CLASS 7

MATHEMATICS

Olympiad
Prepguide & PYQs

+

Workbook
After School Practice

- Concept Maps
- Olympiad Specific Concepts
- Topicwise Solved Examples
- Achievers MCQs
- Olympiad Exam PYQs
- Everyday Curiosity Qns

IMO, iOM, Hindustan Olympiad, NSTSE, SEAMO, ISTSE and others

Overview of Major Olympiad Exams

International Mathematics Olympiad (IMO)

Exam Details

Feature	Information
Frequency of conduct	Once a year
Exam Mode	Offline
Medium	English
Exam Duration	60 Minutes
Type of Questions	Multiple Choice Questions (Objective Type)

Syllabus

Section–1: Verbal and Non-Verbal Reasoning.

Section–2: Integers, Fractions and Decimals, Exponents and Powers, Algebraic Expressions, Simple Equations, Lines and Angles, Comparing Quantities, The Triangle and its Properties, Symmetry, Rational Numbers, Perimeter and Area, Data Handling, Visualising Solid Shapes.

Section–3 : Syllabus as per Section–2.

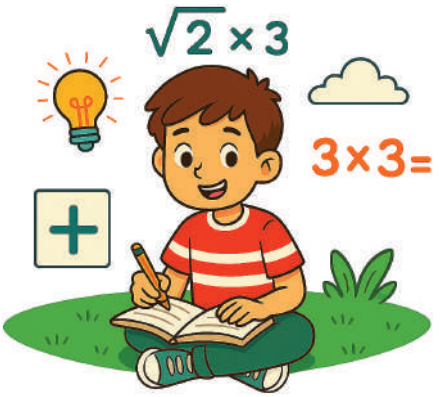
Section–4: Higher Order Thinking Questions - Syllabus as per Section–2.

Exam Structure

Levels	Details
Level 1	All students are eligible
Level 2	Top 5% of the participating students in Level 1 exam

Note:

- **Level 1 Questions:** 60% from class 7 syllabus + 40% from class 6 syllabus.
- **Level 2 Questions:** From class 7 syllabus only.
- **Achievers Section Questions:** From class 7 syllabus only.



Exam Pattern

Levels	Sections	Questions	Marks/ Question	Total Marks
Level 1	1: Logical Reasoning	15	1	15
	2: Mathematical Reasoning	20	1	20
	3: Everyday Mathematics	10	1	10
	4: Achievers Section	5	3	15
	Total	**50**		**60**
Level 2	1: Mathematics	45	1	45
	2: Achievers Section	5	3	15
	Total	**50**		**60**

Silverzone Olympiad (iOM)

Exam Details

Feature	Information
Exam Frequency	Conducted annually, two dates to choose from
Exam Mode	Offline, conducted in schools during school hours
Medium	English
Exam Duration	40 minutes
Type of Questions	Multiple Choice Questions (Objective Type)

Syllabus

Section 1:

- **Numbers and Their Operations:** Integers, Simplifying Arithmetic Expressions, Fractions and Decimals, Rational Numbers, Exponents
- **Algebra:** Algebraic Expressions, Simple Equations
- **Ratio and its Applications:** Ratio and Proportion, Percentage, Profit and Loss, Simple Interest
- **Geometry and Mensuration:** Lines and Angles, Triangles, Quadrilaterals, Solid Shapes, Perimeter, Area of Closed Figures
- **Data Handling:** Arithmetic Mean, Median, Mode, Bar graphs

Exam Structure

Levels	Details
Level 1	All students are eligible
Level 2	Top 1000 rank holders (Minimum 50% marks & Above)
Level 3	1st rank holders at Level 2

Exam Pattern

Sections	Questions	Marks/ Question	Total Marks
Section 1: Mathematics	20	2.5	50
Section 2: Reasoning and Aptitude	10	3	30
Section 3: Scholar's Zone	5	4	20
Total	35		100

Note: There is no negative marking for wrong answers.

Hindustan Olympiad

Exam Details

Detail	Information
Exam Frequency	Once a year
Exam Mode	Online
Duration	120 minutes
Medium	Hindi or English
Type of Questions	Multiple Choice Questions (Objective Type)

Note: An additional 10 minutes is provided for reading the instructions and filling the OMR sheet.

Exam Structure

Levels	Details
Level 1	All students are eligible (open-book exam)
Level 2	Top 10% of participants (proctored exam)

Exam Pattern

Sections	Ques-tions	Marks/ Ques-tion	Total Marks
Section A: Mathematics	20	1	20
Section B: English	20	1	20
Section C: Science	20	1	20
Section D: General Knowledge	20	1	20
Section E: Logical Reasoning	20	1	20
Total	100		100

Note: There is no negative marking.

National Level Science Talent Search Examination (NSTSE)

Exam Details

Feature	Details
Exam Frequency	Once a year
Exam Mode	Online & Offline
Duration	60 minutes
Medium	English
Type of Questions	Multiple Choice Questions

Syllabus

Sections:

- **Section A (Mathematics):** Integers, Fractions and Decimals, Data Handling, Simple Equations, Lines and Angles, Triangle and its Properties, Comparing Quantities, Rational Numbers, Perimeter and Area, Algebraic Expressions, Exponents and Powers, Symmetry

- **Section B (Physics):** Motion and time, Heat, Electric Current and its Effects
- **Section C (Chemistry):** Physical and chemical changes, Acids bases and salts, Water - A precious resource
- **Section D (Biology):** Nutrition in plants, nutrition in animals, Organization in living beings, Respiration in organisms, Transportation in living beings, Reproduction and growth in plants.
- **Critical Thinking:** This section includes a combination of skills like conscious application in real life, Logical & Inductive Reasoning, Tactics & Strategies in decision making, higher order thinking

Exam Pattern

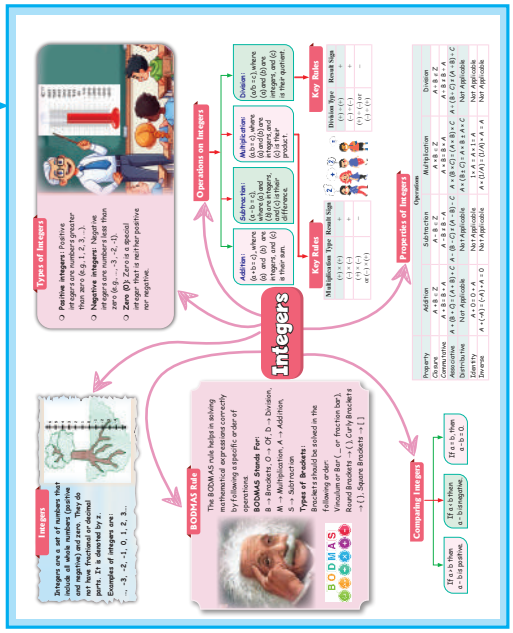
Sections	Questions	Marks/ Question	Total Marks
Section A: Mathematics	25	1	25
Section B: Physics	10	1	10
Section C: Chemistry	10	1	10
Section D: Biology	10	1	10
Section E: Critical Thinking	5	1	5
Total	60		60

How to Use this Book

This book is structured to support your learning journey of preparing for your olympiad exams through a variety of engaging and informative elements. Here's how to make the most of it:

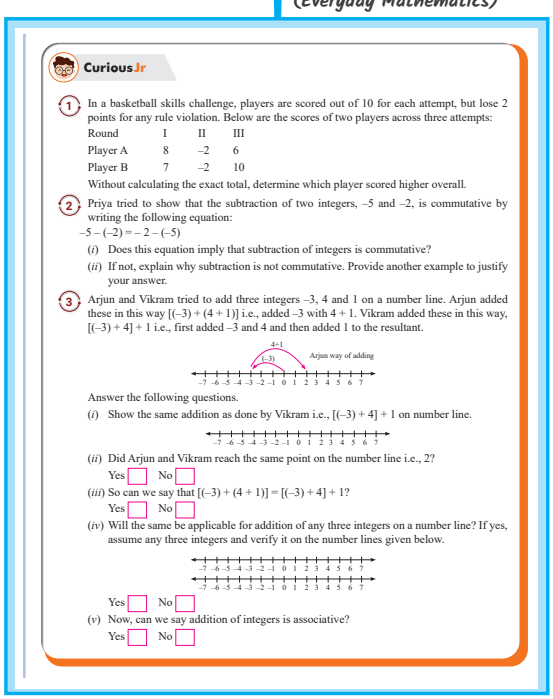
The concept map appears to be a comprehensive study aid that outlines key concepts in a structured format. Use it to understand the chapter's concepts and as a quick reference to recall important highlights.

Concept Map



CuriousJr brings real-life questions that make you think and wonder. These questions help you see how what you learn connects to the world around you.

CuriousJr
(Everyday Mathematics)



CuriousJr

1. In a basketball skills challenge, players are scored out of 10 for each attempt, but lose 2 points for any rule violation. Below are the scores of two players across three attempts:

Round	I	II	III
Player A	8	–2	6
Player B	7	–2	10

Without calculating the exact total, determine which player scored higher overall.

2. Priya tried to show that the subtraction of two integers, –5 and –2, is commutative by writing the following equation:

–5 – (–2) = – 2 – (–5)

(*i*) Does this equation imply that subtraction of integers is commutative?

(*ii*) If not, explain why subtraction is not commutative. Provide another example to justify your answer.

3. Arjun and Vikram tried to add three integers –3, 4 and 1 on a number line. Arjun added these in this way [(–3) + (4 + 1)] i.e., added –3 with 4 + 1. Vikram added these in this way, [(–3) + 4] + 1 i.e., first added –3 and 4 and then added 1 to the resultant.

Answer the following questions.

(*i*) Show the same addition as done by Vikram i.e., [(–3) + 4] + 1 on number line.

(*ii*) Did Arjun and Vikram reach the same point on the number line i.e., 2?

Yes ☐ No ☐

(*iii*) So can we say that [(–3) + (4 + 1)] = [(–3) + 4] + 1?

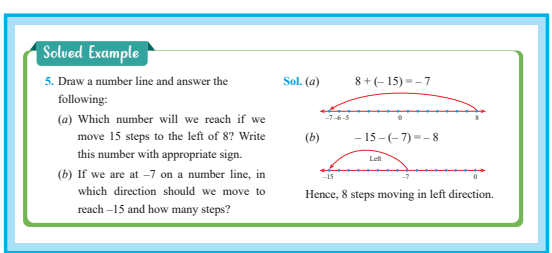
Yes ☐ No ☐

(*iv*) Will the same be applicable for addition of any three integers on a number line? If yes, assume any three integers and verify it on the number lines given below.

Yes ☐ No ☐

(*v*) Now, can we say addition of integers is associative?

Yes ☐ No ☐



Solved Example

5. Draw a number line and answer the following:

(*a*) Which number will we reach if we move 15 steps to the left of 8? Write this number with appropriate sign.

(*b*) If we are at –7 on a number line, in which direction should we move to reach –15 and how many steps?

