آغا خان یونیورسٹی ایگزامینیشن بورڈ

AGA KHAN UNIVERSITY EXAMINATION BOARD

Pacing Guide for Teachers

PHYSICS

Grade IX

Theory

Number of weeks: 28

Number of periods per week: 4

Key Textbook: Punjab Curriculum and Textbook Board Grade IX Physics

Developer(s): Rafana Saif

Institution(s): Al-Murtaza School, Karachi

Topic — Total Periods

1. Physical quantities and measurements — 8

Sub-Topic	Range of SLOs	Periods (40 mins)
1.1 Introduction	1.1.1	0.5
1.2 Physical Quantities	1.2.1	0.5
1.3 International System of Units	1.3.1-1.3.3	1
1.4 Prefixes (Multiples and Sub-Multiples)	1.4.1	1
1.5 Standard Form/Scientific Notation	1.5.1	1
1.6 Measuring Instruments	1.6.1-1.6.3	2
1.7 Significant Figures	1.7.1-1.7.3	2

Learning Resources

- Physics (A course for 'O' levels) 2nd edition by Dr. Charles Chew, Leong See Cheng and Chow Sien Foong
- Mathematics for Class IX (in logarithm chapter)

Suggested Activities and/or Formative Assessment

Activity 1

Group discussion in the classroom can be carried out on the given questions.

- What is physics?
- Application of physics in our daily life.
- Physics and technological advancements.

Activity 2

- Introduce the concept of physical quantities in physics.
- Discuss the importance of physical quantities in measuring and understanding the natural world.
- Provide real-world examples of physical quantities such as length, mass, temperature, time, and energy.
- Discuss the significance of Standardized Unit in the real world.

Activity 3

Divide students into small groups and give them a list of physical quantities to measure (e.g., length, mass, volume, time). Students must search the classroom or school to find objects that can be used to measure these physical quantities. They can then present their findings to the class and discuss how they made their measurements.

Activity 4

Introduce the concept of prefixes in physics. Provide real-world examples of prefixes such as kilo, mega, and giga. Provide examples of converting between different units using prefixes such as meters and kilometers, grams and milligrams, and seconds and microseconds.

Activity 5

Introduce the concept of scientific notation and exponents in physics. Explain how scientific notations are used to represent large or small numbers. Provide examples of using exponents to represent physical quantities such as the distance between planets or the size of atoms.

Activity 6

Introduce the students to the measuring instruments practically and help them to identify each of them and their applications. Have students practice measuring physical quantities using appropriate instruments and unit Introduce the concepts of precision and accuracy in measuring instruments.

Activity 7

Introduce the concept of significant figures in physics. Discuss the rules for determining significant figures in a measured value. Introduce the concept of rounding and precision in significant figures. Have students practice performing calculations with appropriate significant figures and units. Have students discuss and analyse how significant figures are used in real-world situations.

Activity 8

Teachers can carry out discussions on real-world examples of physical quantities.

Activity 9

Provide students with a worksheet containing a list of quantities and ask them to identify and differentiate between Base & Derived quantities.

Activity 10

Homework assignments and problem sets on converting between standard and scientific notation.

Activity 11

Assess the students on the basis of their practical work with measuring instruments.

Activity 12

Quiz students on significant figures and their applications in physics.

Further Resources

For additional resources related to teaching, learning and formative assessments, please refer to **Learn Smart Classroom by Knowledge Platform:**

https://akueb.knowledgeplatform.com/login

Topic	Total Periods
2. Kinematics	17

Sub-Topic	Range of SLOs	Periods (40 mins)
2.1 Rest and Motion	2.1.1-2.1.2	0.5
2.2 Types of Motion (Translatory, Rotatory, Vibratory)	2.2.1-2.2.2	0.5
2.3 Terms associated with Motion (Distance and Displacement, Speed and Velocity and Acceleration)	2.3.1-2.3.2	1
2.4 Scalars and vectors	2.4.1-2.4.2	1
2.5 Forces on Bodies	2.5.1	0.5
2.6 Addition of Forces	2.6.1	1.5
2.7 Resolution of Forces	2.7.1-2.7.2	2
2.8 Graphical Analysis of Motion (Distance-Time Graph and Speed-Time Graph)	2.8.1-2.8.2	2
	2.8.3-2.8.4	2

	2.8.5-2.8.6	2
2.9 Equation of Motion	2.9.1-2.9.2	2
2.10 Motion due to Gravity	2.10.1	2

Learning Resources

- Physics for Class 9 Sindh Textbook Board Jamshoro
- Physics (A course for 'O' levels) 2nd edition by Dr Charles Chew, Leong see Cheng and Chow Sien Foong
- Co-ordinate Physics by Stephen Pople
- Physics (GCE 'o' levels) by Dr Charles Chew, Leong See Cheng and Chow Sien Foong

Suggested Activities and/or Formative Assessment

Activity 1

Students can drop different types of balls from the same height and observe how they bounce and come to rest. They can then compare their observations and draw conclusions about the effects of different factors on rest and motion.

