Secondary

MATHEMATICS

Class-VI

Contents

NATURAL NUMBERS AND WHOLE NUMBERS

INTRODUCTION

Do you remember numbers? Let us solve some problems.

We like to play with numbers.

1. **Fill in the following blanks.**

    (a) The place value of 5 in 37572 is _____ .

    (b) 8 occurs at _____ place in 105876.

    (c) Place value of 4 in 42160 is _____ .

    (d) 5 occupies the _____ place in 37652.

    (e) The face value of 7 in 4709606 is _____ .

    (f) $3 \times 100000 + 5 \times 1000 + 7 \times 10 + 8 \times 1 =$ _____ .

    (g) $200000 + 4000 + 800 + 6 =$ _____ .

2. **Find the product of the place value and face value of 5 in 76085432.**

3. **Find the product of the largest 4-digit number and the smallest 4-digit number. Write the product in expanded form also.**

4. **Write all the possible 3-digit numbers using the digits 7, 5, 1.**
    (Repetition not allowed)

5. **Write all the possible 3-digit numbers using the digits 4, 0, 6.**
    (Repetition not allowed)

6. **Write the following numbers in Indian System of Numeration.**

    (a) 8751432   (b) 60002   (c) 491603   (d) 632245687

7. **Write the following numbers in International System of Numeration.**

    (a) 5737802   (b) 411809   (c) 33246951   (d) 898576449

8. **Write the numerals for the following:**

    (a) Thirty two million four thousand three hundred and twenty nine.

    (b) Thirty nine crore forty eight lakh nine thousand and eighty eight.
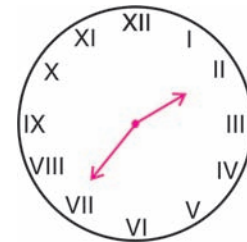
9. **How many lakhs make 6 millions?**

10. **How many millions make 17 crores?**

ROMAN NUMERALS

Have you ever seen a clock of this type?

See! In place of numerals 1 to 12, symbols like I, II, III, IV are shown here.

These symbols are called **Roman Numerals.**

Now observe these Hindu Arabic Numerals and their corresponding Roman Numerals.

Hindu Arabic Numerals	I	5	10	50	100	500	1000
Roman Numerals	I	V	X	L	C	D	M

The rules for this system of numeration are given below:

- **Rule 1 –** If a symbol is repeated, its value is added as many times as it occurs.
  For example: II = 1 + 1 = 2
  $$XXX = 10 + 10 + 10 = 30$$

- **Rule 2 –** A symbol is not repeated more than three times but the symbols V, L and D are never repeated.

- **Rule 3 –** If a symbol of smaller value is written to the right of a symbol of greater value, its value gets added to the value of greater symbol.
  For example: VI = 5 + 1
  $$= 6$$
  $$LXV = 50 + 10 + 5$$
  $$= 65$$

- **Rule 4 –** If a symbol of smaller value is written to the left of a symbol of greater value, its value is subtracted from the symbol of the greater value.
  For example: IV = 5 − 1 = 4
  $$XL = 50 − 10 = 40$$
  $$XC = 100 − 10 = 90$$

- **Rule 5 –** The symbols V, L and D are never written to the left of a symbol of greater value, i.e. V, L, D are never subtracted.

Observe the Roman Numerals corresponding to some Hindu Arabic Numerals.

1 = I	10 = X
2 = II	20 = XX
3 = III	30 = XXX
4 = IV	40 = XL
5 = V	50 = L
6 = VI	60 = LX
7 = VII	70 = LXX
8 = VIII	80 = LXXX
9 = IX	90 = XC
10 = X	100 = C

Let us study some examples.

Example 1: Write the Roman Numerals corresponding to the following Hindu Arabic Numerals.

(a) 19   (b) 56   (c) 44   (d) 98   (e) 78

Solution: (a)   19 = 10 + 9   (b)   56 = 50 + 6

                                = XIX   = LVI

                 (c)   44 = 40 + 4   (d)   98 = 90 + 8

                                = XLIV   = XCVIII

                 (e)   78 = 70 + 8

                                = (50 + 10 + 10) + 8

                                = LXXVIII

Example 2:   Convert the following into Hindu Arabic Numerals.

(a) LXXIX   (b) XLIX   (c) XCVII   (d) XCI

Solution: (a)   LXXIX = 50 + 10 + 10 + 9   (b)   XLIX = 40 + 9

                                 = 79   = 49

                 (c)   XCVII = 90 + 7   (d)   XCI = 90 + 1

                                 = 97   = 91

Worksheet 1

1. **Write the Roman Numeral for each of the following:**

(a) 33   (b) 500   (c) 48   (d) 76   (e) 95

(f) 41   (g) 87   (h) 66   (i) 19   (j) 1000

2. **Convert the following into Hindu Arabic Numerals.**

(a) XXVI   (b) LXXVII   (c) XCI   (d) LXXXV   (e) D

(f) XCIX   (g) XCVII   (h) LV   (i) XLI   (j) XXIX

3. **Solve and write the results in Roman Numerals.**

(a) 32 + 67   (b) 216 − 174

(c) 12 × 7   (d) 3645 ÷ 45

4. **Which of the following is meaningless?**

(a) VVII   (b) XLI   (c) LIV   (d) IC   (e) LIL
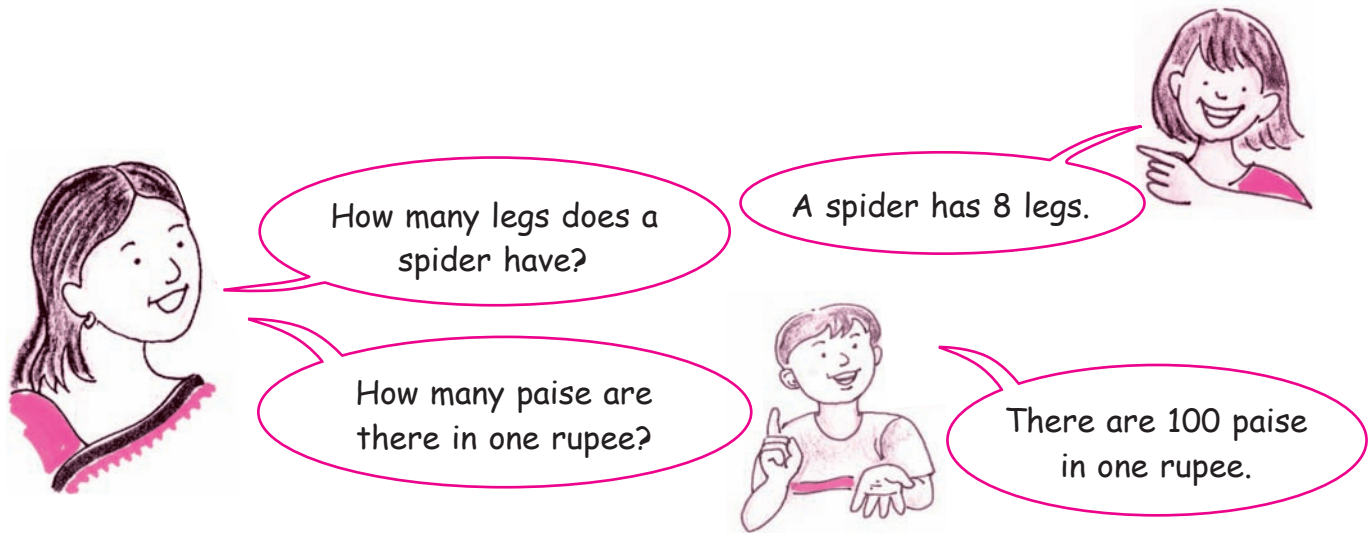
(f) IVC   (g) XCI   (h) VL

5. **Match the following:**

DXLV	908
MMX	591
CMVIII	545
CCIII	2010
DXCI	203

6. **Write the following in Roman Numerals.**

(a)   Year in which India got Independence.

(b)   Year in which India became Republic.

(c)   Year in which you were born.

(d)   Present year.

WHOLE NUMBERS AND THEIR REPRESENTATION ON NUMBER LINE

How many legs does a spider have?

A spider has 8 legs.

How many paise are there in one rupee?

There are 100 paise in one rupee.

So we have used the numbers 1, 2, 3, 4, ... for answering these questions.

Numbers 1, 2, 3, 4, ... which we use for counting form the system of **Natural Numbers** (Counting numbers).

Remember
- The smallest natural number is 1.
- We cannot find the greatest natural number.

Look at the following picture. What is the number of boys in this group?
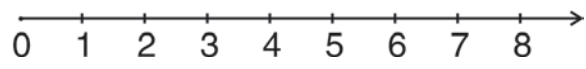
The number of boys in this group is zero (0).

Natural numbers along with zero form the system of **Whole Numbers**.

Now look at the whole numbers given on a number line.
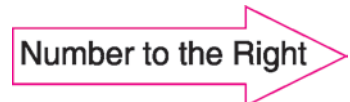
0 1 2 3 4 5 6 7 8

SUCCESSOR AND PREDECESSOR

One more than any whole number is called the **successor** of that whole number.

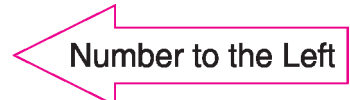For example: 51 is the successor of 50

10000 is the successor of 9999

One less than any whole number is called the **predecessor** of that whole number.

For example: 61 is the predecessor of 62

99999 is the predecessor of 100000

Number to the Right

Number to the Left

Let us take up some examples.

Example 3: Write the greatest 4-digit number using the digits 5, 0, 2. **(digits may repeat)**

Solution: Any 4-digit number occupies four places, i.e. thousands, hundreds, tens and ones. Since 5 is the largest number here, it will occupy most of the places in the required number and rest of the numbers will occur only once and that too in descending order. So, the required number will be,

Th	H	T	O
5	5	2	0

Example 4: Rearrange the digits of 72094186 to form the smallest 8-digit number.

Solution: We write the digits in ascending order–

0, 1, 2, 4, 6, 7, 8, 9

Since we cannot start a number with zero, we start the number with 1. So the required number is–

1, 02, 46, 789

6

Worksheet 2

1. **Complete the statements by filling in the blanks.**

   (a) The smallest whole number is _____.

   (b) There is _____ largest whole number.

   (c) In whole numbers, _____ has no predecessor.

   (d) The predecessor of the smallest 5-digit number has _____ digits.

   (e) The successor of the greatest 5-digit number is _____.

   (f) The smallest 7-digit number ending in 5 is _____.

   (g) 387 is to the _____ of 388 on the number line.

   (h) 4397 is to the _____ of 4396 on the number line.

2. **Write the successor of the following:**

   (a) 45638   (b) 10009   (c) 220209   (d) 4226372

3. **Write the predecessor of the following:**

   (a) 33801   (b) 100000   (c) 6698979   (d) 80115670

4. **Find the next three successors of 647999.**

5. **Find the three immediate predecessors of 552002.**

6. **Compare the following numbers:**

   (a) 729 ◯ 279   (b) 10899 ◯ 10799

   (c) 9785 ◯ 7835   (d) 135629 ◯ 136529

7. **Arrange the following in ascending order.**

   43, 287, 15769, 833, 49538, 34, 798665

8. **Arrange the following in descending order.**
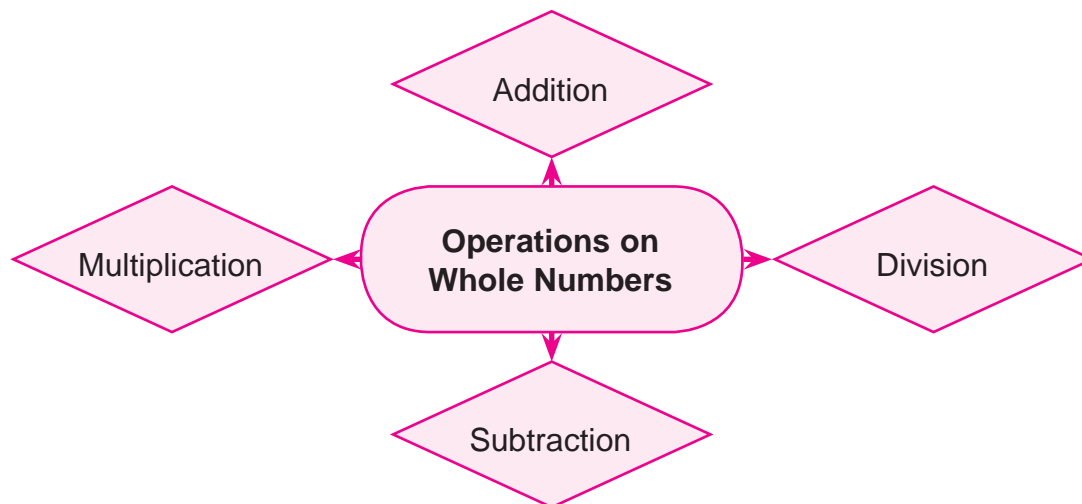
   3951, 1024, 977, 422596, 38675, 560832, 67.

9. **Form the greatest 7-digit number using the digits 3, 8, 9.**
   (digits may repeat)

10. **Write the smallest 6-digit number using the digits 4, 5, 0.**
    (digits may repeat)

OPERATIONS ON WHOLE NUMBERS

Let us take up the properties of each and every operation one by one.

A. ADDITION OF WHOLE NUMBERS

Properties of Addition

Property-1: The sum of two whole numbers is again a whole number.

e.g. 3 + 8 = 11

Property-2: The sum remains the same even after changing the order of addends.

e.g. 23 + 18 = 18 + 23

Property-3: The sum remains the same, when the order or the grouping of three or more addends is changed.

e.g. 11 + (18 + 25) = (11 + 18) + 28

Property-4: When a number is added to zero or zero is added to the number, sum is the number itself.

e.g. 7 + 0 = 0 + 7 = 7

Let us take up an example to see that the sum remains same even if the order of the addends is changed.

Example 5: Add 469, 35, 31, 5 in 2 different ways.

Solution:

469 + 35 + 5 + 31   469 + 31 + 35 + 5

504   +   36   500   +   40   (By interchanging the order of the addends.)

540   540

B. SUBTRACTION OF WHOLE NUMBERS

Properties of Subtraction

Property-1: The difference between two whole numbers may or may not be a whole number.
e.g. $5 - 4 = 1$ (is a whole number). But $4 - 5 = -1$ is not a whole number.

Property-2: The difference between two same whole numbers is always zero.

e.g. $5 - 5 = 0$

Property-3: For any three whole numbers, say 6, 4, 2 $(6 - 4) - 2$ is not equal to $6 - (4 - 2)$.

Property-4: When zero is subtracted from a whole number, the difference is the number itself.

e.g. $5 - 0 = 5$

Property-5: If 8, 5, 3 are whole numbers, such that $8 - 5 = 3$ then $5 + 3 = 8$

Let us study an example based on Property-5.

Example 6: Subtract 40 from 96

Solution: $96 - 40 = 56$

or 96 $= 56 + 40$

Worksheet 3

1. **Fill in the blanks to make the following statements true.**

    (a) 1794 + 624 = 624 + _____

    (b) (287 + 163) + 800 = 287 + (_____ + 800)

    (c) 432 + _____ = 111 + 432

    (d) 97 + 561 = _____ + 97

    (e) (200 + 1020) + 3303 = _____ + (200 + _____)

    (f) 0 + 268 = _____

    (g) 469 – 0 = _____

    (h) 1238 – _____ = 1238

    (i) 29487 + _____ = 29487

2. Replace (*) with the appropriate digit.

(a)
```
  2 9 4 2 2
−   6 8 * 5
───────────
  2 * 5 4 7
───────────
```

(b)
```
  4 7 8 * 5
+ 3 * 3 3 4
───────────
  8 4 * 3 9
───────────
```

(c)
```
    2 3 9 * 8
+ 1 * 9 8 0 *
─────────────
  1 4 3 * 6 9
─────────────
```

(d)
```
  8 0 0 1 9
− * 4 3 * *
───────────
  2 5 * 0 3
───────────
```

3. Add 718662 to 360895. Now add 360895 to 718662. Are the two results same?

4. Add the following numbers by rearranging them: **(Use property here)**

(a) 786 + 342 + 214

(b) 479 + 2000 + 21

(c) 225 + 725 + 275 + 275

(d) 67 + 1376 + 624 + 933

(e) 637 + 908 + 363

(f) 2062 + 547 + 938 + 353

5. Subtract the following and check your answer by corresponding addition.

(a) 29435 − 17005

(b) 100000 − 62581

(c) 75691 − 45512

(d) 77426 − 71236

6. In a school, the number of students is 5637. If 142 students took admission during that year, find the total number of students in the school.

7. The price of a car is ₹ 3,76,866. If it is increased by ₹ 42,049, find the new price of the car.

8. A club organises a trip to the Disney World. The cost of the whole package is ₹ 1,83,420. The club gives a discount of ₹ 47,632. What is the cost of the package after the discount?

9. Rahul deposited ₹ 57,630 in the bank. After a week, he withdrew ₹ 19,211. What is the current balance in Rahul's account?

10. A garment factory produces 33000 trousers every year. Out of these, 12309 are for men and 9538 are for women. Find the number of trousers produced for children.

C. MULTIPLICATION OF WHOLE NUMBERS

Properties of Multiplication

Property-1: If two whole numbers are multiplied in either order, the product remains the same.

e.g. $3 \times 8 = 8 \times 3 = 24$

Property-2: If three numbers are multiplied in any grouping or order, the product remains the same.

e.g. $2 \times (5 \times 7) = (2 \times 5) \times 7 = (2 \times 7) \times 5 = 70$

Property-3: The product of a whole number and 1 is the number itself.

e.g. $1 \times 5 = 5 \times 1 = 5$

Property-4: The product of any whole number and zero is zero.

e.g. $2 \times 0 = 0 \times 2 = 0$

Worksheet 4

1. **Use the properties of multiplication and fill in the following blanks.**

    (a) $0 \times 489 =$ _____

    (b) $1 \times 741 =$ _____

    (c) $27 \times 635 = 635 \times$ _____

    (d) $(242 \times 197) \times 581 = 242 \times (197 \times$ _____ $)$

    (e) $479 \times$ _____ $= 479$

    (f) _____ $\times 831 = 0$

    (g) $162 \times 0 \times 1025 =$ _____

2. **If the cost of one burger is ₹ 50.50, what will be the cost of 25 such burgers?**

3. **In a library, there are 27 book shelves. If there are 479 books on each book shelf, find the total number of books in the library.**

4. **A store has 432 dresses for girls. If the cost of each dress is ₹ 583.50, find the cost of all dresses.**

MORE ABOUT MULTIPLICATION PROPERTIES

Consider the numbers 3, 4 and 5.

Let us add 3 and 4 and multiply the sum by 5

$$(3 + 4) \times 5$$

$$\downarrow$$

$$7 \times 5$$

$$= 35$$

Now multiply 3 and 4 separately by 5 and then add the products.

$$3 \times 5 + 4 \times 5$$

$$15 + 20$$

$$35$$

In both the cases, we get 35. So, we can say that–

$$(3 + 4) \times 5 = 3 \times 5 + 4 \times 5$$

Similarly, $(7 - 3) \times 5 = 7 \times 5 - 3 \times 5$

> This is known as **Distributive Property of Multiplication.** It is useful for multiplying large numbers.

Example 7: Multiply 172×97

Solution: We know that $97 = (100 - 3)$
$172 \times (100 - 3)$

or $172 \times (100 - 3) = 172 \times 100 - 172 \times 3$
$= 17200 - 516$
$= 16684$

Example 8: Solve $569 \times 45 + 569 \times 55$

Solution: $569 \times (45 + 55)$ ← Taking out 569 as common factor from both the products.

$= 569 \times 100$ ← Multiplying by 100 orally.

$= 56900$

Example 9:   Solve $361 \times 162 - 361 \times 60 - 2 \times 361$

Solution: $361 \times (162 - 60 - 2)$ ← Taking out 361 as common factor and putting rest of the terms in a bracket.

$= 361 \times (162 - 62)$

$= 361 \times 100$

$= 36100$

Worksheet 5

1. **Fill in the following blanks by using different properties of multiplication.**

   (a) 52 × (63 + 37) = (52 × _____) + (_____ × 37)

   (b) 297 × (_____ + 43) = (297 × 88) + (297 × _____)

   (c) _____ × (84 + 16) = 36 × 84 + 36 × _____

   (d) 218 × 94 = (218 × _____) − (218 × 6)

   (e) 778 × 994 = (778 × 1000) − (778 × _____) − 778.

2. **Rearrange the numbers and then multiply them.**

   (a) 125 × 488 × 8   (b) 625 × 25 × 20 × 4

   (c) 16 × 125 × 8 × 625   (d) 20 × 1975 × 5

   (e) 8 × 25 × 125 × 40   (f) 200 × 625 × 16 × 50

3. **Find the product by using distributive property.**

   (a) 241 × 107   (b) 685 × 94

   (c) 439 × 995   (d) 1009 × 1392

   (e) 98 × 553   (f) 999 × 399

4. **Find the value by using distributive property.**

   (a) 1562 × 62 + 1562 × 38   (b) 638 × 176 − 638 × 75 − 638

   (c) 85 × 15 + 15 × 15   (d) 688 × 10 × 437 − 6880 × 337

   (e) 125 × 8 × 883 + 117 × 25 × 40

   (f) 750 × 17 + 750 × 38 + 27 × 750 + 18 × 750

5. **Rohan buys 12 computers and 12 printers. If the cost of one computer and one printer is ₹ 56,233 and ₹ 7,867 respectively, find the total cost incurred by Rohan. (Use distributive property of multiplication.)**

6. In a school, the monthly fee of a child is ₹ 497. If there are 2983 students in a school, find the total fee collected in a month.

   (Use distributive property of multiplication.)

D. DIVISION OF WHOLE NUMBERS

Property-1: If two whole numbers are divided, their quotient may or may not be a whole number.

e.g. $3 \div 6 = ½$ but $6 \div 3 = 2$

Property-2: A number divided by itself, gives the quotient as 1.

e.g. $5 \div 5 = 1$.

Property-3: A number divided by one gives the quotient as the number itself.

e.g. $4 \div 1 = 4$

Property-4: A multiplication fact of two distinct and non-zero whole numbers gives two division facts.

e.g. $4 \times 5 = 20$ and $20 \div 5 = 4$, $20 \div 4 = 5$

Property-5: Zero divided by any number gives the quotient as zero.

e.g. $0 \div 3 = 0$

We also know

In division

Dividend = Divisor × Quotient + Remainder

Let us take up some examples.

