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**Worksheet**

Multiple Choice Questions :

1. A car is accelerated on a levelled road and attains a velocity 4 times of its initial velocity. In this process, potential energy of the car is :

|  |  |
| --- | --- |
| a) Does not change | b) Becomes twice that of initial |
| c) Becomes 4 times that of initial | d) Becomes 16 times that of initial |

1. In case of negative work, the angle between the force and displacement is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 0 | b) 45 | c) 90 | d) 180 |

1. A girl is carrying a school bag of 3 kg mass on her back and moves 200 m on a levelled road. The work done against the gravitational force will be :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 6 x 103 J | b) 6 J | c) 0.6 J | d) 0 |

1. Which one of the following is not the unit of energy?

|  |  |  |  |
| --- | --- | --- | --- |
| a) joule | b) newton metre | c) kilowatt hour | d) kilowatt |

1. The work done on an object does not depend upon the :

|  |  |
| --- | --- |
| a) Displacement | b) Force applied |
| c) Angle between Force and displacement | d) Initial velocity of an object |

1. Water stored in a dam possesses.

|  |  |  |  |
| --- | --- | --- | --- |
| a) Potential energy | b) Electrical energy | c) Kinetic energy | d) No energy |

1. A body is falling from a height h. After it has fallen a height h/2, it will possess:

|  |  |
| --- | --- |
| a) Only potential energy | b) only kinetic energy |
| c) half potential and half kinetic energy | d) more kinetic and less potential energy |

1. A body of mass 2kg is projected vertically upwards with a speed of 3 m/s. The maximum gravitational potential energy of the body is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 18 J | b) 4.5 J | c) 9 J | d) 2.25 J |

1. At sea level, a nitrogen molecule in air has an average transitional kinetic energy of 6.2 x 10 – 21 J. Its mass is 4.7 x 10 – 26 kg. If the molecule shoots up straight without resistance, it will rise to a height of :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1.35 Km | b) 13.5 Km | c) 135 Km | d) 1350 Km |

1. When a force retards the motion of a body, work done by the force on the body is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) Positive | b) Negative | c) cannot be defined | d) zero |

1. The kinetic energy of a body depends on its :

|  |  |
| --- | --- |
| a) Mass only | b) Velocity only |
| c) Mass and (Velocity)2 | d) Mass and (Velocity)3 |

1. A stretched string possesses :

|  |  |
| --- | --- |
| a) Kinetic energy | b) gravitational potential energy |
| c) both kinetic and gravitational potential energy | d) elastic potential energy |

1. Choose the correct option :

|  |  |
| --- | --- |
| a) The power of an agent is constant | b) The unit of power is Joule (J) |
| c) The unit of power is kilowatt hour (kWh) | d) The unit of power is watt (w) |

1. Out of the following physical quantities, which has the same unit as work?

|  |  |  |  |
| --- | --- | --- | --- |
| a) Power | b) force | c) Velocity | d) Energy |

1. If force and displacement of a body are doubled, work done is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) doubled | b) 4 times | c) 1/4 times | d) halved |

1. An electric bulb of 60 W is used for 6 h per day. The energy consumed by it in one day is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 3.6 kWh | b) 0.36 kW | c) 0.36 kWh | d) 36 kWh |

1. The power of an agent that consumes 1000 J of energy in 10 s is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1 kW | b) 10 kW | c) 0.1 kW | d) 10 W |

1. A man of mass 60 kg possesses kinetic energy of 750 J. The velocity with which the man is running is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 25 m/s | b) 5 m/s | c) 10 m/s | d) 15 m/s |

1. Two bodies of equal masses move with velocities v and 3 v respectively. The ratio of their kinetic energies is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1 : 3 | b) 3 : 1 | c) 9 : 1 | d) 1 : 9 |

1. An object of mass 12 kg is at a certain height above the ground. If the potential energy of the object is 480 J, its height with respect to the ground is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 40 m | b) 4 m | c) 10 m | d) 20 m |

1. The increase in the potential energy of a block of 2 kg when lifted through 2 m is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 4 J | b) 400 J | c) 40 J | d) 100 J |

Fill in the Blanks :

1. Work done is \_\_\_\_\_\_\_\_ when the force is in the direction of displacement.
2. Kinetic energy is the energy possessed by an object due to its \_\_\_\_\_\_\_\_\_\_.
3. The kinetic energy of an object of mass 15 kg moving with a uniform speed of 4 m/s is \_\_\_\_\_\_\_\_\_.
4. The sum of kinetic energy and potential energy of an object is called its total \_\_\_\_\_\_\_\_\_ energy.
5. An electric motor exerts a force of 20 N on a cable and pulls it through a distance of 15 m in one minute. The power supplied by the motor in watts is \_\_\_\_\_\_\_\_\_.

