

CLASS- 8th

FOUNDATION COURSE

- CBSE, ICSE & OTHER BOARD EXAM
- PRE JEE MAIN & ADVANCED
- PRE MEDICAL (NEET | AIIMS)
- NTSE, KVPY & OTHER COMPETITIVE EXAM







Study Material for Pre foundation Class 8 Prepared by Career Point Kota Experts

CONTENTS OF THE PACKAGE AT A GLANCE

Class VII

Physics		Ch	emistry	Bi	Biologoy				
٠	Force	•	Synthetic Fibres & Plastics	•	Crop Production & Management				
٠	Pressure	•	Metals & Non-Metals	•	Microorganisms, Friends & Foe				
٠	Friction	•	Combustion and Flame	•	Conservation of Plants & Animals				
٠	Sound	•	Coal & Petroleum	•	Cell Structure and Functions				
٠	Chemical Effects of Current			•	Reproduction				
٠	Some Natural Phenomena			•	Pollution of Air & Water				
٠	Light								
٠	Night sky								

Social Science [Set-1]

History

- How, When and Where
- From Trade to Territory
- Ruling the Country Side
- Tribal, Dikus and the Vision of a Golden Age
- When People Rebel
- Colonialism and the city

Geography

- Resources
- Natural Resources-1 (Land, Water & Soil)
- Natural Resources-2 (Natural Vegetation & Wildlife
- Mineral & Power Resources

Civics

- The Indian Constitution
- Understanding Secularism
- Why do we need a Parliament
- Understanding Laws
- Judiciary

Social Science [Set-2]

History

- Weavers, Iron Smelters & Factory Owners
- Civilising the native, Educating the Nation
- Women, Caste and Reform
- The Changing World of Visual Arts
- The Making of the National Movement (1870-1947)
- India After Independenc

Geography

- Agriculture
- Industries
- Human Resources

Civics

- Understanding Our Criminal Justice System
- Understanding Marginalisation
- Confronting Marginalisation
- Public Facilities
- Law and Social Justice

English

- ♦ Noun
- Pronuoun
- Verb Forms
- ♦ Adjective
- ♦ Adverb
- ♦ Tense
- Passive Voice
- One Word Substitution
- ♦ Spelling
- Notice
- Informal Letter Writing
- Diary Writing
- Comprehension
- Preposition
- Determiners
- Conjunctions
- Reported Speech
- Modals
- Proverbs
- Subject Verb Concord
- Conditionals
- Synonyms & Antonyms
- Idioms & Phrases
- ♦ E-Mail
- Formal Letter
- ♦ Article Writing

Note to the Students

Career Point offers this must have Study Package in Physics, Chemistry and Mathematics to meet the complete curriculum needs of engineering aspirants. The set comprises of 18 books: **Physics** - set of 3 books for class 11 and set of 3 books for Class 12; **Chemistry** - set of 3 books for class 11 and set of 3 books for Class 12 and **Mathematics** - set of 3 books for class 11 and set of 3 books for Class 12 and **Mathematics** - set of 3 books for class 11 and set of 3 books for Class 12 and **Mathematics** - set of 3 books for class 11 and set of 3 books for Class 12 and **Mathematics** - set of 3 books for class 11 and set of 3 books for Class 12 and **Mathematics** - set of 3 books for class 11 and set of 3 books for Class 12 and **Mathematics** - set of 3 books for class 11 and set of 3 books for Class 12 and **Mathematics** - set of 3 books for class 11 and set of 3 books for Class 12. The set caters to the different requirements of students in classes XI and XII. It offers complete and systematic coverage of **JEE Main** and **JEE Advanced** syllabi and aims to provide firm foundation in learning and develop competitive edge in preparation of the JEE and other engineering entrance examinations.

COMPONENTS OF EACH CHAPTER

These books are designed with an engaging and preparation-focused pedagogy and offer a perfect balance of conceptual learning and problem solving skills.

Mind Map

Each chapter contains many articles (Concepts, Theories etc.). Mind map interconnect all these articles logically. By this student can understand whole chapter articles interconnectivity clearly in a single picture frame.



Theory & Concepts

Each chapter consist of exhaustive theory which gives conceptual clarity and command over topics. Appropriate explanation of theory with the help of images, diagrams, flowcharts, mind maps, info graphics, and tables.



MAGNETIC EFFECT OF ELECTRIC CURRENT

Magnet & Magnetism

Magnet

The substance which attract Ni, Fe, Co, etc and align in geographical north south direction when suspended freely.

Two bodies even after being neutral (showing no electric interaction) may attract / repel strongly if they have a special property. This property is known as magnetism. This force is called magnetic force. Those bodies are called magnets.

• Origin of the Magnet

Around 120 A.D. near Magnesia in Asia Minor, an ore of iron Fe_3O_4 was found in abundance. This ore of iron, which was found attracting small pieces of iron, was called Magnetite. Hence, the name 'magnet' was given to the pieces that exhibited this property.

• Types of Magnet



Competitive Level

Competitive level is specially designed for competition exam rquirements and to better understanding the concepts, well explained theory, clearly explained formulas with good number of quality examples are given in this.

COMPETITIVE LEVEL • Magnitude of magnetic field produced by a straight current-carrying conductor: The magnitude of magnetic field (or strength of magnetic field) B produced by an infinitely long conductor in vacuum at a distance r from it, is given by: $B = \frac{\mu_0 I}{2\pi r}$ where, B = Magnetic field strength μ_o = Permeability of vacuum (a constant) I = Current (flowing in conductor) and r = Distance from the conductor (where magnetic field is measured). The SI unit of magnetic field B is Tesla which is denoted by the symbol T (1 tesla is equal to 1 newton per ampere per metre). The CGS unit of magnetic field B is Gauss which is denoted by the symbol G. (1 Tesla = 10⁴ Gauss) Permeability of vacuum μ_o is $4\pi \times 10^{-7}$ tesla metre per ampere.

In Chapter Example

To understand the application of concepts, there is *in chapter solved example* are given. It contains large variety of all types of solved examples with explaination to ensure understanding the application of concepts.

Ex.31	Compute the heat generated while transferring 96000 coulomb of charge in one hour through a potential difference of 50 V.
Sol.	The amount of heat (H) produced is given by the Joule's law of heating as $\mathrm{H}=\mathrm{VIt}$
	where, Voltage, $V = 50 V$
	Time, t = 1 h = $1 \times 60 \times 60$ s = 3600 s
	Amount of current, $I = q/t = 96000 / 3600 = (80/3) A$
	$H = 50 \times \frac{80}{3} \times 60 \times 60 = 4.8 \times 10^{6} J$
	Therefore, the heat generated is 4.8×10^6 J.
Ex.32 Sol.	An electric iron of resistance 20 Ω takes a current of 5 A. Calculate the heat developed in 30 s. The amount of heat (<i>H</i>) produced is given by the Joule's law of heating as H = VIt where, Current, $I = 5$ A

Practice Exercises

Includes three sets of exercises covering all the topics. Helps the students to assess their strengths and weaknesses and work on them accordingly. Separate exercises for subjective as well as objective questions and previous year competitive exams questions (NTSE, Olympiads)



	Exercise-2											
Q.1	 When a body is new friction, it means (A) the body has electrons (B) the body has acquised (C) the body has lost at (D) the body has lost at (D)	egatively charged by acquired excess of ired excess of protons some electrons some neutrons	Q.8	Deutron and α -particle are put 1Å apart in air. Magnitude of intensity of electric field due to deutron at α -particle is (A) Zero (B) 2.88 × 10 ¹¹ newton/coulomb (C) 1.44 × 10 ¹¹ newton/coulomb (D) 1.44 × 10 ¹¹ newton/coulomb								
Q.2	When the distance particles is halved, th becomes (A) One-fourth (C) Double	between the charged le force between them (B) Half (D) Four times	Q.9	What is not true for electric charge : (A) Electric charge is scalar quantity (B) Charge on a body may be + ve or - ve (C) S.I. unit of charge is coulomb (D) One coulomb is charge of one electron								

EXERCISE-3

Q.1 In the given circuit diagram, the value of resistance X in ohm when the bridge is balanced will be [Raj./ NTSE Stage-I/2005]

10Ω

(B) 8

(D) 12

(A)	high	melting	point	and	high	specific
	resist	tance				
$\langle \mathbf{D} \rangle$	la di sula				1	

- (B) high melting point and low specific resistance(C) low melting point and high specific
- (c) low melting point and high specific resistance
 (D) low melting point and high specific
- $\left(D\right)$ low melting point and high specific resistance

 $(B) H/n^2$

/D) -- II

Q.5 A uniform wire when connected directly across a 220V line produces heat H per second. If the wire is divided into n-parts and all parts are connected in parallel across a 220 V line, the heat produced per second will be [Haryana/NTSE Stage-I/2014]

(A) H/n

Answer key

Answer key is provided at the end of the exercise sheets.

10Ω

 4Ω

(A) 4

(C) 10

	ANSWER KEY														
	Exercise - 1														
3.	3. 40o														
5.	5. 2J														
8.	8. $\frac{R_1}{R_2} = \left(\frac{r_2}{r_1}\right)^2$														
10.	10. $1.44 \times 10^{6} \text{ J}$														
12.	2qv	1 l													
13.	(a) 6	.25 × 1	0 ¹³ (b)	3 × 10 ⁻⁴	C										
	Exercise - 2														
Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	А	D	А	D	С	С	С	С	D	Α	А	Α	С	А	В
Ques.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	D	С	D	А	А	В	D	D	В	С	С	А	С	С	А
	Exercise - 3														
Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	В	А	В	В	В	С	А	С	A	А	С	В	D	В	A
Ques.	16	17	18	19	20	21	22	23	24						
Ans.	В	А	А	В	А	В	D	Α	С						



FORCE



CAREER POINT

Force 1



Force

To define force first of all one has to see the effects of force. By 'effects of force' we mean what force can do or what changes a force can bring about.

Set Effects of Force

- Force can set a stationary object in motion: When force is applied to a stationary object, it can make it move. For example, if you push a book placed on a table, it starts moving. When you pull a chair, it starts moving. When you push a handcart, it starts moving. However, it is not necessary that force always makes a stationary body move. For example, if you try to push the wall of your classroom, it will not move. For that matter even if all the boys in your class push the wall, it will not move. The reason is that the force applied by all of you is not sufficient to move the wall.
- Force can stop the moving objects or slow them down: Imagine your friend is riding a bicycle. If you pull his bicycle from behind, it is going to slow down. It means that if you apply a force in the direction opposite to the direction of the moving body, the body slows down.

Similarly, if we apply brakes to a moving bicycle, it first slows down and then stops. We ourselves have to apply force to stop our bodies while running. A cricket ball is stopped by a player by applying a force in the direction opposite to that of the ball.

From the above examples, it is clear that a force may stop a moving body or may reduce the speed of the moving body.

• Force can change the direction of moving objects: When a cricket player hits the ball with a bat, his force changes the speed as well as the direction of the ball. Similarly, a football player changes the direction of a moving ball by angling his foot. You change the direction of your moving bicycle by applying force on its handle in the desired direction.



Force can change the direction of a ball

• Force can change the shape of objects: Imagine a spring fixed in a wall with a nail. When we pull the spring, it gets stretched and hence, its shape changes, similarly, when we crumple a paper, its shape changes. Thus by applying force, we can change the shape of object.



Force changes the shape of objects

Solution of Force

Based on the effects of force, it may be defined as:

Force is a pull or push, which changes or tends to change the state of rest or of uniform motion of a body or changes its direction or shape.

COMPETITIVE LEVEL

♦ Mathematical Representation of Force

Mathematically, force F is equal to the product of mass 'm' of a body and acceleration 'a' produced in the body due to that force.

i.e. F = ma

Where a = (final velocity – initial velocity)/time

• Units of Force:

(i) In C.G.S. system:

 $F = ma \rightarrow gram \times cm/s^2 = dyne$

If m = 1 gram and a = 1 cm/s² then by F = ma,

 $\mathbf{F} = 1 \times 1 = 1 \ \mathbf{g} \times \mathbf{cm/s^2} = 1 \ \mathbf{dyne}$

When a force is applied on a 1 gram body and the acceleration produced in the body is 1 cm/s^2 then the force acting on the body will be one dyne.

(ii) In S.I. system:

 $F = ma \rightarrow kg \times m/s^2 = Newton$

If m = 1 kg and $a = 1 \text{ m/s}^2$ then by F = ma

 $F = 1 \times 1 = 1 \text{ kg} \times \text{m/s}^2 = 1 \text{ Newton.}$

If a force is applied on a body of mass 1 kg and acceleration produced in the body is 1 m/s^2 then the force acting on the body will be one Newton.

• Relationship between the Newton and dyne:

1 N = 1 kg × 1 m s⁻²

- $= 1000 \text{ g} \times 100 \text{ cm s}^{-2}$
- = 100000 g cm s⁻² = 10⁵ dyne

Thus $1 \text{ N} = 10^5 \text{ dyne}$

Calculate the force required to produce an acceleration of 5 m/s² in a body of mass 2.4 kg. Ex.1 Sol. We know that force = mass \times acceleration $= 2.4 \text{ kg} \times 5 \text{ m/s}^2 = 12.0 \text{N}$ A force acts for 0.2 s on a body of mass 2.5 kg initially at rest. The force then ceases to act and the Ex.2 body moves through 4m in the next one second. Calculate the magnitude of force. Sol. When the force ceases to act, the body will move with a constant velocity. Since it moves a distance of 4 m in 1 s, therefore, its uniform velocity = 4m/s. Now, initial velocity, u = 0Final velocity, v = 4 m/sTime interval. $\Delta t = 0.2 \, s$ $a = \frac{v - u}{\Delta t} = \frac{4 - 0}{0.2} = 20 \text{m/s}^2$ \therefore Acceleration, From the relation, F = ma, we get Force, $F = 2.5 \times 20 = 50 N$ Ex.3 A ball of mass 20 gm is initially moving with a velocity of 100 m/s. On applying a constant force on the ball for 0.5s, it acquires a velocity of 150 m/s. Calculate the following: (i) Acceleration of the ball (ii) Magnitude of the force applied Sol. Given, m = 20 gm = 0.02 kgInitial velocity, u = 100 m/sTime interval. t = 0.5 sFinal velocity. v = 150 m/s $a = \frac{v - u}{t} = \frac{150 - 100}{0.5} = 100 \text{ ms}^{-2}$ (i) Acceleration, (ii) Force. $F = mass \times acceleration$ $= 0.02 \times 100 = 2.0$ N A cricket ball of mass 200 gm moving with a speed of 40 m/s is brought to rest by a player in 0.04s. Ex.4 Calculate the average force applied by the player. $m = 200 \text{ gm} = \frac{200}{1000} \text{ kg} = 0.2 \text{ kg}$ Sol. Mass. Initial velocity, u = 40 m/sFinal velocity, v = 0Time, t = 0.04s $\frac{\text{Change in momentum}}{\text{Time}} = \frac{-8.0}{0.04} = -200 \text{ N}$ Average force (The negative sign shows that the force is applied in a direction opposite to the direction of motion of the ball).

- **Ex.5** A motorcycle is moving with a velocity of 108 km/hr and it takes 5 s to stop it after the brakes are applied. Calculate the force exerted by the brakes on the motorcycle if its mass along with the rider is 250 kg.
- **Sol.** Given that initial velocity of the motorcycle

= 108 km/hr = 30 m/s

Final velocity = 0 m/s

Time taken to stop = 5s, the mass of the motorcycle with rider = 250 kg.

The change in the velocity of the motorcycle in 5s = 0 - 30 = -30 m/s

Therefore, the acceleration of the motorcycle, $a = \frac{-30}{5} = -6 \text{ m/s}^2$

The magnitude of the force applied by the brakes is given by the equation,

 $F = mass \times acceleration$

 $= 250 \text{ kg} \times (6) \text{m/s}^2 = 1500 \text{ N}$

Ex.6 A force produces an acceleration of 5.0 cm/s^2 in a body of mass 20g. Then find out the force acting on the body in Newton.

Sol. Acceleration of the body,

 $a = 5 \text{cm/s}^2 = 0.05 \text{ m/s}^2$ Mass of the body, m = 20 g = 0.02 kgF = ma

 $\Rightarrow \mathbf{F} = 0.05 \times 0.02 = 10^{-3} \text{ N}$

Ex.7 A force of 15 N acts on a body of mass 5 kg for 2s. What is the change in velocity of the body?

Sol. Given: F = 15 N, t = 2s, m = 5 kg

$$a = \frac{F}{m} = \frac{15}{5} = 3 \text{ m/s}^2$$
$$a = \frac{v - u}{t}$$
$$\Rightarrow v - u = at = 3 \times 2 = 6 \text{m/s}$$

Balanced and Unbalanced Forces

A number of forces acting on an object may either be balanced or unbalanced.

Salanced Forces

If a number of forces acting on an object does not produce any change in its state of rest or uniform motion or direction of motion then they are known as balanced forces.

For example

(i) A person holding a briefcase in hand.

- (ii) A book resting on a table.
- (iii) Squeezing a lemon, etc.

6 Force

Inbalanced Forces

If a number of forces acting on an object produce a change in its state of rest or uniform motion or direction of motion, then they are termed as unbalanced forces:

For example:

- (i) A briefcase released from a persons hand.
- (ii) A stone dropped, etc.

Resultant Force

If a number of forces act on an object then a single force that produces same change in the state of rest or motion is called resultant force. For example, if a number of people push a large almirah and the same almirah can also be pushed by a single person then the force of this single person is the resultant force of all these people. If two forces act on an object in the same direction then the resultant force is obtain by adding them. If two forces act on an object in the opposite direction then the resultant force is obtain by subtracting them.

Note: If resultant force is zero it means either object is at rest or in uniform motion.

Types of Force



Contact Force

Force which acts on a body only when the body is in contact with another body (exerting force), the force is known as contact force.

• Types of contact force

COMPETITIVE LEVEL

(i) Normal force: If contact forces between the bodies are perpendicular to the surfaces in contact, then the forces are known as normal forces.

e.g.: Consider a book on a table. The table pushes the book upwards and book pushes the table downwards, these forces are perpendicular to the surfaces of book and table. Thus, the table applies a normal force on book in the upward direction and book applies a normal force on table in downward direction.



Normal force exerted by book on table

(ii) Force of friction: Two bodies placed in contact can also exert forces parallel to the surfaces in contact; such a force is called force of friction or simply friction. It always opposes relative motion of object.



(iii) Muscular force: This is the force we can exert with our bodies by using our muscles, e.g. pull, push, kick, etc. Such forces are also called mechanical forces. These are contact forces.



Muscular or mechanical forces

♦ Non-Contact force

Force which acts on a body when the body is not in contact with any other body (exerting force), is known as non-contact force.

- Types of non-contact force:
 - (i) Gravitational force: Newton said that every object in this universe attracts every other object with a certain force. The force with which two objects attract each other is called the force of gravitation. The force of gravitation acts even if the two objects are not connected by any means. If, however, the masses of the objects are small, the force of gravitation between them is small and cannot be detected easily. The force of attraction between any two particles in the universe is called gravitation or gravitational force.

