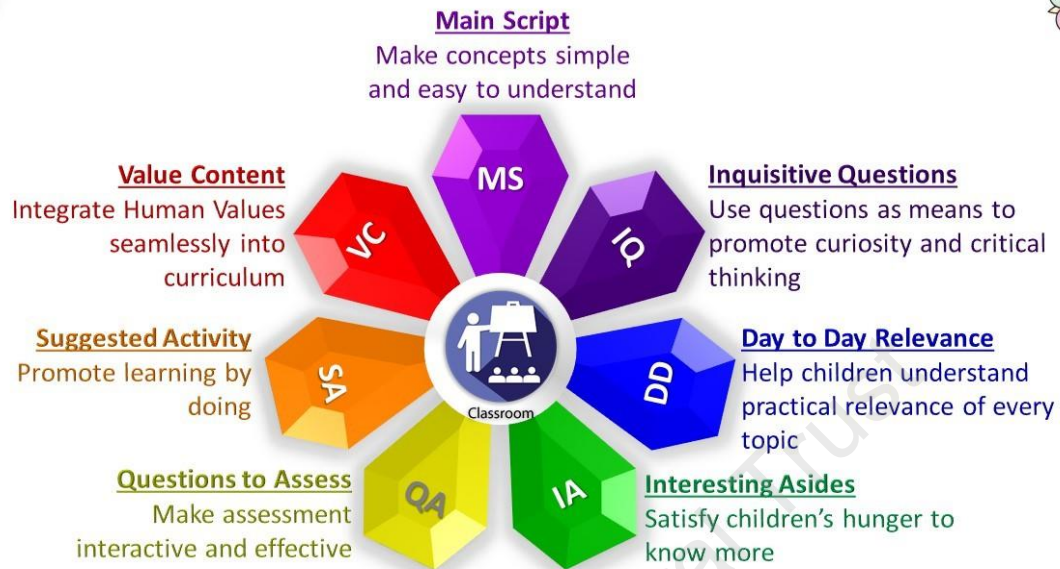


Master Lesson Plan
for
Circles

Board	Standard	Subject	Chapter	Language	Creation date
NCERT	STD IX	Mathematics	Circles	English	



Master Lesson Plan (MLP) - Covers the entire chapter with the help of these 7 asset types



For more information on how to use the lesson plan effectively, please scroll to the guidelines at the end of this document.

MS_Ideation Module_Circles

[Notes to teacher : Dear Teachers, through this MLP, we bring to you, suggestions, pedagogical approaches, ideas, Teacher Reference Documents(TRD) , Teaching Aids(TA) and Learning Aids(LA) for the topic 'Circles' for grade 9.

This ideation for lesson planning and delivery has been designed based on the curricular expectations and learning outcomes as prescribed by CBSE.]

Curricular Expectations :

Students are expected to develop ability and attitude for —

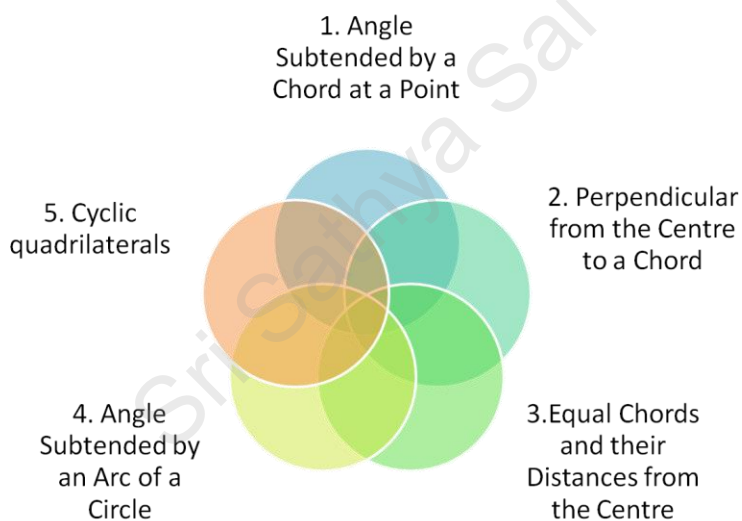
Learning Outcome:

