QIB FOR CLASS X - PHYSICS PBA

Ser	SLO	Questions	Answer
1.	To study the effect of the length of simple pendulum on time and hence find “g” by calculation.	1.What factors could cause discrepancies in the value of 'g' compared to the standard value (9.81 m/s²)?	Discrepancies can arise from: · Air resistance affecting the pendulum's motion. · Errors to measuring timing or length. · Very large amplitude of vibrating pendulum (the formula of time period of simple pendulum is derived with assumption of small angle of amplitude). · Incorrectly assuming the mass of pendulum which has no effect on the time period.
		2.If the length of a pendulum is doubled, how does it effect on the time period?	If the length L is doubled, the period T increases by a factor of $\sqrt{2}$. $T' = \sqrt{2}\,(2\pi\sqrt{\frac{l}{g}})$
		3.Define frequency and amplitude in the context of the motion of a simple pendulum. How are they related to the periodic motion of the pendulum?	In a simple pendulum: **Frequency** is the number of oscillations per second. **Amplitude** is the maximum displacement from the equilibrium position. They are related to the periodic motion, with frequency determined by the pendulum's length and gravity, while amplitude affects the swing height but not the period.
		4.How we can calculate the percentage error in this experiment?	Percentage Error = [(Calculated Value - True Value) / True value] × 100
		5.Why should the amplitude of simple pendulum be small?	The amplitude of a simple pendulum should be small to ensure that the motion remains approximately simple harmonic. For larger amplitudes, the motion becomes non-linear, and the restoring force no longer follows Hooke's Law, causing deviations from ideal simple harmonic motion.
		6. Write the formula for time period and frequency of simple pendulum.	$T = 2\pi\sqrt{\frac{L}{g}}$ $f = \frac{1}{T}$
		7.How does a change in mass affect the period T at a specific length?	For a simple pendulum, the period T is independent of mass. It is determined by the length L of the pendulum and the acceleration due to gravity g.
		8.What happens to the kinetic energy of a particle in simple harmonic motion (SHM) at the extreme positions?	At the extreme positions in simple harmonic motion (SHM), the kinetic energy of the particle is zero because its velocity is momentarily zero. The particle has maximum potential energy at these points.
		9.Why is the time for more than one period measured in simple pendulum?	The time for more than one period is measured in a simple pendulum to reduce errors and obtain a more accurate average value for the period.
2.	To verify the laws of refraction by using a glass slab.	1.What is the objective of using a glass slab in verifying the law of refraction?	The objective is to measure the angles of incidence and refraction, and verify that they satisfy Snell's law: $n_1\,sin(\theta_1) = n_2\,sin(\theta_2)$, where $n_1\,and\,n_2$ are refractive indices of air and glass, and $\theta_1\,and\,\theta_2$ are angles of incidence and refraction.
		2.How do you measure the angle of incidence and refraction in the experiment?	Using a protractor to measure the angle between the incident ray and the normal to the glass surface (angle of incidence, θ_1), and the angle between the refracted ray and the normal (angle of refraction θ_2).

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		3.What is the significance of the normal Line to the surface in the law of refraction?	The normal to the surface is an imaginary line perpendicular to the surface at the point of incidence. It serves as a reference line for measuring angles of incidence and refraction.
		4.How can you verify Snell's law using the measured values of θ_1 and θ_2?	$n_1 Sin\theta_1 = n_2 Sin\theta_2$ Calculate the sine of θ_1 and θ_2, and check if the ratio $: n = sin(\theta_1) / sin(\theta_2)$, is approximately equal to the refractive index of glass.
		5.How does the angle of incidence relate to the angle of refraction when light passes from air into glass?	When light passes from air into glass, the angle of refraction is smaller than the angle of incidence. This happens because the light slows down as it enters the denser medium (glass), bending toward the normal.
