#16

Name: KEY

Seat Assignment: _____

Specify your **EXAM ID** on the right. Use 000 if you do not know your exam ID.

[633]

0 ○	0 ○	0 ○
1 ○	1 ○	1 ○
2 ○	2 ○	2 ○
3 ○	3 ●	3 ●
4 ○	4 ○	4 ○
5 ○	5 ○	5 ○
6 ●	6 ○	6 ○
7 ○	7 ○	7 ○
8 ○	8 ○	8 ○
9 ○	9 ○	9 ○

Circle your **LAB SECTION**

	102	212	216	217	218
8:10	A102 Jackson	A212 Adam	A216 Min	A217 Siavash	A218 Erik
9:40	B102 Jackson	B212 Dhruv	B216 Min	B217 Siavash	B218 Erik
11:10	C102 Savannah	C212 Adam	C216 Will	C217 Siavash	C218 Erik
12:40	D102 Savannah	D212 Min	D216 Will	D217 Teague	D218 Eric
2:10	E102 Savannah	E212 Adam	E216 Dhruv	E217 Teague	E218 Eric
3;40	F102 Jackson	F212 Will	F216 Dhruv	F217 Teague	F218 Eric

Instructions

- Sit in your assigned seat.
- Do not open the exam until instructed to do so.
- Completely color in the dot for your chosen answers on multiple choice.
- Do not leave if there is less than 5 minutes to go in the exam.
- When time is called, immediately stop writing, remain seated, and pass your exam to the center aisle.
- Working after time is called results in an automatic deduction.
-

Guidelines

- Assume 3 significant figures for all given numbers unless otherwise stated
- Show all of your work – no work, no credit
- Write your final answer in the box provided
- Include units for all answers and directions for all vectors

1. (2 pts) Both slides start at the same height above the water. Assuming negligible friction, how does the speed (v_1) of swimmer 1 compare with the speed of swimmer 2 (v_2) at the bottom of the slide?

#1 1.7/2 (85%)

$V_1 = V_2$	$V_1 > V_2$	$V_1 < V_2$	Can't tell without the mass of each swimmer
●2	○	○	○

2. (2 pts) A 3.0 kg ball is dropped from a height of 2.0 m. What is the approximate kinetic energy of the ball just before it hits the ground?

#2 1.7/2 (85%)

0 J	25J	50 J	60 J
○	○	○	●2

m*g*h

3. (2 pts) A 75 W light bulb produces 200 J of thermal energy every 4 seconds. How efficient is the bulb at producing light?

#3 0.7/2 (35%)

5%	33%	38%	67%
○	●2	○	○

Eloss=200 J
Etot=75W*4s=300J
n=(300-200)/300 * 100%

4. (2 pts) A spring loaded gun shoots a ball with a speed of 1.0 m/s. If the spring is compressed 3 times as far, the speed of the ball will be:

#4 0.7/2 (35%)

.0 m/s	3.0 m/s	9.0 m/s
○	●2	○

.5*k*x1^2=.5*m*v1^2
.5*k*(3x1)^2 = .5*m*v2^2
v2/v1=3

5. (2 pts) You push a 150 lb refrigerator 25.0 ft across a level floor at a constant 0.5 ft/s. The coefficient of friction between the refrigerator and the floor is 0.25. What is the net work done on the refrigerator during this process?

#5 1.0/2 (50%)

0 ft lbs	19 ft lbs	38 ft lbs	75 ft lbs
●2	○	○	○

6. (2 pts) The area under a force-time graph gives which quantity?

W=change in KE
constant speed, change in KE=0

#6 1.7/2 (85%)

Energy	Impulse	Work
○	●2	○

7. (·2 pts) A force $\vec{F} = (5t - 8\hat{j})\ lb$ acts on an object that moves through a displacement $\vec{r} = (6\hat{t})\ ft$. How much work was done by the force?

#7 1.8/2 (90%)

18 ft lbs	30 ft lbs	-48 ft lbs
○	●2	○

W=F dot r
W=5*6+(-8)*0 = 30 ft-lb

8. (2 pts) A ball is dropped from a height of 3.0 m. It bounces off the floor and rebounds to a height of 2.5 m. During the collision with the floor, which of the following quantities are conserved?

#8 1.2/2 (60%)

Only momentum	Only mechanical energy	Both momentum and mechanical energy are conserved	Neither momentum or mechanical energy are conserved
●2	○	○	○

System is floor and ball

#9
8.0/12 (66.7%)

9. (12 pts) Dr. Chesnutt wants to figure out the spring constant of a spring she found in the basement. She places the spring on the ground and attaches a level platform to the top. Then she climbs a ladder so she is standing 1.20 m above the platform. She steps off and falls to the platform. It compresses another 6.00 cm after she hits it. Assuming she has a mass of 60.0 kg and the mass of the spring and platform are negligible, what is the spring constant?

