Unit 7: Data Entry and Keyboarding Skills

Assignment Solutions

Multiple-Choice Questions (MCQs)

1. In touch typing, we make use of .... fingers of each hand.
   - a. 10
   - b. 5
   - c. 4
   - d. 2

2. In the RapidTyping application, control buttons are present in the ....
   - a. Tool Bar
   - b. Text Panel
   - c. Title Bar
   - d. Navigation Panel

3. During typing, your elbows must be aligned at a ....
   - a. Left angle
   - b. Right angle
   - c. Straight angle
   - d. Curved angle

4. While typing in the RapidTyping software, the toolbar displays the .... buttons.
   - a. Pause and Continue
   - b. Continue and Delete
   - c. Print and Restart
   - d. Create and Continue

5. In typing, the speed parameter KPS stands for ....
   - a. Keyterms per second
   - b. Keywords per second
   - c. Keystrokes per second
   - d. Keys per second

6. The .... progress bar reflects the acceptable time for typing a single character.
   - a. Red
   - b. Yellow
   - c. Green
   - d. Black

7. The fourth level of the RapidTyping software is the .... level.
   - a. Testing
   - b. Advanced
   - c. Experienced
   - d. Intermediate

ANSWERS

1. b.   2. a.   3. b.   4. a   5. c
6. b.   7. b.

Very Short Answer Questions

1. What is the use of the Caps Lock key in a keyboard?

Ans. Caps Lock is like a toggle key. Once it is pressed to switch on, it types all the letters of the alphabet in capital casing. Press the key again to return to the normal casing mode.

2. What are home keys?

Ans. Home keys represent the keys in the middle row of the keyboard.

3. What is the name of the * key?

Ans. The "*" key is known as Asterisk, star symbol, or mathematical multiplication symbol.

4. Which finger is placed on the A key while typing?

Ans. The little finger of left hand is placed on the A key.

5. What is the use of space bar key?

Ans. The space bar key is used to insert a blank space.

Short Answer Questions-I

1. What is the shortcut key for hiding and showing a virtual keyboard?

Ans. You can show/hide a virtual keyboard by clicking the F9 key.

2. How can you delete a course?

Ans. To delete a newly created course, click the Delete button on the Taskbar. Moreover, you can also delete a particular course or a lesson by right-clicking it and selecting the Delete option.

3. How can you open the Course menu using a keyboard?

Ans. To open a course menu, we can use Ctrl+ K keys.

4. What do you call F1-F12 keys on the keyboard?

Ans. F1-F12 keys on the keyboard are called function keys.

5. What are the '~' and '!' symbols present on the keyboard called?

Ans. " ~ " is called Tilde and "!" is called the Exclamation mark/ Bang.

6. What are the different ways of opening the RapidTyping application in a computer?

Ans. You can start the RapidTyping tutor either by double-clicking the RapidTyping 5 shortcut icon

on the desktop of your computer or by selecting the following menu path: Start → All Programs → RapidTyping 5 → RapidTyping.

Short Answer Questions-II

1. What is the significance of interpreting result in the RapidTyping application?

Ans. Interpreting result helps you assess your performance in various ways. The results window displays your performance in the following manner:

- **Overall rating:** The upper slider indicator shows grades in terms of: Could be better, OK, Good and Excellent.
- **Speed:** This indicator shows your typing speed in the Speed/Net speed, words/characters/keystrokes per minute/second format.
- **Accuracy:** This indicator shows your typing accuracy.
- **Slowdown:** This indicator shows the slowdown of your typing rhythm.

2. Expand the following acronyms:

(i) WPM

(ii) CPM

(iii) KPM

(iv) WPS

(v) CPS

(vi) KPS

Ans. The expansion of acronyms is given as follows:

(i) **WPM:** Words Per Minute

(ii) **CPM:** Characters per Minute

(iii) **KPM:** Keystrokes Per Minute

(iv) **WPS:** Words per Second

(v) **CPS:** Characters per Second

(vi) **KPS:** Keystrokes Per Second

3. Enlist the different types of courses that are available in the RapidTyping application.

Ans. The following are the different types of courses mentioned in RapidTyping:

- **Introduction:** This category of course helps in knowing the location of keys on the keyboard.
- **Beginner:** The aim of the beginner course is same as the Introduction course having a little higher level than the Introduction course.
- **Experienced:** This course helps in improving your typing speed by learning symbols and words, which are used repeatedly.
- **Advanced:** The course enables you to further enhance your typing skills by entering the actual text matter.
- **Testing:** This course tests your touch typing skills.

4. Explain the main components of the RapidTyping tutor.

Ans. The description of the main components of the RapidTyping tutor is as follows:

- **Current Lesson tab:** The Current Lesson tab button is used to move back to the current lesson from any other screen in the RapidTyping tutor.
- **Student Statistics tab:** This button shows the current user statistics.
- **Lesson editor tab:** The Lesson editor tab opens the Lesson editor window.
- **Options button:** This button allows you to customize the various features or components of the RapidTyping tutor such as keyboard, background and text color, font, etc.
- **Minimize window button:** This button minimizes the Main window of the RapidTyping application in the Windows task bar.
- **Maximize window button:** This button maximizes the Main window of the RapidTyping application up to the entire screen of the computer.
- **Close program button:** This button closes the RapidTyping application window.
- **Toolbar:** The Toolbar provides several options, such as selecting a lesson, course, start or pause the lesson.
- **Text panel:** This panel shows the text which needs to be typed by the typist or user.
- **Status bar:** It shows the tips for completing the ongoing lesson.
- **Virtual keyboard:** The keyboard which appears on the screen of the Main window of the RapidTyping tutor is called the virtual keyboard.

Long Answer Questions

1. Mention the points that should be observed to maintain a correct posture while typing.

Ans. When you have to do typing, you should sit on a chair and face the screen. The following points may help you maintain the correct posture while typing:

- Keep your back straight. Bend your elbows at the right angle.
- Keep your feet firmly on the ground.
- When you see at the screen, your head must be tilted slightly forward.
- You should keep at least 20-30 inches (or 45-70 cm) distance between your eyes and the screen while typing.
- The keyboard must be kept at the height of 28 to 30 inches from the floor.
- Put the least possible strain on the shoulder, arms and wrist muscles while typing.

2. Which of the following fingers are used for:
    a. Pressing the T key
    b. Pressing the/key
    c. Pressing the L key
    d. Pressing the K and, keys
    e. Pressing the N key
    f. Pressing the B key
    g. Pressing the J key

Ans. The fingers used for pressing the given keys have been mentioned corresponding to them:

a.	Pressing the T key	:	Index finger of the left hand
b.	Pressing the/key	:	Little finger of the right hand
c.	Pressing L key	:	Ring finger of the right hand
d.	Pressing the K and, keys	:	Middle finger of the right hand
e.	Pressing the N key	:	Index finger of the right hand
f.	Pressing the B key	:	Index finger of the left hand
g.	Pressing the J key	:	Index finger of the right hand

3. Why is the Lesson Editor window used? Explain the process of creating a new lesson in the RapidTyping Application.

Ans. The Lesson editor window enables you to create or add a new user-defined course in the RapidTyping application. When you click the Course menu, you get the options:

- **Create new course:** Allows you to create a new blank course by just typing a new name

- **Add courses:** Allows you to add an existing course from a file stored in the computer's hard disk or from an already existing library stored in the RapidTyping application

- **Save selected courses:** Allows you to save a selected course with the .rapidtyping.course extension

- **Save all:** Allows you to save all the changes in all the existing courses

We can perform the following steps to create a course:

1. Open the RapidTyping application. The main window displays.
2. Click the Lesson editor tab. The Lesson editor window displays.
3. Click the Course menu and select the Create new course option.
4. Press the Enter key to enter the new course name into the system. A new course will be created and displayed in the list of courses.

4. Identify the following symbols present on the keyboard:
    a. @   b. #
    c. $ d. %
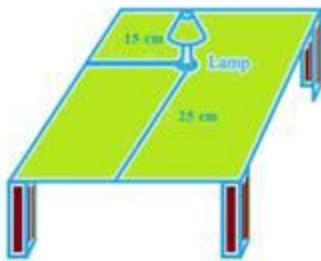   e. ^   f. &

Ans. The names of the following symbols present on the keyboard are as follows:

a. @: At, or At symbol
b. #: Hash symbol
c. $: Dollar symbol
d. %: Percent symbol
e. ^: Caret symbol
f. &: Ampersand, or and symbol

By Anthony Jamatia

Ans. Let us consider the given below figure of a study stable, on which a study lamp is placed.

Let us consider the lamp on the table as a point and the table as a plane. From the figure, we can conclude that the table is rectangular in shape, when observed from the top. The table has a short edge and a long edge.

Let us measure the distance of the lamp from the shorter edge and the longer edge. Let us assume that the distance of the lamp from the shorter edge is 15 cm and from the longer edge, its 25 cm.

Therefore, we can conclude that the position of the lamp on the table can be described in two ways depending on the order of the axes as $(15, 25)$ or $(25, 15)$.

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2. Ans. We need to draw two perpendicular lines as the two main roads of the city that cross each other at the center and let us mark it as N-S and E-W. Let us take the scale as 1 cm = 200m.
We need to draw five streets that are parallel to both the main roads, to get the given below figure.
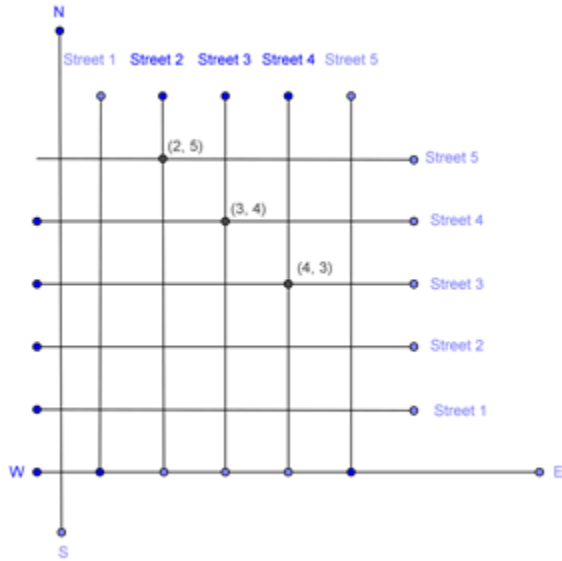
(i) From the figure, we can conclude that only one point have the coordinates as $(4,3)$.

Therefore, we can conclude that only one cross - street can be referred to as (4, 3).

(ii) From the figure, we can conclude that only one point have the coordinates as $(3,4)$.

Therefore, we can conclude that only one cross - street can be referred to as (3, 4).

(Ex. 3.2)

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Ans. (i) The horizontal line that is drawn to determine the position of any point in the Cartesian plane is called as **x-axis**.

The vertical line that is drawn to determine the position of any point in the Cartesian plane is called as **y-axis**.
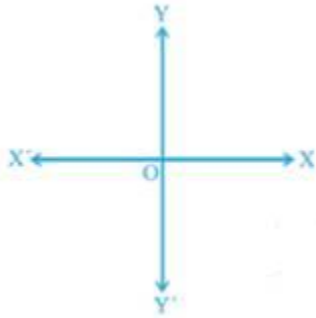
(ii) The name of each part of the plane that is formed by x-axis and y-axis is called as **quadrant**.
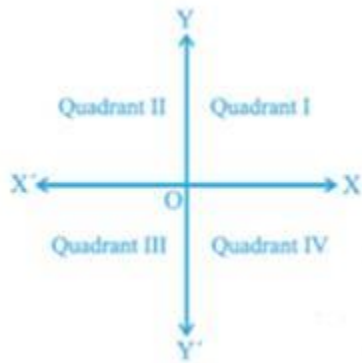
(iii) The point, where the x-axis and the y-axis intersect is called as **origin**.
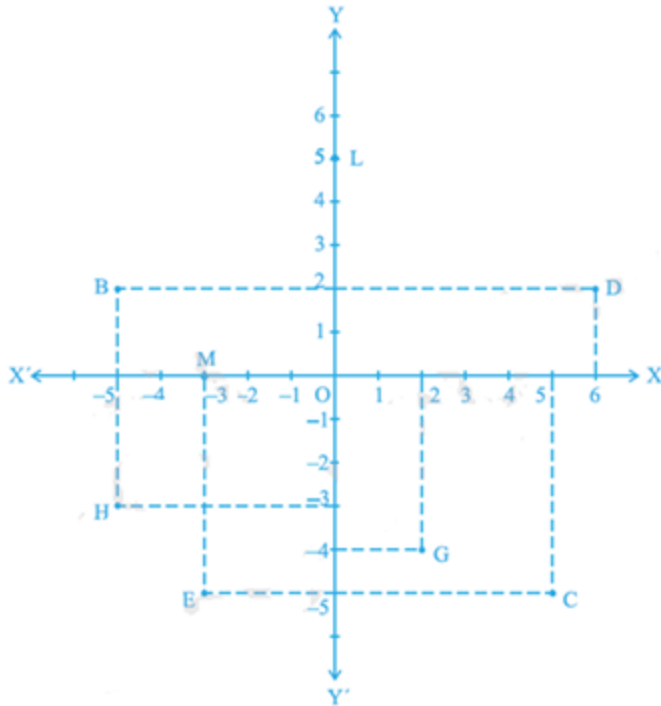
2.

Ans. We need to consider the given below figure to answer the following questions.

(i) The coordinates of point B in the above figure is the distance of point B from x-axis and y-axis. Therefore, we can conclude that the coordinates of point B are (-5, 2).

(ii) The coordinates of point C in the above figure is the distance of point C from x-axis and y-axis. Therefore, we can conclude that the coordinates of point C are (5, -5).

(iii) The point that represents the coordinates (-3, -5) is E.

(iv) The point that represents the coordinates (2, - 4) is G.

(v) The abscissa of point D in the above figure is the distance of point D from the y-axis. Therefore, we can conclude that the abscissa of point D is 6.

(vi) The ordinate of point H in the above figure is the distance of point H from the x-axis. Therefore, we can conclude that the abscissa of point H is -3.

(vii) The coordinates of point L in the above figure is the distance of point L from x-axis and y-axis. Therefore, we can conclude that the coordinates of point L are (0, 5).

(viii) The coordinates of point M in the above figure is the distance of point M from x-axis and y-axis. Therefore, we can conclude that the coordinates of point M are (-3, 0).

(Ex. 3.3)

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1. In which quadrant or on which axis do each of the points (- 2, 4), (3, - 1), (- 1, 0), (1, 2) and (- 3, - 5) lie ? Verify your answer by locating them on the Cartesian plane.

Ans. We need to determine the quadrant or axis of the points **(- 2, 4)**, (3, **- 1**), (- 1, 0), (1, 2) and **(- 3, - 5)**.
First, we need to plot the points **(- 2, 4)**, (3, **- 1**), (- 1, 0), (1, 2) and **(- 3, - 5)** on the graph, to get
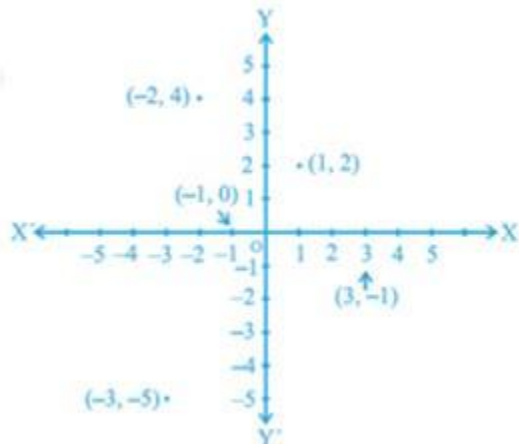
We need to determine the quadrant, in which the points **(- 2, 4)**, (3, **- 1**), (- 1, 0), (1, 2) and **(- 3, - 5)** lie.
From the figure, we can conclude that the point **(- 2, 4)** lie in IInd quadrant.
From the figure, we can conclude that the point (3, **- 1**) lie in IVth quadrant.
From the figure, we can conclude that the point (-1, 0) lie on x-axis.
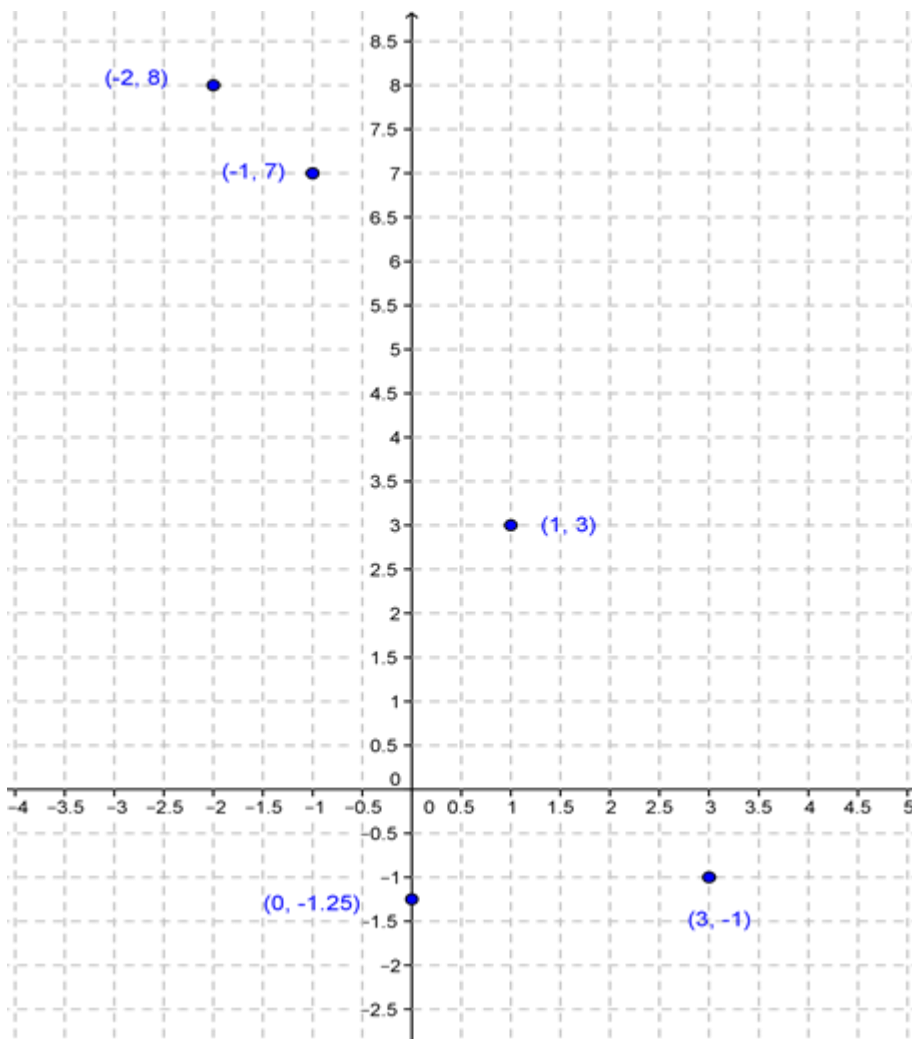From the figure, we can conclude that the point (1, 2) lie in Ist quadrant.
From the figure, we can conclude that the point **(- 3, - 5)** lie in IIIrd quadrant.

