

Ordinary Thinking

Objective Questions

Work Done by Constant Force

- A body of mass m is moving in a circle of radius r with a constant speed v . The force on the body is $\frac{mv^2}{r}$ and is directed towards the centre. What is the work done by this force in moving the body over half the circumference of the circle [NCERT 1977]

(a) $\frac{mv^2}{\pi r^2}$ (b) Zero
(c) $\frac{mv^2}{r^2}$ (d) $\frac{\pi r^2}{mv^2}$
- If the unit of force and length each be increased by four times, then the unit of energy is increased by [CPMT 1987]

(a) 16 times (b) 8 times
(c) 2 times (d) 4 times
- A man pushes a wall and fails to displace it. He does [CPMT 1992]

(a) Negative work
(b) Positive but not maximum work
(c) No work at all
(d) Maximum work
- The same retarding force is applied to stop a train. The train stops after 80 m. If the speed is doubled, then the distance will be [CPMT 1984]

(a) The same (b) Doubled
(c) Halved (d) Four times
- A body moves a distance of 10 m along a straight line under the action of a force of 5 N. If the work done is 25 joules, the angle which the force makes with the direction of motion of the body is [NCERT 1980; JIPMER 1997; CBSE PMT 1999; BHU 2000; RPMT 2000; Orissa JEE 2002]

(a) 0° (b) 30°
(c) 60° (d) 90°
- You lift a heavy book from the floor of the room and keep it in the book-shelf having a height 2 m. In this process you take 5 seconds. The work done by you will depend upon [MP PET 1993]

(a) Mass of the book and time taken
(b) Weight of the book and height of the book-shelf
(c) Height of the book-shelf and time taken
(d) Mass of the book, height of the book-shelf and time taken
- A body of mass m kg is lifted by a man to a height of one metre in 30 sec. Another man lifts the same mass to the same height in 60 sec. The work done by them are in the ratio [MP PMT 1993]

(a) 1 : 2 (b) 1 : 1
(c) 2 : 1 (d) 4 : 1
- A force $\mathbf{F} = (5\hat{i} + 3\hat{j})$ newton is applied over a particle which displaces it from its origin to the point $\mathbf{r} = (2\hat{i} - 1\hat{j})$ metres. The work done on the particle is [MP PMT 1995; RPET 2003]

(a) - 7 joules (b) + 13 joules
(c) + 7 joules (d) + 11 joules
- A force acts on a 30 gm 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 metres and t is in seconds. The work done during the first 4 seconds is [CBSE PMT 1998]

(a) 5.28 J (b) 450 mJ
(c) 490 mJ (d) 530 mJ
- A body of mass 10 kg is dropped to the ground from a height of 10 metres. The work done by the gravitational force is ($g = 9.8 \text{ m/sec}^2$) [SCRA 1994]

(a) - 490 Joules (b) + 490 Joules
(c) - 980 Joules (d) + 980 Joules
- Which of the following is a scalar quantity [AFMC 1998]

- (a) Displacement (b) Electric field
(c) Acceleration (d) Work
12. The work done in pulling up a block of wood weighing 2 kN for a length of 10 m on a smooth plane inclined at an angle of 15° with the horizontal is [AFMC 1999; Pb PMT 2003]
(a) 4.36 kJ (b) 5.17 kJ
(c) 8.91 kJ (d) 9.82 kJ
13. A force $\vec{F} = 5\hat{i} + 6\hat{j} - 4\hat{k}$ acting on a body, produces a displacement $\vec{s} = 6\hat{i} + 5\hat{k}$. Work done by the force is [KCET 1999]
(a) 18 units (b) 15 units
(c) 12 units (d) 10 units
14. A force of 5 N acts on a 15 kg body initially at rest. The work done by the force during the first second of motion of the body is [JIPMER 1999]
(a) 5 J (b) $\frac{5}{6}\text{ J}$
(c) 6 J (d) 75 J
15. A force of 5 N , making an angle θ 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 [EAMCET (Engg.) 2000]
(a) 1.5 N (b) 2.5 N
(c) 3.5 N (d) 4.5 N
16. The work done against gravity in taking 10 kg mass at 1 m height in 1 sec will be [RPMT 2000]
(a) 49 J (b) 98 J
(c) 196 J (d) None of these
17. The energy which an e^- acquires when accelerated through a potential difference of 1 volt is called [UPSEAT 2000]
(a) 1 Joule (b) 1 Electron volt
(c) 1 Erg (d) 1 Watt .
18. A body of mass 6 kg is under a force which causes displacement in it given by $s = \frac{t^2}{4}$ metres where t is time. The work done by the force in 2 seconds is [EAMCET 2001]
(a) 12 J (b) 9 J
(c) 6 J (d) 3 J
19. A body of mass 10 kg at rest is acted upon simultaneously by two forces 4 N and 3 N at right angles to each other. The kinetic energy of the body at the end of 10 sec is [Kerala (Engg.) 2001]
(a) 100 J (b) 300 J
(c) 50 J (d) 125 J
20. A cylinder of mass 10 kg is sliding on a plane with an initial velocity of 10 m/s . If coefficient of friction between surface and cylinder is 0.5 , then before stopping it will describe [Pb. PMT 2001]
(a) 12.5 m (b) 5 m
(c) 7.5 m (d) 10 m
21. A force of $(3\hat{i} + 4\hat{j})$ Newton acts on a body and displaces it by $(3\hat{i} + 4\hat{j})\text{ m}$. The work done by the force is [AIIMS 2001]
(a) 10 J (b) 12 J
(c) 16 J (d) 25 J
22. A 50 kg man with 20 kg load on his head climbs up 20 steps of 0.25 m height each. The work done in climbing is [JIPMER 2002]
(a) 5 J (b) 350 J
(c) 100 J (d) 3430 J
23. A force $\vec{F} = 6\hat{i} + 2\hat{j} - 3\hat{k}$ acts on a particle and produces a displacement of $\vec{s} = 2\hat{i} - 3\hat{j} + x\hat{k}$. If the work done is zero, the value of x is [Kerala PMT 2002]
(a) -2 (b) $1/2$
(c) 6 (d) 2
24. A particle moves from position $\vec{r}_1 = 3\hat{i} + 2\hat{j} - 6\hat{k}$ to position $\vec{r}_2 = 14\hat{i} + 13\hat{j} + 9\hat{k}$ under the action of force $4\hat{i} + \hat{j} + 3\hat{k}\text{ N}$. The work done will be [Pb. PMT 2002,03]
(a) 100 J (b) 50 J
(c) 200 J (d) 75 J

25. A force $(\vec{F}) = 3\hat{i} + \hat{j} + 2\hat{k}$ 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 $6 J$, then the value of ' d ' is [CBSE PMT 2002]
 (a) 0 (b) 1
 (c) 6 (d) 12
26. In an explosion a body breaks up into two pieces of unequal masses. In this [MP PET 2002]
 (a) Both parts will have numerically equal momentum
 (b) Lighter part will have more momentum
 (c) Heavier part will have more momentum
 (d) Both parts will have equal kinetic energy
27. Which of the following is a unit of energy [AFMC 2002]
 (a) Unit (b) Watt
 (c) Horse Power (d) None
28. If force and displacement of particle in direction of force are doubled. Work would be [AFMC 2002]
 (a) Double (b) 4 times
 (c) Half (d) $\frac{1}{4}$ times
29. A body of mass $5 kg$ is placed at the origin, and can move only on the x-axis. A force of $10 N$ is acting on it in a direction making an angle of 60° with the x-axis and displaces it along the x-axis by $4 metres$. The work done by the force is [MP PET 2003]
 (a) $2.5 J$ (b) $7.25 J$
 (c) $40 J$ (d) $20 J$
30. A force $\vec{F} = (5\hat{i} + 4\hat{j}) N$ acts on a body and produces a displacement $\vec{S} = (6\hat{i} - 5\hat{j} + 3\hat{k})m$. The work done will be [CPMT 2003]
 (a) $10 J$ (b) $20 J$
 (c) $30 J$ (d) $40 J$
31. A uniform chain of length $2m$ is kept on a table such that a length of $60cm$ hangs freely from the edge of the table. The total mass of the chain is $4kg$. What is the work done in pulling the entire chain on the table [AIEEE 2004]
 (a) $7.2 J$ (b) $3.6 J$
 (c) $120 J$ (d) $1200 J$
32. A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle, the motion of the particle takes place in a plane. It follows that [AIEEE 2004]
 (a) Its velocity is constant
 (b) Its acceleration is constant
 (c) Its kinetic energy is constant
 (d) It moves in a straight line
33. A ball of mass m moves with speed v and strikes a wall having infinite mass and it returns with same speed then the work done by the ball on the wall is [BCECE 2004]
 (a) Zero (b) $mv J$
 (c) $m/v.J$ (d) $v/m J$
34. A force $\vec{F} = (5\hat{i} + 3\hat{j} + 2\hat{k})N$ is applied over a particle which displaces it from its origin to the point $\vec{r} = (2\hat{i} - \hat{j})m$. The work done on the particle in joules is [AIEEE 2004]
 (a) -7 (b) $+7$
 (c) $+10$ (d) $+13$
35. The kinetic energy acquired by a body of mass m is travelling some distance s , starting from rest under the actions of a constant force, is directly proportional to [Pb. PET 2000]
 (a) m^0 (b) m
 (c) m^2 (d) \sqrt{m}
36. If a force $\vec{F} = 4\hat{i} + 5\hat{j}$ causes a displacement $\vec{s} = 3\hat{i} + 6\hat{k}$, work done is [Pb. PET 2002]
 (a) 4×6 unit (b) 6×3 unit
 (c) 5×6 unit (d) 4×3 unit
37. A man starts walking from a point on the surface of earth (assumed smooth) and reaches diagonally opposite point. What is the work done by him [DCE 2004]
 (a) Zero (b) Positive
 (c) Negative (d) Nothing can be said
38. It is easier to draw up a wooden block along an

inclined plane than to haul it vertically, principally because

[CPMT 1977; JIPMER 1997]

- (a) The friction is reduced
- (b) The mass becomes smaller
- (c) Only a part of the weight has to be overcome
- (d) 'g' becomes smaller

39. Two bodies of masses 1 kg and 5 kg are dropped gently from the top of a tower. At a point 20 cm from the ground, both the bodies will have the same

[SCRA 1998]

- (a) Momentum
- (b) Kinetic energy
- (c) Velocity
- (d) Total energy

40. Due to a force of $(6\hat{i} + 2\hat{j})N$ the displacement of a body is $(3\hat{i} - \hat{j})m$, then the work done is

[Orissa JEE 2005]

- (a) 16 J
- (b) 12 J
- (c) 8 J
- (d) Zero

41. A ball is released from the top of a tower. The ratio of work done by force of gravity in first, second and third second of the motion of the ball is

[Kerala PET 2005]

- (a) 1 : 2 : 3
- (b) 1 : 4 : 9
- (c) 1 : 3 : 5
- (d) 1 : 5 : 3

Work Done by Variable Force

1. A particle moves under the effect of a force $F = Cx$ from $x = 0$ to $x = x_1$. The work done in the process is

[CPMT 1982; DCE 2002; Orissa JEE 2005]

- (a) Cx_1^2
- (b) $\frac{1}{2}Cx_1^2$
- (c) Cx_1
- (d) Zero

2. A cord is used to lower vertically a block of mass M by a distance d with constant downward acceleration $\frac{g}{4}$. Work done by the cord on the block is

[CPMT 1972]

- (a) $Mg\frac{d}{4}$
- (b) $3Mg\frac{d}{4}$
- (c) $-3Mg\frac{d}{4}$
- (d) Mgd

3. Two springs have their force constant as k_1 and k_2 ($k_1 > k_2$). When they are stretched by the same force

[EAMCET 1981]

- (a) No work is done in case of both the springs
- (b) Equal work is done in case of both the springs
- (c) More work is done in case of second spring
- (d) More work is done in case of first spring

4. A spring of force constant 10 N/m has an initial stretch 0.20 m. In changing the stretch to 0.25 m, the increase in potential energy is about

[CPMT 1977]

- (a) 0.1 joule
- (b) 0.2 joule
- (c) 0.3 joule
- (d) 0.5 joule

5. The potential energy of a certain spring when stretched through a distance 'S' is 10 joule. The amount of work (in joule) that must be done on this spring to stretch it through an additional distance 'S' will be

[MNR 1991; CPMT 2002; UPSEAT 2000; Pb. PET 2004]

- (a) 30
- (b) 40
- (c) 10
- (d) 20

6. Two springs of spring constants 1500 N/m and 3000 N/m respectively are stretched with the same force. They will have potential energy in the ratio

[MP PMT/PET 1998; Pb. PMT 2002]

- (a) 4 : 1
- (b) 1 : 4
- (c) 2 : 1
- (d) 1 : 2

7. A spring 40 mm long is stretched by the application of a force. If 10 N force required to stretch the spring through 1 mm, then work done in stretching the spring through 40 mm is

[AIIMS 1998; AFMC 2000; JIPMER 2000]

- (a) 84 J
- (b) 68 J
- (c) 23 J
- (d) 8 J

8. A position dependent force $F = 7 - 2x + 3x^2$ newton acts on a small body of mass 2 kg and displaces it from $x = 0$ to $x = 5$ m. The work done in joules is

[CBSE PMT 1994]