Example 10: Find the least number that should be subtracted from 1000 so that 30 divides the difference exactly.

Solution: Divide 1000 by 30

$$
\begin{array}{r}
30\ \overline{)\ 1000\ }\ \lfloor 33 \\
\underline{90} \\
100 \\
\underline{90} \\
10
\end{array}
$$

$1000 - 10 = 990$

So, 10 should be subtracted from 1000 so that the difference, i.e. 990 is exactly divisible by 30.

Example 11: Find the least number that should be added to 1000 so that 35 divides the sum exactly.

Solution:

```
35 ⌐ 1000 ⌐ 24
      70
     ―――
      300
      280
     ―――
       20
     ―――
```

The difference between divisor and remainder is 35 − 20 = 15

Therefore, 15 should be added to 1000 so that the sum 1015 is exactly divisible by 35.

Worksheet 6

1. **Divide and check your answer.**

   (a) 2781 ÷ 35   (b) 49277 ÷ 511

   (c) 7335 ÷ 122   (d) 64895 ÷ 247

2. **Find the least number that should be subtracted from 1000 so that 35 divides the difference exactly.**

3. **Find the least number that should be added to 2000 so that 45 divides the sum exactly.**

4. **Find the largest 5-digit number which is exactly divisible by 40.**

5. **In a parade, the soldiers are arranged in 14 rows. If the number of soldiers is 504, find the number of soldiers in each row.**

6. **In a dance class, 137 students got themselves enrolled. If the total fee collected is ₹ 3,56,200, find the fee paid by each student.**

ESTIMATION

Do you remember Rounding off numbers? Let us recall.

1. **Round off the given numbers as directed.**

   (a) 48 (to the nearest ten)

   (b) 3,285 (to the nearest thousand)

   (c) 87,08,463 (to the nearest ten lakh)

   (d) 4,53,73,043 (to the nearest crore)

2. **Round off the given numbers as directed.**

    (a)   3.84 (to the nearest ones)

    (b)   21.472 (to the nearest hundredth)

    (c)   1.53 (to the nearest tenth)

3. **Round 4,25,163 to the nearest hundred, ten thousand and lakh.**

ESTIMATION OF OUTCOMES OF NUMBER SITUATIONS

Let us take some situations.

Situation 1: Rohan plans to give a treat to his eight friends in school on his birthday. His father gave him ₹ 500 for this. He decides to give a sandwich, pastry and fruit juice to these friends. One sandwich costs ₹ 20, one pastry costs ₹ 25 and one fruit juice costs ₹ 15. Rohan roughly calculates the amount he needed. This will be the sum of amount he spends on these three items.

Situation 2: On a particular day a businessman has to receive ₹ 5,38,485 and ₹ 2,19,560 from two different parties. He also has to pay a sum of ₹ 6,35,750 to someone on the same day. He quickly round off the numbers to the nearest lakh and then works out if he will be able to pay the money by evening. Will he be able to pay back the amount?

The estimation of outcomes of numbers is a reasonable guess of the actual value.

Remember

- **Estimating** means approximating a quantity to the accuracy required.
- Estimation is done by rounding off the numbers involved and getting a quick and rough answer.

ESTIMATION OF SUM OR DIFFERENCE

When we estimate sum or difference, we should have an idea of why we need to round off and therefore, the place to which the rounding is needed.

Example 12: Estimate 4,356 + 13,849

Solution: We shall round off the numbers to the nearest thousands.

    13,849 is rounded off to 14,000

    4,356 is rounded off to 4,000

    Estimated sum   = 14,000 + 4,000

                    = 18,000

Example 13: Estimate 7,412 – 236

Solution: Let us round off these numbers to the nearest thousands.

7,412 is rounded off to 7,000

236 is rounded off to 0

Estimated difference = 7000 – 0

= 7000

This is not a reasonable estimate. Why?

We need a closer estimate.

Let us round the numbers to the nearest hundreds.

7,412 is rounded off to 7,400

236 is rounded off to 200

Estimated difference = 7,400 – 200

= 7,200

This is a better and more meaningful estimate.

Worksheet 7

Estimate.

1. 215 + 436
2. 1,238 + 4,298
3. 15,409 + 3,288
4. 618 + 561 + 372

5. 869 – 341
6. 8,565 – 4,341
7. 1,048 – 692
8. 78,432 – 71,496

ESTIMATE OF PRODUCT OF NUMBERS

Let us estimate 63 × 182

If we round off 63 to the nearest hundred, we get 100

If we round off 182 to the nearest hundred, we get 200

Hence, the estimated product = 100 × 200 = 20,000

This is much greater than the actual product.

So to get a more reasonable estimate, we try rounding off 63 to the nearest tens that is 60, and also 182 to the nearest tens that is 180.

We get 60 × 180 = 10800

This is a good estimate but not quick enough.

So we round off 63 to the nearest ten which is 60 and 182 to the nearest hundred which is 200.

Now the estimated value of 63 × 182 = 60 × 200

$$= 12,000$$

12,000 is a quick and good estimate of the product of numbers.

> **Remember**
>
> To estimate the product, round off each factor to its greatest place, then multiply the rounded off factors.
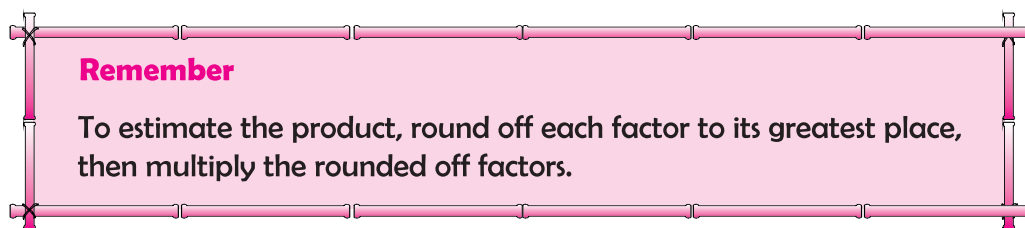
Example 14: Estimate 52 × 786

Solution: 52 can be rounded off to the nearest ten as 50.

786 can be rounded off to the nearest hundred as 800.

Hence, the estimate product = 50 × 800 = 40,000

Worksheet 8

Estimate the given products.

1. 61 × 47
2. 589 × 245
3. 9 × 677
4. 864 × 342
5. 913 × 752
6. 4,329 × 609
7. 1,234 × 5,678
8. 13,459 × 7,801

BRACKETS AND THEIR USE

Do you remember solving numerical expressions involving the fundamental operations of addition, subtraction, multiplication and division?

Recall the DMAS Rule—

Division	$\rightarrow$	First
Multiplication	$\rightarrow$	Second
Addition	$\rightarrow$	Third
Subtraction	$\rightarrow$	Last

Use this rule to simplify:

1. $3 + 6 \div 2 - 4$

2. $49 \div 7 + 7 \times 2$

3. $1\dfrac{1}{2} + \dfrac{3}{4} \times \dfrac{4}{5} - \dfrac{1}{5}$

4. $3.5 - 0.1 \times 5 + 1.2$

Let us now learn to solve numerical expressions involving brackets. Most commonly used brackets are:

Brackets symbol	Name
( )	Parentheses or Round brackets
{ }	Curly brackets
[ ]	Square brackets

In writing mathematical expressions consisting of more than one brackets, Round brackets are used in the innermost part followed by Curly brackets and these two are covered by Square brackets.

We first perform the operations within the Round brackets followed by the operations within the Curly brackets and lastly within the Square brackets.

Example 15: Simplify $27 - [5 + \{28 - (17 - 7)\}]$

Solution: We have $27 - [5 + \{28 - (17 - 7)\}]$

$= 27 - [5 + \{28 - 10\}]$ $\longleftarrow$ Removing Round brackets

$= 27 - [5 + 18]$ $\longleftarrow$ Removing Curly brackets

$= 27 - 23$ $\longleftarrow$ Removing Square brackets

$= 4$

Example 16: Simplify 45 − [38 − {60 ÷ 3 − (9 − 7 + 3)}]

Solution: We have 45 − [38 − {60 ÷ 3 − (9 − 7 + 3)}]

$$= 45 - [38 - \{60 \div 3 - 5\}]$$
$$= 45 - [38 - \{20 - 5\}]$$
$$= 45 - [38 - 15]$$
$$= 45 - 23$$
$$= 22$$

Worksheet 9

Simplify the following numerical expressions.

1. 25 + 14 ÷ (5 − 3)

2. 3 − (5 − 6 ÷ 3)

3. 36 − [12 + (3 × 10 ÷ 2)]

4. 20 − 3 − [7 − {2 + (4 − 3)}]

5. 15 + [18 − {4 + (16 − 5)}]

6. $22 - \dfrac{1}{4}\{16 - (8 \div 4 + 2)\}$

7. 18 − [18 − {18 − (18 − 18) − 18}]

8. 150 − [70 − {60 − (30 + 20)} − 10]

✔ALUE BASED QUESTIONS

1. **Members of an NGO decided to provide blankets to an old age home. For this purpose a sum of ₹ 8435 was collected and 35 blankets were purchased. The old people were very happy with the blankets. They blessed the NGO members for their concern for the old people.**

    (a) What is the cost of one blanket donated?

    (b) Name any two items that you can donate to an old age home.

2. **Trees not only make the air pure but also beautify the environment. In a school, the members of Eco club were taken for a trip to a nearby nursery. As a part of a project the children planted 95 saplings of different trees in the nursery. The cost of each sapling was ₹ 175. The children were very thrilled and happy with the project.**

    (a) What is the amount spent on the saplings? (Use distributive property)

    (b) Name any two saplings that you will like to plant in your garden or nearby park.

BRAIN TEASERS

1. **A. Tick (✓) the correct answer.**

   (a) Which of the following is meaningless?

      (i) XLVI   (ii) ICVII   (iii) XML   (iv) XLIX

   (b) The greatest 2-digit number exactly divisible by 17 is–

      (i) 68   (ii) 91   (iii) 85   (iv) 97

   (c) The smallest 5-digit number formed by using the digits 3, 0, 1 (Repetition of digits allowed) is–

      (i) 10003   (ii) 10013   (iii) 13000   (iv) 00013

   (d) The estimated value of 36 + 71 – 55 is–

      (i) 40   (ii) 50   (iii) 70   (iv) 150

   (e) Which of the following is not a natural number?

      (i) 3 + 5 – 2   (ii) 4 × 0   (iii) 8 ÷ 8   (iv) 6 – 3 + 1

   B. Answer the following questions.

   (a) How many millions make 3 crores?

   (b) Which whole number does not have a successor?

   (c) What is the estimated value of 786 × 1385?

   (d) What is the value of 125 × 4 × 25 × 8?

   (e) What is the difference between the place value and face value of 8 in 38,46,197?

2. **Write the greatest 6-digit number using three different digits.**

3. **Find the smallest and greatest 7-digit and 8-digit numbers using the digits 5, 0, 4, 1.**

4. **Find the difference between the largest and the smallest 7-digit numbers formed by using the digits in the number 6427310. (digits should not repeat)**

5. **Using distributive property, simplify:**

   223 × 25 × 6 – 223 × 10 × 15

6. **Complete the series–**

   1, 1, 2, 3, 5, 8, 13, 21, 34, _____, _____,

7. Fill in the blanks in the following magic square.

	10	3	6
4	5		9
	11	2	7
1	8		

8. Form the greatest 6-digit number using the digits of prime numbers between 80 and 100.

9. Find the number which is–

(a) the successor of the successor of 304998.

(b) the predecessor of the predecessor of the smallest 6-digit number.

10. Fill in the blanks using Roman Numerals.

(a) CXIX − [   ] = XXV   (b) [   ] + XLVI = LXX

11. Arrange the following in ascending order.

LVII, XC, XV, LXIV, LXXI, XXIX

12. Estimate the following:

(a) $234 + 649 - 186$ (b) $9483 - 6321 - 2178$

(c) 3284×639 (d) 12345×6789

HOTS

1. How many times does the digit 7 occurs if we write all the numbers from 1 to 200?

2. Write all the 2-digit numbers which when added to 27 get reversed.

ENRICHMENT QUESTIONS

1. Get 100 using four 9's and some of the symbols like +, −, ×, ÷

2. A number is three times the sum of its digits. Find the number.

YOU MUST KNOW

1. Various systems of numerations are used in different parts of the world. We use the Hindu–Arabic System of Numeration. Another systems of writing numerals is called Roman System.

2. The numbers 1, 2, 3, ... which we use for counting are called Counting numbers or Natural numbers. The numbers 0, 1, 2, 3, ... form the set of Whole numbers. All natural numbers are whole numbers but all whole numbers are not natural numbers.

3. Every whole number can be represented on the number line. Every whole number has a successor. Every whole number except zero has a predecessor.

4. Addition of two whole numbers always give a whole number. Similarly multiplication of two whole numbers is always a whole number. But this is not true for the operations of subtraction and division.

5. Zero is the identity element of addition and one is the identity element of multiplication.

6. The sum remains the same if the order or group of three or more addends is changed. Similarly when three or more numbers are multiplied the product remains the same.

7. Multiplication is distributive over addition for whole numbers.

8. In division, Dividend = Divisor × Quotient + Remainder

9. There are number of situations in which we do not need the exact number of quantity but only a reasonable guess or estimation. Estimation involves approximating a quantity to an accuracy required.

10. In some situations, we need to estimate the outcome of number operations. A quick rough answer is obtained by rounding off the numbers involved in the operation.

FACTORS AND MULTIPLES

INTRODUCTION

Do you remember factors and multiples? Let us recall them once again.

Multiples: For getting multiples of a number, we recite the multiplication table of that number.
e.g. multiples of 4 are 4, 8, 12, 16 .....

Factors: A factor of a number divides the number exactly (with zero as the remainder).
e.g. the factors of 12 are 1, 2, 3, 4, 6, 12.

Prime Number: A number which has only two different factors, 1 and the number itself is called prime number.
e.g. 2, 3, 5, 7 .....

Composite Number: A number which has more than two different factors is called composite number.
e.g. 4, 6, 8, 9 .....

MORE ABOUT FACTORS

One (1) is a factor of every number.

Every number is a factor of itself.

Two prime numbers whose difference is 2 are called **Twin Prime Numbers.**
e.g. 5 and 3; 41 and 43.

Two numbers are said to be **Co-prime** when they have only 1 as common factor.
e.g. 3 and 5; 19 and 20.

Example 1: State whether the following are prime or composite by listing their factors:

(a) 36   (b) 13

Solution: (a) 36

We have $1 \times 36 = 36$

                     $2 \times 18 = 36$

$$3 \times 12 = 36$$
$$4 \times \ \ 9 = 36$$
$$6 \times \ \ 6 = 36$$

Factors of 36 are 1, 2, 3, 4, 6, 9, 12, 18, 36.

Therefore, 36 is a composite number.

(b) 13

We have $\qquad$ $1 \times 13 = 13$

Factors of 13 are 1 and 13.

Therefore, 13 is a prime number.

Example 2: List the first five multiples of 19.

Solution: The required multiples are–

$$1 \times 19 = 19$$
$$2 \times 19 = 38$$
$$3 \times 19 = 57$$
$$4 \times 19 = 76$$
$$5 \times 19 = 95$$

19, 38, 57, 76 and 95 are the first five multiples of 19.

Worksheet 1

1. **Fill in the following blanks.**

   (a) Numbers which have more than two different factors are called _____ .

   (b) Numbers which are not divisible by any other number except 1 and the number itself are called _____ .

   (c) 1 is neither _____ nor composite.

   (d) 6 is a composite number as it has _____ factors.

   (e) _____ is the only even prime number.

   (f) The smallest prime number is _____ .

   (g) The smallest composite number is _____ .

   (h) The smallest odd composite number is _____ .

   (i) The greatest 2-digit prime number is _____ .

2. Are the following numbers prime or composite. Show by finding the factors.

(a) 9   (b) 48   (c) 89   (d) 96   (e) 78   (f) 101

3. Write down the first ten prime numbers.

4. Write down all the prime numbers between 50 to 110.

5. A number lies between 2000 and 2070 and has 5 in its ones place. Is it a prime or composite number? Give reasons.

6. List the first five multiples of–

(a) 25   (b) 17   (c) 100   (d) 41

7. List all the multiples of 15 between 50 to 100.

8. Between which multiples of 10 does 3486 lie?

9. Write any four pairs of twin primes.

10. Which of the following numbers are co-prime?

(a) 13, 14   (b) 8, 20   (c) 31, 59   (d) 34, 85

TEST OF DIVISIBILITY

There are certain tests which can confirm whether a number is divisible by some other number. Given below are the tests of divisibility.

I.   **Divisibility by 2**

Is 368 divisible by 2?   (Yes/No)

Is 490 divisible by 2?   (Yes/No)

Is 43 divisible by 2?   (Yes/No)

Is 48 divisible by 2?   (Yes/No)

Here we see that 368, 490 and 48 are divisible by 2 whereas 43 is not divisible by 2.

> A number is divisible by 2 if the digit at ones place is divisible by 2, i.e. if the digit at ones place is 0, 2, 4, 6 or 8.

II.   **Divisibility by 5**

Is 8955 divisible by 5?   (Yes/No)

Is 6320 divisible by 5?   (Yes/No)

Is 7939 divisible by 5? (Yes/No)

Is 387 divisible by 5? (Yes/No)

Here we can see that 8955 and 6320 are divisible by 5 but 7939 and 387 are not divisible by 5.

> **A number is divisible by 5 if the digit at ones place is 0 or 5.**

III. Divisibility by 10

Is 7442 divisible by 10? (Yes/No)

Is 10240 divisible by 10? (Yes/No)

Is 73 divisible by 10? (Yes/No)

Is 1390 divisible by 10? (Yes/No)

Here the numbers 10240 and 1390 are divisible by 10 but 7442 and 73 are not divisible by 10.

> **A number is divisible by 10 if the digit at ones place is 0.**

IV. Divisibility by 4

Is 6943284 divisible by 4?

Step 1: Separate the number formed by the digits at tens and ones place.

69432 / 84

Step 2: Now divide 84 by 4.

```
      21
   4) 84
      8
      ‾‾‾
       4
       4
      ‾‾‾
       0    84 is divisible by 4.
```

Hence, 6943284 is also divisible by 4.

> **A number is divisible by 4 if the number formed by its digits at tens and ones place is divisible by 4.**

V. Divisibility by 8

Let us find if 3364280 is divisible by 8?

Step 1: Separate the number formed by the digits at hundreds, tens and ones place.

3364 / 280

Step 2: Divide 280 by 8.

```
        35
    8 ) 280
        24
        ──
        40
        40
        ──
         0      280 is divisible by 4.
```

Hence, 3364280 is also divisible by 8.

> A number is divisible by 8 if the number formed by the digits at hundreds, tens and ones place is divisible by 8.

VI. Numbers with trailing zeroes

Divide 2500 by 4.	Is it divisible?	(Yes/No)
Divide 23900 by 4.	Is it divisible?	(Yes/No)
Divide 34000 by 8.	Is it divisible?	(Yes/No)
Now divide 196000 by 8.	Is it divisible?	(Yes/No)

- **If a number has zeroes in its tens and ones places, it is divisible by 4.**
- **If a number has zeroes in its hundreds, tens and ones places, it is divisible by 8.**

Worksheet 2

1. **Look at the following numbers and fill in the blanks.**

    (a) 435, 6552, 988, 3870, 5211, 9343

    The numbers that are divisible by 2 are _____, _____, _____.

    (b) 3522, 9765, 1000, 45012, 28775

    The numbers that are divisible by 5 are _____, _____, _____.

    (c) 7780, 10000, 2567, 57514, 82210

    The numbers that are divisible by 10 are _____, _____, _____.

    (d) 4924, 63402, 11507, 36572

    The numbers that are divisible by 4 are _____, _____, _____.

    (e) 789984, 365832, 10098, 395529

    The numbers that are divisible by 8 are _____, _____, _____.

2. Apply the divisibility rule and show that–

(a) 432566 is divisible by 2
(b) 352115 is divisible by 5
(c) 868060 is divisible by 10
(d) 3496 is divisible by 4
(e) 117904 is divisible by 8
(f) 784300 is divisible by 4
(g) 694000 is divisible by 8
(h) 35088 is divisible by 2

VII. Divisibility by 3

Is 4392126 divisible by 3?

Step 1: Add all the digits of the given number.

4 + 3 + 9 + 2 + 1 + 2 + 6 = 27

Step 2: Divide the sum by 3.

$$\begin{array}{r} 9 \\ 3\overline{)27} \\ \underline{27} \\ 0 \end{array}$$ 27 is divisible by 3

Therefore, 4392126 is also divisible by 3.

> **A number is divisible by 3 if the sum of its digits is divisible by 3.**

VIII. Divisibility by 9

Is 8826921 divisible by 9?

Step 1: Add up all the digits of the given number.

8 + 8 + 2 + 6 + 9 + 2 + 1 = 36

Step 2: Divide the sum by 9.

$$\begin{array}{r} 4 \\ 9\overline{)36} \\ \underline{36} \\ 0 \end{array}$$ 36 is divisible by 9
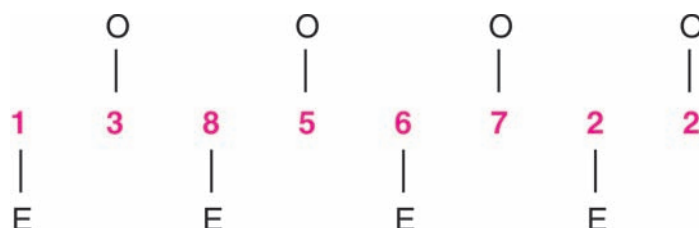
So, 8826921 is also divisible by 9.

> **A number is divisible by 9 if the sum of its digits is divisible by 9.**

IX. Divisibility by 11

Let us consider a number 13856722. To test whether it is divisible by 11, following steps are taken.

Step 1: Add alternate digits (digits in odd places and digits in even places separately) starting from the ones place.

```
        O           O           O           O
        |           |           |           |
  1     3     8     5     6     7     2     2
  |           |           |           |
  E           E           E           E
```

Step 2: Sum of the digits at odd places = 2 + 7 + 5 + 3 = 17

Sum of the digits at even places = 2 + 6 + 8 + 1 = 17

Step 3: Difference of the two sums, i.e.

