1. 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

(a) mnu (b) 2 mnu

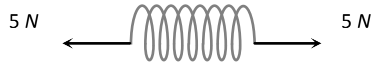
(c) 4 mnu (d) $\frac{1}{2}mnu$

2. A coin is dropped in a lift. It takes time t_1 to reach the floor when lift is stationary. It takes time t_2 when lift is moving up with constant acceleration. Then

(a) $t_1 > t_2$ (b) $t_2 > t_1$

(c) $t_1 = t_2$ (d) $t_1 >> t_2$

3. The tension in the spring is



(a) Zero (b) $2.5\,N$

(c) $5\,N$ (d) $10\,N$

4. A rope of length L is pulled by a constant force F. What is the tension in the rope at a distance x from the end where the force is applied

(a) $\frac{FL}{x}$ (b) $\frac{F(L-x)}{L}$

(c) $\frac{FL}{L-x}$ (d) $\frac{Fx}{L-x}$

5. 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

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

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

6. 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

(a) $3v\cos\theta$ (b) $2v\cos\theta$

(c) $\frac{3}{2}v\cos\theta$ (d) $\frac{\sqrt{3}}{2}v\cos\theta$

7. 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

(a) 45° (b) 90°

(c) 135° (d) 180°

8. 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

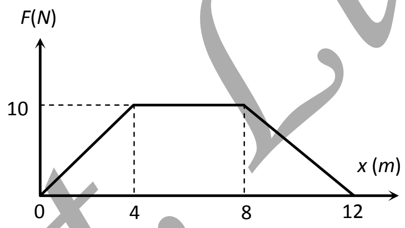
(a) 1 : 1

(b) 2 : 1

(c) 4 : 1

(d) 9 : 1

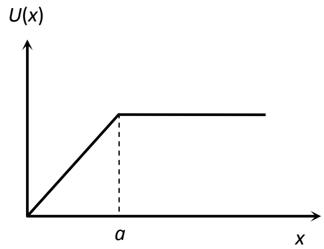
9. A particle of mass 0.1 kg is subjected to a force which varies with distance as shown in fig. If it starts its journey from rest at $x = 0$, its velocity at $x = 12\,m$ is



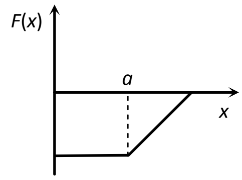
(a) 0 m/s (b) $20\sqrt{2}\ m/s$

(c) $20\sqrt{3}\ m/s$ (d) $40\ m/s$

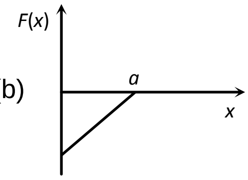
10. The potential energy of a system is represented in the first figure. The force acting on the system will be represented by



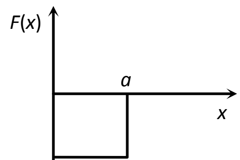
(a)



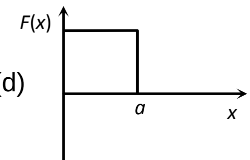
(b)



(c)



(d)

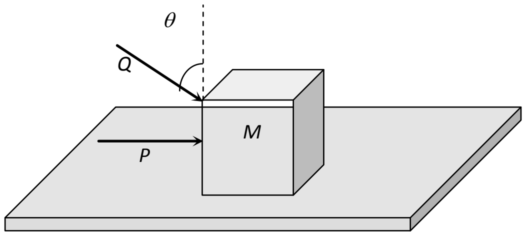


11. The upper half of an inclined plane of inclination θ is perfectly smooth while the lower half is rough. A body starting from the rest at top comes back to rest at the bottom if the coefficient of friction for the lower half is given by

(a) $\mu = \sin\theta$ (b) $\mu = \cot\theta$

(c) $\mu = 2\cos\theta$ (d) $\mu = 2\tan\theta$

12. A block of mass *m* lying on a rough horizontal plane is acted upon by a horizontal force *P* and another force *Q* inclined at an angle θ to the vertical. The block will remain in equilibrium, if the coefficient of friction between it and the surface is



(a) $\frac{(P+Q\sin\theta)}{(mg+Q\cos\theta)}$ (b) $\frac{(P\cos\theta+Q)}{(mg-Q\sin\theta)}$

(c) $\frac{(P+Q\cos\theta)}{(mg+Q\sin\theta)}$ (d) $\frac{(P\sin\theta-Q)}{(mg-Q\cos\theta)}$

13. A body of mass *M* is kept on a rough horizontal surface (friction coefficient μ). A person is trying to pull the body by applying a horizontal force but the body is not moving. The force by the surface on the body is *F*, where

(a) $F = Mg$

(b) $F = \mu Mgf$

(c) $Mg \le F \le Mg\sqrt{1+\mu^2}$

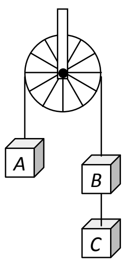
(d)

14. A cyclist moves in a circular track of radius 100 *m*. If the coefficient of friction is 0.2, then the maximum velocity with which the cyclist can take the turn with leaning inwards is

(a) 9.8 *m*/*s* (b) 1.4 *m* /*s*

(c) 140 *m*/*s* (d) 14 *m*/*s*

15. Three equal weights *A*, *B* and *C* of mass 2 *kg* each are hanging on a string passing over a fixed frictionless pulley as shown in the figure The tension in the string connecting weights *B* and *C* is



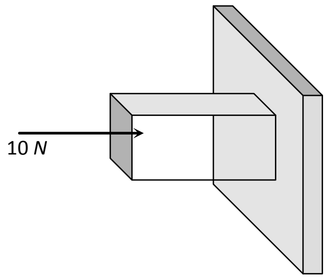
(a) Zero

(b) 13 *N*

(c) 3.3 *N*

(d) 19.6 *N*

16. A horizontal force of 10 *N* is necessary to just hold a block stationary against a wall. The coefficient of friction between the block and the wall is 0.2. the weight of the block is



(a) 2 *N* (b) 20 *N*

(c) 50 *N* (d) 100 *N*

17. The potential energy between two atoms in a molecule is given by ; where *a* and *b* are positive constants and *x* is the distance between the atoms. The atom is in stable equilibrium when

(a) (b)

(c) (d) $x = \sqrt[6]{\frac{2a}{b}}$

18. If the *K.E.* of a body is increased by 300%, its momentum will increase by

(a) 100% (b) 150%

(c) 90% (d) 120%

19. A running man has half the kinetic energy of that of a boy of half of his mass. The man speeds up by 1*m*/*s* so as to have same *K.E*. as that of the boy. The original speed of the man will be

(a) (b)

(c) (d)

20. 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

(a) (b)

(c) (d)

21. 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

(a) 100 *kW* (b) 10 *Kw*

(c) 1 *kW* (d) 1000 *kW*