PHY101: Final All inclusive: Chapters 1-15, 18, 19

Test day/time: Total Time: **3 Hours**

10:00 AM	Friday (5/8)	1 PM – 4 PM
11:15 AM	Thursday (5/7)	6 PM – 9 PM

36 Multiple Choice (3 Pts each) – 108 points (Prior to F16 = no thermo)
6 Short Answer (a) – (d), you complete 4 (12 pts each) – 48 points

Follows a similar format to Test #3 in terms of use of D2L.

Questions come from:

(a) Test problems you missed
(b) Recent material (Chapters 12, 15 + Thermo)
(c) Questions I wanted to ask on previous exams, but didn't

Review Sessions:

Tuesday (12/3)	Chap 1-7	Bracy 02/04/06	9:30 – 11:00 PM
Saturday (12/7)	Chap 12,15,thermo	Bracy 02/04/06	4:00-5:30 PM

Office hours during finals week, as posted on website or by appointment.

If these change due to meetings/appointments, I will let you know.
After the exams, please email me if you wish to meet or have questions.

Sample Questions: Taken from Reviews 1-3 See posted solutions

Setup the following. Calculations are your responsibility.

1.15

A roof tile falls straight down from a two-story building.
It lands in a swimming pool and settles gently to the bottom.
Draw a complete motion diagram for the tile.

1.22

Draw a pictorial representation of this problem. Do not solve it. What acceleration does a rocket need to reach a speed of 200 m/s at a height of 1.0 km.

2.13
A jet plane is cruising at 300 m/s when suddenly the pilot turns the engines up to full throttle. After traveling 4.0 km, the jet is moving with a speed of 400 m/s. What is the acceleration of the jet?

Ans: 8.8 m/s^2

2.19
A student standing on the ground throws a ball straight up. The ball leaves the student's hand with a speed of 15 m/s when the hand is 2.0 m above the ground. How long is the ball in the air before it hits the ground. (The student moves her hand out of the way).

Ans: 3.2 s

2.55
Santa loses his footing and slides down a frictionless, snowy roof that is titled at an angle of 30º. If Santa slides 10 m before reaching the edge, what is his speed as he leaves the roof?

Ans: 9.9 m/s (down the roof)

3.7
Draw each of the following vectors, then find its x- and y-components.

$a.\ \vec{v} = (10\ m/s, negative\ y-direction)$

$b.\ \vec{a} = (20\ m/s^2, 30°\ below\ \ positive\ \ x-axis)$

$c.\ \vec{F} = (100\ \ N, 36.9°\ counterclockwise\ \ from\ positive\ \ y-axis)$

Ans: See book

3.31

Bob walks 200 m south, then jogs 400 m southwest, then walks 200 m in a direction, 30º east of north (60º NE). (a) Draw a graphical representation of Bob's Motion. (b) Using components determine the displacement that will return Bob to his starting position.

Ans: 360 m, 59.4º North of East

4.31

A supply plane needs to drop a package of food to scientists working on a glacier in Greenland. The plane flies 100 m above the glacier at a speed of 150 m/s. How far short of the target should it drop the package?

Ans: 678 m

4.44

A ball is thrown toward a cliff of height h with a speed of 30 m/s and an angle of 60º above the horizontal. It lands on the edge of the cliff 4.0 s later. (a) How high is the cliff? (b) What was the maximum height of the ball? (c) What is the ball's impact speed?

Ans: (a) 26 m (b) 34 m (c) 20 m/s

4.35

Your roommate is working on his bicycle and has the bike upside down. He spins the 60 cm diameter wheel, and you notice that a pebble stuck in the tread goes by three times every second. What are the pebble's speed and acceleration?

Ans:5.7 m/s, 108 m/s^2

4.68

A computer hard disk 8.0 cm in diameter is initially at rest. A small dot is painted on the edge of the disk. The disk accelerates at 600 rad/s^2 for ½ s, then coasts at a steady angular velocity for another ½ s. (a) What is the speed of the dot at 1.0 s? (b) Through how many revolutions has the disk turned?

