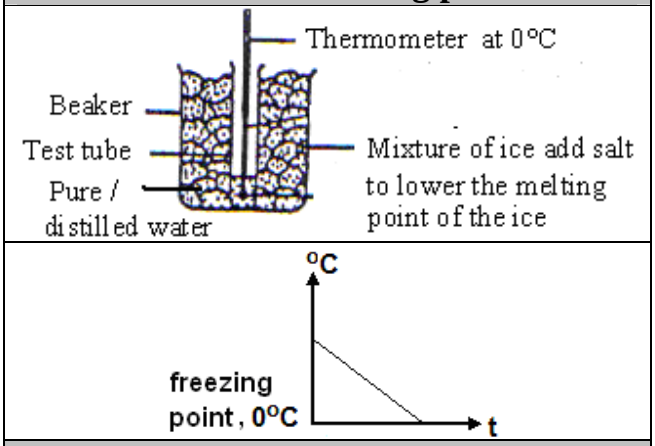
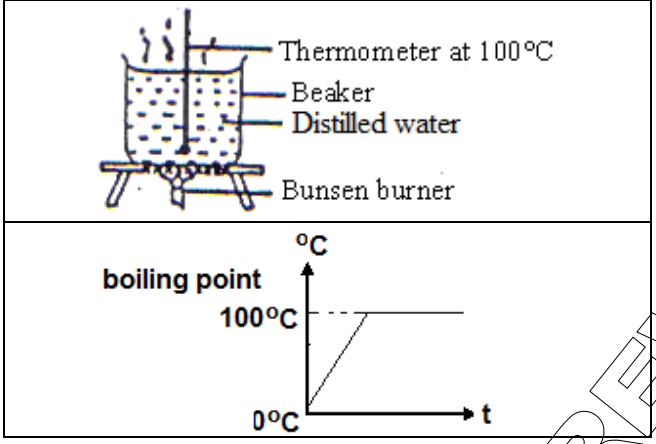
1.

i. **To find freezing point**



ii. **To find boiling point**



a. **Determination of Pure water**

i. The freezing point of pure water is 0°C and the boiling of pure water is 100°C. (**pure water** or distilled water do not contain any dissolve substances which has boiling point at 100 °C and freezing point at 0°C)

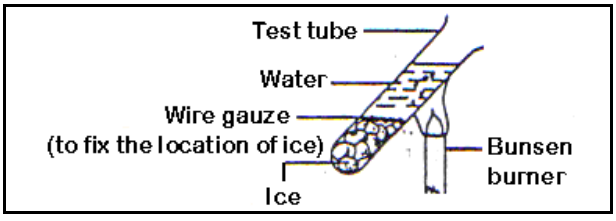
ii. When **impurities** like **common salt** (sodium chloride) is added into the pure water, the boiling point of the impure water will be **higher** than 100°C and its freezing point will be **lower** than 0°C (**Impure water / sea water** contains dissolve substances / salt which has boiling point over 100 °C and freezing point below 0°C).

iii. **An ice-cream hawker adds salt into his ice box** to **lower the melting point of ice / to prevent the ice cream from melting too fast.**

iv. Workers **pour salt** onto the road during winter to prevent the snow from melting too fast.

v. Experiment to study the effect of salt on the boiling point of the water

Hypothesis
The longer the time, the higher the temperature.
Variable
Manipulated: Presence of impurities Responding: Temperature Constant: Volume of water
Relationship
The temperature increases with time and become constant at 102 °C
Inference
The boiling point is above 100 °C
Conclusion
Impurities increases the boiling point of the water
Definition of impure water : Impure water contain dissolve substances and has boiling point above 100 °C



b. Water is a **poor conductor of heat** because the ice does not melt even though the upper portion is boiling (the heat from the bunsen burner does not reach to the lower portion).

c. The density of water is 1g/cm³ or 1000kg/m³
d. If the water temperature below 4°C, the water expands and the density of water would be less than 1g/cm³.
e. Ice floats on water because the density of the ice is lower than water 1g/cm³
f. An egg can float in the salt water which is denser than pure water.

