JEE PHYSICS

Topic: Work, Power, Energy

Q.1 A block of mass 2kg slipped up a slant plane requires 300J of work. If height of slant is 10m the work done against friction is -

(A) 100J (B) 200J

(C) 300J (D) zero

Q.2 A chain of mass m and length ℓ is placed on a table with one-sixth of it hanging freely from the table edge. The amount of work done to pull the chain on the table is-

(A) $mg\ell/4$ (B) $mg\ell/6$

(C) $mg\ell/72$ (D) $mg\ell/36$

Q.3 Under the action of a force a 2kg mass moves such that its position x as a function of time is given by $x = t^3/3$ where x is in metres and t in seconds. The work done by the force in first two seconds is-

(A) 1600 joules (B) 160joules

(C) 16joules (D) 1.6 joules

Q.4 A locomotive of mass m starts moving so that its velocity varies according to the law $v = k\sqrt{s}$ where k is constant and s is the distance covered. Find the total work performed by all the forces which are acting on the locomotive during the first t seconds after the beginning of motion.

(A) $W = \frac{1}{8} mk^4t^2$ (B) $W = \frac{1}{4} m^2k^4t^2$

(C) $W = \frac{1}{4} mk^4t^4$ (D) $W = \frac{1}{8} mk^4t^4$

Q.5 A metal ball hits a wall and does not rebound whereas a rubber ball of the same mass on hitting the wall the same velocity rebounds back. It can be concluded that -

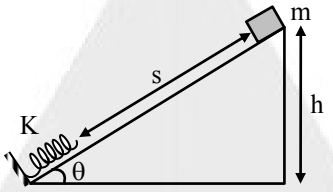
(A) metal ball sufferes greater change in momentum

(B) rubber ball suffers greater change in momentum.

(C) the initial momentum of metal ball is greater than the initial momentum of rubber ball.

(D) both suffer same change in momentum.

Q.6 A block of mass m slips down an inclined plane as shown in the figure. When it reaches the bottom it presses the spring by a length (spring length <<h and spring constant = K)-



(A) $(2mgh/K)^{1/2}$ (B) $(mgh/K)^{1/2}$

(C) $(2gh/mK)^{1/2}$ (D) $(gh/mK)^{1/2}$

Q.7 The force required to row a boat over the sea is proportional to the speed of the boat. It is found that it takes 24 h.p. to row a certain boat at a speed of 8km/hr, the horse power required when speed is doubled -

(A) 12 h.p. (B) 6 h.p.

(C) 48 h.p. (D) 96 h.p.

Q.8 Two balls at the same temperature collide inelastically. What is conserved-

(A) momentum (B) velocity

(C) temperature (D) kinetic energy

Q.9 From a waterfall, water is pouring down at the rate of 100kg per second on the blades of turbine. If the height of the fall is 100m, the power delivered to the turbine is approximately equal to-

(A) 100 kW (B) 10kW

(C) 1 kW (D) 100W

Q.10 An engine pumps a liquid of density 'd' continuously through a pipe of area of cross section A. If the speed with which the liquid passes through a pipe is v, then the rate at which the Kinetic energy is being imparted to the liquid is-

(A) $Adv^3/2$ (B) (1/2)Adv

(C) $Adv^2/2$ (D) Adv^2

Q.11 A 5 kg block is lifted vertically through a height of 5 metre by a force of 60N. Determine **(i)** the work done by applied force in lifting the block, **(ii)** the potential energy of the block at 5m, **(iii)** the kinetic energy of the block at 5 m **(iv)** the velocity of the block at 5 m-

(A) 300 J, 245 J, 55J, 4.69 m/s

(B) 200 J, 245 J, 50J, 4.69 m/s

(C) 150 J, 150 J, 50J, 4.69 m/s

(D) 300 J, 245 J, 100J, 10.69 m/s

Q.12 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}

Q.13 A particle moves in the x - y plane under the action of a force $\vec{F}$ such that the value of its linear momentum P at any time t is $P_x = 2 \cos t$, $P_y = 2 \sin t$ the angle 'θ' between $\vec{F}$ and $\vec{P}$ at any given time t will be -

