PHYSICS

BOOKS - SAI PHYSICS (TELUGU ENGLISH)

WORK, ENERGY AND POWER

Mcq

1. A man of weight 50 kg carries an object to a height of 20m in a time of 10 sec. The power

used by the man in this process is 2000W, then find the weight of the object carried by the man [assume $g = 10ms^{-2}$]

A. 100KG

B. 25KG

C. 50KG

D. 10KG

Answer: c

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2. A body of mass 10 kg is acted upon by a force given by equation $F = \left(3t^2 - 30\right)$ Newtons. The initial velocity of the body is 10 m/s. The velocity of the body after 5 secs. is

A. 4.5m//s

B. 6m//s

C. 7.5m//s

D. 5m//s

Answer: c

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3. A ball is released from the top of a tower. The ratio of work done by force of gravity in 1st second, 2nd second and 3rd second of the motion of ball is

A. $1:3:5$

B. $1:4:16$

C. $1:9:25$

D. $1:2:3$

Answer: a

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4. A body of mass 2.4 kg is subjected to a force which varies with distance as shown is figure. The body starts from rest at x = 0. Its velocity at x = 9 m is

A. $5\sqrt{3m/\sec}$

B. $20\sqrt{3m/\sec}$

C. 10m//sec

D. 40m//sec

Answer: c

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5. When a big drop of water is formed from n small drops of water, the energy loss is 3E, where, E is the energy of the bigger drop. If the radius of the bigger drop is R and r is the radius of the smaller drop, then number of smaller drops (n) is

A. $4\frac{R}{r^2}$

B. $4\frac{R}{r}$

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

D. $4\frac{R^2}{r^2}$

Answer: d

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6. A canon shell fired breaks into two equal parts at its highest point. One part retraches the path to the canon with kinetic enegry E_1

and the kinetic energy of the second part is E_2

. Relation between E_1 and E_2 is

A. $E_2 = 15E_1$

B. $E_2 = E_1$

C. $E_2 = E_3$

D. $E_2 = 9E_1$

Answer: d

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7. The work done in moving an object from origin to a point whose position vector is $r = 3\hat{i} + 2\hat{j} - 5\hat{k}$ by a force $F = 2\hat{i} - \hat{j} - \hat{k}$

A. 1 unit

B. 9 unit

C. 13 units

D. 60 units

Answer: b

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8. A ball at rest is dropped from a height of 12 m. It losses 25% of its kinetic energy on striking the ground and bounces back to a height 'h'. then value of 'h' is

A. 3m

B. 6m

C. 9m

D. 12m

Answer: c

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9. Two bodies of mass 4 kg and 5 kg are moving along East and North directions with velocities 5 m//s and 3 m//s respectively. Magnitude of the velocity of centre of mass of the system is

A. $\frac{25}{9} m/s$

B. $\frac{9}{25} m/s$

C. $\frac{41}{9} m/s$

D. $\frac{16}{9} m/s$

Answer: a

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10. The velocity v reached by a car of mass m at certain distance from the starting point driven with constant Power P is such that

A. $v\alpha\frac{3P}{m}$

B. $v^2\alpha\frac{3P}{m}$

C. $v^3\alpha\frac{3P}{m}$

D. $v\alpha\left(\frac{3P}{m}\right)^2$

Answer: c

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11. A ball is let fall from a height h. It makes n collisions with the earth. After n collisions it rebounds with a velocity v_(n) and the ball rises to a height h_(n) then coefficient of restitution is given by

A. $e = \left[\frac{h_n}{h_0}\right]^{1/2n}$

B. $e = \left[\frac{h_0}{h_n}\right]^{1/2n}$

C. $e = \frac{1}{n}\frac{\sqrt{h_n}}{h_0}$

D. $e = \frac{1}{n}\frac{\sqrt{h_0}}{h_n}$

Answer: a

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12. A large open tank has two holes in the wall. One is a square hole of side L at a depth y from the top and the other is a circular hole of radius R at a depth 4y from the top. When the tank is completely filled with water, the

quantities of water flowing out per second from the two holes are the same. The value of R is

A. $\frac{L}{\sqrt{2\pi}}$

B. $2\pi L$

C. $L\frac{\sqrt{2}}{\pi}$

D. $\frac{L}{2}\pi$

Answer: a

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13. A body of mass 5 kg makes an elastic collision with another body at rest and continues to move in the original direction after collision with velocity equal to $\frac{1}{10}$th of its original velocity . Then the mass of the second body is

A. 4.09kg

B. 0.5kg

C. 5kg

D. 5.09kg

Answer: a

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14. A particle of mass 4 m explodes into three pieces of masses, m, m and 2 m. The equal masses move along X-axis and Y-axis with velocities $4ms^{-1}$ and $6ms^{-1}$ respectively. The magnitude of the velocity of the heavier mass is

