UNIT 7 PERCENT (I) APPLICATIONS TO EVERYDAY ACTIVITIES

Structure

7.1 INTRODUCTION

Imagine a world without numbers and computations. Certainly we cannot even think of such a situation. We certainly need to be able to compute when we buy or sell goods, deposit our savings, try to understand matters such as income tax and perhaps to check our bills. The concept of percentage is one idea which has the widest application in every day life situations. It characterises both the concepts of fraction as well as ratio and provides maximum skills in computations with four fundamental operations in real life situations.

Prior to this unit, the pupils have already learnt common fractions and decimal fractions. They are familiar with skills in converting common fractions into decimals and vice versa. They have also solved problems involving computations with fractions and decimals. This unit provides for the study of fractions of the form 5/100, 80/100 etc. which have 100 as denominator (In decimal form these are expressed as 'hundredth'). When written in specific way these are called "percents" and have applications to daily life problems.

7.2 OBJECTIVES

After studying this unit, you will be able to :

- clarify to your pupils the meaning of **percent**, **rate**, **base**, and **percentage**;
- develop in them an ability to distinguish between percent and percentage, rate and percentage, and rate and percent;
- make your pupils understand the relation between common fraction and percent, and decimal fraction and percent;
- develop in them an ability to compute any one of the base, rate and percentage when the other two are known;
- develop in them the skills to convert common fractions and decimal fractions into equivalent percents;
- help your pupils solve practical problems involving a relationship between common fractions and percents, and decimal fractions and percents;

- clarify to your students the meanings of cost price, selling price, profit, loss, profit percent and loss percent;
- develop in them the skills to compute profit/loss percent if cost price and selling price are given;
- help them solve practical problems involving profit, loss and percent, given adequate data;
- clarify to your students the definition and meaning of "commission" in trade and business;
- develop in them skills to compute commission when commission rate and selling price are given;
- help them solve practical problems related to commission in trade and business;
- clarify to your students the definitions and meanings of discount, successive discounts, cash discount, and discount price;
- develop in them skills to perform computations related to discount;
- help them to solve practical problems based on discount;
- help them to perform computations and solve practical problems associated with brokerage;
- enable students to appreciate the application of percentage in all the various concepts dealt with in this lesson.

7.3 PERCENT : CONCEPT AND COMPUTATION

The study of this unit assumes that your pupils have learnt the concepts of fraction, decimal, ratio and proportion. Before introducing the idea of percent, the pupils may be given some revision exercises to ensure their readiness to learn per cent. The teacher may ask some introductory questions to assess the pupils' "readiness in terms of knowledge and understanding of these prerequisite concepts". Since the concept of percent is applied widely in business practices, the teachers should take extra care to see that students understand properly the language of percent, and develop proficiency in skills of computation and interpretation of results of such computations. The teacher should also see that these procedures grow out of a basic understanding of inherent relationships.

7.3.1 Definitions

Main Teaching Point : Difference between percent and percentage.

Teaching-Learning Process : Ask pupils to recall that common fractions can have any natural number as denominator. For example, the fractions $\frac{2}{3}$, $\frac{5}{8}$, $\frac{11}{12}$, $\frac{7}{13}$ and $\frac{23}{75}$ have the numbers 3, 8, 12, 13 and 75 as denominators.

Note : We do not have zero as denominator of a fraction because division by zero is not defined. Fractions which have powers of ten as denominator can be expressed as decimals much more easily as compared to other fractions.

Decimals such as 2, .05, 1.5, .253, and 2.3315 can be easily expressed as common fraction $\frac{2}{10}, \frac{5}{100}, \frac{15}{10}, \frac{253}{1000}$ and $\frac{23315}{10000}$

Let pupils observe that among these fractions (which have powers of ten as denominators) there are fractions with 100 as denominator. These form a special category and are called 'percents' Thus 5/100 or .05; 25/100 or .25 etc. can be expressed as 'per cent'

Percent is derived from the Latin word "percentum" which means "by the hundred". Thus the term "percent" means "hundredths". We use the symbol % to express a percent. 8% means 8 hundredths. The symbol % is derived from 010 which is a re-arrangement of the digits of the numeral 100.

Per cent, therefore, means "per hundred" or "out of one hundred". Thus 5% of a number is the same as 5/100 of it. The symbol % can be taken as part of the numeral and it indicates the hundredth fraction.