Sol. (*a*) 8 + (– 15) = – 7

(*b*) – 15 – (– 7) = – 8

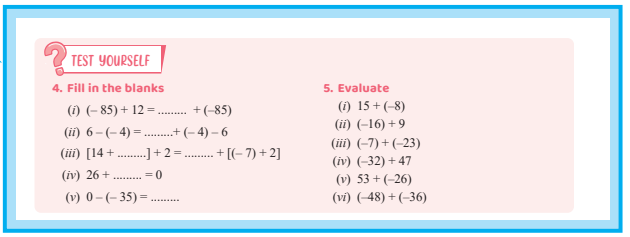
Hence, 8 steps moving in left direction.

Solved Example

Solved Example contains solved questions for each topic. These examples show how to solve problems step by step, making it easier for you to understand the method and apply it on your own. It helps you build strong problem-solving skills.

This section gives you practice questions based on each concept. Solving these will show how well you have learned and help you find areas where you need more practice.

Test Yourself



TEST YOURSELF

4. Fill in the blanks

(*i*) (– 85) + 12 = ... + (–85)

(*ii*) 6 – (– 4) = ...+ (– 4) – 6

(*iii*) [14 + ...] + 2 = ... + [(– 7) + 2]

(*iv*) 26 + ... = 0

(*v*) 0 – (– 35) = ...

5. Evaluate

(*i*) 15 + (–8)

(*ii*) (–16) + 9

(*iii*) (–7) + (–23)

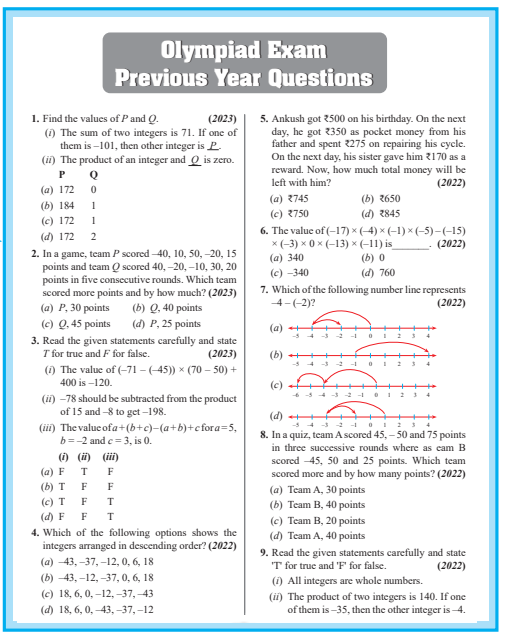
(*iv*) (–32) + 47

(*v*) 53 + (–26)

(*vi*) (–48) + (–36)

This section includes questions that were asked in past exams. Solving these helps you understand questions pattern, difficulty level, & most important topics. It's a great way to prepare for the actual exam with full confidence.

Olympiad Exam Previous Year Questions



Olympiad Exam Previous Year Questions

1. Find the values of *P* and *Q*. **(2023)**

(*i*) The sum of two integers is 71. If one of them is –101, then other integer is *P*.

(*ii*) The product of an integer and *Q* is zero.

	P	Q
(*a*)	172	0
(*b*)	184	1
(*c*)	172	1
(*d*)	172	2

2. In a game, team *P* scored –40, 10, 50, –20, 15 points and team *Q* scored 40, –20, –10, 30, 20 points in five consecutive rounds. Which team scored more points and by how much? **(2023)**

(*a*) *P*, 30 points (*b*) *Q*, 40 points

(*c*) *Q*, 45 points (*d*) *P*, 25 points

3. Read the given statements carefully and state *T* for true and *F* for false. **(2023)**

(*i*) The value of (–71 – (–45)) × (70 – 50) + 400 is –120.

(*ii*) –78 should be subtracted from the product of 15 and –8 to get –198.

(*iii*) The value of $a+(b+c)-(a+b)+c$ for $a=5$, $b=-2$ and $c=3$, is 0.

	(*i*)	(*ii*)	(*iii*)
(*a*)	F	T	F
(*b*)	T	F	F
(*c*)	T	F	T
(*d*)	F	F	T

4. Which of the following options shows the integers arranged in descending order? **(2023)**

(*a*) –43, –37, –12, 0, 6, 18

(*b*) –43, –12, –37, 0, 6, 18

(*c*) 18, 6, 0, –12, –37, –43

(*d*) 18, 6, 0, –43, –37, –12

5. Ankush got ₹500 on his birthday. On the next day, he got ₹350 as pocket money from his father and spent ₹275 on repairing his cycle. On the next day, his sister gave him ₹170 as a reward. Now, how much total money will be left with him? **(2022)**

(*a*) ₹745 (*b*) ₹650

(*c*) ₹750 (*d*) ₹845

6. The value of (–17) × (–4) × (–1) × (–5) – (–15) × (–3) × 0 × (–13) × (–11) is_____. **(2022)**

(*a*) 340 (*b*) 0

(*c*) –340 (*d*) 760

7. Which of the following number line represents –4 – (–2)? **(2022)**

(*a*)

(*b*)

(*c*)

(*d*)

8. In a quiz, team A scored 45, – 50 and 75 points in three successive rounds where as eam B scored –45, 50 and 25 points. Which team scored more and by how many points? **(2022)**

(*a*) Team A, 30 points

(*b*) Team B, 40 points

(*c*) Team B, 20 points

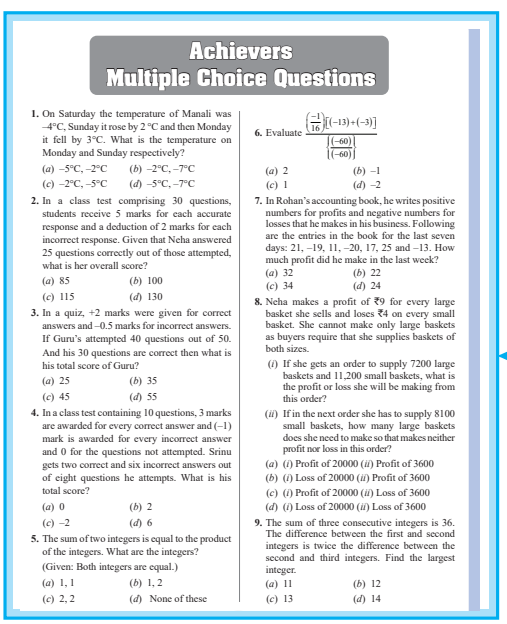
(*d*) Team A, 40 points

9. Read the given statements carefully and state 'T' for true and 'F' for false. **(2022)**

(*i*) All integers are whole numbers.

(*ii*) The product of two integers is 140. If one of them is –35, then the other integer is –4.

Achievers Multiple Choice Questions



Achievers Multiple Choice Questions

1. On Saturday the temperature of Manali was –4°C, Sunday it rose by 2 °C and then Monday it fell by 3°C. What is the temperature on Monday and Sunday respectively?

(*a*) –5°C, –2°C (*b*) –2°C, –7°C

(*c*) –2°C, –5°C (*d*) –5°C, –7°C

2. In a class test comprising 30 questions, students receive 5 marks for each accurate response and a deduction of 2 marks for each incorrect response. Given that Neha answered 25 questions correctly out of those attempted, what is her overall score?

(*a*) 85 (*b*) 100

(*c*) 115 (*d*) 130

3. In a quiz, +2 marks were given for correct answers and –0.5 marks for incorrect answers. If Guru's attempted 40 questions out of 50. And his 30 questions are correct then what is his total score of Guru?

(*a*) 25 (*b*) 35

(*c*) 45 (*d*) 55

4. In a class test containing 10 questions, 3 marks are awarded for every correct answer and (–1) mark is awarded for every incorrect answer and 0 for the questions not attempted. Srinu gets two correct and six incorrect answers out of eight questions he attempts. What is his total score?

(*a*) 0 (*b*) 2

(*c*) –2 (*d*) 6

5. The sum of two integers is equal to the product of the integers. What are the integers? (Given: Both integers are equal.)

(*a*) 1, 1 (*b*) 1, 2

(*c*) 2, 2 (*d*) None of these

6. Evaluate $\frac{\left(\frac{-1}{16}\right)[(-13)+(-3)]}{[(-60)]+[(-60)]}$

(*a*) 2 (*b*) –1

(*c*) 1 (*d*) –2

7. In Rohan's accounting book, he writes positive numbers for profits and negative numbers for losses that he makes in his business. Following are the entries in the book for the last seven days: 21, –19, 11, –20, 17, 25 and –13. How much profit did he make in the last week?

(*a*) 32 (*b*) 22

(*c*) 34 (*d*) 24

8. Neha makes a profit of ₹9 for every large basket she sells and loses ₹4 on every small basket. She cannot make only large baskets as buyers require that she supplies baskets of both sizes.

(*i*) If she gets an order to supply 7200 large baskets and 11,200 small baskets, what is the profit or loss she will be making from this order?

(*ii*) If in the next order she has to supply 8100 small baskets, how many large baskets does she need to make so that makes neither profit nor loss in this order?

(*a*) (*i*) Profit of 20000 (*ii*) Profit of 3600

(*b*) (*i*) Loss of 20000 (*ii*) Profit of 3600

(*c*) (*i*) Profit of 20000 (*ii*) Loss of 3600

(*d*) (*i*) Loss of 20000 (*ii*) Loss of 3600

9. The sum of three consecutive integers is 36. The difference between the first and second integers is twice the difference between the second and third integers. Find the largest integer.

(*a*) 11 (*b*) 12

(*c*) 13 (*d*) 14

Achievers Multiple Choice Questions

In this section, you'll get multiple-choice questions (MCQs) to strengthen your preparation. These questions help you practice in a way that is useful for exams.

CONTENTS

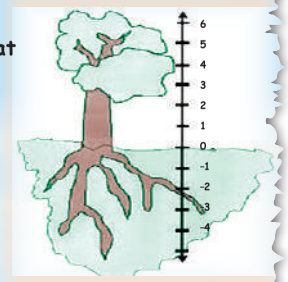
Integers

Integers

Integers are a set of numbers that include all whole numbers (positive and negative) and zero. They do not have fractional or decimal parts. It is denoted by z.

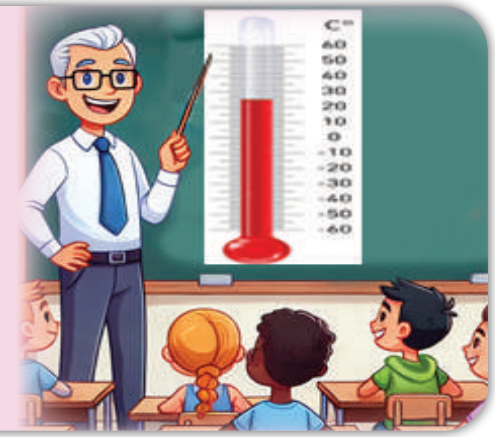
Examples of integers are:

…, -3, -2, -1, 0, 1, 2, 3….

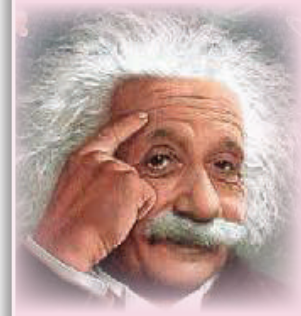


Types of Integers

- **Positive integers:** Positive integers are numbers greater than zero (e.g., 1, 2, 3, …).
- **Negative integers:** Negative integers are numbers less than zero (e.g., …, -3, -2, -1).
- **Zero (0):** Zero is a special integer that is neither positive nor negative.



