MULTIPLE CHOICE QUESTIONS

1. When a force of 1 N acts on a 1kg body that is able to move freely, the body receives **[CPMT 71, 82]**
   (*a*) a speed of 1 m/s
   (*b*) an acceleration of 1 m/s^2
   (*c*) an acceleration of 980 cm/s^2
   (*d*) none of these

2. A force of 12 N gives an object an acceleration of 4 m/s^2. The force required to give it an acceleration of 10 m/s^2 is
   (*a*) 15 N (*b*) 20 N
   (*c*) 25 N (*d*) 30 N

3. A body of mass 2 kg, moving on a horizontal surface with an initial velocity of 4 m/s, comes to rest after 2 seconds. If one wants to keep this body moving on the same surface with a velocity of 4 m/s, the force required is
   (*a*) zero (*b*) 2 N
   (*c*) 4 N (*d*) 8 N

4. How much force is required to push a 100 N wooden block up a frictionless plane that is inclined at an angle of 30° with the horizontal so that it has an acceleration along the plane of 2.5 m/s^2 ? The force is to be applied along the plane. (g = 10 m/s^2)
   (*a*) 50 N (*b*) 75 N
   (*c*) 100 N (*d*) 125 N

5. A weight of 290 N and another of 200 N are suspended by a rope on either side of a frictionless pulley. The acceleration of each weight is
   (*a*) 1.5 m/s^2 (*b*) 1.8 m/s^2
   (*c*) 2.2 m/s^2 (*d*) 2.5 m/s^2

6. Two boxes, one of mass 20 kg and the other of mass 40 kg, are sliding down a frictionless inclined plane that makes an angle of 30° with the horizontal. Their respective accelerations in m/s^2 are
   (*a*) 9.8 ; 9.8 (*b*) 4.9 ; 9.8
   (*c*) 9.8 ; 4.9 (*d*) 4.9 ; 4.9

7. Two masses, each equal to m, are attached to one another by a massless string passing over a smooth pulley. The tension in the string is
   (*a*) mg (*b*) $2mg$
   (*c*) $mg/2$ (*d*) zero

8. What force should be applied on a 5 kg body so that it has a downward acceleration of 4 m/s^2 ?
   (*a*) 69 N upwards
   (*b*) 69 N downwards
   (*c*) 29 N upwards
   (*d*) 29 N downwards

9. A certain force gives a 2 kg object an acceleration of 0.5 m/s^2. What acceleration would the same force give a 10 kg object?
   (*a*) 0.1 m/s^2 (*b*) 0.2 m/s^2
   (*c*) 0.5 m/s^2 (*d*) 1.0 m/s^2

10. An 80 kg man stands on a spring balance in an elevator. When it starts to move, the scale reads 700 N. What is the acceleration of the elevator ? (g = 10 m/s^2)
    (*a*) 1.25 m/s^2 upwards
    (*b*) 2.0 m/s^2 downwards
    (*c*) 2.0 m/s^2 upwards
    (*d*) 1.25 m/s^2 downwards

11. A body rolling freely on the surface of the earth eventually comes to rest because
    (*a*) it has mass
    (*b*) it suffers friction
    (*c*) it has inertia of rest
    (*d*) it has momentum

12. A body of mass 1 kg is moving towards east with a uniform speed of 2 m/s. A force of 2N is applied to it towards north. The magnitude of the displacement of the body, 2 s after the force is applied, is
    (*a*) 4 m (*b*) $4\sqrt{2}$ m
    (*c*) 8 m (*d*) $8\sqrt{2}$ m

13. A ship of mass 3×10^7 kg, initially at rest, is pulled by a force of 5×10^4 N through a distance of 3 m. Assuming that the resistance due to water is negligible, the speed of the ship is **[IIT 80, MP PMT 2000]**

(a) 1.5 m/s (b) 60 m/s
(c) 0.1 m/s (d) 5 m/s

14. A body of mass 50 kg acquires a speed of 20 m/s under a force of 100 N in time
(a) 5 s (b) 10 s
(c) 15 s (d) 20 s

15. The mass of an elevator is 4000 kg. When the tension in the supporting cable is 48000 N, the acceleration of the elevator is (g = 10 m/s^2)
(a) 2 m/s^2 upwards
(b) 2 m/s^2 downwards
(c) 20 m/s^2 upwards
(d) 20 m/s^2 downwards

16. While launching a rocket of mass 10^4 kg, a force of 10^6 N is applied for 10 s. The speed attained by the rocket at the end of 10 s is
(a) 500 m/s (b) 1000 m/s
(c) 1500 m/s (d) 2000 m/s

17. The mass of a balloon and its contents is M. It is descending with an acceleration a. By how much the mass should be decreased, keeping the volume constant, so that the balloon starts ascending with the same acceleration ?

(a) $\frac{a}{a+g}M$ (b) $\frac{g}{a+g}M$

(c) $\frac{2a}{a+g}M$ (d) $\frac{2g}{a+g}M$

18. Two blocks A and B having masses m_1 and m_2, respectively, are placed in contact on a smooth horizontal surface. A force F is applied horizontally on A. The contact force between A and B is

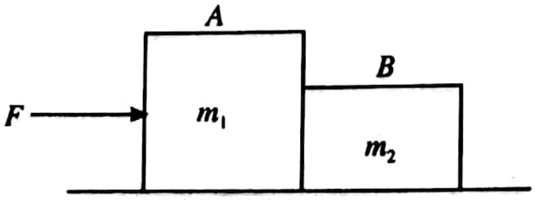

Fig. 5.24

(a) $\frac{m_1}{m_2}F$ (b) $\frac{m_2}{m_1}F$

(c) $\frac{m_1 F}{m_1+m_2}$ (d) $\frac{m_2 F}{m_1+m_2}$

19. Two masses m_1 and m_2, placed on a smooth horizontal surface, are connected by a massless, inextensible string. A horizontal force F is applied on m_2 as shown. The tension in the string is

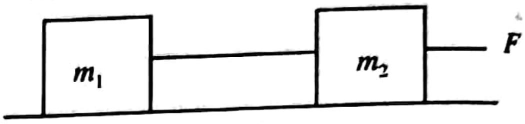

Fig. 5.25

(a) $\frac{m_1}{m_2}F$ (b) $\frac{m_2}{m_1}F$

(c) $\frac{m_1 F}{m_1+m_2}$ (d) $\frac{m_2 F}{m_1+m_2}$

20. A block of mass 9 kg, lying on a frictionless table, is connected to a block of mass 1 kg by means of a string which passes over a frictionless pulley as shown in Fig. 5.26. The tension in the string is (g = 10 m/s^2)
(a) 1 N (b) 4 N
(c) 7 N (d) 9 N

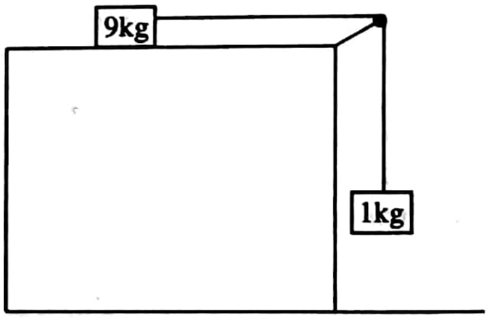

Fig. 5.26

21. In Q. 20, the common acceleration of the masses is
(a) 1 m/s^2 (b) 4 m/s^2
(c) 7 m/s^2 (d) 9 m/s^2

22. A unform rope of length l is pulled by a constant force F as shown. The tension in the rope at a distance x from the end where the force is applied is [IIT 78]

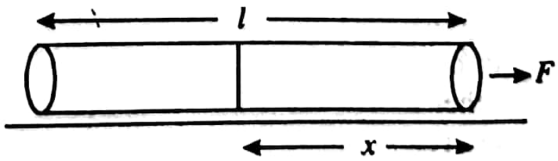

Fig. 5.27

(a) F (b) $F\left(1+\frac{x}{l}\right)$

(c) $F\frac{x}{l}$ (d) $F\left(1-\frac{x}{l}\right)$

23. A block of mass M is pulled along a horizontal frictionless surface by a rope of mass m by applying a force at one end of the rope. The force which the rope exerts on the block is **[CPMT 85, 82]**

(a) $\frac{P}{M-m}$ (b) $\frac{PM}{M+m}$

(c) $\frac{Pm}{M+m}$ (d) $Pm\,(M+m)$

24. The equation $v^2 = u^2 + 2as$, where the symbols have their usual meanings, follows from
(a) Newton's first law
(b) Newton's second law
(c) Newton's third law
(d) none of these laws

25. An elevator is moving vertically up with an acceleration a. The force exerted on the floor by a passenger of mass m is **[CPMT 78, 74]**

(a) mg (b) ma
(c) $mg - ma$ (d) $mg + ma$

26. Two masses of 10 kg and 20 kg are connected by a massless spring as shown. A force of 200 N acts on the 20 kg mass. At a certain instant the acceleration of 10 kg mass is 12 m/s^2. The acceleration of the 20 kg mass at that instant is

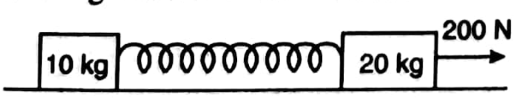

Fig. 5.28

(a) 4 m/s^2 (b) 10 m/s^2
(c) 12 m/s^2 (d) none of these

27. Two masses, each of 5 kg, are connected by a massless, inextensible string passing over a smooth peg. One of the masses is on a frictionless 30° incline and the other hangs vertically. When the masses are released, the tension in the string and the common acceleration of the masses are (g = 10 m/s^2)

(a) 37.5 N; 2.5 m/s^2
(b) 37.5 N ; 5 m/s^2
(c) 25 N ; 2.5 m/s^2
(d) 25 N ; 5 m/s^2

