**EMERALD ROYAL INTERNATIONAL SCHOOL, MPAPE ABUJA**

**LESSON PLAN AND NOTE FOR WEEK 8 ENDING FRIDAY: 3rd MARCH, 2023**

**TERM:** 2nd

**WEEK:** 8th

**DATE** : 27th Feb - 3rd March, 2023

**SUBJECT:** Physics

**CLASS :** SS 2

**TOPIC: Simple Machines**

**SUB - TOPIC: 1. Lever and pulley**

**2. Inclined plane and Hydraulic press**

**3. Wheel and Axle, Gear**

**PERIOD:** 3rd

**TIME:** 9: 30 - 10:10am

**DURATION:** 40 minutes

**AVERAGE AGE:** 16 years

**SEX:** Mixed

**SPECIFIC OBJECTIVES:** By the end of the lesson, students should:

1. Define lever and pulley
2. Explain inclined plane and hydraulic press
3. Explain wheel and axle, Gear

**RATIONALE:** To enables students understand the concept of simple machines

**PREVIOUS KNOWLEDGE:** Students have being taught Machines

**INSTRUCTIONAL RESOURCES:** Charts showing Simple Machines

**REFERENCE:** Senior Secondary School Physics by P.N. Okeke et al, New School Physics for Senior Secondary Schools by Anyakoha, M.W, Comprehensive Certificate Physics by Olumuyiwa Awe and Okunola, O.O, Science Teachers Association of Nigeria Physics for Senior Secondary School, Book 1. New Edition and Melrose Physics for Senior Secondary School, Book 1 by Akano, O and Onanuga, O.O.

