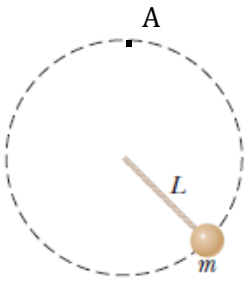
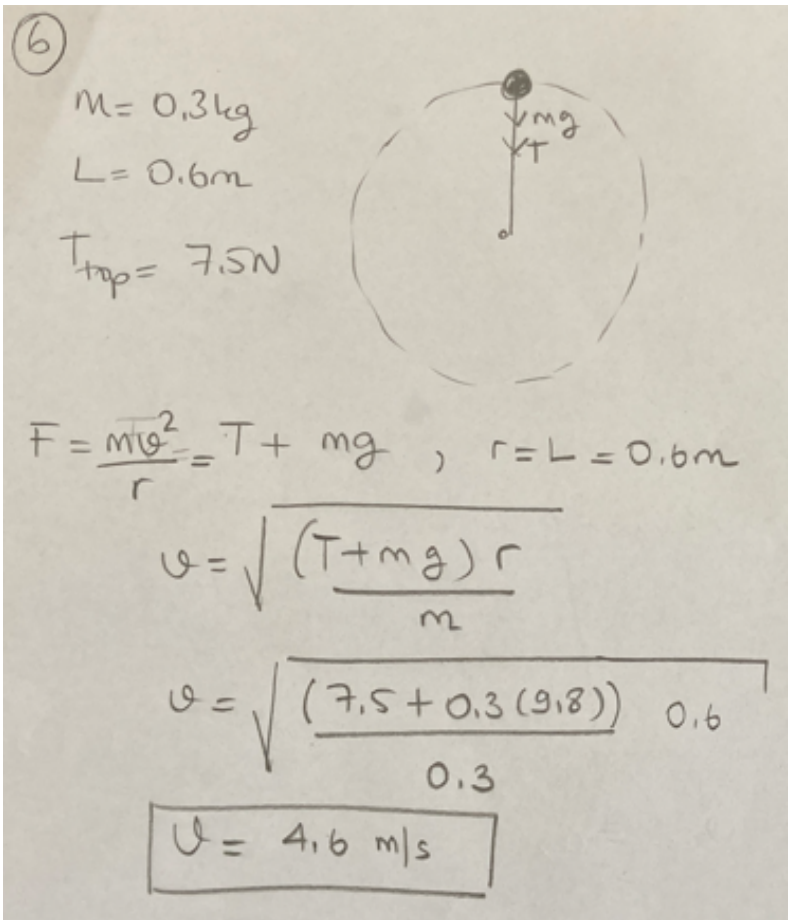
QUESTIONS

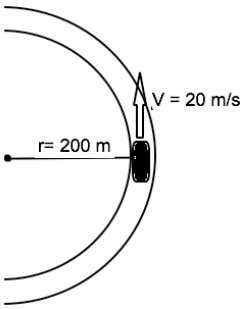
1. A ball of mass m = 300 g swings in a vertical circular path on a string L = 0.6 m long as in figure. If the tension is 7.5 N at the top of the circle, what is the speed (in m/s) of the ball at this point? (g = 9.8 m/s^2)



A) 2.5 B) 3.3 C) 4.6 D) 5.9 E) 7.1



2. What must be the coefficient of minimum friction between the tires and the level roadway to allow a car to make a curve of radius r = 200 m at a speed of 20 m/s? (g = 9.8 m/s^2)



