حل مراجعة نهائية وفق الهيكل الوزاري منهج انسباير

Physics G 10 advanced

Exam Revision term 1 – Haykal 2024-2025

Whenever necessary, use the following physical formulas			
Vibrations and Waves	*Sound*		*Electrostatics*
$F = -kx$		$f_d = f_s\left(\frac{v - v_d}{v - v_s}\right)$	$F = k\frac{q_1 q_2}{r^2}$
$PE_{spring} = -\frac{1}{2}kx^2$	Closed Pipe	$f_1 = \frac{v}{\lambda_1} = \frac{v}{4L}$	$E = \frac{F_{on\ q'}}{q'}$
	Closed Pipe	$f_3 = \frac{3v}{4L} = 3f_1$	$E = k\frac{q}{r^2}$
$T = 2\pi\sqrt{\frac{\ell}{g}}$	Closed Pipe	$f_5 = \frac{5v}{4L} = 5f_1$	
$f = \frac{1}{T}$	Open Pipe	$f_1 = \frac{v}{\lambda_1} = \frac{v}{2L}$	
	Open Pipe	$f_2 = \frac{v}{L} = 2f_1$	
$\lambda = \frac{v}{f}$	Open Pipe	$f_3 = \frac{3v}{2L} = 3f_1$	

Whenever necessary, use the following physical constants		
$g = 9.81\ m/s^2$	$c = 3 \times 10^8\ m/s$	$k = 9 \times 10^9\ N.m^2/C^2$
$q_{elecrton} = -1.6 \times 10^{-19}\ C$	$q_{proton} = +1.6 \times 10^{-19}\ C$	

Force on test charge q' F= q'.E

Electric Potential Difference ΔV= E . d

Work *W = q . ΔV*

Capacitance $c = \frac{q}{\Delta V}$

Taher

1	**Apply the equation (T=2π√(l/g)) to calculate the period of a simple pendulum for small-angle oscillations.**	**Student Book** **Q.(5-8 & 11)**	**P.(7-8)** **P.8**

motion which all repeat in a regular cycle, are examples of **periodic motion**.

$$T = 2\pi\sqrt{\frac{l}{g}}$$

Q5-What is the period on Earth of a pendulum with a length of 1.0 m?

$$T = 2\pi\sqrt{\frac{l}{g}} \quad \dashrightarrow \quad T =$$

Q6. How <u>long</u> must a pendulum be on the Moon, where g = 1.6 N/kg, to have a period of 2.0 s?
(answer; L=0.16

Q7.On a certain planet, the period of a 0.75-m-long pendulum is 1.8 s. What is **g** for this planet?
(answer; g=9.12

Q8-explain why a pendulum is an example of periodic motion?
motion repeated in equal intervals of time

Q 11. How must the length of a pendulum be changed to double its period? (answer; 4L

How must the length be changed to halve the period? (answer; ¼ L

2	**Apply Hooke's law to calculate the force exerted by a spring, the spring constant, or the distance by which a spring is stretched or compressed.**	**Student Book** **Q.(1-4)**	**P.(4-6)** **P.6**

HOOKE'S LAW $F = -k\,x$

potential energy of spring $PE_{spring} = \frac{1}{2} k x^2$.

Q1. What is the spring constant of a spring that stretches 12 cm when an object weighing 24 N is hung from it?

F = -Kx
(-24) = -K (0.12) → K= 200 N/m

Q2. A spring with k = 144 N/m is compressed by 16.5 cm. What is the spring's elastic potential energy?
PE=½ K. x^2 = ½ X 144 X $(0.165)^2$ = 1.96 J

Q3. A spring has a spring constant of 56 N/m. How far will it stretch when a block weighing 18 N is hung from its end?