**LESSON DEVELOPMENT**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **STEPS** | **TEACHER’S ACTIVITIES** | **STUDENTS’ACTIVITIES** | **LEARNING POINTS** |  |  |
| **INTRODUCTION** | The teacher introduces the lesson by asking the following questions::   1. What is Simple machine? 2. Give examples of simple machines. 3. What is efficiency of a machine? | The students respond based on their previous knowledge | To arouse the students interest toward the lesion. |  |  |
| **STEP 1** | The teacher explains pulley and lever | The students pay attention. | To keep them focus. |  |  |
| **STEP 2** | The teacher explains inclined planes giving examples | The students pay rapt attention | To encourage critical thinking |  |  |
| **STEP 3** | The teacher explains wheel and axle, gear | The students listen carefully | To ensure better understanding of the lesson |  |  |
| **BOARD SUMMARY** | **SUB-TOPIC 1: Lever and pulley**  LEVER: In a lever the relative positions of force(F), Effort(e) and Load(L) may vary and this leads to different types of lever. The lever operates on the principle of moment.  FIRST ORDER LEVER: In first order lever, the fulcrum is between the load and the effort e.g crowbar, claw hammer, pliers, scissors, see-saw e.t.c    L  F  E  Y  X  taking moment about F gives;  clockwise moment = anticlockwise moment  Y x L = X x E  SECOND ORDER LEVER: In second order lever, the load is between the effort and the fulcrum. E.g wheelbarrow, bottle opener, nut cracker  F  L  E  THIRD ORDER LEVER: In third order lever, the effort is between the load and fulcrum. E.g Forearm of a human being, tongs e.t.c  SUGAR TONG  L  F  E  E  L  T  T  L  E  T  T  FIXED PULLEY  MOVABLE PULLEY  **PULLEYS:**      A simple pulley is a fixed wheel with a rope passing round a groove in its rim. A load is attached to one end of the rope while effort is applied at the other end. If there is no friction, load is equal to the effort which is equal to the tension in the rope.  L =T =E, therefore M.A =V.R  ***For a block and tackle or systems of pulley of n pulleys, the velocity ratio is equal to the number of pulley.***  Velocity ratio = number of pulley = n  VELOCITY RATIO = NUMBER OF PULLEYS =N  A system of pulley is used for lifting loads. They are used by builders for hauling heavy loads to high floors or in loading and unloading ships.  CALCULATIONS:  Example 1. The velocity ratio and efficiency of a system of pulleys are 6 and 80% respectively. How much effort is required to lift a load of mass 120kg with this system? [g = 10ms-1]  SOLUTION:  V.R = 6, Efficiency = 80%, Load = 1200N, e = ?  Calculating M.A,  **SUB-TOPIC 2: Inclined plane and hydraulic press.**  INCLINED PLANE:  An inclined plane is a sloping surface used for pulling or pushing a load up, rather than lifting them vertically.  X  h  L  E  θ  **HYDRAULIC PRESS:**  Hydraulic press is a device used to produce a very large force to compress or lift up a heavy load. It is used in the printing press where a large force presses the type with ink on it against the paper. Pressure is transmitted equally to all parts of a liquid at the same level.  **Effort**  L  E  A 1  r = radius of small piston  R =radius of large piston  A2  If A1 is the area of small piston and A2 area of the large piston, pressure(P) is transmitted equally at the same level, then  **P =** , E = P X A1  P = A2  Therefore a small effort lifts a large load.  If x and y are the distances moved by E and L respectively, A1x = A2y  **CALCULATIONS:**  Example 2. An inclined plane of angle 150 is used to raise a load of 4500N through a height of 2m. If the plane is 75% efficient, calculate i. Velocity ratio of the plane ii. Work done on the load  SOLUTION:  1. = 150, Load = 4500N, Distance moved by load = 2m, efficiency = 75%  ii. Workdone on the load = Load x distance moved by load  Workdone on the load = 4500 x 2 = 9000J.  Example 3. In a hydraulic press, a force of 40N is applied to the smaller piston of area 10cm2. If the area of the large piston is 200cm2, calculate the force obtained.  SOLUTION:  = 800N  **SUB-TOPIC 3: SCREW, WHEEL AND AXLE, GEAR.**  **Screw**  Screw, mechanical fastening device consisting essentially of an inclined plane wound spirally around a cylinder or a cone. The ridges formed by the winding planes are called threads, and depending on the intended use, the threads may be square, triangular, or rounded in cross section.      **PARTS OF A SCREW THREAD**  A screw thread is made of the following parts:  1. Thread or Lead: Is the distance along the screw's axis that is covered by one complete  rotation of the screw (360°).  2. Pitch: The distance between two corresponding points on adjacent threads  3. Plane or Start : It can be Single-start or double-start.**Single-start- means that there is only one "ridge" wrapped around the cylinder of the screw's body.Double-start" -means that there are two "ridges" wrapped around the cylinder of the screw's body Each time that the screw's body rotates one turn (360°), it has advanced axially by the width of two ridges.**    Another application of the screw is Screw jack , Ratchet brace.  