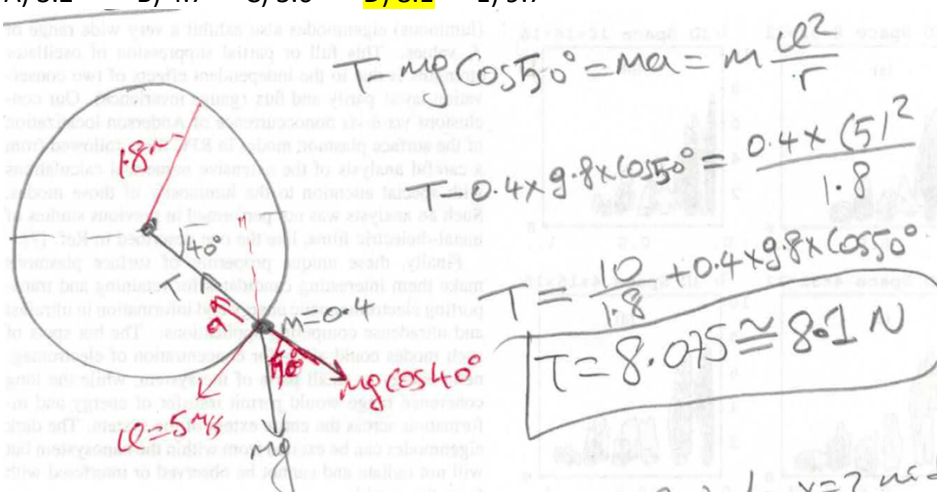
A) 0.1 B) 0.2 C) 0.3 D) 0.4 E) 0.5

$$F_s = \mu Mg = \frac{MV^2}{r}$$

$$\mu = \frac{V^2}{gr} = \frac{20^2}{9{,}8.200} = 0{,}2$$

3. 0.4 kg mass attached to the end of a string swings in a vertical circle having a radius of 1.8 m. At an instant when the string makes an angle of 40° below the horizontal, the speed of the mass is 5 m/s. What is the magnitude of the tension (in N) in the string at this instant? (g = 9.8 m/s^2)

A) 3.2 B) 4.7 C) 5.6 D) 8.1 E) 9.7



4. A block of mass m can turn a frictionless bend with a slope of θ and a radius of r = 100 m at a speed of 20 m/s without slipping. What is the banked angle θ (in degrees)? (g = 10 m/s^2)

A) 22 B) 25 C) 28 D) 30 E) 32

$N\ sin\theta = mv^2/r$
$N\ cos\theta = mg$
Taraf tarafa bölünürse
$tan\theta = \frac{v^2}{rg} = \frac{20^2}{(100)(10)}$
$\theta \approx 21{,}8°$

5. A particle moves at constant speed in a circular path. The instantaneous velocity and instantaneous acceleration vectors are:

A) Perpendicular to each other.
B) Both perpendicular to the circular path.
C) Both tangent to the circular path.
D) Opposite to each other.
E) None of the above.

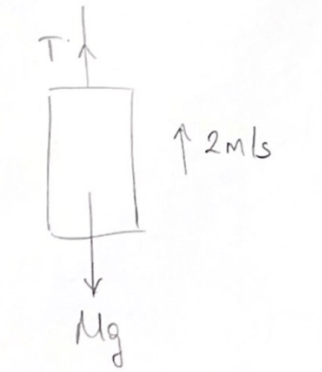
6. When a certain rubber band is stretched a distance x, it exerts a restoring force of magnitude F = $ax+bx^2$, where a and b are constants. The work done in stretching this rubber band from x = 0 to x = L is:

A) $aL^2 + bLx^3$
B) $aL + 2bL^2$
C) $a + 2bL$
D) bL
E) $aL^2/2 + bL^3/3$

$W = \int \vec{F} \cdot \overrightarrow{dx}$ $W = \int_0^L (ax + bx^2)\, dx$ $W = \frac{1}{2}aL^2 + \frac{1}{3}bL^3$

7. A 1400 kg elevator driven by an electric motor can safely carry a maximum load of 900 kg. What is the power in kW provided by the motor when the elevator ascends with a full load at a constant speed of 2 m/s? (g = 10 m/s^2)

A) 13 B) 23 C) 32 D) 46 E) 72



Tam yük olduğunda ;

$M = 1400 + 900\,kg = 2300\,kg$

$P = T\,v$

$\Sigma F = T - Mg = Ma = 0$

$T = Mg = 2300 \times 10 = 23 \times 10^3\,N$

$P = 23 \times 10^3 \times 2 = 46\,kW$

8. A box is being pulled up a rough incline by a rope connected to a pulley. How many forces are doing work on the box?

A) one force
B) two forces
C) three forces
D) four forces
E) no force is doing work

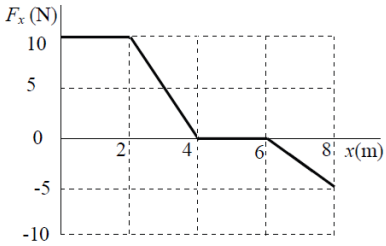
9. A force **F** of magnitude 12 N does work on a particle as the particle moves through the displacement **d**=2**i**−4**j**+3**k** m. What is the angle (in degrees) between the force and the displacement vector if the change in the particle's kinetic energy is 30 J?

