Final Exam

1. Academic Integrity - Code of Conduct

UCLA is a community of scholars committed to the values of integrity. In this community, all members including faculty, staff, and students alike are responsible for maintaining the highest standards of academic honesty and quality of academic work. As a student and member of the UCLA community, you are expected to demonstrate integrity in all of your academic endeavors. When accusations of academic dishonesty occur, the Office of the Dean of Students investigates and adjudicates suspected violations of this student code. Unacceptable behavior include cheating, fabrication or falsification, plagiarism, multiple submissions without instructor permission, using unauthorized study aids, facilitating academic misconduct, coercion regarding grading or evaluation of coursework, or collaboration not authorized by the instructor. Please review our campus' policy on academic integrity in the UCLA Student Conduct Code: http://www.deanofstudents.ucla.edu/Student-Conduct-Code

If you engage in these types of unacceptable behaviors in our course, then you will receive a zero as your score for that assignment. If you are caught cheating on an exam, then you will receive a score of zero for the entire exam. These allegations will be referred to the Office of the Dean of Students and can lead to formal disciplinary proceedings. Being found responsible for violations of academic integrity can result in disciplinary actions such as the loss of course credit for an entire term, suspension for several terms, or dismissal from the University. Such negative marks on your academic record may become a major obstacle to admission to graduate, medical, or professional school.

We cannot make exceptions to our campus' policy on academic integrity, and as we hopefully have communicated effectively here, penalties for violations of this policy are harsh. Please do not believe it if you hear that "everyone does it". The truth is, you usually don't hear about imposed disciplinary actions because they are kept confidential. So our advice, just don't do it! Let's embrace what it means to be a true Bruin and together be committed to the values of integrity.

By submitting my assignments and exams for grading in this course, I acknowledge the above-mentioned terms of the UCLA Student Code of Conduct, declare that my work will be solely my own, and that I will not communicate with anyone other than the instructor and proctors in any way during the exams.

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2. Submit a copy of your solutions using this form:

Please upload all work using this form.

The submission uses Google Forms which requires you to be signed into a Google account and will send a confirmation email when the form and your uploads are successfully submitted. If you do not receive a confirmation email or have any other issues please email support@kudu.com. There are free apps that allow you to use your phone camera to scan to PDF or you can use a printer with a scanner. If you are not able to do this you can take photos of your work with your phone and upload them directly or email the files to yourself, download them on your computer then upload them with the Google Form. You can upload up to 10 images at a time.

If the work you submit via the form is correct, or very nearly correct, I may opt to give you a point back where Kudu would otherwise mark you as wrong, which is why it is important to submit your solutions (neatly, organized, and readable) and show all of your work.

Any numbered solutions (not multiple choice problems) on Kudu that do not have accompanying work justifying your answer I may mark as wrong, even if Kudu marks you as correct, which is why it is important to submit your solutions (neatly, organized, and readable) and show all of your work.

When you submit your written solutions via the form, the multiple choice questions need to have the text of the answer in the written work, not just "A, B, C" etc. The reason is that Kudu displays the options in a random order to students, so the letters alone won't mean much.

3. General instructions

- For any technical issues, please contact support@kudu.com They will respond promptly.
- Your numerical answer must be within 5% of the correct answer to be counted.
- The grade will not depend on the number of significant digits you provide.
- You have only one attempt for each problem - make sure the answer you submit is your final answer.
- In all problems, neglect air resistance, unless instructed otherwise.
- Written solutions showing work and all necessary derivations must be uploaded in addition to submission of numerical answers.
- Multiple choice questions need to have the text of the answer in the written work uploaded, not just "A, B, C" etc.

If you have questions during the active exam time, please send a group text to the lecture TAs ('EBRYANTO SOEMARDY' <626-898-2437>; 'Aaron John Sabu' <310-873-8348>) and one or more of us will get back to you ASAP. For technical question about Kudu itself, please contact support and support@kudu.com.

Please note the questions below can be edited and changed by your instructor. The printed version is NOT guaranteed to match the online version at a later stage.

Homework Questions

Q1

(1 points)

Which of the following is a scalar quantity?

Select the correct answer

- Acceleration
- Displacement
- Speed
- None of these
- Velocity

Q2

(1 points)

Which of the following is a vector quantity?

