



IIT

FOUNDATION & OLYMPIAD

EXPLORER
CLASS - IX

BRAIN MAPPING ACADEMY



CHEMISTRY

Be Early! Be Smart!



IIT

FOUNDATION & OLYMPIAD

E X P L O R E R

CHEMISTRY

CLASS - 9



www.bmatalent.com

Published by:

Brain Mapping Academy

#16-11-16/1/B, First Floor,
Farhat Hospital Road,
Saleem Nagar, Malakpet,
Hyderabad-500 036
Andhra Pradesh, India.

040-65165169, 66135169

E-mail: info@bmatalent.com

Website: www.bmatalent.com

© Brain Mapping Academy

ALL RIGHTS RESERVED

No part of this book may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior written permission of the publisher.

Publication Team

Editor: E.V.S.S. Lakshmi

Design & Typing: M. Nagender & M. Manjula

ISBN: 978-81-907285-8-4

Disclaimer

Every care has been taken by the compilers and publishers to give correct, complete and updated information. In case there is any omission, printing mistake or any other error which might have crept in inadvertently, neither the compiler / publisher nor any of the distributors take any legal responsibility.

In case of any dispute, all matters are subject to the exclusive jurisdiction of the courts in Hyderabad only.

Preface

Speed and accuracy play an important role in climbing the competitive ladder. Students have to integrate the habit of being able to calculate and function quickly as well as efficiently in order to excel in the learning culture. They need to think on their feet, understand basic requirements, identify appropriate information sources and use that to their best advantage.

The preparation required for the tough competitive examinations is fundamentally different from that of qualifying ones like the board examinations. A student can emerge successful in a qualifying examination by merely scoring the minimum percentage of marks, whereas in a competitive examination, he has to score high and perform better than the others taking the examination.

This book provides all types of questions that a student would be required to tackle at the foundation level. The questions in the exercises are sequenced as *Basic Practice*, *Further Practice*, *Multiple Answer Questions*, *Paragraph Questions*, *Numerical Problems*, *Conceptual Questions* and *Brain Nurtures*. Simple questions involving a direct application of the concepts are given in *Basic Practice*. More challenging questions on direct application are given in *Further Practice*. Questions involving higher order thinking or an open-ended approach to problems are given in *Brain Nurtures*. These questions encourage students to think analytically, to be creative and to come up with solutions of their own. Constant practice and familiarity with these questions will not only make him/her conceptually sound, but will also give the student the confidence to face any entrance examination with ease.

Valuable suggestions as well as criticism from the teacher and student community are most welcome and will be incorporated in the ensuing edition.

Publisher

CONTENTS

1. Matter and its Classification	01
2. Language of Chemistry	23
3. Atomic Structure	51
4. Classification of Elements	75
5. Chemical Bonding	94
6. Study of Gas Laws	113
7. Atoms, Molecules and Ions	135
8. Solutions	154
9. Nitrogen	173
10. Sulphur	189
11. Chlorine	204
12. Phosphorus and its Compounds	219
13. Analytical Chemistry	236
Answers	249
Answers to Crossword Puzzles	269

Matter and its Classification

Common Misconception	Fact
1. Alloys cannot be separated into their constituents by physical methods. Hence they are considered as compounds.	1. An alloy cannot be separated into their constituents by physical methods. But still it is considered as a mixture because i) it shows the properties of its constituents. ii) it has a variable composition.
2. Distillation is similar as fractional distillation.	2. Distillation is the boiling of liquid to form vapour and the cooling of the vapour to form liquid again. Fractional distillation involves the boiling of a mixture of miscible liquids followed by the separation of each liquid at its respective boiling point.
3. All homogeneous substances are pure.	3. No. Mixtures are not pure but still some mixtures can be homogeneous in nature for example : Brine solution. Thus "All pure substances are homogenous".



