# St. Mary's School, Dwarka Holidays Homework <br> Class XI <br> Subject: Physics 

## Worksheet 1: Units and dimensions

## Objective:

$>$ To revise concepts.
$>$ to acquire skills to carry out research and develop scientific aptitude
$>$ to encourage learning through experience
$>$ NOTE: Holidays HW assignments should be done in an assignment notebook and scanned copy of the notebook should be mailed to me.

## ACTIVITY :

Please refer to the given article and answer the following questions:


Cyclone Amphan barreled into the coasts of West Bengal, India, with sustained winds of 160 kilometers per hour ( 100 mph ). Strong winds with speed up to 125 km per hour upturned cars in Kolkata and left uprooted trees and electricity poles blocking roads. In Kolkata, the storm began with a wind speed of 69 kmph but it reached 130 kmph within a span of 2 hours and thereafter increased its intensity.
a) Name a physical quantity which is used to estimate the intensity of a cyclone.
b) Find the change in the speed of the cyclone AMPHAN after it had hit Kolkata. Refer to the article. 1
c) How long does a cyclone last?
d) What is the full form of IMD? Write a brief note on its role.

## Assignment 1

Q1. The unit of impulse is the same as that of
(i) energy
(ii) momentum
(iii) power
(iv) velocity

Q2. The angular speed of a fly - wheel making 120 r.p.m. is
(i) $\pi \mathrm{rad} \mathrm{s}^{-1}$
(ii) $2 \pi \mathrm{rad} \mathrm{s}^{-1}$
(iii) $4 \pi \mathrm{rad} \mathrm{s}^{-1}$
(iv) $4 \pi 2 \mathrm{rad} \mathrm{s}^{-1}$

Q3. Which of the following physical quantity has the dimension of $\left[\mathrm{ML}^{-1} \mathrm{~T}^{-2}\right]$ ?
(i)work
(ii) gravitational constant
(iii) pressure (iv) acceleration due to gravity

Q4. In van der Waals' equation $\left[p+\left(\frac{a}{V^{2}}\right)\right](V-b)=R T$, where $p$ is pressure, Vis volume, $T$ is temperature and $R$ is gas constant so the dimension of constant b will be
(i) $\quad\left(\mathrm{ML}^{3} \mathrm{~T}^{0}\right)$
(ii) $\left(\mathrm{M}^{0} \mathrm{~L}^{3} \mathrm{~T}^{0}\right)$
(iii) $\left(\mathrm{MLT}^{-2}\right)$
(iv) $\left(\mathrm{ML}^{2} \mathrm{~T}^{-2}\right)$
1

Q5. (i) How many protons would make 1 Kg ? Given: Mass of proton $=1.67 \times 10^{-27} \mathrm{~kg}$.
(ii) Wavelength of a laser light is 6463 Angstrom. Express it in mm and micrometer.

Q6.Check the correctness of the relation: $\mathbf{h}=\mathbf{r} \boldsymbol{\rho g} / \mathbf{2 S c o s} \boldsymbol{\theta}$ where $\rho$ denotes density, $g$ is acceleration due to gravity, $r$ is radius of the tube, $h$ is height of liquid in the column and $S$ is surface tension of the liquid .(Given: Surface tension is defined as Force / length)

Q7(i) The length, breadth and thickness of a rectangular sheet of metal are $4.234 \mathrm{~m}, 1.005 \mathrm{~m}$ and 2.01 cm respectively. Find the area and volume of the sheet to correct significant figures Q8. Specific resistance $\rho$ of a thin circular wire of radius $r \mathrm{~cm}$, resistance $R$ ohms and length $L$ is given by $\rho=\pi r^{2} R / L$. If $r=(0.26+0.01) \mathrm{cm}, R=(30+2)$ ohm and $L=(75.00+0.01) \mathrm{cm}$, find the percentage error in $\rho$.

Q9.A gas bubble from an explosion under water oscillates with a period T proportional to $\mathrm{P}^{a} d^{b} \mathrm{E}^{c}$ where P is the static pressure, $d$ is density of water and E is total energy of the explosion.