17 – 17 = 0

> **If the difference between the sum of the digits at even places and sum of the digits at odd places is either 0 or a multiple of 11, the number is divisible by 11.**

MORE ON DIVISIBILITY TESTS

I.   A number is divisible by 6 if it is divisible by co-prime factors of six.

e.g. 42 is divisible by 2 and 3, therefore, 42 is also divisible by **2 × 3 = 6.**

Similarly,

- A number is divisible by 12 if it is divisible by 4 and 3.
- A number is divisible by 15 if it is divisible by 3 and 5.
- A number is divisible by 24 if it is divisible by 8 and 3.
- A number is divisible by 36 if it is divisible by 9 and 4.

II.   If a number is divisible by another number, then it is divisible by each factor of that number.

e.g.   18 is divisible by 6

18 is also divisible by   1, 2, 3   Factors of 6

III. If a number is divisible by two co-prime numbers, then it is divisible by their product.

> Two numbers whose HCF is one are called **Co-prime Numbers.**

e.g. 4 and 3 are co-prime numbers.

24 is divisible by 4

24 is divisible by 3

24 is also divisible by 12
$$\longrightarrow 4 \times 3$$

IV. If two given numbers are divisible by a number, then their sum is also divisible by that number.

e.g. 8 and 12 are divisible by 4

20 is also divisible by 4

8 + 12 ←

V. If two given numbers are divisible by a number, then their difference is also divisible by that number.

e.g. 15 and 35 are divisible by 5

20 is also divisible by 5

35 – 15 ←

Worksheet 3

1. **Look at the following group of numbers and fill in the blanks.**

   (a) 389510, 7781450, 4203324, 12342

   The numbers divisible by 3 are _____ and _____ .

   (b) 3437712, 4222910, 6880172, 9811602

   The numbers divisible by 9 are _____ and _____ .

   (c) 362442, 8502153, 774067, 46627207

   The numbers divisible by 11 are _____ and _____ .

2. **Pick out the numbers from the following that are divisible by 3 but not by 9.**

   (a) 38721   (b) 422679   (c) 6110586   (d) 257796

3. **Test the following for the divisibility by 3 and 9.**

(a) 294414 (b) 145404 (c) 99999

4. **Test the divisibility of the following numbers by 11.**

(a) 86611291 (b) 100001 (c) 9427355

(d) 7023643 (e) 58334661 (f) 602111213

5. **Fill in the blanks.**

(a) A number is divisible by 6 if it is divisible by its two co-prime factors _____ and _____ .

(b) 43185 is divisible by 15 as it is divisible by _____ and _____ .

(c) The number 8625 is not divisible by 6 as it is divisible by _____ but not by _____ .

(d) The number 54420 is divisible by 12 as it is divisible by _____ and _____ .

(e) The number 781022 is divisible by 11 as the difference of the sum of the digits at odd places and the sum of the digits at even places is _____ .

6. **Replace** ☐ **by a digit so that the number is divisible by 9.**

(a) 384 ☐ 62 (c) 9080 ☐

(b) 1 ☐ 80498 (d) 46 ☐ 21

7. **Write 'True' or 'False' for the following statements.**

(a) If a number is divisible by 3, it must be divisible by 9. ☐

(b) If a number is divisible by 18, it must be divisible by 6 and 3. ☐

(c) If a number is divisible by both 9 and 10, then it must be divisible by 90. ☐

(d) All numbers which are divisible by 8 are divisible by 4. ☐

(e) If a number is exactly divisible by two numbers separately then it must be exactly divisible by their sum. ☐

PRIME FACTORISATION

Let us look at the example given below.

Example 3: Find the prime factorisation of 360 by division method.

Solution:

360 is divisible by the prime number 2

45 is divisible by the prime number 3

We divide by the prime number 5

2	360
2	180
2	90
3	45
3	15
5	5
	1 → We stop

Hence, the prime factorisation of 360 = 2 × 2 × 2 × 3 × 3 × 5

Worksheet 4

1. **Find the prime factorisation of the following.**

   (a) 78   (b) 120   (c) 256   (d) 84   (e) 441

   (f) 240   (g) 2304   (h) 3125   (i) 1260

2. **Write the greatest 4-digit number. Express it as a product of primes.**

3. **Write the smallest 4-digit number and show its prime factorisation.**

4. **Express each of the following numbers as sum of two odd primes.**

   (a) 18   (b) 32   (c) 66   (d) 90

5. **Express the following as sum of three odd primes.**

   (a) 41   (b) 23   (c) 75   (d) 59

HIGHEST COMMON FACTOR (HCF)

HCF of two or more numbers is the **Highest Common Factor** of these numbers.

Let us now find HCF of 27 and 36.

(a) Factor Method

27) My factors are 1, 3, 9, 27

36) My factors are 1, 2, 3, 4, 6, 9, 12, 18, 36

27) Our common factors are 1, 3, 9
Our highest common factor is 9 (36

So, HCF of 27 and 36 is 9.

(b) Prime Factorisation Method

My prime factors

27

3	27
3	9
3	3
	1

2	36
2	18
3	9
3	3
	1

My prime factors

36

27 = 3 × 3 × 3   → Prime factors of 27

36 = 2 × 2 × 3 × 3   → Prime factors of 36

Common factors of 27 and 36 are 3, 3

Therefore, HCF = 3 × 3 = 9

(c) Continued Division Method

36 is greater than 27, so 36 will be the dividend.

Divisior ⟶ 27) 36 (1 ⟵ Dividend
                  27

Remainder is not 0.
So division continues ⟶ 9) 27 (3   The previous divisor
                           27   becomes the dividend.
                            0

The last divisor is 9   We stop when we get
                             remainder equal to zero.

Therefore, HCF is 9.

Let us take some more examples.

Example 4: Find the HCF of 204, 144 and 252.

Solution: Here we have three numbers.

We select any two numbers ⟶ 144) 204 (1
                                    144

                              60) 144 (2   Previous divisors
                                   120   become dividends

Remainders become divisors ⟶ 24) 60 (2
                                   48

Last divisor is the HCF ⟶ 12) 24 (2
                               24
                                0   Remainder = 0
                                       Division stops

So, HCF of 144 and 204 is 12.

Now, let us find the HCF of 12 and the third number, i.e. 252.

HCF = 12 $\longrightarrow$ 12 $\overline{)252}$ (21
  252
  ___
   0   Remainder = 0
         Division stops

So, the HCF of 204, 144 and 252 = 12.

Example 5 : Find the greatest number that will divide 140, 170, 155 leaving remainder 5 in each case.

Solution: Here, we have to find a number which exactly divides (140 – 5), (170 – 5), (155 – 5)

The required number is the HCF of 135, 165 and 150.

First take any two numbers, say 135 and 165.

135 $\overline{)165}$ (1
    135
    ___
    30 $\overline{)135}$ (4
       120
       ___
HCF $\longrightarrow$ 15 $\overline{)30}$ (2
         30
         ___
          0

HCF of 165 and 135 is 15.

Now, we find the HCF of 15 and 150

15 $\overline{)150}$ (10
   150
   ___
    0

The required number is 15.

Example 6 : The floor of a room is 6 m 75 cm long and 5 m wide. It is to be paved with square tiles. Find the largest size of tile needed.

Solution: In order to find the largest size of tile needed, we find the number that divides 675 and 500 exactly.

500 $\overline{)675}$ (1
    500
    ___
    175 $\overline{)500}$ (2
        350
        ___
        150 $\overline{)175}$ (1
            150
            ___
HCF $\longrightarrow$ **25** $\overline{)150}$ (6
              150
              ___
               0

6 m 75 cm = 675 cm
     5 m = 500 cm

The largest size of tile needed is 25 cm.

1. **Find the HCF of the following numbers by factor method.**

    (a) 7, 18 (b) 12, 30, 54 (c) 70, 14, 35

2. **Find the HCF of the following numbers by prime factorisation method.**

    (a) 76, 28 (b) 24, 16, 36 (c) 38, 64, 82

3. **Find the HCF of the following numbers by continued division method.**

    (a) 345, 506 (b) 144, 384, 120

    (c) 287, 533 (d) 208, 494, 949

    (e) 1212, 6868, 1111 (f) 1794, 2346, 4761

    (g) 70, 105, 175 (h) 270, 450, 315

4. **What is the HCF of–**

    (a) two consecutive natural numbers.

    (b) two consecutive even numbers.

    (c) two consecutive odd numbers.

    (d) any two prime numbers.

5. **Find the greatest number which divides 203 and 434 leaving remainder 5 in each case.**

6. **Find the greatest number which will divide 625 and 1433 leaving remainders 5 and 3 respectively.**

7. **The length, breadth and height of a room are 8.25 m, 6.75 m and 4.50 m respectively. Determine the longest tape which can measure the three dimensions of the room exactly.**

8. **There are 312 mango bites, 260 eclairs and 156 coffee bites in a box. These are to be put in packets so that each packet contains the same number of toffees. Find the maximum number of toffees in each packet.**

LEAST COMMON MULTIPLE (LCM)

LCM of two or more numbers is the **Least Common Multiple** of these numbers.

Let us find the LCM of 3, 6 and 9.

(a) By Listing Multiples

3 ← My multiples are 3, 6, 9, 12, 15, 18, 21 ......

6 ← My multiples are 6, 12, 18, 24, 30 ......

9 ← My multiples are 9, 18, 27, 36, 45 ......

The least common multiple of these three numbers is 18.

So, LCM of 3, 6, 9 is 18.

(b) Prime Factorisation Method

Let us find the LCM of 24, 15 and 45.

Divide by prime number till you get 1 as quotient.

2	24
2	12
2	6
3	3
	1

3	15
5	5
	1

3	45
3	15
5	5
	1

We have, $24 = 2 \times 2 \times 2 \times 3$

$15 = 3 \times 5$

$45 = 3 \times 3 \times 5$

Therefore, $LCM = 2 \times 2 \times 2 \times 3 \times 3 \times 5$

$= 8 \times 9 \times 5 = 360$

2 occurs maxiumum three times, 3 occurs two times and occurs one time only.

(c) Common Division Method

Let us find the LCM of 30, 45, 60.

Divide the numbers by the common prime factor of one or more numbers.

Repeat the same process of division.

Write numbers in a line separated by commas.

45 is not divisible by 2. Write it as it is.

Stop when you get all quotients equal to one.

$$\begin{array}{r|ccc}
2 & 30, & 45, & 60 \\ \hline
2 & 15, & 45, & 30 \\ \hline
3 & 15, & 45, & 15 \\ \hline
3 & 5, & 15, & 5 \\ \hline
5 & 5, & 5, & 5 \\ \hline
 & 1, & 1, & 1
\end{array}$$

$$\text{LCM} = 2 \times 2 \times 3 \times 3 \times 5$$
$$= 180$$

Let us solve some examples.

Example 7:   Find the smallest number which when divided by 25, 40, 60 leaves remainder 7 in each case.

Solution: The required number will be 7 added to the least common multiple (LCM) of these numbers.

Let us first find the LCM.

$$\begin{array}{r|ccc}
2 & 25, & 40, & 60 \\ \hline
2 & 25, & 20, & 30 \\ \hline
2 & 25, & 10, & 15 \\ \hline
3 & 25, & 5, & 15 \\ \hline
5 & 25, & 5, & 5 \\ \hline
5 & 5, & 1, & 1 \\ \hline
 & 1, & 1, & 1
\end{array}$$

$$\text{LCM} = 2 \times 2 \times 2 \times 3 \times 5 \times 5$$
$$= 600$$

Therefore, the required number = 600 + 7 = 607.

Let us check.

$$\begin{array}{r}
25\overline{)607}\,(24 \\
50 \\ \hline
107 \\
100 \\ \hline
7
\end{array}
\qquad
\begin{array}{r}
40\overline{)607}\,(15 \\
40 \\ \hline
207 \\
200 \\ \hline
7
\end{array}
\qquad
\begin{array}{r}
60\overline{)607}\,(10 \\
60 \\ \hline
7
\end{array}$$

See in all cases the remainder is 7.

Example 8: In a morning walk, three boys step off together. Their steps measure 80 cm, 85 cm and 90 cm respectively. What minimum distance should each walk so that all can cover the distance in complete steps?

Solution: The minimum distance needed will be the Least Common Multiple (LCM) of 80, 85, 90.

2	80, 85, 90
2	40, 85, 45
2	20, 85, 45
2	10, 85, 45
3	5, 85, 45
3	5, 85, 15
5	5, 85, 5
17	1, 17, 1
	1, 1, 1

$$LCM = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 17$$

$$= 12240$$

Required distance = 12240 cm

or 122 m 40 cm

Worksheet 6

1. **Find LCM of the following numbers by listing their multiples.**

    (a) 12, 9   (b) 4, 5, 2   (c) 25, 15

2. **Find the LCM by prime factorisation method.**

    (a) 10, 15, 6   (b) 16, 12, 18   (c) 25, 30, 40

3. **Find the LCM by common division method.**

    (a) 12, 15, 45   (b) 24, 90, 48

    (c) 30, 24, 36, 16   (d) 16, 48, 64

    (e) 35, 49, 91   (f) 20, 25, 30

    (g) 12, 16, 24, 36   (h) 40, 48, 45

4. **Find the least number which when divided by 40, 50 and 60 leaves remainder 5 in each case.**

5. **Three Haryana Roadways buses stop after 50, 100 and 125 km respectively. If they leave together, then after how many kilometres will they stop together?**

6. **Four bells toll at intervals of 8, 9, 12 and 15 minutes respectively. If they toll together at 3 p.m., when will they toll together next?**

PROPERTIES OF HCF AND LCM

1. **HCF of given numbers is not greater than any of the numbers.**

   e.g.   HCF of 5 and 15 = 5

   HCF of 12 and 18 = 6

2. **LCM of given numbers is not smaller than any of the numbers.**

   e.g.   LCM of 5, 15 = 15

   LCM of 12, 18 = 36

3. **HCF of given numbers is a factor of their LCM.**

   e.g.   HCF of 16, 12 = 4

   LCM of 16, 12 = 48

   HCF 4 is a factor of LCM 48

4. **LCM of given numbers is a multiple of their HCF.**

   e.g.   HCF of 16, 12 = 4

   LCM of 16, 12 = 48

   LCM 48 is a multiple of HCF 4

5. **If HCF of two numbers is one of the number then LCM is the greater number.**

   e.g.   HCF of 5 and 15 = 5

   LCM = 15 (greater number)

6. **HCF of co-prime numbers is 1.**

   5 and 9 are co-prime

   HCF = 1

7. **LCM of co-prime numbers is the product of the numbers.**

   LCM of 5 and 9 = 45

8. **Product of HCF and LCM of two numbers is equal to the product of the numbers.**

   HCF of 9 and 12 = 3

   LCM of 9 and 12 = 36

   Product of 9 and 12 = 108

   Product of HCF and LCM = 3 × 36 = 108

Let us study some examples.

Example 9: Find HCF and LCM of 25, 65.

Solution: Here, we find only HCF of 25 and 65.

HCF of 25, 65 ⟶

$$
\begin{array}{r}
25\,\overline{)\,65\,}\,(2 \\
50 \\
\hline
15\,\overline{)\,25\,}\,(1 \\
15 \\
\hline
10\,\overline{)\,15\,}\,(1 \\
10 \\
\hline
\textbf{5}\,\overline{)\,10\,}\,(2 \\
10 \\
\hline
0
\end{array}
$$

HCF ⟶ **5**

HCF = 5

LCM will be found by using the property.

Product of numbers = Product of HCF and LCM.

$$25 \times 65 = 5 \times LCM$$

$$LCM = \frac{\overset{5}{\cancel{25}} \times 65}{\underset{1}{\cancel{5}}} = 325$$

Example 10: HCF of two numbers is 16 and their product is 6400. Find their LCM.

Solution: We have,

HCF × LCM = Product of numbers

16 × LCM = 6400

$$LCM = \frac{\overset{400}{\cancel{6400}}}{\underset{1}{\cancel{16}}} = 400$$

LCM = 400

Worksheet 7

1. **For each of the following pairs of numbers, verify that product of numbers is equal to the product of their HCF and LCM.**

   (a) 10, 15   (b) 35, 40   (c) 32, 48

2. **Find HCF and LCM by using the property in Question no. 1.**

   (a) 27, 90   (b) 145, 232   (c) 117, 221

3. **Can two numbers have 16 as HCF and 380 as LCM? Give reasons.**

4. The HCF of two numbers is 16 and product of numbers is 3072. Find their LCM.

5. The LCM and HCF of two numbers are 180 and 6 respectively. If one of the number is 30, find the other.

6. LCM of two numbers 160 and 352 is 1760. Find their HCF.

7. Write 'True' or 'False' for the following statements.

(a) LCM of two numbers is a factor of their HCF.

(b) Product of three numbers is equal to the product of their HCF and LCM.

(c) HCF of given numbers is always a factor of their LCM.

(d) LCM of given numbers cannot be smaller than the numbers.

(e) LCM of co-prime numbers is equal to their product.

✔ALUE BASED QUESTIONS

1. The schools nowadays have a council which consists of student representatives. This council helps the school in organising various events. Rohan has also been selected in his school council this year.

   The school organised a picnic in which 108, 162 and 270 students of Classes-VI, VII and VIII respectively were going. Rohan's teacher asked him to help the transport incharge.

   (a) Find out the number of buses required, if each bus had to carry maximum but equal number of students from each class.

   (b) As a member of school council Rohan was made a part of decision making. What other values does the student council develop in a child?

   (c) Suggest one way by which you can help your school if you are selected as a council member.

2. You know 5 June is celebrated every year as World Environment Day. As a part of its celebration, Vrinda and her two friends decided to have a cycling race to promote environmental friendly transport. They started at 12 noon and took 3 minutes 20 seconds, 3 minutes 40 seconds and 4 minutes respectively to cycle on a circular track.

(a) If Vrinda and her friends started together at 12 noon, then when will they meet next?

(b) Suggest the ways by which you can save the environment.

BRAIN TEASERS

1. **A. Tick (✓) the correct answer.**

(a) Six bells commence tolling together and toll at intervals of 2, 4, 6, 8, 10 and 12 seconds respectively. After how many minutes will they toll together again?

(i) 5 minutes (ii) 6 minutes

(iii) 4 minutes (iv) 2 minutes

(b) The HCF of two numbers is 11 and their LCM is 7700. If one of the numbers is 275, then the other number is–

(i) 279 (ii) 283 (iii) 308 (iv) 318

(c) The greatest possible length which can be used to measure exactly the lengths 7 m, 3 m 85 cm, 12 m 95 cm is–

(i) 35 cm (ii) 25 cm (iii) 15 cm (iv) 42 cm

(d) 252 can be expressed as a product of primes as–

(i) $2 \times 2 \times 3 \times 3 \times 7$ (ii) $2 \times 2 \times 2 \times 3 \times 7$

(iii) $3 \times 3 \times 3 \times 3 \times 7$ (iv) $2 \times 3 \times 3 \times 3 \times 7$

(e) Which of the following is a factor of every natural number?

(i) 1 (ii) 0 (iii) – 1 (iv) any number

B. Answer the following questions.

(a) Find the highest common factor of 36 and 84.

(b) How many factors does 36 have?

(c) Express 132 as the sum of two odd primes.

(d) What should be added to 4057 to make it divisible by 9?

(e) Find the HCF of 95, 105 and 115 by continued division.

2. **Are 32 and 34 co-prime numbers? Why?**

3. **Write any four twin primes between 50 and 110.**

4. **Express the greatest 3-digit number as a product of primes.**

5.   Express the smallest 5-digit number as a product of primes.

6.   State which of the following numbers are divisible by both 3 and 9?

(a) 235674   (b) 78015

7.   Test which of the following numbers are divisible by 11.

(a) 147246   (b) 2352825

8.   What least number should be subtracted from the following numbers to make them divisible by 3?

(a) 2825   (b) 856291

9.   What least number should be added to the following numbers to make them divisible by 9?

(a) 42724   (b) 39065

10. Replace the blank in 625 ☐ with the least number, so that the number is divisible by 11.

11. Write any two numbers which are–

(a) divisible by 3 but not 9.

(b) divisible by 5 but not 10.

(c) divisible by both 4 and 8.

(d) divisible by 2, 4 and 8.

12. Find the HCF of 1624, 522 and 1276.

13. Find the LCM of 198, 135, 108 and 54.

14. The HCF and LCM of two numbers are 13 and 1989 respectively. If one number is 117, find the other.

15. Can two numbers have 15 as HCF and 350 as LCM? Why?

HOTS

Find the greatest number of four digits which is divisible by 15, 20 and 25.

ENRICHMENT QUESTION

To find the factors of a number, you have to find all the pairs of numbers that multiply together to give that number.

The factors of 48 are:

1 and 48   2 and 24   3 and 16   4 and 12   6 and 8

If we leave out the number we started with, 48, and add all the other factors, we get 76:

$$1 + 2 + 3 + 4 + 6 + 8 + 12 + 16 + 24 = 76$$

So ... 48 is called an **abundant number** because it is less than the sum of its factors (without itself). (48 is less than 76.)

A number less than the sum of its factors except itself is called an **abundant number.**

See if you can find some more abundant numbers!

YOU MUST KNOW

1. Two prime numbers whose difference is 2 are called twin prime numbers.
2. Two numbers are said to be co-prime when they have only 1 as common factor.
3. Every number has infinite number of multiples and finite number of factors.
4. A number is divisible by another number if it is divisible by its co-prime factors.
5. If a number is divisible by another number, then it is divisible by each factor of that number.
6. If a number is divisible by two co-prime numbers, then it is divisible by their product.
7. If two given number are divisible by a number, then their sum is also divisible by that number.
8. If two given number are divisible by a number, then their difference is also divisible by that number.
9. Prime factorisation of a number is the factorisation in which every factor is a prime number.
10. HCF is also known as the Greatest Common Divisior (GCD).
11. Product of HCF and LCM of two numbers is equal to the product of the numbers.
12. HCF of given numbers is not greater than any of the numbers.
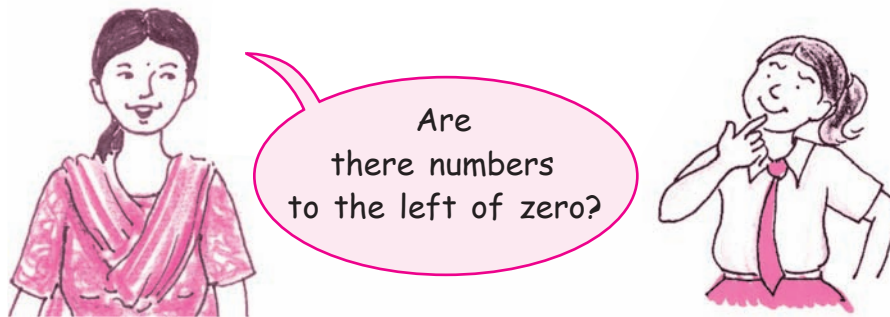13. LCM of given numbers is not smaller than any of the numbers.

