



# CHEMISTRY

## PAPER-1 (MCQ's)

- ✓ All Variants
- ✓ References of repeated questions added
- ✓ Questions order new to old

2002  
/  
2017



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# Chemistry Paper-1

## Topical Worked Solutions MCQ's

(2002-2017)

### Features:

- Solved
- All variants
- Classified to subtopics
- Mark Schemes
- References of repeated questions added
- Questions order from new to old

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## Unit 1 Experimental Chemistry

### 1.1 Experimental Design

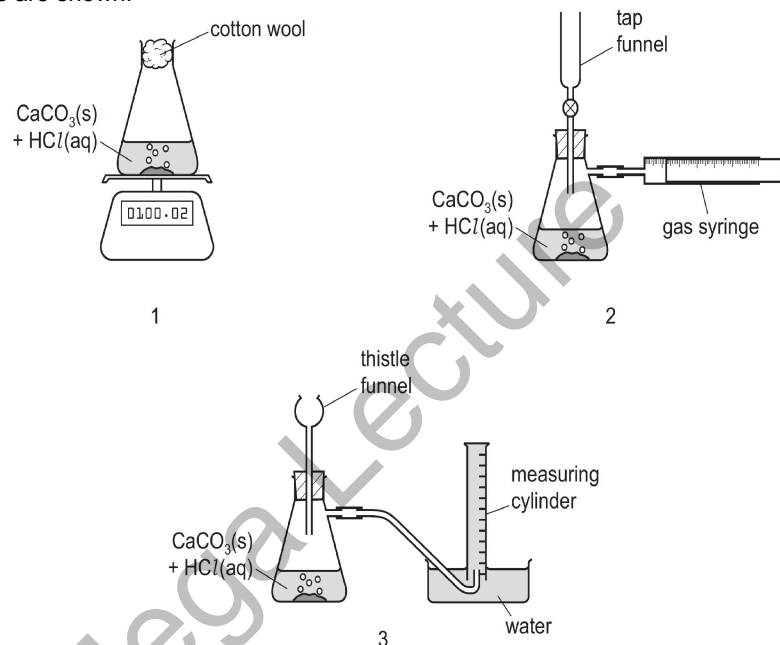
1. O/N 16/P11/Q17

A student investigates how the concentration of a reagent affects the rate of a chemical reaction. Which piece of apparatus is essential for all rate investigations?

- A balance                      B gas syringe                      C measuring cylinder                      D stopwatch

2. O/N 16/P12/Q2

When calcium carbonate is added to dilute hydrochloric acid, carbon dioxide gas is released. Three sets of apparatus are shown.



Which sets of apparatus are suitable, together with a stopwatch, for following the rate of this reaction?

- A 1, 2 and 3                      B 1 and 2 only                      C 2 only                      D 2 and 3 only

3. M/J 16/P12/Q2

A student plans two experiments.

experiment 1      find the concentration of a solution of sodium hydroxide by titration with dilute hydrochloric acid

experiment 2      find the rate of the reaction between pieces of calcium carbonate and dilute hydrochloric acid by measuring the volume of gas given off every minute

A flask is provided.

Which other apparatus is needed?

	experiment 1	experiment 2
A	balance, measuring cylinder, thermometer	gas syringe, clock
B	burette, pipette	balance, measuring cylinder, thermometer
C	burette, pipette	gas syringe, clock
D	gas syringe, clock	burette, pipette

4. **M/J 15/P12/Q2**

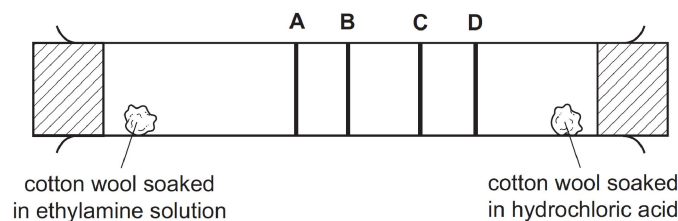
The concentration of aqueous sodium carbonate can be found by reaction with hydrochloric acid of known concentration using the indicator methyl orange.

Which items of equipment are needed?

- |          |  |          |                                 |
|----------|--|----------|---------------------------------|
| <b>A</b> | burette, measuring cylinder, gas syringe | <b>C</b> | burette, pipette, conical flask |
| <b>B</b> | burette, measuring cylinder, thermometer | <b>D</b> | burette, pipette, stopwatch     |

5. **M/J 14/P11/Q3**

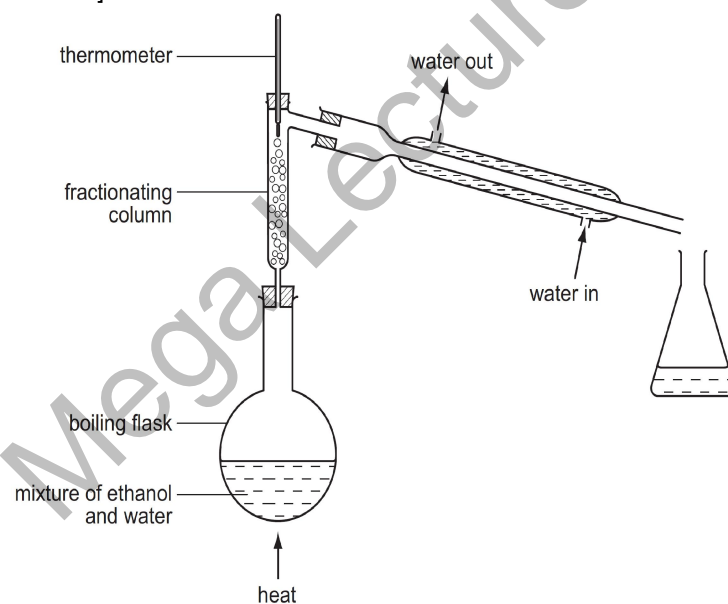
Ethylamine gas,  $C_2H_5NH_2$ , and hydrogen chloride gas,  $HCl$ , react together to form a white solid, ethylamine hydrochloride. At which position in the tube would a ring of solid white ethylamine hydrochloride form?



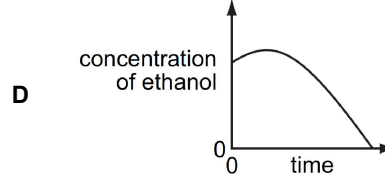
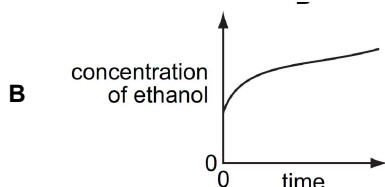
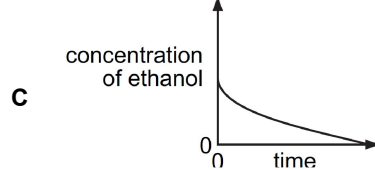
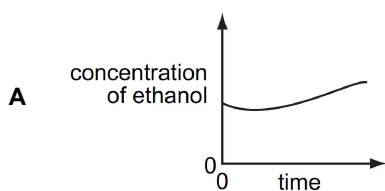
6. **O/N 13/P12/Q4, O/N 13/P11/Q4**

The apparatus shown is used to distil a dilute solution of ethanol in water.

[B.P.: ethanol, 78 °C; water 100 °C]



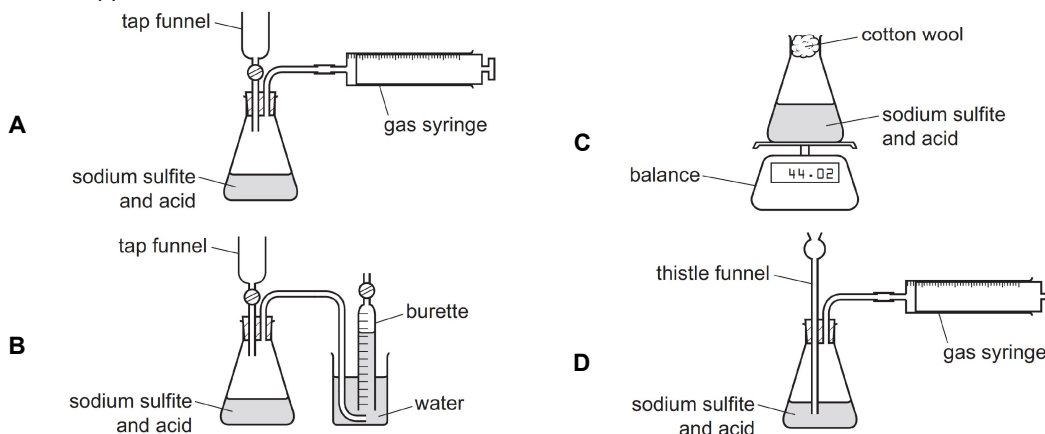
Which graph shows the change in concentration of the ethanol in the boiling flask as the distillation proceeds?



7. O/N 13/P11/Q3

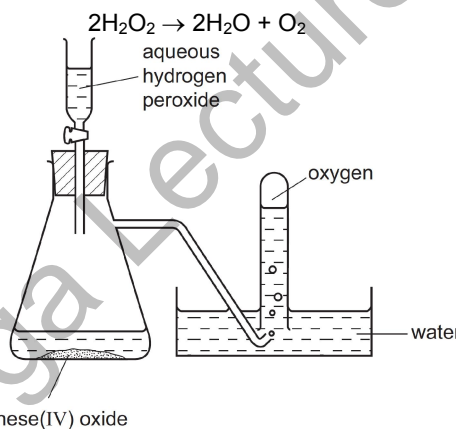
A student wanted to follow how the rate of the reaction of sodium sulfite with acid varies with time. The reaction produces gaseous sulfur dioxide.

Which apparatus is **not** suitable?



8. M/J 15/P12/Q7, O/N 11/P12/Q1, O/N 11/P11/Q3, M/J 08/P1/Q1,

Oxygen was prepared from hydrogen peroxide, with manganese(IV) oxide as catalyst. The oxygen was collected as shown in the diagram.

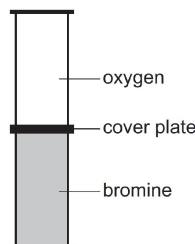


The first few tubes of gas were rejected because the gas was contaminated by

- A** hydrogen.      **B** hydrogen peroxide.      **C** nitrogen.      **D** water vapour.

9. O/N 05/P1/Q3

The coverplate is removed from the gas jars shown in the diagram. After several days, the colour of the gas is the same in both jars.



Which statement explains this change?

- A** Oxygen and bromine gases have equal densities.  
**B** Oxygen and bromine molecules are in random motion.  
**C** Oxygen and bromine molecules diffuse at the same rate.  
**D** Equal volumes of oxygen and bromine contain equal numbers of molecules.



