



PHYSICS

BOOKS - PRADEEP PHYSICS (HINGLISH)

WORK AND ENERGY

Solved Problems

1. A boy pushes a book by applying a force of 40N. Fin the work done by this force as the

book is displaced through 25cm along the path.



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2. A ball of mass 1kg thrown upwards, reaches a maximum height of 4m. Calculate the work done by the force of gravity during the vertical displacement. ($g = 10m / s^2$).



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3. Find the amount of work done by a labor who carries n bricks of m kilogram each to the roof of a house h meter high by climbing a ladder.



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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 $5 \times 10^5 N$.





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5. A man weighing 70kg carries a weight of 10kg on the top of a tower 100 m high. Calculate the work done by the man.

$$(g = 10m / s^2)$$



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6. How fast should a man of mass 60kg run so that his kinetic energy is 750 J ?



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7. Find the mass of the body which has 5J of kinetic energy while moving at a speed of $2m / s$.

A. $2kg$

B. $2.5kg$

C. $3kg$

D. $3.5kg$

Answer: B



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8. A player kicks a ball of mass 250g at the centre of a field. The ball leaves his foot with a speed of 10m/s Find the work done by the player on the ball.



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9. A body of mass 5 kg initially at rest, is subjected to a force of 20N. What is the kinetic

energy acquired by the body at the end of half minute?



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10. A bullet of mass 20 g moving with a velocity of 500 m/s, strikes a free and goes out from the other side with a velocity of 400 m/s . Calculate the work done by the bullet in joule in passing through the tree.



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11. A body of mass 4kg, is taken from a height of 5 m to a height 10m. Find increase in potential energy.



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12. An object of mass 1kg is raised through a height h . Its potential energy increases by 1J. Find the height h .



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13. 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.



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14. A 5kg ball is dropped from a height of 10 m. (a) Find the initial potential energy of the ball. (b) Find the kinetic energy, just before it reaches the ground and (c) Calculate the velocity before it reaches the ground.



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15. A body is thrown up with a kinetic energy of 10J. If it attains a maximum height of 5m, find the mass of the body.



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16. A rocket of mass 3×10^6 kg takes off from a launching pad and acquires a vertical velocity of 1km//s and an altitude of 25km. Calculate its
(a) potential energy (b) kinetic energy.



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17. A boy of mass 40 kg runs up a flight of 50 steps, each of 10 cm high, in 5s, Find the power developed by the boy,

A. 200W

B. 300W

C. 400W

D. 500W

Answer: C



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18. A car of mass 2000 kg is lifted up a distance of 30m 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? Neglect power dissipation against friction.



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19. What should be the power of an engine required to lift 90 metric tonnes of coal per hour from a mine whose depth is 200m?



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20. How much time does it take to perform 500J of work at a rate of 10W?

A. 20s

B. 30s

C. 40s

D. 50s

Answer: D



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21. Calculate the units of energy consumed by
100W electric bulb in 5 hours,



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22. A lift is designed to carry a load of 4000 kg through 10 floors of a building, average 6m per floor, in 10s. Calculate the power of the lift.



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Ncert Questions

1. A force of 7N acts on an object. The displacement is, say 8m, in the direction of the force, Let us take it that the force acts on the

object throughout the displacement. What is the work done in this case ?

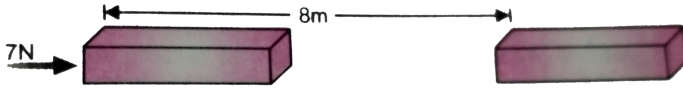


FIGURE 5.16



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2. When do we say that work is done ?



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



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4. Define 1 J of work.



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5. A pair of bullocks exerts of work done on an onject when a force of 1 N displaces it by 1m along the line of action of the force.



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6. What is the kinetic energy of an object ?



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7. Write an expression for kinetic energy of an object.



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8. The kinetic energy of an object of mass m moving with a velocity of $5m/s$ 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 ?



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9. What is power ?



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10. Define 1 W of power.



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





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12. Define average power.



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13. Look at the activities listed below. Reason out whether or not work is done in the light of your understanding of the term 'work'. (a) Suma is swimming in a pond. (b) A donkey is carrying a load on its back. (c) A wind-mill is lifting water from a well. (d) A green plant is

carrying out photosynthesis. (e) An engine is pulling a train. (f) Food grains are getting dried in the Sun. (g) A saliboat is moving due to wind energy.



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14. An object thrown at a certain angle to the ground moves in a curved path and falls back to the ground. The intial and the final points of the path object lie on the same horizontal

line. What is the work done by the force of gravity on the object ?



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15. A battery lights a bulb. Describe the energy changes involved in the process.



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16. Certain force acting on a 20 kg mass changes its velocity from $5m/s \rightarrow 2m/s$.

calculate the work done by the force.