**Answers**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1. a | 1. d | 1. d | 1. d | 1. d | 1. a | 1. c |
| 1. c | 1. b | 1. b | 1. c | 1. d | 1. d | 1. d |
| 1. b | 1. c | 1. c | 1. b | 1. c | 1. b | 1. c |

22. positive 23. Motion 24. 120 J 25. Mechanical 26. 5

Problem For Practice :

**Based on Work :**

1. A force of 5 N is acting on an object. The object is displaced through 2 m in the direction of the force. If the force acts all through the displacement. Find the work done by the force.
2. A ball of mass 1 kg thrown upwards, reached a maximum height of 4 m. Calculate the work done by the force of gravity during the vertical displacement.
3. A porter lifts a luggage of 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 luggage.
4. An engine pulls a train 1 km over a level track. Calculate the work done by the train given that the frictional resistance is 5 x 105 N.
5. A man weighing 70 kg carries a weight of 10 kg on the top of a tower 100 m high. Calculate the work done by the man.
6. Calculate the work done by a student in lifting 0.5 kg book from the ground and keeping it on a shelf 1.5 m high.
7. A coolie carries a load of 50 kg on his head and walks on a level road upto 100 m. What is the work done by him?
8. A crane pulls up a car of mass 500 kg to a vertical height of 4 m. Calculate the work done by the crane.
9. A boy of mass 55 kg runs up a flight of 40 stairs, each measuring 0.15 m. Calculate the work done by the boy.
10. A force of 7 N acts on an object. The displacement is 8 m in the direction of the force, what is the work done in this case?
11. A pair of bullocks exert 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?

**Based on Kinetic Energy :**

1. How fast should a man of mass 60 kg run so that his kinetic energy is 750 J?
2. Find the mass of the body which has 5 J of kinetic energy while moving at a speed of 2 m/s.
3. An object of mass 15 kg is moving with a uniform velocity of 4 m/s. What is the kinetic energy possessed by the object?
4. A body of mass 5 kg, initially at rest, is subjected to a force of 20 N. What is the kinetic energy acquired by the body at the end of 10 s.
5. What is the work done to increase the velocity of a car from 30 km/h to 60 km/h if, the mass of the car is 1500 kg ?
6. A bullet of mass 0.03 kg moving with a speed of 400 m/s penetrates 12 cm into fixed block of wood. Calculate the average force exerted by the wood on the bullet.
7. A bullet of mass 5 g travels with a speed of 500 m/s. If it penetrates a fixed target which offers a constant resistive force of 1000 N to the motion of the bullet. Find

(a) The initial kinetic energy of the bullet

(b) The distance through which the bullet has penetrated.

1. Two bodies of equal masses move with uniform velocities v and 3 v respectively. Find the ratio of their kinetic energies.
2. The mass of a ball ‘A’ is doubled the mass of another ball ’B’. The ball ‘A’ moves at half the speed of the ball ‘B’. Calculate the ratio of the kinetic energy of ‘A’ to the kinetic energy of the ‘B’.
3. A truck weighing 5000 kg f and a cart weighing 500 kg f are moving with the same speed. Compare their kinetic energies.
4. A bullet of mass 20 g is found to pass two points 30 m apart in 4 s. Assuming the speed to be constant , find its kinetic energy.
5. A person pushed a 72 kg patient on a 15 kg trolley, producing an acceleration of 0.6 m/s2.
6. How much work does the person do by pushing the patient and the trolley through a distance of 2.5 m? Assume the trolley moves without friction.
7. How far must the person push the trolley to do 140 J of work.
8. A truck moving at 15 m/s has a K.E. of 4.2 x 105J. What is the mass of the truck?
9. How much work is required for a 74 kg sprinter to accelerate from rest to 2.2 m/s?
10. A woman lifts a box weighing 40 N from the floor to a shelf 1.5 m above.