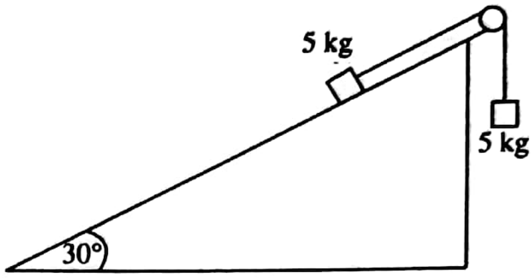

Fig. 5.29

28. Two masses m_1 and m_2 are connected by a light string passing over a smooth pulley. When set free m_1 moves downwards by 1.4 m in 2s. The ratio m_1/m_2 is (g = 9.8 m/s^2)

(a) $\frac{9}{7}$ (b) $\frac{11}{9}$

(c) $\frac{13}{11}$ (d) $\frac{15}{13}$

29. The minimum acceleration with which a fireman can slide down a rope of breaking strength two-third of his weight is **[CPMT 79]**

(a) Zero (b) $g/3$
(c) $2g/3$ (d) g

30. Three blocks A, B and C, each of mass 2 kg, are hanging over a fixed pulley as shown. The tension in the string connecting B and C is **[MP PMT 85]**

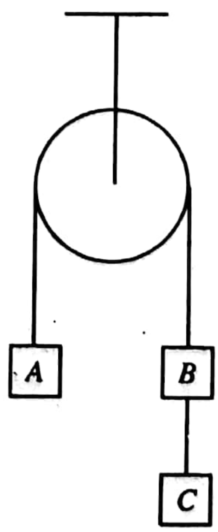

Fig. 5.30

(*a*) zero (*b*) 3.3 N
(*c*) 13.3 N (*d*) 19.6 N

31. A lift is moving downwards with an acceleration equal to g. A body of mass m, kept on the floor of the lift, is pulled horizontally. If μ is the coefficient of friction, then the frictional resistance offered by the floor is
(*a*) μmg (*b*) mg
(*c*) zero (*d*) none of these

32. A body kept on a smooth inclined plane having inclination 1 in x will remain stationary relative to the inclined plane if the plane is given a horizontal acceleration equal to
(*a*) $\frac{g}{\sqrt{x^2-1}}$ (*b*) $\frac{gx}{\sqrt{x^2-1}}$
(*c*) $\frac{\sqrt{x^2-1}}{x}g$ (*d*) $\left(\sqrt{x^2-1}\right)g$

33. A disc of mass 10 g is kept floating horizontally by throwing 10 marbles per second against it from below. The marbles strike the disc normally and rebound downward with the same speed. If the mass of each marble is 5 g, the velocity with which the marbles are striking the disc is (g = 9.8 m/s^2)
(*a*) 0.98 m/s (*b*) 9.8 m/s
(*c*) 1.96 m/s (*d*) 19.6 m/s

34. A ball of mass 0.1 kg strikes a wall normally with a speed of 30 m/s and rebounds with a speed of 20 m/s. The impulse of the force exerted by the wall on the ball is
(*a*) 1 N-s (*b*) 5 N-s
(*c*) 2 N-s (*d*) 3 N-s

35. A cricket ball of mass 150 g is moving with a velocity of 12 m/s and is hit by a bat so that it is turned back with a velocity of 20 m/s. The force of blow acts for 0.01 s. The average force exerted by the bat on the ball is **[IIT 74]**
(*a*) 120 N (*b*) 240 N
(*c*) 480 N (*d*) 960 N

36. A vehicle, having a mass of 1000 kg, is moving with a uniform velocity of 20 m/s. Sand is dropped into it at the rate of 5 kg/ min. The force needed to keep the vehicle moving with uniform velocity is
(*a*) 3 N (*b*) 5 N
(*c*) $\frac{3}{5}$ N (*d*) $\frac{5}{3}$ N

37. The pulley arrangements of Fig. 5.31 (*i*) and (*ii*) are identical. The mass of the rope is negligible. In Fig. 5.31 (*i*), The

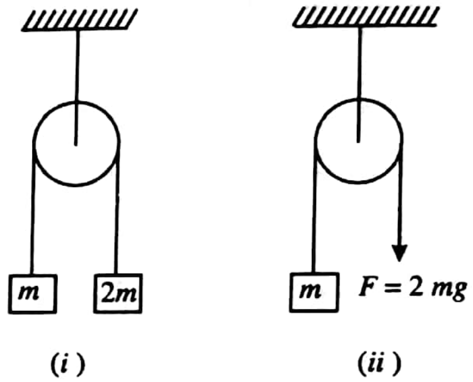

Fig. 5.31

mass m is lifted by attaching a mass $2m$ to the other end of the rope. In Fig. 5.31 (*ii*), m is lifted by pulling the other end of the rope with a downward force $F = 2mg$. The acceleration of m is
(*a*) the same in both cases
(*b*) less in (*i*) than in (*ii*) by a factor 1/3
(*c*) more in (*i*) than in (*ii*) by a factor 3
(*d*) less in (*i*) than in (*ii*) by a factor 1/2

38. A monkey of mass 40 kg climbs on a massless rope of breaking strength 600 N. The rope will break if the monkey (g = 10 m/s^2)
(*a*) climbs up with a uniform speed of 5 m/s
(*b*) climbs up with an acceleration of 6 m/s^2
(*c*) climbs down with an acceleration of 4 m/s^2
(*d*) climbs down with a uniform speed of 5 m/s

39. An aeroplane requires for take off a speed of 80 km/h, the run on the ground being 100 m. The mass of the plane is 20,000 kg and the coefficient of friction between the plane and the ground is 0.25. Assuming that the plane accelerates uniformly during the take-off, the minimum force required by the engine for take off is

(*a*) 4.92×10^4 N (*b*) 2.46×10^4 N
(*c*) 9.84×10^4 N (*d*) 19.68×10^4 N

40. A block *A* of mass 200 kg rests on a block *B* of mass 300 kg. *A* is tied with a horizontal string to a wall. Coefficient of friction between *A* and *B* is 0.25 and that between *B* and floor is 0.2. The horizontal force *F* needed to move the block *B* is (g = 10 m/s^2)

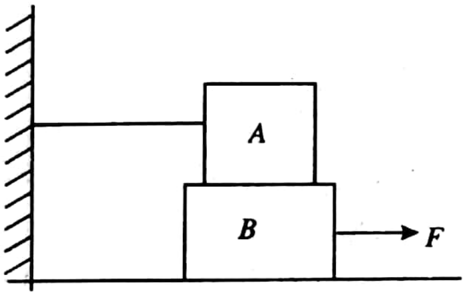

Fig. 5.32

(*a*) 550 N (*b*) 1100 N
(*c*) 1500 N (*d*) 2200 N

41. A ball of mass *m* is thrown upward with a velocity v. If air exerts an average resisting force *F*, the velocity with which the ball returns back to the thrower is

(*a*) $v\sqrt{\frac{mg}{mg+F}}$ (*b*) $v\sqrt{\frac{F}{mg+F}}$

(*c*) $v\sqrt{\frac{mg-F}{mg+F}}$ (*d*) none of these

42. A particle is projected up a 45° rough incline with a velocity v. The coefficient of friction is 0.5. The speed with which it returns back to the staring point is v'. Then v/v' is

(a) $\sqrt{3}$ (b) $1/\sqrt{3}$

(c) $\sqrt{3}$ (d) $1/\sqrt{2}$

43. A body takes *n* times as much time to slide down a 45° rough incline as it takes to slide down a smooth 45° incline. The coefficient of friction is **[AIEEE 05]**

(*a*) $1-\frac{1}{n^2}$ (*b*) $\frac{1}{1-n^2}$

(*c*) $\sqrt{1-\frac{1}{n^2}}$ (*d*) $\frac{1}{\sqrt{1-n^2}}$

44. A block of mass 2 kg rests on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of static friction between the block and the plane is 0.7. The frictional force on the block is **[IIT 80]**

(*a*) 9.8 N (*b*) 0.7×9.8 N

(*c*) $9.8 \times \sqrt{3}$ N (*d*) $0.7 \times 9.8 \times \sqrt{3}$ N

45. A uniform chain of length *L* lies on a table. If the coefficient of friction is μ, then the maximum length of the chain which can hang from the edge of the table without the chain sliding down is

(*a*) $\frac{L}{\mu}$ (*b*) $\frac{L}{\mu-1}$

(*c*) $\frac{\mu L}{\mu+1}$ (*d*) $\frac{\mu L}{\mu-1}$

46. Two masses *A* and *B* of 10 kg and 5 kg respectively are connected with a string passing over a frictionless pulley fixed at the corner of a table as shown. The coefficient of static friction between *A* and the table is 0.2 The minimum mass *C* that should be placed on *A* to prevent it from moving is equal to **[MP PET 84]**

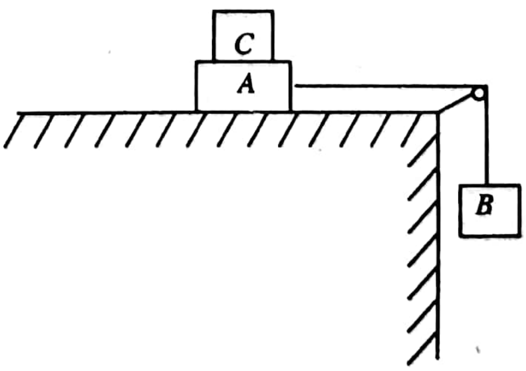

Fig. 5.33

(*a*) 12 kg (*b*) 5 kg
(*c*) 10 kg (*d*) 15 kg

47. A 40 kg slab rests on a frictionless floor. A 10 kg block rests on the slab. The coefficient of static friction between the block and the slab is 0.6 while the kinetic coefficient is 0.4. The 10 kg block is acted upon by a horizontal force of 100 N. If $g = 9.8\ m/s^2$, the resulting acceleration of the slab will be **[CBSE PMT 99]**