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



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



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19. What are the various energy transformations that occur when you are riding a bicycle ?



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20. Does the transfer of energy take place when you push a huge rock with all your might and fail to move it ? Where is the energy you spend going ?



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21. A certain household has consumed 250 units of energy during a month. How much energy is this in joules ?

A. $9 \times 10^8 J$

B. $9 \times 10^6 J$

C. $0.9 \times 10^6 J$

D. $0.9 \times 10^8 J$

Answer: A



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22. 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.



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23. What is the work done by the force of gravity on a satellite moving round the Earth ?
Justify your answer.



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24. Can there be displacement of an object in the absence of any force acting on it ? Think. Discuss this question with your friends and teacher.



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25. 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.



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

A. 12 units

B. 20 units

C. 15 units

D. 10 units

Answer: C



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27. 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 ?\



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28. An object of mass m is moving with a constant velocity v How much work should be

done on the object in order to bring the object to rest ?



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29. Calculate the work required to be done to stop a car of 1500kg moving with a speed of $60\text{km} / \text{h}$.



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30. 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.

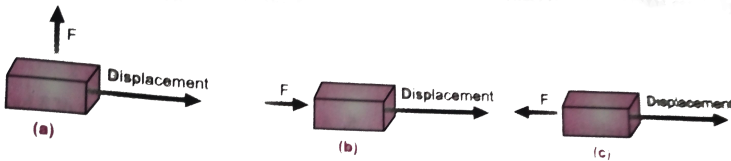


FIGURE 6.26



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31. Soni says that the acceleration in an object could be zero even when several forces are acting on it. Do you agree with her ? Why ?



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32. find the energy in kWh consumed in 10 hours by four devices of power 500 W each.



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



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Short Answer Questions

1. A rocket is moving up with a velocity v if the velocity of this rocket is suddenly tripled, what will be the ratio of two kinetic energies ?



2. Avinash can run with a speed of 8 m/s against the frictional force of 10 N , and Kapli can move with a speed of 3 m/s against the frictional force of 25 N . Who is more powerful and why ?

- A. Kapil is more powerful.
- B. Avinash is more powerful.
- C. Both have some power.
- D. Cannot be determined

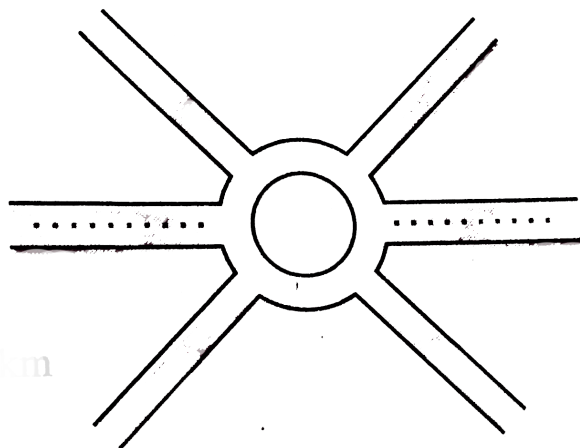
Answer: B



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3. A boy is moving on a straight road against a frictional force of 5 N. After travelling a distance of 1.5 km, he forgot the correct path at a round about, of radius 100m. However, he moves on the circular path for one and half cycle and then he moves forward upto 2.0 km.

Calculate the work done by him.



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4. Can any object have mechanical energy even if its momentum is zero? Explain.



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5. Can any object have mechanical energy even if its momentum is zero? Explain.



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6. The power of a motor pump is 2kW. How much water per minute the pump can raise to a height of 10 m? (Given $g = 10\text{m} / \text{s}^2$)



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7. The weight of a person on a planet A is about half that on the Earth. He can jump upto 0.4 m height on the surface of the Earth. How high can he jump on the planet A ?



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8. The velocity of a body moving in a straight line is increased by applying a constant force F , for some distance in the direction of the motion. Prove that the increase in the kinetic

energy of the body is equal to the work done by the force on the body.



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9. Is it possible that an object is in the state of accelerated motion due to external force acting on it, but no work is being done by the force. Explain it with as example.



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10. A ball is dropped from a height of 10 m. If the energy of the ball reduces by 40% after striking the ground, how much high can the ball bounce back? ($g = 10\text{m} / \text{s}^2$)

A. 4 m

B. 8 m

C. 6 m

D. 5 m

Answer: C



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11. If an electric iron of 1200 W is used for 30 minutes everyday, find electric energy consumed in the month of April.



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Long Answer Questions

1. A light and a heavy object have the same momentum. Find out the ratio of their kinetic

energies. Which one has a larger kinetic energy?



