PHY 2053 FINAL REVIEW w/ Dajia J.

DISCLAIMER: This sheet is student made w/ topics discussed in college physics 1... Therefore, this is not the actual exam. PLEASE treat this sheet as an aid.

Important Formulas to remember!

Percent Uncertainty: $\%\,unc = \frac{\delta A}{A} \times 100\%$

Displacement = $\Delta x = x_f - x_0$ (final position − initial position)
SI Unit: m

Velocity = $\frac{\Delta d}{\Delta t} = \frac{x_f - x_0}{t_f - t_0}$ (final time − initial time)
SI Unit: m/s

Acceleration = $\frac{\Delta V}{\Delta t} = \frac{V_f - V_0}{t_f - V_0}$ (final velocity − initial velocity)
SI Unit: m/s^2

Constant Acceleration

$V_y = V_{oy} + at$

$(y - y_0) = V_{oy}t + \frac{1}{2}at^2$

$V_y^2 = V_{oy}^2 + 2a(y - y_0)$

Projectile Motion

$V = \sqrt{V_{ox}^2 + V_{oy}^2}$

$V_y = 0$ @ max height

$h = \frac{1}{2}a_y t^2$

$V_{oy} \sin\theta$

$V_{ox} \cos\theta$

Newton's Laws

1. Inertia: object in motion stays in motion unless F_{net} acts on it
2. $\Sigma F = ma$
   SI Units = N
3. Equal + opposite forces act on opposite

Weight = mg

Friction = $f_s = \mu_s N$ OR $f_k = \mu_k N$

Young's Modulus = $\Delta L = \frac{1}{Y}\frac{F}{A} L_0$

Linear Velocity = V
m/s

$V = r\omega$

Period = T

$V = \frac{2\pi r}{T}$

Angular Velocity, ω

$\omega = \frac{\Delta\theta}{\Delta t}$ (change of rotation) / (change of time)
SI Units = rad/s

Centripetal Acceleration, Ac

$a_c = \frac{V^2}{r}$ $\quad a_c = r\omega^2$

Centripetal Force, F

$F = \frac{mV^2}{r} = m\omega^2 r$

Centripetal Force, F_c

$F_c = ma_c \longrightarrow \frac{mv^2}{r}$

$F_c = \frac{mv}{r} = N\sin\theta$

$N = \frac{mg}{\cos\theta} \cdot \sin\theta = mg\tan\theta$

Gravitational Force: $F = \frac{GM_1M_2}{r^2}$

$\frac{mv^2}{r} = mg\tan\theta$

Work =

$W = F\cos\theta d$ or $\frac{1}{2}mv_f^2 - \frac{1}{2}mv_0^2$

Kinetic Energy $= \frac{1}{2}mv_f^2$

Potential Energy $= mg(h_0 - h_f)$

Spring Potential Energy =

$\frac{1}{2}kx$

$\frac{v^2}{v} = g\tan\theta$

$v = \sqrt{rg\tan\theta}$

$r = \frac{v^2}{g\tan\theta}$

$\theta = \tan^{-1}\left(\frac{v^2}{rg}\right)$

$\text{Energy} = E_f - E_0 = \left(\frac{1}{2}mv_f^2 + mgh_f\right) - \left(\frac{1}{2}mv_0^2 + mgh_0\right)$

$\text{Power} = \frac{\text{work}}{\text{time}} = \frac{W}{t} = \frac{F\ (\text{Force})}{V\ (\text{velocity})}$

Momentum, $\vec{p}$

SI Units kg·m/s

$= \vec{p} = mv$

Impulse $= F_{net} = \frac{\Delta\vec{p}\ (\text{change of momentum})}{\Delta t\ (\text{change of time})}$

Collisions ($\vec{p_1} = \vec{p_2}$) no F_{net}

Elastic $= KE_0 = KE_f$

Inelastic $= KE_0 \neq KE_f$

Perfectly/Completely Inelastic = Stick together

- maximum loss of collision

Torque: $\tau = Fl$ (magnitude of Force × lever Arm)