2. Plot the points (x, y) given in the following table on the plane, choosing suitable units of distance on the axes.

X	−2	−1	0	1	3
y	8	7	−1.25	3	−1

Ans. We need to plot the given below points on the graph by using a suitable scale.

X	−2	−1	0	1	3
y	8	7	−1.25	3	−1

1. **Basic Terms and Definitions**
2. **Intersecting Lines and Non-intersecting Lines**
3. **Pairs of Angles**
4. **Parallel Lines and a Transversal**
5. **Lines Parallel to the same Line**
6. **Angle Sum Property of a Triangle**

(1) **Point** - We often represent a point by a fine dot made with a fine sharpened pencil on a piece of paper.

(2) **Line** - A line is completely known if we are given any two distinct points. Line AB is represented by as . A line or a straight line extends indefinitely in both the directions.

(3) **Line segment** - A part (or portion) of a line with two end points is called a line segment.

(4) **Ray** - A part of line with one end point is called a ray.It usually denotes the direction of line

(5) **Collinear points** - If three or more points lie on the same line, they are called collinear points, otherwise they are called non-collinear points.

(6) **Angle** - An angle is the union of two non-collinear rays with a common initial point.

Types of Angles -

(1) **Acute angle** - An acute angle measure between and

(2**) Right angle** - A right angle is exactly equal to

(3) **Obtuse angle** - An angle greater than but less than

(4) **Straight angle** - A straight angle is equal to

(5) **Reflex angle** - An angle which is greater than but less than is called a reflex angle.

(6) **Complementary angles** - Two angles whose sum is are called complementary angles. Let one angle be x, then its complementary angle be

(7) **Supplementary angle** - Two angles whose sum is are called supplementary angles. Let one angle be x, then its supplementary angle be

(8) **Adjacent angles** -Two **angles** are **Adjacent** when they have a common side and a common vertex (corner point) and don't overlap.

(9**) Linear pair** - A **linear pair** of angles is formed when two lines intersect. Two angles are said to be **linear** if they are adjacent angles formed by two intersecting lines. The measure of a straight angle is 180 degrees, so a **linear pair** of angles must add up to 180 degrees

(10**) Vertically opposite angles** - Vertically opposite angles are formed when two lines intersect each other at a point. Vertically opposite angles are always equal.

TRANSVERSAL - A line which intersects two or more given lines at distinct points, is called a transversal of the given line.

(a) Corresponding angles

(b) Alternate interior angles

(c) Alternate exterior angles

(d) Interior angles on the same side of the transversal.

- If a transversal intersects two parallel lines, then

(i) each pair of corresponding angles is equal.

(ii) each pair of alternate interior angles is equal.

(iii) each pair of interior angle on the same side of the transversal is supplementary.

- If a transversal interacts two lines such that, either

(i) any one pair of corresponding angles is equal, or

(ii) any one pair of alternate interior angles is equal or

(iii) any one pair of interior angles on the same side of the transversal is supplementary ,then the lines are parallel.

- Lines which are parallel to a given line are parallel to each other.
- The sum of the three angles of a triangle is
- The sum of all angles round a point is equal to
- If a side of a triangle is produced, the exterior angle so formed is equal to the sum of the two interior opposite angles.
- If two parallel lines are intersected by a transversal, the bisectors of any pair of alternate interior angles are parallel and vice-versa.
- If two parallel lines are intersected by a transversal, then bisectors of any two corresponding angles are parallel and vice-versa.
- If a line is perpendicular to one of the given parallel lines, then it is also perpendicular to the other line.

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1. In Fig. 6.13, lines AB and CD intersect at O. If $\angle AOC + \angle BOE = 70°$ **and** $\angle BOD = 40°$, **find** $\angle BOE$ **and reflex** $\angle COE$ **.**
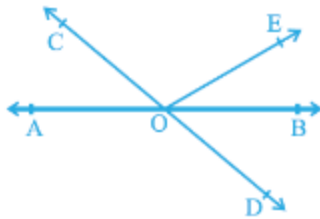

Fig. 6.13

Ans. We are given that $\angle AOC + \angle BOE = 70°$ and $\angle BOD = 40°$.

We need to find $\angle BOE \text{ and reflex } \angle COE$.

From the given figure, we can conclude that form a linear pair.

We know that sum of the angles of a linear pair is $180°$.

$\therefore \angle AOC + \angle BOE + \angle COE = 180°$
$\Rightarrow 70° + \angle COE = 180°$
$\Rightarrow \angle COE = 180° - 70°$
$= 110°$.

Reflex $\angle COE = 360° - \angle COE$
$= 360° - 110°$
$= 250°$.
$\angle AOC = \angle BOD$ (Vertically opposite angles), or
$\angle BOD + \angle BOE = 70°$.
But, we are given that $\angle BOD = 40°$.
$40° + \angle BOE = 70°$

$\angle BOE = 70° - 40°$

$= 30°.$

Therefore, we can conclude that $\text{Reflex } \angle COE = 250°$ and $\angle BOE = 30°$.

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2. In Fig. 6.14, lines XY and MN intersect at O. If $\angle POY = 90°$ and *a:b* = 2 : 3, find *c*.

Fig. 6.14
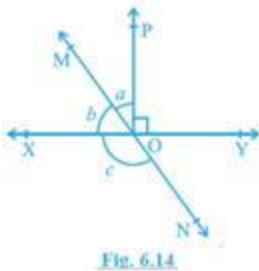
Ans. We are given that $\angle POY = 90°$ and $a:b = 2:3$.

We need find the value of *c* in the given figure.

Let *a* be equal to *2x* and *b* be equal to *3x*.

$\because a + b = 90° \Rightarrow 2x + 3x = 90° \Rightarrow 5x = 90°$

$\Rightarrow x = 18°$

Therefore $b = 3 \times 18° = 54°$

Now $b + c = 180°$ [Linear pair]

$\Rightarrow 54° + c = 180°$

$\Rightarrow c = 180° - 54° = 126°$

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3. In the given figure, $\angle PQR = \angle PRQ$, then prove that $\angle PQS = \angle PRT$.
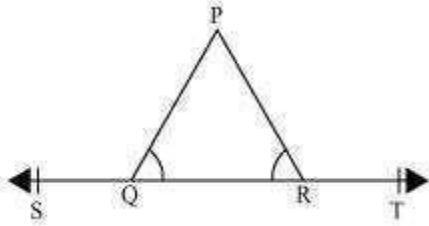
Ans. We need to prove that $\angle PQS = \angle PRT$.

We are given that $\angle PQR = \angle PRQ$.

From the given figure, we can conclude that
$\angle PQS$ and $\angle PQR$, and $\angle PRS$ and $\angle PRT$ form a linear pair.

We know that sum of the angles of a linear pair is $180°$.

$\therefore \angle PQS + \angle PQR = 180°$, and (i)

$\angle PRQ + \angle PRT = 180°$. (ii)

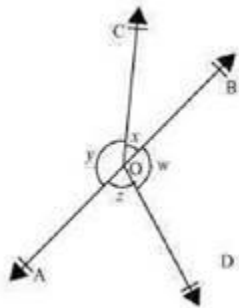From equations (i) and (ii), we can conclude that
$\angle PQS + \angle PQR = \angle PRQ + \angle PRT$.

But, $\angle PQR = \angle PRQ$.

$\therefore \angle PQS = \angle PRT$.

Therefore, the desired result is proved.

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4. In Fig. 6.16, if *x* + *y* = *w* + *z*, then prove that AOB is a line.

Ans. We need to prove that *AOB* is a line.

We are given that $x + y = w + z$.

We know that the sum of all the angles around a fixed point is $360°$.

Thus, we can conclude that $\angle AOC + \angle BOC + \angle AOD + \angle BOD = 360°$, or
$y + x + z + w = 360°$.

But, $x + y = w + z$ (Given).

$2(y+x) = 360^\circ.$

$y+x = 180^\circ.$

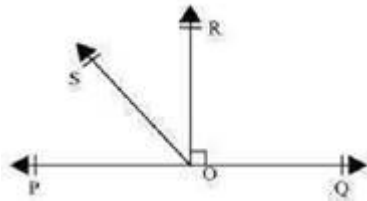From the given figure, we can conclude that y and x form a linear pair.

We know that if a ray stands on a straight line, then the sum of the angles of linear pair formed by the ray with respect to the line is 180°.

$y+x = 180^\circ$.

Therefore, we can conclude that AOB is a line.

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5. In the given figure, POQ is a line. Ray OR is perpendicular to line PQ. OS is another ray lying between rays OP and OR. Prove that

$\angle ROS = \dfrac{1}{2}(\angle QOS - \angle POS).$

Ans. We need to prove that $\angle ROS = \dfrac{1}{2}(\angle QOS - \angle POS)$.

We are given that OR is perpendicular to PQ, or

$\angle QOR = 90^\circ.$

From the given figure, we can conclude that $\angle POR$ and $\angle QOR$ form a linear pair.

We know that sum of the angles of a linear pair is 180°.

$\therefore \ \angle POR + \angle QOR = 180^\circ$, or

$\angle POR = 90^\circ$.

From the figure, we can conclude that $\angle POR = \angle POS + \angle ROS$.

$\Rightarrow \angle POS + \angle ROS = 90^\circ$, or

$\angle ROS = 90^\circ - \angle POS$ ...(i)

From the given figure, we can conclude that $\angle QOS$ and $\angle POS$ form a linear pair.

We know that sum of the angles of a linear pair is $180°$.
$\angle QOS + \angle POS = 180°$, or
$\frac{1}{2}(\angle QOS + \angle POS) = 90°$.(ii)

Substitute (ii) in (i), to get
$\angle ROS = \frac{1}{2}(\angle QOS + \angle POS) - \angle POS$
$= \frac{1}{2}(\angle QOS - \angle POS)$.

Therefore, the desired result is proved.

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6. It is given that $\angle XYZ = 64°$ and XY is produced to point P. Draw a figure from the given information. If ray YQ bisects $\angle ZYP$,
find $\angle XYQ$ and reflex $\angle QYP$

Ans. We are given that $\angle XYZ = 64°$, XY is produced to P and YQ bisects $\angle ZYP$.

We can conclude the given below figure for the given situation:
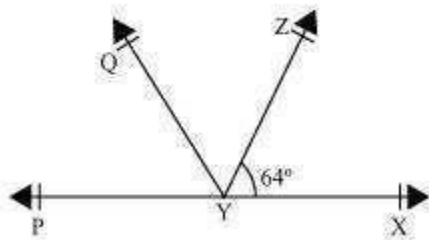
We need to find $\angle XYQ$ and reflex $\angle QYP$.

From the given figure, we can conclude that $\angle XYZ$ and $\angle ZYP$ form a linear pair.

We know that sum of the angles of a linear pair is $180°$.
$\angle XYZ + \angle ZYP = 180°$.

But $\angle XYZ = 64°$.
$\Rightarrow 64° + \angle ZYP = 180°$
$\Rightarrow \angle ZYP = 116°$.

Ray *YQ* bisects $\angle ZYP$, or

$$\angle QYZ = \angle QYP = \frac{116^\circ}{2} = 58^\circ$$

$$\angle XYQ = \angle QYZ + \angle XYZ$$
$$= 58^\circ + 64^\circ = 122^\circ.$$

Reflex $\angle QYP = 360^\circ - \angle QYP$
$$= 360^\circ - 58^\circ$$
$$= 302^\circ.$$

Therefore, we can conclude that $\angle XYQ = 122^\circ$ and Reflex $\angle QYP = 302^\circ$

(Ex. 6.2)

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1. In the given figure, find the values of x and y and then show that AB || CD.
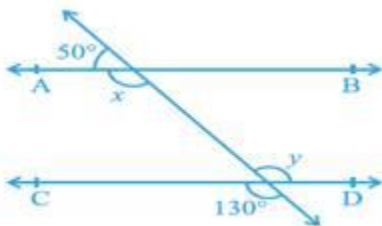
Ans. We need to find the value of *x* and *y* in the figure given below and then prove that $AB \parallel CD$.

From the figure, we can conclude that

$y = 130^\circ$ (Vertically opposite angles), and

x and 50° form a pair of linear pair.

We know that the sum of linear pair of angles is 180°.

$x + 50^\circ = 180^\circ$

$x = 130°$.

$x = y = 130°$.

From the figure, we can conclude that x and y form a pair of alternate interior angles corresponding to the lines *AB* and *CD*.
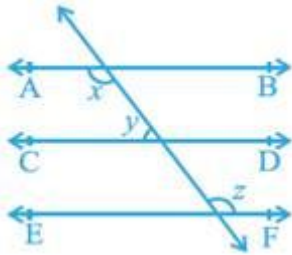
Therefore, we can conclude that $x = 130°, y = 130°$ and $AB \parallel CD$.

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2. In the given figure, if AB || CD, CD || EF and y : z = 3: 7, find x.

Ans. We are given that $AB \parallel CD$, $CD \parallel EF$ and $y : z = 3 : 7$.

We need to find the value of *x* in the figure given below.

We know that lines parallel to the same line are also parallel to each other.

We can conclude that $AB \parallel CD \parallel EF$.

Let Angles be $y = 3a$ and $z = 7a$.

We know that angles on same side of a transversal are supplementary.

$\therefore \ x + y = 180°$.

$x = z$ (Alternate interior angles)

$z + y = 180°$, or

$7a + 3a = 180°$

$\Rightarrow 10a = 180°$

$a = 18°.$

$z = 7a = 126°$

$y = 3a = 54°.$

Now $x + 54° = 180°$

$x = 126°.$

Therefore, we can conclude that $x = 126°$.

---

3. In the given figure, If AB || CD, $EF \perp CD$ and $\angle GED = 126°$, find $\angle AGE, \angle GEF$ and $\angle FGE$.
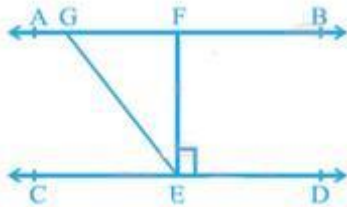
Ans. We are given that $AB \parallel CD$, $EF \perp CD$ and $\angle GED = 126°$.

We need to find the value of $\angle AGE, \angle GEF$ and $\angle FGE$ in the figure given below.

$\angle GED = 126°$

$\angle GED = \angle FED + \angle GEF.$

But, $\angle FED = 90°.$

$126° = 90° + \angle GEF$

$\Rightarrow \angle GEF = 36°.$

$\because \angle AGE = \angle GED$ (Alternate angles)

$\therefore \angle AGE = 126°.$

From the given figure, we can conclude that $\angle FED$ and $\angle FEC$ form a linear pair.

We know that sum of the angles of a linear pair is $180°$.

$\angle FED + \angle FEC = 180°$

$\Rightarrow 90° + \angle FEC = 180°$

$\Rightarrow \angle FEC = 90°$

$\angle FEC = \angle GEF + \angle GEC$

$\therefore 90° = 36° + \angle GEC$

$\Rightarrow \angle GEC = 54°$.