(a) Find the work done by the force (F) the woman exerts on the box.

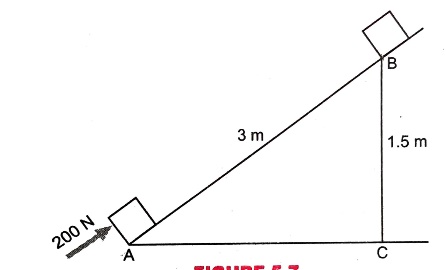
(b) Find the work done on the box by its own weight (w).

(c) Find the net work done on the box.

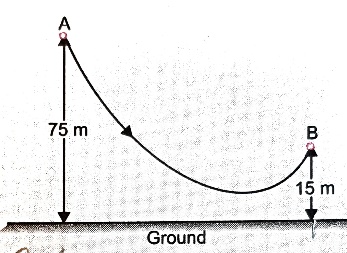
1. The kinetic energy of an object of mass, m moving with a velocity of 5 m/s is 25 j. what will be its kinetic energy when its velocity is doubled? What will be its kinetic energy when its velocity is increased three times?
2. Certain force acting on a 20 kg mass change its velocity from 5 m/s to 2 m/s. Calculate the work done by the force.
3. Calculate the work required to be done to stop a car of 1500 kg moving at a velocity of 60 km/h?

**Based on Potential Energy :**

1. Find the energy possessed by an object of mass 10 kg when it is at a height of 6 m above the ground.
2. A body of mass 4 kg is taken from a height of 5 m to a height of 10 m. Find increase in kinetic energy.
3. An object of mass 12 kg is taken from a height above the ground. If the potential energy of the object is 480 J, find the height at which the object is with respect to the ground.
4. A rocket of mass 3 x 106 kg takes off from a launching pad and acquires a vertical velocity of 1 Km/s and an altitude of 25 km. Calculate its (a) Potential energy (b) Kinetic energy.
5. Calculate the increase in potential energy as a block of 2 kg is lifted through 2 m.
6. A body of mass 5 kg falls from a height of 5 m. How much energy does it possess at any instant.
7. A block of mass 30 kg is pulled up by a rope as shown in figure with a constat speed by applying a force of 200 N parallel to the slope. ‘A’ and ‘B’ are the initial and final positions of the block. Calculate :
8. The work done by the force in moving the block A to B.
9. The potential energy gained by the block.



1. In given figure , a skier of mass 60 kg stands at ‘A’ at the top of the ski-jump. He moves from A to B and takes off for his jump at ‘B’.



1. Calculate the change in the gravitational potential energy of the skier between A and B.
2. If 75 % of the energy in part (a) becomes the kinetic energy at ‘B’, calculate the speed at which the skier arrives at ‘B’.
3. A 5 kg ball is thrown upwards with a speed of 10 m/s.

(a) Find the potential energy when it reaches the highest point.

(b) Calculate the maximum height attained by it.

1. A 5 kg ball is dropped from a height of 10 m.

(a) Find the initial potential energy of the ball.

1. Find the kinetic energy just before it reaches the ground.
2. Calculate the velocity before it reaches the ground.
3. A body is thrown up with a kinetic energy of 10 J. If it attains a maximum height of 5 m. Find the mass of the body.
4. A ball of mass 1 kg is dropped from a height of 5 m.

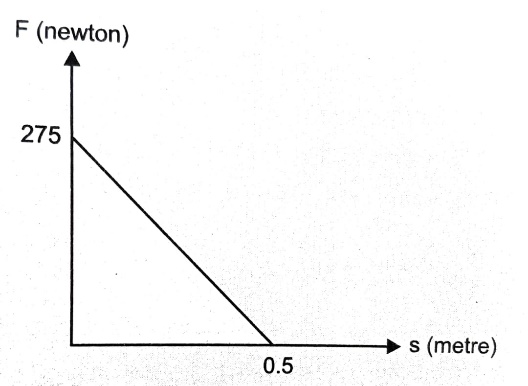
(a) Find the kinetic energy of the ball just before it reaches the ground.

(b) What is the speed at this instant?

1. A spring is compressed by a toy car of mass 150 g. On releasing the car, it moves with a speed of 0.2 m/s. Calculate the elastic potential energy of the spring.
2. 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.