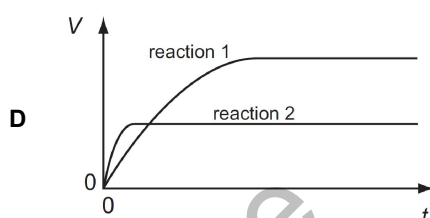
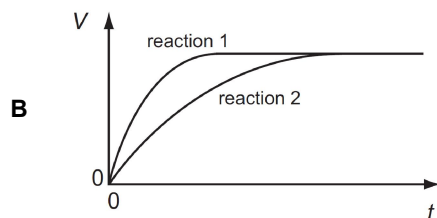
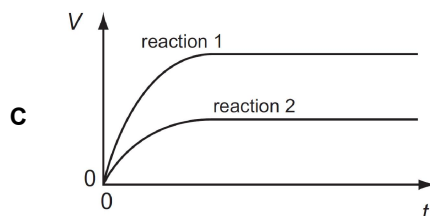
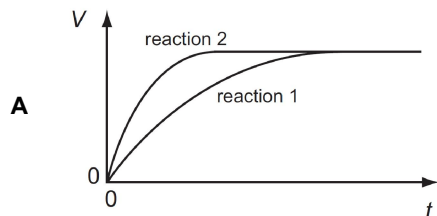
10. M/J 10/P12/Q15, M/J 10/P11/Q13

A student performs two reactions.

reaction 1 10g of magnesium ribbon with excess 2.0 mol/dm<sup>3</sup> dilute hydrochloric acid

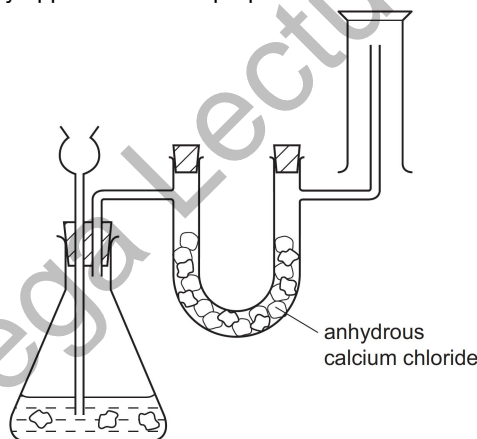
reaction 2 5g of magnesium powder with excess 2.0 mol/dm<sup>3</sup> dilute hydrochloric acid

In both experiments, the volume of hydrogen produced, V, is measured against time, t, and the results plotted graphically. Which set of graphs is correct?



11. M/J 10/P12/Q1, M/J 07/P1/Q4, M/J 10/P11/Q3

The diagram shows a simple laboratory apparatus for the preparation and collection of a dry gas.

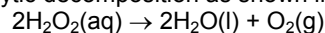


What is the gas?

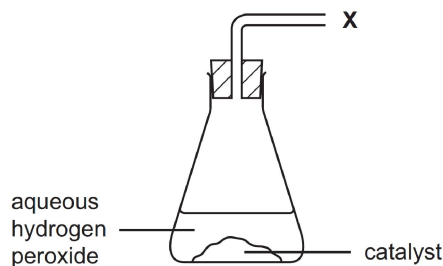
- A** carbon dioxide      **B** chlorine      **C** hydrogen      **D** hydrogen chloride

12. M/J 04/P1/Q1

Aqueous hydrogen peroxide undergoes catalytic decomposition as shown in the equation below.



The diagram shows part of the apparatus used to measure the rate of decomposition.

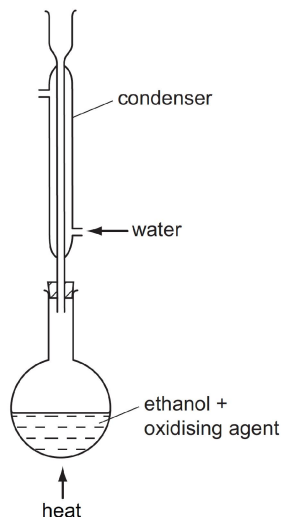


Which piece of apparatus is connected at position X?

- A** burette      **B** gas syringe      **C** measuring cylinder      **D** pipette

13. M/J 09/P1/Q3

The oxidation of ethanol to ethanoic acid is often carried out in the apparatus shown.



What is the purpose of the condenser?

- A to prevent air reacting with the ethanoic acid
- B to prevent any ethanol from escaping
- C to prevent the ethanoic acid changing back to ethanol
- D to prevent the ethanoic acid reacting with the ethanol

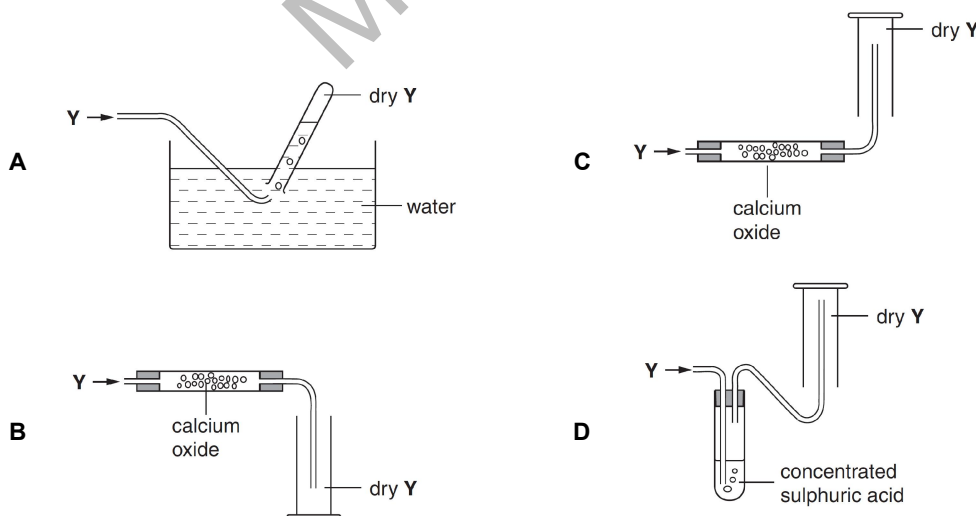
14. O/N 04/P1/Q3

A liquid boils at a temperature of 100 °C.  
Which other property of the liquid proves that it is pure water?

- A It does not leave a residue when boiled.
- B It freezes at 0 °C.
- C It is neither acidic nor alkaline.
- D It turns white anhydrous copper(II) sulphate blue.

15. M/J 03/P1/Q2

A gas Y, is less dense than air, very soluble in water and is an alkali.  
Which method is used to collect a dry sample of the gas?



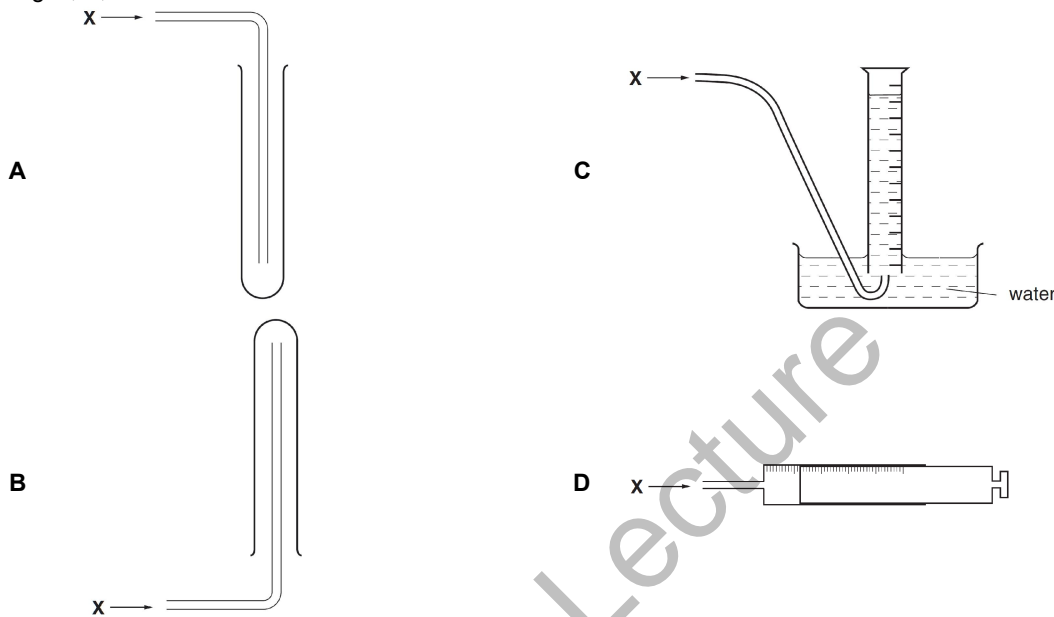
16. M/J 04/P1/Q25

Which method of preparation of a pure salt solution requires the use of a pipette and burette?

- A  $\text{BaCl}_2(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{HCl}(\text{aq})$
- B  $\text{CuO}(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CuCl}_2(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- C  $\text{KOH}(\text{aq}) + \text{HCl}(\text{aq}) \rightarrow \text{KCl}(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- D  $\text{MgCO}_3(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{MgSO}_4(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$

17. O/N 03/P1/Q2

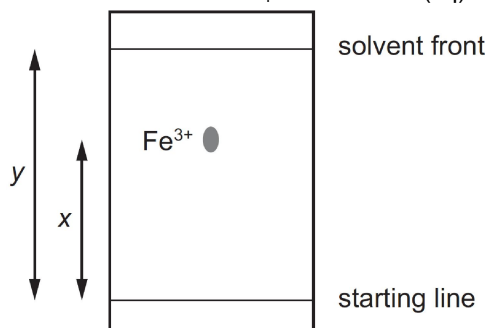
A gas, X, is less dense than air and insoluble in water. Which method **cannot** be used to collect the gas?



## 1.2 Methods of Purification and Analysis

### 18. O/N 16/P11/Q3

A paper chromatography experiment is carried out to find an  $R_f$  value for  $\text{Fe}^{3+}(\text{aq})$ . The result is shown.



To make the spot containing  $\text{Fe}^{3+}(\text{aq})$  more visible, the paper is sprayed with aqueous sodium hydroxide so that a precipitate of iron(III) hydroxide forms.

Under the conditions of the experiment, the  $R_f$  of  $\text{Fe}^{3+}(\text{aq})$  is given by .....1..... and the colour of the precipitate is .....2.....

