DEPARTMENT OF SCHOOL EDUCATION

RIGHT TO EDUCATION
SAMAGRA SHIKSHA - A.P.
EDUCATION FOR ALL

STRUCTURED LESSON PLANS FOR CBSE-AFFILIATED SCHOOLS

PHYSICS

GRADE - 09

A Teacher Resource Book for
Competency Based Teaching-Learning

STATE COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING (SCERT)

Committee for Development of Structured Lesson Plans

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MESSAGE BY PRINCIPAL SECRETARY

It brings me a great joy to invite all the teachers of CBSE-affiliated government schools to this valuable resource book of structured lesson plans. Inspired by the vision of our honorable Chief Minister, we are committed to supporting the teachers in shaping a bright future for all the children in Andhra Pradesh. We envision our children transforming into global citizens, excelling in academics and being ready for the world of work. In order to aid the teachers in this pivotal task of preparing the students to emerge as global citizens, the School Education Department is committed to making available the best resources and training. This lesson plans resource book is a transformational step in that direction. Utilized appropriately, this resource books will transform the teaching-learning process and experience in the classroom and lead to deeply engaging the students.

I hope you make the best use of this resource, which has been put together by our own teachers trained by experts from Azim Premji University and facilitated by the Center for Research in Schemes and Policies (CRISP). They have taken into consideration the teaching-learning needs of all types of learners and created lesson plans that are rich in activities, examples, and assessments. They have followed the CBSE Learning Framework and NCERT Learning Outcomes for Secondary Stage, along with principles from the National Curriculum Framework: School Education 2023.

At the crucial juncture of secondary school, our children need spirited teachers like you to prepare them for the changing and dynamic world. You bear the power and responsibility to shape their minds and hearts and guide them to step out into the world and contribute to our state's growth and country's economy.

Your dedication and efforts in implementing these structured pedagogical approaches will not only enhance the learning experience of our students but also equip them with the necessary skills and knowledge to thrive in an ever-evolving global landscape. Together, let us embark on this journey of educational excellence and empower our students to become the leaders of tomorrow.

With great hope and appreciation,

Shri Praveen Prakash, IAS
Principal Secretary, Department of School Education
Government of Andhra Pradesh

MESSAGE BY COMMISSIONER

The United Nations Sustainable Development Goal 4 (SDG 4) underscores the pivotal role of education in unleashing human potential and fostering self-respect. As the Commissioner of School Education, I am privileged to champion a vision that empowers the children of Andhra Pradesh with boundless possibilities and opportunities. Through pioneering reforms in education, encompassing cutting-edge infrastructure, ongoing professional development for educators and administrators, innovative digital initiatives, and an unwavering commitment to providing top-tier educational resources, our state stands as a beacon of educational transformation.

Government of Andhra Pradesh is committed to implement best initiatives to enhance rthe quality of education in the State. Obtaining CBSE affiliation to 1000 schools is one of such key initiatives. This lesson plan resource book developed for the use of teachers working in CBSE schools represents yet another milestone in our journey. Recognizing teachers as the cornerstone of our education system, we have entrusted them to craft these lesson plans for your benefit. After undergoing rigorous training in pedagogy, subject matter, learning outcomes and competencies, our educators have infused these lesson plans with their profound knowledge of the subject, and understanding of our students and their diverse contexts. It is a labor of love and thought, an amalgamation of explorations and experiments, presented for you to embrace and utilize effectively.

These lesson plans are created with the aim of providing a rich repository of ideas to enhance classroom engagement and productivity, and provide yet another innovative resource that teachers can employ. Feel free to adapt and supplement these plans as you see fit. The teacher reflections section serves as a tool for self-assessment and improvement, allowing you to augment your lessons and address any gaps you may identify.

I am optimistic about our state's trajectory towards competency-based teaching, with a focus on measurable learning outcomes that can be continually evaluated and enhanced. The decision to affiliate 1000 schools with CBSE and implement a curriculum aligned with national standards is indeed a significant stride in the right direction. Together, let us embrace this transformative journey towards educational excellence and empower our students to thrive in an ever-evolving world.

I congratulate everyone who worked towards bringing this excellent resource book for the teachers. I thank Center for Research in Schemes and Policies (CRISP) for the innovative ideas they presented to the Government, including development of structured lesson plans. The support of SPD Samagra Shiksha, continuous facilitation by CRISP, expert technical advice of Azim Premji University faculty, hard work of our teachers, CBSE team in Commissionerate office and SCERT made it possible to bring out this resource book in time for the 2024-25 academic year.

With sincere optimism and appreciation,
Shri S Suresh Kumar, IAS
Commissioner,
Department of School Education,
Government of Andhra Pradesh

MESSAGE BY THE STATE PROJECT DIRECTOR

The National Education Policy 2020 highlights that the purpose of education is to develop good human beings capable of rational thought and action, possessing compassion and empathy, courage and resilience, scientific temper and creative imagination, with sound ethical moorings and values. It aims at producing engaged, productive, and contributing citizens for building an equitable, inclusive, and plural society as envisaged by our Constitution. To realize the NEP's vision, it is essential for educators to align with this goal and transition from curriculum-centric to competency-driven teaching methods.

The State's commitment to this shared vision is visible in the Strengthening Andhra's Learning Transformation (SALT) Project, where one of the pivotal focus areas is the professional development of teachers. This entails utilizing insights from self-assessments, academic performance data from school-based evaluations, and classroom observations to enhance pedagogical skills. With continuous support from the education department, teachers will refine their pedagogical approaches, ensuring effective delivery of lessons.

In the same vein, I am delighted to introduce this Lesson Plan resource book for our CBSE-affiliated schools, crafted by experts from both within our state and across the nation. These lesson plans signify a shift away from rote memorization and content accumulation towards a structured approach aimed at fostering values, dispositions, and competencies in students. Rooted in the vision of the NEP and operationalized by the National Curriculum Framework: School Education 2023, each plan corresponds to a 40-minute class targeting specific learning outcomes from NCERT's Secondary Stage. These outcomes collectively contribute to observable learning achievements and the development of competencies over time. Moreover, this resource book empowers teachers to tailor their content and assessments dynamically by monitoring and addressing students' learning needs continuously.

I hope the teachers will find these resources valuable and helpful in transforming classroom transactions. Together I hope we will reshape the educational landscape of Andhra Pradesh in the years ahead. Best wishes for your endeavors!

Shri B Srinivasa Rao, IAS
State Project Director, Samagra Shiksha
Government of Andhra Pradesh

MESSAGE BY JOINT DIRECTOR, CBSE

In a landmark decision, the Government of Andhra Pradesh affiliated 1000 Government schools with the Central Board of Secondary Education (CBSE). This transition marks a significant milestone in our efforts to provide standardized and high-quality education to our students. The CBSE curriculum is widely recognized for its comprehensive and contemporary approach to learning, offering students a competitive edge on a national scale. The Board emphasizes holistic development of learners by providing a stress-free learning environment that will develop competent, confident and enterprising citizens who will promote harmony and peace. It is committed to providing quality education to promote intellectual, social and cultural vivacity among its learners.

By aligning our schools with CBSE, we aim to ensure our students are well-prepared to compete on a national level and excel in today's dynamic world. In order to achieve this, our utmost efforts have gone into developing these structured lesson plans incorporating NCERT's Secondary Stage Learning Outcomes, the National Curricular Framework: School Education 2023, and CBSE Learning Framework document developed by Azim Premji University. 'Structured Pedagogy' is a scientific, evidence-based, learner-centric approach for teaching that equips every teacher with clearly defined objectives, proven methods, well-structured tools, and practical training. After many rounds of rigorous training, expert teachers from our CBSE schools integrated the conceptual and practical aspects of their subjects and condensed them into these easy-to-use lesson plans.

We thank the Center for Research in Schemes and Policies (CRISP) and Azim Premji University for their innovative ideas and tireless support.

I encourage each of you to fully utilize these plans and personalize them to fit your teaching style. May this invaluable resource serve as a valuable tool as you guide Grade 10 students through this critical stage of their education. Your dedication as teachers brings us immense joy and pride, as we entrust the future of our state's children to your capable hands. Wishing you all the best!

Mr Krishna Reddy
Joint Director, CBSE
Department of School Education
Government of Andhra Pradesh

MESSAGE BY CENTRE FOR RESEARCH IN SCHEMES AND POLICIES (CRISP)

Shri. **R. Subrahmanyam**
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Mrs. P. Usha Kumari
I.A.S.(Retd), State Lead of AP Team CRISP

In October 2023, the Centre for Research in Schemes and Policies (CRISP) forged a significant partnership with the Government of Andhra Pradesh, to help bring about a transformation for the state's School Education system. Our inaugural initiative was designed to cultivate excellence within the 1000 CBSE-affiliated schools. CRISP's primary focus was to support both teachers and students during the transition from the State Board to the CBSE Board.

Research reveals that an average teacher grapples with approximately 1,500 decisions daily. While it may be impractical to intervene in every decision-making process, our aim was to alleviate the cognitive load associated with tasks such as lesson planning, question formulation, activity design, and assessment creation. Recognizing the novelty of transitioning from the State Syllabus to CBSE, our initiative encompassed the provision of essential resources alongside comprehensive training for all educators involved.

To enhance our efforts, we collaborated with Central Square Foundation, a renowned organization in the field of Education, to train our teachers in their Structured Pedagogy approach. This evidence-based, learner-centric methodology equips educators with clearly defined objectives, proven methods, well-structured tools, and practical training.

We are thankful to professors from Azim Premji University who provided invaluable support by mentoring the core group of teachers over a six-month period, guiding them through NCERT's Learning Outcomes for the Secondary Stage and the National Curriculum Framework: School Education 2023. The culmination of these efforts is the creation of this resource book, comprising structured lesson plans for the benefit of teachers, and vetted meticulously by the SCERT. We hope that the tremendous effort of our teachers serves as an inspiration to continue shaping the minds of our youth.

We extend our sincere gratitude to Dr. Emmanuel Joseph, Joint Commissioner (Academics) at CBSE, New Delhi, professors from Azim Premji University, experts from Central Square Foundation, the State CBSE team, SCERT, and the entire Department of School Education for their invaluable guidance and support throughout this endeavor. Their deep commitment to enhance the quality of education and to transform the teaching-learning process in the classrooms made it possible to bring this initiative to life within a remarkably short span of time.

We thank the Government of Andhra Pradesh for giving us this opportunity, for the trust they reposed in accepting the innovative idea and facilitating it to germinate and fructify.

Centre for Research in Schemes and Policies
February, 2024

FOREWORD BY DIRECTOR, SCERT

At the heart of quality education lie two indispensable pillars: the teacher and the student. While textbooks, digital resources, infrastructure, and curriculum play crucial roles in the educational landscape, it is the teacher who bears the primary responsibility of delivering lessons, facilitating comprehension of complex concepts, nurturing independent thinking, and molding individuals into responsible members of society. The Department of School Education, Government of Andhra Pradesh aspires to create citizens equipped with the skills and competencies to succeed and solve problems at a global scale, while remaining locally rooted and aware.

To achieve this goal, we have developed a comprehensive resource book to support teachers across the state, enhancing their planning and teaching processes with ease and creativity.

These meticulously crafted lesson plans have been curated by trained educators and thoroughly reviewed by SCERT experts. Each lesson plan is structured into distinct period plans, addressing specific topics within the lesson. Clear learning outcomes are outlined at the beginning of each lesson and progressively addressed throughout the class session. Furthermore, each period plan is divided into sections including Learning Outcomes, Teaching-Learning Process, Pointers for Assessment, and Material Required, offering teachers a flexible framework to tailor to their preferences. The provided questions to assess prior knowledge, suggested activities, and prompts for understanding checks serve as guides, encouraging teachers to adapt the plans to suit the unique needs of their classroom and students.

The SCERT extends its sincere appreciation to the dedicated members of its textbook committee, source material reviewers, lesson plan creators, and technical partners for their invaluable contributions in realizing this vision. We also express our gratitude to the Principal Secretary and Commissioner, Department of School Education, and State Project Director, Samagra Siksha, Department of School Education for their steadfast commitment to promoting quality education, consistently driving us toward excellence in all facets. We appreciate the steadfast support of Center for Research in Schemes and Policies (CRISP) and professors from Azim Premji University in developing the lesson plans.

Dr B Pratap Reddy
Director,
State Council of Educational, Research, and
Training Government of Andhra Pradesh

INTRODUCTION AND BACKGROUND TO THE STRUCTURED LESSON PLANS RESOURCE BOOK

The National Education Policy, 2020 (NEP) focuses strongly on a need for a well-defined Curriculum and a Structured Pedagogy in schools, to ensure holistic, integrated, enjoyable and engaging learning of the students.[1] In pursuance of the Memorandum of Understanding (MoU) signed between Government of Andhra Pradesh (GoAP) and Centre for Research in Schemes and Policies (CRISP), and the recommendation made by CRISP in the Action Plan for CBSE, GoAP agreed that *"Structured pedagogy should be adopted for Classes 8 and above in the newly converted CBSE schools. For this purpose, while using material already available, standard lesson plans should be prepared."* In furtherance of adapting structured pedagogy approach in Government CBSE Schools to improve the quality of teaching-learning, the GoAP organized the following:

1. Organised a Structured Pedagogy workshop was organized in collaboration with CRISP in Vijayawada from 11th to 13th July 2023. Experts from Central Square Foundation and Azim Premji University (APU) anchored the workshop, with additional sessions by Room to Read, Leadership for Equity, Ambitus World School, and SCERT Telangana. Sessions focused on the need for a structured way of teaching and learning, shifting from rote method to competency based curriculum, and delved into the NCERT Learning Outcome Framework for the Secondary Stage. A total of 60 subject teachers along with A.P SCERT subject experts participated in the workshop representing English, Mathematics, Social Science, Biology, Chemistry, and Physics. Each subject group consisted of 10 teachers, 1 SCERT expert, and 1 CBSE School Principal acting as a Coordinator. With guidance from CSF and APU, the subject groups prepared one sample lesson plan per subject by the end of the 3-day workshop.
2. Post the workshop, facilitated the expert subject teachers to work on lesson plan development, with virtual support from APU faculty virtually.
3. Organised a Capacity Building workshop from 11th to 14th October 2023 in Vijayawada with expert support of experts from APU. Sessions were held on mapping content to specific learning competencies, designing and using creative Teaching-Learning Materials, adding Check for Understanding questions, using interdisciplinary approach in the lessons, addressing student misconceptions, and

[1] Chapter 4 & 5, National Education Policy, 2020 (NEP, 2020)

creating a diverse range of assessments. The workshop enhanced the ability of the teachers to

a. understand the principles and practices underpinning competency-based curriculum as outlined in NEP 2020 and NCF-SE 2023;

b. equip the teachers to analyse the need to effectively align curriculum content, competencies, pedagogical practices, and assessment methods in the classroom;

c. helped them to learn to develop competency-based lesson plans that integrate NCF-SE 2023 guidelines, ensuring that learning outcomes are aligned to the desired competencies with the help of model lesson plans

d. trained them to gain practical insights into designing and implementing both formative and summative assessments that accurately measure students' progress toward achieving the competencies set forth in NCF-SE 2023

4. Held a physical camp for the core team of teachers to develop and quality check the lesson plans for all the subjects in Vijayawada for 12-days, from 20th November to 1st December 2023. APU teachers and Leadership for Equity team provided technical support.

5. In early February 2024 the lesson plans developed for Grade 9 and 10 were vetted and finalised by AP SCERT and sent to the Textbook Press for printing and distribution.

ELEMENTS OF THE STRUCTURED LESSON PLANS

All lesson plans are meticulously organized into detailed period plans, each focusing on a specific topic and its corresponding Learning Outcomes. These period plans are then subdivided into four essential sections:

1. Topic and Learning Outcomes, along with associated Indicators
2. Teaching-Learning Process, highlighting Pedagogical Strategies
3. Assessment Strategies to gauge student understanding and progress
4. Materials required, ensuring all necessary resources are readily available for effective instruction.

Within these sections, the following elements have been covered:

- **Higher order thinking questions** have been added to encourage critical thinking, problem-solving, creativity, and analysis. These questions usually move beyond 'What', and 'When', and focus on 'Why', or 'How'. Some examples of these are:
  "Explain the twinkling of stars." [Physics]
  "How does trade help connect the countries in the world?" [History]
  "Why can amphibians and reptiles tolerate mixing of blood to some extent?" [Biology]
  "Do you think it was right for the farmer to be angry with the postmaster? Why or why not? [English]
  "What should India do or achieve to become a developed country?" [Economics]
  "Why does a snail change its sex?" [Biology]
  "How did Gendhadhur, a backward village in Mysore, Karnataka, become rich in rain water?" [Geography]
  "Why can't astronauts see the rainbow from the surface of the moon?" [Physics]
- **Keywords and key concepts** are stated in the beginning of every chapter so that the teacher can be sure to cover them during the course of the lesson
- **Prior knowledge and skills are tested** at the beginning of every period to assess whether students have retained concepts covered in previous lessons, and to gauge the overall level of knowledge on the topic to be covered
- **Prompts and questions to address common misconceptions** about the topic have been given in the plans to clarify any incorrect ideas students may have. For example:
  "A woman in your neighborhood is blamed for giving birth to a baby girl. Is the sex of the baby determined by her? Remove the misconception through your argument." [Biology]
- **Discussion prompts** for class or group discussions have been given, especially for the humanities subjects. For example:
  "Why do you think men receive higher wages than women for the same job? Discuss." [Economics]
  "Human societies have steadily become more interlinked. Comment." [History]
  "Discuss the benefits and drawbacks of using chemical fertilizers." [Geography]
- **Assessment and remedial periods** have been allocated after every lesson plan to gauge student learning, and revise concepts that students need more clarity or practice in, before moving to the next lesson
- **Inter-disciplinary nature of subjects and topics** has been encouraged in the plans so that students recognize the value of all subjects equally. It also promotes a holistic understanding of the topic and opens them up to thinking about an issue from various lenses
- **Formative and summative assessments, check for understanding questions, and worksheets** are given for every lesson to assess student learning at every stage of the lesson
- **Space for teachers to reflect on every period** has been provided at the end of the plan. The prompts are designed to assist teachers in assessing the alignment of their plan with overarching curricular goals and competencies, evaluating student engagement levels, ensuring effectiveness of assessment strategies in measuring

student understanding, and gauging the efficacy of teaching materials, activities, and case studies utilized

HOW TO USE THESE LESSON PLANS

Teachers should have a comprehensive understanding of the curricular goals, competencies, and the nature of the subject they teach. It is essential to thoroughly review the section on "Pedagogical Practices" to gain deeper insight into teaching methodologies. With this groundwork, teachers can then delve into the lesson plans for their subject. It is highly recommended to study the entire lesson plan before initiating the lesson in class. Throughout the lesson, teachers can refer to each period plan and manage class time effectively to cover the elements outlined in the plan. Additionally, teachers are encouraged to modify the plan as needed, incorporating or removing content, questions, or activities to address the specific needs of their students and contextual requirements.

PEDAGOGICAL PRACTICES

Broad Aims of School Education

The Learning Standards are guided by certain widely agreed upon broad Aims of School Education that are articulated in this NCF. These aims have been arrived at from the vision and purpose of education as envisaged by NEP 2020:

1. **Rational Thought and Autonomy:** An individual should have the capacity of rational reasoning and sufficient knowledge to understand the world around them. An individual should be able to make an informed decision. This fundamentally requires knowledge in breadth and depth.
2. **Health and wellbeing**: School education should be a wholesome experience for students. Students should acquire Knowledge, Capacities, and Dispositions that promote mind-body wellness.
3. **Democratic participation:** This requires appropriate knowledge capacities, values, and dispositions so that an individual may be oriented towards sustaining and improving the democratic functions of Indian society.
4. **Economic participation:** Education should work as an enabler for a healthy democracy as well as a healthy economy.
5. **Cultural and social participation:** Along with democracy and economy, society, and culture also play an important role in the mode of associated living. An individual should acquire capacities and a disposition to contribute meaningfully to culture.

NATURE OF THE SUBJECT: SCIENCE

(Adapted from the CBSE Learning Standards document. Please refer to it here: https://cbseacademic.nic.in/cbe/documents/Learning_Standards_Science.pdf)

Among many ways in which the inquiring and imaginative human mind engages, expresses, and explains nature's wonder is through science. It is a human endeavour that observes the physical and biological environment carefully, looks for any meaningful patterns, processes, and relations, making and using new tools to interact with nature, and building conceptual models to understand the world. Also, the knowledge developed helps understand the evolutionary past, current state and predict the future of humanity and nature. It provides us with a way to present ideas that can be tested, repeated, and verified. Scientists gather evidence (as opposed to "proof") to support or falsify hypotheses. Theories, laws, and principles are supported, modified, or replaced as new evidence appears and are central to scientific thinking.

Despite many attempts to shrug it off in textbook chapters and a note to the teacher section, the prevailing perception on the nature of doing science is through the scientific method and not a scientific method. And that method is linear. This perception of the nature of doing science needs countering, for the art of doing science is a creative, iterative, and interconnected process built on curiosity, healthy scepticism, and questioning.

While science is at its best in understanding simple linear systems of nature, its predictive or explanatory power is limited when it comes to dealing with nonlinear complex systems of nature. Yet, with all its limitations and failings, science is unquestionably the most reliable and powerful knowledge system about the physical world known to humans, augmenting the spirit of enquiry, creativity, objectivity, and aesthetic sensibility leading towards the development of scientific temper. The school science curriculum across classes could gradually nurture scientific temper through appropriate learning opportunities.

NCF 2005 position paper on teaching of science at secondary stage emphasises the learning of science as a composite discipline, in doing so, it encourages the designing of advanced technological modules, analysing issues of health and the surrounding environment, and experimenting systematically to discover and verify theoretical principles.

In a progressive forward-looking society, science can play a truly liberating role, helping people out of the vicious circle of poverty, ignorance, and superstition. In a democratic

political framework, the possible aberrations and misuse of science can be checked by the people themselves. Science, tempered with wisdom, is the surest and the only way to human welfare. This conviction provides the basic rationale for science education.

The structured lesson plans in this book are rooted in the vision of the National Education Policy 2020, operationalized by the National Curriculum Framework: School Education 2023, and based on the Learning Outcomes from NCERT's Learning Outcomes at the Secondary Stage. The following content has been adapted from the original documents to provide context and explanation for the pedagogical practice behind the development of these lesson plans.

NCERT Curricular Expectations for the Secondary Stage:

For detailed Learning Outcomes and suggested Pedagogical Processes, please refer to the **NCERT Learning Outcomes at Secondary Stage**

SCIENCE Curricular Expectations

At this stage learners are expected to:

- develop understanding of concepts, principles, theories, and laws governing the physical world, consistent with the stage of cognitive development.
- develop the ability to acquire and use the methods and processes of science, such as observing, questioning, planning investigations, hypothesising, collecting, analysing and interpreting data, communicating explanations with evidence, justifying explanations, thinking critically to consider and evaluate alternative explanations, etc.
- conduct experiments, also involving quantitative measurements.
- appreciate how concepts of science evolve with time giving importance to its historical perspective.
- develop scientific temper (objectivity, critical thinking, freedom from fear and prejudice, etc.).
- nurture natural curiosity, aesthetic sense, and creativity.
- imbibe the values of honesty, integrity, cooperation, concern for life and preservation of the environment.
- develop respect for human dignity and rights, equity and equality.

