Class 9 Science Chapter 7: Work, Energy and Simple Machines - Notes, Important Questions and MCQs (2026-27)

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These Class 9 Science Chapter 7 notes cover “Work, Energy and Simple Machines” from the new NCERT textbook Exploration (2026-27): work by a constant force, positive, negative and zero work, the work-energy theorem, kinetic and potential energy, conservation of mechanical energy, power, and simple machines – pulley, inclined plane and lever – with solved numericals, 10 MCQs and a free PDF.

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Chapter Overview

In science, work is done when a force displaces an object. Energy is the capacity to do work: when positive work is done on an object, it gains energy that it can later use to do work, like a thrown ball knocking down a wicket or a raised flowerpot falling.

Mechanical energy is the sum of kinetic energy (due to motion) and potential energy (due to position). Power measures how fast work is done. Simple machines change the size or direction of the force needed, and their mechanical advantage is load/effort.

Important Topics and Concepts

Work Done by a Constant Force

- Work = force × displacement in the direction of the force: $W = F \times s$.
- SI unit: joule (J); 1 J = 1 N × 1 m.
- Zero work: no displacement (pushing a wall) or force perpendicular to displacement (carrying a bag while walking on level ground).
- Positive work: force and displacement in the same direction (lifting a bag).
- Negative work: force opposite to displacement (friction on a sliding box, brakes).

Work-Energy Theorem and Forms of Energy

- The net work done on an object equals the change in its kinetic energy.
- Energy is the capacity to do work; unit joule.
- Forms include mechanical (kinetic and potential), heat, light, sound, chemical, electrical and nuclear energy.
- Energy can change from one form to another.

Kinetic and Potential Energy

- Kinetic energy: energy due to motion, $KE = \frac{1}{2}mv^2$.
- Doubling speed makes KE four times.
- Gravitational potential energy: energy due to height, $PE = mgh$ ($g \approx 9.8$ m s^{-2}, often taken as 10).
- Potential energy depends on height above a chosen reference level, not on the path taken.

Conservation of Mechanical Energy and Power

- If only gravity does work, KE + PE stays constant.
- A freely falling object loses PE and gains equal KE; just before hitting the ground PE has become KE.
- Power = work done / time taken = W/t; SI unit watt (W) = 1 J/s; 1 kW = 1000 W.
- Power tells how fast work is done – running up stairs needs more power than walking, though the work is the same.

Simple Machines

- Effort: force applied; load: force overcome.
- Mechanical advantage (MA) = load/effort.
- Pulley: a single fixed pulley changes the direction of force (MA ≈ 1); combinations can reduce effort.
- Inclined plane: lifting a load along a slope needs less force over a longer distance – the work done is the same.
- Lever: rigid bar turning about a fulcrum; effort × effort arm = load × load arm. Classes depend on whether fulcrum, load or effort is in the middle (see-saw, wheelbarrow, tweezers).
- Machines do not reduce work; they make work easier.

Solved Numericals

Board-pattern problems.

- A 10 N force moves a box 5 m in its direction. W = 10 × 5 = 50 J.
- KE of a 2 kg ball moving at 3 m/s. KE = ½ × 2 × 9 = 9 J.
- PE of a 5 kg object raised 4 m (g = 10 m s^{-2}). PE = 5 × 10 × 4 = 200 J.
- A 60 kg student climbs 10 m in 20 s. W = 60 × 10 × 10 = 6000 J; P = 6000/20 = 300 W.
- A 2 kg object falls from 5 m. PE lost = 100 J = KE gained; v = √(2gh) = √100 = 10 m/s.
- A lever lifts a 600 N load at 0.5 m from the fulcrum with an effort arm of 2 m. Effort = 600 × 0.5/2 = 150 N; MA = 600/150 = 4.

Zero, Positive and Negative Work

Type	Condition	Example
Positive	Force along displacement	Lifting a bag
Negative	Force opposite to displacement	Friction on a sliding box
Zero	No displacement or force ⊥ displacement	Pushing a wall; carrying a bag on level road

Key Formulas at a Glance

Quantity	Formula	SI unit
Work	W = F × s	joule (J)
Kinetic energy	½mv^2	J
Potential energy	mgh	J
Power	W/t	watt (W)
Mechanical advantage	load/effort	no unit
Lever principle	effort × effort arm = load × load arm	—

Important Definitions and Terms

Term	Meaning
Work	Product of force and displacement in the direction of force
Joule	Work done when 1 N moves an object 1 m
Energy	Capacity to do work
Kinetic energy	Energy due to motion
Potential energy	Energy due to position or height
Power	Rate of doing work
Effort	Force applied to a machine
Load	Force overcome by a machine
Fulcrum	Fixed point about which a lever turns

Short Answer Questions

Q1. When is the work done by a force zero?

Q2. Give an example of negative work.

Friction acting on a box sliding on the floor does negative work because it acts opposite to the displacement.

Q3. State the work-energy theorem.

The net work done on an object equals the change in its kinetic energy.

Q4. What happens to KE if the speed of an object is doubled?

KE becomes four times, since KE $\propto v^2$.

Q5. Calculate the power of a motor that does 3000 J of work in 10 s.

P = 3000/10 = 300 W.