The student will be able to

1. Derive proofs of mathematical statements related to circles by applying axiomatic approach and solve problems using them
2. Identify and classify the daily life situations in which circles can be used
3. Solve problems that are not in the familiar context of the child using above learning

Topics in this Chapter

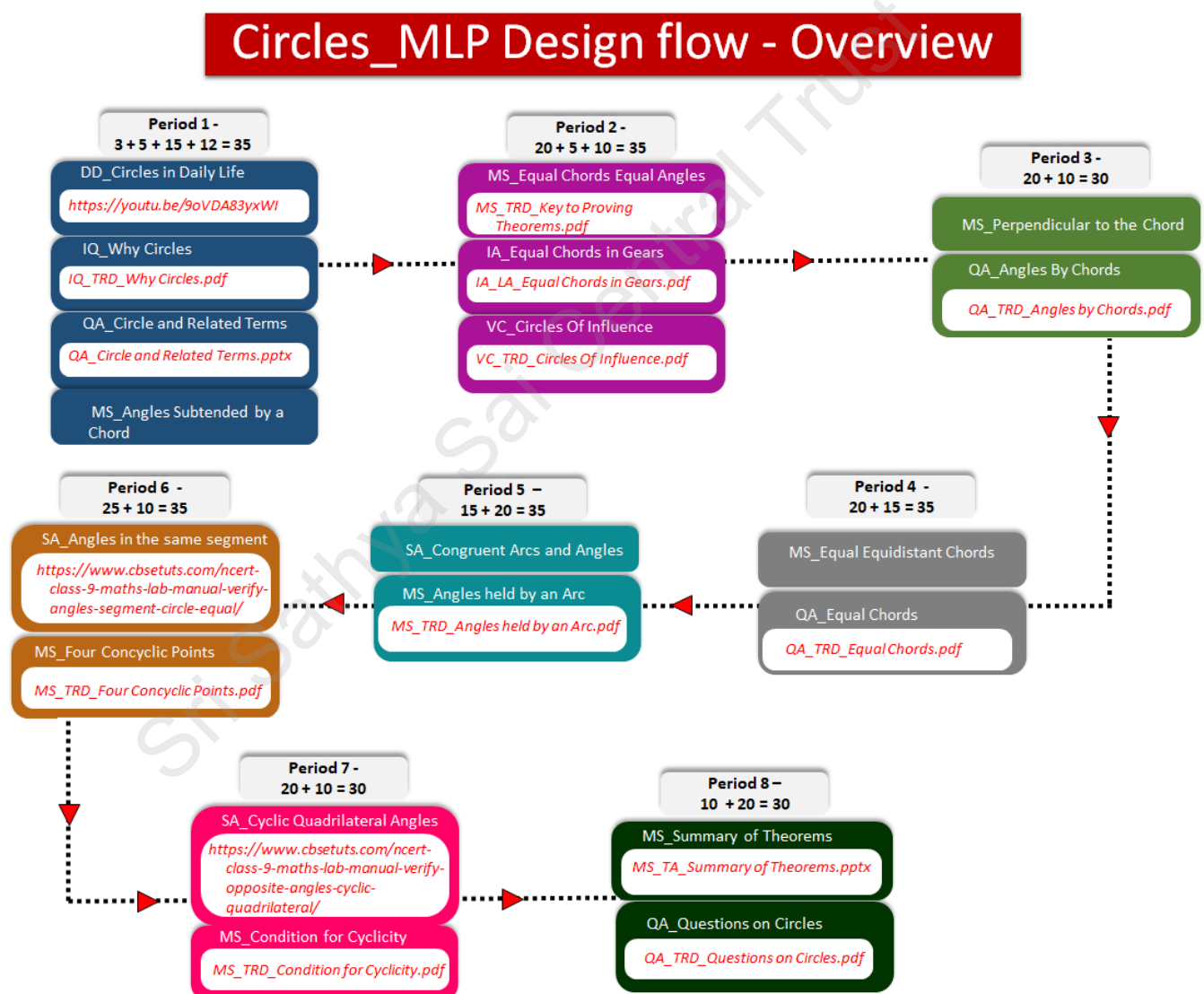
Total Time : 280 minutes, 8 periods



[Notes to teacher: The chapter on Circles has been broken down into these subtopics. Ideas and strategies on how each topic can be dealt with has been suggested. As you view this lesson plan, you will find that all the seven assets are integrated seamlessly to make learning ‘Insightful’, ‘Inspiring’, ‘Enjoyable’, and ‘Participative’. You will also notice that the activities and Value content are designed towards attainment of curricular expectations.

