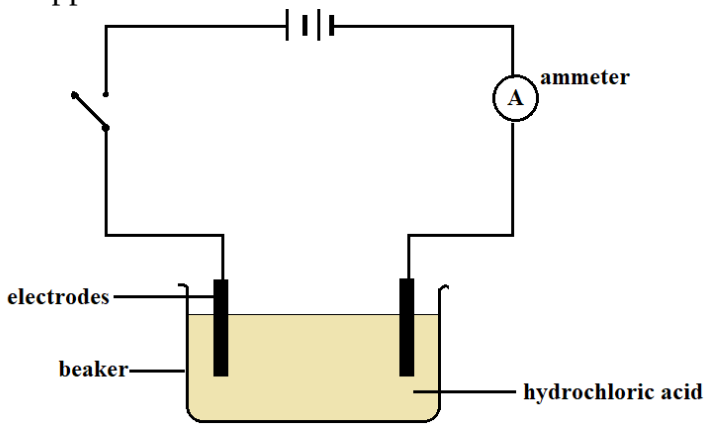
2021 MOCK CHEMISTRY

DESCRIPTIVE QUESTIONS

1. With the aid of a well labelled diagram, describe an experiment that could be done to distinguish a strong acid from a weak acid using conductivity apparatus.

DISTINGUISHING STRONG ACID FROM WEAK ACID USING CONDUCTIVITY APPARATUS.

- Materials required; conductivity apparatus, ethanoic acid, hydrochloric acid and ammeter.
- Set up the apparatus as shown below.



- Close the switch and observe the ammeter reading.
- Record the observation in the table of results.
- Replace the hydrochloric acid with ethanoic acid, and observe the ammeter reading.

Table of results

Acid	Ammeter reading (A)
Hydrochloric acid	
Ethanoic acid	

- Compare the conductivity of the two acids (hydrochloric acid and ethanoic acid).
- The reading of the ammeter should be high when the hydrochloric acid is used than when ethanoic acid is used. This shows that hydrochloric acid is strong acid while ethanoic acid is a weak acid.

2. Explain how 500 $cm^3$of a 0.2M sodium chloride (NaCl) solution can be prepared using sodium chloride crystals. The explanation should include all the necessary mathematical calculations. **(Relative atomic mass of Na=23 and Cl=35**)

PREPARING 500cm^3 OF 0.2M SODIUM CHLORIDE SOLUTION

- Materials required are as follows; balance, 500cm^3 volumetric flask, glass stirring rod, distilled water in wash bottle, beaker, funnel and sodium chloride crystals.
- Workout the mass to be dissolved as follows:
- Mass = molarity × volume × molar mas

  But R.F.M = 23+35 = 58

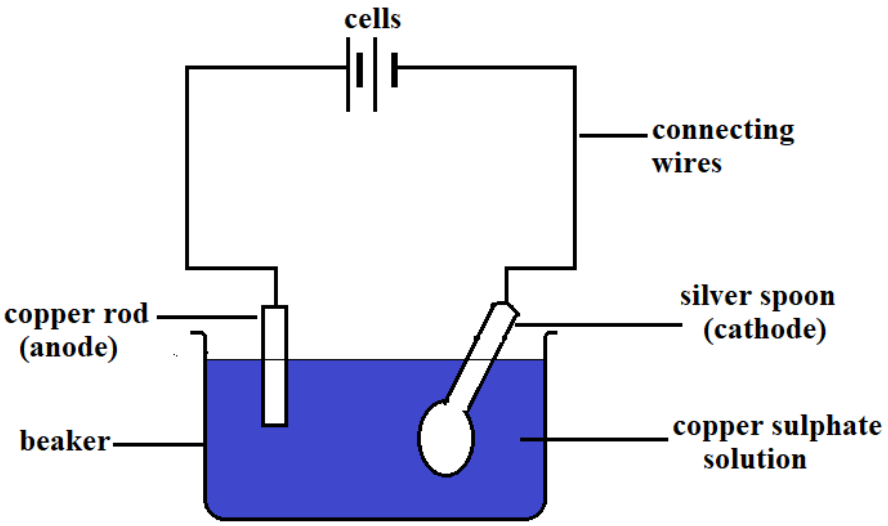
  $$\text{Mass} = 0.2 \times \frac{500}{1000} \times 58$$

