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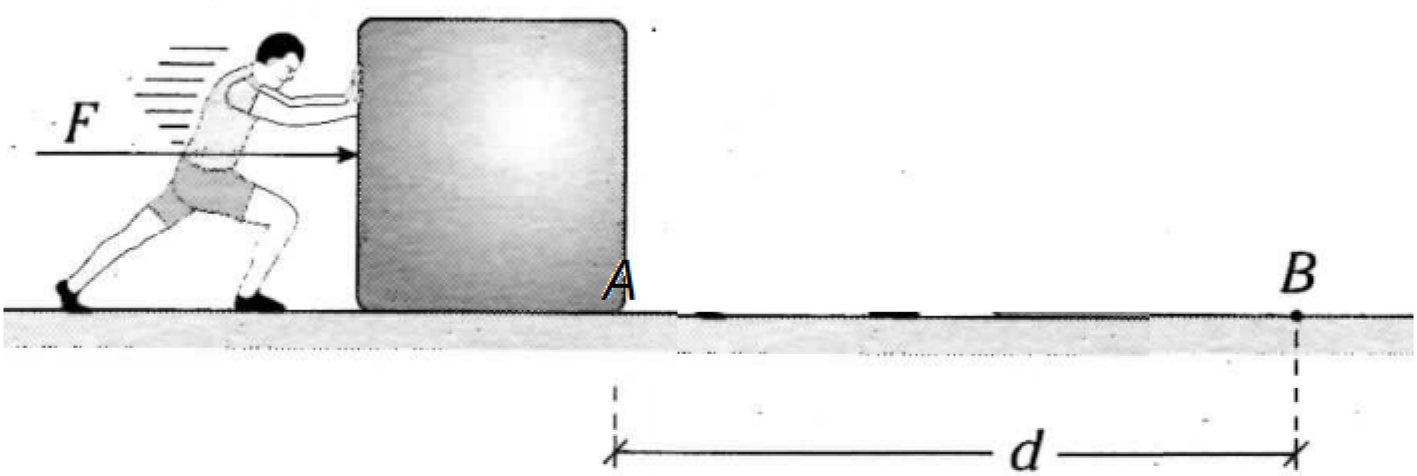
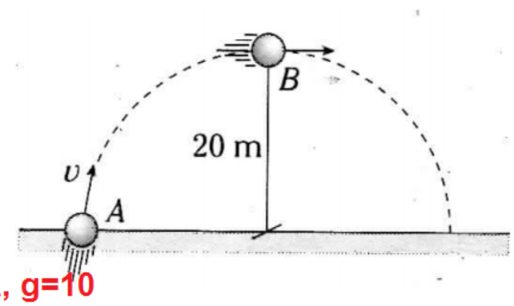
Basic Sample problems Energy and Work



- Remember that P= mparticle() ... then
- Some function used in Energy
  - P.energia() = Sumatory Energy in A an B
    - P.energia(ktype='1') = Energy in A
    - P.energia(ktype='2') = Energy in B
    - P.energia(ktype='P1') = Energy Potential in A
    - P.energia(ktype='E1') = Energy kcinetic in A
    - etc.
  - P.simple_ac() = (Sum Force in X)/ mass
  - P.simple_ac(ktype='y') = (Sum Force in Y)/ mass

```
from sympy import *
from polyclass import *
from libaldo_math import *
from libaldo_show import *
from physic_lib import *
from IPython.display import display, Math
init_printing()
```

La esfera de 0,2 kg lanzada como se indica, experimenta un MPCL. Cuando la esfera alcanza su altura máxima tiene una energía cinética de 30 J. Determine su energía mecánica, respecto al piso, en la posición A. $(g=10\ m/s^2)$.



mass=0.2Kg,r=20m, when hight is max, Ek= 30, Find E Total in A, g=10

```
# Declaring P object with data get by problem
P=mparticle(m=0.2,g=10,x1=0,x2=20,y1=0,y2=20)  # remmeber put x,y position if you have
```

```
# Total Energy in A = Total Energy in B
P.energia(ktype='p2') # ktype ='1' Energy total in A, 2=B, P1 pot in A pP2 is pot in B  . E1 is Enr Kc
```

