Thurs Apr 18th

Checkup on Previous Learning

Friction - handback and take up friction activity

Today's Plan

Unit Review

Coming Up

Unit Test - Tuesday - Apr 24th

Test Date
Apr 24th, 2019

Unit 2 : Dynamics Summary

Key Topics

Types of Forces found in nature

Free Body Diagrams

Newton's Laws

Law of Universal Gravity

Friction

2/3 → word problems
1/3 → mc, matching
T/F

Word Problems

Newton's Laws

Example : Two people pull with 150 N and 130 N in opposite directions on a 50 kg sled on frictionless ice. What is the sled's acceleration?

Newton's Laws and Kinematics

Example : A 25 kg sled that is originally moving northwards at 15 m/s is acted on by a net force (F_{net}) of 113N [South]. How far will the sled travel before it stops?

Universal Gravity

Example : Calculate the force of gravity on a 2000kg satellite that is in an orbit 30,000km above the surface of the earth (the radius of the earth is 6.38×10^6m, and the mass is 5.97×10^{24}kg).

Friction

Example : A 1,500 kg car is moving along a road when it starts to coast to a stop. If the coefficient of kinetic friction between the tire and the road is 1.02, what will the acceleration of the car be? How long will it take to stop if its initial velocity is 18 m/s?

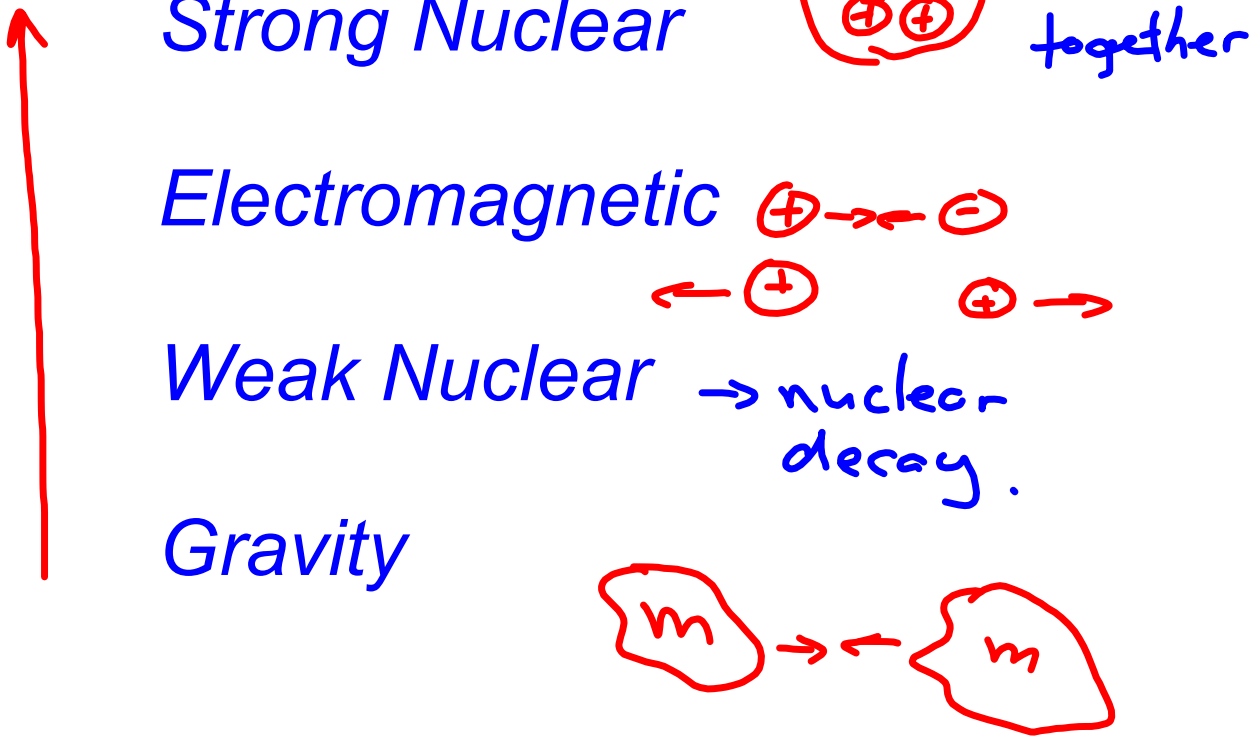
Other stuff to know ☺...