F=-Kx

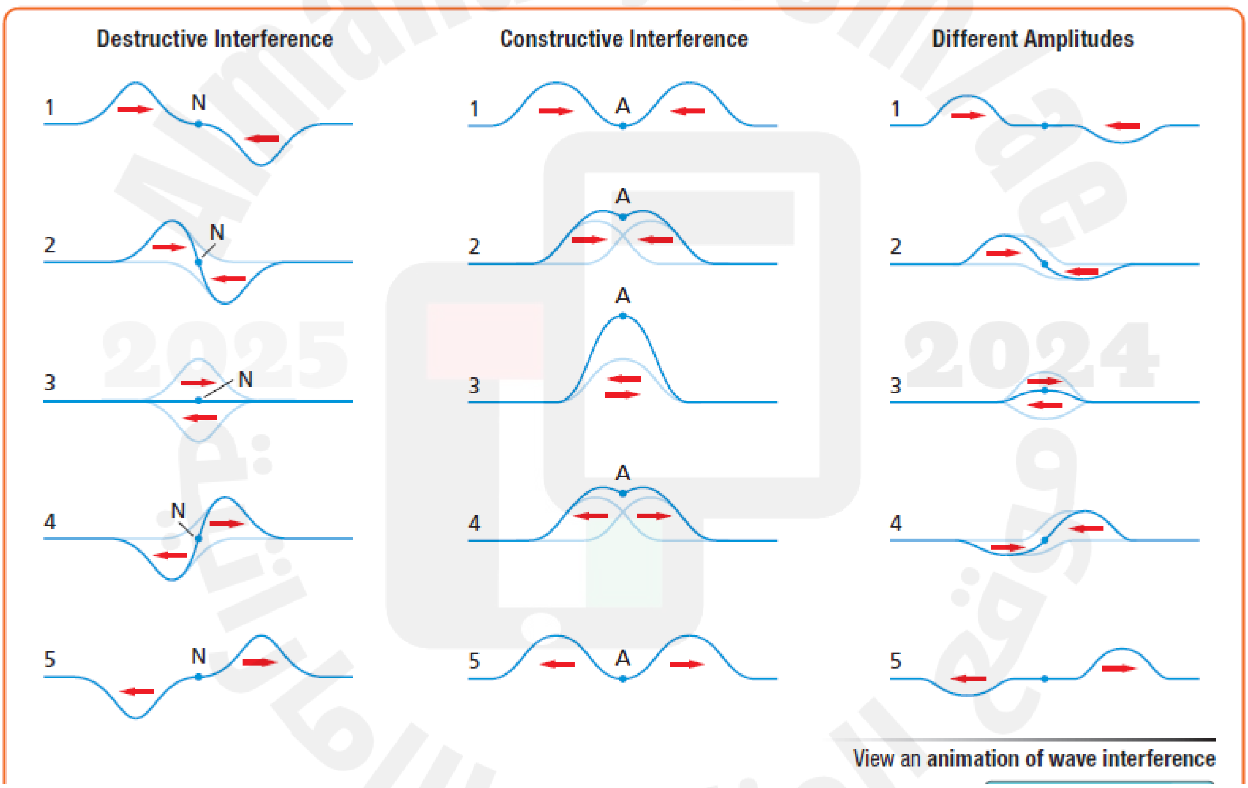
-18 = -56 X x → x= 0.32 m

Q4. CHALLENGE A spring has a spring constant of 256 N/m. How far must it be stretched to give it an elastic potential energy of 48 J?

PE= ½ K x^2

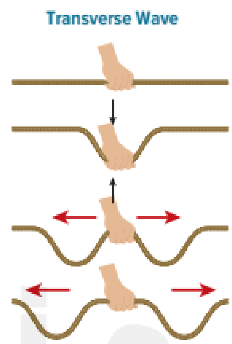
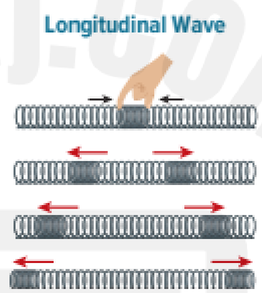
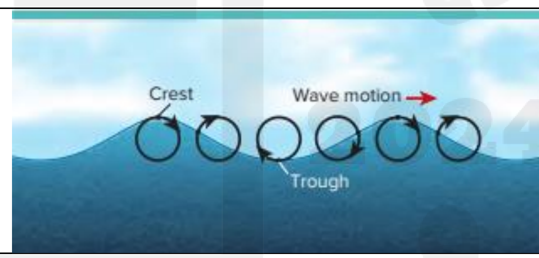
48= ½ 256 X x^2 → x = 0.61 m

3	Sketch snapshots for the superposition of two overlapping wave pulses (same wavelength) traveling in opposite directions showing the resultant wave.	Student Book	P.(16-17)
		Q.31	P.20



Q31- Superposition of Waves; Sketch two wave pulses whose interference produces a pulse with an amplitude greater than either of the individual waves. (Answer ; figure above)

4	Differentiate between transverse, longitudinal, and surface waves and give examples.	Student Book Q.(25-27)	P.(9-10) P.14

A wave that disturbs the particles in the medium perpendicular to the direction of the wave's travel is called a **transverse** wave.	
A wave that disturbance is parallel to the direction of the wave's travel is called a **longitudinal** wave	
A wave that particles follow a circular path that is at times parallel to the direction of travel and at other times perpendicular to the direction of wave travel, is called a **surface** wave	

Q 25. Suppose you and your lab partner are asked to demonstrate that a transverse wave transports energy without transferring matter. How could you do it?
Tie a piece of yarn somewhere near the middle of a rope. With your partner holding one end of the rope, shake the other end up and down to create a transverse wave. Note that while the wave moves down the rope, the yarn moves up and down but stays in the same place on the rope.

Q26. Wave Characteristics; You are creating transverse waves on a rope by shaking your hand from side to side. Without changing the distance your hand moves, you begin to shake it faster and faster. What happens to the amplitude, wavelength, frequency, period, and velocity of the wave?
The amplitude and velocity remain unchanged, but the frequency increases while the period and the wavelength decrease.

Q27. Longitudinal Waves; Describe longitudinal waves. What types of mediums transmit longitudinal waves

In longitudinal waves, the particles of the medium vibrate in a direction parallel to the motion of the wave.

5	**Explore through an experiment, like using a number of musical instruments, the perception of sound depending on its different physical quantities like amplitude and frequency, and relate them to loudness and pitch.**	**Student Book** **Q.6**	**P. (29-30)** **P.33**

Pitch is the highness or lowness of a sound ,it is related to **Frequency**.
The **loudness** of a sound is the intensity of the sound, The **intensity** depends primarily on the **amplitude** of the pressure wave

Q6-Wave Characteristics What physical characteristic of a sound wave should be changed to alter the pitch? The loudness?

