

CLASS 10 ICSE PHYSICS — 100 COMPLETE **QUESTIONS & ANSWERS (THEORY & NUMERICAL)**

PART A: THEORETICAL & CONCEPTUAL QUESTIONS **(FORCE, WORK, ENERGY, POWER)**

Q1. Define the 'Moment of a Force' and write its SI unit.

Ans: The turning effect of a force on a pivoted body about the pivot point is called the moment of force. Its SI unit is Newton-metre (N m).

Q2. State the two main factors that determine the magnitude of the torque.

Ans: (i) The magnitude of the force applied, and (ii) The perpendicular distance of the line of action of the force from the axis of rotation.

Q3. What is a couple? Write its mathematical formula.

Ans: Two equal and opposite parallel forces acting simultaneously on a body along different lines of action form a couple. Moment of couple = Force \times Couple Arm.

Q4. Why is the handle of a heavy iron door fixed at its extreme free edge?

Ans: To maximize the perpendicular distance from the hinges, which produces the required turning torque with minimum applied force.

Q5. State the Principle of Moments.

Ans: For a body in rotational equilibrium, the algebraic sum of all moments about any point is zero (Sum of anticlockwise moments = Sum of clockwise moments).

Q6. Define the 'Center of Gravity' of a body.

Ans: The center of gravity (CG) is that fixed point through which the entire weight of the body acts, regardless of its orientation.

Q7. Can the center of gravity of an object lie at a point where there is no mass? Give an example.

Ans: Yes. Examples include the geometric center of a hollow circular ring, a hollow sphere, or a boomerang.

Q8. What are the two essential conditions for a rigid body to be in mechanical equilibrium?

Ans: (i) Resultant of all translational forces must be zero, and (ii) Resultant of all rotational torques must be zero.

Q9. Differentiate between static and dynamic equilibrium with one example each.

Ans: Static: A body remains at rest under multiple forces (e.g., a book on a table). Dynamic: A body remains in uniform motion under multiple forces (e.g., a rain drop falling at terminal velocity).

Q10. Why does a person carrying a heavy bucket in their right hand naturally lean towards their left side?

Ans: To shift their body weight so that the combined center of gravity of the person and the bucket stays vertically within the base of their feet.

Q11. What is the mathematical sign convention used for clockwise and anticlockwise moments?

Ans: Anticlockwise moments are taken as positive (+), and clockwise moments are taken as negative (-).

Q12. Where does the center of gravity of a uniform triangular lamina lie?

Ans: At its centroid (the intersection point of its three medians).

Q13. How does the position of the center of gravity change when a solid metal sphere is heated uniformly?

Ans: It does not change; it remains exactly at the geometric center because the thermal expansion is perfectly symmetrical.

Q14. Define 'Work' in physics and state its SI unit.

Ans: Work is done when a force acting on a body produces a displacement in the body. Its SI unit is Joule (J).

Q15. Under what two conditions is the work done by a force on a body zero?

Ans: (i) When the displacement is zero ($s = 0$), or (ii) When the force is perpendicular to the displacement ($\theta = 90^\circ$).

Q16. What is the work done by the gravitational force on a satellite revolving around the Earth in a circular orbit? Why?

Ans: Zero, because the gravitational force acts radially inwards, which is perpendicular (90°) to the tangential displacement at every point.

Q17. Define 1 Watt of power.

Ans: Power is said to be 1 Watt when 1 Joule of work is performed in 1 second ($1 \text{ W} = 1 \text{ J/s}$).

Q18. State the relationship between the commercial unit Kilowatt-hour (kWh) and the SI unit Joule (J).

Ans: $1 \text{ kWh} = 3.6 \times 10^6 \text{ Joules}$ (or 3.6 MJ).

Q19. State the Work-Energy Theorem.

Ans: The work done by a net force on a rigid body is equal to the change in its kinetic energy ($\text{Work} = \Delta K$).

Q20. Differentiate between a conservative and a non-conservative force field.

Ans: Conservative: Work done is independent of the path taken (e.g., gravity). Non-conservative: Work done depends on the path taken (e.g., friction).