This lesson plan is designed for 8 periods, considering **each period to be of 35 minutes**. Additional one or two periods may be used, if required.]

Lesson Plan Flow



[Notes to the teacher: Here is the MLP at a glance for a quick reference.]

PERIOD 1

Topic : Introduction to Circle and related terms**Time :** $3 + 5 + 15 + 12 = 35$ **Asset Types:** DD, IQ, QA, MS**Objective:** Students will be able to

1. relate the application of circular shape in common engineering structures around them (such as water tank)
2. correlate the relevance of circular shape in the domains of science (such as physics and chemistry)
3. summarise the terms related to the circle.
4. identify the angles subtended by chords in the centre, minor and major segment

1) DD_Circles in Daily Life

Discuss the construction of a circular water tank and ask the following questions and allow students to share their thoughts and reasons. Ask leading or prompting questions if required.

Sample leading questions :

Why are water tanks often built in a circular shape and not square or rectangular?

Expected Answer: Circular shapes distribute pressure more evenly, making them structurally stronger. This is important for holding large volumes of water without risking collapse.

How does the circular shape of the tank help in storing and distributing water efficiently?

Expected Answer: The circular shape maximizes the volume of the tank for a given amount of material, allowing it to store more water. Additionally, the shape facilitates an even distribution of water pressure across the surface.

Imagine the tank was shaped like a triangle or a square. How might that affect its ability to hold water compared to a circle?

Expected Answer: Triangles and squares have corners, which are weaker points for holding pressure. A circular shape evenly distributes the pressure, making it more suitable for containing large amounts of water.

What are the factors you'd consider if you were asked to erect or design a water tank?

Expected answer : Capacity, material of water tank, shape of water tank, durability of water tank and any other relevant answer.

2) IQ_Why Circles

Ask questions that lead to students comprehending the relevance of circular shape in physics and chemistry.

You may refer to sample questions and examples that are provided as a Teacher Reference document in **IQ_TRD_Why Circles.pdf**

3) QA_Circle and Related Terms

QA_Circle and Related Terms.pptx has been provided as a Teacher Resource Document. Use it to

facilitate the students to recollect their previous knowledge about the various terms related to circles.

4) MS_Angles Subtended by a Chord

1. Use the blackboard to explain the concept of the angle subtended by a chord at the centre, major and minor segments.

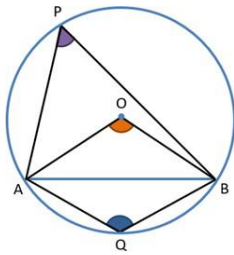


Image source : OC

2. Then explain the relationship between the length of a chord and the angle subtended by it at the centre with the help of a diagram. [Longer chords subtend bigger angles at the centre than shorter chords]

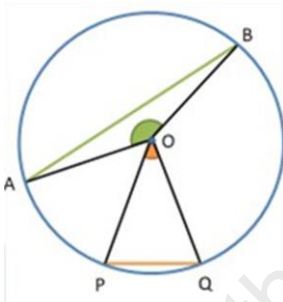


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PERIOD 2

Topic : Angle Subtended by equal chords

Time : 20+5+10 = 35 mins

Asset Types: MS, IA, VC

Objective: Students will be able to

- 1) conclude that equal chords of a circle subtend equal angles at the centre and that the converse is also true
- 2) a) appreciate the use of equal chords in gear systems (For option 1)
b) gain knowledge about the use of equal chords in gear systems (For Option 2)
- 3) discriminate between essential and good connections versus undesirable and harmful ones.