For a more detailed explanation, please refer to the National Curriculum Framework: School Education 2023 (p.45-51, p.88-92, p.101-102, p.116-121)

Aims of Science:

Science aims to develop an understanding of the natural and physical world through systematic inquiry. Learning Science also builds important capacities such as observation, analysis, and inference. This in turn enables the meaningful participation of individuals in

society and the world of work with scientific temper, critical and evidence-based thinking, asking relevant questions, analysing practices and norms, and acting for necessary change. Science Education aims to achieve:

a. **Scientific understanding of the natural and physical world:** Scientific understanding develops through scientific observations, questions, experiments, theories, laws, principles and concepts. An adequate knowledge of these is essential to build a systematic and verifiable understanding of the way the natural and physical world functions.
b. **Capacities for Scientific enquiry:** The abilities to put forth hypotheses, arguments, predictions and analyses, and to test hypotheses, evaluate situations, and draw logical conclusions, are fundamental to the learning of science. Science education must thus build these skills in students systematically over the stage in school.
c. **Understanding the evolution of scientific knowledge.** There are crucial historical moments in the development of Science and scientific knowledge that could not have occurred without the efforts of various individuals and organisations over thousands of years. Understanding these key moments and discoveries will develop students' understanding of how scientific knowledge and the methods of science evolved and still evolve over time.
d. **Interdisciplinary understanding between Science and other curricular areas:** Learning in science involves understanding interlinkages across disciplines. Students would learn to inquire and learn about the world through such an interdisciplinary approach.
e. **Understanding of relationship between science, technology and society:** Engaging with issues related to connections between Science, Technology and Society including the ethical aspects and implications, and appreciating the role of science in addressing the challenges and the world is undergoing, will add to the breadth of students' learning.
f. **Scientific temper:** Students will imbibe scientific values and dispositions such as honesty, integrity, scepticism, objectivity, tenacity, preservance, collaboration and cooperation, concern for life, and preservation of the environment.
g. **Creativity:** Asking good questions, formulating hypotheses and designing good experiments to test those hypotheses often require artistry and creativity. Developing such creativity and a sense of aesthetic in the pursuit of scientific understanding and exploration is very important.

For more details on the Aims of specific subjects please refer to the NCFSE following pages: English: p234-267; Mathematics: p268-293; Science: p294-319; Social Science: p320-352.

CLASS -9
CHAPTER – 8
FORCE AND LAWS OF MOTION

AIMS OF EDUCATION:

- Rational thought and autonomy
- Democratic and community participation.

AIMS OF SCIENCE EDUCATION:

- Scientific understanding of the natural and physical world .
- Capacities for scientific enquiry
- Interdisciplinary understanding between science and other curricular areas
- Understanding of relationship between science, technology and society.

CURRICULAR GOALS AND COMPENTENCIES :

CURRICULAR GOALS:1.Explore the physical world around them and understand scientific principles.

Competencies:

- Applies Newton's law to explain the effect of forces(change in state of motion)
- Explains the relationship between mass and inertia, momentum and velocity, force and acceleration connects it to laws of motion.
- Manipulates the amount of force and acceleration and extends this understanding to why does a fielder moves his hands backward while catching it.

- Analyses different laws of motion and applies it to every day usage(fish swimming in water, birds flying in the sky etc -3rd law of motion)
- Defines force, momentum in scientific terms and represents the relationship between force, mass and acceleration, mass and velocity in mathematical expressions.
- Describes the origin and properties of objects in motion and differences in state of the object based on the amount of unbalanced force acting on it.

CURRICULAR GOAL:2.Draws linkages between scientific knowledge and knowledge across other curricular areas.

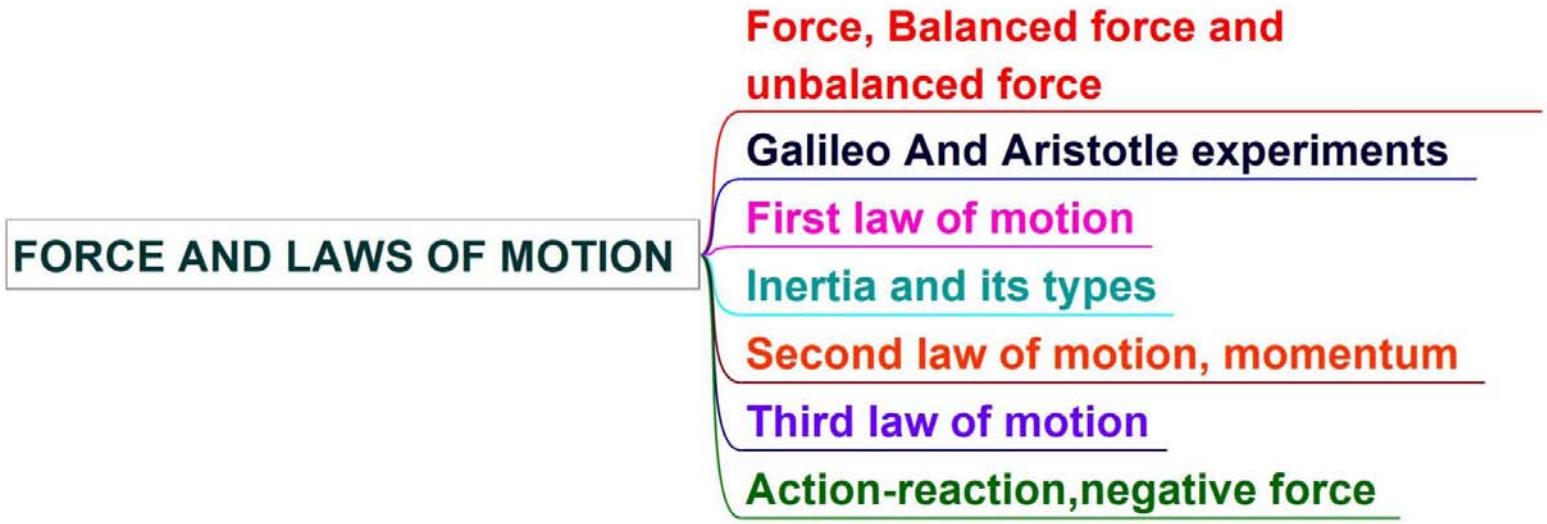
Explores the nature of science by doing science.

- Examines a case study of Galileo Galilee related to the use of science in human life from the perspective of Astronomy and social science.

CURRICULAR GOAL :3.Explore the nature of science by doing Science.

- Develops accurate and appropriate models to represent real life events and phenomena using scientific principles and use models to manipulate variables and predict results.

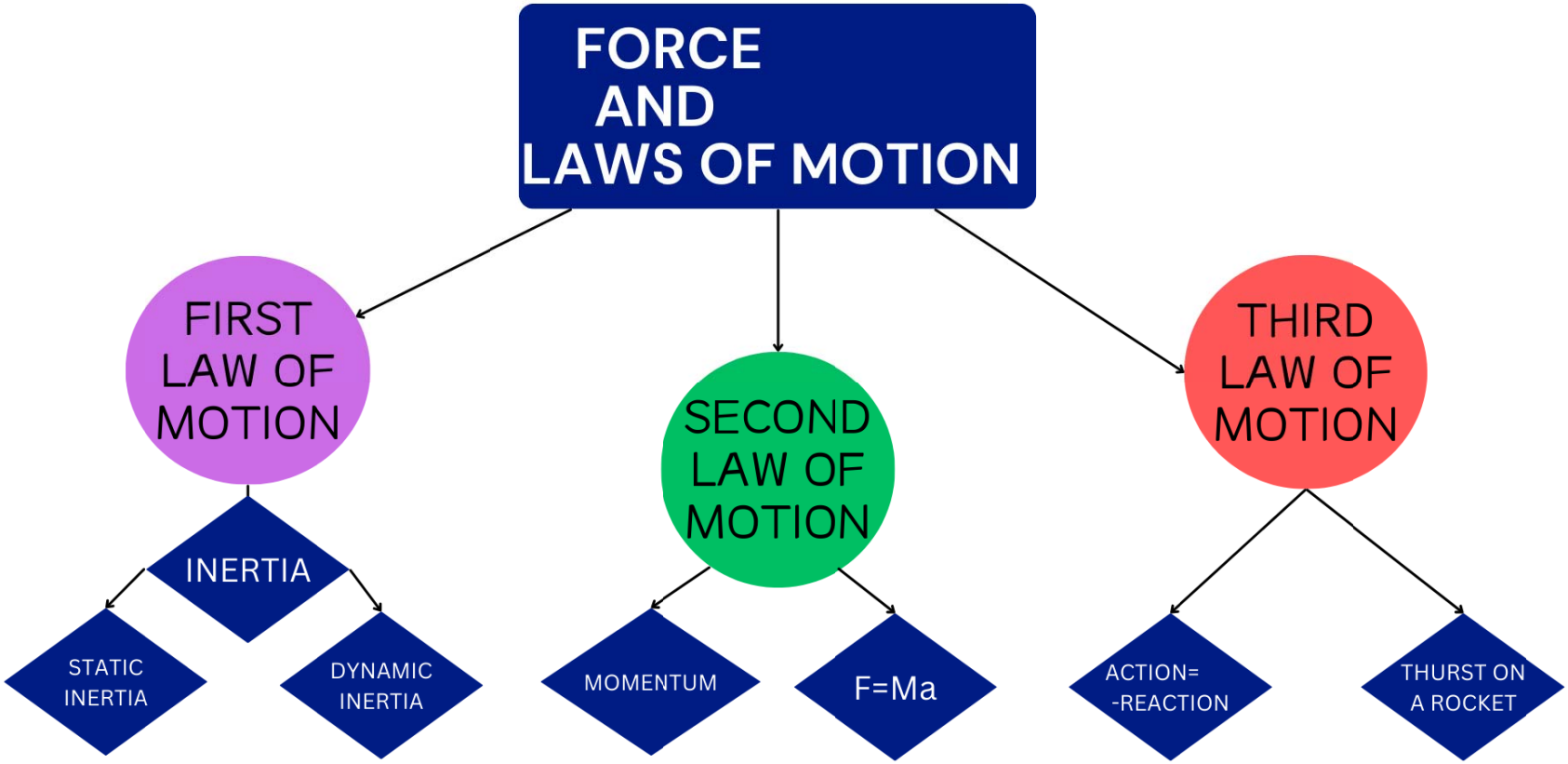
PERIOD WISE - LESSON FLOW



PERIOD WISE - LEARNING OUTCOMES

PERIOD NO.	TOPIC	LEARNING OUTCOMES
1	Force, Balanced force and unbalanced force	Draws linkages between the effect of force on an object due to balanced and unbalanced force.
2	Galileo And Aristotle experiments	Explores the physical world around and understands scientific principles and laws based on observations and analysis.
3	First law of motion	Explores inter connection between net force and the state of motion.
4	Inertia and its types	Explains the relationship between inertia and mass, dynamic inertia and static inertia.
5	Second law of motion, momentum	Analyses the situation and formulate the newton's second law of motion. Analyse the situation and formulate the second law of motion.
6	Third law of motion	State Newton's law of motion. Identify that action and reaction forces act on two different bodies.
7	Action-reaction, negative force	Applies action reaction in their daily life ,identifies the action and reaction bodies,

MIND MAP


FORCE AND LAWS OF MOTION
FIRST LAW OF MOTION
SECOND LAW OF MOTION
THIRD LAW OF MOTION
INERTIA
STATIC INERTIA
DYNAMIC INERTIA
MOMENTUM
F=Ma
ACTION= -REACTION
THURST ON A ROCKET

PERIOD PLAN - 1

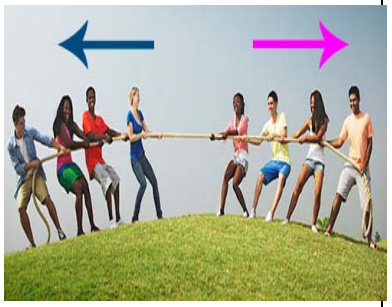
Class : IX

Chapter : FORCE AND LAWS OF MOTION

Total no.of periods: 8

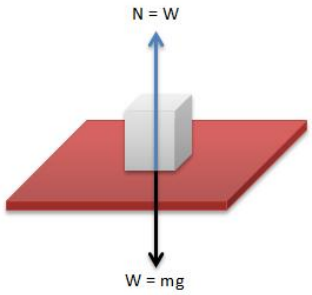
Period number : 1

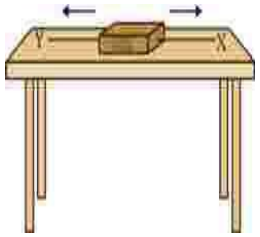
Key Concepts : Magnitude, vector, balanced and unbalanced forces

Learning Outcomes	Teaching-Learning Process	Pointers for Assessment	Materials required
Explains the cause of motion and its nature. ❖ Differentiates balanced and unbalanced forces	**Introductory activity (5min) : (observe the following pictures)**  What is women doing in the picture?		

	 What is railway porter doing? ✓ What is force? (push/pull) ✓ Have you ever played the game of **tug of war?** ✓ Which team wins the game? ✓ What happens when two teams Pull equally hard?  What do you do to make a football	Does the magnitude and direction matters when we deal with forces?	

	move? ✓ Why does a ball return back when thrown upwards?  ✓ How do you walk? ✓ How does a bus move? ✓ What do you do to make the moving ball move faster? ✓ How does a goalkeeper stop a ball? ✓ What happens when a hockey player flicks a ball? ✓ What happens when you stretch a rubber band?	• When a goal keeper stops the football • How many total forces are acting ? • Are the directions of the forces same or not?	Unbalanced force https://youtu.be/YCi_bDKxjN4?si=ShjegQ2bMfRsHOEQ

	<u>Teacher statement:</u> In all these examples we observe that at least two objects must interact for a force to come into play and its effects. ✓ In this chapter let's explore balanced and unbalanced forces ✓ Let's us consider wooden block placed on a table ✓ What are the various Forces acting on the wooden block? ✓ How many forces are acting on the wooden block?  ✓ Is the net force in such case Zero?		

	✓  ✓ What is the state of the block? Does any force act on the wooden block? **Statement :** An object will always move in net force direction. ✓ Balanced forces cannot produce motion or stop a moving body, and can change the shape of the body. Example: squeezing a rubber balloon. ✓ Observe the figure : 1. Does the block move? 2. Increase the force of push? Does the block move?	✓ What is a balanced force?	

	3. Further increase the force of push .Does the block move? ✓ Teacher statement: Block does not move when we increase the force of push, frictional force also increases up to a maximum limit called limiting friction. ✓ When our applied force is greater than maximum static frictional force, box moves.(15 min) ✓ Net force is not equal to zero. ✓ What do we call such forces?(unbalanced force) Unbalanced force acting on an object brings change in its motion (change either in its speed or in the direction of motion)	What is an unbalanced force? What are the differences between balanced and unbalanced forces?	

Teachers' reflections and experiences:

1.Did I clearly communicate the lesson objectives to the students?

2.How can I ensure that students understand the objectives and can demonstrate their knowledge or skills related to them?

3.Did I use effective instructional strategies to engage students in the lesson?

PERIOD PLAN - 2

Class : IX

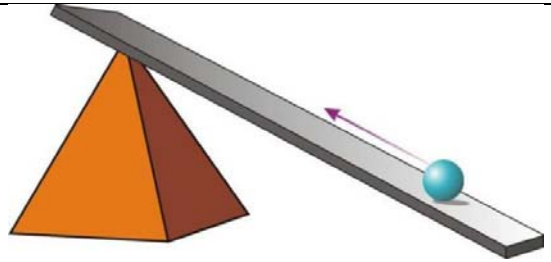
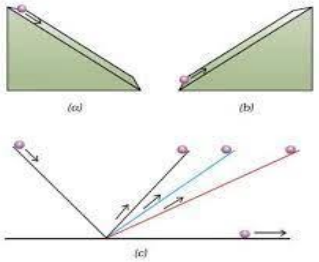
Chapter : FORCE AND LAWS OF MOTION

Total no.periods: 8

Period Plan : 2

Key Concepts : Galileo's Experiments.

Learning Outcomes	Teaching-Learning Process	Pointers for Assessment	Materials required
❖ classify the forces, based on effects as balanced and unbalanced force. ❖ Explains processes and phenomena of Galelio' experiment. ❖ classifies the forces based on the effects as balanced and unbalanced force.	**History of force and Galileo work on forces :** Observe the following pictures and find out the difference? 	✓ What do we call sloppy surfaces?Where do we observe such sloppy surfaces? ✓ What observation you	Both side inclined surface.

.	 ✓ What is an inclined plane? ✓ What happens when a ball is rolled down an inclined plane? ✓ What happens when a ball rolls on a plane smooth surface? ✓ Children will perform **this experiment.** Children will perform this experiment on both inclined Surfaces  .	made and what you can conclude about the whole experiment you perform? ✓ Why does the marble stop after moving some distance? ✓ Which force is responsible for marble to stop? ✓ How can we minimize frictional force? ✓ Without frictional can marble be stopped?	**https://youtu.be/Abbngm**

	❖ Students will put the ball/ marble from the top of the inclined surface. ❖ Students will change the slope of the one surface and will observe and note their observation in the notebook after dropping the ball. ❖ Teacher will make the 2nd surface into a zero inclination. Now, students will again drop the ball from the top of the inclined surface and will note down the readings. 1. What if the inclinations of the right side plane gradually decreased? 2. If the slope length is not limited, the ball will stop or it will go infinitely. 3. You observed that when the second plane slope was decreasing the ball was falling down from the slope. 4. What will happen if we increase the slope length? 5. What will happen if the surface	Can you stop any moving object(marble) Without frictional force?	PoCwo?si=IDA4czIHFeVY7Rva

	is very smooth? **Galileo deduced that objects move with a constant speed when no force acts on them.** Like you, Galileo also conducted several experiments on motion of an object's inclined plane on double planes as shown above. Let's see his experiment on it.		

Teachers' reflections and experiences:

1.How can I improve the variety and effectiveness of my teaching methods to cater to different learning styles and needs?

2. How well I managed the classroom during the lesson?

3.Were there any disruptions or behavioral issues that I need to address?

PERIOD PLAN - 3

Class : IX **Chapter : FORCE AND LAWS OF MOTION**
Total no.periods :08 **Period Plan : 3**
Key Concepts : Newton's first law of motion

Learning Outcomes	Teaching-Learning Process	Pointers for Assessment	Materials required
❖ Analyzes and interpret Galileo experiments and how Newton further studies Galileo's ideas on force and Motion and presents three fundamental laws that govern the motion of objects.	**Teacher will ask question to children:**  ✓ Have you played carom board? ✓ Have you struck the pile of carom coins? ✓ What do you observe when you hit the base of a pile of carom coins? **Let's do the following activity :** ✓ Make a pile of your textbooks or notebooks, one above the other. ✓ Now pull quickly the book which is	✓ Why only the carom coin at the bottom of the pile is removed when a fast moving striker hits it? ✓ What was the state of books when piled up? ✓ Why do the books remain in the stack even though we applied force?	https://youtu.be/5oi5j11FkQg?si=gyNdc9tszKmbu82x A glass tumbler. Cardboard. Five Rupee Coin.

	placed at the bottom. What do you observe? ✓ Teacher performs the following activity in the class. **Now the teacher will call two children to come in front and perform this activity together.**  ✓ What did you observe in this activity, write in your notebook?	✓ What is the common reason for these events? ✓ What is another name for Newton's First Law? ✓ Which property does Newton's First Law depicts about?	Any coin, a cardboard slate / any writing pad/notebook, a glass.

	✓ Why was the coin falling in the glass? ✓ Why was the coin not moving with the cardboard? ✓ Teacher will collect the children's response and move towards the law of inertia concept. The reason for the above mentioned events was Newton's first law of motion. ✓ Have you heard about it? ✓ **The first Law of Motion is also known " Law of inertia"** First Law gives a relationship between zero net forces acting on an object. **F_{net} t = O (balanced Force)** **Rest (v=0)** **Uniform Motion (v=constant)**	✓ Explain why some of the leaves may get detached from a tree if we vigorously shake its branch? ✓ When you hit a ball, why does it continue to move? ✓ When a carpet is beaten with a stick , dust comes out of it? Explain. ✓ Why does dust come out from a door-mat when beaten with a stick?	

	✓ What is the mathematical expression for Newton's first Law of motion? $F_{net} = o$ ● Teacher defines Newton's first Law of motion. ● Teacher defines inertia and its types. ● Teacher explains examples for static inertia.	What is called as Law of inertia? How many types of inertia do you know?	

Teachers reflections and experience :

1.What strategies can I implement to improve classroom management?

2.Did the students actively participate and show interest in the lesson?

3. How can I increase student engagement and create a more interactive learning environment?

PERIOD PLAN - 4

Class : IX

Chapter : FORCE AND LAWS OF MOTION

Total no.periods :8

Period Number : 4

Key Concepts : Inertia and Mass

Learning Outcomes	Teaching-Learning Process	Pointers for Assessment	Materials required
❖ Relates the processes and phenomena, how inertia depends on the object.	✓ Do all the bodies have the same inertia? ✓ What factors can decide the inertia of a body? **Let us try to perform this activity-** Take two rectangular wooden blocks with different masses and place them on a straight line drawn on a floor. Give the same push at the same time to both blocks with the help of the wooden scale.	✓ What is inertia? ✓ What do you think if you push a bicycle and car then which one will move easily or go farther by applying equal force?	Two rectangular wooden blocks of different masses and wooden scales.

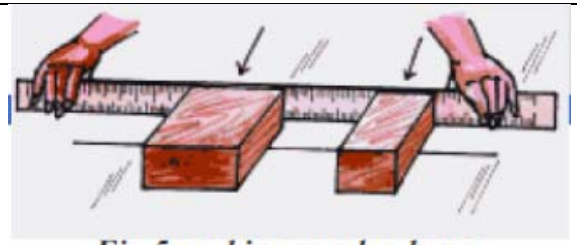


Fig-5 pushing wooden boxes with same force

- ✓ What do you find?
- ✓ Which goes farther? Why?

Let us think about these cases.

- ✓ Which is easier for you, to push a bicycle or a car?
- ✓ Why were you able to push bicycle

- ✓ What you observed in all above examples of daily life?