Acceleration due to gravity = _____.
Convert from cm to m and km to m _____.
Difference between mass and weight _____.
Convert from g to kg _____.
Review Newton's Laws Quiz (on-line)

Practice Problems

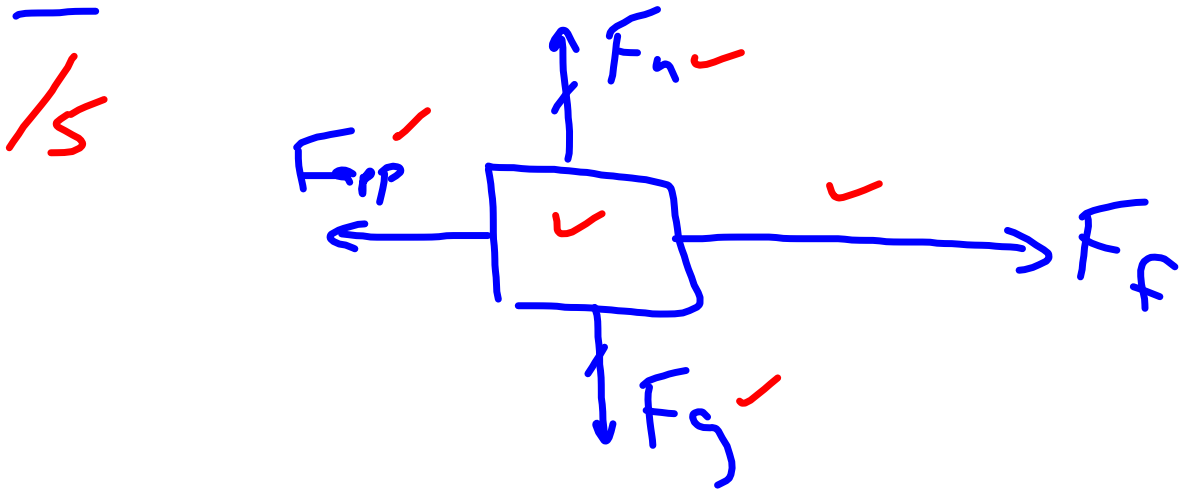
Textbook: page 114 #13, 14b, 20, 21, 23, 24, 25, 26, 27a,