6	**Describe the sound level and define the decibel (dB) as a unit of measuring sound level.**	**Student Book** **Figure 4**	**P.(29-30)** **P.30**

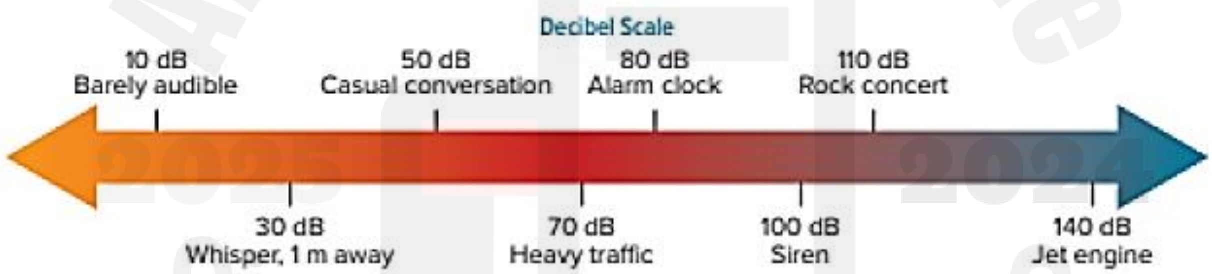


Figure 4 This decibel scale shows the sound level for a variety of sounds.

Because humans can detect a wide range of intensities, it is convenient to measure these intensities on a logarithmic scale called the sound level. The most common unit of measurement for sound level is the decibel (dB).

7	**Explore the meaning of resonance and understand how musical instruments work.**	**student Book** **Q.(13-16)**	**P.(35-40)** **P.40**

Q 13. A 440-Hz tuning fork is used with a resonating column to determine the velocity of sound in helium gas. If the spacing between resonances is 110 cm, what is the velocity of sound in helium gas? *(answer v = 970 m/s)*

Q14. The frequency of a tuning fork is unknown. A student uses an air column at 27°C and finds resonances spaced by 20.2 cm. What is the frequency of the tuning fork? Use the speed calculated in Example Problem 2 for the speed of sound in air at 27°C. *(answer f= 859Hz)*

Q15. A 440-Hz tuning fork is held above a closed pipe. Find the spacing between the resonances when the air temperature is 20°C. *(answer ,spacing= 0.39 m)*

Q 16. CHALLENGE A bugle can be thought of as an open pipe. If a bugle were straightened out, it would be 2.65-m long.
a. If the speed of sound is 343 m/s, find the lowest frequency that is resonant for a bugle (ignoring end corrections). *(Answer f =64.7 Hz)*
b. Find the next two resonant frequencies for the bugle.*(answer , f2= 129Hz , f3= 194Hz)*

8	**Analyze a position-time graph to describe an object's motion.**	**Student Book**	**P. (41-42)**
		Figure 17 & 18; Q.22	**P.44**

Q17- MAINIDEA What is the vibrating object that produces sounds in each of the following?
a. a human voice ***the two vocal cords***
b. a clarinet **a *reed***
c. a tuba ***the player's lips***
d. a violin ***string***

Q18. Resonance in Air Columns; Why is the tube from which a tuba is made much longer than that of a cornet?
The longer the tube, the lower the resonant frequency it will produce. (L α 1/ f)

Q 22. Timbre Why do various instruments sound different even when they play the same note?
Each instrument produces its own set of fundamental and harmonic frequencies, so they have different timbres

9	**Distinguish between electrical conductors and insulators giving typical examples**	**Student Book**	**P. (53-54)**
		Q. (2-4)	**P.54**

Charge spreads out evenly on a conductor. An insulator holds charges where they are placed.

Q2. Charged Objects; After you rub a comb on a wool sweater, you can use the comb to pick up small pieces of paper. Why does the comb lose this ability after a few minutes?
The comb loses its charge to its surroundings and becomes neutral once again.

Q3. Types of Charge; A pith ball is a small sphere made of a light material, such as plastic foam, that is often coated with a layer of graphite or aluminum paint. How could you determine whether a pith ball suspended from an insulating thread is neutral, charged positively, or charged negatively?
Bring a positively charged glass rod near the two strips of tape. The one that is repelled by the rod is positive.

Q4. Charge Separation ; You can give a rubber rod a negative charge by rubbing the rod with wool. What happens to the charge of the wool? Why?
The wool becomes positively charged because it gives up electrons to the rubber rod.

10	**Demonstrate an understanding that the work performed in moving a charged particle in an electric field can result in the particle gaining electric potential energy or kinetic energy or both.**	**Student Book**	**P. (74 - 75)**
		Q.(43 - 52)	**P. (74 - 75)**

Electric Potential Difference $\Delta V = E \cdot d$
Work $W = q \cdot \Delta V$
Electron charge(elementary charge) $|e| = 1.6\times10^{-19}$ C ,
proton charge $|p| = 1.6\times10^{-19}$ C

Q43 - The electric field intensity between two large, charged parallel metal plates is 6000 N/C. The plates are 0.05 m apart. What is the electric potential difference between them?

$$\Delta V = Ed = (6000\ \text{N/C})(0.05\ \text{m}) = 300\ \text{J/C} = 3\times10^2\ \text{V}$$

Q44-. A voltmeter reads 400 V across two charged, parallel plates that are 0.020 m apart. What is the magnitude of the electric field between them?

$$\Delta V = Ed$$
$$E = \frac{\Delta V}{d} = \frac{400\ \text{V}}{0.020\ \text{m}} = 2\times10^4\ \text{N/C}$$

Q45. What electric potential difference is between two metal plates that are 0.200 m apart if the electric field between those plates is 2.50×10^3 N/C?

