Mechanics Review Part I – Unit 1 Motion, Unit 3 – Projectiles, Unit 2 – Vectors Unit 7 – Centripetal & Gravity, Unit 4 – Forces & Newtons Laws, Friction & Inclines

REVIEW for REGENTS –

Pre-Unit Review Skills –

1) Know rough estimation questions, In SI or metric system how does the Following translate into our English units of measure –

Distance (or displacement)

Meter Centimeter Millimeter Kilometer

Nonometer Micrometer

Mass –

Kilogram – gram –

Force *(Or weight)* – ***Energy or Work –***

Newton – Joules –

2) Know how to make decimal numbers into Sci-Notation numbers & Vice Versa. Know how to use your calculator to express Sci-Notation numbers & do mathematical operations (+ - X -).

3) References Tables Skills – Where to Find Constants (1st 3 Pages), Where to Find Equations pg 6 – Mechanics, pg 5 Light Waves Modern Pg 4 – Electricity & Magnetism.

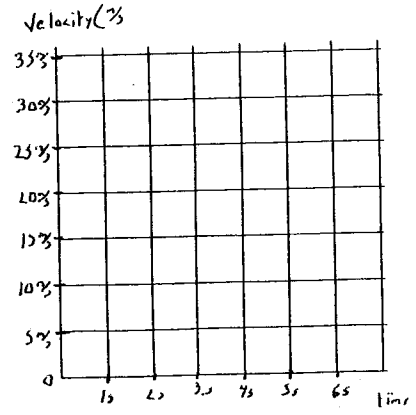
4) Equation & Substitution with units skills. Know especially in Part B2 and C How to do written equation solving process.
(Show Equation, with Substitution and Units !!)

A car starts from a speed of 12 m/s and accelerates at a rate of 1.5 m/s^2 over A distance of 192 meters. What is the cars speed at the end of this time ?

5) Have good graphing skills.

a. Get data points in the right place.
b. Do best fit line or curve (90% of time it's a line)
c. (0, 0) does not necessarily be a point on your graph
d. Know how to calculate slope with units on it.

Velo	time
3 m/s	1sec
10 m/s	2sec
17 m/s	3sec
22 m/s	4sec
24 m/s	5sec



Unit 1 – Motion

Review for Motion and Projectiles

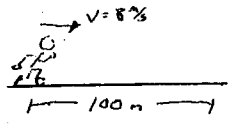
1) Understand three types of motion. What is the difference between velocity and acceleration. What are the units for velocity ? What are the units for acceleration ? How does a meter/sec of velocity compare to a mile/hour ?

2) What is the constant velocity, or steady speed equation. If you are traveling at constant velocity what is your number (or magnitude of) for your acceleration.

Watch out for steady speed problems that involve the speed of sound, or speed of light (Remember you can use v=d/t on traveling waves also).

Watch out for v=d/t problems where the object goes around a circle.

i.



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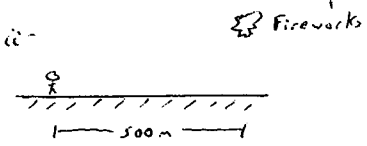

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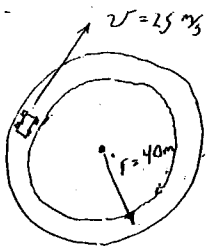
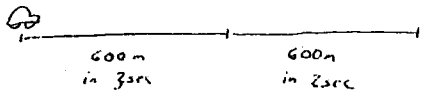
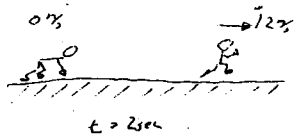


Watch out for steady speed problems where car is going different speeds over different parts of trip.



3) What is the basic acceleration formula ($a=\Delta v/t$). Be able to apply in simple situations given 2 of the three quantities. Understand the unit m/s^2 Watch out for objects slowing down. Watch out for objects changing direction.

i.