COMPETITIVE LEVEL

(a) Force of gravity: The earth attracts all the bodies towards its centre. The force exerted by the earth on the body is known as weight of the body or force of gravity. It acts in vertically downward direction. If mass of the body is m and acceleration due to gravity is g. Then, force of gravity or weight = mg.

The value of g is 9.8 m/s^2 . For a body moving downward, g is taken as positive while for a body moving upward, g is taken as negative.

(b) Gravitational units of force: The force due to gravity on a body of mass m at a place where acceleration due to gravity is g, is given as

F = mg

The above relation can be used to define the gravitational units of force.

In M.K.S. system, the unit of force is the kilogram force (kgf). One kilogram force is the force due to gravity on a mass of 1 kilogram.

Thus, 1 kgf = force due to gravity on a mass of 1 kg

 $1 \text{ kgf} = 1 \text{ kg mass} \times \text{acceleration}$ due to gravity g (ms⁻²) = g Newton.

Since, the average value of g is 9.8 m s^{-2} ,

1 kgf = 9.8 newton (or 9.8 N).

In C.G.S. system, the gravitational unit of force is the gram force (gf). One gram force is the force due to gravity on a mass of 1 gram.

Thus, 1 gf = force due to gravity on a mass of 1 g

1 gf = 1g mass × acceleration due to gravity g (cms⁻²) = g dyne.

Since, the average value of g is 980 cms^{-2} , 1 gf = 980 dyne.

Further, 1 kgf = 1000 gf.

To an approximation 1 kgf can be treated to be nearly equal to 10 N.

Then, 1 N = 0.1 kgf or 1 N = 100 gf.

Exercise-1

Very Short Answer Type Questions

- **Q.1** How many minimum number of objects should be present for a force to come into play?
- **Q.2** What happens to the speed of a body when a force is applied?
- **Q.3** Is it possible that a force changes the direction of motion but not the speed of an object?
- **Q.4** What do you mean by resultant force.
- **Q.5** In a tug of war, side A applies 10 Newton force and side B applies 8 Newton force. Which side will the rope move?

Short Answer Type Questions

- **Q.6** What do you mean by the direction of force? What is the standard unit of force?
- **Q.7** If the force is applied opposite to the motion, what will happen to the speed of the object?
- **Q.8** What is meant by contact force? Name the different types of contact forces.
- **Q.9** What is meant by non-contact forces? Name the different types of non contact forces.
- **Q.10** State the two factors, which describe the state of motion of an object.

Long Answer Type Questions

- **Q.11** Force can change the direction of a moving body. Explain with the help of some examples.
- **Q.12** Differentiate between contact and noncontact forces.

- **Q.13** Name the forces acting on a plastic bucket containing water held above ground level in your hand. Discuss why the forces acting on the bucket do not bring a change in its state of motion.
- Q.14 Name the type of force in the following cases.
 - (a) Raindrops falling on the earth.
 - (b) Holding a book on your hand.
 - (c) Running a comb through your dry hair.
 - (d) A bar magnet suspended freely.
 - (e) Bullocks ploughing the field.
- **Q.15** How do the mud particles fly off the wheel of a vehicle moving on the wet road?

Fill in the Blanks

- Q.16 (i) To draw water from a well we have to the rope.
 - (ii) A charged body.....an uncharged body towards it.
 - (iii) To move a loaded trolley we have to it.
 - (iv) The north pole of a magnet the north pole of another magnet.
 - (v) S.I. unit of force is

True or False

- **Q.17** (i) Gravitational force is a type of contact force.
 - (ii) A force cannot be seen but the effect of the force can be felt.
 - (iii) When we lift a bucket of water, we use gravitational force.
 - (iv) Newton and kgm/s² both are the units of force
 - (v) Only the earth exerts gravitational force on all objec

Exercise-2

- **Q.1** A force applied on a moving body may:
 - (A) bring it to rest
 - (B) increase its speed
 - (C) decrease the speed
 - (D) all of the above
- Q.2 A hockey player uses his hockey stick:(A) to push the ball(B) to pull the ball(C) to change its direction
 - (D) all of these
- Q.3 C.G.S unit of force is: (A) Dyne (B) Newton (C) gf (D) can't say
- Q.4 How many dynes are equal to 1N?
 (A) 10⁶ (B) 10⁴ (C) 10⁵ (D) 10³
- Q.5 When an object undergoes acceleration:
 (A) its speed always increases
 (B) its velocity always increases
 (C) it always falls towards the earth
 - (D) a force always acts on it
- Q.6 The net force acting on a body of mass 1 kg moving with a uniform velocity of 5 ms⁻¹ is:
 (A) 5 N
 (B) 0.2 N
 (C) 0 N
 (D) None
- **Q.7** A body is moving with certain velocity towards right. A force of 5N is applied on it towards right and a force of 6N is applied on it towards left then:
 - (A) speed of body increases towards right
 - (B) speed of body increases towards left
 - (C) speed of body remains the same
 - (D) speed of body decreases
- Q.8 A contact force cannot act through
 - (A) empty space
 - (B) touching
 - (C) touching with a metal rod
 - (D) touching with a wooden rod

- **Q.9** If you press an inflated balloon, it deforms due to a type of:
 - (A) contact force
 - (B) non-contact force
 - (C) gravitational force
 - (D) none of these
- Q.10 Which of the following is the action-at-distance force?(A) muscular force (B) frictional force
 - (C) magnetic force (D) mechanical force
- **Q.11** The force exerted by one object on another by virtue of their masses is:
 - (A) magnetic force
 - (B) electrostatic force
 - (C) gravitational force
 - (D) frictional force
- **Q.12** Earth always pull everything towards it due to:
 - (A) muscular force
 - (B) mechanical force
 - (C) gravitational force
 - (D) electrostatic force
- **Q.13** A cart being carried by a horse is an example of:
 - (A) muscular force
 - (B) mechanical force
 - (C) gravitational force
 - (D) electrostatic force
- **Q.14** Force exerted by the muscles is known as:
 - (A) mechanical force
 - (B) gravitational force
 - (C) electrostatic force
 - (D) muscular force
- **Q.15** The force you will use to collect the iron nails scattered on a sandy ground is:
 - (A) frictional force
 - (B) gravitational force
 - (C) magnetic force
 - (D) none of these

10 Force

Q.1 Match Column-I with Column-II and select the correct option from the codes given below. [NSO Stage-I/13]

	Column-I		Column-II
(a)	A child	(i)	Force can
	running to		make a
	catch the		stationary
	school bus		object to move
(b)	A man	(ii)	Force can
	blowing a		stop a moving
	balloon		object
(c)	A woman	(iii)	Force can
	pushing a		change the
	table		shape of an
			object
(d)	A cricketer	(iv)	Force can
	catching a		make an
	ball		object move
			faster

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

Q.2 A ball is dropped from a spacecraft revolving the earth at a height of 100 km. What will happen to the ball?

[NSO Stage-I/13]

- (A) It will continue to move with the same speed along the original orbit of spacecraft
- (B) It will move with the same speed, tangentially to the spacecraft
- (C) It will go very far in the space
- (D) It will fall down to earth gradually.
- **Q.3** A plank is supported on the steps of a staircase as shown in the figure. How many forces are acting on the plank?

[NSO Stage-I/14]



- Q.4 When a constant force acts on a mass, and the mass starts moving from rest, then the [NSO Stage-I/14]
 - (i) Acceleration is constant
 - (ii) Velocity increases at a constant rate
 - (iii) Distance traveled is directly proportional to the time.
 - (A) (i) only (B) (i) and (ii) only
 - (C) (i) and (iii) only (D) (ii) and (iii) only
- Q.5 Which of the following objects experience balanced forces? [NSO Stage-I/14] (A) A ball dropping vertically
 - (B) A car accelerating uniformly from rest
 - (C) A trolley moving at a constant velocity down an inclined plane
 - (D) A plane flying in a circle with constant speed

Q.6 A windmill s pushed by four external forces as shown in the given figure. The force F required to make the windmill stand still is
 [NSO Stage-I/14]



EXERCISE - 1

> <u>Fill in the Blanks</u>:

- **16.** (i) pull
 - (ii) attracts
 - (iii) push
 - (iv) repels
 - (v) newton

> <u>True & False</u>:

- **17.** (i) False
 - (ii) True
 - (iii) False
 - (iv) True
 - (v) False

> <u>Match the Column</u> :

18. $a \rightarrow (iv)$; $b \rightarrow (iii)$; $c \rightarrow (v)$; $d \rightarrow (i)$; $e \rightarrow (ii)$

EXERCISE - 2

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	D	D	А	С	D	С	D	А	А	С	С	С	А	D	С
Ques.	16	17	18	19	20										
Ans.	D	А	В	В	A										

EXERCISE - 3

Ques.	1	2	3	4	5	6
Ans.	A	A	D	В	С	В



SYNTHETIC FIBRES & PLASTICS

Chapter Outline

- ♦ Synthetic Polymers
- ♦ Fibres
- ♦ Synthetic Fibres
- ♦ Advantages & Disadvantages of Synthetic Fibre
- ♦ Plastics
- ♦ Types of Plastic
- ♦ Characteristics of Plastic
- ♦ Uses of Plastic
- ♦ Plastics and the Environment
- ♦ Solution of problem associated with disposal of plastic



Natural & Synthetic Fibres





Synthetic Fibres

MIND MAP



SYNTHETIC FIBRES & PLASTICS

Introduction

Through scientific knowledge and development of technology man has been able to develop new materials from the materials already existing.

Scarcity and drawbacks of traditional natural materials has spurred development of new man made materials.

Synthetic Polymers

A polymer is a compound of high molecular mass formed by combination of a large number of small molecules.

The small molecules which constitute the repeating units in a polymer are called monomer units. The process by which monomers are transformed into a polymer is called polymerization.

 $n (monomer) \xrightarrow{Polymerisation} (monomer)_{n}$

Where n is an integer.

♦ On the basis of structure of polymers, these can be classified as

- 1. Linear polymers: These are polymers in which monomeric units are linked together to form linear chains. These linear polymers are well packed and therefore, have high densities, high tensile (pulling) strength and high melting points. Some common examples of linear polymers are: polyethylene, nylons, polyesters, etc
- 2. Branched chain polymers: These are polymers in which the monomers are joined to form long chains with side chains or branches of different lengths. These branched chain polymers are irregularly packed and therefore, they have low tensile strength and melting points than linear polymers. Some common examples are: low density polythene, glycogen starch, etc.
- **3.** Cross-linked polymers: These are polymers in which monomer units are cross-linked together to form a three-dimensional network. These are also called three-dimensional network polymers. These polymers are hard, rigid, and brittle because of network structure. For example, bakelite, melamine formaldehyde resin, etc

In this section, we will study common synthetic polymers -

(i) Fibres

(ii) Plastics

Plastics and synthetic fibres are categorized as a class of substance known as polymers. This is because they consist of many repeating molecular units or monomers.



(b) Cross-linked monomer

Linkage of monomers

Note: The word polymer is derived from two greek word poly means many and mer means part / unit.

Fibres

In daily life we use different things like shirt, socks etc. These things are made up of different kinds of fabrics made of different types of fibres. A thread or filament from which a cloth is made is called a fibre.

Fibres may be of three types:

- (1) Natural firbres
- (2) Synthetic fibres
- (1) Natural fibres: Fibres obtained from plants and animals are known as natural fibres. These are usually short fibres.
 - e.g.: Wool, cotton, silk (it can be obtained up to 1 km length)

Natural fibres are also of two types:

- (i) Animal Fibre: These fibres are obtained from animals, for example, wool and silk.
- (ii) Plant Fibre: These fibres are obtained from plants, for example, cotton, jute, flax and hemp.
- (2) Synthetic fibres: Fibres synthesized by human being are known as synthetic fibres. All synthetic fibres are prepared from raw materials of petroleum origin called 'petrochemicals'. Synthetic fibres are continuous filament fibres.

e.g.:Nylon, polyester, Acrylic, spandex etc.

COMPETITIVE LEVEL

Fleece: Thick covering of wool on a sheep, used to make a piece of clothing.

Hair: The mass of thin thread like structure that grows out of the skin.

Wool has several qualities that distinguish it from hair or fur. It is crimped (tight curls), it has a different texture, it is elastic and grows in staples (clusters).

Synthetic Fibres

- A synthetic fibres is a chain of small units joined together. Each small unit is actually a chemical substance.
- Most synthetic fabrics can be used as clothing material, Nylon, rayon, polyester, acrylic and spandex are some commonly used synthetic clothing fabrics.
- Synthetic fabrics find varied applications depending upon their properties and climatic conditions. For example, stocking and socks are generally made up of nylon because of the ability of nylon fibres to retain their original shape even after repeated use.

Properties and uses of some commonly used synthetic fibres

Rayon

Rayon is made from cellulose obtained from wood pulp. Rayon is a reformed cellulose. Cellulose is an organic compound and is basic component of cotton. The characteristics of clothes formed by rayon or viscose are different from those of cotton clothes. It is prepared by modifying cotton chemically. It is known as artificial silk. Rayon fibres are available in three different varieties – viscose, cupro, acetate rayon.



Bedsheets Made of Rayon Fibre

• **Preparation of rayon:** Cellulose is soaked in a 20% sodium hydroxide solution for about 3 hours. The purified cellulose is then treated with carbon disulphide (CS₂) to get a pale-yellow syrup-like liquid called viscose.



Sulphuric acid

Fig. : Production of Viscose Rayon Yarn

This viscose solution is forced through fine pores in a metal cylinder kept inside a dilute sulphuric acid bath.

Here, cellulose is regenerated in the form of lustrous continuous fibre, called rayon.

- Properties:
 - (i) It has tendency to absorb moisture. So it absorb sweat. Therefore, it is generally preferred over other synthetic fabrics in summer.
 - (ii) It is shiny and lustrous and resembles to silk in appearance. So, it is also called artificial silk.
- Uses:
 - (i) Shirts, ties, linings etc. are made up of rayon fabric.
 - (ii) It is used in home furnishing materials (bed sheets, curtains, table clothes, sofa covers etc.) and bandages.

Nylon

It is the first fully synthetic fibres. It was prepared in 1931 using coal, water and air. It's monomer units are adipic acid and hexamethylene diamine.

- **Preparation of Nylon:** Nylon is prepared on heating the coal with water vapour in the presence of oxygen.
- Properties:
 - (i) Nylon is a high strength fibre.
 - (ii) It does not lose strength even after repeated use.
 - (iii) It is one of the most elastic and light synthetic fabrics available.

• Uses:

- (i) It is used in making sarees, socks, stockings etc.
- (ii) It is blended with wool to increase the strength.
- (iii) It is used for making tents, umbrellas, parachutes.
- (iv) Its fibres are used for making tooth brush bristles.
- (v) Due to their high strength and elasticity, nylon threads are used to make fishing nets, climbing ropes and strings in badminton and tennis racquets.

Note: • Nylon is an acronym obtained from the name of the cities New York (NY) and London (LON).

• Kevlar is the synthetic fibre bounded tightly to form net-like structure to be used as Bulletproof material

Polyester

It is made of repeating units of a chemical called ester which has fruit like smell. Most polyester fabrics have excellent wash and wear characteristics and therefore, require very less care.

• **Properties:**

- (i) It absorbs very little water and hence dry quickly after washing.
- (ii) It is a strong, lightweight and elastic fabric.
- (iii) It resists wrinkling and springs back into shape when creased.
- Uses:
 - (i) Polyester fibres are widely used in textile industry for making a variety of textiles such as sarees, dress materials, curtains etc.
 - (ii) Terrywool, a blend of Terylene (a type of polyester) and wool, is used for making suits.

Terylene is also called Dacron or Mylar.

- (iii) Terrycot, a blend of Terylene and cotton is commonly used for making skirts, shirts and other dress materials.
- (iv) It is light weight and strong. This property makes it suitable for making light weight sails.
- (v) Terylene is used for making conveyor belts as it is very elastic.
- (vi) Polyester films (commonly known as mylar) are also used for making magnetic recording types in audio cassettes, video cassettes and floppy discs.
- *Note:* The term 'spinneret' originated from the spinning organ of a spider. Most spiders have six spinnerets, but some may have four or even two. The spinnerets are usually present at the lower side of spider's abdomen and they work in coordination to build the web.
 - An ester in a sweet smelling organic compound formed when an alcohol combine and release water
 - Fabrics are sold by names like polycot, polywool, terrycot, etc. As the name suggests, these are made by mixing two types of fibres. Polycot is a mixture of polyester and cotton; polywool is a mixture of polyester and wool

Acrylic

Acrylic fabrics are also known as Orlon or Acrilan fabrics. Acrylic fabric closely resembles to wool in its properties.

• Properties:

- (i) It is warm, soft, light and flexible fibre.
- (ii) Acrylic yarn can be easily knitted.
- (iii) It is cheaper than natural wool and is available in a variety of colours.
- Uses:
 - (i) Acrylic fabric is used for making sweaters, socks and shawls.
 - (ii) It is used for making carpets and blankets.

Spandex

Spandex is also known as Lycra.

• Properties:

- (i) These fabrics have excellent elasticity. The high elasticity of these fabrics make them suitable for use in clothes that require snug fitting, for example swimming costumes.
- (ii) Spandex is mixed with other fabrics, such as cotton, to get stretch fabrics, which are used for making T-shirts and caps.
- Uses: It is used in the making of costumes, caps, T-shirts etc.

S.No.	Name of the synthetic fibre	Characteristics	Uses
1.	Rayon	Resembles silk in appearance and texture and absorbs moisture	Shirts, dress material, bed linen, carpets, etc.
2.	Nylon	Elastic, lightweight, lustrous and easy to wash	Clothes, ropes, socks and parachutes
3.	Polyester	Wrinkle-resistant, lighweight and elastic	Mixed with natural fibres like wool, silk and cotton to make fabrics
4.	Acrylic	Resembles wool and not affected by moisture, chemicals or bacteria.	Socks, shawls and sweaters
5.	Spandex (also known as lycra)	Soft, rubbery and highly elastic.	Swimming costumes, shirts, etc.

Properties and uses of some commonly used synthetic fibres

Advantages and Disadvantages of Synthetic Fibres

Different properties of synthetic fabrics like moisture absorbing capacity, tensile strength, elasticity etc. make synthetic fabrics very advantageous but they also need great care.

Advantages

- (i) Most synthetic fabrics can handle heavy loads without breaking: The ability to withstand loads is called tensile strength.
- (ii) Most synthetic fabrics are elastic: Elasticity refers to the ability of a material to regain its original shape, after it has been stretched or compressed.
- (iii) Most synthetic fabrics do not wrinkle easily: If wrinkled and released, they retain their original shape. Hence, people find them convenient to wash and wear.

In addition to these properties, synthetic fibres drawn from the spinneret can be made very fine and thin. Thus, the texture of the synthetic fabrics produced is generally soft.

(iv)They are less expensive and readily available: Synthetic fibres are cheaper than natural fibre.

Solution Disadvantages

- (i) Most synthetic fabrics can absorb very little moisture. They become sticky when the body sweat. On the other hand, most natural fabrics absorb moisture readily. As a result when we sweat, the sweat is not trapped between the fabric and the skin. It keeps on evaporating from the fabric and we feel that our skin can breathe.
- (ii) Most synthetic fabrics melt very easily thus they should not be worn while working in the kitchen and in laboratory. They require very careful ironing.

