PHYSICS

BOOKS - DISHA PUBLICATION PHYSICS (HINGLISH)

CONCEPT BUILDER

Jee Main 5 Years At A Glance

1. A body of mass m starts moving from rest along x-axis so that it velocity varies as v=$a\sqrt{s}$

where a is a constant and s is the distance covered by the body .The total work done by all the forces acting on the body in the first second after the start of the motion is :

A. $\frac{1}{8}ma^4t^2$

B. $4ma^4t^2$

C. $8ma^4t^2$

D. $\frac{1}{4}ma^4t^2$

Answer: A

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2. Two particles of the same mass m are moving in circular orbits because of force, given by

$$F(r) = \frac{-16}{r} - r^3$$

The first particle is at a distance r =1 , and the second, at r = 4. The best estimate for the ratio of kinetic energies of the first and the second particle is closet to :

A. 10^{-1}

B. 6×10^{-2}

C. 6×10^{2}

D. 3×10^{-3}

Answer: B

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3. A particle is moving in a circular path of radius a under the action of an attractive potential $U = -\frac{k}{2r^2}$. Its total energy is :

A. $-\frac{K}{4a^2}$

B. $\frac{K}{2a^2}$

C. Zero

D. $-\frac{3k}{2a^2}$

Answer: C

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4. An object is dropped from a height h from the ground .Every time it hits the ground it looses 50% of its kinetic energy.The total distance covered as $t \to \infty$ is:

A. 3h

B. ∞

C. $\frac{5}{3}h$

D. $\frac{8}{3}h$

Answer: A

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5. A time dependent force $F = 6t$ acts on a particle of mass $1kg$. If the particle starts from rest, the work done by the force during the first $1\,\text{sec.}$ will be

A. 9 J

B. 18 J

C. 4.5 J

D. 22 J

Answer: C

6. A person trying to lose weight by burning fat lifts a mass of 10 kg upto a height of 1 m 1000 times. Assume that the potential energy lost each time he lowers the mass is dissipated. How much fat will he use up considering the work

done only when the weight is lifted up? Fat supplies $3.8x10^{7}J$ of energy per kg which is converted to mechanical energy with a $20\,\%$ efficiency rate. Take $g = 9.8ms^{-2}$:

A. $9.89 \times 10^{-3}kg$

B. $12.89 \times 10^{-3}kg$

C. $2.45 \times 10^{-3}kg$

D. $6.45 \times 10^{-3}kg$

Answer: B

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7. A particle is moving in a circle of radius r under the action of a force F=αr^2 which is directed towards centre of the circle.Total mechanical enery (kinetic energy+potential energy)of the particle is (take potential energy=0 for r=0)

A. $\frac{1}{2}\alpha r^3$

B. $\frac{5}{6}\alpha r^3$

C. $\frac{4}{3}\alpha r^3$

D. αr^3

Answer: B

8. A particle of mass m moving in the x direction with speed 2v is hit by another particle of mass 2m moving in they y direction with speed v. If the collision is perfectly inelastic, the percentage loss in the energy during the collision is close to :

A. 0.56

B. 0.62

C. 0.44

D. 0.5

Answer: A

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9. A bullet looses $\left(\frac{1}{n}\right)^{th}$ of its velocity passing through one plank.The number of such planks that are required to stop the bullet can be:

A. $\frac{n^2}{2n-1}$

B. $\frac{2n^2}{n-1}$

C. infinite

D. n

Answer: A

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10. When a rubber-band is stretched by a distance x, it exerts a restoring force of magnitude $F = ax + bx^2$ where a and b are

constants. The work done in stretching the unstretched rubber band by L is :

A. $aL^2 + bL^3$

B. $\frac{1}{2}(aL^2 + bL^3)$

C. $\frac{aL^2}{2} + \frac{bL^3}{3}$

D. $\frac{1}{2}\left(a\frac{L^2}{2} + \frac{bL^3}{3}\right)$

Answer: C

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Exercise 1 Concept Builder Topicwise

1. If the amount of work done by a force depends only on the initial and final positions of the object which has been moved, then such a force is called

A. A conservatitve or non conservative force

B. A conservatitve force

C. A non-conservative force

D. None of these

Answer: B

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2. The vessels A and B of equal volume and weight are immersed in water to depth h.The vessel A has an opening at the bottom through which water can enter.If the work done in immersing A and B are W_A and W_B respectively,then

A. $W_A = W_B$

B. $W_A < W_B$

C. $W_{A > W_B}$

D. None of these

Answer: B

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3. A spring, which is initially in its unstretched condition, is first stretched by a length x and then again by a further length x. The work done in the first case is W_1 and in the second case is W_2.