(*a*) $0.98\ m/s^2$ (*b*) $1.47\ m/s^2$
(*c*) $1.52\ m/s^2$ (*d*) $1.96\ m/s^2$

48. A body is projected up a 45° rough incline. If the coefficient of friction is 0.5, then the retardation of the block is **[EAMCET Engg. 2001]**

(*a*) $\frac{g}{2\sqrt{2}}$ (*b*) $\frac{g}{\sqrt{2}}$
(*c*) $\frac{3g}{2\sqrt{2}}$ (*d*) $\frac{g}{2}$

49. A block of mass 5 kg is placed on a rough inclined plane. The inclination of the plane is gradually increased till the block just begins to slide down. The inclination of the plane is then 3 in 5. The coefficient of friction between the block and the plane is ($g = 10\ m/s^2$)

(*a*) 3/5 (*b*) 3/4
(*c*) 4/5 (*d*) 2/3

50. In Q. 49, the minimum force required to move the block up the plane at this inclination is

(*a*) 30 N (*b*) 40 N
(*c*) 60 N (*d*) 120 N

51. A body rests on a rough horizontal plane. A force is applied to the body directed towards the plane at an angle ϕ with the vertical. The body can be moved along the plane

(*a*) only if ϕ is more than the angle of friction
(*b*) only if ϕ is less than the angle of friction
(*c*) only if ϕ is equal to the angle of friction
(*d*) for all values of ϕ

52. Two blocks *A* and *B*, each of weight 200 N, are connected by a massless string passing over a smooth pulley. *A* rests on a rough 30° incline and *B* is hanging vertically as shown . *A* will remain at rest if the frictional force on it is **[DCE 92]**

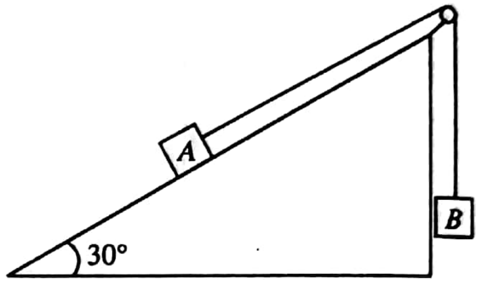

Fig. 5.34

(*a*) 100 N up the plane
(*b*) 100 N down the plane
(*c*) 110 N up the plane
(*d*) 110 N down the plane

53. Three light strings are connected at the point *P.* A weight *W* is suspended from one of the strings. End *A* of string *AP* and end *B* of string *PB* are fixed as shown. In equilibrium *PB* is horizontal and *PA* makes an angle of 60° with the horizontal. If the tension in *PB* is 30 N then the tension in *PA* and weight *W* are respectively **[DCE 93, 92]**

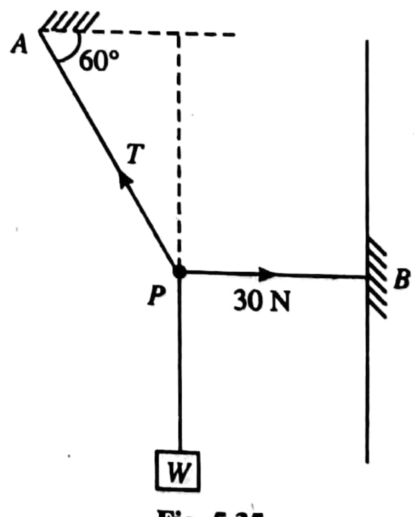

Fig. 5.35

(*a*) 60 N ; 30 N
(*b*) $60/\sqrt{3}$ N; $30/\sqrt{3}$ N
(*c*) 60 N; $30\sqrt{3}$ N
(*d*) $60\sqrt{3}$ N; $30\sqrt{3}$ N

54. The mass-string system shown in the figure is in equilibrium. If the coefficient of friction between A and the table is 0.3, the frictional force on A is [DCE 92]

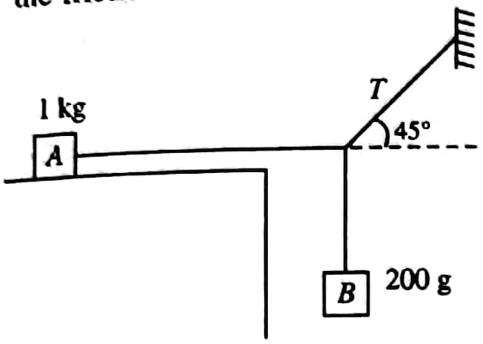

Fig. 5.36

(a) 9.8 N (b) 2.04 N
(c) 1.98 N (d) 0.59 N

55. A 1000 kg lift is supported by a cable that can support 2000 kg. The shortest distance in which the lift can be stopped when it is descending with a speed of 2.5 m/s is (g = m/s^2) [DPMT 92]

(a) $\frac{5}{16}$ m (b) $\frac{5}{32}$ m
(c) 1 m (d) 2 m

56. A particle of mass 100 g is suspended from a light string. The string is moved (i) upwards and (ii) downwards with an acceleration of 5 m/s^2. if T_u and T_d are the tensions in the string during upward and downward motions respectively, then $T_u - T_d$ is equal to [DCE 91]
(a) 1 N (b) 0.5 N
(c) 0.98 N (d) 1.96 N

57. A block A of mass 2 kg rests on another block B of mass 8 kg which rests on a horizontal floor as shown in the figure. The coefficient of friction between A and B is 0.2 while that between B and the floor is 0.5. When a horizontal force of 25 N is applied on B, the force of friction between A and B is [IIT Screening 93]

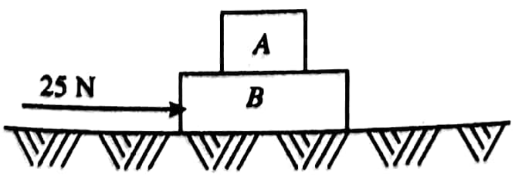

Fig. 5.37

(a) zero (b) 3.9 N
(c) 5.0 N (d) 49.0 N

58. A weight W can be just supported on a rough inclined plane by a force P either acting along the plane or horizontally. If ϕ is the angle of friction then P/W is [MNR 87]

(a) $\tan\phi$ (b) $\sec\phi$
(c) $\sin\phi$ (d) none of these

59. A body of 6 kg rests in limiting equilibrium on an inclined plane whose slope is 30°. If the plane is raised to a slope of 60°, the force in kg-wt along the plane required to support it is (g = 10 m/s^2) [MNR 85]

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

60. A body is on the point of sliding down an inclined plane under its own weight. If the inclination of the plane to the horizon is 30°, then the angle of friction is [MNR 78]

(a) 30° (b) 60°
(c) 45° (d) 15°

61. A plumb bob is hanging from the ceiling of a car. If the car moves with an acceleration a, the angle made by the string with the vertical is

(a) $\sin^{-1}\left(\frac{a}{g}\right)$ (b) $\sin^{-1}\left(\frac{g}{a}\right)$

(c) $\tan^{-1}\left(\frac{a}{g}\right)$ (d) $\tan^{-1}\left(\frac{g}{a}\right)$

62. A painter is raising himself and the crate on which he stands with an acceleration of 5 m/s^2 by a massless rope and pulley arrangement. Mass of the painter is 100 kg and that of the crate is 50 kg. If g = 10 m/s^2, then the
(a) tension in the rope is 2250 N
(b) tension in the rope is 1125 N
(c) force of contact between the painter and the floor is 750 N
(d) force of contact between the painter and the floor is 375 N

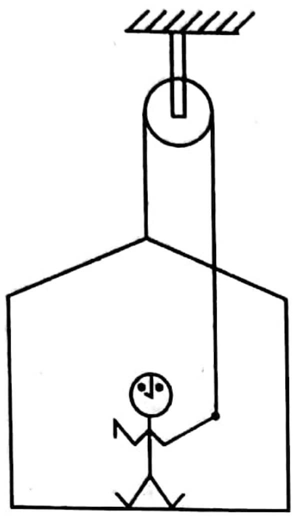

Fig. 5.38

63. In Fig. 5.39, with what force must the man pull the rope to hold the plank in position ? Weight of the man is 60 kgf. Neglect the weights of plank, rope and pulley.
(*a*) 15 kgf (*b*) 30 kgf
(*c*) 60 kgf (*d*) 120 kgf

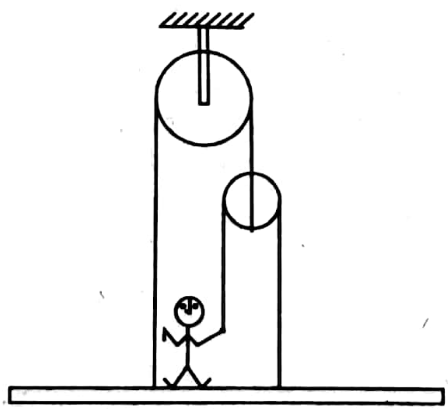

Fig. 5.39

64. A balloon has 2 g of air. If a small hole is pierced into it, the air comes out with a speed of 2 m/s. If the balloon shrink completely in 5 s, the average thrust experienced by the balloon is
(*a*) 8×10^{-1} N (*b*) 8×10^{-2} N
(*c*) 8×10^{-3} N (*d*) 8×10^{-4} N

65. A stream of water flowing horizontally with a speed of 10 m/s gushes out of a tube of cross sectional area 2.0×10^{-2} m^2 and hits a vertical wall. The force exerted on the wall by the impact of water, assuming that it does not rebound, is
(*a*) 200 N (*b*) 1000 N
(*c*) 2000 N (*d*) 4000 N

66. The total mass of an elevator, with an 80 kg man in it, is 1000 kg. It is moving upwards with a speed of 8 m/s. If it is brought to rest over a distance of 16 m, then during retardation, the tension in the supporting cable and the force exerted by the man on the floor are, respectively (g = 10 m/s^2)
(*a*) 4000 N, 640 N
(*b*) 8000 N, 640 N
(*c*) 4000 N, 320 N
(*d*) 8000 N, 320 N