(iii) Most synthetic fibres accumulate electric charge on them so they cling together and stick to the skin.

Other Uses of Synthetic Fibres

- Synthetic fibres are not only used for making clothes, but they have diverse uses ranging from making of curtains, upholstery, furniture, mops, mats, parachutes, aeroplane tyres and many other things.
- The textile industry is one of the major users of synthetic fibres. The synthetic fibre is blended with natural fibres in different proportions to enhance its properties. For example, terylene is blended with cotton, silk and wool to form terrycot, terrysilk and terrywool, respectively. The blended material has:
- (i) The ability to absorb sweat, so it is more comfortable.
- (ii) More durability and less electrical charge.
- (iii) Better heat setting properties.
- (iv) Less lustrous and more resemblance to natural fibre.



Plastics

Plastics are polymers like synthetic fibres. The only difference between the two is in the nature of monomer units they are made of. For example, polyethylene, a plastic used to make polyethene bags, is a polymer of monomer called ethene.

- (i) They are easily mouldable, i.e., they can be shaped in different forms.
- (ii) They can be melted, coloured, recycled, reused, rolled into sheet and drawn into wires.



Articles Made of Plastics

Note: Plasticity: The property of plastics which make them mouldable.

Types of Plastics

Different types of plastics may be classified as thermosetting plastics and thermoplastics on the basis of their reaction to heat.

(1) **Thermoplastics**: Thermoplastics can be melted by heating and then moulded into desired shapes and sizes. These plastics soften on heating and harden when cooled. They retain their plasticity even after repeated heating and cooling.

Examples of thermoplastics are polythene (polyethylene), polyvinylchloride (PVC), polystyrene etc., used to make bags, toys etc.

(2) Thermosetting plastics:

- Thermosetting plastics are harder and stronger than thermoplastics and can retain their shape and size even at high temperature.
- These polymers once set in a given shape on heating cannot be softened or melted on being reheated. These polymers undergo a permanent change upon melting and set to a solid which cannot be remelted.

For example bakelite, melamine.

- Bakelite is an insulator and used to make electrical switches and handles of various utensils.
- Melamine has fire resistant and heat resistant properties and is used to make floor tiles, kitchenware and fire resistant fabrics.

Note: Bakelite, the first completely synthetic substance, is a thermosetting plastic. It was created by Leo Baekeland in 1907.

Characteristic Properties of Plastics

Although different types of plastics differ in some physical and chemical properties, the following properties are common to most of them.

- (1) Thermal conductivity: 'Thermal' means 'heat'. Plastic (like bakelite etc.) are poor conductors of heat. This is why they are used -
 - (i) For making handles of cooking containers.
 - (ii) In the thermal innerwear that people wear in extreme winters.
 - (iii) For making containers and films used in microwaves ovens.

Activity

Aim: To show that plastics are bad conductors of heat.



Comparison of Thermal Conductivity of Steel and Plastic

Procedure:

- (i) Take a pan containing boiling hot water.
- (ii) Now place a metal spoon and plastic spoon into it. You can use a plastic scale also in place of a plastic spoon.
- (iii) Keep them in boiling hot water for some time.
- (iv) Touch the other ends of the spoons, which are not dipped in water.

What do you observe? Has the other end of the metal spoon become hot? Is the other end of the plastic spoon also equally hot? No, but why?

Conclusion: Metals are good conductors whereas plastics are bad conductors of heat.

- (2) Electrical conductivity: Plastics are poor conductors of electricity. This explains why they are used as covering materials in electrical appliances, cords, electrical outlets and wiring.
- (3) Solubility in water: Plastics are insoluble in water and for this reason bottles, buckets and containers made of plastic are used for storing water and plastic tumblers and cups used for drinking water.
- (4) Effect of flame: Plastic polybags melting on accidentally coming in contact with a hot pan. This happens because plastics are inflammable.
- (5) Non-reactivity: Plastics do not react with air and water. Unlike metals they are not corroded and thus are used as storage containers in which a variety of materials, including chemicals, can be stored.
- (6) Plastics are light, strong, durable and can be moulded in any desired shape and size.

Activity

Aim: To observe electrical conductivity of plastic.

Procedure:

(i) Set a circuit with the help of a battery, bulb and conducting wires as shown in the figure.



A Plastic Object does not Conduct Electric Current

(ii) Connect metal, rubber and plastic objects in the circuit and observe in which case the bulb glows.

Does the bulb glow when a plastic object is used as test materials?

Conclusion: Plastic is a bad conductor of electricity and does not allow current to pass through it.

Uses of Plastics

Plastics can be recycled, reused, coloured, melted, rolled into thin sheets or made into wires. Thus, they find a variety of uses, some of which are listed below:

PET (Poly Ethylene	Containers for microwave cooking, carbonated beverage bottles and other food
terephthalate)	containers.
HDPE (High Density	For packaging strong and corrosive household and industrial chemicals like
PolyEthylene)	bleaches, acids and liquid detergents.
PVC (PolyVinyl Chloride)	PVC pipes for sanitary fittings (such as water pipes).
LDPE (Low Density PolyEthylene)	Polybags, grocery bags and packages of frozen foods and bread.
PP (PolyPropylene)	Ketchup bottles, yoghurt containers, medicine bottles, automobile battery casings.
PS (Polystyrene)	Thermocol, a form of PS, is used for making disposable cups and packaging material for fragile items like computers and televisions.

Exercise-1

Very Short Answer Type Questions

- **Q.1** Name the fibres that are obtained from natural sources.
- **Q.2** Name the fibres which are synthesized in the laboratory with the help of chemicals.
- **Q.3** Name the fibres which are not attacked by moths and are wrinkle resistant.
- Q.4 Write the brand name of polytetrafluoroethylene.
- **Q.5** Name the first man made fibre from natural base material.

Short Answer Type Questions

- **Q.6** What are monomers and polymers?
- **Q.7** What are the disadvantage of plastics?
- Q.8 What is biodegradable plastics?
- **Q.9** What is spinneret?
- Q.10 What is 4R principle?

Long Answer Type Questions

- Q.11 Write short notes on
 - (a) Polycot
 - (b) Terrywool
 - (c) Cotswool
- **Q.12** Say no to polythene bags and say yes for paper bags. Comment
- **Q.13** What are the main advantages of synthetic fibres?
- **Q.14** Why are synthetic materials widely used now-a-days?
- **Q.15** Give two properties & uses of each of the following-
 - (i) Polyester
 - (ii) Spandex
 - (iii) LDPE
 - (iv) PS
 - (v) PP

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D. Fill in the Blanks

- Q.16 (i) The unit of polymer is called
 - (ii) All synthetic fibres are prepared from raw materials of petroleum origin called
 - (iii) is a mixture of polyester and cotton.
 - (iv) Artificial wool is prepared from another type of synthetic fibre called
 - (v) resists fire and can tolerate heat better than other plastics.

E. True & False

- **Q.17** (i) Teflon is a scratch proof and corrosion resistant plastic.
 - (ii) Plastics are poor conductors of heat & electricity.
 - (iii) Bakelite is a poor conductor of electricity.
 - (iv) Cellulose is a monomer made up of large number of glucose units.
 - (v) The material similar to silk in appearance is terylene.

F. Match the Column

Q.18

	Column-A	C	olumn-B
(a)	It burns very slowly with smell of burning hair	(i)	Petroleum
(b)	Used to give non- stick coating to kitchen ware	(ii)	Wool
(c)	The source for all the synthetic polymer, like fibres and plastics	(iii)	Polyvinyl chloride
(d)	Used to make shoe soles	(iv)	Polythene
(e)	Made by polymerization of ethene molecules	(v)	Teflon

EXERCISE-2

- Q.1 Nylon is obtained by -(A) Treating wood pulp
 - (B) Solidifying water
 - (C) Mixing coal, air & water
 - (D) Mixing chemicals
- Q.2is stronger than steel wire -(A) Cotton fibre (B) Silk thread (C) Plastic thread (D) Nylon fibre
- Q.3is polyester used for making bottles, utensils, films -(A) Leather (B) Nylon (C) PET (D) Plastic
- Q.4 Polyster is repeating units of (A) Ether (B) Beads (C) Carbon (D) Ester
- **Q.5** You must not wear synthetic fibres while working with fire because
 - (A) They make you feel cold and so you may get a froast bite.
 - (B) They are lustrous and so they shine under the flame.
 - (C) They melt on heating and stick to your body when they catch fire.
 - (D) None of the above
- **Q.6** Synthetic fibres are made using as raw materials -
 - (A) Woolen products
 - (B) Polymers
 - (C) Cotton
 - (D) Petrochemicals
- Q.7 Plastics and synthetic fibres are made of large units called as -(A) Nylon (B) Rayon

(A) Nylon	(b) Rayon
(C) Monomers	(D) Polymers

- **Q.8** Polycot is obtained by mixing -
 - (A) Nylon and wool(B) Polyester and wool
 - (C) Nylon and cotton
 - (D) Polyester and cotton

Q.9 Which of the following groups contain all synthetic substances –
(A) Nylon, Terylene, Wool

- (B) Cotton, Polycot, Rayon
- (C) PVC, Polythene, Bakelite
- (D) Acrylic, Silk, Wool
- Q.10 The fibres that are obtained from cotton, jute and silk are known as -(A) Man made or synthetic fibres
 - (B) Natural fibres
 - (C) Artifical fibres
 - (D) Plastics
- **Q.11** Which fibre is also known as regenerated fibre?
 - (A) Plastic(B) Polymer(C) Rayon(D) Acrylon
- Q.12 What is PET?
 - (A) Polyester
 - (B) Polyester & Terylene
 - (C) Polyethylene Tetraphthalate
 - (D) Polyethene Terylene
- Q.13 The polymer in which monomers are arranged in a straight chain are known as -
 - (A) Polythene (B) Melamine
 - (C) Bakellite (D) None of these
- **Q.14** Bakelite and Melamine are examples of -
 - (A) Thermosetting plastics
 - (B) Silk
 - (C) Nylon
 - (D) Rayon
- Q.15 Nylon absorbs very little water hence it is most suitable for making (A) Fishing net
 (B) Tyre cords
 - (C) Parachute (D) All of these
- Q.16 We should never dispose of polythene in the sewage system because (A) chokes drains and soil
 - (B) makes sewage non-biodegradable
 - (C) release toxic fumes and gases
 - (D) all of them

- Q.1 The characteristics of different fibres are listed as [NSO Stage-I/16] W: I am strong, elastic, light and hard
 - beads

I shrink on heating and form hard beads with smell of burning hair.

- X: I burn completely leaving no residue.
- Y: I can be woven like silk fibres and dyed in a wide variety of colours. I burn quickly with a smell of burning paper
- Z: I do not get wrinkled easily. I burn slowly and produce black smoke.
- W, X, Y and Z are respectively
- (A) Tervlene, rayon, cotton and nylon
- (B) Bakelite, nylon, rayon and cotton
- (C) melamine, PVC, nylon and rayon
- (D) Nylon, cotton, rayon and polyester
- Match the items given in column A with Q.2 the synthetic fibres from which they are obtained in column B and mark the correct option. [NSO Stage-I/10]

Column A	Column B
(P)	(i) Bakelite
(Q)	(ii) Nylon
(R)	(iii) PET
(S)	(iv) PVC

(B) (P)-(iv); (Q)-(ii); (R)-(i); (S)-(iii) (C) (P)-(iii); (Q)-(ii); (R)-(i); (S)-(iv) (D) (P)-(i); (Q)-(iii); (R)-(ii); (S)-(iv) Q.3 We should not wear polyester clothes while working in kitchen because

[NSO Stage-I/11]

- (A) It produces heat and we feel hot.
- (B) It feels uncomfortable, as it does not allow air to pass through.
- (C) Its fabric melts and sticks to the body, in case of fire.
- (D) It is not hygienic to wear synthetic fibre clothes.
- **Q.4** Which of the following describes moulting?

[NSO Stage-I/11]

- (A) The resting stage in the life cycle of a silkworm
- (B) Change in appearance during the different stages in the life cycle of a silkworm
- (C) Spinning of cocoon
- (D) Casting off old skin.

Column A	Column B	
(P)	(i) Bakelite	
(Q)	(ii) Nylon	
(R)	(iii) PET	
(S)	(iv) PVC	
$(\mathbf{D}) (\mathbf{D}) (\mathbf{C}) (\mathbf{D}) (\mathbf{C}) (\mathbf{D}) (\mathbf{C}) (\mathbf{D}) (\mathbf{C}) (\mathbf{D}) (\mathbf{C}) ($	(0) ()	-

(A) (P)-(ii); (Q)-(i); (R)-(iv); (S)-(iii)

Match Column-I with Column-II an select Q.5 the correct option from the codes given [NSO Stage-I/10] below

		L	
	Column-I		Column-II
(n)	A synthetic fibre	(i)	Aomilio
(p)	obtained from cellulose	(1)	Acrylic
	A synthetic fibre used		
(q)	for making woolen	(ii)	Nylon
	clothes		
(r)	A thermosetting plastic	(iii)	Rayon
	This polymer is used		
(s)	for making ropes and	(iv)	Bakelite
	fishing nets		
	(A) (i)-(p); (ii)-(q); (iii)-(r)	; (iv)-((s)
	(B) (i)-(r): (ii)-(p): (iii)-(s)	: (iv)-(a)

(C) (i)-(s); (ii)-(r); (iii)-(q); (iv)-(p) (D) (i)-(p); (ii)-(r); (iii)-(q); (iv)-(s)

Q.6 Sakshi wants to test the quality of her dupatta. She pulled a small strand of yarn from the dupatta and burned it. Smelled like a burning plastic. She inferred that the dupatta is made of _____. [NSO Stage-I/13] (A) Pure wool (B) Nylon (C) Pure silk (D) Cotton

- **Q.7** Solve the following riddles by identifying X, Y and Z.
 - X: Your mother loves to cook in the utensils which are coated with me because I make them non-stick.
 - Y: I protect the firemen by coating their uniforms to make them fire resistant.
 - Z: I am a very familiar form of polyester and used for making bottles, utensils, films, etc. [NSO Stage-I/13]

X	Y	Z
(A) Acrylic	Rayon,	Bakelite
(B) PET.	Polythene,	Teflon
(C) Rayon,	Bakelite,	Melamine
(D) Teflon,	Malamine,	PET

Q.8 Match the articles given in Column-I with the fibres/plastics from which they are made in Column-II. [NSO Stage-I/14]

Column I	Column II
(a) Toothbrush bristles	(i) Melamine
(b) Carpet	(ii) PVC
(c) Bottle	(iii) Nylon
(d) Toy	(iv) Rayon
(e) Fire resistant fabric	(v) PET

(A) (a)-(i); (b)-(iv); (c)-(ii); (d)-(v), (e)-(iii)

(B) (a)-(iv); (b)-(ii); (c)-(iii); (d)-(i), (e)-(v)

(C) (a)-(iii); (b)-(iv); (c)-(v); (d)-(ii), (e)-(i)

(D) (a)-(iii); (b)-(v); (c)-(iv); (d)-(i), (e)-(ii)

ANSWER KEY

EXERCISE - 1

> Fill in the Blanks:

- **16.** (i). Monomer
 - (ii). petrochemicals
 - (iii). polycot
 - (iv). acrylic
 - (v). melamine

> True & False:

- 17. (i). True
 - (ii). True
 - (iii). True
 - (iv). True
 - (v). False

> Match the Column:

18. $[a\rightarrow(ii); b\rightarrow(v); c\rightarrow(i); d\rightarrow(iii); e\rightarrow(iv)]$

EXERCISE - 2

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	С	D	С	D	С	D	D	D	С	В	С	С	А	А	D
Ques.	16	17	18	19	20										
Ans.	D	С	В	D	D										

EXERCISE - 3

Ques.	1	2	3	4	5	6	7	8
Ans.	D	А	С	D	В	В	D	С



CROP PRODUCTION & MANAGEMENT

Chapter Outline

- ♦ Agriculture
- ♦ Crop Season
- ♦ Basic Practices of Crop Production
- ♦ Preparation of Soil
- ♦ Sowing
- ♦ Addition of Manure and Fertilizers
- ♦ Irrigation
- ♦ Crop Protection
- ♦ Harvesting
- ♦ Storage
- ♦ Animal Husbandry
- ♦ White Revolution and Green

Revolution



Moat System



Crop Production
MIND MAP



CROP PRODUCTION & MANAGEMENT

Agriculture

The process of growing crops on a large scale is called agriculture.

OR

(Ager means field : cultura means cultivation). It is the applied biological science which deals with the production of plants and raising of animals useful to man, involving soil cultivation, breeding and management of crops and livestock.

Horticulture

It is the process of growing fruits, vegetables & ornamental plants.

Crop Plants And Crop Seasons

The plants which are grown by man in large numbers to get useful products are known as crops.

- The land where plants are cultivated on a large scale is called field.
- Earthworms help to turn and loosen the soil. Earthworms and microbes help in adding humus (dead organic matter) to the soil. The organisms are, therefore, **friends of the farmer**.

	TABLE : CLASSIFICATION OF CROP PLANTS							
S.No.	Type of Crop Plant	Examples	Importance					
1.	Cereals	Wheat, Rice, Maize, Minor millets, Sorghum	Rich in carbohydrates for energy requirements.					
2.	Pulses	Gram (Chana), Pea (Matar), Black gram (Moong), Pigeon pea (Arhar), etc.	Rich in proteins that are body builders.					
3.	Oil seed crops	Soyabean, Groundnut, Sunflower, Niger, Sesame, Castor, Mustard, Linseed, etc.	Rich in oils and fatty acid.					
4.	Root Crops	Turnip, Carrot, Sweet potato.	It is utilized as the vegetables & medicines.					
5.	Sugar Crops	Sugarcane and Beet.	Important for wine Industry.					
6.	Fibre Crops	Jute & Cotton.	Important for jute & cotton industry.					
7.	Plantation Crops	Tea, Coffee, Coconut and Rubber.	Increases cash and also called as cash crops.					
8.	Fodder Crops	Berseem, Maize, Sorghum and Elephant grass.	Provide fodder for animals.					
9.	Horticulture Crops (fruits & vegetables)	Apple, Banana, Guava, Pomegranate, Pear, Chilies, Dhania, Jira, Carrot, Raddish, Cabbage, Cauliflower, Spinach, Cucurbit.	Provide vitamins, Minerals alongwith small quantities of carbohydrate, proteins and oils.					

In India there are two main crop seasons for cultivating crops. These are known as **rabi seasons** and **Kharif season**.

Rabi Crops

These crops are sown in the beginning of winter i.e. between October and November, and harvested by March or April. These crops do not depend on monsoon rains.

Examples : Wheat, barley, gram, potato, mustard.

& Kharif Crops :

These crops are sown at the beginning of the monsoon seasons between June and July, and harvested by September or October. These crops depend on monsoon rains for growth.

S.No.	Kharif Crop/Rainy Season Crop	Rabi Crop/Winter Season Crop	Zaid/Zayad Crop/Summer Season
1.	Are grown during monsoon/rainy season.	Are grown during winter season.	Are grown during mainly in the summer season.
2.	They require warm & wet weather.	They require cold & dry weather.	They require warm day weather.
3.	They are sown in June/July & harvested in September/October	They are sown in October/November & harvested in March/April.	They are sown in march & harvested in june.
4.	e.g Rice, Jowar, Bajra, Cotton, Groundnut, Urad, Moong, etc.	e.g Wheat, Barley, Gram, Mustard, Potato, etc.	e.g Seasonal fruits and vegetables.