Types of Forces



Free Body Diagrams / Force Diagrams

example : Sled being pulled by a child to the left and slowing down



Newton's Laws

1. Inertia
2. $\vec{F}_{net} = m\vec{a}$ net → total
3. equal & opposite.

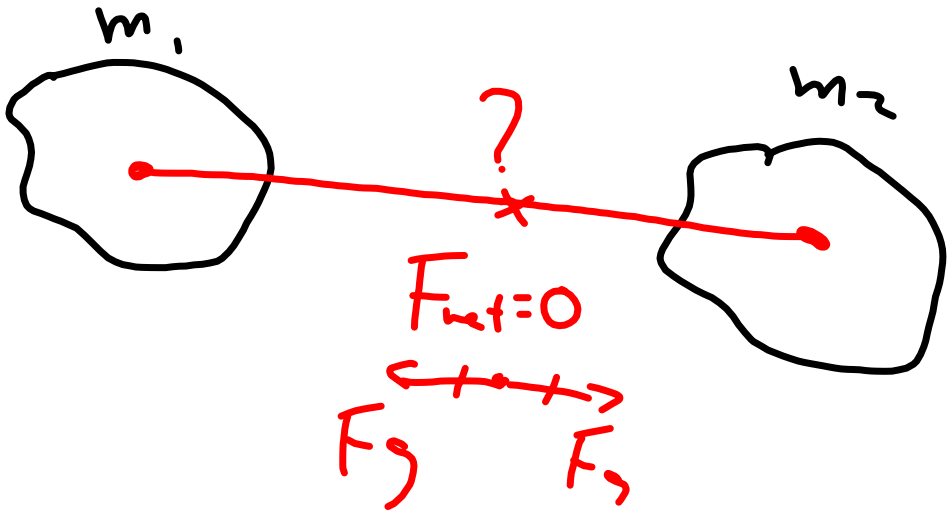
Law of Universal Gravity

$$F_g = \frac{G m_1 m_2}{r^2}$$

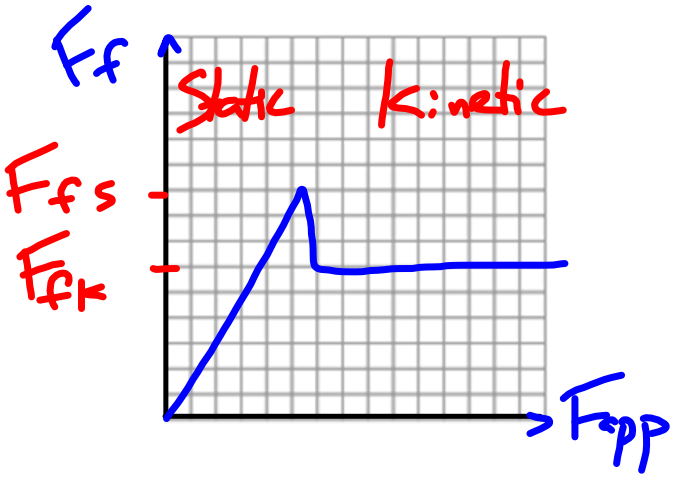
G (universal gravitational constant)
$= 6.67 \times 10^{-11} N \cdot m^2/kg^2$

$m_1, m_2 \rightarrow$ masses (kg)
$r \rightarrow$ distance (m)

2 body problem



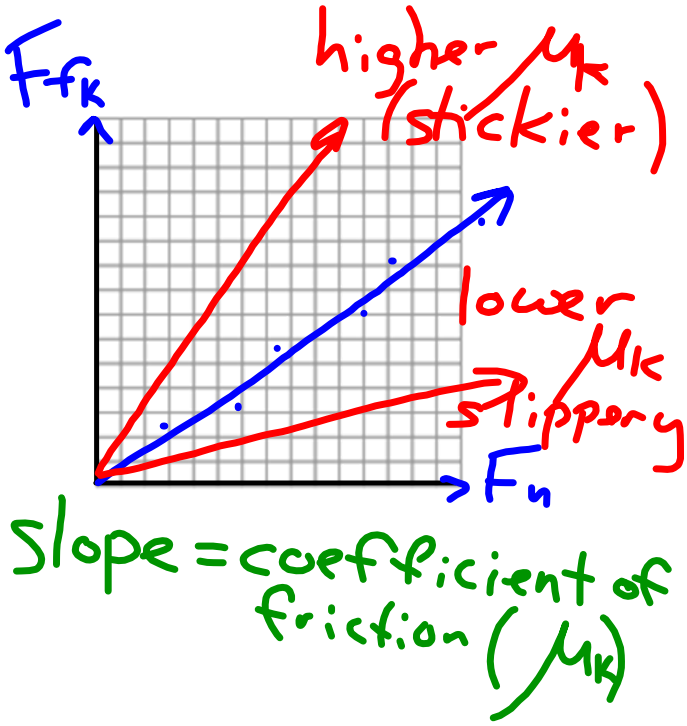
Friction



$$F_f = \mu F_n$$

$$F_{fs} = \mu_s F_n$$

$$F_{fk} = \mu_k F_n$$



Nice to Know Stuff

$a = g = 9.8 m/s^2$ (acc due to gravity on earth)