Percent is the expression of a ratio between two quantities or numbers, the second one being 100. The statement "56 percent of the total population of India are illiterate according to the 1991 census" gives the ratio of the number of persons in India who are illiterate to the total population of India according to the 1991 census

The number of persons who are illiterate in India bears the same relation to the total population of the country as 56 does to 100. Pose a problem

"Find 15 percent of the number 700"

In this problem, 15 percent or 15% is known as "**rate**", 700 is the "**base**" and the "**percentage**" is the number 105 resulting from the rate being multiplied by the base So,

$$15\% \text{ of } 700 = \frac{15}{100} \times 700 = 105$$

rate × base = percentage (i)

The teacher should give a few more examples of this type and ask the students to identify rate, base and percentage in each case. After this, the definitions of these terms may be summarized as follows:

a) The **rate** is the fraction whose denominator is 100, or it is the numeral along with the "%" symbol.

b) The **base** is the number to which the rate is applied to find a given percent of that number.

c) The **percentage** is the number that results after the rate has been applied to the base.

It is the responsibility of the teacher to make the pupils understand the relationship among these terms.

$rb = p$

where r = rate, b = base and p = percentage.

This relation can lead to two other relationships. The students may be asked to divide both sides of this equation by b : $rb/b = p/b$, which can be re-written as $r = p/b$. This leads to the generalization.

rate = percentage/base (ii)

Similarly, if we divide the equation rb=p by r, on both sides, we get

$rb/r = p/r$

or $b = p/r$

This leads to another generalization which can be stated as

base = percentage/rate (iii)

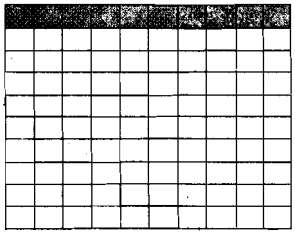
Methodology used : Mainly the lecture method is used with numerous illustrations.

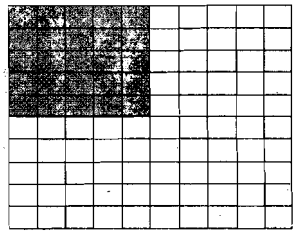
7.3.2 Introducing the Concept of Percent

Main Teaching Points : a) Percent as a fraction
b) Percent as a ratio

Teaching-Learning Process : Teachers often find it difficult to introduce the concept of percent because there are at least two different approaches to do so. These approaches are:
a) Percent as a fraction, and
b) Percent as a ratio

a) Percent as a fraction : This is the traditional approach to teaching the concept of percent to children in the elementary classes. To follow this approach, the teacher may devise a teaching aid called "hundredths board" This is a very useful and effective visual aid to clarify the concept of percent. This is simply a square divided into ten rows of ten squares each. This provides a "row by column" arrangement of 100 squares of the same size.





If the smaller squares can be turned over or twisted, their back faces being different in colour as compared to their face, then the cube becomes more effective and interesting. Each smaller square indicates 1% or 1/100 or one hundredth. The shaded region in the diagram shows 10% of the whole area enclosed within the larger square. In order to depict any percent of the total area the required number of smaller squares may be shaded. For example, if the teacher wants to depict 25%, then 25 smaller squares would have to be shaded as shown in the diagram.

The teacher should make it clear to the students that for depicting a given percent, for example 10%, which 10 smaller squares are shaded is immaterial. Even several truncated shaded regions can be combined to make 10 shaded smaller squares to depict 10 percent. The teacher should clarify to the students that if all 100 smaller squares are shaded, the shaded region will indicate 100% which equals the whole.

$$100\% = \frac{100}{100} = 1$$

Similarly, if 25 smaller squares are shaded it will indicate 25% which is one-fourth of the whole. This may be shown as

$$25\% = \frac{25}{100} = \frac{1}{4}$$

In the same way, several other fractions may be shown to be equal to corresponding percents and vice versa. For example,

$$10\% = \frac{10}{100} = \frac{1}{10}$$

$$50\% = \frac{50}{100} = \frac{1}{2}$$

$$75\% = \frac{75}{100} = \frac{3}{4}$$

The "hundredth board" is a very good device to exhibit the relationship between percents and corresponding fractions. It is better that the teachers have a large ten-by-ten square for class discussion and manipulation while pupils have their own smaller ten-by-ten squares to use individually. To begin with, the teacher should establish the meaning of the big ten-by-ten square and of each small square. It is essential for the pupils to understand clearly that, in this case, the big square represents the whole number 1, and each of the smaller squares represents 1 of the 100 equal parts of the whole. Once this has been established, the teacher may ask his students several questions related to it.

b) Percent as ratio : This approach requires that pupils are well versed in the concepts of ratio and proportion.