Basic Practices of Crop Productions

All the activities which are involved in cultivation of crops, from sowing to harvesting, are known as **agricultural practices**. Cultivation of crops involves several activities undertaken by a farmers over period of time.

- These activities are listed below :
 - (i) Preparation of soil
 - (ii) Sowing
 - (iii) Adding manure and fertilizers
 - (iv) Irrigation
 - (v) Protecting from weeds
 - (vi) Harvesting
 - (vii) Storage

(A) Preparation of soil :

This is the first essential stage for cultivating any crop plant. Preparation of soil involves the following step – ploughing and digging, levelling and manuring.

Ploughing and Digging :

The process of loosening and turning up of the soil is called tilling or ploughing. This is done by using a wooden or iron plough.

• Significance of Ploughing :

- (i) This practice loosens the soil.
- (ii) The soil is overturned and properly aerated.
- (iii) This allows the roots to penetrate deeper easily.



Levelling :

- Soil, if ploughed in dry season, breaks into big mud pieces called crumbs. It is necessary to break these crumbs with the help of a wooden plank or iron leveller. The field is levelled for sowing as well as for irrigation.
- This is the agricultural process to make the soil in level for sowing the seeds. This is done by leveller which is made of wood or iron. It is a flat 1.8 2 m long wooden plank with a log to put weight on it.
- Significance of levelling : This practice smoothens the soil surface.

♦ Manuring :

Mixing soil with manure is called manuring. Manure is usually added to the soil both before and after tilling. Adding manure before tilling helps in proper mixing of manure with the soil.

Agriculture Implements :

The tools which are used in cultivation of plant are known as agricultural implements. A list of commonly used agricultural implements along wih their uses are given below in the table.

Name of implement	Uses	Name of implement	Uses
Khurpa	For weeding	Seed drill	For sowing
Spade	For digging	Harrow	For weeding
		Sickle	For harvesting
Wooden plough	For tillage	Combines	For harvesting and
Iron plough	For tillage		threshing
Soil plank	For breaking crumps	Sprayers	For spraying
Leveller	For leveling and		insecticides
	Pressing the soil		

(B) Sowing : The process of putting seeds into the soil is called sowing.

♦ Selection of Seeds :

Good quality seeds are heavier than damaged seeds. Damaged seeds become hollow and are thus lighter. So they float on water.

Seeds should be high yielding varieties, free from insects and pests.

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Methods of Sowing :

Seeds are sown in the field by any of the three methods described below.

- (i) **Broadcasting :** Seeds are sown manually by directly scattering them into the soil. This process is called broadcasting.
- (ii) Seed Drills : The other method is to use a seed drill. A simple seed drill consists of an iron tube with a funnel at the top attached to the plough.
- ✤ To find out seeds of good quality.
 - Materials Required : Wheat or bean seeds, beaker and water.
 - **Procedure :** Take some wheat or bean seeds. Put them in a beaker of water.
 - **Observation and conclusion :** Some seeds will sink and some seeds will float on water. The ones that float are not fit for sowing. The ones that sink are fit for sowing. Often, seeds that have been stored for a long time are eaten by insects. They may have tiny holes in them and thus float in water. These seeds are unfit for sowing.



Fig: Seed Drill

COMPETITIVE LEVEL

- **Vegetative Propagation :** In this type of propagation vegetative parts of plants like leaf, stems and roots can give rise to new plant.
- In crops like sugarcane, potato, ginger, onion, turmeric, etc, vegetative plant parts instead of seeds are used for growing the crop.
- The uncultivated fields are known as fallow.
- (iii) **Transplantation :** There are certain crops like paddy and some vegetables for which seeds are not directly sown in the field and then the seedlings are transferred to the main field. This process is known as transplantation.

Precautions during Sowing :

- (i) Spacing should be proper.
- (ii) Seeds should be treated with pesticides.
- (iii) Depth should be proper.
- (C) Adding Manure and Fertilizers : Crops absorb various nutrients from the soil through their roots. They are required for their growth and development. The replenishment is done by adding manures and fertilisers to the soil. This process is called manuring.

Natural Methods of Replenishing the Soil with Nutrients

- (i) Leaving the Field Fallow : It is the process of leaving the field uncultivated (fallow) for one or more seasons. Fallow land will regenerate the lost nutrients. However, due to high demand of foodgrains this method is no longer followed.
- (ii) Crop Rotation : It is the method of growing different crops alternately on the same land. Earlier, farmers in northern India used to grow legumes (e.g. pea, gram) as fodder in one season and wheat or rice in the next season. This practice was helpful in the replenishment of the soil with nitrogen. Farmers should be encouraged to adopt this practice.
- (iii) Mixed Cropping : Sometimes two or more crops are grown together in the same field. This practice is called mixed cropping or multiple cropping. The crops are chosen in such a way that the products and waste materials from one crop help in the growth of the other. Cotton and groundnut crops are often grown together for this reason.

However, these methods alone are not enough to maintain soil fertility and farmers have to add manures and fertilisers from time to time.

(D) Irrigation : Plants need water for proper growth and development. Seeds need water for germination. Plants need water to draw nutrients from the soil and for making food by photosynthesis. Water helps the plant to translocate food from one part to other parts of the body. It also protects the crop from frost and extremely hot air currents. Thus water plays an important role in the life of plants right from the germination stage to the maturity stage.

Purpose of Irrigation :

In agriculture, irrigation fulfills the following requirements and goals of crop plants :

- Irrigation supplies two essential macronutrients-hydrogen and oxygen to the crop plants.
- It provides moisture to the soil, which helps in the germination of seeds.
- It helps in growth and elongation of the roots of crop plants.
- It helps in the absorption of nutrients by the roots of crop plants from the soil.
- It helps in increasing the number of aerial branches.

***** Water Resources in India and Judicious use of Water :

India has enormous surface water resources comprising 12 major river basins and 8 composite river basins. Ground water, which is replenished from rain fall, also contributes significantly to total water resources of our country. In fact more than 55 percent of our cropped area does not have irrigation facilities and depends on rainfall for crop production.

Water is a precious natural resource. It should be used in irrigation by exploiting proper techniques of soil and water management. The efficiency of existing irrigation system can be enhanced by **using water judiciously**. This can be achieved by adopting the following measures :

- (i) By proper selection of appropriate crop and cropping system.
- (ii) By applying only optimum quantity of water at appropriate time.
- (iii) By keeping weeds under control in the fields.
- (iv) By time scheduling during irrigation operations.

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COMPETITIVE LEVEL

***** Water Requirements or Irrigation of Crop Plants Depends on Two Factors

- (i) Crop-Based Irrigation : Water requirement of different crop plants varies at different stages of their growth & maturation e.g. paddy crop is transplanted in standing water and also requires continuous water supply whereas this is not so, for the crops of wheat, gram, cotton, maize, etc.
- (ii) Soil-Based Irrigation : Irrigation also depends on the nature of soil in which the crop is grown e.g. if two wheat crops are grown together one in sandy and another in clay soil, then in sandy soil more frequent irrigation is needed than clay soil.

♦ Sources of Irrigation

The main sources of irrigation in our country are rivers, lakes, ponds, wells, tubewells, dams and canals. Water from these sources is delivered by irrigation canals or pumped by using electric or diesel pumps.

Traditional Methods of Irrigation

In our country traditional systems of irrigation like the pulley system (moat), chain pump, lever system (rahat) and dhekli have been in use for centuries to lift water from water reservoirs and supply it to the field for irrigation. These methods are cheaper but less efficient.



Modern Methods of Irrigation :

There are four modern methods of irrigation commonly used in India :

- (i) **Sprinkler Irrigation :** This type of irrigation is used where the soil cannot retain water for a long time. Here the water is sprinkled by sprinklers.
- (ii) Drip Irrigation : Drip irrigation is also called trickle irrigation or micro-irrigation. In this system water falls drop by drop just at the root zone. The system minimises the use of water and fertilizers. Drip irrigation is used by farms, commercial greenhouses and residential gardens. 3

COMPETITIVE LEVEL

Modern Methods of Irrigation

- (i) **Furrow Irrigation :** In this method of irrigation, water is allowed to enter the field through channels or furrows made between two rows of crop.
- (ii) Basin Irrigation : In this method of irrigation, the field is just filled with water as in the case of paddy.
- (v) Fertigation is an innovative method for applying fertilizers through drip irrigation to maximize farm productivity with available water.

♦ Disadvantages of Excessive or Untimely Irrigation :

- All crop plants require water at different stages of their development. Plants require the right amount of water at the right time.
- Excess of water (waterlogging) in the soil inhibits the process of germination of the seeds as the seeds do not get sufficient air to respire.
- Roots do not grow well if there is waterlogging in the field.
- If the crop is irrigated when fully mature, it gets damaged. The excess water from the field then has to be drained of immediately.

Note :

- To protect plants from frost in winters, farmer water their field, especially at night. The water in the fields freezes earlier than water in the plant cells, thereby releasing a lot of heat. This heat keeps the air around the plants warmer and protects them from freezing.
- Chaff is the material consisting of seed coverings and small stem pieces that have been separated from the grains.
- (E) Protection from Weeds : Weeds are the unwanted plants which grow alongwith the main crops. They are undesirable because they compete with the main crop for nutrients, space, air, light and water, etc. and reduce the crop yield. They also spread pests into crops and sometime produce poisonous substances which are harmful to animals and humans. The process of removing weeds from the field is called weeding.

Time for Weeding :

The best time for the removal of weeds is before they produce flowers and seeds.

Some Common Weeds :

Some of the most common weeds found in crop fields are :

- Wild oats (Javi)
- Grass
- Amaranthus (Chaulai)
- Chenopodium (Bathua)

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Methods of Weeding

- (i) Manual Weeding : Weeds may be removed manually either by uprooting them or by cutting them with the help of tools like handfork, khurpa and harrow.
- (ii) By Using weedicides : The chemical substances which destroy (kill) weeds but do not harm the crop are called weedicides or herbicides. Some common weedicides in use are : Dalapon, Metachlor, Siniazine and Butachlor. These weedicides are diluted in water and sprayed in the field with a sprayer. Using chemicals called herbicides or weedicides e.g. 2, 4 D, nitrofen, atrazine.

Weedicides must be used with care as they are poisonous and have side effects if consumed. Farmers should cover their nose and mouth with a piece of cloth during spraying.

COMPETITIVE LEVEL

Method of Weeding :

(i) **Biological Method :** Weeds can also be controlled by biological methods. For example, cochineal insects are used to control the growth of the weed called opuntia.

Biological method employs living organisms to destroy weeds. Cassia plant prevents the growth of parthenium weed. Herbivorous fish feed on aquatic weeds.

• Advantages of biological methods : It does not cause pollution. Organisms are harmless to the main crop.

Protection of Crops :

Pests are organisms that attack and damage crops. They may be rodents (rats), insects (locusts, weevils, termites), stray animals and birds. It is estimated that 10% of our crop is destroyed every year by these pests.

Crops are also attacked by bacteria, fungi and viruses by causing several diseases which reduces the quality and quantity of the product. These diseases get transmitted through seeds, air, soil or through insects.

- **Pesticides :** The chemical substances which kill pests without harming the crops are called pesticides. These chemicals are sprayed by using a sprayer. The following chemicals are used to kill these pests.
- Insecticides : These are used to destroy insects. *Examples* : DDT, BHC, Malathion.
- Fungicides : These are used to destroy fungi. Examples : sulphur, lime sulphur.
- Rodenticides : These are used to kill rodents. Examples : zinc phosphide, warfarin.
- Insecticides, Fungicides and rodenticides are collectively called pesticides. Birds can be scared away by putting scarecrows in the fields as shown in Fig.



Fig. : Scarecrow to keep Birds Away from the Crop

(F) Harvesting : Once the crop has matured, it has to be gathered. The process of cutting and gathering a matured crop is known as harvesting.

All over the world, harvest season is celebrated with excitement. Baisakhi, Holi, Pongal, Diwali, Nabanya and Bihu are some of the harvest festivals celebrated in India.

♦ Harvesting of Grain Crops

Most of the grain crops are reaped close to the ground with the help of a sickle.

- (i) **Threshing :** The process of separating the grain from the harvested stalks of hay is known as threshing. This is done by spreading the harvested crop on the ground and walking over them. Animals such as bullocks, buffaloes or camels are also used on a large scale for this purpose.
- (ii) Winnowing : The process of separating the grain from the chaff is known as winnowing. Farmers hold the mixture of grains and chaff at a height and allow them to fall in a gentle stream. The wind blows away the chaff which is lighter. The heavier grains fall directly on the ground below and are thus separated.

Big farms use huge machines called combines which cut, thresh as well as separate the grain from the chaff.

(iv)Harvesting of other crops : Besides grain crops, all other crops like vegetable crops, cash crops, etc. are harvested through different processes and techniques. Plucking, gathering, packing, storing of crops, etc. are the different steps in the process of harvesting some specific crops.

Note :

- Storage : There are two types of food materials perishable and non-perishable.
 - **Perishable food materials :** Perishable food materials are those which get spoiled easily when kept for sometime at room temperature, for example, vegetables, fruits, fish, meat and milk.
 - Non-perishable food materials : Non-perishable food materials are those which do not get spoiled even when kept for a long time at room temperature, for example, wheat flour, food grains, spices and sugar.

♦ Modes of Storage

There are two different modes of storage : dry storage and cold storage.

(a) Dry storage : This method is used for storage of non-perishable food materials. Foodgrains are dried in the sun to bring down the moisture content should be below 14% of weight to prevent the attack by pests. The dried foodgrains are then weighed, packed in gunny bags and transferred to properly ventilated halls called godowns or granaries.

The gunny bags in the godown should be kept about 60 to 70 cm away from the walls and on wooden platforms about 10 to 15 cm above the ground. The godown must be kept free from pests by spraying various pesticides from time to time.

Grain silos are specially designed tall cylindrical structures for bulk storage of foodgrains. These silos can store different stocks of food grains at different levels. The required foodgrain can be taken out from the openings provided in the silos.

(b) Cold storage : This method is used for storage of perishable food materials. These food material have very short shelf-life so that these are usually stored at low temperature.

Icebox or refrigerator is used at home to store fruits, vegetables, milk, milk products, fish, etc. On commercial scale, the perishable food materials are stored in either a deep freezer or a cold storage.

Advantages of Food Storage

- It prevents the food from being spoiled by the action of enzymes and microorganisms.
- It increases the storage period of food materials.
- It helps in the availability of season fruits and vegetables around the year
- It makes the transportation of food materials easier.
- It helps to maintain prices in the market.

Food From Animals

The keeping of animals for specific purpose is called **domestication**. All domesticated and useful animals constitute **livestock**. The breeding, feeding and carrying of livestock for food and other useful purpose is known as **animal husbandry**.

Note :

- Large-scale rearing of honeybees is called **apiculture**.
- Large-scale rearing of fish is called **pisciculture**.
- Cod liver oil obtained from fish is rich in Vitamin D.
- Milk, eggs and fish are rich in proteins.
- Meat is a rich source of fats and proteins.

COMPETITIVE LEVEL

White revolution in India

Operation Flood, launched in 1966, was a project of India's National Dairy Development Board (NDDB), which was the world's biggest dairy development program. It transformed India from a milkdeficient nation into the world's largest milk producer, surpassing the USA in 1998, with about 17 percent of global output in 2010–11. In 30 years it doubled milk available per person, and made dairy farming India's largest self-sustainable rural employment generator.

The Anand pattern experiment at Amul, a single, cooperative dairy, was the engine behind the success of the program. Verghese Kurien, the chairman and founder of Amul, was named the chairman of NDDB by the then Prime Minister of India Lal Bahadur Shastri.

Sreen Revolution in India

The Green Revolution in India refers to a period when agriculture in India improved due to the adoption of modern methods and technology in agriculture. The key leadership role played by the Indian agricultural scientist M. S. Swaminathan together with many others including GS Kalkat, earned him the popularly used title 'Father of Green Revolution of India'.

The Green Revolution allowed developing countries, like India, to overcome poor agricultural productivity. Within India, this started in the early 1960s and led to an increase in food grain production, especially in Punjab, Haryana and Uttar Pradesh during the early phase. The main development was higher-yielding varieties of wheat, for developing rust resistant strains of wheat.

Very Short Answer Type Questions

- **Q.1** Which agriculture task has to be completed before sowing ?
- **Q.2** What do you mean by the term agricultural practices ?
- **Q.3** Name the implement used for sowing seeds.
- Q.4 Give two examples of rabi and Kharif crops.
- Q.5 Name two harvest festivals of India ?

Short Answer Type Questions

- **Q.6** Why weeds should be removed ?
- **Q.7** Why seeds should be grown at proper distance ?
- **Q.8** Why should the grains, fruits & vegetables be washed properly before use ?
- **Q.9** What do you mean by transplantation ? Which crops are grown by this method ?
- **Q.10** Define manure. What purpose is served by a manure ?

Long Answer Type Questions

- **Q.11** List in sequence the various agricultural practices which a farmer has to adopt for growing wheat crop.
- **Q.12** State four differences between manures and fertilisers.
- Q.13 Write a short note on crop seasons.
- **Q.14** Explain how soil gets affected by continuous plantation of crops in a field.
- **Q.15** Why is storage of food materials needed ? Name the types of storage.
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> Fill in the Blanks

- Q.16 _____ contain _____ matter in large quantities.
- Q.17 _____ is a phosphatic fertilizer.
- **Q.18** Sowing of seeds by hands is called _____.
- Q.19 Soil crumbs are broken with the help of
- Q.20 Crop rotation increases soil _____.

> True and False

- Q.21 Fertilisers are nutrient specific.
- **Q.22** The plants grown in a field for food and fibres are called crop plants.
- **Q.23** In India, special festivals are held commemorating the harvest.
- **Q.24** Mustard, sunflower and groundnuts are all pulses.
- **Q.25** The soil should be loosened before seeds are sown.

