Important Questions for Class 11 Physics Chapter 1: Chapter 1 of Class 11 Physics, "Units and Measurement," focuses on the fundamental concepts of physical quantities and their units. Key topics include the importance of measurement in physics, types of physical quantities (scalar and vector), and the system of units.

The chapter also covers the International System of Units (SI units), unit conversion, and dimensional analysis. Important questions often involve calculating physical quantities using SI units, converting units, understanding significant figures, and applying dimensional analysis to verify formulas or equations. Mastery of these concepts is essential for accurately solving problems in physics.

Important Questions for Class 11 Physics Chapter 1 Overview

Chapter 1 of Class 11 Physics, "Units and Measurement," lays the foundation for understanding physical quantities, measurement techniques, and unit systems. It is crucial for grasping the basics of all physics concepts, as accurate measurement forms the basis for experimental data and theoretical analysis.

Important questions from this chapter focus on SI units, conversion between different units, and dimensional analysis, which helps verify physical equations and solve problems. Mastering these topics is essential for developing problem-solving skills, ensuring precision in experiments, and providing a clear understanding of the measurement systems used in scientific work across various fields.

Important Questions for Class 11 Physics Chapter 1 Units and Measurement

Below is the Important Questions for Class 11 Physics Chapter 1 Units and Measurement -

1. What is the difference between A◦A◦ and A.U.?

Ans: Angstrom ($\overset{o}{A}$) and astronomical unit (A.U.) are both the units of distance.

However, their values are very different. Their values in SI unit of distance are: $1A^0 = 10^{-10}m$ and $1A.U. = 1.496 \times 10^{11}m$.

2. Define S.I. Unit of Solid Angle.

Ans: The SI unit of solid angle is steradian. One steradian is defined as the angle made by a spherical plane of unit square meter area at the centre of a sphere with radius of unit length.

3. Name Physical Quantities Whose Units are Electron Volt and Pascal.

Ans: The physical quantities whose units are electron volt and pascal are energy and pressure respectively.

4. Fill ups.

a. $3.0m/s^2 = \ldots\ldots\ldots\ldots km/hr^2$

Ans:

$3.0m/s^2 = \ldots\ldots\ldots\ldots km/hr^2$

We have, $1m = 10^{-3}km$

$1hr = 3600s$

$\Rightarrow 1s^2 = \left(\frac{1}{3600}\right)^2 hr^2$

Then,

$3.0m/s^2 = \frac{3\times10^{-3}}{\left(\frac{1}{3600}h\right)^2} km/hr^2$

$\therefore 3.0m/s^2 = 3.9 \times 10^4 km/hr^2$

b. $6.67 \times 10^{-11} Nm^2/kg^2 = \ldots\ldots\ldots\ldots g^{-1}cm^3s^{-2}$

Ans:

We have,

$1N = 1kgms^{-2}$

$1kg = 10^{-3}g$

$1m^3 = 10^6 cm^3$

$$\Rightarrow 6.67 \times 10^{-11} Nm^2kg^{-2} = 6.67 \times 10^{-11} \times \left(1kgms^{-2}\right)\left(1m^2\right)\left(1s^{-2}\right)$$

$$= 6.67 \times 10^{-11} \times \left(1kg \times 1m^3 \times 1s^{-2}\right)$$

$$= 6.67 \times 10^{-11} \times \left(10^{-3}g^{-1}\right)\left(10^6 cm^3\right)\left(1s^{-2}\right)$$

$$\therefore 6.67 \times 10^{-11} Nm^2/kg^2 = 6.67 \times 10^{-8} cm^3s^{-2}g^{-1}$$

Very Short Questions and Answers (2 Marks Questions)

1. When a planet X is at a distance of 824.7 million kilometres from earth its angular diameter is measured to be 35.72″ of arc. Calculate the diameter of planet X.

Ans:

Distance between planet X and earth, $r = 824.7 \times 10^6 km$.