40.0

```
show_res(30+40,'Energy  \ in \ A \ is')
```

$$Energy\ in\ A\ is = 70$$

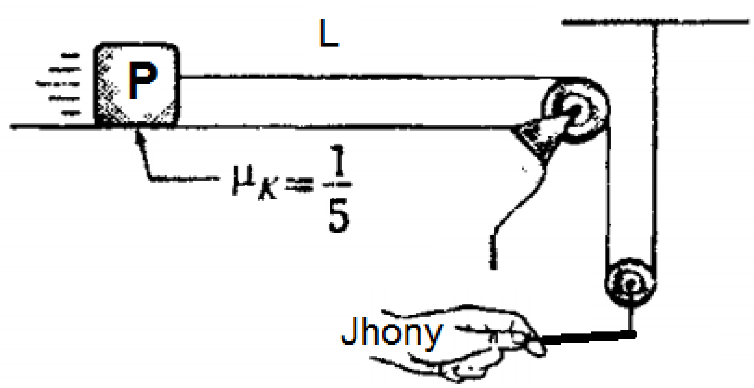
---

mass=4kg, ace=2m/s

L =1 mt mu=0.2 g=10

Find Work generate by Jhony

in P run in L




```
N1,fr,T=symbols('N1 fr T')
P=mparticle(m=4,g=10,x1=0,x2=1,ac=2,y1=0,y2=0)
```

```
P.add_forza(40,-pi/2)
P.store_val(N1,40)
P.add_forza(N1,pi/2)
P.store_val(fr,N1*0.2)
P.add_forza(fr,-pi)
P.add_forza(T,0)
```

```
P.work_x()
```

$$T - 8.0$$

```
csolve(P.simple_ac('x')-2,T)
```

$$16.0$$

```
P.store_val(T,16)
```

```
P.work_x()
```

$$8.0$$

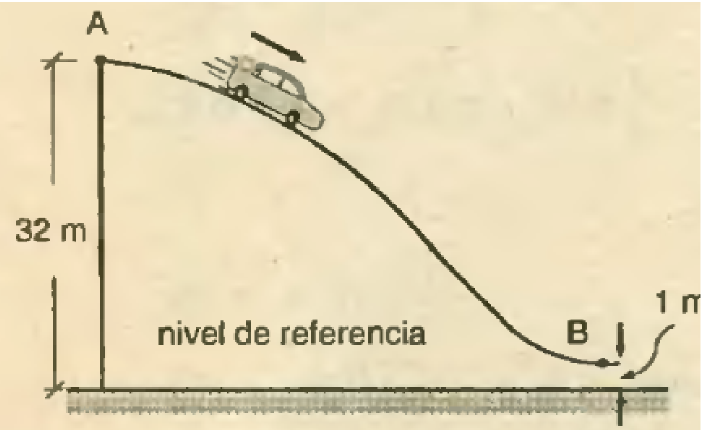
En la figura se muestra un coche que se desliza por una vía sin fricción, pasando por A, a razón de 40 m/s. ¿Con qué velocidad pasará por B?

$V_A = 40\ m/s$

$h_B = 1\ m$

$V_A = 40\ m/s$ $\quad V_B = ?$

$h_A = 32\ m$




```
P=mparticle(y1=32,y2=1,v1=40,x1=0,g=10)
```

```
P.energia()
```

$$\frac{mv_2^2}{2} - 1110m$$

```
# answer default
v=csolve(P.energia(),v2,'v') # total sol
```