Select the correct answer

- Mass
- Speed
- Density
- Temperature
- None of these

Q3

(1 points)

Which of the following statements is true for an object in uniform circular motion:

Select the correct answer

- none of the above
- The instantaneous velocity and instantaneous acceleration vectors are opposite to each other.
- The instantaneous velocity and instantaneous acceleration vectors are both perpendicular to the circular path.
- The instantaneous velocity and instantaneous acceleration vectors are both tangent to the circular path.
- The instantaneous velocity and instantaneous acceleration vectors are perpendicular to each other.

Q4

(1 points)

You are in an elevator. You will experience the largest apparent weight when the elevator...

Select the correct answer

- moves upward with increasing speed
- moves downward with increasing speed
- remains stationary
- moves upward with decreasing speed
- moves downward at constant speed

Q5

(1 points)

Superman is flying at a constant 686 m/s (twice the speed of sound) and experiencing an air drag force of 352,800 N.

According the 1978 superman movie, Lois Lane interviews the man of steel to obtain the following information:

LOIS:	And how big are you? How tall are you?
SUPERMAN:	About six four.
LOIS:	And, uh, how much do you weight?
SUPERMAN:	Around two twenty-five.

Taking this information, 225 pounds is around 102 kg, which you can treat as superman's mass.

The magnitude of the net force on superman is...

Image size: s M L **Max**

Select the correct answer

- 999.6 N
- 0 N
- 352801 N
- 353800 N
- none of these

Q6

(1 points)

In uniform circular motion,

Select the correct answer

- the acceleration is always constant in magnitude and direction.
- both the acceleration and the velocity are continually changing direction.
- the velocity is always changing direction but the acceleration is always in the same direction.
- the net force is always constant in magnitude and direction.
- the velocity is always constant in magnitude and direction.

Q7 (1 points)

An object moves in a circle at constant speed. The work done by the centripetal force is zero because:

Select the correct answer

- the displacement for each revolution is zero
- the magnitude of the acceleration is zero
- there is no friction
- the centripetal force is perpendicular to the velocity
- the average force for each revolution is zero

Q8 (1 points)

When a wheel rolls without slipping,

Select the correct answer

- every point on its rim has the same linear velocity.
- whether its motion is purely rotational or purely translational depends on whether it is rolling up or downhill.
- its motion is purely translational.
- its motion is purely rotational.

its motion is purely rotational

its motion is a combination of rotational and translational motion.

Q9

(1 points)

Pure rolling motion requires friction forces, but we can still rely on the conservation of mechanical energy because...

Select the correct answer

there is no friction in the real world

the linear velocity of the point of contact (relative to the inclined surface) is zero

the coefficient of static and kinetic friction are equal

the angular velocity of the center of mass about the point of contact is zero

the coefficient of kinetic friction is zero

Q10

(1 points)

Consider that a coin is dropped into a wishing well. You want to determine the depth of the well from the time T between releasing the coin and hearing it hit the bottom. If the speed of sound is 330 m/s, and $T = 2.48$ seconds, what is the depth h of the well?

Select the correct answer

- 33.6 m
- 22.5 m
- 28.1 m
- 38.8 m
- 19.1 m

Q11

(1 points)

When a 4.22 kg mass is hung veritcally on a light spring that obeys Hooke's law, the

When a 1.22 kg mass is hung vertically on a light spring that obeys Hooke's law, the spring stretches 2.30 cm. How much work must an external agent do to stretch the spring 4.62 cm from its equilibrium position?

Select the correct answer

- 2.33 J
- 1.49 J
- 1.92 J
- 1.66 J
- 0.985 J

Q12

(1 points)

Calculate the centripetal force required to keep a 4 kg mass moving in a horizontal circle of radius 0.8 m at a speed of 6 m/s.

[$\hat{r}$ is the radial vector pointing outward with respect to the center of the circle]

Select the correct answer

- -180 N $\hat{r}$
- -30.0 N tangent to the circle
- 180 N $\hat{r}$
- 1440.0 N $\hat{r}$
- 39.2 N tangent to the circle

Q13

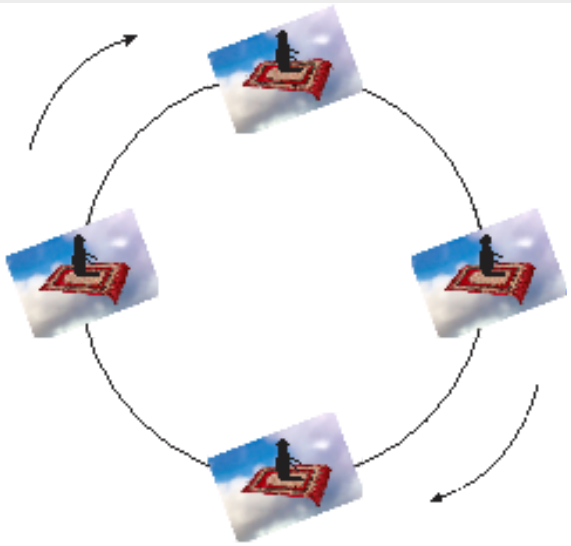
(1 points)

Here we go again...