- (a) 70
- (b) 270
- (c) 35
- (d) 135

9. A body of mass 3 kg is under a force, which causes a displacement in it is given by $S = \frac{t^3}{3}$ (in m). Find the work done by the force in first 2 seconds [BHU 1998]
 (a) 2 J (b) 3.8 J
 (c) 5.2 J (d) 24 J
10. The force constant of a wire is k and that of another wire is $2k$. When both the wires are stretched through same distance, then the work done [MH CET 2000]
 (a) $W_2 = 2W_1^2$ (b) $W_2 = 2W_1$
 (c) $W_2 = W_1$ (d) $W_2 = 0.5W_1$
11. A body of mass 0.1 kg moving with a velocity of 10 m/s hits a spring (fixed at the other end) of force constant 1000 N/m and comes to rest after compressing the spring. The compression of the spring is [MP PMT 2001]
 (a) 0.01 m (b) 0.1 m
 (c) 0.2 m (d) 0.5 m
12. When a 1.0 kg mass hangs attached to a spring of length 50 cm , the spring stretches by 2 cm . The mass is pulled down until the length of the spring becomes 60 cm . What is the amount of elastic energy stored in the spring in this condition, if $g = 10\text{ m/s}^2$ [MP PET 2001]
 (a) 1.5 Joule (b) 2.0 Joule
 (c) 2.5 Joule (d) 3.0 Joule
13. A spring of force constant 800 N/m has an extension of 5 cm . The work done in extending it from 5 cm to 15 cm is [AIEEE 2002]
 (a) 16 J (b) 8 J
 (c) 32 J (d) 24 J
14. When a spring is stretched by 2 cm , it stores 100 J of energy. If it is stretched further by 2 cm , the stored energy will be increased by [Orissa JEE 2002]
 (a) 100 J (b) 200 J
 (c) 300 J (d) 400 J
15. A spring when stretched by 2 mm its potential energy becomes 4 J . If it is stretched by 10 mm , its potential energy is equal to [BCECE 2003]
 (a) 4 J (b) 54 J
 (c) 415 J (d) None
16. A spring of spring constant $5 \times 10^3\text{ N/m}$ is stretched initially by 5 cm from the unstretched position. Then the work required to stretch it further by another 5 cm is [AIEEE 2003]
 (a) 6.25 N-m (b) 12.50 N-m
 (c) 18.75 N-m (d) 25.00 N-m
17. 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 $k = 50\text{ N/m}$. The maximum compression of the spring would be [CBSE PMT 2004]
 (a) 0.15 m (b) 0.12 m
 (c) 1.5 m (d) 0.5 m
18. A particle moves in a straight line with retardation proportional to its displacement. Its loss of kinetic energy for any displacement x is proportional to [AIEEE 2004]
 (a) x^2 (b) e^x
 (c) x (d) $\log_e x$
19. A spring with spring constant k when stretched through 1 cm , the potential energy is U . If it is stretched by 4 cm . The potential energy will be [Orissa PMT 2004]
 (a) $4U$ (b) $8U$
 (c) $16U$ (d) $2U$
20. A spring with spring constant k is extended from $x = 0$ to $x = x_1$. The work done will be [Orissa PMT 2004]
 (a) kx_1^2 (b) $\frac{1}{2}kx_1^2$
 (c) $2kx_1^2$ (d) $2kx_1$
21. If a long spring is stretched by 0.02 m , its potential energy is U . If the spring is stretched by 0.1 m , then its potential energy will be [MP PMT 2002; CBSE PMT 2003; UPSEAT 2004]

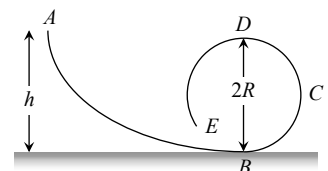
- (a) $\frac{U}{5}$ (b) U
(c) $5U$ (d) $25U$
22. Natural length of a spring is 60 cm, and its spring constant is 4000 N/m. A mass of 20 kg is hung from it. The extension produced in the spring is, (Take $g = 9.8 \text{ m/s}^2$) [DCE 2004]
(a) 4.9 cm (b) 0.49 cm
(c) 9.4 cm (d) 0.94 cm
23. The spring extends by x on loading, then energy stored by the spring is :
(if T is the tension in spring and k is spring constant) [Pb. PMT 2003]
(a) $\frac{T^2}{2k}$ (b) $\frac{T^2}{2k^2}$
(c) $\frac{2k}{T^2}$ (d) $\frac{2T^2}{k}$
24. The potential energy of a body is given by, $U = A - Bx^2$ (Where x is the displacement). The magnitude of force acting on the particle is [BHU 2002]
(a) Constant
(b) Proportional to x
(c) Proportional to x^2
(d) Inversely proportional to x
25. The potential energy between two atoms in a molecule is given by $U(x) = \frac{a}{x^{12}} - \frac{b}{x^6}$; where a and b are positive constants and x is the distance between the atoms. The atom is in stable equilibrium when [CBSE PMT 1995]
(a) $x = \sqrt[6]{\frac{11a}{5b}}$ (b) $x = \sqrt[6]{\frac{a}{2b}}$
(c) $x = 0$ (d) $x = \sqrt[6]{\frac{2a}{b}}$
26. Which one of the following is not a conservative force [Kerala PMT 2005]
(a) Gravitational force
(b) Electrostatic force between two charges
(c) Magnetic force between two magnetic dipoles
(d) Frictional force

Conservation of Energy and Momentum

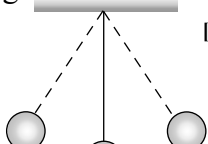
1. Two bodies of masses m_1 and m_2 have equal kinetic energies. If p_1 and p_2 are their respective momentum, then ratio $p_1 : p_2$ is equal to [MP PMT 1985; CPMT 1990]
(a) $m_1 : m_2$ (b) $m_2 : m_1$
(c) $\sqrt{m_1} : \sqrt{m_2}$ (d) $m_1^2 : m_2^2$
2. Work done in raising a box depends on
(a) How fast it is raised
(b) The strength of the man
(c) The height by which it is raised
(d) None of the above
3. A light and a heavy body have equal momenta. Which one has greater K.E [MP PMT 1985; CPMT 1985; Kerala PMT 2004]
(a) The light body (b) The heavy body
(c) The K.E. are equal (d) Data is incomplete
4. A body at rest may have
(a) Energy (b) Momentum
(c) Speed (d) Velocity
5. The kinetic energy possessed by a body of mass m moving with a velocity v is equal to $\frac{1}{2}mv^2$, provided
(a) The body moves with velocities comparable to that of light
(b) The body moves with velocities negligible compared to the speed of light
(c) The body moves with velocities greater than that of light
(d) None of the above statement is correct
6. If the momentum of a body is increased n times, its kinetic energy increases
(a) n times (b) $2n$ times
(c) \sqrt{n} times (d) n^2 times
7. When work is done on a body by an external force, its
(a) Only kinetic energy increases
(b) Only potential energy increases
(c) Both kinetic and potential energies may increase

- (d) Sum of kinetic and potential energies remains constant
8. The bob of a simple pendulum (mass m and length l) dropped from a horizontal position strikes a block of the same mass elastically placed on a horizontal frictionless table. The K.E. of the block will be
 (a) $2 mgl$ (b) $mgl/2$
 (c) mgl (d) 0
9. From a stationary tank of mass 125000 *pound* a small shell of mass 25 *pound* is fired with a muzzle velocity of 1000 *ft/sec*. The tank recoils with a velocity of [NCERT 1973]
 (a) 0.1 *ft/sec* (b) 0.2 *ft/sec*
 (c) 0.4 *ft/sec* (d) 0.8 *ft/sec*
10. A bomb of 12 *kg* explodes into two pieces of masses 4 *kg* and 8 *kg*. The velocity of 8*kg* mass is 6 *m/sec*. The kinetic energy of the other mass is
 [MNR 1985; CPMT 1991; Manipal MEE 1995; Pb. PET 2004]
 (a) 48 *J* (b) 32 *J*
 (c) 24 *J* (d) 288 *J*
11. A rifle bullet loses $1/20^{\text{th}}$ of its velocity in passing through a plank. The least number of such planks required just to stop the bullet is [EAMCET 1987; AFMC 2004]
 (a) 5 (b) 10
 (c) 11 (d) 20
12. A body of mass 2 *kg* is thrown up vertically with K.E. of 490 joules. If the acceleration due to gravity is 9.8 m/s^2 , then the height at which the K.E. of the body becomes half its original value is given by [EAMCET 1986]
 (a) 50 *m* (b) 12.5 *m*
 (c) 25 *m* (d) 10 *m*
13. Two masses of 1 *gm* and 4 *gm* are moving with equal kinetic energies. The ratio of the magnitudes of their linear momenta is
 [AIIMS 1987; NCERT 1983; MP PMT 1993; IIT 1980; RPET 1996; CBSE PMT 1997; Orissa JEE 2003; KCET 1999; DCE 2004]
 (a) 4 : 1 (b) $\sqrt{2}$: 1
 (c) 1 : 2 (d) 1 : 16
14. If the K.E. of a body is increased by 300%, its momentum will increase by [JIPMER 1978; AFMC 1993; RPET 1999; CBSE PMT 2002]
 (a) 100% (b) 150%
 (c) $\sqrt{300}\%$ (d) 175%
15. A light and a heavy body have equal kinetic energy. Which one has a greater momentum? [NCERT 1974; CPMT 1997; DPMT 2001]
 (a) The light body
 (b) The heavy body
 (c) Both have equal momentum
 (d) It is not possible to say anything without additional information
16. If the linear momentum is increased by 50%, the kinetic energy will increase by [CPMT 1983; MP PMT 1994; MP PET 1996, 99; UPSEAT 2001]
 (a) 50% (b) 100%
 (c) 125% (d) 25%
17. A free body of mass 8 *kg* is travelling at 2 *meter* per second in a straight line. At a certain instant, the body splits into two equal parts due to internal explosion which releases 16 *joules* of energy. Neither part leaves the original line of motion finally [NCERT 1979]
 (a) Both parts continue to move in the same direction as that of the original body
 (b) One part comes to rest and the other moves in the same direction as that of the original body
 (c) One part comes to rest and the other moves in the direction opposite to that of the original body
 (d) One part moves in the same direction and the other in the direction opposite to that of the original body
18. If the K.E. of a particle is doubled, then its momentum will [EAMCET 1979; CPMT 2003; Kerala PMT 2005]
 (a) Remain unchanged (b) Be doubled
 (c) Be quadrupled (d) Increase $\sqrt{2}$ times
19. If the stone is thrown up vertically and return to ground, its potential energy is maximum [EAMCET 1979]

- (a) During the upward journey
(b) At the maximum height
(c) During the return journey
(d) At the bottom
20. A body of mass 2 kg is projected vertically upwards with a velocity of 2 msec^{-1} . The K.E. of the body just before striking the ground is
[EAMCET 1980]
(a) 2 J (b) 1 J
(c) 4 J (d) 8 J
21. The energy stored in wound watch spring is
[EAMCET 1982]
(a) K.E. (b) P.E.
(c) Heat energy (d) Chemical energy
22. Two bodies of different masses m_1 and m_2 have equal momenta. Their kinetic energies E_1 and E_2 are in the ratio
[EAMCET 1990]
(a) $\sqrt{m_1} : \sqrt{m_2}$ (b) $m_1 : m_2$
(c) $m_2 : m_1$ (d) $m_1^2 : m_2^2$
23. A car travelling at a speed of 30 km/hour is brought to a halt in 8 m by applying brakes. If the same car is travelling at 60 km/hour , it can be brought to a halt with the same braking force in
[NCERT 1976]
(a) 8 m (b) 16 m
(c) 24 m (d) 32 m
24. Tripling the speed of the motor car multiplies the distance needed for stopping it by
[NCERT 1978]
(a) 3 (b) 6
(c) 9 (d) Some other number
25. If the kinetic energy of a body increases by 0.1% , the percent increase of its momentum will be
[MP PMT 1994]
(a) 0.05% (b) 0.1%
(c) 1.0% (d) 10%
26. If velocity of a body is twice of previous velocity, then kinetic energy will become
[AFMC 1996]
(a) 2 times (b) $\frac{1}{2}$ times
(c) 4 times (d) 1 times
27. Two bodies A and B having masses in the ratio of $3 : 1$ possess the same kinetic energy. The ratio of their linear momenta is then
[Haryana CEE 1996]
(a) $3 : 1$ (b) $9 : 1$
(c) $1 : 1$ (d) $\sqrt{3} : 1$
28. In which case does the potential energy decrease
[MP PET 1996]
(a) On compressing a spring
(b) On stretching a spring
(c) On moving a body against gravitational force
(d) On the rising of an air bubble in water
29. A sphere of mass m , moving with velocity V , enters a hanging bag of sand and stops. If the mass of the bag is M and it is raised by height h , then the velocity of the sphere was
[MP PET 1997]
(a) $\frac{M+m}{m}\sqrt{2gh}$ (b) $\frac{M}{m}\sqrt{2gh}$
(c) $\frac{m}{M+m}\sqrt{2gh}$ (d) $\frac{m}{M}\sqrt{2gh}$
30. Two bodies of masses m and $2m$ have same momentum. Their respective kinetic energies E_1 and E_2 are in the ratio
[MP PET 1997; KCET 2004]
(a) $1 : 2$ (b) $2 : 1$
(c) $1 : \sqrt{2}$ (d) $1 : 4$
31. If a lighter body (mass M_1 and velocity V_1) and a heavier body (mass M_2 and velocity V_2) have the same kinetic energy, then
[MP PMT 1997]
(a) $M_2 V_2 < M_1 V_1$ (b) $M_2 V_2 = M_1 V_1$
(c) $M_2 V_1 = M_1 V_2$ (d) $M_2 V_2 > M_1 V_1$
32. A frictionless track $ABCDE$ ends in a circular loop of radius R . A body slides down the track from point A which is at a height $h = 5\text{ cm}$. Maximum value of R for the body to successfully complete the loop is
[MP PMT/PET 1998]
(a) 5 cm
(b) $\frac{15}{4}\text{ cm}$



