Work energy power continued

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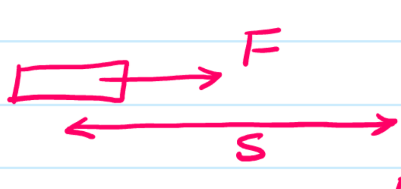
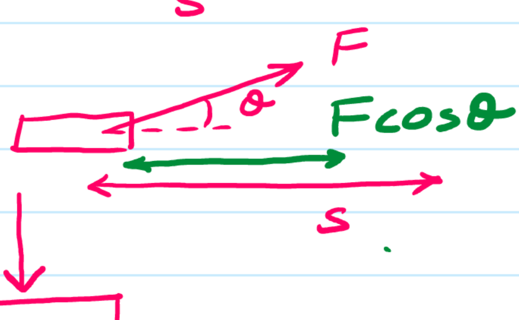
formula

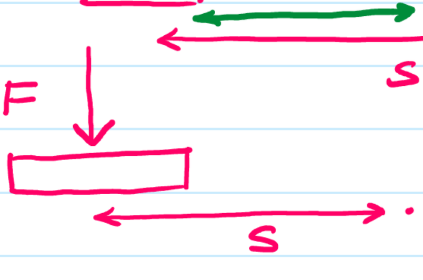
① $W = F \cdot s$



② $W = (F\cos\theta) \cdot s$



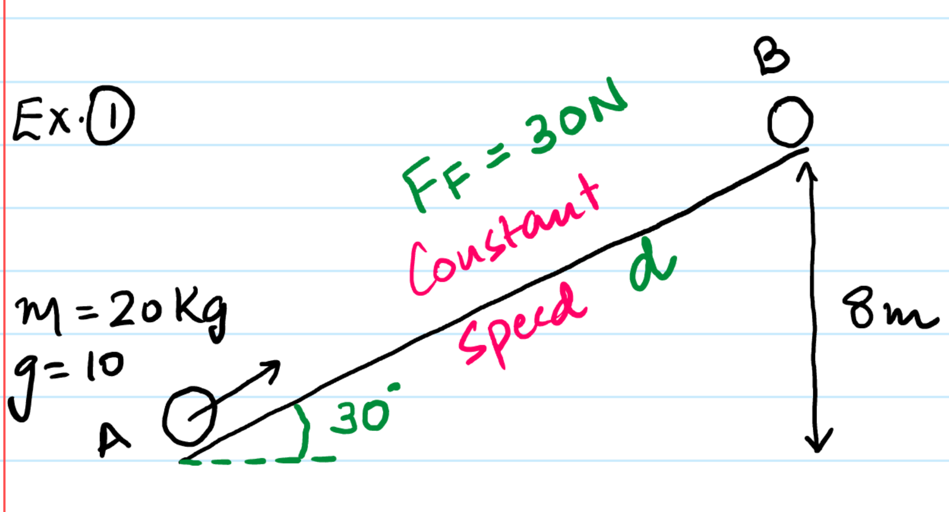
③ $W = 0$



• W.done in mechanics gets converted into diff. forms of energies. i.e

W. done
- Kinetic Energy $\frac{1}{2}mv^2$
- G.P.E mgh
- Heat Energy: W.done against friction $F_F \cdot d$

Ex.①



$\sin 30° = \frac{8}{d}$

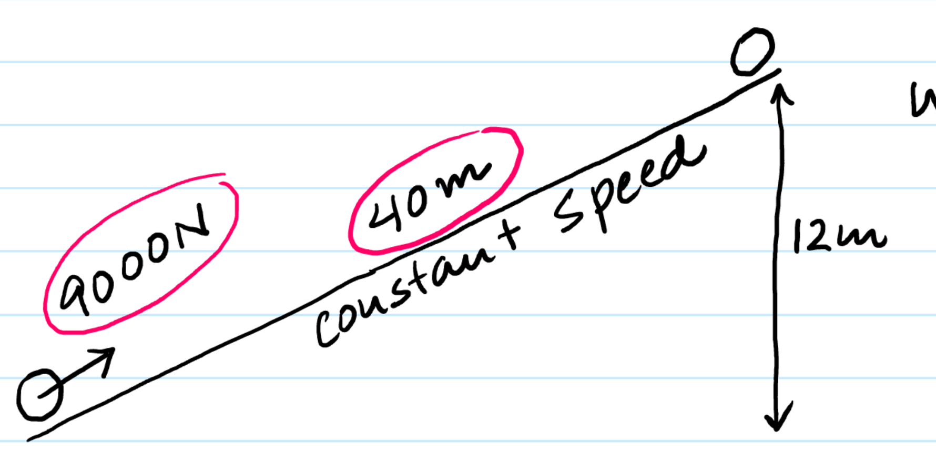
$d = 16m$

Cal. the W.done in moving the object from A to B.

