PHYSICS

BOOKS - FULL MARKS PHYSICS (TAMIL ENGLISH)

WORK, ENERGY AND POWER

In Text Solved Examples

1. A box is pulled with a force of 25 N to produce a displacement of 15 m. If the angle between the force and displacement is 30°. Find the work done by the force ?

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2. An object of mass 2 kg falls from a height of 5 m to the ground. What is the work done by the gravitational force on the object? (Neglect air

resistance, Take $g = 10ms^{-2}$).

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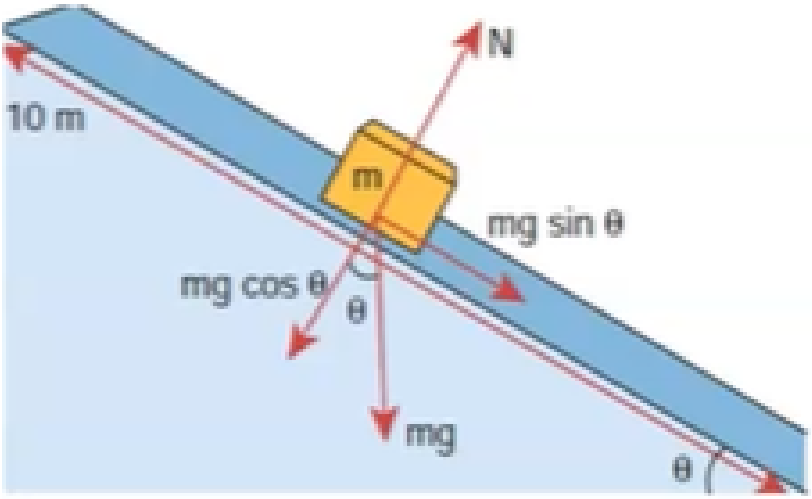
3. An object of mass $m = 1kg$ is sliding from top to bottom in the frictionless inclined plane of inclination angle $\theta = 30^{\circ}$ and the length of inclined plane is 10m as shown in the figure. Calculate the work done by gravitational force and normal force on the object Assume acceleration due to gravity, $g = 10ms^{-2}$



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4. If an object of mass 2 kg is thrown up from the ground reaches a height of 5 m and falls back to the Earth (neglect the air resistance) Calculate

(a) The work done by gravity when the object reaches 5 m height

(b) The work done by gravity when the object comes back to Earth

(c) Total work done by gravity both in upward and downward motion and mention the physical significance of the result

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5. A weight lifter lifts a mass of 250 kg with a force 5000 N to the height of 5 m.

(a) What is the work done by the weight lifter!

(b) What is the work done by the gravity?

(c) What is the network done on the object?

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6. A variable force $F = kx^2$ acts on a particle which is initially at rest. Calculate the work done by the force during the displacement of the particle from $x = 0m to x = 4m$. (Assume the constant $k = 1Nm^{-2}$)

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7. Two objects of masses 2 kg and 4 kg are moving with the same momentum of 20 kg ms

(a) Will they have some kinetic energy!

(b) Will they have same speed?

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8. An object of mass 2 kg is taken to a height 5 m from the ground $\left(g = 10ms^{-2}\right)$.

(a) Calculate the potential energy stored in the object

(b) Where does this potential energy come from?

(c) What external force must act to bring the mass to that height?

(d) What is the net force that acts on the object while the object is taken to the height h?

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9. Let the two springs A and B be such that $K_A > K_B$, On which spring will more work has to be done if they are stretched by the same force ?

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10. A body of mass m is attached to the spring which is elongated to 25 cm by an applied for from its equilibrium position,

(a) Calculate the potential energy stored in the spring-mass system?

(b) What is the work done by the spring force in this elongation?

(C) Suppose the spring is compressed to the same 25 cm, calculate the potential energy stored and also the work done by the spring force during compression. (The spring constant,$k = 0.1Nm^{-1}$).

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11. Match the following

1.	J.J. Thomson	(a)	Atomic model for hydrogen atom
2.	Rutherford	(b)	Theoretical atom model
3.	Geiger and Marsden	(c)	Nucleus
4.	Neils Bohr	(d)	Scattering of alpha particles

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12. Consider an object of mass 2 kg moved by an external force 20 N in a surface having coefficient of kinetic friction 0.9 to a distance 10 m. What is the work done by the exteranl force and kinetic friction? Comment on the result. (Assume $g = 10m^{-2}$)

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13. An object of mass 1 kg is falling from the heighth - 10 m. Calculate

(a) The total energy of an object at h = 10

(b) Potential energy of the object when it is at h = 4 m

(c) Kinetic energy of the object when it is at h = 4 m

(d) What will be the speed of the object when it hits the ground?

Assume $g = 10ms^{-2}$)

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14. A body of mass 100 kg is lifted to a height 10 m from the ground in two different ways as shown in the figure. What is the work done by the gravity in both the cases? Why is it easier to take the object through a ramp?

