possible in construction. They should have no seams and crevices into which milk can collect. Any cracks or seams in copper or tin surfaces should be well flushed with solder. All parts should be accessible so that they may be thoroughly cleaned. They should be strong and durable and at the same time, any extra metal or other material is objectionable. On account of its durability and the ease with which it may be cleaned, metallic is usually preferable to wooden construction.

When possible, metallic construction should be of some non-rustable material.

EXERCISE I

A Study of Dairy Apparatus

1. *Bottle Fillers*—Study the tubes of the different fillers used. Show by drawings how the milk flows from the tank through the tube into the bottle, and the provision made for removing air and surplus milk from the bottle.

Pasteurizers—Show by cross-sectional drawing the method of operation of a holder pasteurizer and a flash pasteurizer.

2. *Clarifiers*—Explain the action of a centrifugal clarifier. In each case show by means of a drawing the chief differences between the inner device of the clarifier and a cream separator of the same make. Also compare the relative speed of clarifiers and separators of the same make and having the same capacity per hour.

3. *Coolers*—Make drawings of a conical and tubular type of cooler and explain the action of each.

In case of the tubular cooler, show its connection with a brine barrel and indicate the relative position of the cooler, brine barrel and pump.

4. *Milk Bottles*—Make drawings of two different styles of milk bottles.

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STUDENT'S NOTES AND REPORT

DIRECTIONS FOR STANDARDIZATION

The process of standardization consists in raising or lowering the percentage of fat in milk or cream to a definite standard. This is done by adding milk of a higher or lower fat content, than the material which is being standardized.

Some market milk does not normally contain sufficient fat to be satisfactory to the consumer. In order to make this milk satisfactory the dealer oftentimes standardizes it by the addition of cream.

Since the law states that unadulterated milk is milk to which nothing has been added or anything taken away, there has been raised some slight question as to the legality of the process of standardization. However, the addition of cream to milk increases its value, so that no serious objection has been raised to that part of the process. One would, however, have no right to reduce the fat content of milk by the addition of skimmed milk, as this would be essentially the same as removing fat from the milk.

At the present time much of the cream sold is paid for on a basis of its fat content and for this reason a knowledge of standardization is useful to the cream shipper. If a dealer receives a certain price for cream containing a definite percentage of fat it is desirable to have no more or no less fat than the percentage agreed upon. If there is more fat than the contract calls for, the seller loses, and if there is less fat the buyer loses.

In standardization there are two classes of problems involved: first, one in which two products containing a known percentage of fat are mixed to make a definite amount of milk or cream containing a fixed percentage of fat, and second, one in which a definite amount of milk or cream of a known percentage of fat is used and enough of some other product added to make the resulting mixture test the desired percentage of fat. In the first case the amount is definite, and in the second case it is indefinite.

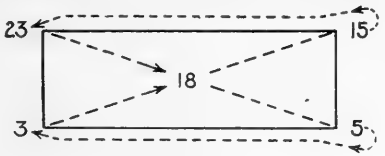
The usual method of working standardization problems is quite difficult, but Pearson has devised a method which greatly simplifies the computation. It is as follows: Draw a rectangle and place in the center of it the percentage of fat desired. On the left hand corners place the percentages of fat in the materials to be mixed. It is customary to place the larger percentage on the upper left hand corner and the smaller percentage on the lower left hand corner,

although the position of these numbers might be reversed without affecting the results. Subtract the smaller number on the left hand corner of the rectangle from the number in the center and place the remainder on the diagonally opposite right hand corner. Then subtract the number in the center of the rectangle from the larger number on the left hand corner and place the remainder on the diagonally opposite right hand corner. The two numbers on the right hand corners of the rectangle represent the number of pounds of materials required. The sum of these two numbers will be a mixture containing the desired percentage of fat, expressed by the number in the center of the rectangle.

In each case the number on the right hand corner of the rectangle corresponds to the number on the left hand corner directly opposite.

A few concrete examples will illustrate the rectangle method of working problems in standardization.

Problem I. How many pounds of 23% cream and 3% milk will be required to make 500 pounds of an 18% cream? Using our diagram as described above we have the following results:



These results mean that if five pounds of 3% milk were mixed with 15 pounds of 23% cream the result will be 20 pounds of a mixture testing 18%. The amount of the mixture desired was 500 pounds, which is twenty-five times the amount obtained with the rectangle method ($500 \div 20 = 25$). If we multiply the numbers on the upper and lower right hand corners of the rectangle by twenty-five we will obtain respectively the pounds of 23% cream and 3% milk required to make 500 pounds of an 18% mixture. These are 375 pounds of 23% cream ($15 \times 25 = 375$), and 125 pounds of 3% milk ($5 \times 25 = 125$).

The problem may also be worked by simple proportion:

$$5 : 20 :: X : 500$$
$$20X = 2500$$
$$X = 125 \text{ pounds of } 3\% \text{ milk.}$$

$$15 : 20 :: X : 500$$
$$20X = 7500$$
$$X = 375 \text{ pounds of } 23\% \text{ cream.}$$

In the above problems the amount of the mixture desired is definite.

In working problems in standardization it is wisest to prove the answer as this will show if the results are correct. While proving a problem will point out errors it will not show where mistakes have been made. The proof of the above problem is as follows:

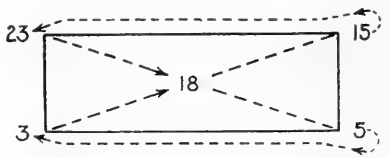
Proof:

It is desired to make 500 pounds of an 18% mixture which would necessarily contain 90 pounds of fat (500 X .18 = 90). According to our computations the 500 pounds of 18% cream will consist of 125 pounds of 3% milk and 375 pounds of 23% cream. If these materials furnish 90 pounds of fat, the problem is worked correctly. One hundred twenty-five pounds of 3% milk will contain 3.75 pounds of fat: (1.25 × .03 = 3.75). Three hundred seventy-five pounds of 23% cream will contain 86.25 pounds of fat (375 × .23 = 86.25), 86.25 + 3.75 = 90 pounds of fat.

In the following problem the amount of mixture to be made up is indefinite.

Problem 2:

How much 23% cream must be mixed with 500 pounds of 3% milk to make a mixture testing 18%? Using our diagram according to the directions previously given we have the following results:



These results mean that we must mix the materials in the proportion of 15 pounds of 23% cream to five pounds of 3% milk to make an 18% mixture. According to the conditions of the problem we must use 500 pounds of 3% milk which is 100 times as large as the amount given in the above proportion (500 ÷ 5 = 100). The 23% cream and the 3% milk must be kept in the proportion of 15:5 and if the 3% milk is increased one hundred times the 23% cream must be increased the same number of times. This would give 1500 pounds of 23% cream (15 × 100 = 1500), which should be added to the 500 pounds of 3% milk, giving 2000 pounds of an 18% mixture. The problem may also be worked by simple proportion.

$$15 : 5 :: X : 500$$
$$5X = 7500$$
$$X = 1500 \text{ pounds of } 23\% \text{ cream.}$$

Proof:

The 2000 pounds of 18% cream will contain 360 pounds of fat ($2000 \times .18 = 360$). According to our results, the 2000 pounds of 18% cream is made up of 500 pounds of 3% milk and 1500 pounds of 23% cream. The 500 pounds of 3% milk will contain 15 pounds of fat ($500 \times .03 = 15$). The 1500 pounds of 23% cream will contain 345 pounds of fat, $345 + 15 = 360$ pounds of fat, which is the number of pounds in the mixture.

In the original method of working problems in standardization all computations are made on a pound basis. From this basis it is easy to compute the amount of different materials needed to make up any given quantities of milk or cream. Problems are worked by this method as follows:

Problem 3.

How much 23% cream must be mixed with 500 pounds of 3% milk to make a mixture testing 18%?

One pound of 23% cream will contain .23 pounds of fat.
One pound of 3% milk will contain .03 pounds of fat.

The difference is..... .20 pounds of fat.

