JRG College of Pharmacy

JRG COLLEGE OF PHARMACY

UNIVERSITY SOLVED QUESTION WITH ANSWER

Year : 2024-25

Subject : Ph.Inorganic Chemistry

Subject Code : BP104T

Subject In-Charge : MS.Kiranmayee Bhatra & Mr.Jyotiprasanna Nanda

Registration No.: | | | | | | | | | | |

Total Number of Pages:02 Course: B. Pharm

SUBJECT: Pharmaceutical Inorganic Chemistry Sub Code: BPT104T

1st Semester Regular/Back Examination: 2024-25

BRANCH(S): B. Pharm Q. Code: A221

Time: 3 Hours Max Marks: 75

Answer Question No.1 (Part-I) which is compulsory, any seven from Part-II, and any two from Part-III.

The figures in the right-hand margin indicate marks.

Part-I

QI		Answer the following questions mentioning the answer with correct option(MCQs)								(20 x 1)
	1)	In limit test for lead the reagent used as per I.P. and B.P. is								
		a	Lead sulphide	b	Lead nitrate	c	Both	d	Dithiazone	
	2)	In limit test for iron interference of other metal cation is removed by								
		a	Thioglycolic acid	b	Citric acid	c	Both	d	Ammonia solution	
	3)	Which of the following is a Lewis base								
		a	CH_3NH_2	b	H_3O^+	c	$AlCl_3$	d	BF_3	
	4)	The strength of the acid depends on the								
		a	Number of hydrogen atoms present in the molecule	b	Density	c	Oxygen content	d	Concentration of hydrogen ions furnished by ionisation	
	5)	Concentration of H_2O_2 for use as mouth wash is								
		a	3% W/V	b	4%W/V	c	2%W/V	d	None	
	6)	Zeolite or permutit is								
		a	Aluminium hydroxide gel	b	Aluminium silicate	c	Magnesium silicate	d	None	
	7)	Which of following is used for estimation of reticulo-endothelial activity								
		a	Cobalt	b	Gold solution	c	Cyanocobalamine	d	All	
	8)	Which of the following is called Rochelle salt								
		a	Potassium bitartrate	b	Sodium potassium tartrate	c	Potassium citrate	d	All	
	9)	Ferrous sulphate is also known as								
		a	Blue vitriol	b	Caustic potash	c	Condy's Crystals	d	Melanterite	
	10)	Radioactive isotopes in decay by								
		a	Zero order kinetics	b	Pseudo Zero order kinetics	c	First order Kinetics	d	Second Order Kinetics	
	11)	Which of the following is NOT a component of the Henderson-Hasselbalch equation?								
		a	pKa	b	pH	c	Concentration of the acid	d	Concentration of the base	
	12)	Which enzyme becomes active in stomach during low value pH								
		a	Mellitin	b	Pepsin	c	Thyroxin	d	Adrenaline	
	13)	Sodium citrate in oral rehydration powder used as								
		a	pH maintenance	b	Sodium supplement	c	Nitrate supplement	d	Anticoagulant	
	14)	Which of the following is desensitizing agents								
		a	Zinc chloride	b	Strontium chloride	c	Both (a) & (b)	d	Sodium fluoride	

	15)	Hypo is synonym for?								
		a	Calcium hydroxide	b	Sodium thiosulphate	c	Bentonite	d	Talc	
	16)	First edition of USP was published in								
		a	1830	b	1820	c	1840	d	1890	
	17)	The pH of solution having hydrogen ion concentration $4.2x10^{-4}$								
		a	3	b	2.5	c	4.7	d	5.89	
	18)	Plant cells will became turgid when placed in this type of solution								
		a	Hypotonic	b	Hypertonic	c	Megatonic	d	Isotonic	
	19)	Which one is strong in action								
		a	Laxative	b	Purgative	c	Cathartics	d	All of the above	
	20)	Which of the following is anti-flatulent, anti-spasmodic, sedative and antacid								
		a	Dimethadione	b	Semithicone	c	Silicondione	d	All	

Part-II

QII **Focused-Short Answer Type Questions- (Answer Any Seven)** **(7 x 5)**

1) Write in detail about the sources and types of impurities.
2) What are electrolytes and write a short note on replacement therapy
3) Define isotonic solution. Explain the methods of adjusting tonicity.
4) What are antidotes? Write the preparation, properties, assay and medicinal uses of Sodium thiosulphate.
5) Classify cathartics according to their mechanism of action with suitable examples.
6) Define antacid. What should be their ideal properties? Discuss in brief about aluminium hydroxide.
7) Write notes on history of Indian pharmacopoeia.
8) Describe about Activated Charcoal and Potash Alum.
9) What are Haematinics? Write the preparation, properties, assay and medicinal uses of ferrous sulphate.