The angular diameter θ is given to be,

$\theta = 35.72''$

$\theta = \frac{35.72}{60 \times 60} \times \frac{\pi}{180} radian$

Diameter $l = ?$

We have the relation,

$l = r\theta$

$\Rightarrow l = 824.7 \times 10^6 \left(\frac{35.72}{60 \times 60} \times \frac{\pi}{180}\right)$

$\therefore l = 1.429 \times 10^5 km$

2. A Radar Signal Is Beamed Towards a Planet from the Earth and Its Echo is Received Sever Minutes Later. Calculate the Velocity of the Signal, If the Distance Between the Planet and the Eartr is $6.3 \times 10^{10} m$.

Ans:

Time after which the echo is received, $t = 7 \min = 7 \times 60 s$.

Distance between the planet and earth, $x = 6.3 \times 10^{10} m$.

The net distance covered while the radar signal reaches the planet and echo to reach back to earth $2x$.

We know that the velocity is defined as the net distance covered per total time taken. So,

$c = \frac{2x}{t}$

$\Rightarrow c = \frac{2 \times 6.3 \times 10^{10}}{7 \times 60}$

$\therefore c = 3 \times 10^8 m/s$

3. Find the Dimensions of Latent Heat and Specific Heat.

Ans:

It is known that:

$$\text{Latent Heat} = \frac{Q(\text{Heat energy})}{m(\text{mass})}$$

$$\text{Dimension of Latent Heat} = \frac{ML^2T^{-2}}{M} = [M^0L^2T^{-2}]$$

Specific Heat:

$$S = \frac{Q}{m\Delta T}$$

$$\Rightarrow [S] = \frac{[Q]}{[m\Delta T]} = \frac{ML^2T^{-2}}{M \times K}$$

$$\therefore [S] = [M^0L^2T^{-2}K^{-1}]$$

4. What are the dimensions of 'a' and 'b' in Vander Waals equation $\left(P + \frac{a}{V^2}\right)(V - b) = RT$?

Ans: We know that physical quantities undergoing addition or subtraction should be of the same dimension.

So, $\frac{a}{V^2}$ will have the same dimensions as P and b will have the same dimensions as V.

So,

$$[P] = \left[\frac{a}{V^2}\right] \Rightarrow [a] = [PV^2]$$

$$\Rightarrow [a] = \left[\frac{F}{A} \times V^2\right]$$

$$\Rightarrow [a] = \frac{[MLT^{-2}]}{[L^2]} \times [L^3]^2$$

$$\Rightarrow [a] = \frac{MLT^{-2}L^6}{L^2}$$

Therefore, the dimension of 'a' would be,

$$\therefore [a] = [ML^5T^{-2}]$$

Also, $[b] = [V]$

Therefore, the dimension 'b' would be,

$$\therefore [b] = [M^0L^3T^0]$$

5. If E, m, l and G denote energy, mass, angular momentum and gravitational constant respectively, determine the dimensions of $\frac{EL^2}{m^5G^2}$.

Ans:

We have, dimensions of:

$E = [ML^2T^{-2}]$

$L = [ML^2T^{-1}]$

$m = [M]$

$G = [M^{-1}L^3T^{-2}]$

Now, the dimensions of $\frac{EL^2}{m^5G^2}$ could be written as,

$= \frac{[ML^2T^{-2}][ML^2T^{-1}]^2}{[M]^5[M^{-1}L^3T^{-2}]^2}$

$= \frac{M^3L^6T^{-4}}{M^3L^6T^{-4}} = 1$

Therefore, the given term is dimensionless.

6. Calculate the time taken by light to pass through a nucleus of diameter $1.56 \times 10^{-16} m$. (Take tl speed of light to be $c = 3 \times 10^8 m/s$).

Ans:

We know that speed could be defined as the total distance covered per unit time. Mathematically,

$c = \frac{x}{t}$

$\Rightarrow t = \frac{x}{c}$

Here, the net distance covered is the diameter of the nucleus. Now, on substituting the given values, we get,

$t = \frac{1.56 \times 10^{-16}}{3 \times 10^8}$

$\therefore t = 5.2 \times 10^{-25} s$

Therefore, we found that light takes $t = 5.2 \times 10^{-25} s$ to cross the given nucleus.