A. $\sqrt{17ms^{-1}}$

B. $2\sqrt{13ms^{-1}}$

C. $\sqrt{13ms^{-1}}$

D. $\frac{\sqrt{13}}{2}ms^{-1}$

Answer: c

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15. A river of salty water is flowing with a velocity 2 ms^{-1} If the density of the water is 1.28 c c^{-1}, then the kinetic momentum during

a collision, the condition is energy of each cubic meter of water is

A. 2.4j

B. 24 j

C. 2.4 kj

D. 4.8 kj

Answer: c

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16. A ball is dropped from a heighth on a floor of coefficient of restitution e. the total distance coverewd by the ball just before second hit is

A. $h\left(1-2e^2\right)$

B. $h\left(1+2e^2\right)$

C. $h\left(1+2e^2\right)$

D. he^2

Answer: b

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17. A block of mass m=25 kg sliding on a smooth horizontal mg surface with a velocity v = 3 ms' meets the spring of 4d spring constant k = 100 Nm' fixed at one end as shown in figure. The maximum compression of the spring and 23. Consider the following statements A and B and identify velocity of block as it returns to the original position the correct answer respectively are

A. $1.5m, \ -3ms^{-1}$

B. $1.5m, 0.01ms^{-1}$

C. $1.0m, 3ms^{-1}$

D. $0.5m, 2ms?^{-1}$

Answer: a

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18. In two separate collisions, the coefficient of restitutions d) A is false but B is true e and e are in the ratio 3: 1. In the first collision the

relative velocity of approach is twice the relative velocity of separation, then the ratio between relative velocity of approach and the relative velocity of separation in the second collision is,

A. $1:6$

B. $2:3$

C. $3:2$

D. $6:1$

Answer: d

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19. A motor of power P_0 is used to deliver water at a certain rate through a given horizontal pipe. To increase the rate of flow of water through the same pipe n times, the power of the moter is increased to P_1 to P_0 is

A. n-times

B. $n^2 - \times$

C. $n^3 - \times$

D. $n^4 - \times$

Answer: c

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20. A bullet of mass 10 g is fired horizontally 1000 m/s from a rifle situated at a height 50 m above the ground. If the bullet reaches the ground with velocity 500 m/s the work done against air resistance in the trajectory of the bullet in joule is $\left(g = 10\frac{m}{s^{-2}}\right)$

A. 5005 j

B. 3755 j

C. 3750 j

D. 17.5 j

Answer: B

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21. For a system to follow the law of conservation of linear momentum during a collision, the condition is (1) Total external force acting on the system is zero (2) Total

external force acting on the system is finite and time of collision is negligible (3) Total internal force acting on the system is zero

A. (1) Only

B. (2) Only

C. (3) Only

D. (1) or (2)

Answer: a

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22. To the free end of spring hanging from a rigid support, a block of mass m is hung and slowly allowed to come to its equilibrium position. Then, stretching in the spring is d. If the same block is attached to the same spring and allowed to fall suddenly, the amount of stretching is (force constant k)

A. mg/k

B. 2d

C. mg/3k

D. 4 d

Answer: b

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23. Consider the following statements A and B and identify the correct answer A. In an elastic collision, if a body suffers a head on collision with another of same mass at rest, the first body comes to rest while the other starts moving with the velocity of the first one B. Two bodies of equal mass suffering a head on

elastic collision merely exchanges their velocities

A. Both A and B are true

B. Both A and B are false

C. A is true but B is false

D. A is false but B is true

Answer: a

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24. A 2 kg ball moving at 24 ms undergoes inelastic head on collision with a 4 kg ball moving in the opposite direction at 48 ms. If the coefficient of restitution is 2/3, their velocities in ms-after impact are

A. - 56, -8

B. - 28,-4

C. – 14. - 2

D. -7,-1

Answer: a

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25. A block of mass $2kg$ is initially at rest on a horizontal frictionless surface. A horizontal froce $\overline{F} = \left(9 - x^2\right)\bar{i}$ newton acts on it, when the block is at $x = 0$. The maximum kinetic energy of the block between $x = 0m$ and $x = 3m$ in joule is

Conservation of mechanical energ

A. 24

B. 20

C. 18

D. 15

Answer: c

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26. Two identical blocks A and B, each of mass m resting on smooth floor, are connected by a light spring of natural length L and the spring constant k, with the spring at its natural length. A third identical block C (mass m)

moving with a speed v along the line joining A and B collides with A. The maximum compression in the spring is proportional to