Q6. Why is it easier to push a box up an inclined plane than lift it straight up?

The inclined plane needs a smaller force applied over a longer distance; the work done is about the same but the effort is less.

Q7. Define mechanical advantage.

Ratio of load to effort: MA = load/effort.

Q8. What is the function of a single fixed pulley?

It changes the direction of the applied force, making lifting more convenient (MA ≈ 1).

Long Answer Questions

Q1. Show that mechanical energy is conserved for a freely falling object.

At height h (point A) the object is at rest: PE = mgh, KE = 0, total = mgh.

After falling a distance x: PE = mg(h − x), $v^2 = 2gx$ so KE = mgx; total = mgh.

Just before hitting the ground: PE = 0, $v^2 = 2gh$, KE = mgh; total = mgh.

Total mechanical energy stays mgh throughout.

Hence, when only gravity acts, mechanical energy is conserved.

Q2. Explain how a lever works, with its parts and an example.

A lever is a rigid bar that turns about a fixed point called the fulcrum.

Effort is applied at one point and the load at another; distances from the fulcrum are effort arm and load arm.

In equilibrium, effort × effort arm = load × load arm.

A long effort arm lets a small effort lift a large load, but the effort moves a larger distance.

Examples: see-saw, crowbar, scissors, wheelbarrow, tweezers.

Q3. A 1000 kg car moving at 20 m/s is brought to rest. Find the work done by the brakes.

Initial KE = ½ × 1000 × 400 = 200,000 J.

Final KE = 0.

By the work-energy theorem, work done = change in KE = −200,000 J.

This energy is converted mainly into heat in the brakes and tyres.

MCQs with Answers

1. SI unit of work is(a) newton (b) joule (c) watt (d) pascalAnswer: (b) joule

2. Work done in carrying a bag horizontally at constant height is(a) positive (b) negative (c) zero (d) infiniteAnswer: (c) zero – force ⊥ displacement

3. KE of a 4 kg body moving at 5 m/s is(a) 50 J (b) 100 J (c) 20 J (d) 10 JAnswer: (a) 50 J

4. PE of a 2 kg object at 10 m (g = 10) is(a) 20 J (b) 200 J (c) 100 J (d) 2 JAnswer: (b) 200 J

5. 1 watt equals(a) 1 J s (b) 1 J/s (c) 1 N m (d) 1 N/sAnswer: (b) 1 J/s

6. Mechanical advantage is(a) effort/load (b) load/effort (c) load × effort (d) work/timeAnswer: (b) load/effort

7. If speed doubles, KE becomes(a) double (b) half (c) four times (d) sameAnswer: (c) four times

8. Friction on a moving object does(a) positive work (b) negative work (c) zero work (d) no effectAnswer: (b) negative work

9. The fixed point of a lever is the(a) load (b) effort (c) fulcrum (d) armAnswer: (c) fulcrum

10. A freely falling body’s total mechanical energy(a) increases (b) decreases (c) remains constant (d) becomes zeroAnswer: (c) remains constant

Quick Revision Points

- W = Fs; unit joule.
- Zero work: no displacement or force ⊥ displacement.
- Work-energy theorem: net work = change in KE.
- KE = ½mv²; PE = mgh.
- KE + PE constant under gravity alone.
- P = W/t; watt.
- MA = load/effort; effort × effort arm = load × load arm.

Chapter Summary

Work is done when a force produces displacement in its direction (W = Fs). It can be positive, negative or zero. Energy is the capacity to do work; the work-energy theorem links net work to change in kinetic energy.

Kinetic energy is ½mv² and gravitational potential energy is mgh; their sum is conserved for a freely falling object. Power is the rate of doing work. Simple machines – pulleys, inclined planes and levers – make work easier by changing the size or direction of force, with mechanical advantage = load/effort.

Exam Tips and PYQ Pattern

- Expect numericals on KE, PE, work and power – write formulas and units.
- Use g = 9.8 or 10 m s^{-2} as the question says.
- Learn examples of zero and negative work.
- Practise the conservation-of-energy derivation for free fall.
- Lever and inclined-plane questions often ask for MA or effort.

Frequently Asked Questions

Is this chapter in the 2026-27 CBSE syllabus?

Yes. It is part of the new NCERT Class 9 Science textbook “Exploration” (first edition 2026), prescribed for the 2026-27 session.

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Yes. Use the free PDF link at the top of this page – no signup needed.

What is the work-energy theorem?

The net work done on an object equals the change in its kinetic energy.

What is mechanical advantage?

The ratio of load to effort for a machine.

Conclusion

Work, Energy and Simple Machines links force to energy. Learn the formula table, practise the numericals here and save the free PDF for revision.

More Notes: Class 9 Science Chapter 6: How Forces Affect Motion notes | Class 9 Science Chapter 8: Journey Inside the Atom notes | All Class 9 Science notes

Author Bio: Written and reviewed by the Nextoper Editorial Team, a group of CBSE science educators who build chapter notes directly from the NCERT textbook and past board paper patterns.

Freshness Note: These notes follow the NCERT Class 9 Science textbook, Exploration (First Edition 2026, NCF-SE 2023), and the CBSE syllabus for the 2026-27 session. Last checked on 17 November 2026.