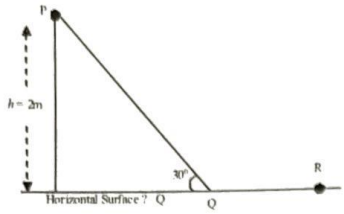
JEE Mains & Advanced Past Years Questions

JEE-MAIN PREVIOUS YEAR'S

1. A point particle of mass m, moves along the uniformly rough track PQR as shown in the figure. The coefficient of friction, between the particle and the rough track equals ì. The particle is released, from rest, from the point P and it comes to rest at a point R. The energies, lost by the ball, over the parts, PQ and QR, of the track, are equal to each other, and no energy is lost when particle changes direction from PQ to QR.
The values of the coefficient of friction ì and the distance x(= QR), are, respectively close to :

[*JEE Main-2016*]



(*a*) 0.2 and 6.5 m (*b*) 0.2 and 3.5 m
(*c*) 0.29 and 3.5 m (*d*) 0.29 and 6.5 m

2. A person trying to lose weight by burning fat lifts a mass of 10 kg upto a height of 1 m 1000 times. Assume that the potential energy lost each time he lowers the mass is dissipated. How much fat will he use up considering the work done only when the weight is lifted up? Fat supplies 3.8×10^7 J of energy per kg which is converted to mechanical energy with a 20% efficiency rate. Take g = 9.8 ms^{-2} : **[*JEE Main-2016*]**

(*a*) 2.45×10^{-3} kg (*b*) 6.45×10^{-3} kg
(*c*) 9.89×10^{-3} kg (*d*) 12.89×1^{-3} kg

3. A body of mass m = 10^{-2} kg is moving in a medium and experiences a frictional force F = $-kv^2$. Its intial speed is v_0 = 10 ms^{-1}. If, after 10 s, its energy is $\frac{1}{8}mv_0^2$, the value of k will be: **[*JEE Main-2017*]**

(*a*) 10^{-4} kg m^{-1} (*b*) 10^{-1} Kg m^{-1} s^{-1}
(*c*) 10^{-3} kg m^{-1} (*d*) 10^{-3} Kg s^{-1}

4. A time dependent force F = 6t acts on a particle of mass 1 kg. If the particle starts from rest, the work done by the force during the first 1 sec. will be: **[*JEE Main-2017*]**

(*a*) 9 J (*b*) 18 J
(*c*) 4.5 J (*d*) 22 J

5. 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 Main-2018*]**

(*a*) $\frac{k}{2a^2}$ (*b*) zero

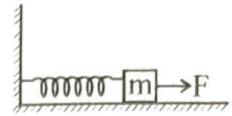
(*c*) $-\frac{3}{2}\frac{k}{a^2}$ (*d*) $-\frac{k}{4a^2}$

6. 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 Main-2019 (January)*]**

(*a*) 850 J (*b*) 950 J
(*c*) 875 J (*d*) 900 J

7. A block of mass m, lying on a smooth horizontal surface, is attached to a spring (of negligible mass) of spring constant k. The other end of the spring is fixed, as shown in the figure. The block is initially at rest in a equilibrium position. If now the block is pulled with a constant force F, the maximum speed of the block is

[*JEE Main-2019 (January)*]



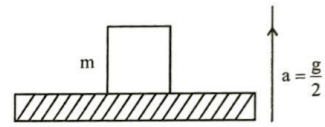
(*a*) $\frac{2F}{\sqrt{mk}}$ (*b*) $\frac{F}{\pi\sqrt{mk}}$

(*c*) $\frac{\pi F}{\sqrt{mk}}$ (*d*) $\frac{F}{\sqrt{mk}}$

8. A particle which is experiencing a force, given by $\vec{F} = 3\vec{i} - 12\vec{j}$, undergoes a displacement of $\vec{d} = 4\vec{i}$. If the particle had a kinetic energy of 3 J at the beginning of the displacement, what is its kinetic energy at the end of the displacement ? **[*JEE Main-2019 (January)*]**

(*a*) 9 J (*b*) 12 K
(*c*) 10 J (*d*) 15 J

9. A block of mass m is kept on a platform which starts from rest with constant acceleration g/2 upward, as shown in figure. Work done by normal reaction on block in time t is: **[*JEE Main-2019 (January)*]**

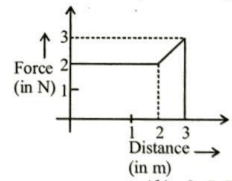


(*a*) $-\frac{mg^2t^2}{8}$ (*b*) $\frac{mg^2t^2}{8}$

(*c*) 0 (*d*) $\frac{3mg^2t^2}{8}$

10. A particle moves in one dimension from rest under the influence of a force that varies with the distance travelled by the particle as shown in the figure. The kinetic energy of the particle after it has travelled 3m is

[*JEE Main-2019 (April)*]