- ✓ What is the SI unit of mass?

	easier than a car? ✓ What differences leads to this kind of effect? ✓ What is the measure of inertia? ✓ Why it is easier to push a bicycle than a car? ✓ Which of these has more inertia? ✓ Have you found any similarity among above all examples of pushing? ✓ Which objects are able to move easily; lighter or heavier? **Inertia is measured by the mass of an object.** If mass is higher, inertia will be higher and vice versa also.	✓ Two objects have masses 8 Kg and 5 Kg . Which one has more inertia? Why? **On which factors inertia is dependent?**	

Teacher reflections and Experiences :

1.Did I assess student understanding effectively during the lesson?

2.Did I provide timely and constructive feedback to guide their learning?

3.How can I improve my assessment and feedback practices?

PERIOD PLAN - 5

Class : IX

Chapter : FORCE AND LAWS OF MOTION

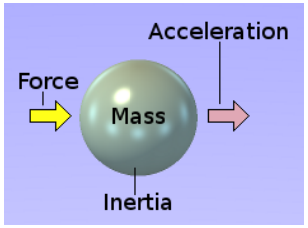
Total no.periods: 8

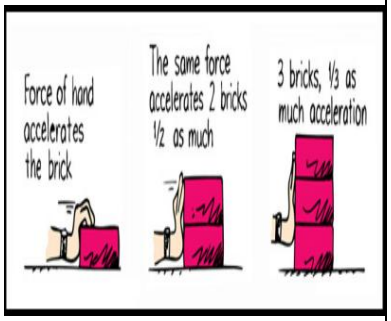
Period Plan : 5

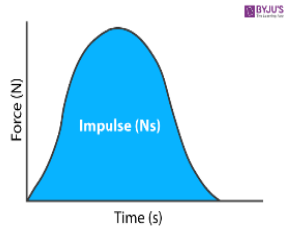
Key Concepts : Mass and velocity relation (momentum), F=ma, relation, second law of motion statement.

Learning Outcomes	Teaching-Learning Process	Pointers for Assessment	Materials required
❖ Differentiates the terms mass, weight, acceleration and force. ❖ Explains about unbalanced forces.	**Introductory Activity: (Teacher will show these pictures)**  	**Previous knowledge:** ✓ When an object is at rest/stationary and when it comes into motion?. ✓ What is inertia?	***IFP BOARD***

	✓ We may observe these kind of situations several times on roads when vehicles break-down. ✓ Which vehicle is easy to move and which is difficult too move by pushing. Why?  ✓ In tug of war why, the rope not moved from Centre line? **Teacher's statement:** ❖ To push heavy objects we have to use more force. ❖ Force Is proportional to mass of the body		

❖ **Relates the processes and phenomena of mass, velocity and force.**	❖ If the same amount of force is applied to move a bike and a bicycle, which one accelerates more? ❖ If the same amount of force is applied to move a car and truck, which one accelerates more?  **Teacher's statement:** ✓ If the mass is less, acceleration is more and if force is more acceleration also more. ✓ Mass is inversly proportional to acceleration. ✓ Force is directly proportional to	❖ What is acceleration? ❖ Can acceleration of a body become zero?	

	acceleration.		
✓ **Apply mathematical knowledge and will solve the problems on momentum.**	✓ Why a small mass of bullet may kill a person when fired from a gun. ✓ Why the table tennis ball hits a player it doesn't hurt, but a fast-moving cricket ball hits a spectator, it hurts him? ✓ Why a moving truck, even as low as 5m/s may kill a person. **F=ma** ✓ **Teacher's statement and Explanation:** **P=mv** Units of momentum is kilogram-meter/sec. https://youtu.be/4glY-Rv5KHM	✓ If you add an external force to moving objects, what happens? ✓ Can you Find the momentum of a round stone weighing 12.05kg rolling down a hill at 8m/s.	

✓ **Defines the term momentum and second law of motion**	**Demonstration and Explanation:** Let's consider a situation that a car needs a speed of 1m/s by pushing as it stopped due to dead battery. ✓ How many persons need to push the car to move. Is one person enough? ✓ Does the Car starts immediately after pushing? **https://youtu.be/ph48Xwj_eS8** **https://youtu.be/K9YGboqsa4k**	How acceleration depends on force? How acceleration depends on mass?	 **Second Law of Motion**

Teachers reflections and experiences :

1.Was the pacing of the lesson appropriate?

2.Did I cover all the planned content without rushing or leaving gaps?

3.How can I better manage the time allocated for each activity?

PERIOD PLAN - 6

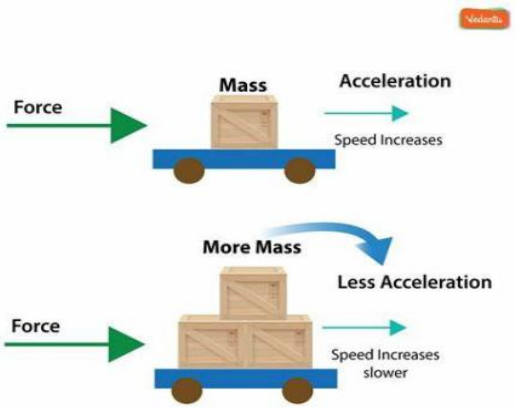
Class : IX

Chapter : FORCE AND LAWS OF MOTION

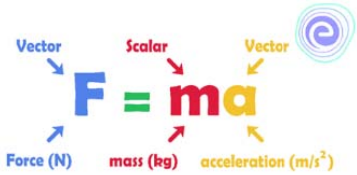
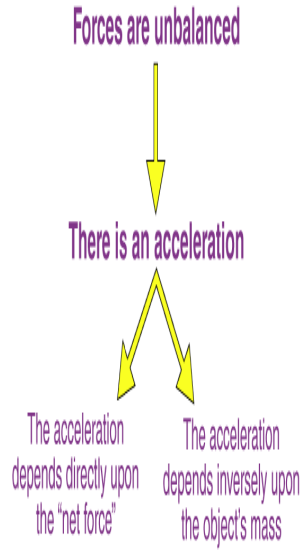
Total no.of periods :8

Period Plan :6

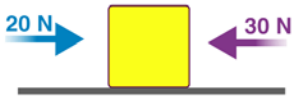
Key Concepts : F=ma, Problems solving using Newton's second law of motion.

Learning Outcomes	Teaching-Learning Process	Pointers for Assessment	Materials required
❖ Analyses the situation and formulate the newton's second law of motion. ❖ Applies Newton"s in daily life situations	 Teacher defines 2nd law of motion and derives the formula for force.		

	<u>EXPLANATION and DERIVING:</u> Let us consider an object of mass m, moving along a straight line with an initial velocity of u. Let us say, after a certain time t, with a constant acceleration, the final velocity becomes v. Here we see that, the initial momentum is: $P_1 = mu$ The final momentum is: $P_2 = mv$ The change in momentum can be written as: $P_2 - P_1 = (mv-mu)$ $P_2 - P_1 = m(v-u)$ As we know, the rate of change of momentum with respect to time is proportional to the applied force. The applied force_	✓ Calculate the force required to impart a car a velocity of 30m/s in 10 seconds. The mass of the car is 1500 kg.	

	$F \propto m(v-u)/t$ The rate of change of velocities is called as? $F \propto ma$ $F=Kma$ k is the constant of proportionality, taken as one when unit of mass and of unit acceleration  ✓ The unit of force is kg-m/s^2 or newton(N). The force acting on an object as a product of its mass and acceleration.	✓ A constant force acts on an object of mass 5 kg for duration of 2 second. It increases the object's velocity from 3cm/s to 7m/s. Find the magnitude of the applied force. Now if the force were applied for a duration of 5 seconds, what would be the final velocity of the object? ✓ List out some daily life situations related to Newton's second law of motion	 https://youtu.be/B6CmOrg2spE

	APPLICATIONS : • Kicking a ball: When we kick a ball, we exert force in a specific direction. The stronger the ball is kicked, the stronger the force we put on it and the further away it will travel. • Pushing a cart It is easier to push an empty cart in a supermarket than a loaded one, and more mass requires more acceleration. • Two people walking Among the two people walking, if one is heavier than the other, the one weighing heavier will walk slower because the acceleration of the person weighing. lighter is greater. • A cricket fielder pulls his hands backwards in order to decrease the effect due to force duly increasing time of impact.	✓ A car with a mass of 1,500 kg is travelling at a velocity of 25 m/s when it collides with a stationary truck. The car comes to a stop after the collision. If the force of the collision is 50,000 N, what is the acceleration of the car during the collision? (Answer: -16.67 m/s^2)	An application of using the second law is in designing fighter jets. Fighter jets need to quickly turn around to dodge artillery fire from the ground or enemy planes. Jets with lighter mass are easy to turn around quickly with lesser force. Heavy aeroplane take more time to change direction due to inertia.

			
	PROBLEM SOLVING: 1. If there is a block of mass 2kg, and a force of 20 N is acting on it in the positive x-direction, and a force of 30 N in the negative x-direction, then what would be its acceleration? 		

	Solution: We first have to calculate the net force acting on it to calculate its acceleration. F_{NET}= 20N-30N = -10N Mass = 2kg Acceleration = F/a = -10/2 = - 5m/s^2 The negative acceleration indicates that the block is slowing and its acceleration vector is moving in an opposite direction directed opposite to the direction of motion.		

Teachers reflections and Experiences :

1.What were my strengths during the lesson?

2.In what areas can I improve as a teacher?

3. How can I continue to develop my teaching skills and practices?

PERIOD PLAN - 7

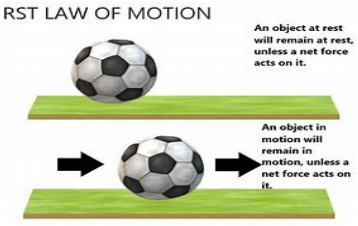
Class : IX

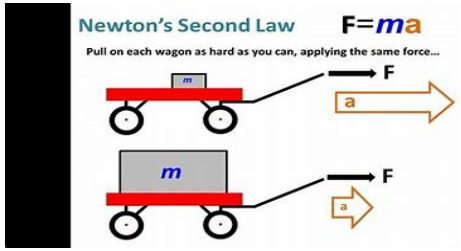
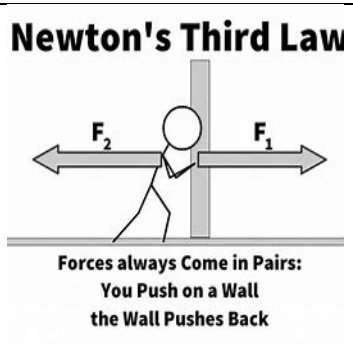
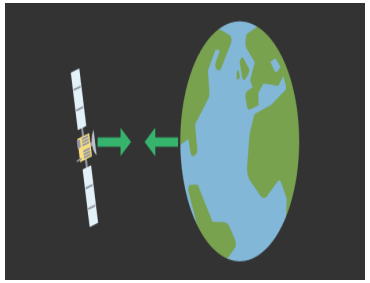
Chapter : FORCE AND LAWS OF MOTION

Total periods :8

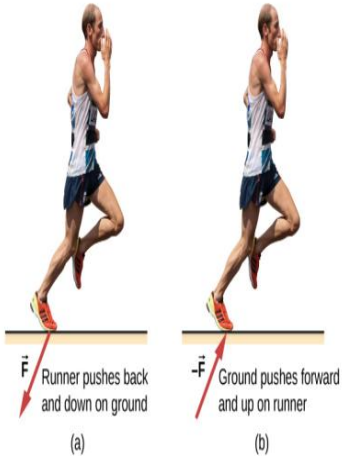
Period Plan : 7

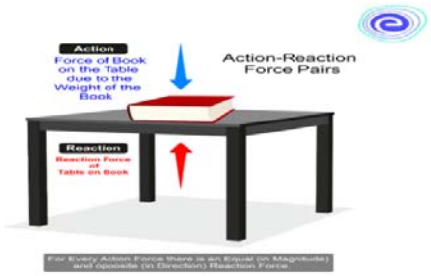
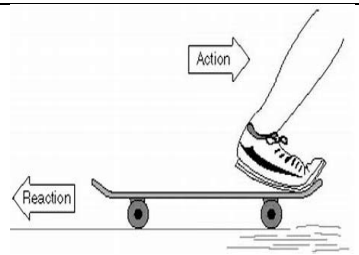
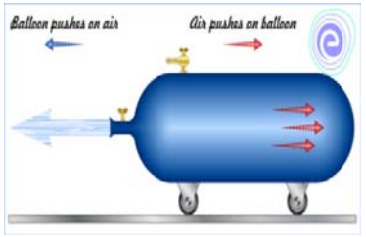
Key Concepts : Action – reaction, Negative force.(Newton's third law)

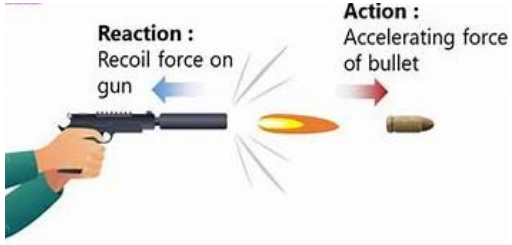
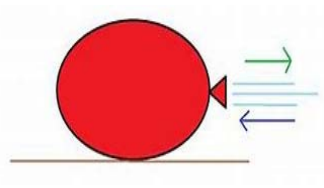
Learning Outcomes	Teaching-Learning Process	Pointers for Assessment	Materials required
❖ Explains Newton's third law of motion ❖ Identify the action and reaction forces in different situations ❖ Apply Newton's third law to define systems and solve problems of motion	**Introductory part:** By the first law of motion we can understand, how the force can be changing the state of motion. ✓ What implies the first law of motion? 		

	By the second law of motion, provide us with a method of determining the force. ✓ What implies the second law of motion?  **<u>Example</u>:** A dog sits on the ground ... ✓ the cat pulls the Earth up ✓ the Earth pulls the cat down These forces are equal in size and opposite in direction. Car Tyre on a road... ✓ the Tyre pushes the road backwards	✓ In first two cases the force acts on how many objects and what type of forces they are? ✓ If the forces act on two different objects What happens?	  .

	✓ the road pushes the Tyre forwards These forces are equal in size and opposite in direction. What type of forces you are observing here? A satellite in Earth orbit ✓ the Earth pulls the satellite ✓ the satellite pulls Earth These forces are equal in size and opposite in direction. **Teacher defines newton's 2nd law of motion.**		
❖ Derives Newton's third law qualitatively and mathematically.	**<u>Demonstration and explanation:</u>** **<u>EXAMPLE:</u>** Consider two spring balances A	✓ Explain how does a bird fly in the sky?	Two spring balances.

	and B connected together. And the fixed end of B is attached to a rigid support like wall. When a force is applied through the free end of spring balance A, it is observed that both the spring balances show the same readings on their scales. That means the force exerted by spring A on the spring balance B is equal but opposite in direction to the force exerted by the balance B on balance A. These two forces can be called as ACTION – REACTION forces. https://www.gpb.org/physics-in-motion/unit-3/newtons-third-law	✓ which principle is involved in walking? 	

• Present examples of equal-and-opposite force action-reaction pairs	Newton's Third Law of Motion states that: *"To every action, there is an equal and opposite reaction."*  ✓ These forces are pair forces. ✓ The action and reaction forces are always equal in magnitude, these forces may not produce accelerations of equal magnitude. This is because of each force acts	 ✓ Observe the following picture and mention the action and reaction forces.	

	on different object that may have different mass.   	✓ Which principle is involved in swimming? How many forces acting on the balloon? 	 https://youtu.be/By-ggTfeuJU

Teacher's Reflections and Experiences:

1.Did I encourage self-reflection and meta cognition among students?

2.How can I incorporate more opportunities for students to reflect on their learning and assess their own progress?

3.Did I critically examine student work to gain insights into their understanding and identify areas for improvement?

FORCE AND LAWS OF MOTION

WORK SHEET-1

I.Answer the following questions

1.Give one example for each where

(a)A force moves a stationary body

(b) a force stops a moving body

(c) a force changes the speed of a moving body

(d) a force changes the direction of a moving body.

(e) a force changes the shape of a body.

2. which type of force brings an object in motion

3. No force is required to move an object with a constant velocity,why?.

4.what are the changes possible on an abject at rest if we apply force on it?

5.Give two examples to show that greater the mass greater is inertia of a body.

6.Give reason, an athlete runs a certain distance before taking a long jump

II.Choose the correct answer

7.The function of mud guards is based on

(a)inertia of rest (b)inertia of direction (c)inertia of motion (d)both a and b

8.The law that defines force and inertia is

(a) Newton's first law (b) Newton's"second law (c)Newton's third law (d) Universal law of Gravitation

9.Inertia of a body in linear motion is measured by

(a)velocity (b) momentum (c)mass (d) force

10.when we kick a stone ,we get hurt due to which one of the following properties of the stone does it happen?

11.why do we get hurt by falling a concrete structure than on sand track?

12. Explain why is it difficult for a fire man to hold hose which ejects large amounts of water at high velocity?

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FORCE AND LAWS OF MOTION

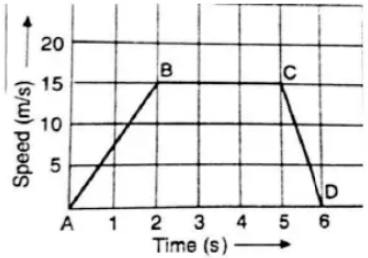
WORK SHEET-2

1.Give reasons for the following.

(a) A rolling foot ball slows down and comes to rest.

(b) A rocket moves forward by ejecting gas in the backward direction.

2. The speed-time graph of a car of 1000kg mass is given below. On the basis of this answer the following questions.



(a) When is the maximum force acting on car?
(b) What is the retarding force acting on the car?
(c) For how long is there no force acting on the car?
(d) What is the velocity of the car after 5 second?
(e) Find the acceleration of the car during each of the first two intervals of four second each?

.

3.A force acting on a body A of mass 5kg produces an acceleration of 10 m/s^2. Find the acceleration produced by the same force when it acts on a body of mass 2kg

4. A body of mass 5 kg at rest experiences a constant force of 30 N.Find the time taken by the ball to cover a distance of 60 meters.

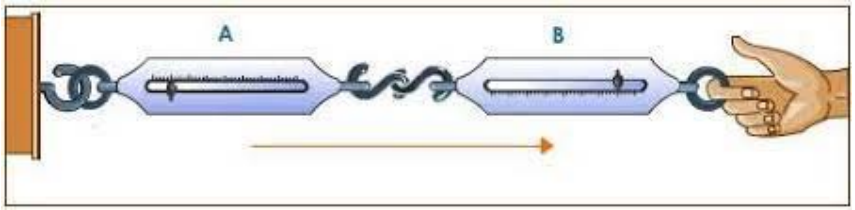
5.Match the following

Column(I)	column(II)
1.Newton's first law	(A) rate of change of momentum
2.Newton's second law	(B) product of mass and velocity
3.Momentum	(C) Inertia
4. Impulse	(D) Newton
5. SI unit of force	(E) Product of force and time

6.A man jumps forward from a boat and the boat moves backwards

Identify the action and reaction forces .

7.Two spring balances A and B are connected to each other as shown in figure



(a)Find the reading on B if A shows reading of 5N
(b) Give reason(s) for your answers

8. Mention the effects of force on a body.

9.A force of 5N is exerted on a body of mass 2 kg at rest .find the acceleration produced by the force on the body?

10. The momentum of an object of mass 1kg moving with a velocity of 2m/s is

(a) 1kg.m/s (b) 4kg.m/s (c) 2kg.m/s (d) 3kg.m/s

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GRAVITATION –CHAPTER-9

CLASS : **9 TH**

LESSON NAME : **GRAVITATION**

TOTAL NUMBER OF PERIODS : **10**

AIMS OF EDUCATION:

- RATIONAL THOUGHT AND AUTONAMY
- DEMOCRATIC AND COMMUNITY---

AIMS OF SCIENCE EDUCATION:

1. Scientific understanding of natural and physical world.
2. Capacities for science inquiry.
3. understanding the evolution of scientific knowledge
4. scientific temper and creativity.

CURRICULAR GOALS AND COMPITENCIES:

CURRICULAR GOALS : Explores the physical world around them and understands scientific principles and laws based on observations and analysis

COMPETENCIES : Applies learning to hypothetical situations (weight of an object at moon)
Explains universal aw of gravitation and analysis, mathematical representation of universal law of gravitation.
Explains the relation between mass and weight using universal law of gravitation.Differentiate mass and weight.
. Manipulates and analysis and interprets graphs and figures(centripetal force)

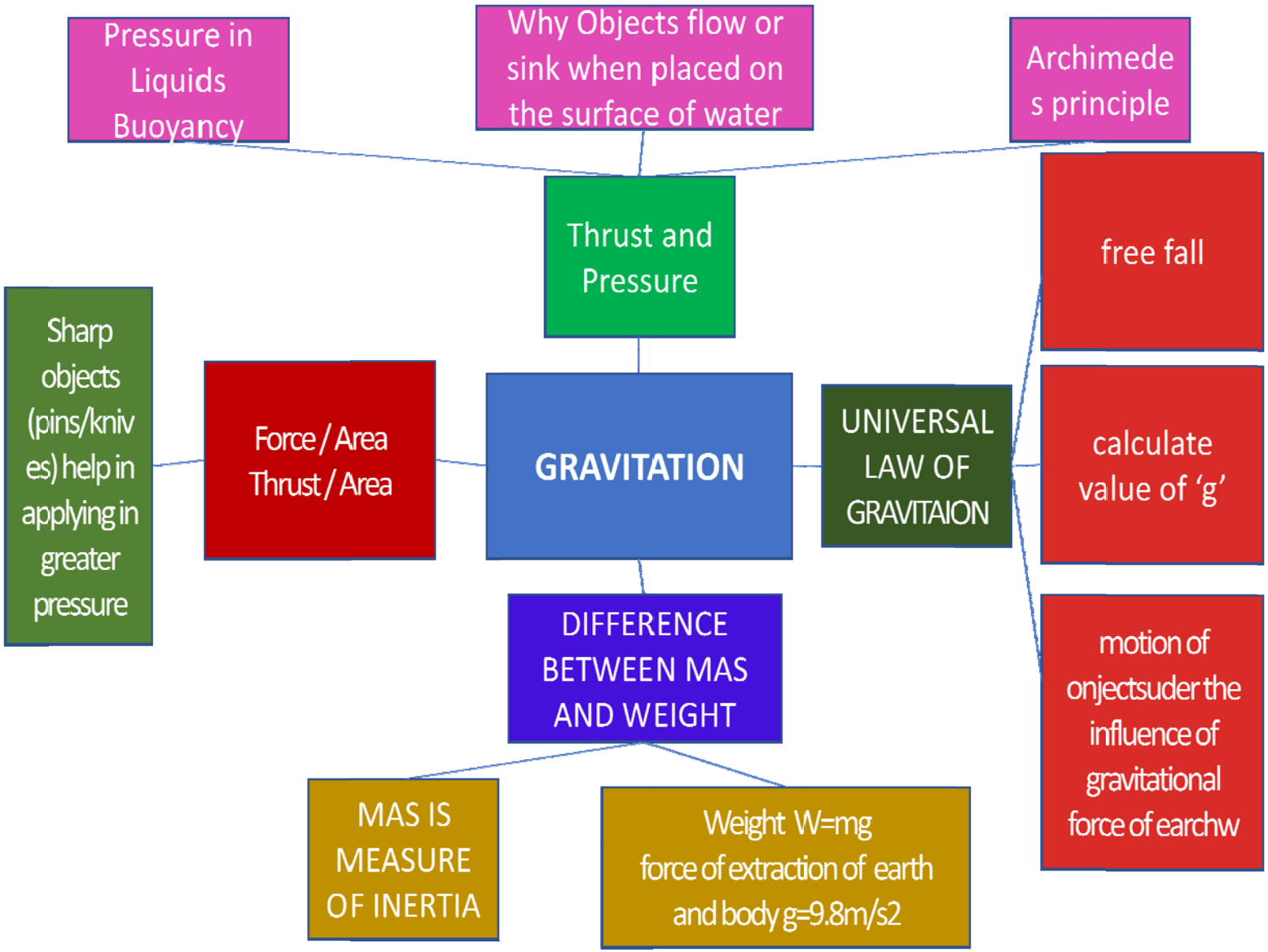
CURRICULAR GOALS : Draws linkages between scientific knowledge and knowledge across other curricular areas.