2. EVAPORATION OF WATER

Liquid ⟶ Gas	
(water)	(water vapour)

a. Release of water molecules into the air from the **surface** of the water (The water molecules absorb heat energy and turn into gas).
b. **Factors affects the rate of evaporation of water are:-**
   i. **Humidity of air** (Humidity ↓ , evaporation ↑)
   ii. **Temperature of the environment** (temperature ↑, evaporation ↑)
   iii. **Surface area** (surface ↑, evaporation ↑)
   iv. **Movement of air** (movement ↑, evaporation ↑)
c. **Ways to increase the rate of evaporation**
   i. Higher surrounding temperature
   ii. Increase the surface area
   iii. Increase the air movement
   iv. Lower the humidity of air
d. **Similarities of boiling and evaporation:**
   - Both **absorb heat**.
   - Both release of water molecules into the air (both turn into gas).

e. Differences between

Boiling	Evaporation
i. Occurs only at boiling point 100°C (fixed temperature)	Occurs at any temperature (below 100°C)
ii. Occurs all over the water (whole)	Occurs only at the **surface** of the water exposed
iii. Fast / Vigorous process	It is a slow process

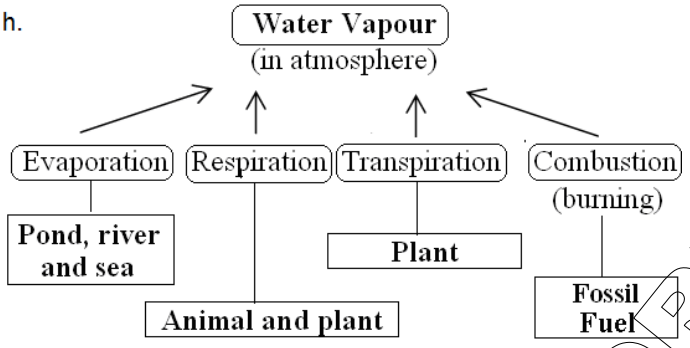
f. **Evaporation could be used**
   a. **to obtain salt from sea water or sugar from sugar solution.**
   b. drying clothes
   c. Making salted fish, dried prawn, enchorvies and cuttlefish / squid. (to prevent the growth of bacteria) [slice open the fish to increase the surface area of evaporation]
   d. Moving fan help to move the air to increase the rate of evaporation.

g. **Experiment to study the factors that affect the rate of evaporation.**

Experiment	i. **To study the effect of humidity of air on the rate of evaporation**	ii. **To study the effect of temperature on the rate of evaporation**	iii. **To study the effect of surface area on the rate of evaporation**	iv. **To study the effect of movement of air on the rate of evaporation**
Variables				
Manipulated	Humidity of air	Temperature	Surface area	Movement of air
Constant	Wet filter paper	Wet filter paper	Wet filter paper	Wet filter paper

Responding	Time taken to dry up	Time taken to dry up	Time taken to dry up	Time taken to dry up
Hypothesis (relationship)	The lower the humidity of air, the shorter the time taken for the wet filter paper dries up.	The higher the temperature the shorter the time taken for the wet filter paper dries up.	The larger the surface area, the shorter the time taken for the wet filter paper dries up.	The higher the movement of air, the shorter the time taken for the wet filter paper dries up.
Inference	The lower the humidity of air, the higher the rate of evaporation.	The higher the temperature, the higher the rate of evaporation.	The larger the surface area, the higher the rate of evaporation.	The higher the movement of air, the higher the rate of evaporation.
Conclusion	Humidity of air affects the rate of evaporation.	Temperature affects the rate of evaporation.	Surface area affects the rate of evaporation.	Movement of air affects the rate of evaporation.
Operational definition of the rate of evaporation	The time taken to dry up.			

h.

