Experiment Instruction Manual:

(English Version Manual)

Compulsory Education Textbook Experimental Support Kits

1. Length Measurement Experiment

1.1 Measuring Length and Width

- **Objective:** Measure the length and width of a textbook using the tape measure provided.
- **Procedure:**
    - Use the tape measure from the kit to measure the dimensions of the textbook.
    - Compare your measurements with expected values to analyze accuracy.

1.2 Measuring Height and Waist Circumference

- **Objective:** Measure and record height and waist circumference using rulers and tape measures.
- **Procedure:**
    - Measure each participant's height and waist circumference. Record the results in the provided table:

Frequency/ Measurements	1st time	2nd time	3rd time	4th time
Height (m)				
Waist Circumference (m)				

1.3 Units of Length

- **Common Units:** Kilometer (km), meter (m), decimeter (dm), centimeter (cm), millimeter (mm), micrometer (μm), nanometer (nm).

2. Measurement of Mass

2.1 Using a Balance

- **Objective:** Learn to measure mass using a balance.
- **Procedure:**
    - **Setup:** Remove the protective cover from under the balance pan. Place the balance on a horizontal surface and set the cursor to the zero mark.
    - **Calibration:** Adjust the balance nuts so the pointer aligns with the center line.
    - **Weighing:** Place the object in the left pan and weights in the right pan. Add weights from large to small, using the slide scale, if necessary, until balance is achieved. Record the total mass of weights and the scale value.

2.2 Pallet Balance Specifications (Figure 1)

- **Pan Specification:** 200g
- **Maximum Range:** 5g
- **Minimum Scale Graduation:** 0.2g
- **Weights:**
    - Largest weight: 100g
    - Smallest weight: 5g
    - Total weight: 205g (1x 100g, 1x 50g, 2x 20g, 1x 10g, 1x 5g)

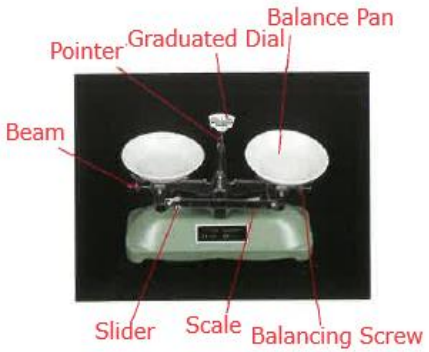

Figure 1


Figure 2

3. Measurement of Volume

3.1 Using a Graduated Cylinder

- **Objective:** Measure the volume of water using a graduated cylinder.
- **Procedure:**
    - Observe the liquid level at eye level to ensure accuracy.
    - Read the volume from the graduations on the cylinder.

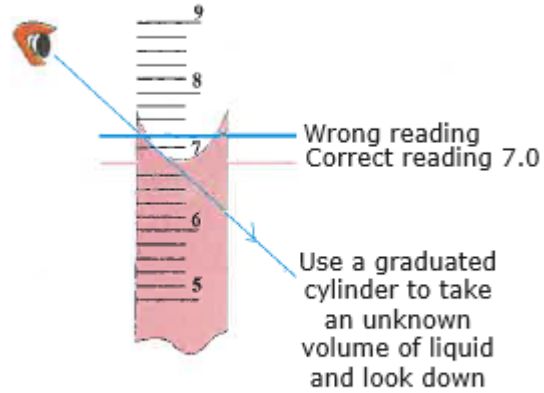

Figure 3 (Observing the measuring cylinder)

4. Measurement of Density

4.1 Calculating Density

- **Objective:** Calculate the density of a substance.
- **Formula:** Density (ρ) = Mass (M) / Volume (V)
- **Procedure:**
    - Measure the mass of the substance and its volume.
    - Use the formula to calculate density.

Figure 4 (Balance)

Figure 5 (Graduating Cylinder)

5. Measurement of Force

5.1 Using a Dynamometer (Figure 7)

- **Objective:** Measure force with a dynamometer.
- **Procedure:**
    - Observe the scale on the dynamometer to determine the value of each grid.
    - Pull the scale hook and note the force indicated by the dynamometer. (Figure 6)

Figure 6 - Dynamometer pulled

Figure 7 - Dynamomter

6. Measurement of Gravity

6.1 Using a Dynamometer and Hook Weight (Figure 8)

- **Objective:** Explore the relationship between gravity and mass.
- **Procedure:**
    - Zero the dynamometer if necessary.
    - Hook different numbers of weights and record the measured gravity.
    - **Formula:** G=mg

