CHAPTER - INTEGERS

Various Types of Numbers

Natural Numbers → Counting numbers are called natural numbers.
Thus, 1, 2, 3, 4 - - - are natural numbers.
Whole Numbers → All natural numbers together with 0 (zero) is called whole numbers.
Thus. 0, 1, 2, 3 - - - are whole numbers.
Integers → All natural numbers, zero and negatives of counting numbers are called integers.
Thus, - - - -4, -3, -2, -1, 0, 1, 2, 3 - - - etc are integers.

Types of Integers

(i) Positive Integer : 1, 2, 3, 4 - - - etc are all positive.
(ii) Negative Integer: -1, -2, -3, etc are all negative
(iii) Zero is an integer which is neither positive nor negative.

ADDITION OF INTEGERS

Rule① If two positive or two negative integers are added, we add their values regardless of

their signs and give the sum their common sign.

Eg.→ Add : (i) 36 and 27 (ii) −31 and −25

Sol^{n}: We have,

(i) $+36$
$+27$
63

$\therefore 36+27=63$

(ii) (-31)
$+(-25)$
(-56)

$\therefore (-31)+(-25)=-56$

Rule (2) To add a positive and a negative integer, we find the difference between the numerical values regardless of their sign and give the sign of the integer with the greater value to it.

Eg.→ Add : (i) $-47+18$ (ii) $(-29)+52$

Sol^{n}→ (i) $-47+18=-29$

as -47
$+18$
-29

we will put (−)ve sign in the result as 47>18 i.e. integer with the greater value it 47 and it has (−)ve sign.

(ii) $-29+52=23$

as $+52$
-29
$+23$

we will put (+)ve sign in the result as 52>29 i.e. integer with the greater value is 52 and it has (+)ve sign.

Properties of Addition of Integers

(1) Closure property of Addition: It says that "the sum of two integers is always a integer"

E.g. → • $5+4=9$, 5, 4 & 9 all are integers.
• $(-3)+5=2$, -3, 5 & 2 all are integers.

(2) Commutative Law of Addition: If a and b are any two integers, then

$$\boxed{a+b=b+a}$$

E.g. → • $(-4)+9=5$ & $9+(-4)=5$
$\therefore (-4)+9=9+(-4)$

(3) Associative Law of Addition: If a, b, c are any three integers, then

$$(a+b)+c=a+(b+c)$$

E.g. → $\{(-6)+(-8)\}+5=(-14)+5=-9$
& $(-6)+\{(-8)+5\}=(-6)+(-3)=-9$
$\Rightarrow \{(-6)+(-8)\}+5=(-6)+\{(-8)+5\}$.

(4) Existence of Additive Identity for any integer a, we have

$$a+0=0+a$$

$\therefore$ 0 is called the additive identity for integers.

E.g.→ $9+0=0+9=9$
$(-6)+0=0+(-6)=(-6)$

(5) Existence of Additive Inverse for any integer a, we have
$a+(-a)=(-a)+a=0$
The opposite of an integer a is $(-a)$
The sum of an integer and its opposite is 0.
Additive inverse of a is $(-a)$.
Similarly, additive inverse of $(-a)$ is a.

E.g. Additive inverse of 3 is -3
Additive inverse of -5 is 5.

SUBTRACTION of INTEGERS

for any integers a and b, we define:
(i) $a-b = a+$(additive inverse of b) $= a+(-b)$
(ii) $a-(-b) = a+\{$additive inverse of $(-b)\} = a+b$

SUMMARY
$a-b = a+(-b)$
$a-(-b) = a+b$

E.g.→ Subract : (i) 9 from 4 (ii) -9 from $+5$

(i) $4-9 = 4+(-9) = -5$

(ii) $5-(-9) = 5+9 = 14$

Properties of Subtraction of Integers

① **Closure Property for Subtraction**

If a and b are any two integers, then $(a-b)$ is always an integer.

E.g. → $2-5 = 2+(-5) = -3$, 2, -5, -3 all are integers.

② **Subtraction of Integers is not Commutative**

E.g. → $3-5 = 3+(-5) = -2$

$5-3 = 5+(-3) = 2$

$\Rightarrow 3-5 \neq 5-3$

③ **Subtraction of Integers is not Associative**

E.g. → $\{3-(-4)\}-(-5) = (3+4)-(-5) = 7-(-5)$

$= 7+5 = 12$

& $3-\{(-4)-(-5)\} = 3-\{(-4)+5\} = 3-1 = 2$

$\Rightarrow \{3-(-4)\}-(-5) \neq 3-\{(-4)-(-5)\}$

Hence, subtraction of integers is neither commutative nor associative.

EXERCISE

① Evaluate:

(a) $15+(-8)$ (b) $(-7)+(-23)$
(c) $(-32)+47$ (d) $(-48)+(-36)$
(e) $(-16)+9$ (f) $53+(-26)$

② find the sum of:

(a) 153 & −302 (b) −2035 & 297
(c) −489 & −324 (d) −238 & 500
(e) 1005 & −277 (f) −1000 & 438

③ find the additive inverse of—

(a) −83 (b) 0
(c) 256 (d) −2001
(e) −111 (f) 32

④ Subtract:

(a) 28 from −42 (b) 318 from 0
(c) −66 from −34 (d) −56 from 144
(e) −64 from 0 (f) −37 from −53
(g) −36 from 42 (h) −153 from −240

⑤ Subtract the sum of −1032 and 136 from −34.

(6) Subtract −136 from the sum of −85 & 30.

(7) Fill in the blanks:

(a) $\{(-13)+27\}+(-41)=(-13)+\{27+(\quad)\}$

(b) $(-26)+\{(-49)+(-83)\}=\{(-26)+(-49)\}+(\quad)$

(c) $53+(-37)=(-37)+(\quad)$

(d) $(-68)+(-76)=(\quad)+(-68)$

(e) $(-72)+0=(\quad)$

(f) $-(-83)=(\quad)$

(g) $(-60)-(\quad)=-59$

(h) $(-31)+(\quad)=-40$

(8) Simplify:

(a) $\{(-13)-(-27)\}+\{-25+(-40)\}$

(b) $\{-26+(-30)\}-\{-38\}$

(c) $(-68)+(-37)+(-76)-(-80)$

(d) $60+(-30)-(-59)+(-40)$

(e) $260+(-1000)-(-438)-7$.

(9) Find $36-(-64)$ and $(-64)-36$. Are they equal?

(10) If $a=-8$, $b=-7$, $c=6$, verify that $(a+b)+c=a+(b+c)$

(11) If $a=-9$ and $b=-6$ show: $(a-b)\neq(b-a)$

(12) The sum of two integers is -16. If one of them is 53. find the other.

(13) The sum of two integers is 65. If one of

them is −31. find the other.

(14) The difference of an integer a and (−6) is 4. find the value of a.

(15) write a pair of integers whose sum gives:

(a) zero
(b) a negative integer
(c) an integer smaller than both the integers
(d) an integer greater than both the integers.
(e) an integer smaller than only one of the integers.
(f) a positive integer.