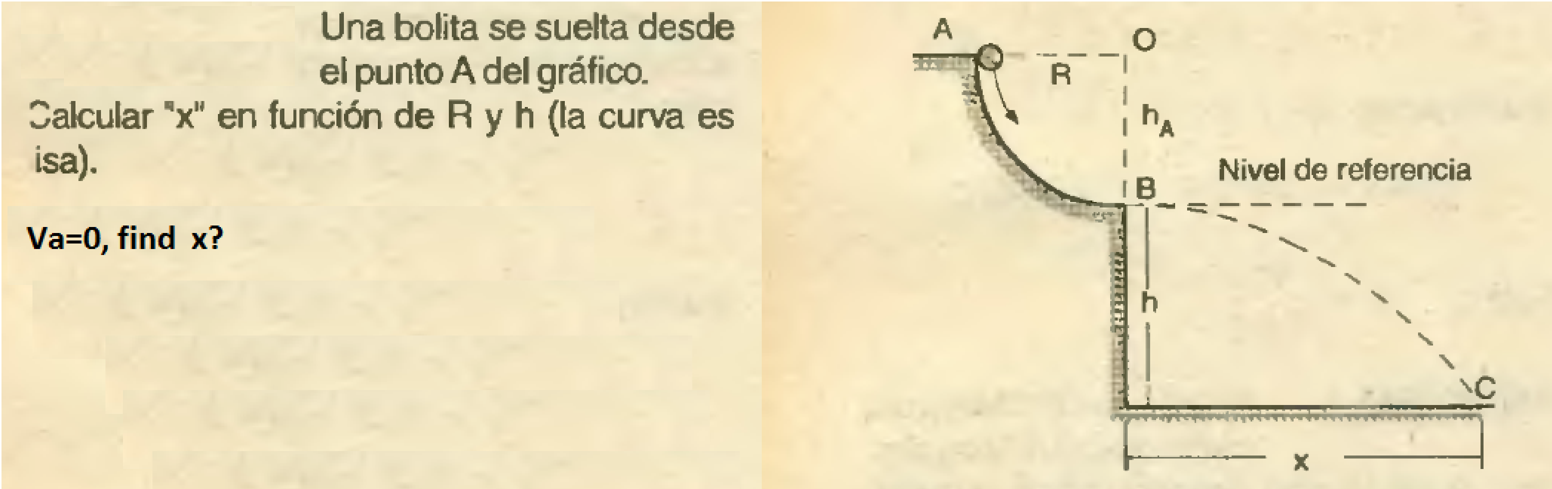
$$v = \left[-2\sqrt{555},\ 2\sqrt{555}\right]$$

```
# the same answer but  ...
v=csolve(P.energia(),v2,'v',kpositive=True) # only possitive
```

$$v = 2\sqrt{555}$$

```
# the same answer but usefull type
v=csolve(P.energia(),v2,'v',kpositive=True,kope='v')#   possitive and float
```

$v_1 = 47.116875957559$




```
# Creating object to use from A to B
R=symbols('R')
P=mparticle(x1=0,x2=R,y1=R,y2=0,v1=0)
```

```
V2=csolve(P.energia(),powsimp(v2**2),'V_2') # is more easy fin squarw(V2) because used
```

$$V_2 = 2Rg$$

```
# Creating object to use from B to C
h=symbols('h')
P2=mparticle(x1=0,y1=h,y2=0,v=sqrt(2*R*g),a=0,ac=0) # using parabolic setup
```

```
P2.y_pos()
```

$$-\frac{gt^2}{2} + h$$

```
csolve(P2.y_pos(),t**2) # Find t^2 when y2=0
```

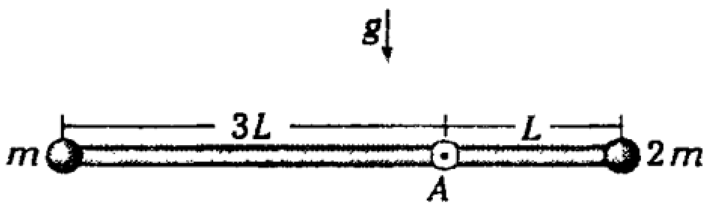
$$\frac{2h}{g}$$

```
P2.x_pos(t=sqrt(2*h/g),kope='2') # Find x when t=upper answer and kill sqrt whit kope='2'
```

