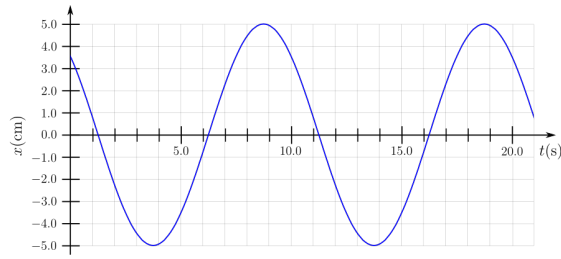
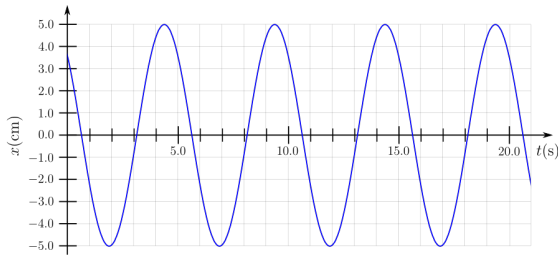


**Problem 1:** Some physics students are studying periodic motion using an oscillating mass on a spring. After collecting data, they sketched position *versus* time graphs, including the two shown.



Select *all* attributes that are the same for both graphs. All phase constants are a multiple of  $45^\circ$ .

**Grade = 66.67%**

Correct Answer	Student Final Submission	Feedback
phase constant , amplitude	amplitude	One or more choices are missing from your selection.

**Grade Summary**

Deduction for Final Submission	33.33%
Deductions for Incorrect Submissions, Hints and Feedback [?]	0%
<b>Student Grade = 100 - 33.33 - 0 = 66.67%</b>	

**Submission History**

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

Date	Time	Answer	Hints	Feedback
1 Dec 14, 2024	4:08 PM	amplitude		

**Problem 2:** A diver on a diving board is undergoing simple harmonic motion. Her mass is **51.5** kg and the period of her motion is **0.75** s. The next diver is a male whose period of simple harmonic oscillation is **1.015** s.

What is his mass, in kilograms, if the mass of the board is negligible?

**Grade = 100%**

Correct Answer	Student Final Submission	Feedback
$m_2 = 94.32$	$m_2 = 94.4693$	

$$m_2 = 94.47$$

### 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	Dec 14, 2024	5:06 PM	$m_2 = 94.4693$ $m_2 = 94.47$		
2	Dec 14, 2024	5:10 PM	$m_2 = 94.4693$ $m_2 = 94.47$		

### Problem 3:

How long, in seconds, does it take a child on a swing to complete one swing if her center of gravity is 2.5 m below the pivot?

**Grade = 70%**

Correct Answer	Student Final Submission	Feedback
$T = 3.173$ s	$T = 1.54327785533$ $T = 1.543$ s	You have the basic relationship ( $T \propto \sqrt{L}$ ) but you are missing the constants.

### Grade Summary

Deduction for Final Submission 30%  
Deductions for Incorrect Submissions, Hints and Feedback [?] 0%

Student Grade = 100 - 30 - 0 = 70%

### Submission History

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

	Date	Time	Answer	Hints	Feedback
1	Dec 14, 2024	5:27 PM	$T = 1.54327785533$ $T = 1.543$ s		

**Problem 4:** A guitar with strings of length  $L = 0.55$  m has new strings put on it. The low E string has a linear density of  $\rho = 0.0051$  kg/m and when tuned properly should produce a fundamental tone of  $\nu = 82.41$  Hz.

### Randomized Variables

$L = 0.55$  m  
 $\rho = 0.0051$  kg/m

**Part (a)** What is the proper tension the string should be under, in Newtons?

**Grade = 0%**

Correct Answer	Student Final Submission	Feedback
$T = 41.91$	$T = 34.6361$ $T = 34.64$	

**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 Dec 14, 2024	3:59 PM	$T = 34.6361$ $T = 34.64$		

**Part (b)** If the string was mistakenly tuned to high E ( $\nu = 330$  Hz) what would the tension be, in Newtons? (Note that in reality, the string would likely break!)

**Grade = 0%**

Correct Answer	Student Final Submission	Feedback
$T = 672.0$	$T = 555.39$ $T = 555.4$	

**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 Dec 14, 2024	4:02 PM	$T = 555.39$ $T = 555.4$		

**Problem 5:** Air temperature in the Sahara Desert can reach  $56.0^\circ\text{C}$  (about  $134^\circ\text{F}$ ). A table of the wave speed of sound in various media is included below.