BODMAS Rule



The BODMAS rule helps in solving mathematical expressions correctly by following a specific order of operations.

BODMAS Stands For:

B → Brackets, O → Of, D → Division, M → Multiplication, A → Addition, S → Subtraction

Types of Brackets:

Brackets should be solved in the following order:

Vinculum or Bar (_ or fraction bar), Round Brackets → ( ), Curly Brackets → { }, Square Brackets → [ ]

Integers

Operations on Integers

Addition: (a + b = c),, where (a) and (b) are integers, and (c) is their sum.

Subtraction: (a – b = c), where (a) and (b) are integers, and (c) is their difference.

Multiplication: (a.b = c), where (a) and (b) are integers, and (c) is their product.

Division: (a/b = c), where (a) and (b) are integers, and (c) is their quotient.

Key Rules

Multiplication Type	Result Sign
(+) × (+)	+
(–) × (–)	+
(+) × (–) or (–) × (+)	–

Key Rules

Division Type	Result Sign
(+) ÷ (+)	+
(–) ÷ (–)	+
(+) ÷ (–) or (–) ÷ (+)	–

Comparing Integers

- If a > b then a – b is positive.
- If a < b then a – b is negative.
- If a = b, then a – b = 0.

Properties of Integers

	Operations			
Property	Addition	Subtraction	Multiplication	Division
Closure	$A + B \in Z$	$A - B \in Z$	$A \times B \in Z$	$A \div B \notin Z$
Commutative	$A + B = B + A$	$A - B \neq B - A$	$A \times B = B \times A$	$A \div B \neq B \div A$
Associative	$A + (B + C) = (A + B) + C$	$A - (B - C) \neq (A - B) - C$	$A \times (B \times C) = (A \times B) \times C$	$A \div (B \div C) \neq (A \div B) \div C$
Distributive	Not Applicable	Not Applicable	$A \times (B \pm C) = A \times B \pm A \times C$	Not Applicable
Identity	$A + 0 = 0 + A$	Not Applicable	$1 \times A = A \times 1 = A$	Not Applicable
Inverse	$A + (-A) = (-A) + A = 0$	Not Applicable	$A \times (1/A) = (1/A) \times A = A$	Not Applicable

CHAPTER-1

Integers

OLYMP-PICKS

Introduction

Integers are whole numbers that can be either positive, negative, or zero. We use integers in everyday life when we talk about things like temperature or altitude. In this chapter, you will learn how to add, subtract, multiply, and divide integers, as well as how to represent them on a number line.

Integers

Integers are a set of numbers that include all positive whole numbers (1, 2, 3, ...), negative whole numbers (... –3, –2, –1) and zero (0). It is denoted by Z

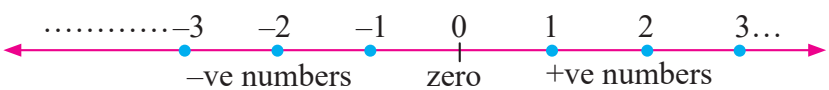
$Z = \{... -3, -2, -1, 0, 1, 2, 3, ...\}$

- Positive integers are numbers greater than zero e.g., (1, 2, 3, ...).
- Negative integers are numbers less than zero e.g., (... – 3, –2, –1).
- Zero (0) is a special integer that is neither positive nor negative.

Integers do not include fractions or decimals. They form an essential part of arithmetic and algebra.

Understanding the Number Line of Integers

- Integers are arranged on a number line with zero (0) at the center.
- Positive integers (1, 2, 3, ...) are always on the right side of zero.
- Negative integers (... –3, –2, –1) are always on the left side of zero.
- As we move right, the numbers increase (ascending order).
- As we move left, the numbers decrease (descending order).
- Zero is neither positive nor negative, but it acts as the dividing point between positive and negative numbers.

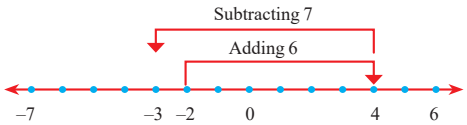


Solved Example

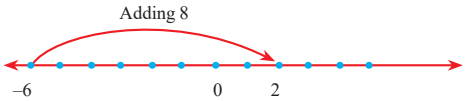
1. Draw a number line and represent each of the following:

$(a) -2 + 6 + (-7)$ $(b) -6 + 8$

Sol. $(a) -2 + 6 + (-7) = -3$



$(b) -6 + 8 = 2$



TEST YOURSELF

1. Draw a number line and represent each of the following on it:

$(i) -2 + 8 + (-9)$ $(ii) -2 + (-3) + (-5)$

2. What value of x on number line which makes the following statement true?

$(-20) + x = (-35) + (-5)$

Key Properties of Integers on a Number Line

1. No Largest or Smallest Integer

- The set of integers is infinite in both directions.
- There is no largest integer because we can always find a greater number by adding 1.
- There is no smallest integer because we can always find a smaller number by subtracting 1.

2. Comparison of Integers

- Any integer is greater than all the integers to its left on the number line.
- Any integer is less than all the integers to its right on the number line.

3. Spacing Between Integers

- No number exists between two consecutive integers. For example, there is no integer between 2 and 3 or between –1 and 0.
- At least one integer exists between two non-consecutive integers. For example, between 1 and 4, the integers 2 and 3 exist.

Absolute Value of an Integer

The absolute value of an integer is its numerical value without considering its sign. It is represented by $|x|$, where x is any integer. The absolute value always results in a non-negative number.

Solved Example

2. $|5| = 5$ (Absolute value of positive 5 is 5.)

3. $|-2| = 2$ (Absolute value of negative 2 is 2.)

4. $|0| = 0$ (Absolute value of zero is zero.)

Key Concept:

- The absolute value represents the distance of a number from zero on the number line, regardless of direction.
- Distance cannot be negative, so the absolute value is always positive or zero.

Addition and Subtraction of Integers Using a Number Line

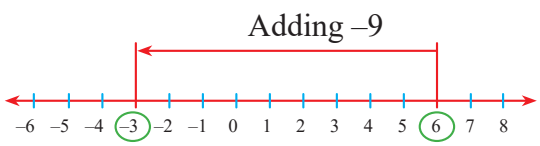
A number line is a visual tool that helps in understanding the addition and subtraction of integers by moving left or right.

Addition of Integers

1. To add a positive integer (+) → Move right on the number line.
2. To add a negative integer (–) → Move left on the number line.
3. The final position represents the sum of the two integers.

Example: 6 + (− 9)

- Start at 6.
- Move 9 steps left (since 9 is negative).
- The result is –3.



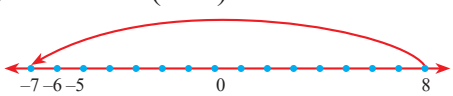
Solved Example

5. Draw a number line and answer the following:

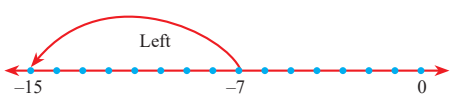
(*a*) Which number will we reach if we move 15 steps to the left of 8? Write this number with appropriate sign.

(*b*) If we are at –7 on a number line, in which direction should we move to reach –15 and how many steps?

Sol. (*a*) 8 + (– 15) = – 7



(*b*) – 15 – (– 7) = – 8



Hence, 8 steps moving in left direction.

TEST YOURSELF

3. Draw a number line and answer the following:

(*i*) Which number will we reach if we move 12 steps to the left of 5? Write this number with appropriate sign.

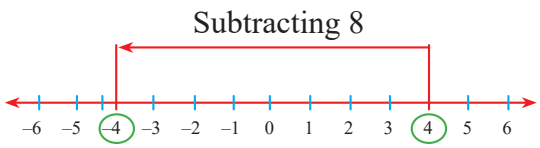
(*ii*) If we are at –4 on a number line, in which direction should we move to reach –12, and how many steps?

Subtraction of Integers

1. Subtracting a positive integer (+) → Move left on the number line.
2. Subtracting a negative integer (–) → Move right on the number line (since subtracting a negative is the same as adding the positive).
3. The final position represents the difference of the two integers.

Example: 4 – 8

- ⇨ Start at 4,
- ⇨ Move 8 steps left.(since subtracting)
- ⇨ Result: 4 – 8 = –4



Key Concept:

- ❑ Subtracting a negative integer is the same as adding its positive counterpart.
- ❑ Example: 6 – (– 2) = 6 + 2 = 8.

Solved Example

6. The sum of two integers is –11. If one of them is 9. Find the other.

Sol. Let the other integer be a. Then

$9 + a = -11 \Rightarrow a = (-11) - 9 = -11 - 9 = -20$.

Hence, the other integer is –20.

TEST YOURSELF

4. Fill in the blanks

(*i*) (– 85) + 12 = ... + (–85)

(*ii*) 6 – (– 4) = ...+ (– 4) – 6

(*iii*) [14 + ...] + 2 = ... + [(– 7) + 2]

(*iv*) 26 + ... = 0

(*v*) 0 – (– 35) = ...

5. Evaluate

(*i*) 15 + (–8)

(*ii*) (–16) + 9

(*iii*) (–7) + (–23)

(*iv*) (–32) + 47

(*v*) 53 + (–26)

(*vi*) (–48) + (–36)

Properties of Addition and Subtraction of Integers

Properties of Addition

Closure Property: The sum of any two integers is always an integer.
e.g., 5 + (– 3) = 2 (which is also an integer).

Commutative Property: The order of addition does not change the sum. i.e., $x + y = y + x$.
e.g. (– 4) + 7 = 7 + (– 4)

Associative Property: The way numbers are grouped does not change the sum. i.e., $x + (y + z) = (x + y) + z$ e.g., $(-2) + (3 + 5) = ((-2) + 3) + 5$

Additive Identity: Adding of zero to any integer does not change its value, so 0 is additive identity. i.e., $x + 0 = x$. e.g., $(-6) + 0 = -6$

Additive Inverse: The additive inverse of any integer is 'a' is '$-a$' i.e., $a + (-a) = (-a) + a = 0$

Solved Example

7. If $a = -8$, $b = -7$, $c = 6$. Verify that $(a + b) + c = a + (b + c)$

Sol. $a + b = -8 + (-7) = -8 - 7 = -15$

$(a + b) + c = -15 + (6) = -9$ ...(*i*)

$b + c = -7 + (6) = -1$

$a + (b + c) = -8 + (-1) = -9$ ...(*ii*)

from (*i*) and (*ii*)

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

TEST YOURSELF

6. Given the integers p = –6, q = 9 and r = –2, solve the following:

(*i*) Verify the associative property of addition by computing both $(p + q) + r$ and $p + (q + r)$.

(*ii*) Demonstrate the commutative property of addition by showing $p + q = q + p$.

Properties of Subtraction

Closure Property: The difference of any two integers is always an integer. i.e., If x and y are integers, then $x - y$ is also an integer.