Activity 2

The teacher can use different toys (top, friction car etc. to show different types of motion. Students can create a simple pendulum using a weight and a string and observe how it moves back and forth. Students can create a ramp using cardboard or other materials and race balls down it to observe and compare the different types of motion, such as rolling, sliding, and bouncing.

Activity 3

Speed

Students can explore speed by racing different objects, such as toy cars or marbles, down a ramp and measuring the time it takes for them to reach the bottom. They can then calculate the speed of the objects using the distance and time measurements.

Velocity

Students can explore velocity by using a stopwatch and measuring the time it takes to walk a certain distance. They can then calculate their velocity by dividing the distance traveled by the time it took to travel that distance.

Acceleration

Students can explore acceleration by experimenting with different objects and how they accelerate. For example, they can drop objects of different sizes and weights from the same height and observe how they accelerate differently due to their mass and air resistance.

Activity 4

Students can be asked to find examples of scalar and vector quantities in the environment around them. For example, they can find examples of scalar quantities such as temperature, time, and mass, and vector quantities such as velocity, force, and acceleration. Students can practice drawing vectors using arrows to represent magnitude and direction. They can then use their vector drawing skills to analyze and describe the motion of objects in different situations.

Activity 5

Students can explore the concept of balancing forces by building a balanced tower using blocks or other objects. They can then add weights to each side to see how the forces balance out. Students can explore the concept of the center of mass by building a balance scale using a board and a pivot point. They can then experiment with adding weights to each side to find the point where the forces balance out.

Activity 6

Force diagrams

Students can practice drawing force diagrams for different objects and situations, and then use vector addition to calculate the net force acting on the object.

Graphical Vector Addition

Students can use graphical methods to add vectors and find the resultant vector. They can practice adding vectors of different magnitudes and directions to develop their vector addition skills.

Activity 7

- Students can practice drawing force diagrams for different objects and situations, and then use the concept of resolution of forces to break down the vectors into their components.
- Have students practice resolving forces into their components by deriving appropriate equations Ask students to determine the magnitude and direction of forces from its perpendicular components.

Activity 8

Calculating Average Speed

Provide students with a distance-time graph and ask them to calculate the average speed of the object for different intervals of time.

Identifying Acceleration

Provide students with an acceleration-time graph and ask them to identify the periods of time when the object is accelerating, decelerating, or moving at a constant speed.

Calculating Displacement

Provide students with a velocity-time graph and ask them to calculate the displacement of the object for different intervals of time.

Predicting Motion

Provide students with a distance-time graph and ask them to predict the motion of the object for different intervals of time, including speed, direction, and any changes in speed or direction.

Real-World Scenarios

Provide students with real-world scenarios, such as a car accelerating from a stop sign or a person riding a bike up and down a hill and ask them to create graphs to represent the motion of the object.

Activity 9

Provide students with real-world scenarios, such as a car driving on a straight road or a ball being thrown into the air and ask them to use the equations of motion to calculate different variables, such as speed, acceleration, time, or distance.

Deriving Equations of Motion

Provide students with a scenario and ask them to derive the equations of motion for the object, using the given information about the motion, such as the initial velocity, final velocity, acceleration, and time.

Activity 10

Provide students with different objects of varying weights and ask them to drop them from a fixed height. Ask them to measure and record the time taken for each object to fall to the ground and use these measurements to calculate the acceleration due to gravity.

Activity 11

https://www.youtube.com/watch?v=Sw2P1hpwpqU?t=116

Show the video in the classroom and provide students with work sheet to answer.

Further Resources

For additional resources related to teaching, learning and formative assessments, please refer to **Learn Smart Classroom by Knowledge Platform:**

https://akueb.knowledgeplatform.com/login

Topic	Total Periods
3. Dynamics	15

Sub-Topic	Range of SLOs	Periods (40 mins)
3.1 Force	3.1.1-3.1.3	1
3.2 Momentum	3.2.1-3.2.3	2
	3.2.4-3.2.5	1
	3.2.6-3.2.7	1
	3.2.8	1
3.3 Newton's Laws of motion	3.3.1-3.3.2	2
	3.3.3-3.3.4	1
	3.3.5	2
	3.3.6	1
3.4 Friction	3.4.1-3.4.3	1