After a terrifying experience during her last solo ride with Magic Carpet, in hindsight, Jazmine realizes she quite enjoyed the thrill of that experience. On her next opportunity to ride with Carpet, she requests to fly around in a loop-the-loop circle all over again with uniform speed v, with a careful request this time that Capet doesn't go so fast to risk her falling off!

If Jazmine experiences an apparent weight at the bottom of the loop that is twice her apparent weight at the top of the loop, what is the radius of the circular path?

Image size: s M L **Max**



Select the correct answer

- v^2/g
- $2v^2/g$
- $4v^2/g$
- $3v^2/g$

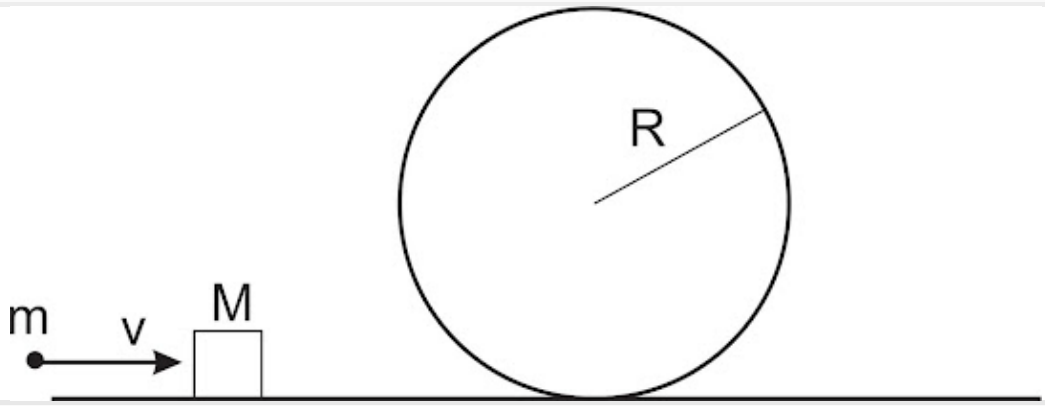
- $5v^2/g$

Q14

(1 points)

A bullet of mass $m = 0.00302$ kg makes a completely inelastic collision with a block of mass $M = 0.0820$ kg which is initially at rest. After the collision, the block then slides forward on a frictionless track into a circular loop of radius $R = 1.83$ m. What is minimum speed of the bullet in order to push the block through the circular loop track?

Image size: s M L Max



Select the correct answer

- 122 m/s
- 94.7 m/s
- 267 m/s
- 137 m/s
- 183 m/s

Q15

(1 points)

Let the application of a force be $\vec{F} =$ (0.864, 6.08, -0.867) N be at a position $\vec{r} =$ (4.64,-1.22,9.74) m in some cartesian coordinate system. Calculate the magnitude of torque about the origin due to this force.

Please enter a numerical answer below. Accepted formats are numbers or "e" based scientific notation e.g. 0.23, -2, 1e6, 5.23e-8

Q16

(1 points)

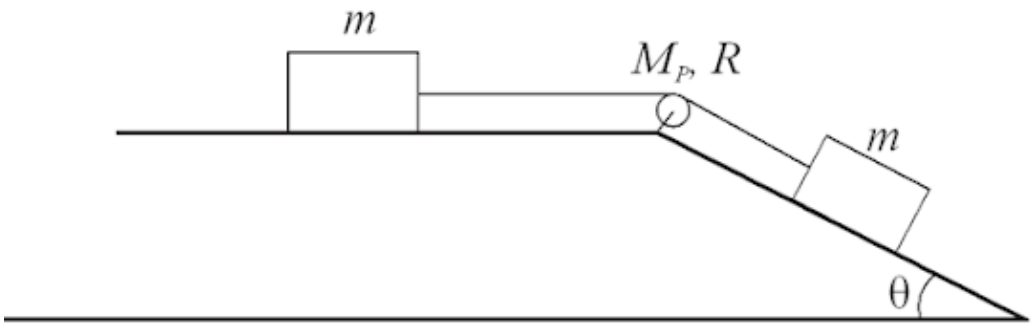
Look familiar? This is the same system that we encountered on Midterm 2, but now we will deal with a massive pulley!