Every time one pound of .23% cream is removed and a pound of 3% milk substituted there is removed .20 pounds of fat.

One pound of 23% cream contains .23 pounds of fat.
One pound of 18% cream contains .18 pounds of fat.

The difference is .....05 pounds of fat.

It is desired to reduce the fat content .05 pounds of fat for every pound of the mixture. This is done by the addition of 3% milk which may in this case be regarded as a reducing agent. Since the substitution of a pound of 3% milk for a pound of 23% cream reduces the fat content of a pound mixture .20 pounds of fat and it is desired to reduce the fat content .05 pounds of fat, it will require as much of the 3% milk as .20 is contained into .05 or .25 ($.05 \div .20 = 25$). The .25 is the number of pounds of 3% milk there would be in one pound of an 18% mixture. The remainder .75 pounds ($1 - .25 = .75$), would be 23% cream. The following simple proportion will give the number of pounds of 23% cream which must be added to 500 pounds of 3% milk to make a mixture testing 18% fat.

.75 :.25 : : X : 500

.25 X = 375

X = 1500 pounds of 23% cream.

The following problem is an illustration of the original method of working standardization problems when a definite amount of the mixture is desired.

Problem 4.

How much 23% cream and 3% milk must be mixed to make a cream testing 18%? Since the percentages of fat in these problems are the same as those in Problem 3, the amount of 3% milk in one pound of an 18% mixture would be the same as already shown, and therefore needs no further explanation. Since .25 is the number of pounds of 3% milk in one pound of 18% cream, we would have the simple proportion:

1 :.25 :: 500 : X

X = 125, the number of pounds of 3% milk in an 18% mixture. The remainder of the mixture, 375 pounds (500 — 125), will be 23% cream. The cream could, of course, be found by forming the following simple proportion.

1 :.75 :: 500 : X

X = 375 pounds of 23% cream.

NOTE:—In the two following exercises on Standardization it is intended that one shall consist of a problem where the amount to be standardized is definite and the other shall be a problem where the resulting amount is indefinite.

EXERCISE II

STANDARDIZING

1. Test for fat by the Babcock method the samples of milk and cream to be used in standardization. Report the percentages of fat found and a definite percentage to which the milk or cream is to be standardized will be assigned.

2. After standardizing the milk or cream as directed, test it for fat by the Babcock method in order to verify the accuracy of your work.

STUDENT'S NOTES AND REPORT

EXERCISE III

1. Test for fat by the Babcock method, the samples of milk and cream to be used in standardization. Report the percentages of fat found and a definite percentage to which the milk or cream is to be standardized will be assigned.

2. After standardizing the milk or cream as directed, test it for fat by the Babcock method in order to verify the accuracy of your work.

STUDENT'S NOTES AND REPORT

PASTEURIZATION

Pasteurization applied to dairy work is the process of heating milk or cream to a temperature sufficiently high and for a time sufficiently long to kill most of the organisms in them. The materials should then be cooled to a temperature of 50° F. or lower to prevent germ growth. Cooling the product is just as important a part of the process as is heating, for if there are any organisms not killed by the heating process, they will multiply rapidly if the milk or cream is kept at temperatures favorable for germ growth. Milk or cream from the market standpoint should be kept at just as low a temperature as possible and still not freeze them.

Pasteurization has for its purpose two objects, (1) the killing of pathogenic organisms, and (2) checking germ growth. The first is the most important, and it is supposed that the process of pasteurization is efficient in destroying all pathogenic organisms. This supposition is based upon a great many experiments on the thermal death point of such pathogenic organisms as those which cause tuberculosis, typhoid, and diphtheria.

Pasteurization differs from sterilization in that the latter process kills all living material in and about an object. It is not possible to sterilize milk for market purposes because the high temperatures and length of time required for sterilization change the normal taste of milk and render it objectionable to the consumer. Too high temperatures also change the chemical composition of milk, the chief of these changes being the precipitation of albumin and causing the lime salts to become more insoluble. For these reasons both the degree of heat and the length of time employed in the process of pasteurization are limited.

There are two methods of pasteurization one called the flash method and the other the holder method. In the flash method, milk is heated to a comparatively high temperature for a short time, usually 160° F. for one minute or less, and frequently the time which the milk is subjected to the proper temperature is only a few seconds.

In the holder method, milk is heated to a low temperature for a comparatively long period of time, 140° F.—145° F. for 30 minutes being a very common time and temperature employed. The holder process of pasteurization is considered more efficient than the flash

method and many boards of health have forbidden the use of the flash method of pasteurization of milk sold under their jurisdiction.

Pasteurization should never be used as a means of placing dirty milk upon the market. While the process does kill the micro-organisms found in milk it does not always destroy their products, and if badly contaminated milk is pasteurized and placed upon the market, although its germ content may be small, it may still be unfit for human consumption.

EXERCISE IV

Pasteurization by the Holder Method

Note:—This exercise should be performed in combination with Exercise V.

1. Thoroughly mix four cans of milk by pouring from one can to another. Take in a sterile bottle a small amount of milk from each can and place the sample on ice until it can be plated for bacteria. Two of the cans of milk are to be used in Exercise V.

2. Thoroughly scald the machine. This may be done by running hot water through the coils. Pasteurize two cans of milk at a temperature of 140° F. for 30 minutes. After heating the milk for the proper time at the proper temperature, cool the milk to as low a temperature as possible in the time allowed and lower the temperature of the milk as rapidly as possible. Carefully record the weights of the milk used, the time required to raise the milk to 140° F., the temperature to which the milk was cooled, the temperature of the refrigerating substance as it enters the coils, and the time required for the entire process.

When the process is complete, take in a sterile bottle a sample of the milk to be plated for bacteria. Compare the bacteria counts obtained with that of the raw milk, and that from the milk pasteurized by the flash method.

STUDENT'S NOTES AND REPORT

EXERCISE V

Pasteurization by the Flash Method

Note:—This exercise should be performed in combination with Exercise IV.

1. Thoroughly scald the machine. This may best be done by allowing water to pass through the machine and turning on the steam at the same time. Allow this hot water to pass over the cooler and so far as possible sterilize it. Use for this experiment the two cans of milk, mixed as directed in Exercise IV. Pasteurize the milk at a temperature of 160° F. Carefully record the pounds of milk used, time required for the process, temperature of refrigerating material as it enters and leaves the cooler and the temperature to which the milk is cooled.

2. Take in a sterile bottle a sample of the milk to be plated for bacteria. Compare the count obtained with that of the raw milk and that obtained from the milk pasteurized by the holder method.

STUDENT'S NOTES AND REPORT

EXPLANATION OF EXERCISE VI

On the average dairy farm, one of the most practical methods of cooling milk is to set the can containing the milk in a tank of ice water. For this purpose a cement tank is the most durable and in the long run cheapest. The walls of the tank should be from four to six inches thick and that side on which the milk is lifted in and out of the tank should be faced with iron to prevent the cans from chipping the cement. The tank will be most convenient if it is sunk in the floor as this will make it easier to lift the cans in and out. The walls should, however, extend about twelve inches above the floor to prevent dirt working into the tank. An outlet should be made in the bottom of the tank so that it may be easily cleaned as more or less milk will be spilled, causing the tank to become unsanitary.

A galvanized iron tank, useful in cooling milk and capable of holding four cans, may be purchased from dairy supply houses for from eight to ten dollars.

In order to have milk cool properly in a tank of this kind it is necessary to frequently stir the milk in the cans. Unless milk is stirred frequently it will not cool rapidly and rapid cooling is essential in preventing an increase of germ life.

The purpose of the following exercise is to show the effect of stirring at different intervals on the rapidity with which milk cools. The student should also draw conclusions regarding the frequency with which milk should be stirred to get the best practical results.

EXERCISE VI

Cooling Milk in Cans

1. Heat four cans of milk to 95° F. and place in a tank of ice water. For this experiment about 135 pounds of ice will be required.

Stir can No. I every five minutes and record the temperature.

Stir can No. II every ten minutes and record the temperature.