Match the Column

Q.26	Column - A	Column-B		
	Uses	Instruments		
	(i) weeding	(a) sickle		
	(ii) Digging and	(b) seed drill		
	bunds formation			
	(iii) Tillage	(c) wooden plough		
	(iv) sowing	(d) spade		
	(v) Harvesting	(e) Khurpa		



- Q.1 The process of separating grains from the chaff is known as -(A) Threshing (B) Winnowing
 - (C) Harvesting (D) Weeding
- Q.2 Transfer of seedlings from the nurseries to the main field is termed as –
 (A) weeding
 (B) sowing
 - (C) transplantation
 - (D) ploughing
- Q.3 The unwanted wild plants growing along with the crop plants are called – (A) weeds (B) seedlings
 - (C) minor crops (D) grasses
- Q.4 Dalapon is used to kill
 - (A) Weeds(B) Insects(C) Pests(D) Rodents
- Q.5 Which one of the following does not cause plant diseases ?
 (A) Viruses
 (B) Bacteria
 (C) Algae
 (D) Fungi
- **Q.6** Rahat and Dhekli are the (A) Names of two persons
 - (B) Names of two villages
 - (C) Traditional methods of irrigation
 - (D) None of these
- Q.7 Which one of the following is traditional method of Irrigation ?
 (A) Moat
 (B) Chain pump
 (C) Rahat
 (D) All of these
- Q.8 Chemicals which are used for removal of weeds are(A) Insecticides (B) Pesticides
 - (C) Weedicides (D) None of these
- **Q.9** Ditches made between the two rows of a crop are called as -
- (B) Canal (A) Furrow (C) Line (D) None Q.10 In which of the following storage structure food grains are stored? (A) Silos (B) Jute bags (C) Granaries (D) All of the these Q.11 Fertilizers are harmful for soil because -(A) they increase soil fertility. (B) they cause the soil pollution. (C) provides the nutrients. (D) they are inorganic salt. Q.12 The crops that are harvested by March and April are -(A) Rabi crops (B) Kharif crops (C) Medicinal crop (D) Fibre crops Q.13 Which one of the following is kharif crop? (A) Wheat (B) Maize (C) Barley (D) Mustard **Q.14** Ploughing, levelling and manuring are the steps of -(A) Preparation of soil (B) Sowing (C) Irrigation (D) Weeding Q.15 Which one of the following is the advantage of soil preparation? (A) It increase soil fertility. (B) It improves soil aeration. (C) Soil become loose for roots to penetrate. (D) All of these are correct. Q.16 Fertigation is a new method to apply : (A) Manures (B) Fertilizers (C) Water (D) Both (B) & (C) Q.17 Large scale rearing of fish is called -(A) Apiculture (B) Pisciculture (C) Animal husbandry (D) Agriculture



The given graph shows two crop fields (X and Y) that have been treated by different types of materials for nutrient replenishment, keeping other environmental factors same. Given are some assumptions regarding the crop fields and the materials used. Select the most correct one(s). [NSO/Stage-I/2014]

- Addition of chemical fertilizers in Y has resulted in sudden increase in yield due to increased release of N, P, K nutrients, but it gradually declined as continuous use of chemicals killed useful microbes that replenish the soil fertility.
- II. The difference in the two graphs indicates that the crop fields X and Y are treated with fertilizer and manure respectively, as fertilizer is beneficial for long time and gives durable yield whereas manure gives immediate yield but later causes problems.
- III. The highest peak in crop field X is slightly delayed because manure enriches soil fertility gradually.
- (A) I and II
- (B) II only
- (C) III only
- (D) I and III
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- Q.2 Which of the following statements are correct? [NSO/Stage-I/2017]
 - (i) Water logging increases the amount of salt in the soil that reduces soil fertility.
 - (ii) 2,4-D, MCPA and butachlor are common weedicides.
 - (iii) Leguminous crops (like pea and beans) cannot be grouped in combination with cereals (like wheat and rice) under mixed cropping as both use large amount of nitrogen from the soil.
 - (iv) Manures provide specific nutrients to the soil.
 - (v) Paddy, maize, cotton and groundnut are examples of kharif crops while wheat, gram, pea and mustard are examples of rabi crops.
 - (A) (i), (iv) and (v) only
 - (B) (ii), (iii), (iv) and (v) only (
 - (C) (i),(ii) and (v) only
 - (D) (i), (ii), (iii) and (iv) only
- Q.3 Read the given paragraph where few words have been italicised. [NSO/Stage-I/2016] Preparation of soil in a field, before sowing of seeds involves tow steps : broadcasting and leveling. Soil in the crop field is enriched with nutrients by adding manures and fertilisers to it. Crop fields need to be irrigated water is allowed to fall drop by drop from a pipe just near the plant roots whereas in drop irrigation water escapes from a revolving nozzle. Weeding in crop fields can be done using thresher. After the crop is harvested, the grain in separated from cut crop using a machine called harvester.

Select the correct option regarding these.

- (A) Broadcasting should be replaced by winnowing.
- (B) Positions of sprinkler system and drip irrigation should be interchanged.
- (C) Thresher should not be replaced as it is correctly mentioned.
- (D) Harvester should be replaced by seed drill.

- Q.4 In which of the following agricultural methods, the nutrient needs of one crop are fulfilled by the other crop ? [NSO/Stage-I/2010]
 - **★** = Ground nut
 - = Ground nut
 - **★** = Ground nut



Q.5 Which of the following agricultural tools is/are used in weeding ? [NSO/Stage-I/2011]



ANSWER KEY

EXERCISE - 1

Fill in The Blanks:

16. Manure and organic19. Leveller	17. Ammonium phosphate20. Fertility	18. Broadcasting
<u>True and False</u> :		
21. True	22. True	23. True
24. False	25. True	

> <u>Match the Column</u> :

26. i-(e) ; ii-(d) ; iii-(c) ; iv-(b) ; v-(a)

EXERCISE - 2

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	В	С	А	А	С	С	D	С	А	D	В	А	В	А	D
Ques.	16	17													
Ans.	D	В													

EXERCISE - 3

Ques.	1	2	3	4	5
Ans.	D	С	В	С	С

Chapter

RATIONAL NUMBERS





RATIONAL NUMBERS

Classification of numbers

- Natural Numbers : (N) : The collection of counting numbers 1, 2, 3, 4..... are called natural numbers N = {1, 2, 3,}
- Even Numbers : All natural numbers which are divisible by 2 are called even numbers and denoted by 2n where $n \in N$.

Ex. 2, 4, 6, 8 etc.

• **Odd Numbers :** All natural numbers which are not divisible by 2 are called odd numbers and denoted by 2n + 1, where $n \in N$.

Ex. O = 1, 3, 5, 7 etc.

• **Prime Numbers :** All natural numbers that have exactly two factors one & the number it self, as their factors are called prime numbers.

So *P* = {2, 3, 5, 7, 11, 13, 17, 19, 23,.....}

Note : 2 is only even prime number & it is smallest prime number.

Identification of Prime Number :

Step (I) : Find approximate square root of given number.

- Step (II): Divide the given number by prime numbers less than approximate square root of number. If given number is not divisible by any of these prime numbers then the number is prime otherwise not.
- **Ex.** 571 a prime number ?
- **Sol.** Approximate square root = 24.

Prime number < 24 are 2,3,5,7,11,13,17,19 & 23.

But 571 is not divisible by any of these prime numbers. So, 571 is a prime number.

• Composite Numbers : All natural numbers which are not prime called composite numbers.

So $C = \{4, 6, 8, 9, 10, 12, 14....\}$

Note : 1 is neither prime nor composite number.

• **Co-prime Numbers :** If the H.C.F. (or G.C.D.) of the given numbers is 1 then they are known as co-prime numbers.

Ex. 5, 8 are co-prime \because Their HCF is 1.

Note: Any Two consecutive numbers are always co-prime.

- Whole Numbers : (W) : The collection of natural numbers with '0' is called set of whole numbers W = {0, 1, 2, 3,}
- Integers (I or Z): The collection of natural numbers, zero and negative of natural numbers together form a set of integers.

 $\mathbf{Z} = \mathbf{I} = \{ \dots, -3, -2, -1, 0, 1, 2, 3, \dots \}$



Rational Numbers

The numbers which can be represented in form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$

Ex.
$$\frac{5}{7}$$
, $\frac{-3}{8}$, $\frac{11}{1}$, 0, $\frac{2}{71}$ etc

• **Positive Rational Number :** A rational numbers $\frac{p}{q}$ is positive, if p and q are either both positive or

both negative.

Each of the rational numbers $\frac{2}{3}$, $\frac{-5}{-12}$, $\frac{-1}{-15}$ is a positive rational number.

• Negative Rational Number : A rational number $\frac{p}{q}$ is negative, if p and q are of opposite signs.

 $\frac{-1}{8}$, $\frac{-11}{16}$, $\frac{3}{-4}$ these are negative rational numbers.

Note :

(i) All natural numbers, whole numbers and integers are rational number.

(ii) Rational numbers, includes all integers, terminatiting fractions (if the decimal parts are terminating like 0.2, 0.5, -3.5 etc) and non terminating recurring decimals like $0.\overline{6}$, -3.777 etc.

Standard form of Rational Number

A rational number is said to be in the standard form if its denominator is a positive integer and the numerator and denominator have no common factor other than 1. If a rational number is not in the standard form, then it can be reduced to the standard form.

Ex. Standard form of $\frac{-5}{10}$ is $\frac{-1}{2}$ and standard form of $\frac{35}{-14}$ is $\frac{-5}{2}$

Representation of Rational Numbers on the Number Line

Any rational number can be represented on the number line in the following way. In a rational number, the denominator, tells the number of equal parts into which the first unit has been divided. The numeral above the bar i.e., the numerator, tells 'how many' of these parts are considered. So, a

rational number such as $\frac{4}{9}$ means four of nine equal parts on the right of 0 (Fig i) and for $\frac{-7}{4}$, we make 7 marking of distance $\frac{1}{4}$ each on the left of zero and starting from 0. The seventh marking is $\frac{-7}{4}$ (Fig ii).

(Fig ii)
$$\frac{-8 -7}{4 \cdot 4} - \frac{-6}{4} - \frac{-5}{4} - \frac{-3}{4} - \frac{-2}{4} - \frac{-1}{4} - \frac{-1$$

Ex.1 Represent $\frac{13}{3}$ and $-\frac{13}{3}$ on number line.

$$-4\frac{1}{3} = -\frac{13}{3}$$

$$4\frac{1}{3} = \frac{13}{3}$$

$$F' = D' - C' - B' - A' - O - A - B - C - D = E$$

$$-5 -4 -3 -2 -1 - 0 + 1 + 2 + 3 + 4 + 5$$

Sol. Draw a line *l*, mark zero on it and name it as O

$$\frac{13}{3} = 4\frac{1}{3} = 4 + \frac{1}{3}$$
 and $\frac{-13}{3} = -\left(4 + \frac{1}{3}\right)$

Therefore, from O mark OA, AB, BC, CD and DE to the right of O. Such that OA = AB = BC = CD = DE = 1 unit.

Clearly,

Point A represents the Rational number = 1

Point B represents the Rational number = 2

Point C represents the Rational number = 3

Point D represents the Rational number = 4

Point E represents the Rational number = 5

Since we have to consider 4 complete units and a part of the fifth unit, therefore divide the fifth unit DE into 3 equal parts. Take 1 part out of these 3 parts. Then point P is the representation of number $\frac{13}{3}$ on the number line. Similarly, take 4 full unit lengths to the left of 0 and divide the fifth unit D'E' into 3 equal parts. Take 1 part out of these three equal parts. Thus, P' represents the rational number $-\frac{13}{3}$.

- **Ex.2** Represent the rational number $\frac{7}{4}$ on the number line.
- Sol. In order to represent $\frac{7}{4}$ on the number line, we first draw a number line and mark a point O on it which represent '0' as shown in the figure.

$$0$$

O N

Now we have to find a point, say, N on the number line which represents the numerator 7 of the rational number $\frac{7}{4}$.

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So, N is the point that represents the integer 7 on the number line and is on the right hand side of the point O. Divide the segment ON into four (Denominator of $\frac{7}{4}$) equal parts (with the help of a ruler). Let A, B, C be the points of division as shown in the figure.

Then OA = AB = BC = CN.

By construction, each segment OA, AB, BC and CN represents $\frac{1}{4}$ th of segment ON. Therefore, the point A represents the rational number $\frac{7}{4}$.

Absolute Value of Rational Number

We have learned in earlier class that the absolute value of a rational number is its numerical value (value without signs).

For example :
$$\left| -\frac{3}{5} \right| = \frac{3}{5}$$
 and $\left| \frac{7}{9} \right| = \frac{7}{9}$.

Ex.3 Verify that $|x + y| \le |x| + |y|$ by taking $x = \frac{3}{5}$, $y = \frac{-4}{15}$

Sol. If
$$x = \frac{3}{5}$$
, $y = \frac{-4}{15}$, then
 $|x + y| = \left|\frac{3}{5} + \left(\frac{-4}{15}\right)\right| = \left|\frac{9-4}{15}\right| = \left|\frac{5}{15}\right| = \frac{15}{15|} = \frac{5}{15}$
 $|x| + |y| = \left|\frac{3}{5}\right| + \left|\frac{-4}{15}\right| = \frac{|3|}{|5|} + \frac{|-4|}{|15|}$
 $= \frac{3}{5} + \frac{4}{15} = \frac{9+4}{15} = \frac{13}{15}$
But $\frac{5}{15} < \frac{13}{15}$

Hence $|x + y| \le |x| + |y|$ is true in this case.

Comparison of Rational Numbers

Ex.4 Arrange the following rational numbers in ascending order.

$$\frac{3}{8}, \frac{4}{12}, \frac{-7}{16}, \frac{-2}{3}.$$

Sol. LCM of denominators 8, 12, 16, and $3 = 2 \times 2 \times 2 \times 2 \times 3 = 48$.

;

Then
$$\frac{3}{8} = \frac{3 \times 6}{8 \times 6} = \frac{18}{48}$$

 $\frac{4}{12} = \frac{4 \times 4}{12 \times 4} = \frac{16}{48};$

 $\frac{-7}{16} = \frac{-7 \times 3}{16 \times 3} = \frac{-21}{48};$ $-\frac{2}{3} = \frac{-2 \times 16}{3 \times 16} = \frac{-32}{48}$ The equivalent rational numbers are $\frac{18}{48}, \frac{16}{48}, \frac{-21}{48}$ and $\frac{-32}{48}$

Therefore, the smallest rational number is $\frac{-32}{48}$, then comes, $\frac{-21}{48}$, then comes $\frac{16}{48}$, and the greatest rational number is $\frac{18}{48}$. Hence, their ascending order is $\frac{-2}{3}$, $\frac{-7}{16}$, $\frac{4}{12}$, $\frac{3}{8}$.

Addition of Rational Numbers

When denominators are equal :

- **Ex.5** Add $\frac{5}{6}$ and $\frac{7}{6}$. **Sol.** $\frac{5}{6} + \frac{7}{6} = \frac{5+7}{6} = \frac{12}{6}$
- **Ex.6** Add $\frac{7}{5}$ and $\frac{-13}{5}$. **Sol.** $\frac{7}{5} + \left(\frac{-13}{5}\right) = \frac{7-13}{5} = \frac{-6}{5}$

When one denominator is a multiple of the other denominator :

Ex.7	Solve $\frac{4}{3}$ and $\frac{5}{6}$.
Sol.	We know that $\frac{4}{3} = \frac{4 \times 2}{3 \times 2} = \frac{8}{6}$
	$(\frac{8}{6}$ is equivalent rational number of $\frac{4}{3}$)
	So, $\frac{4}{3} + \frac{5}{6} = \frac{8}{6} + \frac{5}{6} = \frac{13}{6}$

Ex.8 Solve
$$\frac{-3}{7} + \left(\frac{-5}{21}\right)$$

Sol. We know that

$$\frac{-3}{7} = \frac{3 \times 3}{7 \times 3} = \frac{-9}{21}$$

So, $\frac{-3}{7} + \left(\frac{-5}{21}\right) = \frac{-9}{21} - \frac{-5}{21}$
$$= \frac{-9 - 5}{21} = \frac{-14}{21}$$

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When denominator are co-prime :

Ex.9 Find the sum of $\frac{4}{5}$ and $\frac{-6}{7}$.

Sol. $\frac{4}{5} + \left(\frac{-6}{7}\right) = \frac{4 \times 7}{5 \times 7} - \frac{6 \times 5}{7 \times 5}$

(Multiplying and dividing each fraction by the denominator of the other fraction)

$$=\frac{28}{35}-\frac{30}{35}=\frac{28-30}{35}=\frac{-2}{35}$$

When denominator have a common factor :

Ex.10 Solve $\frac{5}{12} + \frac{7}{8}$.

Sol. Since 12 and 8 have common factors, we will proceed by finding the LCM of 12 and 8. LCM of 12 and 8 is $2 \times 2 \times 2 \times 3 = 24$

Now we will find equivalent fractions of the given numbers having 24 in the denominator.

Hence,
$$\frac{5}{12} = \frac{5 \times 2}{12 \times 2} = \frac{10}{24}$$

and $\frac{7}{8} = \frac{7 \times 3}{8 \times 3} = \frac{21}{24}$
So, $\frac{5}{12} + \frac{7}{8} = \frac{10}{24} + \frac{21}{24} = \frac{10 + 21}{24} = \frac{31}{24}$

Properties of Addition of Rational Number

• Closure property :

When two rational numbers are added, the result is always a rational number, i.e., if $\frac{a}{b}$ and $\frac{c}{d}$ is added then the resultant is always a rational number.

For example, $\frac{2}{5} + \frac{3}{6} = \frac{12+15}{30} = \frac{27}{30}$, which is also a rational number.

• Commutative property :

When two rational numbers are added, the order of addition does not matter, i.e., if $\frac{a}{b}$ and $\frac{c}{d}$ are two rational numbers, then

$$\frac{a}{b} + \frac{c}{d} = \frac{c}{d} + \frac{a}{b}$$

For example, $\frac{3}{4} + \frac{4}{5} = \frac{15+16}{20} = \frac{31}{20}$ and

 $\frac{4}{5} + \frac{3}{4} = \frac{16+15}{20} = \frac{31}{20}$. Both results are equal.

• Associative property

If
$$\frac{a}{b}$$
, $\frac{c}{d}$ and $\frac{e}{f}$ three rational numbers, then $\left(\frac{a}{b} + \frac{c}{d}\right) + \frac{e}{f} = \frac{a}{b} + \left(\frac{c}{d} + \frac{e}{f}\right)$
Consider the fractions $\frac{2}{5}$, $\frac{1}{4}$ and $\frac{2}{3}$.

• Additive identity

If $\frac{a}{b}$ is a rational number, then there exists a rational number zero such that $\frac{a}{b} + 0 = \frac{a}{b} = 0 + \frac{a}{b}$. Zero is called the identity element of addition. Addition of zero does not change the value of the rational number.

• Additive inverse

If $\frac{a}{b}$ is a rational number, then there exists a rational number $\left(\frac{-a}{b}\right)$, called the additive inverse, such that $\frac{a}{b} + \frac{(-a)}{a} = 0 = \frac{(-a)}{a} + \frac{a}{a}$

that
$$\frac{a}{b} + \left(\frac{-a}{b}\right) = 0 = \left(\frac{-a}{b}\right) + \frac{a}{b}$$

The additive inverse is also referred to as 'negative' of the given number.

Ex.
$$\frac{3}{4} + \left(\frac{-3}{4}\right) = 0.$$

 $\therefore \left(\frac{-3}{4}\right)$ is the additive inverse of $\frac{3}{4}$.
Ex. $\frac{-5}{6} + \frac{5}{6} = 0.$
 $\therefore \frac{5}{6}$ is the additive inverse of $\left(\frac{-5}{6}\right).$

Subtraction of Rational Numbers

For rational numbers $\frac{a}{b}$ and $\frac{c}{d}$, we define: $\left(\frac{a}{b} - \frac{c}{d}\right) = \frac{a}{b} + \left(\frac{-c}{d}\right) = \frac{a}{b} + \left(additive \text{ inverse of } \frac{c}{d}\right)$

When we have to subtract a rational number, say $\frac{5}{9}$ from $\frac{8}{9}$, we add the additive inverse of $\frac{5}{9}$, i.e., $\frac{-5}{9}$ to $\frac{8}{9}$. Thus, $\frac{8}{9} - \frac{5}{9} = \frac{8}{9} + \left(\frac{-5}{9}\right) = \frac{8-5}{9} = \frac{3}{9} = \frac{1}{3}$

Ex. Subtract $\frac{3}{-7}$ from $\frac{4}{11}$. Here, $\frac{4}{11} - \left(\frac{-3}{7}\right) = \frac{4}{11} + \left(\frac{+3}{7}\right)$ $= \frac{4 \times 7}{11 \times 7} + \frac{3 \times 11}{7 \times 11} = \frac{28}{77} + \frac{33}{77} = \frac{61}{77}$

Multiplication of Rational Numbers

When we multiply two rational numbers, we multiply the numerator with the numerator and the denominator with the denominator.