3.5 Uniform Circular Motion	3.5.1-3.5.3	2

Learning Resources

- Physics (A course for 'o' levels) 2nd edition by DR Charles Chew, Leong See Cheng and Chow Sien Foong
- Physics for Class 9 Sindh Textbook Board Jamshoro
- Comprehensive Physics for 'O' Level Science by Charles Chew and Leong See Cheng
- Explaining Physics by Stephen Pople

Web Resources

https://www.youtube.com/watch?v=DoxkySFRrxI
https://www.youtube.com/watch?v=YnXU-AwAjGk
https://www.youtube.com/watch?v=QYCrTFaE4EI

Suggested Activities and/or Formative Assessment

Activity 1

Introduce students to the concept of force along with its real-life applications. Describe different type of forces to students along with their standard units and examples of each in real life like magnetic force gravitational force etc.

Activity 2

Give students different scenarios in which momentum is at work. Have them identify the objects in motion, their masses, velocity and help them calculate momentum.

Activity 3

- Provide students with an object of known mass e.g. (toy car or a tennis ball) ask them to measure the initial velocity of their object by the distance it travels in a given time using the measuring tape.
- Now ask them to calculate the momentum of their object using the formula p = mv, where p is momentum, m is mass, and v is velocity.
- Ask them to simultaneously push their objects towards each other, ensuring that their objects do not collide.
- After the objects come to a stop, each group measures the final velocity of their object.
- Using the final velocity and the known mass of their object, each group should calculate the final momentum of their object. Now ask them to add up the initial

momentum of both objects to get the total initial momentum of the system and do the same for the final momentum to get the total final momentum of the system.

Activity 4

Provide students with a balanced scale and different objects of varying masses. Ask them to place the objects on the scale and observe how the forces balance each other out. Ask them to explain their observations in terms of Newton's second law of motion. Provide students with two identical balls and ask them to collide them in different ways, such as head-on, at an angle, or one ball stationary and the other moving. Ask them to observe and explain their observations in terms of Newton's laws of motion, including how the concept of inertia applies.

Activity 5

Weighing Objects

Provide students with a variety of objects and a balance scale. Ask them to weigh the objects and record their weights. Discuss with the students how the weight of an object is different from its mass and how weight depends on gravity.

Mass Comparison

Provide students with several objects that have different masses. Ask them to compare the masses of the objects using their sense of touch and observation. Discuss with the students how mass is a measure of the amount of matter in an object and how it is different from weight.

Activity 6

Ask students to set up the pulley at a height that can accommodate the weights, and tie one end of the string to the pulley. Tie the other end of the string to a weight and hang the weight from the pulley. Measure the length of the string from the pulley to the weight and record this value. Attach another weight to the weight hanging from the pulley and let the two weights hang. Measure the distance the weights have fallen after a specific time interval, such as 5 seconds, and record this value and help them derive expressions.

Activity 7

Provide each student with a raw egg and a sheet of paper. Ask them to hold the paper vertically and place the egg on top of it. Challenge them to remove the paper quickly without breaking the egg. Discuss with the students how the egg remains at rest due to its inertia and how a force is needed to change its state of motion. Set up the toy car on a flat surface and place the figurines or objects inside the car to represent passengers.

- Ask the students to predict what will happen to the passengers when the car starts moving. Push the car gently and observe what happens to the passengers inside. Discuss with the students how the passengers move due to the force exerted by the car on them.

- Ask the students to predict what will happen if the car suddenly stops.
- Push the car gently and then suddenly stop it and observe what is happening to the passengers inside.
- Discuss with the students how the passengers continue to move forward due to their inertia even though the car has stopped.
- Ask the students to suggest ways to prevent the passengers from moving forward when the car suddenly stops.
- Introduce the concept of seat belts and how they help to prevent passengers from moving forward due to their inertia when the car suddenly stops.
- Ask the students to conduct further experiments with the toy car, such as changing the speed of the car, or adding more passengers to see how it affects the force and inertia experienced by the passengers.

Activity 8

Friction Experiment

To demonstrate the effects of friction, you can have students place different objects on a table and try to slide them. Then, have them place the same objects on a rough surface, such as sandpaper, and try to slide them again. They will notice that the objects are harder to move on the rough surface, which is an example of increased friction.

Activity 9

Ball on a String

Tie a ball to a string and swing it around in a circular motion. Students can observe the ball moving in a uniform circular motion and can also try changing the speed or radius of the circle to see how it affects the motion. Pendulum Swings: Show students a pendulum swinging back and forth and ask them to consider what happens when the pendulum is released at a specific angle. They can observe that the pendulum swings back and forth in a uniform circular motion.

