

PERCENTAGE

9.1 PERCENT

Per means '*for every*' or '*out of*', and **cent** means '*hundred*.' Thus, **percent** means '*for every hundred*' or '*out of hundred*.'

For example :

If in an examination for 100 marks, Geeta secured 83 marks; that means Geeta scored 83 percent marks.

Conversely, if in the same examination, Rohit secured 67 percent marks that means Rohit has got 67 marks out of 100.

The symbol for percent is %.

9.2 PERCENTAGE

Percentage is the numerator of a fraction with denominator 100.

For example : $60 \text{ out of } 100 = \frac{60}{100}$ As fraction with denominator 100
 $= 60 \text{ as percentage, written as } 60\%.$

Thus, when a fraction is so expressed that its **denominator is 100**, the corresponding **numerator is** called **percentage**.

$$\therefore \text{(i) } \frac{3}{100} = 3\% \quad \text{(ii) } \frac{7}{50} = \frac{7 \times 2}{50 \times 2} = \frac{14}{100} = 14\% \text{ and so on}$$

In fact, we do not follow any difference between percent and percentage strictly.

Example 1 :

Express each of the following statements in the percentage form :

- (i) 5 out of 20 eggs are bad.
- (ii) 3 children in a class of 30 are absent.

Solution :

(i) 5 out of 20 eggs are bad means $\frac{5}{20}$

$$\text{And } \frac{5}{20} = \frac{5 \times 5}{20 \times 5} = \frac{25}{100} = 25\% \therefore \text{25\% eggs are bad. (Ans.)}$$

(ii) 3 children out of 30 are absent is written as $\frac{3}{30}$

$$\text{And } \frac{3}{30} = \frac{1}{10} = \frac{10}{100} = 10\% \therefore \text{10\% children are absent. (Ans.)}$$

9.3 CONVERTING A GIVEN FRACTION OR DECIMAL INTO PERCENTAGE (PERCENT FORM) :

Multiply the given fraction or decimal by 100 and at the same time write the sign of percentage.

For example :

$$(i) \quad \frac{3}{4} = \frac{3}{4} \times 100\% = 75\% \quad (ii) \quad 0.225 = 0.225 \times 100\% = 22.5\% \quad \text{and so on.}$$

In example 1 given above :

$$(i) \quad \text{5 out of 20 are bad} = \frac{5}{20} \text{ eggs are bad} = \frac{5}{20} \times 100\% \text{ eggs are bad} \\ = \text{25\% eggs are bad.}$$

$$(ii) \quad \text{3 children in a class of 30 are absent} = \frac{3}{30} \text{ children are absent} \\ = \frac{3}{30} \times 100\% \text{ children are absent} \\ = \text{10\% children are absent}$$

9.4 CONVERTING A GIVEN PERCENTAGE INTO A FRACTION OR DECIMAL:

Remove the sign of percentage and at the same time divide by 100. Then reduce the resulting fraction obtained to its lowest terms or decimal as required.

For example :

$$(i) \quad \text{25\%} = \frac{25}{100} = \frac{1}{4} \text{ or, } 25\% = \frac{25}{100} = \text{0.25}$$

$$(ii) \quad \text{37.5\%} = \frac{37.5}{100} = \frac{375}{100 \times 10} = \frac{3}{8} \text{ or, } 37.5\% = \frac{37.5}{100} = \text{0.375} \text{ and so on.}$$

When a whole number is divided by 100, decimal point is placed just after two digits from the right. But when a decimal number is divided by 100, the decimal point is shifted two places to the left.

EXERCISE 9(A)

1. Express each of the following statements in percentage form :

(i) 13 out of 20

(ii) 21 eggs out of 30 are good

2. Express the following fractions as percent :

(i) $\frac{3}{200}$

(ii) $\frac{5}{6}$

(iii) $\frac{65}{80}$

(iv) $\frac{2}{3}$

3. Express as percent :

(i) 0.10

(ii) 0.02

(iii) 0.7

(iv) 0.15

(v) 0.032

4. Convert into fractions in their lowest terms :

(i) 8%

(ii) 20%

(iii) 85%

(iv) 250%

(v) $12\frac{1}{2}\%$

5. Express as decimal fractions :

(i) 25%

(ii) 108%

(iii) 95%

(iv) 4.5%

(v) 29.2%

6. Express each of the following numbers as percent :

(i) 7

(ii) 2

(iii) 19.5

(iv) 5.37

9.5 EXPRESSING ONE QUANTITY (NUMBER) AS A PERCENTAGE OF THE OTHER :

Divide the first quantity by the second one and at the same time multiply the result by 100%.