Q10(i) To study the flow of a liquid through a narrow tube, the following formula is used: $\boldsymbol{\eta}=\pi \mathbf{p r}^{4} / \mathbf{8 v l}$ where the letters have their usual meanings. The value of $\mathrm{p}, \mathrm{r}, \mathrm{v}$ and l are measured to be 76 cm of $\mathrm{Hg}, 0.28 \mathrm{~cm}, 1.2 \mathrm{~cm}^{3}$ $/ \mathrm{s}$ and 18.2 cm respectively. If these quantities are measured to accuracies of 0.5 cm of $\mathrm{Hg}, 0.041 \mathrm{~cm}, 0.1 \mathrm{~cm}^{3} / \mathrm{s}$ and 0.1 cm respectively, Find the percentage error in $\eta$, the coefficient of viscosity. (ii) What are systematic errors? Give two examples of systematic errors?
$(3+2=5)$

## ACTIVITY: Earthquake of Magnitude 2.2 Hits Delhi

An earthquake with a magnitude of 2.2 on the Richter Scale hit the national capital and its adjoining areas on Friday, May 29, 2020. Delhi has been witnessing earthquakes in the range of two to three magnitude frequently.


## How can we measure earthqualkes?

The Richter Scale
This measures the magnitude of a tremor (how powerful it is) using an instrument called a seismograph.
On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. Although the Richter Scale has no upper limit, the largest earthquake ever recorded was in 1960 in Chile. It measured 9.5 on the Richter Scale.

It is a logarithmic scale which means that a size ' 6 ' on the Richter Scale is 10 times larger than a size ' 5 ' and 100 times larger than a size '4'.

Q1. What is the difference between Seismograph and Richter scale?
Q2. Richter scale is a logarithmic scale. Explain.

Q3. What do you mean by epicentre of an earthquake? Does an earthquake start at the epicentre?
Q4. Delhi has experienced frequent earthquakes in the last two months. What does this signify?

## Assignment 2

Q1. Find the value of following measurements up to appropriate significant figures: (i) 3.27+33.5472 Q2. State the number of significant figures in the following measurements:
(i) $7.057 \mathrm{~m}^{2}$ (ii) $45.064 \times 10{ }^{24} \mathrm{~kg}$

Q3. Moon revolves round earth in an almost circular orbit. Does the earth exert some force on the moon? Does the earth also perform some work on the moon?

Q4. The displacement of a car $\mathrm{d}=(200 \pm 0.5) \mathrm{m}$ and time taken by it is $\mathrm{t}=(20 \pm 0.2) \mathrm{s}$. Find the percentage error in the calculation of velocity.

Q5(i) The nearest star to our solar system is 4.3 light years away. How much is its distance in terms of parsecs? (ii) Write two important characteristics of nuclear force.

Q6 Suraj went to Big Bazaar to purchase certain goods. There he noticed an old lady struggling to carry her shopping bags through the stairs. Immediately he showed her the lift and explained to her how it carries the load from one floor to the next. Even then the old lady was not convinced. Then Suraj took her inside the lift and showed her how to operate it. That old lady was very happy. i) What values does Suraj possess? (ii) Explain the physics behind the working of a lift.
Q7. The escape velocity $V_{E}$ from a planet depends upon gravitational constant $G$, radius $R$ of the planet and its density $\rho$. Establish a relation for escape velocity using method of dimensions.

Q8. The following observations were made during an experiment to find the value of acceleration due to gravity g using a simple pendulum. Given: Length $L$ of the pendulum $=100 \mathrm{~cm}$, Time for 20 oscillations $=40 \mathrm{~s}$.
Calculate the percentage error in the measurement of $g$ if the length was measured by a meter scale having least count 0.1 cm and time was measured by a stop watch having least count 0.1 s . (Use $\mathrm{g}=4 \pi^{2} \mathrm{~L} / \mathrm{T}^{2}$ )

Q9 In an experiment, the value of two resistances were measured to be $\mathrm{R}_{1=} 5 \pm 0.2 \mathrm{ohm} ; \mathrm{R}_{2}=10 \pm 0.1 \mathrm{ohm}$. Find the total value of resistance in (i) series (ii) parallel with limits of possible percentage error in each case.