**Speed of Sound for Select Materials**

Gases at $0^\circ\text{C}$		Liquids at $20^\circ\text{C}$		Solids (longitudinal of bulk)	
Medium	$v(m/s)$	Medium	$v(m/s)$	Medium	$v(m/s)$
air	331	ethanol	1160	vulcanized rubber	54
carbon dioxide	259	mercury	1450	polyethelene	920
oxygen	316	water (fresh)	1480	marble	3810
helium	965	sea water	1540	glass (Pyrex)	5640

hydrogen	1290	human tissue	1540	lead	1960
				aluminum	5120
				steel	5960

What is the speed of sound, in meters per second, in the air at that temperature?

**Grade = 0%**

Correct Answer	Student Final Submission	Feedback
$v(56.0^\circ\text{C}) = 363.4 \text{ m/s}$	$v(56.0^\circ\text{C}) = 331.0 \text{ m/s}$	
<b>Grade Summary</b>		
Deduction for Final Submission		100%
Deductions for Incorrect Submissions, Hints and Feedback [?]		0%
<b>Student Grade = 100 - 100 - 0 = 0%</b>		

### Submission History

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

Date	Time	Answer	Hints	Feedback
1 Dec 14, 2024	4:41 PM	$v(56.0^\circ\text{C}) = 331.0 \text{ m/s}$		

**Problem 6:** One day when the speed of sound in air is 343 m/s, a fire truck traveling at  $v_s = 21 \text{ m/s}$  has a siren which produces a frequency of  $f_s = 401 \text{ Hz}$ .

### Randomized Variables

$$v_s = 21 \text{ m/s}$$

$$f = 401 \text{ Hz}$$

**Part (a)** What frequency, in units of hertz, does the driver of the truck hear?

**Grade = 100%**

Correct Answer	Student Final Submission	Feedback
$f_d = 401.0 \text{ Hz}$	$f_d = 401.0 \text{ Hz}$	
<b>Grade Summary</b>		
Deduction for Final Submission		0%
Deductions for Incorrect Submissions, Hints and Feedback [?]		0%
<b>Student Grade = 100 - 0 - 0 = 100%</b>		

### Submission History

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

Date	Time	Answer	Hints	Feedback
1 Dec 14, 2024	4:11 PM	$f_d = 401.0 \text{ Hz}$		

**Part (b)** What frequency, in units of hertz, does an observer hear when the truck is moving away?

**Grade = 100%**

Correct Answer	Student Final Submission	Feedback
$f_o = 377.9 \text{ Hz}$	$f_o = 377.86$ $f_o = 377.9 \text{ Hz}$	
<b>Grade Summary</b>		
Deduction for Final Submission		0%
Deductions for Incorrect Submissions, Hints and Feedback [?]		0%
<b>Student Grade = 100 - 0 - 0 = 100%</b>		

### Submission History

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

Date	Time	Answer	Hints	Feedback
1 Dec 14, 2024	3:51 PM	$f_o = 377.86$ $f_o = 377.9 \text{ Hz}$		

**Problem 7:** Former UT Diver Alison Gibson, who we will assume has a mass of **50.6** kilograms, steps off a diving board and drops straight down into the water. The effect of the water is to contribute an average force of resistance of **1200** Newtons on the diver. If the diver comes to rest **4.1** meters below the water's surface, what is the total distance between the diving board and the diver's stopping point underwater?

If the diver comes to rest **4.1** meters below the water's surface, what is the total distance between the diving board and the diver's stopping point underwater?

**Grade = 100%**

Correct Answer	Student Final Submission	Feedback
Total Distance = 9.912 meters	Total Distance = 9.9116 Total Distance = 9.912 meters	
<b>Grade Summary</b>		
Deduction for Final Submission		0%
Deductions for Incorrect Submissions, Hints and Feedback [?]		0%
<b>Student Grade = 100 - 0 - 0 = 100%</b>		

### Submission History

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

Date	Time	Answer	Hints	Feedback
1 Dec 14, 2024	3:47 PM	Total Distance = 9.9116 Total Distance = 9.912 meters		

**Problem 8:** A bullet is shot horizontally over level ground. The initial height is **1.3** m, and its initial speed is **150** m/s.