- (c) $\frac{10}{3} \text{ cm}$
(d) 2 cm
33. The force constant of a weightless spring is 16 N/m . A body of mass 1.0 kg suspended from it is pulled down through 5 cm and then released. The maximum kinetic energy of the system (spring + body) will be [MP PET 1999; DPMT 2000]
(a) $2 \times 10^{-2} \text{ J}$ (b) $4 \times 10^{-2} \text{ J}$
(c) $8 \times 10^{-2} \text{ J}$ (d) $16 \times 10^{-2} \text{ J}$
34. Two bodies with kinetic energies in the ratio of $4 : 1$ are moving with equal linear momentum. The ratio of their masses is [CBSE PMT 1999]
(a) $1 : 2$ (b) $1 : 1$
(c) $4 : 1$ (d) $1 : 4$
35. If the kinetic energy of a body becomes four times of its initial value, then new momentum will [AIIMS 1998; AIIMS 2002; KCET 2000; J & K CET 2004]
(a) Becomes twice its initial value [SCRA 1996]
(b) Become three times its initial value
(c) Become four times its initial value
(d) Remains constant
36. A bullet is fired from a rifle. If the rifle recoils freely, then the kinetic energy of the rifle is [AIIMS 1998; JIPMER 2001; UPSEAT 2000]
(a) Less than that of the bullet
(b) More than that of the bullet
(c) Same as that of the bullet
(d) Equal or less than that of the bullet
37. If the water falls from a dam into a turbine wheel 19.6 m below, then the velocity of water at the turbine is ($g = 9.8 \text{ m/s}^2$) [AIIMS 1998]
(a) 9.8 m/s (b) 19.6 m/s
(c) 39.2 m/s (d) 98.0 m/s
38. Two bodies of masses $2m$ and m have their K.E. in the ratio $8 : 1$, then their ratio of momenta is [EAMCET (Engg.) 1995]
(a) $1 : 1$ (b) $2 : 1$
(c) $4 : 1$ (d) $8 : 1$
39. A bomb of 12 kg divides in two parts whose ratio of masses is $1 : 3$. If kinetic energy of smaller part is 216 J , then momentum of bigger part in kg-m/sec will be [RPET 1997]
(a) 36 (b) 72
(c) 108 (d) Data is incomplete
40. A 4 kg mass and a 1 kg mass are moving with equal kinetic energies. The ratio of the magnitudes of their linear momenta is [CBSE PMT 1993; Orissa JEE 2003]
(a) $1 : 2$ (b) $1 : 1$
(c) $2 : 1$ (d) $4 : 1$
41. Two identical cylindrical vessels with their bases at same level each contains a liquid of density ρ . The height of the liquid in one vessel is h_1 and that in the other vessel is h_2 . The area of either base is A . The work done by gravity in equalizing the levels when the two vessels are connected, is [SCRA 1996]
(a) $(h_1 - h_2)g\rho$ (b) $(h_1 - h_2)gA\rho$
(c) $\frac{1}{2}(h_1 - h_2)^2 gA\rho$ (d) $\frac{1}{4}(h_1 - h_2)^2 gA\rho$
42. If the increase in the kinetic energy of a body is 22% , then the increase in the momentum will be [RPET 1996; DPMT 2000]
(a) 22% (b) 44%
(c) 10% (d) 300%
43. If a body of mass 200 g falls from a height 200 m and its total P.E. is converted into K.E. at the point of contact of the body with earth surface, then what is the decrease in P.E. of the body at the contact ($g = 10 \text{ m/s}^2$) [AFMC 1997]
(a) 200 J (b) 400 J
(c) 600 J (d) 900 J
44. If momentum is increased by 20% , then K.E. increases by [AFMC 1997; MP PMT 2004]
(a) 44% (b) 55%

- (c) 66% (d) 77%
45. The kinetic energy of a body of mass 2 kg and momentum of 2 Ns is [AFMC 1998; DPMT 2000]
 (a) 1 J (b) 2 J
 (c) 3 J (d) 4 J
46. The decrease in the potential energy of a ball of mass 20 kg which falls from a height of 50 cm is [AIIMS 1997]
 (a) 968 J (b) 98 J
 (c) 1980 J (d) None of these
47. An object of 1 kg mass has a momentum of 10 kg m/sec then the kinetic energy of the object will be [RPMT 1999]
 (a) 100 J (b) 50 J
 (c) 1000 J (d) 200 J
48. A ball is released from certain height. It loses 50% of its kinetic energy on striking the ground. It will attain a height again equal to [RPMT 2000]
 (a) One fourth the initial height
 (b) Half the initial height
 (c) Three fourth initial height
 (d) None of these
49. A 0.5 kg ball is thrown up with an initial speed 14 m/s and reaches a maximum height of 8.0m. How much energy is dissipated by air drag acting on the ball during the ascent [AMU (Med.) 2000]
 (a) 19.6 Joule (b) 4.9 Joule
 (c) 10 Joule (d) 9.8 Joule
50. An ice cream has a marked value of 700 kcal. How many kilowatt- hour of energy will it deliver to the body as it is digested [AMU (Med.) 2000]
 (a) 0.81 kWh (b) 0.90 kWh
 (c) 1.11 kWh (d) 0.71 kWh
51. What is the velocity of the bob of a simple pendulum at its mean position, if it is able to rise to vertical height of 10 cm (Take $g = 9.8 \text{ m/s}^2$) [BHU 2000]
 (a) 0.6 m/s
 (b) 1.4 m/s
- 
- (c) 1.8 m/s
 (d) 2.2 m/s
52. A particle of mass 'm' and charge 'q' is accelerated through a potential difference of 'V' volt. Its energy is [UPSEAT 2001]
 (a) qV (b) mqV
 (c) $\left(\frac{q}{m}\right)V$ (d) $\frac{q}{mV}$
53. A running man has half the kinetic energy of that of a boy of half of his mass. The man speeds up by 1m/s so as to have same K.E. as that of the boy. The original speed of the man will be [Pb. PMT 2001]
 (a) $\sqrt{2} \text{ m/s}$ (b) $(\sqrt{2} - 1) \text{ m/s}$
 (c) $\frac{1}{(\sqrt{2} - 1)} \text{ m/s}$ (d) $\frac{1}{\sqrt{2}} \text{ m/s}$
54. The mass of two substances are 4gm and 9gm respectively. If their kinetic energies are same, then the ratio of their momenta will be [CPMT 2001]
 (a) 4 : 9 (b) 9 : 4
 (c) 3 : 2 (d) 2 : 3
55. If the momentum of a body is increased by 100%, then the percentage increase in the kinetic energy is [BHU 1999; Pb. PMT 1999; CPMT 2000; CBSE PMT 2001; BCECE 2004]
 (a) 150% (b) 200%
 (c) 225% (d) 300%
56. If a body loses half of its velocity on penetrating 3 cm in a wooden block, then how much will it penetrate more before coming to rest [AIIEE 2002; DCE 2002]
 (a) 1 cm (b) 2 cm
 (c) 3 cm (d) 4 cm
57. A bomb of mass 9kg explodes into 2 pieces of mass 3kg and 6kg. The velocity of mass 3kg is 1.6 m/s, the K.E. of mass 6kg is [AIIEE 2002]
 (a) 3.84 J (b) 9.6 J
 (c) 1.92 J (d) 2.92 J
58. Two masses of 1kg and 16kg are moving with

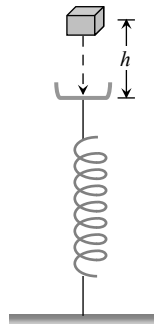
- equal K.E. The ratio of magnitude of the linear momentum is [AIEEE 2002]
- (a) 1 : 2 (b) 1 : 4
(c) 1 : $\sqrt{2}$ (d) $\sqrt{2}$: 1
59. A machine which is 75 percent efficient, uses 12 joules of energy in lifting up a 1 kg mass through a certain distance. The mass is then allowed to fall through that distance. The velocity at the end of its fall is (in ms^{-1}) [Kerala PMT 2002]
- (a) $\sqrt{24}$ (b) $\sqrt{32}$
(c) $\sqrt{18}$ (d) $\sqrt{9}$
60. Two bodies moving towards each other collide and move away in opposite directions. There is some rise in temperature of bodies because a part of the kinetic energy is converted into [BHU 2002]
- (a) Heat energy (b) Electrical energy
(c) Nuclear energy (d) Mechanical energy
61. A particle of mass m at rest is acted upon by a force F for a time t . Its Kinetic energy after an interval t is [Kerala PET 2002]
- (a) $\frac{F^2 t^2}{m}$ (b) $\frac{F^2 t^2}{2m}$
(c) $\frac{F^2 t^2}{3m}$ (d) $\frac{Ft}{2m}$
62. The potential energy of a weight less spring compressed by a distance a is proportional to [MP PET 2003]
- (a) a (b) a^2
(c) a^{-2} (d) a^0
63. 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 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 [EAMCET 2003]
- (a) $v\sqrt{\frac{m}{2k}}$ (b) $m\sqrt{\frac{v}{2k}}$
- (c) $\sqrt{\frac{mv}{k}}$ (d) $\frac{mv}{2k}$
64. Two bodies of masses m and $4m$ are moving with equal K.E. The ratio of their linear momentums is [Orissa JEE 2003; AIIMS 1999]
- (a) 4 : 1 (b) 1 : 1
(c) 1 : 2 (d) 1 : 4
65. A stationary particle explodes into two particles of masses m_1 and m_2 which move in opposite directions with velocities v_1 and v_2 . The ratio of their kinetic energies E_1 / E_2 is [CBSE PMT 2003]
- (a) m_1 / m_2 (b) 1
(c) $m_1 v_2 / m_2 v_1$ (d) m_2 / m_1
66. The kinetic energy of a body of mass 3 kg and momentum 2 Ns is [MP PET 2004]
- (a) 1 J (b) $\frac{2}{3}$ J
(c) $\frac{3}{2}$ J (d) 4 J
67. A bomb of mass 3.0 Kg explodes in air into two pieces of masses 2.0 kg and 1.0 kg. The smaller mass goes at a speed of 80 m/s. The total energy imparted to the two fragments is [AIIMS 2004]
- (a) 1.07 kJ (b) 2.14 kJ
(c) 2.4 kJ (d) 4.8 kJ
68. A bullet moving with a speed of 100 ms^{-1} can just penetrate two planks of equal thickness. Then the number of such planks penetrated by the same bullet when the speed is doubled will be [KCET 2004]
- (a) 4 (b) 8
(c) 6 (d) 10
69. A particle of mass m_1 is moving with a velocity v_1 and another particle of mass m_2 is moving with a velocity v_2 . Both of them have the same momentum but their different kinetic energies are E_1 and E_2 respectively. If $m_1 > m_2$ then [CBSE PMT 2004]
- (a) $E_1 < E_2$ (b) $\frac{E_1}{E_2} = \frac{m_1}{m_2}$

- (c) $E_1 > E_2$ (d) $E_1 = E_2$
70. A ball of mass 2kg and another of mass 4kg are dropped together from a 60 feet tall building. After a fall of 30 feet each towards earth, their respective kinetic energies will be in the ratio of [CBSE PMT 2004]
 (a) $\sqrt{2} : 1$ (b) $1 : 4$
 (c) $1 : 2$ (d) $1 : \sqrt{2}$
71. Four particles given, have same momentum which has maximum kinetic energy [Orissa PMT 2004]
 (a) Proton (b) Electron
 (c) Deuteron (d) α -particles
72. A body moving with velocity v has momentum and kinetic energy numerically equal. What is the value of v [Pb. PMT 2002; J&K CET 2004]
 (a) $2m/s$ (b) $\sqrt{2}ml\ s$
 (c) $1m/s$ (d) $0.2\ ml\ s$
73. If a man increase his speed by $2\ m/s$, his K.E. is doubled, the original speed of the man is [Pb. PET 2002]
 (a) $(1 + 2\sqrt{2})\ ml\ s$ (b) $4\ m/s$
 (c) $(2 + 2\sqrt{2})\ ml\ s$ (d) $(2 + \sqrt{2})\ ml\ s$
74. An object of mass $3m$ splits into three equal fragments. Two fragments have velocities \hat{v}_j and \hat{v}_i . The velocity of the third fragment is [UPSEAT 2004]
 (a) $\hat{v}_j - \hat{v}_i$ (b) $\hat{v}_i - \hat{v}_j$
 (c) $-\hat{v}_i + \hat{v}_j$ (d) $\frac{\hat{v}_i + \hat{v}_j}{\sqrt{2}}$
75. A bomb is kept stationary at a point. It suddenly explodes into two fragments of masses $1\ g$ and $3\ g$. The total K.E. of the fragments is $6.4 \times 10^4\ J$. What is the K.E. of the smaller fragment [DCE 2004]
 (a) $2.5 \times 10^4\ J$ (b) $3.5 \times 10^4\ J$
 (c) $4.8 \times 10^4\ J$ (d) $5.2 \times 10^4\ J$
76. Which among the following, is a form of energy [DCE 2004]
 (a) Light (b) Pressure
- (c) Momentum (d) Power
77. A body is moving with a velocity v , breaks up into two equal parts. One of the part retraces back with velocity v . Then the velocity of the other part is [DCE 2004]
 (a) v in forward direction (b) $3v$ in forward direction
 (c) v in backward direction (d) $3v$ in backward direction
78. If a shell fired from a cannon, explodes in mid air, then [Pb. PET 2004]
 (a) Its total kinetic energy increases
 (b) Its total momentum increases
 (c) Its total momentum decreases
 (d) None of these
79. A particle of mass m moving with velocity v_0 strikes a simple pendulum of mass m and sticks to it. The maximum height attained by the pendulum will be [RPET 2002]
 (a) $h = \frac{v_0^2}{8g}$ (b) $\sqrt{v_0 g}$
 (c) $2\sqrt{\frac{v_0}{g}}$ (d) $\frac{v_0^2}{4g}$
80. Masses of two substances are $1\ g$ and $9\ g$ respectively. If their kinetic energies are same, then the ratio of their momentum will be [BHU 2004]
 (a) $1 : 9$ (b) $9 : 1$
 (c) $3 : 1$ (d) $1 : 3$
81. A body of mass $5\ kg$ is moving with a momentum of $10\ kg\cdot m/s$. A force of $0.2\ N$ acts on it in the direction of motion of the body for $10\ seconds$. The increase in its kinetic energy is [MP PET 1999]
 (a) $2.8\ Joule$ (b) $3.2\ Joule$
 (c) $3.8\ Joule$ (d) $4.4\ Joule$
82. If the momentum of a body increases by 0.01% , its kinetic energy will increase by [MP PET 2001]
 (a) 0.01% (b) 0.02%
 (c) 0.04% (d) 0.08%

83. 1 *a.m.u.* is equivalent to [UPSEAT 2001]
 (a) 1.6×10^{-12} Joule (b) 1.6×10^{-19} Joule
 (c) 1.5×10^{-10} Joule (d) 1.5×10^{-19} Joule

84. A block of mass m initially at rest is dropped from a height h on to a spring of force constant k . the maximum compression in the spring is x then [BCECE 2005]

- (a) $mgh = \frac{1}{2} kx^2$
 (b) $mg(h+x) = \frac{1}{2} kx^2$
 (c) $mgh = \frac{1}{2} k(x+h)^2$
 (d) $mg(h+x) = \frac{1}{2} k(x+h)^2$

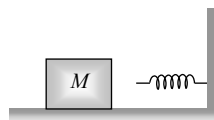


85. A spherical ball of mass 20 kg is stationary at the top of a hill of height 100 m. It slides down a smooth surface to the ground, then climbs up another hill of height 30 m and finally slides down to a horizontal base at a height of 20 m above the ground. The velocity attained by the ball is [AIIEE 2005]

- (a) 10 m/s (b) $10\sqrt{30}$ m/s
 (c) 40 m/s (d) 20 m/s

86. The block of mass M moving on the frictionless horizontal surface collides with the spring of spring constant K and compresses it by length L . The maximum momentum of the block after collision is [AIIEE 2005]

- (a) Zero
 (b) $\frac{ML^2}{K}$
 (c) $\sqrt{MK} L$
 (d) $\frac{KL^2}{2M}$

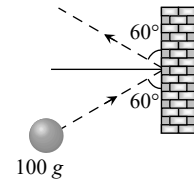


87. A bomb of mass 30kg at rest explodes into two pieces of masses 18 kg and 12 kg. The velocity of 18 kg mass is 6 ms^{-1} . The kinetic energy of the other mass is [CBSE PMT 2005]