Conversions

(1000) km → m

MKS
- metres
- kilograms
- seconds

Definitions

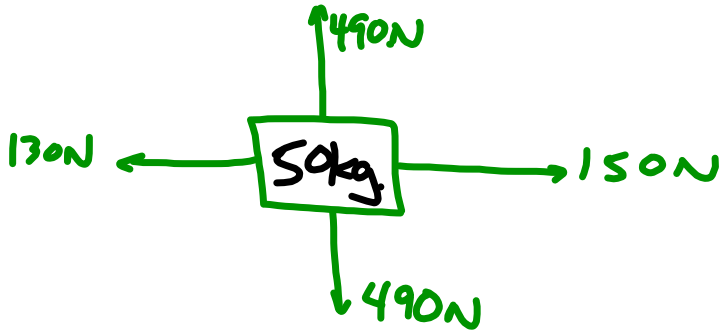
mass vs weight

↓ kg
amount of matter in an object.

↓
Newton's force of gravity on an object.

Newton's Laws

Example : Two people pull with 150 N and 130 N in opposite directions on a 50 kg sled on frictionless ice. What is the sled's acceleration?

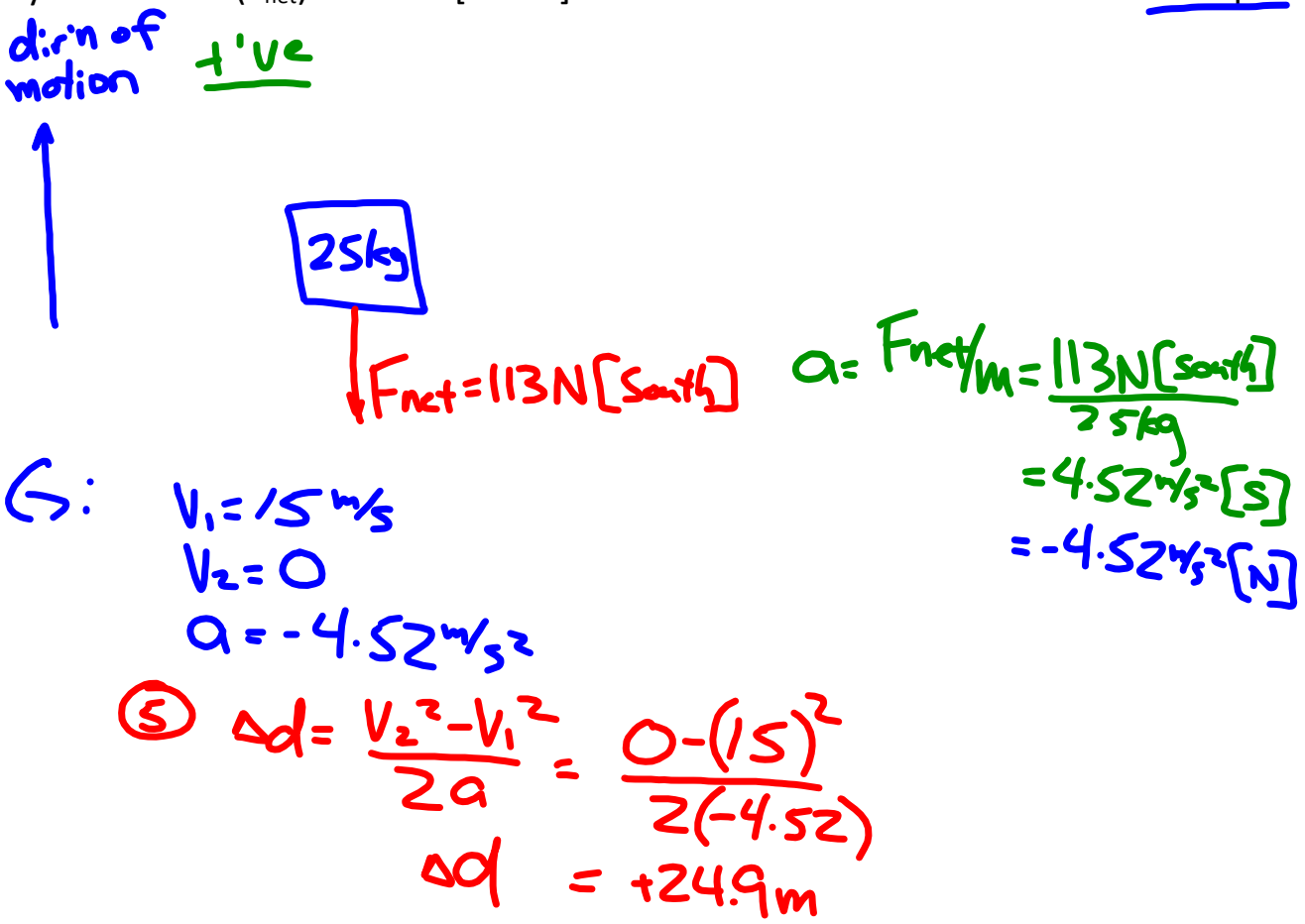


$F_{net} = 20N[right]$

$a = F_{net}/m = 20N[right]/50kg = 0.40 m/s^2[right]$

