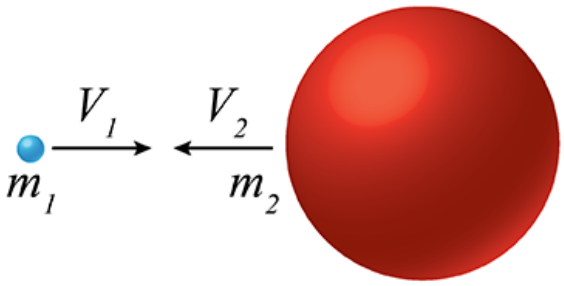
Problem 1: Two masses, m_1 and m_2, are traveling toward each other. The speed of m_1 is v_1 and oriented along the positive x-direction, while that of m_2 is v_2 and oriented along the negative x-direction. The masses are such that $m_1 = m_2/10$.



If the two masses stick together, in what direction do they travel after they impact?

Grade = 50%

Correct Answer	Student Final Submission	Feedback
Not enough information.	To the left.	It depends on the ratio of the velocities. If v_1 is more than 10 times greater than v_2 it will go to the right, exactly 10 times and they stop, less than 10 times and they move to the left.

Grade Summary

Deduction for Final Submission	50%
Deductions for Incorrect Submissions, Hints and Feedback [?]	0%
Student Grade = 100 - 50 - 0 = 50%	

Submission History

All Date times are displayed in Central Standard Time. Red submission date times indicate late work.

	Date	Time	Answer	Hints	Feedback
1	Nov 20, 2024	1:42 PM	To the left.		

Problem 2: A student of mass $m = 41$ kg runs at a velocity $v_i = 1.5$ m/s before jumping on a skateboard that is initially at rest. After jumping on the board the student has a velocity $v_f = 1.4$ m/s.

What is the mass of the skateboard, in kilograms?

Grade = 0%

Correct Answer	Student Final Submission	Feedback
$m_b = 2.929$	$m_b = 234.0$	

Grade Summary

Deduction for Final Submission	100%
Deductions for Incorrect Submissions, Hints and Feedback [?]	0%
Student Grade = 100 - 100 - 0 = 0%	

Submission History

All Date times are displayed in Central Standard Time. Red submission date times indicate late work.

	Date	Time	Answer	Hints	Feedback
1	Nov 20, 2024	1:54 PM	$m_b = 234.0$		

Problem 3: One hazard of space travel is the debris left by previous missions. There are several thousand objects orbiting Earth that are large enough to be detected by radar, but there are far greater numbers of very small objects, such as flakes of paint.

Calculate the magnitude of the force, in newtons, exerted by a 0.075 mg chip of paint that strikes (and sticks to) a spacecraft window at a relative speed of 3.75×10^3 m/s, given the collision lasts 5.75×10^{-8} s.

Grade = 80%

Correct Answer	Student Final Submission	Feedback
$F = 4891$ N	$F = 4.8913 * 10^6$ $F = 4.891 \times 10^6$ N	You may have confused mg and g.

Grade Summary

Deduction for Final Submission	20%
Deductions for Incorrect Submissions, Hints and Feedback [?]	0%
Student Grade = 100 - 20 - 0 = 80%	

Submission History

All Date times are displayed in Central Standard Time. Red submission date times indicate late work.

	Date	Time	Answer	Hints	Feedback
1	Nov 20, 2024	1:36 PM	$F = 4.8913 * 10^6$ $F = 4.891 \times 10^6$ N		

Problem 4: A hollow sphere and a hollow cylinder of the same mass and radius are released at the top of an inclined plane. They are released simultaneously and from rest, and they roll down the incline without slipping.

Which is the first to reach the bottom of the incline?

Grade = 100%

Correct Answer	Student Final Submission	Feedback
The spherical shell reaches the bottom first.	The spherical shell reaches the bottom first.	