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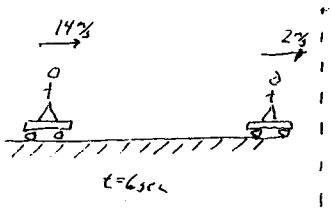
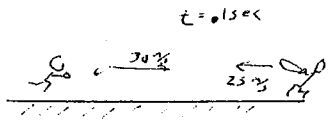
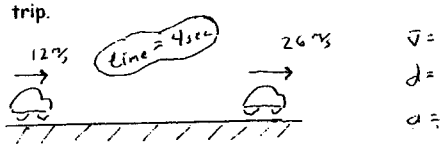




Graphing Motion

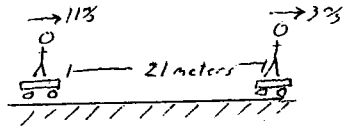
4) UnWritten simple formula for average velo. $\bar{v} = \frac{v_i + v_f}{2}$ Always remember average velocity is like the middle velocity for a speed up or slow down trip.



$\bar{v} =$

$d =$

$a =$



$\bar{v} =$

$t =$

$a =$

5) Working with the four motion equations for accelerating objects.
You can almost always use these instead
(You need to remember the ins and outs of these)

i- A car having an initial speed of 15 meters per second is uniformly brought to rest in 4.0 seconds. How far does the car travel during this 4.0-second interval?
(1) 33 m (3) 86 m
(2) 82 m (4) 4.0 m

ii- A car moving at a speed of 8.0 meters per second enters a highway and accelerates at 3.0 meters per second^2. How fast will the car be moving after it has accelerated for 56 meters?
(1) 24 m/s (3) 18 m/s
(2) 20. m/s (4) 4.0 m/s

iii- A boat initially traveling at 10. meters per second accelerates uniformly at the rate of 5.0 meters per second^2 for 10. seconds. How far does the boat travel during this time?
(1) 50. m (3) 350 m
(2) 250 m (4) 500 m

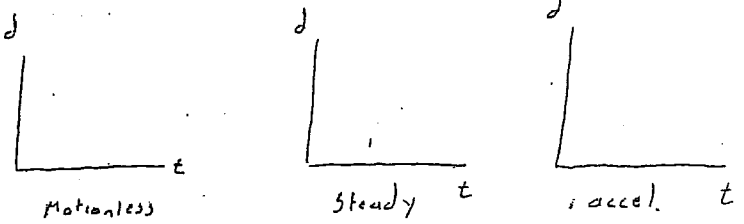
$v_f = v_i + at$

$d = v_i t + \frac{1}{2} a t^2$

$v_f^2 = v_i^2 + 2ad$

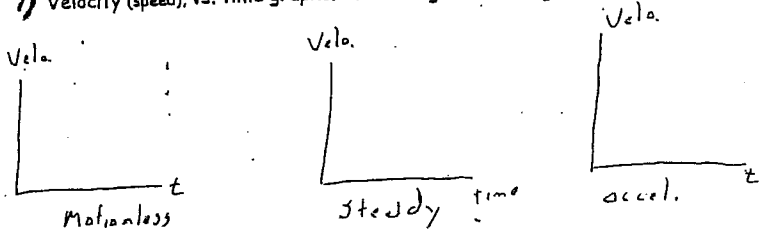
$\star\ d = \frac{1}{2}(v_i + v_f)t$

6) Distance (displacement), vs. Time graphs. What one thing can you get



Slope = _____

7) Velocity (speed), vs. time graphs. You can get two things

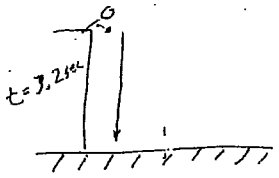


Slope = _____

Area Under = _____

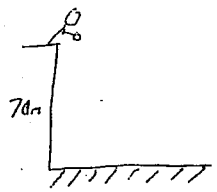
Falling Bodies

8) Easy falling body problems, and accel. of gravity. (If they give time of fall, or velocity it has just befor it hits *its easy*)



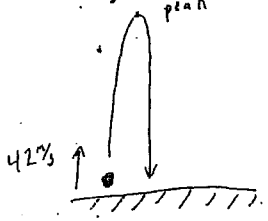
Find V_{Final} & d (height)

9) Harder falling body problems. (If they only give distance of fall)



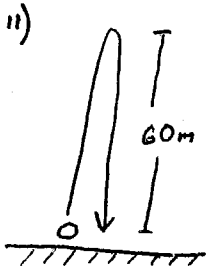
Find time and V_{Final}

10) Rising – Falling Body problems.



