Shiksha Classes, Bhandara

Physics

Subject : Physics **Topic : Work, Energy, Power and Conservation laws** **M.M. : 180**

Marking Scheme:
(i) Each question is allotted 4 (four) marks for each correct response.
(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

Q.1 If the values of force and length are increased four times then the unit of energy will increase by–
(1) 4 times (2) 2 times
(3) 8 times (4) 16 times

Q.2 A bullet of mass P is fired with velocity Q in a large body of mass R. The final velocity of the system will be
(1) $\frac{R}{P+R}$ (2) $\frac{PQ}{P+R}$
(3) $\frac{(P+Q)}{R}$ (4) $\frac{(P+R)}{P}Q$

Q.3 A sphere of mass m moving with a constant velocity collides with another stationary sphere of same mass. The ratio of velocities of two spheres after collision will be, if the co-efficient of restitution is e-
(1) $\frac{1-e}{1+e}$ (2) $\frac{e-1}{e+1}$
(3) $\frac{1+e}{1-e}$ (4) $\frac{e+1}{e-1}$

Q.4 An electric motor produces a tension of 4500N in a load lifting cable and rolls it at the rate of 2m/s. The power of the motor is –
(1) 9KW (2) 15KW
(3) 225KW (4) 9×10^3 HP

Q.5 A ball falls from a height of 5m and strikes the roof of a lift. If at the time of collision, lift is moving in the upward direction with a velocity of 1m/s, then the velocity with which the ball rebounds after collision will be – (e = 1)
(1) 11 m/s downwards (2) 12 m/s upwards
(3) 13 m/s upwards (4) 12 m/s downwards

Q.6 A force $\vec{F} = (5\hat{i} + 3j + 2\hat{k})$ N is applied over a particle which displaces it from its origin to the point $\vec{r} = (2\hat{i} - j)$ m. The work done on the particle in joules is
(1) – 7 (2) + 7
(3) + 10 (4) + 13

Q.7 Two elastic bodies P and Q having equal masses are moving along the same line with velocities of 16 m/s and 10 m/s respectively. Their velocities after the elastic collision will be in m/s :-
(1) 0 and 25 (2) 5 and 20
(3) 10 and 16 (4) 20 and 5

Q.8 If the momentum of a body is increased n times, its kinetic energy increases.
(1) n times (2) 2n times
(3) $\sqrt{n}$ times (4) n^2 times

Q.9 A metal ball does not rebound when struck on a wall, whereas a rubber ball of same mass when thrown with the same velocity on the wall rebounds. From this it is inferred that –
(1) Change in momentum is same in both
(2) Change in momentum in rubber ball is more
(3) Change in momentum in metal ball is more
(4) Initial momentum of metal ball is more than that of rubber ball.

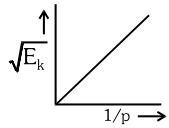
Q.10 The unit of the co–efficient of restitution is –
(1) m/s (2) s/m
(3) m × s (4) None of the above

Q.11 A bomb of mass 9 kg explodes into two pieces of 3kg and 6 kg. The velocity of 3 kg piece is 16 m/s. The kinetic energy of 6 kg piece is –
(1) 768 Joule (2) 786 Joule
(3) 192 Joule (4) 687 Joule

Q.12 Two solid balls of rubber A and B whose masses are 200 gm and 400 gm respectively, are moving in mutually opposite directions. If the velocity A is 0·3 m/s and both the balls come to rest after collision, then the velocity of ball B is –
(1) 0·15 m/s (2) – 0·15 m/s
(3) 1·5 m/s (4) None of the above

Q.13 The graph between $\sqrt{E_k}$ and $\frac{1}{p}$ is

(E_K = kinetic energy and p = momentum) –



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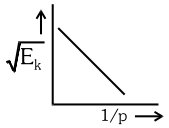

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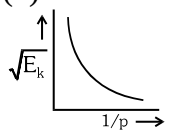

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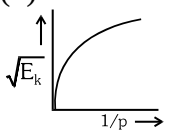


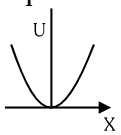
(4)

Q.14 A 1 Kg ball falls from a height of 25 cm and rebounds upto a height of 9 cm. The coefficient of restitution is

(1) 0·6 (2) 0·32

(3) 0·40 (4) 0·56

Q.15 The graph between potential energy U and displacement X in the state of stable equilibrium will be–



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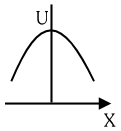

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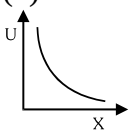

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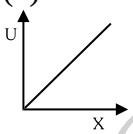


(4)

Q.16 A force $\vec{F} = (3x^2+2x-7)$ N acts on a 2 kg body as a result of which the body gets displaced from x=0 to x = 5m. The work done by the force will be –