Which row correctly completes gaps 1 and 2?

	gap 1	gap 2
<b>A</b>	$\frac{x}{y}$	red-brown
<b>B</b>	$\frac{x}{y}$	green
<b>C</b>	$\frac{y}{x}$	red-brown
<b>D</b>	$\frac{y}{x}$	green

### 19. O/N 16/P12/Q4

Benzene and cyclohexane are both flammable liquids. They are able to mix with each other without separating into two layers. They have very similar boiling points. It is difficult to separate a mixture of these two liquids by fractional distillation.

Why is it difficult to separate a mixture of benzene and cyclohexane by fractional distillation?

- A** They are both flammable.
- B** They are both liquids.
- C** They have very similar boiling points.
- D** They mix with each other completely.

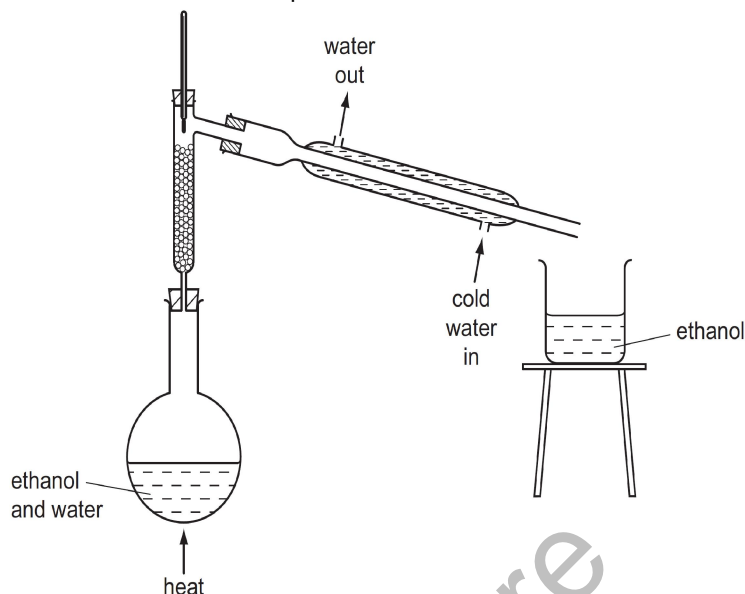
### 20. O/N 15/P12/Q2, O/N 15/P11/Q3, O/N 11/P12/Q3, O/N 11/P11/Q1

In a titration between an acid (in the burette) and an alkali, you may need to re-use the same titration flask. Which is the best procedure for rinsing the flask?

- A** Rinse with distilled water and then with the alkali.
- B** Rinse with tap water and then with distilled water.
- C** Rinse with tap water and then with the acid.
- D** Rinse with the alkali.

21. O/N 15/P12/Q1

The diagram shows the fractional distillation of an aqueous solution of ethanol.



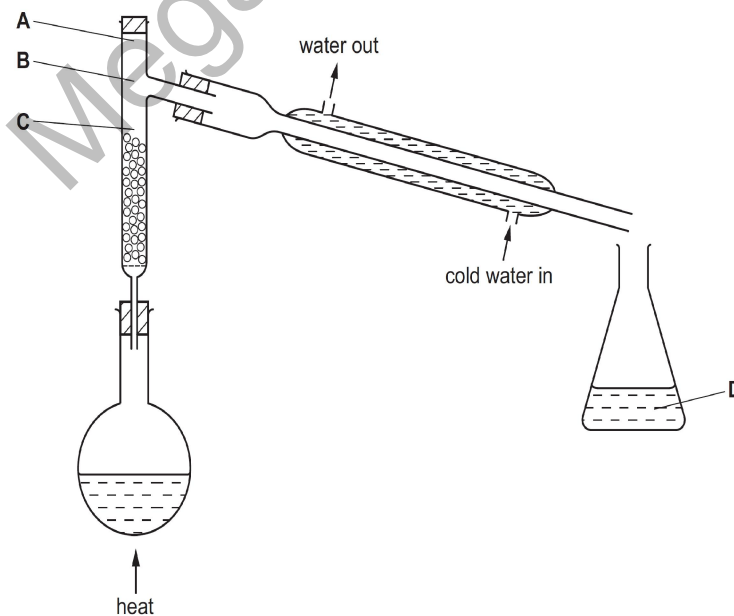
Which statement explains why ethanol is collected as the distillate?

- A Ethanol has a higher boiling point than water.
- B Ethanol has a higher melting point than water.
- C Ethanol has a lower boiling point than water.
- D Ethanol has a lower melting point than water.

22. M/J 15/P12/Q1, M/J 15/P11/Q1, O/N 10/P12/Q3, O/N 10/P11/Q5

The fractional distillation apparatus shown is being used to separate a mixture of two liquids. A thermometer is missing from the apparatus.

Where should the bulb of the thermometer be placed?



23. O/N 14/P12/Q2

Solutions of lead (II) nitrate and potassium iodide are mixed together in the preparation of lead(II) iodide. Which method can be used to separate the lead(II) iodide from the mixture?

- A crystallisation      B distillation      C evaporation      D filtration

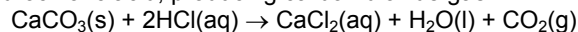
24. O/N 14/P11/Q3

What is the correct sequence for obtaining pure salt from a mixture of sand and salt?

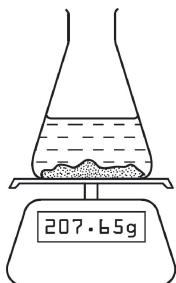
- A add water, evaporate      C add water, filter, evaporate  
B add water, filter      D filter, add water, evaporate

25. O/N 14/P11/Q1

Calcium carbonate reacts with hydrochloric acid, producing carbon dioxide gas.



The rate of this reaction can be measured using the apparatus shown.



Which additional piece of apparatus is also required?

- A a burette      B a clock      C a gas syringe      D a thermometer

26. M/J 14/P12/Q1

Which process is suitable for obtaining the water from an aqueous solution of sugar?

- A crystallisation      C filtration  
B distillation      D use of a separating funnel

27. O/N 13/P12/Q12

Which process will separate an ionic compound PQ into its elements P and Q?

- A distillation      B electrolysis      C filtration      D precipitation

28. M/J 13/P12/Q2

Which process involves boiling a liquid and condensing the vapour?

- A crystallisation      B distillation      C evaporation      D filtration

29. M/J 13/P12/Q1

Which mixture could best be separated by using a separating funnel?

- A oil and sand      C sodium chloride and sand  
B oil and water      D sodium chloride and water

30. M/J 13/P11/Q1

In which method of separation are  $R_f$  values used?

- A chromatography      C filtration  
B crystallisation      D fractional distillation

31. O/N 12/P11/Q1

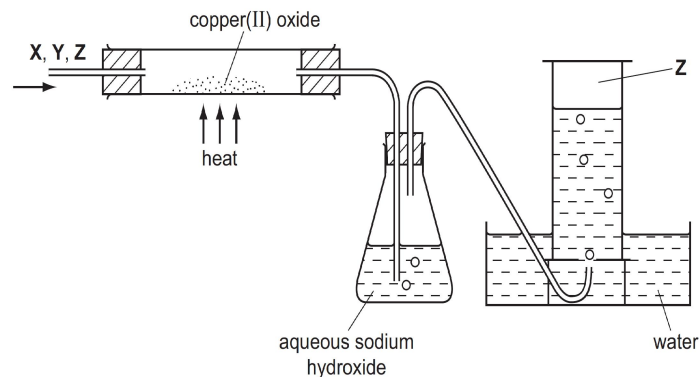
It is suspected that a lollipop contains traces of a poisonous green dye (boiling point 73 °C) as well as two harmless orange and red dyes (boiling points 69 °C and 73 °C respectively).

What is the best method by which the green dye may be detected?

- A filtration      C paper chromatography  
B fractional distillation      D recrystallisation

32. M/J 13/P12/Q28

Gas Z is to be separated from a mixture of gases X, Y and Z by the apparatus shown in the diagram.



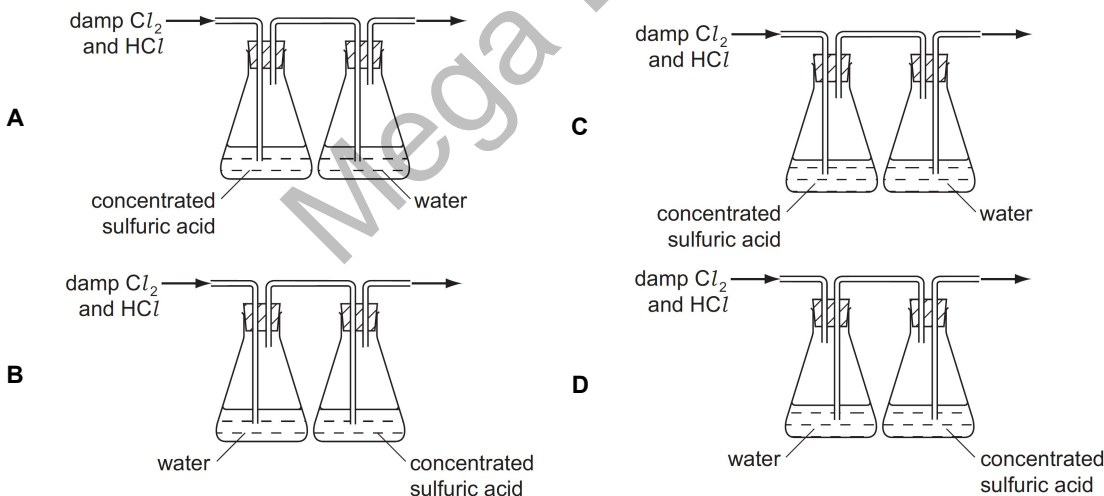
For which mixture will this system work successfully?

	X	Y	Z
A	hydrogen	carbon dioxide	nitrogen
B	oxygen	hydrogen	carbon monoxide
C	nitrogen	oxygen	hydrogen
D	carbon dioxide	nitrogen	oxygen

33. O/N 12/P12/Q3, O/N 12/P11/Q5

Hydrogen chloride is very soluble in water, whereas chlorine is only slightly soluble in water. Both gases can be dried using concentrated sulfuric acid.

Which diagram represents the correct method of obtaining pure dry chlorine from damp chlorine containing a small amount of hydrogen chloride?



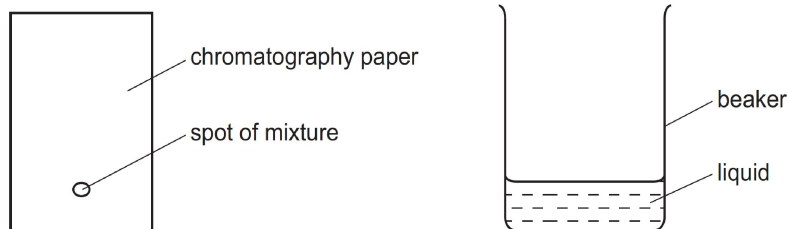
34. M/J 12/P12/Q5, O/N 09/P1/Q3

Which reagent could be used to distinguish between dilute nitric acid and dilute hydrochloric acid?

