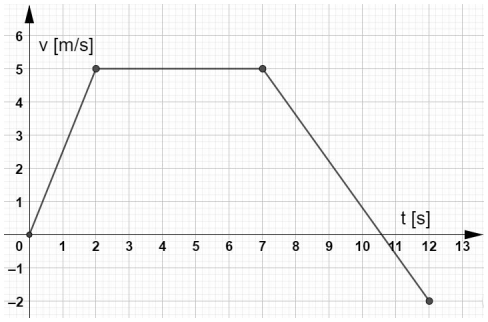
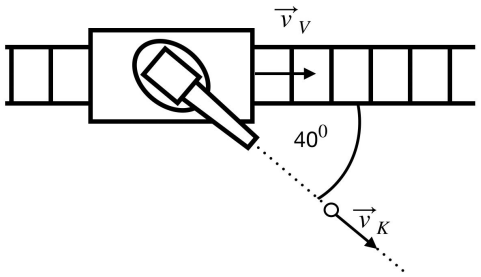
1. poskusni kolokvij iz fizike - 15. 12. 2020

1.) Avto vozi po ravni cesti tako kot prikazuje graf njegove hitrosti v odvisnosti od časa.

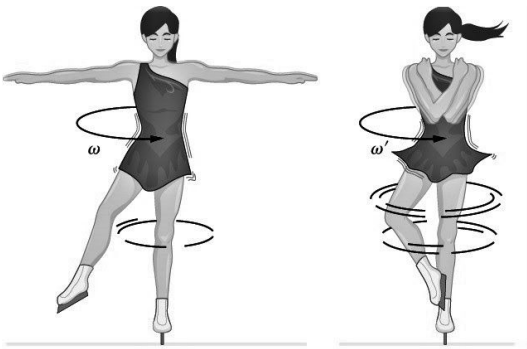


a) Kolikšno pot prepotuje avto po $t = 7\ s$?
b) Kolikšen je pospešek avta zadnjih $5\ s$?
c) Nariši časovno odvisnost lege in pospeška avta. Privzemi, da se avto giblje v 1D.

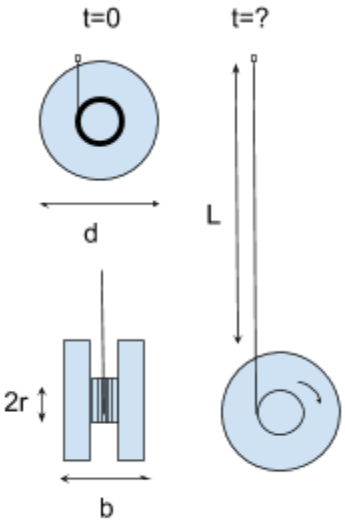
2.) Oklepni vlak, z maso $30\ t$, se giblje s hitrostjo $10\ km/h$. Topnik na vlaku izstreli $20\ kg$ težko kroglo, s hitrostjo $200\ m/s$, pod kotom $40°$ glede na smer gibanja vlaka. S kolikšno hitrostjo se giblje vlak po tem, ko izstreli topniško kroglo, če so njegovi pogonski motorji izklopljeni? Kolikšen sunek sile pri tem prevzamejo tračnice? Ker je hitrost krogle velika, v primerjavi s hitrostjo vlaka, lahko privzameš, da ima krogla enako velikost in smer hitrosti v sistemu vlaka in v laboratorijskem sistemu.



3.) Umetnostna drsalka na ledu izvede pirueto. Na začetku ima roke v odročenju in se vrti s krožno frekvenco $2.5\ s^{-1}$ Takrat je njen vztrajnostni moment $1.5\ kgm^2$. V pirueti roke priroči, tako da se njen vztrajnostni moment zmanjša na $1\ kgm^2$. S kolikšno krožno frekvenco se vrti v pirueti? Koliko dela je opravila drsalka, ko je skrčila roki?



4.) Janezek je jojo izrezal iz homogenega kosa lesa gostote $500\ kg/m^3$, tako da je v valj premera $d = 6\ cm$ in širine $b = 3\ cm$ izdolbel $1\ cm$ široko os za vrvico. Koliko časa preteče preden se vrvica v celoti odvije, če Janezek spusti jojo v dvigalu, ki se enakomerno pospešeno dviga v višje nadstropje s pospeškom $a = 1\ m/s^2$. Dolžina vrvice je $L = 1\ m$ in je na začetku navita okoli osi z radijem $r = 1\ cm$, kot to prikazuje skica.