1) MS_Equal Chords Equal Angles

1. **MS_TRD_Key to Proving Theorems.pdf** has been provided as a teacher resource document. Use it to explain the process of proving theorems related to circles.
2. Theorem: Equal Chords of a circle subtend equal angles at the centre.
Converse: If the angles subtended by the chords of a circle at the centre are equal then the chords are equal.
Use the format in the guideline provided in the teacher resource document (MS_TRD_Key to Proving Theorems.pdf) and interactively elicit the proof of the theorem and its converse

2) IA_Equal Chords in Gears

IA_LA_Equal Chords in Gears.pdf has been provided as a Learning Aid.

OPTION 1: Use the poster given in that to enable student discussion on how equal chords are used in the design and functioning of gear systems.

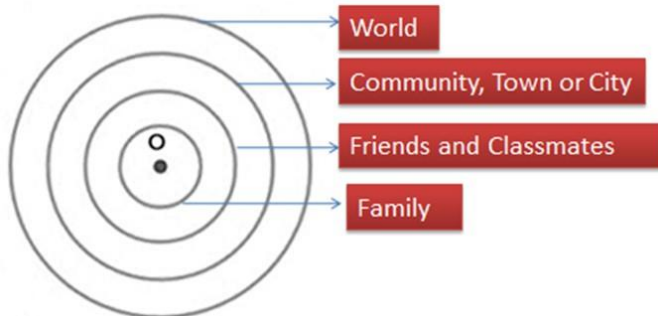
You can use the following points to help discuss the poster:

- In gear system design, gears are typically designed with teeth that mesh with the teeth of another gear.
- The shape of the gear teeth is crucial for proper meshing and transfer of power between gears.
- One method for designing gear teeth is to use the equal arc method, which involves dividing the circle that represents the gear into equal arc lengths and then shaping the gear teeth as equal chords of those arcs.
- This method ensures that the gear teeth have equal pitch and are evenly spaced around the gear.
- The gear teeth are then designed as equal chords of those arcs. As you can see, the teeth are evenly spaced around the gear and have equal pitch

OR

OPTION 2: Put up the poster in the notice board so that students observe and read up during their leisure time and gain knowledge on the use of equal chords in the design of gears.

[Note to the teacher: In option 2 we are using the CORRIDOR as a learning space and students learn directly from the poster at their own pace. You may take a print out of the poster to be put up on the noticeboard and the same can be reused in subsequent years.]



This asset discusses the need for the student to discriminate and choose people and activities that add value to her/his life and let them be in the core circle.

VC_TRD_Circles Of Influence.pdf has been provided as a teacher resource document. You can refer to the document and transact the content in the class.

PERIOD 3

1)MS_Perpendicular to the Chord

Theorem: A perpendicular from the centre of a circle to a chord bisects the chord.

Converse: The line drawn through the centre of a chord to bisect the chord is perpendicular to the chord.

Interactively elicit the proof of the above theorem and the converse using the format in the guideline provided in the Teacher Resource Document (MS_TRD_Key to Proving Theorems.pdf)

Topic : Perpendicular from the Centre to a Chord

Time : 20+10 = 30 mins

Asset Types: MS, QA

Objective: Students will be able to

- 1) conclude that a perpendicular from the centre of a circle to the chord bisects the chord and that the converse is also true
- 2) apply the theorem on equal chords and equal angles in solving problems

2)QA_Angles By Chords

QA_TRD_Angles by Chords.pdf has been provided as a teacher resource document.

Use it to reinforce the problem solving ability of the students.

PERIOD 4

Topic : Equal Chords and their Distances from the Centre

Time : 20+15 = 35 mins

Asset Types: MS, QA

Objective: Students will be able to

- 1) conclude that equal chords of a circle(or of congruent circles) are equidistant from the centre(or centres) and that the converse of this theorem is also true.
- 2) apply the concepts learned so far in this chapter in solving problems.

