Class 9 Science Practice Worksheet
New NCERT Syllabus (2026-27) - Exploration Science
Chapter 3: Work, Energy, and Power

Section A: Conceptual Section (5 Questions)

Q1. Identify the fundamental terms of work and energy:
(a) Work is scientifically done only when a force is applied to an object and the object undergoes _______________.
(b) The form of energy possessed by an object due to its change in position, height, or shape is called _______________ energy.
(c) Commercial units of electrical energy are measured in kilowatt-hours (kWh), where 1 kWh is equal to ______ mega-joules (MJ).

Q2. Match the everyday examples with the specific energy transformation they undergo:
(a) A battery lighting up an LED torch: _______________ to Electrical to Light
(b) An object falling freely from a high rooftop: _______________ to Kinetic
(c) A green leaf preparing starch during photosynthesis: Light to _______________

Q3. State whether the following statements are True or False:
(a) If the direction of the applied force is perpendicular (90 degrees) to the direction of displacement, the net work done is zero. ()
(b) Kinetic energy of an object is directly proportional to its velocity, so doubling the velocity doubles its kinetic energy. ()
(c) The total mechanical energy (Kinetic + Potential) of a freely falling object remains constant at all points during its flight. (________)

Q4. Write down the complete mathematical formulas matching the descriptions:
(a) Work done by a constant force in the direction of motion (W): _______________
(b) Kinetic energy of a moving mass (Ek): _______________
(c) Gravitational potential energy at a height (Ep): _______________

Q5. A porter lifts a heavy suitcase weighing 15 kg from the ground and puts it on their head, 1.5 metres above the ground. Calculate the exact work done by the porter on the suitcase. Take acceleration due to gravity $g = 10\ m/s^2$. Show your steps. [1]

Section B: Logical Section (5 Questions)

Q6. Look carefully at two different situations: In Situation X, a man pushes hard against a massive concrete wall for 2 hours, sweating profusely, but the wall does not budge. In Situation Y, a girl lifts a small book up by 1 metre.

(a) Logically deduce the scientific work done in Situation X: _______________
(b) Logically deduce the scientific work done in Situation Y: _______________
(c) Why does human fatigue not count as mechanical work in physics? Explain the logical condition.

Q7. A satellite is orbiting around the Earth in a perfect circular orbit under the continuous pull of gravitational force. Explain logically why the net work done by gravity on the satellite over one complete orbit is exactly zero.

Q8. Two identical cars, Car A and Car B, are driving on a highway. Car B is traveling at a speed that is exactly three times faster than Car A. Logically deduce the ratio of their kinetic energies.

Q9. Look at two distinct electrical machines: Machine 1 does 1000 Joules of work in 10 seconds. Machine 2 does 1000 Joules of work in 20 seconds.
(a) Logically deduce which machine delivers higher power: _______
(b) Calculate the precise power rating of Machine 1 in Watts: _______

Q10. Predict energy shifts logically: A simple pendulum swinging back and forth passes through three points—the left extreme, the center lowest point (mean position), and the right extreme. Describe logically how kinetic energy and potential energy swap values at these extreme and mean positions.

Section C: High Thinking Section / HOTS (5 Questions)

Q11. An object of mass 10 kg is dropped from a cliff height of 40 metres. By calculating the values manually, show how the potential energy lost by the object at a height of 20 metres is perfectly converted into an equal amount of kinetic energy, verifying the Law of Conservation of Energy. Take $g = 10\ m/s^2$.

Q12. Analyze an advanced computational energy scenario: An electric pump is rated at 2 kilowatts (kW). It is used to pump water up to an overhead tank located at a vertical height of 10 metres.
(a) Calculate the total work energy the pump can output if it runs for exactly 1 minute.

(b) Find the total mass of water in kilograms that the pump can lift up to the tank in that 1 minute. Take $g = 10 \text{ m/s}^2$.

Q13. Derivation logic challenge: An object of mass m starts from an initial velocity u and accelerates uniformly to a final velocity v over a displacement s due to a constant force F. Use the third equation of motion ($v^2 - u^2 = 2as$) and Newton's Second Law ($F = ma$) to logically derive the kinetic energy formula when the object starts from rest.

Q14. In a household, four electric tubes of 40 Watts each are used for 5 hours a day, and an electric refrigerator of 300 Watts is used for 10 hours a day.
(a) Calculate the total electrical energy consumed by these appliances in a single day in terms of "units" (kWh).
(b) If the electricity board charges 6 rupees per unit, calculate the total cost for running these appliances for a month of 30 days.

Q15. Think deeply about velocity thresholds: When a car driver jams on the brakes, the stopping distance of the car depends heavily on its initial speed. If a car's speed is doubled, the stopping distance actually becomes four times longer under the same braking force. Explain this non-linear dependency using work-energy theorems.