$\angle GEC = \angle FGE = 54°$ (Alternate interior angles)

Therefore, we can conclude that $\angle AGE = 126°, \angle GEF = 36°$ and $\angle FGE = 54°$.

---

4. In the given figure, if PQ || ST, $\angle PQR = 110°$ and $\angle RST = 130°$, find $\angle QRS$.

[Hint: Draw a line parallel to ST through point R.]
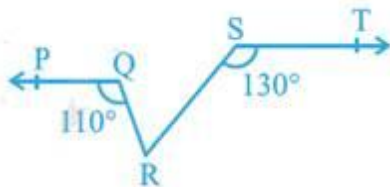
Ans. We are given that $PQ \parallel ST$, $\angle PQR = 110°$ and $\angle RST = 130°$.

We need to find the value of $\angle QRS$ in the figure.
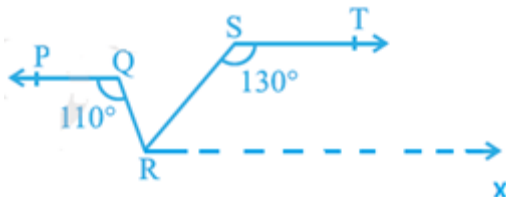
We need to draw a line *RX* that is parallel to the line *ST*, to get

Thus, we have $ST \parallel RX$.

We know that lines parallel to the same line are also parallel to each other.

We can conclude that $PQ \parallel ST \parallel RX$.

$\angle PQR = \angle QRX$ (Alternate interior angles)

So $\angle QRX = 110^\circ$.

We know that angles on same side of a transversal are supplementary.

$\angle RST + \angle SRX = 180^\circ \Rightarrow 130^\circ + \angle SRX = 180^\circ$

$\Rightarrow \angle SRX = 180^\circ - 130^\circ = 50^\circ$.

From the figure, we can conclude that

$\angle QRX = \angle SRX + \angle QRS \Rightarrow 110^\circ = 50^\circ + \angle QRS$

$\Rightarrow \angle QRS = 60^\circ$.

Therefore, we can conclude that $\angle QRS = 60^\circ$.

---

5. In the given figure, if AB || CD, $\angle APQ = 50^\circ$ and $\angle PRD = 127^\circ$, find x and y.
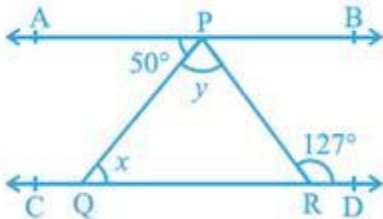
Ans. We are given that $AB \parallel CD$, $\angle APQ = 50^\circ$ and $\angle PRD = 127^\circ$.

We need to find the value of *x* and *y* in the figure.

$\angle APQ = x = 50^\circ$. (Alternate interior angles)

$\angle PRD = \angle APR = 127^\circ$. (Alternate interior angles)

$\angle APR = \angle QPR + \angle APQ$.

$127° = y + 50° \Rightarrow y = 77°$.

Therefore, we can conclude that $x = 50°$ and $y = 77°$.

---

6. In the given figure, PQ and RS are two mirrors placed parallel to each other. An incident ray AB strikes the mirror PQ at B, the reflected ray moves along the path BC and strikes the mirror RS at C and again reflects back along CD. Prove that AB || CD.

Ans. We are given that *PQ* and *RS* are two mirrors that are parallel to each other.
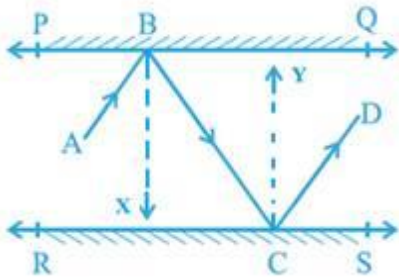
We need to prove that $AB \parallel CD$ in the figure.

Let us draw lines *BX* and *CY* that are parallel to each other, to get $AB \parallel CD$

We know that according to the laws of reflection

$\angle ABX = \angle CBX$ and $\angle BCY = \angle DCY$.

$\angle BCY = \angle CBX$ (Alternate interior angles)

We can conclude that $\angle ABX = \angle CBX = \angle BCY = \angle DCY$.

From the figure, we can conclude that

$\angle ABC = \angle ABX + \angle CBX$, and $\angle DCB = \angle BCY + \angle DCY$.

Therefore, we can conclude that $\angle ABC = \angle DCB$.

From the figure, we can conclude that $\angle ABC$ and $\angle DCB$ form a pair of alternate interior angles corresponding to the lines *AB* and *CD*, and transversal *BC*.

Therefore, we can conclude that $AB \parallel CD$.

(Ex. 6.3)

---

1. In the given figure, sides QP and RQ of ΔPQR are produced to points S and T respectively. If $\angle$ SPR = 135⁰ and $\angle$ PQT = 110⁰, find $\angle$ PRQ.
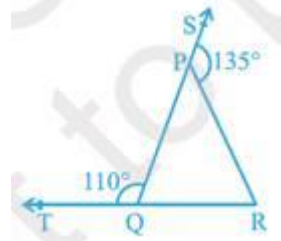
Ans. We are given that $\angle SPR = 135°$ and $\angle PQT = 110°$.

We know that the sum of angles of a linear pair is $180°$.

$\angle SPR + \angle RPQ = 180°$, (Linear Pair axiom)

and $\angle PQT + \angle PQR = 180°$ (Linear Pair axiom)

$135° + \angle RPQ = 180°$, and $110° + \angle PQR = 180°$,

Or, $\angle RPQ = 45°$, and $\angle PQR = 70°$.

From the figure, we can conclude that

$\angle PQR + \angle RPQ + \angle PRQ = 180°$.(Angle sum property)

$\Rightarrow 70° + 45° + \angle PRQ = 180° \Rightarrow 115° + \angle PRQ = 180°$

$\Rightarrow \angle PRQ = 65°.$

Therefore, we can conclude that $\angle PRQ = 65°$.

---

2. In the given figure, $\angle$ X = 62⁰, $\angle$ XYZ = 54⁰. If YO and ZO are the bisectors of $\angle$ XYZ and $\angle$ XZY respectively of ΔXYZ, find $\angle$ OZY and $\angle$ YOZ.
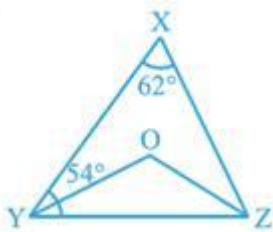
Ans. We are given that $\angle X = 62°, \angle XYZ = 54°$ and *YO* and *ZO* are bisectors of $\angle XYZ$ and $\angle XZY$, respectively.

We need to find $\angle OZY$ and $\angle YOZ$ in the figure.

From the figure, we can conclude that in $\triangle XYZ$

$\angle X + \angle XYZ + \angle XZY = 180°.$(Angle sum property)

$\Rightarrow 62° + 54° + \angle XZY = 180° \Rightarrow 116° + \angle XZY = 180°$

$\Rightarrow \angle XZY = 64°.$

We are given that *OY* and *OZ* are the bisectors of $\angle XYZ$ and $\angle XZY$, respectively.

and

From the figure, we can conclude that in $\triangle OYZ$

$\angle OYZ + \angle OZY + \angle YOZ = 180°$ (Angle sum property)

$27° + 32° + \angle YOZ = 180°$

$$\Rightarrow 59^{\circ} + \angle YOZ = 180^{\circ}$$

$$\Rightarrow \angle YOZ = 121^{\circ}.$$

Therefore, we can conclude that $\angle YOZ = 121^{\circ}$ and $\angle OZY = 32^{\circ}$.

---

3. In the given figure, if AB || DE, $\angle$ BAC = 35⁰ and $\angle$ CDE = 53⁰, find $\angle$ DCE.
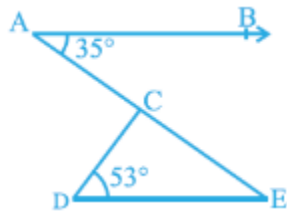
Ans. We are given that $AB \parallel DE$, $\angle BAC = 35^{\circ}$ and $\angle CDE = 53^{\circ}$.

We need to find the value of $\angle DCE$ in the figure given below.

From the figure, we can conclude that

$\angle BAC = \angle CED = 35^{\circ}$ (Alternate interior)

From the figure, we can conclude that in ΔDCE

$\angle DCE + \angle CED + \angle CDE = 180^{\circ}$ (Angle sum property)

$\angle DCE + 35^{\circ} + 53^{\circ} = 180$

$$\Rightarrow \angle DCE + 88^{\circ} = 180^{\circ}$$

$$\Rightarrow \angle DCE = 92^{\circ}.$$

Therefore, we can conclude that $\angle DCE = 92^{\circ}$.

---

4. In the given figure, if lines PQ and RS intersect at point T, such that $\angle$ PRT = 40⁰,

∠RPT = 95⁰ and ∠TSQ = 75⁰, find ∠SQT.

Fig. 6.42

Ans. We are given that $\angle PRT = 40°$, $\angle RPT = 95°$ and $\angle TSQ = 75°$.

We need to find the value of $\angle SQT$ in the figure.

From the figure, we can conclude that in $\triangle RTP$

$\angle PRT + \angle RTP + \angle RPT = 180°$ (Angle sum property)

$40° + \angle RTP + 95° = 180°$

$\Rightarrow \angle RTP + 135° = 180°$

$\Rightarrow \angle RTP = 45°$.

From the figure, we can conclude that

$\angle RTP = \angle STQ = 45°$ (Vertically opposite angles)

From the figure, we can conclude that in $\triangle STQ$

$\angle SQT + \angle STQ + \angle TSQ = 180°$ (Angle sum property)

$\angle SQT + 45° + 75° = 180° \Rightarrow \angle SQT + 120° = 180°$

$\Rightarrow \angle SQT = 60°$.

Therefore, we can conclude that $\angle SQT = 60°$.

---

5. In the given figure, if $PQ \perp PS$, PQ || SR, $\angle SQR = 28°$ and $\angle QRT = 65°$, then find the values of x and y.
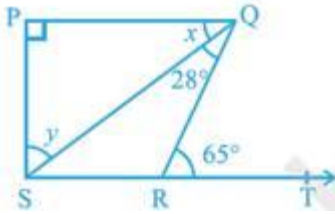
Ans. We are given that $PQ \perp PS, PQ \parallel SR, \angle SQR = 28°$ and $\angle QRT = 65°$.

We need to find the values of *x* and *y* in the figure.

We know that "If a side of a triangle is produced, then the exterior angle so formed is equal to the sum of the two interior opposite angles."

From the figure, we can conclude that

$\angle SQR + \angle QSR = \angle QRT$, or

$28° + \angle QSR = 65°$

$\Rightarrow \angle QSR = 37°$

From the figure, we can conclude that

$x = \angle QSR = 37°$ (Alternate interior angles)

From the figure, we can conclude that $\triangle PQS$

$\angle PQS + \angle QSP + \angle QPS = 180°$ (Angle sum property)

$\angle QPS = 90°$ $(PQ \perp PS)$

$x + y + 90° = 180°$

Therefore, we can conclude that

---

6. In the given figure, the side QR of △PQR is produced to a point S. If the bisectors of $\angle PQR$ and $\angle PRS$ **meet at point T, then prove that**

$$\angle QTR = \frac{1}{2} \angle QPR.$$
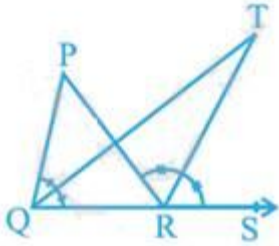
Ans. We need to prove that $\angle QTR = \frac{1}{2} \angle QPR$ in the figure given below.

We know that "If a side of a triangle is produced, then the exterior angle so formed is equal to the sum of the two interior opposite angles."

From the figure, we can conclude that in $\triangle QTR$, $\angle TRS$ is an exterior angle

$\angle QTR + \angle TQR = \angle TRS$, or

$\angle QTR = \angle TRS - \angle TQR$ ...(i)

From the figure, we can conclude that in, is an exterior angle

$\angle QPR + \angle PQR = \angle PRS.$

We are given that QT and RT are angle bisectors of $\angle PQR$ and $\angle PRS.$

$\angle QPR + 2\angle TQR = 2\angle TRS$

$\angle QPR = 2(\angle TRS - \angle TQR).$

We need to substitute equation (*i*) in the above equation, to get

$\angle QPR = 2\angle QTR$, or

$\angle QTR = \frac{1}{2} \angle QPR.$

Therefore, we can conclude that the desired result is proved.

1. teaching children music

Ans. With the coveted award resting on his chest and his eyes glinting with rare happiness he said, "All I would like to say is: Teach your children music, this is Hindustan's richest tradition; even the West is now coming to learn our music."

2. the film world

Ans. "I just can't come to terms with the artificiality and glamour of the film world," he says with emphasis.

3. migrating to the U.S.A.

Ans. But Khansaab asked him if he would be able to transport River Ganga as well. Later he is remembered to have said, "That is why whenever I am in a foreign country, I keep yearning to see Hindustan."

4. playing at temples

Ans. For years to come the temple of Balaji and Mangala Maiya and the banks of the Ganga became the young apprentice's favourite haunts where he could practise in solitude.

5. getting the Bharat Ratna

Ans. With the coveted award resting on his chest and his eyes glinting with rare happiness...

6. the banks of the Ganga

Ans. ...and the banks of the Ganga became the young apprentice's favourite haunts where he could practise in solitude.
But Khansaab asked him if he would be able to transport River Ganga as well.

7. leaving Benaras and Dumraon

Ans. "While in Mumbai, I think of only Benaras and the holy Ganga. And while in Benaras, I miss the unique *mattha* of Dumraon."

III. **Answer these questions in 30–40 words.**

1. Why did Aurangzeb ban the playing of the pungi?

Ans. Emperor Aurangzeb banned the playing of the pungi in the royal residence because its sound was shrill and unpleasant.

2. How is a shehnai different from a pungi?

Ans. The shehnai has a better tonal quality than the pungi. It is longer and broader than the pungi. The shehnai is the improved form of the pungi.

3. **Where was the shehnai played traditionally? How did Bismillah Khan change this?**

Ans. Traditionally, the shehnai was part of the naubat or traditional ensemble of nine instruments played at royal courts. Until recently, it was played exclusively in temples and weddings. Bismillah Khan changed this by bringing the shehnai onto the stage of Hindustani classical music and giving it a much wider audience.

4. **When and how did Bismillah Khan get his big break?**

Ans. Bismillah Khan got his big break in 1938 in Lucknow with the commencement of the All India Radio. He began to play the shehnai for the radio regularly and gained immense popularity.

5. **Where did Bismillah Khan play the shehnai on 15 August 1947? Why was the event historic?**

Ans. On 15 August 1947, Bismillah Khan played the shehnai at the Red Fort. The event was historic because it was the day when India got its independence from British Rule.

6. **Why did Bismillah Khan refuse to start a shehnai school in the U.S.A.?**

Ans. Bismillah Khan refused to start a shehnai school in the US because he did not wish to live away from Benaras, the river Ganga and his native Dumraon. He loved his country too much to want to migrate from it.

7. **Find at least two instances in the text which tell you that Bismillah Khan loved India and Benaras.**

Ans. The instances are
   i. When he first started playing the shehnai, Bismillah would play for hours on the banks of River Ganga and in the temples of Benaras.
   ii. When he got a chance to start a shehnai school in the US, he refused the offer as that would have meant leaving India.

Thinking about Language

Notre Dame School

Sub- Biology class 9

Chapter- 7

Diversity in living organisms

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1.There are a wide range of life forms (about 10 million –13 million species) around us. These life forms have existed and evolved on the Earth over millions of years ago. The huge range of these life forms makes it very difficult to study them one by one. Therefore, we look for similarities among them and classify them into different classes to study these different classes as a whole. Thus, classification makes our study easier.

2.Examples of range of variations observed in daily life are:

(i)   Variety of living organisms in terms of size ranges from microscopic bacteria to tall trees of 100 metres.

(ii)   The colour, shape, and size of snakes are completely different from those of lizards.

(iii)   The life span of different organisms is also quite varied. For example, a crow lives for only 15 years, whereas a parrot lives for about 140 years.

1.The kind of cells that living organisms are made up of is a more basic characteristic for classifying organisms, than on the basis of their habitat. This is because on the basis of the kind of cells, we can classify all living organisms into eukaryotes and prokaryotes. On the other hand, a habitat or the place where an organism lives is a very broad characteristic to be used as the basis for classifying organisms. For example, animals that live on land include earthworms, mosquitoes, butterfly, rats, elephants, tigers, etc. These animals do not resemble each other except for the fact that they share a common habitat. Therefore, the nature or kind of a cell is considered to be a fundamental characteristic for the classification of living organisms.