Further Resources

For additional resources related to teaching, learning and formative assessments, please refer to **Learn Smart Classroom by Knowledge Platform:**

https://akueb.knowledgeplatform.com/login

Topic	Total Periods
4. Turning Effect of Force	12

Sub-Topic	Range of SLOs	Periods (40 mins)
4.1 Moment of Force	4.1.1-4.1.2	1
4.2 Principle of Moments	4.2.1-4.2.2	3
4.3 Centre of Gravity	4.3.1	1
4.4 Couple	4.4.1-4.4.2	1
4.5 Equilibrium	4.5.1-4.5.3	1
	4.5.4-4.5.5	3
	4.5.6	1
4.6 Stability	4.6.1	1

Learning Resource

- Comprehensive Physics for 'O' Level Science by Charles Chew and Leong See Cheng
- Explain physics by Stephen Pople

Web Resources

https://www.youtube.com/watch?v=DWVBK_xh7cs

https://www.youtube.com/watch?v=T-rMLMCuSRo

Suggested Activities and/or Formative Assessment

Activity 1

You can demonstrate the concept of the moment of force using a lever and weights. Have students place a pivot point, such as a pencil or ruler, on a table and attach a string to one end of it. Then, have them hang a weight from the string and move the other end of the lever up and down. They can observe that the weight moves because of the moment of force created by the lever.

Activity 2

Set up a seesaw with two people of different masses sitting on each end. Have the students calculate the moments of force acting on each end and confirm that they are equal when the seesaw is in equilibrium.

Activity 3

Stacking Challenge

Provide students with blocks or other small objects and challenge them to stack the objects on top of each other without them falling over. Have them adjust the placement of each object until they find the centre of gravity of the stack?

Activity 4

Use a door hinge and a board or a piece of cardboard to demonstrate the concept of a couple. Attach the board to the door using the hinge, and then apply a force to one end of the board. The force will create a couple, and the board will rotate but will not move.

Activity 6

Give some examples of systems in equilibrium, such as a balance with two equal weights or some chemical reaction in which the forward and reverse reactions occur at the same rate. Use a simple balance or a virtual balance to demonstrate the concept of equilibrium. Ask students to place different objects on the balance, and then challenge them to balance it by adding or removing objects until the balance is stable. This activity can help students understand that equilibrium is a state of balance between opposing forces.

Further Resources

For additional resources related to teaching, learning and formative assessments, please refer to **Learn Smart Classroom by Knowledge Platform:**

https://akueb.knowledgeplatform.com/login

Topic	Total Periods
5. Gravitation	7

Sub-Topic	Range of SLOs	Periods (40 mins)
5.1 Law of Gravitation	5.1.1-5.1.3	1
	5.1.4-5.1.5	1
5.2 Measurement of Mass of Earth	5.2.1	1
5.3 Variation of ‘g’ with Altitude	5.3.1	1
5.4 Motion of Artificial Satellites	5.4.1	1
5.5 Earth and Space	5.5.1-5.5.2	1
	5.5.3-5.5.4	1

Learning Resource

Physics for Grade IX Sindh Textbook Board Jamshoro

Web Resources

https://www.youtube.com/watch?v=0ewWkfBA3vw?t=210
http://www.enchantedlearning.com/subjects/astronomy/planets/
http://www.universetoday.com/85738/why-do-planets-orbit-the-sun/

Suggested Activities and/or Formative Assessment

Activity 1

Conduct a simple experiment to demonstrate the concept of gravity. For example, drop objects of different masses from the same height and observe their acceleration towards the ground. This activity can help students understand that the force of gravity is proportional to the mass of the object in accordance with newton's Law of gravitation.

Activity 2

Provide students with the formula for calculating the force of gravity [$F=G(m_1m_2/r^2)$] and ask them to calculate the force between different objects (such as the sun and the earth). This activity can help students develop problem-solving skills while learning about the mathematical aspects of Newton's Law of Gravitation.

Activity 3

Build a simple launcher that uses rubber bands to propel a small object (such as a ping-pong ball) into the air. Ask students to experiment with different angles and speeds to launch the ball into orbit. This activity can help students understand the concept of escape velocity and how it affects the motion of objects in space.

Activity 4

Weight Calculation

Ask students to calculate their weight on different planets or celestial bodies using Newton's Law of Gravitation. This activity can help students understand that weight is a measure of the force of gravity on an object and can vary depending on the mass and distance of the object.

Activity 5

Provide student with formula and needed values to find the mass of earth. Ask to make 'g' as subject of formula.