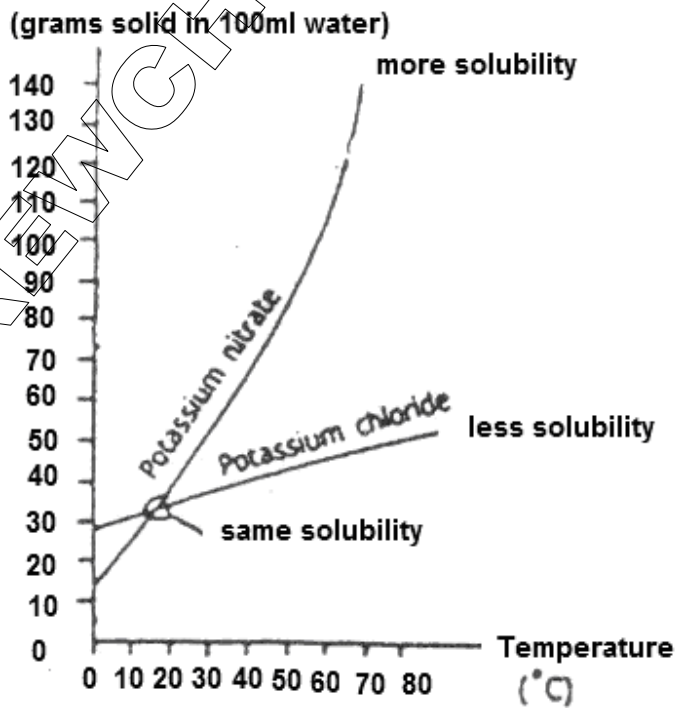


3. **SUSPENSION**

- **i.** Is **insoluble** substance in a liquid for example chalk, dust, muddy water, milo or soya milk, sugar cane and orange **juice.**
- **ii. A suspension usually cloudy or non-homogeneous (heterogeneous)**

4. **SOLUBILITY**

a. Is the maximum amount of solute which can dissolve in a given amount of solvent at a specified temperature.



Solubility of salt increases with temperature

5a. Water as a universal solvent

- because water can dissolve many type of solutes.

6. Organic solvents (non-aques solvent / non-water)

i. Organic solvents are used to dissolve solutes that cannot be dissolved by water.

ii. Example of organic solvents and solutes.

Organic Solvent	Solutes
Petrol	Paint, tar, oil, grease, rubber, wax
Kerosene	Paint, tar, oil
Alcohol	Shellac, iodine, ink, chlorophyll, varnish
Benzene	Stains(rust), grease, oil, iodine, rubber
Amil Acetat / Acetone	Iodine, varnish, lipstick
Chloroform	Plastic
Turpentine	Paint, tar, varnish
Salt solution	Blood
Borax	Coffee

iii. **Some of the daily usages of organic solvents are**:

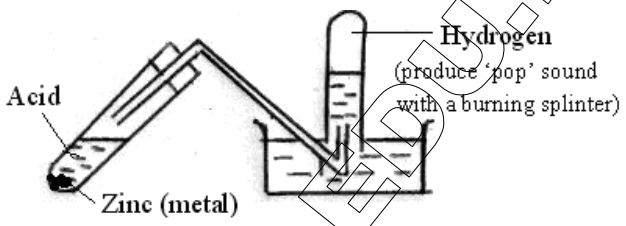
a. **Turpentine** is used as solvent for paint
b. **Alcohol** is used as solvent to prepare medicines/cough syrup.
c. **Acetone** is used to remove nail polish / varnish.
d. Rubber which dissolves in **petrol** or **benzene** is used to patch punctured tyres
e. **Petrol, kerosene** and **turpentine** are used to remove paint and oil stains
f. **Chloroform** is used to stick plastic components together.
g. **Salt solution** is used to remove blood stains from clothes.
h. The preparation of shellac and cosmetics uses **alcohol / acetone.**
i. Paint can be thinned with **turpentine.**

7. a. **ACIDS**

Mineral acids	Organic acids
(inorganic acids)	(plants / animals)
- **Hydrochloric acid** - **Sulphuric acid** - **Nitric acid**	- **Citric acid** (lime) - **Acetic acid** (vinegar) - **Lactic acid** (milk) - **Tartaric acid** (grape)

b. **Properties of acids are**:

i. Sour taste, PH < 7, corrosive
ii. Turn **moist** blue litmus paper into red
iii. React with **metal**, produce hydrogen

