103. A bullet of mass m strikes a pendulum bob of mass M with velocity u. It passes through and emerges out with a velocity u/2 from bob. The length of the pendulum is ℓ. What should be the minimum value of u if the pendulum bob will swing through a complete circle?

(A) $\frac{2M}{m} \times \sqrt{5g\ell}$ (B) $\frac{M}{2m}\sqrt{5g\ell}$ (C) $\frac{2M}{m} \times \frac{1}{\sqrt{5g\ell}}$ (D) $\frac{M}{2m} \times \frac{1}{\sqrt{5g\ell}}$

104. An open water tight railway wagon of mass 5×10^3 kg coasts at an initial velocity of 1.2 m/sec. without friction on a railway track. Rain falls vertically downwards into the wagon. What change then occurred in the velocity of the wagon, when it has collected 10^3kg of water ?

(A) 10 m/s (B) 3m/s (C) 0.2m/s (D) 9m/s

105. Two equal lumps of putty are suspended side by side from two long strings so that they are just touching. One is drawn aside so that its centre of gravity rises a vertical distance h. It is released and then collides inelastically with the other one. The vertical distance risen by the centre of gravity of the combination is -

(A) h. (B) 3h/4 (C) h/2 (D) h/4

106. A billiard ball moving at a speed 2m/s strikes an identical ball initially at rest, at a glancing blow. After the collision one ball is found to be moving at a speed of 1m/s at 60º with the original line of motion. The velocity of the other ball shall be -

(A) $(3)^{1/2}$m/s at 30º to the original direction.
(B) 1m/s at 60º to the original direction.
(C) $(3)^{1/2}$m/s at 60º to the original direction.
(D) 1 m/s at 30º to the original direction.

107. Three particles each of mass m are located at the vertices of an equilateral triangle ABC. They start moving with equal speeds υ each along the medians of the triangle and collide at its centroid G. If after collision, A comes to rest and B retraces its path along GB, then C

(A) also comes to rest (B) moves with a speed υ along CG

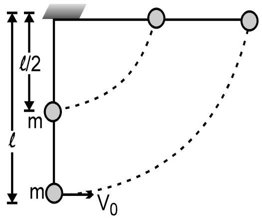
(C) moves with a speed υ along BG (D) moves with a speed along AG

108. An object of mass m slides down a hill of height h and of arbitrary shape and stops at the bottom because of friction. The coefficient of friction may be different for different segments of the path. Work required to return the object to its position along the same path by a tangential force is

(A) mgh (B) 2 mgh

(C) – mgh (D) it can not be calculated

109. A light rod of length ℓ is pivoted at the upper end. Two masses (each m), are attached to the rod, one at the middle and the other at the free end. What horizontal velocity must be imparted to the lower end mass, so that the rod may just take up the horizontal position?



(A) $\sqrt{6\ell g}/5$ (B) $\sqrt{\ell g}/5$

(C) $\sqrt{12\ell g/5}$ (D) $\sqrt{2\ell g}/5$

110. A machine, which is 72 percent efficient, uses 36 joules of energy in lifting up 1kg mass through a certain distance. The mass is the allowed to fall through that distance. The velocity at the end of its fall is

(A) 6.6 ms^{-1} (B) 7.2 ms^{-1} (C) 8.1 ms^{-1} (D) 9.2 ms^{-1}

111. A billiard ball moving at a speed of 6.6 ms^{-1} strikes an identical stationary ball a glancing blow. After the collision, one ball is found to be moving at a speed of 3.3, ms^{-1} in a direction making an angle of 60º with the original line of motion. The velocity of the other ball is

(A) 4.4 ms^{-1} (B) 6.6 ms^{-1} (C) 3.3 ms^{-1} (D) 5.7 ms^{-1}

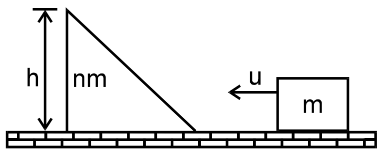
112. A projectile of mass 3m explodes at highest point of its path. It breaks into three equal parts. One part retraces its path, the second one comes to rest. The range of the projectile was 100 m if no explosion would have taken place. The distance of the third part from the point of projection when it finally lands on the ground is -

(A) 100 m (B) 150 m (C) 250 m (D) 300 m

113. A man of mass m moves with a constant speed on a plank of mass 'M' and length 'L' kept initially at rest on a frictionless horizontal surface, from one end to the other in time 't'. The speed of the plank relative to ground while man is moving, is -

(A) $\frac{L}{t}\left(\frac{M}{m}\right)$ (B) $\frac{L}{t}\left(\frac{m}{M+m}\right)$ (C) $\frac{L}{t}\left(\frac{m}{M-m}\right)$ (D) None of these

114. A block of mass m is pushed towards a movable wedge of mass nm and height h, with a velocity u. All surfaces are smooth. The minimum value of u for which the block reach the top of the wedge is -



(A) $\sqrt{2gh}$ (B) 2ngh

(C) $\sqrt{2gh\left(1+\frac{1}{n}\right)}$ (D) $\sqrt{2gh\left(1-\frac{1}{n}\right)}$

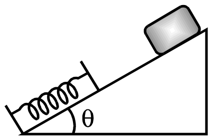
115. A uniform flexible chain of mass m and length 2ℓ hangs in equilibrium over a smooth horizontal pin of negligible diameter. One end of the chain is given a small vertical displacement so that the chain slips over the pin. The speed of chain when it leaves pin is-

(A) $\sqrt{2g\ell}$ (B) $\sqrt{g\ell}$ (C) $\sqrt{4g\ell}$ (D) $\sqrt{3g\ell}$

116. A particle of mass 0.5 kg is displaced from position $\vec{r}_1(2, 3, 1)$ to $\vec{r}_2(4, 3, 2)$ by applying of force of magnitude 30 N which is acting along $(\hat{i}+\hat{j}+\hat{k})$. The work done by the force is -