Part-III

QIII **Long Answer Type Questions (Answer Any Two)** **(2 x 10)**

1) Discuss in detail about Arsenic limit test along with neat labelled diagram of apparatus used in Arsenic limit test.
2) Define and classify antimicrobial agents with examples. Write the mechanism involved. Write the method of preparation, assay and uses of Chlorinated lime.
3) Explain any two methods to measure radioactivity and write about the precautions & pharmaceutical application of radioactive substances

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Part - I

(1) In limit test for lead the reagent used as per I.P. 2010 B.P is :-

Ans) a / lead sulphide

(2) In limit test for iron interference of other metal cation is removed.

Ans) a / Thioglycolic acid

(3) which of the following is a lewis base.

Ans) d / BF_3

(4) The strength of the acid depends on the

Ans) d / concentration of hydrogen ions furnished by ionisation

(5) concentration of H_2O_2 for use as mouthwash is

Ans) b / 4% w/v

(6) zeolite or permutit is

Ans) c / magnesium silicate.

(7) which of the following is used for estimation of reticulo endothelial activity.

Ans) b / Gold solution

(8) which of the following is called rochelle salt

Ans) b / sodium potasium tartarate

(9) ferrous sulphate is also known as

Ans) d / melanterite

Radioactivity isotopes in decay by

ans ⇒ c / First order kinetics

(11) which of the following is not a component of the Henderson Hasselbalch eqn?

ans ⇒ d / Concentration of the base.

(12) which enzyme becomes active in stomach during low value pH.

ans ⇒ b / Pepsin

(13) sodium citrate in oral rehydration powder is used as

ans ⇒ a / pH maintenance

(14) which of the following is desensitizing agents

ans ⇒ c / Both (a) and (B)

(15) Hypo is synonym for?

ans ⇒ b / Sodium thiosulphate

(16) First edition of USP was published in

ans ⇒ b / 1820

(17) The pH of soln having hydrogen ion conc. 4.2×10^{-4}.

ans ⇒ a / 3

(18) Plant cells will became turgid when placed in this type of soln.

ans ⇒ a / Hypotonic

(9) which one is strong in action

ans ⇒ c / Cathartics

(2) which of the following is anti-flatulent, anti-spasmodic, sedative and antacid.

ans ⇒ d / All.

Part - II

Q II) 1) Impurities

- Impurity is any material that affect the purity of interest, presence of impurity may produce toxic effect.
- It may lower the strength of pharmaceutical substance.
- common impurities may include
  1. lead
  2. Arsenic
  3. iron
  4. chloride etc.

Types

They are basically 3 types :-

1. organic impurities.
2. inorganic impurities.
3. Residual impurities (solvent)

organic impurities

- These impurities basically arise during synthesis, purification and storage of drug substances.
- They may be identified or non-identified.
- They basically include starting material, byproduct, synthesis, intermediate, reagents, ligands and catalysts.

, organic impurities

- They derive from manufacturing Process.
- They are generally identified
- They basically include reagents, ligands, catalysts, heavymetals, inorganic salts.

③ Residual impurities (solvent)

- They arise during manufacturing Process.
- These are impurities that are basically present in solvents used in pharmaceutical manufacturing.

Sources of impurities

① Synthesis related impurities:-

- During synthetic process most of the impurities are generated from raw materials & solvent, intermediates & biProducts.
- These impurities present in raw materials or solvent may react with chemical, used in the synthesis to produce additional impurities or biproducts.
- Impurity may be generated through product storage & formulation of dosage form.

