A LaGuardia Physics Professor is in a small boat somewhere in the middle of an ocean studying surface water waves. He can estimate the distance between two consecutive wave crests as 20 m. Also, the boat goes up and down about 2 times every 5.2 seconds. What are the wavelength, period, and frequency of the wave?

The wavelength of the wave, \( \lambda \) = __________ Units \( \text{Select an answer} \).  

The period of the wave, \( T \) = __________ Units \( \text{Select an answer} \).  

The frequency of the wave, \( f \) = __________ Units \( \text{Select an answer} \).  

What is the speed of the wave?

The speed of the wave, \( v \) = __________ Units \( \text{Select an answer} \).  

Question Help:  

The frequency of a radio station is 81.5 MHz. Find the period and wavelength of the radio waves emitted by this station in empty space. The speed of electromagnetic waves in vacuum is \( c = 3 \times 10^8 \) m/s.

The period, \( T \) = __________ Units \( \text{Select an answer} \).  

The wavelength, \( \lambda \) = __________ Units \( \text{Select an answer} \).  

When a radio wave of the same frequency propagates in water, its wavelength is measured to be 2.77 m. What is the speed of that radio wave in water?

The speed of the wave in water, \( v \) = __________ Units \( \text{Select an answer} \).  

Find the ratio of the wave speed in vacuum to the speed in water: \( n = \frac{c}{v} \) (it is called the index of refraction of the medium).

The index of refraction of water, \( n \) = __________ Units \( \text{Select an answer} \).  

The index of refraction is always greater or equal to 1, it means that the speed of electromagnetic waves in any medium is always \( \text{Select an answer} \) the speed of electromagnetic waves in empty space.
We hear sounds best from 1000 Hz to 5000 Hz. Assuming the same air conditions for the sound waves at these frequencies which of the following statements are True?

The speed of 1000-Hz wave is greater than the speed of 5000-Hz wave: Select an answer.

The wavelength of 1000-Hz wave is shorter than the wavelength of 5000-Hz wave: Select an answer.

If the speed of sound is 342 m/s, what are the wavelengths of 1000-Hz and 5000-Hz waves?

The wavelength at 1000 Hz frequency, \( \lambda_1 = \) ________ Units Select an answer.

The wavelength at 5000 Hz frequency, \( \lambda_2 = \) ________ Units Select an answer.

Question Help: Message instructor  Post to forum
A snapshot of a simple wave moving in the positive x-direction is shown in the graph below. Find the following parameters of the wave if \( a = 12 \) cm, \( b = 50 \) cm, and the wave has a frequency of 35 Hz.

The amplitude of the wave, \( A = \) _______ Units [Select an answer].

The wavelength of the wave, \( \lambda = \) _______ Units [Select an answer].

The period of the wave, \( T = \) _______ Units [Select an answer].

The speed of the wave, \( v = \) _______ Units [Select an answer].
A transverse wave propagating along a string is described by the following equation

\[ y = -0.2 \cdot \sin(-21.9 \cdot t - 135 \cdot x + 8.2 \cdot \pi), \]

where \( x \) is the coordinate along the string, \( y \) is the deviation from the equilibrium (both coordinates are in meters), \( t \) is the time in seconds, and the argument of the \( \sin \) function is in radians. Find the parameters of the wave listed below.

The amplitude, \( A = \) __________ Units  

Select an answer  

The frequency, \( f = \) __________ Units  

Select an answer  

The wavelength, \( \lambda = \) __________ Units  

Select an answer  

The angular frequency, \( \omega = \) __________ Units  

Select an answer  

The magnitude of the wave vector, \( k = \) __________ Units  

Select an answer  

The wave speed, \( v = \) __________ Units  

Select an answer  

The direction of the wave propagation,  

Select an answer  

The maximum transverse speed, \( V_{y, \text{max}} = \) __________ Units  

Select an answer  

Find the transverse velocity of the string point located at \( x = 0.25 \) m at \( t = 4.1 \) sec.

The transverse velocity, \( V_y = \) __________ Units  

Select an answer  

Question Help:  

Message instructor  

Post to forum
A steel string has a length of \( L = 26 \text{ cm} \) and a mass of \( m = 7.1 \text{ g} \). If the string is under a tension of \( 1.7 \text{ lb} \), what is the speed of waves on the string?

The speed of wave, \( v_1 = \) \underline{\hspace{2cm}} \text{ Units} \ Select an answer \ Select an answer.

If we keep the same material and geometrical parameters of the string, but double the tension, what is the new speed of wave on the string?

The speed of wave, \( v_2 = \) \underline{\hspace{2cm}} \text{ Units} \ Select an answer \ Select an answer.

If we keep the same tension, the same material and cross section area of the string, but double the length of the string, what is the new speed of wave on the string?

The speed of wave, \( v_3 = \) \underline{\hspace{2cm}} \text{ Units} \ Select an answer \ Select an answer.

If we keep the same tension, the same material and length of the string, but double the radius of the cross section of the string, what is the new speed of wave on the string?

The speed of wave, \( v_4 = \) \underline{\hspace{2cm}} \text{ Units} \ Select an answer \ Select an answer.

Question Help: 
 0/1 pt 
MyOpenMath https://www.myopenmath.com/assess2/?cid=105715&ai...
5 of 10 6/10/21, 13:36
A 110-m telephone wire has a mass of 770 gram. A 1.5 m long segment of this wire is used to suspend a ball of mass $m = 1.8$ kg, see the picture below. What is the speed of wave on the horizontal section of the wire which has a length of $L = 0.7$ m?

The speed of wave, $v_1 = \underline{\text{Units}}$ Select an answer.

What is the speed of wave on the vertical section of the wire?

The speed of wave, $v_2 = \underline{\text{Units}}$ Select an answer.

What is the linear mass density of the wire?

The linear mass density, $\lambda = \underline{\text{Units}}$ Select an answer.

Question Help:  

An uniform rope of length $L = 0.55$ m and mass $m$ is attached to the ceiling, so it hangs down freely. A LaGuardia physics student briefly shakes the free end of the rope generating a pulse that travels up to the ceiling. How long does it take for the pulse to reach the ceiling? The free fall acceleration is $g = 9.81 \text{ m/s}^2$.

The time of travel, $t = \underline{\text{Units}}$ Select an answer.

Question Help:  

Question 8  

Question 9
Under what tension should be a guitar string (with length 59 cm and linear mass density 0.11 g/cm), so that its first harmonic sounds at 190 Hz?

The tension in the string, $\tau = \underline{\phantom{1}}$ Units Select an answer.

What are the frequencies and wavelengths of the 2nd and 3rd harmonics?

The frequency of 2nd harmonic, $f_2 = \underline{\phantom{1}}$ Units Select an answer.

The wavelength of 2nd harmonic, $\lambda_2 = \underline{\phantom{1}}$ Units Select an answer.

The frequency of 3rd harmonic, $f_3 = \underline{\phantom{1}}$ Units Select an answer.

The wavelength of 3rd harmonic, $\lambda_3 = \underline{\phantom{1}}$ Units Select an answer.

Consider a string under tension with the both ends fixed. One possible resonance frequency of the string is 1200 Hz and the next higher resonance frequency of the same string is 1350 Hz. What is the lowest (fundamental) frequency of this string?

The fundamental frequency, $f_1 = \underline{\phantom{1}}$ Units Select an answer.

What is the next higher resonance frequency after 1350 Hz?

The next after 1350 Hz frequency, $f = \underline{\phantom{1}}$ Units Select an answer.

What are the harmonics of 1200-Hz and 1350-Hz waves?

The harmonic number of 1200-Hz wave is ______.

The harmonic number of 1350-Hz wave is ______.

What is the length of the string if the speed of wave is 120 m/s?

The length of the string, $L = \underline{\phantom{1}}$ Units Select an answer.
An organ pipe with open ends produces sound of 290 Hz (fundamental frequency). What will be the fundamental frequency of the same pipe with the ends closed? What will be the fundamental frequency if one end is open and one is closed?

The frequency with the closed ends, \( f_{\text{closed}} \) = ___________ Units

The frequency with the one open/one closed ends, \( f_{\text{closed-open}} \) = ___________ Units

If the speed of sound is 323 m/s, how long is the pipe?

The length of the pipe, \( L \) = ___________ Units

The graph shown below represents a standing wave on a string with fixed ends. The length of the string is \( L = 55 \) cm and its mass is \( m = 27 \) g. If the string is under tension of 8.5 N, find the wavelength (in cm) and period (in msec) of the oscillations.

The wavelength, \( \lambda \) = ___________ Units

The period, \( T \) = ___________ Units

Question Help:  

Message instructor  
Post to forum
Consider a pipe that is open at both ends. How long is the pipe, if the fundamental frequency in this pipe submerged in air is 248 Hz? Take the speed of sound in air 338 m/s?

The length of the pipe, \( L = \) ___________ Units. Select an answer. 

What is the frequency of the fourth harmonic in this pipe in air?

The frequency, \( f_4 = \) ___________ Units. Select an answer.

What is the fundamental frequency of the same pipe submerged in helium? Take the speed of sound in helium 970 m/s.

The frequency of the pipe in Helium, \( f_1(\text{in He}) = \) ___________ Units. Select an answer.

Question Help:  

Real Life Examples: Resonance Frequency and Standing Waves

1. Find the first and second lowest resonance frequencies of air oscillations in between two parallel buildings separated by 15 m distance. Take 337 m/s for the speed of sound in air.

The first frequency, \( f_1 = \) ___________ Units. Select an answer.

The second frequency, \( f_2 = \) ___________ Units. Select an answer.

2. How deep should be ocean to enhance physiologically harmful infrasonic waves of 6 Hz frequency? Take 1.46 km/s for the speed of sound in water and find the minimum and next to minimum depths of the ocean. Hint: in this case the quantization rule for standing waves is: \( \frac{\lambda}{4} + (N - 1) \cdot \frac{\lambda}{2} = L \) , where \( N = 1,2,3,... \) - an integer number.

The minimum depth, \( h_1 = \) ___________ Units. Select an answer.

The next to minimum depth, \( h_2 = \) ___________ Units. Select an answer.

3. Why do you think the shape of stringed instruments such as violins, guitars and cellos is curved and reminds a “hourglass” figure? How does this shape effect the quality of sound? Please write a small paragraph below (up to 100 words).


Question Help:  

MyOpenMath https://www.myopenmath.com/assess2/?cid=105715&ai...
A standing wave is formed as result of superposition of two plain waves that travel on the same string:

\[ y_1(x, t) = 19 \text{ m} \cdot \cos(290 \cdot t - 2.45 \cdot x), \]
\[ y_2(x, t) = -19 \text{ m} \cdot \cos(290 \cdot t + 2.45 \cdot x), \]

where \( x \) is in meters and \( t \) is in seconds. What is the distance between nodes?

The distance between the nodes, \( d = \) \[ \text{Units} \] Select an answer .

What is the position of the first anti-node (for \( x > 0 \))?

The first anti-node, \( x_{\text{1, anti-node}} = \) \[ \text{Units} \] Select an answer .

What is the amplitude of oscillations at \( x = 0.35 \text{ m} \)?

The amplitude, \( A(x = 0.35 \text{ m}) = \) \[ \text{Units} \] Select an answer .

Question Help:  
- Message instructor
- Post to forum
There are several ways to calculate the speed of sound $c_s$ in a gas, for example

$$c_s = \sqrt{\frac{\gamma \cdot R \cdot T}{M}},$$

where $\gamma$ is the adiabatic coefficient of the gas, $R$ is the ideal gas constant, $T$ is the temperature in Kelvin, and $M$ is the molar mass. Find the speed of sound in air at $T = 0^\circ C$ and at $T = 20^\circ C$, use $\gamma = 1.4$, $M = 28.97$ g/mol, and $0^\circ C = 273.15$ K.

The speed of sound in air at $0^\circ C$, $c_1 =$ ___________ Units Select an answer.

The speed of sound in air at $20^\circ C$, $c_2 =$ ___________ Units Select an answer.

A convenient approximate way to find the speed of sound at low temperatures (note that the temperature must be small in Celsius, not in Kelvin: $T (\text{in } ^\circ \text{C}) \ll 273.15$) is the following

$$c_s = c_0 \sqrt{1 + \frac{T}{273.15}} \approx c_0 + \alpha \cdot T,$$

where $T$ is the gas temperature in Celsius and $c_0$ and $\alpha$ are constants. Using the values you found above ($c_1$ and $c_2$) find the constants $c_0$ and $\alpha$ for the speed of sound in air.

The constant $c_0 =$ ___________ Units Select an answer.

The constant $\alpha =$ ___________ Units Select an answer.

Use the second (approximate) equation to find the speed of sound in air at $14^\circ C$.

The speed of sound, $c_3 =$ ___________ Units Select an answer.