Find t_{rise}, and d (height)

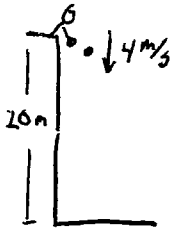
11)



Find $V_{Initial}$, t_{rise}

12) **An object on planet Alpha is dropped from an astronauts hand and falls 2 meters, in 1.2 seconds. Find the acceleration of gravity on planet Alpha.**

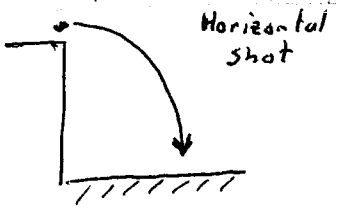
13) **An object is thrown down wards from a height of 20 meters with an initial velocity of 4 m/s. Explain why this object will be in the air a shorter time than if it were just dropped. Find the objects final velocity and time of fall.**

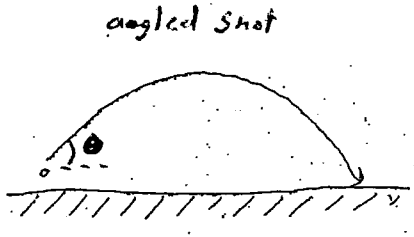


14) **What affect does air resistance have on falling objects ?**

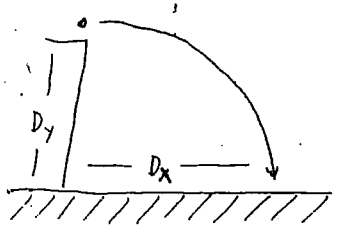
PROJECTILES

1) General characteristics –





2) Horizontally fired –

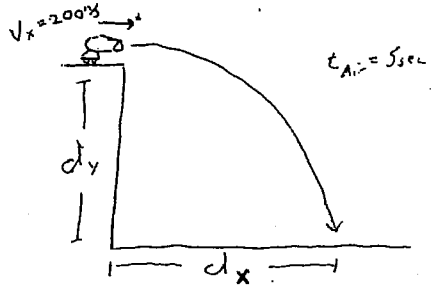


★

Horizontal	Vertical
$V_x = \frac{D_x}{t}$	$V_{fy} = V_{iy} + a_y t$
	$V_{fy}^2 = V_{iy}^2 + 2a_y d_y$
	$d_y = V_{iy} t + \frac{1}{2} a t^2$
	$d_y = \frac{1}{2}(V_{iy} + V_{fy})t$

i-

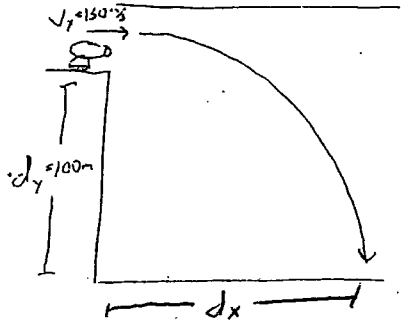
(IF they give time) its Easy



Find d_y & d_x, V_{fy} & V_x

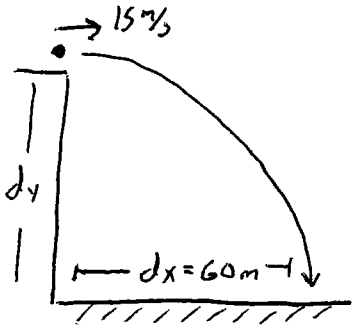
ii

(If they only give height Not so Easy)



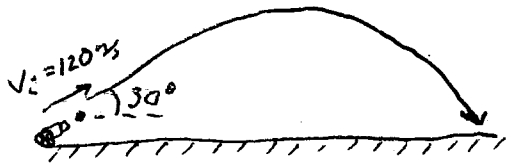
Find t, d_x, V_{fy}, V_x

iii



Find time, d_y, V_{fy}

3)



Know how to do problems for objects fired at an up angle
To find -

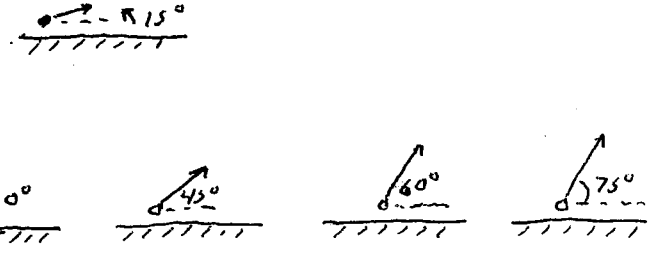
Time of Rise -

Maximum Height -

Total time in air -

Forward distance traveled or range

4)



Know affect of angle on -

Time of Rise -

Maximum Height -

Total time in air -

Forward distance traveled or range

Unit 2 - Vectors

VECTORS

1) Know what a vector is and how it is different from a scalar. Memorize list of vectors and scalars.

