

India's Number 1 Education App

PHYSICS

BOOKS - DHANPAT RAI & CO PHYSICS (HINGLISH)

WORK, POWER AND ENERGY



1. A horizontal force of 15 N is required to maintain a velocity of $3ms^{-1}$ in a body of mass

20 kg . How much work is done by this force in 1

mintue?



2. Calculate the amount of work done by a labourer who carries n bricks, each of mass m, to the roof of a house of height h by climbing up a ladder.

3. A gardener pushes a lawn roller through a distance of 20 m. If he applies a force of 20 kg wt in a direction inclined at 60° to the ground , find the work

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4. A person is holding a bucket by applying a force of 10 N. He moves a horizontal distance of 5 m and then climbs up a vertical distance of 10 m. Find the total work done him.

5. A body constrained to move along the Z-axis of a co-ordinate system is subject to a constant forece $\overrightarrow{F} = -\hat{i} + 2\hat{j} + 3\hat{k}$, where $\hat{i}, \hat{j}, \hat{k}$ are unit vectors along the X-,Y- and Z-axis of the system respectively. What is the work done by this force in moving the body a distance of 4 m along the Z-axis ?

6. A force $\overrightarrow{F} = \hat{i} + 5\hat{j} + 7\hat{k}$ acts on a particle and displaces it throught $\overrightarrow{s} = 6\hat{I} + 9\hat{k}$. Calculate the work done if the force is in newton and displacement in metre. (ii) Find the work done by force

 $\stackrel{
ightarrow}{F}=2\hat{i}-3\hat{j}+\hat{k}$ when its point of application

moves from the point A(1,2,-3) to the point B (2,0, -5).

7. The distance x covered by a body of 2 kg under the action of a force is related to time t as $x = t^2/4$. What is the work done by this force in 2 seconds ?

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8. A force $F=a+b \times acts$ on a particle in the Xdirection, where a and b are constants. Find the work done by this force during a displacement from x=0 to x=d/

9. A body moves from point A to B under the action of a force, varying in magnitude as shown in figure. Obtain the work done. Force is expressed in newton and displacement in meter.





10. A uniform chain of length L and mass M is lying on a smooth table and one-third of its length is hanging vertically down over the edge of the table. If g is the acceleration due to gravity, the work required to pull the hanging part on to the table is



11. A rain drop of radius 2mm, falls from a height of 500 m above the ground. It falls with decreasing acceleration due to viscous resistance of air until half its original height. It attains its maximum (terminal) speed, and moves with uniform speed there after. What is the work done by the gravitational force on the drop in the first half and second half of its journey ? Take density of water $= 10^3 kg \, / \, m^3$. What is the work done by the resistive force in the entire journey if its speed on reaching the ground is $10ms^{-1}$?



12. Calculate the work done in raising a stone of mass 5 kg and specific gravity 3, lying at the bed

of a lake through a height of 5 m.

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13. A cluster of clouds at a height of 1000m above the earth burst and enough rain fell to cover an area of $10^6 m^2$ with a depth of 2cm. How much work would have been done in

raising water to the height of clouds ? Take $g=10m/s^2$ and density of water $10^3kg/m^3$.

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1. A body of mass 5 kg initially at rest is subject

to a force of 20 N. What is the kinetic energy

acquired by the body at the end of 10 s?



2. A body of mass 2 kg initially at rest is moved by a horizontal force of 0.5 N on a smooth frictionless table. Obtain the work done by the force in 8 s and show that this equals the change in kinetic energy of the body.

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3. A toy rocket of mass 0.1 kg hass a small fuel of mass 0.02 kg, which it burns out in 3s. Starting from rest on a horizontal smooth track, it gets a speed of $20ms^{-1}$ after the fuel is burnt out. What is the approcimate thrust of the rocket ? What is the energy content per unit mass of the fuel ? (Ignore the small mass variation of teh rocket during fuel burning).



