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**Pakistan School , Kingdom of Bahrain**

**E- Support and Learning Material / Session 2020-2021**

**Subject: Physics Grade : 11**

**Book: Physics Grade 11 by KPKTB Peshawar First Term**

***NOTE: FOR HSSC CLASSES PRESCRIBED TEXTBOOKS ARE THE MAIN SOURCE OF INFORMATION. FOLLOW THE TEXTBOOK ACCORDING TO ONLINE LECTURES. SAMPLE NOTES ARE PROVIDED FOR YOUR ASSISSTANCE.***

**Chapter 1: Measurement**

**Q # 1.Define Physics? Describe its main areas of research.**

**Ans.** Physics is the branch of science that deals with matter, energy and the relationship between them. The study of physics involves laws of motion, the structure of space and time, the nature and types of forces, the interaction between different particles, the interaction of radiation with matter etc.

**Q # 2.What do you know about the natural philosophy?**

**Ans.** Initially, the observations of man about the world around him give birth to the single discipline of science, called natural philosophy.

**Q # 3.Differentiate among the physical and biological sciences.**

**Ans.** There was a huge increase in the volume of scientific knowledge up till the beginning of

nineteenth century and it was found necessary to classify the natural philosophy into two branches, the physical sciences and the biological sciences:

**Physical Sciences Biological Sciences**

i) Physical sciences deal with non-living things.

Examples: Physics, Chemistry, Astronomy

ii) Biological sciences deal with living things.

Examples: Zoology, Botany etc.

**Q # 4.Describe the main frontiers of fundamental sciences.**

**Ans.** The main frontiers of the fundamental sciences are as follows:

* The world of extremely large, that includes the study universe itself, the information from the far side of the universe and the big bang.
* The world of extremely small, that of the particles such as electrons, protons, neutrons etc.
* The world of complex matter and it is also the world of middle sized things, from molecule at one extreme to the earth at the other. This is all fundamental physics, which is the heart of science.

**Q # 5.Describe the birth of modern Physics. Also define the following branches of modern**

**physics:**

**(i) Nuclear Physics (ii) Particle Physics (iii) Relativistic Mechanics (iv) Solid State Physics**

**Ans.** By the end of the 19th century, many physicists started believing that everything about physics has been discovered. However, about the beginning of 20th century, many new experimental facts revealed that the laws formulated by the earlier scientists need modifications. Further researches gave birth to many new disciplines which are known as modern Physics. Some braches of modern Physics

are as follows:

**(i) Nuclear Physics:** The nuclear physics deals with the atomic nuclei.

**(ii) Particle Physics:** It deals with the ultimate particles with which the matter is

composed.

**(iii) Relativistic Mechanics:** It deals with motion of bodies which moves with very large

velocities (approaching that of light).

**(iv) Solid State Physics:** The solid state physics deals with structure and properties of matter.

**Q # 6.Write down the significance of science and technology. Also describe the role of physics in**

**the development of science and technology?**

**Ans.** Modern tools of science and technology have brought all parts of world in close contact. The information media and fast means of communications have made the world a global village. The computer networks play pivotal role in the development of science and technology. The computer networks are the products of chips developed from basic ideas of physics.

**MULTIPLE CHOICE QUESTIONS**

**1.** The branch of physics which deals with the ultimate particles of which the matter is composed is:

a) Plasma physics

b) Atomic physics

c) Nuclear physics

d) Particle physics

**2.** The sciences which deals with non-living

things are called:

a) Natural Philosophy

b) Biological Sciences

c) Physical Sciences

d) None of these

**3.** Silicon is abundantly obtained from:

a) Water

b) Metal

c) Sand

d) Stones

**1.2 PHYSICAL QUANTITIES:**

**Q # 7.What do you know about physical quantities? Also describe their significance.**

**Ans.** The quantities that can be measured and are used to describe the properties of matter are called physical quantities.

**Significance:** The foundation of physics rest upon physical quantities in terms of which the laws of physics are expressed.

**Q # 8.Differentiate among the base and derived quantities.**

**Base Quantities Derived Quantities**

(i) The base quantities are those physical quantities in terms of which other physical quantities are defined.