- (a) 256 J (b) 486 J
 (c) 524 J (d) 324 J

88. A mass of 100g strikes the wall with speed 5m/s at an angle as shown in figure and it rebounds with the same speed. If the contact time is 2×10^{-3} sec, what is the force applied on the mass by the wall [Orissa JEE 2005]

- (a) $250\sqrt{3}$ N to right
 (b) 250 N to right
 (c) $250\sqrt{3}$ N to left
 (d) 250 N to left



Power

1. If a force F is applied on a body and it moves with a velocity v , the power will be [CPMT 1985, 97; DCE 1999; UPSEAT 2004]

- (a) $F \times v$ (b) F / v
 (c) F / v^2 (d) $F \times v^2$

2. A body of mass m accelerates uniformly from rest to v_1 in time t_1 . As a function of time t , the instantaneous power delivered to the body is [AIIEE 2004]

- (a) $\frac{mv_1 t}{t_1}$ (b) $\frac{mv_1^2 t}{t_1}$
 (c) $\frac{mv_1 t^2}{t_1}$ (d) $\frac{mv_1^2 t^2}{t_1^2}$

3. A man is riding on a cycle with velocity 7.2 km/hr up a hill having a slope 1 in 20. The total mass of the man and cycle is 100 kg. The power of the man is

- (a) 200 W (b) 175 W
 (c) 125 W (d) 98 W

4. A 12 HP motor has to be operated 8 hours/day. How much will it cost at the rate of 50 paisa/kWh in 10 days

- (a) Rs. 350/- (b) Rs. 358/-
 (c) Rs. 375/- (d) Rs. 397/-

5. A motor boat is travelling with a speed of 3.0 m/sec. If the force on it due to water flow is 500 N, the power of the boat is [EAMCET 1982]

- (a) 150 kW (b) 15 kW
 (c) 1.5 kW (d) 150 W

6. An electric motor exerts a force of 40 N on a cable and pulls it by a distance of 30 m in one

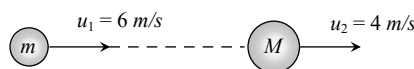
- minute. The power supplied by the motor (in *Watts*) is [EAMCET 1984]
 (a) 20 (b) 200
 (c) 2 (d) 10
7. An electric motor creates a tension of 4500 *newton* in a hoisting cable and reels it in at the rate of 2 *m/sec*. What is the power of electric motor [MNR 1984]
 (a) 15 *kW* (b) 9 *kW*
 (c) 225 *W* (d) 9000 *HP*
8. A weight lifter lifts 300 *kg* from the ground to a height of 2 *meter* in 3 *second*. The average power generated by him is [CPMT 1989; JIPMER 2001,02]
 (a) 5880 *watt* (b) 4410 *watt*
 (c) 2205 *watt* (d) 1960 *watt*
9. Power of a water pump is 2 *kW*. If $g = 10 \text{ m/sec}^2$, the amount of water it can raise in one minute to a height of 10 *m* is [CBSE PMT 1990; Kerala PMT 2004]
 (a) 2000 *litre* (b) 1000 *litre*
 (c) 100 *litre* (d) 1200 *litre*
10. An engine develops 10 *kW* of power. How much time will it take to lift a mass of 200 *kg* to a height of 40 *m*. ($g = 10 \text{ m/sec}^2$) [CPMT 1992]
 (a) 4 *sec* (b) 5 *sec*
 (c) 8 *sec* (d) 10 *sec*
11. 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 is '*V*', the rate at which the engine of the car is doing work will be [MP PMT/PET 1998; JIPMER 2000]
 (a) RV (b) maV
 (c) $(R+ma)V$ (d) $(ma-R)V$
12. The average power required to lift a 100 *kg* mass through a height of 50 *metres* in approximately 50 *seconds* would be [SCRA 1994; MH CET 2000]
 (a) 50 *J/s* (b) 5000 *J/s*
 (c) 100 *J/s* (d) 980 *J/s*
13. From a waterfall, water is falling down at the rate of 100 *kg/s* on the blades of turbine. If the height of the fall is 100 *m*, then the power delivered to the turbine is approximately equal to [KCET 1994; BHU 1997; MP PET 2000]
 (a) 100 *kW* (b) 10 *kW*
 (c) 1 *kW* (d) 1000 *kW*
14. The power of a pump, which can pump 200*kg* of water to a height of 200*m* in 10*sec* is ($g = 10 \text{ m/sec}^2$) [CBSE PMT 2000]
 (a) 40 *kW* (b) 80 *kW*
 (c) 400 *kW* (d) 960 *kW*
15. A 10 *H.P.* motor pumps out water from a well of depth 20*m* and fills a water tank of volume 22380 *litres* at a height of 10*m* from the ground. the running time of the motor to fill the empty water tank is ($g = 10 \text{ ms}^{-2}$) [EAMCET (Engg.) 2000]
 (a) 5 *minutes* (b) 10 *minutes*
 (c) 15 *minutes* (d) 20 *minutes*
16. A car of mass 1250 *kg* is moving at 30*m/s*. Its engine delivers 30 *kW* while resistive force due to surface is 750*N*. What max acceleration can be given in the car [RPET 2000]
 (a) $\frac{1}{3} \text{ m/s}^2$ (b) $\frac{1}{4} \text{ m/s}^2$
 (c) $\frac{1}{5} \text{ m/s}^2$ (d) $\frac{1}{6} \text{ m/s}^2$
17. A force applied by an engine of a train of mass $2.05 \times 10^6 \text{ kg}$ changes its velocity from 5*m/s* to 25 *m/s* in 5 *minutes*. The power of the engine is [EAMCET 2001]
 (a) 1.025 *MW* (b) 2.05 *MW*
 (c) 5 *MW* (d) 6 *MW*
18. A truck of mass 30,000*kg* moves up an inclined plane of slope 1 in 100 at a speed of 30 *kmph*. The power of the truck is (given $g = 10 \text{ ms}^{-1}$) [Kerala (Engg.) 2001]
 (a) 25 *kW* (b) 10 *kW*
 (c) 5 *kW* (d) 2.5 *kW*
19. A 60 *kg* man runs up a staircase in 12 *seconds* while a 50 *kg* man runs up the same staircase in 11, *seconds*, the ratio of the rate of doing their work is [AMU (Engg.) 2001]
 (a) 6 : 5 (b) 12 : 11

- (c) 11 : 10 (d) 10 : 11
20. A pump motor is used to deliver water at a certain rate from a given pipe. To obtain twice as much water from the same pipe in the same time, power of the motor has to be increased to [JIPMER 2002]
- (a) 16 times (b) 4 times
(c) 8 times (d) 2 times
21. What average horsepower is developed by an 80 kg man while climbing in 10 s a flight of stairs that rises 6 m vertically [AMU (Med.) 2002]
- (a) 0.63 HP (b) 1.26 HP
(c) 1.8 HP (d) 2.1 HP
22. A car of mass 1000 kg accelerates uniformly from rest to a velocity of 54 km/hour in 5s. The average power of the engine during this period in watts is (neglect friction) [Kerala PET 2002]
- (a) 2000 W (b) 22500 W
(c) 5000 W (d) 2250 W
23. A quarter horse power motor runs at a speed of 600 r.p.m. Assuming 40% efficiency the work done by the motor in one rotation will be [Kerala PET 2002]
- (a) 7.46 J (b) 7400 J
(c) 7.46 ergs (d) 74.6 J
24. An engine pumps up 100 kg of water through a height of 10 m in 5 s. Given that the efficiency of the engine is 60% . If $g = 10ms^{-2}$, the power of the engine is [DPMT 2004]
- (a) 3.3kW (b) 0.33kW
(c) 0.033kW (d) 33kW
25. A force of $2\hat{i} + 3\hat{j} + 4\hat{k}$ N acts on a body for 4 second, produces a displacement of $(3\hat{i} + 4\hat{j} + 5\hat{k})m$. The power used is [Pb. PET 2001; CBSE PMT 2001]
- (a) 9.5 W (b) 7.5 W
(c) 6.5 W (d) 4.5 W
26. The power of pump, which can pump 200 kg of water to a height of 50 m in 10 sec, will be [DPMT 2003]
- (a) 10×10^3 watt (b) 20×10^3 watt
(c) 4×10^3 watt (d) 60×10^3 watt
27. From an automatic gun a man fires 360 bullet per minute with a speed of 360 km/hour. If each weighs 20 g, the power of the gun is [Pb. PET 2003]
- (a) 600W (b) 300W
(c) 150W (d) 75W
28. An engine pump is used to pump a liquid of density ρ continuously through a pipe of cross-sectional area A . If the speed of flow of the liquid in the pipe is v , then the rate at which kinetic energy is being imparted to the liquid is
- (a) $\frac{1}{2} A\rho v^3$ (b) $\frac{1}{2} A\rho v^2$
(c) $\frac{1}{2} A\rho v$ (d) $A\rho v$
29. If the heart pushes 1 cc of blood in one second under pressure 20000 N/m² the power of heart is [J&K CET 2005]
- (a) 0.02 W (b) 400 W
(c) 5×10^{-10} W (d) 0.2 W
30. A man does a given amount of work in 10 sec. Another man does the same amount of work in 20 sec. The ratio of the output power of first man to the second man is [J&K CET 2005]
- (a) 1 (b) 1/2
(c) 2/1 (d) None of these

Elastic and Inelastic Collision

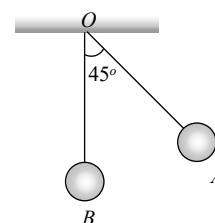
1. The coefficient of restitution e for a perfectly elastic collision is [CBSE PMT 1988]
- (a) 1 (b) 0
(c) ∞ (d) -1
2. The principle of conservation of linear momentum can be strictly applied during a collision between two particles provided the time of impact is
- (a) Extremely small
(b) Moderately small
(c) Extremely large
(d) Depends on a particular case

3. A shell initially at rest explodes into two pieces of equal mass, then the two pieces will
[CPMT 1982; EAMCET 1988; Orissa PMT 2004]
- (a) Be at rest
(b) Move with different velocities in different directions
(c) Move with the same velocity in opposite directions
(d) Move with the same velocity in same direction
4. A sphere of mass m moving with a constant velocity u hits another stationary sphere of the same mass. If e is the coefficient of restitution, then the ratio of the velocity of two spheres after collision will be [RPMT 1996; BHU 1997]
- (a) $\frac{1-e}{1+e}$ (b) $\frac{1+e}{1-e}$
(c) $\frac{e+1}{e-1}$ (d) $\frac{e-1}{e+1} e^2$
5. Two 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 [CPMT 1978, 86, 88]
- (a) 0.15 m/sec (b) 1.5 m/sec
(c) -0.15 m/sec (d) None of the above
6. Two perfectly elastic particles P and Q of equal mass travelling along the line joining them with velocities 15 m/sec and 10 m/sec. After collision, their velocities respectively (in m/sec) will be [CPMT 1988; MP PMT 1994]
- (a) 0, 25 (b) 5, 20
(c) 10, 15 (d) 20, 5
7. A cannon ball is fired with a velocity 200 m/sec at an angle of 60° with the horizontal. At the highest point of its flight it explodes into 3 equal fragments, one going vertically upwards with a velocity 100 m/sec, the second one falling vertically downwards with a velocity 100 m/sec. The third fragment will be moving with a velocity [NCERT 1983; AFMC 1997]
- (a) 100 m/s in the horizontal direction
(b) 300 m/s in the horizontal direction
(c) 300 m/s in a direction making an angle of 60° with the horizontal
(d) 200 m/s in a direction making an angle of 60° with the horizontal
8. A lead ball strikes a wall and falls down, a tennis ball having the same mass and velocity strikes the wall and bounces back. Check the correct statement
- (a) The momentum of the lead ball is greater than that of the tennis ball
(b) The lead ball suffers a greater change in momentum compared with the tennis ball
(c) The tennis ball suffers a greater change in momentum as compared with the lead ball
(d) Both suffer an equal change in momentum
9. When two bodies collide elastically, then [CPMT 1974; MP PMT 2001; RPET 2000; Kerala PET 2005]
- (a) Kinetic energy of the system alone is conserved
(b) Only momentum is conserved
(c) Both energy and momentum are conserved
(d) Neither energy nor momentum is conserved
10. Two balls at same temperature collide. What is conserved [NCERT 1974; CPMT 1983; DCE 2004]
- (a) Temperature (b) Velocity
(c) Kinetic energy (d) Momentum
11. A body of mass 5 kg explodes at rest into three fragments with masses in the ratio 1 : 1 : 3. The fragments with equal masses fly in mutually perpendicular directions with speeds of 21 m/s. The velocity of the heaviest fragment will be [CBSE PMT 1991]
- (a) 11.5 m/s (b) 14.0 m/s
(c) 7.0 m/s (d) 9.89 m/s
12. A heavy steel ball of mass greater than 1 kg moving with a speed of 2 m sec^{-1} collides head on with a stationary ping-pong ball of mass less than 0.1 gm. The collision is elastic. After the collision the ping-pong ball moves approximately with speed [EAMCET 1982]