Stir can No. III continuously and record the temperature every ten minutes.

Do not stir can No. IV at all but record the temperature of the milk in the center at ten minute intervals.

2. Carry on the experiment for one hour and at the end of one hour thoroughly stir can No. IV and record the temperature of the mixed milk with that of the temperature of the milk before the milk was thoroughly stirred.

3. Compare the temperature obtained in the four different cans. Draw conclusions concerning the frequency with which milk should be stirred, to get the best practical results.

STUDENT'S NOTES AND REPORT

EXPLANATION OF EXERCISE VII

There are several kinds of conical coolers on the market, which are suitable for use on farms. These coolers furnish an efficient piece of apparatus at a reasonable price. Their use has often been abused since they are frequently stationed and used in places where they are exposed to dust and dirt, and in order to minimize the danger from such contamination, some coolers are provided with a hood which surrounds that part of the cooler over which the milk flows. The refrigerating material most commonly used in these coolers is ice and water, although they may be attached to a brine barrel or a running water supply, if such a supply is available. Whatever the refrigerating substance used in these coolers, it should be stirred frequently. If it is not stirred, the refrigerating material next to the walls soon becomes warmed by the milk passing over the cooler and so loses its efficiency.

The purpose of the following experiment is to compare the efficiency of a conical type of cooler when the refrigerating material inside the cooler is stirred and when it is not stirred.

EXERCISE VII

Cooling Milk with a Conical Cooler

1. Weigh a can of whole milk and heat it to 95° F. The purpose of heating the milk is to bring it to nearly the same temperature as when drawn from the cow. Place forty pounds of ice inside the cooler and fill the cooler to the overflow pipe with cold water. Run the milk over the cooler and note the time it takes the first milk which comes from the receiving tank to reach the outlet spout of the cooler. Do not stir the water inside the cooler. Record the temperature of the milk at the outlet spout every three minutes. Note the time required to pass the milk over the cooler. After all of the milk has passed over the cooler, stir it thoroughly and record the final temperature. Take the temperature of the water near the walls of the cooler. Stir the water and then take its temperature. Weigh the amount of ice left.

2. Repeat the experiment, heating the milk to the same temperature and using the same amount of ice, but in this case stir the ice water in the cooler continuously. Record the temperature of the milk every three minutes. Stir the can of milk and take the final temperature. Weigh the amount of ice left. Compare the results obtained by the two methods of cooling. Make a drawing of the cooler. Compute the capacity of the cooler per hour.

State in your notes the name of the cooler used.

STUDENT'S NOTES AND REPORT

COMPUTING AMOUNT OF ICE NECESSARY TO COOL A GIVEN AMOUNT OF MILK

The study of refrigeration is essentially a study of heat. The unit of heat used by refrigeration engineers is called the British Thermal Unit, and it is the amount of heat required to raise one pound of water one degree Fahrenheit at its maximum density, 39.1° F.

Not all substances require the same amount of heat to raise their temperature per unit of mass. Water is taken as a standard, and the ability of a substance to absorb heat in comparison with water is called the specific heat of the substance. The specific heat of water is called 1, and most substances have a specific heat less than that of water. The specific heat of milk is variable, depending to a large extent upon the temperature and the variation in fat content. The lower the fat content the higher the specific heat. The specific heat of normal milk is variously given by different investigators as ranging between .92 and .95. In computations on refrigeration, the melting point of ice is used as a basis, because this is definite and constant. It requires 144 B. T. U. to melt one pound of ice, and knowing this fact, the amount of ice necessary to cool a given amount of milk may be readily computed. The method of computation may best be illustrated by a specific problem.

How many pounds of ice will be required to cool 500 pounds of milk from 80° F. to 32° F.? In this case, the specific heat of the milk is considered as .93.

Five hundred × .93 = 465, the number of heat units required to raise the 500 pounds of milk one degree as compared with the same amount of water. Since the milk is to be cooled 48° F. (80 — 32 = 48) multiplying 465 by 48 will give 22,320 heat units to be extracted from the milk, (465 × 48 = 22,320). Since it requires 144 B. T. U. to melt one pound of ice, it would require as many pounds of ice to cool the 500 pounds of milk as 144 is contained in 22,320, or 155, (22,320 ÷ 144 = 155).

If the milk is cooled to a temperature above 32° F. the available refrigeration of one pound of ice is increased and the difference between 32° F. (the temperature of the melting ice), and the temperature to which the milk is cooled, must therefore be added to the B. T. U. necessary to melt a pound of ice (144).

For example, suppose we wished to find the number of pounds of ice necessary to cool 500 pounds of milk from 80° F. to 40° F. Assuming the specific heat of the milk to be .93, the number of heat units to be extracted from the milk would be 500 × .93 × 40 (80 — 40 = 40) = 18,600. Since the milk is to be cooled to a point 8° F. above the melting point of ice (40 — 32 = 8), the available refrigeration of a pound of ice would be increased to 152 (144 + 8 = 152). The number of pounds of ice necessary would therefore be 18,600 ÷ 152 = 122.3 pounds.

The theoretical amount of ice will usually be insufficient to cool milk to the desired temperature. This is because of outside influences such as temperature of the air, temperature of the water with which the ice is mixed, and temperature of the apparatus through which the water is run.

EXPLANATION OF EXERCISE VIII

Lower temperatures may be obtained with a mixture of salt and ice than with ice alone. This is because of the fact that when two solids unite to form a liquid, they absorb heat. Within certain limits the larger the percentage of salt used, the lower the temperature that can be obtained. After a certain amount of salt has been added the solution becomes saturated and the further addition of salt has no effect in lowering the temperature.

The following table from B. A. I. Bulletin No. 98 gives the approximate temperatures which may be obtained with different percentages of salt and ice.

Percentage of salt in mixture	Temperature of mixture °F	% of salt in mixture	Temperature of salt in mixture °F
0	32	15	11
5	27	20	1.5
10	20	25	−10

EXERCISE VIII

Comparative Efficiency of Ice Water and Brine and Ice

Use for this experiment a Tubular cooler.

Heat two cans of milk to 95°F. The purpose of heating the milk to this temperature is to have it nearly the same temperature as when drawn from the cow. Weigh the amount of milk used. Weigh out about 125 pounds of ice. Crush it and place it in the brine barrel. Run in cold water until the barrel is about half full. Stir the mixture of ice and water. Allow the pump to run for about two minutes or until the temperature of the water in the barrel is 32° F. before running the milk over the cooler. Then run the milk over the cooler at its full capacity. Record the length of time required to cool the milk and take the temperature of the milk at the outlet faucet every three minutes. Thoroughly stir the milk in the can and record the final temperature. Record the temperature of the return water from the cooler every three minutes. Weigh the amount of ice left.

Repeat the experiment, heating the milk to 95° F. and using the same amount of ice. The ice left from the previous experiment may be used in this one. Add 40 pounds of salt to the mixture in this barrel and thoroughly stir until the salt is dissolved. The amount of salt required will depend somewhat on its quality. If it is insoluble, more will be required. Have the temperature at 28° F. to 30° F. Take temperature of the milk every three minutes, the temperature of the return water every three minutes, and the final temperature of the milk in the can. Weigh the amount of ice left. Draw diagram of the cooler, and figure out its capacity per hour. Show in drawing the relative position of the cooler, brine barrel, and pump.

STUDENT'S NOTES AND REPORT

EXERCISE IX

Heat to a temperature of 95° F., two cans of milk. Weigh out 125 pounds of ice, crush it, and place it in the brine barrel which has previously been filled about half full of cold water. Add, in salt, to the ice water in the barrel, 5% of the weight of the ice. Thoroughly mix the salt and ice water in the barrel and pump the brine through the cooler, noting its temperature before starting to cool the milk.

Cool the milk and take the temperature of the mixed milk after cooling. Also take the temperature of the brine as it comes from the cooler. Weigh the ice if any is left, and save it for use in the second part of the experiment.