A) 30 B) 13 C) 110 D) 140 E) 62

$d = \sqrt{(2)^2 + (-4)^2 + (3)^2} = 5{,}39\,m$

$W = \Delta K = Fd\cos\theta \Rightarrow 30 = (12)(5{,}39)\cos\theta \Rightarrow \theta = 62{,}4°$

10. The only force acting on a 2 kg mass as it moves along the x-axis varies as shown. If the speed of the mass at x = 0 is 4 m/s, find its speed (in m/s) at x = 8 m.



A) 10.2 B) 9.3 C) 8.4 D) 7.5 E) 6.4

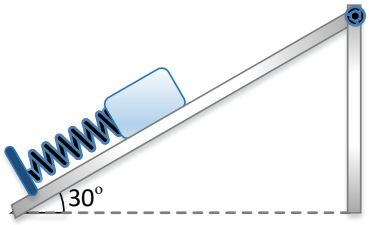
$W_{tot} = \Delta k$

area under the curve = $K_f - K_i$

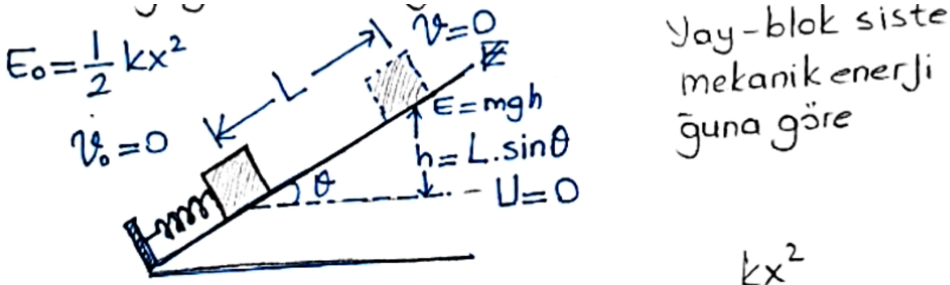
$$2(10) + \frac{1}{2}(2)(10) + \frac{1}{2}(2)(-5) = \frac{1}{2}(2)v^2 - \frac{1}{2}(2)(4)^2$$

$v = 6.4\,m/s$

11. A block of mass 1.8 kg is placed in front of a compressed spring resting on a frictionless inclined plane with an angle of inclination of 30°. With a spring constant of 1980 N/m, the compression amount of the spring is 22 cm. Which of the following is the distance (in m) taken by the released block until it comes to rest relative to its original position on the inclined plane? ($g = 9.8\ m/s^2$)



A) 8.6 B) 5.4 C) 3.2 D) 2.7 E) 1.0



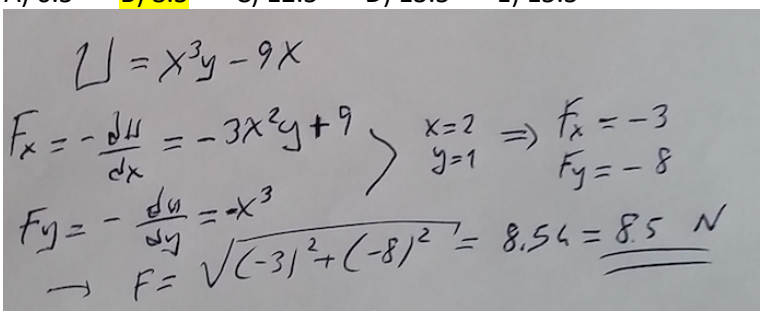
Yay-blok sisteminde mekanik enerji korunduğuna göre

$$\frac{1}{2}kx^2 = m.g.L\sin\theta \Rightarrow L=\frac{kx^2}{2.m.g\sin\theta}$$

$$L=\frac{(1980\ N/m)(0{,}22\ m)}{2.(1{,}8\ kg)(9{,}8\ m/s^2)\,0{,}5}=5{,}4\ m$$

12. A potential energy function for a system in which a two-dimensional force acts is of the form $U= x^3y-9x$. Find the magnitude of the force (in N) that acts at the point (x=−2, y=1).