		6.How would increasing the angle of incidence affect the angle of refraction in a glass slab?	Increasing the angle of incidence in a glass slab will cause the angle of refraction to increase as well, but at a slower rate, since light bends less when moving into a denser medium. Eventually, if the angle of incidence exceeds the critical angle, total internal reflection will occur and no refraction happens.
		7.What do you mean by refraction?	The phenomenon of change in the direction of light when it passes from one transparent medium to another is called refraction.
		8.What factors could affect the accuracy of the refraction measurements?	Factors that could affect the accuracy of refraction measurements using a glass slab include the precision of angle measurements, the quality of the glass slab (e.g., imperfections or uneven surfaces), and inconsistencies in light sources or alignment.
3.	To find the refractive index of water by using concave mirror.	1.What is the refractive index of a medium?	The refractive index is the ratio of the speed of light in vacuum to the speed of light in the medium.
		2.What does refractive index indicate?	The refractive index does indicate how much the light bends (refracts) when entering a material. A higher refractive index means that light travels slower in that material and bends more.
		3.Why do we use a concave mirror in this experiment?	Primary reason for using it in many experiments is its ability to focus parallel rays to a single point, making it easier to observe and measure light behaviors.
		4.What is parallax?	Parallax is the apparent shift in the position of an object when viewed from two different viewpoints. It is used to measure distances, especially in astronomy and when estimating the depth of objects.
		5.How is parallax removed?	Parallax is removed by using a single viewing position or by aligning the object with a fixed reference point, ensuring the object appears in the same position from both perspectives. In instruments, parallax is eliminated by adjusting the viewing scale to match the object's image.
		6.Is there any effect of wavelength on refractive index?	Yes, the refractive index varies with wavelength; shorter wavelengths (e.g., blue light) typically have a higher refractive index than longer wavelengths (e.g., red light). This variation leads to dispersion, causing different colors of light to bend at different angles when entering a medium.
		7.How does refraction affect the apparent image of the needle in this experiment?	Refraction causes the apparent image of the needle to shift when viewed through a different medium, such as water or glass. The light rays bend at the interface between the two media, changing the position of the image. This makes the needle appear to be at a different location than

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			it actually is, depending on the refractive index of the medium.
		8. Which two distances are measured in this experiment?	**d_1:** distance of real image of the needle without water. **d_2:** distance of apparent image of the needle with water inside mirror.
		9.What is the unit of refractive index?	The refractive index is a dimensionless quantity. It has no units.
		10.What is the significance of the refractive index in optical devices?	The refractive index determines how much light bends when passing through a material. It is essential for designing optical devices like lenses and prisms, as a higher refractive index allows for better light focusing and magnification in cameras and telescopes.
		11.When light enters from air to a medium, what is the effect on wavelength of light?	When light enters a denser medium from air, its wavelength decreases, while its speed and frequency remain constant. This is because the refractive index of the medium affects the wavelength.
		12.Can angle of refraction be greater than the angle of incidence?	The relation between incidence and refracted angle depends upon the refractive index of the medium. If a light ray passes from denser medium to rarer medium, the refracted angle is greater than incidence angle and vice versa.
		13.How does placing the object in water rather than in air change the observed image distance?	Placing the object in water rather than air decreases the observed image distance because water has a higher refractive index, causing light to bend more and the image to form closer to the surface.
4.	To determine the critical angle of glass using prism.	1.What is meant by the critical angle in optics?	The critical angle is the minimum angle of incidence at which total internal reflection occurs when light passes from a denser medium to a rarer medium. At this angle, angle of refraction becomes 90°, meaning the refracted light travels along the boundary between the two media. At angles larger than the critical angle, total internal reflection occurs.
		2.What is the relationship between the refractive index of glass and the critical angle?	The critical angle is inversely related to the refractive index, with a higher refractive index resulting in a smaller critical angle as by relation: n = 1/sinC
		3.How would you measure the angle of incidence in the prism during the experiment?	The angle of incidence is measured using a protractor or circular scale Measure the angle between the incident light ray and the normal to the surface at the point of incidence on the prism.