1. Have pupils realise that a percent can be used to express the ratio between two quantities.

   Pose a problem : Class VIII has 40 pupils in the class 32 of whom are present today What is the percent of attendance?

The ratio of those present to those enrolled in the class is $\frac{32}{40}$. This may be expressed as an equivalent fraction with denominator 100

$$\frac{32}{40} \times \frac{100}{100} = \frac{(32 \times 100)}{40} \times \frac{1}{100} = \frac{80}{100}$$

2. Have the pupils note that we are comparing the number of pupils present with the number of pupils enrolled in the register.

   The percent can also be found by the division method.

$$\begin{array}{r} .80 \\ 40\overline{)\,32.00} \\ \underline{320} \\ 00 \\ \underline{00} \end{array}$$

In the above example 32 is called the percentage and 40 is called the base. The ratio of percentage to the base is called the percent or rate

$$\frac{\text{Percentage}}{\text{base}} = \text{rate (or percent)}$$

This equation involves these quantities — percent, base and percentage. In a given problem situation, the pupils may be encouraged to identify which one of these three is unknown.

They may symbolize it as "x" and construct a simple algebraic equation and solve it for the unknown variable involved. There are three types of problems involving these concepts.

1. Finding a percent of a given number. For example, Find "15% of 600"

   Given : rate (percent) = 15

   base = 600

   To find : percentage = X (unknown)

   By the equation, $\frac{\text{Percentage}}{\text{base}}$ = rate (or percent)

   i.e. $\frac{X}{600} = 15\% = \frac{15}{100}$

   or $100 \times X = 15 \times 600$

   or $X = 15 \times \frac{600}{100}$

   or $X = 90$, which is the required percentage.

2. Finding what percent a given number is of another number Example "32 is what percent of 400 ?" The pupils should be guided to construct the equation

   $$\frac{X}{100} = \frac{32}{400}$$

   The solution involves the following steps.

   or $400\,X = 100 \times 32$

   $X = 100 \times \frac{32}{400}$

   $X = 8$ (which is the required percent)

3 Finding a number when a specified percentage of it is given "12% of a number is 108; find the number" This problem takes the following form:

   12% of X = 108

   $\therefore \frac{12}{100} = \frac{108}{X}$

   or $12\,X = 100 \times 108$

   $X = 100 \times \frac{108}{12}$

   $X = 900$, which is the required base.

The teacher should ensure that the teaching of these three types of problems is not done as a routine otherwise the pupils will develop a tendency to search for clues that enable them to identify the given problem as one of the types given above and proceed to solve it

mechanically without understanding. This procedure would defeat the purpose and spirit of problem solving Classification of problems as to types and solution by rote reduces the reasoning process which is not desirable. However, these types of problems occur so frequently that they deserve special attention

In order to stabilize understanding and encourage problem solving, the teacher should give the pupils some exercises based on these three types.

Methodology used : The lecture method is used with frequent use of visual aids such as "hundredths board" and other diagrams.

Check Your Progress

Notes : a) Write your answers in the space given below.

b) Compare your answers with those given at the end of the unit.

1. Find 6% of 500.

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2. What percent of 700 is 77 ?

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3. If 5% of a number is 15, what is the number ?

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4. Find $12\frac{1}{2}$ % of 800.

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7.4.3 Percent and Common Fractions

Main Teaching Point : Conversion of percent into common fraction.

Teaching-Learning Process : Let pupils recall that a fraction means

i) one or more of the equal parts of a whole unit. e.g., 2/3 indicates "two-thirds of something"

ii) one or more of the equal parts of a group of units, e.g 2/3 may indicate "10 out of a group of 15 units"

iii) a ratio, $\frac{2}{1}$ may indicate the ratio of the heights of two persons 110 cm and 165 cm tall respectively.

- Have pupils express percents as fractions with the denominator 100

$$5\% = \frac{5}{100} = \frac{1}{20}$$

$$15\% = \frac{15}{100} = \frac{3}{20}$$

$$25\% = \frac{25}{100} = \frac{1}{4}$$

$$60\% = \frac{60}{100} = \frac{3}{5}$$

$$85\% = \frac{85}{100} = \frac{17}{20}$$

Illustrate that each percent can be reduced to an equivalent fraction.

To convert a common fraction into percent we have to find an equivalent fraction with denominator 100.

