PHYSICS 11 – FINAL EXAM REVIEW –

DYNAMICS · Work, Energy, + Power

Name: Key

① A net force of 6.2 N left is acting on a 1.3 kg bunch of bananas sliding across a level surface with $\mu = 0.38$

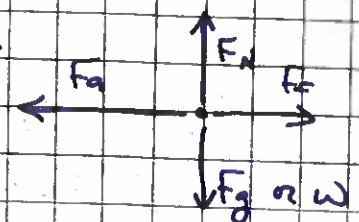
a) What is the bananas' acceleration?

$F_{Net} = F_a - F_f$

$F_{net} = ma$

$6.2\ N = (1.3\ kg)\,a \Rightarrow$ **$a = 4.8\ m/s^2$**

b) Sketch a FBD of this situation.



c) What is the applied force on the bananas?

$F_{Net} = f_{app} - F_f$

c) $F_{app} = 6.2\ N + F_f \quad F_f = \mu F_N$

$= 6.2 + (1.3\ kg)(9.81\ m/s^2)(0.38)$

$= 11.04614$

$F_a = 11\ N$

② A ball hits a wall at a speed of 15 m/s, then bounces straight back at 12 m/s. over 0.50 s

a) What is the ball's acceleration (magnitude only)?

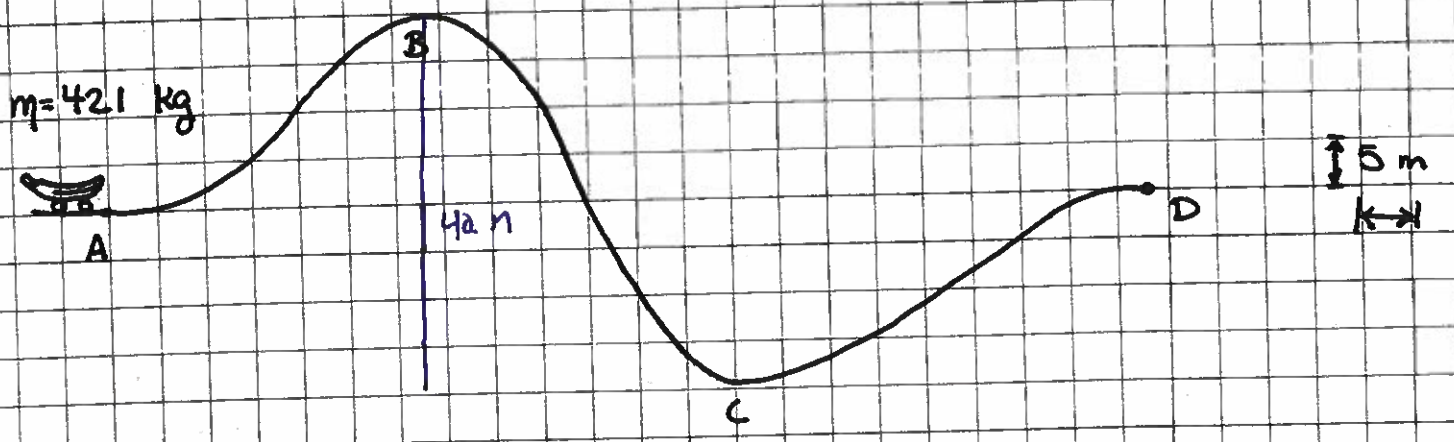
$a = \frac{\Delta v}{\Delta t} = \frac{27\ m/s}{0.50\ s} =$ **$54\ m/s^2$**

b) If the ball's mass is 3.6 kg, what force does it exert on the wall?

$F = ma = (3.6\ kg)(54\ m/s^2)$

$= 194.4 \Rightarrow$ **$F = 190\ N$**

③ Consider the following roller coaster.



a) the banana car accelerates from rest to 3.0 m/s from A to B. Losses to friction total 4600 J. How much energy is required to move the car?

Total = ΔKE + ΔPE + friction losses

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

$= \frac{1}{2}(421\ kg)(3.0\ m/s)^2 + (421\ kg)(9.81\ m/s^2)(20.\ m) + 4600\ J$

$= 1894.5\ J + 82600.2\ J + 4600\ J$

89094.7

⇒ **89 000 J**

b). What is the car's velocity at point C if it loses 5800 J to friction while going downhill?

V = 28 m/s

KE gained + PE lost − friction

$\Delta KE_{BC} = \Delta PE - 5800\ J$

$= (421\ kg)(9.81\ m/s^2)(40.\ m) - 5800\ J$

$= 159\ 400.4\ J$

$KE = KE_B + \Delta KE_{BC}$

$= 1894.5\ J + 159\ 400.4\ J$

$= 161294.9\ J$

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

⇒ $V = 27.6811\ m/s$

c) How much work has been done if the car requires an average force of 120 N to move, from point A to D?

$W = Fd = (120\ N)(110\ m) = 13200$

W = 13,000 J

③ On Planet Throkmorton, Esker weighs 271 N. The planet's radius is 1472 m. Find:

a) the acceleration of gravity on Planet Throckmorton.

$m_{Esker} = 42\ kg$ $\quad W = F_g = mg \Rightarrow (42\ kg)g = 271\ N$

$\boxed{g = 6.5\ m/s^2}$

b) the planet's mass.

$F_g = G\frac{m_1 m_2}{d^2} \Rightarrow 271\ N = \frac{(6.67\times10^{-11})(42\ kg)M_2}{(1472\ m)^2}$

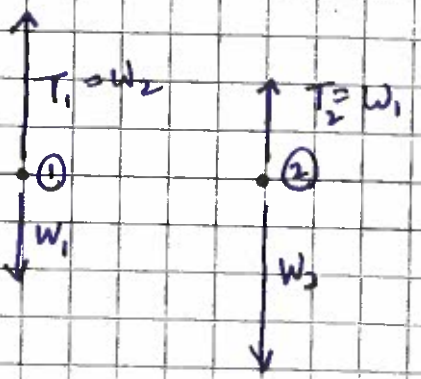
$= 2.096089\times10^{17}$

$\boxed{M = 2.1\times10^{17}\ kg}$

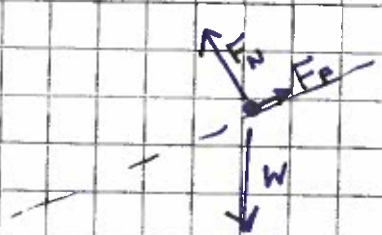
④ Sketch a FBD for the following situations:

a. A constant upward force accelerating a bucket held from a rope

b. A light bucket hanging from a pulley with a heavy bucket hanging from the other side



c. A block resting on an inclined plane



⑤ Esker is pulling on her leash with a force equal to my frictional resistance. I am 96 kg in my winter clothes and $\mu = 0.36$. The rope is rated to 350 N of tension. Will I need a new rope or a new face?

$F_f = \mu F_N = (0.36)(96\ kg)(9.81\ m/s^2)$

$= 339$

$= 340\ N$

New face

⑥ A lightbulb produces 62 J of energy every second. It takes 8200 J to run the bulb for one minute.

a) What is the lightbulb's OUTPUT power?

$$P = \frac{62\ J}{1\ s} = 62\ W$$

b) What is the lightbulb's efficiency?

$$\frac{8200\ J}{60\ s} = 136.\bar{6}\ W \text{ input}$$

$$Eff = \frac{out}{in} \times 100\% = \frac{62\ W}{136.\bar{6}\ W} \times 100\%$$

Eff = 45%