67. A certain force applied to mass m_1 gives it an acceleration of 10 m/s^2. The same force applied to mass m_2 gives it an acceleration of 15 m/s^2. If the two masses are joined together and the same force is applied to the combination, the acceleration will be
(*a*) 6 m/s^2 (*b*) 3 ms^2
(*c*) 9 m/s^2 (*d*) 12 m/s^2

68. The distance x covered in time t by a body, having initial velocity u and having constant acceleration a is given by $x = ut + \frac{1}{2}at^2$. This result follows from
(*a*) Newton's first law
(*b*) Newton's second law
(*c*) Newton's third law
(*d*) none of the above

69. The mechanical advantage of a system of pulleys is four. The force needed to lift a mass of 100 kg will be **[MP PMT 88]**
(*a*) 20 kg wt (*b*) 25 kg wt
(*c*) 5 kg wt (*d*) 15 kg wt

70. A body of mass 2 kg is acted upon by two forces, each of magnitude 1N, making an angle of 60° with each other. The net acceleration of the body in m/s^2 is **[EAMCET 83]**
(*a*) 0.5 (*b*) 1.0
(*c*) $\sqrt{3}/2$ (*d*) $\sqrt{2}/3$

71. The average force necessary to stop a hammer with 25 N-s momentum in 0.05 s is **[EAMCET 91]**

(a) 500 (b) 125
(c) 50 (d) 25

72. A scooter of mass 120 kg is moving with a uniform velocity of 108 km/h. The force required to stop the vehicle in 10 s is **[EAMCET 92]**
(a) 360 N (b) 720 N
(c) 180 N (d) 120×10.8 N

73. An impulse is supplied to a moving object with the force at an angle of 120° with the velocity vector. The angle between the impulse vector and the change in momentum vector is **[EAMCET 90]**
(a) 120° (b) 0°
(c) 180° (d) 240°

74. A body is moving with a speed of 1 m/s and a force F is needed to stop it in a distance x. If the speed of the body is 3 m/s, the force needed to stop it in the same distance x will be
(a) 1.5 F (b) 3 F
(c) 6 F (d) 9 F

75. A machine-gun is mounted on a 5 quintal vehicle on a smooth horizontal road. The gun fires 10 bullets per second, each of mass 10 g, with a speed of 500 m/s. The acceleration produced in the vehicle is
(a) 10 cm/s (b) 20 cm/s
(c) 50 cm/s (d) 1 m/s

76. A man is on a frictionless horizontal plane. It is possible for him to get off the plane by
(a) spitting or sneezing
(b) rolling his body on the surface
(c) running
(d) none of the above

77. When a train stops suddenly, the passengers in the train feel a jerk in the forward direction. This is because
(a) the inertia of rest stops the train and takes the body forward
(b) the back of seat pushes the body forward
(c) the upper part of the body continues to be in the state of motion whereas the lower part of the body, which is in contact with the seat, comes to rest
(d) of some reason other than the above three

78. A man is at rest in the middle of a horizontal plane of perfectly smooth ice. He can move himself to the shore by making use of Newton's **[CPMT 81]**
(a) first law (b) second law
(c) third law (d) all the laws

79. An object with a mass of 10 kg is moving with a speed of 10 m/s. A constant force now acts on it and in 4 s its speed changes to 2 m/s in the opposite direction. The magnitude of the acceleration produced is
(a) 6 m/s^2 (b) 3 m/s^2
(c) 1.5 m/s^2 (d) 4.5 m/s^2

80. In Q. 79, the force is
(a) 60 N (b) 45 N
(c) 30 N (d) 15 N

81. A body of mass 2 kg is placed on a horizontal surface having coefficient of kinetic friction 0.4 and coefficient of static friction 0.5. If a horizontal force of 2.5 N is applied on the body, the frictional force acting on the body will be (g = 10 m/s^2) **[CPMT 93]**
(a) 8 N (b) 10 N
(c) 20 N (d) 2.5 N

82. In Q. 81, if the force applied on the body is 20 N, the acceleration of the body will be **[CPMT 93]**
(a) 5 m/s^2 (b) 6 m/s^2
(c) 8.75 m/s^2 (d) 10 m/s^2

83. A body of mass 2 kg collides with a wall with a speed of 100 m/s and rebounds with the same speed. If the time of contact is 1/50 s, the force exerted on the wall is **[CPMT 93]**
(a) 8 N (b) 2×10^4 N
(c) 4 N (d) 10^4 N

84. A block placed on an inclined plane of slope angle θ slides down with a constant speed. The coefficient of kinetic friction is equal to **[CBSE PMT 93]**

(*a*) $\sin\theta$ (*b*) $\cos\theta$
(*c*) $\tan\theta$ (*d*) $\cot\theta$

85. A monkey is descending from the branch of a tree with a constant acceleration. If the breaking strength of the branch is 75% of the weight of the monkey, the minimum acceleration with which the monkey can slide down without breaking the branch is **[CBSE PMT 93]**
(*a*) g (*b*) $3g/4$
(*c*) $g/2$ (*d*) $g/4$

86. Tow blocks *A* (20 kg) and *B* (50 kg) lying on a frictionless table are connected by a light string. The system is pulled horizontally with an acceleration of 2 m/s^2 by a force *F* on *B*. The tension in the string is **[MP PMT 93]**
(*a*) 40 N (*b*) 100 N
(*c*) 35 N (*d*) 140 N

87. The linear momentum *p* of a body moving in one dimension varies with time according to the equation $P = a + bt^2$, where *a* and *b* are positive constants. The net force acting on the body is **[MP PMT 93]**
(*a*) proportional to t^2
(*b*) proportional to *t*
(*c*) a constant
(*d*) inversely proportional to *t*

88. A monkey sits on the pan of a spring scale kept in an elevator. The reading of the spring scale will be maximum when the elevator **[MP PET 93]**
(*a*) is stationary
(*b*) cable breads and it falls freely towards the earth
(*c*) accelerates downwards
(*d*) accelerates upwards

89. A block of mass 50 kg can slide on a rough horizontal surface. The coefficient of friction between the block and the surface is 0.6. The least force of pull acting at 30° to the upward drawn vertical which causes the block to just slide is (g = 9.8 m/s^2) **[ISM Dhanbad 94]**
(*a*) 29.42 kg wt (*b*) 219.6 N
(*c*) 21.96 kg wt (*d*) 294.2 N

90. A man is standing on a weighing machine placed in a lift. When stationary, his weight is recorded as 40 kg. If the lift is moved upwards with an acceleration of 2 m/s^2, then the weight recorded in the machine will be (g = 10 m/s^2) **[MP PMT 94]**
(*a*) 32 kg (*b*) 40 kg
(*c*) 42 kg (*d*) 48 kg

91. 10,000 small balls, each weighing 1 g, strike one square cm of area per second with a velocity of 100 m/s is a normal direction and rebound with the same velocity. The pressure on the surface (in N/m^2) is
(*a*) 2×10^3 (*b*) 2×10^5
(*c*) 10^7 (*d*) 2×10^7

92. A wagon weighing 1000 kg is moving with a velocity of 50 km/h on smooth horizontal rails. A mass of 250 kg is dropped into it. The velocity with which it moves now is **[MP PMT 94]**
(*a*) 12.5 km/h (*b*) 20 km/h
(*c*) 40 km/h (*d*) 50 km/h

93. In a rocket of mass 1000 kg fuel is consumed at the rate of 40 kg/s. The velocity of the gases ejected from the rocket is 5×10^4 m/s. The thrust on the rocket is **[MP PMT 94]**
(*a*) 2×10^3 N (*b*) 5×10^4 N
(*c*) 2×10^6 N (*d*) 2×10^9 N

94. A satellite in force-free space sweeps stationary interplanetary dust at a rate $dM/dt = \alpha v$, where *M* is the mass and *v* is the velocity of the satellite and α is a constant. The deceleration of the satellite is **[CBSE PMT 94]**
(*a*) $-2\alpha v^2/M$ (*b*) $-\alpha v^2/M$
(*c*) $-\alpha v^2/2M$ (*d*) $-\alpha v^2$

95. Two bodies of masses 3 kg and 4 kg are suspended at the ends of a massless string passing over a frictionless pulley. The acceleration of the system is (g = 9.8 m/s^2) **[MP PET 94]**
(*a*) 4.9 m/s^2 (*b*) 2.45 m/s^2
(*c*) 1.4 m/s^2 (*d*) 9.8 m/s^2

96. Two blocks A and B are arranged as shown in the figure. The pulley is frictionless. The mass of A is 10 kg. The coefficient of friction of A with the horizontal surface is 0.2. The minimum mass of B to start the motion will be **[MP PET 94]**

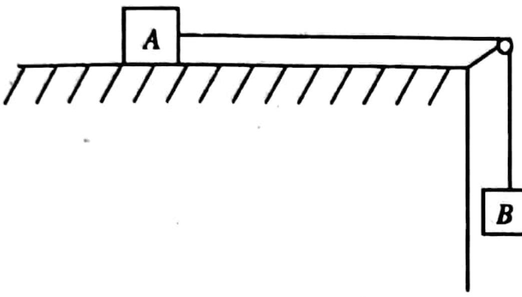

Fig. 5.40

(*a*) 2 kg (*b*) 0.2 kg
(*c*) 5 kg (*d*) 10 kg

97. The mass of a body measured by a physical balance in a lift at rest is found to be m. If the lift is going up with an acceleration a, its mass will be measured as **[MP PET 94]**

(*a*) $m\left(1-\frac{a}{g}\right)$ (*b*) $m\left(1+\frac{a}{g}\right)$
(*c*) m (*d*) zero

98. A machine-gun fires 20 bullets per second into a target. Each bullet weighs 150 g and has a speed 800 of m/s. The force necessary to hold the gun in position is **[EAMCET 94]**

(*a*) 800 N (*b*) 1000 N
(*c*) 1200 N (*d*) 2400 N

99. A body of mass 10 kg, placed on a horizontal surface is acted upon by a constant force of 129.4 N. If the acceleration of the block is 10 m/s^2, the coefficient of kinetic friction between the body and the surface is (g = 9.8 m/s^2) **[EAMCET 94]**

(*a*) 0.03 (*b*) 0.01
(*c*) 0.30 (*d*) 0.25

100. A mass of 10 g is suspended by a string and the entire thing is falling with a uniform acceleration of 400 cm/s^2. The tension in the string is (g = 980 cm/s^2) **[SCRA 94]**

(*a*) 5,800 dynes (*b*) 9,800 dynes
(*c*) 11,800 dynes (*d*) 13,800 dynes

101. Consider the following statements:

Assertion (*A*) : A table cloth can be pulled from a table without dislodging the dishes.