-1 Wrong Units
-2 Wrong Height
-1 No units
-10 Did not use COE
-2 did not finish
-4 Did not have to use KE
-8 Did not use height
-4 incorrect spring energy
-1 wrong conversion
-4 Incorrect PE
-2 wrong delta x
-1 math error
-4 Incorrect Work Calculation

$K = 411600\ N/m$

$K_i^{0} + U_{gi} + U_{si}^{0} + W_{in}^{0} = K_f^{0} + U_{gf}^{0} + U_{sf} + E_{loss}^{0}$

$mgh_i = \frac{1}{2}kx^2$

$(60\ kg)(9.8\ m/s^2)(1.26\ m) = \frac{1}{2}K(0.06\ m)^2$

$K = 411{,}600\ N/m$

#10
10.7/12 (89.2%)

10. (12 pts) A car on a roller coaster starts with a speed of 4 m/s at an elevation of 26 m above the ground. It coasts down a slope and then climbs a hill until it is at an elevation of 16 m above the ground. What is the speed of the car at the top of the hill?

-1 Sig Figs
-1 math error
-1 missing units
-2 wrong gravity
-3 not completing problem
-4 missing term in COE
-4 missing initial velocity
-4 algebra error (cancelling out gravity)
-4 using wrong initial velocity
-4 algebra error (cancelling 1/2)
-4 algebra error
-10 Wrong approach

$V_f = 14.6\ m/s$

$K_i + U_{gi} + U_{si}^{0} + W_{in}^{0} = K_f + U_{gf} + U_{sf}^{0} + E_{loss}^{0}$

$\frac{1}{2}mv_i^2 + mgh_i = \frac{1}{2}mv_f^2 + mgh_f$

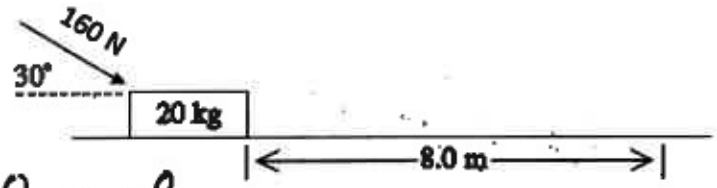
$\frac{1}{2}(4\ m/s)^2 + (9.8\ m/s^2)(26\ m) = \frac{1}{2}v_f^2 + (9.8\ m/s^2)(16\ m)$

$V_f = 14.6\ m/s$

#11
9.5/12 (79.2%)

11. (12 pts) Dr. Maczka pushes a 20 kg box across a rough horizontal surface with a force of 160 N. He pushes the box a distance of 8.00 m, and over this distance the speed changes from 0.500 m/s to 1.50 m/s. How much energy is lost to friction during this process?

$E_{loss} = 1089\ J$



$K_i + U_{gi}^{0} + U_{si}^{0} + W_{in} = K_f + U_{gf}^{0} + U_{sf}^{0} + E_{loss}$

$\frac{1}{2}mv_i^2 + W_{in} = \frac{1}{2}mv_f^2 + E_{loss}$

$W_{in} = (160N)\cos 30^\circ (8m)$

$W_{in} = 1109J$

$E_{loss} = \frac{1}{2}mv_i^2 + W_{in} - \frac{1}{2}mv_f^2$

$= \frac{1}{2}(20kg)(0.5^{m/s})^2 + 1109J - \frac{1}{2}(20kg)(1.5^{m/s})^2$

$E_{loss} = 1089\ J$

-2 calculation error
-3 forgot x component of 160N
-2 solved for friction
-2 used sin instead of cos
-2 forgot to multiply by D for work
-1 sig figs
-6 did not include work
-1 wrong unit
-2 forgot to square v
-1 wrong sign
-2 used weight not mass
-2 no potential energy

#12
11.3/12 (94.2%)

12. (12 pts) Dr. Bennett is driving is 570 kg car at 1.33 m/s when suddenly Prof. Schleter runs into him from behind! Prof. Schleter's car has a mass of 440 kg, and after the unfortunate collision, it is moving backwards with a speed of 5.2 m/s, while Dr. Bennett's car is now moving forward with a speed of 18.3 m/s. How fast was Prof. Schleter driving just before the cars collided?

$V_2 = 16.7\ m/s$

$m_1v_1 + m_2v_2 = m_1v_1' + m_2v_2'$

$(570kg)(1.33^{m/s}) + (440kg)v_2 = (570kg)(18.3^{m/s}) + (440kg)(-5.2^{m/s})$

$V_2 = 16.7\ m/s$

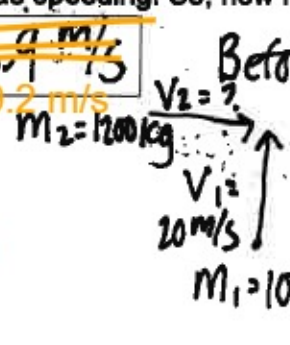
-10 COM, not COE
-10 COM incorrect
-6 wrong type of collision
-6 incomplete
-4 masses don't cancel
-3 unnecessary COR equation
-2 swapped velocities
-2 wrong velocity
-2 wrong mass
-1 math error
-1 sig figs
-1 sign error
-1 units