A) 6.5 B) 8.5 C) 12.5 D) 13.5 E) 15.5



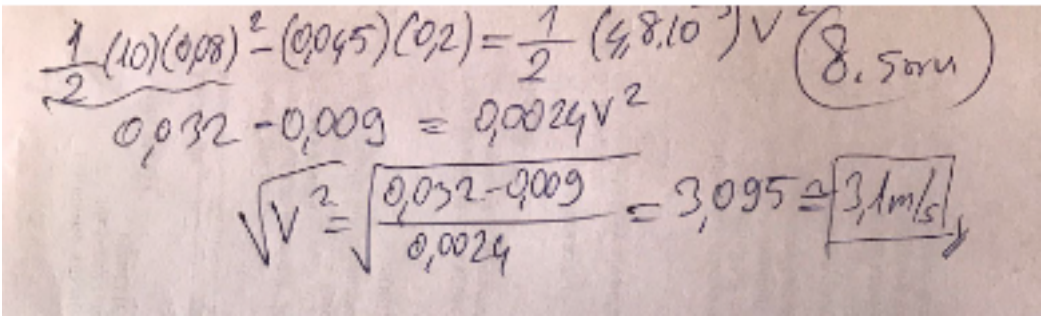
13. A block of mass 2 kg moves on a frictionless horizontal plane with a speed of 10 m/s, colliding with a fixed spring at one end and compressing it by a maximum of 20 cm. What is the spring constant (in N/m)?

A) 9000 B) 8000 C) 6000 D) 5000 E) 2500

$K_i+U_i=K_s+U_s$
$(mv^2)/2 + 0 = 0 + (kx^2)/2$
$k = (mv^2)/2 + 0 = 0+$
$k = 5000\ N/m$

14. A toy cannon uses a spring to project a 4.8 g soft rubber ball. The spring is originally compressed by 8 cm and has a force constant of 10 N/m. When the cannon is fired, the ball moves 20 cm through the horizontal barrel of the cannon, and there is a constant friction force of 0.045 N between the barrel and the ball. With what speed (in m/s) does the projectile leave the barrel of the cannon?

A) 1.2 B) 2.3 C) 3.1 D) 4.9 E) 5.8



15. Which of the following statements is/are correct?

I. The work done by the conservative force is independent of the path taken.

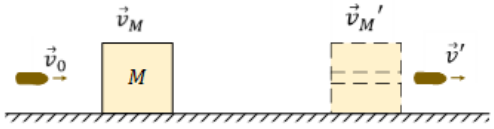
II. The work done by a conservative force on a particle along a closed path is nonzero.

III. Frictional force is an example of a conservative force.

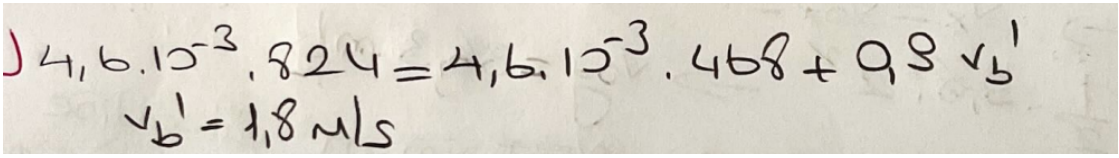
IV. If the force causes a change in mechanical energy, it is nonconservative.

A) Only I B) I, II and III C) Only IV D) I, II and IV E) I and IV

16. A 4.6 g bullet moving along $+x$ axis horizontally with an initial speed of 824 m/s passes completely through a block and emerges with a speed of 468 m/s as shown in figure. Assume that the mass of the block is 0.9 kg, initially it stays at rest on a frictionless, horizontal surface and the mass doesn't change after the collision. Find the magnitude of velocity of the block in m/s.