7. Explain This Statement Clearly:

"To Call a Dimensional Quantity 'large' or 'small' Is Meaningless Without Specifying a Standard for Comparison". in View of This, Reframe the Following Statements Wherever Necessary:

Ans: The given statement is true because a dimensionless quantity may be large or small, but there should be some standard reference to compare that. For example, the coefficient of friction is dimensionless but we could say that the coefficient of sliding friction is greater than the coefficient of rolling friction, but less than static friction.

A. Atoms are Very Small Objects.

Ans: An atom is very small compared to a soccer ball.

B. A Jet Plane Moves With Great Speed.

Ans: A jet plane moves with a speed greater than that of a bicycle.

C. The Mass of Jupiter Is Very Large.

Ans: Mass of Jupiter is very large compared to the mass of a cricket ball.

D. The Air Inside This Room Contains a Large Number of Molecules.

Ans: The air inside this room contains a large number of molecules as compared to that contained by a geometry box.

E. A Proton Is Much More Massive Than an Electron.

Ans: A proton is more massive than an electron.

F. The Speed of Sound Is Much Smaller Than the Speed of Light.

Ans: Speed of sound is less than the speed of light.

8. Explain This Common Observation Clearly: If You Look Out of the Window of a Fast-Moving Train, the Nearby Trees, Houses Etc. Seem to Move Rapidly in a Direction Opposite to the Train's Motion, but the Distant Objects (hill Tops, the Moon, the Stars Etc.) Seem to Be Stationary. (in Fact, Since You Are Aware That You Are Moving, These Distant Objects Seem to Move With You).

Ans: Line-of-sight is defined as an imaginary line joining an object and an observer's eye. When we observe nearby stationary objects such as trees, houses, etc. while sitting in a moving train, they appear to move rapidly in the opposite direction because the line-of-sight changes very rapidly.

On the other hand, distant objects such as trees, stars, etc. appear stationary because of the large distance. As a result, the line-of-sight does not change its direction rapidly.

Short Questions and Answers (3 Marks Questions)

1. Just as precise measurements are necessary in Science; it is equally important to be able to make rough estimates of quantities using rudimentary ideas and common

observations. Think of ways by which you can estimate the following (where an estimate is difficult to obtain, try to get an upper bound on the quantity):

1. **The Total Mass of Rain-Bearing Clouds Over India During the Monsoon.**

For estimating the total mass of rain-bearing clouds over India during the Monsoon:

During monsoons, a meteorologist records about 215 cm of rainfall in India i.e., the height of the water column, $h = 215\ cm = 2.15\ m$

We have the following information,

Area of country, $A = 3.3 \times 10^{12} m^2$

Hence, the volume of rainwater, $V = A \times h = 7.09 \times 10^{12} m^3$

Density of water, $\rho = 1 \times 10^3 kg\, m^{-3}$

We can find the mass from the given value of density and volume as,

$M = \rho \times V = 7.09 \times 10^{15} kg$

Hence, the total mass of rain-bearing clouds over India is approximately found to be $7.09 \times 10^{15} kg$.

b. The Mass of an Elephant.

Ans:

For estimating the mass of an elephant:

Consider a ship floating in the sea whose base area is known. Measure its depth at sea (say d_1).

Volume of water displaced by the ship would be, $V_b = Ad_1$

Now one could move an elephant on the ship and then measure the depth of the ship (d_2).

Let the volume of water displaced by the ship with the elephant on board be given as $V_{be} = Ad_2$.

Then the volume of water displaced by the elephant $= Ad_2 - Ad_1$.

If the density of water $= D$

Mass of an elephant would be $M = AD(d_2 - d_1)$.

c. The Wind Speed During a Storm.

Ans: Estimation of wind speed during a storm:

Wind speed during a storm can be measured by using an anemometer. As wind blows, it rotates and the number of rotations in one second as recorded by the anemometer gives the value of wind speed.

d. The Number of Strands of Hair on Your Head.