(1) 35 Joule (2) 70 Joule

(3) 115 Joule (4) 270 Joule

Q.17 A 50 gm bullet moving with a velocity of 10 m/s gets embedded into a 950 gm stationary body. The loss in kinetic energy of the system will be –

(1) 5% (2) 50%

(3) 100% (4) 95%

Q.18 A crane lifts 300 kg weight from earth's surface upto a height of 2m in 3 seconds. The average power generated by it will be –

(1) 1960 W (2) 2205 W

(3) 4410 W (4) 0 W

Q.19 A body is dropped from a height h. When loss in its potential energy is U then its velocity is v. The mass of the body is –

(1) $U^2 / 2v$ (2) $2v / U$

(3) $2v / U^2$ (4) $2U / v^2$

Q.20 A block of mass 16 kg is moving on a frictionless horizontal surface with velocity 4m/s and comes to rest after pressing a spring. If the force constant of the spring is 100 N/m then the compression in the spring will be –

(1) 3·2 m (2) 1·6 m

(3) 0·6 m (4) 6·1 m

Q.21 A bomb initially at rest explodes by it self into three equal mass fragments. The velocities of two fragments are $(3\hat{i} + 2\hat{j})$ m/s and $(-\hat{i} - 4\hat{j})$ m/s. Velocity of the third fragment is (in m/s)

(1) $2\hat{i} + 2\hat{j}$ (2) $2\hat{i} - 2\hat{j}$

(3) $-2\hat{i} + 2\hat{j}$ (4) $-2\hat{i} - 2\hat{j}$

Q.22 A ball of mass 1 kg is released from the tower of Pisa. The kinetic energy generated in it after falling through 10m will be –

(1) 10 J (2) 9·8 J

(3) 0·98 J (4) 98 J

Q.23 A 10 kg satellite completes one revolution around the earth at a height of 100 km in 108 minutes. The work done by the gravitational force of earth will be –

(1) 108 × 100 × 10 J (2) $\frac{108 \times 10}{100}$ J

(3) 0 J (4) $\frac{100 \times 10}{108}$ J

Q.24 A particle moves in a potential region given by $U = 8x^2 - 4x + 400$ J. Its state of equilibrium will be –

(1) x = 25 m (2) x = 0·25 m

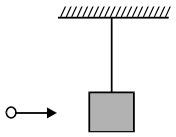
(3) x = 0·025 m (4) x = 2·5 m

Q.25 A person of mass m is standing on one end of a plank of mass M and length L and floating in water. The person moves from one end to another and stops. The displacement of the plank is –

(1) $\frac{Lm}{(m+M)}$ (2) Lm (M + m)

(3) $\frac{(M+m)}{Lm}$ (4) $\frac{LM}{(m+M)}$

Q.26 A bullet of mass m moving with a speed v strikes a wooden block of mass M and gets embedded into the block. The final speed is:-



(1) $\sqrt{\frac{M}{M+m}}\,v$ (2) $\sqrt{\frac{m}{M+m}}\,v$

(3) $\frac{m}{M+m}v$ (4) $\frac{v}{2}$

Q.27 Two men with weights in the ratio 5 : 3 run up a staircase in times in the ratio 11 : 9. The ratio of power of first to that of second is –

(1) 15 / 11 (2) 11 / 15

(3) 11 / 9 (4) 9 / 11

Q.28 The retarding force required to reduce velocity of a 3 kg body from 0·75 m/s to 0·25 m/s in 0·02 sec will be –

(1) 25 N (2) 50 N

(3) 75 N (4) 100 N

Q.29 A 2 Kg mass lying on a table is displaced in the horizontal direction through 50 cm. The work done by the normal reaction will be –

(1) 0 (2) 100 Joule

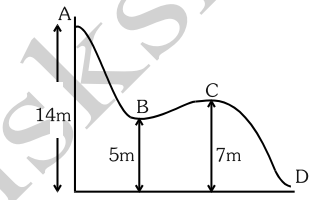
(3) 100 erg (4) 10 Joule

Q.30. A car is moving with a speed of 40 Km/hr. If the car engine generates 7 kilowatt power, then the resistance in the path of motion of the car will be –

(1) 360 Newton (2) 630 Newton

(3) Zero (4) 280 Newton

Q.31 Figure shows the vertical section of frictionless surface. A block of mass 2 kg is released from the position A; its KE as it reaches the position C is :



(1) 180J (2) 140J

(3) 40J (4) 280J

Q.32 A force $F = Kx^2$ acts on a particle at an angle of 60° with the x–axis. the work done in displacing the particle from x_1 to x_2 will be –