Question Help: Message instructor Post to forum

Consider a pipe open at one end and closed at the other end. The length of the pipe is 0.22 m. If the temperature of air is $11.5^\circ C$, what is the fundamental frequency of the sound produced by the pipe? For the speed of sound in air use the following equation:

$$c_{\text{air}} = (331.3 + 0.606 \cdot T) \text{ m/s},$$

where $T$ is the temperature in Celsius.

The frequency, $f_1 (\text{at } T = 11.5^\circ C) =$ ___________ Units Select an answer.

What is the frequency of the fundamental harmonic when the temperature of the air is increased by $20^\circ C$?

The frequency, $f_1 (\text{at } T = 31.5^\circ C) =$ ___________ Units Select an answer.

Question Help: Message instructor Post to forum
A LaGuardia Physics Professor drops a stone into a well. How deep is the well if the Professor hears the sound from the stone hitting the bottom of the well 2.15 s later? Neglect the air resistance and take the free fall acceleration $g = 9.81 \text{ m/s}^2$. The air temperature is $T = 16^\circ \text{C}$.

The depth of the well, $h =$ Units Select an answer.

How long did it take for the sound to travel back?

The time, $t_s =$ Units Select an answer.

Question Help:  

Message instructor  Post to forum
A car of length \( L = 18 \text{ m} \) is moving through the stationary air with a constant velocity \( V \), see the picture below. At the middle of the car there is a source of sound \( S \), which emits signals in all directions, there are also two sound detectors \( D_L \) and \( D_R \) at the car's edges.

Which of the detectors will receive the signal earlier? Select an answer

![Diagram of a car with a source of sound S emitting signals in all directions, and two detectors \( D_L \) and \( D_R \) at the car's edges.]

What is the speed of the car if one detector receives signals by 4.8 msec earlier than the other one? The air temperature is 14°C.

The speed of the car, \( V = \) _______ Units Select an answer.

Now the car is stationary but there is a 30.5-m/s wind blowing towards the car, as shown below.

Which of the detectors will receive the sound signal earlier? Select an answer

![Diagram of a car with a source of sound S emitting signals in all directions, and two detectors \( D_L \) and \( D_R \) at the car's edges.]

What is the time difference in the signal detection between the left and right detectors?

The time difference, \( \Delta t = \) _______ Units Select an answer.

By sending and detecting sound signals, is there any way to determine whether the car is moving through the air or it is the wind blowing and the car stays stationary? Select an answer.
Blitz problem solving: Sound Intensity and Intensity Level.

1. What is the intensity level in dB for a sound that has an intensity of $I_1 = 2 \times 10^{-6} \text{ W/m}^2$?

The intensity level, $\beta_1 =$ _________ Units Select an answer.

2. What is the intensity of a 119-dB sound wave?

The intensity of sound, $I_2 =$ _________ Units Select an answer.

3. The sound intensity level produced by 70 cars on Queens blvd is found to be 119 dB. If the cars contribute equally to the total intensity, what is the sound intensity level produced by one car?

The intensity level of one car, $\beta_3 =$ _________ Units Select an answer.

Question Help:  

Question 7

A point source emits sound isotropically. The sound intensity is 0.016 W/m$^2$ at a distance of 4.5 m from the source. What is the power of the source?

The power of the source, $P =$ _________ Units Select an answer.

What is the sound intensity and sound level 20.3 m from the source?

The sound intensity, $I =$ _________ Units Select an answer.

The sound level, $\beta =$ _________ Units Select an answer.

Question Help:  

Question 8
A LaGuardia Physics Professor is in the front row at a concert of *Grateful Dead* rock band, he is 4.9 meters away from the speaker. If the professor hears the sound at a level of $B_1 = 130$ dB, what is the intensity of the sound at this distance?

The intensity of the sound, $I_1 =$ ___________ Units | Select an answer ▼.

What will be the intensity of the sound if the professor walks 29.6 m away from the speaker? What will be the intensity level at this distance?

The intensity of the sound, $I_2 =$ ___________ Units | Select an answer ▼.

The corresponding intensity level, $B_2 =$ ___________ Units | Select an answer ▼.

How far from the speaker should the professor go to reduce the sound level to 74 dB?

The distance, $d =$ ___________ Units | Select an answer ▼.

Question Help:  Message instructor  Post to forum

The Sun radiates energy at about $3.85 \times 10^{26}$ Joules per second. What is the sunlight intensity near planet Jupiter that is 780 million kilometers away from the Sun?

The intensity of the sunlight, $I =$ ___________ Units | Select an answer ▼.

What is the maximum power a 4.5-m by 1.5-m solar battery can produce if it is placed near Jupiter? Assume that the battery has an efficiency of 0.75.

The power produced by the battery, $P =$ ___________ Units | Select an answer ▼.

Question Help:  Message instructor  Post to forum

Question 9  998  Question 10  998

The Sun radiates energy at about $3.85 \times 10^{26}$ Joules per second. What is the sunlight intensity near planet Jupiter that is 780 million kilometers away from the Sun?

The intensity of the sunlight, $I =$ ___________ Units | Select an answer ▼.

What is the maximum power a 4.5-m by 1.5-m solar battery can produce if it is placed near Jupiter? Assume that the battery has an efficiency of 0.75.

The power produced by the battery, $P =$ ___________ Units | Select an answer ▼.

Question Help:  Message instructor  Post to forum

Question 9  998  Question 10  998
There is a speaker on a platform which emits 1000-Hz sound waves as a stationary source and there is a LaGuardia Physics Professor who can detect these waves and determine their frequency. Both the Professor and the platform can move in any direction along the line joining them. If all the motions indicated below are relative to the ground (and to the air), which of the following statements are True/False?

If the Professor detects 1020-Hz sound, then he and the platform can be moving away from each other.
Select an answer

If the Professor detects 980-Hz sound, then he and the platform can be moving in opposite directions.
Select an answer

If the Professor detects 1000-Hz sound, then he and the platform can be moving in the same direction.
Select an answer

If the Professor detects 1020-Hz sound, then the platform can be stationary.
Select an answer

If the Professor detects 980-Hz sound, then the platform must move towards the Professor.
Select an answer

If the Professor detects 1000-Hz sound, then he and the platform must be stationary.
Select an answer

Note: you MUST complete all sentences before submitting.

While standing next to the main entrance of the E-building a LaGuardia student notices an ambulance car approaching her at a speed of 21.2 m/s. What are the frequency and wavelength of the sound wave that the student hears while the car is approaching? Take that the car has a siren producing a 1.6-kHz signals when it is stationary and 340 m/s for the speed of sound.

The frequency of the sound wave, \( f_1 = \) _______ Units Select an answer.

The wavelength of the sound wave, \( \lambda_1 = \) _______ Units Select an answer.

When the car has passed the building and is moving away from the student, what are frequency and wavelength of the sound wave she would hear in this case?

The frequency of the sound wave, \( f_2 = \) _______ Units Select an answer.

The wavelength of the sound wave, \( \lambda_2 = \) _______ Units Select an answer.
Question 12

H-alpha line is a red visible spectral line in hydrogen atom with a wavelength of 656.3 nm. Consider five distant stars labeled A, B, C, D, and E. The light from these stars was detected on Earth and, after performing spectral analysis, the following H-alpha wavelengths were measured: \( \lambda_A = 663.1 \text{ nm}, \lambda_B = 644.9 \text{ nm}, \lambda_C = 654.2 \text{ nm}, \lambda_D = 663.6 \text{ nm}, \) and \( \lambda_E = 659.5 \text{ nm}. \)

Which star has the slowest speed relative to Earth, in which direction and how fast does it move?

The slowest star is \( ? \) \( \checkmark \) and it moves \( \text{Select an answer} \) \( \checkmark \) Earth.

The speed of the slowest star (in km/s), \( v_{\text{slowest}} = \) \( \text{Select an answer} \) \( \checkmark \).

Which star has the fastest speed relative to Earth, in which direction and how fast does it move?

The fastest star is \( ? \) \( \checkmark \) and it moves \( \text{Select an answer} \) \( \checkmark \) Earth.

The speed of the fastest star (in km/s), \( v_{\text{fastest}} = \) \( \text{Select an answer} \) \( \checkmark \).

Question Help: \( \text{Message instructor} \) \( \text{Post to forum} \)

Question 13

A bat sends an ultrasound signal of 40 kHz frequency towards a prey. Does the prey move away or towards the bat if the signal the bat receives back has 41.6 kHz frequency? What is the speed of the prey relative to the bat? Take 341 m/s for the speed of sound.

The prey moves \( \text{Select an answer} \) \( \checkmark \) the bat.

The speed of the prey, \( v_{\text{prey}} = \) \( \text{Select an answer} \) \( \checkmark \) Units.

What frequency will the bat detect if the prey changes its direction of motion to the opposite but keeps the same speed?

The frequency detected by the bat, \( f = \) \( \text{Select an answer} \) \( \checkmark \) Units.
Two submarines A and B are approaching each other along a straight line as shown below. The speed of submarine A is \( V_A = 23 \text{ m/s} \), the speed of submarine B is unknown. Submarine A sends a 410-Hz acoustic signal towards submarine B and receives a reflected signal of a higher frequency of 437 Hz. What is the speed of submarine B if the speed of sound in water is 1500 m/s?

The speed of submarine B, \( V_B = \) _______ Units [Select an answer].

What frequency does submarine B “hear”?

The frequency on submarine B, \( f_B = \) _______ Units [Select an answer].
Two charges $q_1 = 30 \, \mu\text{C}$ and $q_2 = 15 \, \mu\text{C}$ are separated by a distance $0.25 \, \text{m}$. What is the magnitude of the electrostatic force acting on each charge?

The magnitude of the force, $F = \underline{\text{ }} \, \text{Units}$

Is the force attractive or repulsive? Select an answer

What is the direction of the force exerted on $q_1$? Select an answer

What is the direction of the force exerted on $q_2$? Select an answer

What should be the distance between these two charges so the electrostatic force is three times weaker?

The distance between the charges, $d = \underline{\text{ }} \, \text{Units}$

Question Help: Message instructor Post to forum
Three charges are arranged as shown below: $q_1 = 38 \, \mu C$ is at the origin, $q_2 = 16 \, \mu C$ is at a distance of $b = 0.25 \, m$ along the vertical axis, and $q_3 = 10 \, \mu C$ is at a distance of $a = 0.5 \, m$ along the horizontal axis. Find the forces exerted on $q_1$ by $q_2$, by $q_3$ and by $q_2$ and $q_3$ together (the net force).

The magnitude of the force on $q_1$ due $q_2$, $F_{12} =$ \text{Units} Select an answer.

The direction of the force on $q_1$ due $q_2$ is Select an answer.

The magnitude of the force on $q_1$ due $q_3$, $F_{13} =$ \text{Units} Select an answer.

The direction of the force on $q_1$ due $q_3$ is Select an answer.

The magnitude of the net force on $q_1$, $F_{1, \, \text{Net}} =$ \text{Units} Select an answer.

The direction of the net force on $q_1$ is Select an answer.
A metallic plate holds a charge of $Q = 8 \text{ nC}$.

Does the plate have excess or lack of electrons? Select an answer.

What total number of elementary charges does $Q$ represent?

The number of elementary charges, $N = \underline{\quad} \text{ Units}$ Select an answer.

After $47.5 \times 10^{10}$ electrons were added to the plate, what is the new net charge on the plate?

The new charge of the plate, $Q_{\text{new}} = \underline{\quad} \text{ Units}$ Select an answer.

Three charges $q_1$, $q_2$, and $q_3$ are arranged as shown below. Which of the following statements are True/False?

If $q_1$ is positive, $q_2$ is positive, and $q_3$ is positive, then $q_2$ must experience the net force to the left.

If $q_1$ is negative, $q_2$ is positive, and $q_3$ is positive, then $q_2$ must experience the net force to the left.

If $q_1$ is negative, $q_2$ is negative, and $q_3$ is negative, then $q_3$ must experience the net force to the right.

If $q_1$ is positive, $q_2$ is negative, and $q_3$ is positive, then $q_3$ must experience the net force to the left.

If $q_1$ is negative, $q_2$ is positive, and $q_3$ is negative, then $q_1$ must experience the net force to the right.

If $q_1$ is positive, $q_2$ is negative, and $q_3$ is negative, then $q_1$ must experience the net force to the right.

Note: you MUST complete all sentences before submitting.

Question Help: Message instructor Post to forum
An electric charge \( q_1 = 48 \text{ mC} \) is located at the origin of the \((x,y)\) plane, while another charge \( q_2 = 15 \text{ mC} \) is placed at the position \( x_2 = 2.2 \text{ m} \), see the picture below. At what position should a third charge \( q_3 \) be placed so it experiences no net force?