SYNOPSIS



INTRODUCTION

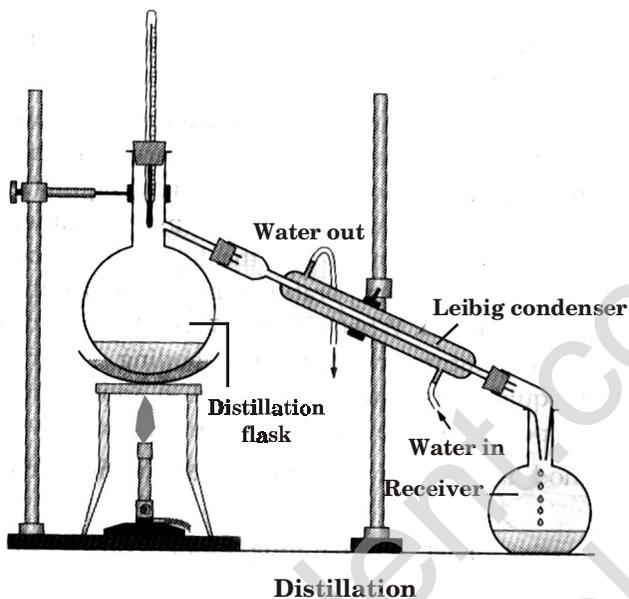
Chemistry deals with the study of matter. The study of matter involves many aspects in which the most important aspect is their classification based on chemical composition into three main categories namely elements, compounds and mixtures. The further classification of metals, nonmetals and metalloids is based on their characteristic properties. This also includes the study based on the differentiation of compounds and mixtures along with their techniques of separation.

CLASSIFICATION OF MATTER ON THE BASIS OF CHEMICAL COMPOSITION

Substances which are homogeneous in nature and contain particles (molecules) of only one kind are called pure substances. A pure substance is homogeneous in nature and has definite set of properties. The composition of pure substances cannot be changed by physical methods. Pure substances can be further classified as elements and compounds.

Elements

Pure substances in which molecules are composed of only one kind of atoms are called elements. Example: silver, iron, oxygen, nitrogen etc.,



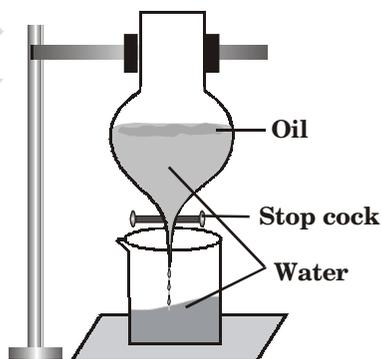
Centrifugation

In this method of separation, difference in size of liquid particles is used. For example milk contains solid fat particles in water and can be separated by this method. Here size of solid particles is less and hence they pass through the filter paper. When this is subjected to centrifugation heavier fat particles settle down at the bottom leaving behind lighter water on the top.

Separation of liquid – liquid mixtures

Separating funnel

In this method of separation, difference in densities of the two immiscible liquid components is used. For example kerosene oil and water are immiscible liquids can be separated by this method. Here when the mixtures are taken in the separating funnel, the lighter liquid (kerosene) forms top layer and the heavier liquid (water) settles down.



Example 2:

Substance X has the following properties :

- i) It melts at 80 °C
- ii) It boils at 150 °C
- iii) It is insoluble in water.

Which method of separation would you use to obtain pure X from a mixture of X and water ?

Solution:

X is insoluble in water. Secondly at room temperature it exists as solid. So, it can be separated by method of filtration.

Example 3:

The boiling points of some gases found in air are given below.

Name	Boiling point (°C)
Krypton	-152
Neon	-246
Nitrogen	-196
Oxygen	-183

If a liquid mixture of the above gases is fractionally distilled, in what order will these gases distil out ?

Solution:

The gases will distil out in order of increasing boiling points. The gases with lowest boiling point first and that of highest boiling point last, i.e. neon, nitrogen, oxygen and krypton.

Example 4:

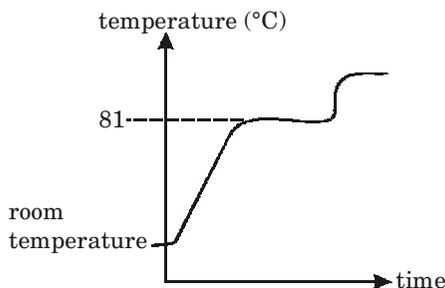
How would you separate a mixture of copper (II) oxide and copper (II) sulphate ?

Solution:

1. Copper (II) oxide is insoluble in water but copper (II) sulphate is soluble in water.
2. Add distilled water to the mixture.
3. Stir the mixture to dissolve the copper (II) sulphate.
4. Filter the mixture to remove copper (II) oxide. Wash and dry with filter paper.
5. Allow the filtrate to evaporate until the solution is saturated and allow the solution formed.
6. Filter the crystals and dry them with filter paper.

Example 5:

The graph below shows the temperature changes as an organic solid X is heated.



- What is happening to the solid X at 81°C ?
- Is solid X a pure substance ? Explain your answer

Solution:

- The melting point of solid X is 81 °C, i.e. X is undergoing a change in state. X is melting to form a liquid.
- Solid X is a pure substance because it has a fixed melting point.

Example 6:

Which of the following is likely to be a pure substance ?