4. An electron and a proton are detected in a cosmic ray experiment, the first with kinetic energy 10 keV, and the second with 100 keV. Which is faster, the electron or the proton ? Obtain the ratio of their speeds.

(Electron mass $= 9.11 imes 10^{-31} kg$, proton

mass

 $= 1.67 imes 10^{-27} kg, 1 eV = 1.60 imes 10^{-19} J).$



5. A bullet weighing 10 g is fired with a velocity of $800ms^{-1}$. After passing through a mud wall 1 m thick, its velocity decreases to $100ms^{-1}$. Find the average resistance offered by the mud wall.



6. A shot travelling at the rate of $100ms^{-1}$ is just able to pierce a plank 4 cm thick. What velocity is required to just pierce a plank 9 cm thick?



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7. A bullet has a mass of 20 g and is moving with a speed of $1000cms^{-1}$. It can penetrate 10 cm of a given target before coming to rest. If the same target were only 6 cm thick, what will be the speed of the bullet when it comes out ?





8. Two identical 5 kg blocks are moving with same speed of 2m/s towards eachother along a frictionless horizontal surface. The two blocks collide, stick together and come to rest. Consider the two blocks as a system. Caluculate work done by (i) external forces (ii) internal forces.

9. A light and a heavy body have equal momenta. Which one has greater K.E
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10. A light body and a heavy body have the same kinetic energy. Which one will have a greater linear momentum ?

11. If the linear momentum of a body increases by 20%, what will be the % increase in the kinetic energy of the body ?

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12. If the kinetic energy of kinetic energy of a body increases by 300%, by what % will the linear momentum of the body rease ?

13. A bomb of mass 40 kg is dropped from an aeroplane at a height of 1 km above the ground. What is its kinetic energy (i) at the end of 10 s and (ii) on reaching the ground ?

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14. A body falls on the ground from a height of 10 m and rebounds to a height of 2.5 m. Calculate (i) the percentage loss of kinetic energy of the body during the collision with the ground and (ii) the ratio of the velocities of the

body just before and just after the collision.



15. A body of mass 2 kg initially at rest moves under the action of an applied horizontal force of 7N on a table with coefficient of kinetic friction = 0.1. Calculate the

(a) work done by applied force in 10s. (b) work done by friction in 10s.

(c) work done by the net force on the body in

10s.

(d) change in K.E. of body in 10s, and interpret

your result.



16. A body of mass 0.3kg is taken up an inclined plane of length 10m and height 5m, 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

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

(b) work done by the applied force on the upward journey?

(c) work done by the frictional force over the round trip ,

(d)kinetic energy of the body at the end of the

trip?

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17. When a 40 kg boy climbs a hills , his potential energy increases by $9.8 imes10^4$ J. What is the height of the hill ?



18. A bob of mass 0.3 kg falls from the ceiling of an elevator moving down with a uniform speed of $7ms^{-1}$. If hits the floor of the elevator (length of the elevator = 3m) and does not rebound. What is the heat produced by the impact ? Would your answer be different if the elevator were stationary ?



19. Calculate the velocity of the bob of a simple pendulum at its mean position if it is able to rise to a vertical height of 10 cm. Take $g = 9.8ms^{-2}$.

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20. The bob A of a simple pendulum is released from a horizontal position A as shownin in figure. If the length of the pendulum is 1.5m, what is the speed with which the bob arrives at the lowermost point B, given that it dissipates

5~%~ of its initial energy against air resistance ?



21. A girl of mass 40 kg sits in a swing formed by a rope of 6 m length. A person pulls the swing to a side so that the rope makies an

angle of 60° with the vertical. What is the gain

in potential energy of the girl?



22. 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?



23. A bullet of mass 0.012 kg and horizontal speed $70ms^{-1}$ strikes a block of wood of mass 0.4 kg and instantly comes to rest with respect to the block. The block is suspended from the ceiling by thin wire. Calculate the height to which the block rises. Also, estimate the amount of heat produced in the block.