A. $W_2 = W_1$

B. $W_2 = 2W_1$

C. $W_2 = 3W_1$

D. $W_2 = 4W_1$

Answer: C

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4. Given that a force $\hat{F}$ acts on a body for time t,and displaces the body by $\hat{d}$.In which of the following cases,the speed of the body must not increase?

A. $F > d$

B. $F < d$

C. $\hat{F} = \hat{d}$

D. $\hat{F} \perp \hat{d}$

Answer: D

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5. A spring,which is initially is its unstretched condition,is first stretched by a length 5cm and then again by a further length 5cm.The work done in the first case is W_1 , and in the second

case is W_2 .Then the work required to stetch it further by another 5 cm is ($K = 5 \times 10^3$)

A. 18.75 J

B. 25.00 J

C. 6.25 J

D. 12.50 J

Answer: A

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6. A particle moving in the xy plane undergoes a displacement $\overrightarrow{S} = \left(2.0\hat{i} + 3.0\hat{J}\right)m$ while a constant

force $\overrightarrow{F} = \left(5.0\hat{1} + 2.0\hat{j}\right)$ N acts on the particle.

(a) Calculate the magnitude of the displacement and that of the force.

(b) Calculate the work done by the force

A. 17 joule

B. 18 joule

C. 16 joule

D. 15 joule

Answer: C

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7. A boy pushes a toy box 2.0 m along the floor by means of a force of 10 N directed downward at an angle of 60° to the horizontal.The work done by the boy is

A. 6J

B. 8J

C. 10J

D. 12J

Answer: C

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8. A rigid body moves a distance of 10m along a straight line under the action of a force 5N. If the work done by this force on the body is 25 joules, the angle which the force makes with the

force makes with the direction of motion of the body is:

A. 0°

B. 30°

C. 60°

D. 90°

Answer: C

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9. If a motorcyclist skids and stops after covering a distance of 15 m.The stopping force acting on the motorcycle by the road is 100N,then work done by the motorcycle on the road is

A. 1500 J

B. $-1500J$

C. 750 J

D. Zero

Answer: D

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10. A uniform force of $\left(3\hat{i}+\hat{j}\right)$ N acts on a particle of mass 2kg. Hence, the particle is displaced from position $\left(2\hat{i}+\hat{k}\right)$m to position $\left(4\hat{i}+3\hat{j}-\hat{k}\right)$m. The work done by the force on the particle is

A. 6J

B. 13J

C. 15J

D. 9J

Answer: D

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11. The position of a Particle of Mass 4 g,acted upon by a constant force is given by x=$4t^2$ +t,where x is in metre and t in second .The work done during the first 2 seconds is

A. 128 mJ

B. 512 mJ

C. 576 mJ

D. 144mJ

Answer: C

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12. A force $\vec{F} = \left(5\vec{i} + 3\vec{j} + 2\vec{k}\right)N$ is applied over a particle which displaces it from its origin to the point $\vec{r} = \left(2\vec{i} - \vec{j}\right)m$. The work done on the particle in joules is.

A. $+10$

B. $+7$

C. -7

D. $+13$

Answer: B

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13. In figure,a carriage P is pulled up from A to B.The relevant Coefficient of friction is 0.40 .The work done will be

A. 10 KJ

B. 23KJ

C. 25 KJ

D. 28 KJ

Answer: B

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14. A particle moved from position $\overrightarrow{r}_1 = 3\hat{i} + 2\hat{j} - 6\hat{k}$to position $\overrightarrow{r}_2 = 14\hat{i} + 13\hat{j} + 9\hat{k}$ undre the action of a

force $\left(4\hat{i}+\hat{j}+3\hat{k}\right)$ newtons . Find the work done .

A. 100 J

B. 50 J

C. 200 J

D. 75 J

Answer: A

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15. A man drags a block through 10 m on rough surface (μ=0.5).A force of $\sqrt{3}$ kN acting at 30° to the horizontal .The work done by applied force is

A. zero

B. 15 kJ

C. 5kJ

D. 10 kJ

Answer: B

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16. A foce acts on a 30.g particle in such a way that the position of the particle as a function of time is given by

$x = 3t - 4t^2 + t^3$, where x is in metre and t in second. The work done during the first 4s is

A. 576 mJ

B. 450 mJ

C. 490 mJ

D. 530 mJ

Answer: A

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17. In kinetic theory of gases, a molecule of mass m of an ideal gas collides with a wall of vessel with velocity v. The change in the linear momentum of the molecule is