Ans: Estimation of the number of strands of hair on your head:

Let the area of the head surface carrying hair be A.

The radius of a hair can be determined with the help of a screw gauge and let it be r .

$\therefore$ Area of one hair strand $= \pi r^2$

Number of strands of hair $\approx \frac{\text{Total surface area}}{\text{Area of one hair}} = \frac{A}{\pi r^2}$

e. The Number of Air Molecules in Your Classroom.

Ans:

Estimation of the number of air molecules in your classroom:

Let the volume of the room be V.

We know that:

One mole of air at NTP occupies $22.4\,l$ i.e., $22.4 \times 10^{-3} m^3$ volume.

Number of molecules in one mole $N_A = 6.023 \times 10^{23}$ (Avogadro number)

$\therefore$ Number of molecules in room of volume(V) could be found as,

$$n = \frac{6.023 \times 10^{23}}{22.4 \times 10^{-3}} \times V$$

$$\Rightarrow n = 134.915 \times 10^{26} V$$

$$\therefore n = 1.35 \times 10^{28} V$$

2. The unit of length convenient on the nuclear scale is a fermi: $\mathbf{1f} = 10^{-15}\mathbf{m}$. Nuclear sizes obey roughly the following empirical relation: $r = r_0 A^{\frac{1}{3}}$, where $\mathbf{r}$ is the radius of the nucleus, $\mathbf{A}$ its mass number, and r_0 is a constant equal to about, $\mathbf{1.2\,f}$. Show that the rule implies that nuclear mass density is nearly constant for different nuclei. Estimate the mass density of sodium nucleus and compare it with the average mass density of a sodium atom obtained in Exercise. 2.27.

Ans:

Let r be the radius of the nucleus given by the relation,

$$r = r_0 A^{\frac{1}{3}}$$

$$r_0 = 1.2f = 1.2 \times 10^{-15} m$$

Then the volume of nucleus would be, $V = \frac{4}{3}\pi r^3$

$$V = \frac{4}{3}\pi\left(r_0 A^{\frac{1}{3}}\right)^3 = \frac{4}{3}\pi {r_0}^3 A \text{ .... (1)}$$

Now, the mass of the nuclei M is equal to its mass number that is,

$$M = A\,\text{amu} = A \times 1.66 \times 10^{-27} kg$$

Density of nucleus could be given by,

$$\rho = \frac{\text{Mass of nucleus}}{\text{Volume of nucleus}}$$

$$\Rightarrow \rho = \frac{A \times 1.66 \times 10^{-27}}{\frac{4}{3}\pi {r_0}^3 A} = \frac{3 \times 1.66 \times 10^{-27}}{4\pi {r_0}^3} kg/\text{m}^3$$

> This relation shows that nuclear mass depends only on constant r_0. Hence, we could conclude that the nuclear mass densities of all nuclei are nearly the same.
>
> Density of sodium nucleus could now be given by,
>
> $$\rho_{sodium} = \frac{3 \times 1.66 \times 10^{-27}}{4 \times 3.14 \times \left(1.2 \times 10^{-15}\right)^3}$$
>
> $$\Rightarrow \rho = \frac{4.98}{21.71} \times 10^{18}$$
>
> $$\therefore \rho = 2.29 \times 10^{17} kg\text{m}^{-3}$$

3. P.A.M. Dirac, a great physicist of this century loved playing with numerical values of fundamental constants of nature. This led him to an interesting observation that from the basic constants of atomic physics (c, e, mass of electron, mass of proton) and the gravitational constant G, one could arrive at a number with the dimension of time. Further, it was a very large number whose magnitude was close to the present estimate on the age of the universe ($\sim$ 15 billion years). From the table of fundamental constants in this book, try to see if you too can construct this number (or any other interesting number you can think of). If its coincidence with the age of the universe were significant, what would this imply for the constancy of fundamental constants?