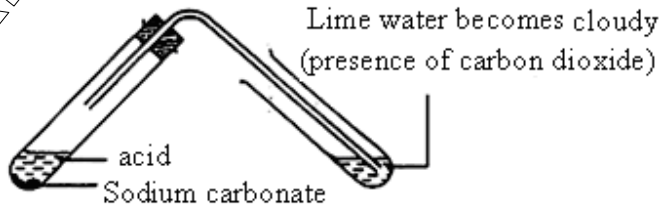


Hydrochloric acid + **Magnesium** (metal) → **Magnesium Chloride** (salt) + **Hydrogen** (gas)

Sulphuric Acid + **Zinc** (metal) → **Zinc Sulphate** (salt) + **Hydrogen** (gas)

iv. React with **carbonate** to produce **carbon dioxide**

Sulphuric Acid + **Calcium Carbonate** → **Calcium Sulphate** + **Water** + **Carbon Dioxide**



v. Able to remove rust from metal.
vi. Turn hydrogen carbonate indicator from red to yellow.

8. Alkalis

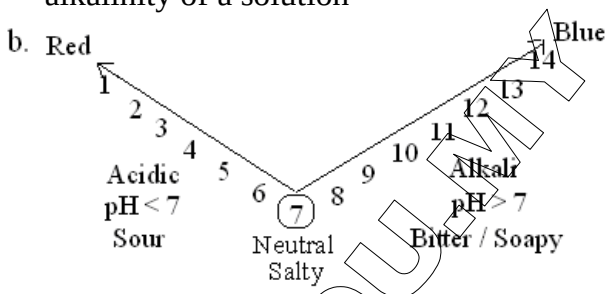
Properties of alkalis are:

i. Bitter taste, soapy, PH >7, corrosive
ii. Turn **moist** red litmus paper into blue
iii. React with **ammonium** salts to release ammonia gas (pungent smell)

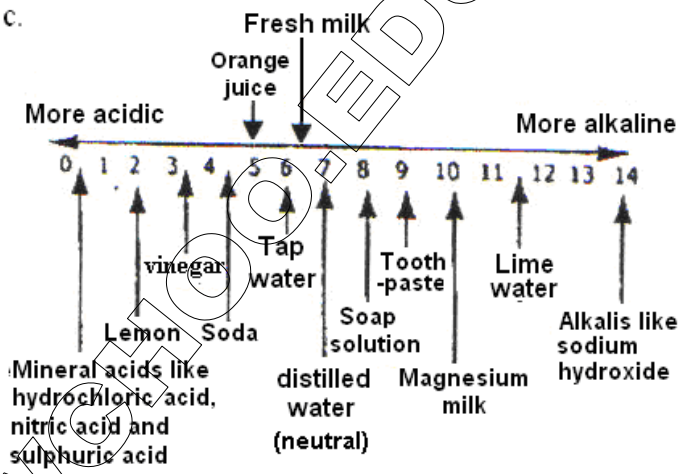
Sodium Hydroxide (alkali) + **Ammonium Chloride** (salts) → **Sodium Chloride** (salt) + **Water** + **Ammonia** (gas)

9. **The role of water in acid and alkali formation**
   a. Acids or alkalis show its properties in the presence of water.
   b. Pure acid and alkali which is dry even though being in liquid form does not show any properties of an acid or alkali if it does not contain water
   c. **Tartaric acid crystals and pure acetic acid liquid**
      i. Do not turn blue litmus paper into red unless it is moist.
      ii. Do not react with carbonates powder to release carbon dioxide gas unless water is present.
      iii. Do not react with metals powder to release hydrogen gas unless water is present.
   d. **Sodium hydroxide crystals and pure ammonium liquid (which is alkali)** needs water to show its properties.
      i. Do not turn red litmus paper into blue unless it is moist.
      ii. Do not react with ammonium salts to release ammonia gas unless water is present.

10. **pH scale and indicator**
   a. To determine the degree of acidity and alkalinity of a solution
   b.



   c.



   d. **Carbon Dioxide**
      i. Turn lime water into chalky / cloudy.
      ii. Carbon dioxide when dissolve into water becomes Carbonic Acid / Acid rain.