INTEGERS

INTRODUCTION
NEED FOR INTEGERS

Observe the number line drawn below.

0   1   2   3   4   5   6   7   8   9   10

On the number line, 0 (zero) is the starting point (called the **origin**) and all the natural numbers are to the right of 0.

Are there numbers to the left of zero?

Now let us consider some situations.

Situation 1: See! these two cats have pounced on a piece of cake that was on the plate.

The white cat is enjoying its share at a distance of 2 metres to the left of the plate.

The black cat is enjoying its share at a distance of 3 metres to the right of the plate.

2 m   3 m
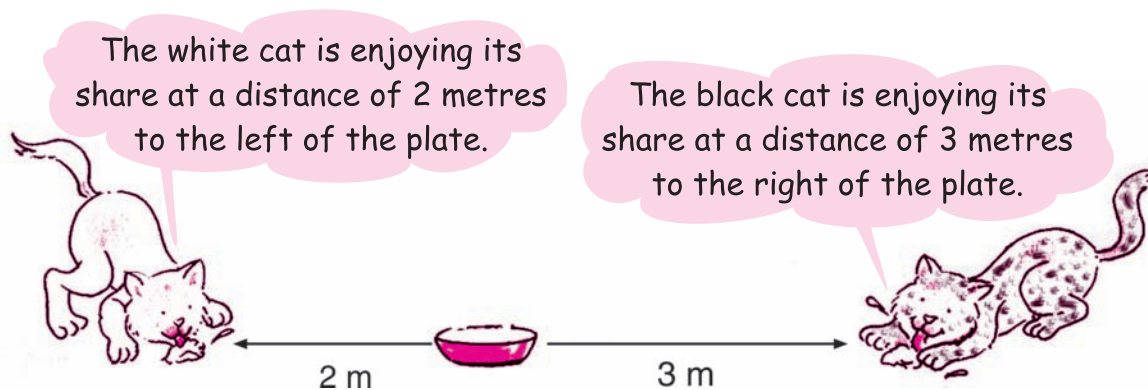
Let us take the plate as the starting point 0. We have two numbers on the opposite sides of 0.

3 m to the **right** of 0 and 2 m to the **left** of 0.

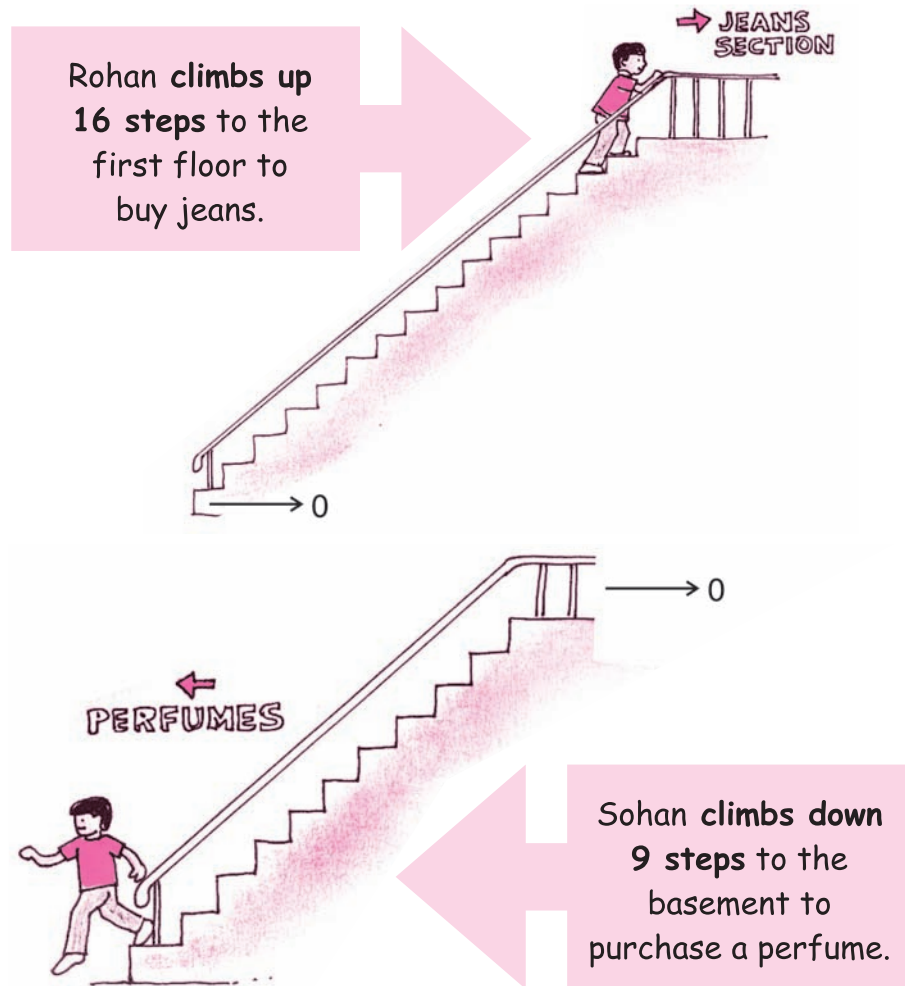**Situation 2:** See! Rohan and Sohan are going to a shop to make some purchases.

Rohan **climbs up 16 steps** to the first floor to buy jeans.

→ JEANS SECTION

→ 0

→ 0

← PERFUMES

Sohan **climbs down 9 steps** to the basement to purchase a perfume.

Now, let us take the ground level as origin 0. Here, we have 2 numbers on the opposite sides of 0.

16 steps **above** 0 and 9 steps **below** 0.

To distinguish numbers on the opposite sides of zero, that is **right** and **left** or **above** and **below**, we use opposite signs, i.e. positive (**+**) and negative (**−**).

Positive (**+**) means to the right of or above the origin.

+ or positive

Negative (**−**) means to the left of or below the origin.

− or negative
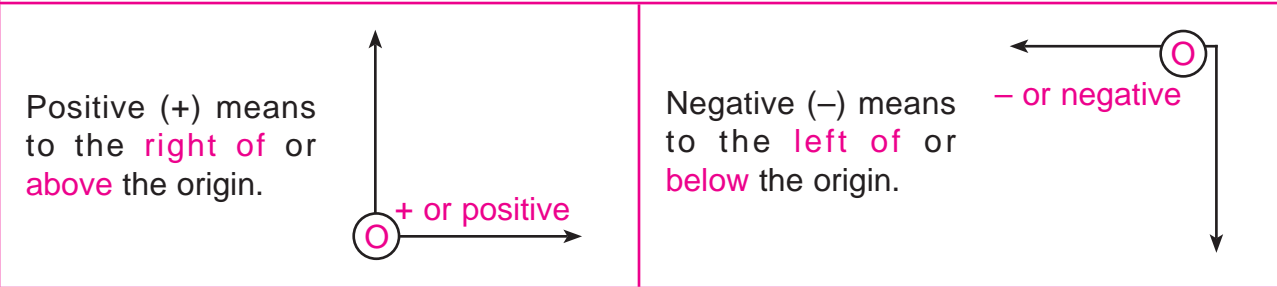
In the above two situations,

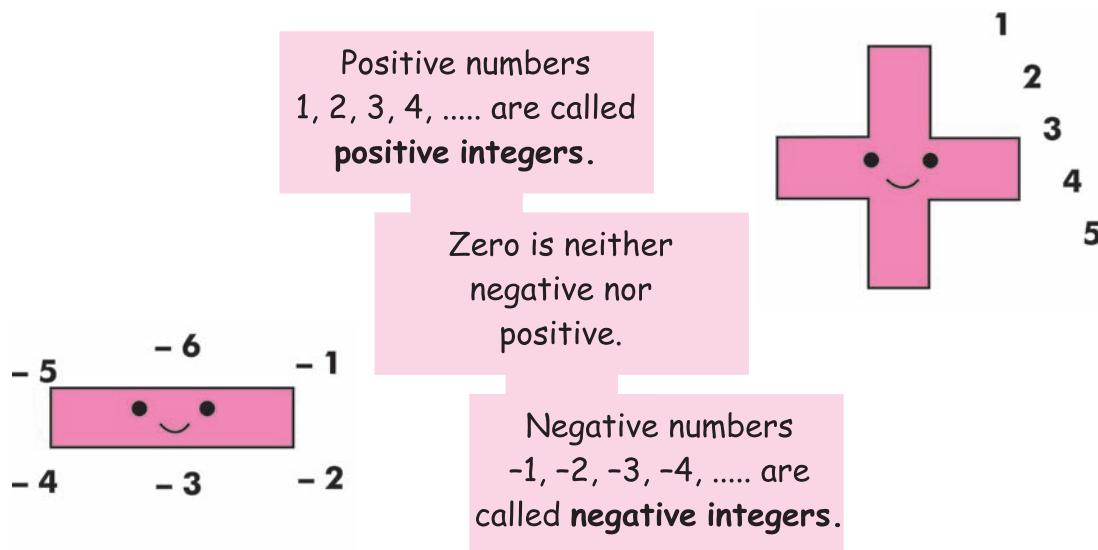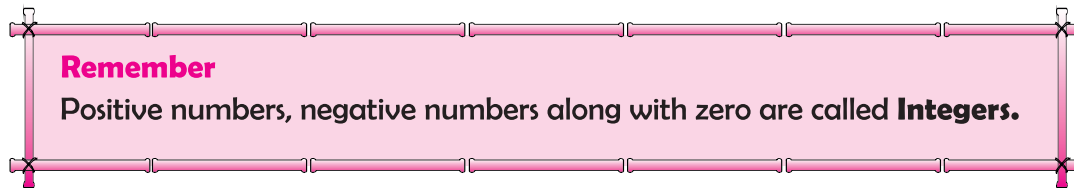|	
3 m to the right of 0 is represented as	**+ 3**
2 m to the left of 0 is represented as	**– 2**
climbing up 16 steps is represented as	**+ 16**
climbing down 9 steps is represented as	**– 9**

Similarly,

A profit of ₹ 200 is	**+ 200**
8°C below the freezing point is	**– 8**
Depositing ₹ 500 in a bank is	**+ 500**

Numbers with positive (**+**) sign are called **positive numbers**.

Numbers with negative (**–**) sign are called **negative numbers**.

Remember
Positive numbers, negative numbers along with zero are called **Integers.**

Positive numbers 1, 2, 3, 4, ... are called **positive integers**.

Zero is neither negative nor positive.

Negative numbers –1, –2, –3, –4, ... are called **negative integers**.

Negative integers – 1, – 2, – 3, ... are read as minus one, minus two, minus three, etc.

OPPOSITES

- Opposite of the **PROFIT** of ₹ 20 is **LOSS** of ₹ 20.
- Opposite of 5°C **ABOVE** freezing point is 5°C **BELOW** freezing point.
- Opposite of – 3 is + 3.

1. **Indicate the following by using integers.**

   (a) Earning ₹ 500

   (b) Loss of ₹ 90

   (c) Climbing up 10 steps

   (d) Withdrawal of ₹ 500 from a bank

   (e) 5 m above sea level

   (f) 3 km towards north

   (g) 10°C below zero

   (h) An increase of 25 marks

2. **Write the opposites of–**

   (a) Depositing ₹ 1,000 in a bank account.

   (b) Decrease of 5 marks.

   (c) Earning ₹ 200.

   (d) Going 2 km towards east.

   (e) Two steps to the left of zero on a number line.

   (f) Losing weight of 7 kg.

3. **Encircle the negative integers from the following numbers.**

   $- 59,$ $6,$ $0,$ $- 1,$ $- 4,$ $45,$ $- 62,$ 107

REPRESENTATION OF INTEGERS ON A NUMBER LINE

We know that negative integers are opposite of positive integers. So let us mark the negative integers on the left of zero on the number line.

See! the number line is extended to the left.
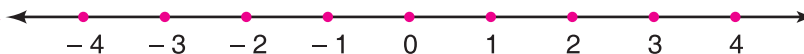
> **Note:**
>
> • The opposite integers (e.g. – 2 and + 2) are at the same distance from zero.
>
> • The distance between consecutive integers is same everywhere.

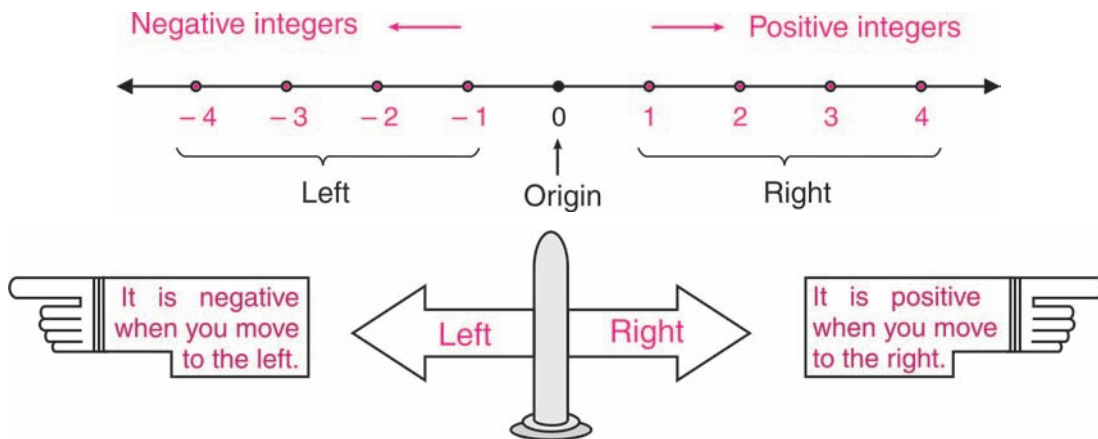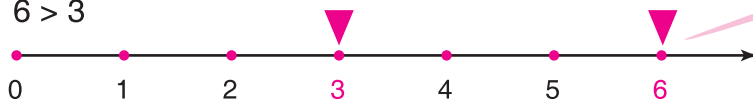So, now we have the number line...

Negative integers ⟵   ⟶ Positive integers

$-4 \quad -3 \quad -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad 3 \quad 4$

Left   Origin   Right

It is negative when you move to the left.

Left   Right

It is positive when you move to the right.

ORDERING OF INTEGERS

We have,
$6 > 3$

6 is to the right of 3.

$0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6$

$2 < 8$

8 is to the right of 2.

$0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8$
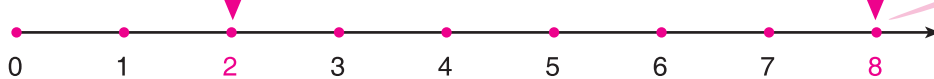
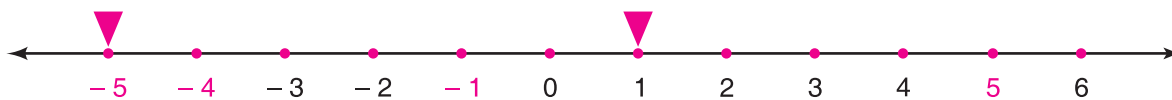**Remember**

A number to the right of a given number is greater than the given number.

Now, let us compare -2 and -3.

$-3 \quad -2 \quad -1 \quad 0 \quad 1$

-2 is to the right of -3

So, -2 is greater than -3
or $-2 \; \bigodot{>} \; -3$

Compare +1 and – 5

So, 1 is greater than – 5
or 1 $>$ – 5.

1 is to the right of – **5**

> **Note:**
> - Every positive integer is greater than any negative integer.
> - Zero is less than every positive integer.
> - Zero is greater than every negative integer.
> - – 1 is the greatest negative integer.
> - We cannot find the greatest positive integer or the smallest negative integer.

ABSOLUTE VALUE OF INTEGERS

See! Sonu and Monu are standing at a point zero (0). After two minutes, see their position.

Sonu walks to the left of 0 and reaches – 3

Monu walks to the right of 0 and reaches + 3
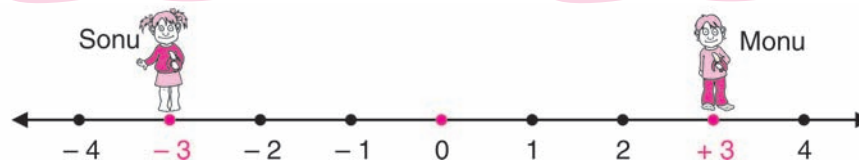
Remember

Absolute value of an integer is its numerical value, without taking the sign into account.

Here the distance walked by both of them is same (3 units) without taking into account the direction (sign). So, we can say that the absolute value of 3 and – 3 is **3**.

Let us find the absolute value of some integers.

The absolute value of an integer is greater than or equal to the integer.

Integer	Absolute Value
+ 1	1
− 1	1
− 7	7
21	21
0	0

The absolute value of any non-zero integer is positive.

The symbol used to write absolute value is **two vertical lines (||)**, one on either side of the integer.

Thus, the absolute value of − 7 is written as $| - 7 | = 7$

Worksheet 2

1. **Do as directed.**

(a) Mark any point as origin on the given number line.

(b) Write integers on either side of the origin with proper signs.

2. **Encircle the number which is to the right of the other on number line in each of the following pairs.**

(a) 3, − 1   (b) 0, − 8

(c) − 6, − 4   (d) 14, − 7

(e) − 9, − 8   (f) 4, 7

3. **Write all the integers between–**

(a) − 5 and 0   (b) − 4 and 3

(c) − 11 and 1   (d) − 6 and − 1

4. **Compare the numbers and insert an appropriate symbol (>, <, =) in the given space.**

(a) 3 ◯ − 3   (b) − 1 ◯ 0

(c) − 101 ◯ − 104   (d) − 82 ◯ − 28

(e) − 4 ◯ − 14   (f) 16 ◯ − 16

(g) − 97 ◯ − 98   (h) − 197 ◯ − 96

(i) 0 ◯ − 7   (j) − 1 ◯ 1

5. **Fill in the following table with the absolute values.**

Integer	Absolute value
17	
− 18	
0	
− 43	
21	
− 105	
− 61	
1283	

6. **Write the following in ascending order.**

(a)   4, − 5, 16, − 11, − 21, 50

(b)   0, − 1, 7, − 16, − 12, − 30

7. **Write the following in descending order.**

(a)   − 171, 26, − 43, 103, − 105, 77

(b)   9, − 8, 0, − 75, − 79, 93

8. **Write 'True' or 'False' for the following statements.**

(a)   Every integer is either positive or negative.

(b)   Zero is greater than every negative integer.

(c)   An integer to the left of another integer is always smaller.

(d)   We can find the smallest integer.

(e)   Absolute value of a given integer is always greater than the integer.

(f)   All natural numbers are positive integers.

(g)   All whole numbers are integers.
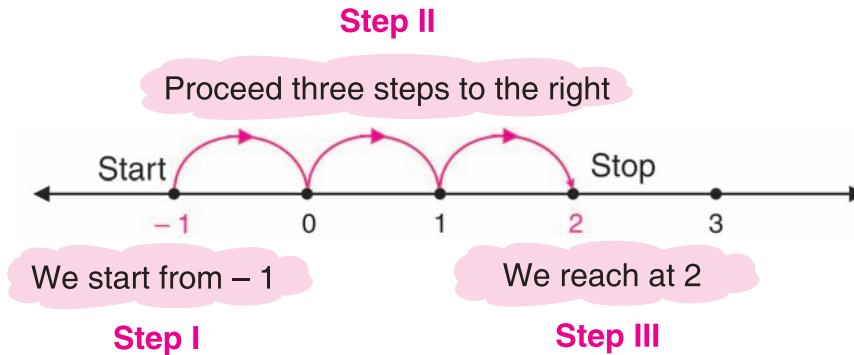
(h)   Absolute value of 3 is − 3.

OPERATIONS ON INTEGERS

A. ADDITION OF INTEGERS

Let us find the position of following numbers on number line.
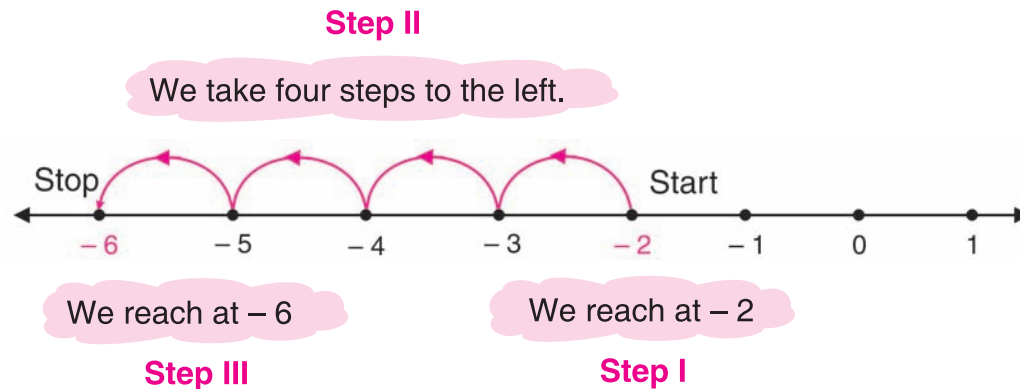
    (a) 3 more than – 1   (b) 4 less than – 2

(a)   3 more than – 1

Step II

Proceed three steps to the right

Start   Stop

– 1   0   1   2   3

We start from – 1   We reach at 2

Step I   **Step III**

So, the number 3 more than – 1 is 2.

(b)   4 less than – 2

Step II

We take four steps to the left.

Stop   Start

– 6   – 5   – 4   – 3   – 2   – 1   0   1

We reach at – 6   We reach at – 2

Step III   **Step I**

So, the number 4 less than – 2 is – 6.

> To find a number more than a given number, we proceed to the right and to find a number less than a given number, we go to the left.

