metric measures

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Teaching of Metric System in Schools

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DECIMAL reckoning and the metric system of weights and measures are simple, unique and fascinating. Their use not only revolutionized mathematical and scientific thought in the latter part of the preceding century and the early part of the present century but facilitated computation and interpretation of results in scientific knowledge. This led to the adoption of this valuable tool for scientific use all over the world. Now these are becoming a part and parcel of our daily transactions through our new coinage and weights and measures.

Of the many advantages we shall derive, the one relating to the impact on education in mathematical ideas in the primary schools is dealt with in detail here, with some reference to the post-primary stage.

The adoption of decimal coinage and the metric system would not only simplify the four fundamental arithmetical operations of addition, subtraction, division and multiplication but also enable us to save useful time during education. It would, of course, necessitate changes of far-reaching consequence in the syllabus for mathematics in the primary and secondary stages of schooling, but it would add greater mathematical culture to the student's knowledge of numbers.

Advantage in Primary Schooling

At the primary stage the rigour of long multiplications and divisions involved in conversion of rupees into pies and pice, pounds to pence, maunds to chattaks, tolas into ratties, miles into yards and yards into inches, tons into pounds and pounds into ounces and *vice versa* would be discarded in favour of the more utilitarian topic of decimal system of money and weights and measures. Having simplified the mathematics syllabus by the omission of most of the superfluities at the primary stage, much of the 'intuitive' geometry and easy ideas of algebra now dealt with at the high school stage could with profit be transferred to the mathematics syllabus at the primary school. Also the lower middle stage would be better adapted to taking in new topics, resulting in greater intake of knowledge and better understanding of this abstract subject at the secondary stage.

There would be fewer 'rules', less 'working' of the sums and greater satisfaction born out of correct solutions of questions, especially in Practice, Areas, Volumes, Simple and Compound Interest.

The use of logarithm tables, which would become more common as the system gets adopted in the country's economy, could be easily taught and would be greatly apprecia-

ted if included in the curriculum at the high school stage.

Teaching at Primary Stage

At the primary stage, the effects of the reform may be discussed under two heads.

(1) Introducing decimals and decimal coinage, and

(2) Making friends with metric weights and measures.

Though it may appear simple, the teaching of the place value system of writing numbers by extending them to the right of the decimal point would require imagination on the part of teacher so as to bring home clearly to the pupils the concepts of the value of numbers at different places.

The time spent in clearing doubts from the pupil's minds and making them understand the meanings of 0·1 and 0·01 and so on would be well spent and establish their computational ability on surer foundation which would facilitate assimilation of other topics. Haste may lead to the very opposite results, making the subject unappealing and a student's bugbear and drudgery.

There would have to be a departure from the old arithemetic syllabus inasmuch as the study of decimals would now precede that of fractions, but multiplication of a decimal by a decimal and division of a decimal by a decimal would have to be deferred to a later stage when fractions are taught to the students.

Teaching of Decimals

This imposes greater responsibility on the teachers to make the children understand that 0·1 is 1 part out of 10 parts into which a thing has been divided and 0·01 is 1 part out of one of these ten parts being further subdivided into 10 parts or the whole being divided into 100 parts.

This certainly would require the introduction of a large number of mathematical aids, as for example, a circular piece of cardboard divided into 10 equal parts each part being painted in a different colour. Suppose that one of these 10 equal parts is painted blue. The blue part is, therefore, 0·1. If another part is red, then the red part is also 0·1. Red and blue together make $0{\cdot}1+0{\cdot}1=0{\cdot}2$. Three coloured parts together are 0.3 of the whole circle and so on. Again dividing each of the circles into 10 further parts, we write numbers to show that 10 parts have now been subdivided into 100 parts and bring home to the students the fact that each small part is 0·1 of the larger part because it is 1 out of 10, but 0·01 of the whole because it is 1 of 100.

Similarly eight such parts are 0·08; 24 such parts are 0·24.

Incidentally, it may also be pointed out that

(A) $10\times.01=0.1$

(B)
$$\begin{array}{r} 10 \\ \times 0.01 \\ \hline 0.10 \end{array}$$

In B, the decimal point is two places to the left and the zero at the end has no significance because it is nothing out of 100. The teacher should, however, emphasise here that it is conventional to put a zero after the right hand figure when there is no digit because it helps us to avoid ambiguity, especially when dealing with decimal coinage.

Here the students may be taught that a rupee has 100 parts called 100 naye paise and each nP is 0.01 of one rupee, and 10 such parts make 10 nP and we say that $10\times0{\cdot}01=0{\cdot}1$ or 10 nP is 0·1 of a rupee.

It is simple to write Rs. 06.23 as Rs. 6 and 23 nP. Some difficulty may, however, be experienced by many students if they are asked to explain how much is Rs. 05.1; most of them would say it is Rupees 5 and 1 nP, but only a few would be able to point out that it is Rupees 5 and 10 nP.

It is here that it may be pointed out that 'in the use of decimals for coinage it is unusual to give less than two figures after the decimal point'. Again it will require a lot of patience in making children write 7 nP in terms of rupees. Some may put it as Re. 0·7 but only a few will be able to put it correctly as Re. 0·07.

Many practical examples in multiplication and division of decimal quantities by whole numbers should be given, such as : If each boy gets 7 nP , how many will 8 boys get? Answer : $0.07 \times 8 = \text{Re. } 0.56$ or 56 nP ; or say, if 56 nP are divided among 7 men, each will get 8 nP or $56 \div 7 = \text{Re. } 0{\cdot}08$.

It would be preferable to demonstrate all such situations if the students are to enjoy learning decimals. The teacher could add a good deal to the general knowledge of the children by showing them pictures of the coins of other countries, and telling them that in India the basic coin is called the naya paisa, in Italy centesimo, in Russia kopeck, in Germany pfennig, in Spain centimo, in Holland, Canada and America cent, in Austria groschen, in Norway, Sweden and Denmark ore and that 100 such coins make one rupee, lira, rouble, mark, peseta, guilder, dollar, schilling and krone or krona respectively

It would also be taught that the values of the coins of different countries are not the same. It would thus add to the mathematical vocabulary of the children if we introduce such exchange relations as 1 dollar=4·76 Rupees and set an example.

An American had 62 dollars with him, how much money would he get in India?

$$\begin{array}{r} 4{\cdot}76 \\ \times 62 \\ \hline 952 \\ 2856+ \\ \hline 295{\cdot}12 \end{array}$$

1 dollar=4·76 Rupees
∴62 dollars=62×4·76=Rs. 295·12
Answer : Rupees 295 and 12 nP.

Again it is unconventional to read numbers to the left of the decimal point as we read towards the right because towards the right each number is a part with 10 as denominator to the preceding number's place value.

Initiation into Length Measures

At the next stage we should initiate the children into measures. In the begining the pupils should be given sufficient practice to represent the relative magnitudes of different lengths of a stick into decimals. It is doubtful whether at this stage they would have developed their perceptional ability to the extent of discerning lengths in millimetres. But measurements up to the centimetre stage should be encouraged frequently.

The length of the room, the height of a pole, the length and breadth of a playground, the length and breadth of a book, the height of an almirah, the length and breadth of a table top are examples of the type of practical work to be set for the child but the measurement should be restricted to metres, decimetres and centimetres.

Only after sufficient drill would he cease to be frightened of decimal digits away from the decimal point. Here are examples of questions on writing in numerals the distances given in words :

(1) One decametre, seven metres, five decimetres, three centimetres (17·53 metres).

(2) Five myriametres, two kilometres, one decametre, seven metres and three centimetres (52017·03 metres).

Of course, the questions all along should be well graded so that they are not presented to the child all too suddenly. Exercises on writing in words distances given in numerals may also be given. All this will help the child in understanding and appreciating different stages in the linear measurement formulae.

The same treatment could, of course, be applied to weights after solving graded problems in addition and subtraction.

In the next stage, conversions from British to metric system may be tried by giving children approximate equivalents. For example :

(1) If 1 inch=2·54 cm, how many centimetres would there be in 8 yards and 6 inches?

Yd. 8-0 ft—6 in=24×12

```
 24    288          2·54
                 ×   294
 --    ---   =  ---------
 24    294       1 0 1 6
               2 2 8 6 +
               5 0 8 + +
               ---------
               7 4 6· 7 6   cm
```

(2) For a shirt 2 yards 32 inches of cloth is required, what will be its length in metres?