Examples: Mass, length, time

(iI) The quantities that are derived from the base quantities are called derived quantities.

Examples: Velocity, acceleration, force

**Q # 9.How the base quantities are measured?**

**Ans.** The measurement of base quantity involves two steps:

(i) The choice of a standard.

(ii) The establishment of a procedure for comparing the quantity to be measure with standard.

**Q # 10.What are the characteristics of an ideal standard?**

**Ans.** An ideal standard has two principle characteristics.

(i) It is accessible

(ii) It is invariable

**Q # 11.Name several repetitive phenomena occurring in nature which can serve as reasonable**

**time standards.**

**Ans.** Any natural phenomenon that repeats itself after exactly same time interval can be used as time standard. The following natural phenomenon can be used as time standard.

**(i)** The rotation of earth around the sun and about its own axis

**(ii)** The rotation of moon around earth

**(iii)** Atomic vibrations in solids

**Q # 12.Give the drawbacks to use the time period of a pendulum as a time standard.**

**Ans.** The drawbacks to use the time period of a pendulum as a time standard are

**(i)** The value of „g‟ changes at different places

**(ii)** The variation in the length of simple pendulum due to change in temperature in different

seasons

**(iii)** Air resistance may affect the time period of simple pendulum

**1.3 INTERNATIONAL SYSTEM OF UNITS**

**Q # 13.What do you know about international system of units?**

**Describe its significance.**

**Ans.**In 1960, an international committee agreed on a set of definitions and standards to describe the physical quantities. The system that was established is called System International of units.

**Significance:** Due to simplicity and convenience with which the units in this system are amenable to arithmetic manipulation, it is in universal use by the world’s scientific community.

**Q # 14. Define following?**

**(i) Base Units (ii) Supplementary Units (iii) Derived Units (iv)**

**Radian (v) Steradian**

**Ans. (i) Base Units:** The units associated with the base quantities

are called base units. The names of base units together with symbols are listed in following table:

**Physical Quantity SI Unit Symbol**

|  |  |
| --- | --- |
| Length meter | m |
| Mass kilogram | kg |
| Time second | s |
| Electric Current ampere | A |
| Thermodynamic Temperature kelvin | K |
| Intensity of Light candela | cd |
| Amount of Substance mole | mol |

**(ii) Supplementary Units:** The General Conference on Weights and Measures has not yet classified

certain unit of SI under either base or derived units. These SI units are called derived supplementary units. Radian and steradian are supplementary units.

**(iii) Derived Units:** SI units derived from base and supplementary units are called derived units.

Some of the derived units are given in the following table:

**Physical Quantity SI Unit Symbol**

Plane Angle radian rad

Solid Angle steradian sr

**(iv) Radian:** The 2D angle between two radii of a circle corresponding to the arc length of one radius on its circumference is called radian.

**(v) Steradian:** It is the 3D angle subtended at the center of the sphere corresponding to its surface area equal to the square of radius of sphere.

**Q # 15.Why we use it useful to have two units for the amount of substance, the kilogram and the**

**mole?**

**Ans.**Both units,the kilogram and mole, are useful in different cases describe below

The unit kilogram is useful when we want to describe the macroscopic behavior of an object

without considering the number of atoms, molecules or ions present in it.

The unit mole is useful when we want to consider a particular number of atoms of a system. It

is used to determine the microscopic behavior of any object.

**Q # 16.What do you mean by scientific notation?**

**Ans.**The standard form to represent numbers using power of ten is called scientific notation. It

scientific notation, a measurement is expressed as a decimal number between 1 and 10 followed by an

integer power of 10.