- A aqueous barium chloride                      C aqueous sodium hydroxide  
B aqueous silver nitrate                         D copper(II) carbonate

35. M/J 12/P12/Q4, M/J 12/P11/Q2

A mixture of two substances is spotted onto a piece of chromatography paper. The paper is inserted into a beaker containing a liquid.



For separation of the substances to occur the spot of mixture must

- A be placed so that the spot is just below the level of the liquid.
- B be soluble in the liquid.
- C contain substances of the same  $R_f$  values.
- D contain substances that are coloured.

36. M/J 12/P12/Q3

When dilute hydrochloric acid is added to a white powder a gas is produced. The solution remaining is tested separately with small volumes of both aqueous ammonia and aqueous sodium hydroxide.

A white precipitate is produced in both tests. What is the white powder?

- A aluminium oxide
- B calcium oxide
- C copper(II) carbonate
- D zinc carbonate

37. O/N 11/P12/Q7, O/N 11/P11/Q5

How many of the molecules shown contain only one covalent bond?

- $\text{Cl}_2$       $\text{H}_2$       $\text{HCl}$       $\text{N}_2$       $\text{O}_2$
- A 2
  - B 3
  - C 4
  - D 5

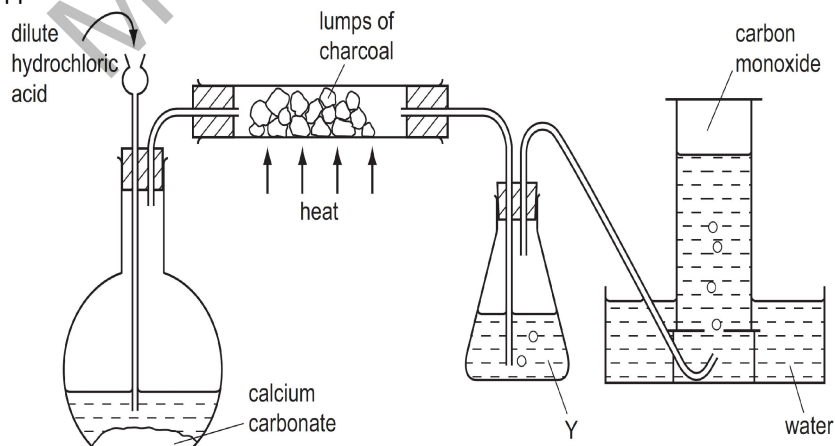
38. O/N 11/P12/Q6, O/N 11/P11/Q4

Radium (Ra) is in the same group of the Periodic Table as magnesium. What is the charge on a radium ion?

- A 2-
- B 1-
- C 1+
- D 2+

39. O/N 10/P12/Q6, O/N 10/P11/Q3

The diagram shows apparatus used to obtain carbon monoxide.



What is the main purpose of Y?

- A to dry the gas
- B to prevent water being sucked back on to the hot carbon
- C to remove carbon dioxide from the gas
- D to remove hydrogen chloride from the gas



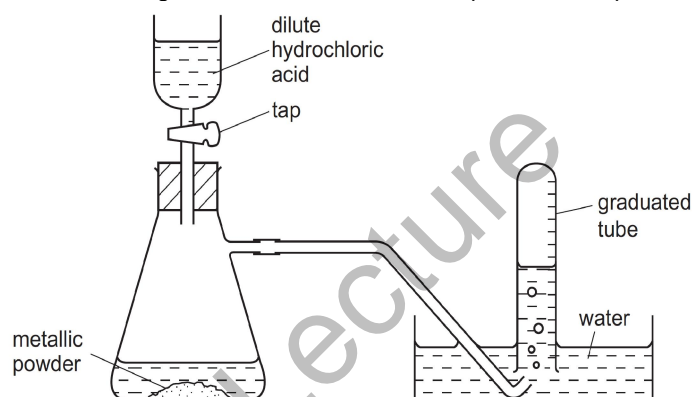
40. M/J 11/P12/Q2, M/J 11/P11/Q2

Copper(II) sulfate crystals are separated from sand using the four processes listed below. In which order are these processes used?

	1st	2nd	3rd	4th
A	filtering	dissolving	crystallising	evaporating
B	filtering	dissolving	evaporating	crystallising
C	dissolving	evaporating	filtering	crystallising
D	dissolving	filtering	evaporating	crystallising

41. M/J 10/P12/Q28, M/J 04/P1/Q19, O/N 07/P1/Q28, M/J 10/P11/Q32

The diagram shows apparatus for measuring the volume of hydrogen given off when an excess of dilute hydrochloric acid is added to powdered metal. The volume of gas is measured at room temperature and pressure.



The experiment is carried out three times, using the same mass of powder each time but with different powders:

- pure magnesium
- pure zinc
- a mixture of magnesium and zinc

Which powder gives the greatest volume of hydrogen and which the least volume?

	greatest volume of H <sub>2</sub>	least volume of H <sub>2</sub>
A	magnesium	zinc
B	magnesium	the mixture
C	zinc	magnesium
D	zinc	the mixture

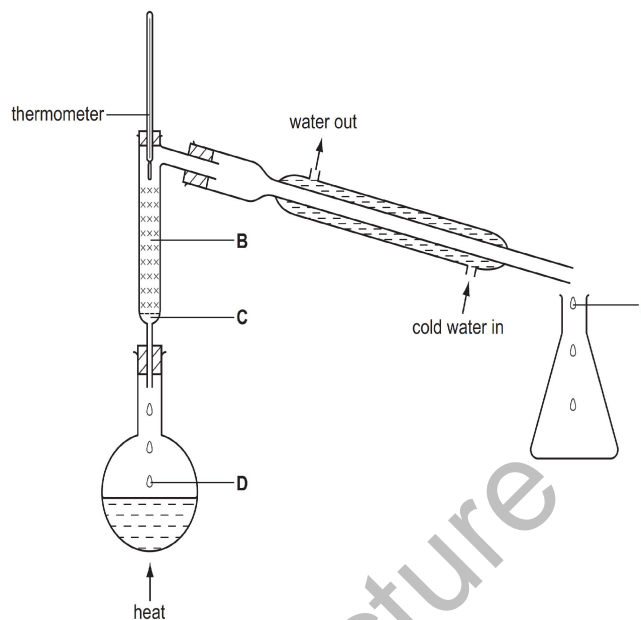
42. M/J 10/P12/Q2, O/N 07/P1/Q5, M/J 10/P11/Q2

What correctly describes the molecules in very dilute sugar solution at room temperature?

	sugar molecules	water molecules
A	close together, moving at random	close together, moving at random
B	widely separated, moving at random	close together, moving at random
C	widely separated, moving at random	close together, not moving
D	widely separated, not moving	widely separated, moving at random

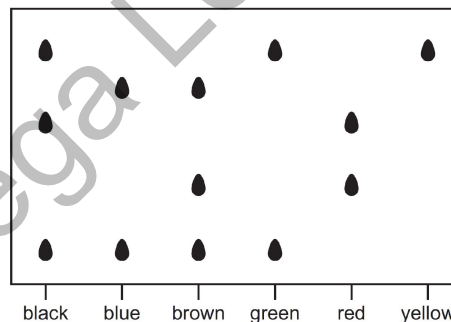
43. M/J 10/P12/Q3, M/J 10/P11/Q4

A mixture containing equal volumes of two liquids that mix completely but do not react together is placed in the apparatus shown and heated until the thermometer first shows a steady reading. At which position will there be the highest proportion of the liquid with the higher boiling point?



44. M/J 09/P1/Q2

The diagram shows a chromatogram of several inks.



Which statement is correct?

- |  |  |
|--|--|
| <b>A</b> Black ink can be made by mixing green, red and yellow inks. | <b>C</b> Yellow ink can be used to make brown ink. |
| <b>B</b> Brown ink can be made by mixing blue and red inks.          | <b>D</b> Yellow ink may be present in green ink.   |

45. O/N 08/P1/Q5

Which property shows that a liquid is pure?

- |   |   |
|---|---|
| <b>A</b> It turns anhydrous copper(II) sulphate blue. | <b>C</b> It has no effect on red or blue litmus paper.        |
| <b>B</b> It is colourless and odourless.              | <b>D</b> It boils at a fixed temperature at a given pressure. |

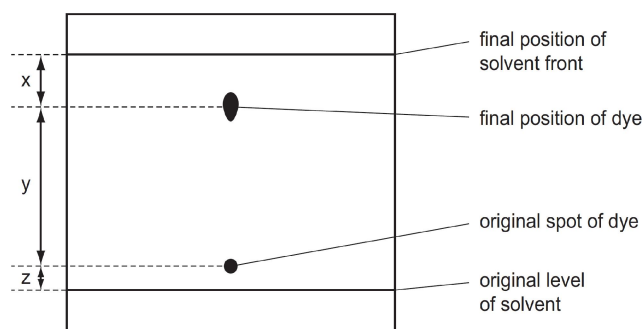
46. O/N 08/P1/Q2

Which method could be used to obtain charcoal from a mixture of powdered charcoal with sodium chloride?

- |  |                              |
|--|------------------------------|
| <b>A</b> chromatography                      | <b>C</b> heating the mixture |
| <b>B</b> filtration after shaking with water | <b>D</b> distillation        |

47. M/J 08/P1/Q7

The diagram shows the chromatogram obtained by analysis of a single dye. Three measurements are shown.



How is the  $R_f$  value of the dye calculated?

- A  $\frac{x}{x+y}$       B  $\frac{y}{x+y}$       C  $\frac{x}{x+y+z}$       D  $\frac{y}{x+y+z}$

48. O/N 07/P1/Q1

A test-tube containing a liquid **X** is placed in a beaker of boiling water. The liquid **X** starts to boil immediately. What is the boiling point of liquid **X**?

- A 100°C      B above 100°C      C between 0°C and room temperature      D between room temperature and 100°C

49. M/J 07/P1/Q9 M/J 03/P1/Q8

How does a magnesium atom form a bond with an oxygen atom?