The process can be illustrated with examples as follows:

$$\frac{7}{10} = \frac{7}{10} \times \frac{100}{100} = \frac{70}{100} = 70\%$$

$$\frac{3}{20} = \frac{3}{20} \times \frac{100}{100} = \frac{15}{100} = 15\%$$

Conversely, a percent may be converted into a common fraction by replacing % by $\frac{1}{100}$ and reducing the fraction to the lowest terms by dividing the numerator and denominator by their H.C.F.

$$65\% = \frac{65}{100} = (65/5) / (100/5) = \frac{13}{20}$$

$$45\% = \frac{45}{100} = (45/5) / (100/5) = \frac{9}{20}$$

$$40\% = \frac{40}{100} = (40/20) / (100/20) = \frac{2}{5}$$

Methodology used : The drill method with sufficient exercises for practice be used for developing the skill of conversion.

Check Your Progress

Notes : a) Write your answers in the space given below.

b) Compare your answers with those given at the end of the unit.

5. Change the following fractions to percents :

a) 3/4, b) 7/40, c) 3/200, d) 15/8

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6. Change the following percengts to equivalent fractions :

a) 15%, b) 35%, c) $37\frac{1}{2}\%$, d) 125%

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7. Fill in the blanks given below :

a) $\frac{1}{8} = -\%$, b) $\frac{3}{5} = -\%$, c) $\frac{5}{6} = -\%$, d) $\frac{3}{10} = \frac{\quad}{100}$, f) $\frac{2}{3} = \frac{\quad}{100}$

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7.3.4 Percent and Decimal Fractions

Main Teaching Point : Conversion of percent into decimal fraction.

Teaching-Learning Process : Ask pupils to recall that percent is a fraction with the denominator 100, i.e, it is a "hundredth" fraction. The sign % is an abbreviation for the

operation of multiplying by 1/100. Thus,

4%, 16%, 27%, 33%, 57%, 73%, 96% may be easily written as

$\frac{4}{100}, \frac{16}{100}, \frac{27}{100}, \frac{33}{100}, \frac{57}{100}, \frac{73}{100}, \frac{96}{100}$

In decimal form these fractions may be written as

0.04, 0.16, 0.27, 0.33, 0.57, 0.73, 0.96

Students will find it difficult to convert when the given percents are less than 1% and more than 100%. For example, the percents $\frac{1}{2}$ %, $\frac{2}{5}$ %, $\frac{1}{8}$ %, $\frac{5}{8}$ % are all less than 1%. By definition these may be written as

(1/2)/100, (2/5)/100, (1/8)/100, (5/8)/100

By converting the common fractions in the numerators to decimal fractions, we have

0.5/100, 0.4/100, .125/100, .625/100

Now, by moving the decimal point two places to the left, we get,

0.005, 0.004, 0.00125, 0.00625

As a result of this process, we have

$\frac{1}{2}$ %, = .005, $\frac{2}{5}$ % = 0.004, $\frac{1}{8}$ % = 0.00125, $\frac{5}{8}$ % = 0.00625

By a similar method, percents greater than 100 can also be converted into decimal fractions. For example, let us consider the conversion of 125% into a decimal fraction.

We have $125\% = \frac{125}{100} = 1.25$

Similarly,

$127.5\% = \frac{127.5}{100} = 1.275$

$262.5\% = \frac{262.5}{100} = 2.625$

Conversion of decimal fraction into percent may be explained by examples such as

$0.68 = \frac{68}{100} = 68\%$

$0.73 = \frac{73}{100} = 73\%$

$2.33 = \frac{233}{100} = 233\%$

$0.245 = \frac{245}{1000} = \frac{245}{10} \times \frac{1}{100} = 24.5\%$

After learning to convert certain decimal fractions to percents, and percents to decimal fractions, the pupils should be directed to discover the general rules :

1. To change a percent to a decimal fraction, remove the percent sign and move the decimal point two places to the left.
2. To change a decimal fraction to percent move the decimal point two places to the right and remove the percent sign.
3. To change a percent to a common fraction, first change the percent to common fraction with the denominator 100, and then reduce this common fraction, if possible.
4. To change a common fraction to a percent, first change the common fraction to a decimal fraction and then change the decimal fraction to percent by rule 2 above.

Methodology used : The drill method with sufficient exercises for practice be used to develop the skill of conversion.

Check Your Progress

Notes : a) Write your answers in the space given below.

b) Compare your answers with those given at the end of the unit.