Commutative Property: Subtraction is not commutative, meaning changing the order changes the result. i.e., $x - y \neq y - x$

Associative Property: Subtraction is not associative, meaning changing the grouping of numbers changes the result. i.e., $x - (y - z) \neq (x - y) - z$.

e.g., $10 - (5 - 2) = 10 - 3 = 7$ and $(10 - 5) - 2 = 5 - 2 = 3$. Since $7 \neq 3$, subtraction is not associative.

Subtractive Identity: Subtracting zero to any integer does not change its value. i.e., $x - 0 = x$, but $0 - x \neq x$.

e.g, $9 - 0 = 9$ and $0 - 9 = -9$ (which is NOT equal to 9)

Solved Example

8. On a particular day, the temperature of Delhi at 10 a.m. was 13°C, but by midnight, it fell to 6°C. The temperature of Chennai at 10 a.m. the same day was 18°C but fell to 10°C by midnight. Which temperature drop is greater?

Sol. We have, fall in Delhi's temperature = 13°C – 6°C = 7°C

Also, fall in Chennai's temperature = 18°C – 10°C = 8°C

So, 8°C > 7°C

Hence, the fall in temperature of Chennai is greater.

Dividing Integers with the Same Sign: When dividing two positive integers or two negative integers, divide their absolute values and assign a positive sign to the quotient. i.e., $x \div y = x \div y$ or $(-x) \div (-y) = x \div y$

e.g., $16 \div 4 = 4$ or $(-18) \div (-6) = 3$

Key Rules for Division of Integers

Division Type	Result Sign	Example
$(+) \div (+)$	+	$12 \div 4 = 3$
$(-) \div (-)$	+	$(-16) \div (-4) = 4$
$(+) \div (-)$ or $(-) \div (+)$	–	$20 \div (-5) = -4$ or $(-20) \div 5 = -4$

Solved Example

11. Evaluate:

(*i*) $98 \div 14$

(*ii*) $(-48) \div (-16)$

Sol. (*i*) $98 \div 14 = \frac{98}{14} = 7$

(*ii*) $(-48) \div (-16) = \frac{-48}{-16} = 3$

TEST YOURSELF

10. Evaluate

(*i*) $(-133) \div 19$

(*ii*) $168 \div (-14)$

Properties of Division of Integers

Closure Property: The result of dividing two integers may or may not be an integer.

e.g., $10 \div 2 = 5$ (integer) and $7 \div 2 = 3.5$ (not an integer)

Since division does not always result in an integer, it does not satisfy the closure property.

Commutative Property: Changing the order of division changes the result. i.e., $x \div y \neq y \div x$

e.g., $12 \div 4 = 3$ and $4 \div 12 = 1/3$ (not the same as 3)

Hence, division is not commutative.

Associative Property: Changing the grouping of numbers changes the result. i.e., $x \div (y \div z) \neq (x \div y) \div z$

e.g., $20 \div (10 \div 2) = 20 \div 5 = 4$ and $(20 \div 10) \div 2 = 2 \div 2 = 1$

Since $4 \neq 1$, division is not associative.

Solved Example

12. Simplify the expression $(-24)/(6)$ and verify your answer.

Sol. Identify the signs:

⇨ Dividend: –24 (negative)

⇨ Divisor: 6 (positive)

⇨ Since the signs are opposite, the quotient will be negative.

Assign the correct sign: $(-24)/6 = -4$

Verification: Multiply the quotient by the divisor to check: $-4 \times 6 = -24$ matches the original dividend).

1 In a basketball skills challenge, players are scored out of 10 for each attempt, but lose 2 points for any rule violation. Below are the scores of two players across three attempts:

Round	I	II	III
Player A	8	–2	6
Player B	7	–2	10

Without calculating the exact total, determine which player scored higher overall.

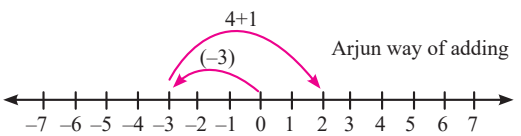
2 Priya tried to show that the subtraction of two integers, –5 and –2, is commutative by writing the following equation:

$-5 - (-2) = -2 - (-5)$

(*i*) Does this equation imply that subtraction of integers is commutative?

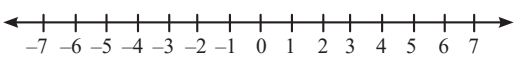
(*ii*) If not, explain why subtraction is not commutative. Provide another example to justify your answer.

3 Arjun and Vikram tried to add three integers –3, 4 and 1 on a number line. Arjun added these in this way [(–3) + (4 + 1)] i.e., added –3 with 4 + 1. Vikram added these in this way, [(–3) + 4] + 1 i.e., first added –3 and 4 and then added 1 to the resultant.



Answer the following questions.

(*i*) Show the same addition as done by Vikram i.e., [(–3) + 4] + 1 on number line.



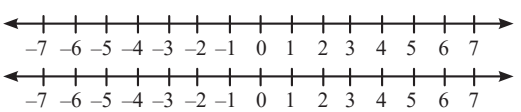
(*ii*) Did Arjun and Vikram reach the same point on the number line i.e., 2?

Yes ☐ No ☐

(*iii*) So can we say that [(–3) + (4 + 1)] = [(–3) + 4] + 1?

Yes ☐ No ☐

(*iv*) Will the same be applicable for addition of any three integers on a number line? If yes, assume any three integers and verify it on the number lines given below.



Yes ☐ No ☐

(*v*) Now, can we say addition of integers is associative?

Yes ☐ No ☐

CLASS 7

SCIENCE

Olympiad

Prepguide & PYQs

+

Workbook

After School Practice

- Concept Maps
- Olympiad Specific Concepts
- Topicwise Solved Examples
- Achievers MCQs
- Olympiad Exam PYQs
- Everyday Curiosity Qns

NSO, ISO, iOS, Hindustan Olympiad, NSTSE and others

Overview of Major Olympiad Exams

National Science Olympiad (NSO)

Exam Details

Feature	Information
Frequency of conduct	Once a year
Exam Mode	Offline
Medium	English
Exam Duration	60 Minutes
Type of Questions	Multiple Choice Questions (Objective Type)

Syllabus

Section–1: Verbal and Non-Verbal Reasoning.

Section–2: Heat, Motion and Time, Electric Current and its Effects, Light, Acids, Bases and Salts, Physical and Chemical Changes, Nutrition in Plants and Animals, Respiration in Organisms, Transportation in Plants and Animals, Reproduction in Plants, Natural Resources and Their Conservation (Forests: Our Lifeline, Wastewater Story).

Section–3: Higher Order Thinking Questions - Syllabus as per Section–2.

Exam Structure

Levels	Details
Level 1	All students are eligible
Level 2	Top 5% of the participating students in Level 1 exam

Note:

- **Level 1 Questions:** 60% from class 7 syllabus + 40% from class 6 syllabus.
- **Level 2 Questions:** From class 7 syllabus only.
- **Achievers Section Questions:** From class 7 syllabus only.

Exam Pattern

Levels	Sections	Questions	Marks/ Question	Total Marks
Level 1	1: Logical Reasoning	10	1	10
	2: Science	35	1	35
	3: Achievers Section	5	3	15
	Total	**50**		**60**
Level 2	1: Science	45	1	45
	2: Achievers Section	5	3	15
	Total	**50**		**60**

Note: There is no negative marking for wrong answers.

Silverzone Olympiad (iOS)

Exam Details

Feature	Information
Exam Frequency	Conducted annually, two dates to choose from
Exam Mode	Offline, conducted in schools during school hours
Medium	English
Exam Duration	40 minutes
Type of Questions	Multiple Choice Questions (Objective Type)

Syllabus

Section 1:

- **How Stuff Works:** Light, Electric Current and Its Effects, Time and Motion
- **Living World:** Respiration, Transportation in Plants and Animals, Reproduction in Plants
- **Materials:** Heat, Acids, Bases and Salts, Physical and Chemical Changes
- **Natural Resources:** Wastewater story, Forest
- **Food:** Nutrition in Plants, Nutrition in Animals

Exam Structure

Levels	Details
Level 1	All students are eligible
Level 2	Top 1000 rank holders (Minimum 50%+ marks & Above)
Level 3	1st rank holders at Level 2

Exam Pattern

Sections	Questions	Marks/ Question	Total Marks
Section 1: Science	23	2.5	57.5
Section 2: Reasoning and Aptitude	7	3	21
Section 3: Scholar's Zone	5	4.3	21.5
Total	**35**		**100**

Note: There is no negative marking for wrong answers.

International Science Olympiad (ISO)

Exam Details

Feature	Information
Exam Frequency	Twice a year (December & February)
Exam Mode	Online & Offline (pen-paper in schools)
Duration	65 minutes (offline), 45 minutes [online except Drawing (60 min) and Essay (40 min)]
Medium	English
Type of Questions	Multiple Choice Questions (Objective Type)

Syllabus

Section 1: Physical Quantities of Measurement, Heat, Light Propagation, Electricity, Sound and Its Propagation, Organization of Living Things, Reproduction in Living Things, Control and Co-Ordination, Circulation, Component of Food, Tissue: Plant and Animal, Natural Resources and Calamities, Waste Water Management, Classification of Substances, Acids, Bases and Salts, Atomic Structure, Metal and Non Metals.

Exam Pattern

Sections	Ques-tions	Marks/ Ques-tion	Total Marks
Section 1: Subjective	35	1	35
Section 2: Logical Reasoning	10	1	10
Section 3: High Order Thinking Section (HOTs)	5	1	5
Total	**50**		**50**

Note: There is no negative marking for wrong answers.

Hindustan Olympiad

Exam Details

Detail	Information
Exam Frequency	Once a year
Exam Mode	Online
Duration	120 minutes
Medium	English or Hindi
Type of Questions	Multiple Choice Questions (Objective Type)

Note: An additional 10 minutes is provided for reading the instructions and filling the OMR sheet.

Exam Structure

Levels	Details
Level 1	All students are eligible (open-book exam)
Level 2	Top 10% of participants (proctored exam)

Exam Pattern

Sections	Questions	Marks/ Question	Total Marks
Section A: Mathematics	20	1	20
Section B: English	20	1	20
Section C: Science	20	1	20
Section D: General Knowledge	20	1	20
Section E: Logical Reasoning	20	1	20
Total	100		100

Note: There is no negative marking for wrong answers.