- (a) 2 msec^{-1} (b) 4 msec^{-1}
 (c) $2 \times 10^4\text{ msec}^{-1}$ (d) $2 \times 10^3\text{ msec}^{-1}$
13. A body of mass 'M' collides against a wall with a velocity v and retraces its path with the same speed. The change in momentum is (take initial direction of velocity as positive) [EAMCET 1982]
 (a) Zero (b) $2Mv$
 (c) Mv (d) $-2Mv$
14. A gun fires a bullet of mass 50 gm with a velocity of 30 msec^{-1} . Because of this the gun is pushed back with a velocity of 1 msec^{-1} . The mass of the gun is [EAMCET 1989; AIIMS 2001]
 (a) 15 kg (b) 30 kg
 (c) 1.5 kg (d) 20 kg
15. In an elastic collision of two particles the following is conserved [MP PET 1994; DPMT 2001]
 (a) Momentum of each particle
 (b) Speed of each particle
 (c) Kinetic energy of each particle
 (d) Total kinetic energy of both the particles
16. A ^{238}U nucleus decays by emitting an alpha particle of speed $v\text{ ms}^{-1}$. The recoil speed of the residual nucleus is (in ms^{-1}) [CBSE PMT 1995; AIEEE 2003]
 (a) $-4v/234$ (b) $v/4$
 (c) $-4v/238$ (d) $4v/238$
17. A smooth sphere of mass M moving with velocity u directly collides elastically with another sphere of mass m at rest. After collision their final velocities are V and v respectively. The value of v is [MP PET 1995]
 (a) $\frac{2uM}{m}$ (b) $\frac{2um}{M}$
 (c) $\frac{2u}{1+\frac{m}{M}}$ (d) $\frac{2u}{1+\frac{M}{m}}$
18. A body of mass m having an initial velocity v , makes head on collision with a stationary body of mass M . After the collision, the body of mass m comes to rest and only the body having mass M moves. This will happen only when [MP PMT 1995]
 (a) $m \gg M$ (b) $m \ll M$
 (c) $m = M$ (d) $m = \frac{1}{2}M$
19. A particle of mass m moving with a velocity \bar{V} makes a head on elastic collision with another particle of same mass initially at rest. The velocity of the first particle after the collision will be [MP PMT 1997; MP PET 2001; UPSEAT 2001]
 (a) \bar{V} (b) $-\bar{V}$
 (c) $-2\bar{V}$ (d) Zero
20. A particle of mass m moving with horizontal speed 6 m/sec as shown in figure. If $m \ll M$ then for one dimensional elastic collision, the speed of lighter particle after collision will be [MP PMT 2003]
- 
- (a) 2 m/sec in original direction
 (b) 2 m/sec opposite to the original direction
 (c) 4 m/sec opposite to the original direction
 (d) 4 m/sec in original direction
21. A shell of mass m moving with velocity v suddenly breaks into 2 pieces. The part having mass $m/4$ remains stationary. The velocity of the other shell will be [CPMT 1999]
 (a) v (b) $2v$
 (c) $\frac{3}{4}v$ (d) $\frac{4}{3}v$
22. Two equal masses m_1 and m_2 moving along the same straight line with velocities $+3\text{ m/s}$ and -5 m/s respectively collide elastically. Their velocities after the collision will be respectively [CBSE PMT 1994, 98; AIIMS 2000]
 (a) $+4\text{ m/s}$ for both (b) -3 m/s and $+5\text{ m/s}$
 (c) -4 m/s and $+4\text{ m/s}$ (d) -5 m/s and $+3\text{ m/s}$
23. A rubber ball is dropped from a height of 5 m on a planet where the acceleration due to gravity is not known. On bouncing, it rises to 1.8 m . The ball loses its velocity on bouncing by a factor of [CBSE PMT 1998]
 (a) $16/25$ (b) $2/5$
 (c) $3/5$ (d) $9/25$

24. A metal ball falls from a height of 32 metre on a steel plate. If the coefficient of restitution is 0.5, to what height will the ball rise after second bounce [EAMCET 1994]
 (a) 2 m (b) 4 m
 (c) 8 m (d) 16 m
25. At high altitude, a body explodes at rest into two equal fragments with one fragment receiving horizontal velocity of 10 m/s. Time taken by the two radius vectors connecting point of explosion to fragments to make 90° is [EAMCET (Engg.) 1995; DPMT 2000]
 (a) 10 s (b) 4 s
 (c) 2 s (d) 1 s
26. A ball of mass 10 kg is moving with a velocity of 10 m/s. It strikes another ball of mass 5 kg which is moving in the same direction with a velocity of 4 m/s. If the collision is elastic, their velocities after the collision will be, respectively [CMEET Bihar 1995]
 (a) 6 m/s, 12 m/s (b) 12 m/s, 6 m/s
 (c) 12 m/s, 10 m/s (d) 12 m/s, 25 m/s
27. A body of mass 2 kg collides with a wall with speed 100 m/s and rebounds with same speed. If the time of contact was 1/50 second, the force exerted on the wall is [CPMT 1993]
 (a) 8 N (b) 2×10^4 N
 (c) 4 N (d) 10^4 N
28. A body falls on a surface of coefficient of restitution 0.6 from a height of 1 m. Then the body rebounds to a height of [CPMT 1993; Pb. PET 2001]
 (a) 0.6 m (b) 0.4 m
 (c) 1 m (d) 0.36 m
29. A ball is dropped from a height h . If the coefficient of restitution be e , then to what height will it rise after jumping twice from the ground [RPMT 1996; Pb. PET 2001]
 (a) $eh/2$ (b) $2eh$
 (c) eh (d) e^4h
30. A ball of weight 0.1 kg coming with speed 30 m/s strikes with a bat and returns in opposite direction with speed 40 m/s, then the impulse is (Taking final velocity as positive) [AFMC 1997]
 (a) $-0.1 \times (40) - 0.1 \times (30)$ (b) $0.1 \times (40) - 0.1 \times (-30)$
 (c) $0.1 \times (40) + 0.1 \times (-30)$ (d) $0.1 \times (40) - 0.1 \times (20)$
31. A billiard ball moving with a speed of 5 m/s collides with an identical ball originally at rest. If the first ball stops after collision, then the second ball will move forward with a speed of [SCRA 1998]
 (a) 10 ms^{-1} (b) 5 ms^{-1}
 (c) 2.5 ms^{-1} (d) 1.0 ms^{-1}
32. If two balls each of mass 0.06 kg moving in opposite directions with speed 4 m/s collide and rebound with the same speed, then the impulse imparted to each ball due to other is [AFMC 1998, 2001]
 (a) 0.48 kg-m/s (b) 0.24 kg-m/s
 (c) 0.81 kg-m/s (d) Zero
33. A ball of mass m falls vertically to the ground from a height h_1 and rebound to a height h_2 . The change in momentum of the ball on striking the ground is [AMU (Engg.) 1999]
 (a) $mg(h_1 - h_2)$ (b) $m\sqrt{2gh_1} + \sqrt{2gh_2}$
 (c) $m\sqrt{2g(h_1 + h_2)}$ (d) $m\sqrt{2g}(h_1 + h_2)$
34. A body of mass 50 kg is projected vertically upwards with velocity of 100 m/sec. 5 seconds after this body breaks into 20 kg and 30 kg. If 20 kg piece travels upwards with 150 m/sec, then the velocity of other block will be [RPMT 1999]
 (a) 15 m/sec downwards (b) 15 m/sec upwards
 (c) 51 m/sec downwards (d) 51 m/sec upwards
35. A steel ball of radius 2 cm is at rest on a frictionless surface. Another ball of radius 4 cm moving at a velocity of 81 cm/sec collides elastically with first ball. After collision the smaller ball moves with speed of [RPMT 1999]
 (a) 81 cm/sec (b) 63 cm/sec

- (c) 144 *cm/sec* (d) None of these
36. A space craft of mass M is moving with velocity V and suddenly explodes into two pieces. A part of it of mass m becomes at rest, then the velocity of other part will be
[RPMT 1999]
- (a) $\frac{MV}{M-m}$ (b) $\frac{MV}{M+m}$
(c) $\frac{mV}{M-m}$ (d) $\frac{(M+m)V}{m}$
37. A ball hits a vertical wall horizontally at 10 m/s bounces back at 10 m/s
[JIPMER 1999]
- (a) There is no acceleration because $10\frac{m}{s} - 10\frac{m}{s} = 0$
(b) There may be an acceleration because its initial direction is horizontal
(c) There is an acceleration because there is a momentum change
(d) Even though there is no change in momentum there is a change in direction. Hence it has an acceleration
38. A bullet of mass 50 gram is fired from a 5 kg gun with a velocity of 1 km/s . the speed of recoil of the gun is
[JIPMER 1999]
- (a) 5 m/s (b) 1 m/s
(c) 0.5 m/s (d) 10 m/s
39. A body falling from a height of 10 m rebounds from hard floor. If it loses 20% energy in the impact, then coefficient of restitution is
[AIIMS 2000]
- (a) 0.89 (b) 0.56
(c) 0.23 (d) 0.18
40. A body of mass m_1 moving with a velocity 3 ms^{-1} collides with another body at rest of mass m_2 . After collision the velocities of the two bodies are 2 ms^{-1} and 5 ms^{-1} respectively along the direction of motion of m_1 . The ratio m_1/m_2 is
[EAMCET (Engg.) 2000]
- (a) $\frac{5}{12}$ (b) 5
(c) $\frac{1}{5}$ (d) $\frac{12}{5}$
41. 100 g of a iron ball having velocity 10 m/s collides with a wall at an angle 30° and rebounds with the same angle. If the period of contact between the ball and wall is 0.1 second , then the force experienced by the ball is
[DPMT 2000]
- (a) 100 N (b) 10 N
(c) 0.1 N (d) 1.0 N
42. Two bodies having same mass 40 kg are moving in opposite directions, one with a velocity of 10 m/s and the other with 7 m/s . If they collide and move as one body, the velocity of the combination is
[Pb. PMT 2000]
- (a) 10 m/s (b) 7 m/s
(c) 3 m/s (d) 1.5 m/s
43. A body at rest breaks up into 3 parts. If 2 parts having equal masses fly off perpendicularly each after with a velocity of 12 m/s , then the velocity of the third part which has 3 times mass of each part is
[UPSEAT 2001]
- (a) $4\sqrt{2}\text{ m/s}$ at an angle of 45° from each body
(b) $24\sqrt{2}\text{ m/s}$ at an angle of 135° from each body
(c) $6\sqrt{2}\text{ m/s}$ at 135° from each body
(d) $4\sqrt{2}\text{ m/s}$ at 135° from each body
44. 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
[EAMCET 2001]
- (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) $\frac{h}{2}\left(\frac{1+e^2}{1-e^2}\right)$
45. The bob A of a simple pendulum is released when the string makes an angle of 45° with the vertical. It hits another bob B of the same material and same mass kept at rest on the table. If the collision is elastic
[Kerala (Engg.) 2001]



- (a) Both A and B rise to the same height
 (b) Both A and B come to rest at B
 (c) Both A and B move with the same velocity of A
 (d) A comes to rest and B moves with the velocity of A
46. A big ball of mass M , moving with velocity u strikes a small ball of mass m , which is at rest. Finally small ball obtains velocity u and big ball v . Then what is the value of v
 [RPET 2001]
 (a) $\frac{M-m}{M+m}u$ (b) $\frac{m}{M+m}u$
 (c) $\frac{2m}{M+m}u$ (d) $\frac{M}{M+m}u$
47. A body of mass 5 kg moving with a velocity 10 m/s collides with another body of the mass 20 kg at, rest and comes to rest. The velocity of the second body due to collision is
 [Pb. PMT 1999; KCET 2001]
 (a) 2.5 m/s (b) 5 m/s
 (c) 7.5 m/s (d) 10 m/s
48. A ball of mass m moving with velocity V , makes a head on elastic collision with a ball of the same mass moving with velocity $2V$ towards it. Taking direction of V as positive velocities of the two balls after collision are [MP PMT 2002]
 (a) $-V$ and $2V$ (b) $2V$ and $-V$
 (c) V and $-2V$ (d) $-2V$ and V
49. A body of mass M_1 collides elastically with another mass M_2 at rest. There is maximum transfer of energy when
 [Orissa JEE 2002; DCE 2001, 02]
 (a) $M_1 > M_2$
 (b) $M_1 < M_2$
 (c) $M_1 = M_2$
 (d) Same for all values of M_1 and M_2
50. A body of mass 2 kg makes an elastic collision with another body at rest and continues to move in the original direction with one fourth of its original speed. The mass of the second body which collides with the first body is [Kerala PET 2002]
 (a) 2 kg (b) 1.2 kg
 (c) 3 kg (d) 1.5 kg
51. In the elastic collision of objects [RPET 2003]
 (a) Only momentum remains constant
 (b) Only K.E. remains constant
 (c) Both remains constant
 (d) None of these
52. Two particles having position vectors $\vec{r}_1 = (3\hat{i} + 5\hat{j})\text{ metres}$ and $\vec{r}_2 = (-5\hat{i} - 3\hat{j})\text{ metres}$ are moving with velocities $\vec{v}_1 = (4\hat{i} + 3\hat{j})\text{ m/s}$ and $\vec{v}_2 = (\alpha\hat{i} + 7\hat{j})\text{ m/s}$ If they collide after 2 seconds, the value of ' α ' is [EAMCET 2003]
 (a) 2 (b) 4
 (c) 6 (d) 8
53. A neutron makes a head-on elastic collision with a stationary deuteron. The fractional energy loss of the neutron in the collision is [AIIMS 2003]
 (a) $16/81$ (b) $8/9$
 (c) $8/27$ (d) $2/3$
54. A body of mass m is at rest. Another body of same mass moving with velocity V makes head on elastic collision with the first body. After collision the first body starts to move with velocity [Orissa PMT 2004]
 (a) V (b) $2V$
 (c) Remain at rest (d) No predictable
55. A body of mass M moves with velocity v and collides elastically with a another body of mass m ($M \gg m$) at rest then the velocity of body of mass m is [BCECE 2004]
 (a) v (b) $2v$
 (c) $v/2$ (d) Zero
56. Four smooth steel balls of equal mass at rest are free to move along a straight line without friction. The first ball is given a velocity of 0.4 m/s . It collides head on with the second

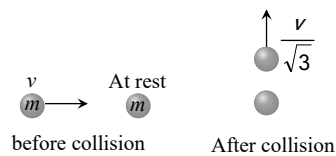
- elastically, the second one similarly with the third and so on. The velocity of the last ball is
[UPSEAT 2004]
- (a) $0.4 m/s$ (b) $0.2 m/s$
(c) $0.1 m/s$ (d) $0.05 m/s$
57. A space craft of mass ' M ' and moving with velocity ' v ' suddenly breaks in two pieces of same mass ' m '. After the explosion one of the mass ' m ' becomes stationary. What is the velocity of the other part of craft [DCE 2003]
- (a) $\frac{Mv}{M-m}$ (b) v
(c) $\frac{Mv}{m}$ (d) $\frac{M-m}{m}v$
58. Two masses m_A and m_B moving with velocities v_A and v_B in opposite directions collide elastically. After that the masses m_A and m_B move with velocity v_B and v_A respectively. The ratio (m_A / m_B) is
[RPMT 2003, AFMC 2002]
- (a) 1 (b) $\frac{v_A - v_B}{v_A + v_B}$
(c) $(m_A + m_B) / m_A$ (d) v_A / v_B
59. A ball is allowed to fall from a height of 10 m . If there is 40% loss of energy due to impact, then after one impact ball will go up to
[CPMT 1985]
- (a) 10 m (b) 8 m
(c) 4 m (d) 6 m
60. Which of the following statements is true [NCERT 1984]
- (a) In elastic collisions, the momentum is conserved but not in inelastic collisions
(b) Both kinetic energy and momentum are conserved in elastic as well as inelastic collisions
(c) Total kinetic energy is not conserved but momentum is conserved in inelastic collisions
(d) Total kinetic energy is conserved in elastic collisions but momentum is not conserved in elastic collisions
61. A tennis ball dropped from a height of 2 m rebounds only 1.5 m after hitting the ground. What fraction of its energy is lost in the impact
- (a) $\frac{1}{4}$ (b) $\frac{1}{2}$
(c) $\frac{1}{3}$ (d) $\frac{1}{8}$
62. 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
[MP PMT 1996]
- (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
63. The quantities remaining constant in a collision are
[MP PET 1997]
- (a) Momentum, kinetic energy and temperature
(b) Momentum and kinetic energy but not temperature
(c) Momentum and temperature but not kinetic energy
(d) Momentum but neither kinetic energy nor temperature
64. An inelastic ball is dropped from a height of 100 m . Due to earth, 20% of its energy is lost. To what height the ball will rise
[RPMT 1996]
- (a) 80 m (b) 40 m
(c) 60 m (d) 20 m
65. A ball is projected vertically down with an initial velocity from a height of 20 m onto a horizontal floor. During the impact it loses 50% of its energy and rebounds to the same height. The initial velocity of its projection is
[EAMCET (Engg.) 2000]
- (a) $20 ms^{-1}$ (b) $15 ms^{-1}$
(c) $10 ms^{-1}$ (d) $5 ms^{-1}$
66. 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 [RPET 2002]

