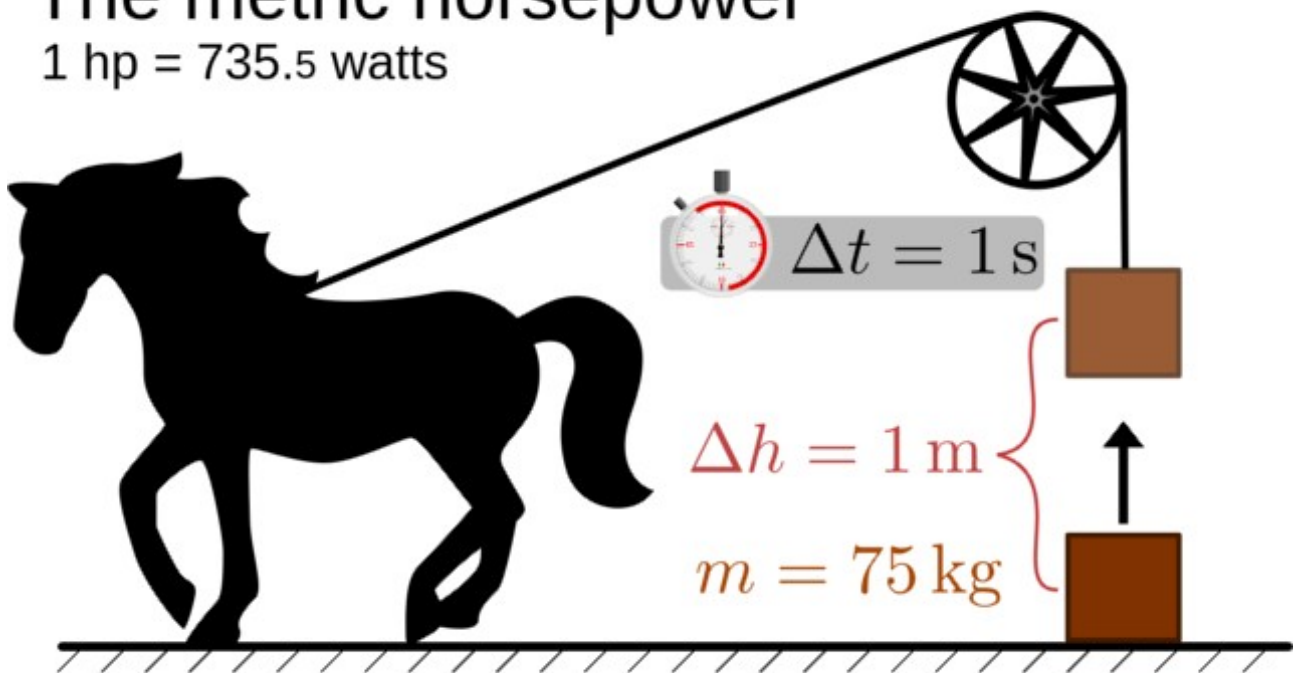


SCIENCE

WORK POWER & ENERGY

The metric horsepower
 $1 \text{ hp} = 735.5 \text{ watts}$



Class 9 – Science (Physics)

Question Bank

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Work Power & Energy

Question Bank based on NCERT Class 9 Chapter and Previous Years Papers

Q1: force of 7 N acts on an object. The displacement is, say 8 m, in the direction of the force. Let us take it that the force acts on the object through displacement. What is the work done in this case?

Q2: When do we say that work is done?

Q3: Write an expression for the work done when a force is acting on an object in the direction of its displacement.

Q4: Define 1J of work.

Q5: A pair of bullocks exerts a force of 140 N on a plough. The field being ploughed is 15 m long. How much work is done in ploughing the length of the field?

Q6: What is the kinetic energy of an object?

Q7: Write an expression for the kinetic energy of an object?

Q8: The kinetic energy of an object of mass m moving with a velocity of 5 m s⁻¹ is 25 J. What will be its kinetic energy when its velocity is doubled? What will be its kinetic energy when its velocity is increased three times?

Q9: What is power?

Q10: Define 1 watt of power.

Q11: A lamp consumes 1000 J of electrical energy in 10 s. What is its power?

Q12: Define average power.