2.The primary characteristic on which the first division of organisms is made is the nature of the cell. It is considered to be the fundamental characteristic for classifying all living organisms. Nature of the cell includes the presence or absence of membrane-bound organelles. Therefore, on the basis of this fundamental characteristic, we can classify all living organisms into two broad categories of eukaryotes and prokaryotes. Then, further classification is made on the basis of cellularity or modes of nutrition.

3.Plants and animals differ in many features such as the absence of chloroplasts, presence of cell wall, etc. But, locomotion is considered as the characteristic feature that separates animals from plants. This is because the absence of locomotion in plants gave rise to many structural changes such as the presence of a cell wall (for protection), the presence of chloroplasts (for photosynthesis) etc. Hence, locomotion is considered to be the basic characteristic as further differences arose because of this characteristic feature.

1.A primitive organism or lower organism is the one which has a simple body structure and ancient body design or features that have not changed much over a period of time. An advanced organism or higher organism has a complex body structure and organization. For example, an Amoeba is more primitive as compared to a starfish. Amoeba has a simple body structure and primitive features as compared to a starfish. Hence, an Amoeba is considered more primitive than a starfish.

2.It is not always true that an advanced organism will have a complex body structure. But, there is a possibility that over the evolutionary time, complexity in body design will increase. Therefore, at times, advanced organisms can be the same as complex organisms.

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1.The criterion for the classification of organisms belonging to kingdom Monera or Protista is the presence or absence of a well-defined nucleus or membrane-bound organelles. Kingdom Monera includes organisms that do not have a well-defined nucleus or membrane-bound organelles and these are known as prokaryotes. Kingdom Protista, on the other hand, includes organisms with a well-defined nucleus and membrane-bound organelles and these organisms are called eukaryotes.

2.Kingdom Protista includes single celled, eukaryotic, and photosynthetic organisms.

3.In the hierarchy of classification,a species will have the smallest number of organisms with a maximum of characteristics in common, whereas the kingdom will have the largest number of organisms.

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1.Thallophyta is the division of plants that has the simplest organisms. This group includes plants, which do not contain a well differentiated

plant body. Their body is not differentiated into roots, stems, and leaves. They are commonly known as algae.

2.

Pteridophyta	Phanerogams
They have inconspicuous or less differentiated reproductive organs.	They have well developed reproductive organs.
They produce naked embryos called spores.	They produce seeds.
Ferns, Marsilea, Equisetum, etc. are examples of pteridophyta.	Pinus, Cycas, fir, etc. are examples of phanerogams.

3.

Gymnosperm	Angiosperm
They are non-flowering plants.	They are flowering plants.
Naked seeds not enclosed inside fruits are produced.	Seeds are enclosed inside fruits.
Pinus, Cedar, fir, Cycas, etc.	Coconut, palm, mango,

are some examples of gymnosperms.	etc. are some examples of angiosperms.

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1.

Porifera	Coelenterate
1.They are mostly marine, non-motile, and found attached to rocks.	1.They are exclusively marine animals that either live in colonies or have a solitary life-span.
2.They show cellular level of organisation.	2.They show tissue level of organisation.
3.Spongilla, Euplectella, etc. are poriferans.	3.Hydra, sea anemone, corals, etc. are coelenterates.

2.

Annelids	Arthropods
1.The circulatory system of annelids is closed.	1.Arthropods have an open circulatory system.
2.The body is	2.The body is

divided into several identical segments.	divided into few specialized segments.

3.

Amphibian	Reptiles
1.They have a dual mode of life.	1.They are completely terrestrial.
2.Scales are absent.	2.Skin is covered with scales.
3.They lay eggs in water.	3.They lay eggs on land.
4.It includes frogs, toads, and salamanders.	It includes lizards, snakes, turtles, chameleons, etc.

4.

Aves	Mammals
1.Most birds have feathers and they possess a beak.	They do not have feathers and the beak is also absent.
2.They lay eggs. Hence, they are oviparous.	2.Some of them lay eggs and some give birth to young

	ones. Hence, they are both oviparous and viviparous.

Exercise

1.There are a wide range of life forms (about 10 million-13 million species) around us. These life forms have existed and evolved on the Earth over millions of years ago. The huge range of these life forms makes it very difficult to study them one by one. Therefore, we look for similarities among them and classify them into different classes so that we can study these different classes as a whole. This makes our study easier.

Therefore, classification serves the following advantages:

    (i)   It determines the methods of organising the diversity of life on Earth.

    (ii)   It helps in understanding millions of life forms in detail.

    (iii)   It also helps in predicting the line of evolution.

2.For developing a hierarchy of classification, we choose the fundamental characteristic among several other characteristics. For example, plants differ from animals in the absence of locomotion, chloroplasts, cell wall, etc. But, only locomotion is considered as the basic or fundamental feature that is used to distinguish between

plants and animals. This is because the absence of locomotion in plants gave rise to many structural changes such as the presence of a cell wall for protection, and the presence of chloroplast for photosynthesis (as they cannot move around in search of food like animals). Thus, all these features are a result of locomotion. Therefore, locomotion is considered to be a fundamental characteristic. By choosing the basic or fundamental characteristic, we can make broad divisions in living organisms as the next level of characteristic is dependent on these. This goes on to form a hierarchy of characteristics.

3.R.H. Whittaker proposed a five kingdom classification of living organisms on the basis of Linnaeus' system of classification. The five kingdoms proposed by Whittaker are Monera, Protista, Fungi, Plantae, and Animalia.

The basis for grouping organisms into five kingdoms is as follows:

(i)   On the basis of the presence or absence of membrane-bound organelles, all living organisms are divided into two broad categories of eukaryotes and prokaryotes. This division lead to the formation of kingdom Monera, which includes all prokaryotes.

(ii)   Then, eukaryotes are divided as unicellular and multicellular, on the basis of cellularity. Unicellular eukaryotes form kingdom Protista, and multicellular eukaryotes form kingdom Fungi, Plantae, and Animalia.

(iii)   Animals are then separated on the basis of the absence of a cell wall.

(iv)   Since fungi and plants both contain a cell wall, they are separated into different kingdoms on the basis of their modes of nutrition. Fungi have saprophytic mode of nutrition, whereas plants have autotrophic mode of nutrition. This results in the formation of the five kingdoms.
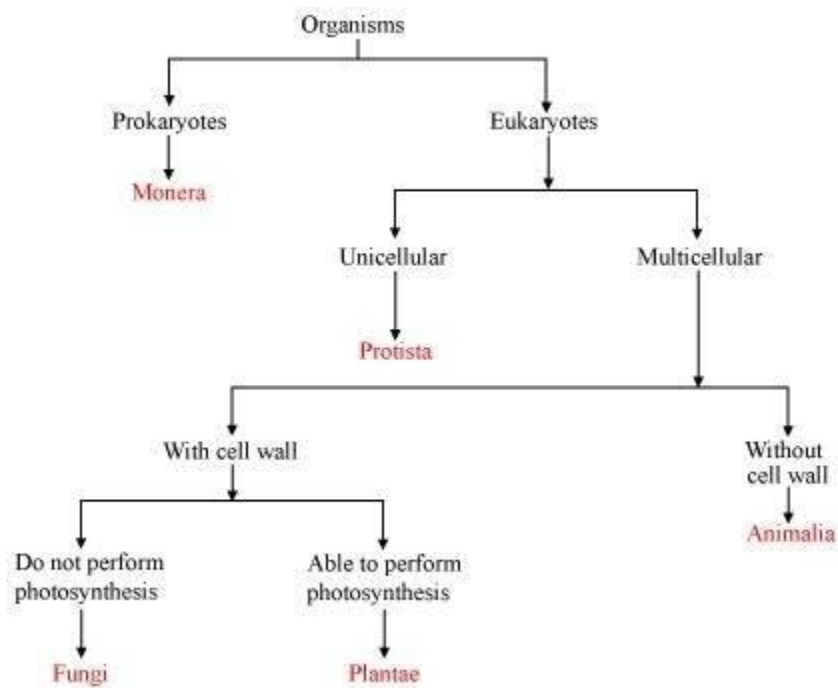
4.The kingdom Plantae is divided into five main divisions: Thallophyta, Bryophyta, Pteridophyta, Gymnosperms, and Angiosperms.

The classification depends on the following criteria:

• Differentiated/ Undifferentiated plant body

• Presence /absence of vascular tissues

• With/without seeds

• Naked seeds/ seeds inside fruits

(i)   The first level of classification depends on whether a plant body is well differentiated or not. A group of plants that do not have a well differentiated plant body are known as Thallophyta.

(ii)   Plants that have well differentiated body parts are further divided on the basis of the presence or absence of vascular tissues. Plants without specialised vascular tissues are included in division Bryophyta, whereas plants with vascular tissues are known as Tracheophyta.

(iii)   Tracheophyta is again sub-divided into division Pteridophyta, on the basis of the absence of seed formation.

4.The other group of plants having well developed reproductive organs that finally develop seeds are called Phanerogams. This group is further sub- divided on the basis of whether the seeds are naked or enclosed in fruits. This classifies them into gymnosperms and angiosperms. Gymnosperms are seed bearing, non-flowering plants, whereas angiosperms are flowering plants in which the seeds are enclosed inside the fruit.

Plants

Do not have differentiated plant body → Thallophyta

Have differentiated plant body

Without specialised vascular tissue → Bryophyta

With vascular tissue

Do not produce seeds → Pteridophyta

Produce seeds (Phanerogams)

Bear naked seeds → Gymnosperms

Bear seeds inside fruits → Angiosperms
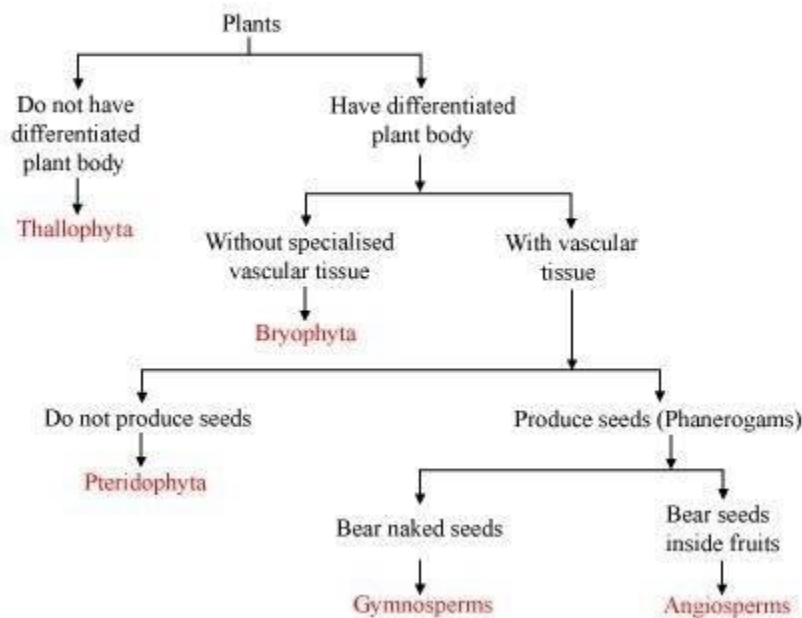
5. Criteria for deciding divisions in plants are:

(i)   Differentiated/ Undifferentiated plant body

(ii)   Presence/ absence of vascular tissues

(iii)   With/without seeds

(iv)   Naked seeds/ seeds inside fruits
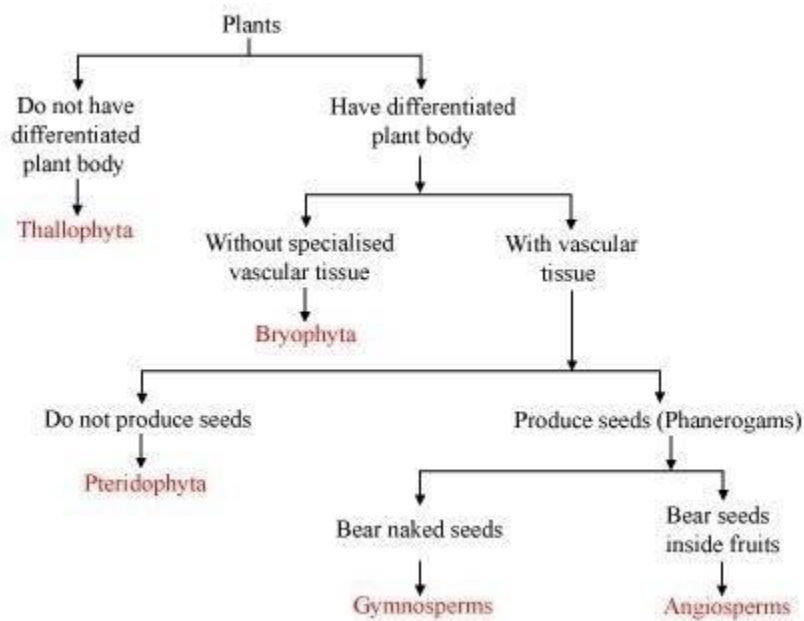
Criteria for deciding subgroups among animals are:
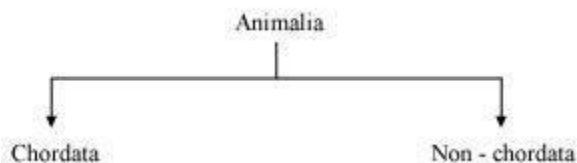
Kingdom Animalia is divided into two major groups on the basis of the presence or absence of a notochord.

```
1. True Tissue        ⎡ Absent
                      ⎣ Present

2. Body cavity        ⎡ Absent
                      ⎣ Present

3. Type of body symmetry    ⎡ Radial
                            ⎣ Bilateral

4. Type of coelom development    ⎡ Acoelom
                                 ⎢ Pseudocoleom
                                 ⎣ True coleom

5. Types of true coelom    ⎡ Enterocoleom
                           ⎣ Schizocoleom
```

Non-chordates do not possess a notochord, while all members of the phylum chordates possess a notochord.

Non-chordate is further divided into subgroups on the basis of the following features:

On the basis of the above features, non-chordates are divided into the following subgroups: Porifera, Coelenterate, Platyhelminthes, Nematodes, Annelids, Molluscs, Arthropoda, and Echinodermata.
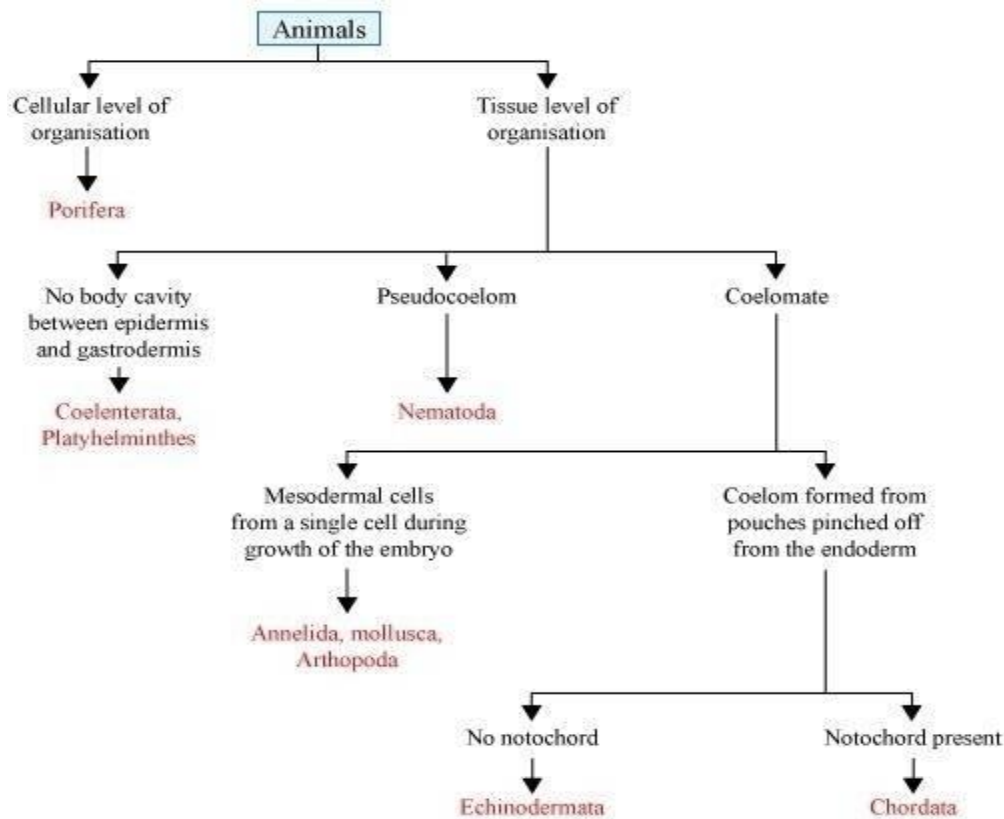
All members of the phylum chordate possess a notochord. However, some animals such as Balanoglossus, Amphioxus, Herdmania, etc. have a notochord, which is either absent or does not run the entire length of the animal's body. Therefore, these animals are kept in a separate sub-phylum called Protochordata, and the rest of the chordates are included in the sub-phylum vertebrata. The members of the sub-phylum vertebrata are advanced chordates. They are divided into five classes: Pisces, Amphibian, Reptilia, Aves, and Mammalia.

```
                        Phylum Chordata
                              |
         _____|_____
        |                                           |
  Notochord present                          Notochord replaced by
  at larval stages;                          vertebral column in
  very rudimentary                                 adults
        |                                           |
        ↓                                           ↓
    Sub-phylum                                  Sub-phylum
    Protochordata                                Vertebrata
```
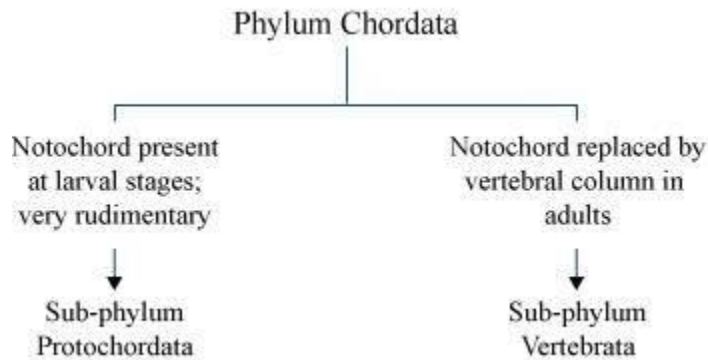
6 Vertebrata are classified into five classes:

(i) Class Pisces: This class includes fish such as Scoliodon, tuna, rohu, shark, etc. These animals mostly live in water. Hence, they have special adaptive features such as a streamlined body, presence of a tail for movement, gills, etc. to live in water.