COMPETENCIES : Examines the case study related rivers flow down to seas, motion of planets in fixed path, atmosphere is held to earth from perspective of social sciences occurrence of seasons.

CURRICULAR GOALS : Explores nature of science by doing science

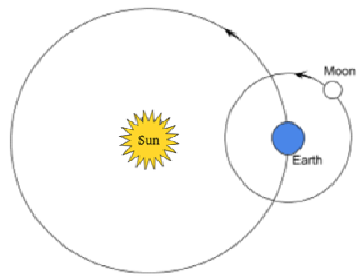
COMPETENCIES **:** Describes scientific discoveries and inventions –Newton's theory in gravitation and Archimedes principle.

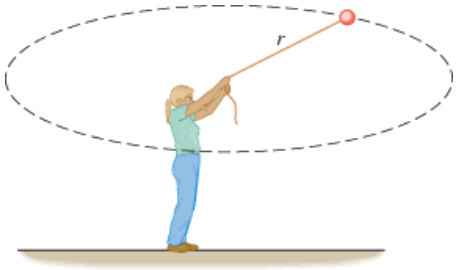
Mind Map

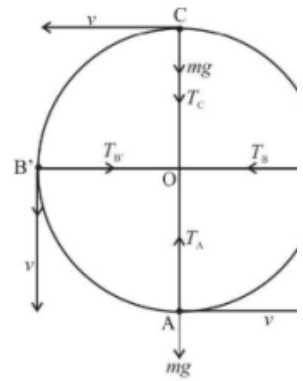
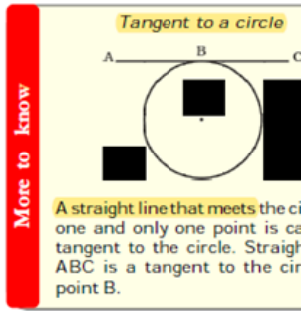
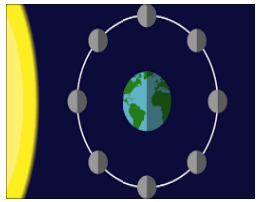

Pressure in Liquids Buoyancy
Why Objects flow or sink when placed on the surface of water
Archimedes principle
Thrust and Pressure
free fall
Sharp objects (pins/knives) help in applying in greater pressure
Force / Area Thrust / Area
GRAVITATION
UNIVERSAL LAW OF GRAVITAION
calculate value of 'g'
DIFFERENCE BETWEEN MAS AND WEIGHT
motion of onjectsuder the influence of gravitational force of earchw
MAS IS MEASURE OF INERTIA
Weight W=mg force of extraction of earth and body g=9.8m/s2

Period	Name of the Topic	Learning outcomes
1	Centripetal force,Gravitational force	Explain centripetal,gravitational force Relate the cause and effect for centripetal and gravitational force
2	Universal law of gravitation	Explain the law of gravitation Calculating force of gravity ,and force exerted by earth on the moon
3	Importance of universal law of gravitation ,free fall	Plans and conducts experiments to arrive at and law of floatation,free fall, Calculate weight ,pressure and acceleration due to gravity
4	To Calculate "g",motion of object under influence of gravitational force	Examines the results of experiment Calculate the value of"g"
5	Difference between mass and weight,gravitation	Differentiate mass and weight. Applies mass , weight ,gravitation problems.
6	Weight of an object on moon	Relates "g" with radius of plant ,calculate "g" on moon
7	Thrust and pressure	Differentiate process and phenomena
8	Pressure in fluids and buoyancy	Relate the processof cause and effect such as buoyancy and gravitation
9	Why objects float or sink on surface of water	Differentiate materials
10	Archimedes Principle	Plans and conducts experiment of Archimedes principle

CLASS	:	**IX**
CHAPTER	:	**GRAVITATION**
TOTAL NO. OF PERIODS	:	**10**
PERIOD	:	**01**
KEY CONCEPTS	:	**Centripetal Force, Gravitation**

LEARNING OUTCOMES	TEACHING-LEARNING PROCESS	POINTERS FOR ASSESSMENT	MATERIAL REQUIR
1. Explains centripetal and gravitational force 2. Relate cause and effect of centripetal and gravitational force	**Introductory activity:**  1.what is position of the bicycle? 2.is it at rest or in motion? 3.Is there any change inits position? 4.what causes the change of position of the bicycle? 	What is the cause of motion?	https://youtu.be/0L-foX49Row

	1.Teacher shows above picture and video and discuss(teacher splits students into group and ask them to discuss on the following questions) **(Teacher gives more example.)** 1. What are these objects? 2. Where are they seen? 3. Do tese objects move? 4. How do they move? Why? 5. Why it is not fallen? **Lets do an activity:** (Teacher make groups and ask students to do this activity)  1.What will happen if we tie this stone and revolve? 2.Why it revolves? 3.Who was pushing ? 4.What is the shape of the path when it is moving? 5.What is the reason for revolving? 6.Can you increase the speed of the stone? How? 6.Can we decrese the speed of the stone? How? (try this activity with different lengths of thread? 7.Is the speed constant for one particular length of thread? 8. Is the velocity constant for length?	What is the name of the force which attracts the objects towards earth or sun? What is the name of the force which is generated in the thread?	

	9. What happens if you leave the thread? (Discuss about the direction of the path of the stone) • What do we need to change the direction of an object? (student's response: force) • In this case tensen force changing the direction stone. • This force which changes direction of object continuously is called centripetal force. • What if we cut the thread ?/ what if if this force is not acting?(stone will travel in straight path) • This straight path will be a tangent to the circle. • **Let's check earth –moon system once more**: • Now, do you find any similarity? (response: moon is revolving around the earth just like the stone in the activity) • In stone activity who is holding the stone? (student's response: thread) • In earth –moon system do you see any thread? (no) • Then who is holding the moon? • This force which is holding the moon is centripetal force generated by the attraction between earth and moon. • Let's seen the solar system also. • What is the center of the solar system, and what revolves around it? (student's response: sun is the center and palnets revolve around the sun) • Can you guess why planets revolve around the sun? • Just like earth –moon system there exist an	What is centripetal force? What is tangent drawn to circle? Prepare a chart having examples from real life or systems around you. Incidents we can see gravitational force and centripetal force . Do you see any connection between movement of stone and the movement of	 Motion of an object in a vertical c  

	attraction force which is nothing but gravitational force between sun and the planes. • Next class we will learn more about universal law of gravitation.	earth/moon around sun/earth?	

Teachers reflections and experiences:

1. Did I clearly communicate the lesson objectives to the students?
2. How can I ensure that students understand the objectives and can demonstrate their knowledge or skills related to them?
3. Did I use effective instructional strategies to engage students in the lesson?
4. How can I improve the variety and effectiveness of my teaching methods to cater to different learning styles and needs?
5. How well did I manage the classroom during the lesson?

These questions can serve as a **review** for teachers to reflect on their teaching practices and make informed decisions for future lessons.

CLASS : **IX**

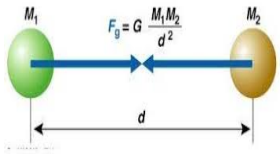
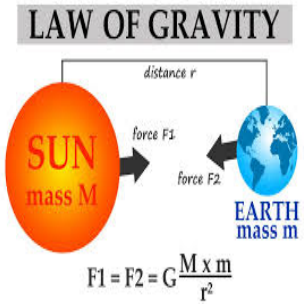
CHAPTER : **GRAVITATION**

TOTAL NO. OF PERIODS : **10**

PERIOD : **02**

KEY CONCEPTS : **UNIVERSAL LAW OF GRAVITATION, CALCULATING FORCE OF ATTRACTION**

LEARNING OUTCOMES	TEACHING-LEARNING PROCESS	POINTERS FOR ASSESSMENT	MATERIAL REQUIRED
Explains the lawsof gravitation,Calculatesforce of gravity. ❖ Explains laws of gravitation mathematically. ❖ Explains how laws of gravitation are universal.	**Introductory activity:** Previous knowledge questions: 1.How can we walk in the ground? 2. What force acting to makes us to walk on the ground? 3. What force is caused to occur tides in the ocean? 4. What is the force responsible for the revolution of the moon? 5. What is the force acting between sun and earth? 6. How planets revolving around the sun? 7. Why did the apple fall on Newton's head? **(teacher activity)** Showing the picture on IFP: - 8. Between twoobjects can gravitational force be changed? 9. If we go on the moon,what changes we see? 10. Why, force between you and moon is less? 11. Why,force between you and earth is more?		

	The force between two objects is directly proportional to the product of their masses. $f \propto m_1 * m_2$ Is there any other way to decrease the force . Q.What happens when we move far away from the earth? The force between two objects is inversely proportional to the square of the distance between them. $f \propto \frac{1}{d^2}$ Combining both equations , we get $f \propto \frac{m_1 * m_2}{d^2}$ or $f = G\frac{m_1 * m_2}{d^2}$ Where G is the constant of proportionality andis called the universal gravitation constant. Let's write units for G in SI system How can you re arrange the formula to calculate G? Expected answer:	What is the relationship between force and masses? What the relationship between force and distance between the objects? What is the units of force in SI system? (newton)	  https://youtu.be/c9shwPMpSq8?si=5VzB_WMiZmti_bNN

❖ **Calculate the force exerted by the earth on themoon.**	$G = \frac{fd^2}{m_1 m_2}$ So, what is the units of G? N m^2 kg^{-2}. Can anyone guess why it is called as universal law? (Applicable to all bodies, big or small, whetherthey are celestial or terrestrial.) **Let's solve a problem:** As a student to read the problem which is displayed on IFP. What is the mass of the earth given in problem?(M=6X10^{24}kg) What is the mass of the moon?(m=7.4X10^{22}kg) What is the distance between moon and earth given?(3.84X10^5km=3.84X10^8m) **Let's substitute:** In the formula	What are units of mass in SI system?(kg) What are the units of distance in SI system?(m) What is the formula for force? The mass of the earth is6 X1024 kg and that of the moon is7.4X1022 kg. If the distance between the earth and the moon is 3.84X105 km,calculate the force exerted by the earth on the moon. (Take G = 6.7X10-11 Nm^2 kg-2)	

	$f = G\frac{m_1 * m_2}{d^2}$ What will be the answer? : 2.02X10^{20} N.		

Teachers reflections and experiences:

1. Were there any disruptions or behavioral issues that I need to address?
2. What strategies can I implement to improve classroom management?
3. Did the students actively participate and show interest in the lesson?
4. How can I increase student engagement and create a more interactive learning environment?
5. Did I assess student understanding effectively during the lesson?

These questions can serve as a **review** for teachers to reflect on their teaching practices and make informed decisions for future lessons.

CLASS : **IX**

CHAPTER : **GRAVITATION**

TOTAL NO. OF PERIODS : **10**

PERIOD : **03**

KEY CONCEPTS : **Importance of the universal law of gravitation, Free Fall, To calculate of value of g**

LEARNING OUTCOMES	TEACHING-LEARNING PROCESS	POINTERS FOR ASSESSMENT	MATERIAL REQUIRED
❖ Plans and conductsexperiments to arriveat and verify the laws ofFlotation, freefall. ❖ Calculates weight,pressure, accelerationdue to gravity, relativeDensity. ❖ Verifies the concept of freefall through experiments. ❖ Calculates the unknown variable (weight, pressure,acceleration due to gravity, relative density) from agiven data and assigns a proper SI unit to it.	**Introductory activity:** To recall the concept of gravitation,the following questions may be probed. 1. What is the force that binds us to the earth? 2. Why planets revolving around the Sun? 3. why tides are forming ? **(Teacher will demonstrate the activity)** Today we will try to get an idea on **free fall**. 1. what happens when you through a stone in the upward? ✓ Why stone is falling down? ✓ What are the forces acting on the stone while it is falling down? ✓ The motion of an object only under the influence of gravitational force itself is called free fall. ✓ While it is falling down is there any change in its direction? ✓ Is there any change in its magnitude? ✓ Is it increasing or decreasing while falling	What is free fall? How do we to change the velocity of an object?	

	down? ✓ Which quantity involves while velocity of an object changes? (Teacher introduces acceleration) ✓ This acceleration is called as acceleration due to gravity – reason is very clear because of gravity this acceleration generated. ✓ Do any one know—what is the notation of acceleration due to gravity is? G **Now we try to get relationship between G and g** Now in free fall- how to express force according to newton's second law? F=mg (a=g) We know formula for universal gravitation. $$F = G\frac{m_1 * m_2}{d^2}$$ By equation above equations we will get $$mg = G\frac{\mathrm{M} * \mathrm{m}}{d^2}$$ $$g = G\frac{\mathrm{M}}{d^2}$$ If we are near to earth we can replace d with R Leads us to $$g = G\frac{\mathrm{M}}{R^2}$$ Next class we will calculate value of g	what is newton's second law mathematically? In free fall what is the acceleration? **Q. The gravitational force between two objects is F. If the masses of both objects are halved without changing the distance between them, then the gravitational force would become** **a. F/4** **b. F/2** **c. F** **d. 2F** **Q. It is seen that a falling apple is attracted towards the earth. Does the apple also attract the earth? If so, we do not see the earth moving towards the apple. Why?**	

		How do we express universal law of gravitation mathematically?	

Teachers reflections and experiences:

1. Did I provide timely and constructive feedback to guide their learning?
2. How can I improve my assessment and feedback practices?
3. Was the pacing of the lesson appropriate?
4. Did I cover all the planned content without rushing or leaving gaps?
5. How can I better manage the time allocated for each activity?

These questions can serve as a **review** for teachers to reflect on their teaching practices and make informed decisions for future lessons.

CLASS : **IX**

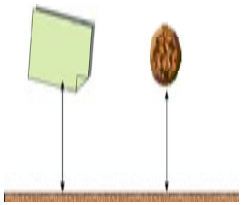
CHAPTER : **GRAVITATION**

TOTAL NO. OF PERIODS : **10**

PERIOD : **04**

KEY CONCEPTS : **To calculate of value of g, motion of object under the influence of gravitational force of earth &related problems)**

LEARNING OUTCOMES	TEACHING-LEARNING PROCESS	POINTERS FOR ASSESSMENT	MATERIAL REQUIRED
❖ Estimate the value of acceleration due to gravity acting a body. ❖ Examine the results acquired while conducting experiment with different sized objects under free fall.	**Introductory activity:** 1. What is themathematical expression newton's second law ? 2. Based on 2nd law of motion,can you Write equation for weight? 3. What is the relation between G and g? $g = G\frac{M}{R^2}$ Now let's try to calculate the value of 'g': What are the terms in the above equation: 1. G= universal gravitation constant 2. M=mass of earth 3. R= radius of earth. On solving we can get the value of acceleration due to gravity g=9.8 m/sec^2 1. Acceleration due to gravity (9.2.2) 2. 'g' doesn't depend on mass of object. Now let's check this with an activity (10 MINS).	Does the value of g depends on mass of object? How can you say that? What is the value of g?	

❖ Calculates using the given data ❖ Calculate the unknown variable (acceleration due to gravity)from a given	 Take a sheet of paper and a stone, drop them simultaneously from some height. 1. What do you observe? (stone reached first) 2. But according to the theory who should reach first ?(both should reach at one time) 3. What may be the reason for paper to reach lately/who is stopping the paper?(air resistance) What if we do the same activity without the presence of air? Both paper and stone reach the ground at the same time. Let's watch this experiment in the absence of air(10 mins). **Video link →** 1. Galileo dropped different objects fromthe topof the Leaning Tower of Pisa in Italy to provethe same. 2. We found that the value of g is 9.8 m/sec^2. So, we can apply equations of motion under constant		https://youtube.com/shorts/UvdKRpZ3roU?si=8gKgYnO5MLvFesAM

data and assigns a proper unit to it	acceleration here also. **Let's solve a problem :** 3. Example 9.2 A car falls off a ledge and Drops to the ground in 0.5 s. Let g = 10 m s–2 (for simplifying the calculations). I. What is its speed on striking the ground? II. ii) What is its average speed during the 0.5 s? III. How high is the ledge from the ground? Identify the given quantities: yes, they have given time of travel t=0.5 sec, g=10 m s–2 and as it is free fall u=0. Do you remember the avg. speed formula: Yes- v_{avg}=u+v/2 Similarly find out displacement – identify which equation is suitable for finding displacement. Yes, you can use second or third as well. s = ½ a t2 = ½ * 10 m s–2 *(0.5 s)2 = ½ *10 m s–2 *0.25 s2 = 1.25 m Try to solve the below problem at home.	**Q:** An object is thrown vertically Upwards and rises to a height of 10 m. Calculate (i) the velocity with which theobject was thrown upwards and (ii) thetime taken by the object to reach theHighest point.	

Teachers reflections and experiences:

1. Did I provide timely and constructive feedback to guide their learning?
2. How can I improve my assessment and feedback practices?
3. Was the pacing of the lesson appropriate?
4. Did I cover all the planned content without rushing or leaving gaps?
5. How can I better manage the time allocated for each activity?

These questions can serve as a **review** for teachers to reflect on their teaching practices and make informed decisions for future lessons.

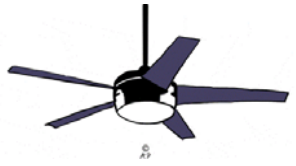
CLASS : **IX**

CHAPTER : **GRAVITATION**

TOTAL NO. OF PERIODS : **10**

PERIOD : **05**

Key Concepts : **Distinction between, mass, weight .Weight and gravitation**

LEARNING OUTCOMES	TEACHING-LEARNING PROCESS	POINTERS FOR ASSESSMENT	MATERIAL REQUIRED
❖ Differentiate between mass and weight qualitatively and Mathematically ❖ Appliesthis knowledge of mass, weight and gravitation in solving problems	**Introductory Activity** ❖ What are objects in our class room at rest? (Chair, Table, Desk, IFP Board) ❖ What are the objects moving in the class room ? (By showing moving fan) ❖ Do they change their state of rest or motion ❖ Why they resist change in its state of motion or rest ❖ What we call the natural tendency of the object to resist the change in its state of motion or rest. ❖ How the inertia related to mass Let us explore mass and weight in this chapter ➢ **Teachers statement:** • The mass of an object is the measure of inertia • Why an elephant is heavier that leaf (The amount of matter in elephant is more than leaf)	What is the reason for state of rest? What is the reason for state of the motion? What is inertia of motion or rest? What is the measure of inertia (mass of an object)?	   https://youtu.be/rFdbY_V7vIo

	• The measure of amount of matter in a body is called (Mass) • Does the mass of the object change place to place? (No) • Mass remains same when the object is on the earth, the moon or in orator space. • What does not change from place to place. • What is the difference between mass and weight? **ACTIVITY:** • If we throw a piece of chalk in upward direction what happens? • Why it falls towards earth? • What we call the force of attraction of earth? • On what factors the gravitational force depends ? • What is the equation for newton second law of motion? F= ma • If you replace a(acceleration) with g(=acceleration due to gravity) it will become earth's gravitational force. F=mg • The force of attraction of earth on an	What is mass ? SI unit of Mass is _____ Q:Does the mass of object change from place to place? What is gravitational force? What is Weight?	Mass - the amount of matter in an object.  An elephant has a lot of mass.  A leaf has very little mass.

object is called as (Weight)

$$F = W$$

Therefore $W = mg$

- In which direction the force is acting.
- Does it has magnitude
- What is the SI unit of Weight?
- In W=mg what is constant an given place?

  Therefore $W \propto m$
- At a given place what is measure of its mass

Mass is the amount of matter in a body	The force of attraction on an object
It is denoted by M	It is denoted by W
It is a scalar quantity (it has no directions	It is a vector quantity (it has both magnitude and direction)
SI Unit of mass is Kg	SI unit of Weight is newton (N)
It is constant(does	It varies from place

What is the formula or equation used to find the weight of the object?

SI Unit of weight is ____?

Is weight a vector quantity?

If a physical quantity is having both magnitude and direction what we call it as ?

Q. The weight of an object at the center of the earth of radius R is

a. Zero

b. Infinite

c. R times the weight at the surface of the earth

d. $1/R^2$ times the weight on the surface of the earth

	not depend upon gravity)	to place dependent on gravity	**Q.Weight of a girl is 294 N. Find her mass.**
	It can be measured by ordinary balance	It can be used by using string balance	

Summary:

Difference between mass and weight:

Teachers reflections and experiences:

1. Did I provide timely and constructive feedback to guide their learning?
2. How can I improve my assessment and feedback practices?
3. Was the pacing of the lesson appropriate?
4. Did I cover all the planned content without rushing or leaving gaps?
5. How can I better manage the time allocated for each activity?

These questions can serve as a **review** for teachers to reflect on their teaching practices and make informed decisions for future lessons.

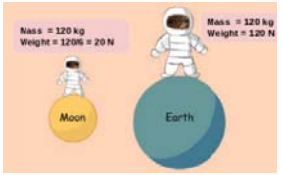
CLASS : **IX**

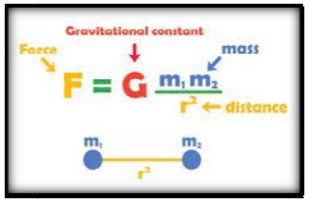
CHAPTER : **GRAVITATION**

TOTAL NO. OF PERIODS : **10**

PERIOD : **06**

KEY CONCEPTS :**Weight of an object on the moon**

LEARNING OUTCOMES	TEACHING-LEARNING PROCESS	POINTERS FOR ASSESSMENT	MATERIAL REQUIRED
Relates processes and phenomena to cause and effect such as force of gravity (weight of the object on the moon) ❖ Relates 'g' with the radius of the planet (object). ❖ Calculates weight of the object on the moon (unknown variable from a given data and assign a proper S.I unit to it)	**Introductory Activity** ❖ Can we walk on earth? ❖ Can we walk on the moon as we walk on the earth? ❖ Why can't we walk normally on the moon? ✓ Gravity on any celestial body(planet,moon,stars)depends up on the mass (m) and size of the celestial body. ✓ Since the mass and size of the moon is very less compared to earth we can say that gravity on moon is very less compared to earth. ✓ Due to this the moon exerts lesser force of attraction on objects. ❖ Let us explore weight of an object on moon ✓ Let the mass of the object be --- m ✓ Let the weight on the moon be --- W_m	On what factors the gravity of a celestial body depends?	