Rough working

```
 0· 0 2 5 4      0· 9 1 4 4
     × 3 2               ×2
 ----------      ----------
      5 0 8      1· 8 2 8 8 m
    7 6 2
 ----------
 0· 8 1 2 8m
```

1 yd=0·9144 metre

1 in=0·0254 metre

∴ 2 yd=1·8288 metres

32 in=0·8128 metre

2 yd 32 in=2·6416 metres, or 2 metres 64 cm.

(3) 1 Yd=0·9144 m

Convert 1 mile, 1 furlong and 62 yards into metres.

```
mile  fur    Yd
  1    1     62
  8        1980                   0·9144
  -        ----                   ×2042
  9        2042      -------------------
                           1 8 2 8 8
                         3 6 5 7 6 +
                     1 8 2 8 8 0 + +
                     -------------------
                     1 8 6 7· 2 0 4 8
                                   metres
```

In such examples the child may be taught that 16 or 48 are not important for his purpose.

Then one day the students may be shown a speedometer and its working and how the figures on the right change from 1,2,3....9 indicating each time that 0·1 of mile or kilometre (1/10th) has been covered and when the new number appears on the left a whole mile or kilometre has been completed. These are all practical illustrations which could be used as projects and would enable the child to understand the utility of the topic.

Inverse questions like changing from kilometres to miles may also be tried.

Interrelation of Units

It would be interesting to teach children the scientific definition of a gram as the weight of 1 cubic centimetre of pure water.

It would be almost a revelation to the children if water filled in a cubical box of 10 cm each side is weighed in their presence and it turns out to be 1,000 grams. It is here the definition of the litre may be introduced.

The same treatment as in measurement would apply to weights. A few examples may be cited.

(1) An empty flask weighs 31.7 grams. Find the total weight if 0·16 litre of water is poured in it.

Weight of 1 litre	=	1,000 g
Weight of 0·16 litre	=	160 g
Weight of flask	=	31·7 g
TOTAL ..	=	191·7 g

(2) Ajmer to Delhi is 272 miles. How many kilometres is this ? (1 mile=1·609 kilometres).

```
          1·609
          ×272
  ---------------
      3 2 1 8
  1 1 2 6 3 +
  3 2 1 8 + +
  ---------------
  4 3 7· 6 4 8 km
```

Continued From P. 6

This may be read as 437 kilometres, 6 hectometres and 4 decametres and 8 metres or simply as 437 kilometres and 648 metres.

(3) Wheat is selling at Rs. 14·50 nP. a maund Find the price of 55 kilograms of wheat.

1 kilogram = 1·0717 seers

∴ 55 kilograms =

```
    1. 0 7 1 7
        × 5 5
  ---------------
    5 3 5 8 5
  5 3 5 8 5 +
  ---------------
  5 8· 9 4 3 5
```

seers or 58·94 seers

Price of 1 seer = 40) 14·50 (0·36
12·0

250
240 = 36 nP.

```
      5 8· 9 4
          × 3 6
  ---------------
      3 5 3 6 4
  1 7 6 8 2 +
  ---------------
  2 1 2 1· 8 4
```

2122 nP or 21 Rupees 22nP.

Metric System in Commercial Branch of Railways

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THE Commercial Branch of the Railways is responsible for all work connected with the weighment and measurement of goods tendered for despatch, fixation of rates and fares according to distance and the realization of the charges due to the Railways for the carriage of goods and passengers.

There is a common belief in some quarters that the introduction of the metric system of weights and measures in the Commercial Branch of the Railways would be comparatively easier than in other Branches or fields. It has also been expressed in some quarters that for initiating action to introduce the metric system, the Commercial Branch is not dependent to any great extent on trade and industry.

These opinions are mainly due to an incorrect or incomplete appreciation of the practical aspects of the problems. The Commercial Branch comes into direct contact with the trade and industry and any action taken by this Branch would, therefore, have an immediate bearing on the trade and industry. Unless the trade and industry adopt the metric system, there is no purpose in Railways switching over to this system. Conversely, also unless the Railways introduce the metric system, the trade would not find it easy to carry on their business in metric units. In fact, the cement industry and the petroleum industry had specifically stated that Railways should switch over to the metric system before or simultaneously with them.

Calculation of Distances Between Stations

Again, the Commercial Branch cannot start the work of change-over to the metric system unless preliminary work regarding the calculation of distances between stations in metric units is completed by the Civil Engineering Branch of the Railways. Also the recalibration of adequate weighing machines and weighbridges and the stencilling of tare weights, carrying capacity, floor area, etc., on goods stock in metric units should be completed before the Commercial Branch could completely switch over to the metric system.

To calculate the rates and fares between different stations, it is necessary for the Commercial Branch to determine the basic distance and the unit of weight or measurement, as the case may be.

The work of converting the basic distance in metric units has already been undertaken

by the Civil Engineering Branch. This work has been completed on some of the Railways while others are making arrangements to have this completed shortly.

As soon as the basic distances are furnished the Commercial Branch would calculate the distance between every pair of stations in metric units and these distances would form the basis for calculation of rates and fares between different pairs of stations. There are more than 6,000 stations on the Indian Railways and the work of compiling the distance tables in the metric units is a stupendous task which would take about 12 to 18 months. The Railways are, however, endeavouring to complete this work by the end of 1959 but it is possible that they may take a little more time.

Recalibration of Weighing Machines

For weighing wagons and small consignments in wagon loads, Railways have installed weighbridges and weighing machines at different places. These weighbridges and weighing machines which show the weights in tons, maunds and seers, require to be recalibrated in metric units. Such recalibrated machines would be useful for the purpose only from the day on which the metric system is introduced on the Indian Railways. It is, therefore, necessary that for some time to come, these machines should show dual markings to indicate the existing weights as well as metric weights. This work would cost a good deal of money. To get over this difficulty the Railways have decided to recalibrate only some of the weighbridges and weighing machines at important stations. The work in other stations would be carried on by using conversion tables as a temporary measure.

Other Preparations

After the preparation of the mileage tables, the Commercial Branch would have to undertake:

(1) the revision of the goods and coaching tarrifs; and

(2) the preparation of goods and parcels ready reckoners, passenger fare lists, etc., incorporating both the decimal coinage and the metric weights and measures.

On some suburban sections passenger tickets are issued with the help of self-printing ticket-issuing machines which have also to be altered to exhibit the units in metric system.

All these preparations involve not only a large amount of labour and money but also take considerable time to be completed.

As an immediate measure to facilitate the introduction of the metric system, the Railways have, however, permitted from 1 October 1958, the senders to show in the forwarding notes the weights of consignments either in the present system or the metric system as they may find it convenient; also where the Railways accept the sender's weight, as the basis for charge, the weights could be shown by the senders in the metric units. If the senders so desire, the weights in the metric units would also be shown on the Railway Receipt. In either case the Railways would convert the weights in the equivalent in maunds and seers and charge the freight as at present. For this purpose the Railway staff have been provided with conversion tables of kilogram to maunds and seers, quintals to tons and hunderedweights, tons and hunderedweights to quintals and maunds and seers to kilograms.

Date of Change-over

Although no firm decision can be stated at this stage when the change-over will be effected fully, it is hoped that it will be possible for the Commercial Branch of the Railways to adopt the metric system with effect from 1 April 1960.

Change-over in the Posts & Telegraphs Department

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AN immediate change-over to the metric system of weights and measures in the Posts and Telegraphs Department is impracticable. The pace of the change-over is dependent on several factors, chief among them being the general awareness of the system among the public, the education and training given to the staff about it, the procurement of the metric weights and scales, the recalibration of the existing scales and weighing machines, the revision of the various instructions and orders in regard to the administrative and accounting procedures, the conversion of the thousands of existing specifications and drawings of the standardized parts, components, assemblies etc., the availability of raw materials in metric standards suitable to the Department, the replacement or conversion of the various machines and tools in the workshops etc.