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2. An automobile engine propels a 1000 kg car (A) along a levelled road at a speed of 36 km/h. Find the power if the opposing frictional force is 100 N. Now, suppose after travelling a distance of 200 m, this car collides with another stationary car (B) of same mass and comes to rest. Let its engine also stop at

the same time. Now car (B) starts moving on the same level road without getting its engine started. Find the speed of the car (B) just after the collision.



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3. A girl having mass of 35 kg sits on a trolley of mass 5 kg. The trolley is given an initial velocity of 4 m/s by applying a force. The trolley comes to rest after traversing a distance of 16m. (a) How much work is done on the

trolley ? (b) How much work is done by the girl ?



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4. Four men lift a 250 kg box to a height of 1m and hold it without raising or lowering it.

(a) How much work is done by the men in lifting the box ? (b) How much work do they do in just holding it ? (c) why do they get tired while holding it ? ($g = 10m / s^2$)



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5. What is power ? How do you differentiate kilowatt from kilowatt hour ? The Jog Falls in Karnataka state are nearly 20 m high. 2000 tonnes of water falls from it in a minute. Calculate the equivalent power if all this energy can be utilized ? ($g = 10\text{m} / \text{s}^2$)



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6. How is the power related to the speed at which a body can be lifted ? How many

kilograms will a man working at the power of 100 W, be able to lift at constant speed of 1 m/s vertically? ($g = 10\text{ m/s}^2$)



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7. Define watt. Express kilowatt in terms of joule per second. A 150 kg car engine develops 500 W for each kg. What force does it exert in moving the car at a speed of 20 m/s ?



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8. Compare the power at which each of the following is moving upwards against the force of gravity ? ($g = 10 \text{ m/s}^2$) (i) a butterfly of mass 1.0 g that flies upward at a rate of 0.5 m/s. (ii) a 250 g squirrel climbing up on a tree at a rate of 0.5 m/s.



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Very Short Answer Question

1. How is work done by a force measured ?



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2. When is work done by a force positive ?



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3. When is work done by a force negative ?



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4. When is work done by a force zero ?



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5. Is work a scalar quantity or a vector quantity ?



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6. Is a person doing any work by holding a suitcase ?



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7. what are the units of work and energy ?



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8. Is energy a vector quantity ?



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9. Name two forms of mechanical energy.



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10. By how much will the kinetic energy of a body increase if its speed is doubled ?



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11. A body is thrown vertically upwards ? Its velocity goes on decreasing. What happens to its kinetic energy as its velocity becomes zero ?



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12. Flowing water can rotate a turbine. What type of energy is used up by the turbine ?



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13. What type of energy is possessed by a cricket ball just before being caught by a fielder ?



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14. Explain by a an example that a body may possess energy when it is not in motion.



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15. How is energy stored in a clock ?



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16. Give an example where potential energy is acquired by a body due to change of its shape.



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17. Name the type of energy possessed by a raised hammer.



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18. Name the type of energy possessed by a stretched rubber band.



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19. A cell converts one form of energy into another. Name the two forms.



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20. Name the device which converts electrical energy into mechanical energy.



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21. Name a machine that transforms muscular energy into useful mechanical work.



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Short Answer Questions 2 Marks

1. What do the machines need for their working ?



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2. Why do some engines require fuels like petrol and diesel ?



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3. How does a bullet pierce a target ?



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4. How does the wind move the blades of a wind-mill ?





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5. How much energy is possessed by a moving body by virtue of its motion ?



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6. What is the difference between potential energy and kinetic energy ?



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7. What is meant by the term potential energy ? Give its two examples.



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8. A nail becomes warm when it is hammered into a plank. Explain why ?



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9. When an arrow is shot from a bow, it has kinetic energy. From where does it get the

kinetic energy ?



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10. What type of energy is stored in the spring of a watch?



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Short Answer Question 3 Marks

1. What do you mean by work ? Give its scientific conception.



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2. What is the work done by a constant force ?

When is it positive, negative or zero ?



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3. What do you understand by the term energy?
? Given its scientific conception.



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4. How does an object possessing energy perform work? What is the unit of energy?



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5. Define kinetic energy. Give some examples of bodies possessing kinetic energy.



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6. What do you mean by the term potential energy ? Give some examples of bodies possessing potential energy ?



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7. Name a few forms of energy and their transformation into each other.



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8. What do you mean by the law of conservation of energy ?



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9. What do you mean by power of an agent ?

Give an expression for power.



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Long Answer Question 3 Marks

1. What do you mean by kinetic energy ? Derive an expression for the kinetic energy of an object of mass m moving with velocity, v .



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2. Define potential energy. Derive an expression for the potential energy of a body of mass m , at a height h above the surface of the Earth.



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3. Prove that the energy remains constant in case of a freely falling body.



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Question With Answers

1. why do living beings and machines need energy ?



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2. When a constant force is applied to a body moving with constant acceleration, is the power, of the force constant ? If not, how would force have to vary with speed for the power to be constant ?