(ii) Class Amphibia: It includes frogs, toads, and salamanders. These animals have a dual mode of life. In the larval stage, the respiratory organs are gills, but in the adult stage, respiration occurs through the lungs or skin. They lay eggs in water.

(iii) Class Reptilia: It includes reptiles such as lizards, snakes, turtles, etc. They usually creep or crawl on land. The body of a reptile is covered with dry and cornified skin to prevent water loss. They lay eggs on land.

(iv)　Class Aves: It includes all birds such as sparrow, pigeon, crow, etc. Most of them have feathers. Their forelimbs are modified into wings for flight, while hind limbs are modified for walking and clasping. They lay eggs.

(v)　Class Mammalia: It includes a variety of animals which have milk producing glands to nourish their young ones. Some lay eggs and some give birth to young ones. Their skin has hair as well as sweat glands to regulate their body temperature.

Vertebrates

Pisces　　Amphibia　　Reptilia　　Aves　　Mammalia
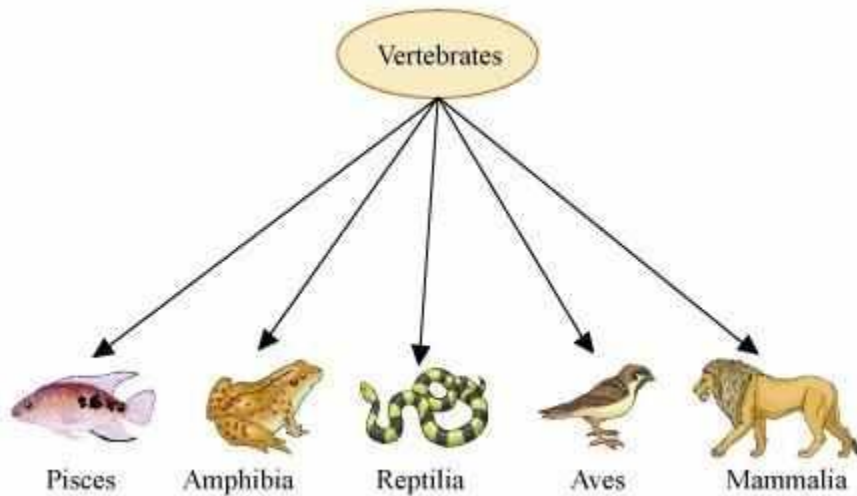
CBSE Class 09 Mathematics
Revision Notes
CHAPTER – 3
COORDINATE GEOMETRY

By Anthony Jamatia

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1. Cartesian System
2. Plotting a Point in the Plane with given Coordinates

Coordinate Geometry : The branch of mathematics in which geometric problems are solved through algebra by using the coordinate system is known as coordinate geometry.

Coordinate System

Coordinate axes: The position of a point in a plane is determined with reference to two fixed mutually perpendicular lines, called the coordinate axes.
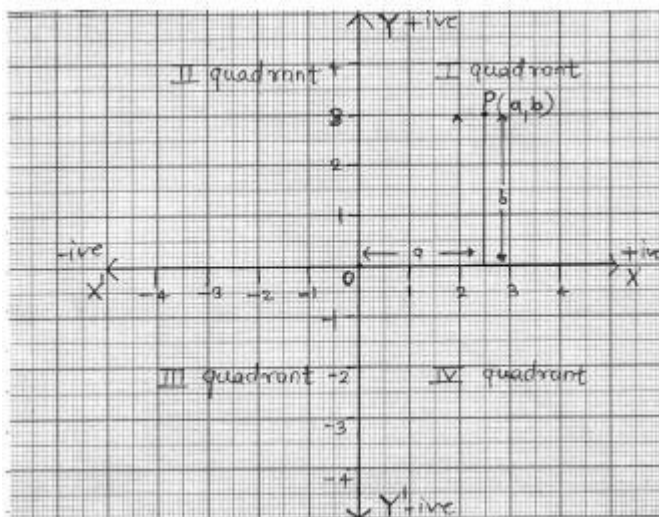
In this system, position of a point is described by ordered pair of two numbers.

Quadrants: The coordinate axes divide the plane into four parts which are known as quadrants.

Ordered pair : A pair of numbers a and b listed in a specific order with 'a' at the first place and 'b' at the second place is called an ordered pair (a,b)

Note that (a,b not equal to b, a)
Thus (2,3) is one ordered pair and (3,2) is another ordered pair.
In given figure O is called origin.
The horizontal line
XOX' is called the x-axis.
The vertical line YOY' is called the -axis.
P(a,b) be any point in the plane. 'a' the first number denotes the distance of point from
y -axis and 'b' the second number denotes the distance of point from x -axis.
a - X - coordinate | abscissa of P.
b - Y - coordinate | ordinate of P.
The point of intersection of the coordinate axes is called the **origin**.
The coordinates of origin are (0,0)
Every point on the x-axis is at a distance o unit from the x -axis. So its ordinate is 0.
Every point on the y-axis is at a distance of unit from the y -axis. So, its abscissa is 0.
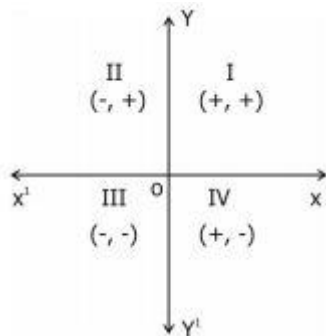
Note : Any point lying on - axis or - axis does not lie in any quadrant.
The sign of coordinates (x, y) of a point in various quadrant are as given below:

Quadrant	Coordinates	
	x	y
I	+	+
II	-	+
III	-	-
IV	+	-

NCERT Textbook for Class 9 Science – Page 15
Question 1. What is meant by a substance?
Answer: A pure substance consists of a single type of particles.

Question 2. List the points of differences between homogeneous and heterogeneous mixtures.
Answer:

Homogeneous mixtures	Heterogeneous m...
• It has uniform composition.	It does not have a unifor...
• No visible boundaries of separation.	Shows visible boundaries...
• They consist of only one phase.	They consist of more tha...
Example: sugar + water → sugar solution.	Example: sugar + sand

Class 9 Science NCERT Textbook Page 18
Question 1. Differentiate between homogeneous and heterogeneous mixtures with examples.
Answer:

Homogeneous mixtures	Heterogeneous m...
• It has uniform composition.	It does not have a unifor...
• No visible boundaries of separation.	Shows visible boundaries...
• They consist of only one phase.	They consist of more tha...
Example: sugar + water → sugar solution.	Example: sugar + sand

Question 2. How are sol, solution and suspension different from each other?
Answer:

Sol. (colloid)	Solution	S
1. Size of solute particles between 1 nm to 100 nm.	Size of solute particles less than 1 nm (10^{-9} m)	Size of s more tha
2. It is stable.	Stable.	Unstable
3. It scatters a beam of light.	It does not scatter light.	It scatter
4. Solute particles pass through filter paper.	Solute particles pass through filter paper.	Solute p pass thro

Question 3. To make a saturated solution, 36 g of sodium chloride is dissolved in 100 g of water at 293 K. Find its concentration at this temperature.
Answer: Mass of solute (sodium chloride) = 36 g
Mass of solvent (water) = 100 g
Mass of solution = Mass of solute + Mass of solvent
= 36 g + 100 g = 136 g

$$\text{Concentration} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

$$= \frac{36}{136} \times 100 = 26.47\%$$

Class 9 Science NCERT Textbook Page 24
Question 1. How will you separate a mixture containing kerosene and petrol (difference in their boiling points is more than 25°C), which are miscible with each other?
Answer: A mixture of kerosene and petrol which are miscible with each other can be separated by distillation.
Method

- Take a mixture in a distillation flask.
- Fit it with a thermometer.
- Arrange the apparatus as shown in the figure.
- Heat the mixture slowly.
- Petrol vaporises first as it has lower boiling point. It condenses in the condenser and is collected from the condenser outlet.

- Kerosene is left behind in the distillation flask.

Distillation process
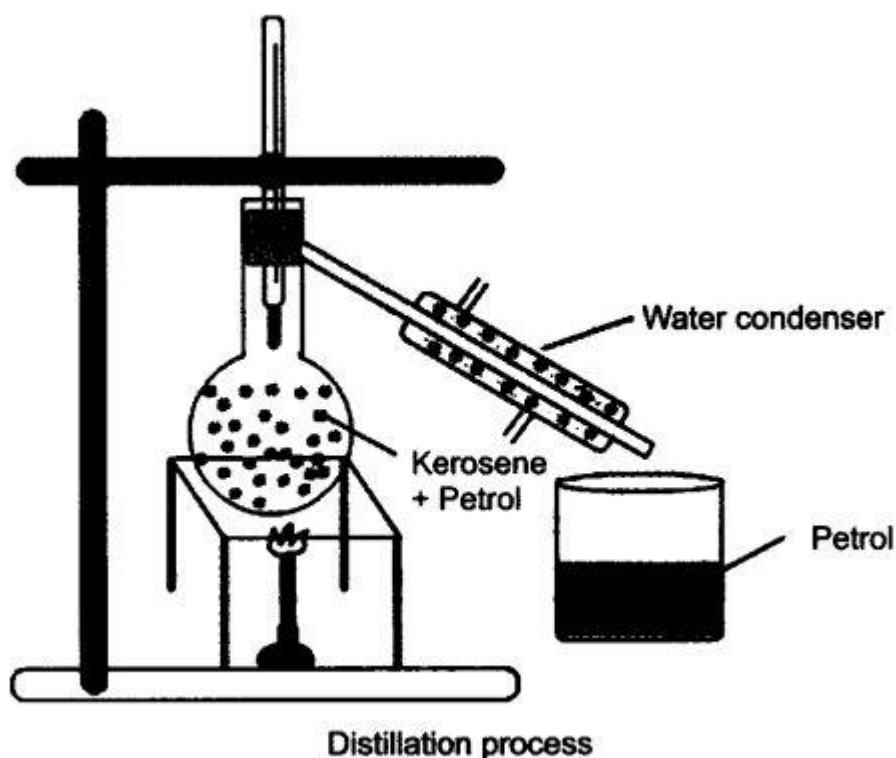
Question 2. Name the technique to separate
(i) butter from curd,
(ii) salt from sea-water,
(iii) camphor from salt.
Answer: (i) Centrifugation,
(ii) Evaporation,
(iii) Sublimation.

Question 3. What type of mixtures are separated by the technique of crystallisation?
Answer: Crystallisation technique is used to purify solid with some impurities in it.
Example: Salt from sea-water.

NCERT Textbook Questions Page 24
Question 2. Classify the following as chemical or physical changes:

- **cutting of trees,**
- **melting of butter in a pan,**
- **rusting of almirah,**
- **boiling of water to form steam,**
- **passing of electric current, through water and the water breaking down into hydrogen and oxygen gas,**
- **dissolving common salt in water,**
- **making a fruit salad with raw fruits and**
- **burning of paper and wood.**

Answer:

Physical Change	Chemical Change
• cutting of trees	• rusting of almirah
• melting of butter in a pan	• passing of electric current
• boiling of water to form steam	water and then breaking
• dissolving common salt in water	into hydrogen and oxygen
• making a fruit salad with raw fruits	• burning of paper and woo

Question 3. Try segregating the things around you as pure substances or mixtures
Answer: Pure substances—Water, bread, sugar and gold.
Mixtures—Steel, plastic, paper, talc, milk and air.

Questions From NCERT Textbook for Class 9 Science

Question 1. Which separation techniques will you apply for the separation of the following?
(a) Sodium chloride from its solution in water.
(b) Ammonium chloride from a mixture containing sodium chloride and ammonium chloride.
(c) Small pieces of metal in the engine oil of a car.
(d) Different pigments from an extract of flower petals.
(e) Butter from curd.
(f) Oil from water.
(g) Tea leaves from tea.
(h) Iron pins from sand.
(i) Wheat grains from husk.
(j) Fine mud particles suspended in water.
Answer: (a) Evaporation
(b) Sublimation
(c) Filtration
(d) Chromatography
(e) Centrifugation
(f) Separating funnel
(g) Filtration
(h) Magnetic separation
(i) Winnowing/ sedimentation
(j) Decantation and filtration

Question 2. Write the steps you would use for making tea. Use the words, solution, solvent, solute, dissolve, soluble, insoluble, filtrate and residue.
Answer: 1. Take a cup of water in a container as solvent and heat it.
2. Add sugar in it which is solute. Heat it till all sugar dissolves.
3. You get a solution of water and sugar.

4. Sugar is soluble in water completely.
5. Add half a tea-spoon of tea-leaves, it is insoluble in water.
6. Boil the content, add milk which is also soluble in water, boil again.
7. Filter the tea with the help of strainer, the tea collected in cup is filtrate and the tea leaves collected on the strainer is residue.

Question 3. Pragya tested the solubility of three different substances at different temperatures and collected, the data as given below (results are given in the following table, as grams of substance dissolved in 100 grams of water to form a saturated solution).

Substance Dissolved	Temperature in K and Solubility			
	283	293	313	333
Potassium nitrate	21	32	62	106
Sodium chloride	36	36	36	37
Potassium chloride	35	35	40	46
Ammonium chloride	24	37	41	55

(a) What mass of potassium nitrate would be needed to produce a saturated solution of potassium nitrate in 50 grams of water at 313 K?
(b) Pragya makes a saturated solution of potassium chloride in water at 353 K and leaves the solution to coo! at room temperature. What would she observe us the solution cools? Explain.
(c) Find the solubility of each salt at 293 K. Which salt has the highest solubility at this temperature?
(d) What is the effect of change of temperature on the solubility of a salt?

Answer:

(a) Mass of KNO_3 to produce a saturated solution of KNO_3 in 100 gr

water at 313 K = 62 g

∴ Mass of KNO_3 in 50 grams of water at 313 K

$$= \frac{62.0 \times 50}{100} = \mathbf{31.0\ g}$$

(b) Crystals of potassium chloride will be obtained on cooling the sat

solution.

(c) Solubility of each salt at 293 K is

    (i) Potassium nitrate   → 32 g

    (ii) Sodium chloride   → 36 g

    (iii) Potassium chloride → 35 g

    (iv) Ammonium chloride → 37 g

(d) On increasing the temperature, solubility of a salt increases.

Question 4. Explain the following giving examples:
(a) Saturated solution
(b) Pure substance
(c) Colloid
(d) Suspension
Answer: (a) Saturated solution: In a given solvent when no more solute can dissolve further at a given temperature is called saturated solution.
(b) Pure substance: A pure substance consists of a single type of particles. E.g., gold, silver.
(c) Colloid: A colloid is a solution in which the size of solute particles are bigger than that of true solution. These particles cannot be seen with our naked eyes, they are stable, e.g., ink, blood.
(d) Suspension: It is a heterogeneous mixture in which the solute particles are big enough to settle down, e.g., chalk-water, paints, etc.

Question 5. Classify each of the following as a homogeneous or heterogeneous mixture: soda water, wood, air. soil, vinegar, filtered tea.
Answer: Homogeneous: Soda water, vinegar, filtered tea.
Heterogeneous: Wood, air, soil.

Question 6. How would, you confirm that a colourless liquid given to you is pure water?
Answer: By finding the boiling point of a given colourless liquid. If the liquid boils at 100°C at atmospheric pressure, then it is pure water. This is because pure substances have fixed melting and boiling point.

Question 7. Which of the following materials fall in the category of a "pure substance"?
(a) Ice (b) Milk (c) Iron
(d) Hydrochloric acid (e) Calcium oxide (f) Mercury
(g) Back (h) Wood (i) Air.
Answer: Pure substances are: Ice, iron, hydrochloric acid, calcium oxide and mercury.