A) 1.5 B) 1.8 C) 2.0 D) 2.3 E) 1.2



17. A 0.1 kg hokey puck is moving on an icy, frictionless, horizontal surface. Initially, the puck is moving to the right at 3 m/s. If a force of 24 N directed to the left is applied for 5×10^{-2} s, what is the final speed (in m/s) of the puck?

A) 15 B) 11 C) 9 D) 7 E) 5

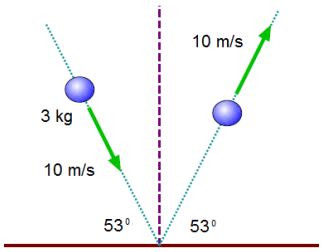
$J_x = (-24)(0,05) = -1,2\,kg$

$p_{2x} = J_x + p_{1x}$

$mv = -1,2 + (0,1)(3)$

$(0,1)\,v = -0,3 \Rightarrow v = -\frac{0,3}{0,1} = 3\,m/s$

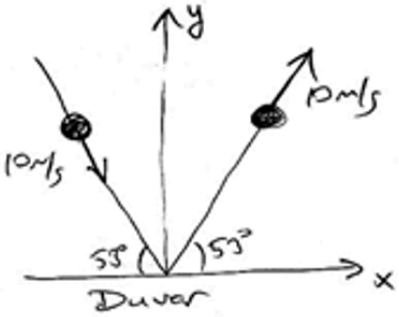
18. A 3.0 kg steel ball strikes a wall with a speed of 10 m/s at an angle of 53° with the surface. It bounces off with the same speed and angle, as shown in Figure. If the ball is in contact with the wall for 0.20 s, what is the average force (in N) exerted by the wall onthe ball?



A) 240; out off the wall
B) 240; towards the wall
C) 80; out off the wall
D) 80; towards the wall
E) 80; 53° with the wall surface

Ortalama kuvvet $\vec{F} = \frac{\Delta\vec{p}}{\Delta t}$ olarak tanımlanır.

Çarpışma sırası ve sonrası hızın x-bileşeni değişmez, y-bileşeni değişir.



O halde

$v_{iy} = -10.\sin 53° = -8\,m/s$

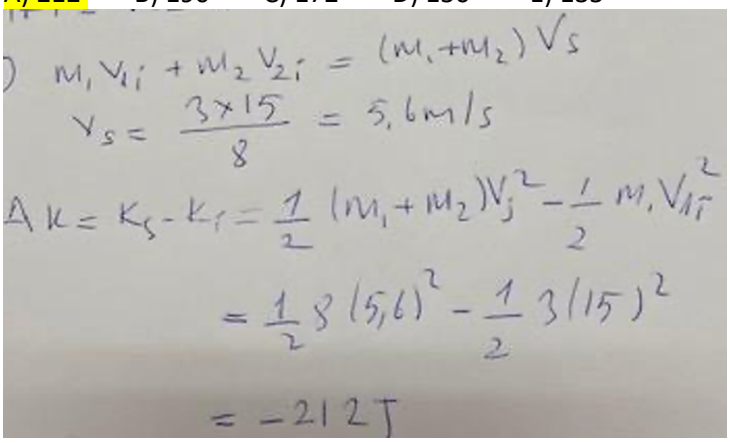
$v_{sy} = 10\sin 53° = +8\,m/s$

$\Delta p_y = m v_{sy} - m v_{iy} = 3.8 - 3.(-8) = 48\,kg.m/s$

$\bar{F}_y = \frac{\Delta p_y}{\Delta t} = \frac{I}{\Delta t} = \frac{48.}{0,2} \Rightarrow \bar{F} = 240\,N/m$ Duvarda dışarı doğru

19. A 3 kg mass moving at 15 m/s collides with a 5 kg mass at rest, which is completely inelastic. How much energy is lost in this collision (in J)?

A) 212 B) 190 C) 172 D) 150 E) 135



20. A firehose directs a steady stream of 15 kg/minute of water with velocity 28 m/s against a flat plate. What force (in N) is required to hold the plate in place?

A) 110 B) 220 C) 11 D) 7 E) 450