Newton's Laws and Kinematics

Example : A 25 kg sled that is originally moving northwards at 15 m/s is acted on by a net force (F_{net}) of 113N [South]. How far will the sled travel before it stops?

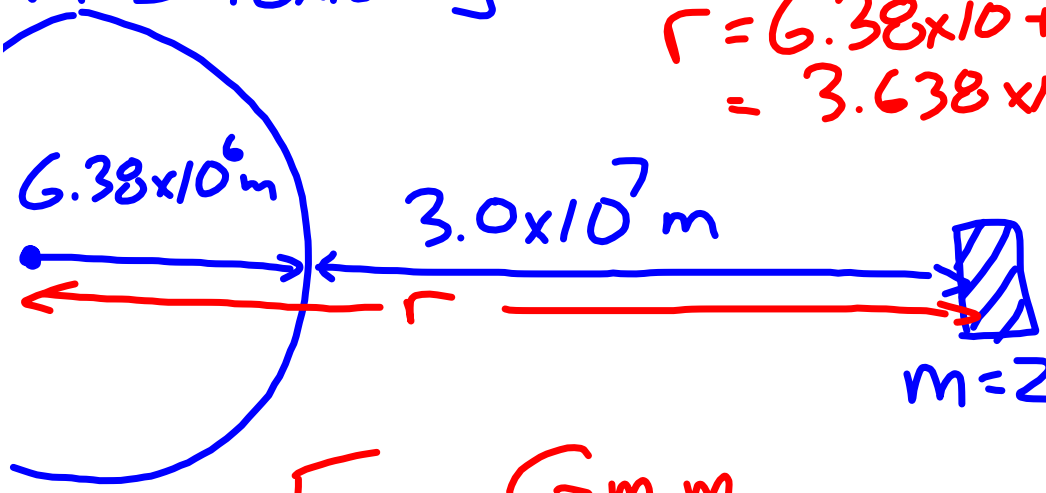


Universal Gravity

Example : Calculate the force of gravity on a 2000kg satellite that is in an orbit 30,000km above the surface of the earth (the radius of the earth is 6.38×10^6m, and the mass is 5.98×10^{24}kg).

$m = 5.98 \times 10^{24}$kg.