Carbon dioxide + Water → Carbonic Acid

11. Acid / alkali of a solution can be tested by various indicators as shown below:

Indicator	Colours in solution		
	Neutral	**Acidic**	**Alkaline**
a. Litmus paper	violet	Red	blue
b. Methyl orange	Orange	Red	Yellow
c. Universal indicator	Green	Yellow	Violet
d. Phenolphthalein	Colourless	Colourless	Pink
e. Bicarbonate indicator	Red	Yellow	Red

12. **Water Purification**

Natural source of water

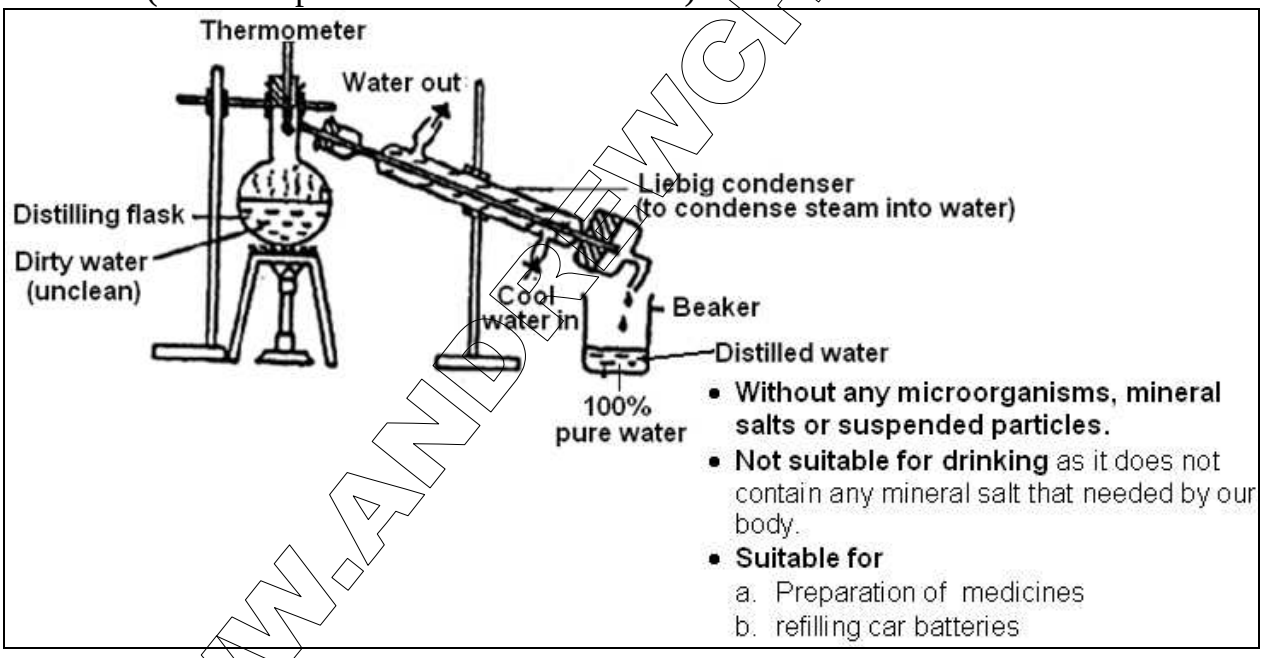
a. **Well water / Spring water**	- Contains soluble mineral salts, microorganisms and organic substances.
b. **Pond / River water** (the dirtiest)	- Have a lot of dirt, organic substances, soluble mineral salts, microorganisms, rubbish…etc.

c. **Sea water**	- Has the most amount of salt.(sodium chloride) - Cleaner than pond / river water.
d. **Rain water**	- Contains soluble gases and pollutants like dirt. Anyway, it is still the purest among the natural water.