Q21. What happens to the kinetic energy of a moving car if its speed is tripled?

Ans: It becomes 9 times its original value, since kinetic energy is directly proportional to the square of the velocity ($K \propto v^2$).

Q22. Two bodies of masses m and $4m$ possess equal kinetic energies. What is the ratio of their linear momenta?

Ans: The ratio is 1:2, calculated using the relationship $p = \sqrt{2mK}$.

Q23. Name the type of energy stored in a compressed spring and a stretched catapult rubber.

Ans: Elastic potential energy.

Q24. State the Law of Conservation of Mechanical Energy.

Ans: In an ideal system free from friction or air resistance, the total mechanical energy (sum of potential and kinetic energy) remains constant.

Q25. Why is the mechanical efficiency of any real practical machine always less than 100%?

Ans: Due to energy losses as heat caused by friction between moving parts and the non-zero weight of the machine's internal components.

Q26. Express Horsepower (hp) in terms of Watts.

Ans: $1 \text{ hp} = 746 \text{ Watts}$.

Q27. Can a body have a constant speed but a changing kinetic energy?

Ans: No, because if the mass is constant and the speed is unchanged, the value $\frac{1}{2}mv^2$ must remain completely constant.

Q28. What type of energy transformation takes place in a solar cell panel?

Ans: Light energy (solar energy) transforms directly into electrical energy.

Q29. What type of energy transformation occurs when a dry chemical cell is used in a circuit?

Ans: Chemical energy converts into electrical energy.

Q30. Why does a professional high-jumper land on a thick foam mattress rather than a hard concrete floor?

Ans: The foam mattress increases the impact time, which reduces the stopping rate of change of momentum and minimizes the force on the athlete.

Q31. Where is the center of gravity of a uniform cylinder located?

Ans: At the mid-point of its central longitudinal axis.

Q32. What is the power output of a force F acting on a body moving with a constant velocity v in its own direction?

Ans: Power equals force multiplied by velocity ($P = F \cdot v$).

Q33. Can a body possess potential energy when it is placed on the surface of the Earth?

Ans: Gravitational potential energy is zero relative to the ground reference, but it can possess elastic potential energy if deformed.

Q34. Define a non-mechanical form of energy and give one example.

Ans: Energy not associated with macroscopic motion or position, such as Sound Energy or Chemical Energy.

Q35. Why are mountain roads designed with gradual winding loops rather than steep straight climbs?

Ans: Winding loops reduce the slope angle, which minimizes the driving force needed against gravity by extending the distance traveled.

Q36. What is the work done by a frictional force when an object slides across a rough floor?

Ans: Negative work, because the force of friction acts directly opposite to the direction of displacement ($\theta = 180^\circ$).

Q37. What happens to the center of gravity of a hollow beaker when it is completely filled with water?

Ans: It remains at the geometric center because the mass distribution stays perfectly symmetrical.

Q38. What happens to the center of gravity of a hollow beaker if it is only half-filled with water?

Ans: It shifts vertically downwards into the lower section because more mass becomes concentrated at the bottom.

Q39. Define mechanical advantage (MA) for an ideal force multiplier machine.

Ans: Mechanical Advantage is the ratio of the Load overcome to the Effort applied ($\text{MA} = \frac{\text{Load}}{\text{Effort}}$); for a force multiplier, $\text{MA} > 1$.

Q40. Is a single isolated force possible in nature?

Ans: No, forces always occur in equal and opposite action-reaction pairs according to Newton's Third Law.

Q41. What is the net torque of a planet orbiting a star in a perfect circle?

Ans: Zero, because the gravitational force acts along the radial line, passing directly through the center of rotation.

Q42. Why are structural steel beams shaped like an 'I' rather than a solid square block?

Ans: The 'I' shape provides high resistance to bending moments while reducing weight by eliminating material where stress is minimal.

Q43. A ball is rolling on a perfectly frictionless horizontal floor. Is it in equilibrium?

Ans: Yes, it is in dynamic equilibrium because no net external force or torque acts on it.