$$\Delta V = Ed = (2.50\times10^3\ \text{N/C})(0.200\ \text{m}) = 5.00\times10^2\ \text{V}$$

Q46. When you apply a potential difference of 125 V between two parallel plates, the field between them is 4.25×10^3 N/C. How far apart are the plates?

$$\Delta V = Ed$$
$$d = \frac{\Delta V}{E} = \frac{125\ \text{V}}{4.25\times10^3\ \text{N/C}} = 2.94\times10^{-2}\ \text{m}$$

Q47. CHALLENGE; You apply a potential difference of 275 V between two parallel plates that are 0.35 cm apart. How large is the electric field between the plates?

$$E = \frac{\Delta V}{d} = \frac{275\ V}{3.5\times10^{-3}\ m} = 7.9\times10^{4}\ N/C$$

Q48. What work is done on a 3.0-C charge when you move that charge through a 1.5-V electric potential difference?

$$W = q\Delta V = (3.0\ C)(1.5\ V) = 4.5\ J$$

Q49. What is the magnitude of the electric field between the two plates shown in Figure 12?

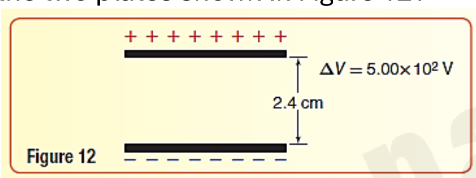


Figure 12

Q50. An **electron** in an old television picture tube passes through a potential difference of 18,000 V. How much work is done on the electron as it passes through that potential difference?

$W = q.\Delta v = 1.6x10^{-19} x18000$

$= 2.88\ x10^{-15}\ J$

Q51. The electric field in a particle accelerator has a magnitude of 4.5×10^{5} N/C. How much work is done to move a proton 25 cm through that field?

$$W = q\Delta V = qEd$$
$$= (1.60\times10^{-19}\ C)(4.5\times10^{5}\ N/C)(0.25\ m)$$
$$= 1.8\times10^{-14}\ J$$

Q52. CHALLENGE A 12-V car battery has 1.44×10^{6} C of usable charge on one plate when it is fully energized. How much work can this battery do before it needs to be energized again?

$$W = q\Delta V = (1.44\times10^{6}\ C)(12\ V)$$
$$= 1.7\times10^{7}\ J$$

11	**1. Use vector addition to calculate the net force on a charge due to other point charges.** **2. Solve problems involving the electrostatic force acting on charged particles by making use of Coulomb's Law.**	**Student Book** **Q.(15-17, 22-23)**	**P.(59-62)** **P.63**

		Student Book	**P.(59-62)**

12	**1. State and apply Coulomb's law to charges separated by finite distances.** **2. Conduct an experiment to demonstrate charging of objects and the electrostatic force between charged objects.**	**Physics Challenge, Q.(9-17, 22-23)**	**P.(62-63)**

Coulomb's Law $$F_{AB} = \frac{K\ q_A\ q_B}{r^2}$$

Q9. A negative charge of -2.0×10^{-4} C and a positive charge of 8.0×10^{-4} C are separated by 0.30 m. What is the force between the two charges?

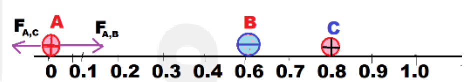
Q10. A negative charge of -6.0×10^{-6} C exerts an attractive force of 65 N on a second charge that is 0.050 m away. What is the magnitude of the second charge?

Q11. Suppose you replace the charge on B in Example Problem 1 with a charge of +3.00 μC. Diagram the new situation, and find the net force on A.

Q12. Describe how the electrostatic force between two charges changes when the distance between those two charges is tripled.

The force will be 1/9 less f/9

Q13. Sphere A is located at the origin and has a charge of $+2.0 \times 10^{-6}$ C. Sphere B is located at +0.60 m on the x-axis and has a charge of -3.6×10^{-6} C. Sphere C is located at +0.80 m on the x-axis and has a charge of $+4.0 \times 10^{-6}$ C. Determine the net force on sphere A.



$$F_{\text{B on A}} = K\frac{q_A q_B}{d_{AB}^2} = (9.0\times10^9\ \text{N·m}^2/\text{C}^2)\frac{(2.0\times10^{-6}\ \text{C})(3.6\times10^{-6}\ \text{C})}{(0.60\ \text{m})^2} = 0.18\ \text{N}$$

direction: toward the right

$$F_{\text{C on A}} = K\frac{q_A q_C}{d_{AC}^2} = (9.0\times10^9\ \text{N·m}^2/\text{C}^2)\frac{(2.0\times10^{-6}\ \text{C})(4.0\times10^{-6}\ \text{C})}{(0.80\ \text{m})^2} = 0.1125 = \text{N}$$

direction: toward the left

$$F_{\text{net}} = F_{\text{B on A}} - F_{\text{C on A}} = (0.18\ \text{N}) - (0.1125\ \text{N}) = 0.068\ \text{N toward the right}$$

Q14. CHALLENGE Determine the net force on sphere B in the previous problem.

(**answer;F= 3.1 N toward the right)**

Q15- Charge and Distance ; What is Coulomb's law and how does it allow you to describe and predict the effects of electrostatic forces between distant objects?

Coulomb's Law $$F_{AB} = \frac{K\ q_A\ \ q_B}{r^2}$$

Q16. Force and Charge; How are electrostatic force and charge related? Describe the force when the charges are like charges and the force when the charges are opposite.
Electric force is directly related to each charge. It is repulsive between like charges and attractive between opposite charges.