1) MS_Equal Equidistant Chords

1. Ask students to draw a line and a point. Some students will place the point on the line and some others outside. From there, explain the two cases of "distance of a line from the point".
[Notes to the teacher: For a point on the line, the distance between the point and line is zero. If the point is outside the line, the distance of the line from the point is the perpendicular distance from the line to the point]
]
2. Theorem: Equal chords of a circle(or of congruent circles) are equidistant from the centre.
Converse: Chords that are equidistant from the centre of a circle(or of congruent circles) are equal.
Use the format in the guideline given in the Teacher Resource Document (MS_TRD_Key to Proving Theorems.pdf) to interactively elicit the proof of the theorem and the converse.

2)Equal Chords

Reinforce their problem solving ability with the help of **QA_TRD_Equal Chords.pdf**

[Notes to the teacher: The teacher may solve the Multiple Choice questions and the first 3 questions in the second section interactively with the students. The other questions may be taken up for additional practice in a subsequent period or given as a home assignment.]

PERIOD 5

Topic : Angle Subtended by an Arc of a Circle

Time : 15+20 = 35 mins

Asset Types : SA, MS

Objective: Students will be able to

- 1) conclude that congruent chords cut off congruent arcs and hence conclude that congruent arcs subtend congruent angles at the centre.
- 2) conclude that the angle subtended by an arc at the centre of a circle is twice the angle subtended by it at any point on the remaining part of the circle and also that the angle in a semicircle is a right angle.

1) SA_Congruent Arcs and Angles

1. Ask the students to draw two congruent chords in a circle. Let them cut along one chord and superimpose it on the other chord so that the minor arcs coincide.
2. They will be able to establish that equal chords cut off equal arcs.
3. As they have already proved that equal chords subtend equal angles at the centre, they may conclude that equal arcs subtend equal angles at the centre and that the converse is also true.

2)MS_Angles held by an Arc

1. **Theorem:** the angle subtended by an arc at the centre of a circle is twice the angle subtended by it at any point on the remaining part of the circle.
MS_TRD_Angles held by an Arc. pdf has been provided as a Teacher Resource Document. Use it and give the skeleton steps to facilitate the students to prove the theorem.
2. Use the questions at the end of the above Teacher Resource Document(TRD) to guide the students to deduce the property that the angle in a semicircle is a right angle.

PERIOD 6

Topic : Angle Subtended by an Arc of a Circle

Time : 25+10 = 35 mins

Asset Types: SA, MS

Objective: Students will be able to

- 1) conclude that angles in the same segment are equal.
- 2) conclude that if a line segment joining two points subtends equal angles at two other points lying on the same side of the line containing the line segment, then the four points lie on a circle.

1)SA_Angles in the same segment

Theorem: Angles in the same segment are equal

Use the link provided below and facilitate the students to do it as a Maths Lab activity.

cbsetuts.com/ncert-class-9-maths-lab-manual-verify-angles-segment-circle-equal/

2)MS_Four Concyclic Points

Theorem: A line segment joining two points subtends equal angles at two other points lying on the same side of the line containing the line segment, then the four points lie on a circle.

MS_TRD_Four Concyclic Points.pdf has been provided as a Teacher Resource Document.

Use it and facilitate the students to prove the theorem.

PERIOD 7

Topic : Cyclic Quadrilaterals

Time : 20+10 = 30 min

Asset Types: SA, MS

Objective: Students will be able to

- 1) conclude that the sum of either pair of opposite angles of a cyclic quadrilateral is 180 degrees.
- 2) conclude that if the sum of a pair of opposite angles in a quadrilateral is 180, the quadrilateral is cyclic.

cbsetuts.com/ncert-class-9-maths-lab-manual-verify-opposite-angles-cyclic-quadrilatera/

1)SA_Cyclic Quadrilateral Angles

Theorem: The sum of either pair of opposite angles of a cyclic quadrilateral is 180 degrees.

Use the link provided below and facilitate the students to do it as a Maths Lab activity.

2)MS_Condition for Cyclicity

Theorem: If the sum of a pair of opposite angles in a quadrilateral is 180, the quadrilateral is cyclic.

MS_TRD_Condition for Cyclicity.pdf has been provided as a Teacher Resource Document.