For example :

(i) **20 kg as a percentage of 200 kg** = $\frac{20}{200} \times 100\% = 10\%$

(ii) **60 paise as a percent of ₹ 3** = 60 paise as a percent of 300 paise
= $\frac{60}{300} \times 100\% = 20\%$

1. Percent / percentage has no unit.
2. In order to express one quantity as a percentage of another quantity, the two quantities must have the same unit.

9.6 FINDING PERCENTAGE (PERCENT) OF A GIVEN QUANTITY :

Express the given percent as fraction and multiply by the given number.

For example :

25% of ₹ 500 = $\frac{25}{100} \times ₹ 500 = ₹ 125$ and **30% of 400** = $\frac{30}{100} \times 400 = 120$

Example 2 :

In a class of 50 students, 40% are girls. Find the number of girls and number of boys in the class.

Solution :

No. of girls in the class = 40% of 50 = $\frac{40}{100} \times 50 = 20$ (Ans.)

No. of boys in the class = 50 - 20 = 30 (Ans.)

Alternative method :

When a class has 40% girls, it has (100 - 40)% boys, i.e. 60% boys.

∴ **No. of girls** = 40% of 50 = $\frac{40}{100} \times 50 = 20$

and **no. of boys** = 60% of 50 = $\frac{60}{100} \times 50 = 30$ (Ans.)

Example 3 :

A girl scored 60 out of 75 in English, 60 out of 90 in Mathematics, and 80 out of 100 in Science. Find girl's score as percentage :

- (i) in Mathematics (ii) in all the three subjects (as a whole)

Solution :

(i) **Percentage score in Mathematics**

= 60 out of 90 = $\frac{60}{90} \times 100\% = \frac{200}{3}\% = 66\frac{2}{3}\%$ (Ans.)

- (ii) Sum of the maximum marks of all the three subjects = 75 + 90 + 100 = 265
and total score in the three subjects = 60 + 60 + 80 = 200

∴ **Percentage score as a whole** = $\frac{200}{265} \times 100\% = 75\frac{25}{53}\%$ (Ans.)

Example 4 :

300 students appeared in an examination. Of these students, 28% got first division, 54% got second division and the remaining just passed. Assuming that no student failed, find the number of students who just passed.

Solution :

$\therefore$ Number of students with first division = 28% of 300

$$= \frac{28}{100} \times 300 = 84$$

And the number of students with second division = 54% of 300

$$= \frac{54}{100} \times 300 = 162$$

$\therefore$ The number of students who just passed = $300 - (84 + 162) = 54$ (Ans.)

Alternative method :

Since the percentage of first divisioners = 28%

and the percentage of second divisioners = 54%

$\therefore$ The percentage of those who just passed = $(100 - 28 - 54)\%$

$$= (100 - 82)\% = 18\%$$

$\Rightarrow$ The number of those who just passed = 18% of 300

$$= \frac{18}{100} \times 300 = 54 \quad (\text{Ans.})$$

EXERCISE 9(B)

1. Express :

(i) ₹ 5 as a percentage of ₹ 25.

(ii) 80 paise as a percent of ₹ 4.

(iii) 700 gm as a percentage of 2.8 kg.

(iv) 90 cm as a percent of 4.5 m.

2. Express the first quantity as a percent of the second :

(i) 40 p, ₹ 2

(ii) 500 gm, 6 kg

(iii) 42 seconds, 6 minutes.

3. Find the value of each of the following :

(i) 20% of ₹ 150

(ii) 90% of 130

(iii) 15% of 2 minutes

(iv) 7.5% of 500 kg.

4. If a man spends 70% of his income, what percent does he save ?

5. A girl gets 65 marks out of 80. What percent marks does she get ?

6. A class contains 25 children, of which 6 are girls. What percentage of the class are the boys ?

7. A tin contains 20 litres of petrol. Due to leakage, 3 litres of petrol is lost. What percent is still present in the tin ?

8. An alloy of copper and zinc contains 45% copper; the rest is zinc. Find the weight of zinc in 20 kg of the alloy.

9. A boy got 60 out of 80 in Hindi, 75 out of 100 in English, and 65 out of 70 in Arithmetic. In which subject is his percentage of marks the best ? Also find his overall percentage.