Grade Summary

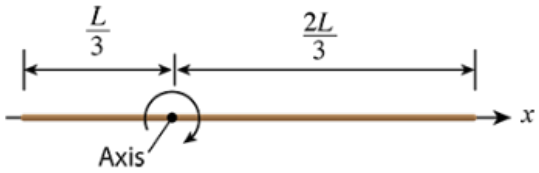
Deduction for Final Submission	0%
Deductions for Incorrect Submissions, Hints and Feedback [?]	0%
Student Grade = 100 - 0 - 0 = **100%**	

Submission History

All Date times are displayed in Central Standard Time. Red submission date times indicate late work.

	Date	Time	Answer	Hints	Feedback
1	Nov 20, 2024	1:48 PM	The spherical shell reaches the bottom first.		

Problem 5: The diagram shows a uniform rod of mass M and length L, where the axis of rotation is a distance of $\frac{L}{3}$ from one end.



Determine an expression for the moment of inertia of the rod.

Grade = 0%

Correct Answer	Student Final Submission	Feedback
$I = (1/9) M L^2$	$I = ((1/12) M) (L/3)^2 + (2 L/3)^2$	

Grade Summary

Deduction for Final Submission	100%
Deductions for Incorrect Submissions, Hints and Feedback [?]	0%
Student Grade = 100 - 100 - 0 = **0%**	

Submission History

All Date times are displayed in Central Standard Time. Red submission date times indicate late work.

	Date	Time	Answer	Hints	Feedback
1	Nov 20, 2024	1:54 PM	$I = ((1/12) M) (L/3)^2 + (2 L/3)^2$		

Problem 6: An ice skater is spinning with her arms out and is not being acted upon by an external torque.

Part (a) When she pulls her arms in close to her body what happens to her angular momentum?

Grade = 50%

Correct Answer	Student Final Submission	Feedback
It remains unchanged	It increases	You may have confused angular momentum with angular speed. If there is no external torque in this system, what can we say about angular momentum?

Grade Summary

Deduction for Final Submission	50%
Deductions for Incorrect Submissions, Hints and Feedback [?]	0%
Student Grade = 100 - 50 - 0 = 50%	

Submission History

All Date times are displayed in Central Standard Time. Red submission date times indicate late work.

	Date	Time	Answer	Hints	Feedback
1	Nov 20, 2024	1:52 PM	It increases		

Part (b) When she pulls her arms in, what happens to her moment of inertia?

Grade = 100%

Correct Answer	Student Final Submission	Feedback
It decreases	It decreases	

Grade Summary

Deduction for Final Submission	0%
Deductions for Incorrect Submissions, Hints and Feedback [?]	0%
Student Grade = 100 - 0 - 0 = 100%	

Submission History

All Date times are displayed in Central Standard Time. Red submission date times indicate late work.

	Date	Time	Answer	Hints	Feedback
1	Nov 20, 2024	1:52 PM	It decreases		

Part (c) What happens to her angular speed when she pulls her arms in?

Grade = 50%

Correct Answer	Student Final Submission	Feedback
It increases	It stays the same	Angular momentum is $I\,\omega$, and we have already

determined that I decreases. If ω stays the same, angular momentum would decrease which would contradict the answer to part (a).

Grade Summary

Deduction for Final Submission	50%
Deductions for Incorrect Submissions, Hints and Feedback [?]	0%
Student Grade = 100 - 50 - 0 = 50%	

Submission History

All Date times are displayed in Central Standard Time. Red submission date times indicate late work.

	Date	Time	Answer	Hints	Feedback
1	Nov 20, 2024	1:55 PM	It stays the same		

Part (d) What happens to her rotational kinetic energy when she pulls her arms in?

Grade = 100%

Correct Answer	Student Final Submission	Feedback
It increases	It increases	

Grade Summary

Deduction for Final Submission	0%
Deductions for Incorrect Submissions, Hints and Feedback [?]	0%
Student Grade = 100 - 0 - 0 = 100%	

Submission History

All Date times are displayed in Central Standard Time. Red submission date times indicate late work.