Thus,
$$-5 \times (-7) = \frac{-5}{1} \times \left(\frac{-7}{1}\right) = \frac{(-5)(-7)}{1 \times 1} = 35$$

And, $\frac{2}{11} \times \frac{5}{5} = \frac{-2 \times 5}{11 \times 5} = \frac{-6}{55}$

Properties of Multiplication of Rational Number

• Closure property :

The rational number are closed under multiplication. It means that the product of two rational numbers is always a rational number, i.e., if $\frac{a}{b}$ and $\frac{c}{d}$ are two rational numbers,

 $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$ is always a rational number.

For example, $\frac{-3}{7} \times \frac{5}{8} = -\frac{15}{56}$ which is rational number.

• Commutative property :

If $\frac{a}{b}$ and $\frac{c}{d}$ are two rational numbers, then

$$\frac{a}{b} \times \frac{c}{d} = \frac{c}{d} \times \frac{a}{b}, \text{ i.e., } \frac{ac}{bd} = \frac{ca}{db}$$

$$\mathbf{Ex.} \quad \frac{4}{5} \times \left(\frac{-3}{7}\right) \left(\frac{-3}{7}\right) \times \frac{4}{5}$$

$$= \frac{4 \times (-3)}{5 \times 7} = \frac{(-3) \times 4}{7 \times 5}$$

$$= \frac{-12}{35} = \frac{-12}{35}$$

$$\frac{4}{5} \times \left(\frac{-3}{7}\right) = \left(\frac{-3}{7}\right) \times \frac{4}{5}$$

• Associative property :

If $\frac{a}{b}$, $\frac{c}{d}$ and $\frac{e}{f}$ are three rational numbers, then $\left(\frac{a}{b} \times \frac{c}{d}\right) \times \frac{e}{f} = \frac{a}{b} \times \left(\frac{c}{d} \times \frac{e}{f}\right)$

i.e., $\frac{ac}{bd} \times \frac{e}{f} = \frac{a}{b} \times \frac{ce}{df}$ or $\frac{ace}{bdf} = \frac{ace}{bdf}$

Thus, rational numbers can be multiplied in any order.

$$\mathbf{Ex.} \left(\frac{-3}{7} \times \frac{4}{5}\right) \times \left(\frac{-5}{8}\right) = \left(\frac{-3}{7}\right) \times \left(\frac{4}{5} \times \frac{-5}{8}\right)$$
$$\frac{(-3) \times 4}{7 \times 5} \times \left(\frac{-5}{8}\right) = \left(\frac{-3}{7}\right) \times \frac{4 \times (-5)}{5 \times 8}$$
$$\frac{-12}{35} \times \left(\frac{-5}{8}\right) = \left(\frac{-3}{7}\right) \times \left(\frac{-20}{40}\right)$$
$$\frac{60}{280} = \frac{60}{280}$$
$$\frac{3}{14} = \frac{3}{14}$$

• Multiplicative identity :

When any rational number, say $\frac{a}{b}$, is multiplied by the rational number 1, the product is always $\frac{a}{b}$.

$$\frac{a}{b} \times 1 = \frac{a \times 1}{b} = \frac{a}{b}$$

or, $1 \times \frac{a}{b} = \frac{1 \times a}{b} = \frac{a}{b}$

Ex.
$$\frac{21}{35} \times 1 = \frac{21}{35} \times \frac{1}{1} = \frac{21 \times 1}{35 \times 1} = \frac{21}{35}$$

Ex. $\frac{-3}{7} \times 1 = \frac{-3}{7} \times \frac{1}{1} = \frac{(-3) \times 1}{7 \times 1} = \frac{-3}{7}$

'One' is called the multiplicative identity or identity element of multiplication for rational numbers.

• Multiplicative inverse, or reciprocal :

Every nonzero rational number $\frac{a}{b}$ has its multiplicative inverse $\frac{b}{a}$.

Thus, $\left(\frac{a}{b} \times \frac{b}{a}\right) = \left(\frac{b}{a} \times \frac{a}{b}\right) = 1.$

 $\frac{b}{a}$ is called the reciprocal of $\frac{a}{b}$. Clearly, zero has no reciprocal. Reciprocal of 1 is 1 and the reciprocal of (-1) is (-1).

Ex. $\frac{2}{3} \times \frac{3}{2} = \frac{2 \times 3}{3 \times 2} = \frac{6}{6} = 1$. So $\frac{3}{2}$ is the multiplicative inverse of $\frac{2}{3}$ and $\frac{2}{3}$ is the multiplicative inverse of $\frac{3}{2}$. **Ex.** $\left(-\frac{4}{7}\right) \times \left(-\frac{7}{4}\right) = \frac{(-4)(-7)}{7 \times 4} = \frac{28}{28} = 1$. So $-\frac{7}{4}$ is the multiplicative inverse of $-\frac{4}{7}$ and vice versa.

• Distributive property :

If $\frac{a}{b}$, $\frac{c}{d}$ and $\frac{e}{f}$ are three rational numbers, then $\frac{a}{b} \times \left(\frac{c}{d} + \frac{e}{f}\right) = \frac{a}{b} \times \frac{c}{d} + \frac{a}{b} \times \frac{e}{f} = \left(\frac{c}{d} + \frac{e}{f}\right) \times \frac{a}{b}$

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$$\mathbf{Ex.} \frac{-3}{5} \left(\frac{3}{4} + \frac{-8}{9}\right) = \left(\frac{-3}{5}\right) \times \frac{3}{4} + \left(\frac{-3}{5}\right) \times \left(\frac{-8}{9}\right)$$
$$\frac{-3}{5} \left(\frac{27 - 32}{36}\right) = \frac{-9}{20} + \frac{24}{45}$$
$$\frac{-3}{5} \times \frac{-5}{36} = \frac{-81 + 96}{180}$$
$$\frac{15}{180} = \frac{15}{180}$$

Note : When any rational number $\frac{a}{b}$ is multiplied by 0, the product is always zero. i.e. $\frac{a}{b} \times 0 = \frac{a \times 0}{b} = \frac{0}{b} = 0$

Division of Rational Numbers

Division is the inverse process of multiplication.

If
$$\frac{a}{b}$$
 and $\frac{c}{d}$ are two rational numbers and $\frac{c}{d} \neq 0$, then $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$.
Ex. $\frac{3}{8} \div \frac{-4}{9} = \frac{3}{8} \times \left(\frac{-9}{4}\right) = \frac{-27}{32}$

Properties of Division of Rational Number

• Closure property :

When a rational number is divided by another non zero rational number, the quotient is always a rational number.

Thus, if $\frac{a}{b}$ and $\frac{c}{d}$ are two rational numbers, then $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$, which is again a rational number since b, c, d are non-zero integers.

Ex.
$$\frac{3}{4} \div \left(\frac{-1}{3}\right) = \frac{3}{4} \times \left(\frac{-3}{1}\right) = \frac{-9}{4}$$

• Division is not commutative :

If $\frac{a}{b}$ and $\frac{c}{d}$ are two rational numbers in which b, c and $d \neq 0$, then

$$\frac{a}{b} \div \frac{c}{d} \neq \frac{c}{d} \div \frac{a}{b} \text{ because,}$$

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc} \text{ and } \frac{c}{d} \div \frac{a}{b} = \frac{c}{d} \times \frac{b}{a} = \frac{cb}{da}$$
So, $\frac{a}{b} \div \frac{c}{d} \neq \frac{c}{d} \div \frac{a}{b}$
Ex. $\frac{4}{7} \div \frac{1}{3}$ is not equal to $(\neq) \frac{1}{3} \div \frac{4}{7}$

$$\frac{4}{7} \div \frac{1}{3} = \frac{4}{7} \times \frac{3}{1} = \frac{12}{7},$$
whereas $\frac{1}{3} \div \frac{4}{7} = \frac{1}{3} \times \frac{7}{4} = \frac{7}{12}$
So, $\frac{4}{7} \div \frac{1}{3} \neq \frac{1}{3} \div \frac{4}{7}$

Ex.11 Find $\frac{3}{7} + \left(\frac{-6}{11}\right) + \left(\frac{-8}{21}\right) + \left(\frac{5}{22}\right)$. Sol. $\frac{3}{7} + \left(\frac{-6}{11}\right) + \left(\frac{-8}{21}\right) + \left(\frac{5}{22}\right)$ $= \frac{198}{462} + \left(\frac{-252}{462}\right) + \left(\frac{-176}{462}\right) + \left(\frac{105}{462}\right)$ (Note that 462 is the LCM of 7, 11, 21 and 22) $= \frac{198 - 252 - 176 + 105}{462} = \frac{-125}{462}$

We can also solve it as.

$$\frac{3}{7} + \left(\frac{-6}{11}\right) + \left(\frac{-8}{21}\right) + \frac{5}{22} = \left[\frac{3}{7} + \left(\frac{-8}{21}\right)\right] + \left[\frac{-6}{11} + \frac{5}{22}\right]$$

(by using commutative and associativity)

$$= \left[\frac{9+(-8)}{21}\right] + \left[\frac{-12+5}{22}\right]$$

(LCM of 7 and 21 is 21; LCM of 11 and 22 is 22)

$$= \frac{1}{21} + \left(\frac{-7}{22}\right) = \frac{22 - 147}{462} = \frac{-125}{462}$$

Ex.12 Find $\frac{-4}{5} \times \frac{3}{7} \times \frac{15}{16} \times \left(\frac{-14}{9}\right)$ **Sol.** We have $\frac{-4}{5} \times \frac{3}{7} \times \frac{15}{16} \times \left(\frac{-14}{9}\right)$ $= \left(-\frac{4 \times 3}{5 \times 7}\right) \times \left(\frac{15 \times (-14)}{16 \times 9}\right)$ $= \frac{-12}{35} \times \left(\frac{-35}{24}\right) = \frac{-12 \times (-35)}{35 \times 24} = \frac{1}{2}$ We can also do it as.

$$\frac{-4}{5} \times \frac{3}{7} \times \frac{15}{16} \times \left(\frac{-14}{9}\right) = \left(\frac{-4}{5} \times \frac{15}{16}\right) \times \left[\frac{3}{7} \times \left(\frac{-14}{9}\right)\right]$$
(Using commutativity and associativity)
$$= \frac{-3}{4} \times \left(\frac{-2}{3}\right) = \frac{1}{2}$$

Rational Numbers Between Two Rational Numbers

If a and b are two rational numbers, then $\frac{a+b}{2}$ is a rational number between a and b such that $a < \frac{a+b}{2} < b$. This shows that there are countless number of rational numbers between any two given rational numbers.

Very Short Answer Type Questions

Direction : (Q.1 to Q.3) Find the value of following expressions

- **Q.1** $-\frac{2}{3} \times \frac{3}{5} + \frac{5}{2} \frac{3}{5} \times \frac{1}{6}$
- **Q.2** $\frac{2}{5} \times \left(-\frac{3}{7}\right) \frac{1}{6} \times \frac{3}{2} + \frac{1}{14} \times \frac{2}{5}$
- **Q.3** $\frac{5}{7} + \frac{1}{3} + \frac{8}{9} + \frac{1}{14}$
- **Q.4** The sum of the two numbers is $\frac{5}{9}$. If one of the numbers is $\frac{1}{3}$, find the other.
- **Q.5** The sum of two rational numbers is-8. If one of the numbers is $\frac{-15}{7}$, find the other.

Short Answer Type Questions – Type I

Q.6 What should be added to
$$\frac{-7}{8}$$
 so as to get $\frac{5}{9}$?

- **Q.7** What number should be subtracted from $\frac{-5}{3}$ to get $\frac{5}{6}$?
- **Q.8** What should be added to $\left(\frac{1}{2} + \frac{1}{3} + \frac{1}{5}\right)$ to get 3?
- **Q.9** What should be subtracted from $\left(\frac{3}{4} \frac{2}{3}\right)$ to get $\frac{-1}{6}$?
- Q.10 Represent these numbers on the number line.

(i)
$$\frac{7}{4}$$
 (ii) $\frac{-5}{6}$ (iii) $\frac{-2}{11}$

Short Answer Type Questions – Type II

- **Q.11** Find five rational numbers between. (i) $\frac{2}{3}$ and $\frac{4}{5}$ (ii) $\frac{-3}{2}$ and $\frac{5}{3}$ (iii) $\frac{1}{4}$ and $\frac{1}{2}$
- **Q.12** Simplify each of the following and write as a rational number of the from $\frac{p}{a}$:

(i)
$$\frac{-9}{10} + \frac{22}{15} + \frac{13}{-20}$$

(ii) $\frac{5}{3} + \frac{3}{-2} + \frac{-7}{3} + 3$
(iii) $\frac{-7}{4} + 0 + \frac{-9}{5} + \frac{19}{10} + \frac{11}{14}$
(iv) $\frac{-7}{4} + \frac{5}{3} + \frac{-1}{2} + \frac{-5}{6} + 2$
(v) $\frac{5}{6} + \frac{-2}{5} - \frac{-2}{15}$
(vi) $\frac{3}{8} - \frac{-2}{9} + \frac{-5}{36}$

Q.13 Simplify each of the following and express the result as a rational number in standard form:

(i)
$$\frac{-19}{36} \times 16$$
 (ii) $\frac{-13}{9} \times \frac{27}{-26}$
(iii) $\frac{-50}{7} \times \frac{14}{3}$ (iv) $\frac{-11}{9} \times \frac{-81}{-88}$
(v) $\frac{-5}{9} \times \frac{72}{-25}$

Q.14 Simplify:
(i)
$$\left(\frac{13}{5} \times \frac{8}{3}\right) - \left(\frac{-5}{2} \times \frac{11}{3}\right)$$

(ii) $\left(\frac{13}{7} \times \frac{11}{26}\right) - \left(\frac{-4}{3} \times \frac{5}{6}\right)$
(iii) $\left(\frac{8}{5} \times \frac{-3}{2}\right) + \left(\frac{-3}{10} \times \frac{11}{16}\right)$

CAREER POINT

Rational Numbers 57

 $\frac{3}{5}$ Find ten rational numbers between Q.15 and $\frac{3}{4}$.

Long Answer Type Questions

By what number should $\left(\frac{1}{-15}\right)$ Q.16 be divided so that the quotient equal to $\left(\frac{1}{-5}\right)$.

- By what number should $(-4)^{-2}$ be Q.17 multiplied so that the product may be equal to 10^{-2} ?
- By what number should $(-12)^{-1}$ be **Q.18** divided so that the quotient may be $\left(\frac{2}{3}\right)^{-1}$?
- (i) Verify that $|x + y| \le |x| + |y|$ by Q.19 taking $x = \frac{-5}{12}$, $y = \frac{-7}{18}$ (ii) Verify that $| \mathbf{x} \times \mathbf{y} | = | \mathbf{x} | \times | \mathbf{y} |$ by taking $x = \frac{-2}{3}$, $y = \frac{-9}{8}$.

Q.20 Simplify:
$$5 - \left[\frac{3}{4} + \left\{2\frac{1}{2} - \left(0.5 + \frac{1}{6} - \frac{1}{7}\right)\right\}\right]$$

Fill in the Blanks

- Q.21 (i) The numbers and are their own reciprocals
 - (ii) The product of two rational numbers is always a
 - (iii) $\frac{7}{-8}$, expressed as a rational number
 - with denominator 24 as
 - (iv) The absolute value of $\frac{-16}{-19}$ is
 - (v) The rational number which is neither positive nor negative is

True or False

- Q.22 (i) Every fraction is a rational number. (ii) |x| = -x if x < 0. (iii) $\frac{10}{21} \div \frac{8}{9} = \frac{8}{9} \div \frac{10}{21}$

 - (iv) $0 \times \frac{4}{5} = \frac{4}{5} \times 0$ implies that 0 is the multiplicative identity for rational numbers.
 - (v) Reciprocal of $\frac{1}{x}$, where $x \neq 0$ is x

Match the Column

Column-I **Column-II** Q.23 (a) $\frac{4}{19}$ (i) A rational number between $\frac{1}{2}$ and $\frac{1}{3}$ (b) $\frac{5}{19}$ (ii) A rational number

$$\begin{array}{c} \text{(iii)} & \frac{-1}{3} \text{ and } \frac{-11}{5} \\ \text{(iii)} & \frac{11}{12} \times \frac{14}{19} \times \frac{16}{84} \times \frac{18}{11} \\ \text{(iv)} & \frac{2}{3} \times \frac{6}{4} \times \frac{5}{11} \div \frac{10}{11} \\ \text{(e)} & \frac{1}{2} \end{array}$$

Exercise-2

Q.1 Which of the following numbers is the additive inverse of $\frac{7}{29}$?

(A)
$$\frac{29}{7}$$
 (B) $-\frac{29}{7}$
(C) $-\frac{7}{29}$ (D) $\frac{7}{29}$

- Q.2 Which of the following is (are) greater than x when $x = \frac{9}{11}$? I. $\frac{1}{x}$ II. $\frac{x+1}{x}$ III. $\frac{x+1}{x-1}$ (A) I only (B) I and II only (C) I and III only (D) II and III only
- Q.3 How many rational numbers exist between any two distinct rational numbers ?
 (A) 2 (B) 3
 (C) 11 (D) Infinite
- Q.4 Which of the following numbers is the product of $\frac{6}{13} & \frac{-26}{3}$? (A) 1 (B) - 4 (C) $\frac{-266}{133}$ (D) $\frac{266}{133}$
- Q.5 The product of $\frac{-2}{5}$ with $\frac{-5}{2}$ is : (A) 1 (B) 0 (C) - 1 (D) None of these
- Q.6 Which of the following numbers is the decimal form of $\frac{1}{4}$? (A) -0.25 (B) 2.5 (C) 0.25 (D) - 2.5

- Q.7 Which of the following numbers lies in the middle of 3/4 &7/4 ?
 (A) 5.0 (B)3.0
 (C) 2.5 (D) 1.25
- Q.8 Which pair of following numbers are respectively the additive & multiplicative identities .
 (A) 2 & 0
 (B) 1 & -1
 (C) -1 & 0
 (D) 0 & 1

Q.9 Which of the following numbers is the simplest form of $\frac{3}{4} + \left(-\frac{1}{4}\right) + \left(-\frac{5}{4}\right)$ (A) $\frac{9}{4}$ (B) $\frac{-3}{4}$ (C) $\frac{-9}{4}$ (D) $\frac{7}{4}$

Q.10 Which of the following properties indicates the given operation $\left[\left(-\frac{1}{5}\right) + \left(-\frac{3}{5}\right)\right] + \left(\frac{1}{7}\right) = \left(-\frac{1}{5}\right) + \left[\left(-\frac{3}{5}\right) + \left(\frac{1}{7}\right)\right]$ (A) commutative (B) associative (C) distributive (D) none of these

Q.11 Which of the following set of rational numbers is arranged in ascending order ?