**Part (a)** How much time, in seconds, elapses before the bullet hits the ground?

**Grade = 0%**

Correct Answer	Student Final Submission	Feedback
$t = 0.5151$	$t = 0.008650$	
<b>Grade Summary</b>		
Deduction for Final Submission		100%
Deductions for Incorrect Submissions, Hints and Feedback [?]		0%
<b>Student Grade = 100 - 100 - 0 = 0%</b>		

#### Submission History

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

Date	Time	Answer	Hints	Feedback
1 Dec 14, 2024	4:48 PM	$t = 0.008650$		

**Part (b)** How far does the bullet travel horizontally, in meters, before hitting the ground?

**Grade = 0%**

Correct Answer	Student Final Submission	Feedback
$x = 77.26$	$x = 5.700$	
<b>Grade Summary</b>		
Deduction for Final Submission		100%
Deductions for Incorrect Submissions, Hints and Feedback [?]		0%
<b>Student Grade = 100 - 100 - 0 = 0%</b>		

#### Submission History

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

Date	Time	Answer	Hints	Feedback
1 Dec 14, 2024	4:53 PM	$x = 5.700$		

**Problem 9:** A fireworks shell has a constant acceleration from rest to a velocity of **61** m/s over a distance of **6.5** m.

**Part (a)** How long, in seconds, does the acceleration last?

**Grade = 75%**

Correct Answer	Student Final Submission	Feedback
$t = 0.2131 \text{ s}$	$t = 0.1065 \text{ s}$	The shell does not move with constant velocity, or you have lost somewhere the factor of 2.

**Grade Summary**

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

**Submission History**

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

Date	Time	Answer	Hints	Feedback
1 Dec 14, 2024	5:16 PM	$t = 0.1065 \text{ s}$		

**Part (b)** Calculate the acceleration, in meters per second squared.

**Grade = 0%**

Correct Answer	Student Final Submission	Feedback
$a = 286.2 \text{ m/s}^2$	No Answer Given	

**Grade Summary**

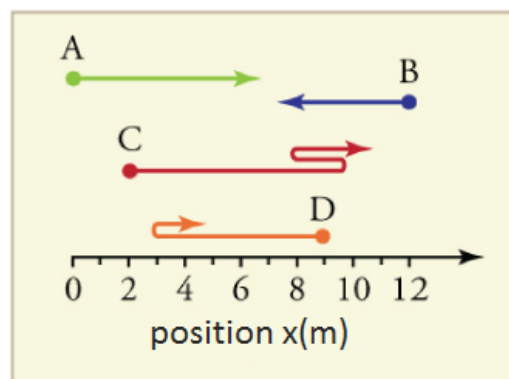
Deduction for Final Submission	0%
Deductions for Incorrect Submissions, Hints and Feedback [?]	0%
<b>Student Grade = 100 - 0 - 0 = 0%</b>	

**Submission History**

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

Date	Time	Answer	Hints	Feedback
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**Problem 10:** The figure shows four paths taken along the horizontal axis. Each path begins at the circular dot beneath the letter denoting the path's name and ends at the very tip of the arrow. In your calculations, round to the nearest integer.



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**Part (a)** What is the distance traveled, in meters, for path D?

**Grade = 80%**

Correct Answer	Student Final Submission	Feedback
$d = 8.000 \text{ m}$	$d = 7.000 \text{ m}$	It may be a bit hard to see, but the segment of the

line after the U-turn actually extends from 3 meters to 5 meters.

### Grade Summary

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

### Submission History

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

Date	Time	Answer	Hints	Feedback
1 Dec 14, 2024	3:41 PM	$d = 7.000$ m		

**Part (b)** What is the magnitude of the displacement from start to finish, in meters, for path D?

**Grade = 100%**

Correct Answer	Student Final Submission	Feedback
$ \Delta x  = 4.000$ m	$ \Delta x  = 4.000$ m	

**Grade Summary**

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

### Submission History

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

Date	Time	Answer	Hints	Feedback
1 Dec 14, 2024	3:42 PM	$ \Delta x  = 4.000$ m		

**Part (c)** What is the displacement from start to finish, in meters, for path D?

**Grade = 80%**

Correct Answer	Student Final Submission	Feedback
$\Delta x = -4.000$ m	$\Delta x = 4.000$ m	Check the figure: what is direction of the displacement?

**Grade Summary**

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

### Submission History

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

Date	Time	Answer	Hints	Feedback
1 Dec 14, 2024	3:43 PM	$\Delta x = 4.000$ m		

**Problem 11:** Consider a 65 kg high-jumper.



Calculate the magnitude of the force, in newtons, the jumper must exert on the ground to produce an upward acceleration 4.00 times the acceleration due to gravity.

**Grade = 30%**

Correct Answer	Student Final Submission	Feedback
$F = 3185$	$F = 2550.6$ $F = 2551$	You may have forgotten to include the force of gravity into your consideration. Check the free body diagram.