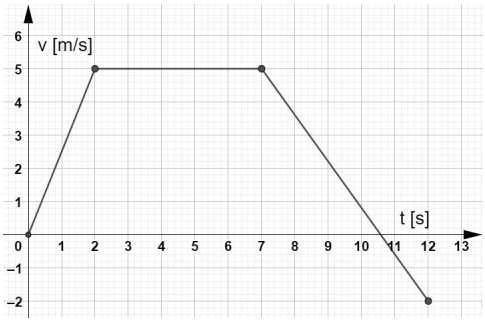


5.) Privzamemo, da živimo v vesolju, kjer sila gravitacije pojenja s četrto potenco in ne kvadratom ($F_g = GmM/r^4$). Hkrati zahtevamo da je na planetu enakemu Zemlji ($M = 6 * 10^{24}\ kg$, $R = 6400\ km$) gravitacijski pospešek na površju $g = 9.81\ m/s^2$. Izračunaj gravitacijsko konstanto v takšnem vesolju in ubežno hitrost planeta enakega Zemlji.

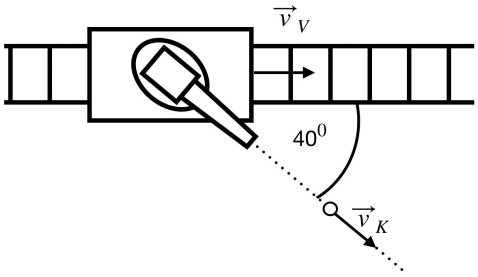
1. trial midterm exam in physics - 15. 12. 2020

1.) A car drives on a straight road. Its speed versus time is shown by the graph on the right.

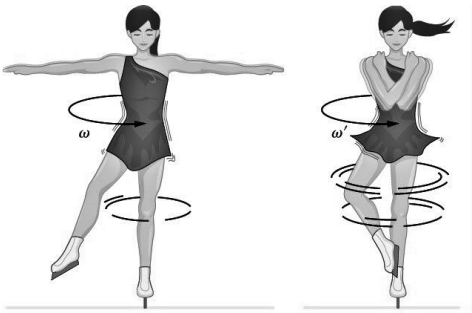
a) How much distance did the car travel within the first $7\ s$?
b) Calculate the acceleration of the car during the last $5\ s$?
c) Plot a graph of the position and the acceleration of the car as a function of time. The car is moving in 1D.



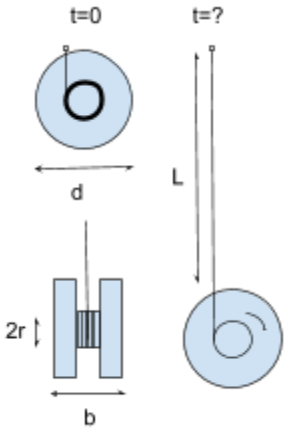
2.) An armoured train with a mass of $30\ t$ is moving with a velocity of $10\ km/h$. We shoot a $20\ kg$ heavy bullet from the train's cannon. The bullet has a velocity of $200\ m/s$, and is shot under a $40°$ angle with respect to the direction of the train's movement. What is the speed of the train if the train engines are shut down? What is the impulse exerted on the rails? You can assume that the bullet velocity has the same size and direction in the train and laboratory system.



3.) An ice skater performs a pirouette. First, she has her hands wide open and is rotating with an angular frequency of $2.5\ s^{-1}$. Her moment of inertia is $1.5\ kgm^2$. When she is performing a pirouette, her hands are collected (see the illustration) so her moment of inertia changes to $1\ kgm^2$. What is her angular frequency after she collects her arms? How much work did the skater do when she collected her arms?



4.) Johnny made a yo-yo out of a homogeneous wooden cylinder with a density of $500\ kg/m^3$, a diameter $d = 6\ cm$, and a width of $b = 3\ cm$ from which he carved a $1\ cm$ opening to create an axle for the string. How much time does the string need to unwind if Johnny spins his yo-yo inside an elevator that is moving to the upper floor with a constant acceleration of $a = 1\ m/s^2$. The length of the string is $L = 1\ m$ and is initially wound around the axle with a radius of $r = 1\ cm$.



5.) Consider living in a universe where the gravitational force diminishes with distance as a fourth power law and not a quadratic one ($F_g = GmM/r^4$). On a planet identical to Earth ($M = 6 * 10^{24}\ kg,\ R = 6400\ km$) the gravitational acceleration on the surface is $g = 9.81\ m/s^2$. Calculate the gravitational constant of this universe as well as the escape velocity of a planet identical to Earth.