Q13: An object thrown at a certain angle to the ground moves in a curved path and falls back to the ground. The initial and the final points of the path of the object lie on the same horizontal line. What is the work done by the force of gravity on the object?

Q14: A battery lights the bulb. Describe the energy changes involved in the process.

Q15: Certain force acting on a 20 kg mass changes its velocity from 5 ms^{-1} to 2 ms^{-1} . Calculate the work done by the force.

Q16: A mass of 10 kg is at a point A on the table. It is moved to a point B. If the line joining A and B horizontal, what is the work done on the object by the gravitational force? Explain your answer.

Q17: The potential energy of a freely falling object decreases progressively. Does this violate the law of conservation of energy? Why?

Q18: An object of mass 40 kg is raised to a height of 5 m above the ground. What is its potential energy? If the object is allowed to fall, find its kinetic energy when it is half way down.

Q19: What is the work done by the force of gravity on a satellite moving round the earth? Justify your answer.

Q20: A person holds a bundle of hay over his head for 30 minutes and gets tired. Has he done some work or not? Justify your answer.

Q21: An electric heater is rated 1500 W. How much energy does it use in 10 hours?

Q22: Illustrate the law of conservation of energy by discussing the energy changes which occur when we draw a pendulum bob to one side and allow it to oscillate. Why does the bob eventually come to rest? What happens to its energy eventually? Is it a

violation of the law of conservation of energy?

Q23: An object of mass m is moving with a constant velocity v . How much work should be done on an object in order to bring the object to rest?

Q24: Calculate the work required to be done to stop a car of 1500 kg moving at a velocity of 60 km/h?

Q25: In each of the following a force, F is acting on an object of mass, m . The direction of displacement is from west to east shown by the longer arrow. Observe the diagrams carefully and state whether the work done by the force is negative, positive or zero.

Q26: Find the energy in kW h consumed in 10 hours by four devices of power 500W each.

Q27: A freely falling object eventually stops on reaching the ground. What happens to its kinetic energy?

Q28: When a horse is pulling a cart, who is applying force? What is the object on which work is being done?

Q29: What is the work done by a weight lifter when he holds a weight of 100 kg on his shoulders for 1 minute? Why?

Q30: What is work done by the earth in moving around the sun?

Q31: Define kinetic energy of an object.

Q32: What do you mean by potential energy?

Q33: Write the formula for gravitational potential energy of an object.

Q34: Define energy. What is its SI unit?

Q35: What is SI unit of power? Define it.

Q36: Define one kilowatt hour (1 kWh).

Q37: State the value of commercial unit of energy in joules.

Q38: State the relation between kWh and joule.

Q39: Speed of a particle is doubled. What will be its new kinetic energy?

Q40: How is work defined in science? When do we say that one joule work has been done by a force on an object?

Q41: A coolie carries luggage of a passenger along a long platform at a railway station. Has he done work on the luggage? Why?

Q42: When is work said to be done against the force of gravity? State and define SI unit of work.

Q43: What are three essential conditions for work done by a force acting on an object?

Q44: In a game of tug of war, one team is slowly giving way to the other. Which team is doing positive work and which team negative?

Q45: What are the conditions for work to be zero?

Q46: Define kinetic energy of an object. On which factors does it depend?

Q47: A cricket ball of mass 0.15 kg is moving with a speed of 40 m s^{-1} . What is its kinetic energy?

Q48: Define potential energy of an object. Give an expression for gravitational potential energy.

Q49: Obtain an expression for gravitational potential energy of an object.

Q50: State the principle of transformation of energy.

Q51: Define power and give its units.

Q52: Define the unit of energy used commercially. What is its value in joules?

Q53: Car A and car B are travelling on the straight path with velocity of 40 kmh^{-1} and 50 kmh^{-1} respectively. Equal forces are applied on both of them. If both cars cover equal distances before they stop, which car does more work? Justify your answer?

Q54: An electric tube of 40 W is used for 6 h per day. What is the energy consumed in one day by the tube? Express the answer in commercial units.

Q55: State the nature of work done in the following cases giving justification for each:

- (a) When a truck moves on the road, work done by friction.
- (b) Work done in pushing a heavy rock.
- (c) Work done by a force in lifting a heavy book from the table.

Q56: An electric pump is used to pump water from a sump to the overhead tank situated 20 m above. It transfers 2000 kg of water to overhead tank in 15 minutes. Calculate the power of pump.