The position of the third charge, \( x_3 = \) ___________ Units

Solve the same problem with all the same values, but with the opposite sign of the second charge: \( q_1 = 48 \text{ mC} \), \( q_2 = -15 \text{ mC} \), and \( x_2 = 2.2 \text{ m} \).

The new position of the third charge, \( x_{3, \text{new}} = \) ___________ Units

Question Help:  
☐ Message instructor  ☐ Post to forum
1. A $q = 22 \, \mu \text{C}$ charge is placed in an external electric field, it experiences a force of 50 mN magnitude. What are the strength and direction of the field?

The strength of E-field, $E = \underline{\underline{}}$ Units \ Select an answer \ .

The direction of E-field is \ Select an answer \ the direction of the force.

2. A $q = -330 \, \mu \text{C}$ charge is placed in an external 1900-N/C electric field. What are the magnitude and direction of the force experienced by the charge?

The magnitude of the force, $F = \underline{\underline{}}$ Units \ Select an answer \ .

The direction of the force is \ Select an answer \ the direction of the electric field.

3. An unknown charge is placed in an external 380-N/C electric field. Find this charge if it experiences a force of 35 N in the direction opposite to the electric field.

The charge, $q = \underline{\underline{}}$ Units \ Select an answer \ .

Question Help:  
  
  • Message instructor  
  • Post to forum
Which of the following statements about E-field are True/False?

E-field lines may cross.
Select an answer

E-field lines do not begin or end in a charge-free region except at infinity.
Select an answer

Negative charges produce lines of E-field that point inward.
Select an answer

E-field lines make circles around positive charges.
Select an answer

A negative point charge released from rest will accelerate along an E-field line.
Select an answer

Positive charges produce lines of E-field that point outward.
Select an answer

Where the lines of E-field are dense then the E-field must be weak.
Select an answer

Note: you MUST complete all sentences before submitting.

Question Help: 📧 Message instructor  🌐 Post to forum
Describe the interaction between a nucleus of calcium (Z = 20) and an electron located at a distance of $0.55 \times 10^{-10}$ m from the nucleus.

1. What is the electric field produced by the nucleus at the electron's position?

   The magnitude of the E-field produced by the nucleus, $E = \underline{\phantom{0000}}$ Units
   
   The electric field points \( \text{Select an answer} \) the nucleus.

2. What is the electrostatic force on the electron produced by the nucleus?

   The magnitude of the force, $F = \underline{\phantom{0000}}$ Units
   
   The force on the electron points \( \text{Select an answer} \) the nucleus.

3. The electron produces its own electric field at the position of the nucleus, find this electric field.

   The magnitude of the E-field produced by the electron, $E = \underline{\phantom{0000}}$ Units
   
   This electric field points \( \text{Select an answer} \) the electron.

4. What is the force on the nucleus produced by the electron?

   The magnitude of the force, $F = \underline{\phantom{0000}}$ Units
   
   The force on the nucleus points \( \text{Select an answer} \) the electron.

Question Help:  

\[ \text{Message instructor} \quad \text{Post to forum} \]
Find the direction of the net electric field for the charge arrangements shown below. In the first arrangement the field is created by two equal charges - one is positive and one is negative (\(q\) and \(-q\)), in the second arrangement the charges are equal and both are positive (\(q\) and \(q\)).

**Arrangement 1.**

- The net electric field at point A is directed \(\text{Select an answer}\).
- The net electric field at point B is directed \(\text{Select an answer}\).
- The net electric field at point C is directed \(\text{Select an answer}\).
- The net electric field at point D is directed \(\text{Select an answer}\).
- The net electric field at point E is directed \(\text{Select an answer}\).
- The net electric field at point F is directed \(\text{Select an answer}\).
- The net electric field at point G is directed \(\text{Select an answer}\).

**Arrangement 2.**

- The net electric field at point H is directed \(\text{Select an answer}\).
- The net electric field at point J is directed \(\text{Select an answer}\).
- The net electric field at point K is directed \(\text{Select an answer}\).
- The net electric field at point L is directed \(\text{Select an answer}\).
- The net electric field at point M is directed \(\text{Select an answer}\).
- The net electric field at point N is directed \(\text{Select an answer}\).
Two charges, q and -q, are located at h/2 and -h/2 coordinates along the y-axis as shown below. Find the net electric field at point A (the origin and the midpoint between the charges), if q = 55 nC and h = 34 cm.

The magnitude of E-field at A, $E_A = \text{Units}$.

The field at point A is directed $\text{Select an answer}$.

Find the net electric field at point B located at a distance $d = 115$ cm from the origin along the x-axis.

The magnitude of E-field at B, $E_B = \text{Units}$.

The field at point B is directed $\text{Select an answer}$.
Find the electric field at the origin of the x,y-plane for charge distributions (a) and (b), see the figures shown below. The field is produced (a) by a thin half-circle with a radius of 25 cm and the linear charge density $\kappa = 59 \text{ pC/cm}$ and (b) by a thin quarter-circle with the same radius and the linear charge density $\kappa = -59 \text{ pC/cm}$.

For the charge distribution (a):

The x-component of $\vec{E}_a$, $E_{a,x}$ = ___________ Units [Select an answer].

The y-component of $\vec{E}_a$, $E_{a,y}$ = ___________ Units [Select an answer].

For the charge distribution (b):

The x-component of $\vec{E}_b$, $E_{b,x}$ = ___________ Units [Select an answer].

The y-component of $\vec{E}_b$, $E_{b,y}$ = ___________ Units [Select an answer].

Question Help:  

Message instructor  Post to forum
Consider an uniformly charged thin rod of length \( L = 53 \text{ cm} \) with a linear charge density of \( \kappa = 30 \text{ nC/cm} \). Find the electric field at a distance \( d = 24.5 \text{ cm} \) from the closest rod's edge along the line of the rod as shown below.

The electric field, \( E = \underline{\underline{\text{Units}}} \) Units Select an answer .

Question Help: Message instructor Post to forum

Question 13
Seven identical charges $q = 5 \, \mu C$ are connected with identical rigid strings as shown below. The distances between any two nearest charges equal $l = 5.5 \, \text{cm}$. Find the magnitude of the tension in each string.

The tension, $T =$ \underline{\hspace{2cm}} Units \ Select an answer \ \checkmark.

Question Help:  
- Message instructor
- Post to forum

\begin{itemize}
\item Question 14
\end{itemize}
Four electrons are orbiting a stationary proton along a perfect circle with a constant speed $v$ as shown below. Find the orbital speed and frequency of this circular motion if the radius of the orbit is $0.8 \cdot 10^{-10} m$. The elementary charge $q = 1.6 \cdot 10^{-19} C$ and the electron mass $m_e = 9.11 \cdot 10^{-31} kg$.

The orbital speed, $v = \underline{\quad} \text{ Units }$ [Select an answer].

The frequency of orbital motion, $f = \underline{\quad} \text{ Units }$ [Select an answer].
Blitz problem solving: Gauss’ theorem

1. The flux of electric field through a closed surface is \( \Phi_E = -340 \text{ V} \cdot \text{m} \). Find the charge enclosed by this surface.

The charge enclosed, \( Q_1 = \) \underline{\hspace{1cm}} \text{ Units} \text{ Select an answer } \checkmark.

2. A point-like charge \(-90 \text{ nC}\) is located at the center of an octahedron. Find the flux of electric field through one side of the octahedron.

The flux, \( \Phi_2 = \) \underline{\hspace{1cm}} \text{ Units} \text{ Select an answer } \checkmark.

3. Find the magnitude of the flux of an uniform electric field \( \vec{E} \) through a hemisphere of radius \( R \), if the field is directed along the hemisphere axis as shown below. The magnitude of the field is \( E = 10 \text{ N} / \text{C} \) and the radius of the hemisphere is \( R = 30 \text{ cm} \).

The flux, \( \Phi_3 = \) \underline{\hspace{1cm}} \text{ Units} \text{ Select an answer } \checkmark.

Question Help:  

\( \checkmark \) Message instructor  \( \circ \) Post to forum
Consider a spherical conducting shell with the inner and outer surfaces, see the shaded area in the picture below. The shell has zero net charge and encloses a point-like central charge Q. Which of the following statements are True/False?

The inner surface of the shell has zero charge. Select an answer.

The outer surface of the shell has charge Q. Select an answer.

The electric field at point C is zero. Select an answer.

The outer surface of the shell has zero charge. Select an answer.

The inner surface of the shell has charge -Q. Select an answer.

The electric field at point A is zero. Select an answer.

The electric field at point B is zero. Select an answer.

Note: you MUST complete all sentences before submitting.

Question Help:  📥 Message instructor  🌐 Post to forum
Consider the system of two concentric conducting spherical shells shown below: the inner shell has the inner radius of $a = 26$ cm, the outer radius of $b = 36$ cm, and the net charge of $Q_1 = -50$ nC; the outer shell has the inner radius of $c = 44$ cm, the outer radius of $d = 60$ cm, and the net charge of $Q_2 = 85$ nC; there is also a point-like charge $Q = -25$ nC placed at the center of the system. Complete the following sentences using Gauss's theorem, see the hint below.

1. Find the charge on each surface of each shell.

The charge on the inner surface of the inner shell ($r=a$), $Q_{1,\text{inner}} = \underline{\hspace{2cm}}$ Units

The charge on the outer surface of the inner shell ($r=b$), $Q_{1,\text{outer}} = \underline{\hspace{2cm}}$ Units

The charge on the inner surface of the outer shell ($r=c$), $Q_{2,\text{inner}} = \underline{\hspace{2cm}}$ Units

The charge on the outer surface of the outer shell ($r=d$), $Q_{2,\text{outer}} = \underline{\hspace{2cm}}$ Units

2. Find the electric field produced by the shells and the central charge at different locations, submit positive value if the field points outward (away from the center) and submit negative value if the field points inward (toward the center).

The radial component of E-field at $r = 10$ cm, $E_1 = \underline{\hspace{2cm}}$ Units
The radial component of E-field at $r = 38\, \text{cm}$, $E_2 = \underline{\phantom{0000}}$ Units. Select an answer.

The radial component of E-field at $r = 84\, \text{cm}$, $E_3 = \underline{\phantom{0000}}$ Units. Select an answer.

Question Help: 📦 Message instructor ☑ Post to forum

Three parallel large uniformly charged planes are arranged as shown in the picture below. Find the electric field at points 1, 2, 3, and 4 if the surface charge densities of the planes are $\sigma_1 = 45\, \text{nC/m}^2$, $\sigma_2 = -35\, \text{nC/m}^2$, and $\sigma_3 = -25\, \text{nC/m}^2$ respectively. Assume the positive direction of the vertical axis upwards.

- 1
  \[ \sigma_1 \]
- 2
  \[ \sigma_2 \]
- 3
  \[ \sigma_3 \]
- 4

The E-field at point 1, $E_1 = \underline{\phantom{0000}}$ Units. Select an answer.

The E-field at point 2, $E_2 = \underline{\phantom{0000}}$ Units. Select an answer.

The E-field at point 3, $E_3 = \underline{\phantom{0000}}$ Units. Select an answer.

The E-field at point 4, $E_4 = \underline{\phantom{0000}}$ Units. Select an answer.

Question Help: 📦 Message instructor ☑ Post to forum

Question 5

0/1 pt 999 998

MyOpenMath https://www.myopenmath.com/assess2/?cid=105715&ai...
The two concentric spherical shells, of radii \( a = 15 \) cm and \( b = 31.5 \) cm, are uniformly charged with the same amounts of charge \( Q \), but of opposite signs, see the picture below. Find the magnitude of the electric field at distances \( r_1 = 11.5 \) cm, \( r_2 = 24.5 \) cm, and \( r_3 = 41 \) cm, take \( Q = 16 \) \( \mu \)C.

The volume charge density of a spherically charged cloud changes with the distance to the cloud center as

\[
\rho(r) = \rho_0 \cdot \frac{r}{a},
\]

where the parameters are \( \rho_0 = 2.6 \) nC/m\(^3\) and \( a = 23 \) m. Find the magnitude of electric field at distance \( d = 26 \) m from the cloud center.

The electric field, \( E(r = 26 \) m) = ___________ Units Select an answer .

Find the electric field (in N/C) as a function of \( r \) (in m). Do not submit the units.

The electric field, \( E(r) = \) N/C.
Question 7

The hydrogen atom consists of a proton (at the center, charge $Q_p = +e$) and an electron distributed around the proton with the following volume charge density given as a function of the electron distance to the proton,

$$\rho(r) = -\frac{e}{\pi a_0^3 \exp\left[-\frac{2 \cdot r}{a_0}\right]},$$

where $a_0 = 0.5 \times 10^{-10} m$ is the Bohr radius and $e$ is the elementary charge. Find the magnitude of the atomic electric field at distances $\frac{a_0}{4}$, $a_0$, and $4a_0$.