Further Resources

For additional resources related to teaching, learning and formative assessments, please refer to **Learn Smart Classroom by Knowledge Platform:**

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Topic	Total Periods
6. Work and Energy	15

Sub-Topic	Range of SLOs	Periods (40 mins)
6.1 Work	6.1.1-6.1.2	1
6.2 Forms of Energy	6.2.1-6.2.3	2
6.3 Kinetic Energy and Potential Energy	6.3.1	1
6.4 Major Sources of Energy	6.4.1-6.4.2	3
	6.4.3-6.4.4	2
	6.4.5-6.4.6	2
	6.4.7	1
6.5 Efficiency	6.5.1-6.5.3	1
6.6. Power	6.6.1-6.6.4	2

Learning Resources

- Physics (GCE 'o' levels) by Dr Charles Chew, Leong See Cheng and Chow Sien Foong
- Physics Matter by Nick England
- Co-ordinate physics by Stephen Pople
- Explain physics by Stephen Pople

Web Resources

https://www.youtube.com/watch?v=4hN18jt5aQE

Suggested Activities and/or Formative Assessment

Activity 1

Provide students with problems that require them to calculate the amount of work done by a force. For example, ask them to calculate the work done in lifting a weight a certain distance or in moving an object with a certain force over a certain distance.

Activity 2

- Ask them to find examples of kinetic energy (such as moving objects), potential energy (such as objects at different heights), thermal energy (such as heat sources), and electrical energy (such as outlets or electronic devices).
- Ask students to create a chain of energy transformations that shows how one form of energy is transformed into another. For example, they could start with the potential energy of water in a hydroelectric dam, which is transformed into kinetic energy as the water falls and turns a turbine, which is then transformed into electrical energy. This activity can help students understand the concept of energy transformation and the different forms of energy involved.

Activity 3

Pendulum Experiment

Conduct an experiment with a simple pendulum to demonstrate the relationship between kinetic and potential energy. Students can measure the height and speed of the pendulum at different points in its swing to calculate the potential and kinetic energy at each point. This activity can help students to differentiate between kinetic and potential energy.

Activity 4

Create a sorting game where students have to categorise different sources of energy into renewable and nonrenewable categories. This activity can help students learn about the different types of energy sources and their impacts on the environment. Draw the block diagram for energy conversion at different stages.

Activity 5

Energy Equation

- Provide students with several small objects.
- Ask them to measure the mass of their objects using measuring tape or ruler.
- Next, ask them to calculate the amount of energy that could be released if all the mass of their objects were converted into energy using the mass-energy equation, $E=mc^2$.
- Once they have completed their calculations, ask them to compare the amount of energy that could be released from their objects to other forms of energy they may be familiar with (such as the energy released by a car or a power plant).

Activity 6

Provide students with a small light bulb, battery and some wires connect and explain how the electrical energy is being converted to light as well as thermal energy. Further ask students to create block diagrams showing different forms of energy conversion (e.g., fossil fuel to light energy).

Activity 7

Ask students to list down the renewable forms and non-renewable forms of energy from daily life examples and the pros and cons associated with each of them.

Activity 8

Begin by discussing with students the basic principles of efficiency and how it is measured. Provide students with sheets of paper, scissors, and a ruler or measuring tape. Ask them to design and build a paper airplane that can fly the farthest distance possible. Once the airplanes are built, ask them to test their planes by launching them from a designated starting point and measuring the distance they fly. After they complete their test flights, calculate the efficiency of each airplane by dividing the distance flown by the amount of energy used (measured in the number of folds or cuts made in the paper). Finally, ask them to brainstorm ways that they could improve the efficiency of their airplane designs and test them again and ask them to calculate efficiency and explain how it can never be 100%.

Activity 9

Ask them to build a basic wind turbine, with the DC motor attached to the blades and the LED light attached to the wires. Next, ask them to test their wind turbine by holding it up to a fan or blowing on it with their breath. After testing their wind turbine, ask them to share their conclusion.

Further Resources

For additional resources related to teaching, learning and formative assessments, please refer to **Learn Smart Classroom by Knowledge Platform:**

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Topic	Total Periods
7. Properties of Matter	17

Sub-Topic	Range of SLOs	Periods (40 mins)
7.1 Kinetic Molecular model of Matter	7.1.1-7.1.2	1
7.2 Density	7.2.1-7.2.2	1
7.3 Pressure	7.3.1-7.3.2	1
7.4 Atmospheric Pressure	7.4.1-7.4.2	1
	7.4.3-7.4.4	1
7.5 Pressure in Liquids	7.5.1-7.5.2	1
	7.5.3	2
	7.5.4	1
	7.5.5-7.5.6	2
7.6 Upthrust	7.6.1	1