8. Change the following common fractions to percents:

a) $\frac{4}{5}$, b) $\frac{5}{6}$

9. Change the following percents to decimal fractions:

a) 25%, b) $16\frac{2}{5}\%$

10. Change the following decimal fractions to percents:

a) 0.374, b) 0.02

7.4 APPLICATIONS OF PERCENT

Percents are very widely used in our daily life. The teacher may draw the attention of students to newspaper reports about growth in the economy, literacy rates, school dropout rates, population increase and decrease in production and consumption, etc., which are expressed in percents. This would help the pupils understand and appreciate the applicability of percent in their social life and would motivate them to learn more about it. Although the concept of percent is applicable to all kinds of problems in commercial mathematics, the topics such as profit-loss, discount, commission, and brokerage have a special place in the curriculum. These are discussed here.

7.4.1 Profit and Loss

Main Teaching Points :

a) To find profit/loss percent.

b) To find cost price when selling price and profit (or loss) percent is given.

Teaching-Learning Process : For children studying in class IX and X, the concepts of profit and loss are not new. They have already learnt these concepts in elementary classes and solved simple problems. At the secondary level, these concepts are used to solve some more advanced problems. As the first step, the teacher should ensure that the pupils are fully acquainted with the basic terminology associated with this topic. There are a few key terms such as cost price, selling price, net profit, net loss, and profit/loss percent which need to be understood by the pupils.

The net amount for which an article is bought by someone is known as its **cost price.** For example, if a dealer buys a radio set for Rs. 750, then this amount is called the cost price of the radio. Suppose, the dealer sells the radio set to a **customer** for Rs. 900; this amount is the **selling price** of the radio for the dealer.

The teacher, at this point, should clarify to the students that Rs. 900 is the cost price of the radio for the customer who bought it from the dealer. The net amount which the dealer

received from the customer in excess of his cost price is known as his **net profit** or simply profit. In this case the profit of the dealer may be computed as follows:

Cost price of the radio = Rs. 750

Selling price of the radio = Rs. 900

Profit = Rs. 900 – Rs. 750 = Rs. 150

This shows that the dealer earned a profit of Rs. 150. His total investment was Rs. 750 on which he earned a profit of Rs. 150. It would be interesting and useful to calculate his profit as percent of his investment. The problem now reduces to a simple problem in comparing one quantity (Rs. 150) with another (Rs. 750) in terms of percent. The conditions of the problem may be written as

$$\frac{150}{750} = \frac{X}{100}$$, where X is profit percent

or $750\,X = 150 \times 100$

$$X = 150 \times \frac{100}{750} = 20$$

In can be said that the dealer's profit is 20 percent (20%).

The students should understand that profit is "Rs. 20 per Rs. 100 of cost price". Sometimes, students mistakenly calculate profit percent taking the selling price (here Rs. 900) as the base. The teacher should ensure that such a confusion is avoided. **The profit is calculated on the cost price.**

Had the dealer sold the radio for Rs. 675, he would have lost Rs. 75 in this deal. If the selling price is less than the cost price, we say that there has been a loss. The difference between selling price and cost price in this case is known as **net loss** or simply loss. The loss of the dealer may be computed as follows:

Cost price of the radio = Rs. 750

Selling price of the radio = Rs. 675

Loss = Rs. 750 – Rs. 675 = Rs. 75

If it is desired to find loss per 100 rupees on cost price, or loss percent, the problem may be written as

$$\frac{75}{750} = \frac{x}{100}$$, where x is the loss percent

or $750\,x = 100 \times 75$

$$x = 100 \times \frac{75}{750} = 10$$

It can be said that the dealer's loss is 10%

Students may be provided sufficient practice in analysing problems and discovering the following rules.

1. Profit = selling price – cost price
2. Loss = cost price – selling price
3. Profit percent = (net profit/cost price) × 100
4. Loss percent = (net loss/cost price) × 100

Example : By selling an article for Rs. 4,500 a trader losses 10%. Find the cost price of the article

Solution : While teaching the solution of this problem, the teacher should ask the students questions regarding the data given in the problem and the conditions imposed. The students should be made to understand that 10% loss means that for every

100 rupees of the cost price, the selling price is 90 rupees, or it can be said that

$$\text{cost price/selling price} = \frac{100}{90}$$

In the given problem the selling price is given as Rs. 4,500 and the cost price is required to be computed. Let the cost price be x, then the problem reduces itself to

$$\frac{x}{4500} = \frac{100}{90}$$

or $90x = 4500 \times 100$

or $x = \frac{4500 \times 100}{90} = 5000$

Therefore, the cost price of the article was Rs. 5,000.