		4.What is the role of the normal line in this experiment, and how is it used?	The normal line is an imaginary line perpendicular to the surface of the prism, and angles of incidence and refraction are measured relative to it.
		5.What are the conditions of total internal reflection?	Total internal reflection occurs when light travels from a denser medium to a less dense medium, and the angle of incidence exceeds the critical angle. Additionally, the refractive index of the first medium must be greater than that of the second.
		6. What is totally reflecting prism?	A totally reflecting prism is a prism designed to reflect light completely through total internal reflection. It usually has angles that ensure light is reflected internally without passing through the prism's surfaces.
		7.How does varying the angle of incidence affect the observation of total internal reflection in the prism?	Varying the angle of incidence affects total internal reflection in the prism by changing the conditions under which it occurs. If the angle exceeds the

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			critical angle, total internal reflection is observed; if it's below, light refracts instead.
5.	To trace the path of a ray of light through glass prism and measure the angle of deviation.	1.Why does light deviate when it passes through a glass prism?	Light deviates because it undergoes refraction twice, once when light enters from air to the prism and then emerge out from the prism to air
		2.What measurements are required to determine the angle of deviation in this experiment?	To determine the angle of deviation, you need to measure the angle of incidence and the angle of emergence as the light enters and exits the prism, along with the prism angle (the angle between the two faces of the prism).
		3.How would you measure the angle of deviation on the traced path?	The angle of deviation is measured as it is the angle between the extended incident ray and the emergent ray on the traced path.
		4.Why does the emergent ray deviate from its original path after passing through the prism?	The emergent ray deviates due to the second refraction from the prism, and the difference in the refractive indices of air and glass.
		5.Name the factors on which the angle of deviation depends.	Factors: angle of incidence, refracting angle of the prism, refractive index of the material used in the prism and wavelength of the light ray.
		6.What do you mean by angle of deviation?	The angle of deviation is the angle between the direction of the incident ray and the direction of the emergent ray after passing through a prism. It quantifies how much the light has been bent.
6.	Verify Ohm's law (using wire as conductor).	1.Enlist the apparatus and materials needed to verify Ohms Law.	The materials include a wire (conductor), a voltmeter, an ammeter, a rheostat, a battery, connecting wires, and a switch.
		2.How do you set up the circuit to verify Ohm's Law?	Connect the wire in series with an ammeter, a rheostat, and a battery and connect the voltmeter in parallel across the wire to measure voltage.
		3.What precautions should be taken during the experiment?	Precautions include ensuring good electrical connections, using a wire with constant resistance, and not allowing the wire to overheat, which could affect resistance.
		4.What happens to the current if you increase the voltage across the wire?	If the voltage increases, the current through the wire increases proportionally, as long as the resistance remains constant. According to Ohm's law (I = V/R).
		5.What role does the rheostat play in this experiment?	The rheostat is used to vary the current by adjusting the resistance in the circuit, letting different voltage and current readings to be taken and allowing precise control over the deflection in the galvanometer for accurate measurements.
		6.State ohms law and write its limitations.	**Ohm's Law** states that the current (I) flowing through a conductor between two points is directly proportional to the voltage (V) across the two points V=IR **Limitations**: 1. Does not apply to non-linear materials. 2. Resistance may change with temperature. 3. Fails at high voltages/currents. 4. Does not apply to superconductors.
		7.What are ohmic conductors? Give two examples.	An ohmic conductor is defined as one which obeys Ohm's law that is $V \propto I$ where V is the voltage and I is the current. There must be a linear graph. Silver and copper are some examples of ohmic conductor.

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		8.What are non-ohmic resistance? Give two examples.	The resistances which do not obey ohm's law are called non-ohmic resistances. Thermistor, diodes and filament of a bulb.
		9.Why the ohm's law is not verified in case of filament lamp?	Ohm's law is not verified in case of filament lamp because its resistance changes with temperature. As the current increases, the filament heats up, causing its resistance to increase, which makes the relationship between voltage and current non-linear.