Q17. Force and Distance; How are electrostatic force and distance related? How would the force change if the distance between two charges were tripled?
Electric force is inversely related to the square of the distance between charges. If the distance is tripled, the force will be one-ninth as great.

Q22. Electrostatic Forces; Two charged spheres are held a distance r apart, as shown in Figure . Compare the force of sphere A on sphere B with the force of sphere B on sphere A.

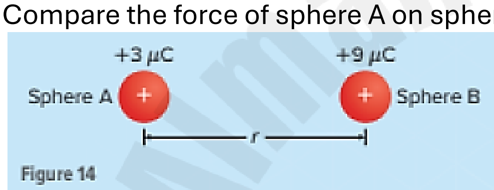


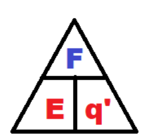
Figure 14

(Answer ; Fab = -Fba)

Q23. Critical Thinking ; Suppose you are testing Coulomb's law using a small, positively charged plastic sphere and a large, positively charged metal sphere. According to Coulomb's law, the force depends on $1/r^2$, where r is the distance between the centers of the spheres. As you bring the spheres close together, the force is smaller than expected from Coulomb's law. Explain.
Some charges on the metal sphere will be repelled to the opposite side from the plastic sphere, making the effective distance between the charges greater than the distance between the spheres' centers.

13	**1. Explain how electric charges are distributed on a spherical conductor, and the effect of this on both the electric field and the electric potential.** **2. Explain the meaning of equipotential.**	**Student Book** **Figure 28; Q. 61**	**P.78** **P.80**

$$E = \frac{F_{on\ q'}}{q'} \qquad E = \frac{K\ q}{r^2}$$



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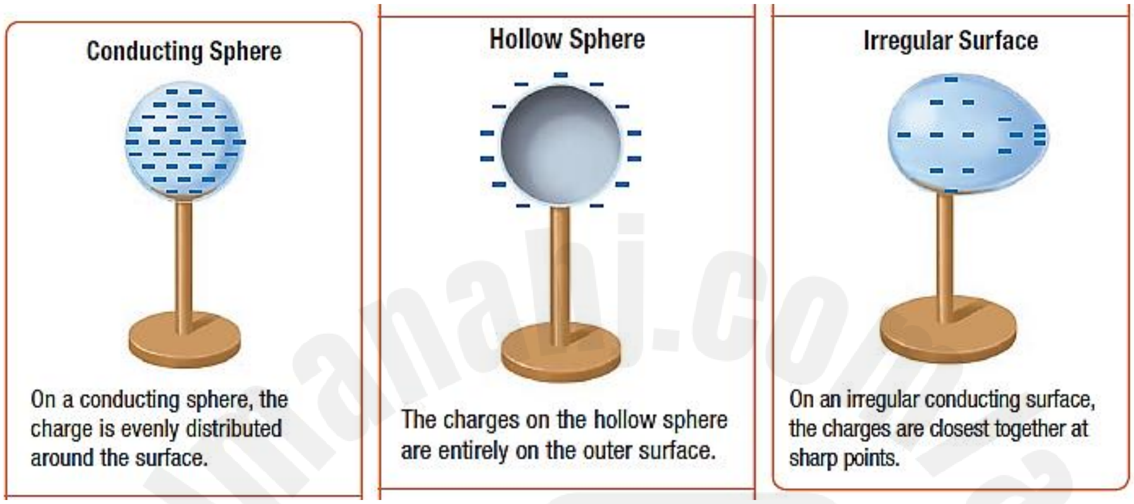
CAPACITANCE
Capacitance is the ratio of the magnitude of the net charge on one plate of the capacitor to the potential difference across the plates.

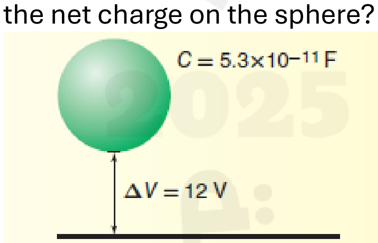
$$C = \frac{q}{\Delta V}$$

$$\Delta V = Ed$$

$$\Delta V = \frac{W}{q}$$



Q61- sphere is charged by a 12 V battery and suspended above Earth as shown in Figure . What is the net charge on the sphere?



14	**Describe Millikan's oil-drop experiment and explain how it confirms that charge exists in discrete amounts, which are integral multiples of the elementary charge.**	**Student Book** **Q.(53-56); Q.66**	**P.(76-77)** **P.81**

Q53-A drop is falling in a Millikan oil-drop apparatus with no electric field. What forces are acting on the oil drop, regardless of its acceleration? If the drop is falling at a constant velocity, describe the forces acting on it.
Gravitational force (weight) downward, friction force of air upward. The two forces are equal in magnitude if the drop falls at constant velocity.

