$$\vec{v} = \frac{d\vec{r}}{dt}$$
$$\vec{\omega} = \frac{d\vec{\theta}}{dt}$$
$$\vec{a} = \frac{d\vec{v}}{dt}$$
$$\vec{\alpha} = \frac{d\vec{\omega}}{dt}$$
$$v_{\mathrm{sf}} = v_{\mathrm{si}} + a_{\mathrm{s}}\,\Delta t$$
$$\omega_{\mathrm{f}} = \omega_{\mathrm{i}} + \alpha\,\Delta t$$
$$s_{\mathrm{f}} = s_{\mathrm{i}} + v_{\mathrm{si}}\,\Delta t + \tfrac{1}{2}a_{\mathrm{s}}\,(\Delta t)^2$$
$$\theta_{\mathrm{f}} = \theta_{\mathrm{i}} + \omega_{\mathrm{si}}\,\Delta t + \tfrac{1}{2}\alpha\,(\Delta t)^2$$
$$s = r\theta$$
$$v = r\omega$$
$$a_{\mathrm{t}} = r\alpha$$

$$\sum \vec{F} = m\vec{a} = \frac{d\vec{p}}{dt}$$
$$\sum \vec{F}_{\mathrm{ext}} = M\vec{a}_{\mathrm{cm}} = \frac{d\vec{P}}{dt}$$
$$\sum \vec{\tau}_{\mathrm{ext}} = I\vec{\alpha} = \frac{d\vec{L}}{dt}$$
$$f_{\mathrm{s,max}} = \mu_{\mathrm{s}} n$$
$$f_{\mathrm{k}} = \mu_{\mathrm{k}} n$$
$$a_{\mathrm{r}} = \frac{v^2}{r}$$
$$\vec{w} = m\vec{g}$$
$$|\vec{F}_{\mathrm{G}}| = \frac{Gm_1m_2}{|\vec{r}|^2}$$
$$D = \tfrac{1}{2}C\rho A v^2$$
$$\vec{\tau} = \vec{r} \times \vec{F}$$

$$W = \int \vec{F} \cdot d\vec{s}$$
$$W_{\mathrm{ext}} = \Delta K + \Delta U + \Delta E_{\mathrm{th}}$$
$$K = \tfrac{1}{2}mv^2$$
$$K = \tfrac{1}{2}I\omega^2$$
$$U_{\mathrm{g}} = mgy$$
$$U_{\mathrm{s}} = \tfrac{1}{2}k\,(\Delta s)^2$$
$$U_{\mathrm{G}} = -\frac{Gm_1m_2}{r}$$
$$P = \frac{dE_{\mathrm{sys}}}{dt}$$
$$P = \vec{F} \cdot \vec{v}$$
$$\vec{J} = \int \vec{F}\,dt = \Delta\vec{p}$$
$$\vec{p} = m\vec{v}$$

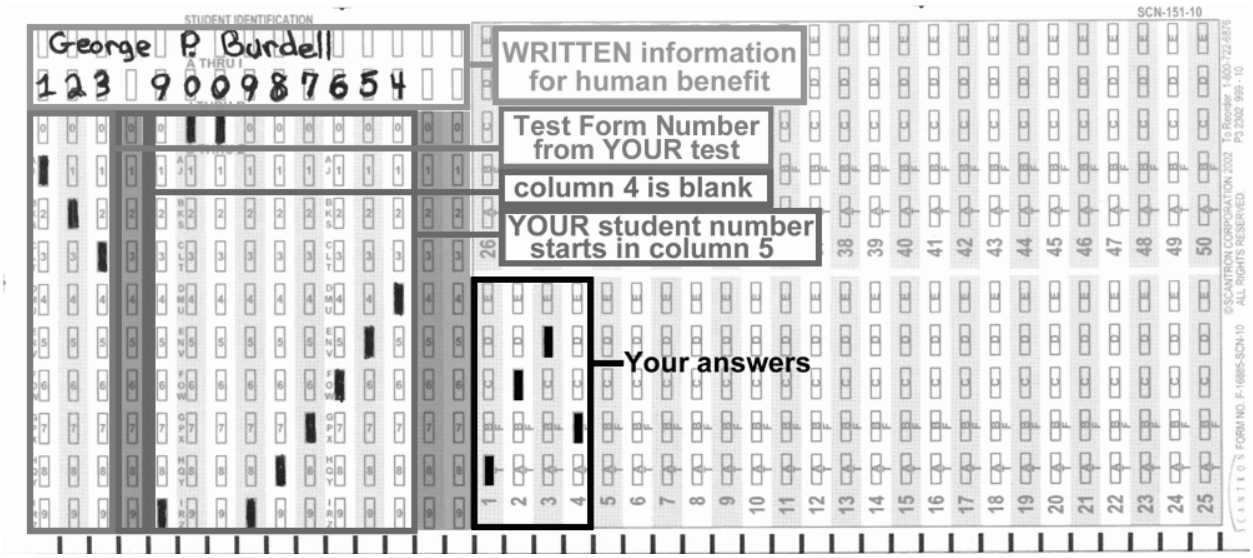
$$\vec{r}_{\mathrm{cm}} = \frac{\sum \vec{r}_i m_i}{\sum m_i}$$
$$\vec{r}_{\mathrm{cm}} = \frac{\int \vec{r}\,dm}{\int dm}$$
$$I = \sum m_i r_i^2$$
$$I = \int r^2\,dm$$
$$I = I_{\mathrm{cm}} + Md^2$$
$$\vec{L} = \vec{r} \times \vec{p}$$
$$\vec{L} = I\vec{\omega}$$
$$x = A\cos(\omega t + \phi_0)$$
$$\vec{a}_{\mathrm{x}} = -\omega^2\vec{x}$$
$$\omega = \sqrt{k/m}$$
$$\omega = 2\pi f = \frac{2\pi}{T}$$