  $$= 5.8g$$
- Weigh 5.8g of sodium chloride crystals in beaker using a balance.
- Add distilled water into the beaker and stir continuously until all the salt dissolves.
- Transfer salt solution into the 500ml volumetric flask using a funnel.
- Rinse the both the beaker and funnel carefully with distilled water in the wash bottle.
- Add more distilled water up to 500ml mark.
- Insert the stopper and shake the conical flask for the contents to mix thoroughly.
- Therefore 500ml of 0.2M sodium chloride solution is prepared.

3. With the aid of a well labelled diagram, explain how silver spoon could be electroplated using copper. In your explanation include the half reaction equations at the cathode and anode.

ELECTROPLATING SILVER SPOON USING COPPER

- Materials required are copper rod, silver spoon, copper sulphate solution, 2 dry cells, beaker and connecting wires.
- The materials are arranged as shown in figure below.

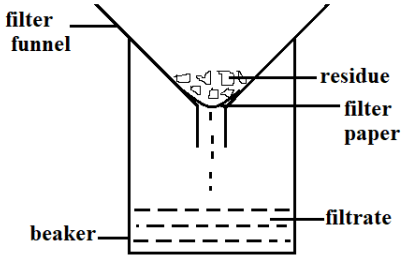


- The silver spoon is used as the cathode and the copper rod is used as the anode.
- At the anode, copper rod is ionized, releasing electrons according to the half equations: $Cu_{(s)} - 2e^- \longrightarrow Cu_{(aq)}^{2+}$.
- $Cu_{(aq)}^{2+}$ ions are attracted to the cathode and gain electrons according to the half equation: $Cu_{(aq)}^{2+} + 2e^- \longrightarrow Cu_{(s)}$. Hence the silver spoon is covered by the copper produced.

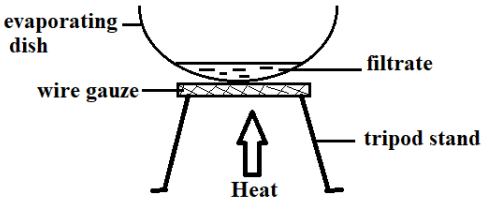
4. With aid of clearly labelled diagrams, describe an experiment that could be done to separate salt from a mixture of salt and sand.

SEPARATING SALT FROM A MIXTURE OF SALT AND SAND

- Materials required; water, filter funnel, filter paper, source of heat, tripod stand, evaporating dish, wire gauze, beaker and the mixture of sand and salt.



A



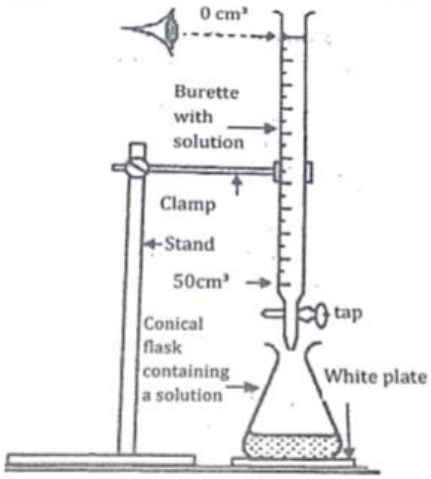
B

- Add water to the mixture in the beaker and stir in order to dissolve the salt.
- Filter the mixture using the apparatus as labelled A.
- Evaporate the filtrate using apparatus labelled B to remain with salt crystals.
- Therefore the salt is separated from the mixture of salt and sand.

5. With aid of a well labelled diagram, describe an experiment that could be done to determine molarity of hydrochloric acid (HCl) using sodium hydroxide (NaOH) solution of a known concentration.

DETERMING THE CONCENTRATION OF HCl BY TITRATION

- Materials required; burette, 0.1 M NaOH solution, clamp and clamp stand, conical flask, measuring cylinder, HCl of uknown concentration, white paper and phelphthalein indicator solution.
- Arrange the apparatus as shown below.