- (a) he^6 (b) e^2h
(c) e^3h (d) None of these

67. A mass ' m ' moves with a velocity ' v ' and collides inelastically with another identical mass. After collision the 1st mass moves with velocity $\frac{v}{\sqrt{3}}$ in a direction perpendicular to the initial direction of motion. Find the speed of the 2nd mass after collision [AIEEE 2005]

- (a) $\frac{2}{\sqrt{3}}v$
(b) $\frac{v}{\sqrt{3}}$
(c) v
(d) $\sqrt{3}v$



68. A sphere collides with another sphere of identical mass. After collision, the two spheres move. The collision is inelastic. Then the angle between the directions of the two spheres is [KCET 1994]
- (a) 90° (b) 0°
(c) 45° (d) Different from 90°

Perfectly Inelastic Collision

1. A particle of mass m moving eastward with a speed v collides with another particle of the same mass moving northward with the same speed v . The two particles coalesce on collision. The new particle of mass $2m$ will move in the north-easterly direction with a velocity [NCERT 1980; CPMT 1991; MP PET 1999; DPMT 1999, 2005]
- (a) $v/2$ (b) $2v$
(c) $v/\sqrt{2}$ (d) v
2. The coefficient of restitution e for a perfectly inelastic collision is [DPMT 1988]
- (a) 1 (b) 0
(c) ∞ (d) -1
3. When two bodies stick together after collision, the collision is said to be
- (a) Partially elastic (b) Total elastic

- (c) Total inelastic (d) None of the above

4. A bullet of mass a and velocity b is fired into a large block of mass c . The final velocity of the system is

[AFMC 1981, 94, 2000; NCERT 1971; MNR 1998]

- (a) $\frac{c}{a+b} \cdot b$ (b) $\frac{a}{a+c} \cdot b$
(c) $\frac{a+b}{c} \cdot a$ (d) $\frac{a+c}{a} \cdot b$

5. A mass of 10 gm moving with a velocity of 100 cm/s strikes a pendulum bob of mass 10 gm . The two masses stick together. The maximum height reached by the system now is ($g = 10\text{ m/s}^2$) [MP PET 1993]

- (a) Zero (b) 5 cm
(c) 2.5 cm (d) 1.25 cm

6. A completely inelastic collision is one in which the two colliding particles

- (a) Are separated after collision
(b) Remain together after collision
(c) Split into small fragments flying in all directions
(d) None of the above

7. A bullet hits and gets embedded in a solid block resting on a horizontal frictionless table. What is conserved?

[NCERT 1973; CPMT 1970; AFMC 1996; BHU 2001]

- (a) Momentum and kinetic energy
(b) Kinetic energy alone
(c) Momentum alone
(d) Neither momentum nor kinetic energy

8. A body of mass 2 kg moving with a velocity of 3 m/sec collides head on with a body of mass 1 kg moving in opposite direction with a velocity of 4 m/sec . After collision, two bodies stick together and move with a common velocity which in m/sec is equal to

[NCERT 1984; MNR 1995, 98; UPSEAT 2000]

- (a) $1/4$ (b) $1/3$
(c) $2/3$ (d) $3/4$

9. 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
[NCERT 1977; RPMT 1999]
- (a) v (b) $2v$
(c) Zero (d) $v/2$
10. In the above question, if another body is at rest, then velocity of the compound body after collision is
(a) $v/2$ (b) $2v$
(c) v (d) Zero
11. A bag (mass M) hangs by a long thread and a bullet (mass m) comes horizontally with velocity v and gets caught in the bag. Then for the combined (bag + bullet) system
[CPMT 1989; Kerala PMT 2002]
- (a) Momentum is $\frac{mvM}{M+m}$
(b) Kinetic energy is $\frac{mv^2}{2}$
(c) Momentum is $\frac{mv(M+m)}{M}$
(d) Kinetic energy is $\frac{m^2v^2}{2(M+m)}$
12. A 50 g bullet moving with velocity 10 m/s strikes a block of mass 950 g at rest and gets embedded in it. The loss in kinetic energy will be
[MP PET 1994]
- (a) 100% (b) 95%
(c) 5% (d) 50%
13. Two putty balls of equal mass moving with equal velocity in mutually perpendicular directions, stick together after collision. If the balls were initially moving with a velocity of $45\sqrt{2} \text{ ms}^{-1}$ each, the velocity of their combined mass after collision is [Haryana CEE 1996; BVP 2003]
- (a) $45\sqrt{2} \text{ ms}^{-1}$ (b) 45 ms^{-1}
(c) 90 ms^{-1} (d) $22.5\sqrt{2} \text{ ms}^{-1}$
14. A particle of mass m moving with velocity v strikes a stationary particle of mass $2m$ and sticks to it. The speed of the system will be
[MP PMT/PET 1998; AIIMS 1999; JIPMER 2001, 02]
- (a) $v/2$ (b) $2v$
(c) $v/3$ (d) $3v$
15. A moving body of mass m and velocity 3 km/h collides with a rest body of mass $2m$ and sticks to it. Now the combined mass starts to move. What will be the combined velocity
[CBSE PMT 1996; JIPMER 2001, 02]
- (a) 3 km/h (b) 2 km/h
(c) 1 km/h (d) 4 km/h
16. If a skater of weight 3 kg has initial speed 32 m/s and second one of weight 4 kg has 5 m/s . After collision, they have speed (couple) 5 m/s . Then the loss in K.E. is
[CPMT 1996]
- (a) 48 J (b) 96 J
(c) Zero (d) None of these
17. A ball is dropped from height 10 m . Ball is embedded in sand 1 m and stops, then
[AFMC 1996]
- (a) Only momentum remains conserved
(b) Only kinetic energy remains conserved
(c) Both momentum and K.E. are conserved
(d) Neither K.E. nor momentum is conserved
18. A metal ball of mass 2 kg moving with a velocity of 36 km/h has an head on collision with a stationary ball of mass 3 kg . If after the collision, the two balls move together, the loss in kinetic energy due to collision is
[CBSE PMT 1997; AIIMS 2001]
- (a) 40 J (b) 60 J
(c) 100 J (d) 140 J
19. A body of mass 2 kg is moving with velocity 10 m/s towards east. Another body of same mass and same velocity moving towards north collides with former and coalesces and moves towards north-east. Its velocity is
[CPMT 1997; JIPMER 2000]
- (a) 10 m/s (b) 5 m/s
(c) 2.5 m/s (d) $5\sqrt{2} \text{ m/s}$
20. Which of the following is not a perfectly inelastic collision
[BHU 1998; JIPMER 2001, 02; BHU 2005]
- (a) Striking of two glass balls
(b) A bullet striking a bag of sand
(c) An electron captured by a proton
(d) A man jumping onto a moving cart

21. A mass of 20 kg moving with a speed of 10 m/s collides with another stationary mass of 5 kg . As a result of the collision, the two masses stick together. The kinetic energy of the composite mass will be [MP PMT 2000]
 (a) 600 Joule (b) 800 Joule
 (c) 1000 Joule (d) 1200 Joule
22. A neutron having mass of $1.67 \times 10^{-27}\text{ kg}$ and moving at 10^8 m/s collides with a deuteron at rest and sticks to it. If the mass of the deuteron is $3.34 \times 10^{-27}\text{ kg}$ then the speed of the combination is [CBSE PMT 2000]
 (a) $2.56 \times 10^3\text{ m/s}$ (b) $2.98 \times 10^5\text{ m/s}$
 (c) $3.33 \times 10^7\text{ m/s}$ (d) $5.01 \times 10^9\text{ m/s}$
23. The quantity that is not conserved in an inelastic collision is [Pb. PMT 2000]
 (a) Momentum (b) Kinetic energy
 (c) Total energy (d) All of these
24. A body of mass 40 kg having velocity 4 m/s collides with another body of mass 60 kg having velocity 2 m/s . If the collision is inelastic, then loss in kinetic energy will be [Pb. PMT 2001]
 (a) 440 J (b) 392 J
 (c) 48 J (d) 144 J
25. A body of mass m_1 is moving with a velocity V . It collides with another stationary body of mass m_2 . They get embedded. At the point of collision, the velocity of the system [DCE 1999, 2001]
 (a) Increases
 (b) Decreases but does not become zero
 (c) Remains same
 (d) Become zero
26. A bullet of mass m moving with velocity v strikes a block of mass M at rest and gets embedded into it. The kinetic energy of the composite block will be [MP PET 2002]
 (a) $\frac{1}{2}mv^2 \times \frac{m}{(m+M)}$ (b) $\frac{1}{2}mv^2 \times \frac{M}{(m+M)}$
 (c) $\frac{1}{2}mv^2 \times \frac{(M+m)}{M}$ (d) $\frac{1}{2}Mv^2 \times \frac{m}{(m+M)}$
27. In an inelastic collision, what is conserved [DCE 2004]
 (a) Kinetic energy (b) Momentum
 (c) Both (a) and (b) (d) Neither (a) nor (b)
28. Two bodies of masses 0.1 kg and 0.4 kg move towards each other with the velocities 1 m/s and 0.1 m/s respectively, After collision they stick together. In 10 sec the combined mass travels [Pb. PET 2003]
 (a) 120 m (b) 0.12 m
 (c) 12 m (d) 1.2 m
29. A body of mass 4 kg moving with velocity 12 m/s collides with another body of mass 6 kg at rest. If two bodies stick together after collision, then the loss of kinetic energy of system is [J&K CET 2005]
 (a) Zero (b) 288 J
 (c) 172.8 J (d) 144 J
30. Which of the following is not an example of perfectly inelastic collision [AFMC 2005]
 (a) A bullet fired into a block if bullet gets embedded into block
 (b) Capture of electrons by an atom
 (c) A man jumping on to a moving boat
 (d) A ball bearing striking another ball bearing

Critical Thinking

Objective Questions

1. A ball hits the floor and rebounds after inelastic collision. In this case [IIT 1986]
 (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 conserved
 (d) The total energy of the ball and the earth is conserved
2. 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

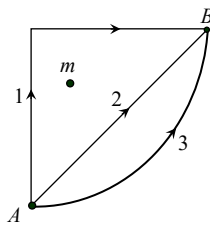
of the table. If g is acceleration due to gravity, the work required to pull the hanging part on to the table is

[IIT 1985; MNR 1990; AIEEE 2002; MP PMT 1994, 97, 2000; JIPMER 2000]

- (a) MgL (b) $MgL/3$
(c) $MgL/9$ (d) $MgL/18$

3. If W_1, W_2 and W_3 represent the work done in moving a particle from A to B along three different paths 1, 2 and 3 respectively (as shown) in the gravitational field of a point mass m , find the correct relation between W_1, W_2 and W_3

[IIT-JEE Screening 2003]



- (a) $W_1 > W_2 > W_3$
(b) $W_1 = W_2 = W_3$
(c) $W_1 < W_2 < W_3$
(d) $W_2 > W_1 > W_3$

4. A particle of mass m is moving in a horizontal circle of radius r under a centripetal force equal to $-K/r^2$, where K is a constant. The total energy of the particle is [IIT 1977]

- (a) $\frac{K}{2r}$ (b) $-\frac{K}{2r}$
(c) $-\frac{K}{r}$ (d) $\frac{K}{r}$

5. The displacement x of a 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 x is in meters and t is in seconds. The work done by the force in the first 6 seconds is

[IIT 1979]

- (a) 9 J (b) 6 J
(c) 0 J (d) 3 J

6. A force $F = -K(yj + xj)$ (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 the point $(a, 0)$ and then parallel to the y -axis to the point (a, a) . The total work done by the force F on the particles is

[IIT 1998]

- (a) $-2Ka^2$ (b) $2Ka^2$
(c) $-Ka^2$ (d) Ka^2

7. If g is the acceleration due to gravity on the earth's surface, the gain in the potential energy of an object of mass m raised from the surface of earth to a height equal to the radius of the earth R , is [IIT 1983]

- (a) $\frac{1}{2}mgR$ (b) $2mgR$
(c) mgR (d) $\frac{1}{4}mgR$

8. A lorry and a car moving with the same K.E. are brought to rest by applying the same retarding force, then

[IIT 1973; MP PMT 2003]

- (a) Lorry will come to rest in a shorter distance
(b) Car will come to rest in a shorter distance
(c) Both come to rest in a same distance
(d) None of the above

9. A particle free to move along the x -axis has potential energy given by $U(x) = k[1 - \exp(-x^2)]$ for $-\infty \leq x \leq +\infty$, where k is a positive constant of appropriate dimensions. Then

[IIT-JEE 1999; UPSEAT 2003]

- (a) At point away from the origin, the particle is in unstable equilibrium
(b) For any finite non-zero value of x , there is a force directed away from the origin
(c) If its total mechanical energy is $k/2$, it has its minimum kinetic energy at the origin
(d) For small displacements from $x = 0$, the motion is simple harmonic

10. The kinetic energy acquired by a mass m in travelling a certain distance d starting from rest under the action of a constant force is directly proportional to [CBSE PMT 1994]

- (a) \sqrt{m} (b) Independent of m
(c) $1/\sqrt{m}$ (d) m

11. An open knife edge of mass ' m ' is dropped from a height ' h ' on a wooden floor. If the blade penetrates upto the depth ' d ' into the wood, the average resistance offered by the wood to the knife edge is [BHU 2002]