National Level Science Talent Search Examination (NSTSE)

Exam Details

Feature	Details
Exam Frequency	Once a year
Exam Mode	Online & Offline
Duration	60 minutes
Medium	English
Type of Questions	Multiple Choice Questions

Syllabus

Sections:

- **Section A (Mathematics):** Integers, Fractions and Decimals, Data Handling, Simple Equations, Lines and Angles, Triangle and its Properties, Comparing Quantities, Rational Numbers, Perimeter and Area, Algebraic Expressions, Exponents and Powers, Symmetry
- **Section B (Physics):** Motion and time, Heat, Electric Current and its Effects
- **Section C (Chemistry):** Physical and chemical changes, Acids bases and salts, Water - A precious resource
- **Section D (Biology):** Nutrition in plants, nutrition in animals, Organization in living beings, Respiration in organisms, Transportation in living beings, Reproduction and growth in plants.
- **Critical Thinking:** This section includes a combination of skills like conscious application in real life, Logical & Inductive Reasoning, Tactics & Strategies in decision making, higher order thinking

Exam Pattern

Sections	Questions	Marks/ Question	Total Marks
Section A: Mathematics	25	1	25
Section B: Physics	10	1	10
Section C: Chemistry	10	1	10
Section D: Biology	10	1	10
Section E: Critical Thinking	5	1	5
Total	60		60

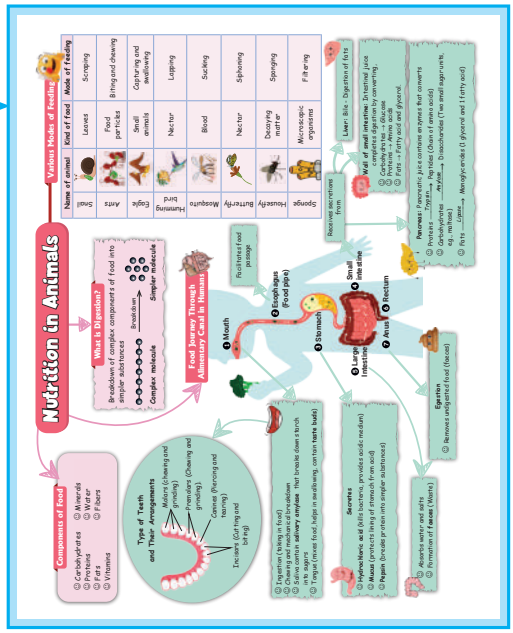
Note: There is no negative marking for wrong answers.

How to Use this Book

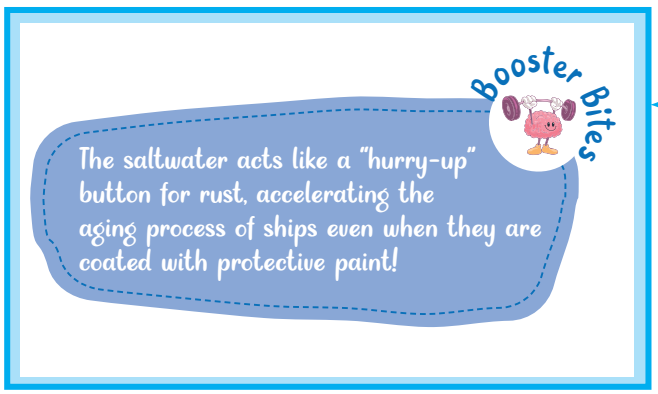
This book is structured to support your learning journey of preparing for your olympiad exams through a variety of engaging and informative elements. Here's how to make the most of it:

The concept map appears to be a comprehensive study aid that outlines key concepts in a structured format. Use it to understand the chapter's concepts and as a quick reference to recall important highlights.

Concept Map



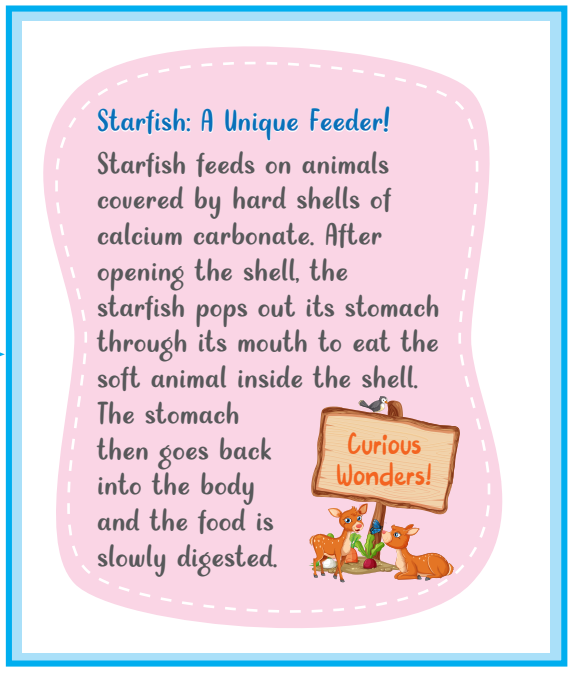
Booster Bites



Booster Bites are power-ups in your learning journey. They give you a boost of knowledge that helps you become smarter and more confident in your studies!

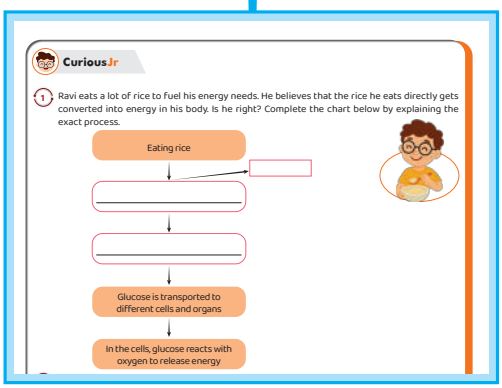
Curious Wonders are like little treasures of knowledge that make you smarter and more fascinated by the natural world. They help you enjoy learning by opening your mind to new and surprising information.

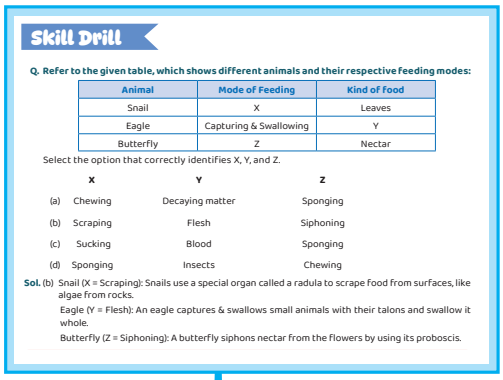
Curious Wonders



CuriousJr brings real-life questions that make you think and wonder. These questions help you see how what you learn connects to the world around you.

CuriousJr





Skill Drill

Q. Refer to the given table, which shows different animals and their respective feeding modes:

Animal	Mode of Feeding	Kind of Food
Snail	X	Leaves
Eagle	Capturing & Swallowing	Y
Butterfly	Z	Nectar

Select the option that correctly identifies X, Y, and Z.

	X	Y	Z
(a)	Chewing	Decaying matter	Sponging
(b)	Scraping	Flesh	Siphoning
(c)	Sucking	Blood	Sponging
(d)	Sponging	Insects	Chewing

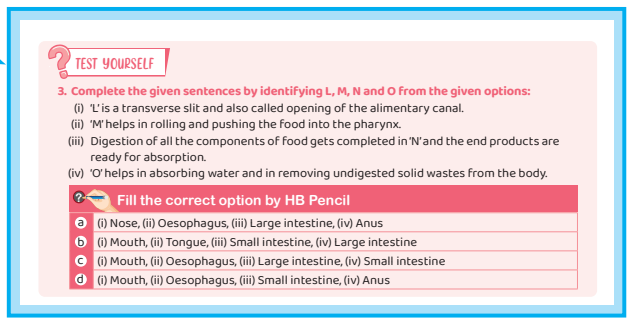
Sol. (b) Snail (X = Scraping): Snails use a special organ called a radula to scrape food from surfaces, like algae from rocks.
Eagle (Y = Flesh): An eagle captures & swallows small animals with their talons and swallow it whole.
Butterfly (Z = Siphoning): A butterfly siphons nectar from the flowers by using its proboscis.

Skill Drill

Skill Drill contains solved questions for each topic. These examples show how to solve problems step by step, making it easier for you to understand the method and apply it on your own. It helps you build strong problem-solving skills.

After learning from Skill Drill, it's time to test your understanding. This section gives you practice questions based on each concept. Solving these will show how well you have learned and help you find areas where you need more practice.

Test Yourself

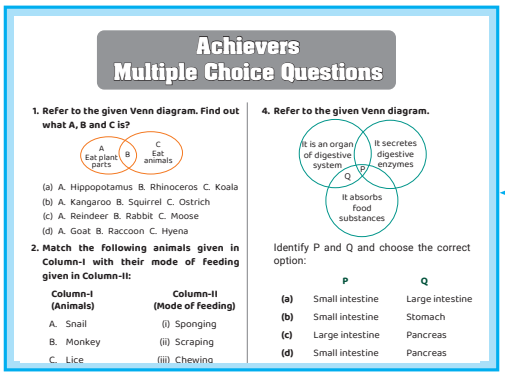


TEST YOURSELF

3. Complete the given sentences by identifying L, M, N and O from the given options:
(i) 'L' is a transverse slit and also called opening of the alimentary canal.
(ii) 'M' helps in rolling and pushing the food into the pharynx.
(iii) Digestion of all the components of food gets completed in 'N' and the end products are ready for absorption.
(iv) 'O' helps in absorbing water and in removing undigested solid wastes from the body.

Fill the correct option by HB Pencil

(a) (i) Nose, (ii) Oesophagus, (iii) Large intestine, (iv) Anus
(b) (i) Mouth, (ii) Tongue, (iii) Small intestine, (iv) Large intestine
(c) (i) Mouth, (ii) Oesophagus, (iii) Large intestine, (iv) Small intestine
(d) (i) Mouth, (ii) Oesophagus, (iii) Small intestine, (iv) Anus



Achievers Multiple Choice Questions

1. Refer to the given Venn diagram. Find out what A, B and C is?

(a) A. Hippopotamus B. Rhinoceros C. Koala
(b) A. Kangaroo B. Squirrel C. Ostrich
(c) A. Reindeer B. Rabbit C. Moose
(d) A. Goat B. Raccoon C. Hyena

2. Match the following animals given in Column-I with their mode of feeding given in Column-II:

Column-I (Animals)	Column-II (Mode of Feeding)
A. Snail	(i) Sponging
B. Monkey	(ii) Scraping
C. Lice	(iii) Chewing

4. Refer to the given Venn diagram.

Identify P and Q and choose the correct option:

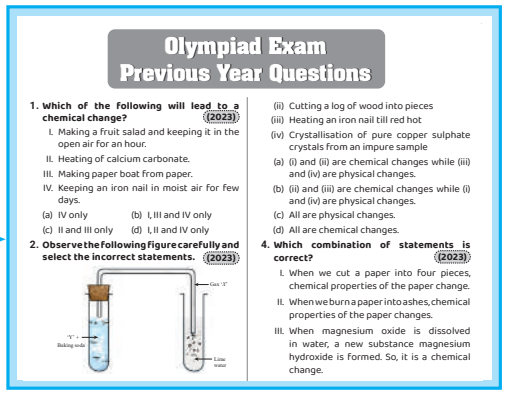
	P	Q
(a)	Small intestine	Large intestine
(b)	Small intestine	Stomach
(c)	Large intestine	Pancreas
(d)	Small intestine	Pancreas

Achievers Multiple Choice Questions

In this section, you'll get multiple-choice questions (MCQs) to strengthen your preparation. These questions help you practice in a way that is useful for exams.

This section includes questions that were asked in past exams. Solving these helps you understand questions pattern, difficulty level, & most important topics. It's a great way to prepare for the actual exam with full confidence.