W.done (find)
- K.E: Const. Speed, ~~$\Delta K.E = 0$~~
- G.P.E: mgh = $(20)(10)(8)$ = **1600 J**
- W.d (friction): $F_F \times d$ = 30×16 = **480 J**

W. done in moving from A to B = 1600 + 480 = **2080 J**

Ex.2

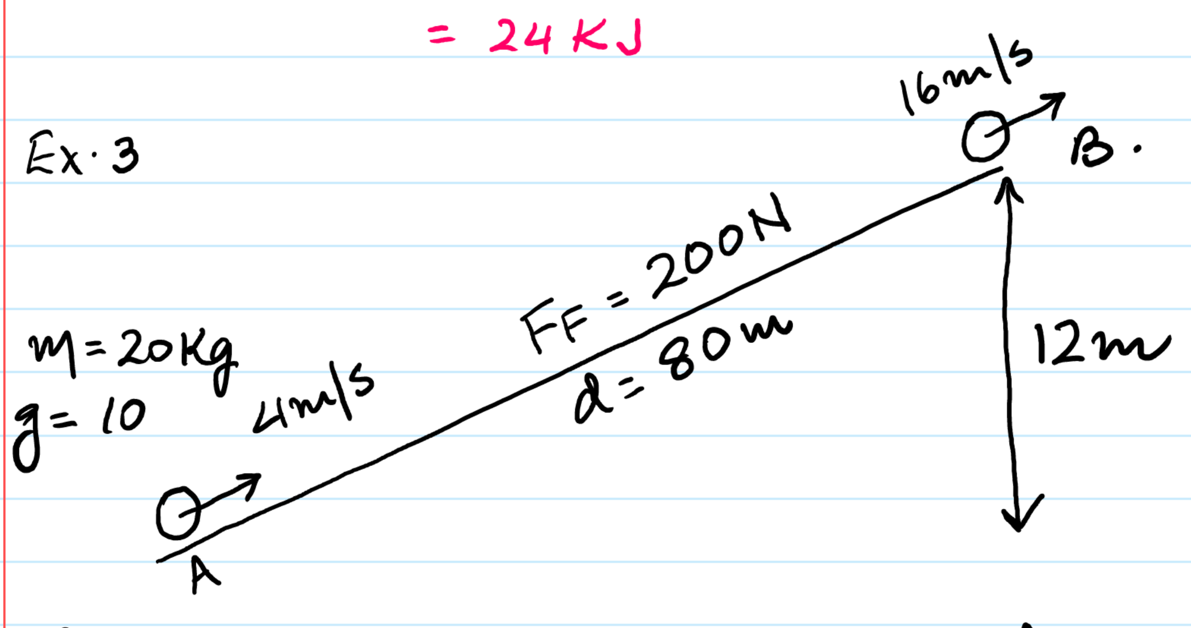


W = 2000N

Cal. how much energy is dissapated as heat (W.done against friction).

W. done = F×d = **360 KJ.**
- K.E: const. speed, ~~$\Delta K.E = 0$~~
- G.P.E: mgh = $(2000)(12)$ = 24 KJ
- W.d friction): find ?? = 360 − 24 = 336 KJ

Ex.3



Cal. W.done in moving the object from A to B

W. done
- K.E: $\frac{1}{2}(20)(16)^2 - \frac{1}{2}(20)(4)^2$, **$\Delta K.E = 2400J$**
- G.P.E: mgh = $(20)(10)(12)$ = **2400J**
- W.d (friction): $F_F \times d$ = 200×80 = **16000J**