② Formulation related impurities:-

→ various factor like water content, PH, nature of excepients, compatibility of anion & cations, mutual interaction of the ingredients, temperature, humidity & Primary container may lead to both degradation as well as microbial contamination. The API drug Product should be

store in appropriate packing & Environmen
↳ Ex = vitamin in liquid dosage form are p
degradation due to their liable nature.

↳ Heavy
↳ Water

③ Storage related impurities

↳ The API drug product must be store in appropriate packing & Environmental cond^{n}.

↳ They may arise due to :-

① use of innappropriate container.
② Degradation in presence of light.
③ High Energy U.V light Exposure.
④ Exposure to adverse (very high or low temp).
⑤ Humidity specially in case of hygroscopic nature.

④ Particulate matter impurities

↳ Accidental inclusion of dust or glass, plastic, metal.
↳ metal particles are likely to be seen in ointment Packed in metal tubes made up of tin and aluminium.

⑤ Bi-Product impurities

↳ During synthesis / manufacture process may form by bi-product impurities.

⑥ Microbial contamination

↳ It could occur due to growth of bacteria, yeast, fungi in humid & warm environment specially in liquid oral / ointment.

be prevented by adding suitable preservative

⑦ Heavy metal impurities

↳ Water is the main resource of heavy metals like Air, Cd, Cr, Na, mg, Mn, etc.

↳ They can be avoided by using distilled water or demineralized water.

2) Electrolytes

↳ Electrolytes are substances that when dissolved in water dissociates into ions & can conduct electricity.

↳ They are essential for maintaining various physiological functions in the body, such as

① nerve conduction.
② muscle contraction
③ Acid-base balance
④ fluid balance.

↳ Ex = Common Electrolytes includes :-

① sodium (Na^+) ② Potassium (K^+), ③ chloride (Cl^-)

④ bicarbonate (HCO_3^-), ⑤ magnesium (mg^{2+})

Replacement therapy

↳ It involves restoring the normal concentrations of electrolytes in the body when it becomes depleted due to illness, dehydration, vomiting, diarrhea, or excessive sweating.

↳ The goal is to maintain osmotic balance, prevent dehydration & support normal cellular function.

ORS

↳ The full form of ORS is oral rehydration salt.

↳ It is also known as oral rehydration therapy (ORT).

↳ It is a type of type of replacement used mainly in the treatment of dehydration occurs due to diarrhoea.

→ ORS is the cheap, simple and effective way to treated dehydration caused by diarrhoea.

→ ORS drinks contains the main elements that are lost from the body during diarrhoea.

Principle of ORS

↳ Glucose when given orally Enhances the intestinal absorption of salt & water, and thus maintai the electrolyte and water imbalance.

...ula of ORS

The formula of ORS recommended by WHO and UNICEF.

① 2.6 g/L Nacl
② 2.9 g/L trisodium citrate
③ 1.5 g/L Kcl
④ 13.5 g/L glucose.

* Total wt = 20.5 gm.

Equipment needed

- Take 1 litre boiled & cooled drinking water.
- clean glass of 200ml capacity.
- A clean vessel to mix the solution.
- A clean spoon to mix the sol^{n} & feed the child.

3) Isotonic solution

- An isotonic is a sol^{n} that has the same osmotic pressure as that of body fluids such as blood plasma or tears.
- When such a sol^{n} is administered, it does not cause shrinkage or swelling of the cells because there is not net movement of water across the cell membrane.
- Ex → 0.9 % Sodium chloride sol^{n}

Methods of Adjusting Tonicity

The tonaccity of pharmaceutical soln can be adjusted using several methods. The most commons are:

(i) Cryoscopic Method

- Based on the principle that isotonic soln have the same freezing point depression (-0.52°C) as body fluids.
- The freezing point depression of each ingredient is known & substances are added or adjusted until the total depression equals -0.52°C.
- Ex → If a drug lowers the freezing point by -0.08°C, then an addition substance (eg. NaCl) must be added to lower it by -0.44°C to reach -0.52°C.