	✓ Let the mass of the moon be --- M_m ✓ It radius be --- R_m ❖ What is the universal law of gravitation $(F= G \frac{m_1 m_2}{r^2})$ ✓ By applying the universal law of gravitation. ✓ The weight of the object on the moon will be $W_m= G.\frac{M_m.m}{R^2m}$ ---① ❖ Let the weight of the same object on earth be --- W_e ✓ The mass of the earth is ----M ✓ Radius of earth is --- --------R ❖ Weight of the object on the earth $W_e =mg$ ------② We know that $g= G.\frac{M}{R^2}$ -----③ from equations ②&③ $W_e =mg$ $=m. G. \frac{M}{R^2}$	Which formula is used to find the weight of object on moon?	 | Celestial body	Mass (kg)	Radius (m)
---	---	---
Earth	5.98×10^{24}	6.37×10^{6}
Moon	7.36×10^{22}	1.74×10^{6}	 $\times$

❖ Calculates weight of the object on the moon	$W_e = G.\ \frac{M.m}{R^2}$ ----- (4) ❖ On substituting the values from the table in equation ①&(4) $W_m = G.\ \frac{7.36 \times 10^{22}\ kg \times m}{(1.74 \times 10^6\ m)^2}$ $= 2.431 \times 10^{10}\ G \times m$ ----(5) And $W_e = 1.474 \times 10^{11}\ G \times m$ -----(6) On dividing equation --(5) by (6) We get $\frac{W_m}{W_e} = \frac{2.431 \times 10^{10}}{1.474 \times 10^{11}}$ $= 0.165 = \frac{1}{6}$ ---------(7) $= \frac{\text{weight of the object on the moon}}{\text{Weight of the object on the earth}} = \frac{1}{6}$ What do you mean by this equation? Therefore weight object on the moon $= \frac{1}{6}$ x it's weight on the earth ❖ Let's check concept of weight of an object on the moon.	Q.Why can't we walk as smooth as on earth? **Q.An object weighs 10 N when measured on the surface of the earth** Lets estimate/guess will it be higher or lesser than earth? What would be its weight when measured on the surface of the moon?	

	❖ Actually gravity on moon is 6 times lesser than the gravity on earth and we also fell 6 time lighter on the moon's surface. Hence we are not pulled towards the surface of the moon as effectively as we are pulled towards surface of the earth that's why it's very hard to walk on the moon.		

Teachers reflections and experiences:.

1. What were my strengths during the lesson?
2. In what areas can I improve as a teacher?
3. How can I continue to develop my teaching skills and practices?
4. Did I encourage self-reflection and meta-cognition among students?
5. How can I incorporate more opportunities for students to reflect on their learning and

These questions can serve as a **review** for teachers to reflect on their teaching practices and make informed decisions for future lessons.

CLASS : **IX**
CHAPTER : **GRAVITATION**
TOTAL NO. OF PERIODS : **10**
PERIOD : **07**
KEY CONCEPTS :**Thrust and pressure**

LEARNING OUTCOMES	TEACHING-LEARNING PROCESS	POINTERS FOR ASSESSMENT	MATERIAL REQUIRED
Differentiates processes and phenomena /process relate to gravitation ❖ Differentiates between thrust and pressure. ❖ Calculates the unknown variable (pressure) from a given data and assigns a proper S.I.unit to it.	**Introductory Activity** ❖ What do you observe from the picture? ❖ What is acting on nail? ❖ In which direction the force is acting? ❖ What we call the force acting on an object perpendicular to the surface (thrust) **Let us explore thrust and pressure.Situation 1** ✓ What is fixed on the bulletin board (poster) ✓ To fix poster what are used? ✓ What is applied on the surface area of the head of pins? ✓ In which direction the force is applied? ✓ What we call this force? ✓ Is thrust vector quantity? ✓ Why it is called vector? ✓ the S.I.unit of thrust (Newton) ✓ A thrust is a force but not every force can be counted as thrust ❖ **situtaion 2** ✓ when you stand loss sand what happens(feet go	What is the S.I.unit of the thrust? What quantity is thrust? What is weight? Define thrust?	

deep into the sand)

- ✓ if you lie down on the same sand dose your body go into the sand deep? (will not go that in the sand)
- ✓ In both cases the force exerted on the sand is weight of the body
- ✓ Here what is acting perpendicular to the sand (a force)
- ✓ The force acting on the object perpendicular to surface is called thrust
- ✓ In the above what is same (thrust)
- ✓ What are different effects are different
- ✓ the effect of thrust on sand is larger while standing than while lying

❖ **Pressure**

- ✓ Why the JVK bags have wide straps so?
- ✓ Why does a sharp knife cut object more effectively than a blunt knife ?
- ✓ Why dose the tip of sewing needle is sharp?
- ✓ Why it is easier to walk on soft sand if we have flat shoes rather than shoes with sharp heels?
- ✓ Why the tractor have broad tyres ?
- ✓ Why the foundations of buildings and dams are laid on larger area ?
- ✓ To answer all these questions let us explore about pressure.

❖ The Thrust on unit area is called pressure.

- ✓ What is the formula for pressure

$$\text{Pressure}(P) = \frac{\text{force}}{\text{Area}}$$

S.I.unit of pressure is N/m^2 or Nm^{-2}

- ✓ In honour of scientist Blaise Pascal

The S.I.unit of pressure is pascal

- ✓ On what factors the pressure depends(2 factors)

1.force – more force more pressure.
2.Area – more area less pressure.

Is thrust and force same?

Define pressure?

What is the S.I.unit of the pressure?

Name the quantity whose one of the unit is pascal?

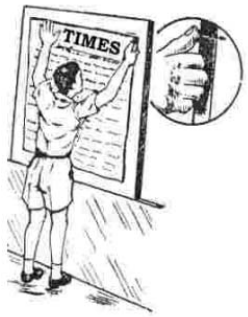
What is the relation between pressure, force and area.

A block of wood is kept on a table top.

The mass wooden block is 5kg and it's dimensions are 40cm x 20cm x 10cm.

Find the pressure exerted by the wooden block on table top if it is made to lie on the table top with it's sides of dimensions a)20cm x 10cm
b)40cm x 20cm.

the pin.



Youtube Link :

https://*byjus.com/physics/thrust-pressure/*

The following diagram gives the formula for pressure: pressure = force ÷ area.

Teachers reflections and experiences:

1.How can I better manage the time allocated for each activity?

2. What were my strengths during the lesson?

3. In what areas can I improve as a teacher?

4. How can I continue to develop my teaching skills and practices?

5. Did I encourage self-reflection and metacognition among students?

6.How can I incorporate more opportunities for students to reflect on their learning and assess their own progress?

These questions can serve as a **review** for teachers to reflect on their teaching practices and make informed decisions for future lessons.

CLASS : **IX**

CHAPTER : **GRAVITATION**

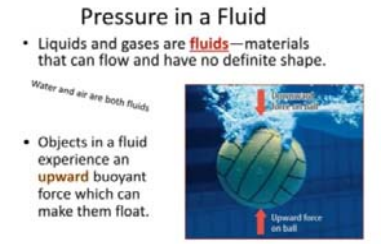
TOTAL NO. OF PERIODS : **10**

PERIOD : **08**

KEY CONCEPTS :**Pressure in fluids, Buoyancy**

LEARNING OUTCOMES	TEACHING-LEARNING PROCESS	POINTERS FOR ASSESSMENT	MATERIAL REQUIRED
Relates processes and phenomena to cause and effect such as buoyancy under gravitation ❖ **Relates the buoyancy to density of fluid , weight the object ,depth of the fluid.** ❖ **Explains the buoyancy in fluids under gravitation** ❖ **Children explains the concept of buoyancy in fluids.** ❖ **Describes scientific discoveries/ inventions such as discovery of verious concepts under gravitation.**	**Introductory Activity** ❖ Why we feel lighter when we swim in a pool? ❖ When you draw water fom a well we feel that the bucket of water is heavier when it is out of the water why? ❖ Why a ship made of iron and steel dose not sink in sea water? ❖ Why the same amount of iron and steel is in the form of a sheet would sink? ❖ Why an helium filled balloon goes up ? ❖ To answer all this questions let us explore pressure in liquids and buoyancy. **Teacher activity (pressure in fluids)** ❖ The substances which can flow easily are called fluids. ❖ All the liquids and gases are fluids .	**Previous knowledge questions .** What are fluids ?	

❖ **Describes using poster on buoyancy** ❖ **Presents the role of activity to understand the buoyancy.**	❖ Like solids exert pressure due to their weight, liquids also have weight and exert pressure. ❖ But a fluid (liquid or gas)exert pressure in all directions – sideward, downward and even upward. Activity (buoyancy): ✓ Take an empty plastic bottle.Close the mouth of the bottle with an air tight stopper. put it in bucket filled with water. the bottle floats. ✓ Push the bottle in to the water we feel an upward push.try to push in further down .we will find it difficult to push deeper and deeper .this indicates that water exerts a force in the upward direction. ✓ The upward force exerted by the water goes on increasing as the bottle is pushed deeper till it is completely immersed. ✓ Now release the bottle. It bounces back to the surface. ✓ The force due to the gravitational attraction of the earth acts on the bottle in the downward direction ,so the bottle is pulled downward direction.	In which direction fluid exert force? Is a gas fluid? Do the liquids exert pressure? In which direction fluid exert pressure?(all directions)	https://youtu.be/khc2wUBsFU4?si=VdscUwGaCXnNhrqe

	✓ But the water exerts an upward force on the bottle. Thus the bottle is pushed upward . ✓ Weight of an object is force due to gravitational attraction of the earth. ✓ The upward force exerted by the water on the bottle is greater than its weight. So the bottle raises up when it is released. ✓ The upward force exerted by the water on the bottle is known as up thrust or buoyant force. ✓ The tendency of a liquid to exert upward force on an object placed in it is called buoyancy. ✓ Factors affecting the buoyant force - the magnitude of buoyant force acting on an object immersed in liquid depends on (1)-Volume of object immersed in liquid . (2)-Density of the liquid. ❖ **Let us check once the concept of buoyancy**	Which floats on water? Which exert a force in upward direction? Dose the upward force increase as the depth of water increase? Which force acts on the bottle to bounces back to the surface ? Which force acts on the bottle in downward direction ? In which direction the force is more (upward or downward direction)? Why it is more? What is buoyant force? What is the other name of the buoyant force? What is buoyancy? On what factors the buoyant forc depends?	  

Teacher's reflections and experiences: 1. Did I critically examine student work to gain insights into their understanding and identify areas for improvement? 2. How can I use student work as a valuable source of information for my teaching? 3. Did I effectively utilize formative assessments to monitor student progress and adjust instruction accordingly? 4.How can I further integrate assessment for learning strategies into my teaching practice? These questions can serve as a **review** for teachers to reflect on their teaching practices and make informed decisions for future lessons.			

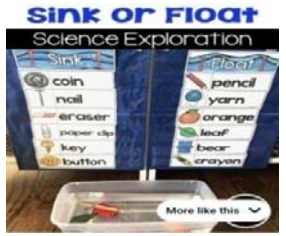
CLASS : **IX**

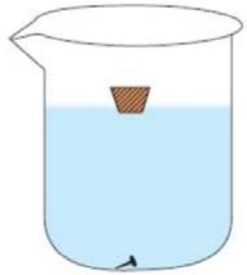
CHAPTER : **GRAVITATION**

TOTAL NO. OF PERIODS : **10**

PERIOD : **09**

KEY CONCEPTS :**Why objects float or sink when placed on the surface of water?**

LEARNING OUTCOMES	TEACHING-LEARNING PROCESS	POINTERS FOR ASSESSMENT	MATERIAL REQUIRED
❖ **Differentiates materials/ objects based on their properties/ characteristics related to gravitation.** ❖ **Differentiates between the sink and float object.** ❖ **Relates processes and**	**Introductory Activity** ✓ observe the figure can you identify what are sinking objects. ✓ What are floating object? ✓ From the **second figure** identify what are sinking objects? What are floating objects? Which objects sink or float in liquids, can you guess the reason? ✓ To answer all these questions let us explore ''why objects float or sink when placed on the surface of water''. **Activity: 9.4** (30min)	✓ Which objects sink in the water ? ✓ Which objects float in water? ✓ Identify the sinking object from the figure. ✓ Identify the floating objects from the figure.	https://youtube.com/watch?v=jQGlQjhUguQ&feature=share  

phenomena to cause and effect such as sink or float under gravitation. ❖ **Explains the process and phenomena of objects sink or float under gravitation.**	Take a beaker filled with water. ✓ Take an iron nail and place it on the surface of water. ✓ Observe what happens. (The nail sinks). ✓ The force due to the gravitational attraction of the earth on the iron nail pulls it downwards. ✓ There is up thrust of water on the nail which pushes it up wards. ✓ But the downward force is acting on the nail is greater than the up thrust of water on the nail. **Activity: 9.5** ✓ Take a beaker filled with water take a piece of cork and iron nail of equal masses. ✓ Place them on the surface of water. ✓ Observe what happens? ✓ The cork floats while the nail sinks. ✓ This happens because of the difference in their **<u>densities.</u>** The density of a substance is	✓ Dos the iron nail sink in the water? ✓ Which force pulls down the iron nail? ✓ Which force acts on the nail in the upward direction? ✓ Which force is greater on the nail? ✓ What were placed on the surface of water? ✓ Which one floats on the water? ✓ Which one sinks in the water? ✓ What is the reason behind sink or float of objects? ✓ What is density? ✓ Which object density is less than that of water?	

❖ **Describes using poster on why objects sink or float in liquids.** ❖ **Presents the role of activity to understand the buoyancy.**	defined as ''The mass per unit volume''. ✓ Density (D)= Mass(M) / Volume (V) ✓ What are equal here? What are different? ✓ If volume increases does the density decrease or increase? ✓ Why the density decreases? The cork is less than that of density of water. ✓ The up thrust or buoyant force on cork is greater than the weight cork. ✓ The density of iron nail is more than the density of water. ✓ The up thrust or buoyant force of water on the iron nail is less than the weight of the nail. So it sinks. ✓ Therefore objects of density less than that o a liquid float on the liquid. ✓ The objects of density greater than that of a liquid sink in the	✓ Which of the objects density is more than the density of water? ✓ Which objet float on the water? ✓ Which objects sink in the object sink in the water ? ✓ On which factor of an object depends sinking or floating ?	

	liquid. ✓ The sinking or floating of an object is determined by its density.		

Teacher's reflections and experiences:

1. Did I clearly communicate the lesson objectives to the students?
2. How can I ensure that students understand the objectives and can demonstrate theirknowledge or skills related to them?
3. Did I use effective instructional strategies to engage students in the lesson?
4. How can I improve the variety and effectiveness of my teaching methods to cater todifferent learning styles and needs?
5. How well did I manage the classroom during the lesson?

These questions can serve as a **review** for teachers to reflect on their teaching practices and make informed decisions for future lessons.

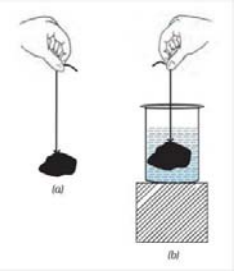
CLASS : **IX**

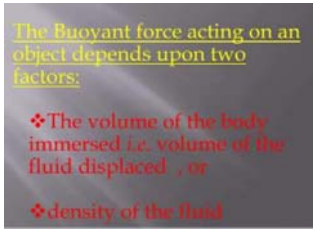
CHAPTER : **GRAVITATION**

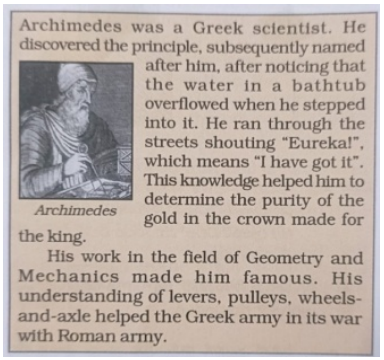
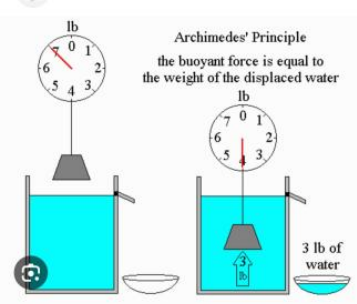
TOTAL NO. OF PERIODS : **10**

PERIOD : **10**

KEY CONCEPTS :**Archimedes principle**

LEARNING OUTCOMES	TEACHING-LEARNING PROCESS	POINTERS FOR ASSESSMENT	MATERIAL REQUIRED
❖ **Planes and conduct experiments to arrive at and verify the law of flotation under gravitation.** ❖ **Verify Archimedes principle through experiments from daily objects.**	**Introductory Activity** ✓ observe the Youtube link and find which objects sink are float in the water . ✓ Why huged bodies like ships and submarians float on the water? ✓ To answer this question let us explore Archimedes principle. ✓ **Teacher demonstrate Activity .1** Take a piece of stone and tie it to on end of rubber string or a spring balance. ✓ Suspend the stone by holding the balance or the string. ✓ Note the elongation of the	✓ Which objects sink in the water ? ✓ Which objects float on the water? ✓ What is the reason for sink or float in the water? ✓ What is suspended to the string? ✓ Why elongation in the string or spring balance takes place ? ✓ What do you observe in the elongation of the string or the reading on the balance? ✓ Why the extension in the string decreases when the stone is lowered in the water? ✓ In which direction the force acts	https://youtube.com/watch?v=jQGlQjhUguQ&feature=share⇐ Click Here. 

❖ **Relates processes and phenomena to cause and effect such as buoyancy , force of gravity.** ❖ **Explain process involved in the Archimedes principle.** ❖ **Describes scientific**	string or the reading on spring balance due to the weight of the stone. ✓ Now slowly dip the stone in the water in a container . ✓ We find the elongation of the string or reading of the balance decreases as the stone is gradually lowered in the water. ✓ No further change is observe once the stone gets fully immersed in the water. ✓ We know that the elongation produced in the string or spring balance is due to the weight of the stone. ✓ Since the extension decreases once the stone is lowered in the water it means that some force acts on the stone in upward direction . ✓ The upward force exerted by water on an object (stone) and know as force of buoyancy. ✓ The buoyant force experienced by a body depends on volume of the body immersed and density of	on the stone ? ✓ What we call this upward force? ✓ On what factors the buoyant force acting on the object depends? ✓ What is the magnitude of the buoyant force experienced by a body? ✓ Do all bodies in a given fluid experience the same buoyant force? ✓ What is Archimedes principle? ✓ What is the difference between buoyancy and Archimedes principle ? ✓ Which principle is used in designing ships and submarines? ✓ On which principle the Lactometer is made? ✓ What is the purpose of hydrometer and under which principle it is made? **Q. An object weighs 10 N in air. When immersed fully in water, it weighs only 8 N. The weight of the liquid** **a. 2 N** **b. 8 N**	

discoveries/ inventions such as discovery of the Eureka moment of Archimedes with respect to the laws of flotation .	the fluid. **Archimedes principle**:- ✓ When a body is immersed fully or partially in fluid it experiences an upward force that is equal to the weight of the fluid displaced by it. ✓ Buoyancy describes the force that a fluid exerts on an object of different/ lesser density than itself. ✓ Archimedes principle describes one aspect of buoyancy. That the buoyant force exerted on an object under a fluid is equal to the weight of the fluid it displaces. ✓ **Applications of Archimedes principle:-** ✓ **1. Used in designing ships and submarines.** **2.lactometers (used to determine the purity of a sample milk)** **3.Hydrometers(used for determining density of a liquid).**	**c. 10 N** **d. 12 N** ✓ What are the applications of Archimedes principle in our daily life?	https://youtu.be/05WkCPORIj4⇐ CLICK HERE   
Teachers reflections and experiences:			

1. Did I clearly communicate the lesson objectives to the students?
2. How can I ensure that students understand the objectives and can demonstrate their knowledge or skills related to them?
3. Did I use effective instructional strategies to engage students in the lesson?
4. How can I improve the variety and effectiveness of my teaching methods to cater to different learning styles and needs?
5. How well did I manage the classroom during the lesson?

These questions can serve as a **review** for teachers to reflect on their teaching practices and make informed decisions for future lessons.

e – Content Reference

Period	Name of the Topic	Video Links
1	Centripetal force,Gravitational force	https://youtu.be/0L-foX49Row
2	Universal law of gravitation	https://youtu.be/c9shwPMpSq8?si=5VzB_WMiZmti_bNN
3	Importance of universal law of gravitation ,free fall	
4	To Calculate "g",motion of object under influence of gravitational force	https://youtube.com/shorts/UvdKRpZ3roU?si=8gKgYnO5MLvFesAM
5	Difference between mass and weight,gravitation	https://youtu.be/rFdbY_V7vIo
6	Weight of an object on moon	
7	Thrust and pressure	https://*byjus.com/physics/thrust-pressure/*
8	Pressure in fluids and buoyancy	https://youtu.be/khc2wUBsFU4?si=VdscUwGaCXnNhrqe
9	Why objects float or sink on surface of water	https://youtu.be/05WkCPORIj4
10	Archimedes Principle	https://youtube.com/watch?v=jQGlQjhUguQ&feature=share

WORK SHEET - 1 :(Gravitation)

SECTION _A

1. _____ holds the earth's atmosphere? 5 x 1 = 5
2. The gravitational force between two bodies does not depend on _____.
3. The law of gravitation describes the gravitational force between _____.
4. If the ball is thrown up the value of 'g' will be _____.
5. The mass of the body on the moon is 40kg. What is the weight on the earth _____.

SECTION _B

5 x 2 = 10

1. Earth attracts apple from the tree and it falls on it but the earth does not move towards the apple. Why?
2. Is uniform circular motion taking place at a constant speed or constant velocity? Why?
3. A stone and a feather are thrown from a tower, both the objects should reach the ground at same time but it does not why?
4. Is value of 'g' same everywhere?
5. Show that the weight of the body on moon = 1/6 of the weight of the body in earth?

WORK SHEET - 2 :(Gravitation)

1.Why is it easier to swim in sea water than in river water?

2. why does an Iron nail sink in water while a ship made of iron floats ?

3.Find the gravitational force between two objects of mass 5kg and 10 kg separated by a distance of 20 meters.

Take G =6.67x10 $^{-11}$N.m2/kg2.