Propaganda

The Department attaches the greatest importance to the propagation of the concepts of the metric system among the general public. It is a vast organization and with more than 60,000 post offices stretches into every nook and corner of the country. It would be readily acknowledged that no other Department of the Government of India comes into such an extensive and intimate contact with the general public as the P & T Department In point of fact, the post office forms part and parcel of the everyday life of the people. For smooth and efficient functioning of the Department, it depends to a great extent on the trust and co-operation of the people. At present the Department handles annually, excluding the postcards and other articles of standard sizes and weight, about 1,500 million unregistered articles which are not weighed by the public at the counters because at present they know that the stamps affixed would be sufficient to cover the postage required for the weight of the article posted by them. On the other hand, if they are not sufficiently familiar with the concepts of the metric weights, which would be the case if sufficient education and understanding of the change-over are not provided, and if the Department adopts the metric system in its dealings, they would naturally require the post offices to weigh every unregistered article posted for satisfying themselves about the adequacy of the postage stamps affixed and in such a contingency the smooth working of the post office would become almost impossible. Again, the registered articles are weighed at the counters of the post

offices and the amount of stamps to be affixed is intimated. The public accept this on trust because they have a rough idea about the weight of the articles. So, without an adequate knowledge and understanding of the metric weights on the part of the public, this sense of mutual trust cannot be developed. Hence this important aspect of public relationship makes it necessary that the change-over to the metric system in the post offices should be preceded by not merely an adequate preparation in the internal working of the Department but also by sufficient publicity of the implications of the change-over among the general public.

Under arrangements with the Directorate of Advertising & Visual Publicity, it has been proposed that the publicity broadsheets, posters, notices etc., should be exhibited at all the P & T Offices for the general information of the public. This would be supplemented with detailed instructions in the various departmental circulars, notices and orders. For the workshops, action has been taken to arrange free exhibition of the documentary film on the metric system in the P & T Workshops and Store Depots in important places.

Replacement of Old Weights

It is obvious that the metric system cannot be introduced in the post offices piecemeal like other Departments or organizations. A uniform system should be adopted throughout the country. It is also obvious that a theoretical change-over to the metric system cannot be effected by merely adopting the converted equivalents of the present postage rates as in that case the rates would involve the use of fractions up to several places of decimals and lead to utter confusion and delay in the work. It is, therefore, necessary to supply all the post offices with the complete sets of metric weights in replacement of the existing weights in tolas and pounds. The requirements of weights for the Department has been assessed to be nearly 2 million pieces of weights ranging from 1 gram to 20 kilograms. It has to be ensured that the weights reach all the post offices well in advance of the dates fixed for the introduction of the change-over. The indent for the necessary weights has already been placed and the supply is expected sometime towards the end of 1959. The mechanical weighing scales have also to be converted to work on the metric system. There are about 1,000 scales of different makes and different capacities scattered throughout the country and the question of their conversion is also engaging attention. It is expected that the preparatory steps connected with the change-over to the metric system would take a period of a full year or more to be completed. The Department is doing its best to expedite the introduction of the system in the post offices.

Engineering Branch

The problems involved in the change-over in the Engineering Branch of the Department are varied and complex. There are thousands of drawings and maps in the FPS system which have to be converted to the metric system. Specifications for components, parts etc., which are at present in the FPS system would also have to be changed. The entire replacement of all the existing machine tools in the P & T Workshops is not feasible but conversion, wherever possible, like graduated dials of the lathes etc., would have to be undertaken. Small tools like drill bits, taps, cutters, dies etc., to work on the metric system would have either to be purchased or manufactured. New measuring instruments like verniers, tapes, gauges etc., would have to be procured. But the more immediate problem in this connection is that the Indian Standards Institution should make available standards for sections, metric

screw threads etc., suitable for use by the Department, and the manufacturers of standardized sections etc., should also start production based on metric system so that the Department can proceed further with its programmes for designing and issue of specifications for various components, and for production of finished goods in the P & T Workshops*. The Department depends also on private enterprises and other Government undertakings for many of its requirements. Thus it has to keep in touch with these enterprises and undertakings also in regard to the phasing of its own programme of change-over to the metric system.

Communications

Some of the assets of the department, for example, the telegraph and telephone alignments which form the back-bone of communications, would continue to be in use for a considerable time. In fact, the question of their complete replacement by entirely new lines based on metric measurements and specifications may not arise at all in the near future.

It would thus be necessary to keep the existing instructions in FPS system current and supplement them with revised instructions, while separate instructions for assets in metric units would have to be issued. It would also be necessary to ensure the interchangeability of the parts in the metric and FPS systems for a long time to come in such cases. These and other problems would necessarily take long to be resolved and the programme for the change-over is being carefully phased out.

As a first step towards the introduction of the system in the Engineering Branch, it has been decided that with effect from the 1 April 1959, the accounts of stores in the Telegraph Store Depots and Workshops should be maintained in the metric units. The estimates of projects and indents for stores would, thereafter, be prepared in the metric system. Thus a beginning has been made to make the staff think in terms of metric system in their daily operations. This would naturally enable the Department to face with greater confidence and ease the more complex problems connected with the change-over that would arise when the system is gradually introduced in other fields also. The attention of the Department is now directed to the question of the revision of the various drawings, specifications etc., the adjustments required to be made in the workshops for the production of the components etc in the metric system. This necessarily involves the intensification of the training of the staff to adopt the metric system in their day-to-day working and the employment of additional draughtsmen and technical personnel. The progress made towards the implementation of this change-over in these directions is, however, influenced by the advance made in other organizations like the Central Public Works Department, the Railways, the Indian Telephone Industries etc as these organizations are all closely interconnected.

It is evident from the foregoing that the Department would have to do considerable preparatory work before the new system is brought into effect in complete shape. Much headway has, however, been made in paving the way for a smoth change-over. But as pointed out the pace of the reform in the Department is dependent on the pace of the adoption of the metric system by the country at large in the various fields.

Even then, the P&T Department is attempting to change over to the metric system in its dealings with the public generally from 1 April 1960, provided other conditions permit.

*It is understood that Indian Standards on sections have already been published and some of these metric sections are being rolled and sold. For others it appears that manufacturers are ready to roll against demand. It is understood that the Indian Standard for metric screw threads is in the press. *Editor.*

Metric System in French Medical Practice

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IT is hardly necessary to recall that the metric system is the legal system of measure in France—as it is in greater part of the world—and is the only one in use both for scientific measurements as well as for the measures of everyday life. There is one aspect of human life where science and common usage closely touch each other and where the measures of the metric system link the professional and the everyday life and that is medicine. In this article a few aspects of the mode of use of the metric system in medical practice in France are indicated.

In Taking Body Temperature

A doctor's first question on being called to a sickbed is about the temperature of the patient. In consequence there is no French home which does not keep on hand a clinical thermometer, specially designed for producing the answer to this question, and used only for measuring the temperature of the human body. The French clinical thermometer is graduated on the outside in tenths of one degree Centigrade, and the whole instrument measures 13 to 14 centimetres in length.

The scale is graduated only from 34° to 42° C (93·2° to 107·6° F) in order to make the tenths and even one-half of one-tenth of one degree clearly legible and because temperatures below 34°C and above 42°C are incompatible with human life.

The temperature of the patient should always be taken at the same place in the body since it varies from place to place. In a healthy person, it is generally 36·5°C in the armpit, 36·6°C in the mouth and 37·2°C in the rectum.

In Measuring Blood Pressure

After determining the temperature, the doctor also carries out other more specialized measurements for diagnosing the illness. But, as a matter of routine, he also checks what is popularly called the blood pressure of the patient by measuring the arterial pressure. A few words of explanation may not be out of place here.

The action of the heart projects a surge of blood into the circulation system which is propagated along the walls of the arteries at a speed of 9 metres (29 1/2 ft) per second. Starting from the heart, the blood enters the arteries and continues through successively smaller vessels into the capillaries from where it returns through successively larger veins to enter the heart again. The passage through the capillaries offers resistance to the blood which distends the arteries. Successive contractions of the latter propel the blood on its way and permit it to overcome the resistance of the capillaries.

Between these two opposing forces, an equilibrium tends to become established which

creates a given constant pressure in the individual and this is what the doctor measures when he takes the pressure of the patient. Maximum (diastolic) pressure normally is about 150 mm (15cm) of mercury and minimum (systolic pressure) about 100 mm (10cm) of mercury.

In Writing Prescriptions

After diagnosing the illness in many cases it is necessary to prescribe some medicine. Such a prescription may be long and complicated. It generally shows the name and amount of the drugs to be utilized, the quantity to be administered (in drops or tea-spoons for liquids, in tea-spoons for powders and granules and in number of capsules or pills for these forms) and the rate at which they should be taken (for example, 20 drops before each of the main meals or 2 capsules morning and evening).

