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Class: XI
Subject: Physics
Topic: Work, Power and Energy
No. of Questions: 30

1. A block of mass m moves up an inclined plane of angle of inclination θ. If μ is the coefficient of friction between the block and the inclined plane, the work done in moving the block through a distance x along the plane is given by

   A. mgx(sin θ + μ cos θ)
   B. mgx sin θ
   C. mgx (sin θ – μ cos θ)
   D. μ mgx cos θ

2. Two particles of masses m and 4 m have linear momenta in the ratio of 2 : 1. What is the ratio of their kinetic energies?

   A. $\sqrt{2}$
   B. 2
   C. 4
   D. 16

3. A particle of mass m has half the kinetic energy of another particle of mass m/2. If the speed of the heavier particle is increased by 2 ms^{-1}, its new kinetic energy equals the original kinetic energy of the lighter particle. The ratio of the original speeds of the lighter and heavier particles is

   A. 1 : 1
   B. 1 : 2
   C. 1 : 3
   D. 1 : 4

4. A particle of mass m has half the kinetic energy of another particle of mass m/2. If the speed of the heavier particle is increased by 2 ms^{-1}, its new kinetic energy equals the original kinetic energy of the lighter particle. What is the original speed of the heavier particle?

A. $2(1 + \sqrt{2})\ ms^{-1}$
B. $2(1 - \sqrt{2})\ ms^{-1}$
C. $(2\sqrt{2} + 1)\ ms^{-1}$
D. $(2\sqrt{2} - 1)\ ms^{-1}$

5. A steel ball falls from a height h on a floor for which the coefficient of restitution is e. The height attained by the ball after two rebounds is

A. eh
B. e^2h
C. e^3h
D. e^4h

6. A body of mass m is thrown vertically upwards with a velocity v. The height h at which the kinetic energy of the body is half its initial value is given by

A. $h = \frac{v^2}{g}$
B. $h = \frac{v^2}{2g}$
C. $h = \frac{v^2}{3g}$
D. $h = \frac{v^2}{4g}$

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7. A body of mass m moving with a speed v suffers a perfectly inelastic collision with another body of mass M at rest. The speed of the composite body will be

A. $\left(\frac{m+M}{m}\right)v$
B. $\left(\frac{m}{m+M}\right)v$
C. $\left(\frac{M}{m+M}\right)v$
D. $\left(\frac{m+M}{M}\right)v$

8. A body of mass m moving with a speed v suffers a perfectly inelastic collision with another body of mass M at rest. The ratio of the final kinetic energy of the system to the initial kinetic energy is

A. $\frac{m}{m+M}$
B. $\frac{M}{m+M}$
C. $\frac{m+M}{m}$
D. $\frac{m+M}{M}$

9. A ball of mass m moving horizontally at a speed v collides with the bob of a simple pendulum at rest. The mass of the bob is also m. If the collision is perfectly inelastic, the height to which the ball and the bob rise after the collision will be given by

A. $\frac{v^2}{g}$
B. $\frac{v^2}{2g}$
C. $\frac{v^2}{4g}$
D. $\frac{v^2}{8g}$

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10. A ball of mass m moving horizontally at a speed v collides with the bob of a simple pendulum at rest. The mass of the bob is also m. If the collision is perfectly inelastic, the ratio of the kinetic energy of the system immediately after the collision to that before the collision will be

A. 1 : 1
B. 1 : 2
C. 1 : 3
D. 1 : 4

11. A ball of mass m moving horizontally at a speed v collides with the bob of a simple pendulum at rest. The mass of the bob is also m. If the collision is perfectly elastic, the bob of the pendulum will rise to a height of

A. $\frac{v^2}{g}$
B. $\frac{v^2}{2g}$
C. $\frac{v^2}{4g}$
D. $\frac{v^2}{8g}$

12. A ball of mass m moving with a velocity v undergoes an oblique elastic collision with another ball of the same mass m but at rest. After the collision, if the two balls move with the same speeds, the angle between their directions of motion will be