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24. A 1 kg mass on a floor is connected to a 2 kg mass by a string passing over a pulley. Obtain

the speed of masses (after they are released), when the 2 kg mass just touches the floor. Establish that the gain in kinetic energy of the system equals the loss in its potential energy. The 2 kg mass is initially at a height of 3 m above the ground. Take $g = 9.8ms^{-2}$.



1. Two springs have force constants k_1 and $k_2(k_1 > k_2)$. On which spring is more work done, if (i) they are stretched by the same force and (ii) they are stretched by the same amount ?



- 2. The length of a steel wire increases by
- $0\cdot 5cm$, when it is loaded with a weight of
- $5\cdot 0 kg$. Calculate force constant of the wire and

workdown in stretching the wire. Take

$$g = 10ms^{-1}.$$



3. Figure shows a force compression curve of a spring. A body of mass 5kg moving with the velocity of 8m/s hits the spring. Calculate the force constant of the spring and also the compression produced in the spring when the





4. A ball of mass m is droppped from a height h on a platform fixed at the top of a vertical spring. The platform is depressed by a distance x. What is the spring constant K?



5. A block of mass 2 kg initially at rest is dropped from a height of 1m into a vertical spring having force constant $490Nm^{-1}$. Calculate the maximum distance through which the spring will be compressed.



1. 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?



2. A car of mass 2000kg is lifted up a distance of 30m by a crane in 1 minute . A second crane does the same job in 2 minues. Do the cranes consume the same or different amounts of fuel ? What is the power supplied by each crane ? Neglect power disspation against friction.



3. A pump on the ground floor of a building can pump of water to fill a tank of volume $30ms^3$ in 15 min . If the tank is 40m above the ground and the efficiency of the pump is 30%, how much electric power is consumed by the pump? $(Takeg = 10ms^2)$

4. The human heart discharges 75ml of blood at each beat against a pressure of 0.1m of Hg. Calculate the power of the heart assuming that the pulse frequency is 80 beats per minute. Given, density of mercury $= 13.6 \times 10^3 kg/m^3$



5. An electric motor is used to lift an elevator and its load (total mass 1500kg) to a height of 20m. The time taken for the job is 20s. What work is done ? What is the rate at which work is done. If efficiency of the motor is 75~%, at

which rate is the energy supplied to the motor?



6. A machine gun fires 60 bullets per minute with a velocity of $700ms^{-1}$. If each bullet has a mass of 50g, find the power of the gun.


7. An elevator weighing 500 kg is to be lifted up at a constant velociyt of 0.20 m/s. What would be the minimum horsepower of the motor to be used?

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8. A well 20m deep and 3m is diameter contains

water to a dept of 14m. How long will a 5hp

engine take to empty it ?

9. A man cycles up a hill whose slope is 1 in 20 with a velocity of $6.4kmh^{-1}$ along the hill. The weight of the man and the cycle is 98kg. What work per minute is the man doing ? What is his horse power ?





1. About $4 imes 10^9 kg$ of matter is converted into energy in the sun each second. What is the





2. How much mass is converted into tenergy per day in a nuclear power plant operated at 10^7 kW?

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3. If 1000kg of water is heated from $0^{\circ}C$ to $100^{\circ}C$, calculate the increase in mass of water.



4. Calculate the energy in MeV equivalent to the rest mass of an electron . Given that the rest mass of an electron , $m=9.1 imes10^{-31}kg$, $1MeV=1.6 imes10^{-13}J$ and speed of light , $c=3 imes10^8ms^{-1}$.

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5. Estimate the amount of energy released in the nuclear fusion reaction:

 $_- \left(1
ight) H^2 + ._1 \, H^2 o ._2 \, He^2 + ._0 \, n^1$ Given that $Mig(._1 \, H^2ig) = 2.0141 u, \, Mig(._2 \, He^3ig) = 3.0160 u$ $m_n = 1.0087 u$,where $1u = 1.661 imes 10^{-27} kg$.