	Date	Time	Answer	Hints	Feedback
1	Nov 20, 2024	1:54 PM	It increases		

Problem 7: An object of mass m is released from rest a distance R above the surface of a planet of mass M and radius R.

Part (a) Derive an expression for the speed with which it hits the planet's surface v.

Grade = 75%

Correct Answer	Student Final Submission	Feedback
$v = (G M/R)^{0.5}$	$v = \sqrt{((2 G M)/R)}$	Given the base **2 G M / R:** • It appears that this base involves other terms. Please think about what else should be included in the base

Grade Summary

Deduction for Final Submission	25%

Deductions for Incorrect Submissions, Hints and Feedback [?] 0%

Student Grade = 100 - 25 - 0 = 75%

Submission History

All Date times are displayed in Central Standard Time. Red submission date times indicate late work.

	Date	Time	Answer	Hints	Feedback
1	Nov 20, 2024	1:25 PM	$v = \sqrt{(G M)/R)}$		
2	Nov 20, 2024	1:25 PM	$v = \sqrt{(2 G M)/R)}$		

Part (b) Calculate this speed in m/s, assuming $M = 21 \times 10^{23}$ kg and $R = 11 \times 10^{3}$ km.

Grade = 0%

Correct Answer	Student Final Submission	Feedback
$v = 3569$	$v = 159.6358 * 10^3$ $v = 1.596 \times 10^5$	

Grade Summary

Deduction for Final Submission 100%

Deductions for Incorrect Submissions, Hints and Feedback [?] 0%

Student Grade = 100 - 100 - 0 = 0%

Submission History

All Date times are displayed in Central Standard Time. Red submission date times indicate late work.

	Date	Time	Answer	Hints	Feedback
1	Nov 20, 2024	1:26 PM	$v = 159.6358 * 10^3$ $v = 1.596 \times 10^5$		

Problem 8: The Sun has a mass of 1.99×10^{30} kg and a radius of 6.96×10^{8} m.

Part (a) Calculate the acceleration due to gravity, in meters per square second, on the surface of the Sun.

Grade = 100%

Correct Answer	Student Final Submission	Feedback
$g_{Sun} = 274.1$	$g_{Sun} = 274.182$ $g_{Sun} = 274.2$	

Grade Summary

Deduction for Final Submission 0%

Deductions for Incorrect Submissions, Hints and Feedback [?] 0%

Student Grade = 100 - 0 - 0 = 100%

Submission History

All Date times are displayed in Central Standard Time. Red submission date times indicate late work.

	Date	Time	Answer	Hints	Feedback
1	Nov 20, 2024	1:22 PM	$g_{Sun} = 274.182$ $g_{Sun} = 274.2$		

Part (b) By what factor would your weight increase if you could stand on the Sun?

Grade = 0%

Correct Answer	Student Final Submission	Feedback
$g_{Sun}/g_{Earth} = 28.00$	No Answer Given	

Grade Summary

Deduction for Final Submission	0%
Deductions for Incorrect Submissions, Hints and Feedback [?]	0%
Student Grade = 100 - 0 - 0 = **0%**	

Submission History

All Date times are displayed in Central Standard Time. Red submission date times indicate late work.

Date	Time	Answer	Hints	Feedback

Problem 9: Using orbital data for satellites, you can find ratios of the masses of their parent bodies.

Parent	Satellite	Average orbital radius r(km)	Period T(y)	$r^3/T^2(km^3/y^2)$
Earth	Moon	3.84×10^5	0.07481	1.01×10^{19}
Sun	Earth	1.496×10^8	1.000	3.35×10^{24}
	Jupiter	7.783×10^8	11.86	3.35×10^{24}
Jupiter	Io	4.22×10^5	0.00485 (1.77 d)	3.19×10^{21}
	Europa	6.71×10^5	0.00972 (3.55 d)	3.20×10^{21}
	Ganymede	1.07×10^6	0.0196 (7.16 d)	3.19×10^{21}
	Callisto	1.88×10^6	0.0457 (16.19 d)	3.20×10^{21}

Find the ratio of the mass of Jupiter to that of Earth based on only data in the table.