Remove all of the brine from the barrel and flush out the barrel and cooler by pumping cold water through them. Repeat the above experiment using 15% of salt instead of 5%. Record all temperatures the same as in the first part of the experiment.

STUDENT'S NOTES AND REPORT

THE DAIRY SCORE CARD

The dairy score card is a card on which are enumerated the good points which a dairy should possess, and these points are given numerical values. The score card is divided into two distinct divisions, equipment and method. Out of a possible 100 points for a perfect score, 40 are given to equipment and 60 to methods. This numerical division is made to give a just recognition to the importance of proper methods in the production of clean milk. Good equipment should be an aid in clean milk production, and other things being equal, a dairyman will produce better milk with good equipment than with poor equipment. However, good equipment without proper method will not produce wholesome milk.

Those who use the score card should not regard it as an infallible set of rules from which no deviation should ever be made. It is simply a guide to help the producer to see the conditions of his dairy and to help the inspector to judge intelligently of those conditions.

The chief value of the score card is that when properly used it is educational, and it is educational because it not only points out defects, but it emphasizes the seriousness of these defects. In this way the dairyman is given a chance to improve in these things which will aid most in clean milk production.

EXPLANATION OF EXERCISES X, XI AND XII

Score dairies according to the official score card, and place the score of the different points on the card. In the blank page reserved for notes, write a short criticism of the place scored, and note those things which might be done to improve the milk supply, and at the same time would not require a big outlay of capital. Also criticise the methods employed, in the same way.

NOTE:—It is intended that at least three dairies of different grade should be scored, one having excellent buildings and equipment, one having medium buildings and equipment, and one having poor buildings and equipment. It would be desirable if the high grade dairy was producing certified milk, or milk of similar grade, and the poorly equipped dairy was producing a good grade of milk by means of superior methods. This would emphasize the importance of clean milk production. If time permits, more than three dairies may be scored, as it is highly desirable that all the practice possible be given to this part of clean milk production.

EXERCISE X

JUDGING DAIRY BARNS

1. Score according to the official score card the dairy visited. Place the score allowed the different points on the score card.

2. On the sheet allotted to notes, write a brief criticism of the dairy and the methods employed. Pay particular attention to those things which are important in clean milk production, and at the same time would not require a big outlay of capital.

SCORE

EQUIPMENT	SCORE Perfect	SCORE Allowed
COWS		
Health	6	
Apparently in good health	1	
If tested with tuberculin within a year and no tuberculosis is found, or if tested within six months and all reacting animals removed	5	
If tested within a year and reacting animals are found and removed	3	
Food clean and wholesome	1	
Water, clean and fresh	1	
STABLES		
Location of stable	2	
Well drained	1	
Free from contaminating surroundings	1	
Construction of stable	4	
Tight, sound floor and proper gutter	2	
Smooth, tight walls and ceiling	1	
Proper stall, tie, and manger	1	
Provision for light: Four sq. ft. of glass per cow	4	
Three sq. ft., 3; 2 sq. ft., 2; 1 sq. ft. 1. Deduct for uneven distribution.		
Bedding	1	
Ventilation	7	
Provision for fresh air, controllable flue system	3	
Windows hinged at bottom, 1.50; sliding windows 1; other openings .50.		
Cubic feet of space per cow, 500 feet	3	
Less than 500 ft., 2; less than 400 ft., 1; less than 300 ft., 0.		
Provision for controlling temperature	1	
UTENSILS		
Construction and condition of utensils	1	
Water for cleaning	1	
Clean, convenient and abundant.		
Small-top milking pail	5	
Milk cooler	1	
Clean milking suits	1	
MILK ROOM, OR MILK HOUSE		
Location free from contaminating surroundings	1	
Construction of milk room	2	
Floor, walls and ceiling	1	
Light, ventilation, screens	1	
Separate rooms for washing utensils and handling milk	1	
Facilities for steam Hot water 0.5	1	
Total	40	

METHODS	SCORE Perfect	SCORE Allowed
COWS		
Clean	8	
Free from visible dirt	6	
STABLE		
Cleanliness of stable	6	
Floor	2	
Walls	1	
Ceiling and ledges	1	
Mangers and partitions	1	
Windows	1	
Stable air at milking time	5	
Freedom from dust	3	
Freedom from odors	2	
Cleanliness of bedding	1	
Barnyard	2	
Clean	1	
Well drained	1	
Removal of manure daily	2	
To 50 feet or more from stable.		
MILK ROOM OR MILK HOUSE		
Cleanliness of milk room	3	
UTENSILS AND MILKING		
Care and cleanliness of utensils	8	
Thoroughly washed	2	
Sterilized in steam for 15 minutes	3	
Placed over steam jet or scalded with boiling water, 2.		
Protected from contamination	3	
Cleanliness of milking	9	
Clean, dry hands	3	
Udders washed and wiped	6	
Udders cleaned with moist cloth, 4; cleaned with dry cloth or brush at least 15 minutes before milking, 1.		
HANDLING THE MILK		
Cleanliness of attendants in milk room	2	
Milk removed immediately from stable without pouring from pail	2	
Cooled immediately after milking each cow	2	
Cooled below 50° F	5	
51° to 55°, 4; 56° to 60°, 2.		
Stored below 50° F	3	
51° to 55°, 2; 56° to 60°, 1.		
Transportation below 50° F	2	
51° to 55°, 1.50; 56° to 60° 1.		
If delivered twice a day allow perfect score for storage and transportation.		
Total	60	

Equipment ..... + Methods ..... = ... **Final Score** .....

NOTE 1—If any exceptionally filthy condition is found, particularly dirty utensils, the total score may be further limited.

NOTE 2—If the water is exposed to dangerous contamination, or there is evidence of the presence of a dangerous disease in animals or attendants, the score shall be 0.

SANITARY INSPECTION OF DAIRY FARMS

MARKET MILK PRODUCTION

SCORE CARD

Indorsed by the Official Dairy Instructors' Association.

Owner or lessee of farm.....

P. O. address.....State.....

Total number of cows.....Number milking.....

Gallons of milk produced daily.....

Product is sold by producer to families, hotels, restaurants, stores,

to .....dealer

For milk supply of.....

Permit No.....Date of inspection.....191..

REMARKS.....

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(*Signed*).....
Inspector

EXERCISE XI

Judging Dairy Barns

1. Score according to the official score card, the dairy visited. Place the score allowed the different points, on the score card.

2. On the sheet allotted to notes, write a brief criticism of the dairy and the methods employed. Pay particular attention to those things which are important in clean milk production, and at the same time would not require a big outlay of capital.

SCORE

EQUIPMENT	SCORE Perfect	SCORE Allowed
COWS		
Health	6	
Apparently in good health	1	
If tested with tuberculin within a year and no tuberculosis is found, or if tested within six months and all reacting animals removed	5	
If tested within a year and reacting animals are found and removed	3	
Food clean and wholesome	1	
Water, clean and fresh	1	
STABLES		
Location of stable	2	
Well drained	1	
Free from contaminating surroundings	1	
Construction of stable	4	
Tight, sound floor and proper gutter	2	
Smooth, tight walls and ceiling	1	
Proper stall, tie, and manger	1	
Provision for light: Four sq. ft. of glass per cow	4	
Three sq. ft., 3; 2 sq. ft., 2; 1 sq. ft., 1. Deduct for uneven distribution.		
Bedding	1	
Ventilation	7	
Provision for fresh air, controllable flue system	3	
Windows hinged at bottom, 1.50; sliding windows 1; other openings .50.		
Cubic feet of space per cow, 500 feet	3	
Less than 500 ft., 2; less than 400 ft., 1; less than 300 ft., 0.		
Provision for controlling temperature	1	
UTENSILS		
Construction and condition of utensils	1	
Water for cleaning	1	
Clean, convenient and abundant.		
Small-top milking pail	5	
Milk cooler	1	
Clean milking suits	1	
MILK ROOM, OR MILK HOUSE		
Location free from contaminating surroundings	1	
Construction of milk room	2	
Floor, walls and ceiling	1	
Light, ventilation, screens	1	
Separate rooms for washing utensils and handling milk	1	
Facilities for steam Hot water 0.5	1	
Total	40	