- Pour the acid into the burette to zero mark.
- Measure 10 ml of 0.1 M NaOH and transfer it into the conical falsk.
- Add few drops of phenolphthalein indicator in the flask and observe the colour change to pink.
- Gradually add the HCl from the burette into the conical flask while shaking the flask.
- Stop adding when there is a colour change of the indicator i.e from pink to colourless.
- Record the volume of acid used in the table of results.

Table of results

Initial volume of HCl (ml)	Final volume of HCl (ml)	Volume of HCl used (ml)

- Write the balanced chemical equation of the reaction as follows

  $NaOH_{(aq)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$
- Workout the concentration of HCl using the formula.

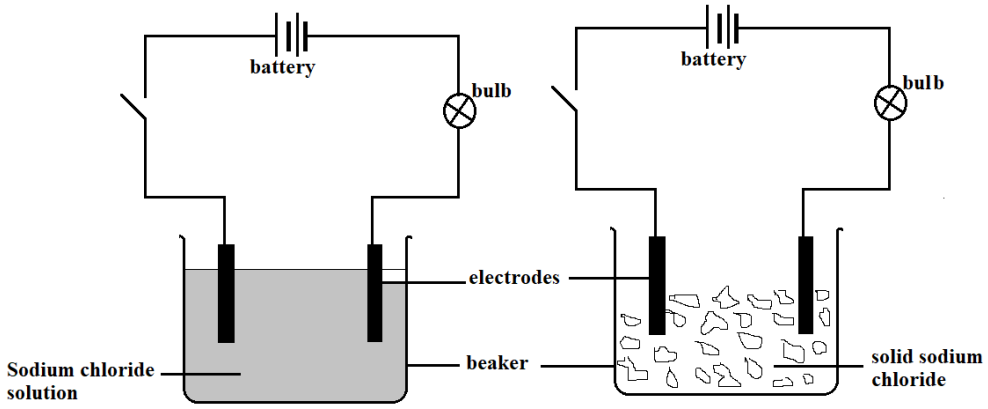
$$\frac{C_1V_1}{N_1} = \frac{C_2V_2}{N_2}$$

- Therefore the concentration of HCl is determined.

6. With the aid of a well labelled diagram, describe an experiment that could be done to show that ionic compounds conduct electricity only in aqueous state and not in solid state.

SHOWING THAT IONIC COMPOUNDS CONDUCT ELECTRICITY IN AQUEOUS STATE NOT IN SOLID STATE

- Materials required; solid sodium chloride, aqueous sodium chloride solution, connecting wires, cells, cell holder bulbs, electrodes, switch and beakers.
- Set the apparatus as shown in figure below:



- Close the switch and record the observation in the table of results.