Express your answer in units of MeV.



6. When slow neutrons are incident on a target containing $_{.92} U^{235}$, a possitle fission reactionis $_{.92} U^{235} + n \rightarrow _{.56} Ba^{141} +_{36} Kr^{92} + 3n + Q$

Estimate the amount of energy released using

the following data :

 $egin{aligned} Mig[._{92} \, U^{235}ig] &= 235.04 u, \ Mig[._{56} \, Ba^{141}ig] &= 140.91 u, \ Mig[._{36} \, Kr^{92}ig] &= 91.926 u, \ M_n &= 1.0087 u. \end{aligned}$ Take $1u &= 1.661 imes 10^{-27} kg.$

 $1MeV=1.602 imes10^{-13}J$



1. Two bodies of masses 5 kg and 3 kg moving in the same direction along the same straingh line with velocities $5ms^{-1}$ and $3ms^{-1}$ respectively suffer one-dimensional elastic collision. Find their velocities after the collision



2. A 10 kg ball and 20 kg ball approach each other with velocities $20ms^{-1}$ and $10ms^{-1}$

respectively . What are their velocities after

collision if the collision is perfectly elastic ?



3. Two ball bearings of mass m each moving in opposite directions with each speeds v collide head on with each other . Predict the outcome of the collision , assuming it to the perfectly elastic.



4. A railway carriage of mass 9000kg moving with a speed of $36kmh^{-1}$ collides with a stationary carriage of the same mass. After the collision, the two get coupled and move together. What is this common speed ? What type of collision is this?



5. A ball of 0.1 kg makes an elastic head on collision with a ball of unknown mass that is initially at rest. If the 0.1kg ball rebounds at one

third of its original speed, what is the mass of

the other ball?



6. What percentage of K. E. of a moving particle is transferred to a stationary particle, when moving particle strikes with a stationary particle of mass (a) 19 times in mass (b) equal in mass (c) $\frac{1}{19}$ th of its mass ?

7. A body of mass M at rest is struck by a moving body of mass. Prove that the fraction of the initial kinetic energy of mass transferred to the struck body is $\frac{4Mm}{(m+M)^2}$

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8. A ball is droped to the ground from a height

of 2 m . The coefficient of restitution is 0.6. To

what height will the ball rebound?



9. A ball is dropped vertically from a height of 3.6 m. It rebounds from a horizontal surface to a height of 1.6 m . Find the coefficient of restitution of the material of the ball.

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10. A ball is dropped from a heigth H. It rebounds from the ground a number of times. If coefficient is e, to what height does it go after nth rebounding ?



11. Sphere A of mass 'm' moving with a constant velocity u hits another stationary sphere B of the same mass. If e is the co-efficient of restitution, then ratio of velocities of the two spheres $v_A : v_B$ after collision will be :



12. A nucleus of radium $\left(._{88} \, Ra^{226}
ight)$

decays to $._{86} Rn^{222}$

by emisson of α - particle $(._2 He^4)$ of energy 4.8MeV. If meass of $._{86} Rn^{222} = 222.0a. m. u$ mass of $._2 He^4$ is 4.003 a.m.u. and mass of $._{88} Ra^{226}$ is 226.00826 a.m.u., then calculate the recoil energy of the daughter nucleus. Take 1a. m. u. = 931 MeV

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13. In the bets decay of Na^{24} , the combined electron neutrino momentum has a magnitude equal to 4MeV/c. What is the recoil energy of daughter nucleus , given that its mass 23.99u?

Take

 $1u = 1.66 \times 10^{-27} kg.$



14. A ball moving with a speed of 9m/s strikes an identical ball at rest, such that after the collision, the direction of each ball makes an angle of 30° with the original line of motion. Find the speeds of the two balls after collision.



15. A ball moving on a horizontal frictionless plane hits an identical ball at rest with a velocity of 0.5m/s. If the collision is elastic, calculate the speed imparted to the target ball, if the speed of projectile after the collision is 30cm/s. Show that the two balls will move at right angles to eachother, after the collision.