- A by giving one pair of electrons to the oxygen atom  
B by sharing one pair of electrons, both electrons provided by the magnesium atom  
C by sharing two pairs of electrons, both pairs provided by the oxygen atom  
D by sharing two pairs of electrons, each atom donating one pair of electrons

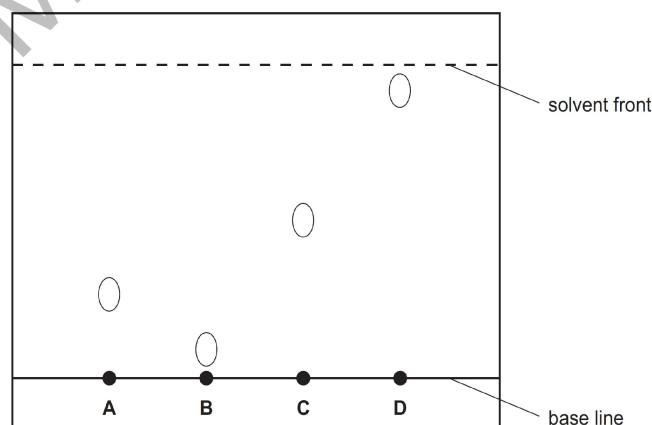
50. O/N 06/P1/Q1

At which temperature does a concentrated aqueous solution of sodium chloride begin to boil?

- A 96 °C      B 99 °C      C 100 °C      D 104 °C

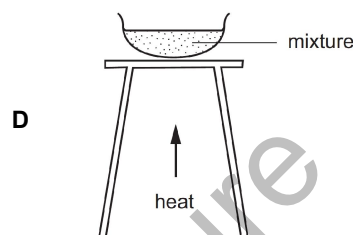
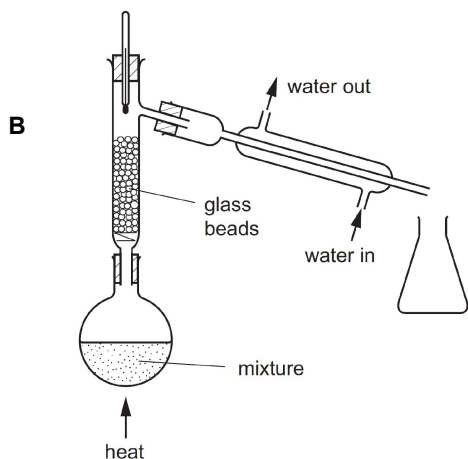
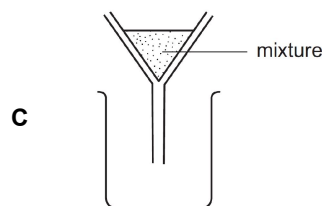
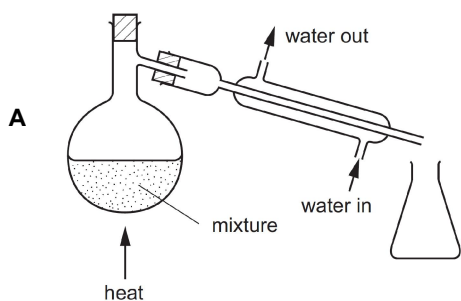
51. O/N 04/P1/Q2

The diagram shows the chromatogram of four different sugars using the same solvent. Glucose has an  $R_f$  value of 0.5. Which sugar is glucose?



52. O/N 05/P1/Q2

Substance **X** melts at 53°C and boils at 100°C. It does not dissolve in water and it does not react with water. Which diagram shows the method most suitable for separating **X** from a mixture of **X** and water?



53. O/N 05/P1/Q1

Which of the following is a pure compound?

- A** ethanol      **B** petrol      **C** steel      **D** tap water

54. M/J 04/P1/Q4

Which of the following is the best method of obtaining pure water from ink?

- A** chromatography      **B** distillation      **C** filtration      **D** freezing

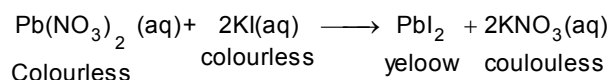
55. O/N 03/P1/Q1

What is the most suitable way of investigating the different food colourings in some drinks?

- A** crystallisation      **C** fractional distillation  
**B** filtration      **D** paper chromatography

56. M/J 03/P1/Q1

The equation for the reaction between aqueous lead(II) nitrate and aqueous potassium iodide is shown.



Which method could be used to separate the products?

- A** chromatography      **B** crystallisation      **C** distillation      **D** filtration

57. O/N 02/P1/Q3

From which mixture can the underlined substance be obtained by adding water, stirring and filtering?

- A** calcium carbonate and sodium chloride      **C** ethanoic acid and ethanol  
**B** copper(II) sulphate and sodium chloride      **D** iron and magnesium

### 1.3 Identification of Ions and Gases

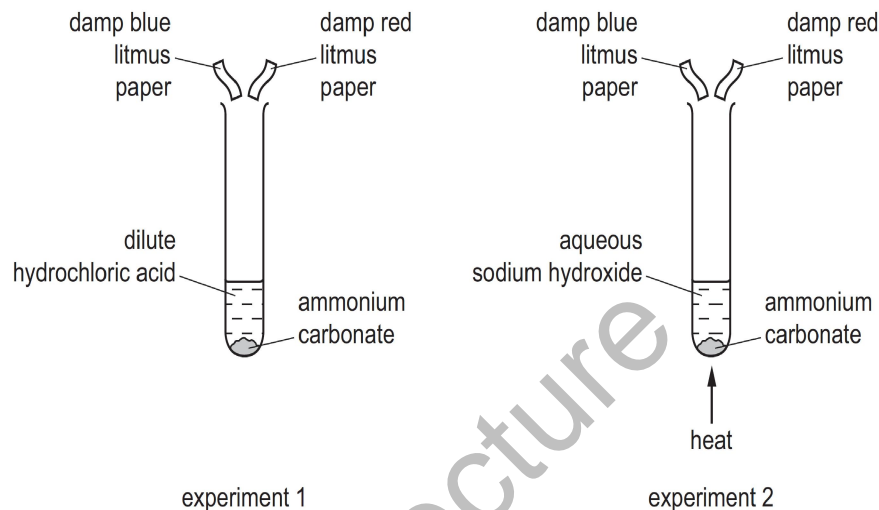
**58. O/N 16/P11/Q2**

Two experiments were carried out.

In experiment 1, ammonium carbonate was reacted with dilute hydrochloric acid.

In experiment 2, ammonium carbonate was heated with aqueous sodium hydroxide.

In each experiment, the gas evolved was tested with damp blue litmus paper and damp red litmus paper.



Which row correctly shows the colour of both the pieces of litmus paper at the end of each experiment?

	experiment 1	experiment 2
<b>A</b>	blue	blue
<b>B</b>	blue	red
<b>C</b>	red	blue
<b>D</b>	red	red

**59. O/N 16/P12/Q11**

Aqueous sodium hydroxide is added to a sample of a colourless solution. Aqueous ammonia is added to a separate sample of the colourless solution.

In both cases a white precipitate forms which is soluble in excess reagent.

Which positive ion is present in the solution?

- A** aluminium      **B** calcium      **C** copper(II)      **D** zinc

**60. M/J 16/P12/Q1**

Which row correctly identifies the gas?

	gas	test	observation
<b>A</b>	$Cl_2$	damp litmus paper	the litmus paper turns blue
<b>B</b>	$NH_3$	damp litmus paper	the litmus paper turns red
<b>C</b>	$O_2$	limewater	no change is observed
<b>D</b>	$SO_2$	acidified aqueous potassium manganate(VII)	the colour of the solution changes from purple to colourless

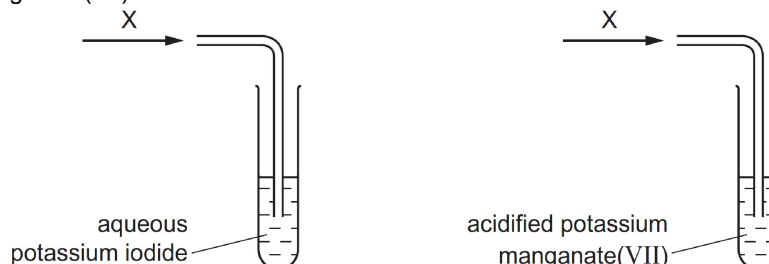
61. O/N 16/P12/Q1

When measured under the same conditions, which gas diffuses at the same rate as nitrogen?

- A ammonia,  $\text{NH}_3$       B carbon monoxide, CO      C ethane,  $\text{C}_2\text{H}_6$       D oxygen,  $\text{O}_2$

62. M/J 16/P11/Q22

Gaseous compound X is an oxidising agent. X is bubbled through separate solutions of aqueous potassium iodide and acidified potassium manganate(VII).



Which row shows the colour changes when X is bubbled through these two solutions?

	aqueous potassium iodide	acidified potassium manganate(VII)
A	brown to colourless	no change
B	brown to colourless	purple to colourless
C	colourless to brown	no change
D	colourless to brown	purple to colourless

63. O/N 15/P12/Q4

A colourless solution is known to contain a sodium salt. Tests were carried out to determine the identity of the anion in the solution.

test	observation
dilute hydrochloric acid	no reaction
dilute nitric acid followed by aqueous silver nitrate	no precipitate
dilute nitric acid followed by aqueous barium nitrate	no precipitate

Which anion could the solution contain?

- A carbonate      B chloride      C nitrate      D sulfate

64. M/J 15/P11/Q2, M/J 15/P12/Q7

The table shows the results of two reactions of an aqueous solution of a salt.

reagents	final observation
excess aqueous sodium hydroxide	white precipitate
dilute nitric acid and aqueous silver nitrate	yellow precipitate

What is the name of the salt?

- A calcium chloride      B calcium iodide      C zinc nitrate      D zinc sulfate

65. O/N 14/P12/Q27, O/N 14/P11/Q26

A gas G

- has no smell,
- is not poisonous,
- reacts with hydrogen at high temperature and pressure.

What is gas G?

- A carbon monoxide      B helium      C nitrogen      D chlorine

66. O/N 14/P12/Q3

A small amount of aqueous copper(II) sulfate is put into a test-tube. A few drops of aqueous ammonia are added to the test-tube. Then an excess of aqueous ammonia is added to the same test-tube. What are the two observations?

	few drops of aqueous ammonia	excess aqueous ammonia
A	light blue precipitate	dark blue solution
B	light blue precipitate	light blue precipitate
C	dark blue solution	dark blue solution
D	dark blue solution	light blue precipitate

67. O/N 14/P11/Q2

Which compound when in aqueous solution will produce a red / brown precipitate on the addition of an aqueous solution of  $\text{Fe}^{3+}$  ions?