A. $\frac{\sqrt{m}}{2k}$

B. $m\frac{\sqrt{v}}{2k}$

C. $\frac{\sqrt{mv}}{k}$

D. $\frac{mv}{2k}$

Answer: a

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27. Consider the following statements A and B and identify the correct answer given below. (A) A body initially at rest is acted upon by a constant force. The rate of change of its kinetic energy varies linearly with time. (B) When a body is at rest, it must be in equilibrium

A. A and B are correct

B. A and B are wrong

C. A is correct and B is wrong

D. A is wrong and B is correct

Answer: c

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28. Two particles having position vectors $\overrightarrow{r}_1 = \left(3\hat{i} + 5\hat{j}\right)m$ and $r_2 = \left(-5\hat{i} + 3\hat{j}\right)m$ are moving with velocities $V_1 = \left(4\hat{i} + 3\hat{j}\right)\frac{m}{s}$ and $V_2 = \left(-a\hat{i} + 4\hat{j}\right)\frac{m}{s}$. If they collide after 2 s, the value of a is

A. 2

B. 4

C. 6

D. 8

Answer: d

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29. A body of mass 4 kg is moving with momentum of $8kgms^{-1}$. A force of 0.2 N acts on it in the direction of motion of the body for 10 s. The increase in kinetic energy is

A. 10

B. 8.5

C. 4.5

D. 4

Answer: c

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30. A body is moving up an inclined plane of angle θ with an initial kinetic energy E. The coefficient of friction between the plane and

the body is μ. The work done against friction before the body comes to rest is

A. $\frac{\mu \cos \theta}{E \cos \theta + \sin \theta}$

B. E

C. $\frac{\mu E \cos \theta}{\mu \cos \theta + \sin \theta}$

D. $\frac{\mu E \cos \theta}{\mu \cos \theta + \sin \theta}$

Answer: b

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31. A body of mass 2 kg starts from rest and moves with uniform acceleration. It acquires a velocity 20 m/s in 4 s. The power exerted on the body in 2 s in Watt is

A. 50

B. 100

C. 150

D. 200

Answer: b

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32. A heavy nucleus at rest breaks into two fragments which fly off with velocities in the ratio 3: 1. The ratio of radii of the fragments is

A. $1:3$

B. $3:4$

C. $4:1$

D. $2:1$

Answer: a

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

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

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

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

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

Answer: a

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34. A body of mass 6 kg is under a force which causes displacement in it given by $s = \frac{t^2}{4}$ metre where t is time. The work done by the force in 2 s is

A. 12j

B. 9j

C. 6j

D. 3j

Answer: d

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35. A force applied by an engine on a train of mass 2.05×10^6 kg changes its velocity from 5 ms' to 25 msin 5 min. The power of the engine is

A. 1.025 MW

B. 2.05 MW

C. 5MW

D. 6MW

Answer: b

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36. A force of 5 N making an angle with the horizontal acting on an object displaces it by 0.4 m along the horizontal direction. If the

object gains kinetic energy of 1 J the horizontal component of the force is

A. 1.5N

B. 2.5N

C. 3.5N

D. 4.5N

Answer: b

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37. A body of mass m, moving with a velocity 10 ms. collides with another body at rest of mass m. After collision the velocities of the two bodies are 2 ms and 5 ms' respectively, along the direction of motion of m The ratio m1/m2is

A. $\frac{5}{12}$

B. $\frac{5}{8}$

C. $\frac{8}{5}$

D. $\frac{12}{5}$

Answer: b

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38. A ball is projected vertically down with an initial velocity from a height of 20 m on to a horizontal floor. During the impact it loses 50% of the energy and rebounds to the same height, the initial velocity of its projection is

A. $20ms^{-1}$

B. $15ms^{-1}$

C. $10ms^{-1}$

D. $5ms^{-1}$

Answer: a

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39. A 10 HP motor pumps out water from a well of 30 m and fills a water tank of volume 2238 L at a height of 10 m from the ground. The running time of the motor to fill the empty water tank is

A. 5min

B. 10min

C. 15min

D. 20min

Answer: d

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40. An object initially at rest explodes into 3 fragments A,B and C. The momentum of A is pi

and that of B is $\sqrt{3p\hat{j}}$ where p is a positive number. The momentum of C will be

A. (1 + sqrt(3))pin a direction of making 120° with that of A

B. (1 + sqrt(3)) Pin a direction of making 150° with that of B

C. 2 p in a direction of making 150° with that of A

D. 2 p in a direction making 150° with that of B

Answer: d

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41. A ball A moving with a speed of 90 ms' collides directly with another identical ball B moving with a speed v in the opposite direction, A comes to rest after the collision. If the coefficients of restitution is 0.8, the speed of B before collision is

