2.0 MEASUREMENT AND UNIT

2.1 INTRODUCTION

Measurement play a viral role in physics, but they can never be perfectly corrected. We usually discovered that the reading accuracy of the measuring instrument specify the measurement only in the correct number of significant figures.

2.2 MEASURING INSTRUMENT

Measuring instrument are tools used in the field of science, especially in physics for getting exact measurements of an objects. Instruments used for measuring in physics include: Vennier callipers, Metre rule, Mirometer screw guage, Thermometer, Voltmeter, Ammeter, Measuring cylinder etc.

2.3 MEASUREMENT OBJECTS

(I) LEVER BALANCE: This is used to measure mass directly. A graduated scale is provided to measure the mass directly in kilogram.

(II) BEAM BALANCE: This is mostly used in measuring unknown mass. The unknown mass on an object is placed in the first scale pan A, While an object of known scale pan is placed in B. If the mass in B does not show any deflection against the balance mark C, the pointer is directed to the balance mark. This implies that the total mass in B is equal to the value of the known mass in A.

(III) SPRING BALANCE: This is an instrument used to measure the weight of an object.

2.4 MEASUREMENT OF TIME

Time is the duration of an event and its measured in seconds. Measurement of time works on the principle of constant oscillation. The standard unit of time is seconds (s). Examples: Ticker tape timer, Stop watch, Sand clock, Simple pendulum, Heart beat.

MEASUREMENT OF DISTANCE

(i) The metre rule
(ii) Micro-metre screw guage
(iii) Vennier callipers

MASS AND WEIGHT

Mass is define as the quantity of matter in a body. This gives the exact values of a substance (which is the quantity of the substance) no matter where it is measured. It is measured in kilogram, e.g The mass of body, such as block,motor,load.

The weight of an object is define as the earth pull of the body, i.e Force acting on an object due to gravitational pull of the earth. it is denoted by w and measured in Newton (N) it is a vector quantity which varies from place to place on earth's surface of the:

(i) distance of a polar axis object to the center of the earth
(ii) shape of the earth, which is not perfectly spherical
(iii) magnitude of the force of attraction of the body to the center of the earth.

N.B: Acceleration due to gravity is more at the poles and less at the equator.

The relationship btw the mass and weight

w = mass x weight

w = m(kg) x g

w = mg (where g = 10m/s^2)

EXAMPLE:

Calculate the weight of an object whose mass is 5kg [g = 10m/s^2]

Solution: Weight = mass x acceleration due to gravity

w = 5 x 10

w = 50N

2.5 DIFFERENT BETWEEN MASS AND WEIGHT

MASS

>> It is the quantity of matter present in a body
>> mass is constant
>> it is a scalar quantity
>> The unit is kg
>> It is measure by beam balance

WEIGHT

>> It occurs due to force of gravity acting on object
>> Weight varies

>> It is a vector quantity
>> The unit is Newton (N)
>> It is measured by spring balance

2.6 FUNDAMENTAL AND DERIVED QUANTITY

Fundamental Unit: These are the accepted standard units or measures in which measurement is made. Fundamental units frequently used in physics are

(i) Metre as the unit of length
(ii) Kilogram as the unit of mass
(iii) Seconds as unit of time
(iv) Ampere as unit of current
(v) Candela as unit of luminous intensity
(vi) Kelvin as unit of temperature
(vii) Weber as unit of magnetic flux

Derived Unit: These are new units derived from fundamental units. They are derived from combinations of fundamental units. The units of acceleration is metre per sec square (m/s^2), velocity is metre per second (m/s), volume is metre (m).

2.7 DIFFERENCE BTW FUNDAMENTAL AND DERIVED UNIT

FUNDAMENTAL UNIT

>> They are standard units of measurement.
>> They are generally accepted all over the world
>> They form the basis of measurement
>> They are accepted by international organisation
>> They are known as SI unit

DERIVED UNIT

>> They are not standard unit of measurement
>> Not all are generally accepted all over the world
>> They are not the basis of measurement
>> Though accepted internationally, they are formulated by individuals
>> They are known as unit

2.8 FUNDAMENTAL AND DERIVED QUANTITY

FUNDAMENTAL QUANTITY: Are the basic quantities that provide the standard units of measurement. E.g "Length, mass, time, temperature, current, luminous intensity,

magnetic flux"

DERIVED QUANTITY: Are the quantities obtained from the fundamental quantities inform of combination. E.G "Velocity, Acceleration, Force, Momentum"

DIFFERENCE BTW FUNDAMENTAL AND DERIVED QUANTITY

FUNDAMENTAL QUANTITY

>> They are generally accepted quantities
>> They are based on international system
>> They can stand alone
>> They have direct calculations
>> They are basic unit of measurement

DERIVED QUANTITY

>> They are just accepted
>> They are formulated from international system
>> They cannot stand alone
>> Their calculations are derieved
>> They are not basic unit of measurement

REVISION EXERCISE

[1] Name the 3 fundamental quantities in science and their respectively units
[2] Distinguish between mass and weight
[3] What is Fundamental unit
[4] What is Fundamental quantities
[5] What is derived quantities
[6] Define dimension
[7] Name 5 fundamental quantities and their respective or associated fundamental units
[8] What is Adhesive force
[9] Name the instrument that can be used to measure length
[1o] Name the instrument that can be used to measure temperature