1. The displacement x of particle moving in one dimension, under the action of a constant force is related to the time t by the equation $t=\sqrt{x}+3$

where $xis \in meters ext{ and } t \in ext{sec} ext{ onds}$. Find

(i) The displacement of the particle when its velocity is zero , and

(ii) The work done by the force in the first $6 \sec onds$.

2. A particle moves along the X-axis from x=0 to x=5 m under the influence of a force given by $F = 7 - 2x + 3x^2$. Find the work done in the process.

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3. A locomotive of mass m starts moving so that its velocity varies according to the law $V = \alpha \sqrt{s}$, where α is a constant and s is the distance covered. Find the total work done by all the forces acting on the locomotive during the first t seconds after the beginning of motion.

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4. A force $\overrightarrow{F}(y\hat{l}+x\widehat{J}), \,$ where K is a positive constant, acts on a particle moving in the XY-Plane. Starting from the origin, the particle is taken along the positive X-axis to a point (a,0) and then parallel to the y-axis to the point (a,a). Calculate the total work done by the force on the particle.



5. A particle of mass m is moving in a horizontal circle of radius r, under a centripetal force equal to $\left(-K/r^2\right)$, where k is a constant. The total energy of the particle is -

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6. A chain is held on a frictionless table with 1/n th of its length hanging over the edge. If the chain has a length L and a mass M, how

much work is required to pull the hanging part

back on the table?





1. A ball falls under gravity from a hight of 10 m height of 10 m wioth an initial downward velocity u .If collides with the gound , loses 50% of its energy in collision and then rises

back back to the same heighrt .Find the initial

velocity u.



spess c/2 . Calculate its

(i) mass (ii) momentum (iii) total energy (iv)K.E.

3. A 50 g lead bullet (specific heat 0.02) is initially at $30^{\circ}C$. It is fired vertically upward with a speed of $840ms^{-1}$. On returning to the starting level it strikes a cake of ice at $0^{\circ}C$. How much ice is melted ? Assume that all energy is spent in melting only. Latent heat of ice $= 336jg^{-1}$.

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4. A perosn decides to use his bath tub water to generate electric power to run a 40W bulb.

The bath tub is located at a height of 10m from the ground and it holds 200 litres of water. He instals a water driven wheel generator on the ground. At what rate should the water drain from the bath tub to light the bulb? How long can he keep the bulb on , if bath tub was full initially ? Efficiency of generator is 90~% . Take $g=9.8m\,/\,s^2$

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5. A body is moved from rest along a straight line by a machine delivering constant power

.Calculate the veloOcity and distance moved by

the body as a function of time .



6. The power output of a $_{-}92U^{235}$ reactor if it takes 30 days to use up 2 kg of fuel and if each fission gives 185 MeV of energy (Avogadro number`=6xx10^(23)//mole) will be -



7. A massless platform is kept on a light elastic spring as shown in figure. When a small stone of mass 0.1 kg is dropped on the pan from a height of 0.24 m, the spring compresses by 0.01m. From what height should the stone be droppped to cause a compression of 0.04m in



8. A 0.5kg block slides from the point A on a horizontal track with an initial speed 3m/stowards a weightless horizontal spring of length 1m and force constant 2N/m. The part AB of the track is frictionless and the part BC has the coefficient of static and kinetic friction as '0.22' and 0.20 respectively. If the distances AB and BD are 2m and 2.14mrespectively, find total distance through which the block moves before it comes to rest completely. $(g=10 \text{ m//s}^{(2)})$.