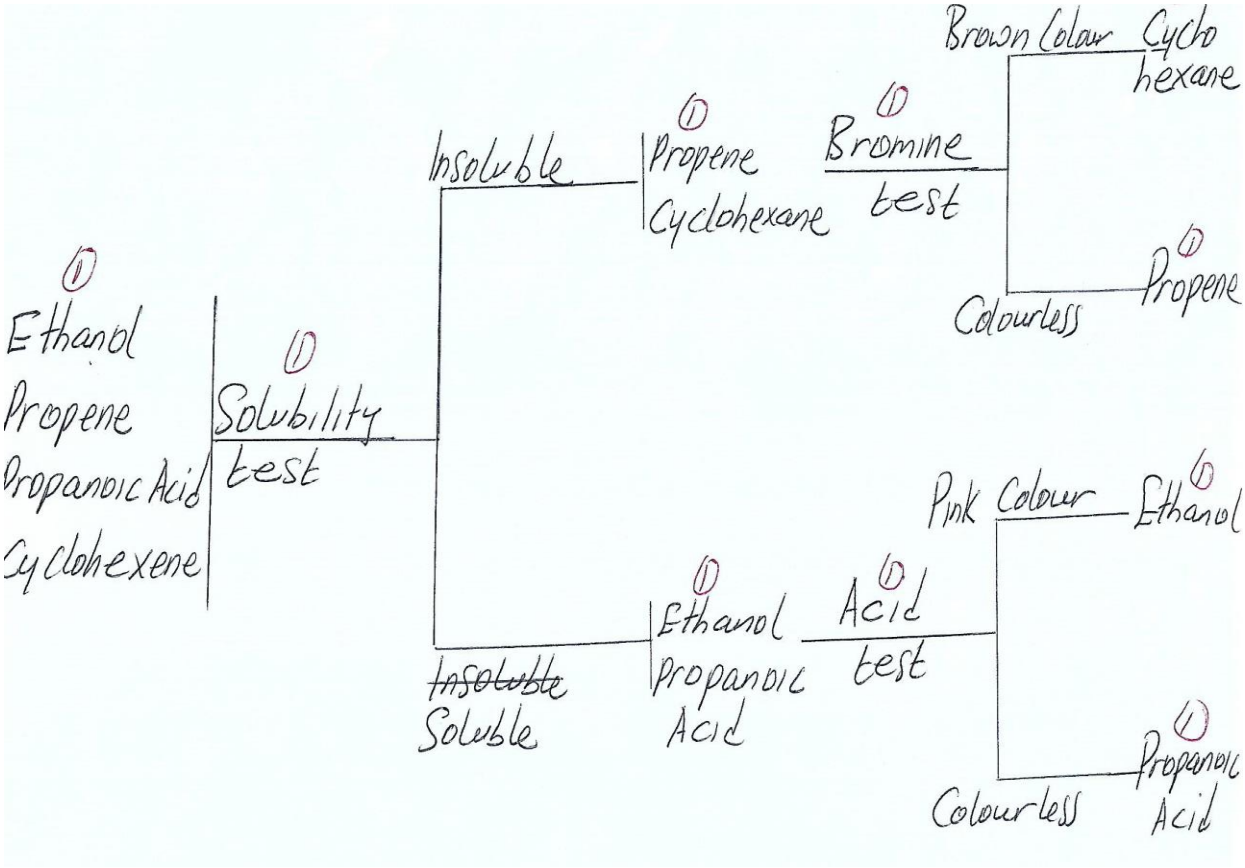
Table of results

State of Sodium Chloride	Observation (effect on the bulb)
Aqueous state	
Solid state/crystals	

- If the bulb lights up, then sodium chloride in that state conduct electricity.
- Therefore only in aqueous state the bulb will light up and not in solid state hence Ionic compounds conduct electricity only in aqueous state and not in solid state.

7. You are provided with bottles containing the following organic compounds Ethanol, propane, propanoic acid and cyclohexene. Construct a flow diagram that can be used to identify the compounds.

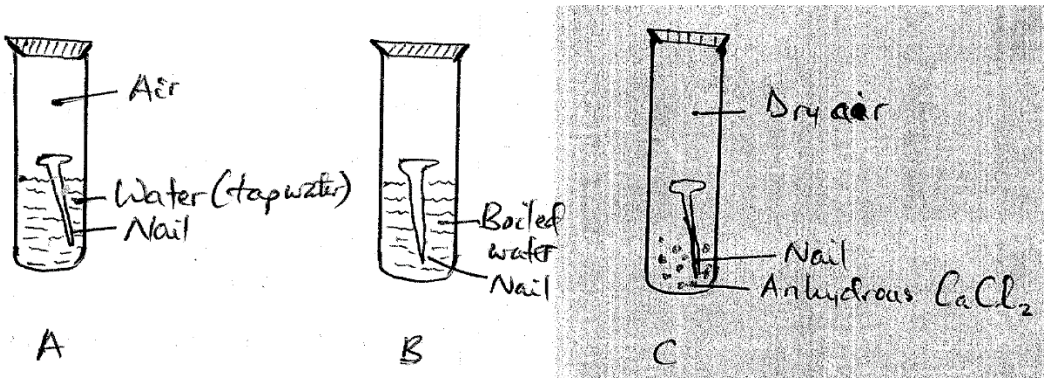
FLOW DIAGRAM



8. With the aid of a well labelled diagrams, discuss conditions necessary for rusting.

CONDITIONS NECESSARY FOR RUSTING

Materials required; 3 iron nails, 3 test tubes, boiled water, anhydrous calcium chloride ($CaCl_2$) and tap water.



a) Sat the apparatus as shown the diagram above.
b) Leave the set up for a week and observe what happens to the nails.
c) In test tube A, the nail will rust. This is because top water contains dissolved. Oxygen and water which are both necessary conditions for lusting.
d) In test tube B the nail will not rust. This is simply because the boiled water has no dissolved Oxygen. There is only water in the test tube. Hence no rusting will take place.
e) In test tube C, rusting will not occur. This is because the pressure of anhydrous $CaCl_2$ will absorb any moisture that might be present.