**Self Assessment:**

**Q # 17. A light year is the distance light travels in one year. How many meters are there in one**

**light year?**

**Q # 18.**

**(i) How many seconds are there in 1 year?**

**(ii) How many nanoseconds in 1 year?**

**(iii) How many years in 1 second?**

**MULTIPLE CHOICE QUESTIONS**

**1.** The number of base units are:

a) Three

b) Five

c) Seven

d) Nine

**2.** Which of the following is a derived

quantity:

a) Force

b) Mass

c) Length

d) Time

**3.** Which of the following is SI base unit?

a) gram

b) slug

c) newton

d) kilogram

**4.** Which one of the following is not a unit

of length:

a) Angstrom

b) Micron

c) Radian

d) Light year

**5.** The SI unit of plane angle is

a) Steradian

b) Radian

c) Degree

d) Candela

**6.** The solid angle subtended at the center

of sphere by an area of its surface equal

to the square of radius of the sphere is

called:

a) Degree

b) Radian

c) Minute

d) Steradian

**7.** The unit of force is\_\_\_\_\_\_\_\_ and its

symbol is \_\_\_\_\_\_\_ which is the correct

pair?

a) Newton, n

b) Newton, N

c) newton, n

d) newton, N

**8.** Which of the following is least multiple:

a) Pico

b) Femto

c) Nano

d) Atto

**1.4 ERROR AND UNCERTAINITIES**

**Q # 19. Define error. Also describe possible causes of error.**

**Ans.**The difference between the observed and true value of a physical quantity is called error. The

errors may occur due to following reasons.

(i) Negligence or inexperience of a person

(ii) The faulty apparatus

(iii) Inappropriate method or technique

**Q # 20.Define the term Uncertainty. Also describe its main causes.**

**Ans.** Uncertainty is the range of values within which the true value of measured quantity is asserted to lie. The uncertainty in a measurement may occur due to following reason:

(i) Inadequacy or limitation of an instrument

(ii) Natural vibrations of the object being measured

(iii) Natural imperfections of a person’s senses

**Q # 21.Differentiate among the random and systematic error.**

**Random Error Systematic Error**

(i) If the repeated measurements of a quantity give different values under same conditions, then the error is called random error.

(ii) The random error occurs due to some unknown causes

(iii) Repeating the measurement several times and taking an average can reduce the effect of random error.

(i) Systematic error refers to the effect that influences all measurement of a particular quantity equally.

(ii) It may occur due to zero error of the instrument, poor calibration or incorrect marking etc.

(iii) The systematic error can be reduced by comparing the instrument with another which is known to be more accurate.

**Q # 22.The time period of the simple pendulum is measured by a stop watch. What types of**

**errors are possible in the time period?**

**Ans.**The possible errors that might occur are the personal errors and systematic errors. The personal

error occurs due to negligence or inexperience of a person, while the systematic may be due to the

poor calibration of equipment or incorrect marking etc.

**MULTIPLE CHOICE QUESTIONS**

**1.** Error occurs due to negligence and inexperience of a person is:

a) Systematic Error

b) Random Error

c) Personal Error

d) None of these

**2.** Error in measurement may occur due to

a) Inexperience of a person

b) The faulty apparatus

c) Inappropriate method

d) Due to all reasons in a, b and c

**1.5 SIGNIFICANT FIGURES**

**Q # 23. What are the significant figures? Describe their significance.**

**Ans.**In any measurement, the accurately known digits and the first doubtful digit are called the significant figures. The uncertainty or accuracy in the value of a measured quantity is indicated by significant figures.

**Q # 24. An old saying is that “A chain is only as strong as its weakest link”. What analogous**

**statement can you make regarding experimental data used in computation?**

**Ans.** The analogous statement for experimental data used in computation will be

*“The result obtained by computation of experimental data is only as much accurate as its least*

*accurate reading in measurements”.*

**Q # 25.Three students measured the length of a needle with a scale on which minimum division**

**is 1 mm and recorded as (i) 0.2145 m (ii) 0.21 m (iii) 0.214m. Which record is correct and why?**

**Ans.**The record (iii) is correct.

**Reason:** As the scale used for measurement has the least count of 1 mm = 0.001 m. So the reading

must be taken up to three decimal places when it is written in meters. Therefore, the reading 0.214 m

is correct.

**Q # 26. Write down the final result of following computation up to appropriate precision.**

**(i)** The final result up to appropriate precision is . It is because of the reason that thefactor, is the least accurate measurement which has three significant figures.Therefore the answer should be written to the three significant figures.