9. Two blocks A and B are connected to each other by a string and a spring , the spring pases and a frictionlesss pulley as down over in the figure . Block B sides over the horizental top surface of a strionry block C both with the verical side of C , both with the same conform

speed



The coefficient of friction between the surface the of block is 0.2 force constant of the spring is 1960 newtons , if mass of block A is 2 kg , celculate the mass of block F and B and the

energy stored is the spring





10. A string with one end fixed on a rigid wall, passing over a fixed frictionless pulley at a distance of 2m from the wall, has a point mass M of 2kg attached to it at a distance of 1mfrom the wall. A mass m of 0.5kq is attached to the free end. The system is initially held at rest so that the stirng is horizontal between wall and pulley and vertical beyond the pulley as shown in figure.



What will be the speed with which point mass M will hit the wall when the system is released? $(g = 10ms^{-2})$

11. A bullet of mass 0.01 kg travelling at a speed of 500 m/s strikes a block of mass 2 kg, which is suspended by a string of length 5 m. The centre of gravity of the block is found to rise a vertical distance of 0.1 m. The speed of the bullet after it emerges from the block will be -



12. A pendulum bob of mass $10^{-2}kg$ is raisted to hightof 5×10^{-2} m and then released At the bottion of its swing , it up a mass of 10^{-3} kg to what hieght will the combimnated mass rise ? Take $g = 10ms^{-2}$

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13. A particle of mass m and veocity \overrightarrow{v} collides elastically with a stationary particle of mass m

Calculate the angle between velocity vector of

the two partiicless after the collision.



14. A bullet of mass M is fired with a velocity 50m/s at an angle with the horizontal. At the highest point of its trajectory, it collides headon with a bob of mass 3M suspended by a massless string of length 10/3 metres and gets embeded in the bob. After the collision, the string moves through an angle of 120° . Find (i) the angle θ ,

(ii) the vertical and horizontal coordinates of the initial position of the bob with respect to the point of firing of the bullet. Take $g = 10m/s^2$



Problem For Self Practice

1. A man wighing 80 kg wt carrice a stone of weight 20kg wt to the top a builling 30 m high
.Calculatethe work done by him .Take

$$g=9.8ms^{-2}$$

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2. A gardener pushes a lawn roller through a distance of 100m with a force of 50N Calcalye the wages if he is to be paid 10 paise for 25 J of work It is given that the applied force is inclined 60° to the direction of motion .



3. What is the work done is crrrying a suitcase wighting 10 kg f on his head when he travels a distance of 5 m in the (i) verticl direction and (ii) horizontal direction ? $Takeg = 9.8ms^{-2}$



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4. A body moving along a circular path with unifrom speed covers a distance of 20 m If the centripetal force acting on it is 10 N ,What is the work done by the force?



5. A man moves on a straight horizontal road with a block of mass 2 kg in his hand If he covers a distance os 40 m with an accelertion of $0.5ms^{-2}$ Find the work done by the man on the block during the motion.



6. A bodys constrained to more in the Ydirection ,Is subject to a force $\overrightarrow{F}=\left(-2\hat{i}+15\hat{j}+6\hat{k}
ight)$ N What is the work done by force in moving the body through a

distance of 10 m along the Y-axis ?



7. A force F=(15+0.50x) acts on a particle in the X-direction ,where F is in newton and x in metre Find the work done ' by this force during a displacement from x=0 to x=2.0 m .



8. A particle is acted upon by constant forces $\overrightarrow{F} = -2\hat{i} + 3\hat{j} + 4\hat{k}$ and $\overrightarrow{F}_2 = -\hat{i} + 2\hat{j} - 3\hat{k}$ is distanced from the point A (2,1,0,) to the point B(-3,-4,2) Find the work done by forces.

9. A man weighing 60kg~f suports a body of 20kgf on his head. Calculate work done by him in moving a distance of 15m up an incline of 1 in 10 . Take $g = 9.8m/s^2$

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10. Calculate the work done in raising a stone of mass 6 kg of specific gravity 2 immersed I water from a depth from a depth of 4 m to 1 m below the surface .Take $g = 10ms^{-2}$

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11. The relation between the displacement x and the time t for a body of mass 2 kg moving under the action of a force is geven by $x = t^3/3$, where x is in metre and t in second ,Calculate the ork done by the body in first 2 seconds.