W.d = 2400 + 2400 + 16000

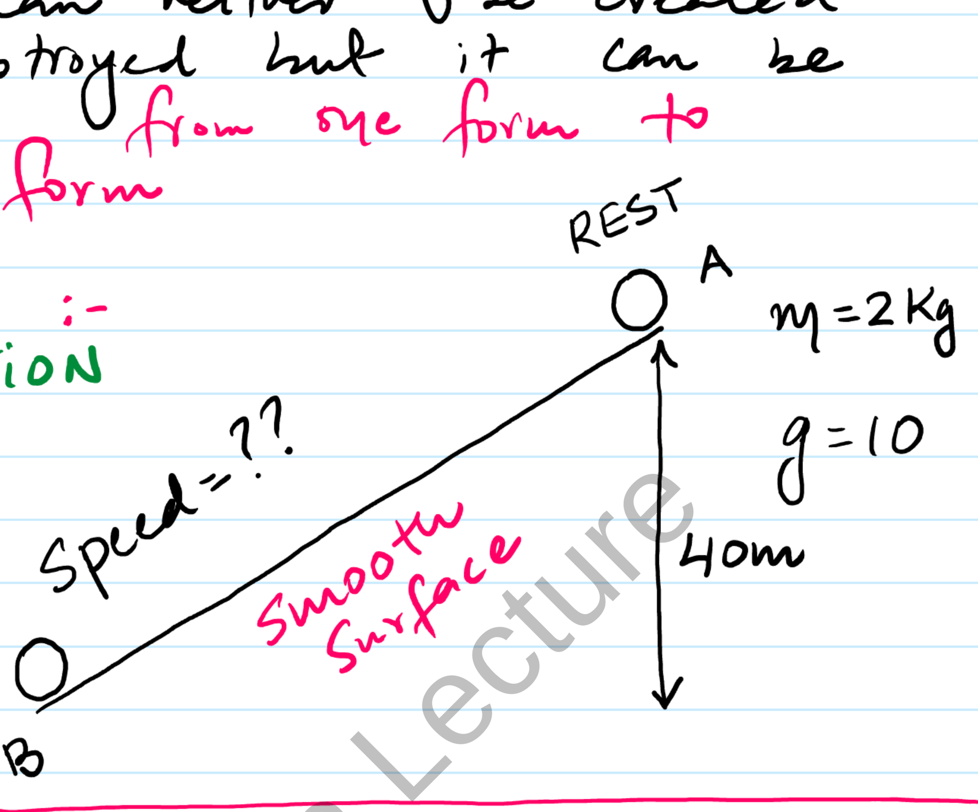
W.d = **20800 J**

Formulas for Energy :-

Energy :- ability to do work.

Law of Conservation of Energy :- Energy can neither be created nor destroyed but it can be converted from one form to another form