METHODS	SCORE Perfect	SCORE Allowed
COWS		
Clean	8	
Free from visible dirt	6	
STABLE		
Cleanliness of stable	6	
Floor	2	
Walls	1	
Ceiling and ledges	1	
Mangers and partitions	1	
Windows	1	
Stable air at milking time	5	
Freedom from dust	3	
Freedom from odors	2	
Cleanliness of bedding	1	
Barnyard	2	
Clean	1	
Well drained	1	
Removal of manure daily	2	
To 50 feet or more from stable.		
MILK ROOM OR MILK HOUSE		
Cleanliness of milk room	3	
UTENSILS AND MILKING		
Care and cleanliness of utensils	8	
Thoroughly washed	2	
Sterilized in steam for 15 minutes	3	
Placed over steam jet or scalded with boiling water, 2.		
Protected from contamination	3	
Cleanliness of milking	9	
Clean, dry hands	3	
Udders washed and wiped	6	
Udders cleaned with moist cloth, 4; cleaned with dry cloth or brush at least 15 minutes before milking, 1.		
HANDLING THE MILK		
Cleanliness of attendants in milk room	2	
Milk removed immediately from stable without pouring from pail	2	
Cooled immediately after milking each cow	2	
Cooled below 50° F	5	
51° to 55°, 4; 56° to 60°, 2.		
Stored below 50° F	3	
51° to 55°, 2; 56° to 60°, 1.		
Transportation below 50° F	2	
51° to 55°, 1.50; 56° to 60° 1.		
If delivered twice a day allow perfect score for storage and transportation.		
Total	60	

Equipment ..... + Methods ..... = ... **Final Score** .....

NOTE 1—If any exceptionally filthy condition is found, particularly dirty utensils, the total score may be further limited.

NOTE 2—If the water is exposed to dangerous contamination, or there is evidence of the presence of a dangerous disease in animals or attendants, the score shall be 0.

SANITARY INSPECTION OF DAIRY FARMS

MARKET MILK PRODUCTION

SCORE CARD

Indorsed by the Official Dairy Instructors' Association.

Owner or lessee of farm.....

P. O. address.....State.....

Total number of cows.....Number milking.....

Gallons of milk produced daily.....

Product is sold by producer to families, hotels, restaurants, stores,

to .....dealer

For milk supply of.....

Permit No.....Date of inspection.....191..

REMARKS.....

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(*Signed*).....
Inspector

EXERCISE XII

Judging Dairy Barns

1. Score according to the official score card, the dairy visited. Place the score allowed the different points, on the score card.

2. On the sheet allotted to notes, write a brief criticism of the dairy and the methods employed. Pay particular attention to those things which are important in clean milk production, and at the same time would not require a big outlay of capital.

SCORE

EQUIPMENT	SCORE Perfect	SCORE Allowed
COWS		
Health	6	
Apparently in good health	1	
If tested with tuberculin within a year and no tuberculosis is found, or if tested within six months and all reacting animals removed	5	
If tested within a year and reacting animals are found and removed	3	
Food clean and wholesome	1	
Water, clean and fresh	1	
STABLES		
Location of stable	2	
Well drained	1	
Free from contaminating surroundings	1	
Construction of stable	4	
Tight, sound floor and proper gutter		
Smooth, tight walls and ceiling	1	
Proper stall, tie, and manger	1	
Provision for light: Four sq. ft. of glass per cow	4	
Three sq. ft., 3; 2 sq. ft., 2; 1 sq. ft. 1. Deduct for uneven distribution.		
Bedding	1	
Ventilation	7	
Provision for fresh air, controllabl flue system		
Windows hinged at bottom, 1.50 sliding windows 1; other openings .50		
Cubic feet of space per cow, 500 feet. Less than 500 ft., 2; less than 400 ft., 1; less than 300 ft., 0.		
Provision for controlling temperature	1	
UTENSILS		
Construction and condition of utensils	1	
Water for cleaning	1	
Clean, convenient and abundant.		
Small-top milking pail	5	
Milk cooler	1	
Clean milking suits	1	
MILK ROOM, OR MILK HOUSE		
Location free from contaminating surroundings	1	
Construction of milk room	2	
Floor, walls and ceiling	1	
Light, ventilation, screens	1	
Separate rooms for washing utensils and handling milk	1	
Facilities for steam Hot water 0.5	1	
Total	40	

METHODS	SCORE Perfect	SCORE Allowed
COWS		
Clean	8	
Free from visible dirt	6	
STABLE		
Cleanliness of stable	6	
Floor	2	
Walls	1	
Ceiling and ledges	1	
Mangers and partitions	1	
Windows	1	
Stable air at milking time	5	
Freedom from dust	3	
Freedom from odors	2	
Cleanliness of bedding	1	
Barnyard	2	
Clean	1	
Well drained	1	
Removal of manure daily	2	
To 50 feet or more from stable.		
MILK ROOM OR MILK HOUSE		
Cleanliness of milk room	3	
UTENSILS AND MILKING		
Care and cleanliness of utensils	8	
Thoroughly washed	2	
Sterilized in steam for 15 minutes	3	
Placed over steam jet or scalded with boiling water, 2.		
Protected from contamination	3	
Cleanliness of milking	9	
Clean, dry hands	3	
Udders washed and wiped	6	
Udders cleaned with moist cloth, 4; cleaned with dry cloth or brush at least 15 minutes before milking, 1.		
HANDLING THE MILK		
Cleanliness of attendants in milk room	2	
Milk removed immediately from stable without pouring from pail	2	
Cooled immediately after milking each cow	2	
Cooled below 50° F.	5	
51° to 55°, 4; 56° to 60°, 2.		
Stored below 50° F.	3	
51° to 55°, 2; 56° to 60°, 1.		
Transportation below 50° F	2	
51° to 55°, 1.50; 56° to 60° 1.		
If delivered twice a day allow perfect score for storage and transportation.		
Total	60	

Equipment..... + Methods..... = ... **Final Score**.....

NOTE 1—If any exceptionally filthy condition is found, particularly dirty utensils, the total score may be further limited.

NOTE 2—If the water is exposed to dangerous contamination, or there is evidence of the presence of a dangerous disease in animals or attendants, the score shall be 0.

SANITARY INSPECTION OF DAIRY FARMS

MARKET MILK PRODUCTION

SCORE CARD

Indorsed by the Official Dairy Instructors' Association.

Owner or lessee of farm.....

P. O. address.....State.....

Total number of cows.....Number milking.....

Gallons of milk produced daily.....

Product is sold by producer to families, hotels, restaurants, stores,

to .....dealer

For milk supply of.....

Permit No.....Date of inspection.....191..

REMARKS.....

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(*Signed*).....
Inspector

EXERCISE XIII

Judging City Milk Plant

1. Judge according to the official score card, a city milk plant. Place the scores allowed on the card.

2. On the sheet allotted to notes, write a brief criticism of the plant and the methods employed. Note especially the arrangement of the plant as regards convenience for performing work. Also note the location and condition of the plant in regard to its sanitary surroundings. Point out any improvements either in equipment or methods which would be beneficial and at the same time require only a small outlay of capital.

STUDENT'S NOTES AND REPORT

SANITARY INSPECTION OF CITY MILK PLANTS

Owner or manager..... Trade name.....

City..... Street and No..... State .....

Number of wagons..... Gallons sold daily { Milk..... Cream .....