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15. An object of mass m is projected from the ground with initial speed v_0

Find the speed at height h.

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16. An object of mass 2 kg attached to a spring is moved to a distance x = 10 m from its equilibrium position. The spring constant $k = 1Nm^{-1}$ and assume that the surface is frictionless

(a) When the mass crosses the equilibrium position, what is the speed of the mass?

(b) What is the force that acts on the object when the mass crosses the equilibrium position

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17. Water in a bucket tied with rope whirled around in a vertical circle of radius 0.5 m. Calculate the minimum velocity at the lowest point so that the water does not spill from it in the course of motion. $\left(g = 10ms^{-1}\right)$

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18. Calculate the energy consumed in electrical units when a 75 W fan is used for 8 hours daily for one month (30 days)

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19. A vehicle of mass 1250 kg is driven with an acceleration 0.25 ms^{-2} along a straight level road against an external resistive force 500 N. Calculate the power delivered by the vehicle's engine if the velocity of the vehicle is 30 ms^{-1}.

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20. A lighter particle moving with a speed of $10ms^{-1}$ collides with an object of double its mass moving in the same direction with half its speed. Assume that the collision is a one dimensional clastic collision. What will be the speed of both particles after the collision?

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21. A bullet of mass 50 g is fired from below into a suspended object of mass 450 g. The object rises through a height of 1.8 m with bullet remaining inside the object. Find the speed of the bullet. Take $g = 10ms_{-2}$

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22. Show that the ratio of velocities of equal masses in an inelastic collision when one of masses is stationary is $\frac{v_1}{v_2} = \frac{1-e}{1+e}$

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23. A force $\overrightarrow{F} = \hat{i} + 2\hat{j} + 3\hat{k}N$ acts on a particle and displaces it through a distances $\overrightarrow{s} = 4\hat{i} + 6\hat{j}m$ calculate the work done.

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24. A particle moves along x-axis from $x = 0 \text{to} x = 8$ under the influence of a force given by $F = 3x^2 - 4x + 5$. Find the work done in the process.

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25. A body of mass 10 kg at rest is subjected to a force of 16N. Find the kinetic energy at the end of 10 s

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26. A body of mass $5kg$ is thrown up vertically with a kinetic energy of $1000J$. If acceleration due to gravity is $10ms^{-2}$, find the height at which the kinetic energy becomes half of the original value.

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27. Two bodies of mass 60 kg and 30 kg moving in the same direction along straight line velocity $40cms^{-1}$ and $30cms^{-1}$ respectively suffer one dimensional elastic collision. Find their velocities after collision

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28. Match the Column I with Column II

Column I	Column II
(*a*) Ley dig cell	(*i*) Inhibin
(*b*) Sertoli cells	(*ii*) Testosterone
(*c*) Corpus luteum	(*iii*) Relaxin
(*d*) Placenta	(*iv*) progesterone

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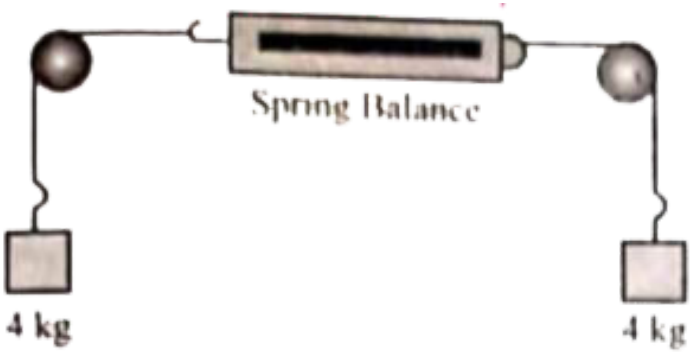
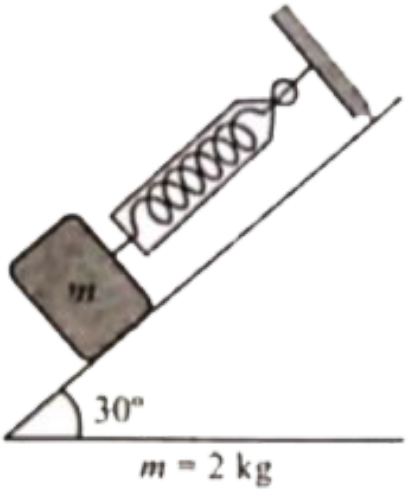
29. What is the reading shown in spring balance





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30. A gun fires 8 bullets per second into a target X If the mass of each bullet is 3 g and its speed $600ms^{-1}$. Then, calculate the power delivered by the bullets

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Textual Questions Solved I Multiple Choice Question