A. 2 mv

B. 4 mv

C. 8 mv

D. 10 mv

Answer: A

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18. A body of mass m moving with velocity $3km/h$ collides with a body of mass 2m at rest. Now, the coalesced mass starts to move with a velocity

A. 1km/h

B. 2km/h

C. 3km/h

D. 4km/h

Answer: A

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19. A ball hits the floor and rebounds after an inelastic collision. In this case

A. the momentum of the ball just after the collision is the same as that just before

the collision

B. the mechanical energy of the ball remains the same in the collision

C. the total momentum of the ball and the earth is consrved

D. the total energy of the ball and the earth is conserved

Answer: C

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20. A sphere of mass $8m$ collides elastically (in one dimension) with a block of mass $2m$. If the initial energy of sphere is E. What is the final energy of sphere?

A. 0.8 E

B. 0.36 E

C. 0.08 E

D. 0.64E

Answer: B

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21. A bomb of mass $30kg$ at rest explodes into two pieces of mass $18kg$ and $12kg$. The velocity of mass $18kgis6m/s$. The kinetic energy of the other mass is

A. 324 J

B. 486 J

C. 256 J

D. 524 J

Answer: B

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22. A tennis ball is released from height h above ground level. If the ball makes inelastic collision with the ground, to what height will it rise after third collision

A. he^6

B. e^2h

C. e^3h

D. $e(4)h$

Answer: A

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23. A body of mass m moving with a constant velocity v hits another body of the same mass moving with the same velocity v but in the opposite direction and sticks to it. The velocity of the compound body after collision is

A. valid

B. 2v

C. zero

D. v/2

Answer: C

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24. A mass of 0,5 kg moving with a speed of 1.5 m/s on a horizontal smooth surface,collides with a nearly weightless spring of force constant k=50 N/m .The maximum compression of the spring would be

A. 0.5 m

B. 0.15 m

C. 0.12 m

D. 1.5 m

Answer: B

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25. Two particles having position verctors $\overrightarrow{r}_1 = \left(3\hat{i} + 5\hat{j}\right)$ metres and $\overrightarrow{r}_2 = \left(-5\hat{i} - 3\hat{j}\right)$ metres are moving with velocities

$\vec{v}_1 = \left(4\hat{i} + 3\hat{j}\right) m/s$ and $\vec{v}_2 = \left(\alpha\hat{i} + 7\hat{j}\right) m/s$

. If they collide after 2 seconds, the value of α is

A. 8

B. 6

C. 4

D. 2

Answer: A

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26. A mass of 20 kg moving with a speed of 10 m / s collides with another stationary mass of . 5kg As a result of the collision, the two masses stick together. The kinetic energy of the composite mass will be

A. 600

B. 800

C. 1000

D. 1200

Answer: B

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27. A body of mass 2 kg makes an elastic collision with another body at rest and continues to move in the original direction but with one - fourth its original speed . What is the mass of the body it collides with ?

A. 0.75 kg

B. 1.0 Kg

C. 1,2 Kg

D. None of these

Answer: D

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28. A bullet of mass $20g$ and moving with $600\frac{m}{s}$ collides with a block of mass $4kg$ hanging with the string. What is the velocity of bullet when it comes out of block, if block rises to height $0.2m$ after collision?

A. 200 m/s

B. 150 m/s

C. 400 m/s

D. 300 m/s

Answer: A

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29. A body of mass m moving with velocity v makes a head-on collision with another body of mass 2 m which is initially at rest. The loss of kinetic energy of the colliding body (mass m) is

A. $\frac{1}{2}$ of its initial kinetic energy

B. $\frac{1}{9}$ of its initial kinetic energy

C. $\frac{8}{9}$ of its initial kinetic energy

D. $\frac{1}{4}$ of its initial kinetic energy

Answer: C

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30. The solid rubber balls A and B having masses 200 and 400 gm respectively are moving in opposite directions with velocity of A

equal to 0.3 m / s . After collision the two balls come to rest, then the velocity of B is

A. 0.15 m/sec

B. 1.5 m/sec

C. `-0.15 m/sec

D. None of these

Answer: A

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31. A ball moving with velocity $2ms^{-1}$ collides head on with another stationary ball of double the mass. If the coefficient of restitution is 0.5, then their velocities (in ms^{-1}) after collision will be

A. 0,1

B. 1,1

C. 1,0.5

D. 0,2

Answer: A

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32. A block of mass 2kg collide with identical stationary block head on elastically with velocity of 20 m/s .After collision second block collide with the third block of mass 2 kg initially at rest.If they collide head on perfectly inelastically then the velocity of their combination will be