- A hydrogen chloride    B sodium chloride    C sodium hydroxide    D sulfur trioxide

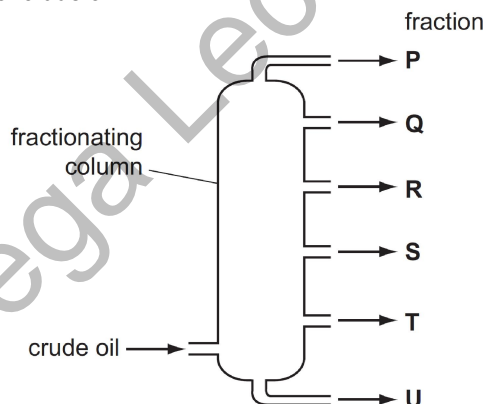
68. M/J 14/P12/Q30

Which gas turns moist blue litmus paper red and produces a precipitate when bubbled through calcium hydroxide solution?

- A  $\text{CO}$     B  $\text{CO}_2$     C  $\text{HCl}$     D  $\text{NH}_3$

69. O/N 13/P12/Q3

The diagram shows the fractionation of crude oil.



Which statement is correct?

- A Each fraction consists of a single compound.  
B Fraction P has the highest boiling point.  
C The highest temperature is at the top of the column.  
D The naphtha fraction is used as feedstock for the chemical industry.

70. O/N 13/P11/Q2

The results of two tests on a solution X are shown.

reagent added	few drops	an excess
aqueous sodium hydroxide	white precipitate	precipitate dissolves
aqueous ammonia	white precipitate	precipitate remains

Which ion is present in solution X?

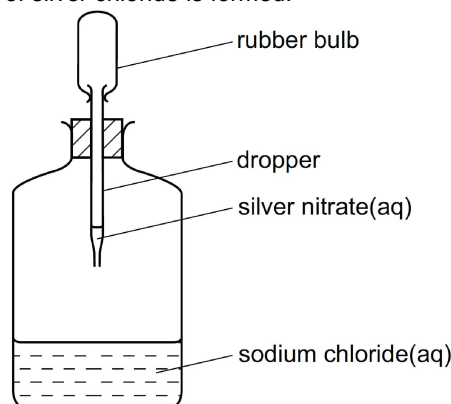
- A  $\text{Al}^{3+}$     B  $\text{Ca}^{2+}$     C  $\text{Cu}^{2+}$     D  $\text{Zn}^{2+}$





79. M/J 12/P12/Q12

When the rubber bulb of the dropper in the diagram is squeezed, the aqueous silver nitrate drops into the aqueous sodium chloride and a white precipitate of silver chloride is formed.

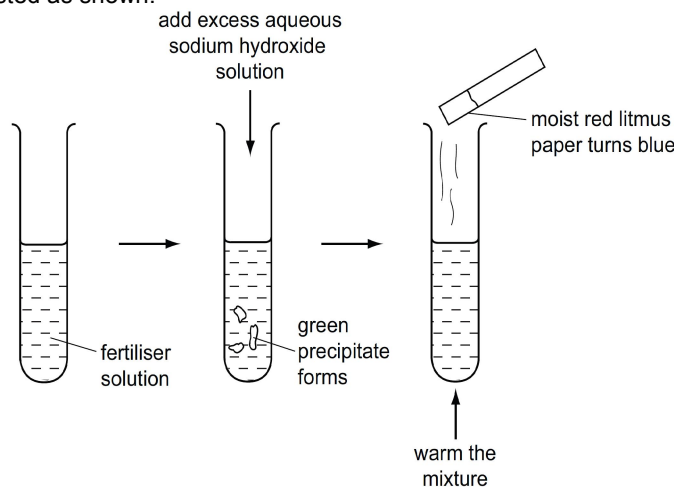


What happens to the total mass of the bottle and contents?

- A** It increases due to the formation of the heavy precipitate.  
**B** It remains the same because only a physical change has taken place.  
**C** It decreases because heat is evolved.  
**D** It remains the same because none of the products escapes from the bottle.
80. M/J 12/P12/Q19, M/J 12/P11/Q7  
Which ion reacts with aqueous ammonia to give a precipitate that dissolves in an excess of ammonia?  
**A**  $\text{Al}^{3+}(\text{aq})$       **B**  $\text{Fe}^{2+}(\text{aq})$       **C**  $\text{Fe}^{3+}(\text{aq})$       **D**  $\text{Zn}^{2+}(\text{aq})$
81. M/J 12/P11/Q8  
Which statement about aqueous sodium chloride is correct?  
**A** It contains sodium atoms.  
**B** It contains two different types of molecules.  
**C** It does not conduct electricity.  
**D** It forms a white precipitate when added to aqueous silver nitrate.
82. M/J 12/P11/Q4  
The addition of dilute acid to a solution containing the anion Q and the subsequent use of limewater can be used to identify the anion Q.  
What is Q?  
**A** a carbonate      **B** a chloride      **C** an iodide      **D** a sulfate
83. O/N 11/P12/Q31, O/N 11/P11/Q32  
A sample of tap water gave a white precipitate with acidified silver nitrate.  
What does this show about the tap water?  
**A** It contained chloride.      **C** It contained nitrates.  
**B** It contained harmful microbes.      **D** It had not been filtered.
84. O/N 11/P12/Q2, O/N 11/P11/Q2  
The labels fell off two bottles each containing a colourless solution, one of which was sodium carbonate solution and the other was sodium chloride solution.  
The addition of which solution to a sample from each bottle would **most** readily enable the bottles to be correctly relabelled?  
**A** ammonia      **B** hydrochloric acid      **C** lead(II) nitrate      **D** sodium hydroxide
85. M/J 11/P12/Q4, M/J 11/P11/Q4, M/J 08/P1/Q4  
A student tested a solution by adding aqueous sodium hydroxide. A precipitate was not seen because the reagent was added too quickly.  
What could **not** have been present in the solution?  
**A**  $\text{Al}^{3+}$       **B**  $\text{Ca}^{2+}$       **C**  $\text{NH}_4^+$       **D**  $\text{Zn}^{2+}$

86. M/J 11/P12/Q21, M/J 11/P11/Q21, M/J 04/P1/Q6

A solution of fertiliser was tested as shown.

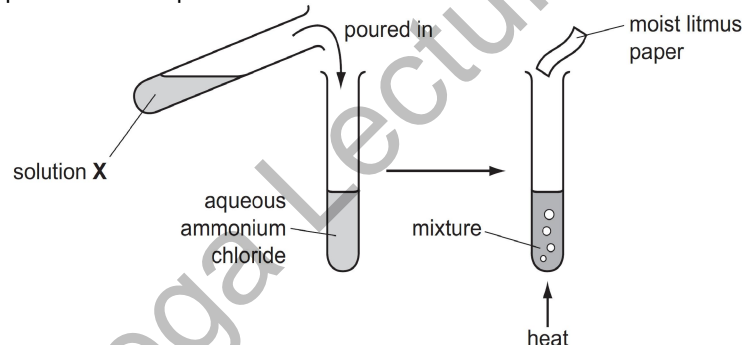


Which ions must be present in the fertiliser?

- A  $\text{Fe}^{2+}$  and  $\text{SO}_4^{2-}$     B  $\text{Fe}^{3+}$  and  $\text{NO}_3^-$     C  $\text{NH}_4^+$  and  $\text{Fe}^{2+}$     D  $\text{NH}_4^+$  and  $\text{NO}_3^-$

87. M/J 11/P12/Q3, M/J 11/P11/Q3, O/N 05/P1/Q4

The diagrams show an experiment with aqueous ammonium chloride.



A gas, Y, is produced and the litmus paper changes colour.  
What are solution X and gas Y?

	solution X	gas Y
A	aqueous sodium hydroxide	ammonia
B	aqueous sodium hydroxide	chlorine
C	dilute sulfuric acid	ammonia
D	dilute sulfuric acid	chlorine

88. O/N 10/P12/Q17, O/N 10/P11/Q18

The tests below were carried out on a solution containing ions of the metal X.

test	observation
add sodium chloride solution	no change
add sodium sulfate solution	no change
add sodium hydroxide solution	a precipitate was formed, soluble in excess of the hydroxide

What is metal X?

- A calcium    B iron    C lead    D zinc

89. O/N 10/P12/Q2, O/N 10/P11/Q1

Substance X dissolves in water to form a colourless solution. This solution reacts with aqueous lead(II) nitrate in the presence of dilute nitric acid to give a yellow precipitate.

What is substance X?

- A calcium iodide      B copper(II) chloride      C iron(II) iodide      D sodium chloride

90. M/J 10/P12/Q19, M/J 10/P11/Q18

A metal reacts with dilute hydrochloric acid to produce a gas.

What is used to identify this gas?

- A a glowing splint      C damp blue litmus paper  
B a lighted splint      D limewater

91. M/J 10/P12/Q4, M/J 10/P11/Q1

Which is an anion that is present in the solution formed when an excess of dilute hydrochloric acid is added to calcium carbonate?

- A  $\text{Ca}^{2+}$       B  $\text{Cl}^-$       C  $\text{CO}_3^{2-}$       D  $\text{H}^+$

92. M/J 09/P1/Q5

A coin is analysed by dissolving it in nitric acid. To the resulting solution an excess of aqueous ammonia is added and the mixture is filtered.

A brown precipitate remains in the filter paper and a deep blue solution is obtained as the filtrate.

Which metals does the coin contain?

- A aluminium and copper      B copper and iron      C iron and lead      D lead and zinc

93. O/N 08/P1/Q6

Solution X contains a simple salt.

The table shows the results of some tests on solution X.

test	observation
addition of aqueous sodium hydroxide	green precipitate forms
addition of acidified barium nitrate	white precipitate forms

What is the name of the salt in solution X?

- A iron(II) chloride      B iron(III) chloride      C iron(II) sulphate      D iron(III) sulphate

94. O/N 07/P1/Q4

An aqueous solution of zinc chloride is tested with various reagents.

Which observation is correct?

- A Acidified barium nitrate solution gives a white precipitate.  
B Aqueous ammonia gives a white precipitate soluble in excess of the reagent.  
C Copper turnings precipitate zinc.  
D Sodium hydroxide solution gives a white precipitate insoluble in excess of the reagent.

95. O/N 07/P1/Q3

Compound X reacts with some metals to liberate hydrogen and is used to make fertilisers.

It gives a white precipitate when added to aqueous barium nitrate.

What is X?