Olympiad Exam Previous Year Questions



Olympiad Exam Previous Year Questions

1. Which of the following will lead to a chemical change? (2023)
I. Making a fruit salad and keeping it in the open air for an hour.
II. Heating of calcium carbonate.
III. Making paper boat from paper.
IV. Keeping an iron nail in moist air for few days.
(a) IV only (b) I, III and IV only
(c) II and III only (d) I, II and IV only

2. Observe the following figure carefully and select the incorrect statements. (2023)

(ii) Cutting a log of wood into pieces
(iii) Heating an iron nail till red hot
(iv) Crystallisation of pure copper sulphate crystals from an impure sample
(a) (i) and (ii) are chemical changes while (iii) and (iv) are physical changes.
(b) (ii) and (iii) are chemical changes while (i) and (iv) are physical changes.
(c) All are physical changes.
(d) All are chemical changes.

4. Which combination of statements is correct? (2023)
I. When we cut a paper into four pieces, chemical properties of the paper change.
II. When we burn a paper into ashes, chemical properties of the paper changes.
III. When magnesium oxide is dissolved in water, a new substance magnesium hydroxide is formed. So, it is a chemical change.

CONTENTS

Nutrition in Plants

Photosynthesis -Food for All

Modes of Nutrition in Plants

Autotrophic (*auto = self; trophos = nourishment*) nutrition:

☺ Plants make their own food using sunlight, air (CO_2), and water (H_2O).

Heterotrophic (*heteros = other; trophos= nourishment*) nutrition:

☺ Animals and other organisms cannot make their own food but depend on plants or other animals for nutrition.

Nutrition

☺ Mode of taking food by an organism and its utilisation by the body.

☺ **Nutrients:** They are components of food. Carbohydrates, proteins, fats, vitamins and minerals.

Photosynthesis

(*Photo: light; synthesis : to combine*)

The process by which **green plants** prepare their food using:

☺ **Carbon dioxide** (from the air)

☺ **Water** (absorbed by roots from the soil)

☺ **Sunlight** (energy source - **ultimate source of energy**)

☺ **Chlorophyll** (green pigment in chloroplasts of leaves that traps sunlight)

Where Else Does Photosynthesis Happen?

Green stems & branches can also photosynthesize in plants.

Desert plants (like **cactus**) have **spine-like leaves** to reduce water loss by **transpiration**. Instead, their **green stems** carry out **photosynthesis**.

Non-green leaves (red, brown, purple) also photosynthesize! They have chlorophyll, but its green color is masked by other pigments.

Algae (found in ponds and stagnant water) are green because they contain **chlorophyll** and perform photosynthesis.

Why is Photosynthesis Important?

Produces Oxygen - Plants release the oxygen we breathe!

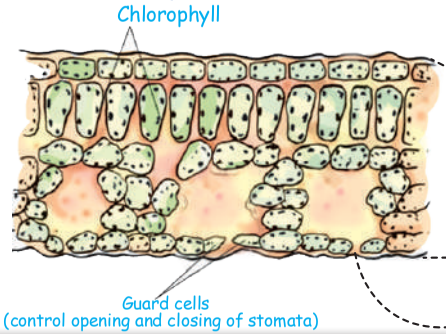
Makes Food for All - It forms the foundation of every food chain (order in which organisms, or living things, depend on each other for food).

Stores Solar Energy - Converts sunlight into chemical energy (food).

3 Sunlight Capture:

Chlorophyll, the green pigment in leaves, absorbs sunlight and this sunlight's energy is used to synthesise food.

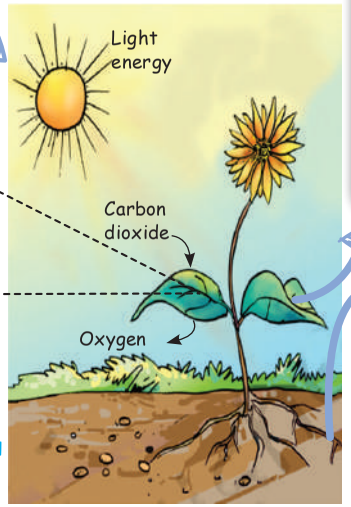
"Just the pizza for me and my friend will have carbon dioxide and water with sunlight."



2 Carbon dioxide Intake:

☺ Tiny pores on leaves, called **stomata**, let carbon dioxide in.

☺ During the process oxygen is also released out through stomata.



4 Food Formation:

With sunlight's energy, carbon dioxide and water are used to make glucose (sugar), releasing oxygen as a byproduct.

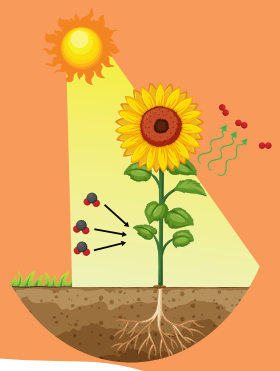
$$\text{Carbon dioxide} + \text{Water} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{Glucose} + \text{Oxygen} + \text{Water}$$

1 Water & Mineral Absorption:

Roots take in water and minerals from the soil and send them to the leaves through xylem (vessels).

CHAPTER-1

Nutrition in Plants



OLYMP-PICKS

Introduction

- **Autotrophs:** Organisms make their own food using carbon dioxide (CO_2), water (H_2O), and minerals, with sunlight and chlorophyll through photosynthesis, e.g., plants, algae.
- **Heterotrophs:** Organisms cannot produce their own food and depend on other organisms for nutrition, either by eating plants or other animals, e.g., humans, animals, fungi, and parasitic plants like *Cuscuta (Amarbel)*.

Photosynthesis — Food Making Process in Plants

Photosynthesis is the process by which green plants having cholorophyll use sunlight, carbon dioxide, and water to prepare food in the form of glucose and release oxygen as a byproduct.

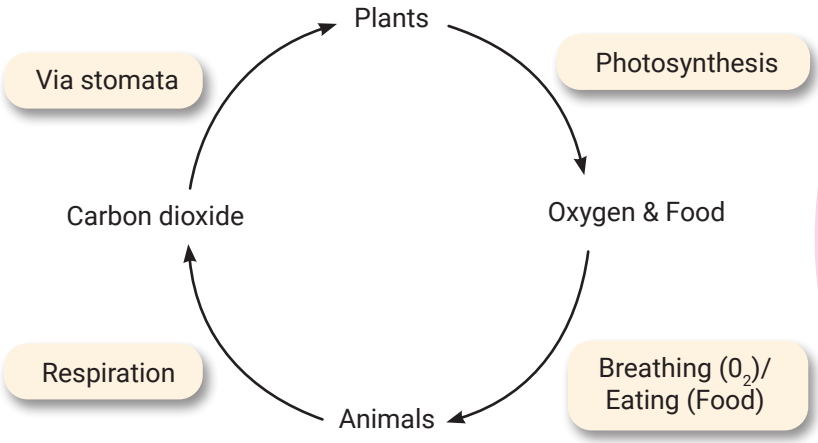
$$\text{Carbon dioxide} + \text{Water} \xrightarrow{\text{Sunlight, Chlorophyll}} \text{Glucose} + \text{Oxygen} + \text{Water}$$

Site of Photosynthesis: Leaves (food factories) are the main site of photosynthesis because they contain chlorophyll (in the chloroplast, a cell organelle). However, some plants with green stems (like cacti) can also perform photosynthesis.

Booster Bites

Sun is the ultimate source of energy for all living organisms.

Relationship of Plants and Animals



Without photosynthesis, there would be no food, no oxygen, and no life on Earth!

Stomata: Tiny openings in leaves help in gas exchange by allowing CO_2 in and O_2 out.

Guard cells: Each stoma is surrounded by guard cells, which control the opening and closing of stomata to prevent water loss.

Booster Bites

Living organisms are made of tiny/microscopic units called cells.
Some organisms are made of just one cell (*Amoeba*), while some are made of more than one (plants).

Cell Structure

- Cell Membrane: A thin outer boundary that encloses the cell.
- Nucleus: A centrally located, spherical structure that controls cell activities.
- Cytoplasm: A jelly-like substance surrounding the nucleus.

Roles of Chemicals in Photosynthesis Experiments

1 Iodine Solution

- Iodine solution is used to test for the presence of starch in a leaf.
- It turns blue-black if starch is present, confirming that photosynthesis has occurred.

2 Boiling the Leaf in Alcohol Before Testing For Starch

- Alcohol removes chlorophyll from the leaf so that the blue-black color of iodine can be seen clearly.
- Direct heating of alcohol is avoided as alcohol is highly flammable; instead, a water bath is used to heat alcohol safely.

3 Potassium hydroxide (KOH)

- Potassium hydroxide (KOH) is used in the bell jar experiment to absorb carbon dioxide, ensuring no CO_2 is available for photosynthesis.
- When tested with iodine, the leaf inside the jar with KOH shows no blue-black color, proving that carbon dioxide is essential for photosynthesis.

Other Modes of Nutrition in Plants

Parasitic Plants

Cuscuta (Amarbel): A yellow, wiry plant that lacks chlorophyll wraps itself around other plants and absorbs nutrients from them. Since it harms the host, it is called a parasite.

Skill Drill

Q. Read the given paragraph where a few words have been italicized and select the incorrect statement regarding them.

Food contains various *nutrients* that are essential for survival. *Nutrition* is the process by which organisms consume and utilize food. *Carbohydrates* help in growth, repair, and body development, while *proteins* provide the necessary energy for life functions. These components play a crucial role in maintaining the overall health of living beings.

(a) *Nutrients* should be replaced with gases as they are the most essential for survival.

(b) *Carbohydrates* should be replaced with *Proteins* as they are responsible for growth and repair.

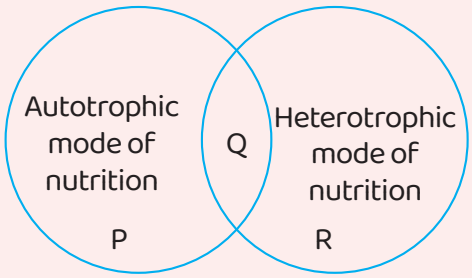
(c) *Proteins* should be replaced with *Fats* or *Carbohydrates* as they are the source of energy.

(d) *Nutrition* should not be changed as it is correctly mentioned.

Sol. (a) Nutrients such as carbohydrates, proteins, fats, vitamins, and minerals are essential for survival, not gases because they provide the necessary substances for growth, repair, and energy to carry out the life processes. Thus, nutrients should not be replaced with gases.

TEST YOURSELF

1. Study the given Venn diagram and select the option that correctly identifies P, Q and R.



Fill the correct option by HB Pencil

a	P - Mango, Q - Venus Flytrap, R - Lion
b	P - Bread mould, Q - Venus Flytrap, R - *Cuscuta*
c	P - *Hibiscus*, Q - Mushroom, R - Humans
d	P - Algae, Q - *Amarbel*, R - Eagle

Q. Richa performed an experiment on photosynthesis in which she removed all the leaves from a plant. How would it affect the plant's ability to carry out photosynthesis?

(a) Photosynthesis would significantly decrease or cease.

(b) Photosynthesis would continue normally.

(c) Photosynthesis would increase.

(d) The effect on photosynthesis cannot be determined.

Sol. (a) Leaves are the primary site of photosynthesis in plants. So removing all leaves would result in a significant reduction or complete cessation of photosynthesis.