Reason (*R*) : To every action there is an equal and opposite reaction.

Of these statements **[IIT 2007]**

(*a*) both A and R are true and R is the correct explanation of A
(*b*) both A and R are true but R is not the correct explanation of A
(*c*) A is true but R is false
(*d*) A is false but R is true

102. A ball of weight 0.1 kg coming with speed 30 m/s strikes a bat and returns in opposite direction with speed 40 m/s, Then the impulse is **[AFMC 97]**

(*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*) $0.1 \times (40) - 0.1 \times (-30)$

103. A body is placed on a plane. The coefficient of friction between the body and the plane is μ. The plane is gradually tilted up. If θ is the inclination of the plane then the frictional force on the body is **[DPMT 97]**

(*a*) constant throughout
(*b*) constant upto $\theta = \tan^{-1}(\mu)$ and decreases after that
(*c*) increases upto $\theta = \tan^{-1}(\mu)$ and constant after that
(*d*) decreases upto $\theta = \tan^{-1}(\mu)$ and constant after that

104. A mass 1 kg is suspended by a thread. It is (*i*) lifted up with an acceleration 4.9 m/s^2, (*ii*) lowered with an acceleration 4.9 m/s^2. The ratio of the tensions is **[CBSE PMT 98]**

(*a*) 3 : 1 (*b*) 2 : 1
(*c*) 1 : 3 (*d*) 1 : ^

105. A bullet is fired from a gun. The force on the bullet is given by $F = 600 - 2 \times 10^5 t$, where F is in newton and t is in seconds. The force on the bullet becomes zero as soon as it leaves the barrel .What is the average impulse imparted to the bullet ? **[CBSE PMT 98]**

(*a*) 0.9 Ns (*b*) Zero
(*c*) 9 Ns (*d*) 1.8 Ns

106. A force of 50 dynes acts on a body of mass 5 g which is initially at rest, for an interval of 3 s The impulse of the force is **[AFMC 98]**

(*a*) 0.15×10^{-3} Ns
(*b*) 0.98×10^{-3} Ns
(*c*) 1.5×10^{-3} Ns
(*d*) 2.5×10^{-3} Ns

107. A body of mass 100 g is sliding on an inclined plane of inclination 30°. If the coefficient of friction is 1.7, then the frictional force experienced by the body is ($g = 10$ m/s^2) **[BHU PMT 98]**

(*a*) $\frac{1.7 \times \sqrt{2}}{\sqrt{2}}$ N (*b*) $\frac{1.7 \times \sqrt{3}}{2}$ N

(*c*) $1.7 \times \sqrt{3}$ N (*d*) $\frac{1.7 \times 2}{\sqrt{3}}$ N

108. Three block of masses m_1, m_2 and m_3 are connected by massless strings as shown on a frictionless table. They are pulled with a force $T_3 = 40$ N. If $m_1 = 10$ kg, $m_2 = 6$ kg and $m_3 = 4$ kg, the tension T_2 will be **[MP CET 98]**

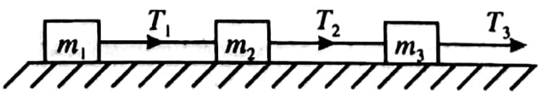

Fig. 5.41

(*a*) 20 N (*b*) 40 N
(*c*) 30 N (*d*) 32 N

109. n small balls, each of mass m, impinge elastically each second on a surface with velocity u. The force experienced by the surface will be **[MP CET 98]**

(*a*) mnu (*b*) $2mnu$

(*c*) $4mnu$ (*d*) $\frac{1}{2}mnu$

110. P, Q and R are three coplanar forces acting at a point and are in equilibrium. Given $P = 1.9318$ kg wt, $\sin\theta_1 = 0.9659$, the value of R is (in kg wt) **[KARNATAKA CET 98]**

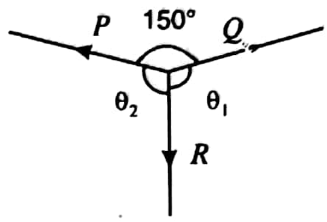

Fig. 5.42

(*a*) 1 (*b*) $\frac{1}{2}$

(*c*) 0.9659 (*d*) 2

111. A 3 kg ball strikes a heavy rigid wall with a speed of 10 m/s at an angle of 60°. It gets reflected with the same speed and angle as shown. If the ball is in contact with the wall for 0.20 s, what is the average force exerted on the ball by the wall ?

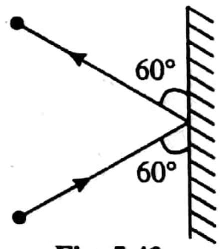

Fig. 5.43

[CBSE PMT 200]

(*a*) 150 N (*b*) Zero

(*c*) $150\sqrt{3}$ N (*d*) 300 N

112. A body is sliding down an inclined plane having coefficient of friction 0.5. if the normal reaction is twice that of the resultant downward force along the incline, the angle between the inclined plane and the horizontal is **[EAMCET Engg. 2000]**

(*a*) 15° (*b*) 30°
(*c*) 45° (*d*) 60°

113. A body of mass 5 kg starts from the origin with an initial velocity **u** = (30 **i** + 40 **j**) ms^{-1}. If a constant force **F** = –(**i** + 5 **j**) N acts on the body, the time in which the y-component of the velocity becomes zero is **[EAM CET Med. 2000]**

(*a*) 5 seconds (*b*) 20 seconds
(*c*) 40 seconds (*d*) 80 seconds

114. A gun of mass 10 kg fires 4 bullets per second. The mass of each bullet is 20 g and the velocity of the bullet when it leaves the gun is 300 ms $^{-1}$. The force required to hold the gun while firing is **[EAMCET Med 2000]**

(*a*) 6 N (*b*) 8 N
(*c*) 24 N (*d*) 240 N

115. A block of mass 2 kg is kept on the floor. The coefficient of static friction is 0.4. If a force F of 2.5 newtons is applied on the block as shown in the figure, the frictional force between the block and the floor will be **[MP PET 2000]**

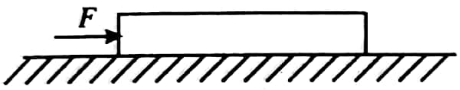

Fig. 5.44

(*a*) 2.5 N (*b*) 5 N
(*c*) 7.84 N (*d*) 10 N

116. The mass of a lift is 500 kg. What will be the tension in its cable when it is going up with an acceleration of 2.0 m/s^2? (g = 9.8 m/s^2) **[MP PMT 2000]**

(*a*) 5000 N (*b*) 5600 N
(*c*) 5900 N (*d*) 6200 N

117. A body of 5 kg is moving with a velocity of 20 m/s. If a force of 100 N is applied on it for 10 s in the same direction as its velocity, what will now be the velocity of the body ? **[MP PMT 2000]**

(*a*) 200 m/s (*b*) 220 m/s
(*c*) 240 m/s (*d*) 260 m/s

118. 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

119. An insect crawls up a hemispherical surface very slowly (see the figure). The coefficient of friction between the insect and the surface is 1/3. If the line joining the center of the hemispherical surface to the insect makes an angle α with the vertical, the maximum possible value of α is given by **[IIT 2001]**

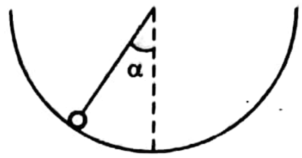

Fig. 5.45

(*a*) $\cot\alpha = 3$ (*b*) $\tan\alpha = 3$
(*c*) $\sec\alpha = 3$ (*d*) $\operatorname{cosec}\alpha = 3$

120. A string of negligible mass going over a clamped pulley of mass m supports a block of mass M as shown in the figure. The force on the pulley by the clamp is given by **[IIT 2001]**

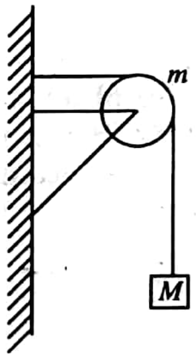

Fig. 5.46

(*a*) $\sqrt{2}\,Mg$ (*b*) $\sqrt{2}\,mg$

(*c*) $\sqrt{(M+m)^2+m^2}g$

(*d*) $\sqrt{(M+m)^2+M^2}g$

121. The pulleys and strings shown in the figure are smooth and of negligible mass, For the system to remain in equilibrium, the angle θ should be **[IIT 2001]**

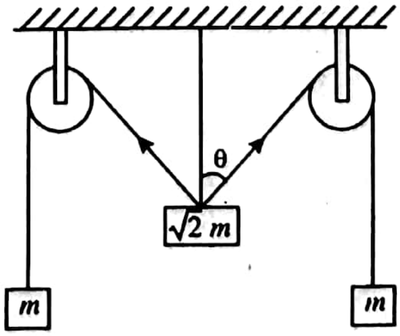

Fig. 5.47

(*a*) 0° (*b*) 30°
(*c*) 45° (*d*) 60°

122. A ball is thrown vertically upwards. Assuming the air resistance to be constant and considerable **[Karnataka CET 2001]**