Q10.The Rate of flow of liquid $(\mathrm{R})$ through a pipe depends on pressure gradient ( $\mathrm{P}^{\prime}$ ) existing between the ends of pipe, radius of the pipe ( $r$ ) and co-efficient of viscosity of liquid $(\eta)$. Using the method of dimensions derive the expression for Rate of flow of liquid(R) through a pipe. (Given: Viscous force $\mathrm{F}=6 \pi \eta \mathrm{rv}$ and pressure gradient ( $\mathrm{P}^{\prime}$ ) is pressure per unit length, rate of flow is volume of the liquid flowing out per second).

ACTIVITY: Few children were playing in the field near an airport when they spotted an aeroplane approaching the airport. If the aeroplane was flying at an altitude of 6 miles, on its flight path, that passes directly over the observer (see the figure given below).
(i)Express the altitude of the aeroplane in SI unit.
(ii) Find the distance of the plane from the observer when $\theta=30^{\circ}$, (b) $\theta=90^{\circ}$ and (c) $\theta=120^{\circ}$ where $\theta$ is the angle of elevation from the observer to the aeroplane.
(iii) Name this indirect method of finding altitude of the aeroplane. Give another use of this method


## Assignment 3

Q1. Draw position time graph for motion of a car in cruise control mode (ie) with zero acceleration. 1
Q2. Moon revolves round earth in an almost circular orbit. Does the earth exert some force on the moon? Does the earth also perform some work on the moon?

Q3. If $x=a+b t+c t^{2}$ where $x$ is in meter and $t$ is in second, what are the units of $b$ and $c$.

Q4. Write two important characteristics of nuclear force.
Q5. The displacement of a body $\mathrm{d}=(200 \pm 0.5) \mathrm{m}$ and time taken by it is $\mathrm{t}=(20 \pm 0.2) \mathrm{s}$. Find the percentage error in the calculation of velocity in SI units.

Q6 (i)The minute hand of a wall clock is 10 cm long. Find its displacement and the distance covered from 12 noon to 12.30 pm .(ii) If velocity time graph of a particle is parallel to time axis, what will be the acceleration of the particle?

Q7. Your father is driving a car in a narrow lane. Assume that car is in uniform motion along a straight line.
Draw position time graph for the motion of the car when (i) $\mathrm{x}_{0}$ is positive, v is positive (ii) $\mathrm{x}_{0}$ is positive, v is negative (iii) $x_{0}$ is negative, $v$ is negative.

Q8Your neighbor took out his car from the parking lot. He starts the car and accelerates uniformly along a straight line at the rate of $10 \mathrm{~m} / \mathrm{s}^{2}$ for 5 seconds. Afterwards he drives the car for 2 seconds with uniform velocity of $50 \mathrm{~m} / \mathrm{s}$. Then he applies brakes to retard uniformly and brings the car to rest in next 3 seconds. Draw velocity time graph of the motion of the car and find the total distance travelled by the car.

Q9A car moving with a constant acceleration covers a distance of 180 m between two points in 6 seconds. Its speed as it passes the second point, is $45 \mathrm{~m} / \mathrm{s}$. What was its speed at the first point? What is its acceleration? 3 Q10.The velocity of a particle is given by the equation, $v=4 t^{2}+5 t+6 \mathrm{~cm} / \mathrm{s}$. Find (i) the change in velocity of the particle during the time interval between $\mathrm{t}_{1}=2 \mathrm{~s}$ and $\mathrm{t}_{2}=4 \mathrm{~s}$ (ii) the average acceleration during the same interval and (iii) the instantaneous acceleration at $\mathrm{t}_{2}=4 \mathrm{~s}$.

