Lesson Plan: Work, Energy, and Simple Machines (CBSE Class IX 2026-27)

Teacher:

Class: IX

Subject: Science (Subject Code - 086)

Theme/Unit: Motion, Force and Work

Chapter: 7 – Work, Energy, and Simple Machines

Estimated Number of Periods: 13

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1. Gist of the Lesson & Curricular Goals

- **Core Syllabus:** Concept of work; work done by a constant force; Work-Energy theorem; Mechanical energy, kinetic and potential energy, and conversion between potential energy and kinetic energy; Conservation of energy; Power; Simple machines and their mechanical advantage (pulley, inclined plane, lever).

- **Educational Aim:** To define work in scientific terms, represent the relationship between potential and kinetic energy mathematically, and demonstrate the principle of mechanical advantage by understanding simple machines (CG-2).

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2. Teaching-Learning Plan & Pedagogy

Key Concepts	Competencies (C) & Learning Outcomes	Teaching-Learning Activities (Pedagogy)	Assessment Strategies
Work Done by a Constant Force	**C-2.5:** Defines work in scientific terms. • *Outcome:* Students will calculate work done $(W = F \times s)$ and identify zero,	• **Visual Mapping:** Discuss lifting a 5 kg wheat bag to different heights to physically map the concept of work ($W = mgh$).	• **[Demonstrate Knowledge - VSA]:** *Define* 1 joule of work. • **[Application - SA]:** *Calculate* the work done by a

	positive, and negative work.	• **Real-World Connection:** Use the example of a goalkeeper stopping a ball (negative work) vs. pushing a wheelchair (positive work), and pushing a wall (zero work).	goalkeeper applying a force of 200 N over a backward displacement of 15 cm.
Kinetic & Potential Energy	**C-2.5:** Represents the relationship between potential and kinetic energy. • *Outcome:* Students will apply formulas for KE ($½mv²$) and PE (mgh).	• **Scientific Inquiry (Activity 7.1):** Drop a heavy ball into a sand container from different heights to observe the depth of depressions, proving PE depends on height. • **Derivation:** Mathematically derive the formula for kinetic energy using the kinematic equation $v² - u² = 2as$ and Newton's second law.	• **[Application - SA]:** *Calculate* the kinetic energy of a 0.2 kg cricket ball bowled at 43 m/s. • **[Formulate & Analyze - Assertion-Reasoning]:** *Evaluate* how the kinetic energy changes if the velocity of an object doubles.
Conservation of Mechanical Energy	**C-2.5:** Represents the conservation of energy in mathematical expressions. • *Outcome:* Students will prove	• **Mandatory Practical (Activity 7.2):** Set up a simple pendulum against a wall with a marked horizontal line. Release the bob and observe it regain its initial	• **[Demonstrate Knowledge - Objective]:** *State* the law of conservation of mechanical energy. • **[Analyze &**

	$PE + KE = Constant$ for a freely falling body.	height, proving energy conservation. • **Case Study:** Discuss how escape ramps for trucks convert kinetic energy into work done against friction.	**Evaluate - LA]:** *Examine* a roller coaster diagram and identify the points of maximum kinetic and maximum potential energy.
Power	**C-2.5:** Calculates power using its mathematical expression. • *Outcome:* Students will define power $(P = W/t)$ and use the unit Watt.	• **Compare & Contrast:** Discuss the difference between running up a flight of stairs in one minute vs. walking up in five minutes (same work, different power).	• **[Application - SA]:** *Calculate* the power required by a weightlifter lifting 75 kg by 2 m in 5 seconds.
Simple Machines & Mechanical Advantage	**C-2.6:** Demonstrates the principle of mechanical advantage. • *Outcome:* Students will calculate Mechanical Advantage (Load/Effort) for pulleys, inclined planes, and levers.	• **Hands-on (Activity 7.5):** Use a scale, string, paper cups, and coins to create a beam balance. Balance 1 coin against 2, proving the principle: Effort $\times$ Effort Arm = Load $\times$ Load Arm. • **Discussion:**	• **[Demonstrate Knowledge - VSA]:** *Define* mechanical advantage. • **[Formulate & Analyze - Case-Based]:** *Interpret* a seesaw scenario to determine where a 30 kg child must sit to balance a 15 kg child seated 2 m

		Analyze how an inclined plane reduces the required effort but increases the distance (Total work remains the same).	from the fulcrum.

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3. Assessment Structure & Weightage

Assessments are strictly modeled on the CBSE 2026-27 Theory Question Paper Design (80 marks):

- **Demonstrate Knowledge and Understanding (50%):** Assessed via questions asking students to *state, name, list, identify, define, suggest, describe, outline, and summarize* (e.g., defining power, identifying classes of levers).

- **Application of Knowledge/Concepts (30%):** Assessed via questions asking students to *calculate, illustrate, show, adapt, explain, and distinguish* (e.g., calculating mechanical advantage, illustrating positive vs. negative work).

- **Formulate, Analyze, Evaluate and Create (20%):** Assessed via questions asking students to *interpret, analyze, compare, contrast, examine, evaluate, discuss, and construct* (e.g., analyzing energy conversion in a hydroelectric dam, evaluating energy-displacement graphs).

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4. Digital Integration & Portfolio Enrichment (Internal Assessment - 20 Marks)

- **Subject Enrichment (Practical Work - 5 Marks):** Evaluated strictly on the execution of the beam balance experiment (Activity 7.5) or the inclined plane experiment (Activity 7.3). Students will be assessed on their ability to record distance and mass accurately, and prove the mechanical advantage equation ($Load/Effort = Effort Arm/Load Arm$) in their practical records.

- **Digital Integration Strategy:** To reinforce abstract energy concepts ahead of Periodic Assessments, utilize interactive physics simulators (like PhET's "Energy Skate Park" via the DIKSHA portal). Students can digitally build roller coaster tracks and instantly view a real-time pie chart showing Kinetic Energy converting to Potential Energy and Thermal Energy (friction).

- **Portfolio Task (5 Marks):** Students will *examine* traditional Indian engineering by researching the *gharat* or *panchakki* (water mill) used in the Himalayan region. They will prepare a brief visual report mapping the exact flow of energy (Gravitational Potential Energy of water $\rightarrow$ Kinetic Energy $\rightarrow$ Rotational Mechanical Energy of the grinding stone) and securely add this cross-disciplinary study to their academic portfolio.