(*a*) the time of ascent < the time of descent

(*b*) the time of ascent $\geq$ the time of descent

(*c*) the time of ascent = the time of descent

(*d*) the time of ascent > the time of descent

123. A body of weight 64 N is pushed with just enough force to start it moving across a horizontal floor and the same force continue to act afterwards. If the coefficients of static and dynamic friction are 0.6 and 0.4 respectively, the acceleration of the body will be: (Accelaration due to gravity = g) **[EAM CET Engg. 2001]**

(*a*) $\frac{g}{6.4}$ (*b*) $0.64g$

(*c*) $\frac{g}{32}$ (*d*) $0.2g$

124. A body of mass m is sliding down a rough inclined plane of angle α. If μ be the coefficient of friction the acceleration of the body is **[MP PMT 2001]**

(*a*) $g \sin\alpha$

(*b*) $g \mu \cos\alpha$

(*c*) $g (\sin\alpha - \mu \cos\alpha)$

(*d*) $g (\cos\alpha - \mu \sin\alpha)$

125. A block of mass 10 kg is placed on an inclined plane. When the angle of inclination is 30°, the block just begins to slide down the plane. The force of static friction is **[Kerala Engg. 2001]**

(*a*) 10 kg wt (*b*) 89 kg wt

(*c*) 49 kg wt (*d*) 5 kg wt

(*e*) 15 kg wt

ANSWERS

1. *b*	2. *d*	3. *c*	4. *b*	5. *b*	6. *d*	7. *a*	8. *c*
9. *a*	10. *d*	11. *b*	12. *b*	13. *c*	14. *b*	15. *a*	16. *b*
17. *c*	18. *d*	19. *c*	20. *d*	21. *a*	22. *d*	23. *b*	24. *d*
25. *d*	26. *a*	27. *a*	28. *d*	29. *b*	30. *c*	31. *c*	32. *a*
33. *a*	34. *b*	35. *c*	36. *d*	37. *b*	38. *b*	39. *c*	40. *c*
41. *c*	42. *a*	43. *a*	44. *a*	45. *c*	46. *d*	47. *a*	48. *c*
49. *b*	50. *c*	51. *a*	52. *b*	53. *c*	54. *c*	55. *a*	56. *a*
57. *a*	58. *a*	59. *b*	60. *a*	61. *c*	62. *b, d*	63. *a*	64 *d*
65. *c*	66. *b*	67. *a*	68. *d*	69. *b*	70. *c*	71. *a*	72. *a*
73. *b*	74. *d*	75. *a*	76. *a*	77. *c*	78. *c*	79. *b*	80. *c*
81. *d*	82. *b*	83. *b*	84. *c*	85. *d*	86. *a*	87. *b*	88. *d*
89. *a*	90. *d*	91. *d*	92. *c*	93. *c*	94. *b*	95. *c*	96. *a*
97. *c*	98. *d*	99. *c*	100. *a*	101. *d*	102. *d*	103. *c*	104. *a*
105. *a*	106. *c*	107. *b*	108. *d*	109. *b*	110. *a*	111. *c*	112. *c*
113. *c*	114. *c*	115. *a*	116. *c*	117. *c*	118. *b*	119. *a*	120. *d*
121. *c*	122. *a*	123. *d*	124. *c*	125. *d*			

MULTIPLE CHOICE QUESTIONS

1. When the velocity of a body is doubled
   (*a*) its K.E. is doubled
   (*b*) its P.E. is doubled
   (*c*) its momentum is doubled
   (*d*) its acceleration is doubled
2. A moving body need not have
   (*a*) kinetic energy (*b*) momentum
   (*c*) potential energy(*d*) velocity
3. Two spheres of the same size, one of mass 5 kg and the other of mass 10 kg, are dropped simultaneously form a tower. When they are about to touch the ground, they have the same
   (*a*) momentum
   (*b*) kinetic energy
   (*c*) potential energy
   (*d*) acceleration
4. If a bomb dropped from an airplane explodes in mid-air
   (*a*) its K.E . increases
   (*b*) its total energy increases
   (*c*) its total energy decreases
   (*d*) its total momentum decreases
5. The work done in holding a mass of 50 kg at a height of 2 m above the ground is
   (*a*) 0 (*b*) 25 J
   (*c*) 100 J (*d*) 980 J
6. A car weighing 1 ton is moving twice as fast as another car weighing 2 tons. The K.E. of the one-ton car is
   (*a*) less than that of the two-ton car
   (*b*) same as that of the two-ton car
   (*c*) more than that of the two-ton car
   (*d*) impossible to compare with that of the two-ton car unless the height of each car above the sea level is known
7. A child on a swing is 1 m above the ground at the lowest point and 6 m above the ground at the highest point. The horizontal speed of the child at the lowest point of the swing is approximately
   (*a*) 8 m/s (*b*) 10 m/s
   (*c*) 12 m/s (*d*) 14 m/s
8. A 1 kg mass has a K.E. of 1 joule when its speed is
   (*a*) 0.45 m/s (*b*) 1 m/s
   (*c*) 1.4 m/s (*d*) 4.4 m/s
9. A 1 kg mass has a P.E. of 1 joule relative to the ground when it is at a height of
   (*a*) 0.102 m (*b*) 1m
   (*c*) 9.8 m (*d*) 32 m
10. A long spring is stretched by 2 cm. Its potential energy is *U*. If the spring is stretched by 10 cm, the potential energy stored in it will be **[CPMT 76]**
    (*a*) $U/25$ (*b*) $U/5$
    (*c*) $5\ U$ (*d*) $25\ U$
11. Energy required to accelerate a car form 10 m/s to 20 m/s compared with that required to accelerate is from 0 to 10 m/s is
    (*a*) twice (*b*) three times
    (*c*) four times (*d*) same
12. A light body A and a heavy body B have equal kinetic energies of translation. Then **[Karnataka CET 98]**
    (*a*) A has larger momentum than B
    (*b*) B has larger momentum than A
    (*c*) A and B have same momentum
    (*d*) nothing can be said about their momentum relationship unless actual masses are known
13. One watt-hour equals
    (*a*) 3.6×10^3 J (*b*) 3.6×10^3 cal
    (*c*) 3.6×10^6 J (*d*) 3.6×10^6 cal
14. A force of $(5 + 3x)$ N, acting on a body of mass 20 kg along the x-axis, displaces it form $x = 2$ m to $x = 6$ m. The work done by the force is **[DCE 92]**
    (*a*) 20 J (*b*) 48 J
    (*c*) 68 J (*d*) 86 J
15. 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. The work required to pull the hanging part on the table is **[MP PMT 2000, IIT 85]**
    (*a*) MgL (*b*) $\frac{MgL}{3}$

(c) $\frac{MgL}{9}$ (d) $\frac{MgL}{18}$

16. Two masses of 1 g and 4 g are moving with equal kinetic energies. The ratio of the magnitudes of their linear momenta is **[AIIMS 87; IIT 80, Kerala PMT 2003]**

(a) 4 : 1 (b) $\sqrt{2}$: 1

(c) 1 : 2 (d) 1 : 16

17. A bullet of mass 10 g hits a target and penetrates 2 cm into it. If the average resistance offered by the target is 100 N, then the velocity with which the bullet hits the target is

(a) 10 m/s (b) $10\sqrt{2}$ m/s

(c) 20 m/s (d) $20\sqrt{2}$ m/s

18. A bullet, when fired at a fixed target, has its velocity decreased to 50 % after penetrating 30 cm into it. The additional thickness it will penetrate before coming to rest is

(a) 10 cm (b) 15 cm

(c) 20 cm (d) 30 cm

19. An electric motor creates a tension of 45 N in a hoisting cable and reels it in at the rate of 2 m/s. The power of the motor is **[MNR 84]**

(a) 15 kW (b) 9 kW

(c) 225 W (d) 9000 H.P

20. A car is moving on a straight road with a speed V_0. If the coefficient of friction between the tyres and the road is μ, the distance travelled by the car before it comes to rest is **[MP PMT 85]**

(a) $\frac{V_0^2}{2\mu g}$ (b) $\left(\frac{V_0}{\mu g}\right)^2$

(c) $\frac{V_0}{\mu g}$ (d) $\frac{V_0^2}{\mu g}$

21. A cord is used to lower vertically a block of mass M a distance d at a constant downward acceleration of $g/4$. Then the work done by the cord on the block is **[CPMT 72]**

(a) $\frac{Mgd}{4}$ (b) $\frac{-Mgd}{4}$

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

22. The displacement x of a particle of mass m kg moving in one dimension, under the action of a force, is related to the time t by the equation $t=\sqrt{x}+3$ where x is in metres and t is in seconds. The work done by the force in the first six seconds in joules is **[IIT 79]**

(a) 0 (b) 3 m

(c) 6 m (d) 9 m

23. A body of mass 5 kg, initially at rest, is moved by a force of 2 N on a smooth horizontal surface. The work done by the force in 10 s is

(a) 20 J (b) 30 J

(c) 40 J (d) 60 J

24. Two particles of masses m_1 and m_2 have equal kinetic energies. The ratio of their momenta is **[MP PMT 86]**

(a) $m_1 : m_2$ (b) $m_2 : m_1$

(c) $\sqrt{m_1} : \sqrt{m_2}$ (d) $m_1^2 : m_2^2$

25. A body is gently dropped on a conveyor belt moving at 3 m/s. If μ = 0.5, how far will the body move relative to the belt before coming to rest ? (g = 10 m/s^2)