9. Describe an experiment that can be used to prepare barium sulphate salt ($BaSO_{4(S)}$) by precipitation.

PREPARING BARIUM SULPHATE BY PRECIPITATION

Apparatus and reagents

Test tube, conical flask, Barium chloride solution, sodium sulphate solution, burner, distilled water, funnel, and filter paper.

Procedure

Mix Barium chloride and sodium sulphate to form barium sulphate crystals according to the equation below

$BaCl_{2(aq)} + NaSO_{4(aq)} \longrightarrow BaSO_{4(s)} + 2NaCl_{(aq)}$

The mixture is filtered to collect barium sulphate crystals. The crystals of barium sulphate is now washed with distilled water. Then warm gently to evaporate the water from crystals.

10. Describe an experiment that can be done to calculate percentage of water of crystallization in hydrated copper sulphate. In your description, show all the materials that may be used.

DETERMINING THE PERCENTAGE OF WATER IN HYDRATED COPPER SULPHATE

- Materials: hydrated copper sulphate, beam balance, source of heat, evaporating dish,

- Weigh hydrated copper sulphate using the beam balance and record its mass.
- Heat the copper sulphate until the water evaporate completely i.e. blue colour changes to silver.
- Weigh the heated (anhydrous) copper sulphate using the beam balance and the record its mass.
- Find the mass of water by subtracting the two masses i.e
    - ✓ Mass of water=Mass of hydrated $CuSO_4$ −Mass anhydrous $CuSO_4$
- Then calculate the percentage of water using the formula:
    - ✓ $\%\ \text{of water} = \frac{\text{mass of water}}{\text{mass of hydated copper sulphate}} \times 100\%$
- Therefore the percentage of water in hydrated copper sulphate is found.

11. a. Define standard solution

- ✓ Is a solution with known concentration.

b. Describe how you can make 0.2M Hydrochloric acid in 500ml from stock solution of 10M Hydrochloric acid.

PREPARING 500 ml OF 0.2M HCL BY DILUTION

- Materials required; 500 ml conical flask, measuring cylinder and 10M HCl stock solution.
- Calculate the volume to be diluted from the stock solution as follows

$$\mathbf{C_1V_1 = C_2V_2}$$

$$\mathbf{V_1} = \frac{\mathbf{0.2}M \times \mathbf{500}\ ml}{\mathbf{10}M}$$

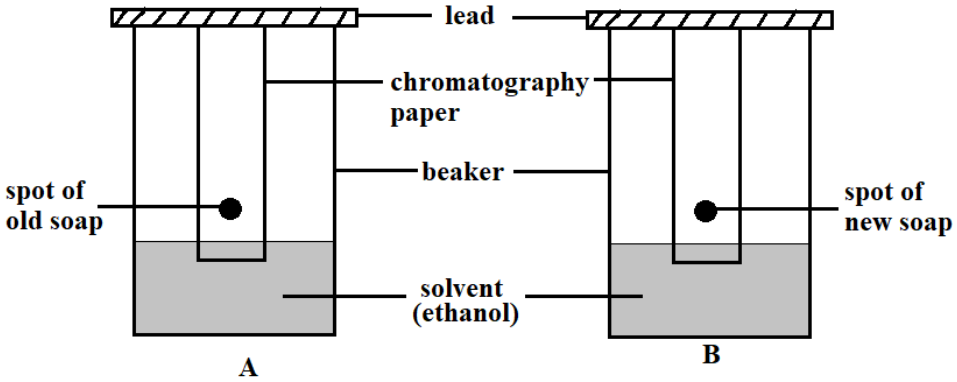
$$\mathbf{= 10\ ml}$$

- Measure 10 ml of 10M HCl stock solution using a measuring cylinder.
- Transfer the measured volume quantitatively into the conical flask.
- Add more distilled water into the conical flask up to 500 ml mark.
- Insert the stopper into the conical flask shake it for the contents to mix thoroughly.
- Therefore 500 ml 0f 0.2M HCl solution is prepared.