When a screw is turned through one complete revolution by the application of an effort ( on the screw head, using the handle of the ratchet brace, or the Tommy bar of the screw jack), the load moves a distance equal to the pitch(P), which is the distance between consecutive threads.  R = Radius of the screw or length of the handle of the ratchet brace of length of the tommy bar.  **WHEEL AND AXLE**  A wheel and axle is really two machines in one because it consists of a wheel mounted rigidly upon an axle or drum of smaller diameter, the wheel and the axle having the same axis.  The wheel & axle device is similar to the lever simple machine. The wheel acts as the lever and the axle acts as a fulcrum. The lever applies force to the fulcrum, causing something to move.      If a rope is fixed onto the wheel and wound round it, leaving a free end where an effort E is to be applied, the rope attached to the axle is wound round in the opposite direction and the load attached to the free end, For each complete rotation of the wheel, there is one complete rotation of the axle.  Let a and b be the radii of the wheel and axle respectively. Then    **Applications of the wheel and axle are:**  steering wheel of an automobile  Doorknob  windlass.  treadmill  windmill  waterwheel  **GEAR:**  Gear is a toothed wheel or cylinder used to transmit rotary or reciprocating motion from one part of a machine to another. Two or more gears, transmitting motion from one shaft to another, constitute a gear train.    Gear work on the wheel and axle principle. If toothed wheel A drives wheel B resulting in turning forces, | The students copy notes into their exercise book | For future reference. |  |  |
| **Evaluation** | The teacher evaluates the students with the following questions:   1. Define Lever and pulley 2. Explain Inclined plane and Hydraulic press 3. Explain Wheel and Axle, Gear | The students attempt the questions. | To ascertain their level of understanding. |  |  |
| **Conclusion** | The teacher concludes the lesson by making corrections where necessary and go through their notes. | The students copy the note on the board. | For future use. |  |  |
| **Assignment** | The teacher gives the students assignment as follows::   1. A man pulls up a box of mass 70kg using an inclined plane of effective length 5m onto a platform 2.5m high at uniform speed. If the frictional force between the box and the plane is 100N, draw the diagram of all the forces acting on the box when in motion and calculate the 2. Minimum effort applied in pulling up the box 3. Velocity ratio of the plane 4. Mechanical advantage of the plane 5. Efficiency of the plane 6. Energy lost in the system 7. Work output of the man 8. Total power developed by the man given that the time taken to raise the box onto the platform is 50s. ( g = 10m/s2) 9. A screw jack whose pitch is 4.4mm is used to raise a body of mass 8000kg through a height of   20cm. The length of the tommy bar of the jack is 70cm. If the efficiency of the jack is 80%, calculate the:  i. velocity ratio of the jack. ii. Mechanical advantage of the jack  iii. Effort required in raising the body. iv. Work done by the effort in raising the body  (g = 10m/s2,  **WEEKEND ASSIGNMENT**:  1 .A screw jack with a tommy bar of length 12cm is used to raise a car through a vertical height of 25cm  by turning the tommy bar through 50 revolutions. Calculate the approximate velocity ratio of the  jack. []  (A) 2 (B) 3 (C) 13 (D) 151 (E) 654  2. A screw jack with a tommy bar of length 12cm is used to raise a car through a vertical height of  25cm by turning the tommy bar through 50 revolutions. Calculate the approximate velocity ratio  of the jack. []  (A) 2 (B) 3 (C) 13 (D) 151 (E) 654  3. The radius of a wheel is 30.0cm and that of its axle is 6.0cm. Calculate the effort required to lift a  load of 12.0N using this machine assuming 100% efficiency.  (A) 12N (B) 120 (C) 24N (D) 30N  4. A wheel and axle of radii 800mm and 200mm respectively is used to raise a body of weight 800N  by the application of 250N. Calculate the efficiency of the machine.  (A) 85% (B) 80(C) 60% (D) 20%  5. Which of the following statements correctly defines a simple machine?  (A) that can produce electric current.  (B) which can only carry people from one place to another.  (C) with which work can be done easily.  (D) which changes the state of rest or uniform motion of an object.    ESSAY  1a. List two examples of a simple machine.  b. Explain the statement that the velocity ratio of a machine is 5.  c. A screw jack, 25% efficient and having a screw of pitch 0.4cm is used to raise a load through  a certain height. If in the process the handle turns through a circle of radius 40.0cm, calculate  the i. Velocity ratio of the machine. ii. Mechanical advantage of the machine.  iii. effort required to raise a load of 1000N with the machine. ( take π = 3.14)  d. List four types of machines.  e. A pulley system with a velocity ratio of 6 is used to raise a load of 80N through a vertical  height of 16m,   1. Draw a diagram of this arrangement 2. Calculate the effort required in the system, if its efficiency is 70%. Calculate the workdone.. | The students copy assignment solve at home and submit for marking endorsement. | To encourage further studying at home. |  |  |



23/3/2023

Principal Head Instructor