1. A uniform force of $\left(2\hat{i}+\hat{j}\right)$ N acts on a particle of mass 1 kg. The particle displaces from position $\left(3\hat{j}+\hat{k}\right)$ m to $\left(5\hat{i}+3\hat{j}\right)$ m. The work done by the force on the particle is

A. 9J

B. 6J

C. 10J

D. 12J

Answer: C

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2. A ball of mass 1 kg and another of mass 2 kg are dropped from a tall building whose height is 80 m. After, a fall of 40 m each towards Earth, their respective kinetic energies will be in the ratio of

A. $\sqrt{2}:1$

B. $1:\sqrt{2}$

C. $2:1$

D. $1:2$

Answer: D

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3. A body of mass 1 kg is thrown upwards with a velocity $20ms^{-1}$. It momentarily comes to rest after attaining a height of 18 m. How much energy is lost due to air friction ? (Take $g = 10ms^{-2}$)

A. 20J

B. 30J

C. 40J

D. 10J

Answer: A

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4. An engine water continuously through a hose. Water leaves the hose with a velocity v and m is the mass per unit length of the kinetic energy is imparted to water ?

A. $\frac{3}{2}mv^3$

B. mv^3

C. $\frac{3}{2}mv^3$

D. $\frac{5}{2}mv^3$

Answer: A

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5. A body of mass 4 m is lying in xy - plane at rest. It suddenly explodes into three pieces. Two pieces each of mass m move perpendicular to each other with equal speed v. The total kinetic energy generated due to explosion is

A. mv^2

B. $\frac{3}{2}mv^2$

C. $2mv^2$

D. $4mv^2$

Answer: B

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6. The potential energy of a system increases, if work is done

A. by the system against a conservative force

B. by the system against a non-conservative force

C. upon the system by a conservation force

D. upon the system by a non-conservation force

Answer: A

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7. What is the minimum velocity with a body of mass m must enter a vertical loop of radius R so that it can complete the loop ?

A. $\sqrt{2gR}$

B. $\sqrt{3gR}$

C. $\sqrt{5gR}$

D. $\sqrt{gR}$

Answer: C

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8. The work done by the conservative force for a closed path is

A. always negative

B. zero

C. always positive

D. not defined

Answer: B

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9. If the linear momentum of the object in increased by 0.1% , then the kinetic energy is increased by :

A. 0.1%

B. 0.2%

C. $0.4\,\%$

D. $0.01\,\%$

Answer: B

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10. If the potential energy of the particle is $\alpha - \frac{\beta}{2}x^2$, then force experienced by the particle is:

A. $F = \frac{\beta}{2}x(2)$

B. $F = \beta x$

C. $F = -\beta x$

D. $F = -\frac{\beta}{2}x^2$

Answer: B

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11. A wind - powered generator converts wind energy into electric energy. Assume that the energy intercepted by its blades into electrical energy. For wind speed v, the electrical power output will be proportional to,

A. v

B. v^2

C. v^3

D. v^4

Answer: C

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12. Two equal masses m_1 and m_2 are moving along the same straight line with velocities $5ms^{-1}$ and $-9ms^{-1}$ respectively. If the collision is elastic, then calculate the velocities after the collision of m_1 and m_2, respectively

A. $-4ms^{-1}$ and $10ms^{-1}$

B. $10ms^{-1}$ and $10ms^{-1}$

C. $-9ms^{-1}$

D. $5ms^{-1}$ and ms^{-1}

Answer: C

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13. A particle is placed at the origin and a force F = kx is acting on it (where k is a positive constant). If U (0) = 0, the graph of U(x) versus x will be (where U is the potential energy function)

A. 

B. 

C. 

D. 

Answer: C

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14. A particle which is constrained to move along x - axis, is subjected to a force in the same direction which varies with the distance x of the particle from the origin as $F(x) = kx + ax^3$. Here, k and a are positive constants. For $x \geq 0$, the functional form of the potential energy U (x) of the particle is

A. 

B. 

C. 

D. 

Answer: D

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15. A spring of force constant k is cut info two pieces such that one piece is double the length of the other. Then, the long plece will have a force constant of

A. $\frac{2}{3}k$

B. $\frac{3}{2}k$

C. 3k

D. 6k

Answer: B

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Textual Questions Solved Ii Short Answer Questions

1. Explain how the definition of work in physics is different from general perception.

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2. Write the various types of potential energy. Explain the formulae.

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3. Write the differences between conservative and Non - conscrvative force. Give two examples each.

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4. Explain the characteristics of elastic and inelastic collision.

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5. Define the following.

Coefficient of restitution

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Textual Questions Solved Iii Long Answer Questions

1. Explain with graphs the difference between work done by a constant force and by a variable force.

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2. State and explain work energy principle. Mention any three examples for it.

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3. Derive an expression for power and velocity.

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4. Arrive at an expression for elastic collision in Dimension and discuss various case.

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5. What is inelastic collision ? In which way it is different from elastic collision. Mention few examples in day to life for inelastic collision.