It may also be that the treatment calls for hypodermic injections. In that case, the doctor specifies the amount of the drug (generally contained in standard ampoules of 1,2,5 and upto 10 cm^3)to be injected each time. The hypodermic syringes on sale in pharmacies are specially designed for the content of the ampoules in current use. All are marked with the volume that they can hold and have a scale graduated in tenths of cubic centimetres so that only a certain part of the content of an ampoule may be given at one time and to permit accurate mixing of two or more different drugs in a given case*.

In all cases, the doctor indicates both the name of the drug and the manufacturer. It is not unusual to find that several laboratories produce the same product or products with very similar names which should not be confused. Recent legislation in France, published in February 1959, specifies the conditions for the manufacture of drugs and establishes still stricter controls to prevent the sale of too many similar products to the public.

In the Dosage of Medicine

As illustrations of this one of our medical friends has furnished us three examples of prescriptions in current use.

(1) *Tonic Potion (a liquid delivered in a bottle)*

Ammonium acetate ..	3	g
Caffeine	0·30	g
Sodium benzoate ..	1·50	g
Tincture of digitalis ..	X	drops
Chinchona syrup ..	30	g
Todd's potion ..	qsp 120	cm^3

Take 4 dessert-spoons per day for 3 days.

This prescription utilizes three different units of measure: the gram (g), the drop and the cubic centimetre (cm^3). The drop is the unit employed for spirituous tinctures (liquid), in this case tincture of digitalis. One gram of tincture contains 50 drops and it is easy to see that measuring out the dose can be done more accurately in drops than by weight because the ten drops (the number of drops is always written in Roman numerals) weigh only 0·200 grams. The notation 'qsp 120 cm^3' indicates that the preparation consisting of the first five components of the formula is highly concentrated and has to be diluted as indicated. The combined

*Instead of being graduated in cm^3, certain syringes have a scale marked in millilitres (ml). We may recall that the cubic centimetre is the unit of volume in the CGS system and that the litre is the legal measure of capacity. Between the litre and the cubic decimetre there exists a difference of 28 parts in a million since 1 litre is equal to 1·000 028 cubic decimetres. When reduced to the volume of the cm^3 and the ml, this difference is absolutely negligible, even in the medical field. It should also be noted that the abbreviation 'cc', which is used occasionally is not generally accepted.

weight of the concentrate is about 35 grams and the doses required to treat the patient must be fractions of that weight. It, therefore, becomes necessary to increase the total volume of the prescription by the addition of a neutral vehicle (liquid) so that the patient can himself easily measure out the doses to be taken, in this case one dessert-spoon. Quite often, the quantity of a dose is indicated in tea-spoons, dessert-spoons, or soup-spoons.

(2) *Drops for Venous Blood Circulation*

Tincture of Castanea ..	10 g
Tincture of Hamamelis..	10 g
Tincture of Viburnum ..	5 g
90° alcohol	15 g
Glycerine	15 g

Take X to XV drops before each of the two main meals.

Here we find another type of measure with alcohol specified to be '90°'. This is not degree of temperature (which must be written as '°C' in all cases) but the percentage of alcohol by volume (90 cm^3 of absolute alcohol per 100 cm^3) at 15°C.

(3) *Pills*

Squill powder	0·05 g
Digitalis extract	5 centigrams (50mg)
Scammony extract ..	0·05 g

For one No. 30 pill.

Take two pills per day

The quantity of digitalis extract is here written in letters because this is a toxic substance whose use is subject to stringent official safety rules. The notation 'for one No. 30 pill' means that the specified components of the prescription, after having been uniformly intermixed, should go to make up 30 pills of equal weight. Since the total weight of the prescription is 0·150 g, each of the pills will contain 0·005 gram of the preparation or 5 milligrams (mg).

However, there is a larger number of manufactured pharmaceutical products which are made industrially by specialized laboratories. The latter are subject to strict control and each shipment by them must bear a serial number of inspection from the National Laboratory for Inspection of Pharmaceutical Products and the product must bear the serial number of the permit for sale of the drug.

No such product may be put on sale or advertised in medical journals and elsewhere unless it has been approved for therapeutic value and non-toxicity in general use. Packaging containers always show the components and their proportion used in the preparation of the drug.

Metric System Best Suited

The danger to public health from incorrectly proportioned preparations (particularly when they contain toxic substances) is evident and the necessity for an *absolutely accurate* system of measurement in medicine and pharmaceutics is equally obvious. The accuracy of such a system must also be absolute, i.e., remain the same for all weights and volumes, however small.

The metric system possesses this absolute accuracy since it suffices to move the decimal point to the left or to the right to obtain tens or tenths of the original unit. This theoretical ease of utilization is accompanied by the accuracy in practice possible with modern means of measuring such as the microgram scales which indicate weights to within one-thousandth of one milligram. Such precision is an absolute guarantee for the proportions of drugs.

The foregoing conclusively demonstrates the advantages of the metric system in a field where it might be assumed that the choice of a particular system of units was relatively unimportant. Actually the metric system constitutes an 'international language' whose use facilitates human endeavour in all fields but especially so in the very essential field of medicine.

Metric System & Handloom Industry*

K. Sreenivasan
Director,
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Coimbatore

ANYONE who goes abroad for the first time and has to get used to handling a new currency knows the difficulty of assessing the value of things during the first few days. As soon as the price of an article is mentioned, the first question one invariably asks oneself is 'How how much is that in rupees?' and one makes a quick mental calculation to relate the value of this article to one's past experience and come to a judgement regarding its cheapness or otherwise. How often do we come across people who still convert naye paise into annas in order to satisfy themselves ! It is only after some time that an automatic judgement of value is possible.

What is true of currency is true of all measurement. A period of time must elapse during which the necessary mental adjustment is brought about and the new unit becomes the standard of judgement. When the new unit of measurement is a simpler one (as in the case of the metric system in most cases) the transition is also fairly easy. But in applying the metric system to cotton yarn—and particularly to yarn supplied in in the form of hanks to the handloom industry—certain specific difficulties are encountered. It is possibly because of these difficulties that even in France— the home of the metric system—the British system

*The author has discussed a very important subject in this article and proposed to hold a conference of all concerned to settle the issues he has raised There is, however, already some pertinent history to be noted.

In the second meeting held on 2 November 1957 in Bombay of the Technical Committee for the Introduction of Metric System in the Cotton Textile Industry, appointed by the Textile Commissioner with Dr. Verman in the chair, it was decided that :

(1) a hank of cotton yarn should be 1,000 metres,

(2) a lea of cotton yarn should be 100 metres, and

(3) the Bombay Millowner's Association should be requested to suggest what and how changes in cotton yarn reeling machine should be made in the context of (1) and (2).

Thus, there seems hardly any need for the proposed Conference to go into (1) and (2) *de novo*.

The proposed conference, or perhaps the Textile Commissioner's Committee which is also quite representative may well :

(i) study the conclusions, if any, which the Bombay Millowners' Association may have come to as regards the work entrusted to them, and

(ii) discuss also whether, when packing cotton yarn, for a direct count system market, the bundles should be standardized on the basis of weight or on the basis of a whole number of knots.

In connection with (ii), it may be stated that, happily, India is familiar with both types of packing of yarn for such markets. For instance in silk and jute yarn markets, direct count systems are prevalent. The net weight of a bundle of silk is constant irrespective of its 'denier'—a direct count system, while, in the case of jute yarn, the weight of a bundle varies with 'grist'—another direct count system.—*Editor*,

is prevalent for the measurement of cotton yarn count.

Yarn is not a finished product going directly to the user, but an intermediate product which is the raw material for handloom weavers. The weavers are very large in number not always educated and are traditional in their methods of working, It is, therefore, very essential that the problems that are likely to arise as a result of the introduction of the metric system should be carefully considered and agreed solutions found so that no inconvenience may be caused to the handloom weaver after the introduction.

Change—What it Means

The introduction of the metric system would mainly result in the following changes:

(1) All measurements of weight to be expressed in kilograms and grams instead of pounds and ounces.

(2) All measurements of length to be expressed in metres and centimetres instead of yards and inches.

(3) A hank in the metric system would consist of 1,000 metres (8 leas of 125 metres or 10 leas of 100 metres) instead of the existing length of 840 yards (7 leas of 120 yards).

(4) Under the now internationally accepted 'tex' system, yarn number (count) is defined as weight in grams of 1,000 metres of yarn.