10. In a camp, there were 500 soldiers, 60 more soldiers joined them. What percent of the earlier (original) number have joined the camp.
11. In a plot of ground of area 6000 sq.m, only 4500 sq.m is allowed for construction. What percent is to be left without construction ?
12. Mr. Sharma has a monthly salary of ₹ 8,000. If he spends ₹ 6,400 every month; find:
 - (i) his monthly expenditure as percent.
 - (ii) his monthly savings as percent.
13. The monthly salary of Rohit is ₹ 24,000. If his salary increases by 12%, find his new monthly salary.
14. In a sale, the price of an article is reduced by 30%. If the original price of the article is ₹ 1,800, find :
 - (i) the reduction in the price of the article
 - (ii) reduced price of the article.
15. Evaluate :
 - (i) 30% of 200 + 20% of 450 – 25% of 600
 - (ii) 10% of ₹ 450 – 12% of ₹ 500 + 8% of ₹ 500.

9.7 TO FIND THE INCREASE OR DECREASE IN PERCENT :

$$\text{Increase \%} = \frac{\text{Increase in value}}{\text{Original value}} \times 100\%$$

$$\text{and decrease \%} = \frac{\text{Decrease in value}}{\text{Original value}} \times 100\%$$

For example :

- (i) If the price of milk increases from ₹ 24 per litre to ₹ 32.40 per litre,
Increase in price = ₹ 32.40 – ₹ 24 = ₹ 8.40

$$\text{and increase \%} = \frac{\text{Increase in price}}{\text{Original price}} \times 100\% = \frac{\text{₹ } 8.40}{\text{₹ } 24} \times 100\% = 35\%.$$

- (ii) If the price of sugar decreases from ₹ 40 per kg to ₹ 32 per kg,
Decrease in price = ₹ 40 – ₹ 32 = ₹ 8

$$\text{and decrease \%} = \frac{\text{Decrease}}{\text{Original}} \times 100\% = \frac{8}{40} \times 100\% = 20\%.$$

Example 5 :

- (i) 70 is increased by 40%. Find the increased number.
- (ii) The cost of an article is decreased by 15%. If the original cost is ₹ 80, find the decreased cost.

Solution :

- (i) Since original number = 70

$$\text{And increase in it} = 40\% \text{ of } 70 = \frac{40}{100} \times 70 = 28$$

$$\therefore \text{Increased number} = 70 + 28 = 98 \quad (\text{Ans.})$$

(ii) Since the original cost = ₹ 80

And decrease in it = 15% of ₹ 80 = $\frac{15}{100} \times ₹ 80 = ₹ 12$

∴ **Decreased cost** = ₹ 80 – ₹ 12 = **₹ 68** (Ans.)

Example 6 :

Out of ₹ 36,000, two-fifth were kept in a bank. Of the remaining money, 40% is spent on food and 15% on rent. Find how much money is spent on food and how much on rent ?

Solution :

∴ Money kept in bank = $\frac{2}{5} \times ₹ 36,000 = ₹ 14,400$

∴ Remaining money = ₹ 36,000 – ₹ 14,400 = ₹ 21,600

Now, **money spent on food** = 40% of ₹ 21,600

= $\frac{40}{100} \times ₹ 21,600 = ₹ 8,640$ (Ans.)

And **money spent on rent** = 15% of ₹ 21,600

= $\frac{15}{100} \times ₹ 21,600 = ₹ 3,240$ (Ans.)

9.8 PROBLEMS RELATED TO ENVIRONMENT

Example 7 :

Most of the water on the earth is salty, i.e. unfit for drinking. Only 2.7% of the available water (by volume) is fresh. Find :

- the percentage of water on the earth that is unfit for drinking.
- out of 5,00,000 m³ of water (taken from different parts of the earth and mixed together), what amount of water is fit for drinking.

Solution :

- Since, 2.7% of the available water is fit for drinking

∴ **The percentage of water unfit for drinking**

= (100 – 2.7)% = **97.3%** (Ans.)

- Quantity of water fit for drinking**

= 2.7% of the water taken

= $\frac{2.7}{100} \times 5,00,000 \text{ m}^3 = \mathbf{13,500 \text{ m}^3}$ (Ans.)

EXERCISE 9(C)

- The price of rice rises from ₹ 30 per kg to ₹ 36 per kg. Find the percentage rise in the price of rice.
- The population of a small locality was 4000 in 1979 and 4500 in 1981. By what percent had the population increased ?
- The price of a scooter was ₹ 8,000 in 1975. It came down to ₹ 6,000 in 1980. By what percent had the price of the scooter come down ?