(A)
$$-\frac{1}{2}, \frac{-3}{7}, \frac{-3}{14}, \frac{-25}{28}$$

(B) $-\frac{25}{28}, -\frac{1}{2}, -\frac{3}{7}, -\frac{5}{14}$
(C) $-\frac{25}{28}, \frac{-5}{14}, \frac{-3}{7}, -\frac{1}{2}$
(D) $-\frac{5}{14}, -\frac{25}{28}, -\frac{3}{7}, -\frac{1}{2}$

Q.12 $-\frac{1}{5}, -\frac{3}{10}, -\frac{11}{15}$ and $\frac{13}{20}$ arranged in descending order are : (A) $\frac{13}{20}, -\frac{3}{10}, \frac{-11}{15}, \frac{1}{5}$ (B) $\frac{13}{20}, \frac{-11}{15}, \frac{-3}{10}, \frac{1}{5}$ (C) $\frac{13}{20}, -\frac{1}{5}, \frac{-3}{10}, \frac{-11}{15}$ (D) $\frac{13}{20}, -\frac{1}{5}, \frac{-11}{15}, -\frac{3}{10}$

Q.13 What number should be added to $\frac{-5}{16}$ to

get
$$\frac{7}{24}$$
?
(A) $\frac{-29}{48}$ (B) $\frac{15}{48}$ (C) $\frac{29}{48}$ (D) $\frac{21}{28}$

Q.14
$$\frac{-5}{7} + \frac{1}{12} + \frac{3}{4} + \frac{-1}{3} + \frac{10}{7} + -\frac{1}{6}$$
 equals :
(A) 0 (B) 1
(C) $1\frac{1}{21}$ (D) -1

Q.15
$$(-36) \times \left(\frac{-35}{76}\right) \times \left(\frac{19}{15}\right) \times \left(\frac{3}{-2}\right)^{-1}$$
 equals :
(A) -64 (B) -14
(C) 14 (D) 64

Q.16 Which of the following statement is true ?
(A)
$$\frac{16}{21} \div \left(\frac{-4}{9} \div \frac{8}{9}\right) = \left(\frac{16}{21} \div \frac{-4}{5}\right) \div \frac{8}{9}$$

(B) $\left(\frac{9}{20} - \frac{17}{40}\right) \div \frac{10}{3} = \left(\frac{9}{20} \div \frac{10}{3}\right) - \left(\frac{17}{40} \div \frac{10}{3}\right)$
(C) $0 \div -\frac{13}{14} = 0$
(D) $\frac{-15}{22} \div \frac{22}{-15} = 1$

Q.17 By what rational number should $\frac{-7}{85}$ be multiplied to obtain $\frac{1}{17}$? (A) $\frac{7}{5}$ (B) $-\frac{7}{5}$ (C) $\frac{5}{7}$ (D) $\frac{-5}{7}$

Q.18 If a triangle has a base of $10\frac{3}{4}$ cm and a height of $15\frac{3}{4}$ cm, what is its area?

(A)
$$150\frac{16}{16}$$
 cm² (B) $75\frac{32}{32}$ cm²
(C) $84\frac{21}{32}$ cm² (D) $150\frac{9}{32}$ cm²

Q.19 In the last three months Mr. Sharma lost $5\frac{1}{2}$ kg, gained $2\frac{1}{4}$ kg, and then lost $3\frac{3}{4}$ kg. If he now weight 95 kg, how much did Mr. Sharma weight to begin with ? (A) 100 kg (B) 102 kg (C) 106.5 kg (D) 104 kg

Q.20 Which of the following is not true ?
(A)
$$\frac{-5}{6} + \frac{-7}{12} = \frac{-7}{12} + \frac{-5}{6}$$

(B) $\frac{8}{9} + \left(\frac{11}{3} + \frac{-2}{5}\right) = \left(\frac{8}{9} + \frac{11}{3}\right) + \frac{-2}{5}$
(C) $\frac{8}{9} - \frac{7}{11} = \frac{7}{11} - \frac{8}{9}$
(D) $\frac{-4}{-5} + 0 = \frac{4}{5}$

- Q.1 Which of the following statements is always true ? [IMO 2016]
 - (A) $\frac{x-y}{2}$ is a rational number between x and y
 - (B) $\frac{x+y}{2}$ is a rational number between x and y
 - (C) $\frac{\mathbf{x} \times \mathbf{y}}{2}$ is a rational number between \mathbf{x} and \mathbf{y}
 - (D) $\frac{x \div y}{2}$ is a rational number between x and y
- **Q.2** The numerical expression $\frac{3}{8} + \frac{(-5)}{7} = \frac{-19}{56}$ shows that [IMO 2016]
 - (A) Rational numbers are closed under addition
 - (B) Rational numbers are not closed under addition
 - (C) Rational numbers are closed under Multiplication
 - (D) Addition of rational numbers are not commutative
- **Q.3** The number 34 is divided into two parts such that $\frac{4}{7}$ th of the first part is equal to

 $\frac{2}{5}$ th of the second part. The numbers are

respectively	[NTSE 2016 W.B.]
(A) 20, 14	(B) 21, 13
(C) 13, 21	(D) 14, 20

Q.4 To reduce a rational number in its standard form, we divide its numerator and denominator by their ____.

	[IMO Set A 2016-2017]
(A) L.C.M	(B) H.C.F
(\mathbf{O}) D 1 $($	(\mathbf{D}) M 1 (\cdot) 1

(C) Product (D) Multiple

Q.5 Which of the following shows distributive property of multiplication over addition for rational numbers? [IMO Set A 2016-2017]

$$(A) -\frac{3}{4} \times \left\{ \frac{1}{3} + \left(-\frac{5}{7} \right) \right\} = \left[-\frac{3}{4} \times \frac{1}{3} \right] + \left[-\frac{3}{4} \times \left(-\frac{5}{7} \right) \right]$$
$$(B) -\frac{3}{4} \times \left\{ \frac{1}{3} + \left(-\frac{5}{7} \right) \right\} = \left[-\frac{3}{4} \times \frac{1}{3} \right] + \left[-\frac{5}{7} \right]$$
$$(C) -\frac{3}{4} \times \left\{ \frac{1}{3} + \left(-\frac{5}{7} \right) \right\} = \frac{1}{3} \left[-\frac{3}{4} \right] \times \left(-\frac{5}{7} \right)$$
$$(D) -\frac{3}{4} \times \left\{ \frac{1}{3} + \left(-\frac{5}{7} \right) \right\} = \left[\frac{1}{3} + \left(-\frac{5}{7} \right) \right] - \frac{3}{4}$$

Q.6 One fruit salad recipe requires $\frac{1}{2}$ cup of sugar. Another recipe for the same fruit salad requires 2 tablespoons of sugar. If 1 tablespoon is equivalent to $\frac{1}{16}$ cup, how much more sugar does the first recipe require? [IMO Set A 2016-2017] (A) $\frac{4}{16}$ cup (B) $\frac{6}{16}$ cup

(1)
$$\frac{5}{5}$$
 cup (D) $\frac{5}{5}$ cup (C) $\frac{3}{8}$ cup (D) $\frac{5}{8}$ cup

Q.7 Fill in the blanks: [IMO Set A 2016-2017]

- (i) __P__ is the multiplicative identity of rational numbers.
- (ii) There are <u>Q</u> rational numbers between two given rational numbers.
- (iii) Rational numbers are not associative for $_R_$.

	Р	\mathbf{Q}	R
(A)	0	infinite	division
(B)	1	infinite	division
(C)	1	finite	subtraction

(D) 0 infinite addition



- Q.9 How many digits are required for numbering the pages of a book having 300 pages? [IMO Stage -2 (2017] (A) 299 (B) 492 (C) 789 (D) 792
- Q.10 Which of the following statements is correct? [IMO Stage -2 (2017] (A) There are finite rational numbers
 - between any two rational numbers.
 - (B) The additive inverse of the rational number $\frac{x}{v}$ is -1 and vice-versa.

y (C) The rational number 1 is additive

- identity of rational numbers.(D) Rational numbers are closed under the operations of addition, subtraction and multiplication.
- **Q.11** The smallest fraction which should be subtracted from the sum of $1\frac{3}{4}$, $2\frac{1}{2}$, $5\frac{7}{12}$, $3\frac{1}{3}$ and $2\frac{1}{4}$ to make the result a greatest

one digit number, is -[IMO Stage -2 (2017]

(A)
$$\frac{\sigma}{12}$$
 (B) $\frac{\tau}{12}$ (C) $\frac{1}{2}$ (D) $6\frac{\sigma}{12}$

Q.12 Which greatest number will divide 3026 and 5053 leaving remainders 11 and 13 respectively? [IMO Stage -2 (2017] (A) 15 (B) 30 (C) 45 (D) 60

- Q.13 Which of the following statements is INCORRECT? [IMO Set A 2017-2018]
 - (A) If a and b are consecutive rational numbers where a < b, then $\frac{a+b}{2}$ < b.
 - (B) $\frac{x+y}{2}$ is a rational number which lies between x and y.
 - (C)Rational numbers are associative under subtraction.
 - (D) The rational numbers $\frac{5}{3}$ and $\frac{-1}{3}$ are
 - lying on the opposite sides of '0' on the number line.

1. 2 2. $-\frac{11}{28}$	3. $\frac{253}{126}$	4. $\frac{2}{9}$	5. $-\frac{41}{7}$	6. $\frac{103}{72}$	7. $\frac{-5}{2}$
8. $\frac{59}{30}$	9. $\frac{1}{4}$				
11. (i) $\frac{41}{60}$, $\frac{42}{60}$, $\frac{43}{60}$, $\frac{43}{60}$	$\frac{44}{60}$, $\frac{45}{60}$ (ii) $\frac{-8}{6}$, $\frac{-7}{6}$, 0,	$\frac{1}{6}, \frac{2}{6}$ (iii) $\frac{9}{32},$	$\frac{10}{32}, \frac{11}{32}, \frac{12}{32}, \frac{13}{32}$		
12. (i) $\frac{-1}{12}$ (ii) $\frac{5}{6}$ (iii) $\frac{-1}{6}$	$\frac{-121}{140}$ (iv) $\frac{7}{12}$ (v) $\frac{17}{30}$ (vi) $\frac{11}{24}$ 13. (i) $\frac{1}{24}$	$\frac{-76}{9}$ (ii) $\frac{3}{2}$ (iii) $\frac{-100}{3}$	$\frac{9}{8}$ (iv) $\frac{-9}{8}$ (v) $\frac{8}{5}$	
14. (i) $\frac{161}{10}$ (ii) $\frac{239}{126}$	(iii) $\frac{-417}{160}$				
15. $\frac{97}{160}$, $\frac{98}{160}$, $\frac{99}{160}$, $\frac{1}{1}$	$\frac{00}{60}, \frac{101}{160}, \frac{102}{160}, \frac{103}{160}, \frac{103}{160}$	$\frac{04}{60}$, $\frac{105}{160}$, $\frac{106}{160}$			
16. $\frac{1}{3}$ 17. $\frac{4}{25}$	18. $\frac{-1}{18}$	20. $\frac{191}{84}$			
21. (i) 1, -1	(ii) Rational number	(iii) $\frac{-21}{24}$	(iv) $\frac{16}{19}$ (v) 0		
22. (i) True	(ii) True	(iii) False	(iv) False	(v) True	

23. (i) \rightarrow (b); (ii) \rightarrow (c, d); (iii) \rightarrow (a); (iv) \rightarrow (e)

EXERCISE - 2

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	С	В	D	В	Α	С	D	D	В	В	В	С	С	С	В
Ques.	16	17	18	19	20										
Ans.	С	D	С	В	С										

EXERCISE - 3

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13
Ans.	В	Α	D	В	Α	С	В	С	D	D	D	С	С

Chapter 2

ALPHABET AND LETTER REPEATING SERIES

♦ ALPHABET SERIES

In the alphabet series we have to find the relation or the order in which the letters have been arranged or grouped together, then find the missing letter or group of letters from the choice given below.

Type of questions asked in the examination :

- (i) Find the missing term(s).
- (ii) Find the wrong term(s).

Position of Alphabet :

(i) Alphabet in order

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

(ii) Alphabet in reverse order

Z Y X W V U T S R Q P O N M L K J I H G F E D C B A 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

Ex.1	R, T, ?, X	, Z
------	------------	-----

(A) V	(B) W
(C) S	(D) Y

- **Sol.** (A) Series consists of alternate letter in order . So, the missing term would be V.
- Ex.2 What will be the next term in BDF, CFI, DHL?

(A) CJM	(B) EIM
(C) EJO	(D) EMI

Sol. (C) Clearly, the first, second and third letters of each term are respectively moved one, two and three steps forward to obtain the corresponding letters of the next term. So, the missing term is EJO.

Ex.3	KTE, SBM, AJU, IR	RC, ?		
	(A) OZL	(B) QYZ		
	(C) QZL	(D) QZK		

Sol. (D) First letter of each group differ by 8 letters. Second letter of each group differ by 8 letters. Third letter of each group differ by 8 letters. Therefore, the missing term would be QZK.

Ex.4	DC, DE, FE, ?, HG, HI	
------	-----------------------	--

(A) FE	(B) FG
(C) GF	(D) GH

Sol. (B) Hint

-	⊦2	0	+2	C)	+2
рС	DE	F	E	FG	НG	ні
0	+	·2	0	+2		0

Direction : (Ex.5 & Ex.6) Find the wrong term (s):

Ex.5 DOU, EPV, FQW, GRX, HTY, ITZ

(A) EPV	(B) FQW
(C) GRX	(D) HTY

Sol. (D) In every term first, second and third letter is in alphabetical order to its next term respectively. Fourth term is not following the same rule. Hence, HTY is the wrong term and should be replaced by HSY.

Ex.6	ABC, DGJ, HMR	R, NTA, SBK, ZKV		
	(A) DGJ	(B) HMR		
	(C) NTA	(D) SBK		
Sol. (C) First letter of first, second, third,.....terms is moved three, four, five,steps forward respectively. Similarly, second letter is moved five, six, seven,.....steps forward respectively and third letter is moved seven, eight, nine,......steps forward respectively. Hence, NTA is the wrong term and should be replaced by MTA.

♦ ALPHA-NUMERIC SERIES

A series in which both alphabets and number are used.

Ex.7 Choose the term which will continue the following series : P3C, R5F, T8I, V12L ?

(A) Y 17 O (C) X 17 O (D) X 16 O (D) X 16 O

- Sol. (C) Clearly, the first letters of the terms are alternate. The sequence followed by the numbers is +2, +3, +4, The last letter of each term is three steps ahead of the last letter of the preceding term. Thus, the next term would be X 17 O.
- Ex.8 Find the missing term : F3X, H7U, J15R, L31O, ? (A) M46L (B) N44L (C) N63L (D) N44M
- Sol. (C) The first letter of each term is moved two steps forward and the last letter is moved three steps backward to obtain the corresponding letters of the next term. The numbers form the sequence $3 \times 2 + 1 = 7, 7 \times 2 + 1 = 15, 15 \times 2 + 1 =$ $31, 31 \times 2 + 1 = 63$. So, the missing term would be N63L.
- Ex.9 Find the wrong term : D4V, G10T, J20R, M43P, P90N (A) G10T (B) J20R (C) M43P (D) P90N

Sol. (A) First letter of every term is moved three steps forward in each next term. Second number of every term of the pattern $\Rightarrow \times 2 + 1$, $\times 2 + 2$, $\times 2 + 3$,.....and third letter of every term is moved two steps backward. Hence, G10T is the wrong term and should be replaced by G9T.

♦ LETTER REPEATING SERIES

It consists of a series of small letters which follow a certain pattern. However, some letters are missing from the series. These missing letters are then given in a proper sequence as one of the alternatives and we have to choose that alternative.

Pattern of such questions is that some letters in sequence are missing :

- (i) The letters may be in cyclic order (clockwise or anti-clockwise).
- (ii) To solve a problem, we have to select one of the alternative from the given alternatives. The alternative which gives a sequence form of letters is the choice.
- **Ex.10** aab _____ aaa ____ bba___
- (A) baa (B) abb (C) bab (D) aabSol. (A) pattern is aabb/aaabbb/aa. Thus our answer is 'bba'.
- **Ex.11** _____ aba____ ba ___ ab (A) abbba (B) abbab (C) baabb (D) bbaba
- Sol. (B) The series is <u>ab</u>/ab/ab/ab/ab/ab thus the pattern ab is repeated
- Ex.12 abca__bcaab__ca __bbc __ a
 (A) ccaa (B) bbaa
 (C) abac (D) abba
- Sol. (C) The series is abc/aabbc/aabbc/aabbcc/a

EXERCISE

Direc	etion : (Q.1 to Q.14) I	Find the missing term		
Q.1	TYU, NSO, HMI, ?			
	(A) AGC	(B) CGC		
	(C) GBC	(D) BGC		
Q .2	Y. W. U. S. Q. ?. ?			
ч	(A) N. J	(B) M. L		
	(C) J, R	(D) O, M		
Q 3	АСЕН?М			
Q .0	(A) \mathbf{L}	(B) K		
	(C) J	(D) I		
	(0)0			
Q.4	MAAL, AALM, ALMA, LMAA, ?			
	(A) AMLA	(B) MAAL		
	(C) AAML	(D) LAAM		
Q.5	A, Z, X, B, V, T, C, R, ?, ?			
	(A) P, D	(B) E, O		
	(C) Q, E	(D) O, Q		
Q.6	A3P, C5N, E8K, G12G, ?			
	(A) I16D	(B) I17B		
	(C) I17D	(D) J16B		
Q.7	V, T, R, ?, N, ?			
v	(A) P, M	(B) O, L		
	(C) P, L	(D) O, M		
Q.8	2Z5, 7Y7, 14X9, 23W11, 34V13, ?			
v	(A) 27U24	(B) 47U15		
	(C) 45U15	(D) 47V14		
Q.9	CE, GI, KM. OQ. ?			
-1	(A) TW	(B) TV		
	(C) SU	(D) RT		
Q.10	AB, DEF, HIJK, ? .	STUVWX		

Q.10 AB, DEF, HIJK, ? , STUVWX (A) MNOPQ (B) LMNOP (C) LMNO (D) QRSTU

JJL					
Q.11	B3M, E7J, H15G, K31D, ?				
	(A) N65A	(B) O63A			
	(C) N63A	(D) N63Z			
Q .12	U. O. I. ?. A				
- L ·	(A) E	(B) C			
	(C) S	(D) G			
Q .13	BEH. KNO. TV	BEH KNO TWZ ?			
- L	(A) IJL	(B) CFI			
	(C) BDF	(D) ADG			
	(0) 221				
Q .14	AB BA ABD DBA PORS ?				
-••	(A) SROP	(B) SRPQ			
	(C) SORP	(D) RSQP			
	() / ()				
Direc	tion : (Q.15 to	Q.19) There is a wrong			
21100	term in the fo	llowing numbers / letters			
	series Find the	wrong term of the series			
Q.15	ABC BCD CDE DEF FEG				
Q.20	(A) BCD	(B) CDE			
	$(\mathbf{C}) \mathbf{D} \mathbf{E} \mathbf{F}$	(D) FEG			
	(0) DH				
Q.16	AACC, BBED, CCHE, DDMF, EEQG				
q. 20	(A) AACC	(B) DDMF			
	(C) BBED	(D) EEQG			
	(0) 2222				
Q.17	ECA, JHF, OMK, TQP, YWU				
	(A) ECA	(B) JHF			
	(C) TQP	(D) YWU			
	(-)	(_)			
Q .18	EPV. FOW. GR	X. HTY. ITZ			
	(A) FOW	(B) GRX			
	(C) HTY	(D) ITZ			
Q.19	PON, RQP, TSR, VVT, XWV, ZYX				
	(A) VVT	(B) TSR			
	(U) AW V	(D) KQP			

Direction : (Q.20 to Q.26) Which sequence of letters when placed at the blanks one after the other will complete the given letter series ?