It is this last change which is the most important as well as the one likely to lead to the greatest difficulties. In the present system of yarn numbering, the count is defined as the number of hanks of 840 yards in a pound (i.e., length per unit weight) while in the new system count is defined as weight per unit length. The change involved, therefore, is not only in the units of measurement but also in the basis of defining count.

Yarn is at present supplied to the handloom weaver in the form of hanks of 840 yards divided generally into 7 leas of 120 yards each. Since the circumference of a reel is 54 inches, each lea contains 80 threads and each hank 560 threads. These hanks are made into knots of ten hanks each, and into bundles of 10 lb below 60 s count and 5 lb for 60 s and above. All marketing of yarn is done in units of 10 lb or 5 lb bundles. This has been found to be the most convenient form for the handloom weaver since he can divide it into units of 120 yards for purposes of warping without having to to measure the yarn. It also enables him to count the number of knots in a bundle and know the count. By applying a simple 'rule of thumb' method he can easily calculate the number of yards of cloth he can get from a given bundle of yarn.

Application of Metric System

In the metric system, a hank would be 1,000 metres. The first thing to be decided is whether there should be 10 leas of 100 metres or 8 leas of 125 metres. The circumference of the reel should also be decided. Any change from the present 54 inches would also affect the production of the reeler in the mills and the process of reeling is an important item of cost.

In the metric system, if yarn is sold in 5 kg bundles for counts below 60 s and 2.5 kg bundles for counts 60 s and above, which are the nearest equivalents to the 10 lb and 5 lb bundles, the two main drawbacks from the point of view of marketing and of the handloom weaver would be:

(1) The number of knots in a bundle cannot be expressed in terms of count or as a simple function of the count.

(2) Fractions of a knot have to be put in a bundle in the case of certain counts.

These two points are illustrated in the following table.

Count	Metric equivalent count (Tex)	Tex rounded off	Number knots per bundle	Number of knots/ bundle rounded off	Weight of bundle with whole number of knots kg
10	59·1	60	8·33	8	4·80
12	49·2	50	10·00	10	5·00
16	36·9	36	13·89	14	5·04
18	32·8	32	15·62	16	5·12
20	29·5	30	16·66	17	5·10
24	24·6	24	20·83	21	5·04
26	22·7	22	22·73	23	5·06
30	19·7	20	25·00	25	5·00
36	16·4	16	31·25	31	4·96
40	14·8	14	35·71	36	5·04
50	11·8	12	41·67	42	5·04
60	9·8	10	25·00	25	2·50
80	7·4	8	31·25	31	2·48
100	5·9	6	41·67	42	2·52

The first difficulty can be partly solved by preparing tables giving the number of knots in the metric system and also by marking on the bundles the number of knots. If a knot comprises of 10 units of 1,000 metres length each, only fractions of the order of 0·1 of a knot could be put in a bundle. This would involve additional work to the mills and create some difficulties in the reeling and bundling departments. The error in the total weight of the bundle, by putting knots corrected to the first decimal place, would be less than 0·4 percent of the standard bundle weight. As an alternative, if the mills adopt a system of packing a whole number of knots in a bundle, the weight of the bundle would slightly vary in the different counts. This is illustrated in the last column of the table.

If the bundle weight varies, one of the main difficulties from yarn selling point would be, to work out exactly the number of bundles for a certain quantity of yarn in weight demanded by the merchant. Also in every bundle it would be necessary to mark, apart from the count, the weight of the bundle and the number of knots. It is, however, worth mentioning that the marketing difficulties enumerated here are not in any way due to the changes in the length of the yarn or the weight of the bundle, but because of adopting a direct method of measuring the yarn count in the metric system.

Preliminary Steps

As a preliminary step towards the introduction of the metric system, a conference of all interests concerned, namely, the managements in spinning mills, representatives of the handloom industry, dealers in yarn and the Indian Standards Instution should be called early in order to arrive at agreed decisions on the following points:

(1) To standardize the hank at 1,000 metres.

(2) To decide the number of leas per hank,

(3) To decide the circumference of the reel,

(4) To decide the method of packing, i.e., whether bundles should be standardized on the basis of weight or on the basis of a whole number of knots, and

(5) On the period that is necessary for the change-over from one system to the other.

There are about two million handloom weavers in India. Most of them are uneducated and are not in a position to undertake any calculations beyond what can be done purely orally. To get them used to a new system of yarn count and also to enable them to estimate the length of cloth that would be got from a bundle of a particular yarn, considerable preparatory work should

be undertaken. Suitable tables should be prepared and distributed to them and these should be followed up by educative propaganda and personal explanations where necessary.

In view of the wide dispersion of handloom weavers throughout the country this is likely to be a very big problem. Any difficulties that the handloom weaver comes across in understanding the new system would affect the efficiency of the handloom industry. Therefore, considerable preparatory work and planning is necessary before the new system is brought into being.

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BOOK REVIEW (*continued from page* 26)

1,650 763.73 wavelengths in vacuum of the radiation corresponding to the transition between the energy levels of $2p_{10}$ and $5d_5$ of the atom krypton 86 and, therefore, the 1927 proposal is not valid any more. The suggestion that the Government should supply new weights in exchange for old, though attractive, is obviously impracticable.

On the whole, however, the book is wellwritten and it would be desirable that such books should also be written in other languages to give the general public a thorough idea of the change-over

Metric Progress in Industries

(In December 1956, the Standing Metric Committee recommended that conferences should be convened with the co-operation of associations or organizations concerned, for groups of industries, to recommend programmes for the adoption of the metric system. This is being done. The progress made in chalking out and implementing the first phase of the programme in various industries is reported. Earlier reports appear in the previous issues of *Metric Measures*.)

Shipping

A meeting of the shipping interest was held in Bombay recently. The representatives of the Director General of Shipping, Ports, Customs, Master Mariners of India, Chamber of Commerce etc., were present. The Chairman said that since it was intended to introduce the metric system from 1 April 1960, in Commercial Branches of the Railways, P & T Departments and Customs and Excise Departments, it was necessary to fix the date for its introduction in the Commercial side of shipping also. It was suggested that 1 April 1960 might be a convenient date for the change-over in the commercial activities of the shipping industry. Representatives of the Coastal Conference, Indian National Steamship Owners Association, Scindia Steam Navigation Company Sailing Vessels Association, Chambers of Commerce and Master Mariners also agreed to the introduction of the metric system from 1 April 1960. As a result of the discussions, the following unanimous recommendations were made :

(1) The metric system may be adopted from 1 April 1960 by shipping concerns for specifying freights and charging freights. Its use would be optional for 6 months and even after that period shipping documents relating to foreign countries may show quantities in foot-pound units also. Ports should also adopt the metric system from 1 April 1960 in levying port charges and paying piece-rate wages.

(2) A committee representing all the interests concerned should be set up to study the subject in detail and recommend measures to facilitate a smooth switch-over to the new system. The Director-General of Shipping or his representative would be the convenor of the Committee. Representatives of the Ministry of Commerce and Industry, Coastal Carriers, International Carriers, Shippers, Port Trust, Customs Department and Master Mariners would be members of the Committee. The Committee would set up Subcommittees to study special problems.

Petroleum

A meeting of the petroleum interests was held recently in Bombay at which representatives of petroleum interests were present.

The various problems relating to the introduction of the metric system in the petroleum industry were discussed.

It was agreed that the components required for the conversion of dispensing pumps be imported in such a manner that the conversions of the pumps would be complete by 1 April 1960, the target date for the change over to the metric system. It was also agreed

that other necessary conversions such as those required for weighing machines, etc., should also be undertaken. So far as the recalibration of main installation tanks was concerned, it was agreed that the Central Board of Revenue, Central Public Works Department and Mercantile Department would calibrate the tanks in both the systems during periodical cleaning. The work was expected to take about 5 years. Conversion tables would be used where recalibration had not been possible. Similar consideration also applied to Railway tank wagons. It was further decided that the weights and measures Departments of the States, which have to verify pumps and lorries should be asked to provide facilities for prompt execution of this work

It was also reported that the Indian Standards Institution had recommended that a standard temperature of 15°C should be adopted for bulk transaction and collection of taxes. It was agreed that this recommendation may be sent to the Central Board of Revenue for approval for the purpose of collection of taxes etc.

Special Working Standards for the Verification of Commercial Bullion and Carat Weights

A meeting of the representatives of the Weights and Measures Organizations of certain States and others concerned was held in Bombay recently, to consider particularly whether it was necessary to prescribe special working standards for the verification of commercial bullion and carat weights.