(*a*) 6.5 J (*b*) 2.5 J
(*c*) 4 J (*d*) 5 J

11. A uniform cable of mass 'M' and length 'L' is placed on a horizontal surface such that its $\left(\frac{1}{n}\right)^{th}$ part is hanging below the edge of the surface. To lift the hanging part of the cable upto the surface, the work done should be

[*JEE Main-2019 (April)*]

(*a*) $\frac{MgL}{n^2}$ (*b*) $\frac{MgL}{2n^2}$

(*c*) $\frac{2MgL}{n^2}$ (*d*) nMgL

12. A spring whose unstreched length is l has a force constant k. The spring is cut into two pieces of unstretched lengths l_1 and l_2 where, $l_1 = nl_2$ and n is an integer. The ratio k_1/k_2 of the corresponding force constants, k_1 and k_2 will be: [*JEE Main-2019 (April)*]

(*a*) $\frac{1}{n^2}$ (*b*) n^2

(*c*) $\frac{1}{n}$ (*d*) n

13. A person of mass M is, sitting on a swing of length L and swinging with an angular amplitude θ_0. If the person stands up when the swing passes through its lowest point, the work done by him, assuming that his centre of mass moves by a distance $\ell(\ell << L)$, is close to:

[*JEE Main-2019 (April)*]

(*a*) $Mg\ell$ (*b*) $Mg\ell(1+\theta_0^2)$

(*c*) $Mg\ell\left(1-\theta_0^2\right)$ (*d*) $Mg\ell\left(1+\frac{\theta_0^2}{2}\right)$

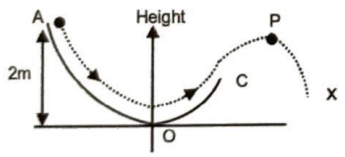
14. A 60 HP electric motor lifts an elevator having a maximum total load capacity of 2000 kg. If the frictional force on the elevator is 4000 N, the speed of the elevator at full load is close to : (1 HP = 746 W, g = 10 ms^{-2})

[*JEE Main-2020 (January)*]

(*a*) 1.5 ms^{-1} (*b*) 1.9 ms^{-1}

(*c*) 2.0 ms^{-1} (*d*) 1.7 ms^{-1}

15. A particle (m = 1 kg) slides down a frictionless track (AOC) starting from rest at a point A(height 2m). After reaching C, the particle continues to move freely in air as a projectile. When it reaching its highest point P(height 1m), the kinetic energy of the particle (in J) is : (Figure drawn is schematic and not to scale; Take g = 10 ms^{-2})..... [*JEE Main-2020 (January)*]



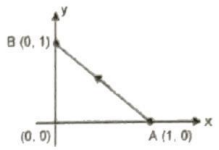
16. An elevator in a building can carry a maximum of 10 persons, with the average mass of each person being 68 kg. The mass of the elevator itself is 920 kg and it moves with a constant speed of 3 m/s. The frictional force opposing the motion is 6000 N. If the elevator is moving up with its full capacity, the power delivered by the motor to the elevator (g = 10 m/s^2) must be at least:

(g = 10 m/s^{-2}) [*JEE Main-2020 (January)*]

(*a*) 62360 W (*b*) 56300W

(*c*) 48000W (*d*) 66000W

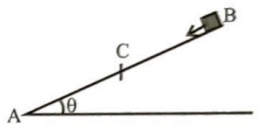
17. Consider a force $\vec{F} = -x\hat{i} + y\hat{j}$. The work done by this force in moving a particle from point A(1,0) to B(0,1) along the line segment is : [*JEE Main-2020 (January)*]
(All quantities are in SI units)



(*a*) $\frac{1}{2}$ (*b*) $\frac{3}{2}$

(*c*) 2 (*d*) 1

18. A small block starts slipping down from a point B on an inclined plane AB, which is making an



angle θ with the horizontal section BC is smooth and the remaining section CA is rough with a coefficient of friction μ. It is found thatt the block comes to rest as it reaches the bottom (point A) of the incl i ned pl ane. If BC = 2AC, the coefficient of friction is given by μ = k tanθ. The value of K is _____.

[*JEE Main-2020 (September)*]

19. A cricket ball of mass 0.15 kg is thrown vertically up by a bowling machine so that it rises to a maximum height of 20 m after leaving the machine. If the part pushing the ball applies a constant force F on the ball and moves horizontally a distance of 0.2 m while launching) the ball, the value of F (in N) is (g = 10 ms^{-2}) ____.

[*JEE Main-2020 (September)*]

20. A person pushes a box on a rough horizontal platform surface. He applies a force of 200 N over a distance of 15 m. Thereafter, he gets progressively tired and his applied force reduces linearly with distance to 100 N. The total distance through which the box has been moved is 30 m. What is the work done by the person during the total movement of the box?

[*JEE Main-2020 (September)*]

(*a*) 5690 J (*b*) 3280 J

(*c*) 5250 J (*d*) 2780 J

21. A body of mass 2 kg is driven by an engine delivering a constant power of 1 J/s. The body starts from rest and moves in a straight line. After 9 seconds, the body has moved a distance (in m) _____.