Ans: 12 m/s (300 rad/s), 35.8 rev

4.71

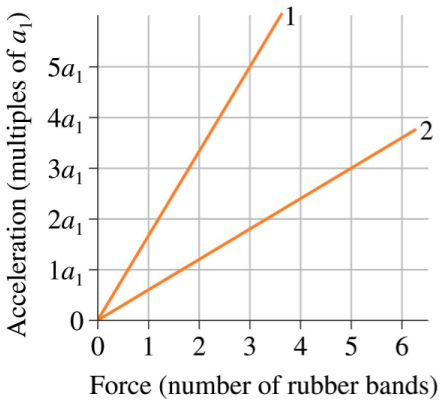
Your 64 cm – diameter car tire is rotating at 3.5 rev/s when suddenly you press down hard on the accelerator. After traveling 200 m, the tire's rotation has increased to 6.0 rev/s. What was the tire's angular acceleration in rad/s^2?

Ans: 0.75 rad/s^2

5.8

The figure shows acceleration versus force graphs for two objects pulled by rubber bands. What is the mass ratio of m_1 to m_2?

Ans: 9/25



5.33

A constant force is applied to an object, causing the object to accelerate at 8.0 m/s^2. What will be the acceleration if… (a) The force is doubled? (b) The object's mass is doubled? (c) The force and the object's mass are both doubled? (d) The force is doubled and the object's mass is halved?

Ans: (a) 16.0 m/s^2 (b) 4.0 m/s^2 (c) 8.0 m/s^2 (d) 32 m/s^2

6.13

A 50 kg box hangs from a rope. What is the tension in the rope if…
(a) the box is at rest? (b) The box moves up at a steady 5.0 m/s? (c) The box has v_y=5.0 m/s and is speeding up at 5.0 m/s^2? (d) The box has v_y=5.0 m/s and is slowing down at 5.0 m/s^2?

Ans: (a) 490 N (b) 490 N (c) 740 N (d) 240 N

6.25

A stubborn, 120 kg mule sits down and refuses to move. To drag the mule to the barn, the exacerbated farmer ties a rope to the mule and pulls with his maximum force of 800 N. The coefficients of friction between the mule and the ground are μ_s=0.80 and μ_k =0.50. Is the farmer able to move the mule?

Ans: No.

6.55b

You are driving along at 25 m/s with your aunt's valuable antiques in the back of your pick-up truck when suddenly you see a giant hole in the road 55 m ahead of you. Fortunately, your foot is right beside the brake and your reaction time is zero. Can you stop without the antiques sliding and being damaged? μ_k = 0.30 and μ_s =0.60

Ans: Yes.

7.6

A 1000 kg car pushes a 2000 kg truck that has a dead battery. When the driver steps on the accelerator, the drive wheels of the car push against the ground with a force of 4500 N. Rolling friction can be neglected. (a) What is the magnitude of the force of the car on the truck? (b) What is the magnitude of the force of truck on the car?

Ans: (a) +(b) 3000N

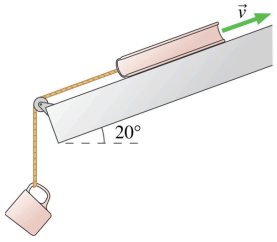
7.13

An 80 kg spacewalking astronaut pushes off a 640 kg satellite, exerting a 100 N force for the 0.50 s it takes him to straighten his arms. How far apart are the astronaut and the satellite after 1.0 min?

Ans: 42 m (book includes the throw dist, I would not)

7.41a

The 1.0 kg physics book shown is connected by a string to a 500g coffee cup. The book is given a push up the slope and released with a speed of 3.0 m/s. The coefficients of friction are μ_s=0.50 and μ_k =0.20. How far does the book slide?



Ans: (a) 0.67 m

8.18

A car drives over the top of a hill that has a radius of 50 m. What maximum speed can the car have without flying off the road at the top of the hill?

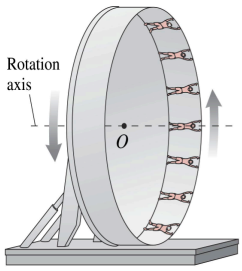
Ans: 22 m/s

13.32

(a) At what height above the earth is the acceleration due to gravity 10% of its value at the surface? (b) What is the speed of the satellite orbiting at that height?