It had earlier been suggested that such special working standards, to be verified directly with the reference standards instead of going through secondary standards, would minimize the profit and loss in transactions in the expensive commodities sold under the bullion and precious stones trades. After considering the pros and cons, such as:

(1) the extra expenditure involved in the preparation of special working standards;

(2) the extremely heavy load that would be put on the reference standards;

(3) the expenditure involved in frequent visits to headquarters by the inspection staff for getting the special working standards verified every year;

(4) the difficulty for an Inspector having to carry two sets of working standards for inspection and verification;

(5) the impossibility of getting such special sets ready within the next few years because of the extremely heavy pressure of work on the Mints; and

(6) most important, the extremely negligible profit and loss involved in using the ordinary working standards instead of the special working standards,

it was decided that special working standards need not be prescribed. The State Legislation in this regard would be amended in the near future.

The Mint Master, Bombay also informed the meeting that the Bombay Mint proposed to maintain an account of gold and silver in metric units. Bullion bars for merchants would be cast in the following weights:

3 kilograms in place of 250 tolas,
200 grams in place of 20 tolas, and
100 grams in place of 10 tolas.

He further stated that the dimensions of the moulds had been altered for the purposes of identification. The casting charges would remain unchanged.

News & Views

Definition of the International Yard and Pound

It has been reported that the Directors of the following standards laboratories, after discussing the existing differences between the values assigned to the yard and to the pound in different countries, have agreed on the definition of the International Yard and the International Pound in terms of the metre and the kilogram. The laboratories concerned are as follows:

(1) Applied Physics Division, National Research Council, Ottawa (Canada),

(2) Dominion Physical Laboratory, Lower Hutt (New Zealand),

(3) National Bureau of Standards, Washington, (United States of America),

(4) National Physical Laboratory, Teddington, (United Kingdom),

(5) National Physical Research Laboratory, Pretoria, (South Africa),

(6) National Standards Laboratory, Sydney, (Australia).

International yard and the international pound are now defined as follows:

the international yard=0·9144 metre ;
the international pound=0·453 592 37 kilogram.

An agreement has also been reached that unless otherwise required, all non-metric calibrations carried out by the above laboratories for science and technology on and after 1 July 1959, would be in terms of the international units defined or their multiples and submultiples.

From the above definitions it is clear that the inch will be 25·4 millimetres exactly and the international grain will be exactly 0·064 798 91 gram.

It may be recorded that the values of the yard and the pound differed in the various countries using these units. For example, in the U.S.A., one yard was taken=3600/3937 metre. The inch on this basis worked out to be approximately 25·400 050 8 millimetres, while the inch used by the National Physical Laboratory of the United Kingdom was defined by the equation 1 inch=25·399 956 mm. The pound in the United States was taken as being=0·453 592 427 7 kilogram. In Britain it was 0·453 592 338 kilogram, and in Canada 0·453 592 43 kilogram.

It may, however, be pointed out that the units will not have at present statutory force in the UK and may not be used for trade purposes in that country. The yard and the pound units to be used for this purpose are the Imperial units laid down in the Weights and Measures Act, 1878.

This step which has been taken after long consultations, does away with the minor differences which existed among the pounds in the different countries and will simplify, for scientific purposes, the exact meanings of the yard and the pound in terms of the metre and the kilogram.

Depth of Ocean

Soviet oceanic scientists claimed they had reached the lowest recorded depth of oceans.

A Moscow Radio broadcast said scientists abroad the *Vityaz*, a research vessel, investigating the Mariana depression in the

Pacific recorded a depth of 11,025 metres (36,173 feet).

The hitherto deepest ocean soundings were by the same Soviet ship in August 1957. A depth of 10,960 metres (35,958 feet) in the same Mariana islands area was then recorded.

Adoption of Decimal Coinage in South Africa

It is understood that the adoption of decimal coinage in South Africa is imminent. It appears that the report of the South African Bureau of Standards was submitted to the Government which then appointed a Committee to study it and to investigate certain aspects not within the terms of reference of the SIBS Committee. The Government has now decided to decimalize South African coinage.

Change-over to the metric system of weights and measures is obviously a more complicated job and the implications are said to be under study.

Adoption of International Paper Sizes in UK

The February 1959 issue of the *B.S.I. News* has given the following information under the title 'Printers' View of International Paper Sizes'.

'The December 1958 issue of the influential *British Printer* devoted two pages to a description of the international paper sizes which B.S.I. and other organizations have recently adopted.

'The article defines the series and the system and how it may or should affect the paper and printing industries in this country, mentioning a number of paper-makers who, as already announced in *B.S.I. News*, have decided to make available from stock, paper in the 'A' series of sizes.

'The journal adds this comment: 'The printers and print-buyers of this country now have the opportunity of testing the practicability of the 'A' series within the terms of their own working requirements and of giving support to a development which promotes really worthwhile long-term advantages in economic manufacture and stocking.... The implications are by no means confined to potential economies in the paper-making and printing fields: universal standardization also has implications in such diverse directions as machine sizes, storage accommodation and stock control, filing cabinets and materials, costing, estimating....'

'Such an outspoken lead may well encourage the printing industry to display even more interest than at present in meeting the inevitably growing demand for printing in the international sizes.'

The *B.S.I. News* has also announced that the Cement and Concrete Association and the Film Producers Association have changed over to the 'A' sizes for all future publications and stationery. It is further reported that after some initial difficulties in getting supplies the position had eased.

Readers' Forum

Recalibration of Weighing Machines

Dear Sir,

We understand that the average person is a little confused as to where to get his platform weighing machines, spring balances etc., recalibrated in terms of the metric system of weights and measures. We are proud to inform you that we have already undertaken jobs of recalibration of different makes, types and sizes of various machines to the entire satisfaction of the owners. Those interested may contact us for further information.

Delhi

Multan Engineering Works.

Nomenclature

Dear Sir,

I read with great interest the leading article of November, '58 issue of your esteemed journal. I refer to the article 'Why Not Indian Names for Metric Weights and Measures' by Shri K.V. Venkatachalam.

I agree with the learned author that introduction of a new terminology of metric weights based on the suggestions dealt with by him in his article would add greatly to the existing confusion. But I do not see any reason why the series of prefixes—milli, centi, deci, deca, hecto and kilo—should not be substituted by simple Indian words. I suggest the following series:

Kilogram	सहस्रग्राम	Sahastragram
Hectogram	शतग्राम	Shatagram
Decagram	दशग्राम	Dashagram
Decigram	दशवाँग्राम	Dashwangram
Centigram	शतवाँग्राम	Shatwangram
Milligram	सहस्रवाँग्राम	Sahastrawangram

I strongly feel that the retention of prefixes —milli to kilo—would be found very difficult by illiterate people in India, who are in vast majority. In the series suggested above only 'gram' will have to be learnt, whereas in the present series one has to learn 6 prefixes and 'gram'. Will this difference not make the learning on the part of an average Indian at least seven times easier ?

I have preferred simple Sanskrit and not Hindi words so as to avoid protest from people whose mother tongue is not Hindi. I hope they would accept 'Sahastra' without any difficulty as Vishnu Sahastranam is equally, if not more, popular among them. 'Shata' and 'dasha' have been preferred because of their being short and simple; 'wan' (वाँ) for denoting fraction is so easy to be understood by all that it does not need any justification.

Delhi

Dr. Hari Bhagwan

(Dr. Hari Bhagwan's suggestion is no doubt interesting and needs some discussion.

So far as nomenclature for metric weights and measures is concerned, there are three schools of thought. The first one is that an entirely Indianized nomenclature should be adopted. The impossibility of Indianizing the names is now being realized and nobody suggests it seriously. The second one is that the basic unit should be metric, and for deriving secondary units the prefixes should be substituted by Indian prefixes. The third one is that the international nomenclature should be adopted as it is without any substantial change.

Dr. Hari Bhagwan has suggested the second alternative and given prefixes which he claims have an all India basis. No doubt this is so. We may examine how Dr. Hari Bhagwan's nomenclature will be used in practice. For example, if you want to buy 25 kilos of a commodity you will have to ask for 25 sahastragram and so on. It will be noted that 'sahastragram' is not as easily pronounced as kilogram or kilo.