A. $10ms^{-1}$

B. $81ms^{-1}$

C. $22.5ms^{-1}$

D. $90ms^{-1}$

Answer: a

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42. A mass of 12 kg at rest explodes into two pieces of masses 4 kg and 8 kg which move in opposite directions. If the velocity of 8 kg

piece is 6 ms' then the kinetic energy of the other piece is (in Joule)

A. 64

B. 128

C. 144

D. 288

Answer: d

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43. A force $\vec{F} = 3\hat{i} + c\hat{j} + 2\hat{k}$acting on a particle causes a displacement $\vec{s} = -4\hat{i} + 2\hat{j} + 3\hat{k}$ in its own direction. If the work done is 6 J, the value of c is

A. zero

B. 1

C. 12

D. 6

Answer: d

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44. A solid wooden block resting on a frictionless surface is hit by a bullet. The bullet gets embedded. During this process

A. Only kinetic energy is conversed

B. Only momentum is conserved

C. Both momentum and kinetic energy are conserved

D. Neither momentum nor kinetic energy is conserved

Answer: b

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45. Two bodies with kinetic energies in the ratio of $4:1$are moving with equal linear momentum. The ratio of their masses is

A. $1:2$

B. $1:1$

C. $4:1$

D. $1:4$

Answer: d

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46. A uniform chain of length L hangs partially from table and held in equilibrium by friction. If greatest length of chain that hangs without slipping is l then the coefficient of friction between chain and table is

A. L

B. $\frac{1}{L+l}$

C. $\frac{l}{L-l}$

D. $\frac{l}{L+l}$

Answer: c

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47. At high altitude, a body explodes at rest into two equal fragments with one of the fragments receiving horizontal velocity 10 ms. The time when the radius vectors connecting

point of explosion to fragments make 90° is $(g = 10ms^{-2})$

A. 10s

B. 4s

C. 2s

D. 1s

Answer: d

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48. 1s 48. Two bodies have masses 2 m and m. Their kinetic energies are in the ratio $8:1$, their linear momentum are in the ratio of

A. $1:1$

B. $2:1$

C. $4:1$

D. $8:1$

Answer: c

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49. Two trolleys of masses m and 3 m are connected by aspring. The spring is compressed and released the trolleys move off in opposite directions and come to rest after travelling distances s, and s, respectively. Assuming coefficient of friction is same for both the ratio of sto s_1 to s_2 is

A. $1:9$

B. $1:3$

C. $3:1$

D. $9:1$

Answer: c

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50. A 2 kg mass moving on a smooth frictionless surface with a velocity of 10 mshits another 2 kg mass kept at rest in an elastic collision. After collision, if they move together

A. They travel with a velocity of 5 ms^1 in the same direction

B. They travel with a velocity of 10 ms^1 in the same direction

C. They travel with a velocity of $10ms^1$ in the

D. They travel in the opposite direction with a velocity of 5 ms^1

Answer: a

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51. A 2 kg body and 3 kg body have equal momentum. If the kinetic energy of 3 kg body is 10 J, the kinetic energy of 2 kg body will be in Joule)

A. 6.66

B. 15

C. 22.5

D. 45

Answer: b

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52. A bullet of mass x moves with a velocity y, hits a wooden block of mass z, at rest and gets embedded in it. After collision if the wooden block with bullet in it moves the velocity is

A. $\frac{x}{x+z}y$

B. $x+\frac{z}{x}y$

C. $\frac{z}{x+y}y$

D. $x+\frac{y}{z}y$

Answer: a

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53. A ball of mass m moving with a velocity collides head on elastically with another of the same mass m but moving with a - in the opposite direction). After the collision

A. The velocities are exchanged between the two balls

B. Both the balls come to rest

C. Both of them move at right angles to the original line of motion

D. One ball comes to rest and the other ball travels back with velocity 2 V

Answer: a

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54. The work done on a particle moving round a horizontal circular path of radius r with

uniform speed v under a centripetal force F is equal to,

A. mvr

B. 0

C. $m \text{ or } ^2$

D. $m\frac{v^2}{r}$

Answer: b

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55. A railway truck of mass $m = 2 \times 10^4$ kg travelling at 0.5 ms^(-1) collides with another of half of its mass moving in the opposite direction with a velocity 0.4 ms. If they collide each other the combined velocity is

A. $0.1ms^{-1}$

B. $0.4ms^{-1}$

C. $0.2ms^{-1}$

D. $0.5ms^{-1}$

Answer: c

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56. A particle of mass 4 m which is at rest explodes into three fragments. Two of the fragments each of mass m are found to move with a speed of v each in mutually perpendicular direction. The total energy released in the process is

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

B. mv^2

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

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

Answer: d

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