Example : A fruit vendor buys oranges at the rate of 8 oranges for Rs. 7, and sells them at the rate of 7 oranges for Rs. 8. Find his profit or loss percent.

Solution : This problem may also be solved in several different ways. The students should be able to understand that the problem would become easier if the number of oranges used in the deal is such that it is a multiple of both 7 and 8. The best thing would be to assume the number of oranges involved in the transaction to be 56 which is the L.C.M. of 7 and 8. We have selected the number because it is divisible by both 7 and 8. Now

Cost price of 56 oranges $= \frac{56}{8} \times 7 = 49$ rupees

Selling price of 56 oranges $= \frac{56}{7} \times 8 = 64$ rupees

Profit $= 64 - 49 = 15$ rupees.

Now let the profit percent be x, then

$$\frac{15}{49} = \frac{x}{100}$$

$$49x = 15 \times 100$$

or $$x = 15 \times \frac{100}{49} = 30.61\%$$

The teacher should give the students a few exercises as home work. The exercises should constitute various types of problems.

Methodology used : The lecture-cum-discussion method is used. It is advisable to use the Heuristic method while solving word problems.

Check Your Progress

Notes : a) Write your answers in the space given below.

b) Compare your answers with those given at the end of the unit.

11. A merchant bought a cycle for Rs. 375 and sold it for Rs. 420. Find his profit or loss percent.

12. A man sold a transistor for Rs. 800 and lost 20%. Find the cost price of the transistor.

13. A car was sold for Rs. 75,000 at a 10% loss. Had it been sold for Rs. 90,000 what would have been the profit percent?

14. A fruit vendor bought bananas at the rate of 11 for Rs. 10 and sold them at the rate of 10 bananas for Rs 11. Find the profit percent.

7.4.2 Commission

Main Teaching Point : To calculate the commission and the commission rate.

Teaching-Learning Process : It is expected that your students know that land and some other kinds of property are purchased or sold through a mediator who is neither the buyer nor the seller. He simply helps the seller and/or buyer finalize the deal. Such a mediator is known as an agent. But the mediator does his job for a price which is a percent of the total amount involved in the deal. This "price" is known as "commission", and the per cent associated with it is known as "commission rate". For example, in a big firm, salesmen often sell goods and receive a commission from the proprietor of the firm. Similarly, insurance companies appoint agents who are paid a commission on the premia of the policies sold by him/her. If a cloth merchant proposes to pay a 5% commission to his salesman, a salesman selling cloth worth Rs. 2,000 on a particular day will get 5% of Rs. 2,000 as commission. In this case the amount of commission would be Rs. 2000 × 5/100 = Rs. 100.

Commission = rate × sale value of the goods sold.

Three kinds of problems may be asked on commission.

i) Given the rate of commission and the sale value of goods, the pupils may be required to find the amount of commission.

ii) Given the sale value of goods sold and the amount of commission, the pupils may be required to find the rate of commission.

iii) Given the commission rate and amount of commission the pupils may be required to find the sale value of the goods sold.

As in the case of percent, these three quantities satisfy the following relation.

Commission = rate × sale value of the goods sold

(percentage) (rate) (base)

Once you are able to relate the problems of commission to the problems of percent and percentage, the teaching of this topic will not pose problems.

Example : A salesman sells goods worth Rs. 2,500 and charges commission at the rate 6%. Find the amount of his commission.

Solution : Here, the pupils should be made to understand that rate of commission = 6%, sale value of goods = Rs. 2,500 then, commission = rate × sale value of goods.

$$= \frac{6}{100} \times 2500 = \text{Rs. } 150$$

Alternatively, the problem takes the form

$\frac{x}{2500} = \frac{6}{100}$, where x is the amount of commission

or $100\,x = 6 \times 2{,}500$

$x = 6 \times 2{,}500/100 = \text{Rs. } 150$

After providing sufficient understanding and practice in solving such problems, you may give your students some problems as assignment.

Methodology used : The lecture-cum-discussion method is used. It is always better to use the Heuristic method while solving word problems.

Check Your Progress

Notes : a) Write your answers in the space given below.

b) Compare your answers with those given at the end of the unit

15. A salesman's commission rate is 7.5%. He sells goods worth Rs. 3,700. How much commission does he receive?

16. A salesman sells goods worth Rs. 5,500. He receives Rs. 165 as commission. Find the rate of his commission.

17. The commission rate of a salesman is 5%. He receives Rs. 375 as commission on a particular day. Find the sale value of the goods sold by him.