(A) $10\sqrt{3}$ J (B) $30\sqrt{3}$ J (C) 30 J (D) None of these

117. In the given figure, the inclined surface is smooth. The body releases from the top. Then-

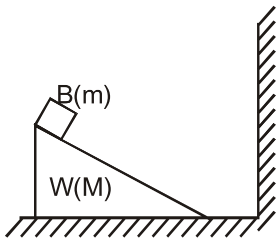


(A) the body has maximum velocity just before striking the spring
(B) The body performs periodic motion
(C) the body has maximum velocity at the compression $\frac{mg\sin\theta}{k}$ where k is spring constant
(D) both (B) and (C) are correct

118. A body of mass 2 kg is moved from a point A to a point B by an external agent in a conservative force field. It the velocity of the body at the points A and B are 5 m/s and 3 m/s respectively and the work done by the external agents is –10 J, then the change in potential energy between points A and B is-

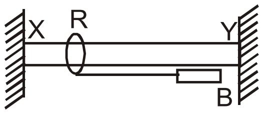
(A) 6 J (B) 36 J (C) 16 J (D) None of these

119. In the figure the block B of mass m starts from rest at the top of a wedge W of mass M. All surfaces are without friction. W can slide on the ground B slides down onto the ground, moves along it with a speed v, has an elastic collision with the wall, and climbs back onto W. then incorrect statement is



(A) B will reach the top of W again
(B) From the beginning, till the collision with the wall, the centre of mass of 'B plus W' does not move horizontally
(C) After the collision, the centre of mass of 'B plus W' moves with the velocity $\frac{2mv}{m+M}$
(D) When B reaches its highest position on W, the speed of W is $\frac{2mv}{m+M}$

120. The ring R in the arrangement shown can slide along a smooth, fixed, horizontal rod XY. It is attached to the block B by a light string. The block is released from rest, with the string horizontal.



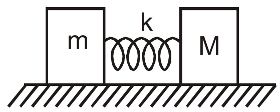
(A) One point in the string will have only vertical motion
(B) R and B will always have momenta of the same magnitude.
(C) When the string becomes vertical, the speed of R and B will be directly proportionaly to their masses
(D) R will lose contact with the rod at some point

121. A block of mass M is hanging over a smooth and light pulley through a light string. The other end of the string is pulled by a constant force F. The kinetic energy of the block increases by 20 J in 1s.
(A) The tension in the string is Mg
(B) The tension in the string is F
(C) The work done by the tension on the block is 20 J in the above 1s
(D) The work done by the force of gravity is –20 J in the above 1s

122. A smooth sphere is moving on a horizontal surface with velocity vector $2\hat{i}+2\hat{j}$ immediately before it hits a vertical wall. The wall is parallel to $\hat{j}$ vector and the coefficient of restitution between the sphere and the wall is e = $\frac{1}{2}$. The velocity vector of the sphere after it hits the wall is:
(A) $\hat{i}-\hat{j}$ (B) $-\hat{i}+2\hat{j}$ (C) $-\hat{i}-\hat{j}$ (D) $2\hat{i}-\hat{j}$

123. Two particles having position vectors $\vec{r}_1 = (3\hat{i}+5\hat{j})$ metres and $\vec{r}_2 = (-5\hat{i}-3\hat{j})$ metres are moving with velocities $\vec{\upsilon}_1 = (4\hat{i}+3\hat{j})$ m/s and $\vec{\upsilon}_2 = (a\hat{i}+7\hat{j})$ m/s. If they collide after 2 seconds the value of a is:
(A) 2 (B) 4 (C) 6 (D) 8

124. A light spring of spring constant k is kept compressed between two blocks of masses m and M on a smooth horizontal surface (figure) When released, the blocks acquire velocities in opposite directions. The spring loses contact with the blocks when it acquires natural length. If the spring was initially compressed through a distance x, find the final speed of mass m.

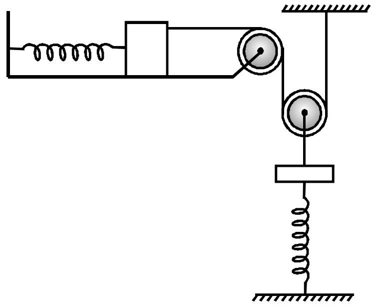


(A) $\sqrt{\frac{KM}{m(M+m)}}\,x$ (B) $\sqrt{\frac{Km}{M(m+M)}}\,x$ (C) $\sqrt{\frac{KM}{m(M-m)}}\,x$ (D) $\sqrt{\frac{Km}{M(M-m)}}\,x$

125. Force acting on a particle is $(2\hat{i}+3\hat{j})$ N. Work done by this force is zero. when a particle is moved on the line 3y + kx = 5. Here value of k is:
(A) 2 (B) 4 (C) 6 (D) 8

126. A pendulum of mass 1 kg and length ℓ = 1m is released from rest at angle θ = 60º. The power delivered by all the forces acting on the bob at angle θ = 30º will be: (g = 10 m/s^2)
(A) 13.4 W (B) 20.4 W (C) 24.6 W (D) zero

127. The system is released from rest with both the springs in unstretched positions. Mass of each block is 1 kg and force constant of each spring is 10 N/m. Extension of horizontal spring in equilibrium is:



(A) 0.2 m (B) 0.4 m
(C) 0.6 m (D) 0.8 m

128. In previous question maximum speed of the block placed horizontally is:
(A) 3.21 m/s (B) 2.21 m/s (C) 1.93 m/s (D) 1.26 m/s