7.	To study resistors in series circuit.	1.How can potential difference across each resistor in a series circuit measured?	The voltage across each resistor is proportional to its resistance. According to Ohm's law, V = IR. Since current (I) is constant and same in a series circuit, voltage (V) varies directly with resistance (R). For different resistor in a series $V_1 = IR_1$, $V_2 = IR_2$, $V_3 = IR_3$ ……
		2.What happens to the magnitude of the current flows through each resistor in a series circuit?	The current flowing through each resistor is the same. In a series circuit, there is only one path for current flow, so the current (I) is remain constant throughout the circuit by using formula: $I = V/R_{eq}$
		3.Can a series circuit with different resistors be operated if one resistor is disconnected or fused?	No, in series same current flows through each resistor and there is only a single path for current. Series circuit will not operate if one resistor is open or disconnected, because the circuit is broken, and no current will flow.
		4.What are the characteristics of a series combination.	In a series combination, the same current flows through all components, and the total voltage across the combination is the sum of the individual voltages across each component.
		5.In which type of combination, the total resistance of circuit increases?	The total resistance of the circuit increases in a series combination because the resistances add up, resulting in a higher overall resistance than any single resistor.
		6.How resistors are combined in series?	Resistors are combined in series by connecting them end-to-end, so the current flowing through one resistor also flows through the next without branching.
		7.If the resistors were light bulbs, how do you expect the brightness of the bulbs to be affected by adding more bulbs in series?	If the resistors were light bulbs, adding more bulbs in series would decrease the brightness of each bulb. This is because the total resistance of the circuit increases as more bulbs are added in series, reducing the overall current. Since brightness is directly related to the current passing through the bulbs, a lower current results in dimmer light bulbs.
		8.Why does the voltage drop differ across resistors in a series circuit if the resistors have different values?	In a series circuit, the current flowing through each resistor is the same, but the voltage drop across each resistor depends on its resistance value. According to Ohm's Law, V=IR, the voltage drop across a resistor is proportional to its resistance. Therefore, a resistor with a higher resistance will have a larger voltage drop, while a resistor with a lower resistance will have a smaller voltage drop. This difference in voltage drops occurs because each resistor resists the flow of current to a different extent, causing varying amounts of electrical potential energy (voltage) to be used up across each one.
8.	To study resistors in parallel circuit.	1.How does the total current in a parallel circuit compare with the currents through each resistor?	The total current is the sum of the currents through each resistor. $$I_{total} = I_1 + I_2 + I_3 + \cdots$$

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		2. What is the formula for calculating equivalent resistance in a parallel combination of resistors in circuit?	The following formula is used for calculating equivalent resistance in a parallel combination of resistors in circuit. $$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots$$
		3.Give any one example of parallel combinations	A common example of a parallel combination is household electrical wiring, where multiple appliances (like lamps and TVs) are connected across the same voltage source, allowing them to operate independently.
		4.How can we compare the power dissipation in each resistor in a parallel circuit?	In a parallel circuit, the power dissipation in each resistor varies depending on its resistance. Resistors with lower resistance dissipate more power, while those with higher resistance dissipate less. $P_1 = I_1^2R_1$, $P_2 = I_2^2R_2$, $P_3 = I_3^2R_3$ ...
		5.Which type of combination is used in buildings for electrical wiring?	Parallel combination of electrical wiring is used in buildings as it allows devices to operate independently and ensures consistent voltage across all appliances.
		6.What are the characteristics of parallel circuit?	1. Voltage: Same across all components. 2. Component Independence: Components are independent. If one fails, others still work.
		7.How is the resistance of a circuit affected by adding additional pathways?	Adding additional pathways (resistors) in parallel decreases the total resistance of the circuit, as the current has more paths to flow through.