Question 8. Identify the solutions among the following mixtures.
(a) Soil (b) Sea water
(c) Air (d) Coal
(e) Soda water.
Answer: Solutions are: Sea water soda water and air.

Question 9. Which of the following will show "Tyndall effect"?
(a) Salt solution (b) Milk
(c) Copper sulphate solution (d) Starch solution.
Answer: Milk and starch solution.

Question 10. Classify the following into elements, compounds and mixtures.
(a) Sodium (b) Soil (c) Sugar solution
(d) Silver (e) Calcium carbonate (f) Tin
(g) Silicon (h) Coal (i) Air
(j) Soap (k) Methane (l) Carbon dioxide
(m) Blood
Answer: Elements – Compounds – Mixtures
Sodium – Calcium carbonate – Sugar solution
Silver – Methane – Soil
Tin – Carbon dioxide – Coal
Silicon – Soap – Air ,Blood

Question 11. Which of the following are chemical changes?
(a) Growth of a plant (b) Rusting of iron
(c) Mixing of iron filings and sand (d) Cooking of food
(e) Digestion of food (f) Freezing of water
(g) Burning of a candle.
Answer: Chemical changes are:
(a) Growth of a plant (b) Rusting of iron
(c) Cooking of food (d) Digestion of food
(e) Burning of a candle

SOCIAL SCIENCE [GEOGRAPHY] – IX

CHAPTER- 4. CLIMATE

-NORBERT JAMATIA

Answer the following questions briefly :

1. What are the controls affecting the climate of India?
   Ans- There are six major controls of the climate of any place. They are latitude, latitude, pressure and wind system, distance from the sea, ocean current and relief features.

2. Why does India have a monsoon type of climate?
   Ans- The monsoon winds play an important role in the climate of India. Therefore it is called the monsoon type of climate.

3. Which part of India does experience the highest diurnal range of temperature and why?
   Ans- The north western part of India experiences the highest diurnal range of temperature. In the thar desert, the day temperature may rise to 50 degree Celsius and drop to near 15 degree the same night. On the other hand there is hardly any difference in day and night temperatures in the Andaman and Nicobar Islands or in kerela.

4. Which winds account for rainfall along the Malabar coast?
   Ans- The south – west monsoon winds are responsible for the rainfall along the Malabar coast.

5. What are jet streams and how do they affect the climate of India?
   Ans- Jet streams are a narrow belt of high altitude above 12000 m westerly winds in the troposphere.
   a) Their speed varies from about 110 km/h in summer to about 184km/h in winter.
   b) A number of separate jet streams have been identified.
   c) The most constant are the mid latitude and subtropical jet streams.
   d) Jet streams over the Indian peninsular during the summer affect the monsoon.

6. Define monsoons. What do you understand by break in monsoon?
   Ans- The monsoon are moisture laden winds from the southwest which bring heavy rainfall to southern Asia in summer.
   'Break' in monsoon means that the monsoon has alternate wet and dry spells. This means that the monsoon rains take place for a few days at a time. These wet spells are interspersed with dry spells related to the movement of the monsoon trough.

7. Why is monsoon considered a unifying bond?
   Ans- The seasonal alteration of the wind system and the associated weather conditions provide a rhythmic cycle of seasons.
   Monsoon rains are unevenly distributed and typically uncertain. The Indian landscape plant and animal life, agriculture, the people and their festivities all revolve around the monsoon.

All the Indian people eagerly await the arrival of the monsoon. It binds the whole country by providing water which sets all agriculture, the people and their festivities, all revolve around the monsoon.

All the Indian people eagerly await the arrival of the monsoon. It binds the whole country by providing water which sets all agricultural activities in motion. That is why the monsoon is considered a unifying bond.

8. Why does rainfall decrease from the east to the west in northern India?

Ans- Rainfall decrease from the east to the west in Northern India because there is a decrease in the moisture of winds. As the moisture bearing winds of the Bay of Bengal branch of the south west monsoon move further and further inland, the moisture gradually decrease and results in low rainfall when moving westwards. Consequently states like Gujurat, and Rajasthan in western India gets very little rainfall.

9. The Tamil Nadu coast receives winter rainfall. Give reason, why?

Ans- During the winter season the north west trade winds prevail over the country. They blow from land to sea and hence for most part of the country it is a dry season.

Some amount of rainfall occurs on the Tamil Nadu coast from these winds as here they blow from sea to land.

10. Give the characteristic of the monsoon rainfall in India.

Ans-

i) The climate of india is described as the monsoon type

ii) Monsoon refers to the seasonal reversal in the wind direction during the year.

iii) The duration of monsoon is between 100-120 days from early june to mid September. Around the time of its arrival the normal rainfall increases suddenly and continues constantly for several days. This is known as burst of the monsoon.

iv) The monsoon has a tendency to have breaks; thus it has wet and dry spells. In other words monsoon rains take place only for a few days at a time.

v) The monsoon is known for its uncertainies.

Some of the questions to try at Home/ Home work

a) Seasonal reversal of wind direction takes place over the Indian sub-continent.

b) The bulk of rainfall in India is concentrated over a few months.

c) The delta region of the eastern coast is frequently struck by cyclones.

d) Parts of Rajasthan, Gujurat and the Leeward side of the western ghat are drought prone.

e) Describe the regional variations in the climatic conditions of India with the help of suitable examples.

f) Discuss the mechanism of Monsoon.

पाठ −02

स्मृति

प्रश्न1. भाई के बुलाने पर लौटते समय लेखक के मन में किस बात का डर था?

उत्तर- सर्दी के दिनों में लेखक अपने साथियों के साथ बेर खाने गया हुआ था| जब वह झरबेरी से बेर तोड़ रहा था, तभी गाँव के एक आदमी ने उसे बताया कि तुम्हारे बड़े भाई तुम्हें बुला रहे हैं, शीघ्र चले आओ| भाई के बुलाने पर लेखक घर की ओर चल दिया, पर उसके मन में डर था| उसके मन में तरह-तरह के विचार उठने लगे| उसे अपने भाई से पिटने का डर सताने लगा| उसे समझ में नहीं आ रहा था कि उससे कौन-सा कसूर हो गया है| उसके किस अपराध का दंड उसे दिया जाएगा| लेखक को इस बात की आशंका थी कि शायद बेर तोड़कर खाने के अपराध के कारण उसकी पिटाई हो| बड़े भाई के हाथों मार पड़ने के डर से ही वह घर में डरते-डरते घुसा था|

प्रश्न2. मक्खनपुर पढ़ने जाने वाली बच्चों की टोली रास्ते में पड़ने वाले कुएँ में ढेला क्यों फेंकती थी?

उत्तर- मक्खनपुर पढ़ने जाने वाली बच्चों की टोली के सभी बच्चे शरारती थे। लेखक भी उनमें से एक था। एक दिन जब वे सब स्कूल से घर जा रहे थे तो उन्होंने रास्ते में पड़ने वाले कुएँ में झाँका। लेखक ने उस कुएँ में एक ढेला फेंका, जिसका उद्देश्य उससे निकलने वाली ध्वनि से था। जैसे ही ढेला कुएँ में गिरा, साँप के फुँफकारने की आवाज़ सुनाई दी, जिसे सुनकर सभी बच्चे हैरान रह गए। उसके बाद प्रतिदिन सभी बच्चे आते-जाते कुएँ में ढेला फेंकते और साँप की क्रोधपूर्ण फुँफकार सुनने में मज़ा लेते थे। कुएँ में ढेला फेंककर उसकी आवाज़ सुनने के बाद अपनी बोली की प्रतिध्वनि सुनने की लालसा उनके मन में रहती थी|

प्रश्न3. 'साँप ने फुँफकार मारी या नहीं, ढेला उसे लगा या नहीं, यह बात अब तक स्मरण नहीं' – यह कथन लेखक की किस मनोदशा को स्पष्ट करता है?

उत्तर- इस कथन से स्पष्ट होता है कि इस घटना के समय लेखक पूरी तरह से अचेत (विकल) था| लेखक ने जब ढेला उठाकर कुएँ में साँप पर फेंका, तब टोपी में रखी चिट्ठियाँ कुएँ में गिर

गई| चिट्ठियों के कुएँ में गिरते ही लेखक बुरी तरह घबरा गया था| वह अपने होश खो बैठा था| उस समय ढेले का कुएँ में गिरना, साँप को लगना या न लगना, साँप का फुँफकारना या न फुँफकारना - इन सबकी ओर से लेखक का ध्यान हट गया था| इससे उसकी घबराहट झलकती थी|

प्रश्न4. किन कारणों से लेखक ने चिट्ठियों को कुएँ से निकालने का निर्णय लिया?

उत्तर- लेखक को डर था कि चिट्ठियों के खोने की बात सुनकर उसे बड़े भाई से अवश्य मार पड़ेगी| पर भाई से झूठ बोलने का साहस भी उसमें नहीं था| उसका मन कहीं भाग जाने को करता था, फिर पिटने का भय और ज़िम्मेदारी की दुधारी तलवार उसके कलेजे पर फिर रही थी| उसे चिट्ठियाँ कुएँ से बाहर निकालकर लानी थीं| उसे विश्वास था कि वह साँप को मारकर चिट्ठियाँ पुनः प्राप्त कर लेगा, क्योंकि इससे पहले भी वह कई बार साँप मार चुका था| इन्हीं सब कारणों से लेखक ने चिट्ठियों को कुएँ से निकालने का निर्णय लिया|

प्रश्न5. साँप का ध्यान बँटाने के लिए लेखक ने क्या-क्या युक्तियाँ

अपनाई?

उत्तर- लेखक को अपने भाई की चिट्ठियाँ उठाने के लिए साँप वाले कुएँ में उतरना ही पड़ा| जैसे ही वह कुएँ में उतरा, साँप साक्षात् मौत के समान उसके सामने था| उसने देखा कि कुएँ का व्यास कम होने के कारण वहाँ डंडा चलाना संभव नहीं है| उसने डंडे से

साँप को दबाने का ख्याल छोड़ दिया| उसने साँप का फन पीछे होते ही अपना डंडा चिट्ठियों की ओर कर दिया और चिट्ठियाँ उठाने की चेष्टा की| लेखक ने साँप का ध्यान बँटाने के लिए डंडे को साँप की विपरीत दिशा में पटका| साँप उस ओर झपटा, तो उसका स्थान बदल गया और लेखक ने तुरंत चिट्ठियाँ उठा लीं| अब लेखक ने देखा कि उसका डंडा साँप के नीचे है| उसने कुएँ की बगल से एक मुट्ठी मिट्टी लेकर साँप के दाईं और फेंकी| साँप उस पर झपटा और उसने दूसरे हाथ से डंडा खींच लिया| इस प्रकार लेखक चिट्ठियाँ और डंडा लेकर सकुशल कुएँ से बाहर आ गया|

प्रश्न6. कुएँ में उतरकर चिट्ठियों को निकालने संबंधी साहसिक वर्णन

को अपने शब्दों में लिखिए|

उत्तर- लेखक द्वारा कुएँ में उतरकर चिट्ठियों को निकाल लाना साहस का कार्य था| लेखक ने इस चुनौती को स्वीकार किया| उसने पाँच धोतियाँ और कुछ रस्सी मिलाकर कुएँ की गहराई तक जाने के लिए धोती के एक सिरे से डंडा बाँधकर कुएँ में डाल दिया तथा दूसरे सिरे को कुएँ की डेंग से बाँधकर छोटे भाई को पकड़ा दिया| उसने सोचा था कि वह डंडे से साँप को मारकर चिट्ठियाँ लेकर बाहर आ जाएगा| किंतु कुएँ का व्यास कम होने के कारण वहाँ डंडा चलाना संभव ही नहीं था| चिट्ठियाँ साँप के आसपास ही गिरी हुई थीं| जैसे ही लेखक ने धीरे-धीरे साँप के पास पड़ी चिट्ठी की ओर डंडा बढ़ाया, तो साँप ने डंडे पर आक्रमण कर दिया| लेखक के हाथ से डंडा छूट गया| उसने पुनः डंडा उठाकर चिट्ठियों को खिसकाने का प्रयास किया| जैसे ही डंडा चिट्ठियों के पास पहुँचा, साँप ने फुँफकार कर डंडे पर डंक मारा| पर लेखक डटा रहा और उसने डंडे के सहारे पुनः चिट्ठियाँ उठाने का प्रयास किया| इस बार डंडे पर वार भी

किया और डंडे से चिपक गया| लेखक ने डंडे को एक ओर पटक

दिया| देवी कृपा से साँप के आसन बदल गए| लेखक ने तुरंत चिट्ठियाँ उठाकर धोती के छोर में बाँध लीं| लेखक ने देखा कि उसका डंडा साँप के नीचे है| उसने कुएँ की बगल से एक मुट्ठी मिट्टी लेकर साँप के दाई और फेंकी| साँप उस पर झपटा और उसने दूसरे हाथ से डंडा खींच लिया| इसके बाद वह डंडा लेकर कुएँ के बाहर सकुशल पहुँचा| लेखक पूरी तरह से थक गया था तथा उसकी छाती फूल कर धौंकनी के समान चल रही थी, किंतु चिट्ठियाँ लेकर कुएँ के बाहर पहुँच जाने की उसे बहुत प्रसन्नता हो रही थी|

प्रश्न7. इस पाठ को पढ़ने के बाद किन-किन बाल-सुलभ शरारतों के विषय में पता चलता है?

उत्तर- बच्चे कोतूहल प्रिय और जिज्ञासु प्रवृति के होते हैं| उनकी जिज्ञासा व पीड़ा उनको निर्णायक मोड़ पर ला खड़ा कर देती है| इस पाठ से लेखक, उनके भाई व उनके साथियों की बाल-सुलभ शरारतों का पता चलता है| वे इस प्रकार है –

1. बच्चे झरबेरी से बेर तोड़कर खाने का आनंद लेते हैं|

2. लेखक और उसके साथी रास्ते में पड़ने वाले कुएँ में झाँककर और ढेला फेंककर शरारत करते हैं|

3. जब कुएँ का साँप उनके ढेले पर फुँफकारता है, तो उन्हें बड़ा मज़ा आता है|

4. बचपन में हम असंभव से असंभव काम को करने के लिए भी तैयार हो जाते हैं|

5. बच्चे रास्ते में चलते हुए जानवरों, जीव-जंतुओं को तंग करते हुए उल्लसित होते हैं|

6. अपने आपको सबसे बहादुर समझना आदि अनेकों बाल-सुलभ शरारतों का पता चलता है|

प्रश्न8. 'मनुष्य का अनुमान और भावी योजनाएँ कभी-कभी कितनी मिथ्या और उलटी निकलती हैं' – का आशय स्पष्ट कीजिए|

उत्तर- इस पंक्ति के माध्यम से लेखक स्पष्ट करना चाहता है कि कई बार मनुष्य सोचता कुछ है किंतु होता कुछ और है। मनुष्य अपनी बुद्धि से सोच-समझकर अनुमान लगाता है और भावी योजनाएँ बनाता है, लेकिन समय आने पर वे सभी अनुमान और

योजनाएँ निरर्थक सिद्ध होती हैं। इस पाठ में भी लेखक साँप को डंडे से मारने की योजना बनाकर कुएँ में उतरता है, परंतु कुएँ के धरातल पर पहुँचकर वह देखता है कि उसका अनुमान और योजना बिल्कुल गलत थी। कुएँ का घेरा कम होने के कारण डंडा चलाने का स्थान ही नहीं था। लेखक ने डंडे से चिट्ठियों को खिसकाने का प्रयास किया तो साँप ने डंडे से चिपककर आसन बदल लिया और लेखक चिट्ठियाँ उठाने में सफल हुआ| लेखक इन सब बातों के लिए पहले से तैयार नहीं था, लेकिन स्थिति के साथ वह अपनी योजना में परिवर्तन करता गया| अतः कल्पना और वास्तविकता में हमेशा अंतर होता है|

प्रश्न९. 'फल तो किसी दूसरी शक्ति पर निर्भर है' – पाठ के संदर्भ में इस पंक्ति का आशय स्पष्ट कीजिए|

उत्तर- इस पंक्ति के माध्यम से लेखक स्पष्ट करना चाहता है कि जब कोई व्यक्ति दृढ़ संकल्प कर लेता है, तो फिर वह फल की चिंता नहीं करता| फल को पाना किसी व्यक्ति के बस की बात नहीं है| किसी भी कार्य की सुखद या दुखद समाप्ति ईश्वर की

इच्छा पर निर्भर करती है| लेखक ने कुएँ में घुसकर चिट्ठियाँ निकालने का साहसिक निर्णय लिया| वह चिट्ठियों के लिए साँप से टकराने को तैयार था| उसने तो दृढ़ संकल्प कर लिया था और अब उसे फल की कोई चिंता नहीं थी| अब चाहे मौत का आलिंगन होता अथवा साँप से बचकर उसे दूसरा जन्म मिलता, उसने पीछे न हटने का निर्णय लिया था| उसने सब कुछ ईश्वर के ऊपर छोड़ दिया था|

১. বালকদিগের সর্দার—

(ক) ফটিক

(খ) মাখন

(গ) দিবাকর

(ঘ) পরাশর

২. একটা প্রকাণ্ড _____ নদীর ধারে পড়েছিল।

(ক) সেগুন কাঠ

(খ) শাল কাঠ

(গ) শিরীষ কাঠ

(ঘ) অর্জুন কাঠ

৩. শাল কাঠ কীসে রূপান্তরিত হওয়ার জন্য পড়েছিল?