7.4.3 Discount

Main Teaching Point : To calculate discount and discount rate

Teaching-Learning Process : The teacher should, as a first step, illustrate with daily life examples the concept of discount and its wide applications. Then they should be made to understand what discount means. Pupils must have observed in daily life that if a customer buys a large amount of goods, the shopkeeper offers some concession in terms of some percent of the marked price or list price. The concession or rebate percent is known as **discount rate**, and the net amount of concession is known as **discount**. As a result of the discount the customer gets the article for a reduced price, the price which is less than its list price. The amount paid by the customer after discount is known as **discounted price or sale price**. For example, if the list price of a T.V. set is Rs. 14,000 and a special festival discount is allowed at the rate of 15%, the discounted price (or cash price) can be computed as follows:

List price of the T.V. set = Rs. 14,000

Festival discount rate = 15%

Amount of discount = Rs. 14,000 $\times \frac{15}{100}$ = Rs 2100

Cash price = Rs. 14,000 – Rs. 2,100 = Rs 11,900

So, the customer will get the T.V. set for Rs 11,900

Sometimes, in addition to the discount allowed to all the good customers (or every customer), a further discount is allowed for paying the price in cash or within a specified short period. Such an additional discount is known as **cash discount**. For example if in the above sale of a T.V. set, in addition to the 15% discount during the festival season a further 5% discount is allowed if the customer pays the price in cash on the spot, there are two successive discounts of 15% and 5%. After the 15% discount the price payable is Rs. 11,900. The amount of cash discount will be (11,900 × 5/100 = Rs 595 which will be further subtracted from the payable price. The net price payable (after two successive discounts) can be computed as follows:

Rs. 11,900 – Rs. 595 = Rs. 11,305

So, the customer will have to pay Rs. 11,305 for the T.V. set against the list price of Rs. 14,000.

The topic on discount involves several types of problems. A few of these are explained with the help of examples given below

Example : A scooter is sold for Rs 17,500 less a discount of 10%. Find the cash price of the scooter

Solution : The selling price of the scooter = Rs 17,500

Discount rate = 10%

Amount of discount = Rs. 17,500 × $\frac{10}{100}$ = Rs. 1750

Cash price = Rs. 17,500 – Rs. 1,750 = Rs 15,750

Alternatively, the problem may be formulated as follows:

Discount = 10%

Therefore if the marked price = Rs. 100 the sale price = Rs. 90.

⇒ the sale price = 90% of the marked price

X/17,500 = $\frac{90}{100}$ where X is cash price

100 X = 90 × 17500

X = 90 × 17,500/100 = 15,750

Example : A washing machine is sold at successive discounts of 10% and 2%. If the list price of the machine is Rs. 3,500 find the cash price.

Solution : Let the selling price after first discount be x. Then

$\frac{x}{3500} = \frac{90}{100}$

or $100 x = 90 \times 3500$

$x = 90 \times 3,500/100$ = Rs. 3,150

Now, suppose the cash price after the second discount is y. Then

$\frac{y}{3150} = \frac{98}{100}$

$100y = 98 \times 3,150$

$y = 98 \times \frac{3150}{100}$ = Rs. 3,087

Example : One dealer offers two successive discounts of 10% and 5%, and another dealer offers a single discount of 15%. Which deal is more beneficial to the customer?

Solution : Let the list price of the article be Rs. 100. The first dealer offers two successive discounts and so the selling price after first discount of 10% = Rs. 90.

The selling price after the second discount of 5% = Rs. 90 – 5% of Rs. 90 = Rs. 90 – Rs. 4.50 = Rs. 85.50

The second dealer offers a single discount of 15%. Therefore, the cash price = Rs. 100 – 15% of 100

$$= \text{Rs. } 100 - \frac{15}{100} \times 100$$

= Rs. 100 – Rs. 15 = Rs. 85

So, the customer will have to pay Rs. 85.50 to the first dealer and Rs. 85 to the second dealer for the same article, whose list price is Rs. 100. Therefore, the second dealer's offer of a single discount of 15% is more beneficial to the customer.

Methodology used : To introduce the concept, a discussion is used. Then a Heuristic approach is used to solve word problems.

Check Your Progress

Notes : a) Write your answers in the space given below.

b) Compare your answers with those given at the end of the unit.