Permit or License No..... Date of inspection....., 191

EQUIPMENT	SCORE Perfect	SCORE Allowed
BUILDING:		
Location: Free from contaminating surroundings	2	
Arrangement	6	
Separate receiving room	1	
Separate handling room	2	
Separate wash room	1	
Separate sales room	1	
Separate boiler room	1	
Construction	8	
Floors tight, sound, cleanable	1	
Walls tight, smooth, cleanable	1	
Ceilings smooth, tight, cleanable	1	
Provision for light	1	
Provision for pure air	1	
Screens	2	
Minimum of shafting, pulleys, hangers, exposed pipes, etc.	1	
APPARATUS	20	
Boiler	2	
Hot-water heater	1	
Milk cooler	2	
Refrigerator	2	
Appliances for cleansing utensils and bottles	2	
Racks, etc., for utensils and bottles after cleaning	1	
Sterilizer for utensils and bottles	2	
Bottling and capping machine	1	
Wash bowl, soap, and towel for attendants	2	
Protection during delivery	2	
Condition of apparatus (make deduction for inaccessible parts, open seams, rusty ware, decayed or battered tables or sink, milk-carrying pipes with rough interiors and lack of frequent hand couplings, and for badly worn and poorly repaired material)	4	
LABORATORY AND EQUIPMENT	2	
WATER SUPPLY	2	
Clean, fresh	1	
Convenient and abundant	1	
Total	40	

METHODS	SCORE Perfect	SCORE Allowed
BUILDING	15	
Cleanliness:		
Floors	3	
Walls	1	
Ceilings	2	
Doors and windows	1	
Shafting, pulleys, hangers, pipes	1	
Freedom from odors	2	
Freedom from flies and other insects	3	
Drainage	2	
APPARATUS	16	
Cleanliness:		
Thoroughly washed and rinsed	6	
Sterilized in live steam, thirty minutes (Thoroughly scaled after washing with water over 200° F. or live steam, 3.)	5	
Bottle caps sterilized	3	
Protected from dirt	2	
HANDLING MILK	16	
Received below 50° F. (50°–55°, 4; 55°–60°, 3.)	5	
Rapidity of handling in plant	3	
Freedom from undue exposure to air in the plant	2	
Capping bottles by machine	1	
Bottle top and cap protected by covering	2	
Storage 45° F. or below (45°–50°, 2; 50°–55°, 1.)	3	
INSPECTION	9	
Bacteriological work	4	
Inspection of dairies supplying milk (Once a year, 1; twice a year, 2; three times a year, 3; four times a year, 4.)	5	
MISCELLANEOUS	4	
Cleanliness of attendants (General appearance, hands, etc., 1; clean, washable clothing, 1.)	2	
Cleanliness of delivery outfit	2	
Total	60	

Score for equipment.....plus score for methods.....equals TOTAL SCORE.....

NOTE—If the conditions in any particular are so exceptionally bad as to be inadequately expressed by a score of "0" the inspector can make a deduction from the total score.

....., *Inspector.*

EXERCISE XIV

Judging City Milk Plant

1. Judge according to the official score card, a city milk plant. Place the scores allowed on the card.

2. On the sheet allotted to notes, write a brief criticism of the plant and the methods employed. Note especially the arrangement of the plant as regards conveniences for performing work. Also note the location and condition of the plant in regard to its sanitary surroundings. Point out any improvements either in equipment or methods which would be beneficial and at the same time require only a small outlay of capital.

SANITARY INSPECTION OF CITY MILK PLANTS

Owner or manager..... Trade name.....

City..... Street and No..... State.....

Number of wagons..... Gallons sold daily { Milk..... Cream.....

Permit or License No..... Date of inspection....., 191

EQUIPMENT	SCORE Perfect	SCORE Allowed
BUILDING:		
Location: Free from contaminating surroundings	2	
Arrangement	6	
Separate receiving room	1	
Separate handling room	2	
Separate wash room	1	
Separate sales room	1	
Separate boiler room	1	
Construction	8	
Floors tight, sound, cleanable	1	
Walls tight, smooth, cleanable	1	
Ceilings smooth, tight, cleanable	1	
Provision for light	1	
Provision for pure air	1	
Screens	2	
Minimum of shafting, pulleys, hangers, exposed pipes, etc	1	
APPARATUS	20	
Boiler	2	
Hot-water heater	1	
Milk cooler	2	
Refrigerator	2	
Appliances for cleansing utensils and bottles	2	
Racks, etc., for utensils and bottles after cleaning	1	
Sterilizer for utensils and bottles	2	
Bottling and capping machine	1	
Wash bowl, soap, and towel for attendants	2	
Protection during delivery	2	
Condition of apparatus (make deduction for inaccessible parts, open seams, rusty ware, decayed or battered tables or sink, milk-carrying pipes with rough interiors and lack of frequent hand couplings, and for badly worn and poorly repaired material)	4	
LABORATORY AND EQUIPMENT	2	
WATER SUPPLY	2	
Clean, fresh	1	
Convenient and abundant	1	
Total	40	

METHODS	SCORE Perfect	SCORE Allowed
BUILDING	15	
Cleanliness:		
Floors	3	
Walls	1	
Ceilings	2	
Doors and windows	1	
Shafting, pulleys, hangers, pipes	1	
Freedom from odors	2	
Freedom from flies and other insects	3	
Drainage	2	
APPARATUS	16	
Cleanliness:		
Thoroughly washed and rinsed	6	
Sterilized in live steam, thirty minutes (Thoroughly scaled after washing with water over 200° F. or live steam, 3.)	5	
Bottle caps sterilized	3	
Protected from dirt	2	
HANDLING MILK	16	
Received below 50° F. (50°–55°, 4; 55°–60°, 3.)	5	
Rapidity of handling in plant	3	
Freedom from undue exposure to air in the plant	2	
Capping bottles by machine	1	
Bottle top and cap protected by covering	2	
Storage 45° F. or below (45°–50°, 2; 50°–55°, 1.)	3	
INSPECTION	9	
Bacteriological work	4	
Inspection of dairies supplying milk (Once a year, 1; twice a year, 2; three times a year, 3; four times a year, 4.)	5	
MISCELLANEOUS	4	
Cleanliness of attendants (General appearance, hands, etc., 1; clean, washable clothing, 1.)	2	
Cleanliness of delivery outfit	2	
Total	60	

Score for equipment.....plus score for methods.....equals TOTAL SCORE.....

NOTE—If the conditions in any particular are so exceptionally bad as to be inadequately expressed by a score of "0" the inspector can make a deduction from the total score.

....., *Inspector.*

EXPLANATION OF EXERCISES XV AND XVI

The ability to judge the flavor and odor of milk and cream requires considerable practice. There are people whose sense of taste and smell is not sufficiently acute to enable them to become good milk and cream judges. Persons who have these two senses developed to at least a normal degree can, by practice, become very proficient in detecting odors and flavors in dairy products.

The first thing to note in judging milk or cream is the visible dirt. The sediment found in milk is usually heavier than the other contents of the bottle, and therefore sinks to the bottom of the package. The dirt is detected by raising the bottle above the eye and noting the sediment resting on the bottom. In order to judge milk or cream properly, the container should be left undisturbed for at least an hour, to give sediment plenty of time to settle. In raising the bottle above the eye, great care should be taken not to agitate the contents and so drive the dirt into suspension. A reading glass or hand lens is useful in aiding one to detect sediment in a bottle of milk or cream.

The package and seal should be judged before the latter is disturbed, and before breaking the seal the contents of the bottle should be well shaken so that the milk or cream will be thoroughly mixed for bacteriological and chemical analysis. Bacteriological examination should be made as soon as the package is opened before the milk or cream becomes contaminated in any way. In milk and cream contests, several bottles of the same lot of milk are entered and one of these is reserved for bacteriological analysis.

After judging the package for appearance, the sample is next examined for flavor and odor. In judging for flavor and odor it is best to warm the sample slightly, as a low temperature disguises odors and flavors in milk or cream.

In order to keep the sense of taste acute it is necessary to rinse out the mouth with warm water after tasting each sample.

EXERCISE XV

Judging Milk

1. Judge according to the official score card, the samples of milk furnished. If enough score cards are not available, the page allotted to notes may be ruled off and used to record the scores of the different samples. Before beginning the work of this exercise, read carefully the directions on the back of the score card and those on page .