The E-field at $\frac{a_0}{4}$, $E_1 =$ _________ Units Select an answer .

The E-field at $a_0$, $E_2 =$ _________ Units Select an answer .

The E-field at $4a_0$, $E_3 =$ _________ Units Select an answer.

Question Help: Message instructor Post to forum

Question 8

The two long uniformly charged wires are parallel to the y-axis and located at $x = \pm \frac{L}{2}$ as shown in the figure below. At what x-coordinate is the net electric field zero? Take $L = 65$ cm, the linear charge densities $\kappa_1 = 20$ nC/cm and $\kappa_2 = 10$ nC/cm?

In which part of the graph do you expect the net field to be zero? Select an answer

The net field is zero at $x =$ _________ Units Select an answer.
How much work is required to move a negative charge, of \( q = -60 \mu C \) and \( m = 60 \, g \), from point '1' to point '2' along the x-axis away from the long uniformly charged line that is parallel to the y-axis as shown in the figure below? The initial and final positions of the charge are \( a = 15 \, cm \) and \( b = 30 \, cm \) and the linear charge density of the line is \( \kappa = 20 \, nC/cm \).

The work required, \( W = \underline{\quad} \) Units [Select an answer].

If the same charge is released from rest from point '2', what will be the speed of this charge as it passes point '1'?

The speed at '1', \( v = \underline{\quad} \) Units [Select an answer].

The three identical charges, of \( q = 15 \mu C \) and \( m = 50 \, g \), are held in the vertices of an equilateral triangle. What is the potential energy of the system if the size of the triangle is \( d = 70 \, cm \)?

The potential energy, \( PE = \underline{\quad} \) Units [Select an answer].

If the charges are released and start moving away from each other, what is the speed of each charge at infinity? Assume that the energy of interaction splits equally between the charges.

The speed at infinity, \( v = \underline{\quad} \) Units [Select an answer].
The two identical charges, of \( q = 45 \, \mu\text{C} \) and \( m = 40 \, \text{g} \), are moving towards each other along the x-axis as shown below. What are the initial potential and kinetic energies of the system if the initial separation distance between the charges \( d = 50 \, \text{cm} \) and the initial speed of each charge \( v = 37 \, \text{m/s} \).

![Diagram of two charges moving towards each other with distance \( d \).]

The potential energy, \( PE = \) ________ Units. 

The kinetic energy, \( KE = \) ________ Units. 

To what minimum distance can the charges approach each other?

The minimum distance, \( d_{\text{min}} = \) ________ Units. 

Question Help:  
- Message instructor
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Question 12

0/1 pt  999  998
An electron is located at the surface of a heavy metallic sphere that is charged to a potential of \( V_0 = 270 \text{ V} \). Find the potential energy of the electron in Joules and in electron-Volts. Use \( 1eV = 1.6 \times 10^{-19} \text{ J} \), \( m_e = 9.11 \times 10^{-31} \text{ kg} \), and \( Q_e = -e = -1.6 \times 10^{-19} \text{ C} \).

The potential energy of the electron in J, \( PE = \) ________ Units [Select an answer].

The potential energy of the electron in eV, \( PE = \) ________ Units [Select an answer].

The electron is attracted to the sphere but if it has enough initial kinetic energy it can escape to a very large distance, see the picture above. Find the minimum speed at which electron can completely escape from the sphere. Take that the electric potential at large distances is zero, \( V_\infty = 0 \text{ V} \).

The escape velocity of the electron, \( v_0 = \) ________ Units [Select an answer].

While the electron moves away from the sphere its potential energy [Select an answer] and its kinetic energy [Select an answer].

Question Help: 📣 Message instructor 💌 Post to forum
A proton \((Q_p = 1.6 \times 10^{-19} \text{ C and } m_p = 1.67 \times 10^{-27} \text{ kg})\) is approaching a metallic sphere from a large distance, as shown below. The sphere is charged to an electric potential of \(V_0 = 150 \text{ V}\). When the proton is far from the sphere it has a potential energy of \(\text{PE}_p = 0 \text{ eV}\) and a kinetic energy of \(\text{KE}_p = 170 \text{ eV}\). What is the speed of the proton at large distances from the sphere?

![Diagram of proton approaching metallic sphere with electric potential](https://www.myopenmath.com/assess2/?cid=105715&ai...)

The speed of the proton at infinity, \(v_\infty = \underline{\text{__________}} \text{ Units}\) Select an answer.

While the proton is approaching the sphere its kinetic energy Select an answer \(\text{Select an answer} ,\) and its potential energy Select an answer.

Find the potential and kinetic energies of the proton when it reaches the surface of the sphere.

The proton potential energy at the surface of the sphere, \(\text{PE} = \underline{\text{__________}} \text{ Units}\) Select an answer.

The proton kinetic energy at the surface of the sphere, \(\text{KE} = \underline{\text{__________}} \text{ Units}\) Select an answer.

What is the speed of the proton at the surface of the sphere?

The speed of the proton at the surface, \(v_0 = \underline{\text{__________}} \text{ Units}\) Select an answer.

Question Help:  
  ☑️ Message instructor  ☢️ Post to forum
Two charged systems $Q_1$ and $Q_2$ produce the electrostatic field presented below with the help of equipotential lines. The step between the lines is 1 kV.

1. What are the signs of $Q_1$ and $Q_2$ and which charge has the greater magnitude?

The left charge $Q_1$ is \(\text{Select an answer} \) and the right charge $Q_2$ is \(\text{Select an answer} \).

Charge \( ? \) has the greater magnitude than charge \( ? \).

2. Calculate the work required to move a $q_1 = -25 \, \mu C$ charge from one point to another:

The work required to move $q_1$ from G to F, $W_1 = \text{___________} \) Units \(\text{Select an answer} \).

The work required to move $q_1$ from B to A, $W_2 = \text{___________} \) Units \(\text{Select an answer} \).

3. Calculate the work required to move a $q_2 = 30 \, \mu C$ charge from one point to another:

The work required to move $q_2$ from G to C, $W_3 = \text{___________} \) Units \(\text{Select an answer} \).

The work required to move $q_2$ from B to E, $W_4 = \text{___________} \) Units \(\text{Select an answer} \).

4. A charged particle of $q_3 = 25 \, \mu C$ and $m_3 = 30 \, \text{mg}$ is released from rest at point E and starts to move in the direction of $Q_1$. What is the speed of the particles when it passes the -3 kV equipotential line?

The speed of the particle, $v = \text{___________} \) Units \(\text{Select an answer} \).
In an x-ray machine, electrons are accelerated from cathode (plate at negative potential) to anode (plate at positive potential) by a high potential difference between the plates, as shown in the figure below. If the potential difference between the plates is 40-kV, find the kinetic energy gained by each electron and its speed as they arrive to the anode. Take electron charge $1.6 \times 10^{-19}$ C and electron mass $9.11 \times 10^{-31}$ kg.

Note: the electron's speed that you will get may be faster than/closer to the speed of light and it is not realistic because at high speed relativistic kinetic energy should be calculated differently. Relativistic kinetic energy reaches infinity when speed reaches the speed of light and hence speed can't be faster than the speed of light. This problem is for illustration purposes only. Relativistic effect need to be taken into account for realistic answer.

(a) Kinetic energy of each electron, $KE = \underline{\hphantom{0}}$ Units

(b) Speed of each electron, $v = \underline{\hphantom{0}}$ Units
A charge \( Q = 105 \text{ nC} \) is placed at the origin of the \((x,y)\)-plane shown below. Find the electric potential at points A and B if the distances are \( a = 30.5 \text{ cm} \) and \( b = 44.3 \text{ cm} \).

The potential at A, \( V_A = \) __________ Units

The potential at B, \( V_B = \) __________ Units

How much work is required to move an electron from point A to point B?

The work, \( W_{A\rightarrow B} = \) __________ Units

Question Help: ✉️ Message instructor  🌎 Post to forum
Consider two separate systems with four charges of the same magnitude $q = 22 \, \mu\text{C}$ arranged in the vertexes of a square of length $h = 55 \, \text{cm}$, see the picture below. Calculate the electric potential at the center of the square (points A and C) and at the middle of the bottom side of the square (points B and D).

The potential at point A, $V_A = \underline{\quad \quad} \, \text{Units}$

The potential at point B, $V_B = \underline{\quad \quad} \, \text{Units}$

The potential at point C, $V_C = \underline{\quad \quad} \, \text{Units}$

The potential at point D, $V_D = \underline{\quad \quad} \, \text{Units}$

How much work is required to move a $-12 \, \mu\text{C}$ charge from point A to point B?

The work required, $W_{A\rightarrow B} = \underline{\quad \quad} \, \text{Units}$

How much work is required to move a $-12 \, \mu\text{C}$ charge from point C to point D?

The work required, $W_{C\rightarrow D} = \underline{\quad \quad} \, \text{Units}$

Question Help:  
  - Message instructor
  - Post to forum
Two charges $q_1 = 40 \text{ nC}$ and $q_2$ (the charge is unknown) are located on the x-axis at the distances $a = 5.5 \text{ cm}$ and $b = 3 \text{ cm}$ from a point $P$ respectively, see the picture below. Find $q_2$ if the electric potential at point $P$ is 500 Volts.

The second charge, $q_2 = \ldots$ Units Select an answer.

There are two points on the x-axis where the electric potential is zero. Find the x-coordinate of the left and right point with zero potential.

The position of the left point, $x_1 = \ldots$ Units Select an answer.

The position of the right point, $x_2 = \ldots$ Units Select an answer.

Question Help:  
  Message instructor  Post to forum
The electric potential of a charged conducting sphere (as well as a spherical shell) can be calculated as

\[ V = k \frac{Q}{R} , \]

where \( Q \) is the charge and \( R \) is the radius of the sphere. Calculate the electric potential of a solid conducting sphere of a radius of \( R = 3.5 \text{ cm} \) if the sphere loses 0.1\% from the total number of its free electrons. The sphere is made of aluminum and has the density \( 2.7 \text{ g/cm}^3 \), molar mass \( 27 \text{ g/mol} \) and one free electron per atom. Follow the steps listed below.

1. Find the number of free electrons per \( \text{cm}^3 \) in aluminum.

The number of free electrons per \( \text{cm}^3 \), \( n_e = \) ___________ Units Select an answer .

2. Calculate the volume of the sphere and use it to find the total number of free electron inside the sphere.

The number of free electrons, \( N_e = \) ___________ Units Select an answer .

3. Calculate the charge of the sphere after it loses 0.1\% of its electrons and use it to find the potential of the sphere.

The electric potential of the sphere, \( V = \) ___________ Units Select an answer .

Question Help:  
Message instructor  
Post to forum

Three concentric conducting spherical shells of radii \( r, 2r, \) and \( 3r \) are charged with net electric charges \( q, 2q \) and \( -3q \) respectively. Find the electric potential of each shell. Assume

\[ V_0 = \frac{kq}{r} = 120V. \]

The potential at \( r, V_1 = \) ___________ Units Select an answer .

The potential at \( 2r, V_2 = \) ___________ Units Select an answer .

The potential at \( 3r, V_3 = \) ___________ Units Select an answer .

Question Help:  
Message instructor  
Post to forum
Consider four points A, B, C and D located in an external constant electric field $\vec{E}$. The field is directed to the right, the magnitude of the field is $E = 1000 \, \text{N/C}$; the points are separated by a distance of $d = 36 \, \text{cm}$ in the horizontal direction and by $h = 12 \, \text{cm}$ in the vertical direction, see the picture below. What information about the electric potential at these points can be obtained in this situation?

At which point(s) the potential is the highest? Select an answer.

At which point(s) the potential is the lowest? Select an answer.

Which points (if any) have the same potential? Select an answer.

Find the difference in the electric potential between the following points:

$\Delta V_{A \rightarrow B} = V(\text{at point B}) - V(\text{at point A}) = \underline{\text{_______}} \, \text{Units} \quad \text{Select an answer.}$

$\Delta V_{A \rightarrow C} = V(\text{at point C}) - V(\text{at point A}) = \underline{\text{_______}} \, \text{Units} \quad \text{Select an answer.}$

$\Delta V_{C \rightarrow D} = V(\text{at point D}) - V(\text{at point C}) = \underline{\text{_______}} \, \text{Units} \quad \text{Select an answer.}$

$\Delta V_{B \rightarrow D} = V(\text{at point D}) - V(\text{at point B}) = \underline{\text{_______}} \, \text{Units} \quad \text{Select an answer.}$

$\Delta V_{D \rightarrow A} = V(\text{at point A}) - V(\text{at point D}) = \underline{\text{_______}} \, \text{Units} \quad \text{Select an answer.}$

$\Delta V_{C \rightarrow B} = V(\text{at point B}) - V(\text{at point C}) = \underline{\text{_______}} \, \text{Units} \quad \text{Select an answer.}$

Question Help:  Message instructor  Post to forum

Question 8  0/1 pt  999  998
The electric potential of a system is presented by the figure shown below. Find the x-component of the electric field at points A, B, and C if $V_0 = 9 \text{ V}$ and $x_1 = 25 \text{ cm}$, $x_2 = 100 \text{ cm}$, $x_3 = 150 \text{ cm}$.