Ans:

One relation that consists of some fundamental constants to give the age of the Universe could be given by:

$$t=\left(\frac{e^2}{4\pi\varepsilon_0}\right)\times\frac{1}{m_p m_e{}^2 c^3 G}$$

Where,

$t =$ Age of universe

$e =$ Charge of electrons $= 1.6\times10^{-19}C$

$\varepsilon_0 =$ Absolute permittivity

$m_p =$ Mass of protons $= 1.67\times10^{-27}kg$

$m_e =$ Mass of electrons $= 9.1\times10^{-31}kg$

$c =$ Speed of light $= 3\times10^{8}m/s$

$G =$ Universal gravitational constant $= 6.67\times10^{11}Nm^2kg^{-2}$

$$\frac{1}{4\pi\varepsilon_0}=9\times10^9 Nm^2/C^2$$

Substituting all these values into the above equation, we would get,

$$t=\frac{\left(1.6\times10^{-19}\right)^4\times\left(9\times10^9\right)^2}{\left(9.1\times10^{-31}\right)^2\times1.67\times10^{-27}\times\left(3\times10^8\right)^3\times6.67\times10^{11}}$$

$$\Rightarrow t=\frac{(1.6)^4\times81}{9.1\times1.67\times27\times6.67\times365\times24\times3600}\times10^{-76+18+62+27-24+11}years$$

$$\Rightarrow t\approx6\times10^{-9}\times10^{18}years$$

$$\therefore t=6\text{ billion years}$$

Very Long Questions and Answers (5 Marks Questions)

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Volume of water displaced by the elephant $= Ad_2 - Ad_1$.

Density of water $= D$

Mass of elephant $= AD(d_2 - d_1)$

c. The Wind Speed During a Storm.

Ans:

Wind speed during a storm can be measured by an anemometer. As the wind blows, it rotates. The rotation made by the anemometer in one second gives the value of wind speed.

d. The Number of Strands of Hair on Your Head.

Ans:

Area of the head surface carrying hair $= A$

With the help of a screw gauge, the diameter and hence, the radius of a hair can be determined. Let it be r.

$\therefore$ Area of one hair strand$= \pi r^2$

Number of strands of hair $\approx \frac{\text{Total surface area}}{\text{Area of one hair}} = \frac{A}{\pi r^2}$

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Ans:

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Ans:

We know that the radius of the nucleus r is given by the relation,

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Volume of nucleus, $V = \frac{4}{3}\pi r^3$

$$V = \frac{4}{3}\pi\left(r_0 A^{\frac{1}{3}}\right)^3 = \frac{4}{3}\pi {r_0}^3 A \text{ .... (1)}$$

Now, the mass of the nuclei M is equal to its mass number i.e.,

$$M = A \text{ amu} = A \times 1.66 \times 10^{-27} kg$$

Density of nucleus,

$$\rho = \frac{\text{Mass of nucleus}}{\text{Volume of nucleus}}$$

$$\Rightarrow \rho = \frac{A \times 1.66 \times 10^{-27}}{\frac{4}{3}\pi {r_0}^3 A} = \frac{3 \times 1.66 \times 10^{-27}}{4\pi {r_0}^3} kg/\text{m}^3$$

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Density of sodium nucleus could be given by,

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Benefits of Solving Important Questions for Class 11 Physics Chapter 1

Here are the benefits of solving important questions for Class 11 Physics Chapter 1, Units and Measurement, in pointers:

Strengthens Core Concepts: Helps in understanding fundamental concepts like SI units, dimensional analysis, and significant figures.

Improves Problem-Solving Skills: Enhances your ability to solve numerical problems related to measurement accuracy and conversions.

Boosts Exam Preparation: Prepares you for various exam formats by practicing commonly asked questions.

Increases Speed and Accuracy: Regular practice improves calculation speed and accuracy under time pressure.

Clarifies Doubts: Helps in identifying areas where you may have confusion or need further clarity.

Enhances Concept Application: Encourages you to apply theoretical knowledge to practical situations.