A. 5 m/s

B. 4 m/s

C. 10 m/s

D. 20 m/s

Answer: C

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33. Hailstorms are observed to strike the surface of a frozen lake at an angle of 30° with the vertical and rebound at an angle of 60° with vertical. Assuming the contact to be smooth, the coefficient of restitution is

A. $e = \frac{1}{\sqrt{3}}$

B. $e = \frac{1}{3}$

C. $e = \sqrt{3}$

D. e=3

Answer: B

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34. A mass m moving horizontal (along the x-axis) with velocity v collides and stricks to mass of $3m$ moving vertically upward (along the y-

axis) with velocity $2v$. The final velocity of the combination is

A. $\frac{1}{4}v\hat{i} + \frac{3}{2}v\hat{j}$

B. $\frac{1}{3}v\hat{i} + \frac{2}{3}v\hat{j}$

C. $\frac{2}{3}v\hat{i} + \frac{1}{3}v\hat{j}$

D. $\frac{3}{2}v\hat{i} + \frac{1}{4}v\hat{j}$

Answer: A

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Exercise 1 Concept Builder Topic 2 Energy

1. A bullet is fired fram a riffie . If the rifle recoils freely determine whether the kinetic energy of the rifle is greater then , equal or less then that of the bullet .

A. less than that of the bullet

B. more than that of the bullet

C. Sane as that of the bullet

D. Equal or less than that of the bullet

Answer: A

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2. A wire extends by $'l'$ on the application of load $'mg'$. Then the energy stored in it is

A. 2 Mg l

B. Mg l

C. $\frac{Mgl}{2}$

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

Answer: C

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3. A body of mass 0.5 kg travels in a straight line with velocity $v = 5x^{3/2}$. The work done by the net force during its displacement from $x = 0$ to $x = 2$ m is

A. 25 J

B. 50 J

C. 75 J

D. 100 J

Answer: B

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4. The figure gives the potential energy funvtion U(x) for a system in which a particle is in one-dimensional motion.In which region the magnitude of the force on the particle is greatest:

A. OA

B. AB

C. BC

D. CD

Answer: D

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5. A ball is allowed to fall from a height of 10m . If there is 40% loss of energy due to impact, then after one impact ball will go up to

A. 10 m

B. 8 m

C. 4m

D. 6m

Answer: D

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6. A body accelerates uniformly from rest to a velocity 1 ms^{-1} in 15 seconds.The kinetic energy of the body will be $\frac{2}{9}j$ when t is equal to [Take mass of body as 1 kg]

A. 4s

B. 8s

C. 10s

D. 12s

Answer: C

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7. The potential energy of a conservative system is given by U=ay^2-by,where y represents the position of the particle and a as well b are constants.What is the force acting on the system?

A. $-ay$

B. $-by$

C. $2ay - b$

D. $b - 2ay$

Answer: D

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8. The kinetic energy of partical moving along a circule of radius R depends upon the distance covered S and given by $K = aS$ where a is a constant. The the force acting on the partical is

A. $\frac{aS}{R}$

B. $\frac{2(aS)^2}{R}$

C. $\frac{aS^2}{R^2}$

D. $\frac{2aS}{R}$

Answer: D

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9. Figure shows a bob of mass m suspended from a string of length L.The velocity is v_0 at A,then the porential energy of the system is

_____ at the lowes point A.

A. $\frac{1}{2}mv_0^2$

B. mgh

C. $\frac{-1}{2}mv_0^2$

D. zero

Answer: D

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10. A spring of unstretched length l has a mass m with one end fixed to a rigid support.Assuming spring to be made of a uniform wire,the kinetic energy possessed by it is its free end is pulled with uniform velocity v is :

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

B. mv^2

C. $\frac{1}{3}mv^2$

D. $\frac{1}{6}mv^2$

Answer: D

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11. Two springs of force constants $300\frac{N}{m}$ (Spring A) and $400\frac{N}{m}$ (Spring B) are joined together in series. The combination is compressed by $8.75cm$. The ratio of energy stored in A and B is $\frac{E_A}{E_B}\text{Then}\frac{E_A}{E_B}$ is equal to:

A. $\frac{4}{3}$

B. $\frac{16}{9}$

C. $\frac{3}{4}$

D. $\frac{9}{16}$

Answer: A

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12. A rubber ball is dropped from a height of $5m$ on a plane, where the acceleration due to gravity is not shown. On bouncing it rises to $1.8m$. The ball loses its velocity on bouncing by a factor of