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3. A light and a heavy body have the same kinetic energy. Which one of the two will have greater momentum ?



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4. A light body and a heavy body have the same momentum, which of the two bodies will have greater kinetic energy ?



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5. A lorry and a car, moving with the same kinetic energy are brought to rest by application of brakes which provided equal retarding forces. Which one of them will come to rest in a shorter distance ?



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6. How do you differentiate between energy and power ?



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7. Can a body have energy without having momentum ?



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8. Is it possible to have a situation where mechnial energy (E) - potential energy (E_p) is negative, i.e., $(E - E_p) < 0$?



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Value Based Questions

1. Many people debate about whether there is a God, or what God is. Is God and individual personality, sitting up in heaven listening to and granting out request, or is God simply all the energy that exists in the Universe, or is God simply nature or the laws of nature ?



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2. In Physics, energy is an indirectly observed quantity that is often understood as the ability of a physical system to do work on other physical system. However, this must be understood as simplified definition as we shall come to know in higher classes that not all energy can perform work. (a) How did the concept of energy emerge ? (b) How much electric energy is generated in a typical lightning strike ? What are the forms to which this energy gets converted ? (c) What is the kinetic energy of a passenger seated in a

moving plane : (i) with respect to the place (ii)
with respect to the Earth.



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3. The recent horrific storm surge flooding New Jersey and New York in US by Hurricane Sandy was almost perfectly predicted well in advance, but was more extreme than the average person might expect from a minimal hurricane. There is a metric that quantifies the energy of a storm based on how far out

tropical - storm force winds extend from the centre, known as Integrated Kinetic Energy (IKE).

(i) What is Sandy's ranking in terms of *IKE* among all the hurricanes witnessed so far ?

(ii) What is the *IKE* of sandy ?

(iii) How was sandy different from Hurricane Katrina ?

(iv) Which human value did Sandy generate among the people round the globe ?



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4. The global climate has always fluctuated. Millions of years ago, some parts of the world that are now quite warm, were covered with ice, and over recent centuries, average temperature have risen and fallen in cycles. What is new, however, is that current and future climate change will be caused not just by natural events but also by activities of human beings. Suggest three simple ways to help save our planet.



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Section A Mock Test

1. When is gravitational potential energy of a body positive ?



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2. What happens to their gravitational potential energy when firefighters slide fire pole ?



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3. The kinetic energy of a freely falling ball is not conserved. Why is this not a violation of the law of conservation of energy ?



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4. When a ball is hung from a vertical spring, it stretches the spring. As it drops, it loses gravitational potential energy , but this does not at all show up as kinetic energy. What

happens to the gravitational potential energy

?



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5. A block of wood loses 100 J of gravitational potential energy as it slides down a ramp. If it has 90 J of kinetic energy at the bottom of the ramp, what can you conclude ?



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6. Describe the energy transformations that occur as the Earth orbits the sun in its elliptical orbit.



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7. You lift a box weighing 200 N from the floor to a shelf 1.5 m above. (a) What is the maximum work done by the force you exert on the box? (b) When would the work be greater than this maximum?





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8. Why does a saw become warm when it is used to cut a log of wood ? State the energy transformation taking place.



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9. Find the power of an engine which lifts 90 metric tonnes of coal per hour from a depth of 200m.



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10. Distinguish between energy and power.



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11. What is the commercial unit of electric energy? Obtain the relation between this unit and the SI unit of energy.



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12. You can decrease the kinetic energy of an object as much as you want. You can do so by either reducing mass by half or reducing the speed by half. Which option would you pick, and why?



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13. An automobile travelling with a speed $60\text{km} / \text{h}$, can brake to stop within a distance

of $20m$. If the car is going twice as fast i. e. , $120km / h$, the stopping distance will be



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14. What do you mean by power ? Derive a relation between power and velocity.



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15. What is gravitational potential energy ? Obtain an expression for it in case of a body of

mass m and at a height h above the Earth's surface.



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16. A tank of size $5\text{ m} \times 5\text{ m} \times 5\text{ m}$ is full of water and built on ground. Find the potential energy of the water in the tank.



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17. 300J of work is done in sliding a 2kg block up an inclined plane of height 10m. Taking $g = 10 \text{ m/s}^2$, work done against friction is



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18. Many people debate about whether there is a God, or what God is. Is God and individual personality, sitting up in heaven listening to and granting out request, or is God simply all

the energy that exists in the Universe, or is God simply nature or the laws of nature ?



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19. (a) A student throws a ball vertically upward so that it just reaches the height of window on the second floor of a dormitory. At the same time the ball is thrown upward, a student at the window drops a ball. Are the mechanical energies of the ball the same at

half the height of the window ? Explain (b)

What does work- energy theorem state ?