		8.How does the voltage drop across each branch in a parallel circuit compare?	In a parallel circuit, the voltage drop across each branch is the same and equal to the total voltage supplied by the source.
		9.What is the advantage of resistors connected in Parallel?	The advantage of resistors connected in parallel is that the total resistance decreases, allowing more current to flow through the circuit while maintaining the same voltage across each resistor. They are independent of each component. If one of them fails or is disconnected, the rest of the circuit still works.
		10.What happens to the brightness of bulbs in a parallel circuit when more bulbs are added?	In a parallel circuit, the brightness of bulbs remains the same when more bulbs are added, as each bulb gets the full voltage of the power source.
9.	To find the resistance of galvanometer by half deflection method.	1.What are the key components of the experimental setup for the half-deflection method?	The key components include galvanometer, high resistance box, resistance box (shunt), battery or power source, key/switch, connecting wires and two key plug.
		2.Why is a known shunt resistance connected in parallel with the galvanometer during this experiment?	The known shunt resistance is connected in parallel to divert some current away from the galvanometer, reducing deflection. By carefully selecting the shunt value, the deflection can be halved, allowing for calculating the galvanometer's internal resistance.
		3.If the deflection does not reduce to exactly half, what steps would you take to correct this?	If the deflection does not reduce to exactly half, check for errors such as incorrect shunt resistance, faulty connections, or calibration issues. Adjust the shunt resistance or recheck the setup to ensure proper alignment and accuracy.

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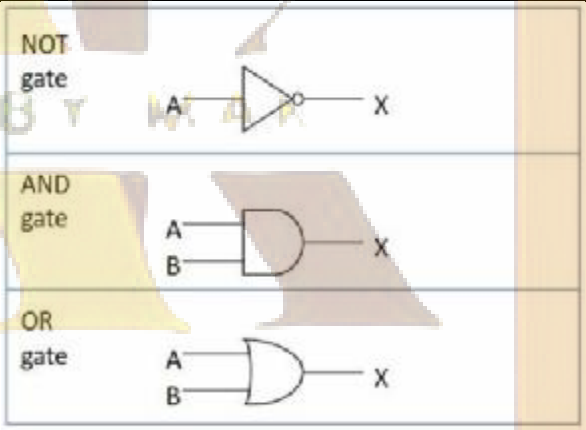
			Fine-tune the current using the rheostat until the deflection is precisely halved.
		4.Why this half deflection method is important for the measurement.	The half-deflection method is important because it helps accurately determine the shunt resistance needed to extend the range of a galvanometer, ensuring proper calibration of the ammeter without overloading the instrument.
		5.What happens if shunt resistance is too high?	If the shunt resistance is too high, it will allow less current to bypass the meter, leading to inaccurate measurements or a significant reduction in the meter's range.
10.	To verify the truth table of OR, AND, NOT, NOR and NAND gates.	1.What is the output of an AND gate if one input is 1 and the other is 0?	The output of an AND gate is 0 if one input is 1 and the other is 0.
		2.What is the output of an OR gate if both inputs are 0?	The output of an OR gate is 0 if both inputs are 0.
		3.What is the purpose of a logic gate?	A logic gate is a basic building block of digital circuits that performs a basic logical operation on one or more input signals to produce a single output, used in digital circuits for tasks like computation, decision-making, and control.
		4.Write Boolean expression for OR, AND, NAND and NOR gate?	OR: A+B AND: A.B NAND: $\overline{A.B}$ NOR: $\overline{A+B}$
		5.Draw the symbol for NOT, AND and OR gate.	
		6.How is the NAND gate differ from the AND gate?	The NAND gate produces the opposite output of an AND gate. It gives 0 only when both inputs are 1.
		7.How many outputs must be provided to AND and OR gate?	An AND or OR gate must provide one output, regardless of the number of inputs. The output depends on the logic of the gate (AND or OR) and the combination of inputs.
		8.What does the binary logic 0 and 1 represents**?**	0 means OFF or open circuit. 1 means ON or close circuit.