Q44. What type of equilibrium is exhibited by a sphere resting on a flat horizontal table?

Ans: Neutral equilibrium, because displacing it slightly neither raises nor lowers its center of gravity.

Q45. Why do table fans have heavy cast-iron bases?

Ans: To keep the overall center of gravity as low as possible, preventing the fan from tipping over due to motor vibrations.

Q46. State the SI unit of momentum.

Ans: Kilogram-metre per second ($\text{kg} \cdot \text{m/s}$).

Q47. When an arrow is released from a stretched bow, what energy conversion takes place?

Ans: The elastic potential energy stored in the stretched bow transforms into the kinetic energy of the flying arrow.

Q48. Can a scalar quantity ever produce a rotational moment?

Ans: No, torque and moments are vector quantities arising from the cross product of force and position vectors.

Q49. What is the coordinate of the center of gravity of a uniform circular wire ring?

Ans: It lies exactly at its center point, which is in the empty space inside the ring.

Q50. State the fundamental law that ensures the total energy of an isolated system remains constant.

Ans: The Law of Conservation of Energy.

PART B: NUMERICAL QUESTIONS (WITH DIRECT ANSWERS)

Q51. A body is pivoted at a point. A force of 20 N is applied at a perpendicular distance of 40 cm from the pivot. Calculate the moment of force.

Ans: 8 N m

Q52. The moment of a force of 15 N about a fixed point is 6 N m. Calculate the distance of the point of application of force from the fixed point.

Ans: 0.4 m (or 40 cm)

Q53. A steering wheel of diameter 0.5 m is rotated by two equal and opposite parallel forces of 10 N each. Calculate the moment of the couple.

Ans: 5 N m

Q54. A mechanic can open a nut by applying a force of 150 N using a wrench of length 20 cm. If he wants to open it by applying a force of 50 N, what should be the length of the wrench?

Ans: 60 cm (or 0.6 m)

Q55. An iron door of width 1.2 m can be opened by a minimum force of 20 N applied at its free edge. Calculate the moment of force required to open the door.

Ans: 24 N m

Q56. What minimum force is needed to open the same door in Q55 if it is applied at a distance of 60 cm from the hinges?

Ans: 40 N

Q57. A uniform metre rule is pivoted at its mid-point (50 cm mark). A weight of 50 gf is suspended at the 10 cm mark. Where should a weight of 100 gf be suspended to keep the rule horizontal?

Ans: At the 70 cm mark

Q58. A uniform metre rule balances horizontally on a knife-edge placed at the 60 cm mark when a mass of 20 g is suspended from the 100 cm end. Find the mass of the metre rule.

Ans: 80 g

Q59. A half-metre rule (0 to 50 cm) is balanced horizontally at its 30 cm mark when a mass of 40 g is suspended from the 45 cm mark. Calculate the mass of the half-metre rule.

Ans: 120 g

Q60. A uniform metre rule of mass 100 g is balanced on a fulcrum at the 40 cm mark by suspending an unknown mass 'm' at the 20 cm mark. Find the value of m.

Ans: 50 g

Q61. Two forces each of magnitude 4 N act vertically upwards and downwards respectively at the two ends of a uniform rod of length 2 m which is pivoted at its center. Calculate the resultant moment of forces about the pivot.

Ans: 8 N m

Q62. A physical balance has its arms of length 40 cm and 42 cm. What mass kept on the pan of the longer arm will balance an object of mass 21 kg kept on the pan of the shorter arm?

Ans: 20 kg

Q63. A uniform metre rule of weight 80 gf is pivoted at its 30 cm mark. Where should a weight of 120 gf be suspended to balance the rule horizontally?

Ans: At the 16.67 cm mark

Q64. A see-saw of length 4 m is balanced at its middle point. A boy of weight 40 kgf sits at a distance of 1.5 m from the support on the left side. Where should a boy of weight 30 kgf sit on the right side to balance the see-saw?