A. $\frac{16}{25}$

B. $\frac{2}{5}$

C. $\frac{3}{5}$

D. $\frac{9}{25}$

Answer: B

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13. A mass of M kg is suspended by a weightless string. The horizontal force that is required to

displace it until the string makes an angle of 45° with the initial vertical direction is

A. Mg($\sqrt{2+1}$

B. Mg$\sqrt{2}$

C. $\frac{Mg}{\sqrt{2}}$

D. Mg($\sqrt{2}$-1)

Answer: D

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14. A body is allowed to fall freely under gravity from a height of $10m$. If it looses 25% of its energy due to impact with the ground, then the maximum height it rises after one impact is

A. 2.5m

B. 5.0m

C. 7.5m

D. 8.2m

Answer: C

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15. A particle is dropped a height h. A constant horizontal velocity is given to the particle. Taking g to be constant every where, kinetic energy E of the particle w. r. t. time t is correctly shown in

A. 

B. 

C. 

D. 

Answer: A

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Exercise 1 Concept Builder Topic 3 Power

1. A car of mass m starta from rest and accelerates so that the instyantaneous power delivered to the car has a constant magnitude P_0. The instaneous velocity of this car is proportional to

A. t^2

B. $t^{1/2}$

C. $t^{-1/2}$

D. $\frac{t}{\sqrt{m}}$

Answer: B

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

A. 1000

B. 1200

C. 100

D. 2000

Answer: B

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3. A body of mass m accelerates uniformly from rest to v_1 in time v_2. As a function of time t, the instantaneous power delivered to the body is

A. $\frac{mv_1t}{t_1^2}$

B. $\frac{mv_1^2t}{t_1}$

C. $\frac{mv_1^2t}{t_1}$

D. $\frac{mv_1^2t}{t_1^2}$

Answer: D

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4. Johnny and his sister Jane race up a hill.Johnny weights twice as much as jane and

takes twice as long as jane to reach the top.Compared to jane

A. Johnny did more work and delivered more power

B. johnny did more work and delivered the same amount of power

C. Johnny did more work and delivered less power

D. Johnny did less work and johnny delivered less power

Answer: B

5. if a particle F is applied on a body and it moves with a velocity v , the power will be

A. $F \times V$

B. F/v

C. F / v^2

D. Fxv^2

Answer: A

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6. An electric motor exerts a force of 40 N on a cable and pulls it by a distance of 30 m in one minute. The power supplied by the motor (in Watts) is

A. 20

B. 200

C. 2

D. 10

Answer: A

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7. An engine pumps water continously through a hose. Water leave the hose with a velocity v and m is the mass per unit length of the Water jet. What is the rate at Which kinetic energy is imparted to water?

A. mv^2

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

C. $\frac{1}{2}m^2v^2$

D. $\frac{1}{2}mv^3$

Answer: D

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8. If two person A and B take 2 s and 4 s, respectively to lift an object to the same height h, then the ratio of their powers is

A. $1:2$

B. $1:1$

C. $2:1$

D. $1:3$

Answer: D

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9. A body of mass 10 kg moves with a constant speed v of 2 ms^{-1} along a circular path of radius 8 m. The power produced by the body will be

A. 10 J/s

B. 98 J/s

C. 49 J/s

D. zero

Answer: D

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10. An engineer claims to have made an engine delivering 10 kW power with fuel consumption

of $1gs^{-1}$. The calorific value of fuel is 2 k cal / g . His claim

A. valid

B. invalid

C. depends on engine design

D. dependent on load

Answer: B

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11. A force applied by an engine of a train of mass 2.05×10^6kg changes its velocity from 5 m/s to 25 m/s in 5 minutes. The power of the engine is

A. 1.025 MW

B. 2.05 MW

C. 5 MW

D. 6 MW

Answer: B

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12. A 10 m long iron chain of linear mass density 0.8 kg m^{-1} is hanging freely from a rigid support .If g=10 ms^{-2} ,then the power required to left the chain upto the point of support in 10 second

A. 10 W

B. 20W

C. 30W

D. 40W

Answer: D

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13. A force $2\hat{i} + 3\hat{j} + 4\hat{k}$ N acts on a body for 4 sec, produces a displacement of $\left(3\hat{i} + 4\hat{j} + 5\hat{k}\right)$ m. the power used is

A. 9.5 W

B. 7.5W

C. 6.5W

D. 4.5W

Answer: A

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14. An elevator can carry a maximum load of $1800kg$ (elevator + passengers) is moving up with a constant speed of $2ms^{-1}$. The friction force opposite the motion is $4000N$.What is minimum power delivered by the motor to the elevator?