TEST YOURSELF

2. The equation given in the box represents the process of photosynthesis.

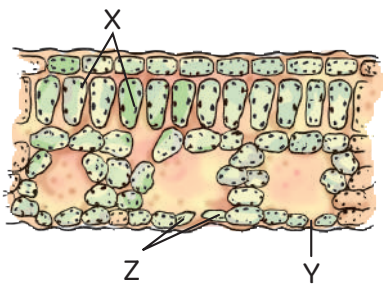
$$X + \text{Water} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{Glucose} + Y + \text{Water}$$

Which of the following represents X and Y in the given equation?

Fill the correct option by HB Pencil

a	X - Oxygen, Y - Carbon dioxide
b	X - Carbon dioxide, Y - Oxygen
c	X - Carbon, Y - Hydrogen
d	X - Oxygen, Y - Hydrogen

Q. Identify X, Y, and Z by carefully looking at the given figure and select the correct option.



(a) X- Chlorophyll, Y- Guard cell and Z- Stomata

(b) X- Chlorophyll, Y- Spore and Z- Stomata

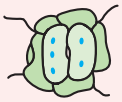
(c) X- Stomata, Y- Guard cell and Z- Chlorophyll

(d) X- Chlorophyll, Y- Stoma and Z- Guard cell

Sol. (d) In the given figure of section of leaf, X- Chlorophyll, Y- Stoma and Z- Guard cell.

TEST YOURSELF

3. **In which of the following given conditions, one can observe the highest rate of transpiration?**

Fill the correct option by HB Pencil	
a	
b	
c	
d	The given data is insufficient

Q. Refer to the given dichotomous key and select the incorrect statement regarding it.

(i) (A) The plants that can eat animals – Go to (ii)

(B) It is a parasite. – Go to (iii)

(ii) (A) A plant part that gets modified into a jug-like structure – X

(B) Part that forms a cover over the jug-like structure – Y

(iii) (A) This plant absorbs nutrients directly from a host plant on which it climbs – W

(B) It derives nutrition from our blood. – Z

(a) X could be a leaf of pitcher plant and the plant gets all the required nutrients from the soil in which they grow.

(b) Y could be lid, a structure at the apex of the leaf that regulates opening and closing the mouth of the pitcher to trap the insect.

(c) W could be *Cuscuta*, that is a yellow wiry branched structure twining around the stem and branches of a tree.

(d) Z could be bed bugs or lice.

Sol. (a) From the given dichotomous key, X refers to leaf, Y refers to lid, W could be *Cuscuta*, Z could be Bed Bugs or Lice.

Insectivorous plants like pitcher plant may not get all required nutrients from the soil. To compensate, they have evolved specialized structures to trap and digest insects to supplement their nutrition, enabling survival in such environments.

TEST YOURSELF

4. In the given list of the organisms, which common characteristic is shared by them?

Cuscuta, mosquitoes, bed bugs, lice and leeches

(i) They all belong to the same group of organisms.

(ii) They all have same mode of nutrition.

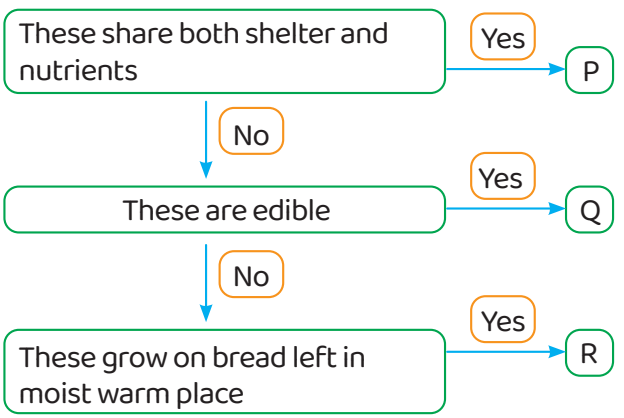
(iii) They all have a mutualistic relationship with their hosts.

(iv) They are all capable of transmitting diseases to their hosts.

Fill the correct option by HB Pencil

a	(i) and (ii) only
b	(ii) and (iv) only
c	(iii) and (iv) only
d	Only (ii)

Q. Refer to the given flowchart



Identify P, Q, and R and select the incorrect statement regarding it.

(a) P could be Lichen, Q could be Mushroom, and R could be Bread mould.

(b) Q grows on rotting wood during the rainy season.

(c) Both Q and R can take in nutrients from live and decaying matter.

(d) In organisms like P, chlorophyll-containing partner and a fungus live together.

TEST YOURSELF

6. Below is a list of plants:

(i) Peas (ii) Mango
(iii) *Moong* (iv) Wheat
(v) Beans (vi) *Cuscuta*
(vii) *Nepenthes*

Which of the following belong to the group of leguminous plants that have a symbiotic relationship with *Rhizobium* bacteria?

Fill the correct option by HB Pencil

a	(i), (iii), and (v) only
b	(ii), (iv), and (vi) only
c	(i), (iii), (v), and (vii) only
d	(i), (ii), (iv), and (vi) only

CuriousJr

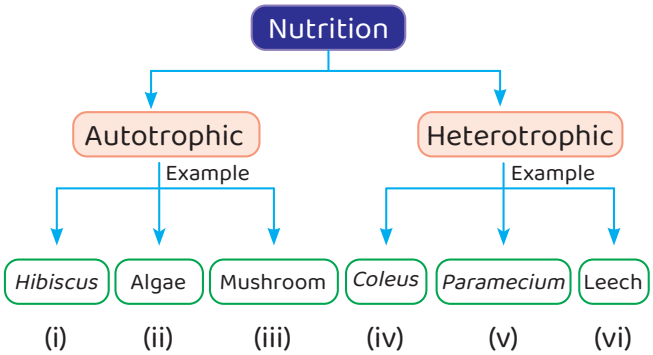
1. Humans can cook their food in the kitchen by using energy from sources like gas or electricity. However, we don't call humans autotrophs. Can you think why are humans not considered autotrophs even though we can prepare our own food?

2. You eat eggs for breakfast to get energy, and this energy originally comes from the Sun. Can you explain how the Sun's energy ends up in the egg you eat?

3. You come across a plant that traps and digests insects to meet its nutrient needs. It seems quite unusual compared to regular plants. Do you think this plant still performs photosynthesis like other plants? Why or why not?

Olympiad Exam Previous Year Questions

1. Refer to the given flow chart and answer the question that follows: **(2021)**



Which of the following examples are wrongly placed?

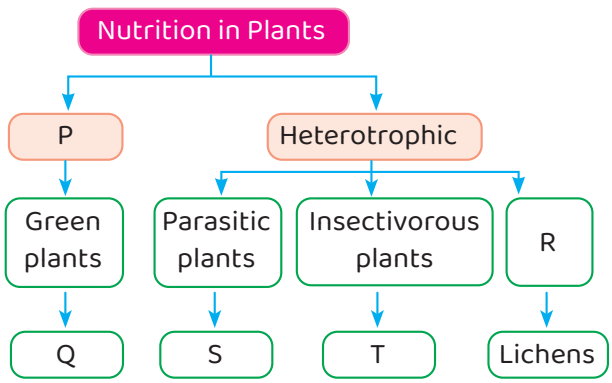
(a) (iii) and (iv) only

(b) (ii), (iii) and (v) only

(c) (i), (iv) and (v) only

(d) (ii), (iv) and (vi) only

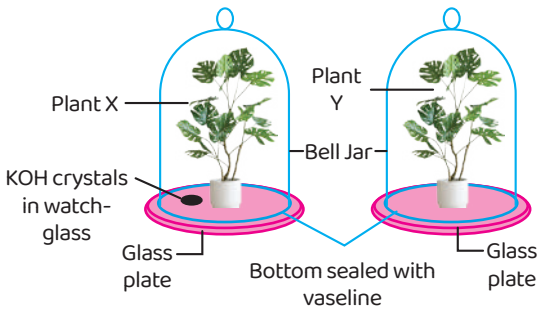
2. Refer to the given flow chart. **(2019)**



Select the option which correctly identifies P, Q, R, S and T.

	P	Q	R	S	T
(a)	Autotrophic	*Nepenthes*	Mutualism	*Utricularia*	*Mistletoe*
(b)	Autotrophic	Dodder	Saprophytic	*Dionaea*	*Acacia*
(c)	Autotrophic	Fenugreek	Symbiotic	*Mistletoe*	*Dionaea*
(d)	Autotrophic	Sundew	Saprophytic	*Rhoeo*	*Hydrilla*

3. Two healthy potted plants of nearly the same size were taken and destarched for 2-3 days. After this, they were placed on two separate glass plates, covered with bell jar and kept in Sun (as shown in the given experimental set-up). **(2023)**



What will be the result if one leaf from both the plants are tested for presence of starch after 4-6 hours?

(a) Leaves of both the plants will turn blue-black in colour.

(b) Leaf of only plant X will turn blue-black in colour.

(c) Leaf of only plant Y will turn blue-black in colour.

(d) Leaves of both the plants will not turn blue-black in colour.

4. Given below is a list of few materials. **(2021)**

(i) Sunlight (ii) Water

(iii) Cellulose (iv) Mineral

(v) Chlorophyll (vi) Oxygen

(vii) Carbon dioxide

Which among these are required by plant to prepare food?

(a) (i), (iii), (v) and (vii) only

(b) (ii), (iv), (v) and (vi) only

(c) (i), (ii), (iv), (v) and (vii) only

(d) (ii), (iii), (v) and (vi) only

Achievers
Multiple Choice Questions

1. The table below represents statements regarding three types of nutrition: P, Q, and R.

Features	P	Q	R
Organisms can prepare their own food	✓	×	×
Requires chlorophyll to prepare food	✓	×	×
Requires a living host to obtain nutrients	×	×	✓

Identify P, Q and R and choose the incorrect statement regarding it.

(a) P could be China rose, Q could be Mushroom, R could be *Cuscuta*

(b) Q could be an organism that can acquire their food by using their mouth.

(c) P utilizes carbon dioxide and release oxygen.

(d) R takes away essential nutrients from the host organism.

2. A student wants to investigate the importance of sunlight in the process of photosynthesis. She sets up two identical plants in separate rooms. Plant A is kept in a room with ample sunlight, while Plant B is kept in a dark room. Both plants are watered. After a week, the student observes the plants and notes down her findings. What will be the most likely observation made by the student in this experiment?

(a) Both plants will have the same amount of growth and green leaves.

(b) Plant A will have more growth and green leaves than Plant B.

(c) Plant B will have more growth and green leaves than Plant A.

(d) Both plants will have no growth or green leaves.

3. Fill in the blanks with appropriate terms and select the correct option.

(i) The process of taking in nutrients by plants from the soil is called _____.

(ii) The green pigment that is essential for photosynthesis is called _____.

(iii) The tiny openings on the surface of leaves that allow for the exchange of gases and water vapor are called _____.

(iv) The process by which green plants make their own food is called _____.

(v) The process by which plants lose water through small pores on their leaves is called _____.