(ক) নৌকায়

(খ) জাহাজে

(গ) মাস্তুলে

(ঘ) হালে

৪. ফটিকের ভাই—

(ক) মাখন

(খ) সুরেশ

(গ) মগন

(ঘ) ছগন

৫. দেখ মার খাবি, এই বেলা ওঠ—বলে—

(ক) মাখন

(খ) ছগন

(গ) মগন

(ঘ) ফটিক

৬. অবাধ্য ভ্রাতা বলতে—

(ক) ফটিক

(গ) মগন

(খ) মাখন

(ঘ) ছগনকে বোঝানো হয়েছে

৭. প্রস্তাব করিল—কে প্রস্তাব করিল?

(ক) মাখন

(গ) গগন

(খ) ফটিক

(ঘ) হীরন

৮. তত্ত্বজ্ঞান সমেত ভূমিস্যাৎ হল—

(ক) ফটিক

(গ) হীরন

(খ) মাখন

(ঘ) জগন

৯. কিন্তু _____ কিছু শসব্যস্ত হল।

(ক) মাখন

(গ) বিশ্বনাথ

(খ) ফটিক

(ঘ) নবীন

১০. গোটাকয়েক _____ উৎপাটন করে ফটিক।

(ক) ঘাস

(খ) কাশ

(গ) গাছ

(ঘ) লতা

১১. ফটিক নৌকার _____ বসে, কাশ চিবোচ্ছিল।

(ক) পাটাতনে

(খ) গলুইয়ে

(গ) ছইয়ে

(ঘ) নৌকার মাথায়

১২. এক ভদ্রলোক _____ জিজ্ঞাসা করিলেন।

(ক) কাঁচা দাড়ি পাকা চুল

(খ) কাঁচা গোঁফ পাকা দাড়ি

(গ) পাকা গোঁফ কাঁচা দাড়ি

(ঘ) কোনোটিই নয়

১৩. ফটিকের মামার নাম—

(ক) বিশ্বম্ভর

(খ) বিশ্বনাথবাবু

(গ) বিশ্বাসবাবু

(ঘ) বিনয় বাবু

১৪. বালক উঁটা চিবাইতে চিবাইতে বলিল—বালকটির নাম—

(ক) মাখন

(খ) ফটিক

(গ) গগন

(ঘ) নগেন।

১৫. বিশ্বম্ভরবাবু _____ বাড়ি খোঁজ করেছিলেন।

(ক) চক্রবর্তীদের

(খ) মুখার্জিদের

(গ) ব্যানার্জিদের

(ঘ) গাঙ্গুলীদের

১৬. _____ আসিয়া ডাকিল, ফটিক মা ডাকছে।

(ক) বাঘা বাগদি

(খ) সমু বাগদি

(গ) হেমু বাগদি

(ঘ) সোনা বাগদি

১৭. _____ নিষ্ফল আক্রোশে হাত পা ছুঁড়ছিল।

(ক) মাখন

(খ) ফটিক

(গ) সুজন

(ঘ) ভজন

১৮. তুই আবার মাখনকে মেরেছিস—বলে—

(ক) ফটিকের মা

(খ) ফটিকের মামা

(গ) ফটিকের মাসি

(ঘ) ফটিকের পিসি

১৯. মা _____ হইয়া কহিল।

(ক) অগ্নিমূর্তি

(খ) শান্তমূর্তি

(গ) চঞ্চল মূর্তি

(ঘ) স্থির মূর্তি

২০. ফটিকের আর সহ্য হল না—কী সহ্য হল না—

(ক) মাখনের মিথ্যা কথা

(খ) মাখনের সত্যি কথা

(গ) মায়ের মিথ্যা কথা

(ঘ) মায়ের সত্যি কথা

৩২. দেওয়ালে আটকে পড়ে কেবল তার — পড়ত।
(ক) গ্রামের কথা
(খ) মায়ের কথা
(গ) মাখনের কথা
(ঘ) সঙ্গী সাথিদের কথা

৩৩. ফটিকের চিত্তকে আকর্ষণ করত তার—
(ক) অত্যাচারিণী-অবিচারিণী মা
(খ) তার স্নেহের ভাই মাখন
(গ) বাঘা বাগদি
(ঘ) তার বন্ধুবান্ধব

৩৪. মামা ফটিককে ছুটির কথা বললেন—
(ক) বৈশাখ মাসের ছুটি
(খ) কার্তিক মাসের ছুটি
(গ) গ্রীষ্মের ছুটি
(ঘ) বড়োদিনের ছুটি

৩৫. মাসে মাসে তোমার নতুন বই কিনে দিতে পারিনে—বলেছে—
(ক) মামা
(খ) মামি
(গ) মামাতো ভাই
(ঘ) মা

৩৬. ফটিকের খোঁজ না পেয়ে বিশ্বম্ভর বাবু—
(ক) পুলিশে খবর দিলেন
(খ) পাড়াপড়শিকে খবর দিলেন
(গ) ফটিকের মাকে খবর দিলেন
(ঘ) চৌকিদারকে খবর দিলেন।

৩৭. কেন বাপু পরের ছেলেকে নিয়ে এ কর্মভোগ বলেছে।
(ক) ফটিকের মামি
(খ) প্রতিবেশি
(গ) মামাতো ভাই
(ঘ) ফটিকের মামা

৩৮. মা, এখন আমি বাড়ি যাচ্ছি—বলেছে—
(ক) ফটিক
(খ) মাখন
(গ) মামাতো ভাই
(ঘ) কেউ নয়

৩৯. 'তাহার চিত্ত অধীর হইয়া উঠিত'—কার চিত্ত অধীর হত?
(ক) মাখনের
(খ) সুনীলের
(গ) সুশীলের
(ঘ) ফটিকের

৪০. ফটিক মাখনকে দিয়ে গেল—
(ক) ছিপ ঘুড়ি লাটাই
(খ) খেলনা
(গ) বই খাতা
(ঘ) জামা

২১. তাহার পিঠে দু-তিনটে চপেটাঘাত করেন—কার পিঠে?

    (ক) মাখনের   (খ) ফটিকের

    (গ) ভজনের   (ঘ) গগনের

২২. বহুদিন হল দাদা _____ কাজ করতে গিয়েছে।

    (ক) দক্ষিণে   (খ) পশ্চিমে

    (গ) পূর্বে   (ঘ) উত্তরে

২৩. ফটিকের মার—

    (ক) তিন সন্তান   (খ) দুই সন্তান

    (গ) এক সন্তান   (ঘ) চার সন্তান

২৪. বিধবা এই প্রস্তাবে _____ হলেন।

    (ক) সম্মত   (খ) অসম্মত

    (গ) রাজি হলেন না   (ঘ) গররাজি হলেন

২৫. ফটিক আমার হাড় জ্বালাতন করেছে—

    (ক) ফটিকের মা বলেছেন   (খ) ফটিকের মাসি বলেছেন

    (গ) ফটিকের মামা বলেছেন   (ঘ) ফটিকের ভাই বলেছে

২৬. উৎসাহে রাত্রে তাহার ঘুম হয় না—কার?

    (ক) মাখনের   (খ) ফটিকের

    (গ) ফটিকের মায়ের   (ঘ) মামার

২৭. ফটিকের মামার ছেলে-মেয়ে কয়টি?

    (ক) চারটি   (খ) দুটি

    (গ) তিনটি   (ঘ) পাঁচটি

২৮. ফটিক যখন মামার বাড়িতে আসে তখন তার বয়স—

    (ক) বারো বছর   (খ) তেরো-চোদ্দো বছর

    (গ) পনেরো বছর   (ঘ) ষোলো বছর

২৯. কলকাতায় মামার বাড়িতে ফটিকের অবস্থান হয়—

    (ক) প্রভুহীন কুকুরের মতো   (খ) সহিসহীন ঘোড়ার মতো

    (গ) বলদহীন চাষার মতো   (ঘ) প্রভুহীন ভৃত্যের মতো

৩০. মামির চক্ষে ফটিক—

    (ক) স্নেহের পুতলি   (খ) একটি দুর্গ্রহ

    (গ) একজন চাকর-বাকর   (ঘ) কোনোটিই নয়

৩১. কলকাতায় ফটিক খুবই—

    (ক) আদরে ছিল   (খ) অনাদরে ছিল

    (গ) সুখে ছিল   (ঘ) দুঃখে ছিল

Chapter 9 - Force And Laws Of Motion

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Question 1. Which of the following has more inertia:
(a) a rubber ball and a stone of the same size?
(b) a bicycle and a train?
(c) a five-rupees coin and a one-rupee coin?

Solution 1

Mass is a measure of the inertia of a body. The greater the mass of a body; the greater is its inertia.

(a) Mass of a stone is more than the mass of a rubber ball of same size. Hence, inertia of a stone is greater than that of a rubber ball of same size.

(b) Mass of a train is more than the mass of a bicycle. Hence, inertia of a train is greater than that of a bicycle.

(c) Mass of a five rupee coin is more than that of a one-rupee coin. Hence, inertia of a five rupee coin is greater than that of a one-rupee coin.

Concept Insight: More mass means more inertia.

Question 2. In the following example, try to identify the number of times the velocity of the ball changes.
"A football player kicks a football to another player of his team who kicks the football towards the goal The goalkeeper of the opposite team collects the football and kicks it towards a player of his own team".
Also identify the agent supplying the force in each case.

Solution 2

The velocity of the ball changes four times.

Agent supplying the force	Change in velocity of ball
1. First player kicks a football.	→ Velocity from '0' changes to 'u'
2. Second player kicks the football towards the goal.	→ Velocity changes again
3. The goalkeeper collects the football.	→ Velocity becomes 0
4. Goalkeeper kicks it towards a player of his team.	→ Change in velocity takes place

Concept Insight:- Velocity is a vector quantity. It has both magnitude and direction.

Question 3. Explain why some of the leaves may get detached from a tree if we vigorously shake its branch.

Solution 3

Some leaves of a tree may get detached when we shake its branch vigorously. This is because when the branch of the tree is shaken, it moves to and fro, but due to inertia its leaves tend to remain at rest. Due to this reason, the leaves fall down from the tree.

Concept Insight:- Inertia resists change in state of motion.

Question 4. Why do you fall in the forward direction when a moving bus brakes to a stop and fall backwards when it accelerates from rest

Solution 4

When a moving bus brakes to a stop, we fall in the forward direction because though the lower part of our body comes to a stop when the bus stops but the upper part of the body continues to be in motion in the forward direction due to its inertia, thus making us fall in the forward direction.

When a bus accelerates from rest, we fall backwards because though the lower part of our body starts moving with the bus but the upper part of the body tries to remain at rest due to its inertia, thus making us fall in the backward direction.

Concept Insight:- Inertia resists any change in the state of motion of a body.

Exercise 126

Question 1. If action is always equal to the reaction, explain how a horse can pud a cart?

Solution 1

A horse pushes the ground in the backward direction. According to Newton's third law of motion, a reaction force is exerted by the ground on the horse in the forward direction. As a result, the horse moves forward along with the cart.

Concept Insight:- Action and reaction forces act on two different bodies and that too in opposite directions.

Question 2. Explain, why is it difficult for a fireman to hold a hose, which ejects a large amount of water at a high velocity.

Solution 2

Due to the backward reaction of the water ejecting from the hose pipe.

When a fireman holds a hose, which is ejecting large amounts of water at a high velocity, then a reaction force is exerted on him by the ejecting water in the backward direction. This is because of Newton's third law of motion. As a result of the backward force, the hose pipe tends to go backward and slips from the hands of fireman which makes it difficult for the fireman to hold the hose pipe.

Concept Insight:- Action and reaction forces act on two different bodies and that too in opposite directions.

Question 3. From a rifle of mass 4 kg, a bullet of mass 50 g is fired with an initial velocity of 35 m/s. Calculate the initial recoil velocity of the rifle.

Solution 3

Mass of the rifle, $m_1 = 4$ kg

Mass of the bullet, $m_2 = 50$ g $= 0.05$ kg

Recoil velocity of the rifle $= v_1$

Bullet is fired with an initial velocity, $v_2 = 35$ m/s

Initially, the rifle is at rest.

Thus, its initial velocity, $v = 0$

Total initial momentum (before firing) of the rifle and bullet system $= (m_1 + m_2)v = 0$

Total final momentum (after firing) of the rifle and bullet system

$= m_1v_1 + m_2v_2$

$= 4(v_1) + 0.05 \times 35$

$= 4v_1 + 1.75$

According to the law of conservation of momentum:

Concept Insight:- Total momentum after the firing = Total momentum before the firing

$4v_1 + 1.75 = 0$

$4v_1 = -1.75$

$$v_1 = -\frac{1.75}{4} = -0.4375 \text{ m/s}$$

The negative sign indicates that the rifle recoils backwards with a velocity of 0.4375 m/s.

Exercise 127

Question 4. Two objects of masses 100 g and 200 g are moving along the same line and direction with velocities of 2 m/s and 1 m/s respectively

Solution 4

Mass of first object, $m_1 = 100$ g $= 0.1$ kg

Mass of second object, $m_2 = 200$ g $= 0.2$ kg

Velocity of first object before collision, $v_1 = 2$ m/s

Velocity of second object before collision, $v_2 = 1$ m/s

Velocity of first object after collision, $v_3 = 1.67$ m/s

Velocity of second object after collision $= v_4$

According to the law of conservation of momentum:

Concept Insight:- Total momentum before collision = Total momentum after collision

$\therefore m_1v_1 + m_2v_2 = m_1v_3 + m_2v_4$

$(0.1) \times 2 + (0.2) \times 1 = (0.1) \times 1.67 + (0.2) \times v_4$

$0.2 + 0.2 = 0.167 + 0.2v_4$

$0.4 = 0.167 + 0.2v_4$

$0.4 - 0.167 = 0.2v_4$

$0.233 = 0.2v_4$

$v_4 = \frac{0.233}{0.2}$

$\therefore v_4 = 1.165$ m/s

Hence, the velocity of the second object becomes 1.165 m/s after the collision.

Exercise 128

Question 1. An object experiences a net zero external unbalanced force. Is it possible for the object to be travelling with a non-zero velocity? If yes, state the conditions that must be placed on the magnitude and direction of the velocity. If no, provide a reason.

Solution 1

Yes. Even when an object experiences a net zero external unbalanced force, it is possible that the object is travelling with a non-zero velocity. This is possible only when the object has been moving with a constant velocity in a particular direction. Then, there is no net unbalanced force applied on the body. The object will keep moving with the same non-zero velocity.

Concept Insight:- To change the state of motion, a net non-zero external unbalanced force must be applied on the object.

Question 2. When a carpet is beaten with a stick, dust comes out of it. Explain.

Solution 2

Inertia of an object tends to resist any change in its state of rest or state of motion. When a carpet is beaten with a stick, then the carpet comes to motion. But, the dust particles try to retain their state of rest. Hence, the dust particles come out of the carpet.

 Concept Insight:- Inertia resists change in state of motion.

Question 3. Why is it advised to tie any luggage kept on the roof of a bus with a rope?

Solution 3

When the bus suddenly accelerates from rest and moves forward, it acquires a state of motion. However, the luggage kept on the roof, owing to its inertia, tends to remain in its state of rest and hence may fall down from the roof of the bus.

Similarly, when the moving bus stops suddenly, then due to its inertia of motion, the luggage kept on the roof of the bus tends to remain in motion and hence may fall down from the roof of the bus.

Hence, it is advised to tie the luggage kept on the roof of a bus with a rope so that it does not fall down when the bus starts or stops suddenly.

Concept Insight:- Inertia resists change in state of motion

Question 4. A batsman hits a cricket ball which then rolls on a level ground. After covering a short distance, the ball comes to rest. The ball slows to a stop because

(a) the batsman did not hit the ball hard enough.

(b) velocity is proportional to the force exerted on the ball.

(c) there is a force on the ball opposing the motion.

(d) there is no unbalanced force on the ball, so the ball would want to come to rest

Solution 4

(c) There is a force on the ball opposing the motion.

A batsman hits a cricket ball, which then rolls on a level ground. After covering a short distance, the ball comes to rest because there is frictional force on the ball opposing its motion.

Frictional force always acts in the direction opposite to the direction of motion. Hence, this force is responsible for stopping the cricket ball.

Question 5. A truck starts from rest and rolls down a hill with a constant acceleration. It travels a distance of 400 m in 20 s. Find its acceleration. Find the force acting on it if its mass is 7 tonnes (Hint : 1 tonne = 1000 kg).