(1) $\frac{kx^2}{2}$ (2) $\frac{k}{2}(x_2^2 - x_1^2)$

(3) $\frac{k}{6}(x_2^3 - x_1^3)$ (4) $\frac{k}{3}(x_2^3 - x_1^3)$

Q.33 A ball moving with velocity of 9m/s collides with another similar stationary ball. After the collision both the balls move in directions making an angle of 30° with the initial direction. After the collision their speed will be

(1) 2·6 m/s (2) 5·2 m/s

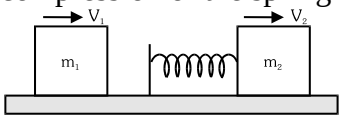
(3) 0·52 m/s (4) 52 m/s

Q.34 A bomb of 50 Kg is fired from a cannon with a velocity 600 m/s. If the mass of the cannon is 10^3 kg, then its recoil velocity will be –

(1) 30 m/s (2) –30 m/s

(3) 0·30 m/s (4) –0·30 m/s

Q.35 Two masses m_1 = 2kg and m_2 = 5kg are moving on a frictionless surface with velocities 10m/s and 3 m/s respectively. m_2 is ahead of m_1. An ideal spring of spring constant k = 1120 N/m is attached on the back side of m_2. The maximum compression of the spring will be.



(1) 0·51 m (2) 0·062 m

(3) 0·25 m (4) 0·72 m

Q.36 A solid sphere is moving and it makes an elastic collision with another stationary sphere of half of its own radius. After collision it comes to rest. The ratio of the densities of materials of second sphere and first sphere is –

(1) 2 (2) 4

(3) 8 (4) 16

Q.37 The mass of a bucket full of water is 15 kg. It is being pulled up from a 15m deep well. Due to a hole in the bucket 6 kg water flows out of the bucket. The work done in drawing the bucket out of the well will be –

(1) 900 Joule (2) 1500 Joule

(3) 1800 Joule (4) 2100 Joule

Q.38 A 5 kg body collides with another stationary body. After the collision, the bodies move in the same direction with one–third of the velocity of the first body. The mass of the second body will be –

(1) 5 kg (2) 10 kg

(3) 15 kg (4) 20 kg

Q.39 A particle of mass m is moving in a circular path of constant radius r such that its centripetal acceleration a_c is varying with time t as $a_c = k^2rt^2$, where k is a constant. The power delivered to the particle by the forces acting on it will be –

(1) mk^2t^2r (2) $mk^2r^2t^2$

(3) zero (4) mk^2r^2t

Q.40 A 10 g bullet, moving with a velocity of 500m/s. enters a stationary piece of ice of mass 10 kg and stops. If the piece of ice is lying on a frictionless plane, then its velocity will be

(1) 5 cm/s (2) 5 m/s

(3) 0·5 m/s (4) 0·5 cm/s

Q.41 A 5gm lump of clay, moving with a velocity of 10 cm/s towards east, collides head–on with another 2gm lump of clay moving with 15 cm/s towards west. After collision, the two lumps stick together. The velocity of the compound lump will be –

(1) 5 cm/s towards east

(2) 5 cm/s towards west

(3) 2·88 cm/s towards east

(4) 2·5 cm/s towards west

Q.42 A frictionless steel ball of radius 2cm, moving on a horizontal plane with a velocity of 5cm/s, collides head–on with another stationary steel ball of radius 3cm. The velocities of two bodies after collision will respectively be (in cm/s) (e = 1) –

(1) 2·7, 2·3 (2) –2·7, 2·3

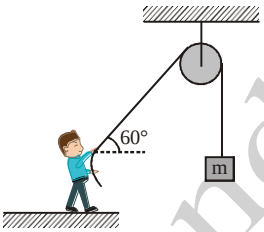
(3) 2·7, –2·3 (4) –2·7, –2·3

Q.43 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 second is :-

(1) 5.28 J (2) 450 mJ

(3) 490 mJ (4) 530 mJ

Q.44 A man is supplying an instantaneous power of 500 J/s to a massless string by pulling it at an instantaneous speed of 10 m/s as shown. It is known that kinetic energy of the block is increasing at a rate of 100 J/s at that instant. Then the mass of the block is –



(1) 5 kg (2) 3 kg

(3) 10 kg (4) 4 kg

Q.45 A shell is fired from a cannon with velocity V m/s at an angle θ with the horizontal direction. At the highest point in its path with same speed it explodes into two pieces of equal masses. One of the pieces retraces its path to the cannon. The speed in m/sec. of the other piece immediately after the explosion is :-

(1) $\left(\frac{\sqrt{3}}{2}\right)$ V cos θ (2) 3V cos θ

(3) 2V cos θ (4) $\left(\frac{3}{2}\right)$ V cos θ