The x-component of E-field at point A, $E_A =$ _________ Units Select an answer

The x-component of E-field at point B, $E_B =$ _________ Units Select an answer

The x-component of E-field at point C, $E_C =$ _________ Units Select an answer

A particle of mass 9.4 g and charge 8.5 μC is moving in an electric potential field

$$V(x, y) = c_1 \cdot x - c_2 \cdot y^2 + c_3 \cdot y \cdot x^2,$$

where $c_1 = 15 \text{ V/m}$, $c_2 = 35 \text{ V/m}^2$, and $c_3 = 75 \text{ V/m}^3$. Find the electric field acting on the particle as a function of its position. Use V/m and meters for the units, but do not put them explicitly in $\vec{E}(x, y)$.

The x-component of the E-field, $E_x(x, y) =$ _________ Units Select an answer

The y-component of the E-field, $E_y(x, y) =$ _________ Units Select an answer

What is the magnitude of the particle's acceleration at $x = 2 \text{ m}$ and $y = -1.5 \text{ m}$?

The acceleration, $a =$ _________ Units Select an answer
Question 10

A point-like charge \( Q = 17.5 \, \mu\text{C} \) is embedded into a dielectric material with constant \( \kappa = 30 \). Find the magnitude of E-field and energy density at distance \( d = 0.3 \, \text{m} \) from the charge.

The magnitude of E-field, \( E = \) ___________ Units [Select an answer].

The energy density, \( u_E = \) ___________ Units [Select an answer].

Find the force on a test charge \( q = 59 \, \mu\text{C} \) placed at the same distance \( 0.3 \, \text{m} \) from \( Q \).

The force on the test charge, \( F_q = \) ___________ Units [Select an answer].

Question 11

An air-filled parallel-plate capacitor with a plate separation of \( 1 \, \text{mm} \) has a capacitance of \( 100 \, \text{pF} \). What is the area of one of the capacitor's plates? Be careful about units.

The plate area, \( A = \) ___________ Units [Select an answer].

What is the magnitude of electric field in the capacitor if it is charged to \( Q = 3.3 \, \text{nC} \)?

The electric field, \( E = \) ___________ Units [Select an answer].

What is the energy density that corresponds to this electric field?

The energy density, \( u_E = \) ___________ Units [Select an answer].

Question 12
Consider an isolated parallel-plate capacitor filled with air. Which of the following statements are True/False? Below $Q$ and $U$ are the charge and the energy stored on the capacitor, $C$ is the capacitance, $d$ is the distance between the plates and $E$ is the electric field in the capacitor.

- When a dielectric material is inserted then the energy $U$ decreases. [Select an answer]
- When the distance $d$ increases then the capacitance $C$ increases as well. [Select an answer]
- The capacitance $C$ increases when a dielectric material is inserted. [Select an answer]
- The charge $Q$ increases when a dielectric material is inserted. [Select an answer]
- When the distance $d$ decreases then the charge $Q$ stays the same. [Select an answer]
- When the distance $d$ increases then the energy $U$ increases as well. [Select an answer]
- When the distance $d$ increases then the electric field $E$ increases as well. [Select an answer]

Note: you MUST complete all sentences before submitting.

Question Help:  
 0/1 pt  999  998
MyOpenMath https://www.myopenmath.com/assess2/?cid=105715&ai...
9 of 10 6/10/21, 13:45

Consider a parallel-plate capacitor with plate’s area $A = 37.9 \text{ cm}^2$ and separation between the plates $d = 5.3 \text{ mm}$. What are the charge and energy stored on the capacitor if it is connected to a 55-Volt battery? The capacitor is filled with air.

The charge, $Q_1 = \underline{\text{}} \text{ Units}$ [Select an answer].

The energy, $U_1 = \underline{\text{}} \text{ Units}$ [Select an answer].

If a dielectric material with $\kappa = 2.45$ is inserted so that it fills the space between the plates (with the capacitor still connected to the same battery), what are the new change and energy on the capacitor?

The new charge, $Q_2 = \underline{\text{}} \text{ Units}$ [Select an answer].

The new energy, $U_2 = \underline{\text{}} \text{ Units}$ [Select an answer].

Question Help:  
 0/1 pt  999  998
MyOpenMath https://www.myopenmath.com/assess2/?cid=105715&ai...
Two concentric spherical conducting shells are separated by vacuum. The inner shell has total charge +Q and radius a, and outer shell has charge -Q and radius b. Using the integration of electric field energy density find the electric energy stored in the system. Take Q = 10.5 μC, a = 15 cm and b = 90 cm.

The energy, \[ U_0 = \, \text{Units} \, \text{Select an answer} \, \]

Using the obtained energy and formula for the energy stored in a capacitor, \[ U = \frac{Q^2}{2C} \], find the capacitance of the system.

The capacitance, \[ C_0 = \, \text{Units} \, \text{Select an answer} \, \]

Repeat the calculations for the same system with a dielectric material of \( \kappa = 6 \) inserted in between the shells.

The energy, \[ U_1 = \, \text{Units} \, \text{Select an answer} \, \]

The capacitance, \[ C_1 = \, \text{Units} \, \text{Select an answer} \, \]

Question Help:  

Message instructor  Post to forum
HW #06

Question 1

1.9×10^{21} electrons are flowing past any point in a wire per minute (electron charge = -1.6×10^{-19} \text{ C}).

(a) How much electric current is flowing through the wire?

The current, \( I = \) \( \text{ } \) \text{ Units} \ Select an answer \( \checkmark \).

(b) How many protons are flowing through the wire?

(c) If the applied potential difference at two ends of the wire is 10 V, find the resistance of the wire.

The resistance, \( R = \) \( \text{ } \) \text{ Units} \ Select an answer \( \checkmark \).

(d) If the radius of the wire is 0.14 mm and resistivity of the material is 1.8×10^{-8} \Omega \cdot \text{ m}, find the length of the wire.

The length of the wire, \( l = \) \( \text{ } \) \text{ Units} \ Select an answer \( \checkmark \).

(e) Find the power dissipation due to resistance of the wire.

The power, \( P = \) \( \text{ } \) \text{ Units} \ Select an answer \( \checkmark \).

(f) How much energy is lost in one hour?

The energy lost, \( E = \) \( \text{ } \) \text{ Units} \ Select an answer \( \checkmark \).

Question Help: \( \text{ } \) Message instructor \( \checkmark \) Post to forum

Question 2

A 0.5 m long wire is stretched to 1.6 m long. What is the percentage change in its resistance?

The change, \( \frac{\delta R}{R} \cdot 100 \% = \) \( \text{ } \) \text{ Units} \ Select an answer \( \checkmark \).

Question Help: \( \text{ } \) Message instructor \( \checkmark \) Post to forum

Question 3
Relativistic Electron Ion Collider (eRHIC) at Brookhaven National Laboratory (BNL) may accelerate two beams of 2.5-A electrons (charge \(-e\)) at very nearly speed of light \((c = 3 \times 10^8 \text{ m/s})\) in opposite direction in circular rings of circumference 3834 m. How many electrons are in each beam? (Here \(e = 1.6 \times 10^{-19} \text{ C}\))

The number of ions, \(N = \) ________.

Question Help:  Message instructor  Post to forum

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A small light-bulb draws 0.17-A current from a 5.5-V battery. In 4 min:

(a) How much charge flows from the battery?

The charge, \(Q = \) __________ Units Select an answer ▼.

(b) How much energy does the battery supply?

The energy, \(E = \) __________ Units Select an answer ▼.

(c) How many electrons passes through a point in the circuit every second?

The number of electrons, \(N = \) __________ Units Select an answer ▼

Question Help:  Message instructor  Post to forum

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The resistors $R_1 = 6.5 \, \Omega$, $R_2 = 66.5 \, \Omega$ and $R_3 = 17.5 \, \Omega$ are connected in series with a 18-V battery. What is the equivalent resistance of the circuit? What is the current through the battery?

The equivalent resistance, $R_{eq} = \boxed{\phantom{0}}$ Units Select an answer.

The current, $I = \boxed{\phantom{0}}$ Units Select an answer.

What is the drop of electric potential across each resistor?

The voltage across $R_1$, $\Delta V_1 = \boxed{\phantom{0}}$ Units Select an answer.

The voltage across $R_2$, $\Delta V_2 = \boxed{\phantom{0}}$ Units Select an answer.

The voltage across $R_3$, $\Delta V_3 = \boxed{\phantom{0}}$ Units Select an answer.

What is the power released in the circuit?

The power, $P = \boxed{\phantom{0}}$ Units Select an answer.
The resistors $R_1 = 76.5 \, \Omega$, $R_2 = 74 \, \Omega$ and $R_3 = 17.5 \, \Omega$ are connected in parallel with a 6-V battery.

What is the equivalent resistance of the circuit? What is the current through the battery?

The equivalent resistance, $R_{eq} = \text{ _________ } \, \text{ Units }$

The current, $I = \text{ _________ } \, \text{ Units }$

What is the current in each resistor?

The current in $R_1$, $I_1 = \text{ _________ } \, \text{ Units }$

The current in $R_2$, $I_2 = \text{ _________ } \, \text{ Units }$

The current in $R_3$, $I_3 = \text{ _________ } \, \text{ Units }$

What is the power released in the circuit?

The power, $P = \text{ _________ } \, \text{ Units }$

Question Help: 

Message instructor  Post to forum
The resistors $R_1 = 23.5 \, \Omega$, $R_2 = 36 \, \Omega$ and $R_3 = 34 \, \Omega$ are connected to a 12-V battery as shown in the figure below. What is the equivalent resistance of the circuit? What is the current through the battery?

![Circuit Diagram]

The equivalent resistance, $R_{eq} =$ __________ Units Select an answer.

The current, $I =$ __________ Units Select an answer.

What is the current in resistors $R_2$ and $R_3$?

The current in $R_2$, $I_2 =$ __________ Units Select an answer.

The current in $R_3$, $I_3 =$ __________ Units Select an answer.

Question Help:  
Message instructor  |  Post to forum
Consider the circuit shown below. What is the equivalent resistance of the circuit? What is the current through the battery? Assume $R_1 = 5 \, \Omega$, $R_2 = 15 \, \Omega$, $R_3 = 25 \, \Omega$, $R_4 = 5 \, \Omega$, $R_5 = 20 \, \Omega$, $R_6 = 10 \, \Omega$, $R_7 = 25 \, \Omega$, $R_8 = 5 \, \Omega$, $R_9 = 15 \, \Omega$, and $V = 40 \, V$.

The equivalent resistance, $R_{eq} =$ Units Select an answer .

The current, $I =$ Units Select an answer .

Question Help:  Message instructor  Post to forum

What is the equivalent resistance between points A and B and between points A and C in the circuit shown below? Each segment is 1 \, \Omega.

The equivalent resistance, $R_{AB} =$ Units Select an answer .

The equivalent resistance, $R_{AC} =$ Units Select an answer .
Find the electric potential at points A and B for the circuit shown below. A $E = 36$ V battery is connected to $R_1 = 20$ $\Omega$, $R_2 = 15$ $\Omega$, $R_3 = 10$ $\Omega$, and $R_4 = 10$ $\Omega$. Note that point C is grounded ($V_C = 0$).

The potential at point A, $V_A = \underline{\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ 

The potential at point A, $V_A =$ __________ Units

The potential at point B, $V_B =$ __________ Units
Consider the circuits shown below: a $V = 30$ V battery is connected to $R_1 = 40 \, \Omega$, $R_2 = 45 \, \Omega$, $R_3 = 15 \, \Omega$, and $R_4 = 35 \, \Omega$. For the left-side circuit, what is the potential difference between points a and b?

The potential difference, $V_{ab} = \underline{\underline{\text{Units}}}$ Units Select an answer  

For the right-side circuit, what is the current between points a and b?

The current, $I_{ab} = \underline{\underline{\text{Units}}}$ Units Select an answer  

Question Help: Message instructor  Post to forum

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A solar cell generates an EMF of 24 V. The terminal potential difference of 18 V is measured when a 6 \, \Omega resistor is connected across the battery. What is the internal resistance of the solar cell?

The internal resistance, $r = \underline{\underline{\text{Units}}}$ Units Select an answer  

How much power is released in the cell and in the load?

The power in the cell, $P_{\text{internal}} = \underline{\underline{\text{Units}}}$ Units Select an answer  

The power in the load, $P_{\text{useful}} = \underline{\underline{\text{Units}}}$ Units Select an answer  

What maximum useful power can be generated by the cell?