4. give the reason for the following

(a) A piece of paper takes much longer to fall from the roof of a building than a stone ,when both are dropped simultaneously.

(b) the mass of an object is constant ,where as weight changes from place to place

5. A solid weighs 60N in air and 54N when completely immersed in water.calculate

(a) up thrust on the solid (b) Volume of the solid (take g= 10 m/s2 and density of water= 1000kg/m3)

6.give reasons why Arun weighs 600N on Earth but weigh 100Non the moon

7.which of the following statement is true about acceleration due to gravity.

(a) It is constant at all places on the earth.

(b) its maximum at the poles and minimum at equator

c) Its minimum at poles and maximum at equator

(d) It increase as we go up from the earth.

8.What happens to the force between two bodies if

(a)Mass of both the bodies is doubled

(d) Distance between the bodies is tripled

(c) Mass of one of the bodies is doubled

9.State Archimedes principle,and its applications ?

10. Would the acceleration due to gravity acting upon a feather and a brick be the same? Explain with reasons.

* * *

Class : 9

Name of the lesson : MOTION

Total number of periods :12

AIMS OF EDUCATION :

RATIONAL THOUGHT AND AUTONAMY

DEMOCRATIC AND COMMUNITY PARTICIPATION

AIMS OF SCIENCE EDUCATION:

- Scientific understanding of the natural and physical world.
- Capacities of scientific enquiry
- Understanding of the relationship between science, technology and society.
- Interdisciplinary understanding between science and other curricular areas

CURRICULAR GOALS AND COMPETENCIES :

CURRICULAR GOAL : **Explores** the physical world around them and understands scientific principles and laws based on observations and analysis.

COMPETENCY : **Applies** the motion and rest to the daily life situations, explains the change in state of motion, displacement, velocity and acceleration, uniform circular, analysis of graphical and mathematical representation.

COMPETENCY : **Explains** the relationship between distance and time, velocity with time, and relation between acceleration and velocity, etc

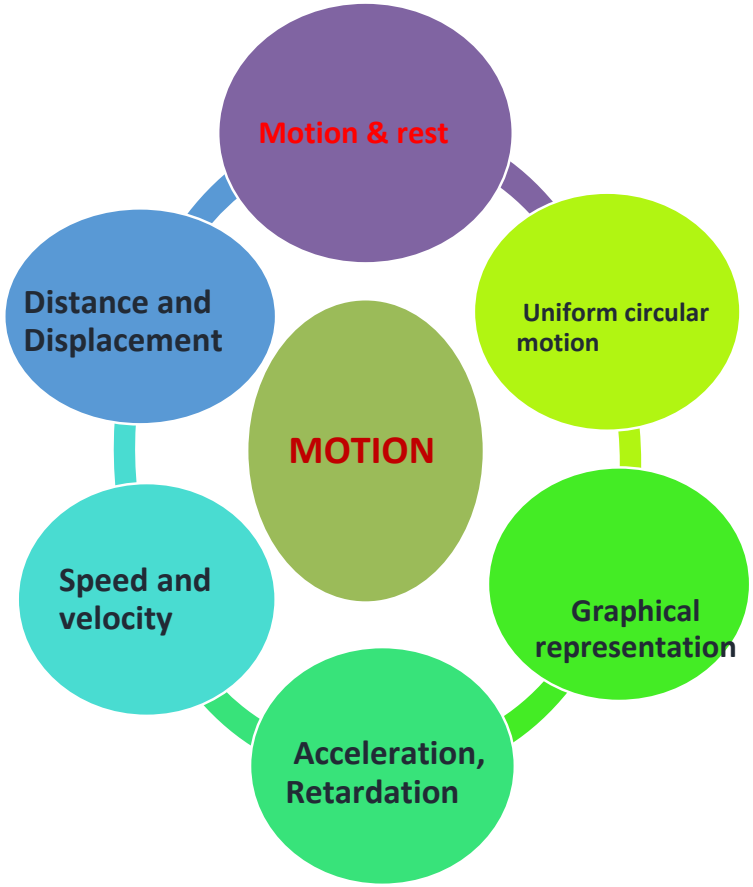
CURRICULAR GOAL : **Draws** linkages between scientific knowledge and knowledge across other curricular areas

COMPETENCY : **Applies** scientific principles to explain phenomenon of displacement,velocity, acceleration, in other uniform circular motion to other subjects like maths etc.

CURRICULAR GOAL : **Explores** the nature of science by doing science

COMPETENCY : **Develops** accurate and appropriate models (including geometric, mathematical ,graphical) to represent real- life events and phenomenon using scientific principles and use models to manipulate variable and predict results.

SUB TOPIC WISE SPLITTING-MOTION



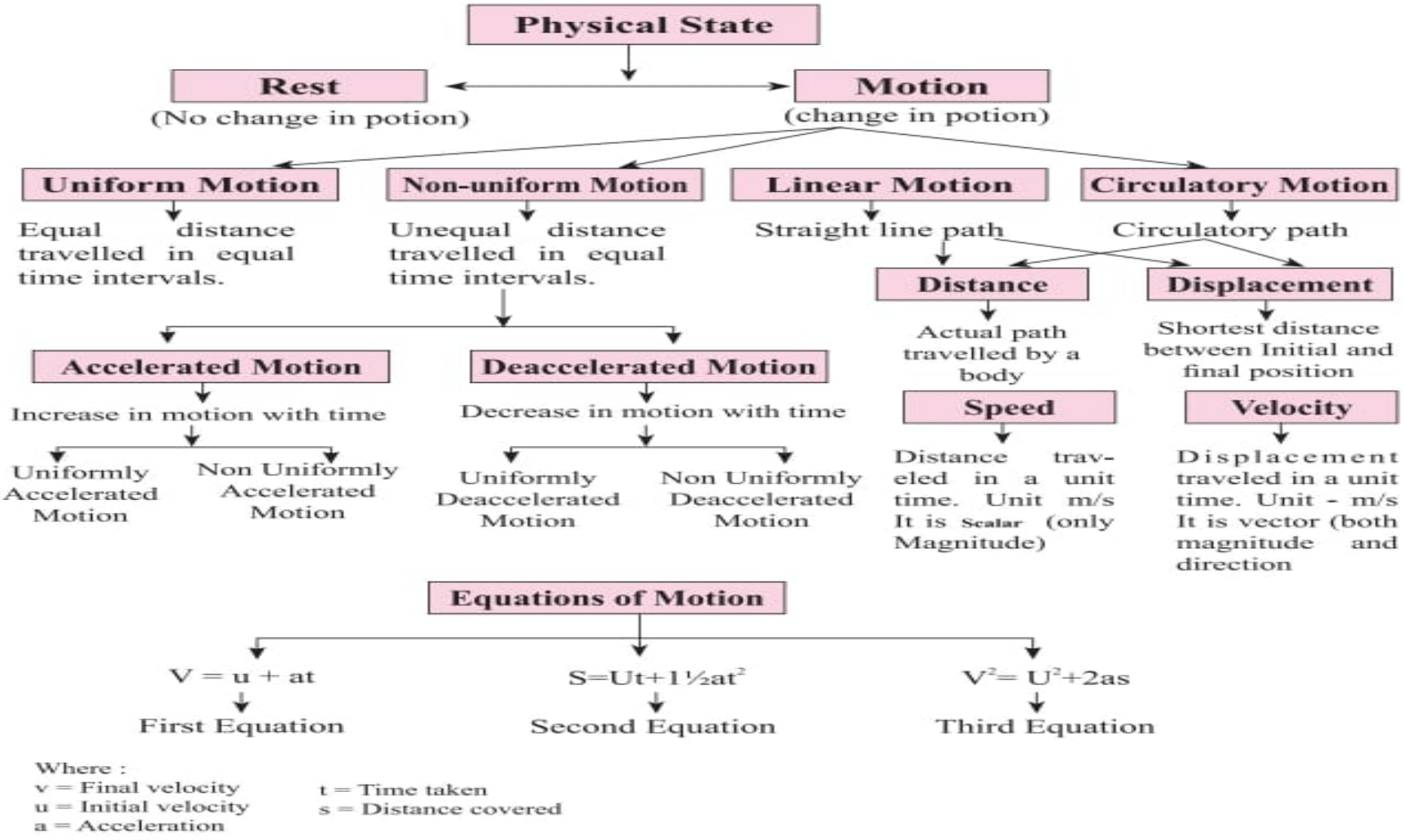
PERIOD NO.	TOPIC	LEARNING OUTCOME
1	Introduction of Motion, Rest and Describing Motion	• Give different examples for motion. • Differentiates moving and non moving objects. • Explains the terms rest and motion
2	Motion along straight a line, and Displacement	• Explains the concept of motion along straight-line • Calculates the distance travelled by an object • Differentiates the distance and displacement • Draws the path of distance and displacement.
3	Uniform and Non uniform Motion	• Compares uniform motion with non-uniform motions • Relates the processes and phenomenon about average speed and distance with time • Calculates the uniform motion from the given data
4	Speed with direction and Velocity	• Explains and describe The comprehensiveness of speed. • Differentiates the speed and velocity • Relates the speed with velocity • Compares the speed and velocity • Applies the average velocity in their daily life situations • Calculates the average velocity.
5	Rate of change of velocity	• Explains and describe The rate of change of velocity • Differentiates the positive and negative accelerations • Relates the change of velocity with time and deduce the formula for acceleration • Compares the uniform and non uniform motion • Applies the acceleration concept at their day to day life situations • Solve the numerical problems based on acceleration

6	Numericals based on Acceleration	• Explains the relation between v,u,t and a • Solve different problems on acceleration • Relates the process while solving problems on ccelerationn. • Uses correct units for u,v,t and a
7	Distance-Time Graph in case of Stationary body and body in motion Determine the speed of an object from Distance-Time graph.	• Learn to plot distance– time graph of an object from the given data. • Develops knowledge of how physical quantities like distance and time are represented graphically. • Analyses and Interpret graphs
8	Distance-Time Graph in case of a body in accelerated motion	• Learn to plot distance– time graph, of an object from the given data. • Develops knowledge of how physical quantities like distance and time are represented graphically. • Analyses and Interpret graphs
9	Velocity-Time Graph, Displacement/Distance travelled by a body using Velocity-Time graph	• Learn to plot distance– time graph, of an object from the given data. • Develops knowledge of how physical quantities like Velocity and time are represented graphically. • Analyses and Interpret graphs • Identify and use the physical quantities from Velocity-time graphs and areas under and gradients of velocity-time graphs.
10	Velocity-Time Graph, Distance travelled by a body using Velocity-Time graph whose motion is uniformly accelerated.	• Develops knowledge of how physical quantities like Velocity and time are represented graphically. • Analyses and Interpret graphs • Identify and use the physical quantities from Velocity-time graphs and areas under and gradients of velocity-time graphs.
11	Derivation of three equations of motions from graphical method	• Learn to plot Velocity– time graph, of an object from the given data. • Develops knowledge of how physical quantities like Velocity

		and time are represented graphically. • Interpret graphs and derive equations of motion from graphs
12	Uniform circular motion, formula for speed of an object 'V' whose motion is a uniform circular motion.	• Calculates speed of an object travelling in a uniform circular motion. • Derives formula for the speed of an object moving in a uniform circular motion.

Motion

Mind Map



Where :
v = Final velocity
u = Initial velocity
a = Acceleration
t = Time taken
s = Distance covered

MOTION LESSON

PERIOD PLAN 1

CLASS : IX

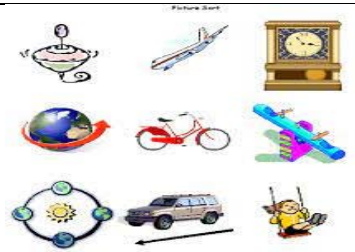
CHAPTER : MOTION

TOTAL NO.OF PERIODS : 12

PERIOD NO : 01

TOPIC/KEY CONCEPTS : INTRODUCTION OF MOTION, REST, and DESCRIBING MOTION

LEARNING OUTCOME	TEACHING LEARNING PROCESS	POINTER FOR FORMATIVE ASSESSMENT	MATERIALS REQUIRED
. ❖ Differentiates moving and non moving objects. ❖ Explains the term rest and motion.	• Is the life possible without moving objects ? • Imagine how would be the life without moving objects? • Can you give some examples for moving objects? • What do you think about motion? • Is the earth in motion or at rest? Activity: **Presentation of concept of motion** By showing different objects like duster, chalk, pen, table, chair, board, fan, etc in the class room .teacher can do the following discussion • Do they move on their own ? • Do any of them are at rest? • Do the walls of our class room are at rest o motion?	1. What are the moving objects? 2. What are the non-moving objects? 3. Is your house moving or not?	Duster, chalk piece, pen ,fan, table, chair, etc. 

	• Is your house moving or not? • How can you say your house is at rest? • Is there any change in the position of your house with respect to your surroundings? • With reference to time is there any change in its position? • What do you say if it does not change its pos From the above discussion, students try to think about motion. Q. Can you give more example for objects which are in motion? Teacher explores on different examples • Birds fly, fishes swim,blood flows, car moves, fan rotates, atoms ,molecules,planets ,stars and galaxies are all in motion. • Do all the above move in the same type of motion? Teacher shows different pics of motion? Fan rotating, earth revolving, birds flying, atoms and molecules vibrate during their motion. Motion of planets etc.   8	4. What do you say if its position changes with resp to its surroundings with time? 5.Do you think that the earth is moving or not? 6. What is the reference point? 7.Without reference point can you describe about rest or motion of an object ? 8. How does the earth move around the sun?	 https://youtu.be/9sIP0Z-y_c?si=1qoplSy9c_qPp0D9 You tube links https://youtu.be/elAzkXyRQFU?si=Pe_aab3J0_sFigYX 

Teacher experiences and reflections :

1) How can I ensure that students understand the objectives and can demonstrates their knowledge or skill related to them

2) How well did I manage the class room during the lesson?

3) How did I assess the students understanding effectively during the lesson?

4) How can I improve the variety and effectiveness of my teaching methods to cater to different learning styles & needs

5). Were there any disruptions or behavioral issues that I need to address?

https://www.youtube.com/live/qh45XvbUWX0?si=lSJ3k4Z39UwpYfj7

PERIOD PLAN 2

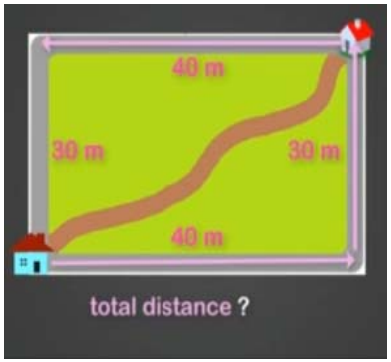
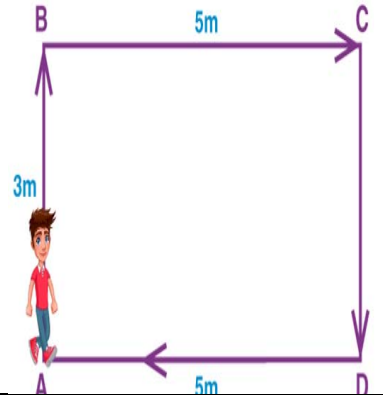
CLASS : IX

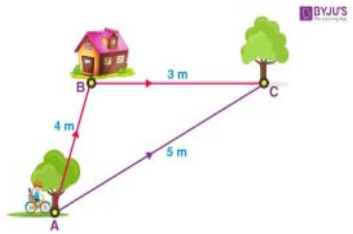
CHAPTER : MOTION

TOTAL NO.OF PERIODS : 12

PERIOD NO : 02

TOPIC/KEY CONCEPTS : MOTION ALONG A STRAIGHT LINE, DISTANCE, and DISPLACEMENT.

LEARNING OUTCOME	TEACHING LEARNING PROCESS	POINTER FOR FORMATIVE ASSESSMENT	MATERIALS REQUIRED
❖ Explains the concept of motion along straight-line	Recall the previous knowledge. Q1. Can you give some examples for the objects in motion and at rest? Q2. Is our class room in motion or at rest? With respect to your surroundings? With respect to solar system?		
	Presentation the key concept •How does a fish move ? •. Is the motion of a fan and motion of a bicycle same ? •Does the bus move in a straight way? *A----------B-*----------*C----------D* In the above path of motion • What is the total length from A to D ? • What is the total length from D to		

	A? • IS there any difference in its length? Students observe that " The total length of the path from initial to final position is called distance."	Q3. What is the distance ?	
	Activity: • One of the student is asked to do an activity,to measure the distance in feets while Walking beside the wall of your class room from one side to remaining three walls and observe the actual distance of the path and shortest distance of that path also	Q4.What is the displacement ?	
❖ Differentiates the distance and displacement	Observe the diagram • How many ways are there to reach point C ? • What is the shortest way? The shortest length of the path is termed as displacement: • What is the distance between point A and C in a specified direction? • What is the displacement in this path from A to C? • Is it from At o C ?	Q6. Are the distance and displacement same in the given path point "A and C "?	, 
❖ Draws the path of distance and displacement.	"Distance never becomes zero." When does displacement become zero?	Q7. When does the displacement becomes zero?	https://youtu.be/9c7-8bhTrpM?si=alAA3ULHbFqV2UVM

	Video link will be provided to the students for digital https://youtu.be/Xo3KBoEMDEo	Q8. What are the differences between distance and displacement? Q9. Is direction play any important role in making difference in the distance or Displacement?	

Teacher experiences and reflections :

1) In what areas can I improve as a teacher?
2) How can continue to develop my teaching skills and practices?
3) Was the pacing of the lesson appropriate?

PERIOD PLAN 3

CLASS : IX

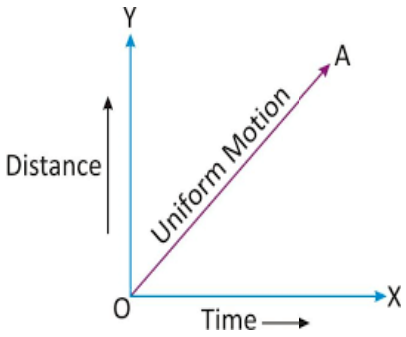
CHAPTER : MOTION

TOTAL NO.OF PERIODS : 12

PERIOD NO : 03

TOPIC/KEY CONCEPTS : UNIFORM MOTION AND NON- UNIFORM MOTION.

LEARNING OUTCOME	TEACHING LEARNING PROCESS	POINTER FOR FORMATIVE ASSESSMENT	MATERIALS REQUIRED
	Recall the previous period knowledge. • What is the motion? • What is the difference between motion of an earth and motion of a car? • When do the distance and displacement become equal? • When does the displacement become zero?		
1. Explains and describe the concept of uniform and non-uniform motion	• Does a bus move with same speed from starting to ending in it's journey? •When you travel in a bus, what do you observe about its distance covered in same intervals of time? • Do you think that speed of a running fan changes time to time? Teacher show the image and ask the following questions.		Byju's content DIKSHA APP IFP VEDIO LINKS https://youtu.be/DcTvuXN27wo?si=8Lkj_I3BVfKbINtd



Q. What do you think about motion of object A ?

Q. What is the distance covered by the object A,B in same interval?

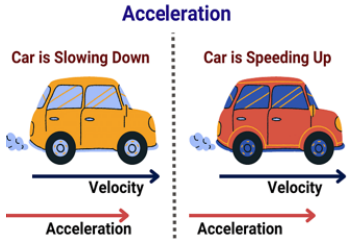
Q. Is that distance changing with same interval of time?

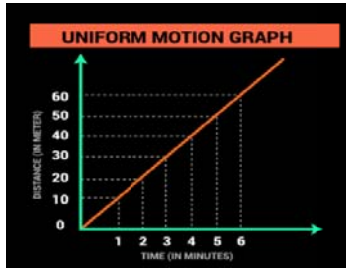
Activity :

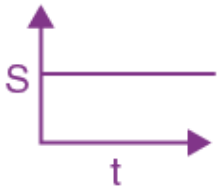
Time	9.30am	9.45am	10.am	10.15am	10.30am
Distance travelled By "A"	1	20	30	40	50
Distance travelled by "B"	1	19	23	35	37

- What is the distance of object "A "at 9.45am?

Q. How is the speed of an object calculated







<table>
<tr>
<td></td>
<td>•What is the distance of object B” at 9.45am?
•. What do you observe in the distance covered by object A and B in the same interval of time?
•Is the distance covered by object B is same in the same interval of time?
•Is its speed equal in all intervals of time?
•How can you find its average speed ?</td>
<td></td>
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<tr>
<td>2. Differentiates the uniform and non-uniform motions</td>
<td>•. What do you observe that the difference between distance travelled by A and B in that table.
•What is the speed of object B?</td>
<td>Q3. What is the relation between distance, speed and time?</td>
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</tr>
<tr>
<td></td>
<td>The average speed of an object is obtained by dividing the total distance travelled by the total time taken.
•. What is the relation between distance and time?</td>
<td>Q4. What is the average speed of an object “?
Q5. Calculate the speed of a train if it covers 50km in first hour and 100 km in one hour 30 minutes?</td>
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</tr>
<tr>
<td>4. Relates the processes and phenomenon about average speed and distance with time</td>
<td>•. What is the unit SI unit of speed?
•What is the C.G.S Unit of speed ?
.</td>
<td>Q6. From the given table,identify that is it uniform motion or non uniform motion.
<table>
<tr><td>Distance</td><td>20 m</td><td>40 m</td><td>60 m</td><td>80 m</td></tr>
<tr><td>Time</td><td>5s</td><td>10 s</td><td>15 s</td><td>20 s</td></tr>
</table>
</td>
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Teacher experiences and reflections :

1) How well did I manage the class room during the lesson
2) Did the students actively participate and show intrest in the lesson
3) Did I provide timely and constructive feed back to guide their learning

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PERIOD PLAN 4

CLASS : IX

CHAPTER : MOTION

TOTAL NO.OF PERIODS : 12

PERIOD NO : 04

TOPIC/KEY CONCEPTS : SPEED WITH DIRECTION-VELOCITY

Learning outcomes	Teaching learning process	Pointers for formative assessment	Materials required
❖ Explains and describes the comprehensiveness of speed.	Recall the previous knowledge. •. what is the relation between distance and time ? •What is the difference between uniform and non uniform motion? •What are the different units of speed •What do you know about distance and displacement?		Text book
❖ Differentiates the speed and velocity ❖ Relates the speed with velocity	Presentation of key concept ". A' Rama walked 2 km in a forest "B" Rama walked 2 km towards east in the forest •What is the main difference between these two statements • In statement B does it indicate any direction? •What do you know about vector quantity? •Can you give some examples for vector quantities? •Can u give some examples for scalar	• What is the main difference between speed and velocity?	DIKSHA APP IFP VEDIO LINKS https://youtu.be/0NHkvwHnMcE?si=9plX-D1pzvEIWfKI

❖ Applies the average velocity in their daily life situation

physical quantities?