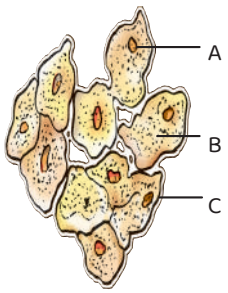
(a) (i)-Respiration, (ii)-Carotenoid, (iii)-Mesophyll, (iv)-Digestion, (v)-Fermentation

(b) (i)-Transpiration, (ii)-Anthocyanin, (iii)-Epidermis, (iv)-Respiration, (v)-Photosynthesis

(c) (i)-Photosynthesis, (ii)-Xanthophyll, (iii)-Cuticles, (iv)-Transpiration, (v)-Absorption

(d) (i)-Absorption, (ii)-Chlorophyll, (iii)-Stomata, (iv)-Photosynthesis, (v)-Transpiration

4. In the given below figure of the cell, identify A, B and C and select the incorrect statement regarding it.



(a) A is located in the centre of the most cells.

(b) B is a jelly-like substance that surrounds the nucleus.

(c) C is the thick outer boundary of the cell called cytoplasm.

(d) C is the thin outer boundary of the cell called cell membrane, while A is nucleus.

5. Ram experimented by adding 4 drops of iodine to both a green leaf (X) and a red color leaf (Y). Before adding iodine, he boiled both leaves in alcohol after heating them in water. What could be the expected results and observations of this experiment?

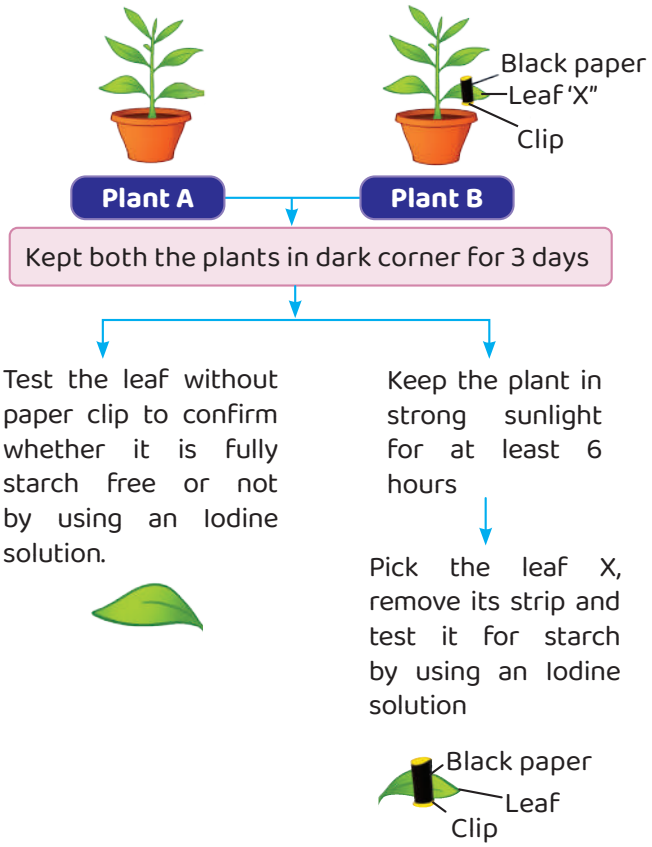
(a) The iodine will turn pink on the leaf (X) and remain brown on the (Y) leaf.

(b) The iodine will turn purple on both (X) and (Y)leaves.

(c) The iodine will turn blue on the (X) leaf and remain brown on the (Y) leaf.

(d) The iodine will turn blue on both (X) and (Y) leaves.

6. Deepali performed an experiment. She took Plant A and B and kept both the plants in the given below conditions as follows:



Based on the information, what conclusion can be drawn?

(i) In plant B, the color of the covered part of the leaf will change.

(ii) In plant A, the color of the leaf will not change.

(iii) The given experimental set up shows that light is necessary for the process of photosynthesis.

(iv) In plant B, the color of the uncovered part of the leaf will not change.

(a) Only (i)

(b) Both (i) and (ii)

(c) Both (ii) and (iii)

(d) Only (iv)

7. Match Column-I with Column-II and select the correct option

Column-I		Column-II	
A.	Chlorophyll	(i)	Absorbs water and minerals from the soil
B.	Root hairs	(ii)	Carry water and minerals from the soil to the leaves
C.	Stomata	(iii)	Responsible for the green color of plants
D.	Vessels	(iv)	Responsible for the exchange of gases

(a) A-(iii), B-(i), C-(iv), D-(ii)

(b) A-(ii), B-(iii), C-(i), D-(iv)

(c) A-(iii), B-(iv), C-(i), D-(ii)

(d) A-(i), B-(iii), C-(iv), D-(ii)

8. A plant X is exposed to long periods of drought. Which of the following adaptations would help plant X to survive? Also identify the plant X and select the correct option.

(i) Probably, plant X is a *Cactus* that has modified leaves in the form of spines.

(ii) Probably, plant X is a venus flytrap that develops large, broad leaves.

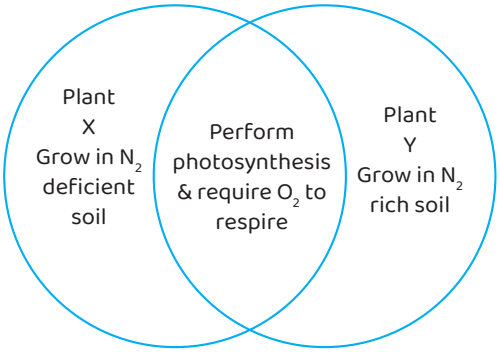
(iii) Probably, plant X is a *Cuscuta* that develops a shallow root system.

(iv) Probably, plant X is a cactus that has green stem to carry out photosynthesis.

(a) (i) and (ii) (b) (ii) and (iii)

(c) Only (iii) (d) (i) and (iv)

14. Refer to the given Venn diagram and select the correct option.



X and Y plant could be

(a) Bladderwort and venus fly trap respectively.

(b) *Moong* and *Cuscuta* respectively.

(c) Venus fly trap and soyabean respectively.

(d) *Cuscuta* and mushroom respectively.

15. Read the given statements and select the option that correctly identifies True (T) and False (F) ones.

(i) Manures and fertilizers provide essential nutrients like nitrogen, potassium, and phosphorus.

(ii) *Rhizobium* bacteria live freely in the soil without any relationship with plants.

(iii) Plants get nitrogen directly from the air just like carbon dioxide.

	(i)	(ii)	(iii)
(a)	T	T	F
(b)	F	T	T
(c)	T	F	F
(d)	T	F	T

Fill the correct option by HB Pencil

1.	a	b	c	d	6.	a	b	c	d	11.	a	b	c	d
2.	a	b	c	d	7.	a	b	c	d	12.	a	b	c	d
3.	a	b	c	d	8.	a	b	c	d	13.	a	b	c	d
4.	a	b	c	d	9.	a	b	c	d	14.	a	b	c	d
5.	a	b	c	d	10	a	b	c	d	15.	a	b	c	d

Answer key

VIDEO SOLUTIONS

Skill Drill (Test yourself)

1. (a) **2.** (b) **3.** (a) **4.** (d) **5.** (a) **6.** (a)

Olympiad Exam Previous Year Questions

1. (a) **2.** (c) **3.** (c) **4.** (c) **5.** (c) **6.** (a) **7.** (c) **8.** (d) **9.** (d) **10.** (b)

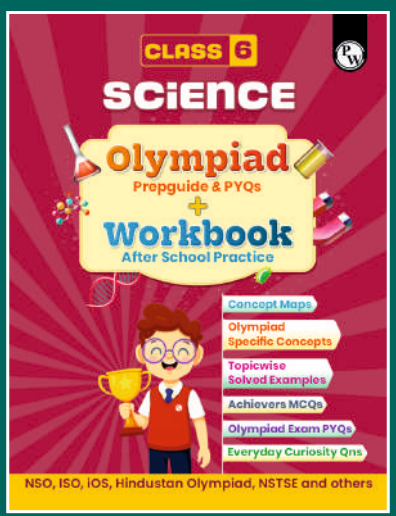
11. (c) **12.** (d) **13.** (a) **14.** (c) **15.** (d) **16.** (a)

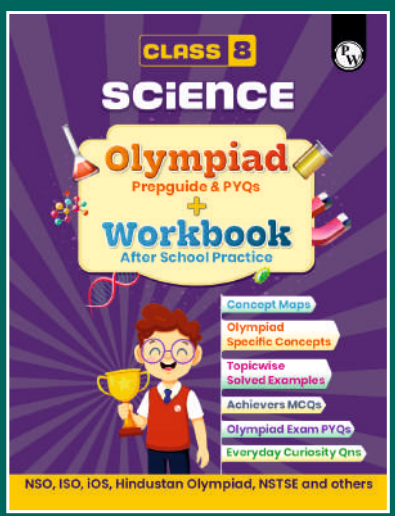
Achievers Multiple Choice Questions

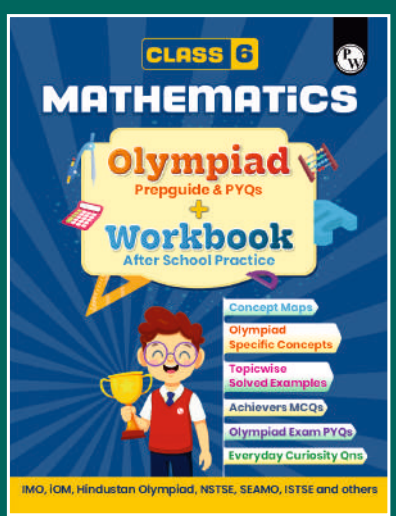
1. (b) **2.** (b) **3.** (d) **4.** (c) **5.** (d) **6.** (c) **7.** (a) **8.** (d) **9.** (d) **10.** (c)

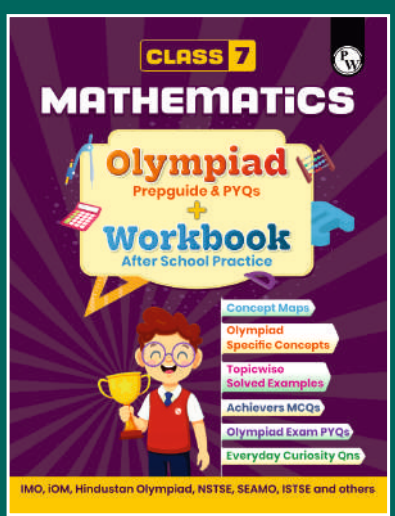
11. (c) **12.** (a) **13.** (b) **14.** (c) **15.** (c)

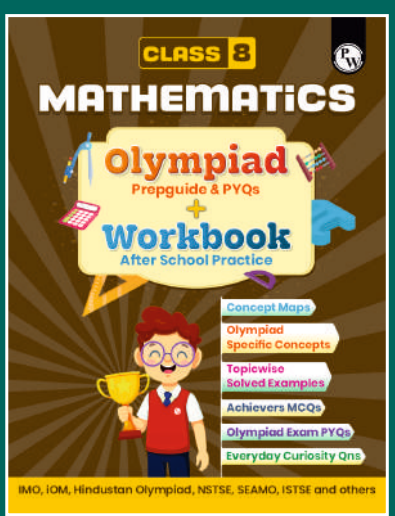
Books in The Series











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