Use it to interactively facilitate the students to prove the theorem.

PERIOD 8

Topic : Summative on Circles

Time : 10+20 = 30 mins

Asset Types: MS, QA

Objective: Students will be able to

- 1) summarise the theorems learnt in the chapter.
- 2) apply their knowledge about the various theorems on circles and cyclic quadrilaterals to solve problems.

1) MS_Summary of Theorems

MS_TA_Summary of Theorems.pptx has been provided as a Teaching Aid.

Use the PPT provided to enable the students to summarise and recollect the theorems learnt in this chapter.

2)QA_Questions on Circles

QA_TRD_Questions on Circles.pdf has been provided as a Teacher Resource Document.

Use it to interactively elicit the answers from the students.

[Notes to the teacher: The teacher may solve the Multiple Choice questions and the first 3 questions in the second section interactively with the students. The other questions may be taken up for additional practice in a subsequent period or given as a home assignment. The teacher may use a few extra periods to facilitate the students to solve the various exercises in the textbook.]

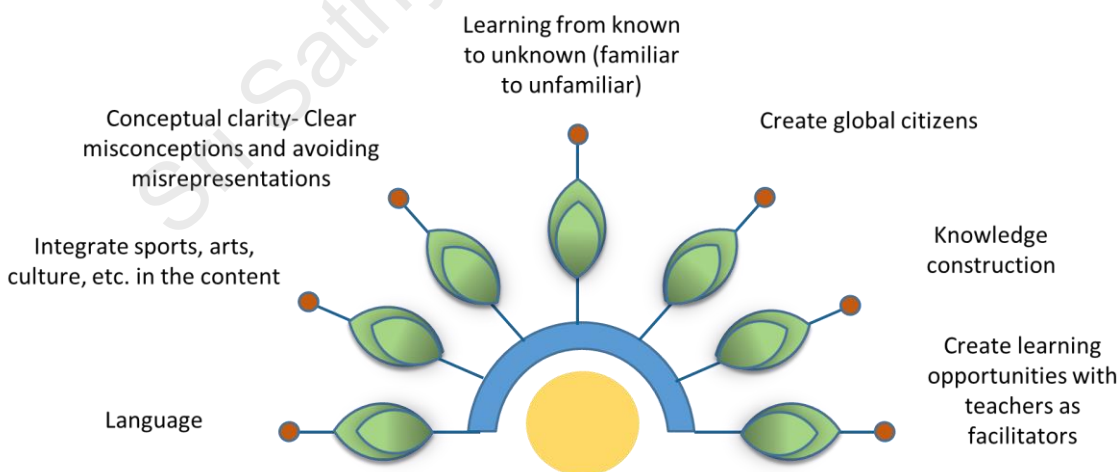
LESSON PLAN DESIGN

You would have noticed that the lesson plan designed has ample opportunities for

- ★ activity based learning
- ★ development of problem solving skills
- ★ development of critical thinking skills
- ★ relevance and connection of the topic to the real world
- ★ relevance to the application of concept in other subjects

Teaching Aids, Learning Aids and Teacher Reference Documents mentioned in this Lesson plan are provided in the folders below.

Salient recommendations of NEP



We hope that this Lesson plan design which is aligned to the NEP2020 guidelines will be helpful for you.

Thank you.

Time to teach	Asset type	Theme	Sub Theme
280 minutes	Main Script	Circles	Angle subtended by a chord Angle subtended by an arc of a circle & theorems Chord, Arc, Segment and Sector Circle passing through three points Circle: Center Circumference, sector and segment of a circle Diameter of a circle Equal chords & theorems Interior, exterior and circular regions Parts of a Circle Perpendicular from the center to a chord Properties of cyclic quadrilaterals Radius of a circle The circle Types of circles