Note:—Plating milk for bacteria involves considerable time and labor. If it is impossible to plate the samples judged, the bacteria score may be called perfect, and the milk judged according to the other points on the card. This will not give the true quality of the milk, but it will give the student practice in methods of judging which is the prime purpose of this exercise. This is particularly true in regard to detecting flavors and odors.

DEPARTMENT OF DAIRY INDUSTRY

SCORE CARD FOR MILK

Place .....

Class ..... *Exhibit No* .....

ITEM	PERFECT SCORE	SCORE ALLOWED	REMARKS
Bacteria	35	.....	Bacteria found per cubic centimeter .....
Flavor and odor ...	25	.....	Flavor ..... Odor .....
Visible dirt	10	.....	.....
Fat	10	.....	Per cent found .....
Solids not fat	10	.....	Per cent found .....
Acidity	5	.....	Per cent found .....
Bottle and cap	5	.....	Cap ..... Bottle .....
Total	100	.....	

Exhibitor .....

Address .....

(*Signed*) .....
Judge

Date, ...191

DIRECTIONS FOR SCORING

BACTERIA PER CUBIC CENTIMETER—PERFECT SCORE, 35

	Points
Less than 400	35
400 to 700	34.5
700 to 1,000	34
1,000 to 2,000	33.5
2,000 to 3,000	33
3,000 to 4,000	32.5
4,000 to 5,000	32
5,000 to 6,000	31.5
6,000 to 7,000	31
7,000 to 8,000	30.5
8,000 to 9,000	30
9,000 to 10,000	29
10,000 to 15,000	28
15,000 to 20,000	27
20,000 to 25,000	26
25,000 to 30,000	25
30,000 to 35,000	24
35,000 to 40,000	23
40,000 to 45,000	22
45,000 to 50,000	21
50,000 to 55,000	20
55,000 to 60,000	19
60,000 to 65,000	18
65,000 to 70,000	17
70,000 to 75,000	16
75,000 to 80,000	15
80,000 to 85,000	14
85,000 to 90,000	13
90,000 to 95,000	12
95,000 to 100,000	11
100,000 to 110,000	10
110,000 to 120,000	9
120,000 to 130,000	8
130,000 to 140,000	7
140,000 to 150,000	6
150,000 to 160,000	5
160,000 to 170,000	4
170,000 to 180,000	3
180,000 to 190,000	2
190,000 to 200,000	1
200,000 and over	0

NOTE—When the number of bacteri per cubic centimeter exceeds the local legal limit the score shall be 0.

FLAVOR AND ODOR, PERFECT SCORE, 25

Deductions for disagreeable or foreign odor or flavor should be made according to conditions found. When possible to recognize the cause of the difficulty it should be described under Remarks.

VISIBLE DIRT—PERFECT SCORE, 10

Examination for visible dirt should be made only after the milk has stood for some time undisturbed in any way. Raise the bottle carefully in its natural, upright position, without tipping, until higher than the head. Observe the bottom of the milk with the naked eye or by the aid of a reading glass. The presence of the slightest movable speck makes a perfect score impossible. Further deductions should be made according to the amount of dirt found. When possible the nature of the dirt should be described under Remarks.

FAT IN MILK—PERFECT SCORE, 10

	Points
4.0 per cent and over	10
3.9 per cent	9.8
3.8 per cent	9.6
3.7 per cent	9.4
3.6 per cent	9.2
3.5 per cent	9
3.4 per cent	8
3.3 per cent	7
3.2 per cent	6
3.1 per cent	5
3.0 per cent	4

NOTE—New York State legal limit, 3% fat.

SOLIDS NOT FAT—PERFECT SCORE, 10

	Points
8.7 per cent and over	10
8.6 per cent	9
8.5 per cent	8
8.4 per cent	7
8.3 per cent	6
8.2 per cent	5
8.1 per cent	4
8.0 per cent	3
7.9 per cent	2
7.8 per cent	1
Less than 7.8 per cent	0

New York State legal limit, 11.5% total solids.

ACIDITY—PERFECT SCORE. 5

	Points
Less than 0.2 per cent	5
0.2 per cent to 0.21 per cent	4
0.21 per cent to 0.22 per cent	3
0.22 per cent to 0.23 per cent	2
0.23 per cent to 0.24 per cent	1
0.24 per cent and over	0

BOTTLE AND CAP—PERFECT SCORE, 5

Bottles should be made of clear glass and free from attached metal parts. Caps should be sealed in their place with hot paraffin, or both cap and top of bottle covered with parchment paper or other protection against water and dirt. Deduct for tinted glass, attached metal parts, unprotected or leaky caps, partially filled bottles, or other conditions permitting contamination of milk or detracting from the appearance of the package.

EXERCISE XVI

Judging Cream

1. Judge according to the official score card, the samples of cream furnished. If enough score cards are not available, the page allotted to notes may be ruled off and used to record the scores of the different samples. Before beginning the work of this exercise, read carefully the directions on the back of the score card and those on page.

Note:—Plating milk for bacteria involves considerable time and labor. If it is impossible to plate the samples judged, the bacteria score may be called perfect and the milk judged according to the other points on the card. This will not give the true quality of the milk, but it will give the student practice in methods of judging which is the prime purpose of this exercise. This is particularly true in regard to detecting flavors and odors.

SCORE CARD FOR MILK

Place .....

Class ..... *Exhibit No* .....

ITEM	PERFECT SCORE	SCORE ALLOWED	REMARKS
Bacteria	35	.....	Bacteria found per cubic centimeter .....
Flavor and odor ...	25	.....	Flavor ..... Odor .....
Visible dirt	10	.....	.....
Fat	20	.....	Per cent found .....
Acidity	5	.....	Per cent found .....
Bottle and cap	5	.....	Cap ..... Bottle .....
Total	100	.....	

Exhibitor .....

Address .....

(*Signed*) .....
Judge

Date, ...191

EXPLANATION OF SCORES

BACTERIA PER CUBIC CENTIMETER—PERFECT SCORE, 35

	Points
Less than 400	35
400 and less than 700	34.5
700 and less than 1,000	34
1,000 and less than 2,000	33.5
2,000 and less than 3,000	33
3,000 and less than 4,000	32.5
4,000 and less than 5,000	32
5,000 and less than 6,000	31.5
6,000 and less than 7,000	31
7,000 and less than 8,000	30.5
8,000 and less than 9,000	30
9,000 and less than 10,000	29
10,000 and less than 15,000	28
15,000 and less than 20,000	27
20,000 and less than 25,000	26
25,000 and less than 30,000	25
30,000 and less than 35,000	24
35,000 and less than 40,000	23
40,000 and less than 45,000	22
45,000 and less than 50,000	21
50,000 and less than 55,000	20
55,000 and less than 60,000	19
60,000 and less than 65,000	18
65,000 and less than 70,000	17
70,000 and less than 75,000	16
75,000 and less than 80,000	15
80,000 and less than 85,000	14
85,000 and less than 90,000	13
90,000 and less than 95,000	12
95,000 and less than 100,000	11
100,000 and less than 110,000	10
110,000 and less than 120,000	9
120,000 and less than 130,000	8
130,000 and less than 140,000	7
140,000 and less than 150,000	6
150,000 and less than 160,000	5
160,000 and less than 170,000	4
170,000 and less than 180,000	3
180,000 and less than 190,000	2
190,000 and less than 200,000	1
200,000 and over	0

FLAVOR AND ODOR, PERFECT SCORE, 25

Deductions for disagreeable or foreign odor or flavor are made according to conditions found. When possible to recognize the cause of the difficulty it is described under Remarks.

VISIBLE DIRT—PERFECT SCORE, 10

Examination for visible dirt is made only after the milk has stood for some time undisturbed in any way. Raise the bottle carefully in its natural, upright position, without tipping, until higher than the head. Observe the bottom of the milk with the naked eye or by the aid of a reading glass. The presence of the slightest movable speck makes a perfect score impossible. Further deductions are made according to the amount of dirt found. When possible the nature of the dirt is described under Remarks.

FAT IN CREAM—PERFECT SCORE, 20

If 20 per cent fat or above, score perfect. Deduct 1 point for each one-half per cent fat below 20.