The max. power, $P_{\text{max}} = \underline{\underline{\text{Units}}}$ Units Select an answer  

Question Help: Message instructor  Post to forum
First, a real battery is connected to a load $R_1 = 1.9 \, \Omega$, then the same battery is connected to another load $R_2 = 0.9 \, \Omega$. What is the internal resistance of the battery if in both cases the power released in the loads is the same.

The internal resistance, $r =$ __________ Units [Select an answer].

What is the emf of the battery if the useful power in both cases was 9 W?

The emf of the battery, $E =$ __________ Units [Select an answer].

A conducting sphere of radius $a = 25 \, \text{cm}$ is grounded with a resistor $R = 75 \, \Omega$ as shown below. The sphere is exposed to a beam of electrons moving towards the sphere with the constant velocity $v = 17 \, \text{m/s}$ and the concentration of electrons in the beam is $n_e = 3.2 \times 10^{18} \, \text{m}^{-3}$. How much charge per second is received by the sphere (find the current)? Assume that the electrons move fast enough.

The current, $I =$ __________ Units [Select an answer].

Find the maximum charge on the sphere.

The maximum charge, $Q =$ __________ Units [Select an answer].

Question Help: [Message instructor] [Post to forum]
Consider the circuit shown below. What is the current in each resistance? Assume $R_1 = 10 \Omega$, $R_2 = 25 \Omega$, $R_3 = 20 \Omega$, $R_4 = 20 \Omega$ and $E_1 = 52 \text{ V}$, $E_2 = 16 \text{ V}$, $E_3 = 32 \text{ V}$.

The magnitude of current in $R_1$, $I_1 =$ 

The magnitude of current in $R_2$, $I_2 =$ 

The magnitude of current in $R_3$, $I_3 =$ 

The magnitude of current in $R_4$, $I_4 =$ 

What is the total power consumed by the circuit?

The power, $P =$ 

Question Help:  

Question 2
The current \( i = 36 \text{ mA} \) is passing through a system of five resistors connected as shown in the circuit below. Find the magnitude of the current in each resistor if \( R_1 = 12 \Omega \), \( R_2 = 14 \Omega \), \( R_3 = 9 \Omega \), \( R_4 = 29 \Omega \), and \( R_5 = 7 \Omega \). Use Kirchhoff’s rules to solve for the currents.

The current through \( R_1 \), \( i_1 = \) _______ Units

The current through \( R_2 \), \( i_2 = \) _______ Units

The current through \( R_3 \), \( i_3 = \) _______ Units

The current through \( R_4 \), \( i_4 = \) _______ Units

The current through \( R_5 \), \( i_5 = \) _______ Units

The direction of the current through \( R_5 \) is Select an answer

Question Help:  
Message instructor  Post to forum
The capacitors $C_1 = 10.5 \, \mu F$ and $C_2 = 31.5 \, \mu F$ are connected to a 3-V battery as shown in the figure below. What is the equivalent capacitance of the circuit?

![Diagram of capacitors $C_1$ and $C_2$ connected to a 3-V battery.]

The equivalent capacitance, $C_{eq} = \underline{\quad}$ Units Select an answer.

What is the charge in each capacitor?

The charge in $C_1$, $Q_1 = \underline{\quad}$ Units Select an answer.

The charge in $C_2$, $Q_2 = \underline{\quad}$ Units Select an answer.

What is the drop of potential across each capacitor?

The potential difference across $C_1$, $\Delta V_1 = \underline{\quad}$ Units Select an answer.

The potential difference across $C_2$, $\Delta V_2 = \underline{\quad}$ Units Select an answer.

Question Help: Message instructor Post to forum
The capacitors $C_1 = 78 \, \mu F$ and $C_2 = 234 \, \mu F$ are connected to a 15-V battery as shown in the figure below. What is the equivalent capacitance of the circuit?

The equivalent capacitance, $C_{eq} =$ ___________ Units Select an answer ▼.

What is the charge in each capacitor?

The charge in $C_1$, $Q_1 =$ ___________ Units Select an answer ▼.

The charge in $C_2$, $Q_2 =$ ___________ Units Select an answer ▼.

What is the energy stored in each capacitor?

The energy in $C_1$, $U_1 =$ ___________ Units Select an answer ▼.

The energy in $C_2$, $U_2 =$ ___________ Units Select an answer ▼.

Question Help:  
  ☑️ Message instructor  ☐ Post to forum
The capacitors $C_1 = 15.5 \, \mu F$, $C_2 = 31 \, \mu F$ and $C_3 = 51.5 \, \mu F$ are connected as shown below. What is the equivalent capacitance between points $a$ and $b$?

The equivalent capacitance, $C_{eq} = \underline{\phantom{0000}} \, \text{Units}$

If a 6-V battery is connected across points $a$ and $b$, what is the charge in each capacitor?

The charge in $C_1$, $Q_1 = \underline{\phantom{0000}} \, \text{Units}$

The charge in $C_2$, $Q_2 = \underline{\phantom{0000}} \, \text{Units}$

The charge in $C_3$, $Q_3 = \underline{\phantom{0000}} \, \text{Units}$

Question Help:  
 0/1 pt  

MyOpenMath https://www.myopenmath.com/assess2/?cid=105715&ai...
The capacitors $C_1 = 42.5 \, \mu F$, $C_2 = 42.5 \, \mu F$, $C_3 = 56.5 \, \mu F$, $C_4 = 48.5 \, \mu F$, $C_5 = 41.5 \, \mu F$, and $C_6 = 73.5 \, \mu F$ are connected as shown below. What is the capacitance of the circuit between points a and b?

The equivalent capacitance, $C_{eq} = \boxed{\text{Select an answer}}$ Units.

What is the total charge and energy stored in the system if a 12-V battery is connected to points a and b?

The charge in the system, $Q = \boxed{\text{Select an answer}}$ Units.

The energy in the system, $U = \boxed{\text{Select an answer}}$ Units.

Consider a parallel plate capacitor with the plate surface area $a \times b$ and distance between the plates $d$. A nonconducting slab of a similar size $x \times b \times d$ with dielectric constant $\kappa$ is completely inserted into the capacitor as shown below. Find the capacitance, charge and energy stored in the system if a battery of 36-V is attached across the capacitor. Take $\kappa = 7.5$, $a = 21 \, \text{cm}$, $b = 23 \, \text{cm}$, $d = 0.2 \, \text{cm}$, and $x = 11 \, \text{cm}$.

The capacitance, $C = \boxed{\text{Select an answer}}$ Units.

The charge, $Q = \boxed{\text{Select an answer}}$ Units.

The energy, $U = \boxed{\text{Select an answer}}$ Units.
Consider an isolated charged parallel plate capacitor with charge stored $Q$, plate surface area $a \times b$, and distance between the plates $d$. A nonconducting slab of a similar size $a \times b \times d$ with dielectric constant $\varepsilon$ is inserted a distance $x$ into the capacitor as shown below. Find the capacitance and energy of the system as a function of $x$. Assume $Q = 22.5 \, \mu C$, $\varepsilon = 3.5$, $a = 19 \, \text{cm}$, $b = 6 \, \text{cm}$, and $d = 0.2 \, \text{cm}$. Use pF, Joules and meters for the units, but do not put them explicitly.

The capacitance, $C(x) =$ __ Units. Select an answer.

The energy, $U(x) =$ __ Units. Select an answer.

With what force is the slab pulled into the capacitor?

The force, $F(x) =$ __ Units. Select an answer.

Question Help: Message instructor  Post to forum
Two capacitors $C_1 = 50 \ \mu\text{F}$ and $C_2 = 55 \ \mu\text{F}$ and two resistors $R_1 = 25 \ \Omega$ and $R_2 = 60 \ \Omega$ are connected to a 6-V battery as shown in the figure below. What is the potential difference between points a and b?

The potential difference, $V_a - V_b =$ _______ Units. Select an answer.

Question Help:  
- Message instructor  
- Post to forum

Question 10  
☑ 0/1 pt  Ⓟ 999  Ⓧ 998
A capacitor $C = 50 \mu F$, resistor $R = 170 \Omega$ and a voltmeter are connected to a battery of $\text{Emf} = 12 \text{ V}$ as shown in the figure below. If the voltmeter is disconnected, what is the potential difference across the capacitor?

The potential difference, $V_1 =$ Units Select an answer.

Then the voltmeter is connected to points a and b and used to measure the potential difference across the capacitor. What does the voltmeter read if its internal resistance is $r_{\text{int}} = 2 \text{ k\Omega}$?

The voltmeter readings, $V_2 =$ Units Select an answer.

How can the accuracy of voltmeter be increased? What internal resistance would provide more accurate measurements? Please write your answer in the box below.

Question Help: ☑️ Message instructor ☐ Post to forum
An uncharged capacitor and a resistor are connected in series to a source of EMF. If $\text{Emf} = 6 \text{ V}$, $C = 70 \mu\text{F}$, and $R = 30 \Omega$, calculate the time constant of the circuit.

The time constant, $\tau = \underline{\underline{\text{Units }}}$ Units Select an answer.

Calculate the maximum charge on the capacitor.

The maximum charge, $Q_{\text{max}} = \underline{\underline{\text{Units }}}$ Units Select an answer.

Calculate the charge on the capacitor after one time constant.

The charge, $Q = \underline{\underline{\text{Units }}}$ Units Select an answer.

Question Help: Message instructor Post to forum

Question 12

A leaky capacitor loses 15% of its charge in 6 min. What is the effective time constant of the system?

The time constant, $\tau = \underline{\underline{\text{Units }}}$ Units Select an answer.

What fraction of charge (in %) will be on the capacitor after 24 min?

The charge, $\frac{Q}{Q_0} \times 100 \% = \underline{\underline{\text{Units }}}$ Units Select an answer.

After what time there will be 5% of the initial charge left on the capacitor?

The time, $t = \underline{\underline{\text{Units }}}$ Units Select an answer.

Question Help: Message instructor Post to forum

Question 13
A 40 μF capacitor with an initial energy of 1.1 J is discharged through a 9 MΩ resistor. What is the initial charge on the capacitor?

The charge, \( Q_0 = \) \( \text{Units} \) Select an answer.

What is the current through the resistor when the discharge starts?

The current, \( I_0 = \) \( \text{Units} \) Select an answer.

Determine the potential difference across the capacitor and the rate at which the thermal energy is dissipating in the resistance 6.6 min after the discharge starts.

The potential difference across \( C \), \( V_C = \) \( \text{Units} \) Select an answer.

The power dissipated in \( R \), \( P = \) \( \text{Units} \) Select an answer.

Question Help: Message instructor  Post to forum
Three resistors, a battery and a capacitor are connected as shown below. Initially the switch 'S' is open for a long time, then at time $t = 0$ the switch is closed. Assuming $R_1 = 3 \, \Omega$, $R_2 = 4 \, \Omega$, $R_3 = 18 \, \Omega$, $C = 3 \, \mu F$, and $V = 6 \, V$, answer the following questions about the charging process in the circuit.

What is the maximum charge on the capacitor (at $t \to \infty$)?

The maximum charge, $Q_{\text{max}} = \underline{\phantom{123456789}}$ Units

What is the time constant of this RC circuit?

The time constant, $\tau = \underline{\phantom{123456789}}$ Units

What is the charge on the capacitor at $t = 18 \, \mu s$?

The charge, $Q = \underline{\phantom{123456789}}$ Units

Question Help:  

- Message instructor
- Post to forum
The deuterons, the nuclei of heavy hydrogen, are accelerated and injected into a region with constant magnetic field (a cyclotron). Determine the cyclotron frequency of the particles, if the strength of the magnetic field in the cyclotron is $2.8 \, \text{T}$ and the mass of deuteron is $3.3 \times 10^{-27} \, \text{kg}$.

The cyclotron frequency, $f =$ \underline{\hspace{2cm}} Units [Select an answer].

Determine the cyclotron radius for the particles, which enters the cyclotron with a kinetic energy of $20 \, \text{MeV}$.

The radius, $R =$ \underline{\hspace{2cm}} Units [Select an answer].

Question Help:  
\checkmark Message instructor  
Post to forum

An electron moves in an uniform magnetic field (with the orbital plane perpendicular to the field). If the cyclotron radius of the electron is $5 \, \text{cm}$ and it's kinetic energy is $2.4 \, \text{keV}$, find the electron's speed, the magnitude of the magnetic field, the cyclotron frequency, and the period of the motion. Use $m_e = 9.11 \times 10^{-31} \, \text{kg}, e = 1.6 \times 10^{-19} \, \text{C},$ and $1 \, \text{T} = 10^4 \, \text{G}$.

The speed, $v =$ \underline{\hspace{2cm}} Units [Select an answer].