## Motion in one dimension

Refer to the information given below to answer the questions

Most of the metro trains around the world run at a max speed of $\mathbf{8 0 - 1 0 0} \mathbf{~ k m} / \mathbf{h r}$. The Delhi Airport Express was designed to run at a max speed of $135 \mathrm{~km} / \mathrm{hr}$ but has been capped at $105 \mathrm{~km} / \mathrm{hr}$.


When two bodies move in opposite direction, then the relative speed = sum of speeds i.e for a person sitting in a train moving with a speed of $40 \mathrm{~km} / \mathrm{hr}$ in the west direction, another train which is going towards east with a speed of $40 \mathrm{~km} / \mathrm{hr}$, will appear to move at a speed of $(40+40)=80 \mathrm{~km} / \mathrm{hr}$.

Q1 What is the difference between motion and relative motion of a body? Can we classify motion of a metro train as relative motion? Explain.
Q2. Is motion possible without force? Justify by giving example.
Q3.A metro train 340 m long is running at a speed of $45 \mathrm{~km} / \mathrm{hr}$. How much time will it take to cross a 160 m long tunnel?
Q4. A train 280 m long crosses a bridge 170 m long in 22.5 seconds. Find the speed of the train in $\mathrm{km} / \mathrm{hr} 2$ Q5. Two metro trains start from the same place at the speed of $36 \mathrm{~km} / \mathrm{hr}$ and $40 \mathrm{~km} / \mathrm{hr}$. Find the distance between them after 10 minutes if they move in the opposite direction.

## Assignment 4:

## Choose the correct option :

Q1. What force will change the velocity of a body of mass 1 Kg from $20 \mathrm{~ms}^{-1}$ to $30 \mathrm{~ms}^{-1}$ in 2 s ?
(i) 25 N
(ii) 10 N
(iii) 5 N
(iv) 2 N
1

Q2. The unit of impulse are the same as those of

1) (i) energy
(ii) momentum
(iii) power
(iv) velocity
1

Q3. A graph is drawn with force along Y - axis and time along X - axis. The area under the graph represents
(i) momentum
(ii) couple
(iii) moment of the force
(iv) impulse of the force
1

## Answer the following questions :

Q4. Two trains are running on parallel tracks in the same direction at $70 \mathrm{~km} / \mathrm{hr}$ and $50 \mathrm{~km} / \mathrm{hr}$ respectively. The faster train passes a man 27 second faster than the slower train. Find the length of the faster train. Q5. A car covers a distance of 100 km in first two hours, 120 km in next 1 hour and 32 km in next $1 / 2$ hour. Calculate its average speed and convert it into $\mathrm{m} / \mathrm{sec}$.
Q6.A car moving on a straight road covers one - third of the distance with $20 \mathrm{~km} / \mathrm{hr}$ and the rest with $60 \mathrm{~km} / \mathrm{hr}$. What is the average speed of the car?
Q7.A boy reached a railway station 4 km away from his house running with a uniform speed in 1 hour. He took rest for 0.5 hour at the station and then came back to his house walking with a uniform speed in 1.5 hour.
Represent the whole journey of the boy by a time - displacement graph and determine his average speed. 2 Q8.Raman starts his car and moves in a straight line along $X$ - axis such that its distance from the origin is given by the equation $x=8 t-3 t^{2}$, where $x$ is in m and $t$ is in s . Find the average velocity of the car in the interval from $t=0$ to $t=1 \mathrm{~s}$ and in the interval from $t=0$ to $t=4 \mathrm{~s}$.

Q9 Two cars are going in two concentric circular orbits of radius ( $r_{1}$ and $r_{2}$ ) with angular velocities ( $\omega_{1}$ and $\omega_{2}$ ). What is the ratio of their linear velocities?
Q10 (i) The displacement - time graph of two bodies P and Q are represented by OA and BC respectively. What is the ratio of velocities of P and Q ?
$\angle O B C=60^{\circ}$ and $\angle A O C=30^{\circ}$.

(ii) The distance $x$ travelled by a body in a straight line is directly proportional to $t^{2}$. Decide on the type of motion associated. If $x \propto t^{3}$ what change will you observe? Explain.