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20. Two students who weigh the same start at the same ground floor location at the same time to go to the same classrooms on the third floor by different routes. If they arrive at different times, which student will have expended more power ? Explain.



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21. The concept of energy and its transformation is useful in explaining and predicting most natural phenomena. (a) What is the concept of energy in the context of chemistry ? (b) How do we associate energy with biology ? (c) What is the role of energy transformations in geology ? (d) What role does energy play in life ?



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22. A bullet of mass 20 g moving with a velocity of 500 m/s, strikes a free and goes out from the other side with a velocity of 400 m/s . Calculate the work done by the bullet in joule in passing through the tree.



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23. (a) Why can we not associate a potential energy with the frictional force as we did with the gravitational force ? (b) A uniform chain of

mass m and length l is lying on a table with $(1/4)$ of its length hanging freely from the edge. Find the amount of work required to be done in dragging the chain on the table completely.



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24. What is power ? How do you differentiate kilowatt from kilowatt hour ? The Jog Falls in Karnataka state are nearly 20 m high. 2000 tonnes of water falls from it in a minute.

Calculate the equivalent power if all this energy can be utilized ? ($g = 10\text{m} / \text{s}^2$)



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Multiple Choice Questions

1. When a body falls freely towards the earth, then its total energy

A. Increases

B. decreases

C. remains constant

D. first increases and then decreases

Answer: C



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2. A car is accelerated on a levelled road and attains a velocity 4 times of its initial velocity.

In this process, the potential energy of the car

A. does not change

B. becomes twice that of initial

C. becomes 4 times that of initial

D. becomes 16 times that of initial

Answer: A



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

A. 0°

B. 45°

C. 90°

D. 180°

Answer: D



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4. An iron sphere of mass 10 kg has the same diameter as an aluminium sphere of mass 3.5 kg. Both spheres are dropped simultaneously

from a tower. When they are 10 m above the ground, they have the same

- A. acceleration
- B. momenta
- C. potetnial energy
- D. kinetic energy

Answer: A



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5. A girl is carrying a school bag of 3 kg mass on her back and moves 200 m on a levelled road. If the value of g be 10 m/s^2 , the work done by the girl against the gravitational force will be :

A. $6 \times 10^3 J$

B. 6 J

C. 0.6 J

D. zero

Answer: D



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

A. joule

B. newton metre

C. kilowatt

D. kilowatt hour

Answer: C



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

A. displacement

B. force applied

C. angle between force and displacement

D. initial velocity of the object

Answer: D



8. Water stored in a dam possesses

A. no energy

B. electrical energy

C. kinetic energy

D. potential energy

Answer: D



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9. A body is falling from a height h . After it has fallen a height $\frac{h}{2}$, 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

Answer: C



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1. A force of 5 N is acting on an object. The object is displaced through 2 m in the direction of the force (Fig. 11.2). If the force acts on the object all through the displacement, then work done is $5N \times 2m = 10N\text{ m}$ or $10J$.

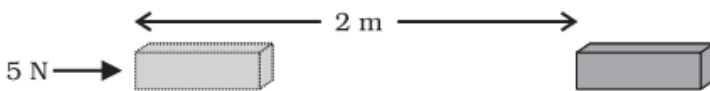


Fig. 11.2



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2. A porter lifts a luggage of 15kg from the ground and puts it on his head 1.5m above the ground. Calculate the work done by him on the luggage.



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3. Calculate the work done by a student in lifting 0.5kg book from the ground and keeping it on a shelf 1.5m high.



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4. A coolie carries a load of 50 kg on his head and walks on a level road upto 100m. What is the work done by him?



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5. A crane pulls up a car of mass 500kg to a vertical height of 4m. Calculate the work done by the crane.



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6. A boy of mass 55kg runs up a flight of 40 stairs, each measuring 0.15m. Calculate the work done by the boy.



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7. An object of mass 15kg is moving with a uniform velocity of 4m/s. What is the kinetic energy possessed by the object?



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8. 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 1500kg ?



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9. A bullet of mass 0.03 kg moving with a speed of 400m/s penerates 12 cm into fixed block of wood. Calculate the average force exerted by the wood on the bullet.



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10. A bullet of mass 5 g travels with a speed of 500m/s. If it penetrates a fixed target which offers a constant resistive force of 1000N to the motion of the bullet, find (a) the initial kinetic energy of the bullet (b) the distance through which the bullet has penetrated.



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11. Two bodies of equal masses move with uniform velocities v and $3v$ respectively. Find the ratio of their kinetic energies.



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12. The mass of a ball A is double 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 B,



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13. A truck weighing 5000 kg f and a cart weighing 500 kg f are moving with the same

speed. Compare their kinetic energies.



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14. A bullet of mass 20g is found to pass two points 30m apart in 4 s? Assuming the speed to be constant, find its kinetic energy?