Ans: 2 m from the support on the right side

Q65. A force of 50 N produces a moment of force of 10 N m about a pivot. If the force acts at an angle of 90 degrees to the arm, find the length of the torque arm.

Ans: 0.2 m (or 20 cm)

Q66. A spanner of length 30 cm is used to untighten a nut by applying a force of 120 N. Calculate the torque produced in SI units.

Ans: 36 N m

Q67. A force of 25 N acts on a body such that its line of action is at a perpendicular distance of 400 mm from a pivoted point. Express the torque in N m.

Ans: 10 N m

Q68. A balance has unequal arms. An object weighs 16 kgw when placed in one pan and 25 kgw when placed in the other pan. What is the true mass of the object?

Ans: 20 kg

Q69. A flat circular disc of radius 1 m is pivotable at its center. Two forces of 5 N and 5 N act as a couple tangentially at opposite ends of a diameter. Find the moment of the couple.

Ans: 10 N m

Q70. Find the force required to produce a maximum torque of 25 N m on a shaft using a handle of length 50 cm.

Ans: 50 N

Q71. A steering wheel of a car has a diameter of 40 cm. The driver applies a couple of forces of magnitude 15 N to turn the wheel. Calculate the torque applied.

Ans: 6 N m

Q72. A force of 40 N displaces a body by 5 m in the direction of the force. Calculate the work done by the force.

Ans: 200 J

Q73. A body of mass 10 kg is lifted vertically upwards through a height of 8 m. Calculate the work done against gravity. (Take $g = 9.8 \text{ m/s}^2$)

Ans: 784 J

Q74. A worker pushes a block with a force of 150 N at an angle of 60° to the horizontal surface. If the block moves a horizontal distance of 6 m, calculate the work done.

Ans: 450 J

Q75. A car of mass 1000 kg moving with a velocity of 20 m/s is brought to rest by applying brakes. Calculate the work done by the braking force.

Ans: -200,000 J (or -200 kJ)

Q76. A porter carries a load of 30 kgf on his head and walks a distance of 50 m on a horizontal platform. Calculate the work done by the porter against gravity.

Ans: 0 J

Q77. A bullet of mass 20 g moving with a speed of 100 m/s penetrates a wooden block and comes to rest. Calculate the work done by the wooden block in stopping the bullet.

Ans: -100 J

Q78. The velocity of a body of mass 5 kg increases from 4 m/s to 10 m/s when a force acts on it. Using the work-energy theorem, calculate the work done by the force.

Ans: 210 J

Q79. A force of 20 N acts on a body of mass 2 kg at rest. Find the work done by the force in 4 seconds.

Ans: 1600 J

Q80. A crane lifts a load of 2000 kg vertically upwards with a uniform velocity of 3 m/s for 5 seconds. Calculate the work done by the crane. (Take $g = 10 \text{ m/s}^2$)

Ans: 300,000 J

Q81. A coolie lifts a suitcase of mass 15 kg from the ground and puts it on his head 1.5 m above the ground. Calculate the work done by him on the suitcase. (Take $g = 10 \text{ m/s}^2$)

Ans: 225 J

Q82. A ball of mass 0.5 kg slows down from a speed of 12 m/s to 4 m/s while sliding across a rough floor. Calculate the work done by friction.

Ans: -32 J

Q83. A boy of mass 50 kg runs up a flight of 40 stairs, each 15 cm high. Calculate the total work done by the boy against gravity. (Take $g = 10 \text{ m/s}^2$)

Ans: 3000 J

Q84. How much work is done by a force of 50 N pulling a cart at an angle of 30° to the horizontal over a distance of 10 m? (Take $\cos 30^\circ = 0.866$)

Ans: 433 J

Q85. An engine does 45,000 J of work in moving a car through a distance of 150 m. Calculate the force exerted by the engine in the direction of motion.

Ans: 300 N

Q86. A dynamic braking system stops a 1200 kg vehicle from a speed of 25 m/s. Find the total work done on the car by the brakes.