- A ammonium sulphate      C potassium nitrate  
B hydrochloric acid      D sulphuric acid





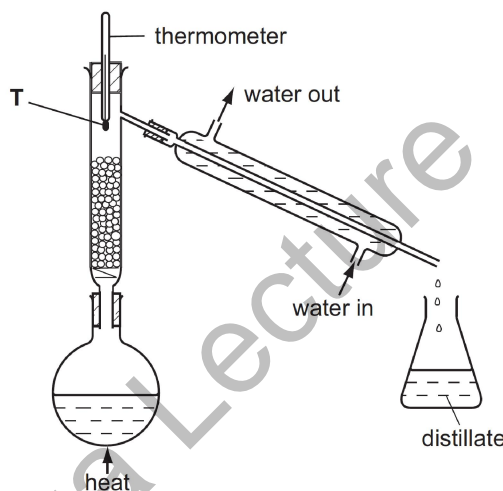
104. M/J 05/P1/Q2

A student adds aqueous sodium hydroxide or aqueous ammonia to aqueous solutions of four different metal compounds. Which solution contains  $Zn^{2+}$  ions?

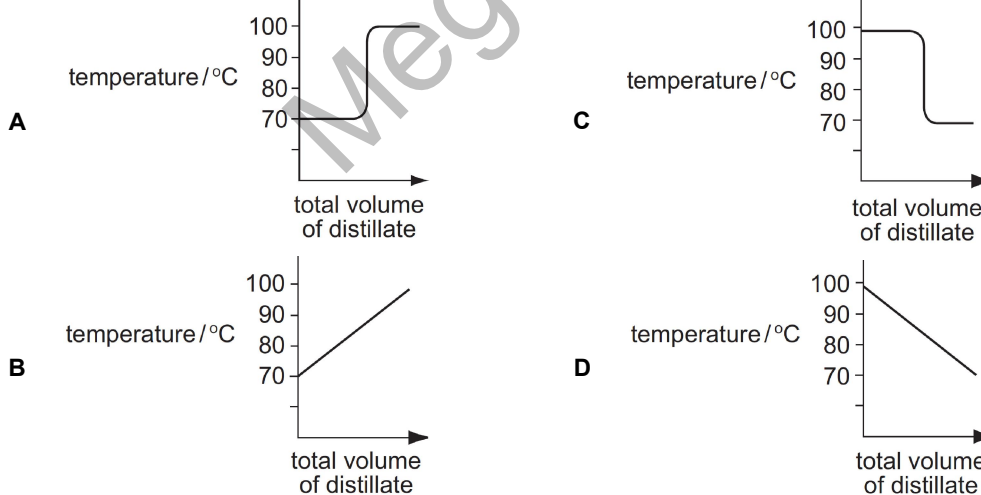
solution	add a few drops of NaOH(aq)	add excess NaOH(aq)	add a few drops of $NH_3(aq)$	add excess $NH_3(aq)$
A	ppt	ppt dissolves	ppt	ppt dissolves
B	ppt	ppt dissolves	ppt	ppt
C	ppt	ppt	no ppt	no ppt
D	no ppt	no ppt	no ppt	no ppt

105. O/N 04/P1/Q4

The diagram shows apparatus used to separate hexane (boiling point,  $70\text{ }^\circ\text{C}$ ) and heptane (boiling point,  $98\text{ }^\circ\text{C}$ ).



Which graph would be obtained if the temperature at point T was plotted against the total volume of distillate collected?



106. O/N 04/P1/Q1

A pale green solution X gives a green precipitate with excess aqueous sodium hydroxide. An alkaline gas is only given off when the mixture is warmed with powdered aluminium. Which ions does X contain?

- |                           |                          |
|---------------------------|--------------------------|
| A ammonium and copper(II) | C copper(II) and nitrate |
| B ammonium and iron(III)  | D iron(II) and nitrate   |

107. M/J 04/P1/Q38

A student carries out three tests on a gas X.

test	results
damp red litmus paper	stays red
aqueous bromine	stays brown
lighted splint	gas burns

Which gas could be X?

- A ammonia      B ethene      C methane      D oxygen

108. M/J 03/P1/Q26

The table shows the results of two tests carried out on separate portions of a solution of salt X.

	test	observation
1	acidified aqueous barium nitrate added	white precipitate
2	aqueous sodium hydroxide added	white precipitate soluble in an excess of aqueous sodium hydroxide

What is X?

- A calcium chloride      B iron(II) sulphate      C lead(II) nitrate      D zinc sulphate

## 1.4 Multiple Topics

### 109. M/J 03/P1/Q3

The diagrams show mixtures of chemicals that react to produce gases.  
In which reaction will the litmus paper change colour?

**A**

damp blue litmus paper

dilute hydrochloric acid

zinc

**B**

damp red litmus paper

dilute hydrochloric acid

sodium carbonate

**C**

damp blue litmus paper

aqueous sodium hydroxide

ammonium chloride

**D**

damp red litmus paper

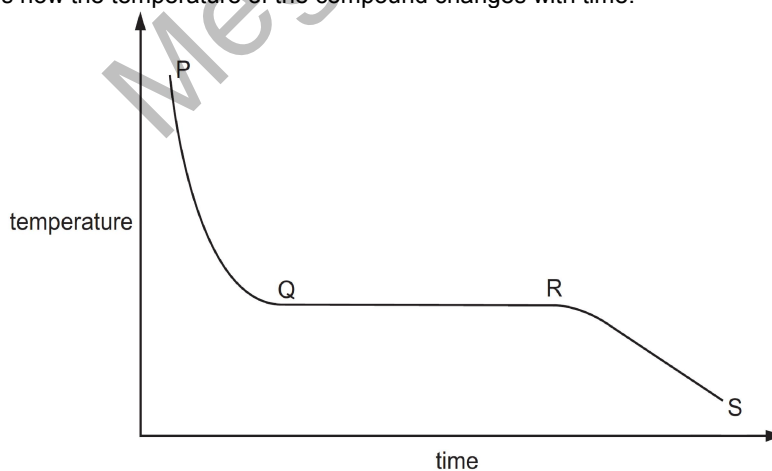
aqueous sodium hydroxide

sodium nitrate and aluminium

### 110. M/J 05/P1/Q3

A sample of a pure compound is heated until it is completely molten and the compound is then allowed to cool until it is completely solid again.

The graph shows how the temperature of the compound changes with time.



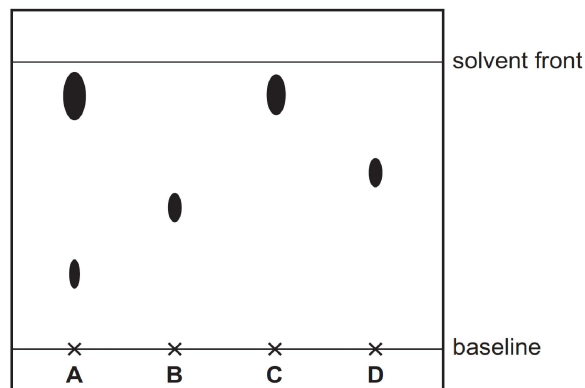
When are liquid and solid both present?

- A P to Q and R to S
- B P to Q
- C Q to R
- D R to S



111. **M/J 16/P12/Q3**

Q is a pure sample of a substance that has a single  $R_f$  value of 0.9.  
In the chromatogram shown, which letter represents Q?



Mega Lecture

## Answers Section

- D  
Obvious Answer
- B  
Because  $\text{CO}_2$  is soluble in water.
- C  
Time clock is required only for rate.
- C  
Titration apparatus is required.
- A  
 $\text{C}_2\text{H}_5\text{NH}_2$  = HC/ = Mr 36  
Mr  $24 + 5 + 14 + 2 = 45$   
 $\text{C}_2\text{H}_5\text{NH}_2$  Mr of  $\text{C}_2\text{H}_5\text{NH}_2$  is greater than HC/ so its movement is slow.
- C  
Concentration of ethanol decreases gradually then it becomes zero, because its boiling point is  $78^\circ\text{C}$ .
- B  
 $\text{SO}_2$  should not be collected over water because it is soluble in water.
- C  
Air contains 78 – 79%  $\text{N}_2$  and 20 – 21%  $\text{O}_2$ . In conical flask there is air and first few tubes of gas contain Nitrogen gas that's why these few tubes were rejected.
- B  
Obvious Answer
- D  
Reaction 2 should be faster than reaction 1 because in reaction 2 magnesium is present in powder form, as the amount of magnesium is less (5g) in reaction 2 hence less volume should be obtained as compare to the reaction 1.
- C  
Lighter gases are collected by the upward delivery of gases or downward displacement of air.
- B  
At X  $\text{O}_2$  gas is collected so use gas syringe.
- B  
This is reflux condenser and it prevent the escape of liquid before completion of the reaction. Ethanol has low boiling point so it may escape before the completion of the reaction between Ethanol and Ethanoic acid.
- B  
Pure water boil at  $100^\circ\text{C}$  and freezes at  $0^\circ\text{C}$ .
- C  
 $\text{CaO}$  is basic in nature & do not react with alkaline.
- C  
Both reactants and products are liquids.
- A  
It is less than air so cannot be collected by downward delivery.

18. A  
 $\text{Fe}^{3+}$  when reacts with  $\text{NaOH}_{(\text{aq})}$  reddish brown ppt is formed  
$$R_f = \frac{\text{distance travelled by } \text{Fe}^{3+}}{\text{distance travelled by solvent}}$$
19. C  
Fractional distillation is based on difference in temperature.
20. B  
First rinse with tap water and then with distilled water. Rinsing with alkali or acids may effect the titration readings.
21. C  
Obvious Answer
22. B  
This is the place which indicate fixed temperature.
23. D  
 $\text{Pb}^{2+} + 2\text{I}^- \longrightarrow \text{PbI}_2$   
ppt. can be separated by yellow ppt. filtration.
24. C  
Salt is soluble and sand is insoluble in water.
25. B  
Rate can be determined by time clock.
26. B  
Obvious Answer
27. B  
Electrolysis is the process of decomposition of electrolyte. So ionic compounds can be changed back to its elements.
28. B  
Obvious Answer
29. B  
Separating funnel is used to separate two immisable liquids.
30. A  
Obvious Answer
31. C  
Chromatography can be used to separate colours.
32. A  
 $\text{H}_2$  reacts with CNO.  
 $\text{CO}_2$  reacts with NaOH.  
 $\text{N}_2$  gas can be collected over water, it is insoluble in water.
33. B  
First pass the gas mixture through water which will absorb the HCl gas molecules then pass the gas through concentrated sulfuric acid to remove the water contents present into the  $\text{Cl}_2$  gas because sulfuric acid is a very good drying agent.
34. B  
Silver nitrate solution will be produced white ppt with dilute hydrochloric acid, but silver nitrate will show no change with nitric acid.
35. B  
Chromatography depends on the extent of solubility in the solvent.
36. D  
Zinc carbonate is a white powder and it produces  $\text{CO}_2$  gas with HCl. The remaining solution contain  $\text{Zn}^{2+}$  ions which gives white precipitate with sodium hydroxide and ammonia solution.
37. B  
Nitrogen molecule has triple covalent bond. Oxygen has double covalent bond between atoms while all other molecules like  $\text{H}_2$ ,  $\text{Cl}_2$  and HCl have single covalent bond between atoms.
38. D  
Elements which are present in the same group they have same no. of valence shell electrons that's why they show same charges on the ions.