18. A car is sold for Rs. 75,000, but a cash discount of 15% is given. Find the cash price of the car.

19. The list price of a watch is Rs. 800, but the dealer offers successive discounts of 12% and 4%. Find the cash price of the watch.

20 Calculate the single discount equivalent for successive discounts of 9% and 3%.

7.4.4 Brokerage

Main Teaching Point : To calculate brokerage.

Teaching-Learning Process : In certain kind of property deals, the agents charge a commission from both the parties, the buyer and the seller. This type of commission is known as "brokerage", and the agent who acts as a mediator and charges a commission from both the parties is known as a "broker". For example, suppose a man wants to sell a building and another man wants to buy that building. If the deal has been finalized through a broker (a property dealer) for Rs. 2,75,000, and the brokerage is 2%, then the broker will get 2% of Rs. 2,75,000 from the buyer and an equal amount from the seller. So he will get 4% of Rs. 2,75,000 as brokerage. The amount of brokerage will be

$$\frac{4}{100} \times 2{,}75{,}000 = \text{Rs. } 11{,}000$$

The teacher may clarify the procedure with the help of examples such as the one given below:

Example : A person sells a motor car through a broker for Rs. 55,000. If the brokerage is 2%, find the net selling price of the seller and the total brokerage of the broker

Solution : The selling price of the motor car = Rs. 55,000

Rate of brokerage = 2%

Amount of brokerage from the seller $= \frac{2}{100} \times 55000$

$= $ Rs. 1,100

The net selling price of the motor car = Rs. 55,000 – Rs. 1,100

= Rs. 53,900

Total brokerage received by the broker $= 2 \times 1100$

= Rs. 2,200

The teacher should make it clear to the pupils that the broker will charge brokerage from the buyer of the motor car also.

Methodology used : The Heuristic method is used to solve the word problems. Initially, the topic may be introduced through the lecture-cum-discussion method.

Check Your Progress

Notes : a) Write your answers in the space given below.

b) Compare your answers with those given at the end of the unit.

21. A broker finalizes the deal of a piece of land for Rs. 1,25,000 at 1% brokerage. Find the total amount of brokerage received by him in the deal.

22. A broker received Rs. 1,650 as brokerage in a deal for a house. If the rate of brokerage is 1.5%, find the selling price of the house.

7.5 LET US SUM UP

This unit deals with the methods of teaching various concepts and skills associated with per cent, including computation of base, rate and percentage when necessary data are given. The unit also presents the approaches to convert common fractions and decimal fractions to percents and vice versa. For the benefit of teachers, some general rules have also been summarized for this purpose. Besides, the unit provides a detailed discussion of the application of the concept of per cent to practical problems related to profit and loss, commission, discounts, and brokerage. This unit provides you with the necessary foundation for teaching certain other concepts in commercial arithmetic such as simple and compound interest, stocks and shares, taxes and banking. Methods of teaching commercial mathematics will be dealt with in a subsequent unit.

7.6 UNIT-END ACTIVITIES

1. Take a suitable problem from class IX arithmetic which involves application of percent and percentage, and apply the approaches of teaching that you have studied in this unit.
2. Take a business magazine in your class and show your students reports and advertisements providing important pieces of information in terms of percentages and percents.
3. Take your students to the market and show them cash memos and receipts recording commission and discount. Also take them to a property dealer's shop and let them have a first hand experience of his functioning.
4. Ask the students to collect at least 5 receipts/records of transaction where percent has been applied.
5. Ask the students to record the number of absentees in their class and make a chart of the percent of absentees for a month.

7.7 ANSWERS TO CHECK YOUR PROGRESS

1. 30
2. 11%
3. 300
4. 100
5. a) 75%
   b) 17.5%
   c) $1\frac{1}{2}$ %
   d) 187.5%
6. a) 3/20
   b) 7/20
   c) 3/8
   d) 5/4
7. a) $12\frac{1}{2}$% b) 60% c) $83\frac{2}{3}$% d) 30 e) 8.33 f) 66.66
8. a) 80% b) $83\frac{2}{3}$ %
9. a) 0.25 b) 0.164
10. a) 37.4% b) 2%
11. Profit = 12%
12. C.P. = Rs. 1,000/-
13. Profit = 8%
14. 21%
15. Rs. 277.50
16. 3%
17. Rs. 7,500/-
18. Rs. 73,875/-
19. Rs. 675.84
20. 11.73%
21. Rs. 2,500/-
22. Rs. 55,000/-

7.8 SUGGESTED READINGS

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