Ans: -375,000 J

Q87. A bucket of mass 20 kg is pulled up from a well of depth 15 m using a rope. Calculate the work done by the pulling force. (Take $g = 9.8 \text{ m/s}^2$)

Ans: 2940 J

Q88. A constant force of 12 N displaces an object from a position where its kinetic energy is 20 J to a position where its kinetic energy is 56 J. Find the displacement of the object in the direction of the force.

Ans: 3 m

Q89. Calculate the kinetic energy of a ball of mass 250 g moving with a velocity of 16 m/s.

Ans: 32 J

Q90. A body of mass 2 kg dropped from a certain height possesses 400 J of kinetic energy just before hitting the ground. From what height was it dropped? (Take $g = 10 \text{ m/s}^2$)

Ans: 20 m

Q91. Two bodies have their masses in the ratio 2:3 and their velocities in the ratio 4:1. Calculate the ratio of their kinetic energies.

Ans: 32:3

Q92. A vessel containing 50 kg of water is placed at a height of 15 m above the ground. Calculate the potential energy stored in the water. (Take $g = 9.8 \text{ m/s}^2$)

Ans: 7350 J

Q93. A spring is compressed such that it stores 25 J of elastic potential energy. If the spring constant is 200 N/m, find the compression distance.

Ans: 0.5 m

Q94. A machine gun fires 60 bullets per minute. If the mass of each bullet is 20 g and its velocity is 400 m/s, find the total power of the gun.

Ans: 1600 W (or 1.6 kW)

Q95. An electric pump lifts 1200 kg of water per minute from a well of depth 20 m. Calculate the power of the pump. (Take $g = 10 \text{ m/s}^2$)

Ans: 4000 W (or 4 kW)

Q96. A man of mass 60 kg climbs up a tower of height 30 m in 2 minutes. Calculate the average power spent by the man. (Take $g = 10 \text{ m/s}^2$)

Ans: 150 W

Q97. An electric motor of power 3 kW lifts a load of 400 kg through a vertical height. If it takes 20 seconds to lift the load, calculate the height through which it is lifted. (Take $g = 10 \text{ m/s}^2$)

Ans: 15 m

Q98. A body of mass 4 kg is moving with a momentum of 24 kg m/s. Calculate its kinetic energy.

Ans: 72 J

Q99. An engine develops 15 kW of power when moving a cart with a uniform velocity of 5 m/s. Find the force exerted by the engine.

Ans: 3000 N

Q100. A body of mass m is raised to a height h . Another body of mass $2m$ is raised to a height $h/2$. Find the ratio of their potential energies.

Ans: 1:1

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CLASS 10 ICSE PHYSICS — 50 SELECT NUMERICAL SUMS
(CHAPTERS 1 & 2)

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MOMENT OF FORCE, COUPLE, AND METRE RULE (CHAPTER 1)

Q1. A force of 25 N acts on a body pivoted at a point. If the perpendicular distance from the pivot is 30 cm, calculate the moment of force.

Ans: 7.5 N m

Q2. A nut is opened by a wrench of length 15 cm if a force of 120 N is applied. Calculate the torque required to loosen the nut.

Ans: 18 N m

Q3. The moment of a force of 20 N about a fixed point is 8 N m. Find the perpendicular distance of the point of application of force from the fixed point.

Ans: 0.4 m (or 40 cm)

Q4. A steering wheel of diameter 60 cm is rotated by two equal and opposite forces of 15 N each. Calculate the moment of the couple.

Ans: 9 N m

Q5. A mechanic can open a nut by applying a force of 200 N using a spanner of length 10 cm. If he wants to open it by applying a force of 80 N, what should be the length of the spanner?

Ans: 25 cm (or 0.25 m)

Q6. An iron gate 1.5 m wide can be opened by a minimum force of 40 N applied at its free edge. What minimum force is needed if it is applied at a distance of 50 cm from the hinges?

Ans: 120 N

Q7. Two forces each of magnitude 5 N act vertically upwards and downwards respectively at the two ends of a uniform rod of length 4 m pivoted at its center. Find the resultant moment of forces.