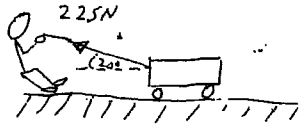
Vector Scalar

2) Difference between Distance and displacement, Speed and Velocity.

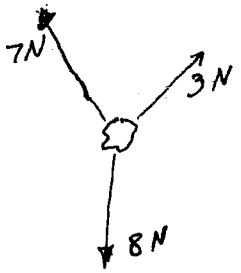
3) 1st Basic Operation done with vector. Combine (find resultant) in the 3 simple cases. Know the characteristics of each simple case.

Case I Case II Case III

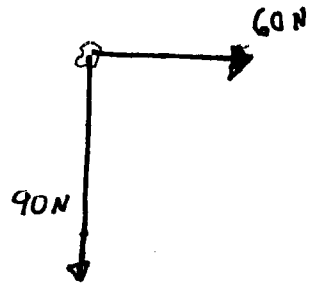
4) 2nd basic operation done with vectors. (break it down into two right angle parts or components). By looking at angle know which part would be bigger, which part smaller.



5) Know vector equilibrium, What type situations would be possible, What situations would be impossible.



6) Graphical Methods of drawing vectors, Finding a resultant, and using A protractor to measure an angle. (they love this on long part C problems)



- Scale = ____ N
- Sketch Resultant
- Find size of R

Unit 4 - Forces & Newton's Laws, Friction & Inclines

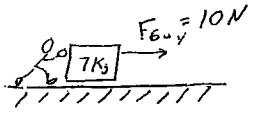
FORCES and NEWTON'S LAWS

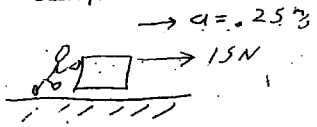
1) Know what force is, What are metric system units for force.

2) Know idea of Newton's 1st and 2nd Law.

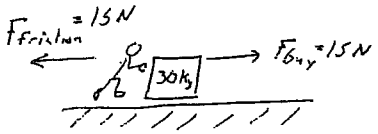
3) Know Mass is inertia, Weight is a force.

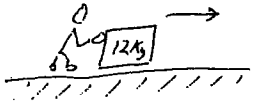
4) Know Newton's 2nd Law Equation. - Units for force. - Basic problems





5) Newton's 2nd law Equ. When there are more than one force acting,
- Or in situations where they don't directly give you a.





Object speeds up from 0 m/s to 8 m/s in 2 sec
Find F_{Guy}

6) Know how to do Double Force or Net Force Problem -

7) Know Mass is Inetia !! Weight force is downward pull Of gravity also called gravitational force

8) Know weight or gravitational force Equ. & how to apply on Earth, & also other planets

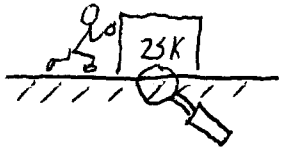
Earth $g = 9.8\ m/s^2 \simeq 10\ m/s^2$

Mars $g \simeq 4\ m/s^2$

9) On Earth be able to quickly change from Newtons of Force to pounds & vice versa, Be able to estimate 1 kg of mass is how much Weight on Earth, 1 gram is how much ?

10) Know what friction is, and what factors affect
It be able to draw Weight Force, Friction Force
& Normal Force as vector arrows.

