PHYSICS

BOOKS - VGS BRILLIANT PHYSICS (TELUGU ENGLISH)

WORK , ENERGY AND POWER

Problems

1. A test tube of mass 10 grams closed with a cork of mass 1 gram contains some ether .

When the test tube is heated the cork flies out under the pressure of the ether gas. The test tube is suspended horizontally by a weight less rigid bar of length 5 cm . What is the minimum velcoity with which the cork should fly out of the tube , so that test tube deseribing a full vertical circle about the point O . Neglect the mass of ether .

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2. A machine gun fires 360 bullets per minute and each bullet travels with a velocity of $600ms^{-1}$. If the mass of each bullet is 5 gm , find the power of the machine gune ?

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3. Find the useful power used in pumping 3425 m^3 of water per hour from a well 8 m deep to the surface , supposing 40 % of the horse

power during pumping is wasted . What is the horse power of the engine ?

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4. A pump is required to lift 600 kg of water per minute from a well 25 m deep and to eject it with a speed of $50ms^{-1}$. Calculate the power required to perform the above task ? $(g = 10m \ \sec^{-2})$

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5. A block of mass 5 kg initially at rest the origin is acted on by a force along the X - positive direction represented by F = (20+5x) N. Calculate the work done by the force during the displacement of the block from x = 0 to x = 4 m .

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6. A block of mass 5 kg sliding down a smooth inclined plane as shown . The spring arranged near the bottom of the inclined plane has a

force constant 600 N/ m . Find the compression in the spring at the moment the velocity of the block is maximum ? 

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7. A force $F = -\frac{K}{x^2}(x \neq 0)$ acts on a particle along the X-axis . Find the work done by the force in displacing the particale from x = +a to x = + 2a. Take K as a positive constant .

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8. A force F acting on a particel varies with the position x as shown in the graph . Find the work done by the force in displacing the particle from x = - a to x = + 2a ? 

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9. Form a height of 20 m above a horizontal floor , a ball is thrown down with initial velocity 20 m /s . After striking the floor , the ball bounces to the same height from which it was thrown . Find the coefficient of restitution

for the collision between the ball and the floor ? (g= 10 m/s^2)

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10. A ball falls from a height of 10 m on to a hard horizontal floor and repeatedly bounces . If the coefficient of restitution is $\frac{1}{\sqrt{2}}$, then what is the total distance travelled by the ball before it ceases to rebound ?

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11. In a ballistics demonstration a , police officer fires a bullet of mass 50 g with speed $200ms^{-1}$ on soft plwood of thickness 2 cm . The bullet emerges with only 10 % of its initital kinetic energy . What is the emergent speed of the bullet ?

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12. Find the total energy of a body of 5 kg mass , which is at a height of 10 m from the earth and falling downwards straightly with a

velocity of 20 m/s (Take the acceleration due to gravity as $10m/s^2$)

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Very Short Answer Questions

1. If a bomb ar rest explodes into two pieces, the pieces must travel in opposite directions . Explain .

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2. State the conditions under which a force does no work .

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3. Define work , power and Energy . State their S.I . Units .

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4. State the relation between the kinetic energy and momentum of a body .

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5. State the sign of work done by a force in the following .

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

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6. State the sign of work done by a force in the following .

Work done by gravitational force in lifting a bucket out of a well by means of a rope tied to the bucket.

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7. State the sign of work done by a force in the following .

work done by friction on a body sliding down an inclined plane .

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8. State the sign of work done by a force in the following .

work done by gravitational force on a body sliding down an inclined plane.

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9. State the sign of work done by a force in the following .

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

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10. State the sign of work done by a force in the following .

work done by the resistive force of air on a vibrating pendulum in bringing it to rest .

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11. State if each of the following statements is true or false . Give reasons for your answer .

Total energy of a system is always conserved , no matter what internal and external forces on the body are present .

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12. State if each of the following statements is true or false . Give reasins for your answer .

The work done by earth's gravitational force in

keeping the moon in its orbit for its one revolution is zero .

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13. Which physical quantity remains constant (i) in an elastic collision (ii) in an inelastic collision ?

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14. A body freely falling from a certain height 'h' , after striking a smooth floor rebounds and h rises to a height h /2 . What is the coefficient of restitution between the floor and the body ?

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15. What is the total displacement of freely falling body , after successive rebounds from the same place of ground , before it comes to

stop ? Assume that 'e' is the coefficient of restitution between the body and the ground .

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Short Answer Questions

1. What is potential energy ? Derive an expression for the gravitational potential energy .

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2. A lorry and a car moving with the same momentum are brought to rest by the application of brakes , which provide equal retarding force . Which of them will come to rest in shorter time ? Which will come to rest in less distance ?

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3. Distinguish between conservation and non-conservative forces with one example each .

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4. Show that in the case of one dimensional elastic collision , the relative velocity of approach of two colloding bodies before collision is equal to the relative velocity of separation after collosion .

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5. Show that two equal masses undergo oblique elastic collision will move at right

angles after collision , if the second body initialyy at rest .

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6. Derive an expression for the height attained by a freely falling body after 'n' number of rebounds from the floor.

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7. Explain the law of conservation of energy .

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Long Answer Questions

1. Develop the notions of work and show that it leads to work-energy theorem . State the condition under which a force does no work .

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2. What are collisions ? Explain the possible types of collision ? Develop the theory of one dimensional elastic collision .

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3. State and prove law of conservation of energy is case of a freely falling body .

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