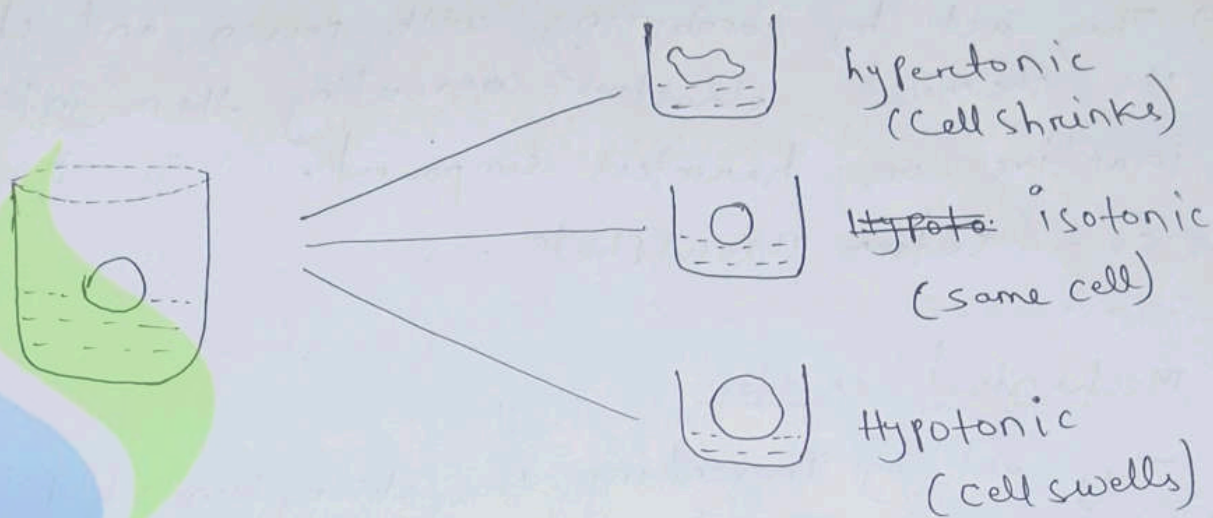
(ii) Haemolytic Method

- The haemolytic method is a biological method used to determine & adjust the tonicity of pharmaceutical substance by observing the effect of the soln on red blood cells (RBCs).
- When RBCs are placed in soln.

- Isotonic soln - No net movement of water, cells remain normal.
- Hypotonic soln - Water enters the cells → they swell & may burst.

Hypertonic soln: Water leaves the cells → they shrink.

→ Hence, the degree of haemolysis or crenation indicates whether a soln is isotonic, hypotonic or hypertonic.



4) Antidotes

1) Antidotes are the substances which reacts with specifically with the ingested poison and overcome its effect.

2) They are used to neutralizes the effect of poison in the body.

Classification

- Physiological antidotes
- Chemical antidotes
- mechanical antidotes

① Physiological antidote

↳ They are also known as Antagonists.

↳ They produce effect just opposite to the poison.

↳ Ex = sodium nitrite.

② Chemical antidote

↳ They act by combining with poison and changing its chemical structure converting them into inactive or harmless compound.

↳ Ex = sodium thiosulphate.

③ Mechanical antidote

↳ They act by Preventing the absorption of poison into the body.

↳ Ex = activated charcoal.

Sodium thiosulphate

Mol. formula = $Na_2S_2O_3 \cdot 5H_2O$

mol. wt = 248.2 g/mol

synonym = Sodium hyposulphate

Preparation = It can be prepared by boiling sodium sulphite with sulphur.

$$Na_2SO_3 + S \longrightarrow Na_2S_2O_3$$

properties = • It occurs as large colourless crystal
• It is odourless & having alkaline taste.
• It is soluble in water & insoluble in alcohol.

Assay =

- Assay of $Na_2S_2O_3$ is based upon redox titration.
- Take about 0.5 gm of sample & dissolve in 20ml water.
- Now it is titrated against 0.05M iodine using starch as indicator.
- Titration continues until blue colour of sol^n disappears.

Uses =

- It is used in the treatment of cyanide poisoning.
- It is also used to treat skin diseases.

5) Cathartics

- These are the drugs that are used to get relief from Constipation.
- These are the drugs that accelerates defecation
- Cathartics act by increasing the fluid content of faeces, making them softer & easier to pass.
- Cathartics increases the mobility of intestine.

Types : Are of 2 types.

1. Laxative
2. Purgative

Laxative

- These are mild acting cathartics
- They work by either :-
  - Increasing intestinal movement
  - Increasing stool bulk
  - make stool softener.
- Prolong use of laxative may cause habit or dependancy.