ACIDITY—PERFECT SCORE, 5

	Points
0.2 per cent or less	5
0.21 per cent or over 0.20	4
0.22 per cent or over 0.21	3
0.23 per cent or over 0.22	2
0.24 per cent or over 0.23	1
Over 0.24 per cent	0

BOTTLE AND CAP—PERFECT SCORE, 5

Bottles should be made of clear glass and free from attached metal parts. Caps should be sealed in their place with hot paraffin, or both cap and top of bottle covered with parchment paper or other protection against water and dirt. Deductions are made for tinted glass, attached metal parts, unprotected or leaky caps, partially filled bottles, or other conditions permitting contamination of milk or detracting from the appearance of the package.

EXPLANATION OF EXERCISE XVII

The main purpose of a bottle filler is to fill several bottles at the same time and to do it in such a manner that there will be the smallest possible amount of loss. With the modern filler the overflow, air, froth, etc., is removed from the bottle by means of a small tube which connects with the filler tube and extends upward above the level of the milk in the filler tank. In cleaning the machine it is necessary to scrub the inside of these tubes with a long handled brush provided for the purpose. Simply rinsing the tube is not sufficient. The filler tubes usually consist of two parts, one which fits over the other, and the outside tube works up and down on the inside tube when the filler is operated. This makes it necessary for the tubes to fit perfectly, and great care must be taken not to roughen the surfaces of these tubes. In some cases the outside and inside tubes are numbered to correspond so that the operator in assembling the machine may always know which tubes fit one another.

The end of the outside filler tube is provided with a rubber gasket so that a perfect union is made with the bottle when the filler is in operation. Bottles with chipped and broken edges are liable to cut the rubber gaskets, and unless pains are taken to clean them they become filled with milk, rendering them unsanitary.

Bottles to be washed, should first be soaked in water as hot as the hand will bear, to which has been added some washing powder. After washing on the brushes, the bottles should be rinsed in a tank of clean, hot water. The bottles should then be sterilized by means of live steam. If live steam is not available they may be placed in scalding hot water. It is best not to place the crates used to fill bottles inside the sterilizer, as the action of live steam soon destroys the crates. Crates suitable for this purpose may be made from ordinary lumber. This method, however, has the disadvantage of making it necessary to transfer the bottles to the filler crates at the time of bottling.

EXERCISE XVII

Bottling Milk and Washing Bottles

1. Place all loose parts of the filler in the filler tank and scald them with hot water. Note whether the outside and inside filler tubes are numbered and if they are, be sure to place together those bearing the same number. Fill two cases of quart and one case of pint bottles. Cap one case of quarts with the standard cap. Ice this crate of bottles and set in the refrigerator. Fill one case of Dacro bottles (small topped) and cap them.

2. Remove the old milk from the refrigerator and pour the milk into a can. Also empty all bottles of milk not iced, and draw off into a can all milk in the fillers. Wash the fillers, using small brushes for the tubes. Collect all dirty bottles and wash them. Wash the Dacro bottles with the foot power washer. Place the washed bottles in the sterilizer and turn on the steam before leaving.

STUDENT'S NOTES AND REPORT

EXPLANATION OF EXERCISE XVIII

The clarification of milk consists in removing from it the insoluble dirt. The modern clarifier does this by means of centrifugal force. The dirt found in milk is usually heavier than the milk itself and the action of the centrifugal force deposits this dirt on the inside of the bowl. Clarifiers work on much the same principle as do separators, but each make of machine has special features tending to prevent separation. Usually a clarifier runs slower than does a separator of the same make and capacity. In a separator, the inner device is so constructed as to spread the milk in a thin layer, thereby making it possible to do more complete separation.

In a clarifier the milk is not separated in as thin a layer and only one outlet to the bowl is provided.

The different construction of each machine will be studied when the machine is used.

EXERCISE XVIII

Effect of Temperature on Clarification

1. Weigh out two cans of milk and thoroughly mix them by pouring from one can to another until they are of uniform composition.

2. Clarify one can of milk at a temperature of 60° F. and clarify the other at a temperature of 85° F. Note if there is any difference in the kind and amount of sediment obtained.

3. Stain some of the sediment obtained from each clarification and make a drawing of the field. In case there is no microscopical difference in the sediment only one drawing need be made.

STUDENT'S NOTES AND REPORT

EXERCISE XIX

1. For use with the clarifier, weigh a can of milk and have the temperature as near 60° F. as possible. Measure out 100 cc. of the milk into a measuring cylinder, both before and after clarification. Set these two cylinders aside and the next day compare the cream line on the two samples. Also note if there is any sediment in the bottom of either cylinder, and if so compare the amount.

2. Run the milk through the clarifier and keep track of the time required for the process. Note the kind and amount of sediment on the inside of the bowl.

3. Stain some of the sediment on a glass slide and examine it under the high power microscope. Make a drawing of the field.

4. Reclarify the same amount of milk and compare the amount and kind of sediment with that obtained in the first clarification.

5. Make a drawing showing the difference between the inner device in a separator and a clarifier of the same make.

STUDENT'S NOTES AND REPORT

EXPLANATION OF EXERCISE XX

In sanitary milk production it must be kept constantly in mind that clean milk means a product reasonably free from germ life. It is not as difficult to keep germs out of milk as is commonly supposed. There are a few simple and inexpensive practices which if carefully followed will do much in aiding the dairyman to produce a good product.

It is the purpose of the following experiments to illustrate the value of certain dairy practices in clean milk production and the harmful effects of certain other practices in producing clean milk.

In performing these experiments it must be borne in mind that anything which prevents the entrance of dust and dirt into milk is an aid to clean milk production. On the other hand, any disturbance which causes dust particles to float around in the air makes it easily possible for these particles to enter the milk while it is being drawn and so contaminate it.

The use of the small top pail, and wiping the udder with a damp cloth just before milking, are two things which are easy to do and are comparatively inexpensive. At the same time, they are exceedingly helpful in keeping germs out of milk.

On the other hand, the practice of feeding hay or grain just before milking stirs up a dust and therefore makes it possible for a larger number of micro-organisms to enter the milk.

EXERCISE XX

The Value of the Small Top Pail in Clean Milk Production

1. Carefully sterilize an ordinary wide top milk pail and a small top or covered milk pail.

2. Select two cows standing near one another and whose flanks and udders are alike as regards the amount of visible dirt on them. Milk one cow in the wide mouth pail and the other cow in the small top or covered pail.

3. Take a sample of milk in a sterile bottle from each pail and plate the samples for bacteria. If it is necessary to hold the samples for any length of time before plating, the bottle should be set on ice.

4. After the colonies in the plates have developed, note if there is any difference in bacterial content of the milk drawn in the wide mouth pail and that drawn in the small top or covered pail.

STUDENT'S NOTES AND REPORT

EXERCISE XXI

Effect of Dampening Udder and Flank on Germ Content of Milk

1. Carefully sterilize two small top or covered pails.

2. Select two cows standing near one another whose udders and flanks are alike so far as amount of visible dirt is concerned.

3. Dampen with a cloth the udder and flanks of one of the cows and milk her.

4. Milk the other cow without dampening the flank and udder.

5. In a sterile bottle, take a sample of milk from each milking and plate the milk for bacteria. If the milk cannot be plated at once, the bottle should be kept on ice. Compare the number of bacteria found in the milk drawn under the two different conditions.

STUDENT'S NOTES AND REPORT

EXERCISE XXII

Effect of Feeding Hay, Just Before Milking, on the Germ Content of Milk

1. Sterilize two small top pails and select two cows whose udders and flanks are alike as regards the amount of visible dirt on them.

2. Milk one of the cows and take in a sterile bottle a sample of the milk for plating.

3. Before milking the second cow, shake two or three forkfuls of hay near where she stands. Milk the cow and take in a sterile bottle a sample of the milk for plating.

4. Compare the number of bacteria found in the milk drawn before and after the hay was shaken.

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