The magnetic field, $B =$ \underline{\hspace{2cm}} Units [Select an answer].

The cyclotron frequency, $f =$ \underline{\hspace{2cm}} Units [Select an answer].

The period, $T =$ \underline{\hspace{2cm}} Units [Select an answer].

Question Help:  
\checkmark Message instructor  
Post to forum
A proton, that is accelerated from rest through a potential of 15 kV enters the velocity filter, consisting of a parallel-plate capacitor and a magnetic field, shown below. What is the proton’s speed? Take \( m_p = 1.67 \times 10^{-27} \) kg and \( e = 1.6 \times 10^{-19} \) C.

The speed, \( v = \) __________ Units Select an answer \( \sqrt{\text{.}} \).

The E-field between the plates is \( 2.8 \times 10^5 \) N/C. What B-field is required so that the protons are not deflected?

The magnetic field, \( B = \) __________ Units Select an answer \( \sqrt{\text{.}} \).

Question Help:  Message instructor  Post to forum

Question 4  

0/1 pt  999  998
The velocity selector shown below allows a 7 μC charged particle to pass through without being deflected as long as its velocity is \( v = 5,500 \) m/sec. Which of the following statements are True/False?

- If \( E \) is increased, all positive charges with \( v = 5,500 \) m/sec deflect right.
- If \( v = 4,500 \) m/sec, a negative charge deflects left.
- If \( B \) is increased, all negative charges with \( v = 5,500 \) m/sec deflect left.
- If \( v = 6,500 \) m/sec, a positive charge deflects right.
- Any charged particle traveling at 5,500 m/sec passes through undeflected.

Note: you MUST complete all sentences before submitting.

Question Help: 

In a mass spectrometer, a singly charged ion having a particular velocity is selected by using a magnetic field of 150 mT perpendicular to an electric field of 6.2 kV/m. The same magnetic field is used to deflect the ion in a circular path with a radius of 103 mm. What is the mass of the ion?

The mass, \( m = \text{[Blank]} \) Units \( \text{Select an answer} \).
A wire carries a current of \( i = 6 \, \text{A} \) in a direction that makes an angle of \( 35^\circ \) with the direction of a magnetic field of \( 0.9 \, \text{T} \). Calculate the magnetic force on a 21 cm length of the wire.

The force, \( F_1 = \) _______ Units Select an answer 

What is the force if the angle is \( 0^\circ \)?

The force, \( F_2 = \) _______ Units Select an answer 

What is the force if the angle is \( 90^\circ \)?

The force, \( F_3 = \) _______ Units Select an answer

Question Help:  

Two very long parallel conductors are located at a distance of \( 2 \cdot a \) from each other, perpendicular to the plane of the figure below. The left-side conductor is carrying a current of \( i = 15 \, \text{A} \) directed into the page. What current \( i_x \) (magnitude and direction) must flow through right-side conductor to produce a zero magnetic field at point \( P_2 \)? Use out of the page as the positive direction and \( a = 2 \, \text{cm} \) and \( b = 12 \, \text{cm} \).

The current, \( i_x = \) _______ Units Select an answer

What is the magnitude and direction of the magnetic field at point \( P_1 \)?

The magnitude of the B-field, \( B_1 = \) _______ Units Select an answer

The field is directed Select an answer 

Question Help:
The figure below shows an arrangement in which four long parallel wires carry equal currents directly into or out of the page at the corners of a square. Find the net force per unit of length on current $i_1$ if all currents are 5 A and $a = 65$ cm.

The x component, $F_x/L = \underline{\text{Units}}$ [Select an answer].

The y component, $F_y/L = \underline{\text{Units}}$ [Select an answer].
In the three separate arrangements (a), (b), and (c) shown below a current \( i = 12.5 \) A is set up in a long conductor formed by bending a wire into a semicircle/circle of radius \( R = 55 \) cm. Find the magnetic field at points 1, 2, and 3? Use out of the page as the positive direction.

(a)

(b)

(c)

The magnetic field at '1', \( B_1 = \) Units. Select an answer.

The magnetic field at '2', \( B_2 = \) Units. Select an answer.

The magnetic field at '3', \( B_3 = \) Units. Select an answer.
A very long wire carries an \( i_1 = 6 \, \text{A} \) current along the x axis and another long wire carries an \( i_2 = 13 \, \text{A} \) current along the y axis. What is the magnetic field at point P located at \( a = 6.8 \, \text{m} \) and \( b = 2.5 \, \text{m} \)? Use out of the page as the positive direction.

The magnetic field at P, \( B = \) _______ Units. Select an answer.
In the figure shown below, the current in the long, straight wire is \( i_1 = 9.5 \, \text{A} \), and the wire lies in the plane of the rectangular loop, which carries \( i_2 = 6.5 \, \text{A} \). The dimensions are \( a = 13.5 \, \text{cm} \), \( b = 5.5 \, \text{cm} \), and \( L = 14.5 \, \text{cm} \). Find the magnitude and direction of the force exerted by the magnetic field due to the straight wire on the top and bottom segments of the loop.

The force on the top segment:

the magnitude, \( F_{\text{top}} = \) \underline{\hspace{2cm}} \, \text{Units} \ Select an answer \ ,
the force is directed \ Select an answer \ .

The force on the bottom segment:

the magnitude, \( F_{\text{bottom}} = \) \underline{\hspace{2cm}} \, \text{Units} \ Select an answer \ ,
the force is directed \ Select an answer \ .

Find the net force on the loop.

The magnitude of the net force, \( F_{\text{net}} = \) \underline{\hspace{2cm}} \, \text{Units} \ Select an answer \ ,
the force is directed \ Select an answer \ .

Question Help:  

Message instructor  
Post to forum
A long solenoid with \( n = 25 \) turns per centimeter and a radius of \( R = 14 \) cm carries a current of \( i = 50 \) mA. Find the magnetic field in the solenoid.

The magnetic field, \( B_0 = \) __________ Units. Select an answer.

If a straight conductor is positioned along the axis of the solenoid and carries a current of 44 A, what is the magnitude of the net magnetic field at the distance \( R/2 \) from the axis of the solenoid?

The net magnetic field, \( B_{\text{Net}} = \) __________ Units. Select an answer.

Question Help:  

Find the maximum speed a charged body can acquire while sliding down an inclined plane in an external magnetic field \( B = 3.5 \) T, see the figure below. The body has the charge \( q = -0.5 \) C and the mass \( m = 2.6 \) kg. The magnetic field is parallel to the plane and perpendicular to the gravitational field \( g \). The inclination angle is \( \alpha = 35^\circ \) and the friction coefficient is \( \mu = 0.2 \). Neglect the air resistance and take the free fall acceleration \( g = 9.81 \) m/s\(^2\).

The maximum speed, \( v = \) __________ Units. Select an answer.

Question Help:  

Question 13  

Question 14
Consider an electron orbiting around a proton with an orbital radius of \( R = 8.48 \times 10^{-10} \) m. What is the orbital frequency of the electron motion? Use \( m_e = 9.11 \times 10^{-31} \) kg, \( e = 1.6 \times 10^{-19} \) C, and \( k = 9 \times 10^9 \) Nm\(^2\)/C\(^2\).

The frequency, \( f_0 = \) \[\text{Units} \ Select\ an\ answer \]

By how much would this frequency increase (assume the same orbital radius) if an external magnetic field of \( B = 0.5 \) T is applied to the system along the electron axis of rotation?

The increase in the frequency, \( \Delta f = \) \[\text{Units} \ Select\ an\ answer \]

Question Help:  

Message instructor  Post to forum
Question 1

A 35-cm side length square coil has 110 turns. An initial uniform magnetic field of strength 13 mT is applied perpendicularly to the plane of the coil. Calculate the magnetic flux through the coil.

The flux, \( \Phi = \underline{\text{_________}} \) Units [Select an answer].

If the field increases in strength from the initial value to 38 mT in 0.35 s, what average emf is induced in the coil?

The induced emf, \( \text{emf} = \underline{\text{_________}} \) Units [Select an answer].

What is the average current in the coil if its resistance is 205 Ω?

The current, \( I = \underline{\text{_________}} \) Units [Select an answer].

Question Help:  

Message instructor  Post to forum

Question 2

[Select an answer]
A single-turn circular loop has a radius of 10 cm, it is placed in a magnetic field of $B = 1.8$ T which is perpendicular to the plane of the loop, see the figure below. The loop is reshaped into a perfect square without stretching the length of the loop. It takes 0.71 s to reshape the loop. What is the magnetic flux through the loop before and after it is reshaped?

**B**

The initial flux, $\Phi_i =$ ___________ Units

The final flux, $\Phi_f =$ ___________ Units

What is the magnitude of the average induced emf in the loop during the reshaping process?

The induced emf, $\text{Emf} =$ ___________ Units

Question Help:  
  💌 Message instructor  ☐ Post to forum

Question 3  ☑ 0/1 pt  ☺ 999  ☐ 998
A wire carries a constant current $I$ to the right. A wire loop moves either upward or downward with a constant velocity $V$ in the plane of the paper. Which of the following statements are True/False?

1. Current flows counterclockwise as the loop moves from A to B and clockwise as the loop moves from C to D.  
2. Current flows counterclockwise as the loop moves from A to B and clockwise as the loop moves from D to C.  
3. Current flows counterclockwise as the loop moves from A to B and counterclockwise as the loop moves from C to D.  
4. Current flows clockwise as the loop moves from B to A and clockwise as the loop moves from D to C.  
5. Current flows clockwise as the loop moves from A to B and counterclockwise as the loop moves from C to D.  
6. Current flows clockwise as the loop moves from A to B and clockwise as the loop moves from C to D.

Note: you MUST complete all sentences before submitting.
A V = 18 mV battery is connected to a single turn loop of dimensions a = 9 cm by b = 6 cm has a resistance of R = 24 Ω. The loop is placed in a uniform magnetic field which is perpendicular to the plane of the loop. If the magnetic field is increasing at a rate of 1.2 T/sec, what is the magnitude and direction of the current in the circuit?

The magnitude, I = 

Units 

Select an answer

The direction: Select an answer

Note: you MUST provide all answers before submitting.

Question Help: Message instructor Post to forum
A conducting rod is pulled horizontally with constant force along a set of rails separated by \( L = 25 \, \text{cm} \). A uniform magnetic field \( B = 0.2 \, \text{T} \) is directed out of the page. There is no friction between the rod and the rails, and the rod moves with constant velocity \( v = 6 \, \text{m/s} \). If the resistance of the system is \( 0.15 \, \Omega \) calculate the induced emf and current in the loop. Assign clockwise to be the positive direction for Emf.

The induced emf, \( \text{Emf} = \) Units.

The induced current, \( i = \) Units.

At what rate does thermal energy releases in the rod?

The power, \( \text{P}_R = \) Units.

What force is required to maintain the constant velocity of the rod? At what rate does this force do work?

The force, \( F = \) Units.

The power, \( \text{P}_F = \) Units.

Question Help: Message instructor  Post to forum
Calculate the average induced voltage between the tips of the wings of a Boeing 747 flying at 800 km/hr above Queens, NY. The downward component of the earth's magnetic field at this place is 1.1 G. Assume that the wingspan is 57 meters. Note: $1G = 10^{-4} T$.

The induced emf, $\text{Emf} = \underline{\underline{\text{Units}}}$ Select an answer.

If you try to use this voltage (for example, to charge a smartphone), would it make harder for the plane to fly? Explain your reasoning in the box below.

If your phone consumes 3.5 W of power while charging from the motional emf generated by the wingspan, what additional force does it exert on the plane?

The force, $F = \underline{\underline{\text{Units}}}$ Select an answer.

A generator is constructed by rotating a coil of $N$ turns in a magnetic field $B$ at a frequency $f$. The internal resistance of the coil is $R$ and the cross sectional area of the coil is $A$. Which of the following statements are True/False?

- The maximum induced EMF doubles if the resistance $R$ is doubled. Select an answer
- The maximum induced EMF occurs when the rotated coil is perpendicular to the magnetic field. Select an answer
- The maximum induced EMF doubles if the magnetic field $B$ is doubled. Select an answer
- The maximum induced EMF doubles if the frequency $f$ is doubled. Select an answer
- The maximum induced EMF doubles if the area $A$ is doubled. Select an answer

What is the maximum induced EMF if $N = 5$, $B = 1.7 \text{T}$, $f = 20 \text{Hz}$, $R = 5 \Omega$, and $A = 19 \text{cm}^2$?

The maximum emf, $\text{EMF} = \underline{\underline{\text{Units}}}$ Select an answer.

Note: you MUST answer all questions before submitting.
**Question 8**

When the coil of a motor is rotating at maximum speed, the current in the windings is 3.85 A. When the motor is first turned on, the current in the windings is 8.99 A. If the motor is operated at 120 V, calculate the resistance of the windings.