Center of Mass

$X = \frac{m_1x_1 + m_2x_2 \cdots}{m_1 + m_2 \cdots}$ x = distance

$$V = \frac{m_1 V_1 + m_2 V_2 \cdots}{m_1 + m_2 \cdots}$$ v = velocity

Equilibrium of Rigid Body

$a_x = a_y = 0$

$\Sigma F_x = \Sigma F_y = 0$

Angular Acceleration, α

$$\alpha = \frac{\Delta \omega}{\Delta t}$$

Tangential Acceleration = a_t

- perpendicular to a_c

$$a_t = \frac{\Delta v}{\Delta t} = r\left(\frac{\Delta \omega}{\Delta t}\right)$$

$a_t = r\alpha$ ··· radius × angular accel

Understanding Sig Figs

1A. 0.08995600

1B. 54.900573

Understanding how to apply units

2. The Scouts travel at an average speed of 183 km/h to escape the titans. What distance do they travel in 2 seconds 50.833 m/s

3. If Jack the Dog gets on a scale that reads a mass of 67 kg with a 3.0% uncertainty. What's the Uncertainty of Jake's mass?

4. What's the acceleration when velocity is constant? _____

5. What is the difference between scalar and vector quantities?

Give 3 examples of each.

Vectors	Scalar
- Have magnitude • How much it is - Have direction • Can be positive OR negative	- have magnitude • How much it is - NO direction • can only be positive
EX: displacement	Ex: distance
Ex: Velocity	Ex: speed
EX: acceleration	EX: Temperature

Using Kinematic Equations

6. A ball is shot straight up from the surface of the Earth w/ an initial speed of 17.84 m/s. Ignore air resistance.

A. What's the maximum height that the ball reaches?

$$v_{fy} = v_{oy} + a_y t$$

$$y - y_0 = v_{oy} + \frac{1}{2} a_y t^2$$

$$v^2 = v_0^2 + 2a(y - y_0)$$

B. What's the velocity of the ball when it returns from the point of release?

$$v_{fy} = v_{oy} + a_y t$$

$$y - y_0 = v_{oy} + \frac{1}{2} a_y t^2$$

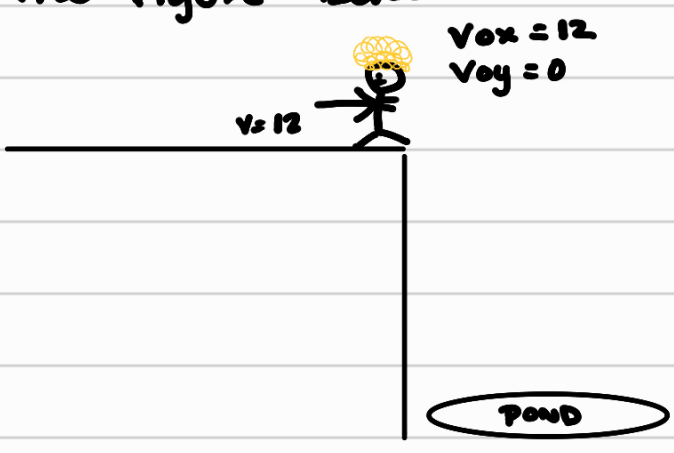
$$v^2 = v_0^2 + 2a(y - y_0)$$

C. What's the time that it takes for the ball to return from the point of release?

Projectile Motion

7 Find the height of a cliff if it takes Percy J. 7.36 s to hit a pond if he's pushed w/ an initial velocity of 12.00 m/s. Find the velocity that he's falling.

Draw the figure below



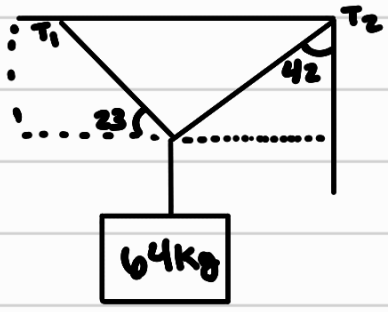
8. During its burn phase, a rocket accelerates at a constant rate of 4.00 m/s^2. Once it reaches 1000 km, it runs out of fuel and continues to fly up until it reaches its max height an the falls back down. What's the max height the rocket reached?