13. Method of water Purification

a. Filtration	- To separate the suspended particles / insoluble solids from water. - Still contain microorganism and dissolved mineral salts.
b. **Boiling**	- To kill microorganisms in small amount of water. - Still contain mineral salt and suspended particles.
c. **Chlorination**	- To kill microorganisms in large amount of water / swimming pool. - Still contain mineral salts and suspended particles. Excess chlorine is harmful to health too.
d. **Distillation**	- Water is heated, so that its component evaporates as a vapours and then condensed to obtain pure water (distilled water) **without** any soluble mineral salts, microorganism or suspended particles.

e. Distillation (to obtain pure water / distilled water)



14. **Pollution of water** is **contamination of water with harmful substances. It affects our health such as**

a. **Domestic waste**	- garbages - carcases - faeces from seawage	contain microorganism which cause cholera
b. **Industrial waste**	- chemical waste - radioactive waste	harmful chemical / toxic
c. **Agriculture waste**	- fertilizers - pesticides	

	- weed killer	
d. **Port / Harbour waste**	- oil spills	

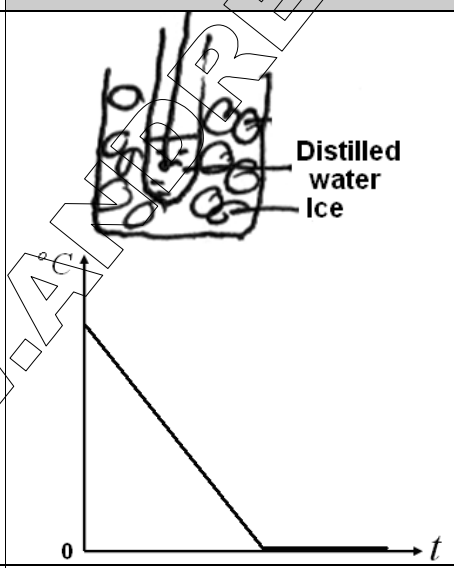
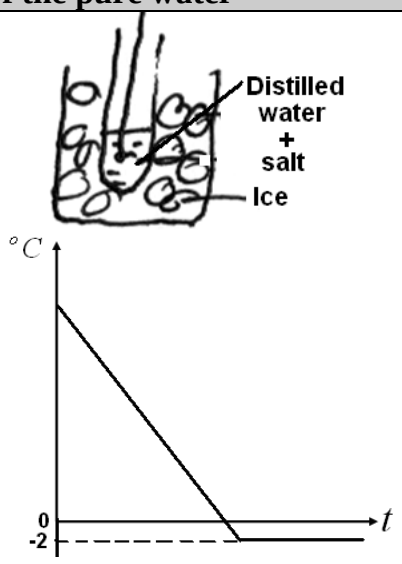
15. a.

Method	Can remove		
	Microorganism	**Soluble mineral**	**Suspended particles**
Filtration			✓
Chlorination / boiling	✓		
Distillation	✓	✓	✓

b.

Method	Remaining in the water / Still presence		
	Microorganism	**Soluble mineral**	**Suspended particles**
Filtration	✓	✓	x
Chlorination / boiling	x	✓	✓
Distillation	x	x	x

16. **Experiment to determine the freezing point of pure water and impure water**

i.	**Experiment**	**a. To study the freezing point of pure water**	**b. To study the effect of impurities on the freezing point of the pure water**
ii.			
iii.	**Variables** Manipulated Constant Responding	 Time Volume of water Temperature	 Presence of salt Volume of water Temperature
iv.	**Hypothesis**	The longer the time, the lower the temperature.	The longer the time, the lower the temperature.
v.	**Relationship**	The temperature decrease with time and then become constant	The temperature decrease with time and then become constant at $-2\,^{\circ}C$

		at $0^{o}C$.	
vii.	**Inference**	The freezing point of pure water is $0^{o}C$.	The freezing point of impure water is below $0^{o}C$.
v	**Conclusion**	The freezing point of pure water is $0^{o}C$.	Impurities lower the freezing point of pure water.
	Definition operational	**Pure water** is the water without any dissolve impurities and has freezing point $0\ ^{o}C$.	**Impure water** is water that has dissolves impurities in it and has a freezing point below $0^{o}C$.