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Textual Questions Solved Iv Numercial Problems

1. Calculate the work done by a force of 30 N in lifting load of 2g to a height of 10 m $\left(g = 10ms^{-2}\right)$.

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2. A ball with a velocity of $5ms^{-1}$ impinges at angle of 60° with the vertical on a smooth horizontal plane. If the coefficient of restitution is 0.5, find the velocity and direction after the impact.

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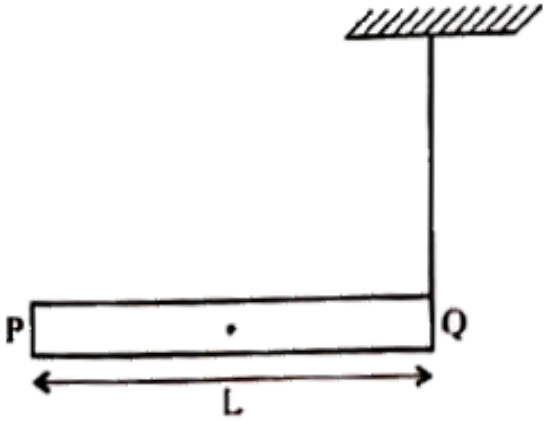
3. A rod PQ of mass M and length L is hinged at end P. The rod is kept horizontal by a mass less than string tied at a point Q as shown in figure. When string is cut, the initial acceleration rod is:



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4. Two different unknown masses A and B collide. A is initially at rest when B has a speed v. After collision B has a speed v/2 and moves at right angles to its original direction of motion. Find the direction in which A moves after collision.

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5. A bullet of mass 20 g strikes a pendulum of mass 5kg. The centre of mass of pendulum rises a vertical distance of 10 cm. If the bullet gets embedded into the pendulum, calculate its initial speed.

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Textual Questions Solved V Conceptual Questions

1. A spring which is initially in un-streatched condition, is first stretched by a length x and again by a further length x. The work done in the first case W_1 is one third of the work done in second case W_2. True of false ?

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2. Which is conserved in inelastic collision ? Total energy (or) Kinetic energy ?

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3. Is there any net work done by external forces on a car moving with a constant speed along a straight road ?

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4. A car starts from rest and moves on a surface with uniform acceleration. Draw the graph of kinetic energy versus displacement. What information you can get from that graph ?

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5. A charge particle moves towards another charged particle. Under what conditions the total momentum and the total energy of the system conserved ?

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Additional Question Solved I Mcq

1. Which of the following pairs of physical quantities have same dimension?

A. Thrust and linear momentum

B. Work and energy

C. Work and power

D. Power and energy

Answer: B

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2. The amount of work done to move charge from one point to another is called _____.

A. energy

B. power

C. force

D. mechinal energy

Answer: B

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3. Unit of work done

A. Nm

B. joule

C. either a or b

D. none

Answer: C

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4. The dimensional formula for work is

A. MLT^{-1}

B. ML^2T^2

C. $M^{-1}L_{-1}T^2$

D. ML^2T^2

Answer: D

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5. When a body moves on a horizontal direction the amount of work done by the gravitatioal force is

A. positive

B. negative

C. zero

D. infinity

Answer: C

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6. The amount of work done by centripetal force on the object moving in a circular path is

A. zero

B. infinity

C. positive

D. negative

Answer: A

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7. The work done by the goal keeper to catch the ball coming towards him by applying a force is

A. positive

B. negative

C. zero

D. infinity

Answer: B

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8. If the angle between force and displacement is acute then the work done is

A. positive

B. negative

C. zero

D. maximum

Answer: A

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9. If the force and the displacement are in the same direction, then the work done is:

A. positive

B. negative

C. zero

D. maximum

Answer: C

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10. If the angle between force and displacement is obtuse, then the work done is

A. positive

B. negative

C. zero

D. minimum

Answer: B

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11. The area under the force, displacement curve is

A. work done

B. acceleration

C. power

D. kinetic energy

Answer: A

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12. The capacity to do work

A. force

B. energy

C. work done

D. Power and energy

Answer: B

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13. The energy possessed by a body by virtue of its motion is called as

A. potential energy

B. kinetic energy

C. mechanical energy

D. none

Answer: B

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14. The energy possessed by a body by virtue of its motion is called as

A. potential energy

B. kinetic energy

C. mechanical energy

D. none

Answer: B

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15. The energy possessed by a body by virtue of its motion is called as

A. potential energy

B. kinetic energy

C. mechanical energy

D. none

Answer: A

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16. 1 erg is equivalent to

A. $10^{-7}J$

B. $1.6 \times 10^{-19}J$

C. 4.186J

D. $3.6 \times 10^{-6}J$

Answer: A

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17. 1 electron volt is equivalent to