4. Find the resulting quantity when :
 - (i) ₹ 400 is decreased by 8%.
 - (ii) 25 km is increased by 5%.
 - (iii) a speed of 600 kmh^{-1} is increased by $12\frac{1}{2}\%$.
 - (iv) there is 2.5% increase in a salary of ₹ 62,500.
5. The population of a village decreased by 12%. If the original population was 25,000, find the population after the decrease ?
6. Out of a salary of ₹ 13,500, I keep one-third as savings. Of the remaining money, I spend 50% on food and 20% on house rent. How much do I spend on food and house rent ?
7. A tank can hold 50 litres of water. At present it is only 30% full. How many litres of water shall I put into the tank so that it becomes 50% full ?
8. In an election, there are a total of 80,000 voters and two candidates, A and B. 80% of the voters go to the polls, out of which 60% vote for A. How many votes does B get ?
9. 70% of our body weight is made up of water. Find the weight of water in the body of a person whose body weight is 56 kg.
10. Only one-fifth of water is available in liquid form. This limited amount of water is replenished and used by man recurrently. Express this information as percent, showing :
 - (i) water available in liquid form.
 - (ii) water available in frozen form.
11. By weight, 90% of tomato and 78% of potato is water. Find :
 - (i) the weight of water in 25 kg of tomato.
 - (ii) the total quantity, by weight, of water in 90 kg of potato and 30 kg of tomato.

Revision Exercise (Chapter 9)

1. Rohit's age is 12 years and Geeta's age is 15 years. Express :
 - (i) Rohit's age as a percent of Geeta's age.
 - (ii) Geeta's age as a percent of Rohit's age.
2. A class has 30 boys and 20 girls. Find :
 - (i) the percentage of girls in the class.
 - (ii) the percentage of boys in the class.
 - (iii) percentage of number of boys as compared with number of girls.
3. Mrs. Sharma went to the market with ₹ 800 in her purse. When she returned to her home, ₹ 240 were still left in her purse. What percent of her money did she spend in the market ?
4. In a mixture of two liquids A and B, 35% is liquid B. If the total quantity of the mixture is 20 kg, find the quantity of A by weight.
5. A girl got 375 marks out of 500 in the first term examination, 560 marks out of 800 in the second term examination, and 840 marks out of 1200 in the third term examination. Find :
 - (i) her percentage score in the first term examination.
 - (ii) her percentage score in the second term examination.
 - (iii) her percentage score in the third term examination.
 - (iv) the total marks secured in all the three examinations.

- (v) the total marks scored in all the three examinations.
- (vi) her percentage score on the whole in all the three examinations.
6. Out of his monthly income of ₹ 2,500, a man spends ₹ 1,750. What percent of his income does he save every month ?
7. Mr. Singh's monthly salary is ₹ 15,000. This month he was promoted with an increment of ₹ 3,000 in his salary. Express his increment as a percent of his original salary.
8. (i) The price of an article increased from ₹ 16 to ₹ 20; find the percentage increase.
(ii) The price of an article decreased from ₹ 20 to ₹ 16; find the percentage decrease.
9. (i) The salary of a man is ₹ 7,200 per month, which is now increased by 8%. Find his new salary per month.
(ii) The salary of Mr. Sahni is ₹. 8,400 per month, which is now decreased by 5%. Find his new salary per month.
10. Find the percentage change from the first quantity to the second :
(i) ₹ 80, ₹ 120 (ii) 75 kg, 60 kg (iii) 50 cm, 45 cm
11. The original price of an article is ₹ 640. Find its new price when its price is :
(i) increased by 30% (ii) decreased by 20%
12. Find the number that is :
(i) 50% more than 48 (ii) 30% less than 70.
13. Evaluate : (i) 8% of 900 – 12% of 750 + 20% of 165.
(ii) 70% of 70 + 90% of 90 – 120% of 120.
14. Approximately 97.3% water on the earth is not fit for drinking. Find :
(i) the percentage of water on the earth that is fit for drinking.
(ii) the total volume of water available in a certain part of the earth where there is 21,600 m³ of drinking water
15. Air is an important inexhaustible natural resource. It is essential for the survival of human beings, microbes, plants and animals. The following table shows the percentage of various gases in air.

Contents of air	Percentage (by volume)
Nitrogen	78
Oxygen	21
Others (carbon dioxide, inert gases, water vapour, etc.)	1

In 800 m³ of air, calculate the approximate quantities of nitrogen, oxygen and other gases.