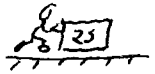
Wood on Wood



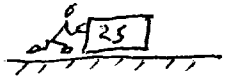
11) Know difference between Static, & Kinetic friction
Know how to apply friction formula for an object

- Just breaking free and starting slide

- Sliding forwards stedy speed
→ constant velo



- accelerating forwards
→ a = 2 m/s²

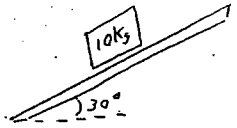


- Having only friction acting & slowing to stop

a ←

12) *INCLINE PLANE -*

On an incline, how does the weight vector break itself up, What do these two parts (components), of the weight vector tend to do ? Which part of these two is the Normal Force ?



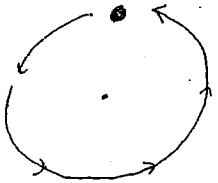
Unit 7 - Centripetal and Gravity

– CENTRIPETAL FORCES and GRAVITATIONAL FORCE

CENTRIPETAL FORCE

1) When something moves around in circle there must be force that pulls toward center to keep it in circle. (There is accel. that goes with this force) What way will object fly if this force gives out ?

2) Know how to point *Centripetal Force, Centripetal Acceleration,* and *Tangential Velocity* vector arrows.



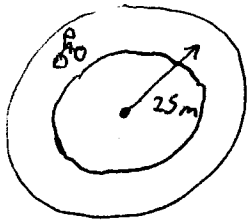
3) What is centripetal Force equation, What part of this equation is the Centripetal acceleration ?

$F_c = m a_c$ $\qquad a_c = \frac{V^2}{r}$

– If you change mass it changes force but not accel.

– If you double up on velocity accel goes up 4X & so does force

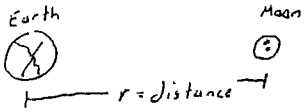
Watch ou for problems wher object goes around in a circle & they give you radius but not velo.



Once around in 20sec

GRAVITATIONAL FORCE BETWEEN OBJECTS

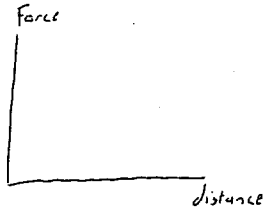
1) You want to know force of gravity equation (where to find it).
What is $\underline{G}$ in that equation. Where do you look up mass of Earth & Moon ?



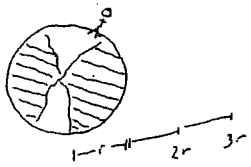
$$F = G\frac{M_1 m_2}{r^2}$$

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

2) Know this equation is an inversed squared form, & what that means -
Double distance ? Triple Distance ? Cut distance $\frac{1}{2}$?
What if we double on of the masses ?



3) This force of gravity between Earth & something on its surface
Is the WEIGHT force.



Old Regents problem

Base your answers to questions 67 through 69 on the passage and data table below.

The net force on a planet is due primarily to the other planets and the Sun. By taking into account all the forces acting on a planet, investigators calculated the orbit of each planet.

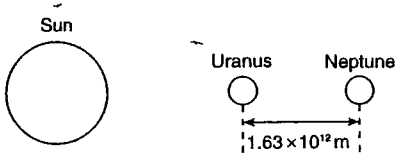
A small discrepancy between the calculated orbit and the observed orbit of the planet Uranus was noted. It appeared that the sum of the forces on Uranus did not equal its mass times its acceleration, unless there was another force on the planet that was not included in the calculation. Assuming that this force was exerted by an unobserved planet, two scientists working independently calculated where this unknown planet must be in order to account for the discrepancy. Astronomers pointed their telescopes in the predicted direction and found the planet we now call Neptune.

Data Table

Mass of the Sun	1.99×10^{30} kg
Mass of Uranus	8.73×10^{25} kg
Mass of Neptune	1.03×10^{26} kg
Mean distance of Uranus to the Sun	2.87×10^{12} m
Mean distance of Neptune to the Sun	4.50×10^{12} m

67 What fundamental force is the author referring to in this passage as a force between planets? [1]

68 The diagram below represents Neptune, Uranus, and the Sun in a straight line. Neptune is 1.63×10^{12} meters from Uranus.



(Not drawn to scale)

Calculate the magnitude of the interplanetary force of attraction between Uranus and Neptune at this point. [Show all work, including the equation and substitution with units.] [2]

69 The magnitude of the force the Sun exerts on Uranus is 1.41×10^{21} newtons. Explain how it is possible for the Sun to exert a greater force on Uranus than Neptune exerts on Uranus. [1]