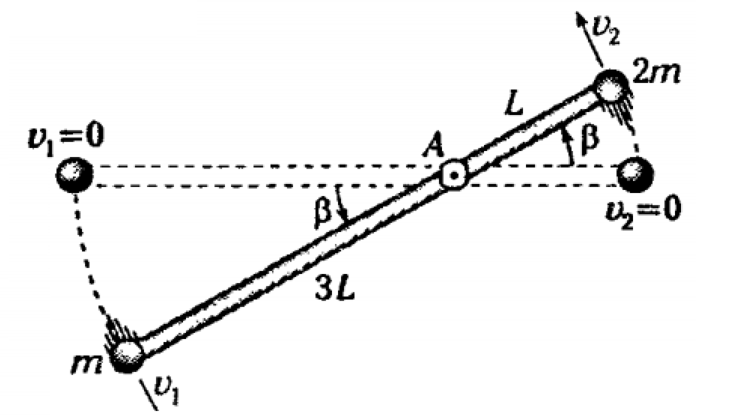
$$2\sqrt{Rh}$$

```
# kope options..?? see below
opemat?
```

```
Signature: opemat(ksym, kope='')
Docstring:
opemat(Equation,kope=opt)
opt
    'f'= factor(Equation),
    't'= trigsimp(Equation)
    'x'= simplify(Equation)
    'v'= Equation.evalf()
    'a'= apart(Equation)
    'c'= cancel(Equation)
    'E'= Equation.expand(force=True)
    '2' = kill sqrt( x^2 )
```



Find beta when final v2 is maximun




```
m,h,L,beta,V=symbols('m h L beta V',positive=True)
A=mparticle(m=2*m,y1=h,y2=h+L*sin(beta),v1=0,v2=V,a=beta)
B=mparticle(m=m,y1=h,y2=h-3*L*sin(A.a),v1=0,v2=3*V)
```

```
A.energia(ktype='1') # Energia Initial in A
```

$$2ghm$$

```
B.energia(ktype='1') # Energia Initial in B
```

$$ghm$$

```
Eq1=A.energia(ktype='1')+B.energia(ktype='1');Eq1
```

$$3ghm$$

```
A.energia(ktype='2') # Energia final in A
```

$$V^2m + 2gm\left(L\sin\left(\beta\right) + h\right)$$

```
B.energia(ktype='2') # Energia final in B
```

$$\frac{9V^2m}{}$$

```
Eq2=A.energia(ktype='2')+B.energia(ktype='2');Eq2
```

$$\frac{11V^2m}{2}+gm\left(-3L\sin\left(\beta\right)+h\right)+2gm\left(L\sin\left(\beta\right)+h\right)$$

```
Eq3=opemat((Eq1-Eq2)/m,'s') ;Eq3 # adding two Eq and simplify store in Eq3
```

$$Lg\sin\left(\beta\right)-\frac{11V^2}{2}$$

```
csolve(diff(Eq3,beta),beta) # find beta when diff Eq3=0
```

$$\left[\frac{\pi}{2},\ \frac{3\pi}{2}\right]$$

```
# we will pick only first answer and store in both physic object
A.store_val(beta,pi/2)
A.kvalue
```

$$\left(\left[\beta\right],\ \left[\frac{\pi}{2}\right]\right)$$

```
B.store_val(A.a,pi/2)
B.kvalue
```

$$\left(\left[\beta\right],\ \left[\frac{\pi}{2}\right]\right)$$

```
# finding  total energy in the system but knowing beta
Eq4=A.energia(ktype='1')+B.energia(ktype='1')-(A.energia(ktype='2')+B.energia(ktype='2'));Eq4
```

$$-\frac{11V^2m}{2}+3ghm-gm\left(-3L\sin\left(\beta\right)+h\right)-2gm\left(L\sin\left(\beta\right)+h\right)$$

```
Eq4=opemat(Eq4,'s')
Eq4
```

$$\frac{m\left(2Lg\sin\left(\beta\right)-11V^2\right)}{2}$$

```
csolve(Eq4,V,korden=1)  # Velocity whe angle is pi/2
```

$$\frac{\sqrt{22}\sqrt{L}\sqrt{g\sin\left(\beta\right)}}{11}$$