Purgative

- They are strong cathartics
- They are given in very serious conditions.
- They are generally given to completely remove solid materials from intestine before surgery.

Classification (on the basis of mechanism)

1. stimulant
2. Lubricants
3. Bulk forming
4. Saline cathartics

Stimulant Cathartics :- They act by producing local irritation on intestinal tract.

Lubricants :- Provide lubricant effect so that stool easily passes through rectum, also known as stool softener.

Bulk forming :- It increases the amount of stool production.

Saline Cathartics :- They increases the osmotic load of GIT, consumed with large amount of water.

Uses of Cathartics

- For easy defacation & other rectal diseases.
- To relief from acute constipation.
- To remove solid material from intestinal tract before surgery.
- To avoid rise in blood pressure due to constipation

Magnesium Sulphate

Chemical formula: $MgSO_4 \cdot 7H_2O$

Molecular formula: 246.47 g/mol

Synonym: Epsom salt

Method of prepⁿ

It is obtained by the action of dil. Sulphuric acid (H_2SO_4) & Magnesium Carbonate ($MgCO_3$).

$$MgCO_3 + H_2SO_4 \longrightarrow MgSO_4 + H_2O + CO_2$$

Properties

- It occurs as white crystals
- It is odourless
- It having a cool, saline, bitter taste.
- It is soluble in water & sparingly soluble in alcohol.

Uses

It is used as Cathartics

It is used in agriculture

It is used to control seizures in pregnancy.

6) Antacids

- These are the drugs that are used to decrease the level of gastric acid in the stomach.
- They are used in the case of Hyperacidity.
- They also prevent from Heart Burn and ulcer.
- They work by increasing gastric PH.

Example :- $CaCO_3$, $NaHCO_3$

Classification of Antacids :-

Antacids are commonly classified into two groups.

1. Systemic Antacids.
2. Non-systemic Antacids.

1) Systemic Antacids :-

→ Antacids which absorbs in the Systemic Circulation are called as Systemic Antacids.

→ They are not Very Suitable antacids as they can cause Metabolic Alkalosis.

2) Non-Systemic Antacids :-

→ Antacids which are not absorbed into systemic circulation & don't affect acid-base balance of the body are called as Non-systemic Antacids.

Ideal Properties of Antacids :-

→ It should be insoluble in water & has fine particle form.
→ It shouldn't cause Metabolic alkalosis.
→ It must have its effect over a long period of time.
→ It shouldn't cause Constipation.
→ It shouldn't cause any side effect.

Combination of Antacids :-

→ Systemic antacids aren't used regularly as they can cause Metabolic alkalosis & Congestive heart failure.

→ Non-systemic antacids are more effective compared to Systemic alkalosis, but they also have some other side effects.

→ To avoid these side effect and to increase the effect and time of duration of action, antacids are generally given in combination.

→ Generally in the combination of antacids, one having a rapid action & other having longer duration of action.

Example :-

Combination of Magnesium and Aluminium as Antacid.

(i) Magnesium → fast acting.

(ii) Aluminium → Longer duration of action.

Aluminium Hydroxide gel :-

Chemical formula - $Al(OH)_3$

Molecular weight - 78.00 g/mol

Synonym - Aluminium Hydrated Powder

Preparation :-

It is prepared when Aluminium chloride is treated with Amonium hydroxide.

$$AlCl_3 + 3NH_4OH \longrightarrow Al(OH)_3 + 3NH_4Cl$$

Properties :-

→ It is a white viscous Suspension.

→ It is tasteless.

→ It is odourless.

→ It is soluble in mineral acid soln, but insoluble in water & alcohol.

Uses :-

→ It is used as antacid.

→ It is used to treat heartburn.

9) Haematinics

↳ These are the substances that are required in the formation of blood and mainly used in the treatment of Anaemia.

↳ These drugs increases the number of red blood cells and amount of haemoglobin when they are below normal level.

↳ Anaemia occurs when the balance bet^n production and destruction of rbc get disturbed.

Anaemia

↳ It is a state of body in which conc. of haemoglobin gets reduced in the blood.