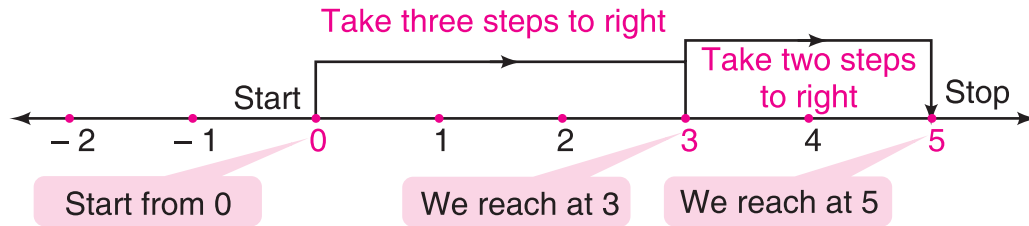Now, let us perform the operation of addition on the number line.

(i) Addition of two positive integers

Add (+ 3) and (+ 2) on a number line.

Remember
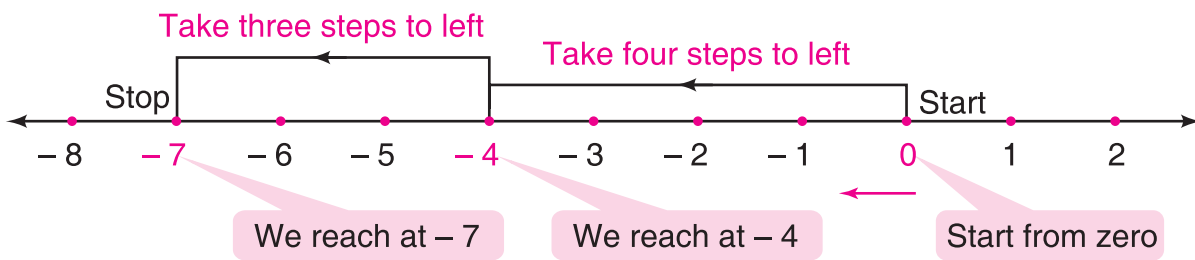
+2 means 2 steps towards right.

Take three steps to right

Start | Take two steps to right | Stop

$$-2 \quad -1 \quad 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5$$

Start from 0   We reach at 3   We reach at 5

So, $(+3) + (+2) = (+5)$.

(ii) Addition of two negative integers

Add $(-4) + (-3)$

Take three steps to left

Stop | Take four steps to left | Start

$$-8 \quad -7 \quad -6 \quad -5 \quad -4 \quad -3 \quad -2 \quad -1 \quad 0 \quad 1 \quad 2$$

We reach at -7 We reach at -4 Start from zero

So, $(-4) + (-3) = (-7)$

Let us do these sums without the help of number line.

Example 1: Add $(+3)$ and $(+2)$

Solution:

$\left.\begin{array}{l} |+3| = 3 \\ |+2| = 2 \end{array}\right\}$ We take the absolute values of integers.

$3 + 2 = 5$ We add the absolute values.

$(+3) + (+2) = +5$ We prefix the sign of addends in their sum.

Example 2: Add (-4) and (-3)

Solution: $(-4) + (-3)$

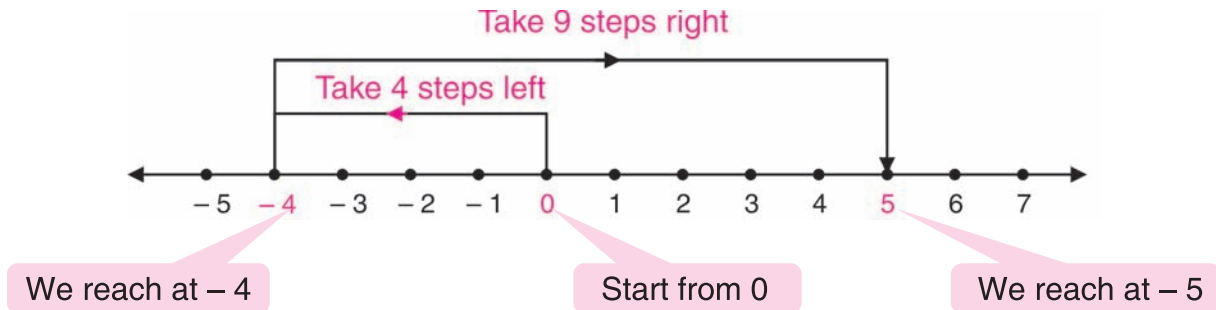$\left.\begin{array}{l} |-4| = 4 \\ |-3| = 3 \end{array}\right\}$ We take absolute values.

$\left.\begin{array}{l} (-4) + (-3) = -(4+3) \\ \qquad\qquad\quad = -7 \end{array}\right\}$ We add the absolute values and prefix the sign of addends.

> **To add two positive integers or two negative integers, add their absolute values and prefix the sign of addends to the sum.**

(iii) Adding one positive and one negative integer

Let us add – 4 and + 9.

Take 9 steps right

Take 4 steps left

– 5   – 4   – 3   – 2   – 1   0   1   2   3   4   5   6   7

We reach at – 4   Start from 0   We reach at – 5

So, (– 4) + (+ 9) = (+ 5)

We can also do this sum without the help of number line.

$|-4| = 4$
$|9| = 9$ } We take the absolute values.

$= + (9 - 4)$ ← We find the difference of absolute values.

$= + 5$ ← We prefix the sign of the integer whose absolute value is greater.

> **If integers have opposite signs, we find the difference of their absolute values and prefix the sign of the integer whose absolute value is greater.**

Worksheet 3

1. **Use the number line and write the number which is:**

   (a)   3 more than 4   (b)   5 less than 1

   (c)   7 more than – 8   (d)   2 less than 2

   (e)   5 more than 6   (f)   7 less than 0

2. **Find the sum on a number line.**

   (a)   8 + (– 3)   (b)   – 7 + 2

   (c)   (– 5) + (– 4)   (d)   (– 2) + 1 + (– 2)

   (e)   7 + (– 4) + (– 3)   (f)   (– 2) + (– 3) + (– 4)

3. **Add the following:**

(a) 67, − 49   (b) − 452, 138

(c) − 95, − 35   (d) 6951, − 6952

(e) 1001, − 101   (f) − 381, − 619

(g) − 419, 386, 419   (h) − 19, 158, − 103

(i) − 9005, 360   (j) − 65, − 35, 100

PROPERTIES OF ADDITION

Property-1: **The sum of any two integers is also an integer.**

Let us add + 5 and − 9

$$+ 5 + (− 9) = − 4 \longrightarrow \boxed{(− 4) \text{ is also an integer.}}$$

Integers

Property-2: **The sum remains the same even if we change the order of the addends.**

Consider the sum of − 6 and + 11

$$(− 6) + (+ 11) = + 5 \quad \boxed{\text{Sum is same}}$$
$$\text{We also have } 11 + (− 6) = + 5$$

The order of addends is changed.

Property-3: **Sum of three integers remains the same even after changing the grouping of the addends.**

Now, add 3, − 5, 9

$[3 + (− 5)] + 9]$ First we add 3 and (− 5)

$= (− 2) + 9$ We add the sum to 9

$= 7$

Now, let us change the groupings.

$3 + [(− 5) + 9]$ Grouping is changed

$= 3 + 4$ We add the sum to 3

$= 7$

See! Sum remains the same.

Property-4: **When zero is added to any integer, the sum is the integer itself.**

We have,   3 + 0 = 0 + 3 = 3

                    − 11 + 0 = 0 + (− 11) = − 11

> *Note:* **Zero** is called the identity element for addition.

Property-5: **When one is added to any integer, we get its successor.**

Let us see what will happen when we add one to any integer.

10 + 1 = + 11   + 11 is the successor of + 10

− 7 + 1 = − 6   − 6 is the successor of − 7

Property-6: **Every integer has an additive inverse such that their sum (integer and additive inverse) is equal to zero.**

Consider the following sums.

5 + (− 5) = 0   − 5 is the opposite of 5

  − 8 + 8 = 0   8 is the opposite of − 8

The opposite of an integer is also called the **negative** or **additive inverse** of the integer.

Worksheet 4

1. **Find the sum in two different ways.**

    (a)   − 32, 50   (b)   − 81, − 79

    (c)   64, − 100   (d)   13, − 78, 15

2. **Write the additive inverse of the following:**

    (a)   31   (b)   − 7

    (c)   21   (d)   − 501

    (e)   0   (f)   − 34

3. **Find the sum using the properties of addition.**

    (a)   200 + (− 105) + (− 36)

    (b)   (− 45) + 100 + (− 55)

    (c)   (− 825) + 725 + 100 + (− 100)

    (d)   927 + (− 517) + (− 518)

(e) (– 215) + (– 215) + 860 + (– 215) + (– 215) + 1

(f) 305 + (– 5) + (– 2) + 2 + (– 200)

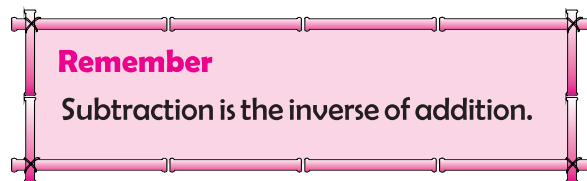(g) 637 + 350 + (– 237) + (– 900)

(h) (– 99) + 7 + (– 101) + 93

4. Fill in the following blanks.

(a) The negative of – 3 is ☐

(b) (– 8) + ☐ = (– 8)

(c) 11 + (– 16) = ☐ + 11

(d) [(– 3) + 5] + 6 = (– 3) + [☐ + ☐]

(e) The identity element of addition is ☐

(f) (– 51) + 51 = ☐

5. Write 'True' or 'False' for the following statements.

(a) 3 + (– 5) is not an integer.

(b) Sum of two negative integers is also a negative integer.

(c) Negative of – 15 does not exist.

(d) [(– 3) + 8] + (– 4) = [8 + (– 3)] + (– 4)

(e) 91 + (– 41) = (– 91) + 41

(f) – 46 + 0 = 0

(g) Sum of a positive integer and a negative integer is always negative.
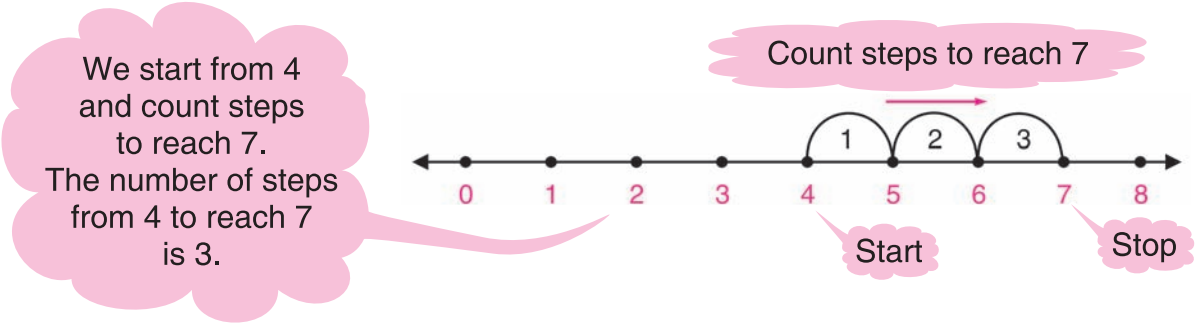
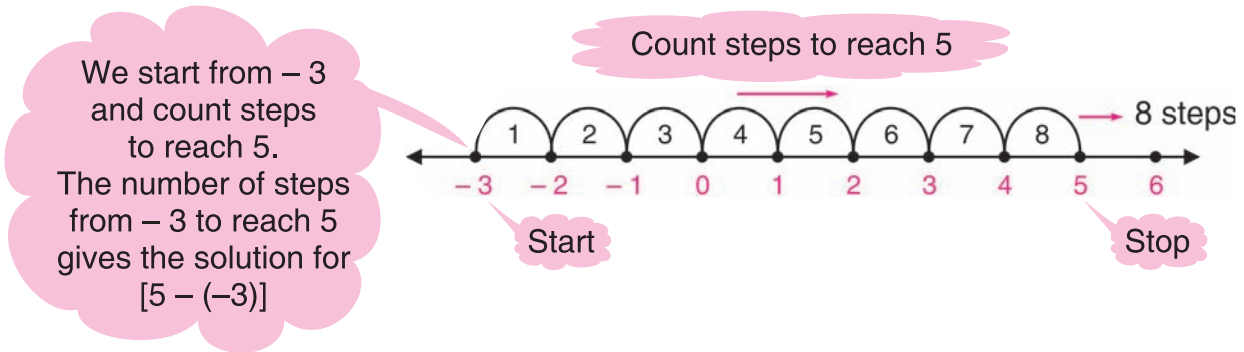(h) | – 9 – 5 | = | – 9 | – | 5 |

B. SUBTRACTION OF INTEGERS

Remember

Subtraction is the inverse of addition.

Subtract 4 from 7

If   7 – 4 = 3,   then   4 + 3 = 7

Using a number line

We start from 4
and count steps
to reach 7.
The number of steps
from 4 to reach 7
is 3.

Count steps to reach 7

Start

Stop

Suppose, we want to subtract – 3 from 5, i.e. 5 – (– 3).

We start from – 3
and count steps
to reach 5.
The number of steps
from – 3 to reach 5
gives the solution for
[5 – (–3)]

Count steps to reach 5

8 steps

Start

Stop

Remember

Negative of a negative integer is the corresponding positive integer.

e.g. 5 – (– 3) = 5 + 3 = 8

So, 5 – (– 3) = 8

Adding negative of integer

Let us do more examples.

Example 3: Subtract 2 from – 6

Solution:
$$-6 - (+2)$$
2 means + 2
$$= -6 + (-2)$$
negative of + 2
adding – 6 and – 2
$$= -8$$

Example 4: Subtract – 3 from – 10

Solution: We have, $-10 - (-3)$
negative of – 3
$$= -10 + 3$$
adding negative of + 3
$$= -7$$

To subtract two integers, we add the negative of the subtrahend to the minuend.

PROPERTIES OF SUBTRACTION

Property-1: The difference of any two integers is also an integer.

e.g. $3 - (+ 5) = - 2$ $- 2$ is an integer.

Property-2: Every integer has its predecessor.

e.g. the predecessor of $- 5$ is $(- 5) - 1 = - 6$

Property-3: Zero subtracted from any integer is the integer itself.

e.g. $- 6 - 0 = - 6$

Worksheet 5

1. **Write the negative of the following integers.**

(a) $- 3$

(b) 5

(c) 100

(d) $- 91$

(e) 108

(f) $- 2004$

2. **Fill in the following blanks. The first one is done for you.**

(a) $9 - 4 = 9 + \boxed{(- 4)}$

(b) $12 - 7 = 12 + \boxed{}$

(c) $3 - (- 2) = 3 + \boxed{}$

(d) $- 4 - 6 = - 4 + \boxed{}$

(e) $70 - (- 19) = 70 + \boxed{}$

(f) $37 - 26 = 37 + \boxed{}$

(g) $- 21 - 64 = - 21 + \boxed{}$

(h) $0 - 8 = 0 + \boxed{}$

(i) $11 - (- 6) = 11 + \boxed{}$

(j) $- 100 - (- 100) = - 100 + \boxed{}$

3. **Subtract the first integer from the second one.**

(a) $9, 4$

(b) $- 9, 4$

(c) $10, - 7$

(d) $- 11, - 6$

(e) $16, 0$

(f) $2001, 201$

(g) $458, - 263$

(h) $0, - 565$

(i) $- 823, - 232$

(j) $41623, 26413$

4. **Subtract $- 6$ from 3 and 3 from $- 6$. Are the results same?**

5. **Sum of two integers is 48. If one of them is $- 25$, find the other.**

6. **Subtract the sum of 38 and $- 49$ from $- 100$.**

7. **Compare.**

(a) (– 25) – (– 15) ◯ (– 25) + (– 15)

(b) 18 + (– 8) ◯ 18 – (– 8)

8. **Find the value of–**

(a) (– 3) – (– 19)

(b) – 12 – 8 – (– 35)

(c) 56 – (– 13) + 15

(d) (– 41) + (– 36) – 23

(e) (– 16) – (– 6) + (– 9) – 4

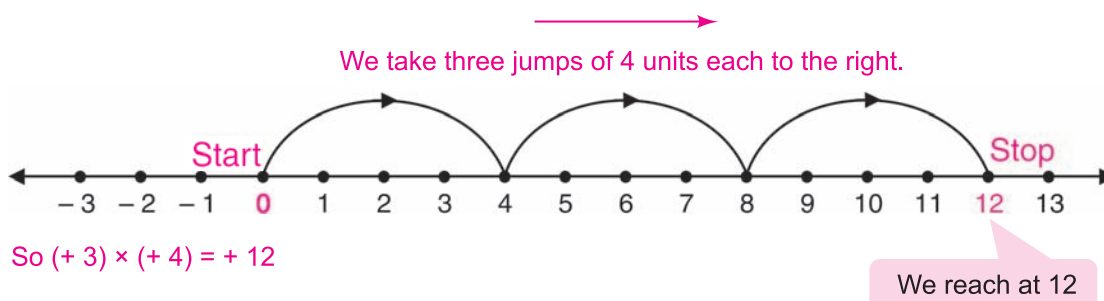(f) 71 – 83 – (– 42) + 15

C. MULTIPLICATION OF INTEGERS

(i) Multiplication of two positive integers

Let us multiply + 3 by + 4

(+ 3) × (+ 4) means + 4 is added 3 times

(+ 4) + (+ 4) + (+ 4) = + 12

Remember

Multiplication is repeated addition.

We take three jumps of 4 units each to the right.

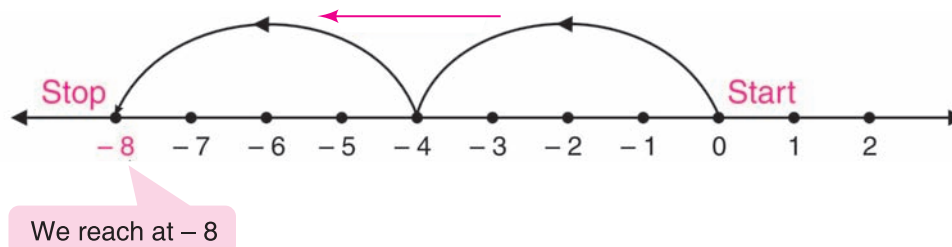So (+ 3) × (+ 4) = + 12

We reach at 12

When both integers are positive, we multiply their absolute values and prefix plus sign to the product.

(ii) Multiplication of a positive and a negative integer

Let us multiply (+ 2) × (– 4)   – 4 is repeatedly added two times

(+ 2) × (– 4) = (– 4) + (– 4) = – 8

We take two jumps of 4 units each to the left.

We reach at – 8

So, (+ 2) × (– 4) = – 8

> When one integer is positive and the other is negative, we multiply their absolute values and prefix minus sign to their product.

(iii) Multiplication of two negative integers

See the following pattern

$$(-3) \times 4 = -12$$
$$(-3) \times 3 = -9 \longrightarrow \boxed{(-12) + 3}$$
$$(-3) \times 2 = -6 \longrightarrow \boxed{(-9) + 3}$$
$$(-3) \times 1 = -3$$
$$(-3) \times 0 = 0$$
$$(-3) \times (-1) = +3$$

The product increases by 3 at each stage

$$(-3) \times (-2) = +6 \longrightarrow \boxed{+3+3}$$

The multiplier decreases by one at each stage

Similarly, $(-3) \times (-3) = +9$ $\boxed{+6+3}$

> When both integers are negative, we multiply their absolute values and prefix plus sign.

Note: The teacher should take a few more examples to show the pattern.

(iv) Product of more than three factors

Find the product of $(-2) \times 3 \times (-1) \times 5 \times (-5)$

$$\longrightarrow -2 \times 3$$
$$= (-6) \times (-1) \times 5 \times (-5)$$
$$\longrightarrow (-6 \times -1)$$
$$= 6 \times 5 \times (-5)$$
$$\longrightarrow 6 \times 5$$
$$= 30 \times (-5)$$
$$= -150$$

> In multiplication, if the number of negative integers is–
> - odd, the product is **negative.**
> - even, the product is **positive.**

PROPERTIES OF MULTIPLICATION

Property-1: **Product of any two integers is also an integer.**

We have, $(-2) \times (+4) = -8$ (-8 is also an integer)

Property-2: **Product remains the same even if we change the order of integers.**

We have, $5 \times (-3) = -15$

$(-3) \times 5 = -15$ Same

Order of integers is changed.

Property-3: **Product remains the same even when we change the groupings of the integers.**

Let us multiply $[2 \times (-10)] \times 3$ in two different ways.

Grouping is changed

$[2 \times (-10)] \times 3$ $2 \times [(-10) \times 3]$

$= (-20) \times 3$ $= 2 \times (-30)$

$= -60$ $= -60$

Product is same

Property-4: **Product of an integer and zero is zero.**

We have, $(-5) \times 0 = 0$

$(+19) \times 0 = 0$

Property-5: **1 multiplied by any integer is the integer itself.**

We have, $(-9) \times 1 = -9$

$(+24) \times 1 = +24$

> **Note:**   One (1) is the identity element of multiplication.

Property-6: **This property is called the distributive property of multiplication over addition.**

If $2, (-3), 5$ are three integers then,

$2 \times [(-3) + 5] = 2 \times (-3) + 2 \times 5$

We have   We have

$2 \times [(-3) + 5]$ $2 \times (-3) + 2 \times 5$

$= 2 \times 2$ $= (-6) + 10$

$= 4$ $= 4$

Same

1. **Write the appropriate sign of the product.**

(a) $(-3) \times (+5) = \boxed{}\,15$ (b) $(+8) \times (-6) = \boxed{}\,48$

(c) $(-15) \times (-3) = \boxed{}\,45$ (d) $(+8) \times (-1) = \boxed{}\,8$

(e) $(+9) \times (-9) = \boxed{}\,81$ (f) $(-100) \times (-6) = \boxed{}\,600$

(g) $(-11) \times (+11) = \boxed{}\,121$ (h) $1000 \times (-100) = \boxed{}\,100000$

2. **Find the product of the following:**

(a) $(-5) \times 6 = $ _____   (f) $(-25) \times 4 \times (-4) = $ _____

(b) $(-19) \times (-3) = $ _____   (g) $7 \times (-4) \times (-12) = $ _____

(c) $15 \times (-4) = $ _____   (h) $(-1) \times (-1) \times (-1) = $ _____

(d) $(-16) \times (-2) = $ _____   (i) $(-14) \times (-10) \times 6 \times (-1) = $ _____

(e) $(-5) \times 10 \times (-100) = $ _____   (j) $(-19) \times 7 \times 0 \times (-5) \times 2 = $ _____

3. **Find the value of the following:**

(a) $1234 \times 567 - 234 \times 567$ (b) $739 \times 99 - (-739)$

(c) $(-70) \times (10 - 5 - 22 - 83)$ (d) $861 \times (-3) + (-861) \times 7$

(e) $326 \times (-108) + 326 \times 8$ (f) $242 \times (-95) + 242 \times (-4) - 242$

4. **Write the integer which when multiplied by (-1) gives,**

(a) -3 (b) 19

(c) 0 (d) 74

(e) -69 (f) -100

5. **Compare the following:**

(a) $(7 + 6) \times 10 \;\bigcirc\; 7 + 6 \times 10$

(b) $(11 - 9) \times 8 \;\bigcirc\; 11 - 9 \times 8$

6. **What will be the sign of the product of the following:**

(a) 7 negative and 3 positive integers. $\boxed{}$

(b) 26 negative and 10 positive integers. $\boxed{}$

(c) 11 negative and 11 positive integers.