- A colourless liquid that boils over the range 70°C to 80°C.
- A green solid which starts to melt at 80°C and is completely melted at 90°C.
- A white solid which produces a chromatogram consisting of only one spot.
- A brown liquid that is completely miscible with water.

Solution:

In the given cases

Case (A) : The liquid does not have a fixed boiling point hence is not a pure substance.

Case (B) : The solid starts to melt at 80°C but continues to melt by increase of temperature. Hence the given solid is not a pure substance.

Case (C) : The chromatogram of a white solid gives only one spot. This implies the solid contains only one substance i.e. it is a pure substance.

Case (D) : In this case, liquid is completely miscible with water forming a mixture. Hence not a pure substance.

Example 7:

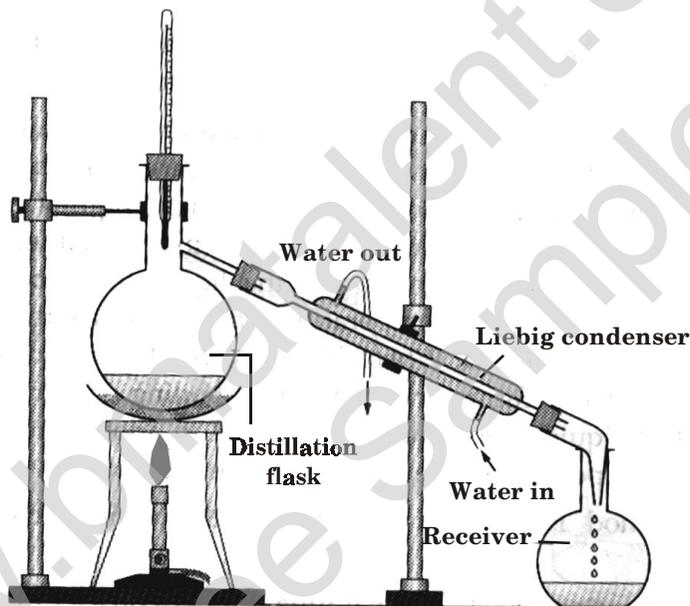
Solder is used for joining two metal surfaces together. Solder is a mixture of lead and tin. Can two metals be separated by distillation?

Solution:

The constituent of solder i.e. lead and tin differ in their boiling points, hence can be separated by method of distillation.

Example 8:

A student set up the following apparatus to separate ethanol and water. What was wrong with his arrangement ?

**Solution:**

Since a mixture of two miscible liquids have to be separated. He need to arrange a fractionating column. This helps in distilling off a lower boiling point liquid first.

Summative Exercise**BASIC PRACTICE****SECTION A****FILL IN THE BLANKS**

- _____ can be classified chemically into pure substances and mixtures.
- Both elements and compounds are _____ substances.
- A special technique used for separation and identification of the constituents in the mixture is _____.
- A mixture of sulphur and charcoal can be separated by _____ method.
- Magnesium sulphate in water is a _____ mixture.
- A mixture of iodine and sand are separated by method of _____.
- During separation of CO_2 and hydrogen gas by diffusion the gas that diffuses rapidly is _____.
- During the separation of CO_2 and O_2 by the process of preferential liquefaction, the component _____ liquefies.
- A mixture of oil and water can be separated by using _____.
- The number of atoms present in the molecule of an element is called its _____.
- Compounds are formed by chemically combining elements in a _____ proportion by weight.
- During distillation of iodine and methyl alcohol the non volatile substance is _____.
- A mixture of barium sulphate and H_2O can be separated by the method of _____.
- The principle of difference in boiling points of liquid is used in the _____.
- Soda water can be separated by _____ the pressure.

TRUE OR FALSE

- Distilled water cannot be separated into its constituents by physical methods.
- Separation of CCl_4 from CS_2 can be carried out by separating funnel method.
- Baking soda is a compound.
- Sand and sawdust can be separated by gravity method.
- A homogeneous mixture of two liquids can be separated using fractional distillation method.
- A handful of soil is homogeneous mixture of solids.
- A mixture of glucose water can be separated by the method of evaporation.
- The properties of compounds are same from those of the elements of which they are made.
- The melting and boiling points of a mixture is fixed depending on the proportions of its components it is made of.
- The components of a mixture can never be separated by physical methods.