Q54. An oil drop weighs 1.9×10^{-15} N. You suspend it in an electric field of 6.0×10^{3} N/C. What is the net charge on the drop? How many excess electrons does it carry?

$$F_g = Eq$$
$$q = \frac{F_g}{E} = \frac{1.9\times10^{-15}\text{ N}}{6.0\times10^{3}\text{ N/C}} = 3.2\times10^{-19}\text{ C}$$
$$\#\text{ electrons} = \frac{q}{q_e} = \frac{3.2\times10^{-19}\text{ C}}{1.60\times10^{-19}\text{ C}} = 2$$

Q55-. An oil drop carries one excess electron and weighs 6.4×10^{-15} N. What electric field strength do you need to suspend the drop so it is motionless?

$$E = \frac{F}{q} = \frac{6.4\times10^{-15}\text{ N}}{1.60\times10^{-19}\text{ C}} = 4.0\times10^{4}\text{ N/C}$$

Q56. CHALLENGE You suspend a positively charged oil drop that weighs 1.2×10^{-14} N between two parallel plates that are 0.64 cm apart. The potential difference between the plates is 240 V. What is the net charge on the drop? How many electrons is the drop missing?

$$E = \frac{\Delta V}{d} = \frac{240\text{ V}}{6.4\times10^{-3}\text{ m}} = 3.8\times10^{4}\text{ N/C}$$
$$E = \frac{F}{q}$$
$$q = \frac{F}{E} = \frac{1.2\times10^{-14}\text{ N}}{3.8\times10^{4}\text{ N/C}} = 3.2\times10^{-19}\text{ C}$$
$$\#\text{ electrons} = \frac{q}{q_e} = \frac{3.4\times10^{-19}\text{ C}}{1.60\times10^{-19}\text{ C}} = 2$$

Q66-Millikan Experiment : When the net charge on an oil drop suspended in a Millikan apparatus is changed, the drop begins to fall. How should you adjust the potential difference between the conducting plates to bring the drop back into balance?

The potential difference should be increased.

15	**1. Define capacitance as the ratio of the net charge on one plate of a capacitor to the potential difference across the plates, and it is measured in Farads.** **2. Apply the equation for capacitance to solve numerical problems.**	**Student Book** **Q.(57-62, 68)**	**P.(79-81)** **P.(80-81)**

CAPACITANCE
Capacitance is the ratio of the magnitude of the net charge on one plate of the capacitor to the potential difference across the plates.

$$C = \frac{q}{\Delta V}$$

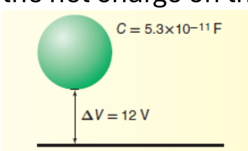
Q57-. A 27-μF capacitor has an electric potential difference of 45 V across it. What is the amount the net charge on the positively charged plate of the capacitor?

Q58-. Suppose you connect both a 3.3-μF and a 6.8-μF capacitor across a 24-V electric potential difference. Which capacitor has the greater net charge on its positively charged plate, and what is its magnitude?

Q59. You later find that the magnitude of net charge on each of the plates for each of the capacitors in the previous problem is 3.5×10^{-4} C. Which capacitor has the larger potential difference across it? What is that potential difference?

Q60. Suppose that you apply an electric potential difference of 6.0 V across a 2.2-μF capacitor. What does the magnitude of the net charge on one plate need to be to increase the electric potential difference to 15.0 V?

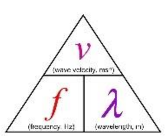
Q61-. A sphere is charged by a 12 V battery and suspended above Earth as shown in Figure 17. What is the net charge on the sphere?



Q62. CHALLENGE You increase the potential difference across a capacitor from 12.0 V to 14.5 V. As a result, the magnitude of the net charge on each plate increases by 2.5×10^{-5} C. What is the capacitance of the capacitor?

PATRT 2

Q1	**1. Determine wave properties such as wavelength, period, frequency, amplitude, and speed using a graphical or a visual representation of a periodic mechanical wave. 2. Explain that transverse and longitudinal waves transfer energy without transferring matter during their propagation.**	**Student Book** **Q.(14-23); Q.25**	**P.(10-14); P.9** **P.14**



$$v = f \times \lambda \quad , \quad v = \frac{distance}{time}$$

Q14. A sound wave produced by a clock chime is heard 515 m away 1.50 s later.
a. Based on these measurements, what is the speed of sound in air?
b. The sound wave has a frequency of 436 Hz. What is the period of the wave?
c. What is its wavelength?

Q15-How are the wavelength, frequency, and speed of a wave related? How do they depend on the medium through which the wave is passing and the type of wave?

$v = f \times \lambda$ *As the frequency increases, the wavelength decreases*
Speed depends on the medium ,

Q16. What is the speed of a periodic wave disturbance that has a frequency of 3.50 Hz and a wavelength of 0.700 m

Q17- How does increasing the wavelength by 50 percent affect the frequency of a wave on a rope?
As the frequency increases, the wavelength decreases

Q18- The speed of a transverse wave in a string is 15.0 m/s. If a source produces a disturbance that has a frequency of 6.00 Hz, what is its wavelength?

Q19- Five wavelengths are generated every 0.100 s in a tank of water. What is the speed of the wave if the wavelength of the surface wave is 1.20 cm?

Q20-. A periodic longitudinal wave that has a frequency of 20.0 Hz travels along a coiled spring toy. If the distance between successive compressions is 0.600 m, what is the speed of the wave?
Q22. How does the frequency of a wave change when the period of the wave is doubled?
As the frequency increases, the period decreases.
F=1/T frequency will be halved

Q23. Describe the change in the wavelength of a wave when the period is reduced by one-half.
v = f.λ f=1/T → v = (1/T).λ = λ / T
wavelength will be halved

Q24. If the speed of a wave increases to 1.5 times its original speed while the frequency remains constant, how does the wavelength change?
Wave-length will increase to 1.5 times as well .