A. 59 hp

B. 22hp

C. 34hp

D. 44hp

Answer: D

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15. A car of mass m is driven with acceleration a along a straight level road against a constant external resistive force R. When the velocity of

the car V, the rate at which the engine of the car is doing work will be

A. Rv

B. mav

C. (R+ma)v

D. (ma-R)v

Answer: C

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16. An engine is hauling a train of mass m on a level track at a constant speed v. The resistance due to friction is f. What power is the engine producing? What extra power must the engine develop to maintain the speed up a gradient 1 in l. What is the new total power developed by the engine develop to maintain the speed up a gradient 1 in l. What is the new total power developed by the engine ?

A. $\frac{Mghv}{s}$

B. $\frac{Mghs}{v}$

C. Mghvs

D. zero

Answer: C

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17. An automobile moves under the action of a constant power supplied by its engine ,it follows that

A. The driving roce and velocity ,both are constant

B. The driving force is constant but not the velocity

C. The velocity is constant but not the driving force

D. Both driving force as well as velocity vary

Answer: D

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18. Water falls from a height of $60m$ at the rate $15kg/s$ to operate a turbine. The losses due to

frictional forces are 10% of energy . How much power is generated to by the turbine? (g=10 m//s^(2))`.

A. 0.9 kW

B. 0.4 kW

C. 0.3 kW

D. 0.6 kW

Answer: A

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19. Ten litre of water per second is lifted from well through 20m and delivered with a velocity of 10 m/s, then the power of the motor is :

A. 1kW

B. 1.5 kW

C. 2kW

D. 2.5 kW

Answer: B

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20. An automobile of mass m accelerates, starting from rest, while the engine supplies constant power P. Find its position and instantaneous velocity at time t assuming the automobile starts from rest.

A. $[Pt/m]^{1/2}$

B. $[2Pt/M]^{1/2}$

C. $[Pt/2M]^{1/2}$

D. $[Pt/4M]^{1/2}$

Answer: B

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Exercise 1 Concept Builder Topic 4 Collisions

1. In case of elastic collision,at the time of impact

A. Total K.E of colliding bodies is conserved

B. total K.E. of colliding bodies is conserved

C. total K.E. of colliding bodies decreases

D. total momentum of colliding bodies decreases

Answer: C

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Exercise 2 Concept Applicator

1. A small block of mass m is kept on a rough inclined surface of inclination θ in an elevator.Th elevator goes up with a uniform velocity v and the block does not slide on the wedge.The work done by the force of friction on the block in

time t as seen by the observer on the inclined plane will be

A. zero

B. mgvt $\cos^2\theta$

C. mgvt $\sin^2\theta$

D. mgvt sin 2θ

Answer: A

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2. The potential energy of a $1kg$ particle free to move along the x- axis is given by $V(x) = \left(\frac{x^4}{4} - \frac{x^2}{2}\right)J$

The total mechainical energy of the particle is $2J$. Then , the maximum speed (in m//s) is

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

B. $\sqrt{2}$

C. $(1)\left(\sqrt{2}\right)$

D. 2

Answer: A

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3. A particle initially at rest on a frictionless horizontal surface, is acted upon by a horizontal force which is constant is size and direction. A graph is plotted between the work done (W) on the particle, against the speed of the particle, (v). If there are no other horizontal forces acting on the particle the graph would look like

A. 

B. 

C. 

D. 

Answer: C

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4. A moving body with a mass m_1 strikes a stationary body of mass m_2. The masses m_1 and m_2 should be in the ratio $\frac{m_1}{m_2}$ so as to decrease the velocity of the first body 1.5 times

assuming a perfectly elastic impact. Then the ratio $\frac{m_1}{m_2}$ is

A. 5

B. $1/5$

C. $1/25$

D. 25

Answer: A

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5. A toy gun a spring of force constant k. When changed before being triggered in the upward direction, the spring is compressed by a distance x. If the mass of the shot is m, on the being triggered it will go up to a height of

A. $\frac{2mg}{kx}$

B. $\frac{kx^2}{mg}$

C. $\frac{kx}{mg}$

D. $\frac{kx^2}{2mg}$

Answer: D

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6. A block of mass 5.0 kg is suspended from the end of a vertical spring which is stretched by 10 cm under the load of the block. The block is given a sharp impulse from below so that it acquires an upward speed of 2.0 m/s. How high will it rise? Take $g = 10\frac{m}{s^2}$