12. A new brand of soap is found to cause skin irritation when used. An old brand of the same soap did not cause skin irritation. A chemist decides to compare the components of the dyes of the two brands of soap to see if they are different, describe an experiment that could be done to isolate the components of the dyes.

ISOLATING THE COMPONENTS OF THE DYES

- Materials required; chromatography papers, 2 beakers, solvent (ethanol), spot of old soap and a spot of new soap.
- Arrange the materials as shown in figure below.

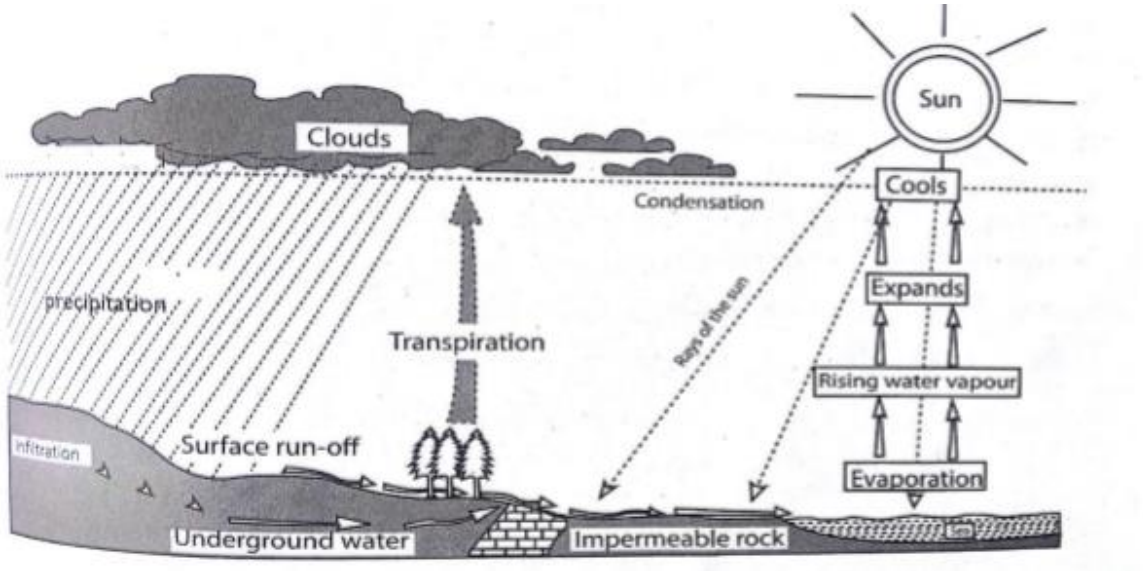


- Leave the apparatus to stand for some minutes.
- As the solvent rises up the chromatograph paper in both set up A and B it carries with it the dissolved components.
- Each component is carried at different speed so ethanol separates out the components of the mixtures. Different layers of different colours on the chromatography paper represent different components.
- The two set ups are compared (the colours on the chromatography papers) hence the component is isolated.

13. Using a well- labelled diagram, describe the water cycle.

WATER CYCLE

- The hydrological (water) cycle is the continuous circulation of water from the Earth's surface to the atmosphere and back to the Earth's surface. The water consists of different processes such as Evaporation, Condensation, precipitation and many more as shown in figure below.



- Evaporation: in this process, liquid water becomes water vapour in the atmosphere from surface water bodies such as oceans, lakes and rivers. Evapotranspiration is the combination of evaporation and transpiration and is initiated by heat from the sun.

- Condensation: this is the process in which water vapour in the atmosphere turns back into liquids. These water droplets remain suspended in the atmosphere in form of clouds.

- Precipitation: this is the process whereby water droplets falls back into the Earth's surface. This can be in the form of rain, hail sleet or snow.

- Surface runoff: as water returns to the Earth's surface, it moves over land and flows following gravity into streams, rivers, ponds and lakes.

- Infiltration: when precipitation occurs, not all the water returns to the oceans as surface run-off. Some is soaked into the ground where it returns to the surface as spring or becomes the groundwater.