7.7 Principle of Floatation	7.7.1	1
7.8 Elasticity	7.8.1-7.8.2	2
7.9 Stress, Strain and Young's Modulus	7.9.1-7.9.3	2

Learning Resources

- Physics (GCE 'o' levels) by Dr Charles chew, Leong See Cheng and Chow Sein Foong
- Physics matter by Nick England
- Explain physics by Stephen Pople

Web Resources

https://www.youtube.com/watch?v=wC0YfyB2Oac
https://www.youtube.com/watch?v=05WkCPORlj4
https://www.youtube.com/watch?v=khc2wUBsFU4
https://www.youtube.com/watch?v=yAlb3T9DPyE

Suggested Activities and/or Formative Assessment

Activity 1

Ask students to draw atoms or molecules on their ping pong balls and use them to create a model of a substance in a particular state of matter (solid, liquid, or gas). Have they place their ping pong ball models in a large container, and observe how the models interact with each other? Discuss with the class how the model represents the behavior of molecules in different states of matter.

Activity 2

Take liquids with different densities. Pour each liquid into the cup, being careful not to mix them together. Discuss with the class how the different liquids have different densities, and how this property allowed them to create a tower. Have students calculate the density of each liquid by dividing the mass of the liquid by its volume. Ask students to think of other substances they could add to the tower and predict where they would fit in the tower based on their density.

Activity 3

- Inflate the balloon to a small size and use the ruler to measure its diameter.
- Record the diameter of the balloon on a piece of masking tape and stick the tape to the balloon.
- Inflate the balloon to a larger size and measure its new diameter.
- Record the new diameter on a second piece of masking tape and stick it next to the first piece of tape.
- Discuss with the students how the balloon became harder to squeeze as it was inflated, and how this relates to the concept of pressure.
- Use the marker to write the word "Small" on the first piece of tape, and the word "Large" on the second piece of tape.
- Ask the students to predict which balloon will have a higher pressure.
- Use the following equation to calculate the pressure of each balloon:
- Pressure = Force / Area
- The force is the weight of the air inside the balloon, and the area is the surface area of the balloon. Assume that the weight of the air inside the balloon is proportional to its volume.
- Compare the pressures of the two balloons and discuss with the students why the larger balloon has a higher pressure.

Activity 4

- Fill a glass with water almost to the top.
- Place an index card over the top of the glass, making sure it is centered.
- Hold the index card in place with one hand, and carefully flip the glass upside down, making sure to keep the index card in place.
- Slowly release your hand from the index card and observe what happens.
- The water should remain in the glass and not spill out, due to the atmospheric pressure pushing up on the index card.
- Use the ruler to measure the distance between the surface of the water and the bottom of the index card.
- Record this distance as the height of the water column.
- Discuss with the class how the weight of the air above the index card exerts a force on the water, creating a pressure that is equal to the atmospheric pressure.
- use DART activity and write few questions on board and ask them to read the text and answer the questions.

Activity 5

- Poke a small hole in the center of a bottle cap using the pin or thumbtack.
- Fill the bottle with water almost to the top.
- Screw the cap back on to the bottle.
- Hold the bottle with one hand and use the other hand to press on the sides of the bottle.

- Observe what happens to the water flow from the pinhole.
- The water flow should increase as you press on the bottle, due to the increase in pressure on the water.
- Use the ruler to measure the distance between the surface of the water and the pinhole.
- Record this distance as the depth of the water.
- Use the following equation to calculate the pressure on the water at that depth:
- Pressure = Density x Gravity x Depth
- The density is the density of water, the gravity is the acceleration due to gravity (9.8 m/s^2), and the depth is the depth of the water measured in meters.
- Discuss with the class how pressure in liquids works, and how the pressure increases with depth due to the weight of the water above it.

Extension: Have students repeat the experiment with different depths of water, and compare the pressure calculated for each depth. This will allow students to observe the relationship between depth and pressure in liquids.

Activity 6

- Fill the container with water almost to the top.
- Drop the small object into the water and observe what happens.
- The object should float on the surface of the water, due to the up-thrust force exerted by the water.
- Use the following equation to calculate the up-thrust force: Up thrust = Density x Gravity X Volume of Water Displaced.
- The density is the density of water, the gravity is the acceleration due to gravity (9.8 m/s^2), and the volume of water displaced is the volume of water that is moved out of the way by the object.
- Discuss with the class how the up-thrust force is equal to the weight of the water displaced by the object, and how this allows the object to float.

Have students repeat the experiment with different objects and compare the up-thrust force calculated for each object.

Activity 7

Fill a container with water almost to the top.