**(ii)** The final result up to appropriate precision is . It is because of the reasonthat the factor has smallest number of decimal places. Thus, the answershould be rounded off to one decimal place.

**1.6 PRECISION AND ACCURACY**

**Q # 27. Differentiate among precision and accuracy.**

**Precision Accuracy**

**(i)** The precise measurement is one which has least absolute uncertainty.

**(ii)** The precision of measurement depends on the instrument or device being used.

**(i)** An accurate measurement is one which has less fractional or percentage uncertainty.

**(ii)** The accuracy in any measurement not only depends on instrument being used, but also on

the total measurement taken.

**MULTIPLE CHOICE QUESTIONS**

**1.** In any measurement the significant figures are

a) All accurately known and all doubtful digits

b) Only accurately known digits

c) Only doubtful digits

d) All accurately know digits and the first doubtful digit

**3 .** What is the number of significant figures in the measurement recorded as

a) 1

b) 3

c) 4

d) 7

**4 .** Zero is not significant only if it

a) Lies to the left of a significant digit

b) is between two digits

c) is to the right of a significant digit

d) is before the decimal point

**1.7 ASSESMENT OF TOTAL UNCERTAINTY IN THE FINAL RESULT**

**1.7.1 ADDITION AND SUBTRACTION:** For assessment of total uncertainty in final result of addition

and subtraction, the absolute uncertainties are added.

**1.7.2 MULTIPLICATION AND DIVISION:** Percentage uncertainties are added for assessment of total

uncertainty in the final result of multiplication and division.

**1.7.3 POWER FACTOR:** In order to assess the total uncertainty for the case of power factor, we

multiply the percentage uncertainty by the power.

**1.7.4 UNCERTAINTY IN AVERAGE VALUE OF MANY MEASUREMENTS**

The uncertainty in average value of many measurements is equal to the mean deviation.

**Q # 28. The six measurements were taken of the diameter of wire using screw gauge which are 1.20,**

**1.22, 1.23, 1.19, 1.22, 1.21. Determine the uncertainty in final result.**

**Given Data:** Measurements of diameter of wire (in mm) are

**Calculations:**Average diameter of wire =

Deviation of each measurement from average value are

Mean Deviation =

Thus uncertainty in mean value of diameter

Hence Diameter of wire =

**1.7.5 UNCERTAINTY IN TIMING EXPERIMENT**

The uncertainty in the time period of a vibrating body is found by dividing the least count of the timing

device by the number of vibrations.

**1.8 DIMENSIONS OF PHYSICAL QUANTITIES**

**Q # 29.What do you know about the dimension analysis?**

**Ans.** To express any physical quantity in terms of specific symbols of corresponding base quantities,

written within square brackets, is called the dimension of that physical quantity. The scientific symbols used to express the dimensions of different physical quantities are as follows:

**Q # 30.What are the advantages of dimension analysis?**

**Ans.**The dimension analysis may be used for

(i) Checking the correctness of a physical equation

(ii) Deriving a possible formula of a physical quantity

**MULTIPLE CHOICE QUESTIONS**

**1.** An accurate measurement is one which

has less:

a) Precision

b) Absolute uncertainty

c) Fractional uncertainty

d) None

**2.** Absolute uncertainties are added in

following operations:

a) Multiplication

b) Division

c) Subtraction

d) None

**3.** Which one of the following is not

regarded as a fundamental quantity in

Physics?

a) Length

b) Mass

c) Time

d) Weight

**4.** The dimension of the following pair is not

the same

a) work & energy

b) work and torque

c) Momentum & impulse

d) Mass & moment of inertia

**5.** Unit of G is ?

a) Nm2 kg2

b) N m2 kg

c) N m2 kg-2

d) None

**6.** The dimensions of strain are

a) [MLT2]

b) [ML-2T]

c) [Mo Lo To]

d) [M-1L-1T-1]

**Homework:**

**Q # 1.A light year is the distance light travels in one year. How many meters are there in one**

**light year?**

**Q # 2.**

**(i) How many seconds are there in 1 year?**

**(ii) How many nanoseconds in 1 year?**

**(iii) How many years in 1 second?**