MATCH THE FOLLOWING

26. Column – I

- A. Sublimation
 B. Magnetic separation
 C. Gravity method
 D. Solvent extraction
 E. Fractional crystallisation

Column – II

- p. Separation of sand and sawdust
 q. Separation of NaCl from KNO_3
 r. Separation of sand and wax
 s. Separation of iron and sand
 t. Separation of iodine and sand

**FURTHER PRACTICE****MULTIPLE CHOICE QUESTIONS**

- Which of the following mixtures will be the most difficult to separate?
 (A) Iron filings (powder) + sand (B) Sand + water
 (C) Sawdust + stones (D) Nitrogen + hydrogen
- You can separate a mixture of sand, salt and water by:
 (A) filtration and distillation (B) decantation and evaporation
 (C) filtration and decantation (D) decantation and crystallization
- In an experiment oxygen was added to hydrogen and heated. On burning a substance containing both oxygen and hydrogen water was formed. What is this substance?
 (A) Element (B) Compound (C) Solution (D) Mixture
- A saturated salt water solution was heated and allowed to cool without adding any more salt. What will happen?
 (A) Some salt appears to settle at the bottom.
 (B) Some more salt can be dissolved now.
 (C) No change takes place.
 (D) Both A or B
- Which of the following statement is NOT true?
 (A) A mixture of water and milk can be separated by filtration.
 (B) A mixture of powdered salt and sugar can be separated by fractional crystallisation.
 (C) Loading is a process which involves alum.
 (D) Salt from sea water is obtained by evaporation.
- Which of the following is an example of a solid-in-gas mixture?
 (A) Soil (B) Smoke (C) Moisture (D) Dew



7. Sugar syrup, usually used to coat sweets with sugar, becomes hard when cooled. From this we can conclude that sugar syrup is:
- (A) a saturated solution (B) an unsaturated solution
(C) not a solution (D) none of these
8. Filtration as a method of separation can be used for mixtures that are:
- (A) homogeneous and liquid-in-gas mixtures
(B) heterogeneous and liquid-in-liquid mixtures
(C) homogeneous and solid-in-liquid mixtures.
(D) heterogeneous and solid-in-liquid mixtures
9. Which changes of state occur during distillation?
- (A) Boiling followed by filtration (B) Boiling followed by condensation
(C) Condensation followed by boiling (D) Filtration followed by boiling
10. Two miscible liquids having different boiling points can be separated by:
- (A) sublimation (B) evaporation
(C) fractional distillation (D) loading
11. To separate the solids which are insoluble in liquids such that solid is heavier than liquid:
- (A) sedimentation and decantation (B) evaporation and condensation
(C) filtration (D) condensation and crystallization
12. Which of the following pair of gases cannot be separated by diffusion method ?
- (A) SO_2 and H_2 (B) CO_2 and N_2O (C) NH_3 and N_2 (D) CO_2 and H_2

MULTIPLE ANSWER QUESTIONS

1. Naphthalene and iron filings can be separated by the method of
- (A) solvent extraction (B) sublimation
(C) magnetic separation (D) filtration
2. Choose the correct statement from the following.
- (A) Oil is miscible in water.
(B) Fractional distillation is a method used for separating homogeneous mixture of two liquids.
(C) All pure substances are homogeneous in nature.
(D) The constituent elements of a compound can be separated only by chemical reactions.
3. Which of the following is not miscible in alcohol ?
- (A) Water (B) Petrol (C) Diesel (D) Kerosene

4. Choose the correct statement from the following.
- (A) Liquor ammonia and soda water are examples of liquid- gas type mixtures.
 - (B) Mixture of coconut oil and water can be separated using separating funnel.
 - (C) A mixture of iodine and sulphur can be separated using magnetic separation.
 - (D) A mixture of sand and sawdust can be separated using solvent extraction.
5. Choose the correct statement from the following.
- (A) Constituents of ink can be separated by a technique known as chromatography.
 - (B) By the method of diffusion a mixture helium and sulphur dioxide can be separated.
 - (C) A mixture of barium sulphate and water can be separated using filtration.
 - (D) A mixture of sand and iron can be separated by sublimation.

ASSERTION AND REASON TYPE QUESTIONS

The questions given below consist of statements of an Assertion and a Reason. Use the following key to choose the appropriate answer.

- (A) If both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
- (B) If both assertion and reason are CORRECT, but reason is NOT THE CORRECT explanation of the assertion.
- (C) If assertion is CORRECT, but reason is INCORRECT.
- (D) If assertion is INCORRECT, but reason is CORRECT.
- (E) If both assertion and reason are INCORRECT.

1. **Assertion** : A mixture ammonium chloride and sand can be separated using sublimation.

Reason : Ammonium chloride on heating converts from solid to gas directly.

2. **Assertion** : The constituents of petroleum can be separated using fractional distillation.

Reason : Fractional distillation is a method of separating heterogeneous liquid – liquid mixtures.

3. **Assertion** : All homogeneous substances are pure.

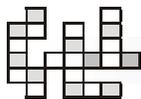
Reason : Alloys are homogeneous mixtures of solids.