- (a) mg (b) $mg\left(1 - \frac{h}{d}\right)$

(c) $mg\left(1+\frac{h}{d}\right)$

(d) $mg\left(1+\frac{h}{d}\right)^2$

(d) $\frac{10}{\sqrt{2}} ml \text{ secona}$ and 45° from either

12. Consider the following two statements
1. Linear momentum of a system of particles is zero
 2. Kinetic energy of a system of particles is zero

Then [AIEEE 2003]

- 1 implies 2 and 2 implies 1
- 1 does not imply 2 and 2 does not imply 1
- 1 implies 2 but 2 does not imply 1
- 1 does not imply 2 but 2 implies 1

13. A body is moved along a straight line by a machine delivering constant power. The distance moved by the body in time t is proportional to

[IIT 1984; BHU 1984, 95; MP PET 1996; JIPMER 2000; AMU (Med.) 1999]

- $t^{1/2}$
- $t^{3/4}$
- $t^{3/2}$
- t^2

14. A shell is fired from a cannon with velocity v m/sec at an angle θ with the horizontal direction. At the highest point in its path it explodes into two pieces of equal mass. One of the pieces retraces its path to the cannon and the speed in m/sec of the other piece immediately after the explosion is

[IIT 1984; RPET 1999, 2001; UPSEAT 2002]

- $3v\cos\theta$
- $2v\cos\theta$
- $\frac{3}{2}v\cos\theta$
- $\frac{\sqrt{3}}{2}v\cos\theta$

15. A vessel at rest explodes into three pieces. Two pieces having equal masses fly off perpendicular to one another with the same velocity $30 \text{ meter per second}$. The third piece has three times mass of each of other piece. The magnitude and direction of the velocity of the third piece will be

[AMU (Engg.) 1999]

- $10\sqrt{2} ml \text{ secona}$ and 135° from either
- $10\sqrt{2} ml \text{ secona}$ and 45° from either
- $\frac{10}{\sqrt{2}} ml \text{ secona}$ and 135° from either

16. Two particles of masses m_1 and m_2 in projectile motion have velocities \vec{v}_1 and \vec{v}_2 respectively at time $t = 0$. They collide at time t_0 . Their velocities become \vec{v}_1' and \vec{v}_2' at time $2t_0$ while still moving in air. The value of $|(m_1\vec{v}_1' + m_2\vec{v}_2') - (m_1\vec{v}_1 + m_2\vec{v}_2)|$ is

[IIT-JEE Screening 2001]

- Zero
- $(m_1 + m_2)gt_0$
- $2(m_1 + m_2)gt_0$
- $\frac{1}{2}(m_1 + m_2)gt_0$

17. 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 directions making angles θ_1 and θ_2 respectively with the initial direction of motion. The sum of the angles, $\theta_1 + \theta_2$, is

[UPSEAT 2004]

- 45°
- 90°
- 135°
- 180°

18. A body of mass m moving with velocity v collides head on with another body of mass $2m$ which is initially at rest. The ratio of K.E. of colliding body before and after collision will be

[Roorkee 1982]

- 1 : 1
- 2 : 1
- 4 : 1
- 9 : 1

19. A particle P moving with speed v undergoes a head-on elastic collision with another particle Q of identical mass but at rest. After the collision

[Roorkee 2000]

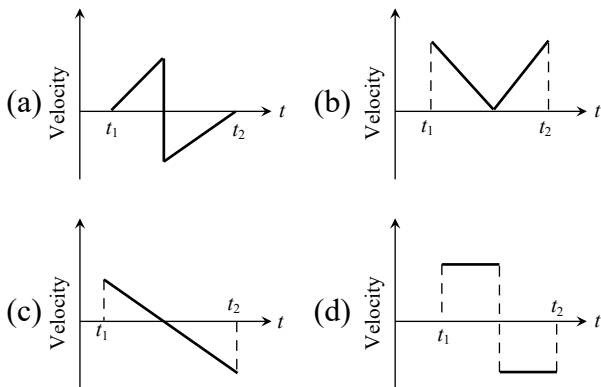
- Both P and Q move forward with speed $\frac{v}{2}$
- Both P and Q move forward with speed $\frac{v}{\sqrt{2}}$
- P comes to rest and Q moves forward with speed v
- P and Q move in opposite directions with speed $\frac{v}{\sqrt{2}}$

20. A set of n identical cubical blocks lies at rest parallel to each other along a line on a smooth horizontal surface. The separation between the near surfaces of any two adjacent blocks is L . The block at one end is given a speed v towards the next one at time $t=0$. All collisions are completely inelastic, then
[IIT 1995]

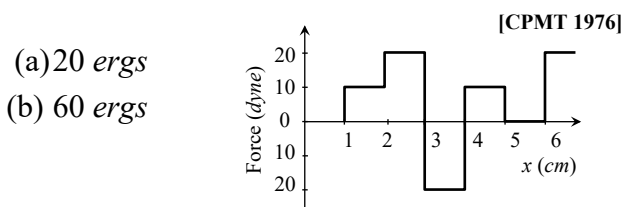
- (a) The last block starts moving at $t = \frac{(n-1)L}{v}$
 (b) The last block starts moving at $t = \frac{n(n-1)L}{2v}$
 (c) The centre of mass of the system will have a final speed v
 (d) The centre of mass of the system will have a final speed $\frac{v}{n}$

Graphical Questions

1. A batsman hits a sixer and the ball touches the ground outside the cricket ground. Which of the following graph describes the variation of the cricket ball's vertical velocity v with time between the time t_1 as it hits the bat and time t_2 when it touches the ground
[AMU (Med.) 2001]

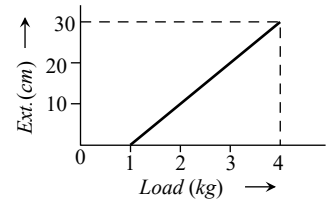


2. The relationship between force and position is shown in the figure given (in one dimensional case). The work done by the force in displacing a body from $x = 1 \text{ cm}$ to $x = 5 \text{ cm}$ is



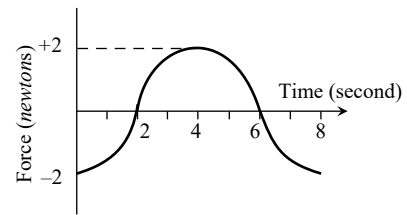
- (c) 70 ergs
 (d) 700 ergs

3. The pointer reading v/s load graph for a spring balance is as given in the figure. The spring constant is



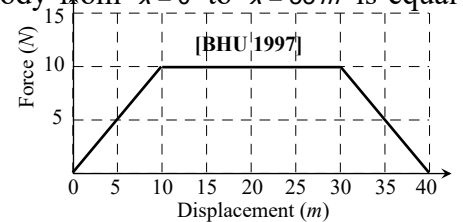
- (a) 0.1 kg/cm
 (b) 5 kg/cm
 (c) 0.3 kg/cm
 (d) 1 kg/cm

4. A force-time graph for a linear motion is shown in figure where the segments are circular. The linear momentum gained between zero and 8 second is
[CPMT 1989]



- (a) $-2\pi \text{ newton} \times \text{second}$ (b) $\text{Zero newton} \times \text{second}$
 (c) $+4\pi \text{ newton} \times \text{second}$ (d) $-6\pi \text{ newton} \times \text{second}$

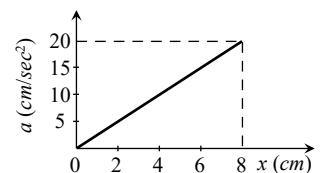
5. Adjacent figure shows the force-displacement graph of a moving body, the work done in displacing body from $x=0$ to $x=35 \text{ m}$ is equal to



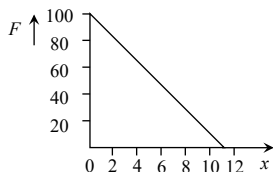
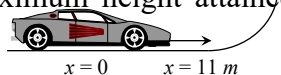
- (a) 50 J
 (b) 25 J
 (c) 287.5 J
 (d) 200 J

6. A 10 kg mass moves along x -axis. Its acceleration as a function of its position is shown in the figure. What is the total work done on the mass by the force as the mass moves from $x = 0$ to $x = 8 \text{ cm}$
[AMU (Med.) 2000]

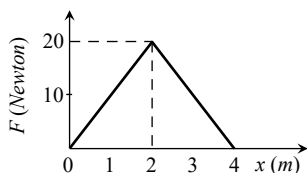
- (a) $8 \times 10^{-2} \text{ joules}$
 (b) $16 \times 10^{-2} \text{ joules}$
 (c) $4 \times 10^{-4} \text{ joules}$
 (d) $1.6 \times 10^{-3} \text{ joules}$



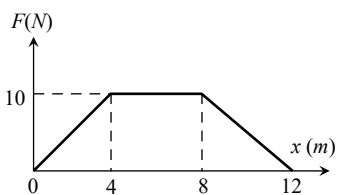
7. A toy car of mass 5 kg moves up a ramp under the influence of force F plotted against displacement x . The maximum height attained is given by



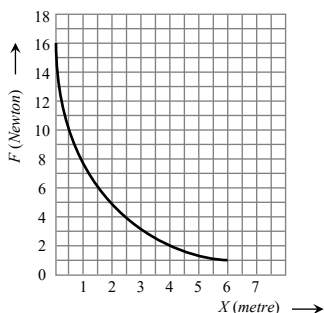
- (a) $y_{\max} = 20m$
 (b) $y_{\max} = 15m$
 (c) $y_{\max} = 11m$
 (d) $y_{\max} = 5m$
8. The graph between the resistive force F acting on a body and the distance covered by the body is shown in the figure. The mass of the body is 25 kg and initial velocity is 2 m/s . When the distance covered by the body is 4 m , its kinetic energy would be



- (a) 50 J
 (b) 40 J
 (c) 20 J
 (d) 10 J
9. A particle of mass 0.1 kg is subjected to a force which varies with distance as shown in fig. If it starts its journey from rest at $x=0$, its velocity at $x=12\text{ m}$ is [AIIMS 1995]



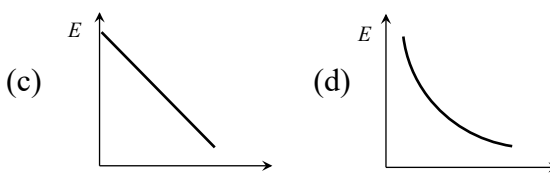
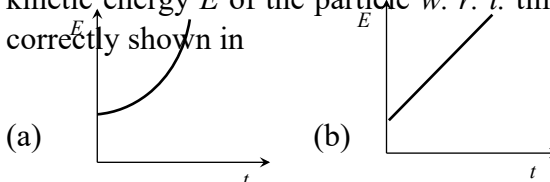
- (a) 0 m/s
 (b) $20\sqrt{2}\text{ m/s}$
 (c) $20\sqrt{3}\text{ m/s}$
 (d) 40 m/s
10. The relation between the displacement X of an object produced by the application of the variable force F is represented by a graph shown in the figure. If the object undergoes a displacement from $X=0.5\text{ m}$ to $X=2.5\text{ m}$ the work done will be approximately equal to [CPMT 1986]



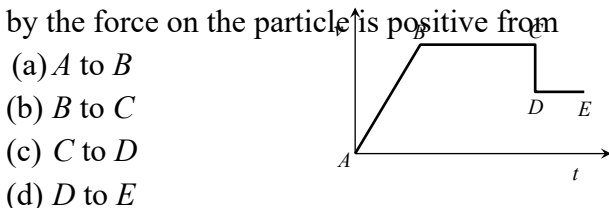
- (a) 16 J
 (b) 32 J

- (c) 1.6 J
 (d) 8 J

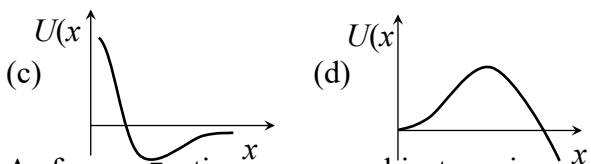
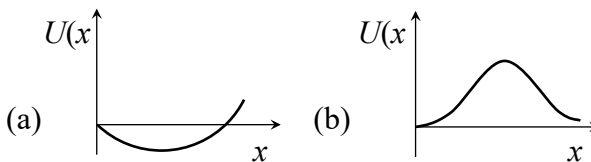
11. A particle is dropped from a height h . A constant horizontal velocity is given to the particle. Taking g to be constant everywhere, kinetic energy E of the particle *w. r. t.* time t is correctly shown in



12. The adjoining diagram shows the velocity versus time plot for a particle. The work done by the force on the particle is positive from



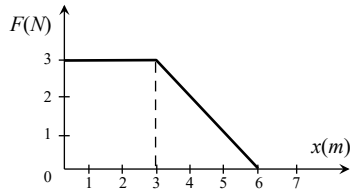
- (a) A to B
 (b) B to C
 (c) C to D
 (d) D to E
13. A particle which is constrained to move along the x -axis, is subjected to a force in the same direction which varies with the distance x of the particle from the origin as $F(x) = -kx + ax^3$. Here k and a are positive constants. For $x \geq 0$, the functional form of the potential energy $U(x)$ of the particle is [IIT-JEE (Screening) 2002]



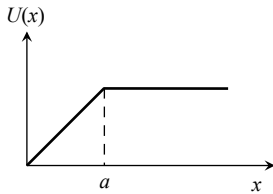
14. A force F acting on an object varies with distance x as shown here. The force is in newton and x in metre. The work done by the

force in moving the object from $x = 0$ to $x = 6m$ is
[CBSE PMT 2005]

- (a) 4.5 J
- (b) 13.5 J
- (c) 9.0 J
- (d) 18.0 J



15. The potential energy of a system is represented in the first figure. the force acting on the system will be represented by



- (a) (b)
- (c) (d)

16. A particle, initially at rest on a frictionless horizontal surface, is acted upon by a horizontal force which is constant in 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)

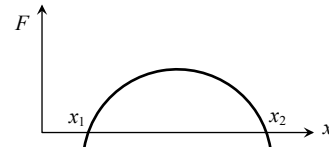
17. Which of the following graphs is correct between kinetic energy (E), potential energy (U) and height (h) from the ground of the particle

- (a) (b)
- (c) (d)

18. The graph between \sqrt{E} and $\frac{1}{p}$ is (E =kinetic energy and p = momentum)

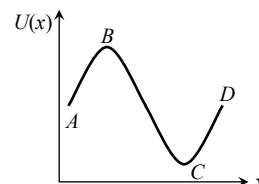
- (a) (b) (c) (d)

19. The force acting on a body moving along x -axis varies with the position of the particle as shown in the fig.



The body is in stable equilibrium at

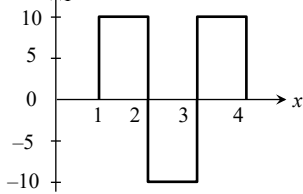
- (a) $x = x_1$ (b) $x = x_2$
(c) both x_1 and x_2 (d) neither x_1 nor x_2
20. The potential energy of a particle varies with distance x as shown in the graph.