A. $10^{-7}J$

B. $1.6 \times 10^{-19}J$

C. 4.186J

D. $3.6 \times 10^{-6}J$

Answer: B

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18. 1 kilowatt hour is equivalent to

A. $10^{-7}J$

B. $1.6 \times 10^{-19}J$

C. 4.186J

D. $3.6 \times 10^{-6}J$

Answer: D

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19. 1 calorie is equivalent to

A. $10^{-7}J$

B. $1.6 \times 10^{-19} J$

C. 4.186J

D. $3.6 \times 10^{-6} J$

Answer: C

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20. The amount of work done by a moving body depends on the

A. mass of body

B. velocity

C. time

D. all of the above

Answer: C

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21. The kinetic energy of a body is given by

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

B. ma

C. Fs

D. $\left(v^2 - u^2\right)m$

Answer: A

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22. Kinetic energy of the body is always

A. zero

B. infinity

C. negative

D. positive

Answer: D

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23. If the work done by force on the body is positive then its kinetic energy

A. increase

B. decreases

C. zero

D. either increase or decreases

Answer: A

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24. If p is the momentum of the particle then its kinetic energy is

A. $\sqrt{2Mp}$

B. $\frac{p}{2M}$

C. $\frac{P^2}{2m}$

D. $\frac{2m}{P}$

Answer: C

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25. If two objects of masses m_1 and $m_2(m_1, > m_2)$ are moving with the same momentum then the kinetic energy will be greater for

A. m_1

B. m_2

C. $m_1 \text{or} m_2$

D. both will have equal kintetic energy

Answer: B

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26. For a given momentum, the kinetic energy is proprtional to

A. mass of body

B. $\frac{1}{m}$

C. m^2

D. $\sqrt{m}$

Answer: B

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27. Elastic potential energy possessed by a spring is

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

B. mgh

C. $\frac{1}{2}kx^2$

D. kx^2

Answer: C

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28. potential energy stored in the spring depends on

A. spring constant

B. mass

C. gravity

D. length

Answer: B

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29. Two springs have their force constants k_1 and $k_2(k_2 > k_1)$. When they are stretched by the same force _____ .

A. $u_1 > u^2$

B. $u_{20>u_1}$

C. $u_1 = u_2$

D. $u_1 \geq u_2$

Answer: B

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30. Conservative force is

A. electrostatic force

B. magnetic force

C. gravitationl force

D. all the above

Answer: D

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31. Non-conservative force is

A. frictional force

B. viscous force

C. air resistance

D. all the above

Answer: D

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32. If the work done is competely recoverable than the force is

A. conservative

B. non-conservative

C. both (a) and (b)

D. frictional in nature

Answer: A

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33. The work done by the conservative force in a cycle is

A. zero

B. one

C. infinity

D. having negative value

Answer: A

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34. Negative gradient of potential energy gives

A. conservative force

B. non-conservative force

C. kinetic energy

D. frictional force

Answer: A

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35. When a particle moving in a vertical circle the variable is are

A. velocity of the particle

B. tension of the string

C. both (a) and (b)

D. mass of the particle

Answer: C

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36. Which of the following is zero at the highest point in vertical circular motion ?

A. velocity of the particle

B. tension of the string

C. potential energy

D. none

Answer: A

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37. The body must have a speed at highest point in vertical circular motion to stay in the circular path

A. $\geq \sqrt{gr}$

B. $\geq \sqrt{2gr}$

C. $gr\sqrt{5gr}$

D. $\geq 5gr$

Answer: A

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38. The boday must have a minimum speed of lowermost point in vertical circular motion complete the circle

A. $\geq \sqrt{gr}$

B. $\geq \sqrt{2gr}$

C. $gr\sqrt{5gr}$

D. $\geq 5gr$

Answer: C

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39. The rate of work done is

A. energy

B. force

C. power

D. energy flow

Answer: C

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40. The unit of the power is

A. J

B. Work and energy

C. JS^{-1}

D. both (b) and (c)

Answer: D

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41. One horse power is

A. 476W

B. 674W

C. 746W

D. 764W

Answer: C

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42. The dimension of the power is

A. ML^2T^{-2}

B. ML^2T^{-3}

C. $ML^{-2}T^2$

D. $ML^{-2}T^3$

Answer: B

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43. kwh is the parctical unit of

A. energy

B. power

C. electrical energy

D. none

Answer: A

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44. If a force F is applied on a body and the body moves with velocity V the power will be

A. $F.V$

B. $\frac{F}{V}$

C. FV^2

D. $\frac{F}{V^2}$

Answer: A

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45. A body of mass m is thrown vertically upward with a velocity v. The height at which the kinetic energy of the body is one third of its initial value is given by

A. $\frac{v^2}{2}$

B. $\frac{v^2}{4}$

C. $\frac{v^2}{6g}$

D. $\frac{v^2}{3}$

Answer: C

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46. A body of mass 5 kg is initially at rest. By applying a force of 20 N at an angle of 60° with horizontal the body is moved to a distance of 4 m. The kinetic energy acquired by the body is

A. 80J

B. 60J

C. 40J

D. 17.2J

Answer: C

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47. A bullet is fired normally on an immovable wooden plank of thickness 2 m. It loses 20% of its kinetic energy in penetrating a thickness 0.2 m of the plank. The distance penetrated by the bullet inside the wooden plank is

A. 0.2m

B. 0.8m

C. 1m

D. 1.5m

Answer: C

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48. Which of the following quantity is conserved in all collision prosess ?