Q.20	abc _ c _ c _ ba	_ bca
	(A) abacb	(B) babac
	(C) baabc	(D) bacba

- Q.21 abb_baa_a_bab_ab (A) abba (B) abab (C) ccac (D) aabb
- Q.22 babbb _ b_b_bb (A) bba (B) baa (C) aba (D) aaa
- Q.23 _ ha _ hach _ c _ _ (A) ccaha (B) achac (C) chaaa (D) aaach
- Q.24 m_l_ml_m_llm (A) lmmm (B) lmlm (C) lmml (D) mllm
- Q.25 _ bc _ bb _ aabc (A) acac (B) babc (C) abab (D) aacc
- **Q.26** gfe_ig_eii_fei_gf_ii (A) eifgi (B) figie (C) ifgie (D) ifige
- **Direction : (Q.27& Q.28)** The series given below are based on the letter series, In each of these series, some letters are missing. Select the correct alternative. If more than five letters are missing, select the last five letters of the series.
- Q.27 abcd _ bc _ e _ _ de _ _ _ _ (A) deabc (B) edcba (C) decba (D) edabc

- Q.28 __r _ tqrptsrpqst _____ (A) pqrts (B) pqtrs (C) pqrst (D) qrpst
- Direction : (Q.29 & Q.30) There is a letter series in the first row and a number series in the second row. Each number in the number series stands for a letter in the letter series. Since in each of that series some term are missing you have to find out as to what those terms are, and answer the questions based on these as given below in the series.
- Q.29 n _ g f _ t _ f h t n _ _ t _ b _ f
 1 3 _ 2 4 5 0 _ 4 _ 3 _ _ _ The last five terms of the number series
 are
 (A) 50123 (B) 40321
 (C) 40231 (D) 51302

Q.30 _m y e _ y l x _ y l m _ l _ _ _ 46 _ 586 _ 57_658 _ _ _ The last five terms of the number series are (A) 46758 (B) 74658

(11) 10100	(D) 11000
(C) 76485	(D) 46785



HOW, WHEN AND WHERE

CONTENTS

- How Important Are Dates?
- Which Dates?
- How do we Periodise?

- What is Colonial?
- Sources of History
- What Official Records Do Not Tell?



HOW IMPORTANT ARE DATES?

History is about changes that occur over time. It is about finding out how things were in the past and how things have changed. Most of us have our moments of wonder, when we are curious, and we ask questions that actually are historical. Like when did people begin to drink tea or coffee? When were railways built and how did people travel long distances before the age of railways? How people got to hear about things before newspapers began to be printed? All such historical questions refer us back to notions of time. But time does not have to be always precisely dated in terms of a particular year or a month. All these things happened over a stretch of time. There was a time when history was an account of battles and big events. Historians now look at how people earned their livelihood, what they produced and ate, how cities developed and markets came up, how kingdoms were formed and new ideas spread, and how cultures and society changed.



Fig. - Advertisements help create taste

WHICH DATES?

The dates we select, are not important on their own. They become vital because we focus on a particular set of events as important. For e.g. in the histories written by British historians in India, the rule of each Governor-General was important. All the dates in the history books were linked to the personalities and their activities, policies, achievements. If we have to focus on the activities of different groups and classes in Indian society we need another format for our history. This would mean that the old dates will no longer have the significance they earlier had. A new set of dates will become more important for us to know.



Fig. – Warren Hastings became the first Governor-General of India in 1773

HOW DO WE PERIODISE?

In 1817, James Mill, a Scottish economist and political philosopher, published a massive three volume work, 'A History of British India'. In this he divided Indian history into three periods – Hindu, Muslim and British. This periodisation came to be widely accepted. Mill thought that all Asian societies were at a lower level of civilisation than Europe. According to his telling of history, before the British came to India, Hindu and Muslim despots ruled the country. Religious intolerance, caste taboos and superstitious practices dominated social life. British ruler. Mill felt. could civilise India. To do this it was necessary to introduce European manners, arts, institutions and laws in India. James Mill, in fact, suggested that the British should conquer all the territories in India to ensure the enlightenment and happiness of the Indian people. For India was not capable of progress without British help. We cannot refer to any period of history as "Hindu" or "Muslim". This division has problems -

- (1) Variety of faiths exist simultaneously in these periods.
- (2) This division suggested that the lives and practices of the others do not really matter.
- (3) Even rulers in ancient India did not share the same faith.
- ♦ Moving away from British classification, historians have usually divided Indian history into 'ancient', 'medieval' and 'modern'. This division too has its problems. It is a periodisation that is borrowed from the West where the modern period was associated with the growth of all the forces of modernity - science, reason, democracy, liberty and equality. Medieval was a term used to describe a society where these features of modern society did not exist. Under British rule people did not have equality, freedom or liberty. Nor was the period one of economic growth and progress.
- Many historians, therefore, refer to this period as 'colonial'.

WHAT IS COLONIAL?

The British came to conquer the country and establish their rule, subjugating local nawabs and rajas. They established control over the economy and society, collected revenue to meet all their expenses, bought the goods they wanted at low prices, produced crops they needed for export. The British rule brought about many changes in values and tastes, customs and practices. When the subjugation of one country by another leads to these kinds of political, economic, social and cultural changes, we refer to the process as colonization.

SOURCES OF HISTORY

(i) Administration produces records :

One important source is the official records of the British administration. The British believed that the act of writing was important. Every instruction, plan, policy decision, agreement, investigation had to be clearly written up. Once this was done, things could be properly studied and debated. This conviction produced an administrative culture of memos, notings and reports.

Steps taken by the British :

- (1) The British also felt that all important documents and letters needed to be carefully preserved. So they set up record rooms attached to all administrative institutions. The village *tahsildar's* office, the collectorate, the commissioner's office, the provincial secretariats, the lawcourts all had their record rooms
- (2) Specialised institutions like archives and museums were also established to preserve important records.

(3) Letters and memos that moved from one branch of the administration to another in the early years of the nineteenth century can still be read in the archives. You can also study the notes and reports that district officials prepared, or the instructions and directives that were sent by officials at the top to provincial administrators.



Fig. – The National Archives of India came up in the 1920s When New Delhi was built, the National Museum and the National Archives were both located close to the Viceregal Place. This location reflects the importance these institutions had a British imagination.

(ii) Survey became important

The practice of surveying also became common under the colonial administration. The British believed that a country had to be properly known before it could be effectively administered.

By the early nineteenth century detailed surveys were being carried out to map the entire country. In the villages, revenue surveys were conducted. The effort was to know the topography, the soil quality, the flora, the fauna, the local histories, and the cropping pattern - all the facts seen as necessary to know about to administer the region.

From the end of the nineteenth century, Census operations were held every ten years. These prepared detailed records of the number of people in all the provinces of India, noting information on castes, religions and occupation. There were many other surveys - botanical surveys, zoological surveys, archaeological surveys, anthropological surveys, forest surveys.

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Fig. - Mapping and survey operations in progress in Bengal, a drawing by James Prinsep, 1832

> WHAT OFFICIAL RECORDS DO NOT TELL

Official records tell us what the officials thought, what they were interested in, and what they wished to preserve for posterity. These records do not always help us understand what other

- **1. Periodise :** Divide (a portion of time) into periods.
- 2. Colonial : The policy or practice of a wealthy or powerful nation's maintaining or extending its control over other countries, especially in establishing settlements or exploiting resources.
- **3.** Administration : The process or activity of running a business, organization etc.
- 4. Archives : A collection of historical documents or records providing information about a place, institution, or group of people.
- 5. Calligraphists : Someone skilled in penmanship. Calligrapher, skilled worker, skilled workman, trained worker - a worker who has acquired special skills.
- **6. Survey :** Examine and record the area and features of (an area of land) so as to construct a map, plan, or description.

people in the country felt, and what lay behind their actions. For that we have diaries of people, accounts of pilgrims and travellers, autobiographies of important personalities and popular booklets that were sold in the local bazars As printing spread. newspapers were published and issues were debated in public. Leaders and reformers wrote to spread their ideas, poets and novelists wrote to express their feelings. To understand how history was experienced and lived by the tribals and the peasants, the workers in the mines or the poor on the streets, is a more difficult task.

GLOSSARY

- **7. Botanical Survey :** An institution set up by the Government of India to survey the plant resource of Indian empire.
- 8. Zoological Survey : A premier Indian organization promote the survey, exploration and research of the fauna in the region.
- **9.** Archaeological Survey : It is a type of field research by which search for archaeological sites and collect information about the location, distribution and organization of past human cultures across a large area.
- **10. Anthropological Survey :** Studies and field data research for human and cultural aspects.

EXERCISE-1

A Objective Type Questions

Q.1	James Mill was a - (A) Indian economist (B) An Italian economist (C) Scottish economist (D) A Dutch economist
Q.2	History is about -(A) changes that occur over time(B) finding out how things were in past(C) how things have changed(D) all of the above
Q.3	Who wrote "History of British India"?(A) Rippon(B) Liton(C) James Mill(D) Irwin
Q.4	 Now a days history lays emphasis on (A) dates (B) periods (C) other issues as compared to dates and periods (D) None of the above
Q.5	 Who published the massive three volume work "A history of British India"? (A) Hindus (B) Muslims (C) Warren Hastings (D) James Mill
Q.6	What was important in the histories written by British historians in India? (A) The role of Kings in making India a great

- (A) The role of Kings in making India a great country
- (B) How the British defeated the French and captured India.
- (C) The rule of each Governor-General
- (D) The role of Indians who supported the British In establishing their rule over India
- Q.7 Warren Hasting became the first governor general of India in -

(A) 1773	(B) 1772
(C) 1774	(D) 1775

Q.8	The idea that Asian societies were at a lower			
	level of civilisation than Europe was propose			
	by -			
	(A) Montesquieu	(B) Robert Lawrence		
	(C) James mill	(D) Rousseau		
Q.9	Subjugation of one country leading to pol and cultural changes is (A) globalization	country by another litical, economic, social s called - (B) war		
Q.10	(C) colonizationThose artists who spbeautiful handwriting a(A) calligraphers(C) writers	(D) imperialismbecialise in the art of are called -(B) graphologists(D) hieroglyphists		

B Fill in the blanks

- **Q.1** The British believed that country could be effectively if it is properly known.
- Q.2 The name of a tea company featured as an advertisement dated 1922 is
- **Q.3** The Nationalis established for keeping the records.
- **Q.4** The study of changes that occurred in the past is called
- **Q.5** The last British Governor General of India was

C True or False

- **Q.1** During the British rule, census operations in India were held every ten years.
- **Q.2** Wellesley, Bentinck and Dalhousie were the British Governor Generals.
- **Q.3** In earlier times, History as a subject was synonymous with literature.

Exercise-2

A Very Short Answer Type Questions

- **Q.1** What is history?
- **Q.2** How does history help us?
- **Q.3** Why do we connect history with dates?
- **Q.4** What is the title of the book written by James Mill?
- **Q.5** What is census?
- **Q.6** What is the importance of dates in history?
- **Q.7** What does 'Political history' refer to?
- **Q.8** What is an archive?
- **Q.9** Name three official documents of the British period.

B Short Answer Type Questions

- Q.1 What were the drawbacks of official records?
- **Q.2** Why do we divide history into different periods?
- **Q.3** What should be the base of selection of dates?
- Q.4 What was the misconception of James Mills?

- **Q.5** How various surveys helped the British administration?
- **Q.6** Why were the British interested in preserving official documents?
- **Q.7** What is periodisation?
- **Q.8** What are the characteristic of modern period?
- **Q.9** Who are calligraphists?
- Q.10 Explain different types of surveys.

C Long Answer Type Questions

- **Q.1** How the periodisation done by James Mill different from other Historians?
- **Q.2** What is colonial?
- **Q.3** How the various surveys conducted by British became a Important source of history?
- **Q.4** How did modernisation lead to colonization?
- **Q.5** How have historical buildings and paintings proved useful as a source of history (i.e., the history of modern India)?



PRONOUN

Pronoun

Pronoun is a word used instead of a Noun.

e.g. Look at Jack. He is studying. John and Mary have come to see him. They are glad to see him studying. He is also glad to see them.

The different kinds of Pronouns are as follows.

- (a) **Personal Pronouns :** They stand for three Persons :
- (i) First Person :
- The Pronouns which refer to the person or persons speaking:
- e.g. I, we, me, us, mine, ours.

(ii) Second Person:

- The pronouns which refer to the person or persons spoken to.
- e.g. you, your, yours, thou, thee

(iii) Third Person:

- The pronouns which refer to the person or thing spoken of.
- **e.g.** he, she, him, her, hers, they, them, theirs, it.

(b) Reflexive or Emphatic Pronouns :

- (i) **Reflexive pronouns** act as Object to the Verb but they refer to the same persons as the Subject of the Verbs.
- e.g. myself, ourselves, yourself, yourselves, himself, herself, itself and themselves.
- I blame myself for my failure.We often talk to ourselves.He hanged himself.They always talk about themselves.She put herself to trouble for nothing.They always talk about themselves.
- (ii) Emphatic Pronouns are used with a Noun or a Pronoun for the sake of emphasis .
- e.g. I myself was present at the accident site. She herself cooked food for the guests. He himself told me the story.
 You yourself/yourselves must do the assignment. Boys, you yourselves should prepare your timetable.

(c) **Demonstrative Pronouns :**

- They are used to point out the object or objects for which they are used.
- This & These refer to things near at hand.
- That & Those refer to things lying at a distance.
- e.g. This is my book. That is my house. These are your friends. Those are her friends.
- (d) Distributive Pronouns :
 - It refers to a number of persons or things, one at a time. These pronouns are always singular and are always followed by a Verb in the singular.
- Each, Either, Neither are such pronouns.
- e.g. Each student secured a reward. Neither of your answer is correct. At either end of the road was a Park.
- (e) Interrogative Pronouns are used for asking questions.
- Who, Whom and Whose are used for asking questions about things.
- e.g Who is calling you? Whom do you want to meet? Whose book is this?
- What is used for asking questions about things.
- e.g. What shall you do after graduation ?
 - Which is used for asking a question about the particular person or thing.

- e.g. Which is the most intelligent student in this class? (Person) Which is the best book ? (Thing)
- (f) Reciprocal pronoun :
 - They are pronouns that denote reciprocal or mutual action. They are :
 - Each other: generally used when two persons or things are referred to.
- e.g. Jack and Jill loved each other.
- **One another:** generally used when more than two persons or things are referred.
- e.g. The people of India love one another.

(g) Relative Pronoun :

- The Pronouns 'Who, Whose, Whom, Which, That', which join two sentences and relate or refer to Nouns which have gone before are called Relative Pronouns.
 - The Noun to which a Relative Pronoun refers or relates is called its Antecedent.
- e.g. This is the boy who was punished. In this example 'boy' is the Antecedent of 'who'.

Use of Relative Pronouns

- (i) Who:
 - Used for persons only.
- e.g. The man who is honest succeeds in his life. The students who were lazy were punished. They who live in glass houses should not throw stones at others. The children who work hard always succeed.

(ii) Whose:

- It is the possessive case of 'Who'. It refers to persons but may also refer to things.
- **e.g.** This is the question **whose** solution baffles me.
 - The school building **whose** roof was damaged, has now been repaired.

(iii) Which:

- Used for animals and for things without life.
- e.g. These are the books which we purchased yesterday. The horse which won the race is John's. The things which we lost have been found.

(iv) Whom:

- Is used in formal written English. It is common to use 'Who' in place of 'Whom' in ordinary conversation.
- e.g. The man who (m) the police caught was a dreaded terrorist. The students who (m) we praised were good in their studies.
- **Note: 'whom'** is often replaced by 'That' except after a preposition. The preposition may be placed at the end and **'that'** used for 'whom'.
- e.g. That is the man about **whom** we were speaking. That is the man **that** we were speaking about.
- (v) That: Used for persons, animals and things.
 It may refer to singular or plural.
- It may refer to singular or plural.
- e.g. These are the boys that can be trusted. This is the book that I want to buy. This is the ring that I lost yesterday.

These are the only horses **that** neigh.

- Note: 'That' is preferred to 'who' or 'which' though 'who' or 'which' can be equally used.
- e.g. a) After the superlative degree of adjectives: Ashoka was the best king that (= who) ruled in India. This is the best book that (= which) I have read.
 b) After the words 'all, none, nothing, any, only, same' etc.
 - All **that** (= which) glitters is not gold.

It is only you **that** (= who) can speak in such a way. Nothing **that** (= which) we can do now will save him.

Pronouns at a Glance

PERSON	Nominative or Subjective	Objective	Reflexive	Possessive & Vocative
FIRST	I We	${ m Me} { m Us}$	Myself Ourselves	My, Mine Our, Ours
SECOND	You	You	Yourself/ Yourselves	Your, Yours
THIRD	He She It They	Him Her It Them	Himself Herself Itself Themselves	His, His Her, Hers Its Their, Theirs

EXERCISE

I. Fill in the blanks with suitable pronouns.

One evening, a rich lady sent (a) ______ housemaid to the market to buy some vegetables for (b) ______. The rich lady sat by (c) ______ for some time. Then she saw her maid returning very quickly. "Madam" she said, " I have forgotten (d) ______ you had asked me to bring." The angry lady said, (e)" ______ can bear with such a fool? (f) ______ was such a simple task and you've come back empty-handed."

II. The following passage has not been edited. There is one error in each line. Write the incorrect word and the correction against the correct blank number. Underline the word that you have supplied.

Incorrect	Correct
We are in very serious times, because they are free. In	(a)
the old days ours task was only to fight, to wrest freedom	(b)
enthuse each other and carry on the freedom struggle.	(c)
Those was easy, as we know, but now that we have freedom	(d)
the entire burden of the future structure of my country is	(e)
on our own shoulders. You must be as true in our conduct	(f)
and thoughts as a brick that supports a building is true.	

III. The following passage has not been edited. There is one error in each line. Write the incorrect word and the correction against the correct blank number. Underline the word that you have supplied.

Incorrect	Correct
Jack and Michael were fast friends. They loved one another.	(a)
Every tried to make the greatest sacrifice for	(b)
the others. Their parents were equally friendly.	(c)
But what knows the quirks or fate? It was just a	(d)