Figure 8

Measured object	Object mass (kg)	Gravity (N)	Ratio between Gravity/mass (N/kg)
Object 1			
Object 2			
Object 3			

7. Two-Force Balance

7.1 Understanding Two-Force Balance (Figure 9)

- **Objective:** Study equilibrium under two forces.
- **Procedure:**
    - Observe objects in equilibrium under two forces, noting how they balance. (Figure 10)

Figure 9

Figure 10

8. Friction (Figure 11-14)

8.1 Rolling Friction

- **Objective:** Measure rolling friction.
- **Procedure:**
    - Pull the cart along a horizontal surface and measure rolling friction using a spring dynamometer.
    - Repeat with different pressures on the cart and different surfaces (e.g., towel).

8.2 Sliding Friction

- **Objective:** Measure sliding friction.
- **Procedure:**
    - Turn the cart over, measure sliding friction using the same method.

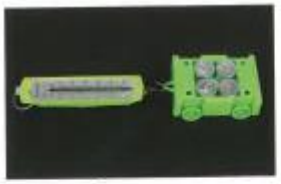

Figure 11

Figure 12

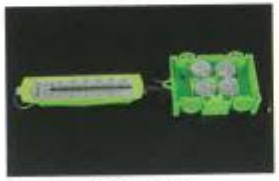

Figure 13

Figure 14

9. Liquid Pressure (Figure 15)

9.1 Measuring Liquid Pressure

- **Objective:** Observe the effect of depth on liquid pressure.
- **Procedure:**
    - Use a U-shaped tube and pressure tube to measure liquid pressure at different depths.

Figure 15

10. Estimating Atmospheric Pressure (Figure 16)

10.1 Simple Atmospheric Pressure Measurement

- **Objective:** Measure atmospheric pressure.
- **Procedure:**
    - Use a syringe to create a vacuum and measure the force with a dynamometer.
    - Calculate atmospheric pressure using the formula P=F/S, where S is the piston area.

Figure 16

11. Pressure and Pressure Effects (Figure 17)

11.1 Observing Pressure Effects

- **Objective:** Study the effect of pressure on objects.
- **Procedure:**
    - Observe how pressure affects the depth of a small table leg or tabletop in a sponge. (Figures 18 & 19)

Figure 17

Figure 18

Figure 19

12. Archimedes' Principle

12.1 Applying Archimedes' Principle

- **Objective:** Study buoyant force.
- **Procedure:**
    - Measure the gravity on an object and the water displaced by it.
    - Compare these measurements to determine the buoyant force.

Frequency	Armor gravity (N)	Dynamometer Reading in Water (N)	Buoyancy (N)	Total gravity (N)	Force on the keg (N)	Displaced water Gravity (N)
1						
2						
3						
4						

Figure 20

Figure 21

Figure 22

13. Kinetic Energy

13.1 Observing Kinetic Energy

- **Objective:** Understand kinetic energy through practical examples.
- **Procedure:**
    - Observe how moving steel and glass balls affect a wooden block and note differences in distance traveled.

Figure 23

14. Leverage

14.1 Lever Classification

- **Objective:** Understand types of levers and balance conditions.

Figure 24

Figure 25

- **Procedure:**
    - Classify levers based on the fulcrum's position.
    - Record the number of hooks and distances to analyze balance conditions.

Left		Right	
# of grids (scale)	# of hook codes	# of grids (scale)	# of hook codes

15. Pulleys and Pulley Blocks

15.1 Fixed and Moving Pulleys

- **Objective:** Compare fixed and moving pulleys.
- **Procedure:**
    - Measure force with a dynamometer through both types of pulleys.

15.2 Pulley Block Efficiency

- **Objective:** Compare single and double pulley block efficiencies.
- **Procedure:**
    - Measure and compare forces using different pulley combinations.


Figure 26


Figure 27


Figure 28


Figure 29

16. Conversion of Kietic and Potential Energy

16.1 Energy Conversion in a Pendulum

- **Objective:** Study the conversion between kinetic and potential energy. Record the changes in kinetic and potential energy as the ball moves between points a, b, and c. Please refer to figures 30 and 31.
- **Procedure:**
    - Observe the changes in energy as a pendulum moves between its highest point and equilibrium.

Figure 30

Figure 31

Movement process	a – b	b	b - c	c
Kinetic Energy				
Potential Energy				
Conversion Energy				