↳ It occur due to :-

1. Excessive blood loss.
2. Unhealthy RBCs formation.
3. Increased destruction of RBCs.

Types of Anaemia

- Iron deficiency Anaemia
- Aplastic Anaemia
- Haemolytic Anaemia
- sickle cell Anaemia.
- Pernicious Anaemia.

Ferrous sulphate

molecular formula = $FeSO_4 \cdot 7H_2O$

molecular wt = 278 g/mol.

synonym = Green vitriol

method of Prep^n = when iron is treated with dil. H_2SO_4 iron dissolves and form ferrous sulphate & hydrogen gets liberated.

$$Fe + H_2SO_4 \longrightarrow FeSO_4 + H_2.$$

Properties = •) It is transparent green crystal.

•) It is odourless.

•) It is having metallic taste.

•) Soluble in water & insoluble in alcohol.

Assay = Assay of $FeSO_4$ is performed by redox titration.

•) Add about 0.76 g of $FeSO_4$ in 100ml water.

•) Add 0.1 ml of 3 drop of H_2SO_4 as indicator.

•) Titrate with 0.1 N $KMnO_4$ std sol^n until purple colour disappears.

Uses =

•) It is used as haematinics.

•) It can be used as disintectants.

PART- II

1) Limit test for Arsenic

- It is based upto the reaction between Arsenic gas and Mercuric chloride paper
- A result of the rxn a complex form known as Mercuric Arsenic, which appears yellow or brownish colour spot in the paper.

$As \xrightarrow{H_2SO_4} H_3AsO_3 / H_3AsO_4$
(Arsenic) (Arsenious acid) (Arsenic acid)

$H_3AsO_4 + H_2SnO_2 \longrightarrow H_3AsO_3 + H_2SnO_3$
(Arsenic acid) (stannous acid) (Arsenious) (stannous acid with oxygen)

$H_3AsO_3 + 3H_2 \longrightarrow AsH_3 + 3H_2O$
(Arsenious) (Necent Hydrogen) (Arsine gas)

$2AsH_3 + HgCl_2 \longrightarrow Hg \begin{cases} AsH_2 \\ AsH_2 \end{cases} + 2HCl$
(Arsin gas) (Mercury chloride paper) (yellow, brown spot) (Mercury Arsenic)

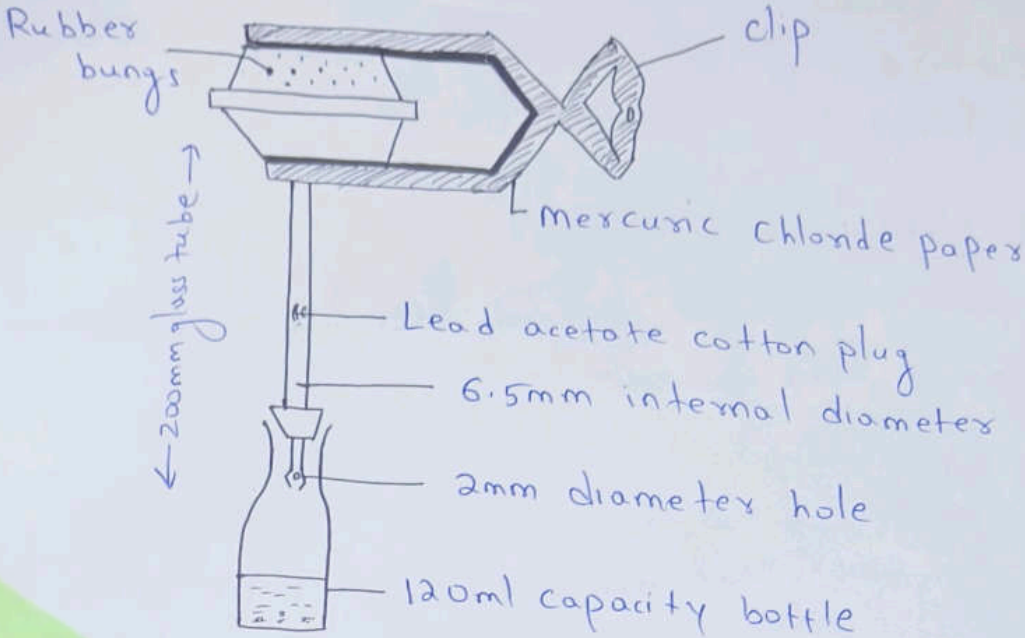
Procedure

Test soln

- 5ml of test Arsenic soln + 50ml of water transfer to a wide mouth glass water.
↓
10ml of stannous acid
↓
5ml of KI + 10gm zinc acid
↓
Assamble apparatus immediately & place on water bath at 40°c for 40 min