[*JEE Main-2020 (September)*]

22. If the potential energy between two molecules is given by $U = -\frac{A}{r^6} + \frac{B}{r^{12}}$, then at equilibrium, separation between molecules, and the potential energy are

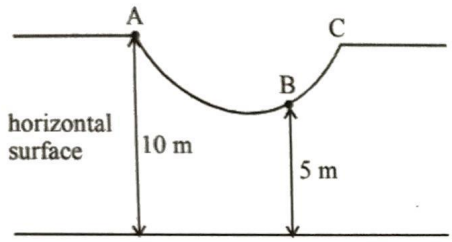
[*JEE Main-2020 (September)*]

23. A ball of mass 4 kg, moving with a velocity of 10 ms^{-1}, collides with a spring of length 8 m and force constant 100 Nm^{-1}. The length of the compressed spring is $\times$ m. The value of x, to the nearest integer, is

[*JEE Main-2021 (March)*]

24. As shown in the figure, a particle of mass 10 kg is placed at a point A. When the particle is slightly displaced to its right, it starts moving and reaches the point B. The speed of the particle at B is x m/s. (Take g = 10 m/s^2) The value of 'x' to the nearest integer is

[*JEE Main-2021 (March)*]



JEE-ADVANCED PREVIOUS YEAR'S

1. The work done on a particle of mass m by a force, K $\left[\frac{x}{(x^2+y^2)^{3/2}}\hat{i} + \frac{y}{(x^2+y^2)^{3/2}}\hat{j}\right]$ (K being a constant of appropriate dimensions), when the particle is taken from the point (a, 0) to the point (0, a) along a circular path of radius a about the origin in the x-y plane is:

[*JEE Advanced-2013*]

(*a*) $\frac{2K\pi}{a}$ (*b*) $\frac{K\pi}{a}$

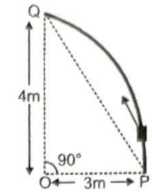
(*c*) $\frac{K\pi}{2a}$ (*d*) 0

2. A particle of mass 0.2 kg is moving in one dimension under a force that delivers a constant power 0.5 W to the particle. If the initial speed (in ms^{-1}) of the particle is zero, the speed (in ms^{-1}) after 5s is:

[*JEE Advanced-2013*]

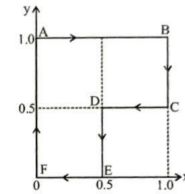
3. Consider an elliptically shaped rail PQ in the vertical plane with OP = 3m and OQ= 4m. A block of mass 1kg is pulled along the rail from P to Q with a force of 18 N, Which is always parallel to line PQ (see the figure given). Assuming no frictional losses, the kinetic energy of the block when it reaches Q is (n $\times$ 10) joules. The value of n is (take acceleration due to gravity = 10 ms^{-2})

[*JEE Advanced-2014*]



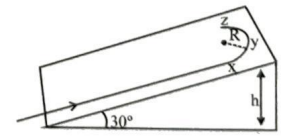
4. A particle is moved along a path AB-BC-CD-DE-EF-FA, as shown in figure, in presence of a force $\vec{F} = (\alpha y\hat{i} + 2\alpha x\hat{j})$ N where x and y are in meter and a = –1N/m–1. The work done on the particle by this force $\vec{F}$ will be ____ Joule

[*JEE Advanced-2019*]



5. A student skates up a ramp that makes an angle 30° with the horizontal. He/she starts (as shown in the figure) at the bottom of the ramp with speed v_0 and wants to turn around over a semicircular path xyz of radius R during which he/she reaches a maximum height h (at point y) from the ground as shown in the figure. Assume that the energy loss is negligible and the force required for this turn at the highest point is provided by his/her weight only. Then (g is the acceleration due to gravity)

[*JEE (Advanced)-2020*]



(*a*) $v_0^2 - 2gh = \frac{1}{2}gR$

(*b*) $v_0^2 - 2gh = \frac{\sqrt{3}}{2}gR$

(*c*) the centripetal force required at points x and z is zero

(*d*) the centripetal force required is maximum at points x and z

JEE Mains & Advanced Past Years Questions

JEE-MAIN
PREVIOUS YEAR'S

1. (*d*)	**2.** (*d*)	**3.** (*a*)	**4.** (*c*)	**5.** (*b*)	**6.** (*d*)	**7.** (*d*)	**8.** (*d*)	**9.** (*d*)	**10.** (*a*)
11. (*b*)	**12.** (*c*)	**13.** (*b*)	**14.** (*b*)	**15.** (10)	**16.** (*d*)	**17.** (*d*)	**18.** (*c*)	**19.** (150.00)	**20.** (*c*)
21. (18.00)	**22.** (*c*)	**23.** [6]	**24.** [10]						

JEE-ADVANCED
PREVIOUS YEAR'S

1. (*d*)	**2.** [5]	**3.** [5]	**4.** (0.75)	**5.** (*a*, *d*)