A. 0.10m

B. 0.20m

C. 0.25m

D. None of these

Answer: B

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7. Water is drawn from a well in a $5kg$ drum of capacity $55L$ by two ropes connected to the top of the drum. The linear mass density of each rope is $0.5kgm^{-1}$. The work done in lifting water to the ground from the surface of water in the well $20m$ below is

$[g = 10ms^{-2}]$

A. $1.4 \times 10^4 J$

B. $1.5 \times 10^4 J$

C. $9.8 \times 10 \times 6 J$

D. 18J

Answer: A

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8. A 2 kg block slides on a horizontal floor with a speed of 4 m/s. It strikes an uncompressed spring, and compresses it till the block is

motionless. The kinetic friction force is 15 N and spring constant is 10000 N/m. The spring is compressed by (in cm):

A. 8.5 cm

B. 5.5 cm

C. 2.5 cm

D. 11.0 cm

Answer: B

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9. A body of mass m kg is ascending on a smooth inclined plane of inclination $\theta\left(\sin\theta=\frac{1}{x}\right)$ with constant acceleration of a m/s^2. The final velocity of the body is v m/s^2. The work done by the body during this motion is (Initial velocity of the body = 0)

A. $\frac{1}{2}mv^2(g+xa)$

B. $\frac{mv^2}{2}\left(\frac{g}{2}+a\right)$

C. $\frac{2mv^2x}{a}(a+gx)$

D. $\frac{mv^2}{2ax}(g+xa)$

Answer: D

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10. A projectile moving vertically upwards with a velocity of 200 ms^{-1} breaks into equal parts at a height of 490 m.One part starts moving vertically upwards with a velocity of 400 ms^{-1} .How much time it will take,after the break up with the other part to hit the ground?

A. $2swrt(10)s$

B. 5s

C. 10s

D. $\sqrt{10s}$

Answer: C

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11. A point particle of mas 0.5kg is moving along the x-axis under a force described by the potential energy U shown below.It is projected towards the right from the origin with a speed v.What is the minimum value of v for which the partilce will escape infinitely far away from the

origin:

A. $2\sqrt{2}m/s$

B. 2 m/s

C. 4m/s

D. the particel will never escape

Answer: B

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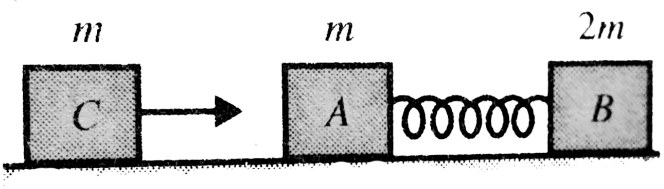
12. Two blocks A and B of masses in and $2m$ respectively placed on a smooth floor are connected by a spring. A third body C of mass m moves with velocity v_0 along the line joining A and B and collides elastically with A. At a certain instant of time after collision it is found that the instantaneous velocities of A and B are same then:



A. $m\dfrac{v_0^2}{x_0^2}$

B. $m\frac{v_0}{2x_0}$

C. $2m\frac{v_0}{x_0}$

D. $\frac{2}{3}m\left(\frac{v_0}{x_0}\right)^2$

Answer: D

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13. A car of weight W is on an inclined road that rises by 100 m over a distance of 1 km and applies a constant frictional force $\frac{W}{20}$ on the car.While moving uphill on the road at a speed

of 10 ms^{-1} ,the car needs power P.If it needs power $\frac{P}{2}$ while moving downhill at speed v then value of v is:

A. $20ms^{-1}$

B. $5ms^{-1}$

C. $15ms^{-1}$

D. $10ms^{-1}$

Answer: C

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14. A horse drinks water from a cunical container of side 1m .The level of the stomach of horse is at 2m from the grounf.Assume that all the water drunk by the horse is at a level of 2m of the ground.The minimum work done by the horse in drinking the entire water of the container is

(Take $\rho_{\text{water}} = 1000kg/m^3 = 10m/s^2$)-

A. 10 KJ

B. 15 KJ

C. 20KJ

D. zero

Answer: B

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15. A wind - powered generator convets and energy into electrical energy . Assume that the generator convents a fixed fraction of the wind energy intercepited by to blades into electrical energy for wind speed V , the electrical power output will be propertional to

A. V^4

B. V^2

C. V^3

D. V

Answer: C

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16. A vertical spring with force constant k is fixed on a table. A ball of mass m at a height h above the free upper end of the spring falls

vertically on the spring , so that the spring is compressed by a distance d. The net work done in the process is