Q2	**1. Use the relation between resonance length and wavelength to solve problems for closed and open pipes.** **2. Define sound pitch and relate it to the frequency of a sound wave.** **3. Define resonance and list some examples and consequences.** **4. Explain resonance in air columns and give examples on different instruments.** **5. Apply the Doppler effect equation to calculate different frequencies and velocities.**	**Student Book** **Q.15; Q.(1-12)**	**P.29; P.37; P8; P.(30-33)** **P.40**

spacing between the resonances $L_A - L_B = \frac{\lambda}{2}$

Doppler $f_d = f_s\left(\frac{v - v_d}{v - v_s}\right)$, **speed of sound in air at 20°C v= 343 m/s**

Taher

Q 15. A 440-Hz tuning fork is held above a closed pipe. Find the spacing between the resonances when the air temperature is 20°C.
(Answer; La-Lb= 0.39 m)

Q1. Repeat Example Problem 1, but with the car moving away from you. What frequency would you hear?
(Answer; f = 304.6 Hz)

Q2. You are in an automobile, like the one in Figure 7, traveling toward a pole-mounted warning siren. If the siren's frequency is 365 Hz, what frequency do you hear? Use 343 m/s as the speed of sound.
(Answer; f_d =391.6 Hz)

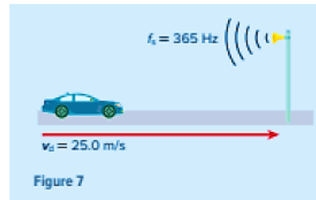


Figure 7

Q3. You are in an automobile traveling at 55 mph (24.6 m/s). A second automobile is moving toward you at the same speed. Its horn is sounding at 475 Hz. What frequency do you hear? Use 343 m/s as the speed of sound.

Q4. A submarine is moving toward another submarine at 9.20 m/s. It emits a 3.50-MHz ultrasound. What frequency would the second sub, at rest, detect? The speed of sound in water at the depth the submarines are moving is 1482 m/s.

$v = 1482$ m/s, $f_s = 3.50$ MHz,
$v_s = 9.20$ m/s, $v_d = 0$ m/s

$$f_d = f_s\left(\frac{v - v_d}{v - v_s}\right)$$

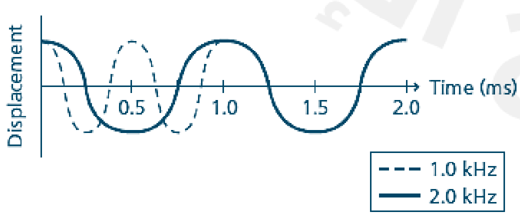
$$= (3.50 \text{ MHz})\left(\frac{1482 \text{ m/s}}{1482 \text{ m/s} - 9.20 \text{ m/s}}\right)$$

$$= 3.52 \text{ MHz}$$

Q5. CHALLENGE A trumpet plays middle C (262 Hz). How fast would it have to be moving to raise the pitch to C sharp (277 Hz)? Use 343 m/s as the speed of sound.

Q6. wave characteristics : What physical characteristic of a sound wave should be changed to alter the pitch of the sound? To alter the loudness?
frequency; amplitude

Q7. Graph ; The eardrum moves back and forth in response to the pressure variations of a sound wave. Sketch a graph of the displacement of the eardrum versus time for two cycles of a 1.0-kHz tone and for two cycles of a 2.0-kHz tone.



Q8. Effect of Medium; List two sound characteristics that are affected by the medium through which the sound passes and two characteristics that are not affected.
affected: speed and wavelength;
unaffected: period and frequency

Q9. Decibel Scale ;How many times greater is the sound pressure level of a typical rock concert (110 dB) than a normal conversation (50 dB)?
The sound pressure level increases by a factor of 10 for every 20-dB increase in sound level. Therefore, 60 dB corresponds to a 1000-fold increase in SPL.

Q10. Early Detection; In the nineteenth century, people put their ears to a railroad track to get an early warning of an approaching train. Why did this work?
The velocity of sound is greater in solids than in gases. Therefore, sound travels faster in steel rails than in air, and the rails help focus the sound so it does not die out as quickly as in air.

Q11. Bats; A bat emits short pulses of high-frequency sound and detects the echoes.
a. In what way would the echoes from large and small insects compare if they were the same distance from the bat?
b. In what way would the echo from an insect flying toward the bat differ from that of an insect flying away from the bat?

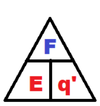
a- They would differ in intensity. Larger insects would reflect more of the sound energy back to the bat.

b- An insect flying toward the bat would return an echo of higher frequency (Doppler shift). An insect flying away from the bat would return an echo of lower frequency.

Q12. Critical Thinking; Can a trooper using a radar detector at the side of the road determine the speed of a car at the instant the car passes the trooper? Explain.
No. The car must be approaching or receding from the detector for the Doppler effect to be observed. Transverse motion produces no Doppler effect

Q3	**1. Describe the charge distribution on a solid conducting sphere, a hollow conducting sphere and an irregular conducting surface. 2. Calculate the electric field strength at a point close a single point charge / a conducting charged sphere.**	**Student Book**	**P.(65-67), P.78**
		Q.(24 - 37)	**P.(66-67)**

Q24. A positive test charge of 5.0×10^{-6} C is in an electric field that exerts a force of 2.0×10^{-4} N on it. What is the magnitude of the electric field at the location of the test charge?

