Work, Energy and Power

Q.No.1:
This question has statement I and statement II. Of the four choices given after the statements, choose the one that best describes the two statements.
Statement – I: A point particle of mass m moving with speed v collides with stationary point particle of mass M. if the maximum energy loss possible is given as $f\left(\frac{1}{2}mv^2\right)$ then $f=\left(\frac{m}{M+m}\right)$.

Statement – II : Maximum energy loss occurs when the particles get stuck together as a result of the collision.

JEE 2013

A. Statement – I is true, Statement – II is true, Statement – II is a **correct** explanation of Statement – I.

B. Statement – I is true, Statement – II is true, Statement – II is **not** a correct explanation of Statement – I.

C. Statement – I is true, Statement – II is false.

D. Statement – I is false, Statement – II is true.

Q.No.2: When a rubber-band is stretched by a distance *x*, it exerts a restoring force of magnitude F = $ax + bx^2$, where a and b are constants. The work done in stretching the unstretched rubber-band by L is

A. $\frac{aL^2}{2}+\frac{bL^3}{3}$

B. $\frac{1}{2}\left(\frac{aL^2}{2}+\frac{bL^3}{3}\right)$

C. $aL^2 + bL^3$

D. $\frac{1}{2}(aL)^2 + bL^3$

Q.No.3: A particle of mass *m* moving in the *x* direction with speed 2*v* is hit by another particle of mass 2*m* moving in the y direction with speed *v*. If the collision is perfectly inelastic, the percentage loss in the energy during the collision is close to: **JEE 2015**

A. 44%
B. 50%
C. 56%
D. 62%

Q.No.4: A particle A of mass m and initial velocity u collides with a particle B of mass $\frac{m}{2}$ which is at rest. The collision is head on, and elastic. The ratio of the de-Broglie wavelengths λ_A to λ_B after the collision is: **JEE 2017**

A. $\frac{\lambda_A}{\lambda_B} = \frac{1}{2}$
B. $\frac{\lambda_A}{\lambda_B} = \frac{1}{3}$
C. $\frac{\lambda_A}{\lambda_B} = 2$
D. $\frac{\lambda_A}{\lambda_B} = \frac{2}{3}$

Q.No.5: It is found that if a neutron suffers an elastic collinear collision with deuterium at rest, fractional loss of its energy is p_d ; while for its similar collision with carbon nucleus at rest, fractional loss of energy is p_c. The values of p_d and p_c are respectively: **JEE 2018**

A. (0, 0)
B. (0, 1)
C. (.89, .28)
D. (.28, .89)

Q.No.6: A particle is moving in a circular path of radius a under the action of an attractive potential $U = -\frac{k}{2r^2}$. Its total energy is : **JEE 2018**

A. Zero
B. $-\frac{3}{2}\frac{k}{a^2}$
C. $-\frac{k}{4a^2}$
D. $\frac{k}{2a^2}$

Q.No.7: In a collinear collision, a particle with an initial speed v_0 strikes a stationary particle of the same mass. If the final total kinetic energy is 50%

greater than the original kinetic energy, the magnitude of the relative velocity between the two particles, after collision, is : **JEE 2018**

A. $\frac{\nu_0}{2}$

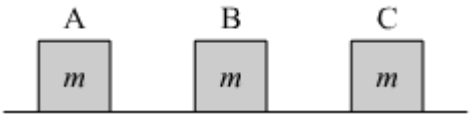
B. $\frac{\nu_0}{\sqrt{2}}$

C. $\frac{\nu_0}{4}$

D. $\sqrt{2}\,\nu_0$

Q.No.8: Three blocks A, B and C are lying on a smooth horizontal surface, as shown in the figure. A and B have equal masses, m while C has mass M. Block A is given an initial speed *v* towards B due to which it collides with B perfectly inelastically. The combined mass collides with C, also perfectly inelastically. The combined mass collides with C, also perfectly inelastically $\frac{5}{6}$th of the initial kinetic energy is lost in whole process. What is value of M/m?

JEE 2019



A. 5

B. 2

C. 4

D. 3

Q.No.9: A force acts on a 2 kg object so that its position is given as a function of time as $x = 3t^2 + 5$. What is the work done by this force in first 5 seconds?

JEE 2019

A. 850 J

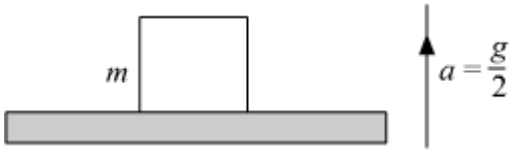
B. 950 J

C. 875 J

D. 900 J

Q.No.10: A block of mass m is kept on a platform which starts from rest with constant acceleration g/2 upward, as shown in fig. Work done by normal reaction on block in time *t* is:

JEE 2019



A. $-\frac{mg^2t^2}{8}$

B. $\frac{mg^2t^2}{8}$

C. 0

D. $\frac{3m\,g^2t^2}{8}$