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15. Find the energy possessed by an object of mass 10 kg when it is at a height of 6 m above

the ground. Given, $g = 9.8m / s^2$



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16. An object of mass 12 kg is at a certain height above the ground if the potential energy of the object is 480J find the height at which the object is with respect to the ground Given, $g = 10m / s^2$

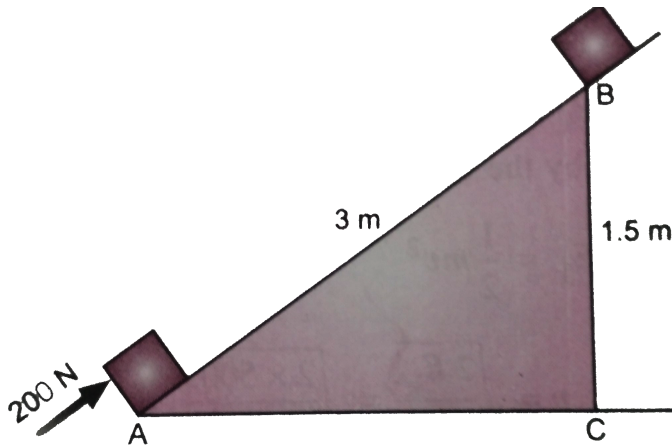


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17. A block of mass 30 kg is pulled up by a rope as shown in Fig. with a constant speed by applying a force of 200 N parallel to the slope. A and B are initial and the final positions of the block. Calculate:

- (a) the work done by the force in moving the block A to B,
- (b) the potential energy gained by the block,
- (c) account for the difference in work done the force and the increase in potential energy of

the block.

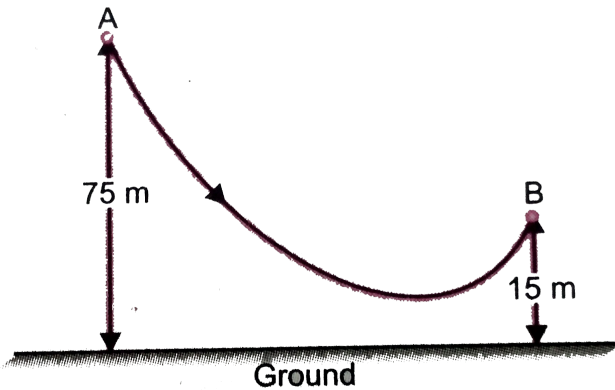


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18. shows a ski -jump. A skier of mass 60 kg stands at A at the top of the ski-jump. He moves from A to B and takes off for his jump at B.

(a) Calculate the change in the gravitational potential energy of the skier between A and B.

(b) If 75 % of the energy in part (a) becomes the kinetic energy at B, calculate the speed at which the skier arrives at B.



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19. Calculate the increase in potential energy as a block of 2kg is lifted through 2m.



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20. A ball of mass 1kg is dropped from a height of 5m. (a) Find the kinetic of the ball just before it reaches the ground (b) What is the speed at this instant?



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21. A body of mass 5kg falls from a height of 5m. How much energy does it possess at any instant?



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



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23. Two girls each of weight 400N, climb up a rope through a height of 8m. We name one of the girls A and the other B. Girl A takes 20s while B takes 50s to accomplish this task. What is the power expended by each girl.



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24. A boy of mass 50kg runs up a staircase of 45 steps in 9s. If the height of each step is 15cm, find his power. Take $g = 10m / s^2$





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25. 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.



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26. A 60 kg person climbs stairs of total height 20m in 2min. Calculate the power delivered.



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27. The work done by the heart 1J per beat.
Calculate the power of the heart if it beats 72
times/min.



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28. A man exerts a force of 200N in pulling a
cart at a constant speed of $16m/s$ Calculate
the power spent by the man.



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29. Calculate the power of an engine required to lift 10^5 kg of coal per hour from a mine 360 m deep.



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30. A man does 200 J of work in 10s and a boy does 100 J of work in 4s. (a) who is delivering more power? (b) Find the ratio of the power delivered by the man to that delivered by the boy.



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Continuous Assessment

1. What amount of work is done in reading this book in terms of scientific definition of work?



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2. What is the relation between a joule (J) and a newton (N)?



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3. What type of energy does a torpedo in motion possess ?



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4. which has a greater kinetic energy : a supertanker berthed at a pier or a motor boat pulling a water skier?



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5. Compare the kinetic energies of two identical objects A and B when velocity of object A is twice that of object B.



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6. A fountain of water shoots high in air. What provides the force that does positive work on the water?



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7. What is meant by kinetic energy?



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8. What do you mean by dissipation of energy ?



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9. What is 1 MJ ?



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10. What is the origin of the word "kinetic"?



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11. (a) Which quantity provides a link between force and energy ?

(b) What is the amount of work done in trying to move a huge rock but failing to do so?