- Do you know the units of velocity?
- How do we represent the velocity?
- What do we call the ratio of displacement and time taken?
- Speed of a body in a particular direction is called what?
- Do objects always maintain constant velocity?
- If not how do you find its velocity?
- What is the arithmetic mean of velocity of a body?
- Can we call it as average velocity?

- What is shown in the given in the diagram?.

- The odometer of a car reads 1000km at the starting of a trip and 1200km at the end of the trip. If the trip took 4 hours .calculate the average speed of the car in m/s.?
- Which data is given in this problem?
- Which is to be find out?
- Which formula is used to solve the problem?

- Initial velocity of a bike is x and final velocity of it is Y,then what is the average velocity of that bike?

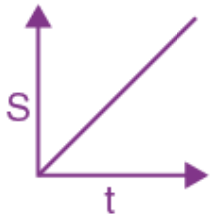
❖ What is the purpose of odometer?

Q5. In a cricket tournament the different bowlers speed of the ball as follows.

Bowler	A	B	C	D
Speed of the ball	140	130	13	1

A) What is the average speed of the bowlers A and B?

B) find the average speed of the ball of all



		bowlers.? Q6. The odometer of a bike reads 500km at the start of a trip and 600km at the end of the trip. if the trip took 2hours. Calculate the average speed of the bike?	

Teacher experiences and reflections :

1) Did I use effective instructional strategies to engage students in the lesson
2) where these any disruptions are behavioral issues that I need to address?
3) Did I assess students understanding effectively during the lesson

PERIOD PLAN 5

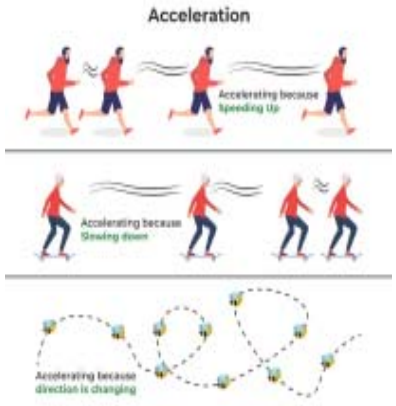
CLASS : **IX**

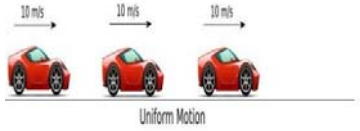
CHAPTER : **MOTION**

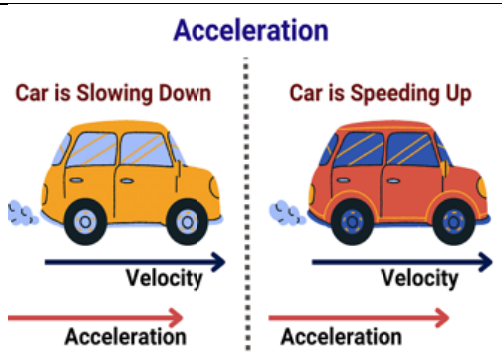
TOTAL NO.OF PERIODS : **12**

PERIOD NO : **05**

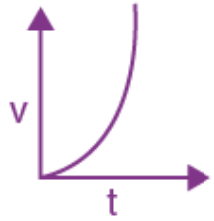
TOPIC/KEY CONCEPTS : **RATE OF CHANGE OF VELOCITY**

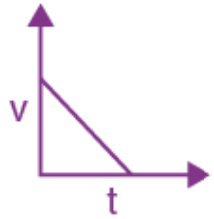
LEARNING OUTCOMES	TEACHING LEARNING PROCESS	POINTER FOR FORMATIVE ASSESSMENT	MATERIALS REQUIRED
❖ Explains and describes the rate of change of velocity • Differentiates the positive and negative acceleration	Recall the previous period knowledge. • Do you remember uniform motion and non uniform motion? • What is the in change in velocity when a body is in uniform motion? • In non uniform motion, does the velocity keep constant? • What is the unit of speed in SI system? • What is the unit of speed in C G S system?	• What do you know about rate change of displacement? And the rate of change of velocity?	
❖ Relates the change of velocity with time and deduce the formula for acceleration	Presentation of key concept • What do you say about change of velocity? • What is the unit of acceleration? • Does the acceleration of freely falling body become zero?	• What is the relation between v, u and t? • What is the acceleration of an	BYJUS'S,content DIKSHA APP IFP

❖ Compares the uniform and non uniform motion ❖ Applies the acceleration concept in their day to day life situations .	• When does acceleration becomes negative? • • When you are travelling in bus or a car, you observe the driver place near by his legs, there are three peddles at the legs of driver, do you know what are they? • Do you observe how does a driver change the speed of vehicle? • When you go by a bike with your parents ,frequently speed of bike changes do you observe , how it happens? • What do you mean by rate of change of velocity? • If the change of velocity per second is 50m/s ,what is its acceleration? • What is the ratio of change of velocity to the time taken? • Do you derive the formula of acceleration?	object if it starts at a point with velocity "p" and after time "x" it has got velocity 'Q". • Give some examples where the acceleration get positive value? • Mention some examples for non uniform acceleration? • What do you mean by the term retardation or negative acceleration? give two examples of such a motion? • What is the acceleration of a body moving with uniform velocity? • Differentiate acceleration from velocity?	VEDIO LINKS https://youtu.be/Sz-1Hg8_I-0?si=BF8mLsTtKbHme4Xp   



- What type of acceleration is observed when a car arriving to stopping position?
- What happens to the acceleration when a car is getting increased its speed?





Uniform and non uniform accelerated motion

	• When a ball thrown up ,what about its acceleration? • When does an acceleration becomes zero? • What is retardation? • What is the unit of acceleration? • Is the acceleration a vector or scalar?		

Teacher's reflections and experiences:

1) Did I covered all the planned content without rushing or leaving gaps?
2) What were my strengths during the lesson?
3) Did I encourage the self reflection and met cognition among students?

PERIOD PLAN 6

CLASS : IX

CHAPTER : MOTION

TOTAL NO.OF PERIODS : 12

PERIOD NO : 06

TOPIC/KEY CONCEPTS : NUMERICALS BASED ON ACCELERATION

LEARNING OUTCOMES	TEACHING LEARNING PROCESS	ASSESSMENT	MATERIALS REQUIRED
	Recall the previous period knowledge. • What is the formula for calculating velocity? • What is the formula for calculating acceleration? • What are the units for acceleration? • Is accelerator in vehicles related to speed, if yes how?		https://youtu.be/nggPwgRvFTk Acceleration concept recap
❖ Solve different problems on acceleration ❖ Relates the process while solving problems on acceleration	Presentation of key concept • A bus decreases its speed from 80m/s to 60m/s in 5seconds.find the acceleration ? Sol. Teacher ask the students to get the given data from the problem. Students may observe that Initial speed (u)= 80m/s Final speed (v) = 60m/s Time taken t=5 sec. We know that relation between u, v ,t, a as	• A motor boat starting from rest on a lake accelerates in a straight line at a constant rate of 0.3m/s2 for 8.0s.how far does the boat travel during the period? • A train starting from railway station and	VEDIO LINKS

• Applies acceleration in their day to day life situations	v-u a = -------- t substitute the values 60-80 a = ---------- 5 = --4m/s^2 There for the acceleration (a)= -4m/s^2 Q5. Starting from a stationary position , Ramu pedals his bicycle to attain a velocity of 6m/s in 30 s .then he applies brakes such that the velocity of the bicycle lower to 4m/s in the nest 5 sec. calculate the acceleration of the bicycle in both the cases.? Sol. Teacher ask the students to go through the question thoroughly to pick the required data for calculating acceleration. In the first case: Initial velocity u= 0,because stationary position Final velocity v= 6m/s, as per question We know the relation for acceleration v-u a = -------- t =6 -0/30 =0.2 m/s^2	moving with uniform acceleration attains a speed 40km/h in 10 minutes .find its acceleration? • A car starts from rest and achieves a speed of 54 km/h in 3 seconds .find its acceleration.? • What will be the acceleration of a car if it slows from 90km/h to as stop in 10 seconds.?	

	In the second case: What is the speed of bicycle before applying breaks? Students reply that (u) = 6m/s Which is initial velocity for case two. After applying breaks what is the velocity of bicycle ? Students can answered that it is (v) = 4m/s The time taken = 5 s Again we know the formula of acceleration $a = \frac{v-u}{t}$ $=4-6/5$ $= -0.4m/s^2$ In the first case the acceleration is $0.2m/s^2$ In the second case the acceleration is $-0.4m/s^2$.		

Teacher experiences and reflections :

1) How can I use student work as a valuable source of information for my teaching?

2) How can I further integrate assessment for learning strategies into my teching practice?

3) How can **I better manage the time allocated for each activity?**

PERIOD PLAN -7

CLASS : IX

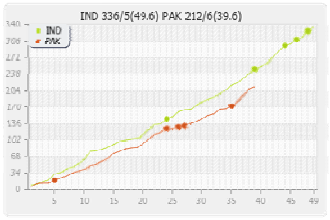
CHAPTER : MOTION

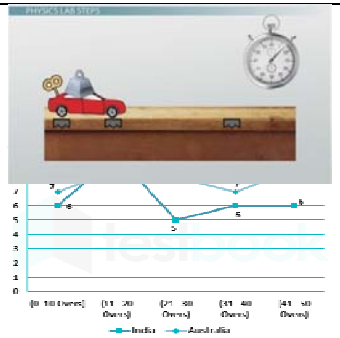
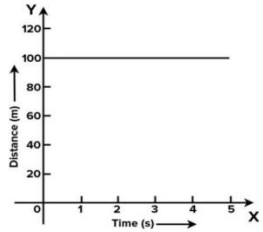
TOTAL NO.OF PERIODS : 12

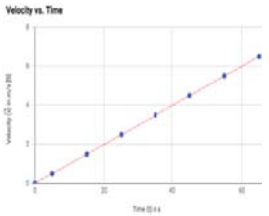
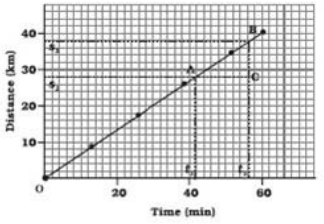
PERIOD NO : 07

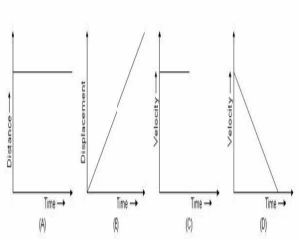
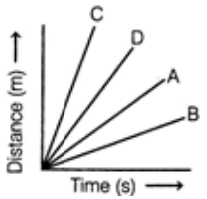
TOPIC/KEY CONCEPTS : Distance-Time Graph in case of Stationary body and body in motion

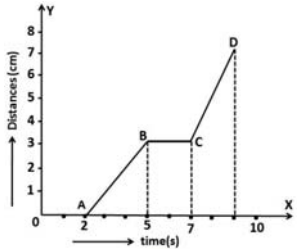
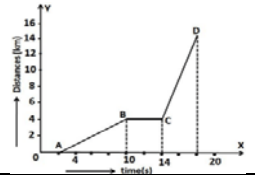
Determine the speed of an object from Distance-Time graph.

Learning outcomes	Teaching learning process	Assessment	Materials required
❖ Analyses and Interpret graphs. ❖ Applies scientific concepts in everyday life and solve problems.	**Introductory Activity** • How many of you have watched India Vs Pakistan Cricket Match any time in Television? • What did you notice on TV screen while the Cricket match is going on? • (Ask one among the students who raised their hands for previous question) • Do you notice anything to compare the run rates of each teams in a over? • Did you study any graphs in your mathematics subject? • (Students will reply various types of Graphs they have learn) • What type of Graph you learn in solving a linear equation with two variables? **Teacher's Statement:** • **We can also use "LINE GRAPHS" to describe the motion of an object and**		Graph Paper, IFP Board, Black/ Green Board Display of Cricket Match on IFP  

	can show the dependence of quantities like distance, speed and velocity on other quantities like Time. • **We will learn about "GRAPHICAL REPRESENTATION OF MOTION OF OBEJECTS" and how to plot Distance-Time graphs.** • Teacher Ask Two Students to perform an activity)(The activity is to measure the distance travelled by a Toy Car placed on the Teacher's table without applying any force on it) • One student asked to note down the time and another student measure the distance travelled from one end of the Table and tabulate the observations. • (Students will perform the activity with the guidance of the teacher and tabulate the observations) • Teacher Project Graph Sheet on IFP/ Show Graph Sheet(If IFP is not available) to demonstrate the drawing of graph on the basis of the observations made by the students in their activity) • Teacher: What are axes we take on the graph paper? • Student: X- axis and Y axis • Teacher: What is the Purpose of Taking Scale for drawing a graph? • Student: for Convenience and to draw graph within the limit of graph paper • What is to be taken on X and Y axes in this graph? ** **Distance travelled by a body is time dependent and hence it is convenient**		 **Time (Sec) / Distance (m)** 0 / 0 5 / 10 10 / 10 15 / 10 20 / 10 25 / 10 30 / 10  Teacher can use online simulations like **Phet.colorado.edu** or **desmos.com**

	to take time on X-Axis and Distance travelled by body on Y-axis. • Teacher marks the coordinates (points) on graph • What is the shape of the graph obtained**?** • What is the information we can conclude from the graph?(Recall the activity performed by the students) • In this manner we can plot Distance –time graph of a body in motion (Uniform). • What is meant by speed? • What is Uniform speed and Uniform Velocity? • Teacher Shows a moving car on IFP and asks to observe the distance covered with time. • Student records the reading in a tabular form as Shown on IFP. • Teacher shares a graph sheet on IFP / distributes graph sheets by arranging students in groups. Through demonstration on IFP, students able to plot graph between Distance travelled by the Car with Time. • Which quantity is to be taken on X-axis? And which quantity is to be taken on Y-axis? • What is the shape of the graph obtained? • A straight line passing through origin indicates that the body is moving with uniform speed. • Let us now find its speed using the graphical method. For that we need to find the slope of the straight line. • Mark two points **A** and **B** on the straight	Q. Which among the following graphs represent a body is	www.Ophysics.com **Time (Sec)** / **Distance(m)** 0 / 0 2 / 2 4 / 4 6 / 6 8 / 8 10 / 10 12 / 12   Speed = Distance / Time Speed of the object = (S_2-S_1) /(t_2-t_1)

	line. Draw parallel lines to Distance axis and Time axis at Point A(X- axis and Y-axis) Similarly draw parallel line to distance axis and Time axis at Point B. • Where these lines meet in graph? • What is the shape of the figure so obtained • what does AC denotes? • What does BC corresponds to? We can observe from the graph that as the object moves from point A to point B, it covers a distance (S2-S1) in time interval (t2-t1) We know that Speed = Distance / Time Speed of the object =(S_2-S_1) /(t_2-t_1) (S_2-S_1) can be known from Distance axis and (t_2-t_1) can be known from Time axis and hence we can determine the speed of an object from graph.	at Rest?  Q. Four cars A, B, C and D are moving on a leveled road. Their distance versus time graphs is shown in figure. Choose the correct statement  A) Car A is faster than car D B) Car B is the slowest C) Car D is faster than car C	

		D) Car C is the slowest Q: The figure is the distance-time graph of an object. Do you think it represents a real situation? If so, why? If not, why not?  Q: The graph in below figure shows the positions of a body at different times. Calculate the speed of the body as it moves from (i) A to B (ii) B to C and (iii) C to D.  	

Teacher Reflections and Experiences: 1. Did I clearly communicate the lesson objectives to the students? 2. How can I ensure that students understand the objectives and can demonstrate their knowledge or skills related to them? 3. Did I use effective instructional strategies to engage students in the lesson? 4. How can I improve the variety and effectiveness of my teaching methods to cater to different learning styles and needs?			

PERIOD PLAN -8

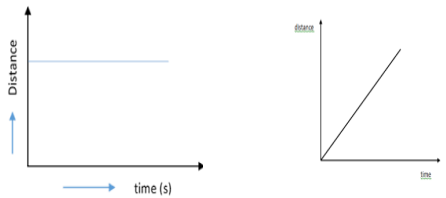
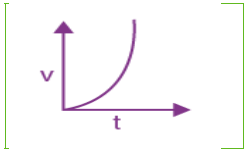
CLASS : **IX**

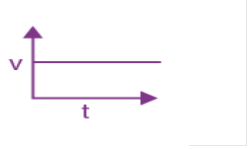
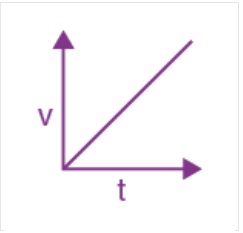
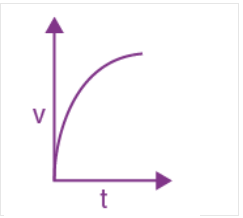
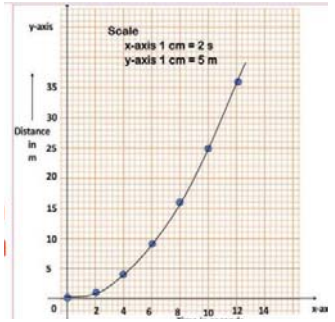
CHAPTER : **MOTION**

TOTAL NO.OF PERIODS : **12**

PERIOD NO : **08**

TOPIC/KEY CONCEPTS : **Distance-Time Graph in case of a body in accelerated motion.**

Learning outcomes	Teaching learning process	Assessment	Materials required
❖ Analyses graphical representation of distance –time graph.	**Introductory Activity** • Teacher ask the students to interpret the graphs shown.  • We have learnt to draw graph between distance travelled and time for bodies in different situations. • We now draw a graph between Distance travelled and Time for a body which is in accelerated motion. • Teacher shows a simulation in IFP and ask the students to observe the distance covered by a body with time and tabulate the observations . • Observe the distance travelled by body in every 2 seconds.	Q. What does the graph indicates? Q. A body travelling in a straight line with a uniformly increasing speed. Which one of the plot represents the changes in distance(s) travelled with time (t)? **A**  **B**	Graph sheet, scale, pencil, Text book, IFP www.phet.colorodo.edu **Time in Sec** / **Distance metres** 0 / 0 2 / 1 4 / 4 6 / 9 8 / 16 10 / 25 12 / 36

	• What observations do you made? What do you call this type of motion? • Is the body moving with uniform speed? • Is the body acquires acceleration? • we plot a graph between distance travelled versus time interval for this case. • What is the shape of the graph drawn?	 **C**  **D**  	

Teacher's reflections and experiences:

1. How well did I manage the classroom during the lesson?
2. Were there any disruptions or behavioural issues that I need to address?
7. What strategies can I implement to improve classroom management?
3. Did the students actively participate and show interest in the lesson?
4. How can I increase student engagement and create a more interactive learning environment?
5. Did I assess student understanding effectively during the lesson?

PERIOD PLAN - 9

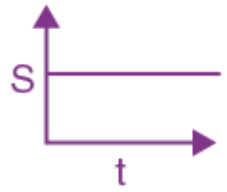
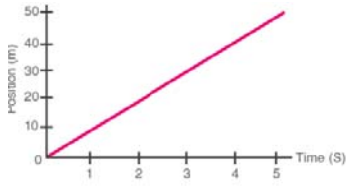
CLASS : **IX**

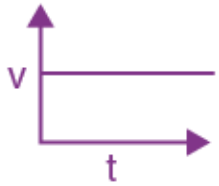
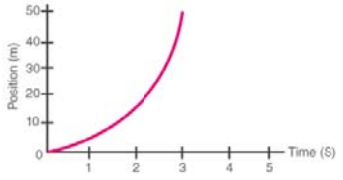
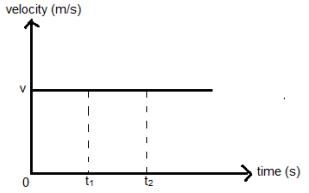
CHAPTER : **MOTION**

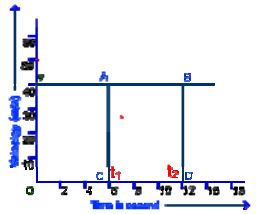
TOTAL NO.OF PERIODS : **12**

PERIOD NO : **09**

TOPIC/KEY CONCEPTS : **Velocity-Time Graph, Displacement/Distance travelled by a body using Velocity-Time graph.**

Learning outcomes	Teaching learning process	Assessment	Materials required
❖ Analyses graphical representation of velocity-time graph.	**Introductory Activity** • What do you know about Velocity of a body? • What is meant by Uniform Velocity? • Can we show the motion of such body on a graph? • We now draw a graph between Velocity and Time for a body which is in uniform motion. • Teacher display a simulation of a moving car in IFP and ask the students to observe the Velocity of the body with time and tabulate the observations .(observe speedometer) • What observations do you made? • How much is the Velocity for every second? • What do you call this type of motion?	Q. If a body is moving with uniform velocity then A) Must be zero B) May be variable	Graph sheet,Scale, Pencil, Text book.  

	• we plot a graph between Velocity versus time interval for this case. • Taking Time on X-axis and Velocity on Y-axis, we draw graph with suitable scale on graph just as we did in the previous cases. • What is the Shape of the graph so obtained after drawing? • Can we interpret the graph? • What is the acceleration of the body ? • Can we determine the distance/displacement travelled by body from this Velocity-Time graph? • We can estimate the distance travelled by a body from the graph. • Let us determine the distance/displacement travelled by the car between t_1 and t_2 • The velocity 40m/sec is represented by the height AC or BD and Time interval (t_2-t_1) is represented by length AB or CD. • So, the distance S travelled by the Car in (t_2-t_1) can be expressed as S= AC x CD or AC x AB S= 40m/sec x (t_2-t_1) Sec S= area of the rectangle ABCD (shaded part in the graph)	C) May be uniform D) Both B and C R. The velocity-time graph shows the motion of a cyclist. Find (i) its acceleration (ii) its velocity and (iii) the distance covered by the cyclist in 15 seconds.  	 https://ophysics.com/k4b.html www.phet.colorodo.edu **Time in Sec** / **Velocity (m/sec)** 0 / 0 2 / 40 4 / 40 6 / 40 8 / 40 10 / 40 12 / 40  Velocity-time graph for uniform motion

Teacher's reflections and experiences:

1. Did I provide timely and constructive feedback to guide their learning?
2. How can I improve my assessment and feedback practices?
3. Was the pacing of the lesson appropriate?
4. Did I cover all the planned content without rushing or leaving gaps?
5. How can I better manage the time allocated for each activity?