A. kinetic eneergy

B. linear momentum

C. both (a) and (b)

D. none

Answer: B

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49. The kinetic energy is conserved in

A. elastic collision

B. inelastic collision

C. both (a) and (b)

D. none

Answer: A

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50. The kinetic energy is not conserved in

A. elastic collision

B. inelastic collision

C. both (a) and (b)

D. none

Answer: B

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51. In inelastic, which is conserved

A. linear collision

B. total energy

C. both (a) and (b)

D. either (a) and (b)

Answer: C

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52. If the two colliding bodies stick togther after collision such collisions are

A. elastic collision

B. inelastic collision

C. perfectly inelastic collision

D. none

Answer: C

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53. When bubblegum is thrown on a moving vehicle, it stricks is an examples for

A. elastic collision

B. inelastic collision

C. perfectly inelastic collision

D. none

Answer: C

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54. Elastic collision is due to

A. conservative force

B. non-conservative force

C. gravitational force

D. electrostatic force

Answer: B

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55. Inelastic collision is due to

A. conservative force

B. non-conservative force

C. gravitational force

D. electrostatic force

Answer: B

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56. If the velocity of separation is equal to the velocity of approach , then the collision is

A. (a) conservative force

B. (b) non-conservative force

C. (c) gravitational force

D. (d) electrostatic force

Answer: A

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57. For elastic collision, coefficient of restitution is

A. 0

B. 1

C. $0 < e < 1$

D. ∞

Answer: B

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58. For inelastic collision coefficient of restiitution is

A. 0

B. 1

C. $0 < e < 1$

D. ∞

Answer: C

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59. For perfectly inelastic collision, coefficient of restitution is

A. 0

B. 1

C. $0 < e < 1$

D. $\in f \in ity$

Answer: A

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60. For perfectly inelastic collision, coefficient of restitution is

A. (a) 0

B. (b) 1

C. (c) $0 < e < 1$

D. (d) ∞

Answer: A

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61. The ratio of velocities of equal masses in an inelastic collision with one of the masses is stationary is

A. (a) $\frac{1-e}{1+e}$

B. (b) $\frac{1+e}{1-e}$

C. (c) $(1+e)(1-e)$

D. (d) $\frac{e-1}{e+1}$

Answer: A

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62. A box is dragged across a surface by a rope which makes an angle 45° with the horizontal. The tension in the rope is 100 N when the box is dragged 10 m . The work done is

A. (a) 707.1J

B. (b) 607.1 J

C. (c) 141.2J

D. (d) 900J

Answer: A

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63. A position dependent force $f = \left(7 - 2x + 3x^2\right)N$ acts on a small body of mass 2 kg and displaces it from $x = 0 \text{ to } x = 5m$. Work done is

A. (a) 35J

B. (b) 70J

C. (c) 135J

D. (d) 270J

Answer: C

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64. In gravitational field the work done in moving body from one point into another depends on

A. intial and final position

B. distance between them

C. actual distance corvered

D. velocity of motion

Answer: C

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65. A particle of mass m moving with velocity v strikes a particle of mass 2m at rest and sticks to it. The speed of the combined mass is

A. $\frac{v}{2}$

B. 2v

C. $\frac{v}{3}$

D. $\frac{v}{4}$

Answer: C

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66. A force of $\left(10\hat{i}-3\hat{j}+6\hat{k}\right)N$ acts on a body of 5 kg and displaces it from $\left(6\hat{i}+5\hat{j}-3\hat{k}\right)m\text{to}\left(10\hat{i}-2\hat{j}+7\hat{k}\right)m$. The work done is

A. 100J

B. 0

C. 121J

D. none of these

Answer: C

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67. A 9 kg mass and 4kg mass are moving with equal kinetic energies. T he ratio of their momentum is

A. $1:1$

B. $3:2$

C. $2:3$

D. $9:4$

Answer: B

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68. If momentum of a body increase by 25% its kinetic energy will increase by

A. (a) 0.25

B. (b) 0.5

C. (c) 1.25

D. (d) 0.5625

Answer:

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69. If momentum of a body increase by 25% its kinetic energy will increase by

A. 25%

B. 5%

C. 125 %

D. 56%

Answer: D

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70. A missile fired from a launcherr explode in mid air, its total

A. kinetic energy increases

B. momentum increases

C. kinetic energy decreases

D. momentum decreases

Answer: A

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71. A bullet hits and gets embedded in a solid block resting on a frictionless surface. In this process which is correct ?