The resistance, \( R_{\text{coil}} = \) _______ Units **Select an answer**.

Calculate the back emf in the coil at maximum speed.

The back emf, \( E_{\text{back}} = \) _______ Units **Select an answer**.

What is the current in the windings if the speed of the motors is half of its maximum value?

The current, \( I = \) _______ Units **Select an answer**.

**Question Help:** 
- Message instructor
- Post to forum

**Question 9**

An ideal step-down transformer has a primary coil of 570 turns and a secondary coil of 100 turns. Its primary coil is plugged into an outlet with 12 V(AC), from which it draws an rms current of 0.28 A. What is the voltage and rms current in the secondary coil?

The voltage, \( V_S = \) _______ Units **Select an answer**.

The current, \( I_S = \) _______ Units **Select an answer**.

Assuming that the transformer secondary is driving a resistive load, calculate the resistance of the load and the average power dissipated in the resistor.

The resistance, \( R = \) _______ Units **Select an answer**.

The power consumed, \( P = \) _______ Units **Select an answer**.

**Question Help:** 
- Message instructor
- Post to forum

**Question 10**

- **Select an answer**
A conducting rod of mass $m = 55 \text{ g}$ can freely slide down along the two vertical rail tracks as shown below. The tracks are parallel to each other, separated by the distance $l = 55 \text{ cm}$, and connected with a resistance $R = 5.6 \text{ } \Omega$ (the entire system forms a circuit). Find the terminal velocity of the rod if there is an external uniform magnetic field $B = 3.4 \text{ T}$ perpendicular to the tracks. Take $g = 9.81 \text{ m/s}^2$.

The terminal velocity, $v =$ ________ Units Select an answer.

Find the speed of the rod (in m/s) as a function of time $t$ (in s), assume that the rod starts to slide down from rest, $v(0) = 0$. Do not submit the units. Hint: use analogy with the RC circuits.

The speed, $v(t) =$ ________ m/s.

Question Help:  
• Message instructor  
• Post to forum
A conducting rod of mass \( m = 15 \, \text{g} \) can freely slide down along the two vertical rail tracks as shown below. The tracks are parallel to each other, separated by the distance \( l = 50 \, \text{cm} \), and connected with a capacitance \( C = 2 \, \text{mF} \) (the entire system forms a circuit). Find the acceleration of the rod if there is an external uniform magnetic field \( B = 2.6 \, \text{T} \) perpendicular to the tracks. Take \( g = 9.81 \, \text{m/s}^2 \).

The acceleration, \( a = \underline{\text{}} \, \text{Units} \) \ Select an answer \ .

Question Help:   \( \text{Message instructor} \)   \( \text{Post to forum} \)
A simple DC generator consists of a rotating rod and a conducting circular track (all placed in an external magnetic field that is perpendicular to the plane of the track, see the picture below). Find the current in a $R = 20 \, \Omega$ load connected to the generator if the rod rotates at $120 \, \text{rad/s}$, the radius of the track is $34 \, \text{cm}$, and the strength of the magnetic field is $B = 0.7 \, \text{T}$.

The current, $I = \, \text{___________}$ Units  Select an answer

What torque must be applied to the rod to make it spin at the given angular velocity? Neglect the friction force on the rod.

The torque, $\tau = \, \text{___________}$ Units  Select an answer

Question Help:  

Question 13  

0/1 pt  999  998
A triangle loop moves into the area with a constant magnetic field shown in the picture below. The field has a strength of $B = 0.5 \text{ T}$ and is perpendicular to the plane of the loop. Find the emf induced in the loop as a function of time (in sec) if the angle $\alpha = 15^\circ$, the loops moves with a constant speed of $v = 2.5 \text{ m/s}$ and at $t = 0$ the loop was just entering the field area (the tip of the triangle was touching the B-field). Do not submit the units.

The induced emf, $\text{Emf} = \square \text{ Units}$ Select an answer .

Question Help:  
  Message instructor  Post to forum

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A small solenoid with a radius of 5 cm and 85 turns is placed inside a long solenoid ($n = 550 \text{ turns/cm}$). The solenoids are concentric. Find the induced emf generated in the small solenoid if the current through the long solenoid increases at 20 mA per second.

The induced emf, $\text{Emf} = \square \text{ Units}$ Select an answer .

Question Help:  
  Message instructor  Post to forum
Inductance of a closely wound coil is such that when the current changes by 4.1 A per second, it induces electromotive force of 7 mV. Furthermore, we know that a steady current of 8 A generates in each turn of the coil a magnetic flux of 55.1 μWb. Calculate the inductance of the coil and determine the number of turns of the coil.

The inductance, \( L = \) _______ Units Select an answer ▼.

The number of turns, \( N = \) _______ Units Select an answer ▼.

Question Help: Message instructor Post to forum

A solenoid of radius 5 cm has 390 turns and a length of 30 cm. Calculate its inductance.

The inductance, \( L = \) _______ Units Select an answer ▼.

Calculate the rate at which current must change through the solenoid to produce an emf of 12 mV.

The rate of change, \( \frac{dI}{dt} = \) _______ Units Select an answer ▼.

Question Help: Message instructor Post to forum
To measure the muon magnetic moment a 2.6-T uniform magnetic field is used. How much energy is stored in the field if the experimental chamber where the field is created has dimensions of 20 cm × 25 cm × 70 cm?

The energy, $U_B =$ \[ \text{Units} \] Select an answer.

How long will it take to “switch on” the field if the experiment uses a 3.5-kW power supply?

The time, $t =$ \[ \text{Units} \] Select an answer.

Question Help: Message instructor  Post to forum
Consider the RL circuit shown below. What is the time constant of the circuit if \( V = 30 \, V \), \( R = 330 \, \Omega \) and \( L = 0.15 \, H \)?

The time constant, \( \tau = \) \[
\text{Units} \]
Select an answer.

What is the voltage across the inductor in the instant just after the switch is closed?

The voltage across \( L \), \( V_0 = \) \[
\text{Units} \]
Select an answer.

What is the voltage across the inductor 1 msec after the switch is closed?

The voltage across \( L \), \( V_1 = \) \[
\text{Units} \]
Select an answer.

After the switch is closed for a long time, what is the energy stored in the inductor?

The energy, \( U = \) \[
\text{Units} \]
Select an answer.

Question Help:  
Message instructor  Post to forum

**Question 5**

☑️ 0/1 pt  ⏳ 15
A capacitor of capacitance 110 μF and an inductor form an LC circuit that oscillates at 15 kHz, with a current amplitude of 5 mA. What are the inductance, the total energy in the circuit, and the maximum charge on the capacitor?

The inductance, \( L = \) \( \) \( \) Units \ Select an answer \( \) .

The total energy, \( U = \) \( \) \( \) Units \ Select an answer \( \) .

The maximum charge, \( Q_{\text{max}} = \) \( \) \( \) Units \ Select an answer \( \) .

Question Help:  
 0/1 pt
 0/1 pt

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A 90-V/30-Hz source is connected to an inductance \( L = 0.9 \) H and a capacitance \( C = 15 \) μF, the elements are connected in series. Find the rms current in the circuit.

The current, \( I = \) \( \) \( \) Units \ Select an answer \( \) .

Find the rms current through the each element in the circuit if the elements are connected in parallel.

The current through \( L, I_L = \) \( \) \( \) Units \ Select an answer \( \) .

The current through \( C, I_C = \) \( \) \( \) Units \ Select an answer \( \) .

The current through the power source, \( I_V = \) \( \) \( \) Units \ Select an answer \( \) .

Question Help:  
 0/1 pt
 0/1 pt

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An RLC series circuit is connected to a 116-V/330-Hz source. Given that \( L = 90 \, \text{mH} \), \( C = 95 \, \mu\text{F} \), and \( R = 84 \, \Omega \), find the rms current in the circuit and rms voltage drop across the inductor, the capacitor, and the resistor.

The current, \( I_{\text{rms}} = \) __________ Unit (Select an answer).

The voltage drop across \( L \), \( (V_L)_{\text{rms}} = \) __________ Unit (Select an answer).

The voltage drop across \( C \), \( (V_C)_{\text{rms}} = \) __________ Unit (Select an answer).

The voltage drop across \( R \), \( (V_R)_{\text{rms}} = \) __________ Unit (Select an answer).

Find the phase shift, resonant frequency, and the power dissipated in the circuit.

The phase shift, \( \phi = \) __________ Unit (Select an answer).

The resonant frequency, \( f_R = \) __________ Unit (Select an answer).

The power dissipation, \( P = \) __________ Unit (Select an answer).

Question Help:  
  - Message instructor  
  - Post to forum

Resonant circuit in a radio has a 82-\( \mu\)H inductor. You want to tune the radio to catch your favorite station which is broadcasting at frequency 120-MHz. What should be the value of the capacitor in the resonant circuit to catch this frequency?

The capacitance, \( C = \) __________ Unit (Select an answer).

What frequency will it tune to if you increase the value of the capacitor by a factor of 2?

The frequency, \( f = \) __________ Unit (Select an answer).

Question Help:  
  - Message instructor  
  - Post to forum
Which of the following statements are True/False?

1. Microwaves, radio waves and infrared travel at the same speed. Select an answer.

2. Microwaves travels through the space faster than radio waves. Select an answer.

3. The higher-frequency waves have shorter wavelengths than the lower-frequency waves. Select an answer.

4. The higher-frequency waves travel slower than the lower-frequency waves. Select an answer.

5. The energy density of an electromagnetic wave in free space is equally divided between the magnetic and the electric fields. Select an answer.

6. Electric and magnetic fields are parallel to each other and also parallel to the direction of wave propagation. Select an answer.

7. Electric and magnetic fields are perpendicular to each other and also perpendicular to the direction of wave propagation. Select an answer.

8. Electric and magnetic fields are parallel to each other and but perpendicular to the direction of wave propagation. Select an answer.

9. Microwaves travels through the space faster than ultraviolet. Select an answer.

Note: you MUST complete all sentences before submitting.

Question Help:  

**Question 10**

What are the wavelengths of electromagnetic wave and sound wave of same frequency 1.1-kHz? Speed of electromagnetic wave is \(3\times10^8 \text{ m/s}\), speed of sound wave is 337 m/s.

Wavelength of electromagnetic wave, \(\lambda_1 = \underline{\text{Unit}}\) Select an answer.

Wavelength of sound wave, \(\lambda_2 = \underline{\text{Unit}}\) Select an answer.

What is the speed of electromagnetic wave in a medium of dielectric constant 4.9 and magnetic permeability \(1.4\times10^{-3} \text{ H/m}\)?

The speed of wave, \(v = \underline{\text{Unit}}\) Select an answer.

**Question 11**


An electromagnetic wave of frequency $5.9 \times 10^{15}$ Hz falls on a medium of refractive index 2.6. The speed of E-M waves in vacuum is $3 \times 10^8$ m/s.

The wavelength of the E-M wave in vacuum, $\lambda_0 =$ __________ Unit Select an answer 

The speed of the E-M wave in the medium, $v =$ __________ Unit Select an answer 

The wavelength of the E-M wave in the medium, $\lambda =$ __________ Unit Select an answer 

If the incident wave falls from air and the angle of incidence is 38°, what is the angle of refraction?

The angle of refraction, $\theta_r =$ __________ Unit Select an answer 

Question Help:  
- Message instructor 
- Post to forum
A ray of light strikes a flat, 3.3-cm-thick block of glass (n = 2) at an angle of 45° with the normal, see the figure below. Trace the light beam through the glass and find the angles of incidence and refraction at each surface.

Angle of incidence at top of glass, $\theta_1 =$ __________ Units Select an answer.

Angle of refraction at top of glass, $\theta_2 =$ __________ Units Select an answer.

Angle of incidence at bottom of glass, $\theta_3 =$ __________ Units Select an answer.

Angle of refraction at bottom of glass, $\theta_4 =$ __________ Units Select an answer.

By what distance is the light displaced after passing through the block of glass?

The displacement, $x =$ __________ Units Select an answer.

Question Help:  
  Message instructor  
  Post to forum
Superposition of waves shows interference pattern. Monochromatic light (light wave of a particular frequency) falls on double-slit 0.031-mm apart produces the 5th-order bright fringe at an 15° angle. Find the wavelength of the light used.

The wavelength, $\lambda = \text{Unit Select an answer}$.

If the distance of the viewing screen is 4.5 m away from the slit, how far this fringe will form on the screen from its center?

The distance to the fringe, $y_5 = \text{Unit Select an answer}$.

640-nm light is shined on two narrow slits separated by 0.027-mm. What is the distance between two adjacent bright fringes on a screen at a distance 8-m from the slits?

The distance, $d = \text{Unit Select an answer}$.

At what angle from the centerline does the 6th-order dark fringe occur?

The angle, $\theta_6 = \text{Unit Select an answer}$.