(a) 0.3 m (b) 0.6 m

(c) 0.9 m (d) 1.8 m

26. If the kinetic energy of a body is increased by 300%, its momentum will increase by

(a) 100% (b) 150%

(c) 200% (d) 400%

27. If the momentum of a body is increased by 50%, its kinetic energy will increase by **[MP CET 99]**

(a) 100% (b) 125%

(c) 150% (d) 200%

28. A 4.0 kg body, moving with a speed of 2.0 m/s, collides with a spring bumper of negligible mass and force constant 100 N/m. The maximum compression of the spring is

(a) 0.4 m (b) 0.8 m

(c) 1.6 m (d) 2.0 m

29. Two bodies, having masses in the ratio 1 : 4, have kinetic energies in the ratio 4 : 1. The ratio of their linear momenta is

(*a*) 1 : 1 (*b*) 1 : 2

(*c*) 2 : 1 (*d*) 1 : 4

30. A simple pendulum of length 1 m has a bob of mass 100 g. It is displaced through an angle of 60° form the vertical and then released. The kinetic energy of the bob when it passes through the mean position is (g = 10 m/s^2)

(*a*) 0.25 J (*b*) 0.5 J

(*c*) 1.0 J (*d*) 1.4 J

31. Two identical cylindrical vessels with their bases at the 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 is h_2. The area of either base is A. The work done by gravity in equalizing the levels when the vessels are interconnected is

(*a*) $A\rho g\left(\frac{h_1 - h_2}{2}\right)$ (*b*) $A\rho g\left(\frac{h_1 - h_2}{2}\right)^2$

(*c*) $A\rho g\left(\frac{h_1 - h_2}{4}\right)$ (*d*) $A\rho g\left(\frac{h_1 - h_2}{4}\right)^2$

32. The kinetic energy of a projectile at the highest point is half of its initial kinetic energy. The angle of projection is

(*a*) 30° (*b*) 45°

(*c*) 60° (*d*) none of these

33. A particle is projected with kinetic energy E at 30° to the horizontal. The kinetic energy at the highest point is

(*a*) $E/4$ (*b*) $E/2$

(*c*) $\frac{\sqrt{3}E}{2}$ (*d*) $\frac{3E}{4}$

34. If the force acting on a body is inversely proportional to its speed, the kinetic energy of the body is

(*a*) constant

(*b*) directly proportional to time

(*c*) inversely proportional to time

(*d*) directly proportional to the square of time

35. If the kinetic energy of a body is directly proportional to time t, the magnitude of the force acting on the body is

(*a*) directly proportional to $\sqrt{t}$

(*b*) inversely proportional to $\sqrt{t}$

(*c*) directly proportional to the speed of the body

(*d*) inversely proportional to the speed of the body

36. The kinetic energy of a body of mass m is E. Its momentum is

(*a*) $\sqrt{2mE}$ (*b*) $2mE$

(*c*) $\sqrt{\frac{mE}{2}}$ (*d*) $\frac{2E}{m}$

37. Two bodies of masses m and $4m$ are dropped from the top of a tower, When they reach the ground their kinetic energies will be in the ratio

(*a*) 1 : 2 (*b*) 2 : 1

(*c*) 1 : 4 (*d*) 4 : 1

38. The time taken by an engine of power 10 kW to lift a mass of 200 kg to a height of 40 m is (g = 10 m/s^2)

(*a*) 2 s (*b*) 4 s

(*c*) 8 s (*d*) 16 s

39. A pump can take out 36 000 kg of water per hour from a 100 m deep well. If the efficiency of the pump is 50%, its power is (g = 10 m/s^2)

(*a*) 5 kW (*b*) 10 kW

(*c*) 15 kW (*d*) 20 kW

40. A truck of mass 30000 kg moves up an inclined plane rising 1 in 100 at a speed of 30 km/h . The power of the engine of the truck is (g = 10 m/s^2)

(*a*) 25 kW (*b*) 90 kW

(*c*) 2.5 kW (*d*) 9.0 kW

41. 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

[AIIMS 97, IIT 84, Raj-PET 2003]

(*a*) $t^{1/2}$ (*b*) $t^{3/4}$

(*c*) $t^{3/2}$ (*d*) t^2

42. A body of mass 0.5 kg is taken up an inclined plane of length 10 m and height 5 m and then allowed to slide down to the bottom again. The coefficient of friction between the body and the plane is 0.1. The work done by the frictional force over the round trip is ($g = 10$ m/s^2)

(*a*) 5 J (*b*) $5\sqrt{3}$ J

(*c*) – 5 J (*d*) $-5\sqrt{3}$ J

43. A bullet of mass 10 g strikes a fixed target and penetrates 8 cm into it. If the average resistance offered by the target to the bullet is 100 N, the velocity with which the bullet hits the target is

(*a*) 10 m/s (*b*) 20 m/s

(*c*) 30 m/s (*d*) 40 m/s

44. A body starts sliding on a rough horizontal surface with a speed of 10 m/s. If the coefficient of friction is 0.2, the distance travelled by the body before coming to rest is ($g = 10$ m/s^2)

(*a*) 12.5 m (*b*) 25 m

(*c*) 37.5 m (*d*) 50 m

45. A body of mass 2 kg, initially at rest, is acted upon simultaneously by two forces, one of 4 N and the other of 3 N, acting at right angles to each other. The kinetic energy of the body after 20 s is

(*a*) 500 J (*b*) 1250 J

(*c*) 2500 J (*d*) 5000 J

46. A uniform rod of length 1 m and mass 100 g is pivoted at one end and is hanging vertically. It is displaced through 60° from the vertical. The increase in its potential energy is ($g = 10$ m/s^2)

(*a*) 0.25 J (*b*) 0.5 J

(*c*) 0.75 J (*d*) 1.0 J

47. A 2 kg block is dropped from a height of 0.4 m on a spring of force constant k = 1960 N/m. The maximum compression of the spring is

(*a*) 0.1 m (*b*) 0.2 m

(*c*) 0.3 m (*d*) 0.4 m

48. A rifle bullet loses $(1/20)^{th}$ of its speed in passing through a plank. The least number of such planks required to stop the bullet is **[EAMCET 87]**

(*a*) 5 (*b*) 10

(*c*) 11 (*d*) 20

49. A bullet, moving with a speed of 150 m/s, strikes a wooden plank. After passing through the plank, its speed becomes 125 m/s. Another bullet of the same mass and size strikes the plank with a speed of 90 m/s. Its speed after passing through the plank would be

(*a*) 25 m/s (*b*) 35 m/s

(*c*) 50 m/s (*d*) 70 m/s

50. The kinetic energy acquired by a body of mass m in travelling a certain distance starting from rest, under a constant force is **[CBSE PMT 94]**

(*a*) directly proportional to m

(*b*) directly proportional to $\sqrt{m}$

(*c*) inversely proportional to $\sqrt{m}$

(*d*) independent of m.

51. A body of mass 2 kg is thrown up vertically with a kinetic energy of 490 J. If g = 9.8 m/s^2, the height at which the kinitic energy becomes half its original value is **[EAMCET 86]**

(*a*) 10 m (*b*) 12.5 m

(*c*) 25 m (*d*) 50 m

52. A body of mass m is moved form rest, along a straight line, by an engine delivering constant power P. The velocity of the body after time t will be

(*a*) $\sqrt{\dfrac{2Pt}{m}}$ (*b*) $\dfrac{2Pt}{m}$

(*c*) $\sqrt{\dfrac{Pt}{2m}}$ (*d*) $\dfrac{Pt}{2m}$

53. Fig. 6.8 shows the force distance curve of a body moving along a straight line. The work done by the force is

(*a*) 10 J (*b*) 20 J

(*c*) 30 J (*d*) 40 J

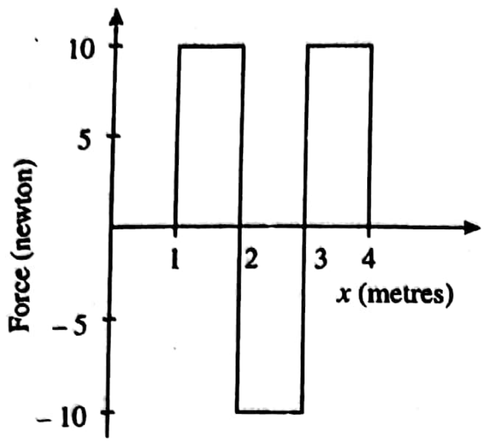

Fig. 6.8

54. A body of mass m accelerates uniformly from rest to a velocity v_0 in time t_0. The instantaneous power delivered to the body at any time t is **[AIEEE 04, 05]**

(a) $\frac{mv_0 t}{t_0}$ (b) $\frac{mv_0^2}{t_0}t$

(c) $\frac{mv_0 t^2}{t_0}$ (d) $\frac{mv_0^2}{t_0^2}t$

55. The potential energy of a certain spring when stretched through a distance x is 10 J. The amount of work (in joules) that must be done on the spring to stretch it through an addition distance x will be **[MNR 91]**

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

56. A loaded bus and an unloaded bus are both moving with the same kinetic energy. The mass of the former is twice that of the latter. Brakes are applied to both so as to exert equal retarding forces. If S_1 and S_2 are the distances covered by the two buses, respectively, before coming to rest, then

(a) $S_1 = S_2$ (b) $2S_1 = S_2$
(c) $S_1 = 2S_2$ (d) $S_1 = 4S_2$

57. The displacement of a body of mass 2 kg as a function of time is given by $x = 2t^2 + 5$, where x is in metres and t in seconds. The increase in its kinetic energy, one second after the start of motion is

(a) 8 J (b) 16 J
(c) 32 J (d) 64 J

58. A long spring, when stretched by a distance x, has potential energy V. On increasing the stretching to nx, the potential energy of the spring will be **[EAMCET 92]**

(a) V/n (b) nV
(c) n^2V (d) V/n^2

59. Work is always done on a bodv when
(a) a force acts on it
(b) it moves through a distance
(c) its momentum changes
(d) it experiences an increases in energy through a mechanical influence.