39. C  
Y is an alkaline medium which is used to dissolve the CO<sub>2</sub> gas.
40. D  
In first step mixture should be added into water then the process of filtration should be done for the removal of sand particles. In next step filtrate should be evaporated to get pure crystals of copper (II) sulfate.
41. A  
Same mass of powder of Mg and Zinc have different number of moles. Mg moles will be more than the Zinc mole in same mass hence Mg will produce greatest volume of H<sub>2</sub> and Zinc will produce least volume of H<sub>2</sub> and mixture will produce less than Mg and more than Zinc.
42. B  
Dilute sugar solution means, solute is very low in quantity and solvent is very high in quantity so solute particles should be widely separated and moving at random while solvent molecule must be close together and moving at random.
43. D  
Fractional distillation is a process in which miscible components are separated from each other on the basis of their boiling points, low boiling point components are separated first & high boiling point components are separated after it. Hence at position D there will be the highest proportion of the liquid with the highest boiling point.
44. D  
Yellow ink has only one spot and its R<sub>f</sub> value matches the green ink so yellow ink may be present in green ink.
45. D  
Pure substances have sharp melting and boiling point. Chromatography can also be used to check the purity of a substance e.g. pure dyes show only one spot on chromatogram.
46. B  
Charcoal is insoluble in water while Sodium Chloride is soluble in water so filtration is the best technique to separate the insoluble component from the mixture of an insoluble and soluble component.
47. B  
$$R_f = \frac{\text{Distance travelled by solute}}{\text{Distance travelled by solvent}}$$
  
$$R_f = \frac{y}{x+y}$$
48. D  
Boiling Point of water is 100°C. If a liquid X starts to boil immediately after placing the tube containing liquid X in a beaker of boiling water means the boiling point of liquid X must be in between room temperature and 100°C.
49. A  
Magnesium is a metal while oxygen is a non-metal. Ionic bond is formed between metals and nonmetals by transferring of electrons from metal atom to a non-metal atom. As magnesium is present in group II so it transfers the two electrons to oxygen atom.
50. D  
Impurity increases the boiling temperature of water.
51. C  
Measure the distance from C to the spot and then calculate R<sub>f</sub>.
52. C  
Obvious Answer
53. A  
Petrol is a mixture. Steel is an alloy and tap water contain salts in it.
54. B  
Obvious Answer
55. D  
Chromatography is a good technique to separate colours.
56. D  
Because PbI<sub>2</sub> is ppt (yellow).
57. A  
CaCO<sub>3</sub> is insoluble in water.

58. C  
In experiment 1  $\text{CO}_2$  and in experiment 2 Ammonia gas evolved.
59. D  
Zinc ion gives precipitate with both  $\text{NaOH}$  and  $\text{NH}_3$  and ppts are soluble in excess.
60. D  
 $\text{SO}_2$  gas is a reducing agent.
61. B  
Because  $\text{CO}$  and  $\text{N}_2$  leave same  $M_r$ .
62. C  
X is reducing agent.
63. C  
 $\text{HCl}$  react with Carbonate.  
 $\text{Cl}^-$  give ppt. with  $\text{AgNO}_3$   
 $\text{Ba}^{2+}$  give ppt. with  $\text{SO}_4^{2-}$ .  
so it is  $\text{NO}_3^-$ .
64. B  
 $\text{Ca}^{2+}$  gives white ppt. with  $\text{NaOH}$ .  
 $\text{I}^-$  give yellow ppt. with  $\text{AgNO}_3$
65. C  
It has high activation energy due to  $\equiv$  bond.
66. A  
 $\text{Cu}^{2+}$  ions give blue ppt. with aqueous  $\text{NH}_3$  then blue solution with excess  $\text{NH}_3_{\text{aq}}$ .
67. C  
 $\text{NaOH}_{\text{aq}}$  from  $\text{Fe}(\text{OH})_3$  Red brown ppt.
68. B  
 $\text{CO}_2$  is acidic gas and reacts with  $\text{NaOH}$  and form  $\text{Na}_2\text{CO}_3$ .
69. D  
Obvious Answer
70. A  
Test of  $\text{Al}^{3+}$ .
71. C  
 $\text{Ba}^{2+}$  gives ppt. with  $\text{SO}_4^{2-}$  and  $\text{CO}_3^{2-}$
72. A  
 $\text{NH}_3$  is basic so colour change is blue and blue litmus paper has no effect.
73. A  
Sulfur dioxide is a reducing agent, and when we pass the gas through acidified solutions of Potassium dichromate (VI) it changes its colour from orange to green and it also reduces the Potassium dichromate (VII) and changes its colour from pink to colourless.
74. A  
All carbonates are insoluble in water except group-I Carbonates. In case of Magnesium salts all salts are soluble except  $\text{MgCO}_3$ .
75. A  
Hydrogen is a highly flammable gas and it readily catches fire so it burns in air.
76. D  
Obvious Answer
77. C  
All the nitrates are soluble.
78. B  
Test of  $\text{NH}_4^+$  &  $\text{SO}_4^{2-}$ .  
D

79. White precipitate of silver chloride along with sodium nitrate solution is formed by the reaction of silver nitrate with sodium chloride so the mass of the bottle and contents remains the same because none of the products escapes from the bottle.
80. D  
 $Al^{3+}$  and  $Zn^{2+}$  ions both forms white ppt with aqueous ammonia but  $Zn^{2+}$  ions are soluble in excess aqueous ammonia.
81. D  
Test of chloride with  $AgNO_3$  (aq).
82. A  
 $CO_2$  gas evolve which turns lime water ( $Ca(OH)_2$ ) milky.
83. A  
Silver nitrate gives white precipitate with the following ions.  
(i) Chloride  
(ii) Sulphate
84. B  
Hydrochloric acid is a good reagent for the identification of these solutions because when we add  $HCl$  in that bottle which has sodium carbonate solution then bubbles of colourless gas (i.e.  $CO_2$ ) will be evolved, but there will be no reaction with sodium chloride solution.
85. B  
 $Ca^{+2}$  ions are insoluble in aqueous sodium hydroxide if there is no precipitate by adding sodium hydroxide then it must be  $Ca^{+2}$  ion because  $Al^{3+}$  and  $Zn^{2+}$  ions are soluble in excess reagent while  $Ca^{+2}$  ions remains insoluble.
86. C  
If the green precipitates are formed by the addition of sodium hydroxide solution it means the fertilizer must contain  $Fe^{2+}$  ions and further heating of the mixture produces basic gas then it must has  $NH_4^+$  ion.
87. A  
When an alkali is reacted with any ammonium salt it produces ammonia gas. Acid and ammonium salt does not react with each other.
88. D  
Zinc ions form white ppt with sodium hydroxide solution and are soluble in excess sodium hydroxide while the precipitates of calcium, iron and lead are insoluble in excess sodium hydroxide.
89. A  
Calcium is not a transition element so its compounds form colour less solution. Lead (II) iodide is a yellow solid so the reaction of Calcium Iodide with Lead (II) nitrate gave Lead (II) iodide.
90. B  
When a metal reacts with a dilute acid then salt and hydrogen gas is obtained but the metal must be above than hydrogen in reactivity series. Pops in a flame is produced if the gas will be hydrogen, so a lighted splint will be used to test the gas.
91. B  
 $CaCO_3$  is an insoluble substance so when we add dilute  $HCl$  to Calcium Carbonate the following reaction occurs.  
$$CaCO_3 + HCl(aq) \longrightarrow CaCl_2(aq) + H_2O + CO_2$$
  
(s) (l) (g)
92. B  
Iron (III) ions give reddish brown ppt with excess aqueous ammonia and deep blue solution is formed when aqueous ammonia is treated with Copper (II) ions.
93. C  
 $Fe^{2+}$  ions form green ppt by the addition of sodium hydroxide and Barium nitrate give white precipitate if the solution contains sulphate ions. Hence the salt in solution X must be iron (II) sulphate.
94. B  
There are two ways to check the presence of  $Zn^{2+}$  ions. 1. By adding aqueous ammonia that produces white precipitate and soluble in excess reagent. 2. By adding aqueous sodium hydroxide that produces white precipitates which is also soluble in excess reagent.

95. D  
When acids react with metals they can produce gas and they are also used to prepare fertilizers, so compound X will be an acid. When HCl reacts with barium nitrate, it gives soluble barium chloride but when sulfuric acid reacts with barium nitrate it produces insoluble barium sulfate (white precipitate).
96. D  
Ammonia is basic in nature while HCl (g) is acidic in nature.  $\text{NH}_3(\text{g})$  lighter than  $\text{HCl}(\text{g})$  so first  $\text{NH}_3(\text{g})$  vapours turns the damp red litmus paper blue, but after it HCl vapours turns blue litmus paper red because HCl vapours are heavier than  $\text{NH}_3$  vapours.
97. B  
Chromatography is a technique which is used to separate the solutes from each other on the basis of their solubility in a particular solvent hence solutes must be soluble in the liquid.
98. D  
Nitrogen gas is neutral so it does not show any effect on damp red litmus paper as well as on damp blue litmus paper. Nitrogen neither burns nor helps in burning.
99. B  
Test of  $\text{CO}_3^{-2}$  &  $\text{Ca}^{2+}$ .
100. C  
Test of  $\text{Fe}^{2+}$  &  $\text{NO}_3^{-1}$
101. A  
Pure substances has fixed F.P.
102. A  
 $\text{NH}_3(\text{g})$ , turns blue and  $\text{Cl}_2$  bleaches.
103. A  
Test of  $\text{NH}_4^+$  &  $\text{CO}_3^{-2}$
104. A  
Test of  $\text{Zn}^{+2}$  already discussed.
105. A  
Fractional distillation.
106. D  
Test of  $\text{Fe}^{2+}$  and  $\text{NO}_3^{-1}$ .
107. C  
Obvious Answer
108. D  
Test of  $\text{Zn}^{2+}$  &  $\text{SO}_4^{-2}$ .
109. D  
Test of  $\text{NO}_3^{-1}$ .
110. C  
When state change temperature remains same.
111. C  
 $R_f$  value already discussed.