Two identical 4.24 kg boxes are connected by a string and pulley with the first block resting on a horizontal surface and the second block inclined on slope with an angle of 33.1° above horizontal, as shown in the figure below. The pulley has a moment of inertia, $I = \frac{2}{3}M_P R^2$, where M_P = 6.99 kg is the mass of the pulley and R = 2.06 m is the radius of the pulley. The system is released from rest and the blocks begin to slide. The coefficient of kinetic friction between the blocks and the surface are μ_k = 0.15.

Assume the string is massless and does not slip across the pulley.

What is the acceleration of the blocks?

Image size: s M L **Max**



Please enter a numerical answer below. Accepted formats are numbers or "e" based scientific notation e.g. 0.23, -2, 1e6, 5.23e-8

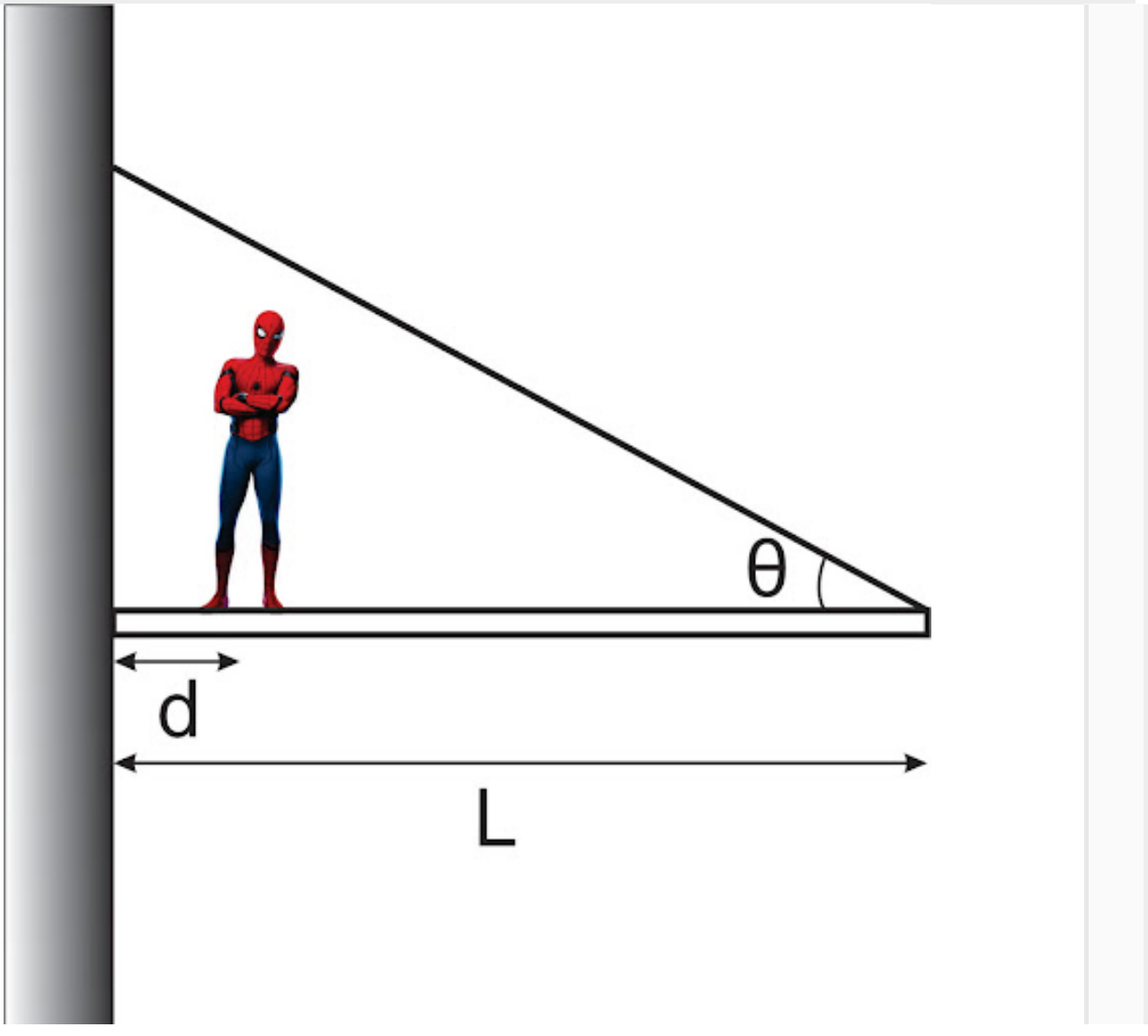
Q17

(1 points)