Voy = 0

9. Maraline pushing a 17kg box across Candy kingdom w/ a force of 45N at a 75° angle. Bonnabel is pulling the box w/ a force of 37N at 22° angle. Find the acceleration.

10. Amy is pushing a box at constant speed w/ a force of 80N at a 57° angle up a hill that forms a 12° angle above the horizontal. What's the static friction coefficient?

11. Find the total Tension



Young's Modulus

12. A 45 kg block hangs from a that has a surface area of $3mm^2$. It was orginally 5m long but stretches by 4cm. What's the Young's Modulus of the wire?

Circular Motion:

13. Draw the Free body Diagram of a banked Curve

14. John Cena is pirouetting at a 12 rev/s. What's his angular velocity? What's his centripetal acceleration if his nose is 0.012m from his axis of rotation?

Universal Gravity

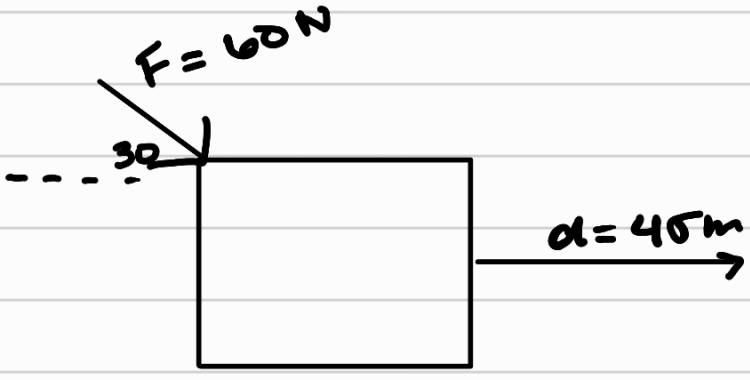
15. What's the acceleration due to gravity of a Planetia whose mass is 235 times as much of earth and 18 times the radius of Earth?

Banked Curve

16. Mario is racing on Rainbow Road that has a radius of 421 at a speed of 81m/s w/out friction. Find the angle of the banked curve.

Work Energy Theorem

17. How much work is done on a box that's being pushed 45m across Nancy?



Energy

18. Simone Biles is jumping on a trampoline w/ an initial velocity of 24m/s. Find the maximum height that she jumped. $v_f = 0$

19. A ball is thrown from a height of 52.0m. The ball is given an initial velocity of 36.0 m/s at angle of 30.0° below the horizontal. Ignoring air resistance, determine the speed of the ball right before it strikes the ground.

Momentum + Projectile Motion

20. A ball (0.0577kg) is dropped from height of 6.30m. What's the magnitude of the ball's momentum when it

hits the ground

m = 0.0577kg

Momentum Collision

21. A 4.0kg cart moving right w/ speed of 1.0m/s has a head on collision w/ a 8.0kg cart that initially move left w/ speed 3.0 m/s. After collision, 4.0kg cart moving left w/ speed 1.0m/s

(a) What's the final velocity of 8.0kg cart

(b) What's the kinetic energy of system b4 collision

(c) What's the kinetic energy of system after collision

(d) Is kinetic energy conserved in this collision

(e) What type of collision is this?

Impulse

22. Daisy crashes her kart head on to the railing on Luigi's Mansion, which exerts 5000 N (neg) on the car for 0.300s.

(a) What impulse is imparted by this force?

(b) Find the final velocity of the bumper car if its initial velocity is 3.7m/s and the car has a mass of 130kg. Neglect friction.

Torque

23. Cosmo and Wanda are sitting a a seesaw w/ negligible mass. Cosmo has a mass of 34 kg and is sitting 1.5m away from the pivot.

(a) If wanda has a mass of 27kg, how far away from the pivot is she?

(b) What's the supported force by the pivot? exerted by the pivot?