Sri Sathya Sai
VIDYA VAHINI
श्री सत्यसाई विद्या वाहिनी

Sri Sathya Sai Central Trust

Annexure to Master Lesson Plan

What is the purpose of this Master lesson Plan?	This Master Lesson Plan (MLP) prepared by Sri Sathya Sai Vidya Vahini (SSSVV), covers the entire chapter for the given board. The MLP for the chapter given in the textbook is broken down into smaller modules known as assets. Any chapter can be taught using the 7 asset types in SSSVV methodology. Several different assets together complete the entire chapter. Depending on the requirement, each asset is supported by teaching aids such as animated presentation, audio, video, and learning aids such as worksheets. The MLP is for the teacher's preparation and the teaching aids are for use in the classroom.
How to use it?	You can prepare for your class with this MLP by following 3 simple steps: 1. Read your textbook; 2. Go through the information given in the assets (document & multimedia); 3. Prepare your teaching notes. Great! Now you are ready to transact the chapter.
Duration	Kindly note the duration given for each asset. Due care has been taken in planning the assets, to ensure the chapter is completed within the time specified by the Board. Note: Preparation time is not included in the asset duration. The teaching time depends on the duration of the teaching aids and is not impacted by the length of the MLP.
What is a 'Main Script' (MS) Asset?	The Main Script asset is there for explaining the main concepts of the chapter clearly. The information given in the textbook is simplified, organised and structured to give more clarity. Additionally, you may find a video or mnemonics or a graphic organiser to deepen the understanding of the concept.
How to teach using the MS asset?	Please use the blackboard, slides and interaction to develop the concept.
What is an 'Inquisitive Questions' (IQ) asset?	The Inquisitive Questions asset uses questions to promote higher order thinking like the n th why, what-if, new perspectives, cause-effect, and others, creating curiosity.
How to teach using the IQ asset?	You may use the questions to connect with the students, encourage exploration to engage them in the learning process. You may allow multiple responses and instead of rejecting any of the responses, ask why, before revealing the suggested answer or hints.
What is a 'Day to day Relevance' (DD) Asset?	The Day to Day Relevance asset helps students understand the practical relevance of every topic, making them eager participants in the classroom. If students connect the concepts to their environment, they would learn meaningfully without dislike or simply memorizing for exams.
How to teach using the DD	You may use the asset by asking questions about their experience and use it to establish why they are learning the topic. If necessary you may substitute with a

asset?	recent or local example.
What is an 'Interesting Aside' (IA) asset?	The Interesting Aside asset uses attention grabbing titbits or anecdotes to bring joy and satisfy the child's hunger to know more. This is a quick/short asset intended to bring attention back to the main concept being taught.
How to teach using the IA asset?	You may use this asset to give a piece of interesting information relevant to the topic, without prolonged explanation/discussion. You may suggest appropriate books for further reading.
What is a 'Suggested Activity' (SA) Asset?	The Suggested Activity asset provides a detailed step by step procedure for the teacher to conduct a hands-on activity. This promotes Activity Based Learning.
How to teach using the SA asset?	You may use this asset to energise your students to learn by doing simple, fun-filled activities based on the topic. The asset includes - preparation, activity, and follow-up. You may engage the students in the preparation and follow-up stages to develop collaboration and responsibility. You could try it once, yourself, before the actual delivery to be more comfortable with it. Note: The duration mentioned in the asset is usually for the activity part only.
What is a 'Value Content' (VC) Asset?	The Value Content asset integrates Universal Human Values (such as empathy, inclusivity, respect for nature that translates into responsible behaviour) seamlessly into the curriculum, as the "End of education is character".
How to teach using the VC asset?	You may use this asset to engage with the students to bring out their innate values and connect with the intrinsic values in the topic/concept. The asset includes pointers on the specific pedagogical technique followed.
What is a 'Questions to Assess' (QA) asset?	The Questions to Assess asset uses an interactive approach to check learning of different types of learners, and provides feedback to the teacher for appropriate action. The questions cater to all the levels of Bloom's Taxonomy. Questions from 'Apply' level and above enable students to reflect on their learning.
How to teach using the QA asset?	You may go through the slides to understand its flow and know when to click for the answer (slides include suggested answers). While presenting in the class, you may display the question and encourage multiple responses, before revealing the answer. In some cases, this asset may include extra questions/worksheet that can be given as homework.