(d) $(-4) \times (-5) \times (-6) \times$ _____ $\times (-13)$.

(e) $(-12) \times (-13) \times (-14) \times (-15) \times$ _____ $\times (-22)$.

7. **Write 'True' or 'Flase' for the following statements.**

(a) The product of two integers is always an integer.

(b) The product of two integers with opposite signs is positive.

(c) The identity element of multiplication is 0.

(d) Of the two integers if one is negative, the product must be negative.

D. DIVISION OF INTEGERS

We know that every multiplication fact has two corresponding division facts.

We know, $4 \times 8 = 32$

$32 \div 8 = 4$ $\qquad$ $32 \div 4 = 8$

Similarly, $(-3) \times (-9) = +27$

$27 \div (-9) = -3$ $\qquad$ $27 \div (-3) = -9$

(i) Division of integers with like signs.

Divide $+20$ by $+5$

$(+20) \div (+5) = (+4)$ $\longrightarrow$ Positive sign

Like signs $(+)$

Remember
Division is the inverse of multiplication.

Now, divide (-12) by (-3)

$(-12) \div (-3) = (+4)$ $\longrightarrow$ Positive sign

Like signs $(-)$
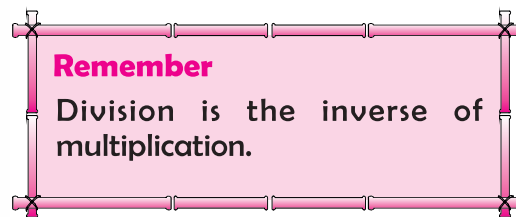
> **To divide two integers of like signs, we divide their absolute values and prefix plus (+) sign.**

66

(ii) Division of integers with unlike signs

Divide 6 by (− 3)

$$(+ 6) \div (− 3) = (− 2)$$

→ negative sign

opposite sign

Now, divide 75 by (− 15)

$$(+ 75) \div (− 15) = (− 5)$$

→ negative sign

opposite signs

To divide two integers of opposite signs, we divide their absolute values and prefix minus (−) sign.

PROPERTIES OF DIVISION

Property-1: The quotient of two integers is not always an integer.

We have, $6 \div (− 2) = − 3$ (− 3 is an integer)

Is $2 \div (− 3)$ an integer?

Is $(− 6) \div 4$ an integer?

Property-2: When an integer (non-zero) is divided by the same integer, the quotient is one.

We have, $(− 3) \div (− 3) = 1$ $(+ 10) \div (+ 10) = 1$

Property-3: When an integer is divided by one, the quotient is the same integer.

We have, $(− 7) \div 1 = − 7$ $(+ 3) \div 1 = + 3$

Property-4: Zero divided by any integer (non-zero) is zero.

We have, $0 \div (− 9) = 0$ $0 \div (+ 3) = 0$

Worksheet 7

1. **Put the appropriate sign in the quotients.**

(a) $(− 9) \div (+ 3) = \boxed{}\ 3$

(b) $(− 30) \div (− 10) = \boxed{}\ 3$

(c) $16 \div (− 4) = \boxed{}\ 4$

(d) $(− 21) \div (+ 3) = \boxed{}\ 7$

(e) $(− 99) \div (− 9) = \boxed{}\ 11$

(f) $(− 105) \div (− 7) = \boxed{}\ 15$

(g) $(+ 1000) \div (− 100) = \boxed{}\ 10$

(h) $(+ 25) \div (− 25) = \boxed{}\ 1$

2. **Find the quotient of the following:**

(a) $(-36) \div 9$ (b) $125 \div (-5)$

(c) $(-5375) \div (-25)$ (d) $374 \div (-17)$

(e) $(-108) \div 12$ (f) $0 \div (-17)$

(g) $(-3000) \div 100$ (h) $(-144) \div (-12)$

(i) $48 \div (-16)$ (j) $(-1331) \div (-11)$

3. **Fill in the following blanks.**
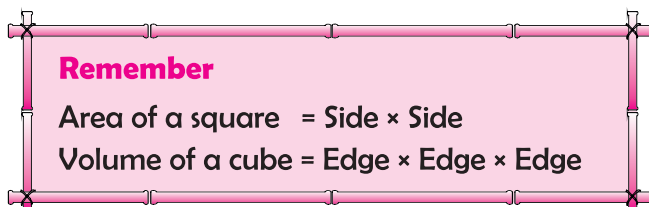
(a) $(-93) \div \boxed{} = (-93)$ (b) $17 \div (-1) = \boxed{}$

(c) $\boxed{} \div (-8) = 0$ (d) $\boxed{} \div 1 = -42$

(e) $(-65) \div \boxed{} = 1$

POWER OF INTEGERS

Remember

Area of a square   = Side × Side

Volume of a cube = Edge × Edge × Edge

Now, let us look at the area of this square.

Area of square   = 4 cm × 4 cm = 16 cm^2

4 × 4 can also be written as 4^2

So, $4^2 = 4 \times 4$

Now, look at the volume of this cube.

Volume of this cube = 5 × 5 × 5 = 125 cm^3

5 × 5 × 5 can also be written as 5^3
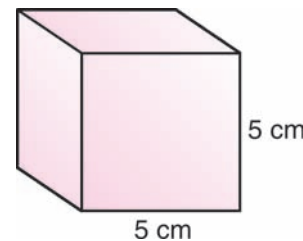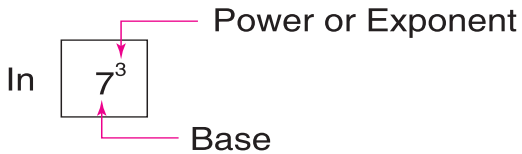
or $5^3 = 5 \times 5 \times 5$

Similarly,

$2^4 = 2 \times 2 \times 2 \times 2$ → 2 is multiplied by itself four times

$(-10)^5 = (-10) \times (-10) \times (-10) \times (-10) \times (-10)$ → (– 10) is multiplied by itself five times

In 2^4, **2** is called the **Base** and **4** is called the **Power** or **Exponent**

Power or Exponent

In 7^3

Base

Power or Exponent indicates the number of times the base is to be multiplied by itself.

We write	We read
2^2	Two square or two to the power two
6^3	Six cube or six to the power three
$(-7)^4$	Minus seven to the power four

See these examples.

Example 5: Find the value of

$(-2)^3 \times 5^2 \times (-10)^2$

Solution: We have,

$$(-2)^3 = (-2) \times (-2) \times (-2) = -8$$

$$5^2 = 5 \times 5 = 25$$

$$(-10)^2 = (-10) \times (-10) = 100$$

$$(-2)^3 \times 5^2 \times (10)^2 = (-8) \times 25 \times 100$$

$$= -20000$$

Example 6: Compute–

(a) $(-1)^3$

(b) $(-1)^6$

Solution: We have,

(a) $(-1)^3 = (-1) \times (-1) \times (-1) = -1$

(b) $(-1)^6 = (-1) \times (-1) \times (-1) \times (-1) \times (-1) \times (-1) = 1$

Remember

- (-1) to the power of odd positive integer is equal to -1.
- (-1) to the power of even positive integer is equal to 1.

Worksheet 8

1. **Read aloud.**

(a) 5^2 　　　　(b) 9^5 　　　　(c) 7^3

(d) $(-2)^4$ 　　　(e) $(-10)^3$ 　　(f) $(-1)^{18}$

2. Complete the table given below. The first one is done for you.

Powered number	Base	Exponent
(a) 7^5	7	5
(b) 9^3		
(c) $(-3)^4$		
(d) $(-1)^6$		
(e) 20^2		
(f) $(-10)^7$		

3. Write in power notation.

(a) $4 \times 4 \times 4$

(b) $(-2) \times (-2) \times (-2) \times (-2)$

(c) $5 \times 5 \times 5 \times 5 \times 5$

(d) $(-10) \times (-10) \times (-10) \times$ .... 8 times

(e) $(-11) \times (-11) \times (-11)$

(f) $(-1) \times (-1) \times (-1)$ .... 33 times

4. Write the following in expanded form.

(a) 2^5 (b) 3^4

(c) $(-7)^3$ (d) $(-12)^2$

5. Compute the following:

(a) 3^4 (b) $(-5)^2$

(c) $(-1)^{78}$ (d) 11^3

(e) $(-4)^3 \times (-10)^3 \times (-1)^{789}$ (f) $(50)^2$

6. Find the number which is—

(a) Cube of -9 (b) Square of 15

(c) 5th power of (-10) (d) 19th power of (-1)

7. Simplify.

(a) $3^2 + 4^2$ (b) $2^3 - 4^2$

(c) $1^3 + 2^3 + 3^3$ (d) $(-10)^3 + (-10)^2 + (-10)^1$

(e) $3^3 - (-2)^3$ (f) $(-1)^{16} + (-1)^{36} + (-1)^7 + (-1)^{54}$

8. Subtract the cube of (– 2) from the cube of 2.

9. Verify.

   (a) $(- 2)^5 \times (- 2)^3 = (- 2)^8$ (b) $6^5 \times 6^4 = 6^9$

   (c) $5^2 - 3^2 = 4^2$ (d) $12^2 + 5^2 = 13^2$

10. Write 'True' or 'False' for the following statements.

    (a) $3^4 = 4^3$

    (b) $9^7 \div 9^5 = 9^2$

    (c) $(- 5)^2 \times (- 5)^3 \times (- 5) = (- 5)^6$

    (d) $6^3 + 6^2 = 6^{3+2}$

    (e) Cube of a negative integer is positive.

    (f) $(- 1)^{101} = - 1$

    (g) $1^3 = 3$

    (h) Cube of a positive integer is negative.

    (i) $3^2 = 6$

    (j) 6th power of a negative integer is positive.

11. What power of–

    (a) 2 is 32   (b) – 4 is – 64

    (c) 10 is 100000   (d) (– 5) is – 125

✔ALUE BASED QUESTIONS

1. **Ravi and Rahul were good friends. Ravi was a poor boy. He was very much in need of a geometry box. Rahul decided to help him. He bought for him a geometry box costing ₹ 65 from his pocket money. Ravi was very excited to get the new geometry box and thanked Rahul for his caring nature.**

   (a) Express spending ₹ 65 as an integer.

   (b) Suggest any two ways by which you have helped any of your friends.

2. **In a quiz competition there were 25 questions. 2 marks was alotted to every correct answer and –1 to every wrong answer. Sheetal attempted 22 questions out of which 2 answers were wrong. The teacher gave her 40 marks. Sheetal went to the teacher and**

informed her that she has been given more marks. The teacher was happy with Sheetal. She did not deduct her marks.

(a) What is Sheetal's actual score?

(b) What quality of Sheetal made the teacher happy?

BRAIN TEASERS

1. **A. Tick (✓) the correct answer.**

   (a) The number of integers between (– 10) and 3, is–

      (i) 11   (ii) 13   (iii) 12   (iv) 14

   (b) If we subtract (– 10) from (– 11) we get–

      (i) – 1   (ii) 1   (iii) – 21   (iv) 21

   (c) Square of 2 subtracted from cube of (– 1) is–

      (i) 3   (ii) 5   (iii) – 5   (iv) 1

   (d) Value of | – 7| + (– 6) + | 3 | is–

      (i) – 10   (ii) 4   (iii) 10   (iv) – 4

   (e) Which of the following does not lie to the right side of (– 61) on the number line?

      (i) – 10   (ii) 18   (iii) – 49   (iv) – 73

   B. Answer the following questions.

   (a) Write any two integers less than (– 101).

   (b) Find the value of | (– 30) – (– 7) |.

   (c) Which integer added to (– 4) will give the integer 5?

   (d) Simplify and write its opposite (– 3) × 5 × (– 1).

   (e) Find the sum of the greatest negative integer and smallest positive integer.

2. **Indicate using integers.**

   (a) 200 BC   (b) 5° Celsius below zero

   (c) Win by 3 goals   (d) 40 km above sea level

3. **Write the opposites of the following statements.**

   (a) India won the match by 3 wickets.

(b) Mohan withdrew ₹ 2500 from his bank account.

4. Write any three integers which are—

(a) smaller than – 25 (b) greater than – 191

5. Arrange in ascending order.

– 104, 48, – 69, 13, – 7, – 96, – 48, 5

6. Find the value on the number line.

(a) (– 3) + 5 – 7 (b) 8 + (– 6) + (– 2)

7. Simplify.

(a) (– 400) + 781 + (– 1400) + (– 81) + 300

(b) (– 273) + (– 541) + 900 + (– 511)

8. Subtract.

(a) – 9 from 0 (b) – 115 from – 115

9. Find the value of–

(a) (– 6) × [9 + (– 11)]

(b) 325 × (– 641) + 325 × (– 359)

(c) $5^2 × (– 1)^{19} × (– 2)^3 × 3^2 × (– 10)^3$

10. Compare.

18 × (– 3) + 21 and 18 × [(– 3) + 21]

11. Fill in the blanks.

(a) There are _____ integers from – 4 to 11?

(b) Natural numbers are called _____ integers (positive/negative).

(c) The additive inverse of 6 is _____

(d) 168 + _____ = 0

(e) The predecessor of – 249 is _____

(f) [(– 2) + (– 7)] × 3 = 3 × _____ + 3 × _____

(g) The opposite of (– 3) × 2 × (– 1) is _____

(h) All the negative integers are _____ than zero.

(i) 14, 7, 0, – 7, _____, _____.
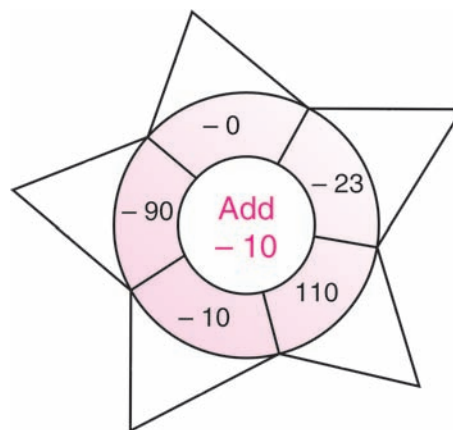
12. **Write 'True' or 'False' for the following statements.**

(a) The absolute value of an integer is always greater than the integer.

(b) The product of 9 negative integers is positive.

(c) Cube of 11 has 1 in its units place.

(d) The base in 7^3 is 3.

(e) $3^8 \div 3^5 = 3^3$

13. **Fill in the missing places with proper integers.**

(a)
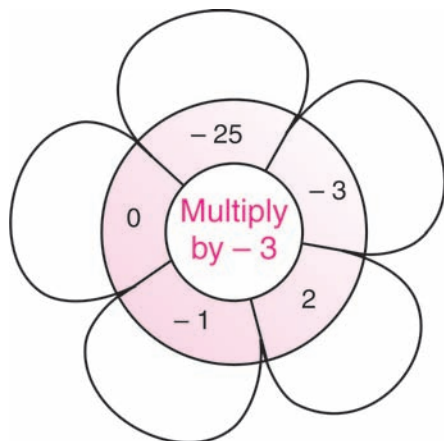
(b)

HOTS

1. (a) Calculate $1 - 2 + 3 - 4 + 5 - 6 + \ldots + 179 - 180$.

(b) Find the value of $5 + (-5) + 5 + (-5) + 5 + \ldots$ if the number of fives are–

(i) 148

(ii) 191

2. **A cement company gains ₹ 12 per bag of white cement sold and gets a loss of ₹ 8 per bag of grey cement sold.**

(a) If the company sells 3500 bags of white cement and 5000 bags of grey cement in a month, find the gain or loss.

(b) If the number of grey cement bags sold is 6000, how many bags of white cement should the company sell to have neither gain or loss?

YOU MUST KNOW

1. We need to use numbers with negative signs in some situations. These are called negative numbers. Some examples of their use are temperature of a day, water level in a sea, etc.

2. Positive numbers, negative numbers along with zero are called integers. Zero is neither positive or negative.

3. Each and every integer can be represented on the number line. The integer to the right side of another integer is greater.

4. Absolute value of an integer is the numerical value without taking the sign to account.

5. To add two positive integers or two negative integers, add their absolute values and prefix the sign of addends to it.

6. If integers are of opposite signs, we find the difference of their absolute values and prefix the sign of the integer whose absolute value is greater.

7. To subtract two integers, we add the negative of the subtrahend to the minuend.

8. In multiplication, if both integers have like signs we multiply their absolute values and prefix plus sign to the product and if the integer have unlike signs we multiply their absolute values and prefix negative sign to the product.

9. One is the identity element of multiplication of integers.

10. To divide two integers of like signs, we divide their absolute values and prefix (+) sign.

11. To divide two integers of unlike signs, we divide their absolute values and prefix (–) sign.

12. In 7^3, 7 is called the base and 3 is called exponent or power. Power or exponent indicates the number of times the base is to be multiplied by itself.

The LIVING WORLD

(A Book of Science & Technology)

CONTENTS

1 | Our Environment

We see a variety of plants and animals around us. They may be similar, or different, depending upon the geographical and climatic conditions. Living objects do not live in isolation. They interact with one another and also with the non-living surroundings in which they live. As a result, both plants and animals get adapted to their surroundings.

We find that there are two types of objects in our surroundings. Plants and animals, including human beings, form the living components. They are also called the **biotic components**. Air, water, soil, light, temperature, etc., are non-living and are also called **abiotic components**. Both biotic (living) and abiotic (non-living) components, taken together constitute our **environment**.

▶ Biotic Environment

Living organisms, i.e. all plants and animals, including humans, form the biotic environment. Let us try to understand its different components one by one.

1. **Plants (Producers):** We all know that plants, like other organisms, need food. All green plants have the colouring matter, called **chlorophyll**. The chlorophyll, which is present in the leaves, absorbs energy from the sunlight. This energy is used to prepare food. For this, plants also use carbon dioxide from the atmosphere, and water and minerals from the soil. This process of preparing food, by the plants, is called **photosynthesis**. The following equation represents this process.

$$\text{Carbon dioxide} \quad + \quad \text{Water} \quad \xrightarrow[\text{chlorophyll}]{\text{sunlight}} \quad \underset{\text{(Carbohydrate)}}{\text{Glucose}} \quad + \quad \text{Oxygen}$$
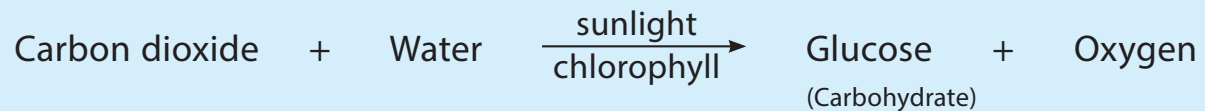
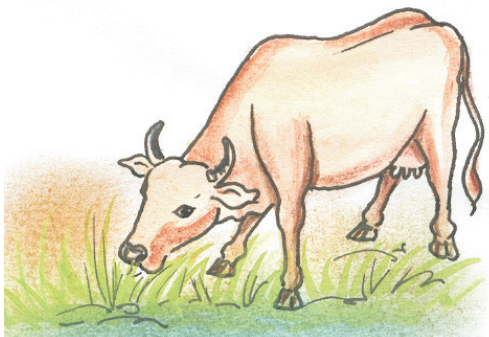The green plants, which prepare their own food (glucose), are called **producers** or **autotrophs** (auto = self; troph = food).

Plants prepare their own food using sunlight

2. **Animals (Consumers):** Animals cannot prepare their own food. They have to depend on plants for their food. They are called **consumers** or **heterotrophs** (hetero = other; troph = food).

Cow feeds on grass

A boy eating plant products (fruits)

All animals feed on green plants, either directly or indirectly. Animals, like cattle and goat, directly eat plants, like grass and fodder. They are called **primary consumers** or **herbivores**. Animals, like tiger and lion, feed on these herbivores. In other words, they hunt, and eat, cattle, goat, etc. Such consumers, which feed on plants indirectly, are called **secondary consumers** or **carnivores**. There are some animals which feed on both producers as well as the primary consumers. They are called **omnivores.** Animals, like bears, pigs, etc., are omnivores. We, human beings, are also omnivores.

| Herbivore (Deer) | Carnivore (Tiger) | Omnivore (Bear) |

3. **Micro-organisms (Decomposers):** In addition to producers and consumers, there are some organisms which derive their food from dead and decaying plants and animals. They are called **decomposers**. Decomposers breakdown the dead and decaying plants and animals into minerals. These minerals get mixed up with the soil and are then again used by the plants. This process is called **recycling of minerals**.

Fungi and bacteria are the organisms that help in decomposition. These are so small that they cannot be seen with the naked eyes. They are called **micro-organisms**.

Fungus on fruits

Animals and birds, like jackals, crows, vultures and kites, consume dead bodies of animals. This process helps in keeping the environment clean. They are called **scavengers**.

Do You Know ?

- If dead organisms are not decomposed, their number will go on increasing and there will be no space left for the living organisms.
- Some bacteria, present in air, water and soil can cause various diseases.

A zoo feeder wants to segregate the animals, listed below, into three groups, on the basis of the types of food they eat.

giraffe | lion | bear | leopard | chimpanzee | tiger | elephant | panda | deer | crocodile | rhinoceros | cheetah | hippopotamus | fox | kangaroo

Help the zoo feeder to organise the animals, into the three groups, listed below.

Herbivores	Carnivores	Omnivores

There are certain materials that cannot be decomposed in nature. Now let us perform the following activity.

Activity 2

Take some pieces of a newspaper, a piece of cloth and a used plastic bag. Burry these in the soil. After one month, dig up the soil and check for the three things.