Answer Key (For Teachers and Parents)

Section A:
Q1: (a) displacement, (b) potential, (c) 3.6 MJ (since $1000 \text{ W} \times 3600 \text{ s} = 3{,}600{,}000 \text{ J}$).
Q2: (a) Chemical, (b) Potential, (c) Chemical Energy.
Q3: (a) True ($\cos 90° = 0$, no work done), (b) False (directly proportional to the square of velocity, so doubling velocity quadruples kinetic energy), (c) True.
Q4: (a) $W = F \times s$, (b) $E_k = 0.5mv^2$, (c) $E_p = mgh$.
Q5: Mass m = 15 kg, height h = 1.5 m, $g = 10 \text{ m/s}^2$.
Work done W = Potential Energy gained = $mgh = 15 \times 10 \times 1.5 = 150 \times 1.5 = 225$ Joules.

Section B:
Q6: (a) Zero Joules, because the displacement of the wall is zero. (b) Positive work done, because both force and displacement are in the same upward direction. (c) Mechanical work requires a macroscopic displacement of the object. While muscles expend chemical

energy internally, no work is done on the wall because s = 0.
Q7: At any point in a circular orbit, the gravitational pulling force acts inward toward the center, while the instantaneous displacement vector acts along the tangent line to the circle. The angle between force and displacement is always exactly 90 degrees. Since $W = F \times s \times \cos(90°)$, the net work done is always zero.
Q8: Kinetic energy formula is $Ek = 0.5mv^2$. Since the masses are identical, the kinetic energy is directly proportional to the square of the velocity (v^2). If the velocity becomes 3 times larger, the kinetic energy increases by $3^2 = 9$ times. The ratio of Ek_A to Ek_B is 1:9.
Q9: (a) Machine 1 delivers higher power because it completes the same work in half the time. (b) Power P = Work / Time = 1000 J / 10 s = 100 Watts.
Q10: At the highest extreme positions (left and right), the pendulum stops for a split second, meaning its velocity is zero and its height is maximum; here, Kinetic Energy = 0 and Potential Energy is maximum. At the lowest center position (mean point), its height is zero and its speed is maximum; here, Potential Energy = 0 and Kinetic Energy is maximum. Energy continuous toggles back and forth. [1]

Section C:
Q11: Total Initial Energy at top (40m) = mgh = 10 × 10 × 40 = 4000 Joules (all Potential, Kinetic = 0).
At a height of 20m, Potential Energy = mgh = 10 × 10 × 20 = 2000 Joules.
To find Kinetic Energy, calculate velocity square after falling 20m: $v^2 - u^2 = 2as \rightarrow v^2 - 0 = 2(10)(20) \rightarrow v^2 = 400$. Kinetic Energy = $0.5mv^2 = 0.5 \times 10 \times 400 = 2000$ Joules.
Total Energy at 20m = 2000 J (PE) + 2000 J (KE) = 4000 Joules. This matches the initial energy.
Q12: (a) Power P = 2 kW = 2000 Watts, Time t = 1 minute = 60 seconds. Work done W = Power × Time = 2000 W × 60 s = 120,000 Joules.
(b) Work done is used to lift water: W = mgh -> 120,000 = m × 10 × 10 -> 120,000 = 100m -> m = 120,000 / 100 = 1200 kilograms of water.
Q13: Work done W = Force × Displacement = F × s. Substitute F = ma: W = ma × s.
From the motion equation: $v^2 - u^2 = 2as$, we can rearrange to find displacement $s = (v^2 - u^2) / 2a$.
Substitute s back into the work equation: $W = ma \times [(v^2 - u^2) / 2a]$. The mass-acceleration cancels out 'a': $W = 0.5m(v^2 - u^2)$. If the object starts from rest (u = 0), the work done is $W = 0.5mv^2$. This work equals the Kinetic Energy gained.
Q14: (a) Tubes consumption = 4 × 40 W × 5 h = 800 Wh. Refrigerator consumption = 1 × 300 W × 10 h = 3000 Wh. Total daily consumption = 800 + 3000 = 3800 Wh = 3.8 kWh = 3.8 electrical units per day.
(b) Total monthly units = 3.8 × 30 = 114 units. Total monthly bill cost = 114 × 6 = 684 rupees.
Q15: According to the Work-Energy Theorem, the negative work done by the braking force

must equal the total initial kinetic energy of the car to bring it to a stop (Braking Force × Stopping Distance = $0.5mv^2$). Since the maximum braking force depends on the tires and road friction and remains constant, the stopping distance is directly proportional to the square of the initial velocity (v^2). Doubling the speed quadruples the kinetic energy, which requires four times the distance to dissipate the energy under the same force.