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12. A body moves from a point A to B under the action of a force shown in figure. What is

the amount of work done ?





Type B Based On K E

1. A body mass 4kg initiallay at rest is moved by a horizntally force 1N on a frictionless table. Find the work done by the force in 4s. Show that this equals the change in K.E. of the body.

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2. The momentum of a body of masss of 5kg is $500 kgm s^{-1}$. Find the its K.E.

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3. A bullet of mass 20g is found is found to pass two points 30cm apart in a time interval of 4s. Calculate the kinetic energy of the bullet if it moves with constant speed.



4. A force fo 3000 dyne acts on a body of mass

400g for 10s. Find the kinetic energy of the

body after 10s.



5. A body having masss oif 100g is allowed to fall freely under the action of gravity. Calcualate the kinetic energy after 10s. Take g= $9.8ms^{-2}$.

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6. A electron and a proton are detected in a cosmic ray experiment, the electron with K.E. of 5eV and the proton with K.E. of 50e. Find the ratio of their speeds.

Given

 $m_e = 911 imes 10^{31} kg \,\, {
m and} \,\, m_p - 1.67 imes 10^{27} kg$



7. A neutron of mass $1.66 \times 10^{-27} kg$ is moving with a speed of $7 \times 10^5 m s^{-1}$. Calculate late (i) its kinetic energy and (ii) the average force it will exert in entering a body to depth of 0.1cm.



8. A body of masss 1kg is allowed to fall freely under gravity. Find the mimimum and kinetic

energy of the body 5 second after it starts

falling. Take g= $10ms^{-2}$



9. Two bodies of masses 1g and 16g are moving

with equal kinetic energies. Find the ratio of

the magnitudes of their linear momenta.



10. If the momentum of a body is increased by 50%, then what will be the perentage increase in the kinetic energey of the body?



11. The kinetic energy of a body decreases by 19%. What is the percentage decreases in its linear momentum?

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12. A running man has half the KE that a body of half his mass has. The man speeds up by $1.0ms^{-1}$ and then has the same energy as the boy. What were the original speeds of the man and the boy?

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13. While catching a cricket ball of mass 200g moving with a velocity of $20ms^{-1}$, the player draws his hands backwards through 20cm. Find

the work done in catching the ball and the

average force exerted by the ball on the hand.



14. A man of 60kg jumps to a height of 1.0m.

What is the potential energy of the man at the

highest point?



15. A vehicle of mass 15 quintal climbs up a hill 200m high. It then moves on a level road with a speed of $30ms^{-1}$. Calculate the potential energy gained by it and its total mechanical energy while running on the top of the hill.

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16. A stone of mass 0.4kg is thrown vertically up with a speed of $9.8ms^{-1}$. Find the potential and kinetic energies after half second.

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17. A ball is throuwn vertially up with a velcity of $20ms^{-1}$. At height , will its K.E. be half its orginal value?

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18. 230 joules were spent inlifting a 10kg wieight to a height of 2m. Calculate the acceleration with which it was raised Take g= $10ms^2$.



19. Calculate the worked done in lifting a 300N weight to a height of 10m with an accelertaion $0.5ms^2$. Take g= $10ms^{-2}$.

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20. A ball is dropped from rest from a height of Om. If it loses 20% of its kinetic energy on striing the ground, what is the height to which the ball bounces?



21. A 3.0kg block has a speed of 2m/s A and 6m/s at B. If the distance from A and B along the curve is 12m, how large a frictional force acts on it ? Assuming the same friction, how far from B will it stop ?

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Type C Potential Energy Of A Spring

1. A 16kg block moving on a frictionless horiozntal surface with a velocity of $5cm^{-1}$ compreses an ideal spering and comes to rest. If the force constant of the spring be $100Nms^{-1}$, then how much is the spring compressed?