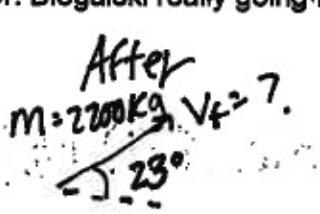
#13
7.3/12 (60.8%)

13. (12 pts) Now two more EF instructors have had a car crash! Dr. McCord was driving her 1000 kg car north at 20.0 m/s when she came to an interserction. She saw Dr. Biegalski in a 1200 kg car approaching the same intersection traveling east. The two cars collided in the intersection and locked together. From looking at the skidmarks on the ground, it was determined that the cars slid in a direction 23° North of East after the collision. Dr. McCord says that Dr. Biegalski is at fault because she was speeding! So, how fast was Dr. Biegalski really going before the collision?

-1 units
-1 sig figs
-1 math error
-10 used CoE
-1 m1+m2=2200
-3 no v'
-3 v'=/0
-3 vy'=/vx'
-6 momentum is conserved, not velocity
-4 combined x and y eqns
-6 need separate eqns for x and y
-2 velocity not conserved
-8 perfectly inelastic collision
-3 energy not conserved
-3 mixed up trig functions

$V_2 = 39.2$ m/s

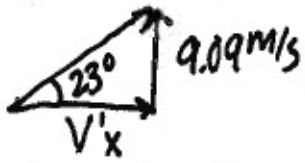




y-direction:

$(1000\text{ kg})(20\text{ m/s}) = (2200\text{ kg})V_y$

$V_y = 9.09$ m/s



x-direction:

$(1200\text{ kg})(V_2) = (2200\text{ kg})(21.4\text{ m/s})$

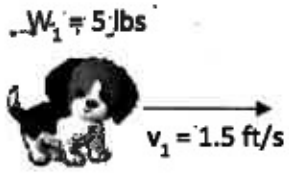
$V_2 = 39.2$ m/s

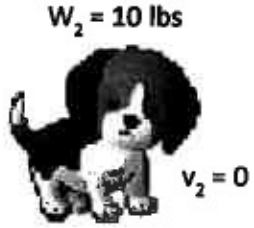
$V'_x = \frac{9.09\text{ m/s}}{\tan 23°} = 21.4$ m/s

#14
9.5/12 (79.2%)

14. (12 pts) A little puppy wants to play with his mom, who weighs twice as much as he does. He collides with her while running at 1.5 ft/s. After the collision, the puppy bounces back with a speed of 0.2 ft/s. Based on this data, what is the coefficient of restitution for puppy collisions?

$e = 0.7$





$m_1V_1 + m_2V_2 = m_1V_1' + m_2V_2'$

$(5\text{ lbs})(1.5\text{ ft/s}) + 0 = (5\text{ lbs})(-0.2\text{ ft/s}) + (10\text{ lbs})V_2'$

$V_2' = 0.85$ ft/s

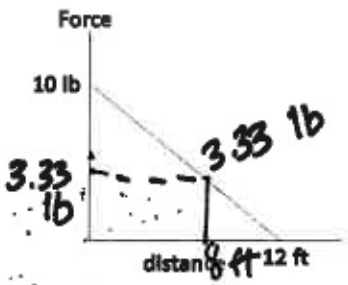
$e = -\frac{(V_2' - V_1')}{V_2 - V_1} = -\frac{(0.85\text{ ft/s} - (-0.2\text{ ft/s}))}{0 - 1.5\text{ ft/s}} = 0.7$

-1 math error
-1 wrong units
-2 wrong velocity direction
-2 wrong equation of e
-1 missing final answer
-6 calculation for e are missing
-6 this is not a perfectly inelastic colision
-6 Conversation of Momentum conceptual error
-6 Final velocity is not 0; find using conservation of momentum

Don't forget to turn the page for the last problem.

#15
8.0/12 (66.7%)

15. (12 pts) A 5 lb object is subject to the force shown in the graph. If it starts at rest, how fast is the object moving after it has gone 8 ft?



$V_f = 26.2\ ft/s$

$W = (3.33\ lb)(8\ ft) + \frac{1}{2}(6.67\ lb)(8\ ft)$

$W = 53.32\ lb\text{-}ft$

$W = \frac{1}{2}mV_f^2 - 0$

$53.32\ lb = \frac{1}{2}\frac{(5\ lb)V_f^2}{(32.2\ ft/s^2)}$

$V_f = 26.2\ ft/s$

-2 used distance instead of mass
-2 used weight not mass
-2 wrong work
-4 did not use area under the curve to find work
-2 used weight in work calculations
-4 wrong KE
-4 wrong work from graph
-4 W = KE
-1 no units/wrong units
-2 KE=1/2*m*v^2
-4 wrong average force
-2 wrong mass
-2 missing term
-2 incomplete
-1 sig figs