(A) 90º (B) 0° (C) 180º (D) 30º

Q.14 Sand drops fall vertically at the rate of 2kg/sec on to a conveyor belt moving horizontally with the velocity of 0.2 m/sec. Then the extra force needed to keep the belt moving is

(A) 0.4 Newton (B) 0.08 Newton

(C) 0.04 Newton (D) 0.2 Newton

Q.15 A boy is standing at the centre of a boat which is free to move on water. If the masses of the boy and the boat are m_1 and m_2 respectively and the boy moves a distance of 1 m forward then the movement of the boat is ..... metres

(A) $\frac{m_1}{m_1+m_2}$ (B) $\frac{m_2}{m_1+m_2}$

(C) $\frac{m_1}{m_2}$ (D) $\frac{m_2}{m_1}$

Q.16 Kinetic energy of a particle moving in a straight line varies with time t as $K = 4t^2$. The force acting on the particle-

(A) is constant

(B) is increasing

(C) is decreasing

(D) first increase and then decrease

Q.17 A force $\vec{F} = (2\hat{i} + 5\hat{j} + \hat{k})$ is acting on a particle. The particle is first displaced from (0, 0, 0) to (2m, 2m, 0) along the path x = y and then from (2m, 2m, 0) to (2m, 2m, 2m) along the path x = 2m, y = 2m. The total work done in the complete path is -

(A) 12 J (B) 8 J (C) 16 J (D) 10 J

Q.18 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

Q.19 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

Q.20 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

Q.21 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) $\sqrt{3g\ell}$

Q.22 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

Q.23 A body of mass m kg collides elastically with another body at rest and then continues to move in the original direction with one half of its original speed. what is the mass of the target body ?

(A) m kg (B) 2/3 m kg

(C) m/3 kg (D) m/2 kg

Q.24 A moving sphere of mass m suffer a perfect elastic collision (not head on) with an equally massive stationary sphere. After collision both fly off at angle θ, value of which is :

(A) 0 (B) π

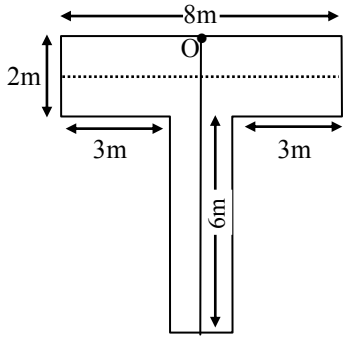
(C) indeterminate (D) $\pi/2$

Q.25 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

Q.26 The distance of the centre of mass of T–shaped plate from O is –



(A) 7m (B) 2.7m (C) 4m (D) 1m

Passage (Q. 27 to 30)

"Ramu picks small block of mass 200 g and kept it at the top of a frictionless incline which is 10 m long and 3.2 m high. There are two ways of carrying the block up. One directly lifting the block and placing at the top of the incline and other by sliding the block to the top from bottom."(Take g = 10 m/s^2)

Q.27 How much work was required to lift the block from the ground and put it at the top ?

(A) 6.4 J (B) 3.2 J (C) 1.6 J (D) None of these

Q.28 How much work was required to slide the block up the incline and put it at the top ?

(A) 6.4 J (B) 3.2 J (C) 1.6 J (D) None of these

Q.29 What will be the speed of the block when it reaches the ground if it falls off the incline ?

(A) 2m/s (B) 4 m/s (C) 8 m/s (D) None of these

Q.30 What will be the speed of the block when it reaches the ground if it slides down the incline ?

(A) 2 m/s (B) 4 m/s (C) 8 m/s (D) None of these

ANSWER KEY

Que.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Ans.	A	C	C	A	B	A	D	A	A	A
Que.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Ans.	A	B	A	A	A	A	C	A	C	B
Que.	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Ans.	B	A	C	D	A	B	A	A	C	C