**Based on Power :**

1. A boy of mass 50 kg runs up a staircase of 45 steps in 9 seconds. If the height of each step is 15 cm, find his power.
2. Two girls, each of weight 400 N, climb up a rope through a height of 8 m. We name one of the girl ‘A’ and other ‘B’. Girl ‘A’ takes 20 s while ‘B’ takes 50 s to accomplish this take. What is the power expended by each girl?
3. A car of mass 2000 kg is lifted up a distance of 30 m by a crane in 1 min. A second crane does the same job in 2 min. What is the power applied by each crane? Do the cranes consume the same or different amount of fuel?
4. What should be the power of an engine required to lift 90 metric tonnes of coal per hour from a mine whose depth is 200 m? ( 1 metric tonnes = 1000 kg).
5. How much time does it take to perform 500 J of work at the rate of 10 W?
6. An electric bulb of 60 W is used for 6 h per day. Calculate the ‘units’ of energy consumed in one day by the bulb. [ 1 KWh = 1 unit].
7. A lift is designed to carry a load of 4000 kg through 10 floors of a building, averaging 6 m per floor in 10 sec. Calculate the power of the lift.
8. A 60 kg person climbs stairs of total height of 20 m in 2 min. Calculate the power delivered.
9. The work done by the heart is 1 J per beat. Calculate the power of the heart if it beats 72 times/min.
10. A man exerts a force of 200 N in pulling a cart at a constant speed of 16 m/s. Calculate the power spent by the man.
11. Calculate the power of an engine required to lift 105 kg of coal per hour from a mine 360 m deep.
12. A man does 200 J of work in 10 s and a boy does 100 J of work in 4 s. Who is delivering more power? Find the ratio of the power delivered by the man to that delivered by the boy.
13. Compute the mechanical power provided by the internal forces within the body of a person of mass 80 kg who runs up a flight of stairs rising a vertical distance of m in 3 s.
14. What quantity does the area of the graph represent? What is the magnitude of this quantity?



1. What is the change in gravitational potential energy of a 50 kg person who climbs a flight of stairs with a height of 3 m.
2. A compact car travelling at 27 m/s on a level highway experiences a frictional force of 300 N due to air resistance and the friction of tyres with the road. What is the horse power of the engine of the car?
3. A lamp consumes 1000 J of electrical energy in 10 s. what is its power?
4. An electric heater is rated 1500 W. How much energy does it use in 10 hours?
5. Find the energy in KWh consumed in 10 hours by four devices of power 500 w each.

**Answers**

**Based on Work :**

1. 10 J 2. – 40 J 3. 225 J 4. – 5 x 108 J 5. 80000 J 6. 7.5 J

7. 0 8. 20000 J 9. 3300 J 10. 56 J 11. 2100 J

**Based on Kinetic Energy :**

1. 5 m/s 2. 2.5 kg 3. 120 J 4. 4000 J 5. 156250 J 6. 2 x 104 N

7. (a) 625 J (b) 0.625 m 8. 9 : 1 9. 1 : 2 10. 10 : 1 11. 0.5625 J

12. (a) 30 J (b) 2.7 m 13. 3733 kg 14. 179 J 15. (a) 60 J (b) – 60 J (c) 0

16. (a) 100 J (b) 225 J 17. 210 J 18. 208333.3 J

**Based on Potential Energy :**

1. 588 J 2. 200 J 3. 4 m 4. (a) 7.5 x 1011 J (b) 1.5 x 1012 J

5. 40 J 6. 250 J 7. (a) 600 J (b) 450 J 8. (a) 36 x 103 J (b) 30 m/s

9. (a) 250 J (b) 5 m 10. (a) 500 J (b) 500 J (c) m/s 11. 0.2 kg

12. (a) 50 J (b) 10 m/s 13. 3 x 10 – 3  J 14. P.E. = 2000 J , K.E. = 1000 J

**Based on Power :**

1. 375 W 2. 160 W , 64 W 3. 10 KW , 5 KW , Same amount of fuel 4. 50 KW

5. 50 s 6. 0.36 units 7. 240 KW 8. 100 W 9. 1.2 W 10. 3.2 KW

11. 100 KW 12. Boy delivers more power , 4 : 5 13. 800 W 14. 68.8 J 15. 1500 J

16. 11 hp 17. 100 W 18. 15 units 19. 20 units