A. momentum alone

B. kinetic energy alone

C. both momentumand kinetic energy

D. no quantity is conserved

Answer: A

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72. Two balls of equal masses movin with velocities $10\frac{m}{s}$ and $-7\frac{m}{s}$ respectively collide elatically. There velocities after collision with be

A. $7ms^{-1}$ and $17ms^{-1}$

B. $-7ms^{-1}$ and $10ms^{-1}$

C. $10ms^{-1}$ and $-7ms^{-1}$

D. $3ms^{-1}$ and $-70ms^{-1}$

Answer: B

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73. A spring of negligible mass having a force constant of $10Nm^{-1}$ is compressed by a force to a distance of 4 cm. A block of mass 900g is free

to leave the top of the spring. If the spring is released, the speed of the block is

A. $11.3ms^{-1}$

B. $13.3 \times 10ms^{-1}$

C. $13.3 \times 10^{-2}ms^{-1}$

D. $13.3 \times 10^{-3}ms^{-1}$

Answer: C

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74. A particle falls from a height h on a fixed horizontal plane and rebounds. If e is the coefficient of restitution, the total distance travelled by the particle on rebounding has stopped

A. (a) $\frac{h(1+e)^2}{(1-e)^2}$

B. (b) $\frac{h(1+e)}{(1-e)}$

C. (c) $\frac{h\left(1+e^2\right)}{\left(1-e^2\right)}$

D. (d) $\frac{h(1-e)^2}{(1+e)^2}$

Answer: A

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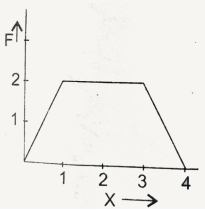
75. If the force F acting on a body as a function of x then the work done in a moviung body from x=1 m to x=3 m



A. 6J

B. 4J

C. 2.5J

D. 1J

Answer: B

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76. A boy "A" of mass 50kg climbs up a stair case in 10s. Another boy "B" of mass 60kg climbs up a same staircase in 15s. The ratio of their power developed by the boys "A" and "B" is

A. $\frac{5}{4}$

B. $\frac{3}{2}$

C. $\frac{4}{5}$

D. $\frac{2}{3}$

Answer: A

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Additional Question Solved Ii Short Answer Questions

1. Define work - energy theorem.

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2. Discuss the possibilities of work done to be zero.

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3. Derive the relation between momentum and kinetic energy.

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4. How can an object move with zero acceleration (constant velocity) when the external force is acting on the object ?

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5. Why should the object be moved at constant velocity when we define potential energy ?

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6. Derive an expression for potential energy near the surface of the earth

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7. Discuss the force - displacement graph for a spring.

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8. Discuss the force - displacement graph for a spring.

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9. Define unit of power

Watch Video Solution

10. Define power, average power, instantaneous power.

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11. Define elastic and inelastic collision.

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12. What will happen to the potentail energy of the system ?

If (i) Two same charged particles are brought towards each other

(ii) Two oppositely charged particles are brought towards cach other

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13. Write the differences between conservative and Non - conscrvative force. Give two examples each.

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14. A light and heavy body have equal momentum, which has greater K.E?

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15. The momentum of the body is doubled, what % does its K.E. change ?

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16. A body is moving along a circular path . How much work is done by the entripetal force ?

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17. Which spring has greater value of spring constant-a hard spring or a delicate springs ?

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18. Two bodies stick together after collision. What types of collision is in between these two bodies ?

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19. State the condition under which a force does not work.

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20. How will the momentum of a body change if its K.E. is doubled ?

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21. K.E. of a body is increased by 300%. Find the % increase in its momentum.

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22. A light and a heavy body have same K.E., which of the two have more momentum and why ?

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23. Does the P.E. of the spring decreases or increases when it si compressed or stretched ?

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24. Name a process in which momentum change but K.E. does not

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25. What happens to the P.E. of a bobble when it rises in water ?

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26. A body is moving at constant speed over a frictionaless surface. What is the work done by the weight of the body ?

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27. Define spring constant of a spring.

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28. How much work is done by a coolise walking on a frontal plastikam vidio a load on his head ? Explain

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29. Mountain roads rarely go striaght up the slop, but wind up gradually. Why ?

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30. A truck and a car moving with the same K.E. on a stright road. Their engines are simultaneously switched off which one will stop at a lesser distance ?

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31. Is in necessary that we does the motion of a body on a closed loop is zero for every force in nature ? Why?

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32. How high most a body be lifted to gain an amount of P.E. equal to K.E. is when moving at speed 20ms^(-1). (The value of acceleration des to grity at a place is $\left(9.83ms^{-2}\right)$

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33. Give an example in which a force does work on a body but fails to change its K.E.