What do you observe? The plastic bag shows no change and is in the same condition as when it was buried. Paper and cloth have changed and are partially decomposed. Why has this difference in these materials occurred? This is due to the difference in the action of decomposers on them.

We observe that paper and cloth are **biodegradable materials** (bio = living organisms; degradable = decomposable). These are materials which can be broken down into simpler substances by micro-organisms. Plastic is **non-biodegradable**, i.e. it cannot be broken down into simpler substances by any micro-organism. Plastic, and other such materials, affect the environment adversely. Their accumulation, in the sewerage system, leads to blocking of drains in our cities. Burning of plastic materials adds to air pollution. We should, therefore, convince our friends and relatives not to use plastic bags!

Children saying 'No' to plastic bags

4

In some cities, a twin bin system has been introduced for the welfare of environment. Blue dustbins and green dustbins are placed in the localities. In the blue bins, non-biodegradable waste (plastic, aluminium foil, glass, batteries, etc.) are disposed off; in green bins, biodegradable waste (vegetable waste, paper, cloth, cardboard, etc.) are disposed off.

It is important for us to segregate biodegradable and non-biodegradable wastes and dispose them in an environment friendly way. The kitchen waste can be put in a pit dug in the garden which is then covered with soil and dry leaves. This waste, in the pit, is acted upon by micro-organisms and gets converted into useful **compost**. This compost can be used for growing healthy plants in fields and gardens.

Vermicomposting

In order to hasten the process of compost making, a variety of earthworms, called **redworms**, can be mixed with the kitchen waste. They convert it into compost very fast. The process, of forming compost with the help of various worms usually redworms, whiteworms and other earthworms, is known as **vermicomposting.** Vermicompost is an excellent, nutrient rich, organic fertiliser and soil conditioner.

Redworms

Activity 3

List the things, or items, you throw away as a waste in the dustbin. Don't you think some of them can be recycled, reused or composted?

Try to categorise the items, in your list, into three columns under their appropriate heading. You may find it interesting to note that the names of some of the items can be put in more than one column!

Items that can be—

| Recycled	Reused	Composted

► Abiotic Environment

Abiotic Components include physical conditions and non-living material that affect the growth, maintenance and reproduction of living components, and can interact with each other. Water, air, light, temperature, soil and rocks, etc., are all examples of non-living or abiotic components. These non-living components form the **physical**, or **abiotic environment** in nature. Let us study about them in detail.

■ Water

Water is essential for the survival and growth of all living organisms. It is needed, and used, for drinking, bathing, cooking, etc. Animals and plants cannot survive without water. It is used for irrigation of crops. Humans, and other animals, need water for different activities of their life. Try to think, and list, the various activities for which we use water.

● Rain Water Harvesting

Rain water harvesting is a way to collect rain water when it rains. Rain water can be stored, above the ground, or underground, and then used later. This happens naturally in open rural areas. However, in congested metropolitan cities, we need to create a method to capture the rain water. 'Roof Top Rain Water Harvesting' is one of such methods. Here, rain water can be collected at the roof tops (terrace) of houses. Through pipes, this water can be transferred to tanks, pits or small wells. Since the water is very likely to get impure, it should be used for household purposes only after filtration and purification.

Continuous Guttering

Rain water filter

Rain water storage tank
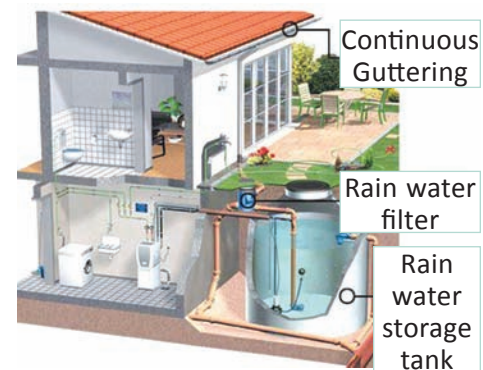
Rain water harvesting can supplement the requirement of water in cities and raise the sub-soil water level. This can help in maintaining, and increasing, greenery in urban areas.

If rain water is not collected, it flows down to the rivers situated far away through the drains and is thus, not available for immediate use.

The rain water, that falls on the roads, or concrete areas, goes into the drains. The rain water, that falls on the untreated ground, seeps into the ground, recharging the groundwater. Innovative water collection methods need to be used in different areas to collect, and use, rain water.

Rain water harvesting

■ Air

We know that all living organisms need air for their survival. Air is a mixture of several gases. Oxygen, nitrogen and carbon dioxide are the important gases present in air. Plants and animals use oxygen for respiration. Plants consume carbon dioxide for photosynthesis and release oxygen back into the atmosphere.

Besides oxygen, nitrogen and carbon dioxide, small amounts of other gases, very many bacteria and viruses, and dust are also present in air. Clean air is essential for our health; as it provides the oxygen that is necessary to sustain life.

■ Light

Natural light is provided to us, by the sun during the day and by the moon during the night. The moon, as you know, only reflects the sun's light. Hence, sun is the ultimate source of natural light. This natural light is used by the plants to grow, and to prepare their food. Life on earth is dependent on sunlight. Plants use sunlight and prepare their own food by photosynthesis.

Light penetrates into the forests as well as into the water bodies. Aquatic plants use sunlight for photosynthesis, just like the other plants. However, the amount of light, reaching these plants, decreases with an increase in the depth of water. That is why very few plants are able to survive in deep waters.

Plants and animals respond to light in different ways. Have you seen a plant called **Morning Glory** (*Ipomoea*)? Its flowers bloom out at sunrise (i.e. morning) and close down after sunset. Similarly, in some plants, the leaves open during the day and close during the night.

Morning Glory *(Ipomoea)*

The sunflower always faces the sun. In the morning, it faces the east; in the evening it turns towards the west.

Animals also show variations in their behaviour with the amount of light available to them. Most of the animals are active during the day when there is light. Some animals, like rats, cockroaches and owls, are active during night.

Owls are active at night

Temperature

The temperature, at a place, is indicative of the degree of hotness, or coldness, of that place. It can be measured by a device called the **thermometer**. The degree of hotness varies from place to place.

Temperature affects activities of living organisms. It is an important factor that determines the distribution of plants and animals on earth. Each organism has its own tolerance range for temperature.

Most plants and animals grow in warm places but some need a cold climate. Cows can tolerate the hot weather better than buffaloes. We often see buffaloes cooling themselves in ponds during summer. This is because buffaloes are black in colour and do not have efficient sweat glands. Hence, they feel the heat more and need to cool themselves by remaining in water.

Buffaloes cooling themselves in water

On the other hand, camels can tolerate even the extreme heat of the deserts. They have no sweat glands. This helps in reducing the loss of water from their body. They can live without water for many days.

Polar bears and penguins are found only in cold regions; tigers and elephants are found in warm regions.
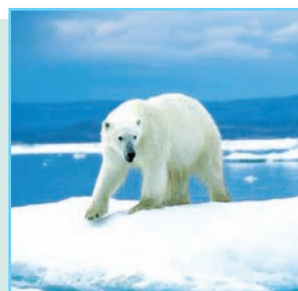
| Polar Bear | Penguins | Tiger | Elephant |
| Cold region animals | | Warm region animals | |

■ Soil

Soil is another important abiotic factor of our environment. Most of the plants cannot grow without soil. Soil provides water and minerals to the plants which are important for their growth. It also provides a home to organisms that live in soil.

▶ Interaction in the Environment

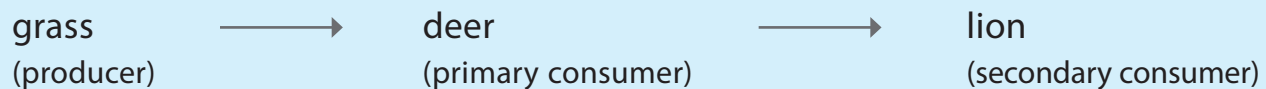Plants and animals are interdependent in their food relationships. There are animals that feed on plants. Many of such animals are eaten by other animals which, in turn, are eaten by some other animals. There is thus, a **'food chain'** in nature. For example—

grass	⟶	deer	⟶	lion
(producer)		(primary consumer)		(secondary consumer)

It is an example of a terrestrial food chain. When such a chain exists between aquatic plants and animals, it makes up an aquatic food chain.

Activity 5

For each of the three cases (a), (b) and (c), use the words, given in the box, to make a 'food chain'. Also identify the nature (terrestrial/aquatic) of each of these three food chains.

(a)

| owl | grass | grasshopper | rat | snake |

⬜ → ⬜ → ⬜ → ⬜ → ⬜

This is a/an _____ food chain. (terrestrial/aquatic)

(b)

| dolphin | snail | tuna | plankton |

⬜ → ⬜ → ⬜ → ⬜

This is a/an _____ food chain. (terrestrial/aquatic)

9

(c)

shark | fish | seal | algae

```
┌──────────┐    ┌──────────┐    ┌──────────┐    ┌──────────┐
│          │ →  │          │ →  │          │ →  │          │
└──────────┘    └──────────┘    └──────────┘    └──────────┘
```

This is a/an _____ food chain. (terrestrial/aquatic)

The Mineral Cycle

There is a relationship between the biotic and abiotic components of our environment. The abiotic substances supply nutrients to the producers. The producers prepare food for the consumers. Both producers and consumers, after their death, are broken down into simpler substances by decomposers. The nutrients return to soil, air and water. These nutrients are again used by the producers. The whole cycle is thus, repeated continuously. This cycling of materials, through biotic and abiotic components, is called the **mineral cycle**.
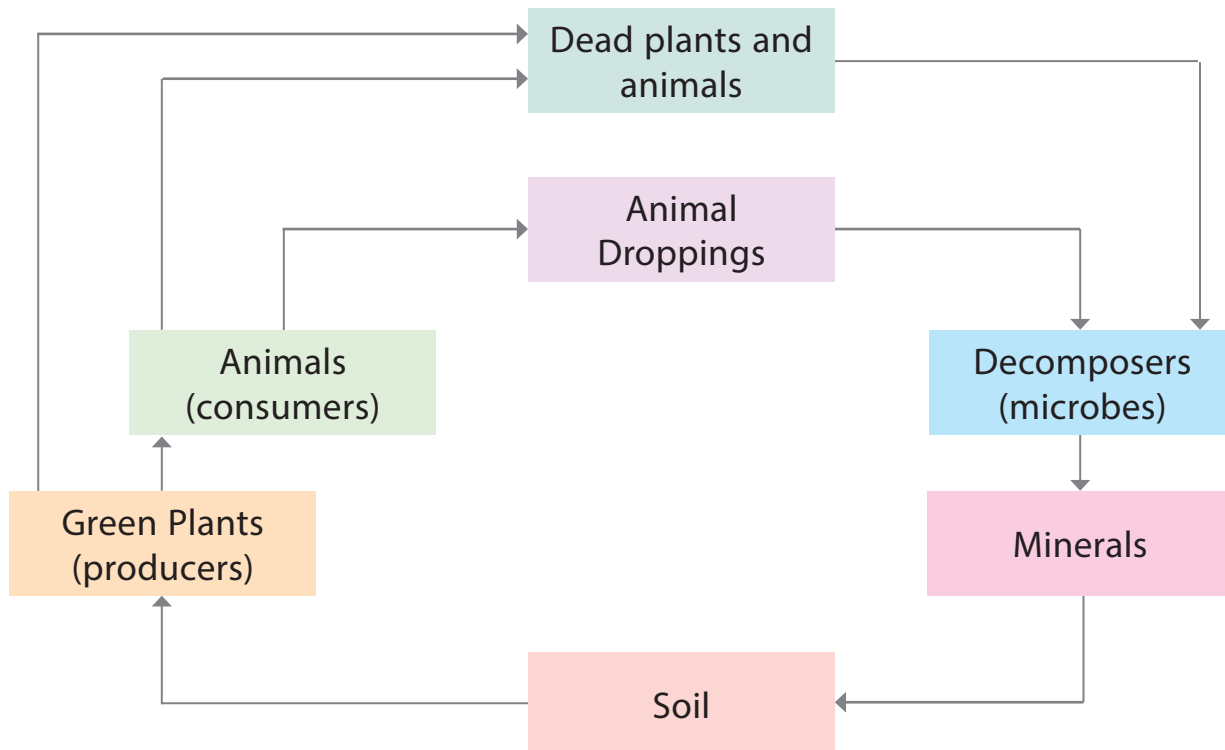
Inter-relationships among different components of the environment

During the process of respiration, both plants and animals take in Oxygen from the atmosphere and give out Carbon dioxide back into the atmosphere. Carbon dioxide also gets added to the atmosphere when burning of wood, coal and petrol takes place. This increases the level of carbon dioxide in the atmosphere. The plants use up carbon dioxide and give out oxygen during the process of photosynthesis. Thus, a balance is maintained, between the amount of oxygen and carbon dioxide, in the atmosphere.
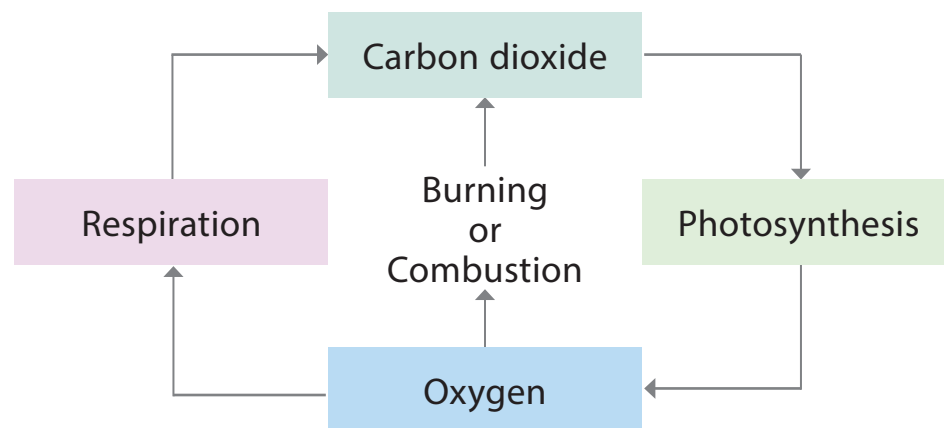
Nature tries to maintain a balance between Oxygen and Carbon dioxide

We thus, realise that in our environment, its living and non-living components keep on interacting with one another. This makes our environment a dynamic system.

Keywords

biodegradable	substances that can be broken down into simpler substances by mirco-organisms.
consumers	animals that do not make their own food and are dependent on producers.
decomposers	organisms which derive their food from dead and decaying plants and animals.
food chain	a series of organisms, inter-related sequencely, via their food. One organism gets eaten by another which, in turn, gets eaten by yet another and, so on.
micro-organism	living organisms too small to be seen by the human eye, by itself.
non-biodegradable	substances that cannot be broken down into simpler substances by micro-organisms.

omnivores	animals that feed on both producers as well as consumers.
producers	the organisms (plants) which make their own food.
rain water harvesting	collection and storage of rain water for reuse.
scavenger	a bird, or animal, that feeds on dead animals.
vermicomposting	process of composting with the help of various suitable worms, like the redworms and other earthworms.

You Must Know

1. Environment consists of biotic (living) components and abiotic (non-living) components.

2. Producers, or Autotrophs, prepare their own food; Consumers, or Heterotrophs, depend directly, or indirectly, upon them.

3. Primary consumers, or Herbivores, feed only on plants.

4. Secondary consumers, or Carnivores, feed on other animals.

5. Animals, which feed on both producers as well as consumers, are called Omnivores.

6. Decomposers break down dead and decaying plants and animals into minerals; these go into the soil and are used again by plants. This process is called recycling of minerals.

7. Biodegradable materials can be decomposed by micro-organisms.

8. Non-biodegradable materials cannot be decomposed by micro-organisms.

9. Vermicomposting is the process of preparing compost from kitchen garbage using redworms and other various worms.

10. The sequence, of one organism eating the other, and then getting eaten by another, and so on, makes up a food chain.

11. The cycling of materials, through biotic and abiotic components, is called the mineral cycle.

12. The balance, of carbon dioxide and oxygen, in the atmosphere, is maintained through the processes of respiration, burning and photosynthesis.

A. **Fill in the blanks.**

1. Plastic is _____ as it cannot be broken down into simpler substances in nature.

2. We must say 'No' to _____ and use _____ or _____.

3. The flowers of the _____ bloom with sunrise and close after sunset.

4. _____ and _____ are among the animals found only in cold regions.

5. _____ and _____ processes help in balancing of carbon dioxide and oxygen in the atmosphere.

B. **Write True or False for the following statements.**

1. Herbivores can prepare their own food. ☐

2. Fungi and bacteria are organisms that can be easily seen by the human eye, by itself. ☐

3. The sunflower faces the east in the morning. ☐

4. Camels do not have sweat glands. ☐

5. Soil is an important biotic component of our environment. ☐

C. **Tick (✓) the correct option.**

1. Biotic environment includes—

   ☐ only the producers and the consumers

   ☐ only the consumers and decomposers

   ☐ only the decomposers and the producers

   ☐ producers, consumers as well as decomposers

2. The group of organisms, which use light for making food, are called—

   ☐ autotrophs   ☐ heterotrophs

   ☐ decomposers   ☐ scavengers

3. Decomposers include—

☐ bacteria only   ☐ fungi only

☐ bacteria as well as fungi   ☐ only the scavengers

4. Which of the following is not biodegradable?

☐ vegetables   ☐ fruits

☐ earthworm   ☐ aluminium foil

5. Vermicomposting is done by—

☐ fungus   ☐ bacteria

☐ worms   ☐ aquatic animals

6. An animal, that is not affected much by the heat of the desert, is the—

☐ rat   ☐ camel

☐ cow   ☐ lion

D. Answer the following questions in brief.

1. Why should we segregate different types of wastes?

2. Write the meaning of the term 'vermicomposting'.

3. Which component of air gets 'used-up' during the process of photosynthesis?

4. Suggest any five activities that can help to save the environment.

5. How does nature maintain a balance, between the amounts of oxygen and carbon dioxide, in the atmosphere?

E. Answer the following questions.

1. Distinguish between—

(a) autotrophs and heterotrophs

(b) decomposers and scavengers

2. State the difference between biodegradable and non-biodegradable materials. Give one example of each.

3. How does decomposition of dead animals turn out to be useful?

4. Why is Rain water harvesting a 'ray of hope' for overcoming the present 'scarcity of water' in cities?

5. Why do buffaloes cool themselves in water during summer?

6. Draw a diagram that shows the relationship between the biotic and the abiotic components of the environment.

Value Based Question

Shuchi's mother did not approve of her idea of taking help from their neighbours for making models for her school exhibition. She told her that she should do her work herself with confidence and honesty. She then helped and guided Shuchi to design very useful, interesting and attractive items from old newspapers. Shuchi's models were very much appreciated as they were in tune with the concepts of 'reuse' and 'recycle'.

1. State the values conveyed by Shuchi's mother.

2. Give one example of 'recycling' of a material.

3. Have a group discussion with your friends in which each one suggests one or more ideas, in tune with the idea of 'recycling' or 'reuse'.

Something To Do

1. **Imagine a scenario**

    The government is planning to ban the use of plastic bags. For a debate over the same, a committee was formed. A meeting of the committee is being called. The members of the committee are:

    -   A government representative

    -   A head of shopkeepers' association

    -   A plastic bag manufacturer

    -   A cloth bag manufacturer

    -   An environmentalist

    Prepare, and present, a skit projecting the likely views of the members who attended the meeting.

2. The waste segregation methods, adopted by two neighbours, Ramesh and Suresh, are shown here in the form of the pie charts. Study the pie charts carefully and answer the questions that follow.

Waste disposed off by Ramesh
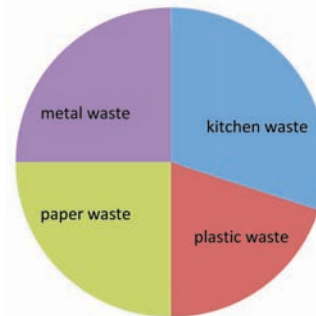
Waste disposed off by Suresh

1. Name the two items of waste, disposed off by Ramesh, that needs to be separated from one another.

2. Identify the biodegradable materials disposed off by Suresh.

3. Of the two, who, according to you, is more eco-friendly and why?

3. Solve the following crossword puzzle with the help of given clues.
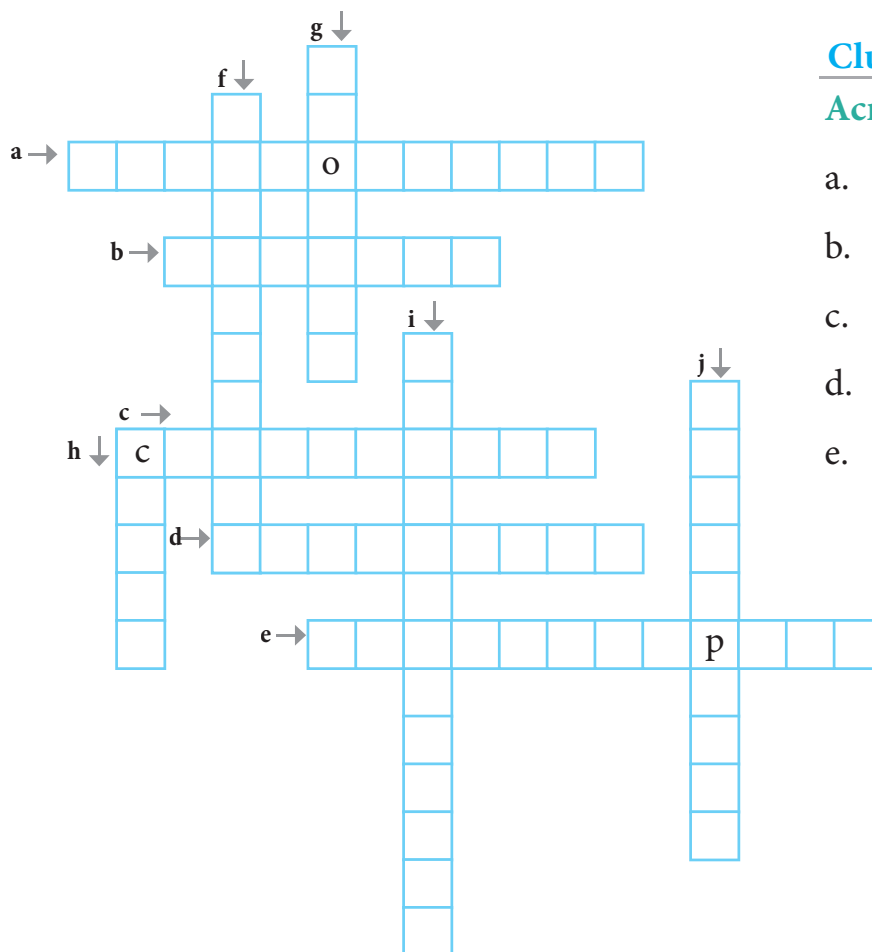
Clues

Across →

a. Do not make their own food.

b. Non-living components.

c. Meat eaters.

d. Vulture is a _____.

e. Compost prepared by worms.