Solution 5

Initial velocity, u = 0 (since the truck is initially at rest)

 Distance travelled, s = 400 m

Time taken, t = 20 s

Acceleration, a=?

 According to the second equation of motion:

$$s = ut + \frac{1}{2}at^2$$

$$400 = 0 + \frac{1}{2} \times a \times (20)^2$$

$$400 = \frac{1}{2} \times a \times 400$$

$$400 = 200a$$

$$a = \frac{400}{200}$$

$$\therefore a = 2 \text{ m/s}^2$$

Given: 1 tonne = 1000 kg
Therefore, 7 tonnes = 7000 kg
Mass of truck, m = 7000 kg
From Newton's second law of motion:
Concept Insight:- Force, F = Mass × Acceleration
F = ma = 7000×2 = 14000 N
Hence, the acceleration of the truck is 2 m/s^2 and the force acting on the truck is 14000 N.

Question 6. A stone of lkg is thrown with a velocity of 20 ms~1 across the frozen surface of a lake and comes to rest after travelling a distance of 50 m. What is the force of friction between the stone and the ice?

Solution 6

Initial velocity of the stone, u = 20 m/s
Final velocity of the stone, v = 0 (finally the stone comes to rest)
Distance covered by the stone, s = 50 m
According to the third equation of motion:
$v^2 = u^2 + 2as$
where, a = acceleration
$(0)^2 = (20)^2 + 2 \times a \times 50$
$0 = 400 + 100 \text{ a}$
$-400 = 100 \text{ a}$

$$-\frac{400}{100} = a$$

$$\therefore a = -4 \text{ m/s}^2$$

Concept Insight:- The negative sign indicates that acceleration is acting against the motion of the stone.

Mass of the stone, m = 1 kg

From Newton's second law of motion:

Force, F = Mass × Acceleration

F = ma

F = 1 × (- 4) = -4 N

Hence, the force of friction between the stone and the ice is -4 N.

Question 7. 40000 kg engine pulls a train of 5 wagons, each of 2000 kg, along a horizontal track. If the engine exerts a force of 40000 N and the track offers a friction force of 5000 N, then calculate:

Solution 7

(a) Force exerted by the engine, F = 40000 N

Frictional force offered by the track, F_f = 5000 N

Hence, net accelerating force, $F_a = F - F_f = 40000 - 5000 = 35000$ N

(b) Let acceleration of the train be a.

Net accelerating force on the wagons, F_a = 35000 N

Mass of the wagons, M = Mass of a wagon × Number of wagons = 2000 x 5 = 10000 kg
From Newton's second law of motion:
Concept Insight:- Force = Mass x Acceleration

F_a = Ma

$$a = \frac{F_a}{M} = \frac{35000}{10000} = 3.5 \ m/s^2$$

Hence, the acceleration of the train is 3.5 m/s^2.
Mass of the four wagons behind the first wagon = 4 2000 = 8000 kg
Acceleration of the wagons = 3.5 m/s^2
Thus, force of wagon 1 on remaining four wagons behind it = 8000 3.5 = 28000 N
Hence, the force exerted by wagon 1 on wagon 2 is 28000 N.

Question 8. An automobile vehicle has a mass of 1500 kg. What must be the force between the vehicle and road if the vehicle is to be stopped with a negative acceleration of 1.7 ms^{-2}?
Solution 8
Mass of the automobile vehicle, m = 1500 kg

Final velocity, v = 0 (finally the automobile stops)

Acceleration of the automobile, a = -1.7 ms^{-2}

From Newton's second law of motion:

Force = Mass × Acceleration = 1500 × (-1.7) = -2550 N

Hence, the force between the automobile and the road is -2550 N, in the direction opposite to the motion of the automobile.

Question 9.What is the momentum of an object of mass m, moving with a velocity v?.
Solution 9
(d) mv

Mass of the object = m

Velocity = v

Concept Insight:- Momentum = Mass × Velocity

Momentum = mv

Question 10.Using a horizontal force of 200 N, we intend to move a wooden cabinet across a floor at a constant velocity. What is the friction force that will be exerted on the cabinet?
Solution 10
Force applied, P = 200 N
Force of friction, F = ?
As the wooden cabinet is to move across the floor with a constant velocity, no force (f) is spent in accelerating the cabinet, i.e.,
f = P-F = 0
or, F = P = 200 N

Concept Insight:- For a non-accelerated motion, no net force is required.

Question 11.Two objects each of mass 1.5 kg, are moving in the same straight line but in opposite directions. The velocity of each object is 2.5 ms⁻¹ before the collision during which they stick together. What will be the velocity of the combined object after collision?

Solution 11

Mass of first object, $m_1 = 1.5$ kg

Mass of second object, $m_2 = 1.5$ kg

Velocity first object before collision, $v_1 = 2.5$ m/s

Velocity of second object before collision, $v_2 = -2.5$ m/s

(Negative sign arises because mass m_2 is moving in an opposite direction)

After collision, the two objects stick together.

Total mass of the combined object $= m_1 + m_2$

Velocity of the combined object $= v$

According to the law of conservation of momentum:

Concept Insight:- Total momentum before collision = Total momentum after collision

$m_1 v_1 + m_2 v_2 = (m_1 + m_2) v$

$1.5(2.5) + 1.5 (-2.5) = (1.5 + 1.5) v$

$3.75 - 3.75 = 3 v$

$v = 0$

Hence, the velocity of the combined object after collision is 0 m/s.

Exercise 129

Question 12. According to the third law of motion when we push on an object, the object pushes back on us with an equal and opposite force. If the object is a massive truck parked along the roadside, it will probably not move. A student justifies this by answering that the two opposite and equal forces cancel each other. Comment on this logic and explain why the truck does not move.

Solution 12 When we push a massive truck parked along the roadside, it does not move. The justification given by the student that the two opposite and equal forces cancel each other is totally wrong. This is because force of action and reaction never act on one body. There is no question of their cancellation. The truck does not move because the push applied is far less than the force of friction between the truck and the road.

Concept Insight:- Action and reaction forces act on different objects.

Question 13. A hockey ball of mass 200 g travelling at 10 ms⁻¹ is struck by a hockey stick so as to return it along its original path with a velocity at 5 ms⁻¹. Calculate the change of momentum occurred in the motion of the hockey ball by the force applied by the hockey stick.

Solution 13

Mass of the hockey ball, $m = 200$ g $= 0.2$ kg

Hockey ball travels with velocity, $v_1 = 10$ m/s

Initial momentum $= mv_1$

After being struck by the stick, the hockey ball travels in the opposite direction with velocity, $v_2 = -5$ m/s

Final momentum $= mv_2$

Concept Insight:- Change in momentum = Final momentum - Initial momentum

Change in momentum $= mv_2 - mv_1 = m (v_2 - v_1) = 0.2 [-5-10] = 0.2 (-15) = -3$ kg ms⁻¹

Hence, the change in momentum of the hockey ball is -3 kg ms⁻¹.

Question 14. A bullet of mass 10 p travelling horizontally with a velocity of 150 m⁻¹ strikes a stationary wooden block and comes to rest in 0.03 s. Calculate the distance of penetration of the bullet into the block. Also calculate the magnitude of the force exerted by the wooden block on the bullet.

Solution 14

Mass of the bullet, $m = 10$ g $= 0.01$ kg

It is given that the bullet is travelling with a velocity of 150 m/s.

Thus, when the bullet enters the block, its velocity = Initial velocity, u = 150 m/s

Final velocity, v = 0 (since the bullet finally comes to rest)

Time taken to come to rest, t = 0.03 s

According to the first equation of motion,

$v = u + at$

where , a is the acceleration of the bullet

$0 = 150 + (a \times 0.03)$

$0 = 150 + 0.03a$

$-150 = 0.03a$

$-\dfrac{150}{0.03} = a$

$\therefore a = -5000 \ m/s^2$

Concept Insight:- Negative sign indicates that the velocity of the bullet is decreasing.
According to the third equation of motion:

$v^2 = u^2 + 2 \ as$

$0 = (150)^2 + 2 \times (-5000) \times s$

$0 = 22500 + 2 \times (-5000) \times s$

$0 = 22500 - 10000 \ s$

$10000 \ s = 22500$

$s = \dfrac{22500}{10000} = 2.25 \ m$

Hence, the distance of penetration of the bullet into the block is 2.25 m.
From Newton's second law of motion:
Concept Insight:- Force, F = Mass Acceleration
Mass of the bullet, m = 0.01 kg
Acceleration of the bullet, a = -5000 m/s²
F = ma = 0.01×(-5000) = -50 N
Hence, the magnitude of force exerted by the wooden block on the bullet is 50 N.

Question 15. An object of mass 1 kg travelling in a straight line with a velocity of 10 ms⁻¹ collides with, and sticks to, a stationary wooden block of mass 5 kg. Then they both move off together in the same straight line. Calculate the total momentum just before the impact and just after the before the impact and just after the impact. Also, calculate the velocity of the combined object.

Solution 15
Mass of the object, m_1 = 1 kg
Velocity of the object before collision, v_1 = 10 m/s
Mass of the stationary wooden block, m_2 = 5 kg
Velocity of the wooden block before collision, v_2 = 0 m/s
Total momentum before collision = $m_1v_1 + m_2v_2$ = (1×10)+(5×0) = 10 kg m s⁻¹
According to the law of conservation of momentum, the total momentum just after the impact will be the same as the total momentum just before the impact.
i.e., the total momentum just after the impact will be 10 kg m s⁻¹.
It is given that after collision, the object and the wooden block stick together.
Total mass of the combined system = $m_1 + m_2$
Velocity of the combined system = v
According to the law of conservation of momentum:
Concept Insight:- Total momentum before collision = Total momentum after collision

$m_1v_1 + m_2v_2 = (m_1 + m_2)v$

$(1 \times 10) + (5 \times 0) = (1 + 5)v$

$10 + 0 = 6v$

$10 = 6v$

$v = \dfrac{10}{6} = \dfrac{5}{3} m/s$

v = 1.67 m/s
Hence, velocity of the combined object after collision will be 1.67 m/s.

Question 16. An object of mass 100 kg is accelerated uniformly from a velocity of 5 ms⁻¹ to 8 ms⁻¹ in 6 s. Calculate the initial and final momentum of the object. Also, find the magnitude of the force exerted on the object

Solution 16
Initial velocity of the object, u = 5 m/s
Final velocity of the object, v = 8 m/s
Mass of the object, m = 100 kg
Time taken by the object to accelerate, t = 6 s
Initial momentum of the object = mu = 100 5 = 500 kg ms⁻¹

Final momentum of the object $= mv = 100 \times 8 = 800$ kg ms^{-1}

Concept Insight:- Force exerted on the object, $F = \dfrac{mv - mu}{t}$

$= \dfrac{m(v-u)}{t} = \dfrac{800-500}{6} = \dfrac{300}{6} = 50$ N

Question 17. Akhtar, Kiran and Rahul were riding in a motorcar that was moving with a high velocity on an expressway when an insect hit the windshield and got stuck on the windscreen. Akhtar and Kiran started pondering over the situation. Kiran suggested that the insect suffered a greater change in momentum as compared to the change in momentum of the motorcar (because the change in the velocity of insect was much more than that of the motorcar). Akhtar said that since the motorcar was moving with a larger velocity, it exerted a larger force on the insect. And as a result the insect died. Rahul while putting an entirely new explanation said that both the motorcar and the insect experienced the same force and a change in their momentum. Comment on these suggestions

Solution 17   Rahul gave the correct reasoning and explanation that both the motorcar and the insect experienced the same force and a change in their momentum. As per the law of conservation of momentum.

When 2 bodies collide:

Initial momentum before collision = Final momentum after collision

$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$

The equal force is exerted on both the bodies but, because the mass of insect is very small it will suffer greater change in velocity.

Question 18. How much momentum will a dumb-bell of mass 10 kg transfer to the floor if it falls from a height of 80 cm? Take its downward acceleration to be 10 ms^{-2}

Solution 18

Mass of the dumbbell, $m = 10$ kg

Distance covered by the dumbbell, $s = 80$ cm $= 0.8$ m

Acceleration in the downward direction, $a = 10$ m/s^2

Initial velocity of the dumbbell, $u = 0$

Final velocity of the dumbbell (when it was about to hit the floor) $= v$

Concept Insight Choose the equation of motion wisely out of the three, to minimize the number of steps in calculations.

According to the third equation of motion:

$v^2 = u^2 + 2as$

$v^2 = 0 + 2 (10) \, 0.8$

$v = 4$ m/s

Hence, the momentum with which the dumbbell hits the floor $= mv = 10 \times 4 = 40$ kg m s^{-1}

Momentum transferred to the floor is 40 kg m/s.

Exercise 130

Question 1. The following is the distance-time table on an object in motion:

Time in seconds	Distance in metres
0	0
1	1
2	8
3	27
4	64
5	125
6	216
7	343

(a) What conclusion can you draw about the acceleration? Is it constant, increasing, decreasing, or zero?

(b) What do you infer about the forces acting on the object?

Solution A1

(a) A careful observation of the distance-time table shows that

$s \propto t^3$

It is known that
(i) for motion with uniform velocity (zero acceleration)

$s = ut$

i.e., $s \propto t$

(ii) for motion with uniform acceleration

$s = ut + \dfrac{1}{2}at^2$

i.e., $s \propto t^2$

In the present case, $s \propto t^3$. Therefore, we conclude in this case that acceleration must be increasing uniformly with time.

(b) As $F = ma$, therefore, $F \propto a$. Hence, the force must also be increasing uniformly with time.

Question 2. Two persons manage to push a motorcar of mass 1200 kg at a uniform velocity along a level road. The same motorcar can be pushed by three persons to produce an acceleration of 0.2 ms^{-2}. With what force does each person push the motorcar? (Assume that all persons push the motorcar with the same muscular effort.)

Solution A2

Here, mass of motorcar, m = 1200 kg
Let each person exert a push F on the motorcar.
Total push of two persons = F + F = 2F
As this push gives a uniform velocity to the motorcar along a level road, it must be a measure of the force of friction (f) between the motorcar and the road,
i.e., f = 2F.
When three person push, total force applied = F + F + F = 3F
Force that produces acceleration (a=0.2 m/s^2),
i.e., ma = 3F-f = 3F-2F = F
or, F = ma = 1200 × 0.2 = 240 N

Question 3. A hammer of mass 500 g, moving at 50 ms^{-1}, strikes a nail. The nail stops the hammer in a very short time of 0.01 s. What is the force of the nail on the hammer?

Solution A3

Given:

Mass of the hammer, $m = 500 \text{ g} = \dfrac{500}{1000} = 0.5 \text{ kg}$

Initial velocity, u = 50 m/s
Final velocity, v = 0 m/s
Time, t = 0.01 s
Force of the nail on the hammer, F = ?

$F = ma = \dfrac{m(v-u)}{t}$

$= \dfrac{0.5(0-50)}{0.01}$

$= \dfrac{0.5(-50)}{0.01}$

$= -\dfrac{25}{0.01}$

$F = -2500 \text{ N}$

Thus, the force of the nail on the hammer is 2500 N. Negative sign indicates the opposing force.

Question 4. A motorcar of mass 1200 kg is moving along a straight line with a uniform velocity of 90 km/h. Its velocity is slowed down to 18 km/h in 4 s by an unbalanced external force. Calculate the acceleration and change in momentum. Also calculate the magnitude of the force required.

Solution A4

Given:

Mass, m = 1200 kg

Initial velocity, $u = 90 \ km/h = \dfrac{90 \times 1000 \ m}{60 \times 60 \ s} = 25 \ m/s$

Final velocity, $v = 18 \ km/h = \dfrac{18 \times 1000 \ m}{60 \times 60 \ s} = 5 \ m/s$

Time, t = 4 s

Acceleration, a = ?

By equation of motion, we get,

$v = u + at$

$a = \dfrac{v-u}{t}$

$= \dfrac{5-25}{4}$

$a = -5 m/s^2$

Change in momentum = mv-mu = m(v-u) = 1200×(5-25)= -24000 kg m/s
Force required , F = ma = 1200×(-5) = -6000 N
Magnitude of force required = 6000 N
Negative sign shows that force is opposing the motion

Question 5. A large truck and a car, both moving with a velocity of magnitude v, have a head- on collision and both of them come to a halt after that. If the collision lasts for 1 s:
(a) Which vehicle experiences the greater force of impact?
(b) Which vehicle experiences the greater change in momentum?
(c) Which vehicle experiences the greater acceleration?
(d) Why is the car likely to suffer more damage than the truck?
Answer:
(a) During head on collision forces applied by truck and car are action-reaction forces. Hence both vehicles experience same (equal) force of impact.
(b) Here initial velocity of both car and truck is same equal to v and final velocity of both is zero. But mass of truck is much more than that of car, hence change in momentum of truck is more than change in momentum of car.
(c) For same force of impact, the acceleration of car will have greater magnitude because its mass is less.
(d) Car suffers more damage than the truck, as acceleration of car is more, its velocity falls to zero in a shorter time and consequently, its momentum changes in a shorter time