60. A particle moves under the influence of a force $F = cx$ from $x = 0$ to $x = x_1$, where c is a constant. The work in this process is **[CPMT 82]**

(a) cx_1^2 (b) $\frac{1}{2}cx_1^2$

(c) cx_1^3 (d) zero

61. The amount of work done in stretching a spring of force constant 500 N/m from a stretched length of 40 cm to 50 cm is
(a) 45 J (b) 22.5 J
(c) 45×10^4 J (d) 22.5×10^4 J

62. A 500 g body has a velocity **v** = 3**i** + 4**j** m/s at a certain instant. Its kinetic energy is
(a) 6.25 J (b) 62.5 J
(c) 6.25×10^3 J (d) 62.5×10^3 J

63. A body is displaced form $x = x_1$ to $x = x_2$ by a force of $2x$. The work done is **[CPMT 93]**

(a) $2x_1 (x_2 - x_1)$ (b) $2x_2 (x_2 - x_1)$
(c) $x_2^2 - x_1^2$ (d) $(x_2 - x_1)^2$

64. A body is lifted by a man to a height of 1 m in 30 s. Another man lifts the same mass to the same height in 60 s. The work done by them are in the ratio **[MP PMT 93]**

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

65. A body of mass 10 kg is dropped to the ground form a height of 10 m. The work done by the gravitational force is ($g = 9.8$ m/s^2) **[SCRA 94]**

(a) – 490 J (b) + 490 J
(c) – 980 J (d) 980 J

66. A stone projected vertically upwards from the ground reaches a maximum height h. When it is at a height $3h/4$, the ratio of its kinetic and potential energies is
(a) 3 : 4 (b) 1 : 3
(c) 4 : 3 (d) 3 : 1

67. A particle A is projected vertically upwards. Another particle B is projected at an angle of 45°. Both reach the same height. The ratio of the initial kinetic energy of A to that of B is
(a) 1 : 1 (b) 2 : 1
(c) $1:\sqrt{2}$ (d) $\sqrt{2}:1$

68. A bullet, moving with a speed of $\sqrt{3}$ m/s, pierces a plank and comes to rest. The speed of the bullet that would be just stopped by triple the thickness of the same plank must be
(a) 3 m/s (b) 6 m/s
(c) $3\sqrt{3}$ m/s (d) 9 m/s

69. An object of mass 2 kg, moving in a straight line, is accelerated from 2 ms^{-1} to 6 ms^{-1} by a force of 5 N acting along the same direction. Then
(a) the work done by the force is 20 J
(b) the distance travelled by the object is 6.4 m
(c) the time taken to change the velocity is 4 s
(d) the increase in the kinetic energy of the object is 32 J

70. An elastic string of unstretched length L and force constant k is stretched by a small length x. It is further stretched by another small length y. The work done in the second stretching is **[IIT Screening 94]**
(a) $\frac{1}{2}ky^2$ (b) $\frac{1}{2}k(x^2+y^2)$
(c) $\frac{1}{2}k(x+y)^2$ (d) $\frac{1}{2}ky(2x+y)$

71. If a body of mass 200 gm falls from a height of 200 m and its total P.E. is converted into K.E. at the point of contact of the body with the earth surface, then what is the decrease in P.E. of the body at the contact ? (g = 10 m/s^2) **[AFMC 97]**
(a) 900 J (b) 300 J
(c) 200 J (d) none of these

72. If a spring extends by x on loading, then the energy stored by the spring is (if T is the tension in the spring and K is spring constant) **[AIIMS 97]**
(a) $\frac{T^2}{2x}$ (b) $\frac{T^2}{2K}$
(c) $\frac{2K}{T^2}$ (d) $\frac{2T^2}{K}$

73. The decrease in the potential energy of a ball of mass 20 kg which falls from a height of 50 cm is **[AIIMS 97]**
(a) 968 J (b) 98 J
(c) 1980 J (d) none of these

74. A force acts on a 3.0 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 98]**
(a) 450 mJ (b) 530 mJ
(c) 490 mJ (d) 570 mJ

75. The kinetic energy of a body of mass 2 kg and momentum 2 Ns is **[AFMC 98]**
(a) 1 J (b) 2 J
(c) 3 J (d) 4 J

76. 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 CET 98]**
(a) RV (b) maV
(c) $(R+ma)V$ (d) $(ma-R)V$

77. Two springs of spring constants 1500 N/m and 3000 N/m respectively are stretched with the same force. They will have potential energies in the ratio **[MP CET 98]**

(a) 4 : 1 (b) 1 : 4

(c) 2 : 1 (d) 1 : 2

78. A force **F** = –K (x**i** + y**j**) (where K is a positive constant) acts on a particles 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 particle is **[IIT 98]**

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

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

79. A particle of mass m at rest is acted upon by a force P for time t. Its kinetic energy after time t is **[NSEP 99]**

(a) $\frac{P^2t^2}{m}$ (b) $\frac{P^2t^2}{2m}$

(c) $\frac{P^2t^2}{3m}$ (d) $\frac{Pt}{2m}$

80. A body of mass 5 kg is moving with a momentum of 10 kg 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 CET 99]**

(a) 2.8 joule (b) 3.2 joule

(c) 3.8 joule (d) 4.4 joule

81. A running man has halt the kinetic energy that a boy half his mass has. The man speeds up by 1 m/s and then has the same kinetic energy as the boy The original speed of the man is **[CBSE PMT 99]**

(a) $(1+\sqrt{2})$ m/s (b) $(2+\sqrt{2})$ m/s

(c) $(3+\sqrt{2})$ m/s (d) $\sqrt{2}$ m/s

82. Two springs A and B ($k_A = 2k_B$) are stretched by applying forces of equal magnitudes at the four ends. If the energy stored in B is E, the energy stored in A is **[CBSE PMT 99]**

(a) 2E (b) E

(c) E/2 (d) 4E

83. 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 **[Karnataka CET 99]**

(a) 10 units (b) 18 units

(c) 11 units (d) 15 units

84. A particle moves with a velocity $6\hat{i} - 4\hat{j} + 3\hat{k}$ m/s under the influence of a constant force $\vec{F} = 20\hat{i} + 15\hat{j} - 5\hat{k}$ N. The instantaneous power applied to the particle is **[CBSE PMT 2000]**

(a) 45 J/s (b) 35 J/s

(c) 25 J/s (d) 195 J/s

85. 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

86. 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 form the ground. The running time of the motor to fill the empty water tank is ($g = 10\ ms^{-1}$) **[EAMCET Engg. 2000]**

(a) 5 minutes (b) 10 minutes

(c) 15 minutes (d) 20 minutes

87. 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 **[EMCET Engg. 2000]**

(a) 20 ms^{-1} (b) 15 m^{-1}

(c) 10 ms^{-1} (d) 5 ms^{-1}

88. A body of mass 5 kg rests on a rough horizontal surface of coefficient of friction 0.2. The body is pulled through a distance of 10 m by a horizontal force of 25 N. The kinetic energy acquired by it is ($g = 10\ ms^2$) **[EAM CET Med 2000]**

(a) 330 J (b) 150 J

(c) 100 J (d) 50 J

89. Water is falling on the blades of a turbine at a rate of 100 kg/sec from a certain spring. If the height of the spring be 100 metres, the power transferred to the turbine will be **[MP PET 2000]**

(*a*) 100 kW (*b*) 10 kW
(*c*) 1 kW (*d*) 100 watt

90. The kinetic energy of a body becomes four times it initial value. The new linear momentum will be **[Karnataka CET 2000]**
(*a*) thrice the initial value
(*b*) four times the initial value
(*c*) same as the initial value
(*d*) twice the initial value

91. 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 **[EAM CET Engg. 2001]**
(*a*) 12 J (*b*) 9 J
(*c*) 6 J (*d*) 3 J

92. A force applied by an engine on a train of mass 2.05 × 106 kg changes its velocity from 5 m/s to 25 m/s in 5 minutes. The power of the engine is **[EAMCET Engg. 2001]**
(*a*) 1.025 MW (*b*) 2.05 MW
(*c*) 5 MW (*d*) 6 MW

93. 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*) 20 J
(*e*) 125 J

ANSWERS

1. *c*	**2.** *c*	**3.** *d*	**4.** *a*	**5.** *a*	**6.** *c*	**7.** *b*	**8.** *c*
9. *a*	**10.** *d*	**11.** *b*	**12.** *b*	**13.** *a*	**14.** *c*	**15.** *d*	**16.** *c*
17. *c*	**18.** *a*	**19.** *b*	**20.** *a*	**21.** *d*	**22.** *a*	**23.** *c*	**24.** *c*
25. *c*	**26.** *a*	**27.** *b*	**28.** *a*	**29.** *a*	**30.** *b*	**31.** *b*	**32.** *b*
33. *d*	**34.** *b*	**35.** *b, d*	**36.** *a*	**37.** *c*	**38.** *c*	**39.** *d*	**40.** *a*
41. *c*	**42.** *d*	**43.** *d*	**44.** *b*	**45.** *c*	**46.** *a*	**47.** *a*	**48.** *c*
49. *b*	**50.** *d*	**51.** *b*	**52.** *a*	**53.** *a*	**54.** *d*	**55.** *c*	**56.** *a*
57. *b*	**58.** *c*	**59.** *d*	**60.** *b*	**61.** *b*	**62.** *a*	**63.** *c*	**64** *b*
65. *d*	**66.** *b*	**67.** *a*	**68.** *a*	**69.** *b, d*	**70.** *d*	**71.** *d*	**72.** *b*
73. *b*	**74.** *b*	**75.** *a*	**76.** *c*	**77.** *c*	**78.** *c*	**79.** *b*	**80.** *d*
81. *a*	**82.** *c*	**83.** *a*	**84.** *a*	**85.** *b*	**86.** *c*	**87.** *a*	**88.** *b*
89. *a*	**90.** *d*	**91.** *d*	**92.** *b*	**93.** *e*			