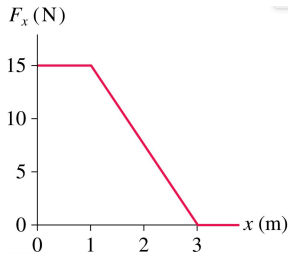
Ans: (a) 1.4 x 10^7 m from earth's surface (b) 4.5 km/s

8.51



In an amusement park ride called "The Roundup", passengers stand inside a 16-m diameter rotating ring. After the ring has acquired sufficient speed, it tilts into a vertical plane.
(a) Suppose the ring rotates once every 4.5 s. If a rider's mass is 55 kg, with how much force does the ring push on her at the top of the ride? At the bottom?
(b) What is the longest rotation period of the wheel that will prevent the riders from falling off at the top? Ans: (a) 3.2×10^2 N at top, 1.4×10^3 N at bottom (b) 5.7s

9.21



A 500 g particle moving along the x-axis experiences the force shown in the figure. The particles velocity is 2.0 m/s at x=0m. What is its velocity at 3 m?

Ans: 11 m/s

9.36

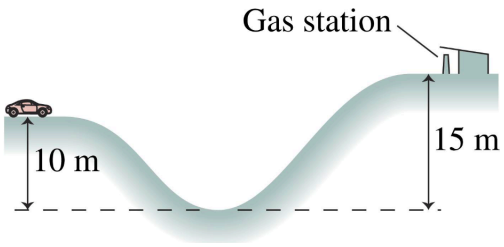
(a) How much work does an elevator motor do to lift a 1000 kg elevator a height of 100 m? How much power must the motor supply to do this in 50 s at constant speed?
Ans: (a) 9.8×10^5 J (b) 2.0×10^4 W

9.56

When a 65 kg cheerleader stands on a vertical spring, the spring compresses by 5.5 cm. When a second cheerleader stands on the shoulders of the first, the spring compresses an.addtional 4.5 cn. What is the mass of the second cheerleader?
Ans: 53 kg

10.11

A 1500 kg car traveling at 10 m/s suddenly runs out of gas while approaching the valley shown. What will be the car's speed as it coasts into the gas station on the other side of the valley?



Ans:1.4 m/s

10.42

A 50 g ice cube can slide without friction up and down a 30º slope. At the bottom, a spring with spring constant 25 N/m is compressed 10 cm and used to launch the ice cube up the slope. How high does it go above the starting point?

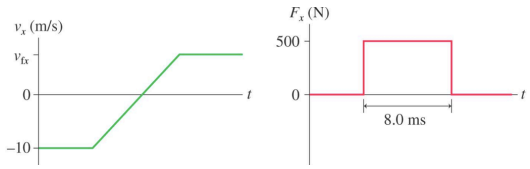
Ans: 51 cm

9.70 (more a chapter 10 problem)

A 10.2 kg weather rocket generates a thrust of 200 N. The rocket, pointing upward, is clamped to the top of a vertical spring. The bottom of the spring, whose spring constant is 550 N/m, is anchored to the ground. (a) Initially before the engine is ignited the rocket sits at rest atop of the spring. How much is the spring compressed? (b) After the engine is ignited, what is the rocket's speed when the spring has stretched 40 cm?

Ans: (a) 20.0 cm (b) ~~3.7 m/s~~ 2.43 m/s

11.13



A 250 g ball collides with a wall. The figure shows the ball's velocity and the force exerted on the ball by the wall. What is the v_{fx}, the ball's rebound velocity?

Ans: 6.0 m/s

11.14

A 5000 kg open train car is rolling on frictionless rails at 22 m/s when it starts pouring rain. A few minutes later, the car's speed is 20 m/s What mass of water has collected in the car? Ans: 5.0×10^2 kg

11.48

One billiard ball is shot east at 2.0 m/s. A second identical billiard ball is shot west at 1.0 m/s. The balls have a glancing collision, not a head-on collision, deflecting the second ball by 90º and sending it north at 1.41 m/s. What are the speed and direction of the first ball after the collision. Give the direction as an angle south east.

Ans: 1.7 m/s, 55º SE

11.63

A 20 g ball is fired horizontally with a speed v towards a 100 g ball hanging motionless from a 1.0 m long string. The ball undergoes a head-on perfectly elastic collision, after which the 100 g ball swings out to a max angle of 50º. What was v?

Ans: 7.9 m/s