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2. A block of mass 2kg is propped from a heught of 40cm on a spring where force

constant is $1960 Nm^{-1}$ The maximum distance

thought which the spring compressed by



3. A block of massm, initally at rest is dropped from a height h onto a spring whose force constant is K. Find the maximum distance x through which the spring will be compressed.



4. An object is attached to a vertical springs and lowered slowly to its equilibrium position. This stretches the spring by a distance *d*. If the same object is attached to the same vertical spring, but permitted to fall freely, through what distance does it stretch the spring ?



Type D Based Of Power

1. A lift is designed to carry a load of 4000kg through 10 floors of a building averaging 6m per floor in 10seconds. Calculate the forse power of the lift.

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2. A labour lifts 100 stones to a height of 6m in two minutes. If mass of each stone be 1kg, calculate the average power of the labourer. Take g= $10ms^{-1}1$.

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3. A machine can take out 1000 kg of mud hour from a dept of 100 m . If efficieny of the machine is 0.9 , calculate its power.

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4. One coolie takes 1 min to raise a box through a height 2 m . Another takes 30 s for the same job and does the same job and does the same amount of work. Which one of these two has a greater power and which one uses greaster

energy?



5. An energies of 4.9 K.W power is used to pump water from a well 50 m deep. Calculate the quantity of water in kilo which it can pump out in one hour.

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6. Water is pumped out of a well 10 m deep by mean of a pump rated at 10 kW . Find the efficient of the motor if 4200 kg of water is pumped out every minutes . Take $g = 10ms^{-2}$.

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7. A 30m deep well is having water up to 15m. An engine evacuates it in one hour . The power of the engine. If the diameter of the well is 4mis 8. The human heart forces $4000cm^3$ of blood per minute through the arteries under pressure of 130mm. The density of blood is 1.03g/cc. What is the horse power of the heart ?



9. A pump can throw up 10 quntals of coal per hour from a coal mine 120m deep. Calculate

the power of the engine in watt assuming that

efficiency is 80%.



10. A man cylces up a hill whose slope is 1 in 25

at $6kmh^{-1}$. The mass of the man and the cycle

is 150 kg . Find the power.



11. A car weighting 1120 kg is going up an incline of 1 in 56 at the rate of 20 m in 2s. Find the power of the engine if frictional force is 64

N.



12. A standard car developes 40 H.P. Find the maximum speed the car can attain agains a resistance of 20kg wt. due to air and friction. Gvien efficiency of the engin is 25 % .1H. P. = 746W and $g = 10ms^{-2}$.



13. A car of mass 1000kg accelerates uniformly from rest to a velocity of 54km/h in 5 seconds. Calculate (i) its acceleration (ii) its gain in KE (iii) average power of the engine during this period.



Type E Based On Mass Energy Equivalence

1. Show that energy equivalent of one atomic

mass unit is nearly 933 MeV.

Take $1amu = 1.66 imes 10^{-27} kg$

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2.500 kg of water is heated from 20° to 100° C . Calculate the increase in the mass of water.Given specific heat of water $= 4.2 \times 10^3 Jkg^{-1} \cdot C^{-1}$.

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3. 1 mg of uranium is completely destroyed in

an atomic bomb. How much energy is liberated

?



Type F Based On Collisions

1. A 5 kg ball and a 10 ball approach each other with equal speeds of $21ms^{-1}$. Determine their

speeds after the elastic collision.

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2. 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 ?

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3. Two particles of masses 0.5 kg and 0.25kg moving with velocity 4.0 m/s and -3.0m/

collide head on in a perfectly inelastic collision.

Find the velocity of the composite particle after

collision and KE lost in the collision.

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4. What percentage of the K.E. of a moving particle is transferred to a stationary particle when it strikes the stationary particle four times its mass ?



5. A ball is dropped from a height of 3 m. What is the height upto which the ball will rebound ? The cofficient of restitution is 0.5.

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6. A ball is dropped from a height h on to a floor . If the cofficient of restitution is e, calculate the height the ball first rebounds ?