- Drop different objects into the water and observe whether they float or sink.
- Add salt to the water and stir until it dissolves. This will increase the density of the water.
- Drop the objects into the saltwater and observe what happens.
- The objects that previously sank in the freshwater may now float in the saltwater, due to the increase in water density.
- Discuss with the class how the principle of floatation works, and how an object will float in a fluid if it displaces a volume of fluid that weighs more than the object.

- Have students explore the concept of buoyancy by adding weight to the floating objects and observing how it affects their ability to float.

Activity 8

Start by stretching a rubber band between your hands. Ask students to observe how the rubber band stretches and how it feels. Explain to students that the rubber band is an example of an elastic material. An elastic material is one that can be stretched or deformed and then return to its original shape when the stretching force is removed.

Activity 9

- Show students how to measure the length of a rubber band when it is not stretched, and then measure it again when it is stretched. Use a ruler to determine the change in length of the rubber band when it is stretched.
- Ask students to predict how much the rubber band will stretch when different weights are added to it.
- Test their predictions by adding weights of different sizes to the rubber band and observing how much it stretches.
- Discuss with the class how the rubber band returns to its original shape once the weight is removed, due to its elastic properties.
- Have students experiment with different rubber bands of varying sizes and strengths and compare how they behave when stretched.

Have students explore the concept of Hooke's law by testing the relationship between the force applied to the rubber band and the amount of stretching it undergoes. This will allow them to apply their understanding of elasticity to a real-world scenario.

Activity 10

Encourage students to make models of hydraulic lift by using two syringes and connecting pipe (one big like 15cc and smaller one 5cc).

Further Resources

For additional resources related to teaching, learning and formative assessments, please refer to **Learn Smart Classroom by Knowledge Platform:**

https://akueb.knowledgeplatform.com/login

Topic	Total Periods
8. Thermal Properties of Matter	12

Sub-Topic/	Range of SLOs	Periods (40 mins)
8.1 Temperature and heat	8.1.1	1
8.2 Thermometer	8.2.1-8.2.3	2
	8.2.4	1
8.3 Specific Heat Capacity	8.3.1-8.3.2	1
8.4 Latent Heat of Fusion	8.4.1	1
8.5 Latent Heat of Vaporisation	8.5.1-8.5.2	2
8.6 Evaporation	8.6.1-8.6.2	1
	8.6.3-8.6.4	1
8.7 Thermal expansion	8.7.1-8.7.2	2

Learning Resources

- Explain physics by Stephen Pople
- Physics (A course for 'o' levels) 2nd edition by Dr Charles Chew, Leong See Cheng and Chow Sien Foong
- Physics matter by Nick England

Web Resource

Thermal Expansion and Contraction of Solids, Liquids and Gases - YouTube

Suggested Activities and/or Formative Assessment

Activity 1

- Begin by asking students to define temperature and heat and write their definitions on the board.
- Fill one beaker or cup with hot water and another with ice cubes. Measure the temperature of each beaker using a thermometer.
- Have students predict what will happen when you place the ice cubes into the hot water.
- Drop the ice cubes into the hot water and observe what happens. Explain to students that the heat from the hot water is transferred to the ice, causing it to melt and the temperature of the water to decrease.
- Measure the temperature of the water again after the ice has melted.
- Discuss with the class how the heat from the hot water caused the ice to melt and how it affected the temperature of the water.
- Ask students to explain the difference between temperature and heat, using the ice melting experiment as an example.

Activity 2

Provide students with a thermometer and liquids at different temperatures and ask students to take readings. Explain to the students regarding different temperature scales and their real-life usage and with the help of formulas, help students to convert to different scales i.e., Celsius, Fahrenheit, Kelvin. Ask students to search for thermometric properties of liquid.

https://www.youtube.com/watch?v=TqJFIBODrjM

https://www.youtube.com/watch?v=8VmkdzRE8sQ

Activity 5

The teacher will use a graph and show students how to determine latent heat of fusion and vaporization.

Activity 6

- Fill both cups or beakers with the same amount of water.
- Add a few drops of food coloring to one of the cups (optional).
- Measure and record the initial temperature of both cups using the thermometer.
- Place the cups in a well-ventilated area where they will not be disturbed.
- Turn on the fan and direct it towards both cups.
- Observe and record the temperature of both cups every few minutes for about 30 minutes.
- Compare the temperature readings of both cups and note any differences.
- Explain to students that the cup without the food coloring is evaporating at a faster rate and therefore cooling down faster than the cup with the food coloring.
- Discuss with students why this is happening and how the process of evaporation works.
- Have students try the experiment with different amounts of water, different temperatures, and different types of liquids to see how they affect the rate of evaporation and cooling.