4. **Assertion** : A mixture of hydrogen and sulphur dioxide gas can be separated using a method of diffusion.

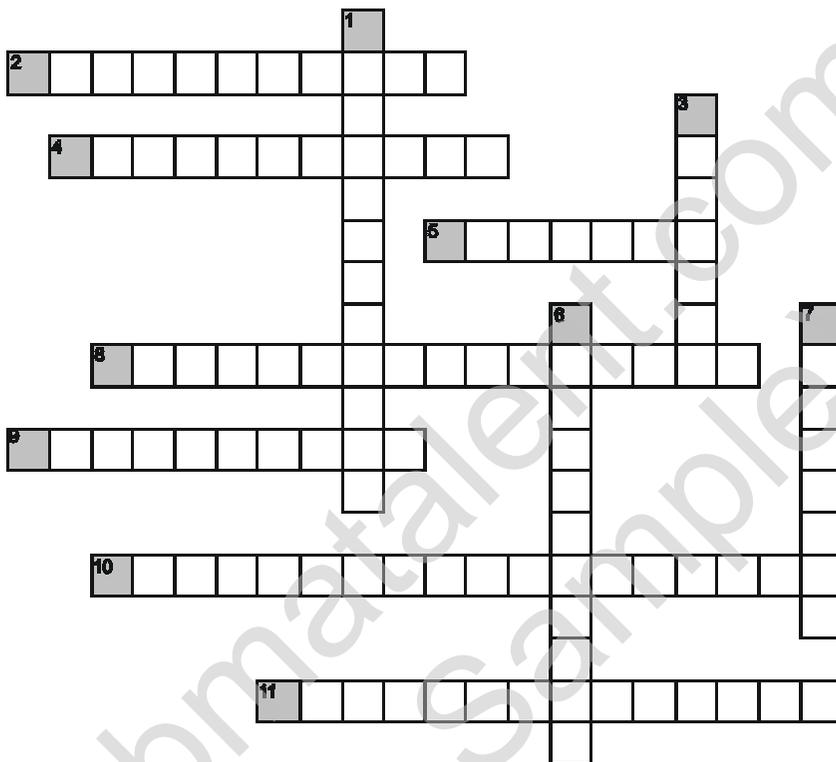
Reason : Diffusion is a method of separation by which two gases with greater difference in their densities are separated.

5. **Assertion** : Carbon dioxide and water can be separated by using a method known as chromatography.

Reason : Chromatography is a method of separation based on the principle that the solubility of a gas in a liquid decreases with increase in temperature.



Crossword Puzzle



ACROSS

2. Separation of mixture of stones and pulses
4. One component is non volatile soluble solid such that only solid component is recovered
5. Pure substance whose smallest entities are atoms
8. Separation of mixture of immiscible that differ in their densities
9. Separation of mixture of sawdust and water
10. Separation of mixture of iron and sulphur
11. Modern technique of separation of a mixture of substances with difference in their adsorptions

DOWN

1. Separation of mixture of salt and water for their recovery
3. Made up of two or more pure substances that can be separated
6. Separation of mixture of camphor and salt
7. Pure substance chemically formed by the union of two or more elements



SALIENT FEATURES >

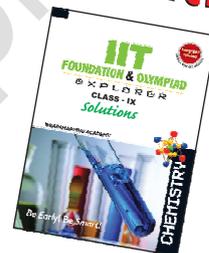
- Simple, clear and systematic presentation
- Concept maps provided for every chapter
- Set of objective and subjective questions at the end of each chapter
- Previous contest questions at the end of each chapter
- Serves as good book for IIT Foundation
- Designed to fulfill the preparation needs for international/national talent exams, olympiads and all competitive exams

UNIQUE ATTRACTIONS >

- Concept Maps
- Cross word Puzzles
- Graded Exercise
 - Basic Practice
 - Further Practice
 - Brain Nurtures
- Numerical Problems
- Conceptual Questions
- Multiple Answer Questions
- Paragraph Questions
- Assertion & Reason Type Questions

Check

this Out!



₹ 75

Detailed solutions for all problems of IIT Foundation & Olympiad Explorer are available in this book

₹ 200

ISBN 978-81-907285-8-4



9 788190 728584



www.bmatalent.com

MapmySTEP
.com

YOUR
OLYMPIAD
COACH



India's **FIRST** scientifically designed portal for Olympiad preparation

- Olympiad & Talent Exams preparation packages
- Analysis Reports • Previous question papers
- Free Demo Packages • Free Android Mobile App

Get 15% discount on all packages by using the discount coupon code: KR157N

A unique opportunity to take about 50 tests per subject.