Ans: 20 N m

Q8. A uniform metre rule is pivoted at its mid-point (50 cm mark). A weight of 60 gf is suspended at the 20 cm mark. Where should a weight of 90 gf be suspended to keep the rule balanced?

Ans: At the 70 cm mark

Q9. A uniform metre rule balances horizontally on a knife-edge placed at the 70 cm mark when a mass of 40 g is suspended from the 100 cm end. Find the mass of the metre rule.

Ans: 60 g

Q10. A half-metre rule (0 to 50 cm) is balanced horizontally at its 40 cm mark when a mass of 30 g is suspended from the 50 cm mark. Calculate the mass of the half-metre rule.

Ans: 20 g

Q11. A uniform metre rule of mass 120 g is balanced on a fulcrum at the 45 cm mark by suspending an unknown mass 'm' at the 15 cm mark. Find the value of m.

Ans: 20 g

Q12. A see-saw of length 4 m is balanced at its middle point. A boy of weight 45 kgf sits at a distance of 1.2 m from the support on the left side. Where should a boy of weight 36 kgf sit on the right side to balance it?

Ans: 1.5 m from the support

Q13. A uniform metre rule of weight 100 gf is pivoted at its 40 cm mark. Where should a weight of 150 gf be suspended to balance the rule horizontally?

Ans: At the 46.67 cm mark

Q14. A balance has unequal arms. An object weighs 9 kgw when placed in the left pan and 16 kgw when placed in the right pan. What is the true mass of the object?

Ans: 12 kg

Q15. A uniform wooden bar of length 1 m and mass 300 g is supported on two knife-edges placed at the 20 cm and 80 cm marks. A 600 g load is hung at the 40 cm mark. Calculate the reaction force at the first knife-edge.

Ans: 450 gf

WORK, ENERGY, AND WORK-ENERGY THEOREM (CHAPTER 2)

Q16. A force of 60 N displaces a body by 8 m in the direction of the force. Calculate the work done.

Ans: 480 J

Q17. A body of mass 15 kg is lifted vertically upwards through a height of 6 m. Calculate the work done against gravity. (Take $g = 9.8 \text{ m/s}^2$)

Ans: 882 J

Q18. A worker pushes a block with a force of 200 N at an angle of 60 degrees to the horizontal surface. If the block moves 5 m horizontally, calculate the work done.

Ans: 500 J

Q19. A car of mass 800 kg moving with a velocity of 15 m/s is brought to rest by brakes. Calculate the work done by the braking force.

Ans: -90,000 J (or -90 kJ)

Q20. A porter carries a load of 40 kg on his head and walks a distance of 100 m on a horizontal platform. Calculate the work done by the porter against gravity.

Ans: 0 J

Q21. A bullet of mass 10 g moving with a speed of 300 m/s penetrates a sandbag and comes to rest. Calculate the work done by the sandbag in stopping the bullet.

Ans: -450 J

Q22. The velocity of a body of mass 4 kg increases from 5 m/s to 12 m/s when a force acts on it. Using the work-energy theorem, calculate the work done.

Ans: 238 J

Q23. A force of 30 N acts on a body of mass 3 kg initially at rest. Find the work done by the force in 3 seconds.

Ans: 1350 J

Q24. A crane lifts a load of 1500 kg vertically upwards with a uniform velocity of 2 m/s for 6 seconds. Calculate the work done by the crane. (Take $g = 10 \text{ m/s}^2$)

Ans: 180,000 J (or 180 kJ)

Q25. A coolie lifts a box of mass 20 kg from the ground and puts it on his head 1.8 m above the ground. Calculate the work done by him. (Take $g = 10 \text{ m/s}^2$)

Ans: 360 J

Q26. A ball of mass 0.8 kg slows down from a speed of 15 m/s to 5 m/s while sliding across a rough floor. Calculate the work done by friction.