Activity 7

- Measure and record the initial length of both the metal and glass rods using the ruler or tape measure.
- Heat the metal and glass rods separately using the heat source. Be careful not to overheat the rods or touch them with your bare hands.
- Measure and record the length of both rods after they have been heated for a few minutes.
- Dunk both rods into the container of ice water and let them cool down.
- Measure and record the length of both rods after they have cooled down.
- Compare the length measurements of both rods at different temperatures and note any differences.
- Discuss with students why the metal rod expanded more than the glass rod when heated and why both rods contracted when cooled down.
- Have students try the experiment with different types of materials and different temperature ranges to see how they expand or contract with changes in temperature.

Activity 8

Give students the given questions for reasoning.

- Why do we feel cool when we sit under fan after coming from hot outside?
- Why do athletes wear jackets after running a race or playing a match?

Activity 9

Students can be asked to investigate how thermal expansion is used in bridges, buildings, and other structures, and the problems that can arise when materials expand or contract too much. Students can also share their findings with the whole class.

Further Resources

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Topic	Total Periods
9. Transfer of Heat	9

Sub-Topic	Range of SLOs	Periods (40 mins)
9.1 Process of Heat Transfer	9.1.1-9.1.2	1
	9.1.3-9.1.4	1
	9.1.5	1
	9.1.6-9.1.7	1
9.2 Conduction	9.2.1	1
9.3 Convection	9.3.1-9.3.2	1
9.4 Radiation	9.4.1	1
9.5 Consequences and Everyday Application of Heat Transfer	9.5.1	1
	9.5.2	1

Learning Resource

- Physics (A course for 'o' levels) 2nd edition by Dr Charles Chew, Leong See Cheng and Chow Sien Foong

Web Resources

https://www.youtube.com/watch?v=EMpgykUinYo

https://www.youtube.com/watch?v=B8H06ZA2xmo

https://www.youtube.com/watch?v=ENXXlMyF6kE

https://www.youtube.com/watch?v=OYW7IR-XuJA

Suggested Activities and/or Formative Assessment

Activity 1

- Give each student a worksheet with different scenarios that involve heat transfer (such as a hot cup of coffee, a snowman melting in the sun, or a fireplace).
- Ask students to identify the types of heat transfer that are occurring in each scenario and explain their reasoning.
- Discuss as a class and compare answers.

These activities can help students understand the different types of heat transfer and how they occur in different scenarios, concept of thermal conductivity, its factors and good and bad conductors. They can also encourage critical thinking and problem-solving skills.

Activity 2

- Heat up a metal rod in hot water and place one end of it in ice water.
- Record the time it takes for the ice water to heat up.
- Repeat the process with different types of metal rods and compare the results.
- Discuss with students why certain types of metals are better conductors than others. Also ask the difference between conductors and insulators.

Activity 3

- Fill a glass container with water and add a few drops of food colouring.
- Heat up the water on a hot plate or heat source.
- Observe the convection currents that are created as the water heats up.
- Discuss with students how convection currents occur due to difference in densities and their role in heat transfer.

Activity 4

- Wrap aluminum foil around a thermometer to create a reflective surface.
- Turn on the light bulb and hold the thermometer at different distances from it.
- Record the temperature readings at each distance.
- Discuss with students how radiation works and what are the factors affecting heat transfer by radiation.

Activity 5

- Show students pictures of different types of buildings, such as houses, skyscrapers, and greenhouses.
- Ask students to identify how each building is heated and cooled.
- Discuss the consequences of using different methods for heating and cooling buildings, such as cost, energy efficiency, and environmental impact.
- Discuss with students the concept of global warming and its consequences.
- Provide articles or videos for students to read or watch about the causes and effects of global warming.

These activities can help students understand the consequences and everyday applications of heat, such as thermal expansion, cooking, heating and cooling of buildings, and global warming. They can also encourage critical thinking and problem-solving skills related to environmental and social issues.

Activity 6

Ask students to watch the video and state the reason why metals are good thermal conductors, also list down good and bad conductors of heat its uses.

https://www.youtube.com/watch?v=0v_1lleI1Dg

Activity 8

List a few daily life examples of reducing conduction of heat like wearing sweaters, birds trapping air in feathers, double glazed windows etc.

Further Resources

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Note: This teacher-led pacing guide has been developed for AKU-EB affiliated schools to facilitate them by

- ensuring smooth transition of a school's academic year.
- ensuring curricular continuity in schools.
- predicting the time and pace of syllabi implementation.

This document also contains **suggested activities and/or formative assessments** that may enhance the learning experience. Please note that these activities are meant to serve as suggestions. As educators, you have the flexibility and autonomy to adapt and modify them to best suit the needs of your students and the dynamics of your classroom.

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