Physical Constants:

Universal Gravitation Constant $G = 6.673 \times 10^{-11}\,\mathrm{N{\cdot}m^2/kg^2}$
Gravitational Acceleration at Earth's Surface $g = 9.81\,\mathrm{m/s^2}$

Unless otherwise directed, drag is to be neglected and all problems take place on Earth, use the gravitational definition of weight, and all springs, ropes and pulleys are ideal.

Please remove this sheet from your Quiz or Exam



YOUR form number is **215**

Recitation Sections

	Room 123	Room 125	Room 325
Tuesday			
12:30–1:20 pm	M01 Gaire, Vinod		
2:35–3:25 pm		M02 Gaire, Vinod	
Wednesday			
12:30–1:20 pm			M03 Pallantla, Ravi Kumar
2:25–3:15 pm			M04 Pallantla, Ravi Kumar
4:30–5:20 pm			M05 Pallantla, Ravi Kumar
Thursday			
12:30–1:20 pm	M06 Gaire, Vinod		
2:35–3:25 pm		M07 Gaire, Vinod	

Version A

Quiz #2 Form #215

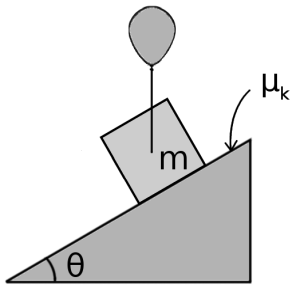
Physics 2211 M Summer 2017

Name:_____

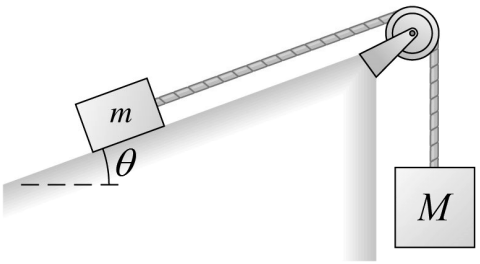
Recitation Section:_____

- Print your name, quiz form number (3 digits at the top of this form), and student number (9 digit Georgia Tech ID number) in the section of the answer card labeled "Student Identification."
- Bubble the Quiz Form Number in columns 1–3, skip column 4, then bubble your Student Number in columns 5–13.
- Free-response questions are numbered I–III. For each, make no marks and leave no space on your card. Show all your work clearly, including all steps and logic. Box your answer.
- Multiple-choice questions are numbered 1–7. For each, select the answer most nearly correct, circle this answer on your quiz, and bubble it on your answer card. Do not put any extra marks on the card.
- Turn in your quiz and answer card as you leave. Your score will be posted when your quiz has been graded. Quiz grades become final when the next quiz is given.
- You may use a calculator that cannot store letters, but no other aids or electronic devices.