Q57: Study the following activities and check which is the force acting on the object on which work is being done and what happens to the object?

- (i) A boy pushes a pebble lying on a surface with his foot and pebble moves through a certain distance.

(ii) A girl pulls a trolley and trolley moves through a distance.

(iii) Satvik lifts a book and puts it at the top of table.

(iv) A bullock is pulling a cart and the cart moves.

Q58: You lift a heavily packed carton of mass m in vertically upward direction through a height h . What is the work done (i) by you on the carton, (ii) by force of gravity on the carton?

Q59: What is the work to be done to increase the velocity of a car from 36 km h^{-1} to 72 km h^{-1} if the mass of the car is 1500 kg ?

Q60: A car weighing 1200 kg is uniformly accelerated from rest and covers a distance of 40 m in 5 s . Calculate the work done by the engine of car during this time. What is the final kinetic energy of car?

Q61: Distinguish between positive work and negative work. When you lift an object up, two forces act on it. Identify these factors. Which one of the two does:

(a) Positive work

(b) Negative work?

Justify your answer?.

Q62: Find the ratio of gravitational potential energy if height of an object is double and its mass tripled. Also find the ratio of work done by gravity in bringing the object to zero height in both cases.

Q63: (a) State the law of conservation of energy.

(b) Give one example each of the following energy transformation:

(i) Heat energy into mechanical energy.

(ii) Mechanical energy into electrical energy.

Q64: Define power. Derive its SI unit. An electric bulb is rated 10 W . What does it mean? What is the energy consumed in joules if it is used for 5 minutes ?

Q65: Calculate the power of the engine required to lift 90 metric tonnes of coal per hour from a coal mine of depth 200 m. ($g = 9.8 \text{ m s}^{-2}$)

Q66: How much time will a pump of 2 kW power take to lift 500 litre of water to a height of 40 m? Given that density of water is 1 kg/litre and $g = 10 \text{ m s}^{-2}$.

Q67: Define commercial unit of energy. Derive relationship between this unit of energy and SI unit of energy. An electrical device of 500 W is used daily in a household for 10 hours. Calculate the energy consumed in the month of April.

Q68: (a) Establish the relation between (a) commercial unit and the SI unit of energy.
(b) An electric heater is rated 2000 W. How much energy does it use in 5 hours?

Q69: Define work and energy. Write their SI units. An electric bulb of 60 W is used for 6 hours per day. Calculate the units of energy consumed in one day by the bulb.

Q70: (a) Define potential energy. Derive an expression for the gravitational potential energy of an object of mass 'm' at a height 'h' above the earth's surface.
(b) A ball of mass 0.25 kg is moving horizontally with a uniform velocity of 25 m s^{-1} . Calculate the kinetic energy possessed by the ball.

Q71: Define kinetic energy. Obtain an expression for the kinetic energy of an object.

Q72: (a) Derive an expression to calculate the kinetic energy of a body.
(b) An object of mass 70 kg is raised to a height of 10 metres above the ground. What is its potential energy? If the object is allowed to fall, find its kinetic energy when it is half way down. ($g = 10 \text{ m s}^{-2}$)

Q73: Show that for a freely falling object the sum of its potential energy and kinetic energy remains unchanged at all points during its fall.

Q74: (a) State law of conservation of energy.
(b) Name the type of energy possessed by the following:

- (i) stretched slinky (ii) a speeding car
(iii) flowing water (iv) stretched rubber band.
- (c) An object of mass 50 kg is raised to a height of 600 cm above the ground. What is its potential energy? ($g=10 \text{ m s}^{-2}$)

Q75: (a) What is meant by power of a machine? Name and define its SI unit.

(b) How is kilowatt different from kilowatt hour?

(c) From a 20 m high fall nearly 25 metric tonnes of water fall per second. Calculate the equivalent power if all this energy is utilized. ($g=10 \text{ ms}^{-2}$)

Q76: (a) Define work. Give SI unit of work done. Write an expression for positive work done.

(b) Calculate the work done in pushing a cart through a distance of 50 m against the force of friction equal to 250 N. Also state the type of work done..

(c) What will be the work done if displacement of the object is perpendicular to the direction of force?

(d) When an object moves on a circular path, what will be the work done?