There is also another factor which we should bear in mind in day-to-day transactions. So far as weights are concerned, only two units are required, namely, gram and kilogram. The other units are not used at all, except milligram, which may be used for gold and other costly commodities and where fine weighment is required. Now the use of only two terms for ordinary weights makes the metric system even simpler for use. There is no necessity for us, therefore, to use hectogram or decagram. In their place we can ask for hundred grams, the word 'hundred' being substituted in each language by the appropriate word. Similar is the case with the decagram, i.e. ten grams. In view of this utter simplicity, it will be difficult to appreciate why it is necessary to prescribe special prefixes for indicating the secondary units.

Another aspect of the question is that in our schools and later on in colleges the students will learn kilogram, milligram, etc., for scientific purposes. Is it necessary to have different nomenclatures for ordinary transactions and for scientific learning when the system used is exactly the same? Would it not mean duplication of effort?

Considering the question from all sides, it would appear that the advantages gained by Indianizing the prefixes would be extremely limited. Wide acceptance of metric terms in all the countries in which it is used is another aspect. Therefore, it would be preferable to use the international terminology only for all purposes. —*Editor*

Book Review

MOJMAPACHI UTKRANTI VA DASHAMAN PADDHATI—by Prof. N. V. Kogekar (Bahishal Shikshan Granthamala, University of Poona), December 1958, Price Re. 1.00 (Marathi)

The book, published by the Extra Curricular Educational Society of the University of Poona with the object of giving general public information about subjects which are useful to them, is a commendable effort.

The book, which runs into about 100 pages including appendices and index, deals with the evolution of weights and measures and the decimal system and explains why India is adopting the metric system and and indicates what steps are being taken to achieve this objective.

It is divided into ten chapters, dealing with the importance of weights and measures in human life, the origin and development of the idea of weights and measures, ancient weights and measures, discovery of the zero and the place value system, the invention of metric system and its propagation, the advantage of decimal reckoning and the metric system, metric system and commerce and industry, the attempts made in India recently to unify weights and measures, the Government of India's Standards of Weights and Measures Act, 1956, and the difficulties that may be experienced in the use of the metric system in India. The six appendices describe the relation of weights and coins, the weights and measures prescribed under the Bombay State Weights and Measures Act, 1932, the Weights and Measures Acts in India before 1956, the Standards of Weights and Measures Act, 1956, the relation of the old and metric weights and measures and the various metric weights and measures prescribed for day-to-day transactions. It also contains seven conversion tables derived from Indian Standard Conversion Tables for Ordinary Use.

The book is written in simple language and gives interesting information about how weights and measures affect daily transactions and traces the history of weights and measures and gives an idea of those current in the ancient world—in Egypt, India, Greece, and Rome. The development of Anglo-Saxon and French weights is also given. A short history of the decimal system and the place value system is included. The advantages of the metric system in education, commerce industry etc., are ably indicated.

In short, it may be said that the book represents a laudable effort to bring out the significance of the change-over to the metric system and gives the necessary information to the general public.

There are a few inaccuracies in the book. For example, the period of 10 years allotted for the change-over will be completed in December 1966, and not 1968. The gallon of 231 cubic inches which is used in the book to explain the difficulty of conversions with the FPS system, is the American gallon ; the British gallon is 277.420 cubic inches. The metre is now likely to be defined as

(*continued on page* 19)

Publicity Week in Madras

A publicity week to acquaint the people with the metric system of weights and measures was celebrated in Madras State during the last week of February 1959, i.e., from 22 to 28 February 1959 (both days inclusive) in the four districts in which the metric system was introduced from 1 Oct. 1958. To mark the beginning of the week a press conference was conducted by the Secretary to Government, Department of Industries, Labour and Co-operation on 22 February 1959.

The week itself was inaugurated by the Minister for Revenue, Madras, with a talk on the Madras station of the All India Radio. On the first day of the commencement of the week, press advertisements on metric system were released by the Government of India in the newspapers in the State. Posters on metric system of weights and measures were also exhibited on the Government transport buses plying in the city of Madras. Pamphlets on the metric system and conversion tables and other materials were widely distributed.

Public meetings were organized under the auspices of various Chambers of Commerce, Merchants' and Trade Associations and Social Organizations, such as Young Women's Christian Association, Kamala Nehru Mathar Sangam, Madras Social Service Centre, and were addressed by Ministers and Members of Legislative Council and Assembly and also by other gentlemen of the localities. In addition, the Controller and the Inspectors of Weights and Measures gave an idea about the implications of the metric system. Meetings of Government Officials were also similarly arranged.

One of the features of the week was the exhibition of new weights and balances. Demonstrations were given by actually weighing some of the common commodities in both systems to show people the differences in quantity and price, when using the new weights. The Inspectors of Weights and Measures also visited many of the slum areas, shandies and markets and held meetings to explain the advantages of the metric system and demonstrated how the metric weights compare with the present weights by weighing articles.

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CONVERSION OF WEIGHTS FOR ORDINARY PURPOSES

(4)		(3)		(2)		(1)	(N)	(1A)		(2A)		(3A)		(4A)	
tons	cwt	mds	seers	seers	tolas	tolas	Number	grams	milli grams	kilo grams	grams	quintals	kilo grams	metric tonnes	kilo grams
1	0	2	27	1	6	0·09	1	11	664	—	933	—	37	1	16
1	19	5	14	2	11	0·17	2	23	328	1	866	—	75	2	32
2	19	8	2	3	17	0·26	3	34	991	2	799	1	12	3	48
3	18	10	29	4	23	0·34	4	46	655	3	732	1	49	4	64
4	18	13	16	5	29	0·43	5	58	319	4	666	1	87	5	80
5	18	16	3	6	34	0·51	6	69	983	5	599	2	24	6	96
6	18	18	30	7	40	0·60	7	81	647	6	532	2	61	7	112
7	17	21	17	8	46	0·69	8	93	310	7	465	2	99	8	128
8	17	24	5	9	52	0·77	9	104	974	8	398	3	36	9	144
9	17	26	32	10	57	0·86	10	116	638	9	331	3	73	10	160
19	14	53	23	21	35	1·71	20	233	276	18	662	7	46	20	321
29	11	80	15	32	12	2·57	30	349	914	27	993	11	20	30	481
39	7	107	7	42	69	3·43	40	466	552	37	324	14	93	40	642
49	4	133	38	53	47	4·29	50	583	190	46	655	18	66	50	802
59	1	160	30	64	24	5·14	60	699	828	55	986	22	39	60	963
68	18	187	22	75	1	6·00	70	816	466	65	317	26	13	71	123
78	15	214	14	85	59	6·86	80	933	104	74	648	29	86	81	284
88	12	241	5	96	36	7·72	90	1049	742	83	979	33	59	91	444
98	8	267	37	107	14	8·57	100	1166	380	93	310	37	32	101	605

How to use the Table:

(1) Find the required number from Column(N)

(2) Look up the required value under appropriate column.

(3) Columns(1) and (1A), (2) and (2A), (3) and (3A), (4) and (4A), should be read together. For example, values from (1) and (1A) can be converted but not from (1) and (2A).

Based on IS:1020—1957 Indian Standard Conversion Tables for Ordinary Use

Example: (1) To convert 20 tolas into grams and milligrams, look up 20 under column(N) and find the equivalent under(1A) *viz.* 233 grams, 276 milligrams. For converting 20 grams look up under column 1. The value is 1·71 tolas.

(2) To convert 50 kilograms into seers, look up 50 under cloumn (N) and find the equivalent under column (2), *viz.*, 53 seers, 47 tolas. To convert 50 seers look up under column 2A. The value is 46 kg and 655 grams.

Standards News

(Indian Standards which have a particular bearing on the change-over to the metric system are indicated here. Copies would be available from the Indian Standards Institution, Manak Bhavan, 9 Mathura Road, New Delhi, or their branch offices at Bombay Calcutta and Madras).

Indian Standard Specification for Structural Steel (IS:226—1958)

The Indian Standards Institution has published an Indian Standard Specification for Structural Steel (IS: 226—1958). This is the *second revision* of IS:226 which was was first issued in 1950, consequent to the representation made by steel manufacturers to the Steel Advisory Committee of the Government of India that the practice of ordering steel to rigid specifications was often not justified on the basis of service requirements. The *first revision* of the standard was issued in 1955.

The revised standard prescribes requirements for steel sections, plates and bars (round, square, flat, hexagonal, etc.) of the following categories for use in structural work:

Steel Designation	Purpose for which Intended
A ..	In structures subject to dynamic loading and other special cases.
B ..	In structures not subject to dynamic loading.
ASW ..	In structures subject to dynamic loading and when special welding jobs are involved.