A. $mg(h+d)-\frac{1}{2}kd^2$

B. $mg(h-d)-\frac{1}{2}kf^2$

C. $mg(h-d)+\frac{1}{2}kd^2$

D. $mg(h+d)+\frac{1}{2}kd^2$

Answer: A

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17. A block of mss m rests on a rough horizontal surface (Coefficient of friction is μ).When a bullet of mass m/2 strikes horizontally,and get embedded in it,the block moves a distance d before coming to rest.The initial velocity of the bullet is $k\sqrt{2\mu gd}$,

Then the value of k is

A. 2

B. 3

C. 4

D. 5

Answer: B

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18. In the figure shown ,a particle of mass m is released from the position A on a smooth track.When the particle reaches at B,then normal reaction on it by the track is

A. mg

B. 2mg

C. $\frac{2}{3}mg$

D. $\frac{m^2g}{h}$

Answer: A

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19. Figure shows a block of mass m,kept on a smooth horizontal plane and attached with two unstretched elastic springs with spring constants k_1 and k_2 .If the block be displace by distance x on either side and released,then the

velocity of the block as it passes through the mwan position is

A. $x\sqrt{\frac{m}{k_1+\frac{m}{k_2}}}$

B. $x\sqrt{\frac{k_1k_2}{m(k_1+k_2)}}$

C. $x\sqrt{\frac{k_1+k_2}{m}}$

D. zero

Answer: C

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20. Consider elastic collision of a particle of mass m moving with a velocity u with another particle of the same mass at rest. After the collision the projectile and the struck particle move in direction making angles θ_1 and θ_2 respectively with the initial direction of motion. The sum of the angles. $\theta_1 + \theta_2$, is

A. 45°

B. 90°

C. 135°

D. 180°

Answer: B

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21. A particle of mass 10 g moves along a circle of radius 64 cm with a constant tangential acceleration. What is the magnitude of this acceleration if the kinetic energy of the particle becomes equal to $8 \times 10^{-4} J$ by the end of the second revolution after the beginning of the motion ?

A. $0.1 m / s^2$

B. $0.15m/s^2$

C. $0.18m/s^2$

D. $0.2m/s^2$

Answer: A

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22. A load hangs from a travelling crane,moving horizintally with velocity v .If the load is not to swing more than 4 m horizontally ,when the crane is stopped suddenly,what is the maximum

allowable speed of the crane?

A. 4.05 m/s

B. 4.00 m/s

C. 3.00 m/s

D. 3.50 m/s

Answer: A

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23. A stone is tied to a string of length l and is whirled in a vertical circle with the other end of the string as the centre. At a certain instant of time, the stone is at its lowest position and has a speed u. The magnitude of the change in velocity as it reaches a position where the string is horizontal (g being acceleration due to gravity) is

A. $\sqrt{2gl}$

B. $\sqrt{2(u^2 - gl)}$

C. $\sqrt{u^2 - gl}$

D. $u - \sqrt{u^2 - 2gl}$

Answer: B

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24. A particle of mass 10 kg moving eastwards with a speed 5 ms^{-1} collides with another particle of the same mass moving north-wards with the same speed $5ms^{-1}$ .The two particles coalesce on collision.The new particle of mass 20 kg will move in the north-east direction with velocity

A. $10ms^{-1}$

B. $5ms^{-1}$

C. $\left(5/\sqrt{2}\right)ms^{-1}$

D. None of these

Answer: C

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25. An object of mass m is tied to string of length L and a variable horizontal force is applied on it which starts at zero and gradually

increases (it is pulled extremely slowly so that equilibrium exists at all times)until the string makes an angle θ with the vertical.Work done by the force F is:

A. $mgL(1-\cos\theta)$

B. $mgL(1-\sin\theta)$

C. mgL

D. $mgL(1+\tan\theta)$

Answer: A

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26. One end of an unstretched vertical spring is attached to the ceiling and an object attached to the other end is slowly lowered to its equilibrium position. If S is the gain in spring energy and G is the loss in gravitational potential energy in the process, then

A. S=G

B. S=2G

C. G=2S

D. None of these

Answer: C

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27. A block of mass $m = 0.1kg$ is connceted to a spring of unknown spring constant k. It is compressed to a distance x from its equilibrium position and released from rest. After approaching half the distance $\left(\frac{x}{2}\right)$ from the euilibrium position, it hits another block and comes to rest momentarily, while the other

block moves with velocity $3ms^{-1}$. The total initial energy of the spring is :

A. 0.3 J

B. 0.6 J

C. 0.8 J

D. 1.5 J

Answer: B

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