Case #1 :- NO FRICTION



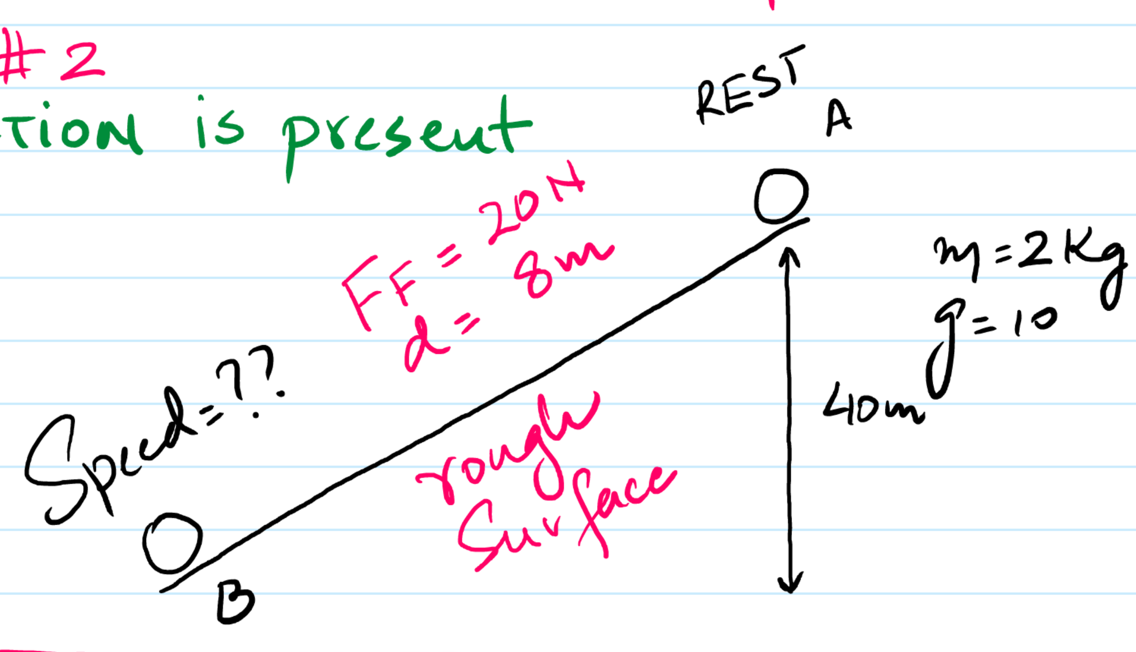
① **Energy at Start = Energy at End**

$mgh = \frac{1}{2}mv^2$

$(2)(10)(40) = \frac{1}{2}(2)(v^2)$

$V = 28.3$ m/s.

Case #2
If FRICTION is present



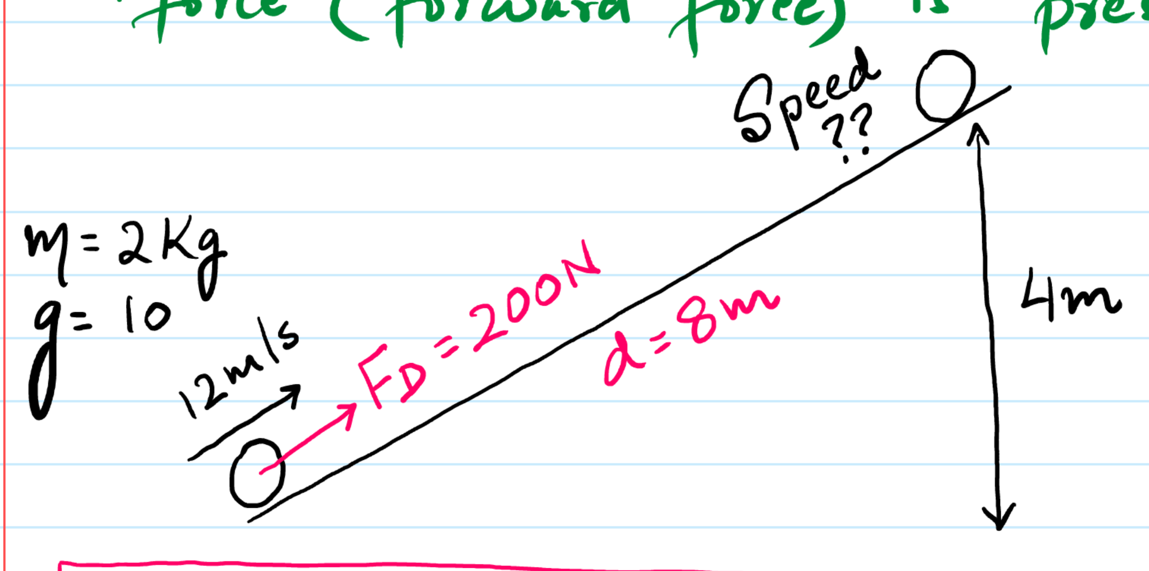
② **Energy at Start − W.d against friction = Energy at End**

$(2)(10)(40) - F_F \cdot d = \frac{1}{2}(2)v^2$

$800 - (20)(8) = \frac{1}{2}(2)v^2$

$V = 25.3$ m/s.

③ Case #3.
what if frictional force is NOT present but instead Driving force (forward force) is present.