Grade = 100%

Correct Answer	Student Final Submission	Feedback
$M_J/M_E = 316.0$	$M_J/M_E = 316.8316$ $M_J/M_E = 316.8$	

Grade Summary

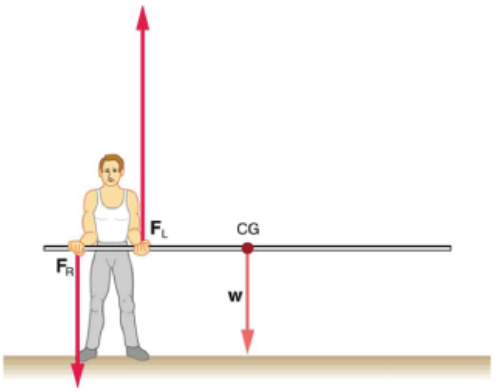
Deduction for Final Submission	0%
Deductions for Incorrect Submissions, Hints and Feedback [?]	0%
Student Grade = 100 - 0 - 0 = **100%**	

Submission History

All Date times are displayed in Central Standard Time. Red submission date times indicate late work.

	Date	Time	Answer	Hints	Feedback
1	Nov 20, 2024	1:19 PM	$M_J/M_E = 316.8316$ $M_J/M_E = 316.8$		

Problem 10: In the figure, the center of gravity (CG) of the pole held by the pole vaulter is *1.75* m from the left hand, and the hands are *0.675* m apart. The mass of the pole is 5.0 kg.



Part (a) Calculate the magnitude of the force, in newtons, exerted by his right hand.

Grade = 100%

Correct Answer	Student Final Submission	Feedback
$F_R = 127.0$	$F_R = 127.166$ $F_R = 127.2$	

Grade Summary

Deduction for Final Submission	0%
Deductions for Incorrect Submissions, Hints and Feedback [?]	0%
Student Grade = 100 - 0 - 0 = 100%	

Submission History

All Date times are displayed in Central Standard Time. Red submission date times indicate late work.

	Date	Time	Answer	Hints	Feedback
1	Nov 20, 2024	1:07 PM	$F_R = 127.166$ $F_R = 127.2$		

Part (b) Calculate the magnitude of the force, in newtons, exerted by his left hand.

Grade = 100%

Correct Answer	Student Final Submission	Feedback
$F_L = 176.0$	$F_L = 176.2166$ $F_L = 176.2$	

Grade Summary

Deduction for Final Submission	0%
Deductions for Incorrect Submissions, Hints and Feedback [?]	0%
Student Grade = 100 - 0 - 0 = 100%	

Submission History

All Date times are displayed in Central Standard Time. Red submission date times indicate late work.

	Date	Time	Answer	Hints	Feedback
1	Nov 20, 2024	1:09 PM	$F_L = 176.21$ $F_L = 176.2$		
2	Nov 20, 2024	1:09 PM	$F_L = 176.2166$ $F_L = 176.2$		

Problem 11: Consider an object moving in a circular orbit around a planet, due to the force of gravity.

If an object's mass is increased, will it orbit faster or slower if the radius of its orbit does not change?

Grade = 25%

Correct Answer	Student Final Submission	Feedback
The same	Slower	What must both a cannon ball and bullet do in order to just miss the curvature of the Earth?

Grade Summary

Deduction for Final Submission	75%
Deductions for Incorrect Submissions, Hints and Feedback [?]	0%
Student Grade = 100 - 75 - 0 = 25%	

Submission History

All Date times are displayed in Central Standard Time. Red submission date times indicate late work.

	Date	Time	Answer	Hints	Feedback
1	Nov 20, 2024	1:51 PM	Slower		