$r = 6.38 \times 10^6 + 3.0 \times 10^7$
$= 3.638 \times 10^7$m



$F_g = \frac{Gm_1m_2}{r^2}$

$= 603N$

$G = 6.67 \times 10^{-11} \frac{N \cdot m^2}{kg^2}$

$6380000 + 30000000 = 36380000$ m

Friction

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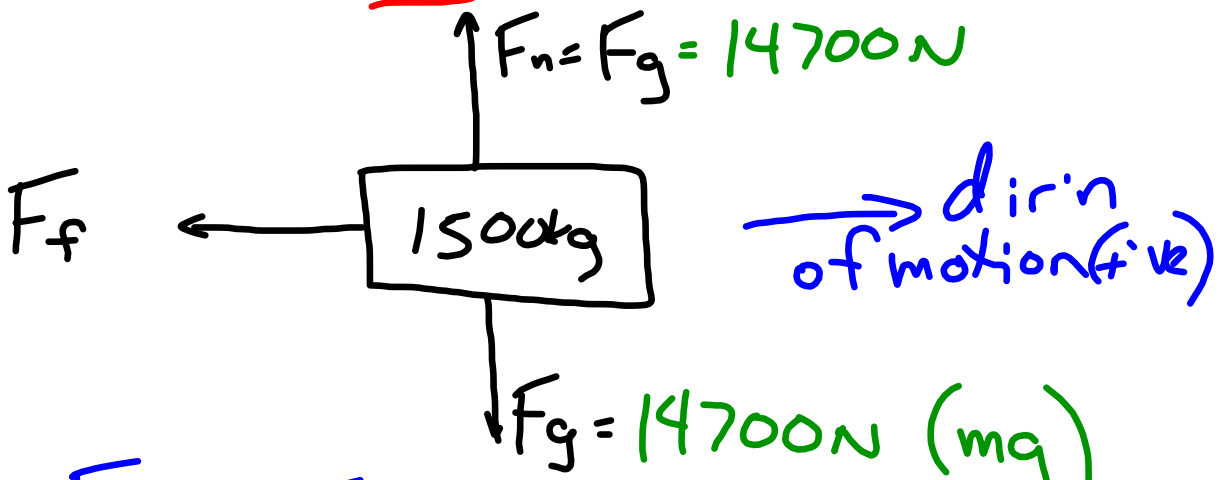


$F_f = \mu F_n = 1.02 \times 14700N$

$= 14994N$ [left]

$a = F_{net}/m = F_f/m = \frac{14994N\,[left]}{1500kg}$

$= 10.0 m/s^2$ [left]

$= -10.0 m/s^2$ [right]

G: $V_1 = 18 m/s$

$V_2 = 0$

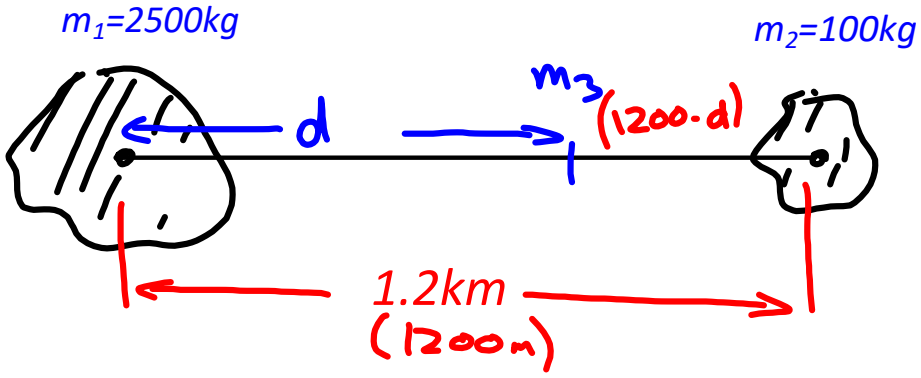
$a = -10.0 m/s^2$

R: $\Delta t \longrightarrow \Delta t = \frac{V_2 - V_1}{a}$

$= \frac{0-18}{-10.0}$

$\Delta t = +1.8s.$

2 Body Problem - Practice



$$F_{g_{13}} = F_{g_{23}}$$

$$\frac{G m_1 m_3}{d^2} = \frac{G m_3 m_2}{(1200-d)^2}$$

$$\frac{2500}{d^2} = \frac{100}{(1200-d)^2}$$

$$2500(1200-d)^2 = 100d^2 \quad \div 100$$

$$25(1200-d)^2 = d^2$$

$$25(1440000 - 2400d + d^2) = d^2$$

$$36000000 - 60000d + 25d^2 = d^2$$

$$24d^2 - 60000d + 36000000 = 0 \quad \div 24$$

$$d^2 - 2500d + 1500000 = 0$$

$$d = 1000\text{m or } 1500\text{m}$$

Homework

Test prep - review notes, quizzes and friction activity

Complete textbook problems on review handout.

Coming Up

Unit Test - Apr 24th