Standard soln

- 5ml of standard Arsenic soln + 50 water transfer to a wide mou glass waters
↓
10ml of stannous acid
↓
5ml of KI + 10gm zinc dust
↓
Assamble apparatus immediat & place on water bath at 4 for 40 min



Gutzeit apparatus

Instrumentation

Glass bottle

- It is a wide mouth glass bottle having capacity of 120ml
- 2.5cm diameter closed with rubber curve.

Glass tube

- The glass tube having the length 20cm (200m)
- External diameter 0.8cm or (8mm)
- Internal diameter 6.5cm
- Lower & thickness 0.1cm or (1mm)
- Hole 0.2cm or (2mm) of lower end

Rubber bungs

- Upper end of glass tube is fitted with two rubber bung thickness about (25mm x 25mm)
- having a hole (6.5mm) diameter

Mercuric chloride paper

- Horizontally place the mercuric chloride paper between a rubber bungs like a sandwich

Spring clips

- The spring clips is used for to fix two rubber, bungs to tighten the position.

Cotton plug

- moisture with lead acetate to interupt other gas.

2) ANTIMICROBIAL AGENTS

- Antimicrobial agents are those chemical compounds or drugs that inhibits or destroys the growth of microorganism
- They can either kill or prevents the growth of bacteria.

Classification of Antimicrobials

1. Antiseptic
2. Disinfectants
3. Germicides
4. Bacteriostatics
5. Sanitizers
6. Sterlization

Antiseptic

- Antiseptic are those antimicrobial agents that are mainly used on living cells.
- They either kills or inhibits the growth of bacteria.
- An ideal antiseptic agent should destroy bacteria, viruses etc & should not cause any harm to applied area.
- Ex → Hydrogen peroxide, silver Nitrate etc.

Disinfectant

- These are the antimicrobial agents that are mainly used on Non-living surfaces.
- They can either kills or destroy bacteria.
- They are mainly used in home & hospital cleaning.
- Ex → Sulpher dioxide

Germicides

- These are the agents that are used to kill microorganisms.
- They can be either use on living or non-living surfaces.
- They can also divided into following types:-

Bactericides :- To kill bacteria

Virucides :- To kill viruses

Fungicides :- To kill fungi

Bacteriostatics

- These are the agents that are used to prevent growth of bacte
- They do not kill bacteria.
- Can be used on living or Non-living surfaces.
- Ex → Chloromphenical

Sanitizers

- Sanitizers are agents that are mainly used in cleaning & washing.
- They are generally used to maintain general public health standards.
- Ex → Soap, Alcohol etc.

Sterilization

- It is a process by which all microorganism are either killed or removed.
- In this process, the products, surface or area will be free from all type of microorganism.

Mechanism of action of Antimicrobials

- Microorganism mainly contains proteins to survive.
- Anti-microbials act by changing their protein structure with results in death of microorganism.
- Mainly acts by 3 mechanism:
  1. Oxidation
  2. Halogenation
  3. Precipitation.

Oxidation

- This MoA shows by oxygen releasing compounds.
- They cause oxidation of active functional groups present in proteins & inactive them.

Halogenation

- This MoA shows by halogen (Br, Cl etc) releasing compounds.
- These agents add halide atom to nitrogen present of peptide linkage of protein & inactivates them.

Precipitation

- This MoA shows by metal containing compounds.
- Metal bonds with important group present in protein change their structure & inactivates them.

CHLORINATED LIME

Chemical formula :-

Molecular weight :-

Synonym :-

Prepⁿ

It is prepared by reacting chloride with calcium hydroxide

$$Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$$

Properties

- It is white or grey powder.
- It has odour of chlorine.
- It is partially soluble in water & alcohol

Uses

- It is used as antimicrobial agent.
- It is used as powerful bleaching powder.