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34. A bob is pulled sideway so that string becomes parallel to horizontal and released. Length of the pendulum is 2 m. If due to air resistance loss of cergy is 10%, what is the speed with which the bob arrived at the lowest point

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35. Two spring A and B are idential except that A is harder than B $(k_A > k_B)$ if these are stretched by the equal force. In which spring will more work be done ?

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36. Find the work done if a particle moves from position $r_1 =$ to a position $\vec{r}_1 = \left(3\hat{i} + 2\hat{j} - 6\hat{k}\right)$ to position $\vec{r}_2 = \left(14\hat{i} + 13\hat{j} - 9\right.$

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37. Spring A and B are identical except that A is stiffer than B, i.e., Force constant $k_A > k_B$. In which spring is more work expended if they are stretched by the same amount ?

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38. A ball at rest is dropped from a height of 12m. It loses 25% of its kinetic energy in striking the ground , find the height to which it bounces. How do you account for the loss in kinetic energy ?

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39. Which of the two kilowatt hour or electron volt is a bigger unit of energy and by what factor ?

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40. A spring of force constant k is cut info two pieces such that one piece is double the length of the other. Then, the long plece will have a force constant of

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41. 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 Do the crunes consume the same or diferent amounts of fuel What is the power supplied by cacheranu? Negleat Power dissipation against friction.

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42. 20 J work is required to stretch a spring through 0.1 m. Find the force constant of the spring If the spring is further stretched through 0.1 m, calculate work done

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43. A pump on the ground floor of a building can pump up water to fill a tank of volume 30 m^3in 15 min. If the tank is 40 m above the ground, how much electric power is consumed by the pump. The efficiency of the pump is 30%

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44. A ball bounces to 80% of its original height. Calculate the mechanical energy lost in each bounce.

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Additional Question Solved Long Answer Questions

1. Obtain an expression for the critical vertical of a body revolving in a vertical circle.

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2. Obtain the expression for the velocities of the two bodies after collision in the case of one dimensional elastic collision ond discuss the specical cases.

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Additional Question Solved Numercials

1. A body is moving along z-axis of a coordinate system under the effect of a constant force $F = \left(2\vec{i} + 3\hat{j} + v\hat{k}\right)N$. Find the work done by the force in moving the body a distance of 2 m along z-axis

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2. Water is pumped out of a well 10 m deep by means of a pump rated 10 KW. Find the efficiency of the motor if 4200 kg of water is pumped out every minute. $\text{Take} g = 10\frac{m}{s}2$

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3. A railway carriage of mass 9000 kg moving with a speed of $36kmh^{-1}$ collides with a stationary carriage of same mass. After the collision, the

carriages get coupled and move together. What is their common speed after collision? What type of collision is this?

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4. In lifting a 10 kg weight to a height of 2m, 230 J energy is spent. Calculate the acceleration with which it was raised

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5. A bullet of mass 0.02 kg is moving with a speed of $10ms^{-1}$. It can penetrate 10 em of wooden block, and comes to rest. If the thickness of the target would be 6 cm only find the KE of the bullet when it comes out

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6. A man pulls a lawn roller through a distance of 20 m with a force of 20 kg weight. If he applies the force at an angle of 60° with the ground,

calculate the power developed if he takes 1 min in doing so.

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7. A body of mass 0.3 kg is taken up an inclined plane to length 10 m and height 5 m and then allowed to slide down to the bottom again. The coefficient of friction between the body and the plane is 0.15. What is the

(i) work done by the gravitational force over the round trip?

(ii) work done by the applied force over the upward joumey?

(iii) work done by frictional force over the round trip?

(iv) kinetic energy of the body at the end of the trip?

How is the answer to (iv) related to the first three answers?

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8. Two blocks of masses m_1 and $m_2(m_1 > m_2)$ in contact with each other on frictionless, horizontal surface. If a horizontal force F is given on

m_1 set into motion with acceleration a, then reaction force on mass m_1 by m_2 is

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9. A truck of mass 1000 kg accelerates uniformly from rest to a velocity of 15 ms'in 5 seconds. Calculate (i) its acceleration (ii) its gain in KE and (iii) average power of the engine during this period, neglect friction

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10. An elevator which can carry a maximum load of 1800 kg (elevator + passengers) is moving up with a constant speed of 2 ms. The frictional force opposing the motion is 4000 N. Determine the minimum power delivered by the motor to the elevator in watts as well as in horse power

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11. To simulate car accidents, auto manufacturers study the collisions of moving cars with mounted springs of different spring constants. Consider a typical simulation with a car of mass 1000 kg moving with a speed $18kmh^1$ on a smooth road and colliding with a horizontally mounted spring of spring constant $6.25 \times 10^{-3} Nm^{-1}$ What is the maximum compression of the spring?

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