I. (16 points) A block with mass $m = 10.0\,\text{kg}$ is on a plane inclined $\theta = 30.0°$ to the horizontal, as shown. A balloon is attached to the block to exert a constant upward force $F_B = 9.8\,\text{N}$. If the block moves down the plane with a constant velocity, what is the coefficient of kinetic friction μ_k between the block and plane? (*On Earth.*)



1. (6 points) The block of mass m is held at rest on the frictionless plane that makes an angle θ with the horizontal. An ideal rope passes over an ideal pulley, connecting it to a hanging block of mass M, as shown. When the block of mass m is released, it accelerates down the plane. Compare the resulting tension T in the rope with gravitational force on the block of mass M. (*On Earth.*)



(a) $0 = T < Mg$
(b) $T > Mg$
(c) $T = Mg$
(d) $0 < T < Mg$

II. (16 points) If $m = 7.7\,\text{kg}$, $M = 2.2\,\text{kg}$, and $\theta = 28°$, what is the acceleration magnitude of the block of mass m after release?

III. (16 points) Saturn's moon Titan requires 16 days to orbit the planet. The orbit is circular, with a radius of 1.222×10^6 km. What is the mass of Saturn?

2. (6 points) What is the ratio of Titan's mass, M_T, to Saturn's mass, M_S?

   (a) M_T/M_S cannot be determined from the information provided.
   (b) $M_T/M_S = 1/16$
   (c) $M_T/M_S = 1/64$
   (d) $M_T/M_S = 1/1.4 \times 10^6$
   (e) $M_T/M_S = 1/256$

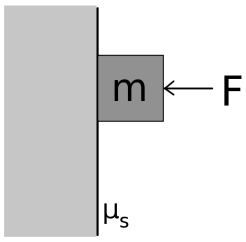
3. (8 points) Imagine a planet with with three times the mass of Earth, and twice the Earth's radius. What would the gravitational acceleration, g_{planet}, be on this planet's surface?

   (a) $13.1\,\text{m/s}^2$
   (b) $9.8\,\text{m/s}^2$
   (c) $14.7\,\text{m/s}^2$
   (d) $6.5\,\text{m/s}^2$
   (e) $7.4\,\text{m/s}^2$

4. (8 points) A spherical object with radius r is dropped on Earth to reach its terminal velocity v_1, if another spherical object with the same mass and drag coefficient, but radius $2r$ is dropped, what is its terminal velocity in terms of v_1? (*Do NOT neglect drag!*)

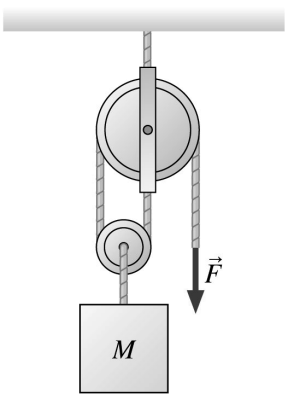
   (a) $v_1/2$
   (b) $2v_1$
   (c) $v_1\sqrt{2}$
   (d) $v_1/4$
   (e) $4v_1$

5. (8 points) A horizontal external force $F = 150\,\text{N}$ is applied to a 10 kg block against the wall. The coefficient of static friction between the wall and the block is $\mu_s = 0.8$. What is the magnitude of the friction force on the block? (*On Earth.*)



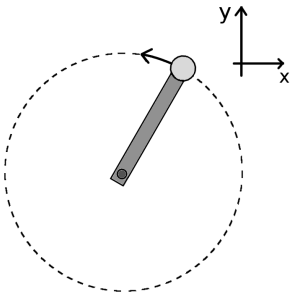
(a) 90 N
(b) 120 N
(c) 130 N
(d) 98 N
(e) 114 N

6. (8 points) A block of mass M is being raised at a constant velocity by the system of ideal ropes and pulleys, as shown. With what force magnitude F is the rope being pulled? (*On Earth.*)



(a) $2Mg$
(b) $Mg/2$
(c) $3Mg$
(d) Mg
(e) $Mg/3$

7. (8 points) A 10 kg spherical object is attached to a 10 m massless rod to form a uniform vertical circular motion with an angular speed $\omega = 1\,\text{rad/s}$ as shown. At the top of the loop, what is the magnitude and direction of the force exerted by the rod on the object? (*On Earth.*)



(a) $+10\,\hat{y}\,\text{N}$
(b) $-10\,\hat{x}\,\text{N}$
(c) $-2\,\hat{y}\,\text{N}$
(d) $-10\,\hat{y}\,\text{N}$
(e) $+2\,\hat{y}\,\text{N}$