Price : Rs. 1·50

Indian Standard Specification for 18-litre Square Tins (IS:916—1958)

The Union Parliament having adopted the Standards of Weights and Measures Act, 1956, the Government of India is now concerned with expediting the introduction of the metric system of weights and measures in various branches of commerce and industry. At the instance of the Standing Metric Committee of the Government of India, the Indian Standards Institution has taken up the formulation of the Indian Standards on metal containers in metric system.

As a basic approach to the problem, the Institution is formulating standards on metal containers on the basis of their respective capacities by volume and not by weight of the materials to be packed therein which has just been issued by the institution.

The Indian Standard Specification for 18-litre Square Tins (IS:916—1958), covers the requirements for 18-litre square tins manumanufactured from tinplate. The 18-litre tin is based on the 4-gallon tin, which is in extensive use in India, judging from the fact that the tonnage of tinplate consumed for 4-gallon tin represents nearly 65 percent of the total tinplate used in India. The 4-gallon tin is used for packing various types of commodities, such as kerosene oil, vegetable oils, vanaspati, insecticides and chemicals, cashewnuts, food products, etc. Consequently, the 4-gallon tins, as at present made in India, are used for packing various commodities exported all over the

world; and as such, represent an important item of foreign exchange earning. The method of manufacturing these tin containers varies enormously; the large-scale organized factories employing completely automatic plants, while simple techniques employing manual labour are also used by a large number of fabricators. It is expected that the standard will assist the industry in the production of square tins of quality, and in switching over to the metric system.

Price : Rs. 1·50

Indian Standard Specification for Foundry Moulding Boxes (IS:1280—1958)

The Indian Standards Institution has published an Indian Standard Specification for Foundry Moulding Boxes (IS:1280-1958).

Moulding boxes constitute an important item of expense for foundries which can be reduced by standardizing the essential dimensions of moulding boxes and their main components. This also leads to increased interchangeability, reduction in number of types and sizes of moulding boxes to be stocked and will aid designing, work planning and costing.

The standard specifies dimensions and materials of two-pin foundry moulding boxes ranging in size from 320 × 320 × 80 mm to 2,000 × 2,000 × 500 mm and their main components, such as pins, lugs and bushes.

The standard covers a majority of moulding boxes most commonly used by foundries in every day practice. No attempt is made to cover the special purpose boxes, which may be required by jobbing foundries ; in their their case, if necessary, use can be made of the components, such as pins, bushes, etc., specified in this standard.

Price : Rs. 1·50

Draft Indian Standard Specifications for Metal Containers [DOC : CDC 28 (921) DOC : CDC 28 (964) DOC : CDC 28 (939) and DOC : CDC 28 (895)]

The Government of India, having adopted the Standards of Weights and Measures Act, 1956, is now concerned with expediting the introduction of the metric system of weights and measures in various branches of commerce and industry. At the instance of the Standing Metric Committee of the Government of India, the Indian Standards Institution has taken up the formulation of Indian Standards on metal containers in metric system. For the purpose of convenience metal containers have been divided into three groups; namely: (*a*) Drums, Large, (*b*) Steel Drums and Kegs; and (*c*) Tinplate Containers.

The Institution has now issued the following four draft Indian Standards which are being circulated to all concerned for eliciting their comments.

Specification for Steel Drums and Kegs [Doc : CDC 28 (921)].

This standard covers a range of steel drums and kegs upto 150 litres nominal capacity in 15 different sizes.

The drums and kegs, covered in this specification, find application in the paint industry among others. The ISI had issued the Indian Standard Specification for Drums for Paints (IS: 442—1954) and the Indian Standard Specification for Kegs (Open Top Drums) for Paints (IS: 618—1956). It was later on felt that a more comrehensive Indian Standard for drums and kegs, covering other uses as well, was desirable. This has now been done and this standard supersedes IS: 442—1954 and IS : 618—1956, since the containers described in the draft standard will meet the needs of the paint industry.

This standard is based on the technical data furnished by the indigenous manufacturers of drums and kegs. Drums and kegs

are at present manufactured in the country in widely varying sizes. In this standard an attempt has been made to rationalize the sizes, and 15 preferred sizes have been specified which, it is hoped will meet all requirements.

(2) Specification for Round Tins [Doc : CDC 28(964)], which lays down the capacities and types of round tins, used primarily for packing paints.

(3) Specification for Rectangular Tins [Doc. : CDC 28 (939)]. The standard covers the requirements of 5-litre, 1-litre, 500 millilitre and 250-millilitre rectangular tins manufactured from tinplate.

(4) Glossary of Terms Relating to Metal Containers Trade [Doc: CDC 28 (895)], which covers the definitions of terms relating to the metal container trade. In the metal containers trade, the necessity of a commonly agreed terminology and definitions has long been felt. It is the purpose of this standard to provide a glossary of terms that will help in fixing precise meanings to terms used in the metal containers trade, thereby avoiding ambiguity and confusion to manufacturers and consumers.

Draft Indian Standard Specification for Rectangular Solid Wood Packing Cases [Doc : BDC 20 (303)]

Packing cases are at present indented by various Government departmnets and manufacturers in the country according to their individual specifications. A survey of the sizes of packing cases, the methods of construction and the requirements, which they were to meet, indicated that there was a very large variety which was not all justified. On account of this variety, a great deal of material was being wasted, and sometimes timber superior in quality than necessary was being used for the purpose. In the context of acute shortage of timber for constructional and other essential needs, it was felt that a standard to simplify and rationalize the sizes, the constructional requirements and the material to be used would be welcome. With a view to eliminate the unnecessary variety of sizes, simplify construction, and to effect economy in the use of timber without loss of efficiency, the Indian Standards Institution has drafted an Indian Standard Specification for Rectangular Solid Wood Packings Cases [Doc : BDC 20 (303)]

The standard covers requirements for materials, construction and internal dimensions of rectangular solid wood packing cases used for general packing purpose.

Draft Indian Standard Specification for Self-Contained Water Coolers [Doc : BDC 18(380)]

The manufacture of refrigeration and air conditioning equipment in India has made substantial headway recently; and most of of the components are being made indigenously excepting hermetically sealed and semi-sealed compressors. The industry, still in its infancy, has appreciated the value of adopting certain minimum standards to which the indigenous manufacture will conform. To meet their needs, and to cover different equipment and components manufactured in the country, several standards are in the course of preparation by the Indian Standards Institution; the following having already been published and issued :

(1) IS : 655—1955 Specification for Metal Air Ducts

(2) IS : 659—1955 Safety Code for Air Conditioning

(3) IS : 660—1955 Safety Gode for Mechanical Refrigeration

(4) IS : 661—1955 Code of Practice for Insulation and Safe Operation of Cold Storages.

The Institution has issued a draft Standard Specification for Self Contained Water Coolers [Doc : BDC 18 (380)], which covers water coolers of both instantaneous and and storage types. The standard prescribes the general constructional requirements, standard sizes, methods of testing and rating, and installation of storage and instantaneous type self contained drinking water coolers, operated by electrically driven vapour compression type refrigerating machines.

Draft Indian Standard Specification for Layout for Regulated Market Yards for Agricultural Commotities. [Doc : AFDC 5(61)]

In our country, much of the trade in agricultural commodities—which contributes nearly 50 percent of the total national income is carried out in markets, the construction and layouts of which are far from satisfactory. These markets ('Mandi' or 'Gunj' as they are known in Hindi) are congested and devoid of civic amenities such as resting sheds for people, urinals, garbage bins, cattle shed, etc.

For some time past a need has been felt for constructing market yards according to planned layouts and conforming to certain standards. It is expected that such standards when made available and implemented would go a long way in improving the present conditions in the markets. The Indian Standards Institution has at the instance of several State Governments formulated a draft standard Layout for Regulated Market Yards for Agricultural Commodities [Doc : AFDC 5 (61)].

The draft standard covers the layout and the requirements for regulated market yards for agricultural commodities. It takes into consideration the recommendations made by the Seminar on Regulated Markets held at Mysore in January, 1959.

In the standard, layouts for regulated market yards for general agricultural produce have been laid down. It is also proposed to include cattle and perishables such as fruits, fish and vegetables in the scope of regulated markets. It may then be necessary to lay down separate standard layouts for market yards, only for special commodities, such as cotton, cattle, fruits and vegetables.