#### Grade Summary

Deduction for Final Submission 70%

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

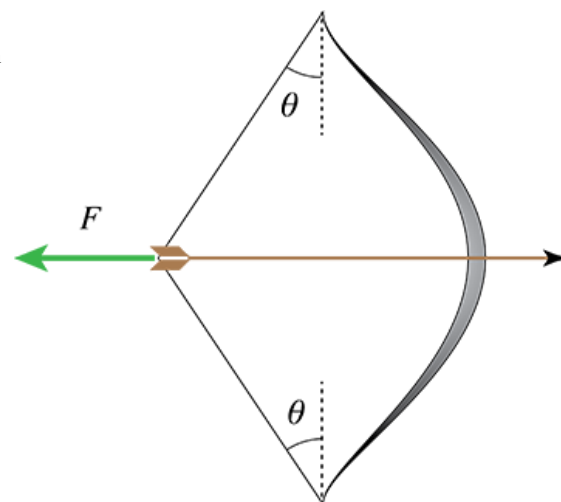
**Student Grade = 100 - 70 - 0 = 30%**

#### Submission History

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

Date	Time	Answer	Hints	Feedback
1 Dec 14, 2024	3:39 PM	$F = 2550.6$ $F = 2551$		

**Problem 12:** Consider a bow and arrow. Suppose the bow is held vertically, and the string is drawn back from its midpoint so the arrow is horizontal. Each half of the string makes an angle  $\theta$  with the vertical, as shown in the diagram. A horizontal force with magnitude  $F$  is applied to the tail of the arrow, and the system is motionless.



Write an expression for the tension,  $T$ , in the string.

**Grade = 100%**

Correct Answer	Student Final Submission	Feedback
$T = F/(2 \sin(\theta))$	$T = F/(2 \sin(\theta))$	

#### 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
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**Problem 13:** 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 = 100%**

Correct Answer	Student Final Submission	Feedback
$v = (GM/R)^{0.5}$	$v = \sqrt{(GM)/R}$	
<b>Grade Summary</b>		
Deduction for Final Submission		0%
Deductions for Incorrect Submissions, Hints and Feedback [?]		0%
<b>Student Grade = 100 - 0 - 0 = 100%</b>		

#### Submission History

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

Date	Time	Answer	Hints	Feedback
1   Dec 14, 2024	4:21 PM	$v = \sqrt{(GM)/R}$		

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

**Grade = 100%**

Correct Answer	Student Final Submission	Feedback
$v = 3569$	$v = 3.5695 * 10^3$ $v = 3570.$	
<b>Grade Summary</b>		
Deduction for Final Submission		0%
Deductions for Incorrect Submissions, Hints and Feedback [?]		0%
<b>Student Grade = 100 - 0 - 0 = 100%</b>		

#### Submission History

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

Date	Time	Answer	Hints	Feedback
1   Dec 14, 2024	5:22 PM	$v = 3.5695 * 10^3$ $v = 3570.$		

**Problem 14:** 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)	$r^3/T^2$ ( $\text{km}^3/\text{y}^2$ )
Earth	Moon	$3.84 \times 10^5$	0.07481	$1.01 \times 10^{19}$
Sun	Earth	$1.496 \times 10^8$	1.000	$3.35 \times 10^{24}$
	Jupiter	$7.783 \times 10^8$	11.86	$3.35 \times 10^{24}$
Jupiter	Io	$4.22 \times 10^5$	0.00485 (1.77 d)	$3.19 \times 10^{21}$
	Europa	$6.71 \times 10^5$	0.00972 (3.55 d)	$3.20 \times 10^{21}$
	Ganymede	$1.07 \times 10^6$	0.0196 (7.16 d)	$3.19 \times 10^{21}$
	Callisto	$1.88 \times 10^6$	0.0457 (16.19 d)	$3.20 \times 10^{21}$

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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
$M_J/M_E = 316.0$	$M_J/M_E = 316.0$	
<b>Grade Summary</b>		
Deduction for Final Submission		0%
Deductions for Incorrect Submissions, Hints and Feedback [?]		0%
<b>Student Grade = 100 - 0 - 0 = 100%</b>		

#### Submission History

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

Date	Time	Answer	Hints	Feedback
1	Dec 14, 2024 3:36 PM	$M_J/M_E = 316.0$		

**Problem 15:** A hollow sphere and a hollow cylinder of the same mass and radius are rolling at the same translational speed when they start to roll up an incline.

Which reaches a greater height before coming to rest?

**Grade = 0%**

Correct Answer	Student Final Submission	Feedback
The cylinder reaches a greater height.	The sphere reaches a greater height.	Determine which object has a greater kinetic energy at the bottom of the incline. Due to conservation of mechanical energy, this object will reach the greatest height.

#### Grade Summary

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

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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	Dec 14, 2024	3:32 PM	The sphere reaches a greater height.		