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12. (a) What is the cause of kinetic energy possessed by a body?

(b) can kinetic energy of a body ever be negative?



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13. (a) Compare the kinetic energies of two identical bodies, one moving north and the other moving south with same speed.

(b) What happens to the kinetic energy of an

object if its mass is doubled while its velocity remains the same



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14. (a) Which of the following does the most work : a force of 3N acting through a distance of 3 m or a force of 4N acting through a distance of 2m?

(b) How much work is done by the centripetal force?



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15. (a) How is the energy of an object measured?

(b) What does work - energy theorem state?



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16. When is the work done by gravity negative ?



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17. What happens when a body performs work?



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18. How can you visualize a joule of energy ?



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19. An object has velocity toward south if a force is directed toward the north, will the kinetic energy increase, decrease, or stay the same ?



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20. Two objects have different masses but the same kinetic energy. If you stop them with the same retarding force, which one will stop in the shorter distance?



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21. A person pushes a 72 kg patient on a 15 kg trolley, producing an acceleration of

$0.60m / s^2$ (a) How much work does the person do by pushing the patient and the trolley through a distance of 2.5m ? Assume the trolley moves without friction. (b) How far must the person push the trolley to do 140J of work. (c) Does the work done by the person depends on the speed of the trolley?



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22. A truck moving at $15m / s$ has KE of 4.2×10^5 J (a) what is the mass of the truck ?

(b) By what multiplicative factor does the kinetic energy of the truck increase if its speed is doubled?



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23. How much work is required for a 74Kg sprinter to accelerate from rest to 2.2 m//s?



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24. A woman lifts a box weighing 40N 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.



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Assessment Through Paper Pen Test

1. If KE of a body increases by 300 % , by what % will the linear momentum of the body increase?

A. 20 %

B. 50 %

C. 100 %

D. 200 %

Answer: C



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2. If the linear momentum is increased by 50%, then KE will be increased by :

A. 50 %

B. 100 %

C. 125 %

D. 25 %

Answer: C



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3. Two bodies of masses m and $4m$ are moving with equal linear momenta. The ratio of their kinetic energies is :

A. 4 : 1

B. $\sqrt{2} : 1$

C. 1 : 2

D. 1 : 16

Answer: A



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4. A 4 kg mass and 1kg mass are moving with equal kinetic energies. The ratio of there momentum is :

A. 1 : 2

B. 1 : 1

C. 2 : 1

D. 4 : 1

Answer: C



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5. The KE acquired by a mass m in travelling a certain distance s , starting from rest, under the action of a constant force is directly proportional to :

A. m

B. \sqrt{m}

C. $\frac{1}{\sqrt{m}}$

D. none of these

Answer:



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6. A car weighing 500 kg moving against a resistance of 500 N, accelerates from rest to 20 m/s in 100m ($g = 10\text{ m/s}^2$). The work done by the engine of the car is :

A. 1.0×10^J

B. $1.5 \times 10^5 J$

C. $1.05 \times 10^5 J$

D. the information given is insufficient

Answer: B



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7. When a player hits a football, it moves along the curved path (parabolic path) and then falls to the ground. What is the work done by the force of gravity on the football ?



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8. What change should be affected in the velocity of the body to maintain same kinetic energy if its mass is increased four times ?



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9. The Earth moving round the sun in a circular orbit is acted upon by a force and hence work must be done on the Earth by the force. Do you agree with this statement ?



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10. What happens to the kinetic energy of the molecules of a substance when it is cooled ?



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11. Why does a saw become warm when it is used to cut a log of wood ? State the energy transformation taking place.



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12. What do you mean by kinetic energy ?

Derive an expression for the kinetic energy of an object of mass m moving with velocity, v .



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13. The force exerted by a certain bow on an arrow decreases linearly after the arrow is released by the archer, starting with a value $F = 275 \text{ N}$ when the bow is fully drawn and decreasing to $F = 0$ as the arrow leaves the bow string. The tail of the arrow moves a distance

of 0.5 m as the arrow is shot. Find the final speed of the arrow, which has a mass of $3 \times 10^{-2} \text{ kg}$.



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14. Tarzan, who weighs 875 N, swings from a vine through the jungle. How much work is done by the vine as he drops, through a vertical distance of 4 m ?



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15. The sign of work done by a force is important to understand. State carefully if the following quantities are positive or negative.

(a) Work done by a man in lifting a bucket out of a well by means of a rope tied to the bucket.

(b) Work done by the gravitational force in the above case. (c) Work done by friction on a body sliding down an inclined plane. (d) Work

done by an applied force on a body moving on a rough horizontal plane with uniform velocity.

(e) Work done by the resistive force of air on a vibrating pendulum in bringing it to rest.