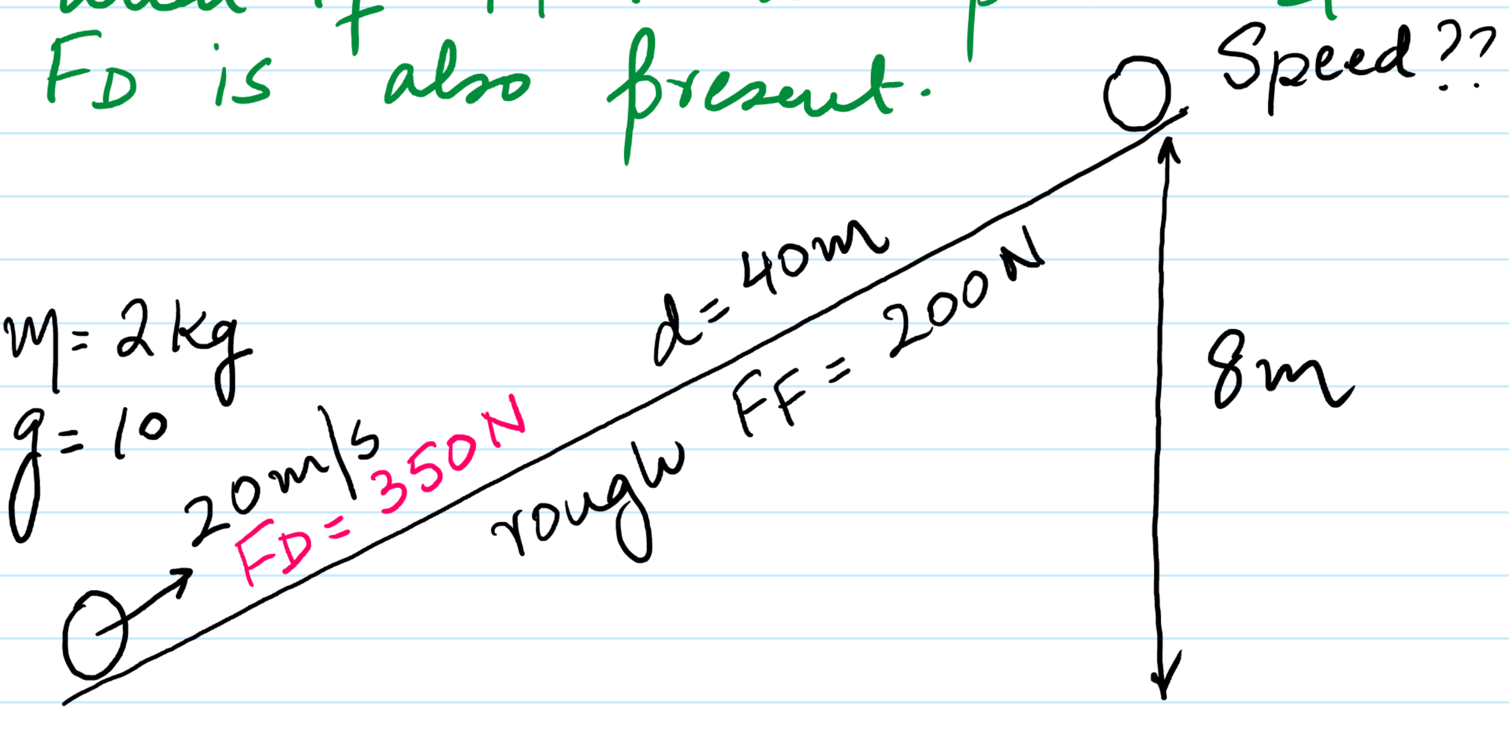
Energy at Start + W.done by forward force/driving force/Engine = Energy at End.

$K.E + F_D \cdot d = K.E + P.E$

$\frac{1}{2}(2)(12)^2 + (200)(8) = \frac{1}{2}(2)v^2 + (2)(10)(4)$

$V = 40.8$ m/s.

Case #4 :-
what if F_F is also present & F_D is also present.



④ **Energy at Start + W.d by Engine − W.d against friction = Energy at End**

$K.E + F_D \cdot d - F_F \cdot d = K.E + P.E$

$\frac{1}{2}(2)(20)^2 + (350)(40) - (200)(40) = \frac{1}{2}(2)(v^2) + (2)(10)(8)$

$V = 79$ m/s.

Formulas for Power.

Power = Rate of work done.

① $\text{Power} = \frac{\text{W.done}}{\text{time}}$

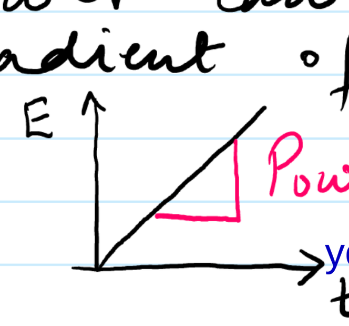
② $\text{Power} = \frac{\text{Energy}}{\text{time}}$

③ $\text{Power} = \frac{F \cdot s}{t}$

④ Since $\frac{s}{t} = v$ (velocity)

$\text{Power} = F \times v$.

* Power can be obtained from the gradient of Energy vs time graph.



grad = $J s^{-1}$ = Power