*Questions and Answers in*

# Environmental Science Practical

**Rahul K Kamble**

Competition Tutor

# QUESTIONS AND ANSWERS IN ENVIRONMENTAL SCIENCE PRACTICAL

By

**Rahul K Kamble**

Assistant Professor
Department of Environmental Science
Sardar Patel College, Chandrapur
Maharashtra

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# Preface

Environmental Science comprises of different matrixes such as air, water, soil and living components. To have in-depth understanding of these, practical knowledge becomes very essential. In this regard, practical is one of the important aspects of the subject. These practical's gives an insight to various phenomenons occurring in the environment. The analysis of various environmental matrixes can be understood thoroughly through methodological insight understanding of them. In this regard, an attempt has been carried out through this book, perhaps may be first of its kind, to provide in detail various aspects involved in environmental analysis of air, water, soil and noise.

This book is primarily prepared to cater students of undergraduate, postgraduate, research scholars and faculty members in Environmental Science, Environmental Engineering, Environmental Technology of universities/ institutes of India and abroad. It provides sufficient theoretical and practical knowledge about various environmental parameters, so as to have a clear understanding of them.

The book comprises of four parts viz. air, water, soil and noise. Each part further containes various parameters involved in them except noise. Number of questions and answers on each parameter are presented in lucid and concise manner, so as to make all the aspects of it understandable. In addition to this, a number of appendixes are also upended which will provide additional knowledge on these parameters for overall understanding of them.

Further suggestions from readers for improvement of the book will be highly appreciated on *rahulkk41279@yahoo.com*.

**– Rahul K Kamble**

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**Rahul K. Kamble**

## In Loving Memory of

**Late Dr. Elizabeth M. Van de Ven**

Former Business Director of
MBA Environmental Management Programme
Cartesius Institute
University of Twente, the Netherlands

# Contents

# Common terminologies used in Environmental Analysis

**Distilled water**: The distilled water is water that has been purified by the distillation process and is free of dissolved salts.

**Deionized water (DI water)**: The deionized water is water that has been prepared by passing it through two resins which attracts positive and negative ions and thus removes all ions from it. This water is also called as DM water or demineralized water.

**$CO_2$ free distilled water**: It is distilled water, boiled for sufficient duration of time so as to remove dissolved $CO_2$ from it. It is then covered and cooled down and used for preparation of reagents.

**Laboratory grade water (Grade I, II, III and IV)**: American Society for Testing and Material (ASTM) had defined four different standard grades for pure water to be used for laboratory analysis. The water quality for these different grade waters is based on conductivity, resistivity, TOC, total silica, sodium, chloride, pH, bacteria and endotoxin content. These waters are also called as Ultrapure Water (UPW).

**Millipore water**: It is an ultrapure water or Type 1 water, prepared by Milli-Q water filtration system.

**Soft water**: Soft water is water from which calcium and magnesium ions have been removed.

**Reagents**: A laboratory chemical used to carry out chemical reactions or formation of coloured compounds.

**AR grade**: Analytical reagent grade (AR grade) contains chemicals used for analytical purposes and research work. These chemicals are of high purity in nature. The chemicals are provided with a certification for minimum assay and maximum limit of trace impurities.

**LR grade**: Laboratory reagent grade (LR grade) contains pure/extra pure chemicals for laboratory analysis.

**Extra pure**: Extra pure are chemicals preferably used in pharmaceutical analysis.

**Atomic weight**: Atomic weight of the elements refers to the relative weights of the atoms as compared with some standards. (The $^{12}C$ isotope of carbon was adopted as the atomic weight standard, with a value of exactly 12). In general, elements do not have atomic weights that are whole numbers because they consist of a mixture of isotopes.

**Gram Atomic Weight**: The gram atomic weight (GAW) of an element refers to a quantity of the element in grams corresponding to the atomic weight.

**Gram Molecular Weight/Mole**: The term gram molecular weight (GMW, the short hand symbol being MW) refers to the molecular weight in grams of any particular compound. It is also referred to as mole.

**Equivalent weight**: Equivalent weight can be defined as follows: EW = MW/Z. Where, Z = the number of $H^+$ or $OH^-$ ions a species can react with or yield in an acid base reaction. One equivalent is defined as one mole of a compound divided by it's EW.

**Valency**: Valency or oxidation state is the same and defines the combining capacity of an element.

**Normality (*N*)**: It is the number of gram equivalent weight of solute dissolved in 1000 mL of solution or number of gram millequivalent of solute per millilitre of solution. It is denoted by *N*. For calculation of normality:

Normality (*N*) = weight/L/ equivalent weight

Example: To prepare 1 *N* $K_2Cr_2O_7$ solution, we will requre

1 *N* $K_2Cr_2O_7$ = weight/L/ equivalent weight

Equivalent weight of $K_2Cr_2O_7$ is 49, then

1 *N* = weight/L/49

Hence, Weight/L= 49 x 1. Thus, 49 gram of $K_2Cr_2O_7$ has to be dissolved in 1000 mL of distilled water to get a solution of 1*N* $K_2Cr_2O_7$.

**Parts per million (ppm)**: It is a weight to weight ratio. A litre of water weights approximately 1000 gram or 10,00,000 mg and hence 1 mg/L is considered to be equivalley 1 ppm.

**mg/L**: It is a weight-volume relationship and, when dealing with liquids, it offers a convenient basis for calculation.

mg/L x 8.34 = lb/million gal, mg/L = $g/m^3$, mg/L x $10^{-3}$ = $kg/m^3$.

**Molar solution (M)**: A molar solution consists of 1 gram molecular weight dissolved in enough water to make 1000 mL of solution. The amount of molecular weight in grams dissolved in 1000 mL of solution.

**Molal solution**: One gram molecular weight dissolved in 1000 mL of water, then resulting solution having a volume slightly in excess of 1000 mL.

**Primary standard**: Primary standard is a solution for which a solution of a definite concentration can be prepared. It is stable in nature. Example: Potassium dichromate, Sodium chloride etc.

**Secondary standard**: Secondary standard is a solution which is prepared by standardizing against primary standard solution so as to prepare the exact concentration of it. It is unstable and reactive in nature. Example: Sodium hydroxide.

**Indicator**: A solution/powder used during titration process so as to know the end point of the titration process.

**Titration**: Titration is a process in which a titrant is added from a burette into a sample usually liquid (water/waste water) into a conical flask so as to complete the reaction between these two solutions.

**Titrant**: A solution of definite concentration (strength) filled into a burette and used for titration.

**Titrate**: A solution taken into a conical flask for titration.

**End point**: End point is a point in a titration process in which titrant reacts with titrate so as to be chemically equivalent. The end point is denoted by change in colour of the titration.

**Aliquots**: Aliquots are serial dilutions prepared from a known strength of solution but having much lower concentration than it or the amount of a sample used for analysis.

**Calibration curve:** In analytical chemistry, a calibration curve, also known as a standard curve, is a general method for determining the concentration of a substance in an unknown sample by comparing the unknown to a set of standard samples of known concentration.

**Standard method**: This is an abbreviation for the book entitled Standard Methods for the Examination of Water and Wastewater published jointly by the American Public Health Association, American Water Works Association, and Water Environment Federation. This book contains various analytical methods for water and wastewater analysis. This book is the primary reference book and new edition is published after every five years. In the year 1905, the First edition was published and as of 2017, 22nd edition is available.

**Ambient environment**: Outside existing natural environment.