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16. A rod of mass m and length l is lying on a horizontal table. Work done in making it stand on one end will be

A. mgl

B. $mgl / 2$

C. $mgl / 4$

D. $2mgl$

Answer: B



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17. A ball of mass 50 g is thrown upwards. It rises to a maximum height of 100m. At what height its KE is reduced to 70% ?

A. 30 m

B. 40 m

C. 60 m

D. 70 m

Answer: A



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

A. 18 J

B. 4.5 J

C. 9 J

D. 2.25 J

Answer: C



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19. A body of mass m , accelerates uniformly from rest to V_1 in time t_1 . The instantaneous power delivered to the body as a function of time t is.

A. $\frac{1}{2} \frac{mv^2}{T^2} t$

B. $\frac{1}{2} \frac{mv^2}{T^2} t^2$

C. $\frac{mv^2}{T^2} t$

D. $\frac{mv^2}{T^2} t^2$

Answer:



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20. At sea level, a nitrogen molecule in air has an average translational kinetic energy of $6.2 \times 10^{-21} J$. its mass is $4.7 \times 10^{-26} kg$. If the molecule shoots up straight without resistance, it will rise to a height of :

A. 1.35 km

B. 13.5km

C. 135km

D. 1350km

Answer: B



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21. The power of a water pump is 2 kW. If $g = 10m/s^2$, the amount of water it can raise in 1 min to a height of 10 m is :

A. 2000 litre

B. 1000 litre

C. 100 litre

D. 1200 litre

Answer: D



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22. Two identical objects made of iron and wood, are allowed to fall from the same height on a heap of sand. It is found that the iron object penetrates more in the wooden object.

Which of the two objects has more potential energy ?



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23. What kind of energy transformation take place in an electric fan and a loudspeaker ?



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24. State the energy transformation taking place when a boy is riding a bicycle.



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25. A spring which is kept compressed by tying its ends together is allowed to be dissolved in an acid. What happens to the potential energy of the spring ?



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26. An aeroplane's velocity is doubled, What happens to kinetic energy ? Is the law of

conservation of energy obeyed ?



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27. Represent graphically the variation of kinetic energy (E_k), potential energy (E_p) and total energy (E) of a body falling freely from a height h . At what height is $E_p = E_k$?



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28. A skier starts from rest at the top of a ski slope and skis downhill. Find the skier's speed after her elevation decreases by 10m, assuming no work is done by friction or air resistance.



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29. Water is pumped out of a well 10m deep by means of a pump rated at 10 kW. Find the

efficiency of the motor if 4200 kg of water is pumped out every minute. Take $g = 10\text{m} / \text{s}^2$.



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30. Explain the difference between work, energy and power. Give their expression and the units in which these are measured.



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Continuous Assessment I Oral Testing

1. What are the other names of potential energy ?



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2. What is the cause of elastic potential energy of a body ?



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3. What is the gravitational potential energy of a body of mass m at a height h ?



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4. Is gravitational potential energy of an object path dependent ?



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5. How is nuclear energy converted into electrical energy ?



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6. What measures the speed at which work is done ?



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7. What is the other name of power ?



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8. What is the relation between a watt (W) and a joule (J) ?



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9. How is horse power (hp) related to a watt (W) ?



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10. What is meant by the abbreviation BOTU ?



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li Quiz Testing

1. (a) What are the various types of potential energy ? (b) What type of energy is stored in a dam ?



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2. (a) What is the gravitational potential energy of an object on Earth due to ? (b) At which point in the swing of an ideal simple pendulum (ignoring friction) is the gravitational potential energy the maximum ?



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3. (a) Under what conditions energy is conserved ? (b) What is the only restriction to the principle of conservation of energy ?



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4. (a) How is light energy converted into chemical energy ? (b) How is light energy into electric energy ?



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5. (a) What is mechanical energy ? (b) What is electromagnetic energy ?



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iii Quiz Testing

1. What would have happened if nature had not allowed the transformation of energy ?



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2. When gravity is the only force doing work on a body, what can we say about its energy ?



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3. What happens to the total energy of a star that undergoes a supernove explosion ?



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4. What does the gravitational potential energy imply ?



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5. When a person does work, what determines his sence of fatigue : total work done or the

rate at which he works ?



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6. What is the implication of negative potential energy of a body ?



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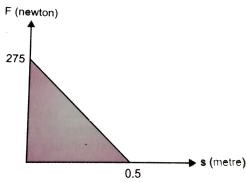
7. Compute the mechanical power provided by the internal forces within the body of a person

of mass 80 kg who runs up a flight of stairs rising a vertical distance of 3m in 3s.



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8. What quantity does the area of the graph represent ? What is the magnitude of this quantity ?



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9. What is the change in gravitational potential energy of a 50 kg person when climbs a flight of stairs with a height of 3m and a horizontal extent of 5m ?



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10. 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 ?



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