PERIOD PLAN - 10

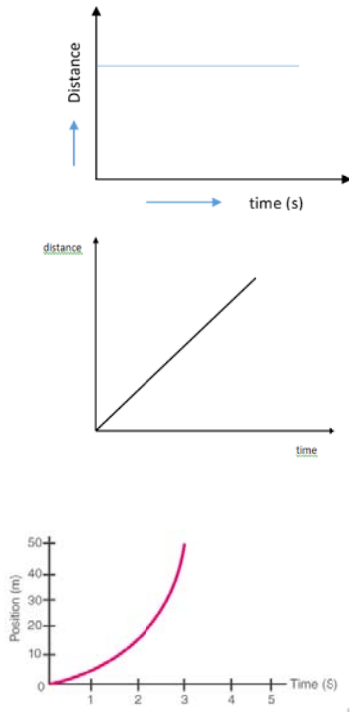
CLASS : **IX**

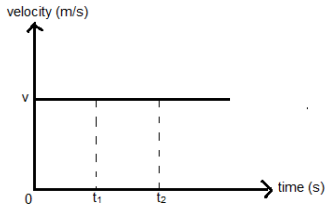
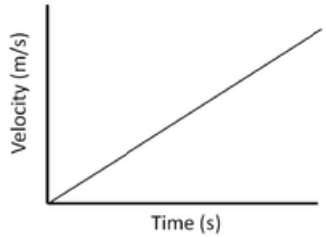
CHAPTER : **MOTION**

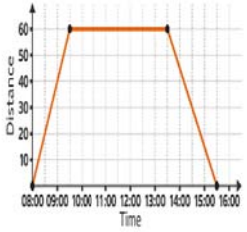
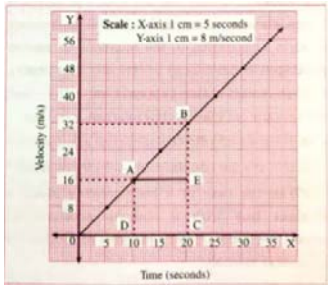
TOTAL NO.OF PERIODS : **12**

PERIOD NO : **10**

TOPIC/KEY CONCEPTS : **Velocity-Time Graph, Displacement/Distance travelled by a body using Velocity-Time graph whose motion is uniformly accelerated.**

Learning outcomes	Teaching learning process	Assessment	Materials required
❖ Analyses graphical representation of velocity-time graph(uniformly accelerated) ❖ **plots** distance–time graph, of an object from the given data.	**Introductory Activity** • **Teacher** shows different graphs on IFP and ask the students to interpret the graphs. • Do you interpret the graph shown on IFP now? • Teacher shows a simulation of a car moving in a straight line on IFP and ask the students to observe the Velocity of the body with time and tabulate the observations .(observe speedometer) • Consider a car being driven along a straight road for testing its engine.Assume that you are sitting next to the driver and records its velocity after every 5 second by note down the reading of the speedometer of the car. The velocity of the car in Kmph as well as in m/sec at different instants of time are tabulated.	Q: The shape of the v-t graph of a body	

	• Do you observe the velocity of body in every 5 seconds? • What observations do you made? • How much is the change Velocity for every 5 second? • What do you call this change of velocity per second? • Is the acceleration uniform or non uniform or non uniform? • We plot a graph between Velocity versus time interval for this case. • Taking Time on X-axis and Velocity on Y-axis, we draw graph with suitable scale on graph just as we did in the previous cases. • What is the Shape of the graph so obtained after joining all the points marked on the graph? • Can we interpret the graph? • Can we determine the distance/displacement travelled by body from this Velocity-Time graph? • We can estimate the distance travelled by a body from the graph . • Let us determine it now. • If the car would have moving with uniform velocity, the distance travelled by it would be represented by the area ABCD under the graph just as we calculated in the previous case(graph is straight line parallel to time axis) • But the magnitude of velocity of the car is changing continuously, the distance S travelled by the car will be given by the area ABECD under the Velocity-Time Graph.	moving with uniform velocity is: A. Parabola B. Line C. Circle D. Hyperbola Q. Given the velocity-time graph. How can it be used to find the distance of the body in a given time. **A** The total area under velocity-time graph **B** The net area under velocity-time graph **C** slope of velocity-time graph **D** negative slope of velocity-time graph **Q.** State how the velocity-times graph can be used to find the distance travelled by the body in a given time? Q. Suppose a squirrel is moving at a	 Velocity-time graph for uniform motion www.phet.colorodo.edu  (Graph shown to students on IFP **Time In Sec** / **Velocity (m/s)** / **Velocity (kmph)** 0 / 0 / 0 5 / 2.5 / 9

	• That is S= area of ABECD. S= area of the rectangle AECD + area of triangle AEB • What is the formula for area of a rectangle? • Identify length and breadth in this graph. • What is the formula for area of a triangle? • Identify Base and height of triangle in the graph • By knowing the components from graph we can determine the distance travelled by the car in a given interval of time. • The distance covered by the body can be obtained from Velocity-Time graph determining the area under the graph.	steady speed from the base of a tree towards some nuts. It then stays in the same position for a while, eating the nuts, before returning to the tree at the same speed. A graph can be plotted with distance on the x-axis and the time on y-axis. 	10 | 5 | 18 15 | 7.5 | 27 20 | 10 | 36 25 | 12.5 | 45 30 | 15 | 54 

Teacher's reflections and experiences:

1. What were my strengths during the lesson?
2. In what areas can I improve as a teacher?
3. How can I continue to develop my teaching skills and practices?
4. Did I encourage self-reflection and metacognition among students?
5. How can I incorporate more opportunities for students to reflect on their learning and assess their own progress?

PERIOD PLAN - 11

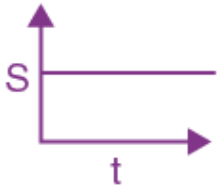
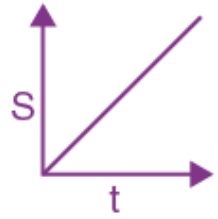
CLASS : **IX**

CHAPTER : **MOTION**

TOTAL NO.OF PERIODS : **12**

PERIOD NO : **11**

TOPIC/KEY CONCEPTS : **Derivation of three equations of motions from graphical method.**

LEARNING OUTCOMES	TEACHING LEARNING PROCESS	ASSESSMENT	MATERIALS REQUIRED
❖ graphical representation of Motion of bodies ' students are able to ❖ **plot** Velocity–time graph, of an object from the given data.	**Introductory Activity**: • **Teacher** shows different graphs on IFP and ask the students to interpret the graphs. • Do you interpret the graph shown on IFP now? • Do you know the set of equations by which we can calculate the distance travelled, velocity,acceleration, time taken mathematically? • We now Derive equations of motions from graphical method. • Consider an object moving along a straight line with uniform acceleration . • Let "u" be the initial velocity of the object at time t=0 and "v " be the final velocity of the object at time t . • Let " s" be the distance travelled by the object in time t. • What is the velocity -time graph of this	Q. Match the Column I with Column II and choose appropriate option from the codes given below	Graph sheet, Scale, Pencil, Text Book, IFP  

motion

- Why the straight line is not started from origin? Do you know the reason?
- From graph
- OP=u=RS
  OW=SQ=v and
  OS=PR=t
- for the first equation of motion :
- What is the slope of a velocity-time graph gives?
- We know that the slope of velocity -time graph of uniformly accelerated motion represents the acceleration of the object
  i.e. acceleration = slope of the velocity - time graph PQ
  or a=QR/PR=QR/OS
  a=(SQ−SR)/ OS=(v−u)/ t
  or v−u=at
  or v=u+at .....(i)
  This is the first equation of uniform accelerated motion.
- (ii) Second equation of motion :
- What is the area under the graph gives us?
- ,We know that the area under the velocity-time graph for a given time interval represents the distance covered by the uniformly accelerated object in that interval of time.
  ∴ Distance (displacement) travelled by the object in time t is :
  S = area of trapezium OSQP
  = area of rectangle OSRP + Area of triangle PRQ
- What is the formula for area of rectangle

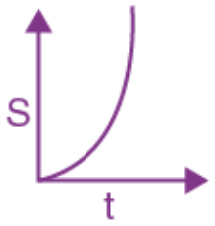
	Column I (Acceleration)		Column II (Example)
(a)	In the direction of motion	1.	Motion of freely falling body
(b)	Against the direction of motion	2.	Car moves through congested market
(c)	Uniform	3.	Brakes applied to
(d)	Non-uniform	4.	Train starts moving from a station

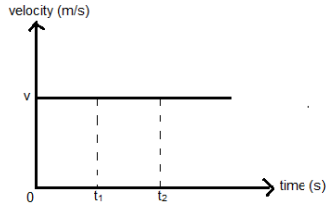
A) A-1, B-2, C-3, D-4

B) A-3, B-2, C-1, D-4

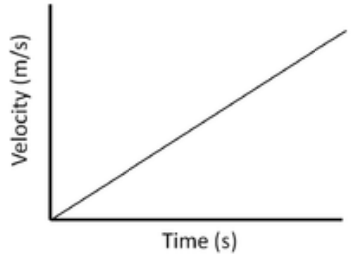
C) A-4, B-3, C-1, D-2

D) A-2, B-4, C-1, D-3





Velocity-time graph for uniform motion



(Graph shown to students on IFP)

and triangle?

- S=(OS×OP)+ 1/2 x(PR×PQ)
- (S= t x u + 1/ 2 × t x (v−u)
  (from the first equation of motion v−u=at)
  s=ut+1/2×t×at
- This is the second equation of uniform is

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

.....(ii)

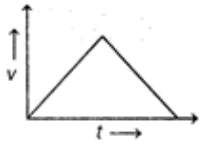
Third equation of motion :

Distance travelled by the object in time interval t is s = area of trapezium OSQP

- What is the formula for area of trapezium
  S=1/2x(OP+SQ)×OS
  ∵OP=SR
  S=1/2x(SR+SQ)×OS.....(iii)
  What is the slope of the V-T graph gives?
- a = slope of the velocity -time graph PQ
- a=RQ/PR
- =(SQ−SR)/ OS
  OS= (SQ−SR) /a.....(iv)
- Putting this value in equation (iii) we get
  S=1/2*(SR+SQ)x(SQ−SR)/a
  or
- $S=(SQ^2-SR^2)/2a$
  or $S = (V^2 - U^{2)}/ 2a$
- $2aS=(V^2-U^{2)}$.....(v)
  This the third equation of uniform accelerated motion.

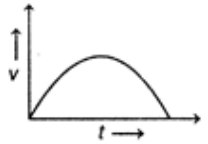
The velocity-time graph of an object thrown vertically up is

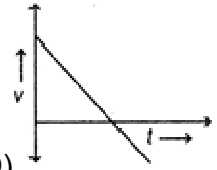
A)



B)

C)



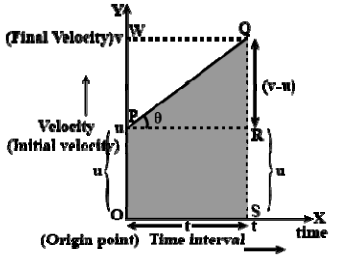


D)

$$v = u + at \quad (1)$$

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

$$2as = v^2 - u^2 \quad (3)$$



Teacher reflections and experiences:

1. Did I critically examine student work to gain insights into their understanding and identify areas for improvement?
2. How can I use student work as a valuable source of information for my teaching?
3. Did I effectively utilize formative assessments to monitor student progress and adjust instruction accordingly?
4. How can I further integrate assessment for learning strategies into my teaching practice?

PERIOD PLAN - 12

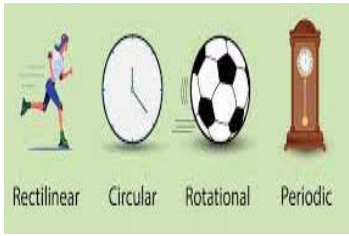
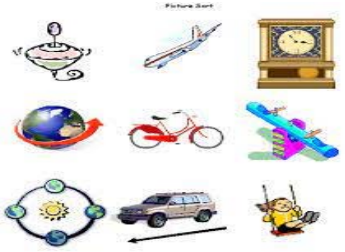
CLASS : IX

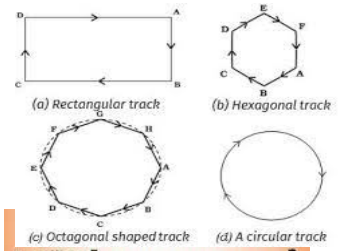
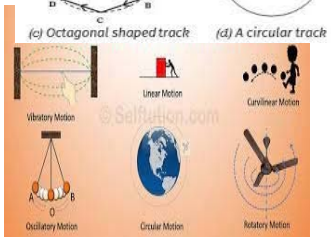
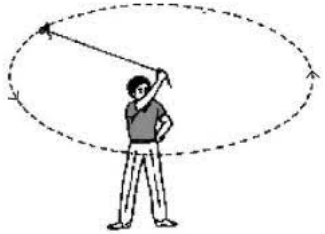
CHAPTER : MOTION

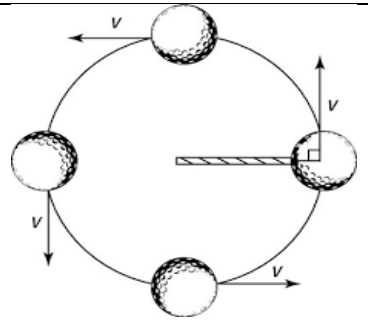
TOTAL NO.OF PERIODS : 12

PERIOD NO : 12

TOPIC/KEY CONCEPTS : Uniform circular motion, formula for speed of an object 'V' whose motion is a uniform circular motion.

LEARNING OUTCOMES	TEACHING LEARNING PROCESS	POINTERS FOR ASSESSMENT	MATERIALS REQUIRED
❖ Calculates speed of an object travelling in a uniform circular motion. ❖ Derives formula for the speed of an object moving in a uniform circular motion. ❖ Derives formula for the speed of an object in a uniform circular motion.	• **Introductory activity** • Teacher shows different kinds of motions and asks the students to identify the type of motion. • What is the difference between speed and velocity? • The quantity which has only magnitude is called? • The quantity which has both magnitude and direction is called? • Which quantity is scalar or vector among Speed and Velocity? • If the velocity of an object changes , then body acquires which quantity? • Is the change of velocity is due to change in its magnitude or the direction or both? • Do you state one example in which object cannot change magnitude of velocity but only its direction? • We will know about the motion of an		Top, toy key Car, Simple pendulum, IFP, Text Book  

	object whose magnitude of velocity does not change but changes its direction continuously ,which we call as **Uniform Circular Motion.** • Teacher display a closed rectangular track ABCD on IFP. • Let us assume that athlete runs at a uniform speed on the straight parts AB,BC,CD and DA of the track. • Teacher may ask a student to run on a closed path drawn on the floor in the class room /out side the room • Is he need to change his direction at any points on ABCD track? • To complete one round on the ABCD track, how many times he changes his direction ? • Suppose instead of a rectangular track, if the athlete runs along a hexagonal shaped track ABCDEF (as shown on IFP), how many times the athlete has to change his direction? • Identify the points where direction of person changes ? • If the track is a rectangular Octagon then? • From these examples , we can conclude that as the number of sides of the track increases , the athlete has to take turns more and more often. • What happen if we go on increasing the number of sides of the track indefinitely? • The shape of the track approaches the shape of a circle and the length of each of the sides will decrease to a point. • If the athlete moves with the velocity of	Q: A cyclist goes around a track for every 2 minutes. If the radius of the track is 105 m, find his speed? Q: A particle is moving in a circular path of radius r. Its displacement after moving through half the circle would be : A .Zero B. r C. 2r D. r2 Q: If a particle moves in a circle with constant speed, its velocity : Q :a particle moves in a circle with constant speed, its velocity : A. remains constant	  

	constant magnitude along the circular path, the only change in its velocity is due to the change in the direction of motion. • The motion of the athlete moving along a circular path is therefore, an example of an accelerated motion. (Teacher may play some clips of a running race on IFP) • If the radius of the circle is "r", what is the circumference of the circle? • If the athlete takes 't' seconds to go once around the circular path of radius 'r', what is the distance travelled by the person? • What is the relation between Speed, Velocity and Time? • Speed = Distance covered / time V = 2πr/ t • When an object moves in a circular path with uniform speed, its motion is called Uniform Circular Motion.	B. changes in magnitude C. changes direction D. changes both in magnitude and direction Q: What is uniform circular motion?	 https://youtu.be/KVaAHk6OHE4?si=_dMsJZ1QdVG6fJkA

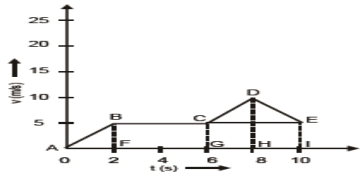
Teacher Reflections and experiences:

1. Did I clearly communicate the lesson objectives to the students?
2. How can I ensure that students understand the objectives and can demonstrate their knowledge or skills related to them?
3. Did I use effective instructional strategies to engage students in the lesson?
4. How can I improve the variety and effectiveness of my teaching methods to cater to different learning styles and needs?
5. How well did I manage the classroom during the lesson?

MOTION

WORK SHEET- 1

1. An artificial satellite is moving in a circular orbit of radius 42250km.calculate its speed if it takes 24 hours to revolve around the earth.
2. Define average speed?
3. Write the differences between speed and velocity?
4. Write the differences between distance and displacement?
5. A body thrown in the vertically upward direction rises up to a height ” h ” and comes back to the position of start.Calculate (1) the total distance travelled by the bodythe displacement of the body.
6. Which is the correct SI unit of acceleration?
7. (a) m/s (b) s/m (c) m/s2 (d) none
8. A bus starting from rest moves with a uniform acceleration of 0.1m/s ^{2} for 2minuts .find the speed.

   (a) 10 m/s (b) 12m/s (c) 20 m/s (d) 24m/s
9. Find  the total displacement of the body from the following graph:

10. A car travels at 54 km/h for first 20 s, 36 km/h for next 30 s and finally 18 km/h for next 10 s. Find its average speed.
11. An object ‘p’ is moving with constant velocity and another object ‘Q’ is moving with change of velocity for 5min.Out of these two objects which has acceleration, why, explain?

WORK SHEET -2

1. A particle is moving in a circle of diameter 5m, calculate the covered and the displacement when it completes 3 revolutions?

2. In a long distance race the athletes were expected to take four rounds of the track such that the line of finish was same as line of start .suppose the length of the track was 200 m.

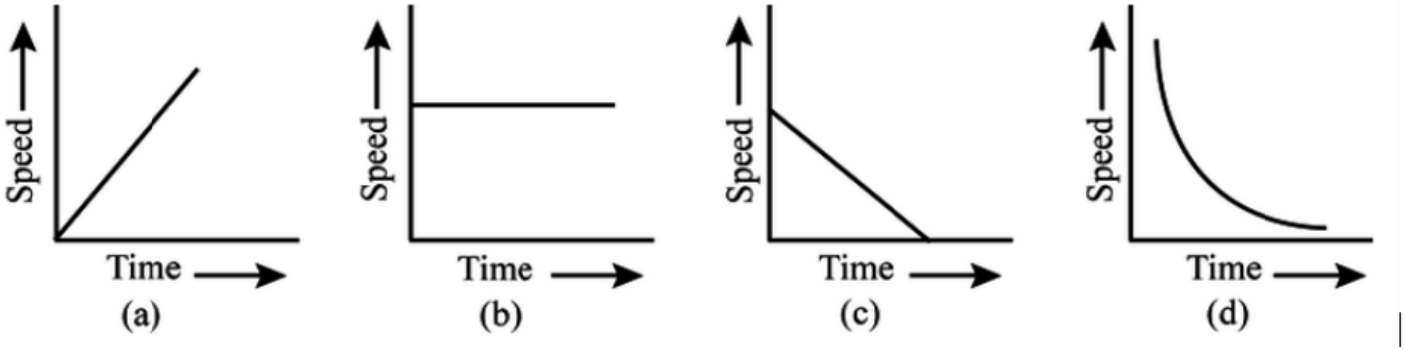
(a) What is the total distance to be covered by the athletes?

(b) What is the displacement of the athletes when they touch the finish line.?

(c) Is the motion of athletes uniform or non uniform?

(d) Is the displacement of an athletes and the distance covered by him at the end of the race equal?

3. Which type of motion is represented by each of the following graph?



4. If the displacement of an object is proportional to square of time, then the object moves with

(a) Uniform velocity (b) uniform acceleration (c) increasing acceleration(d) decreasing acceleration

5. The distance and time graph of a body coincide with its time axis the body must be

(a)In uniform motion (b) At rest (c) In uniform accelerated motion (d)in zig - zag motion

6. Draw the displacement –time graph for the following scenarios

(a) when a body is at rest (b) When a body is in uniform motion

7. A body moving with a uniform acceleration travels 20m in the first 6s and 30m in the next 4s. Find the intial velocity and acceleration of the body?

8. Give some example for vector physical quantities?

9. When does distance and displacement become equal?

10. What is retardation?

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WORK SHEET -3

1. A cyclist moving on a circular track of radius 21m complete one revolution in 4 minutes.what is the

   (a) Average speed (b)Average velocity in one full revolution

2. The slope of a velocity –time graph gives

   (a) distance (b) the displacement (c) the acceleration (d) the speed.

3. An object moves along a circular path of diameter 28cm with constant speed.If it takes 2 min.to move from a point on the path to the diametrically opposite . find

   (a) the distance covered by the object (b) the speed (c) Average velocity

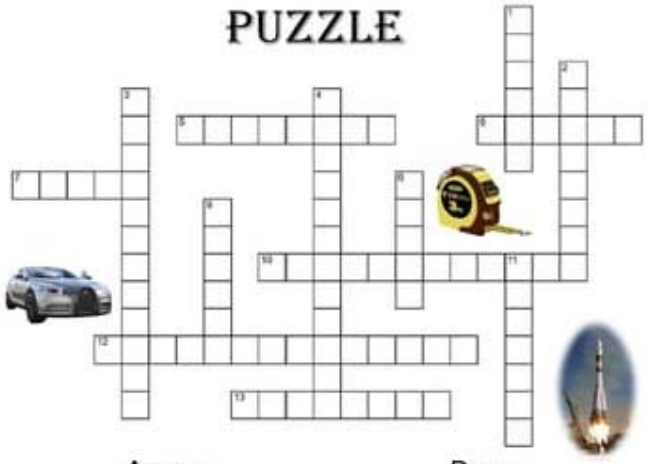
4. A particle with a velocity of 3m/s at t=0 movea along a straight line with a constant acceleration of $0.2m/s^2$?

5. Match the following

Column A		Column B	
(A)	Acceleration	(P)	vector quantity
(B)	Displacement	(Q)	scalar quantity
(C)	Speed	(R)	ms^{-2}
(D)	Distance	(S)	m/r

1. Complete the following cross word puzzle

PUZZLE



Across

5) Speed in a given direction

6) An objects change in position relative to a reference point

7) The SI unit of distance

10) The rate of change of velocity

12) A place or object used for comparison to determine if something is in motion

13) The space travelled between two objects

Down

1) A quantity that has a size and direction

2) A force which opposes motion

3) Total distance divided by total time

4) Change in position from the starting point with a specific direction

8) The rate something moves

9) A quantity that has a size only

11) The tendency of an object to resist any change in its motion

7. Can displacement be zero even if the distance not zero? Explain with an example?

8. Why is uniform circular motion is considered an accelerated motion.

9. Give an example where an object is at rest as well as in motion which at the same time.

10. Which one of the following is a scalar quantity?

(a) displacement (b) velocity (c)speed (d) acceleration.

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