The force acting on the particle is zero at

- (a) C (b) B
(c) B and C (d) A and D

21. Figure shows the $F-x$ graph. Where F is the force applied and x is the distance covered

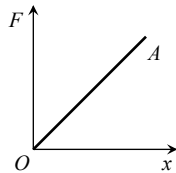


by the body along a straight line path. Given that F is in *newton* and x in *metre*, what is the work done ?

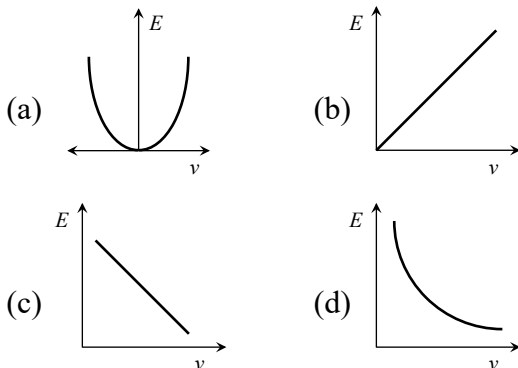
- (a) 10 J (b) 20 J
(c) 30 J (d) 40 J

22. The force required to stretch a spring varies with the distance as shown in the figure. If the experiment is performed with the above spring of half length, the line OA will

- (a) Shift towards F-axis
(b) Shift towards X-axis
(c) Remain as it is
(d) Become double in length



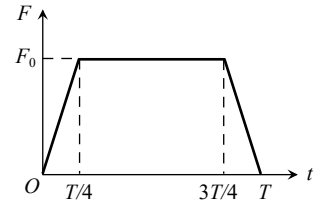
23. The graph between E and v is



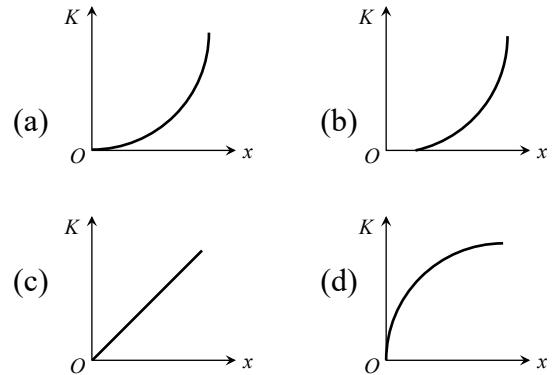
24. A particle of mass m moving with a velocity u makes an elastic one dimensional collision with a stationary particle of mass m establishing a contact with it for extremely small time T . Their force of contact increases from zero to F_0

linearly in time $\frac{T}{4}$, remains constant for a further time $\frac{T}{2}$ and decreases linearly from F_0 to zero in further time $\frac{T}{4}$ as shown. The magnitude possessed by F_0 is

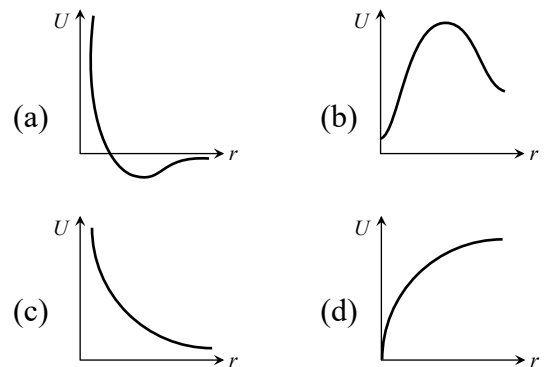
- (a) $\frac{mu}{T}$
(b) $\frac{2mu}{T}$
(c) $\frac{4mu}{3T}$
(d) $\frac{3mu}{4T}$



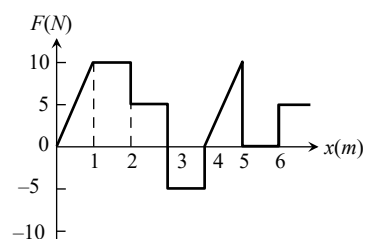
25. A body moves from rest with a constant acceleration. Which one of the following graphs represents the variation of its kinetic energy K with the distance travelled x ?



26. The diagrams represent the potential energy U of a function of the inter-atomic distance r . Which diagram corresponds to stable molecules found in nature.



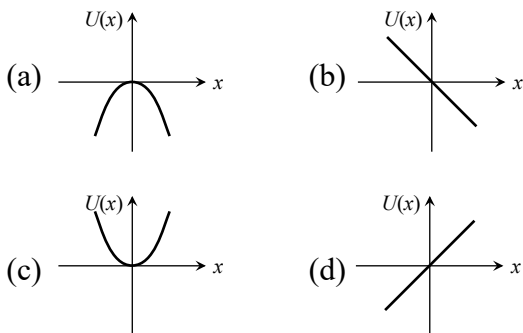
27. The relationship between the force F and position x of a body is as shown in figure. The



work done in displacing the body from $x = 1\text{ m}$ to $x = 5\text{ m}$ will be [KCET 2005]

- (a) 30 J
- (b) 15 J
- (c) 25 J
- (d) 20 J

28. A particle is placed at the origin and a force $F = kx$ is acting on it (where k is positive constant). If $U(0) = 0$, the graph of $U(x)$ versus x will be (where U is the potential energy function) [IIT-JEE (Screening) 2004]



Assertion & Reason

For AIIMS Aspirants

Read the assertion and reason carefully to mark the correct option out of the options given below:

- (a) If both assertion and reason are true and the reason is the correct explanation of the assertion.
- (b) If both assertion and reason are true but reason is not the correct explanation of the assertion.
- (c) If assertion is true but reason is false.
- (d) If the assertion and reason both are false.
- (e) If assertion is false but reason is true.

1. Assertion : A person working on a horizontal road with a load on his head does no work.

Reason : No work is said to be done, if directions of force and displacement of load are perpendicular to each other.

2. Assertion : The work done during a round trip is always zero.

Reason : No force is required to move a body in its round trip.

3. Assertion : Work done by friction on a body sliding down an inclined plane is positive.

Reason : Work done is greater than zero, if angle between force and displacement is acute or both are in same direction.

4. Assertion : When a gas is allowed to expand, work done by gas is positive.

Reason : Force due to gaseous pressure and displacement (of piston) are in the same direction.

5. Assertion : A light body and heavy body have same momentum. Then they also have same kinetic energy.

Reason : Kinetic energy does not depend on mass of the body.

6. Assertion : The instantaneous power of an agent is measured as the dot product of instantaneous velocity and the force acting on it at that instant.

Reason : The unit of instantaneous power is watt.

7. Assertion : The change in kinetic energy of a particle is equal to the work done on it by the net force.

Reason : Change in kinetic energy of particle is equal to the work done only in case of a system of one particle.

8. Assertion : A spring has potential energy, both when it is compressed or stretched.

Reason : In compressing or stretching, work is done on the spring against the restoring force.

9. Assertion : Comets move around the sun in elliptical orbits. The gravitational force on the comet due to sun is not normal to the comet's velocity but

- the work done by the gravitational force over every complete orbit of the comet is zero.
- Reason : Gravitational force is a non conservative force.
10. Assertion : The rate of change of total momentum of a many particle system is proportional to the sum of the internal forces of the system.
- Reason : Internal forces can change the kinetic energy but not the momentum of the system.
11. Assertion : Water at the foot of the water fall is always at different temperature from that at the top.
- Reason : The potential energy of water at the top is converted into heat energy during falling.
12. Assertion : The power of a pump which raises 100 kg of water in 10sec to a height of 100 m is 10 KW.
- Reason : The practical unit of power is horse power.
13. Assertion : According to law of conservation of mechanical energy change in potential energy is equal and opposite to the change in kinetic energy.
- Reason : Mechanical energy is not a conserved quantity.
14. Assertion : When the force retards the motion of a body, the work done is zero.
- Reason : Work done depends on angle between force and displacement.
15. Assertion : In an elastic collision of two bodies, the momentum and energy of each body is conserved.
- Reason : If two bodies stick to each other, after colliding, the collision is said to be perfectly elastic.
16. Assertion : A body cannot have energy without having momentum but it can have momentum without having energy.
- Reason : Momentum and energy have same dimensions.
17. Assertion : Power developed in circular motion is always zero.
- Reason : Work done in case of circular motion is zero.
18. Assertion : A kinetic energy of a body is quadrupled, when its velocity is doubled.
- Reason : Kinetic energy is proportional to square of velocity.
19. Assertion : A quick collision between two bodies is more violent than slow collision, even when initial and final velocities are identical.
- Reason : The rate of change of momentum determine that force is small or large.
20. Assertion : Work done by or against gravitational force in moving a body from one point to another is independent of the actual path followed between the two points.
- Reason : Gravitational forces are conservative forces.
21. Assertion : Wire through which current flows gets heated.
- Reason : When current is drawn from a cell, chemical energy is converted into heat energy.
22. Assertion : Graph between potential energy of a spring versus the extension or compression of the spring is a straight line.
- Reason : Potential energy of a stretched or compressed spring, proportional to square of extension or compression.
23. Assertion : Heavy water is used as moderator in nuclear reactor.
- Reason : Water cool down the fast neutron.
24. Assertion : Mass and energy are not conserved separately, but are

conserved as a single entity called mass-energy.

Reason : Mass and energy conservation can be obtained by Einstein equation for energy.

25. Assertion : If two protons are brought near one another, the potential energy of the system will increase.

Reason : The charge on the proton is $+1.6 \times 10^{-19} C$.

26. Assertion : In case of bullet fired from gun, the ratio of kinetic energy of gun and bullet is equal to ratio of mass of bullet and gun.

Reason : In firing, momentum is conserved.

27. Assertion : Power of machine gun is determined by both, the number of bullet fired per second and kinetic energy of bullets.

Reason : Power of any machine is defined as work done (by it) per unit time.

28. Assertion : A work done in moving a body over a closed loop is zero for every force in nature.

Reason : Work done does not depend on nature of force.

29. Assertion : Mountain roads rarely go straight up the slope.

Reason : Slope of mountains are large therefore more chances of vehicle to slip from roads.

30. Assertion : Soft steel can be made red hot by continued hammering on it, but hard steel cannot.

Reason : Energy transfer in case of soft iron is large as in hard steel.

1	b	2	a	3	c	4	d	5	c
6	b	7	b	8	c	9	a	10	d
11	d	12	b	13	d	14	b	15	b
16	b	17	b	18	d	19	d	20	d
21	d	22	d	23	d	24	a	25	c
26	a	27	d	28	b	29	d	30	a
31	b	32	c	33	a	34	b	35	a
36	d	37	a	38	c	39	c	40	a
41	c								

Work Done by Variable Force

1	b	2	c	3	c	4	a	5	a
6	c	7	d	8	d	9	d	10	b
11	b	12	c	13	b	14	c	15	d
16	c	17	a	18	a	19	c	20	b
21	d	22	a	23	a	24	b	25	d
26	d								

Conservation of Energy and Momentum

1	c	2	c	3	a	4	a	5	b
6	d	7	c	8	c	9	b	10	d
11	c	12	b	13	c	14	a	15	b
16	c	17	b	18	d	19	b	20	c
21	b	22	c	23	d	24	c	25	a
26	c	27	d	28	d	29	a	30	b
31	d	32	d	33	a	34	d	35	a
36	a	37	b	38	c	39	a	40	c
41	d	42	c	43	b	44	a	45	a
46	b	47	b	48	b	49	d	50	a
51	b	52	a	53	c	54	d	55	d
56	a	57	c	58	b	59	c	60	a
61	b	62	b	63	a	64	c	65	d
66	b	67	d	68	b	69	a	70	c
71	b	72	a	73	c	74	c	75	c
76	a	77	b	78	a	79	a	80	d
81	d	82	b	83	c	84	b	85	c
86	c	87	b	88	c				

Power

1	a	2	d	3	d	4	b	5	c
6	a	7	b	8	d	9	d	10	c
11	c	12	d	13	a	14	a	15	c
16	c	17	b	18	a	19	c	20	c
21	a	22	b	23	a	24	a	25	a
26	a	27	a	28	a	29	a	30	c

Elastic and Inelastic collision

Answers

Work Done by Constant Force

1	a	2	a	3	c	4	a	5	c
6	c	7	b	8	c	9	c	10	d
11	d	12	b	13	d	14	c	15	d
16	a	17	c	18	c	19	d	20	a
21	d	22	d	23	b	24	a	25	c
26	a	27	b	28	d	29	d	30	b
31	b	32	a	33	b	34	a	35	c
36	a	37	c	38	d	39	a	40	b
41	b	42	d	43	d	44	a	45	d
46	a	47	a	48	d	49	c	50	b
51	c	52	d	53	b	54	a	55	b
56	a	57	a	58	a	59	d	60	c
61	a	62	c	63	d	64	a	65	a
66	a	67	a	68	d				

Perfectly Inelastic Collision

1	c	2	b	3	c	4	b	5	d
6	b	7	c	8	c	9	c	10	a
11	d	12	b	13	b	14	c	15	c
16	d	17	a	18	b	19	d	20	a
21	b	22	c	23	b	24	c	25	b
26	a	27	b	28	d	29	c	30	d

Critical Thinking Questions

1	c	2	d	3	b	4	b	5	c
6	c	7	a	8	c	9	d	10	b
11	c	12	d	13	c	14	a	15	a
16	c	17	b	18	d	19	c	20	bd

Graphical Questions

1	c	2	a	3	a	4	b	5	c
6	a	7	c	8	d	9	d	10	a
11	a	12	a	13	d	14	b	15	c
16	d	17	a	18	c	19	b	20	c
21	a	22	a	23	a	24	c	25	c
26	a	27	b	28	a				

Assertion and Reason

1	a	2	d	3	e	4	a	5	d
6	b	7	c	8	a	9	c	10	e
11	a	12	b	13	c	14	e	15	d
16	d	17	e	18	a	19	a	20	a
21	c	22	e	23	c	24	a	25	b
26	a	27	a	28	d	29	a	30	a