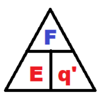


$$E = \frac{F}{q'} =$$

Q25. A negative charge of 2.0×10^{-8} C experiences a force of 0.060 N to the right in an electric field. What are the field's magnitude and direction at that location?

Q26. A positive charge of 3.0×10^{-7} C is located in a field of 27 N/C directed toward the south. What is the force acting on the charge?

Q27. Complete Table 2.



q charge (C)	F force (N)	E electric field (N/C)
1.0×10^{-6}	0.30	
2.0×10^{-6}		3.3×10^{5}
	0.45	1.5×10^{5}

Q28. A negative test charge is placed in an electric field as shown in Figure 17. It experiences the force shown. What is the magnitude of the electric field at the location of the charge?

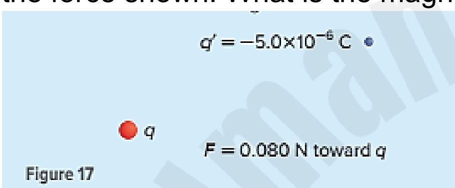


Figure 17

Q 30- What is the magnitude of the electric field at a position that is 1.2 m from a 4.2×10^{-6} C point charge?

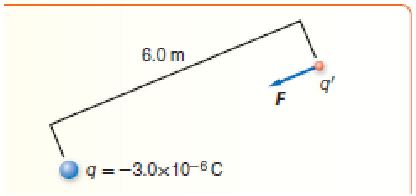
E

Q33-The electric field that is 0.25 m from a small sphere is 450 N/C toward the sphere. What is the net charge on the sphere? The electric field that is 0.25 m from a small sphere is 450 N/C toward the sphere. What is the net charge on the sphere?

Q34- How far from a point charge of $+\,2.4 \times 0^{-6}$ C must you place a test charge in order to measure a field magnitude of 360 N/C?

Q35- Explain why the strength of the electric field exerted on charge q′ by the charged body q is independent of the charge on q′ . Hint: Use mathematics to prove your point.

Q36- What is the magnitude of the electric field exerted on the test charge shown in Figure



Q37- CHALLENGE; You place a small sphere with a net charge of 5.0×10^{-6} C at one corner of a square that measures 5.0 m on each side. What is the magnitude of the electric field at the opposite corner of the square?

Q4	**Demonstrate knowledge of electrostatic charge, differentiate materials based on their electrical conductivity, and describe the methods of electrical charging of objects.**	**Student Book**	**P.(52-58),**
		Q.(2-7), Q.(18-21)	**P.54; P.63**

Q2. Charged Objects After you rub a comb on a wool sweater, you can use the comb to pick up small pieces of paper. Why does the comb lose this ability after a few minutes?
The comb loses its charge to its surroundings and becomes neutral once again.

Q3. Types of Charge A pith ball is a small sphere made of a light material, such as plastic foam, that is often coated with a layer of graphite or aluminum paint. How could you determine whether a pith ball suspended from an insulating thread is neutral, charged positively, or charged negatively?

Bring an object of known charge, such as a negatively charged hard rubber rod, near the pith ball. If the pith ball is repelled, it has the same charge as the rod. If it is attracted, it may have the opposite charge or be neutral. To find out which, bring a positively charged glass rod near the pith ball. If they repel, the pith ball is positive; if they attract, the pith ball must be neutral

Q4. Charge Separation; You can give a rubber rod a negative charge by rubbing the rod with wool. What happens to the charge of the wool? Why?
The wool becomes positively charged because it gives up electrons to the rubber rod.

Q5-. Net Charge ;An apple contains approximately 1026 charged particles. Why don't two apples repel each other when they are brought together?
Each apple contains equal numbers of positive and negative charges, so they appear neutral to each other
Q6. Charging a Conductor; Suppose you hang a long metal rod from silk threads so that the rod is electrically isolated. You then touch a charged glass rod to one end of the metal rod. Describe the charges on the metal rod.
The glass rod attracts electrons off the metal rod, so the metal becomes positively charged. The charge is distributed uniformly along the rod.

Q7. Charging by Friction; You can charge a rubber rod negatively by rubbing it with wool. What happens when you rub a copper rod with wool?
Because the copper is a conductor, it remains neutral as long as it is in contact with your hand.

Q18. Charging by Induction; In an electroscope being charged by induction, what happens when the charging rod is moved away before the ground is removed from the knob?
Charge that had been pushed into the ground by the rod would return to the electroscope from the ground, leaving the electroscope neutral.

Q 19. Electroscopes Why do the leaves of a charged electroscope rise to a certain angle and no farther?
As the leaves move farther apart, the electric force between them decreases until it is balanced by the gravitational force pulling down on the leaves.

Q20. Attraction of Neutral Objects; What properties explain how both positively charged objects and negatively charged objects can attract neutral objects?
Charge separation, caused by the attraction of opposite charges and the repulsion of like charges, moves the opposite charges in the neutral body closer to the charged object and the like charges farther away. The inverse relation between force and distance means that the nearer, opposite charges will attract more than the more distant, like charges will repel. The overall effect is attraction.

Q21. Charging an Electroscope How can you charge an electroscope positively using a positively charged rod?
Using a negatively charged rod?
a. a positive rod.
Touch the positive rod to the electroscope. Negative charges will move to the rod, leaving the electroscope positively charged
a negative rod.
Bring the negative rod near, but not touching the electroscope. Touch (ground) the electroscope with your finger, allowing electrons to be repelled off of the electroscope into your finger. Remove your finger and then remove the rod.