A horizontal beam of length $L = 11.8$ m and weight 246 N is attached to a wall as shown. The far end is supported by a cable which makes an angle of 60 degrees with respect to the beam. Spiderman stands $d = 3.99$m from the wall and weighs 531 N. Determine the tension in the cable.

[Hint: Try picking the point of contact between the beam and the wall as a reference point for the calculation of torques.]

Image size: s M L Max



Please enter a numerical answer below. Accepted formats are numbers or "e" based scientific notation e.g. 0.23, -2, 1e6, 5.23e-8

Q18

This question contains multiple parts. Make sure to read all the instructions and answer each part.

In this question, you will compare the motion of a rolling object to that of point mass.

Hint: While not strictly a requirement, finding a symbolic solution to parts a) and b) before plugging in your numbers will make part c) come out really nice... =)

Part a (1 points)

A point particle of mass 0.128 kg is released from rest a height of $h = 1.50$ m. What is its final velocity after it falls through this height?

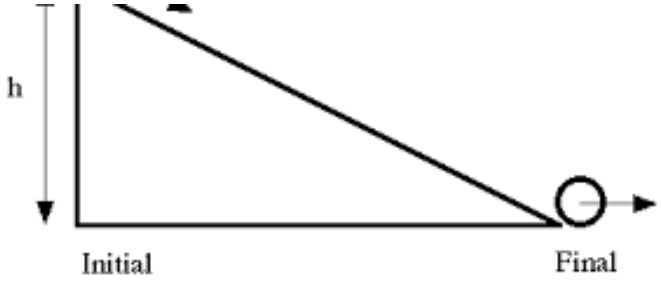
Please enter a numerical answer below. Accepted formats are numbers or "e" based scientific notation e.g. 0.23, -2, 1e6, 5.23e-8

Part b (1 points)

A uniform solid cylinder of mass 0.128 kg and radius $r =$ m rolls without slipping on its side down an incline from a height $h = 1.50$ m. What is the final linear speed of the cylinder at the bottom of the incline?

[The moment of inertia of the rolling cylinder is $I = \frac{1}{2}mr^2$]

Image size: s M L Max



Please enter a numerical answer below. Accepted formats are numbers or "e" based scientific notation e.g. 0.23, -2, 1e6, 5.23e-8

Part c

(1 points)

Both point mass in part a) and the cylinder in part b) have the same mass. Determine the ratio of the final speed of the cylinder at the bottom of the ramp from part b) to the speed of the point object dropped vertically downward from the same height h in part a).

Select the correct answer

- $\sqrt{2}$
- $\sqrt{3}$
- 2
- $\sqrt{2/3}$
- 1

Q19

(1 points)

A neutron star is the collapsed core of a massive supergiant star. Except for black holes, neutron stars are the smallest and densest currently known class of stellar objects. They are so dense that a normal-sized matchbox containing neutron-star material would have the same weight as a 0.5 cubic km chunk of the Earth (a cube with edges of about 800 metres) from Earth's surface. In the formation of a neutron star, the star's core collapses and experiences an enormous increase in its rotational speed. Let us consider the collapse of a supermassive star into neutron star.

Suppose a large star initially with a mass of 3.39×10^{30} kg and a radius of 7.92×10^{5} m is initially spinning at a rate of one rotation every 35 Earth days. In the collapse to a neutron star, its radius shrinks to 16.4 km. Assume that during the collapse the mass of the star remains constant (not true in reality but good enough for this problem). Use conservation of angular momentum to find the new angular speed of the neutron star's spin in rotations per second.

Treat both the original star and the neutron star after collapse as uniform solid spheres. The moment of inertia of solid sphere of mass M and radius R is $I = \frac{2}{5}MR^2$

Please enter a numerical answer below. Accepted formats are numbers or "e" based scientific notation e.g. 0.23, -2, 1e6, 5.23e-8