A. 30°
B. 60°
C. 90°
D. 120°

13. A ball of mass m moving with a velocity v undergoes an oblique elastic collision with another ball of the same mass m but at rest. After the collision, if the two balls move with different speeds, the angle between their directions of motion will be

A. less than 90°
B. more than 90°
C. exactly 90°
D. exactly 180°

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14. A bullet, incident normally on a wooden plank, loses one-tenth of its speed in passing through the plank. The least number of such planks required to stop the bullet is

A. 5
B. 6
C. 7
D. 8

15. A body, having kinetic energy k, moving on a rough horizontal surface, is stopped in a distance x. The force of friction exerted on the body is

A. $\frac{k}{x}$
B. $\frac{\sqrt{k}}{x}$
C. $\frac{k}{\sqrt{x}}$
D. kx

16. A uniform chain of mass M and length L is held on a horizontal frictionless table with $\frac{1}{n}$ of its length hanging over the edge of the table. The work done in pulling the chain up on the table is

A. $\frac{MgL}{n}$
B. $\frac{MgL}{2n}$
C. $\frac{MgL}{n^2}$
D. $\frac{MgL}{2n^2}$

17. A block of wood of mass M is suspended by means of a thread. A bullet of mass m is fired horizontally into the block with a velocity v. As a result of the impact, the bullet is embedded in the block. The block will rise to a vertical height given by

A. $\frac{1}{2g}\left(\frac{mv}{M+m}\right)^2$
B. $\frac{1}{2g}\left(\frac{mv}{M-m}\right)^2$
C. $\frac{1}{2g}\frac{mv^2}{(M+m)}$

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D. $\frac{1}{2g}\frac{mv^2}{(M-m)}$

18. A body of mass m moving with a velocity v in the x-direction collides with a body of mass M moving with a velocity V in the y-direction. They stick together during collision. Then

A. the magnitude of the momentum of the composite body is $\sqrt{(mv^2)+(MV)^2}$
B. the composite body moves in a direction making an angle $\theta = \tan^{-1}\left(\frac{MV}{mv}\right)$ with the x-axis
C. the loss of kinetic energy as a result of collision is $\frac{1}{2}\frac{Mm}{(M+m)}(V^2+v^2)$
D. all the above choices are correct

19. A body of mass 2 kg has an initial velocity v_i = ($\hat{i}+\hat{j}$) ms^{-1}. After collision with another body its velocity becomes v_f = ($5\hat{i}+6\hat{j}+\hat{k}$) ms^{-1}. If the impact time is 0.02 s, the average force of impact on the body (in Newton) is

A. $50(4\hat{i}+5\hat{j}+\hat{k})$
B. $50(4\hat{i}-5\hat{j}-\hat{k})$
C. $100(4\hat{i}+5\hat{j}-\hat{k})$
D. $100(4\hat{i}+5\hat{j}+\hat{k})$

20. Two equal spheres A and B lie on a smooth horizontal circular groove at opposite ends of a diameter. Sphere A is projected along the groove and at the end of time T impinges on sphere B. If e is the coefficient of restitution, the second impact will occur after a time equal to

A. T
B. eT
C. $\frac{2T}{e}$
D. 2 eT

21. A spring is cut into two equal halves. How is the spring constant of each half affected?

22. The momentum of an object is doubled. How does it's. K.E. change?

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23. In which motion momentum changes but K.E. does not?

24. A light body and a heavy body have same linear momentum. Which one has greater K.E.?

25. A shot fired from cannon explodes in air. What will be the changes in the momentum and the kinetic energy?

26. Can a body have momentum without energy?

27. Obtain an expression for K.E. of a body moving uniformly?

28. What is meant by a positive work, negative work and zero work? Illustrate your answer with example?

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

    (1) Work done by the applied force in 10s

    (2) Work done by the friction in 10s

    (1) Work done by the net force on the body in 10s.

30. Derive the expression for the potential energy stored in a spring