Down ↓

f. Plant eaters.

g. Morning glory.

h. A desert animal.

i. Decomposable material.

j. Helps in recycling of minerals.

2 | Food

We know that all living organisms need food to grow and survive. Food provides the energy, needed by living beings, to do work. It also protects us from different diseases and keeps us fit and healthy. Food is the main source that sustains, and nourishes, life.

Green plants make their own food by the process of photosynthesis. Animals and human beings are dependent on plants for their food.
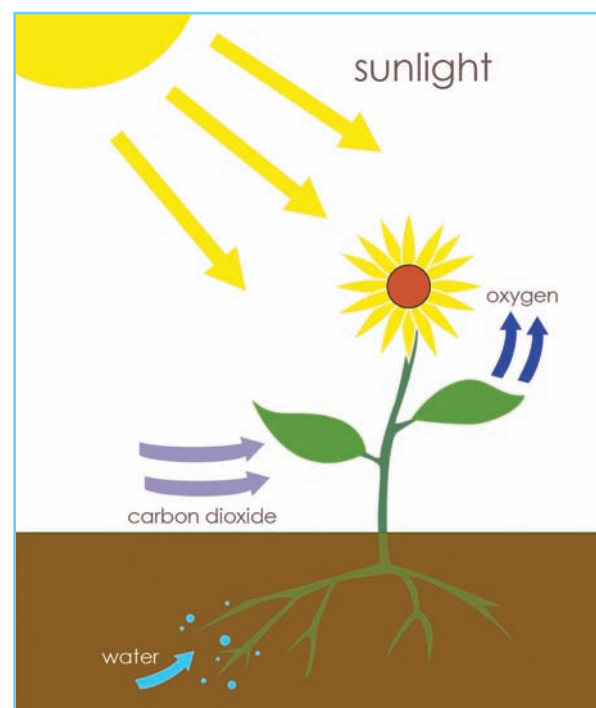
▶ Sources of Food

All living organisms get their food from plants, animals or their products.

apple

eggs

cheese

nuts

spices

pulses

honey

vegetables

milk

yogurt

icecream

wheat and rice

We get the food items, shown above, from different shops or stores. Let us think: 'Where do they come from?', before arriving at the shops. Their origin may be 'either from plants or from animals'.

Try to sort out the above listed food items into two groups – 'Food from Plants' and 'Food from Animals'. Record your conclusions in a tabular form.

Food from Plants	Food from Animals

Try adding two more examples, of each of these two types of foods, on your own.

■ Food from Plants

Plants make their own food by utilising the energy of the sun. Food is prepared by the leaves of the green plants. It is then stored in different parts of the plants. Human beings, and some animals, eat these plants in one form or the other. Cereal grains, like wheat, rice, maize, millets (*jowar* and *bajra*) are important sources of energy; they constitute the major component of our food. Pulses, like green gram (*moong*), gram (*channa*), black gram (*urad*), kidney beans (*rajma*), split red gram (*arhar*), red lentil (*masoor*) and soyabean (*bhatma*), are some of the important sources of proteins in our diet.

Fruits, like mango, apple, banana, orange, watermelon and melon, are good sources of nutrients.

Green leafy vegetables, like spinach, mustard, fenugreek, and many other vegetables, like reddish, lady finger, turnip, carrot, brinjal and potato, are all obtained from plants.

We use oils, like mustard oil, sesame oil, sunflower oil, groundnut oil and coconut oil, to cook our food. These oils are obtained from plants and are the sources of fats.

Spices, like cumin (*jeera*), turmeric (*haldi*), black pepper (*kali mirch*), cardamom (*elaichi*), chilli (*mirch*), carom seeds (*ajwain*) and clove (*laung*), give flavours to our food and make it tasty.

■ Food from Animals

Animals are also an important source of our food. We get the following food items from animals.

- ● Milk

  Milk is considered a complete food. Milk-giving animals are called **milch animals**. Cows and buffaloes are the two main milch animals. Goats and camels also give us milk.

- ● Eggs

  Hens, ducks and fowls lay eggs. These birds are known as **poultry birds**. Their eggs are a rich source of proteins and vitamins and are eaten by many of us.

- ● Meat

  Fish, goat, sheep, pig and chicken are important sources of meat. Prawns, crabs and shrimps constitute the sea food. All these are good sources of proteins.

Have you ever noticed honeybees hovering over the flowers? They collect nectar from the flowers. They make a beehive in which they live and store the nectar, collected from flowers, as honey. We use honey in our food and in several medicines.

▶ Food and Its Components

Carbohydrates, Proteins, Fats, Vitamins and Minerals are the important components of food. They are called **nutrients**.

Roughage (dietary fibres) and water are also important components of our food. Different food items are classified into the following categories on the basis of the nutrients present in them and their functions in our life.

1. Energy giving foods — Carbohydrates and Fats

2. Body building foods — Proteins

3. Protective foods — Vitamins and Minerals

Let us discuss the various nutrients in detail now.

■ Carbohydrates

Carbohydrates are made up of carbon, hydrogen and oxygen. In our food, these are present in the form of sugar and starch. Carbohydrates, in our diet, are a source of energy. Fruits, like mango, banana, litchi, melon, etc., are rich in sugar. Cereals, like wheat, rice and maize, are rich sources of starch. Some vegetables, like potato, and sweet potato, also contain starch.

Sources of Carbohydrates

Test for Sugar

Materials Required: Benedict's solution, test tube, dropper, test tube holder, gas burner or spirit lamp.

Procedure: Take the given food sample. Add a few drops of Benedict's solution. Carefully heat the test tube. Notice the colour change, if any. If sugar is present, it will turn orange.

Test for Starch

Materials Required: Iodine solution, test tube, dropper.

Procedure: Take the material which is to be tested. Add iodine solution with the help of a dropper. If it turns blue-black, it indicates the presence of starch.
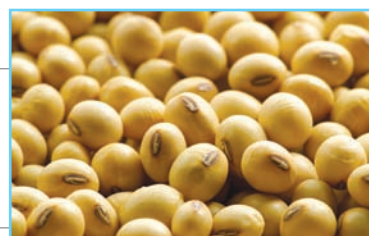
■ Proteins

Proteins are made up of carbon, hydrogen, oxygen, nitrogen; and a small quantity of both sulphur and phosphorous. Proteins help in building up the developing tissues of a growing child. They also take care of the 'wear and tear' of the body tissues at all ages.

Sources of Proteins

Do You Know?

One of the richest sources of protein is soyabean. It contains twice as much proteins as meat and four times as much as eggs.

Test for Protein

Materials Required: Mortar and pestle, test tube, dropper, concentrated nitric acid.

Procedure: Crush some bean seeds in a mortar and pestle. Make a suspension using water. Take a little of this suspension in a test tube. Very carefully, add a few drops of concentrated nitric acid to it. If the colour of this suspension changes to yellow, it indicates the presence of proteins.

■ Fats

Fats are also made up of carbon, hydrogen and oxygen. However, they contain much less oxygen in comparison to the carbohydrates. They provide more than double the amount of energy provided by the same weight of carbohydrates. Vitamins A and D are soluble in fats. Hence, fats are essential for their absorption in our body.

Fats can be obtained from plant as well as animal sources. Vegetable oils, like mustard oil, coconut oil and groundnut oil, are obtained from plants. Dry fruits and nuts are also rich sources of fat. Milk and milk products, such as butter, ghee, along with meat, fish and eggs, are sources of fats that are obtained from animals.

Sources of Fats

Test for Fat

Material Required: Paper.

Take the given food item and rub it on a dry paper. If fat is present in it, it will leave a translucent mark on the paper.

■ Vitamins

Vitamins are essential for maintaining good health and proper growth of the body. They are needed in small quantities only. They do not provide energy. However, they play an important part in most of the biochemical changes within our body.

Sources of Vitamins

Plants are the main source of vitamins. They are found in all fresh foods. However, some vitamins get destroyed by cooking. Vitamins help us to keep our eyes, bones, teeth and gums healthy. If our diet lacks vitamins, many biochemical reactions, in our body, will not take place and we may suffer from deficiency diseases.

Different vitamins have been named as **Vitamin A, Vitamin B-complex, Vitamin C, Vitamin E** and **Vitamin K**. Vitamin B-complex is actually a group of vitamins. These vitamins are of two kinds: **water-soluble vitamins** and **fat-soluble vitamins**. Vitamin A, D, E and K are soluble in fat, whereas, Vitamin B and C are water-soluble.

Do You Know?

Indian gooseberry (*amla*) is the richest source of Vitamin C.

Let us now learn about the different vitamins, their sources and the role they play in our body functions.

Vitamins, their Sources, Functions and Deficiency Diseases

Vitamin	Sources	Functions	Deficiency Disease and its Symptoms
Vitamin A	Cod liver oil, shark liver oil, milk, butter, ghee, yellow vegetables, fruits.	Needed for healthy eyes, skin and tissues.	Night blindness and dryness of skin.
Vitamin B	Wheat, rice, yeast, liver, milk and yoghurt, green leafy vegetables, fermented food and sprouted pulses.	Needed for making muscles strong, getting energy to do work.	Beri-Beri, weak muscles and weakness.
Vitamin C	Citrus fruits like orange, lemon, and guava, green chillies and Indian gooseberry.	Needed for healthy gums and teeth, bones and bone joints.	Scurvy, spongy and bleeding gums.
Vitamin D	Milk and its products, cod-liver oil, shark-liver oil and eggs. Some Vitamin D is made by the skin in sunlight.	Needed for healthy bones and teeth.	Rickets, curved and deformed bones, bow legs.
Vitamin E	Vegetable oils, liver, green vegetables and tomato.	Smooth functioning of reproductive system.	Sterlity.
Vitamin K	Green leafy vegetables.	Helps in blood clotting.	Prolonged and profuse bleeding due to delayed clotting of blood.

We will now discuss in detail the diseases caused due to deficiency of Vitamin C and Vitamin D.

(a) **Vitamin C:** It is a water-soluble vitamin. Deficiency, in intake of Vitamin C, affects bones, joints, teeth and gums and leads to a deficiency disease called **Scurvy**. A person, with scurvy, tends to become weak and anaemic and develops spongy and bleeding gums.

Scurvy

(b) **Vitamin D:** It is a fat-soluble vitamin. It can be synthesised by our skin in the presence of sunlight. Its inadequate intake may affect the bones of our body leading to a disease known as **Rickets**. Rickets develops mainly among young children, though its effects, may persist throughout life. It is most common among children of six months of age. Vitamin D stimulates the absorption of minerals like calcium and phosphorus in our body. Hence, a deficiency of Vitamin D, can also cause calcium and phosphorus deficiency in the body. Vitamin D deficiency is more common among economically poor sections of the society. Bones become weak to such an extent that the ability of the child to sit, crawl and walk gets delayed. Leg bones get bent. The deficiency causes deformation, such as bow-legs and knock-knees. The chest is deformed, due to weakening of ribs, and protrudes out as in a pigeon. This deformation is, therefore, often called **pigeon-chest**.

Child suffering from Rickets

Pregnant, and lactating, mothers are advised to take rich sources of Vitamin D for proper growth of the bones of their children.

Pigeon-chest

■ Minerals

The important minerals, needed by our body, are sodium, potassium, magnesium, calcium, iron, manganese, copper, chloride, iodine, phosphorous and sulphur. They are needed in very small quantities for proper growth and maintenance of the body.

Let us now learn about sources and functions of some of these minerals.

Sources and Functions of Some Minerals Needed by Our Body

Mineral	Sources	Functions
Calcium	Milk and its products, green leafy vegetables.	To build healthy bones and teeth.
Phosphorus	Milk, cereals, pulses, fish and meat.	Growth of bones and teeth.
Iron	Green leafy vegetables and other green vegetables, nuts and jaggery.	Formation of haemoglobin in the blood. Its deficiency causes anaemia.
Iodine	Fruits and vegetables, sea food, iodised salt.	Proper functioning of thyroid gland. Its deficiency causes goitre.

■ Water

Water is essential for all vital processes of the body. It forms 70 per cent of our body weight. Some of the important functions of water are:

- It is essential for all reactions taking place in the cells of our body.

- It helps in the removal of waste products, in the form or urine, from our body.

- Blood contains a large amount of water. Because of this, blood is able to circulate in arteries and veins and transport oxygen, carbon dioxide, nutrients, hormones and minerals to all parts of the body.

- Water helps in maintaining a uniform body temperature by distributing heat. In summer, our body produces sweat which, on evaporation from the skin, helps to keep the body cool.

■ Roughage

Green vegetables, fruits and whole grains contain a large amount of cellulose, that cannot be digested by our body. Cellulosic dietary fibres constitute the **roughage**. Roughage helps in bowel movement and prevents constipation.

■ Mineral Deficiencies

Let us now learn about the deficiency diseases caused by the lack of some of the minerals.

(a) **Calcium Deficiency:** The requirement of calcium is much more in growing children and in pregnant, and lactating, mothers. It is important for bone and teeth formation. Due to its deficiency, bones become weak and fragile. A large amount, about 94 per cent, of calcium is used for the development of bones and teeth in our body. Blood, muscles and nerves also use it in small quantities. Due to its deficiency in the diet, contraction of heart becomes faulty and crampy pain may be felt in various parts of the body, particularly, in the large muscles of the legs. Tooth decay, and general irritability, are other symptoms of its deficiency.

(b) **Phosphorus Deficiency:** Phosphorus, along with calcium, is needed for proper development of nerve cells, bones and teeth. It is also essential for the digestion of carbohydrates and fats. Loss of weight, retarded growth and general weakness occur due to iron and phosphorus deficiency.

(c) **Iron Deficiency:** Iron is an essential element for the formation of haemoglobin of red blood cells, which plays an important role in the transport of oxygen. An inadequate intake of iron leads to a condition known as **Anaemia**.

An anaemic person appears pale and weak. The body shows fatigue, loss of appetite, whitening of nails and swelling of hands and feet.

(d) **Iodine Deficiency: Goitre** is an iodine deficiency disease which is widespread in many parts of our country. Iodine is needed for the synthesis of a hormone, called **thyroxin**, which is produced by the thyroid glands. A person, with goitre, shows swelling in the neck region. Iodine deficiency, during foetal stage, may lead to mental retardation and retardation of growth in later life. It is not prevalent among the people of coastal areas, as they get iodine from the sea food they eat. Deficiency of iodine is common in mountainous regions where the soil and water are poor in iodine. One of the well-tested approach, to control iodine deficiency diseases, is the use of iodised salt by the affected population.

Iodine deficiency causes goitre

► What Should We Eat?

The term **'diet'** refers to the food eaten by human beings. A **balanced diet** consists of all the nutrients which are important for the proper growth and development of the body.

Food is required to provide energy for doing work and for providing nutrients, essential for growth, for repair of tissues and for reproduction. Food also protects our body against infections. Energy, obtained from food, is also needed for all the metabolic activities of the body like respiration, circulation and digestion.

A balanced diet can be vegetarian or non-vegetarian. A balanced simple meal is more nourishing than an imbalanced, greasy or junk food. Deep fried foods loose their nutritive value. Oily and spicy foods may have a good taste but they may not be quite nutritive. Stale and rotten food can be harmful to health. Eating lots of fried items, like *samosas*, *kachories*, or bread *pakoras*, may not provide you the essential nutrients.

► Factors Responsible for Poor Health

■ Malnutrition

Among the poor families, children eat a large amount of starchy food without adequate amount of proteins in their diet. Sometimes they cannot even get one square meal a day. This can result in starvation, i.e. deficiency of proteins, carbohydrates and fats. These conditions are termed as **Protein-Energy-Malnutrition (PEM),** also called **PCM (Protein-Calorie-Malnutrition)**.

Such conditions can result in two problems in children, namely **Kwashiorkor** and **Marasmus.**

Kwashiorkor is seen in infants, up to three years of age, when their diet does not contain enough milk. As a result, there is a deficiency of proteins. The growth of the child gets retarted and the face, feet and abdominal region get swollen due to water retention. Discolouration of hair and diarrhoea are also common in such children.

Child suffering from

Kwashiorkor   Marasmus

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A child suffers from Marasmus when she/he is starving, i.e. not getting enough food. As a result, there is a deficiency of proteins, carbohydrates and fats. These deficiencies cause a wasting of muscles and the child becomes very thin. This results in general weakness and retarded growth.

■ Obesity

The weight of an individual must be in proportion to her or his height. Some individuals have a tendency to eat more than what is needed by their body. As a result, the body gets extra calories. These extra calories get stored below the skin. The person becomes obese. Improper food habits, like eating fried food (high energy and high fat food) is one major reason for obesity. Eating throughout the day, and lack of exercise, are two other important reasons for obesity. Obesity leads to many health problems.

An obese child

Keywords

balanced diet	a diet that contains all the nutrients in right proportion.
beri-beri	a disease caused by deficiency of Vitamin B.
carbohydrate	component of food that provides energy to the body.
fats	major source of energy in the diet.
goitre	an iodine deficiency disease.
minerals	nutrients needed in small amount for growth and maintenance of the body.
nutrients	components in food that we need to grow and survive.
proteins	nutrients needed for growth and repair of damaged tissues.

PCM	Protein-Calorie-Malnutrition.
PEM	Protein-Energy-Malnutrition.
ricket	a disease caused by deficiency of Vitamin D.
roughage	fibrous matter in food which does not get digested.
scurvy	a disease caused by deficiency of Vitamin C.
vitamins	vital nutrients required in limited amounts.

You Must Know

1. Living organisms need food to grow and survive.

2. The sources of our food are plants and animals.

3. Carbohydrates, proteins, fats, minerals, vitamins, water and roughage are the important components of our food.

4. Carbohydrates and fats mainly provide energy to our body.

5. Proteins and minerals are needed for the growth and maintenance of our body.

6. Vitamins help in protecting our body against diseases.

7. Deficiency of vitamins and minerals, in our diet, may result in deficiency diseases.

8. A diet which contains all the essential components of food, in right proportions, is called a balanced diet.

9. The lack of some of the essential nutrients in the diet is known as malnutrition.

10. Eating, more than the requirement of one's body, can make the person obese.

A. **Fill in the blanks.**

1. Living organisms need food to _____ and _____.

2. Vitamins A, D, E and K are soluble in _____, whereas Vitamin B and C are _____ soluble.

3. The deficiency of _____, in the diet, causes a disease called Beri-Beri.

4. Vitamin K helps in _____ of blood.

5. The dietary fibres constitute _____.

B. **Write True or False for the following statements.**

1. Vitamins and minerals are body building foods.

2. Our skin makes Vitamin E in the presence of sunlight.

3. Deficiency of phosphorous can lead to anaemia.

4. We should eat food that has all its essential components in the right proportions.

5. Kwashiorkor occurs due to the deficiency of fat in the diet.

C. **Tick (✓) the correct option.**

1. When a drop of iodine solution was put on the cut surface of a potato, it turned blue-black in colour. This indicates the presence of—

   ☐ vitamin   ☐ fat

   ☐ protein   ☐ starch

2. The deficiency of Vitamin A, in the diet, causes a disease known as—

   ☐ scurvy   ☐ rickets

   ☐ nightblindness   ☐ beri-beri

3. Iron is essential for—

☐ growth of teeth and bones

☐ formation of haemoglobin

☐ functioning of the thyroid gland

☐ making muscles strong

4. A child, who has bow legs, is suffering from a deficiency disease, known as—

☐ scurvy   ☐ rickets

☐ goitre   ☐ anaemia

5. The deficiency of proteins, in the diet of children, can cause a disease known as—

☐ marasmus   ☐ rickets

☐ kwashiorkor   ☐ anaemia

D. Answer the following questions in brief.

1. Name the important sources of our food.

2. State the importance of carbohydrates in our diet.

3. Name the vitamin whose deficiency causes the disease of—

   (a) nightblindness

   (b) beri-beri

   (c) scurvy

   (d) rickets

4. Name any three of the minerals needed by our body.

5. State the role of calcium in our body.

6. Write the full forms of the terms PEM and PCM.

E. **Answer the following questions.**

1. Name two sources of each of the following:

   (a) Carbohydrates   (b) Proteins

   (c) Fats   (d) Roughage

   (e) Vitamin A   (f) Vitamin C

2. Describe one test each for detecting the presence of the following in food:

   (a) proteins

   (b) starch

   (c) fats

3. Why do we need proteins and how do they affect our health?

4. A mineral 'X' is essential for the formation of a component 'Y', in the blood of a person. The function, of component Y, is to transport oxygen in the body.

   The deficiency of mineral 'X', in the diet of a person, causes a disease Z. Identify X, Y and Z. Also mention the symptoms of disease Z.

5. Deficiency of iodine is more common in mountainous regions. Why?

6. What is a balanced diet? Why should we take a balanced diet?

Value Based Question

Rohini had to go to a remote village for one of her photographic assignments. She observed that a large number of the villagers there had swelling in their neck regions. She advised the villagers to use iodised salt and to include fruits and vegetables in their diet, whenever possible. On her way back, she contacted the relevant authorities and ensured that the villagers get a regular supply of iodised salt.

1. State the values displayed by Rohini.

2. Iodine is needed for the synthesis of a harmone. Name this harmone and the gland that produces it.

3. Ask the elders in the family, or the seniors in the school/locality, of any incident in which a person has helped a large number of people in solving, or minimising, a general problem. Share your findings with your classmates.

1. List examples of food items, belonging to the different food groups, listed in the following table.

Carbohydrate Rich Food Items	Protein Rich Food Items	Food Items Rich in Fats	Dairy Products	Food Items that provide Minerals and Vitamins

2. Prepare your own meal plan, by choosing the food items from the above table, so that they form a balanced diet for you.

Breakfast Meal	Lunch Meal	Dinner Meal

3. Perform a test to find out if there is any starch in the sweets prepared from milk/milk products like curd, etc.