Ans: -80 J

Q27. A boy of mass 60 kg runs up a flight of 30 stairs, each 20 cm high. Calculate the total work done by the boy against gravity. (Take $g = 10 \text{ m/s}^2$)

Ans: 3600 J

Q28. How much work is done by a force of 100 N pulling a cart at an angle of 30 degrees to the horizontal over a distance of 20 m? (Take $\cos 30^\circ = 0.866$)

Ans: 1732 J

Q29. An engine does 60,000 J of work in moving a vehicle through a distance of 200 m. Calculate the force exerted by the engine in the direction of motion.

Ans: 300 N

Q30. A box of mass 12 kg is slid down a frictionless inclined plane of length 6 m making an angle of 30 degrees with the horizontal. Calculate the work done by gravity. (Take $g = 10 \text{ m/s}^2$)

Ans: 360 J

KINETIC ENERGY, POTENTIAL ENERGY, AND POWER (CHAPTER 2)

Q31. Calculate the kinetic energy of a ball of mass 400 g moving with a velocity of 20 m/s.

Ans: 80 J

Q32. A body of mass 4 kg dropped from a certain height possesses 800 J of kinetic energy just before hitting the ground. From what height was it dropped? (Take $g = 10 \text{ m/s}^2$)

Ans: 20 m

Q33. Two bodies of masses 2 kg and 18 kg possess equal kinetic energies. Find the ratio of their linear momenta.

Ans: 1:3

Q34. Two bodies have their masses in the ratio 3:4 and their velocities in the ratio 2:3. Calculate the ratio of their kinetic energies.

Ans: 1:3

Q35. If the momentum of a body is increased to three times its initial value, how does its kinetic energy change?

Ans: Becomes 9 times

Q36. A vessel containing 80 kg of water is placed at a height of 25 m above the ground. Calculate the potential energy stored. (Take $g = 9.8 \text{ m/s}^2$)

Ans: 19,600 J

Q37. A stone of mass 200 g is thrown vertically upwards with an initial velocity of 30 m/s. Find its kinetic energy at a height of 15 m. (Take $g = 10 \text{ m/s}^2$)

Ans: 60 J

Q38. A machine gun fires 120 bullets per minute. If the mass of each bullet is 10 g and its velocity is 500 m/s, find the power of the gun.

Ans: 2500 W (or 2.5 kW)

Q39. An electric pump lifts 1800 kg of water per minute from a well of depth 30 m. Calculate the power of the pump. (Take $g = 10 \text{ m/s}^2$)

Ans: 9000 W (or 9 kW)

Q40. A man of mass 70 kg climbs up a tower of height 45 m in 3 minutes. Calculate the average power spent by the man. (Take $g = 10 \text{ m/s}^2$)

Ans: 175 W

Q41. An electric motor of power 5 kW lifts a load of 500 kg through a vertical height. If it takes 15 seconds, calculate the height reached. (Take $g = 10 \text{ m/s}^2$)

Ans: 15 m

Q42. A car engine exerts a force of 3000 N to maintain a constant speed of 90 km/h. Calculate the power of the engine in kilowatts.

Ans: 75 kW

Q43. Find the mass of a bird flying at a speed of 8 m/s if its kinetic energy is 16 J.

Ans: 0.5 kg (or 500 g)

Q44. A body of mass 8 kg is moving with a momentum of 40 kg m/s. Calculate its kinetic energy.

Ans: 100 J

Q45. A girl of mass 50 kg climbs a rope of length 9 m in 15 seconds. Calculate her power output. (Take $g = 10 \text{ m/s}^2$)

Ans: 300 W

Q46. An engine develops 24 kW of power when moving a cart with a uniform velocity of 6 m/s. Find the force exerted by the engine.

Ans: 4000 N

Q47. Express 2.5 kWh in terms of Joules.

Ans: 9,000,000 J (or 9 MJ)

Q48. A heart beats 80 times per minute and does 1.5 J of work per beat. Calculate the power of the heart.

Ans: 2 W

Q49. A toy car of mass 500 g is moving with a speed of 4 m/s. What force is required to stop it in a distance of 2 m?

Ans: 2 N

Q50. A body of mass m is raised to a height $2h$. Another body of mass $3m$ is raised to a height h . Find the ratio of their potential energies.

Ans: 2:3

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