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**A TECHNICAL REPORT OF STUDENT INDUSTRIAL WORK EXPERIENCE SCHEME (SIWES) FOR 3 MONTHS**

**AT**

**THE REDEEMER’S HEALTH CENTRE PHARMACY, THE REDEEMER’S HEALTH CENTRE, REDEMPTION CAMP, LAGOS-IBADAN EXPRESSWAY, OGUN STATE**

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**DEDICATION**

To the Almighty God, who saw me through the period of the industrial training, all glory and honor to His name. He alone made it possible for me to see this day and without Him, I wouldn’t have gone this far.

To my parents, Mr. and Mrs. Adeyemo, who assisted me in getting a place for the training, thank you very much. I really appreciate the support.

To my lecturers who have been doing a fine job in training me to become a successful pharmacologist, I am very much grateful.

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**INTRODUCTION**

**Drugs Classes I Worked With**

🡪Anti-malarias (Prophylaxis, Artemisinin-based Combination Therapy)

🡪Anti-migraine (Ergotamine,)

🡪Antibiotics (β-lactams, Fluoroquinolones)

🡪Anti-ulcer (H2receptor blockers, Proton pump inhibitors, Antacids, Mucosal protective agents, Anti-cholinergics, Prostaglandin analogues)

🡪Anti-hypertensives (Calcium channel blockers, Blood thinners, Vasodilators)

🡪Anti-fungi (Fluconazole, Griseofulvin)

🡪Laxatives (Bisacodyl, Paraffin)

🡪Anti-emetics (Promethazine, Metoclopramide, Cinnarizine)

🡪Anti-allergies (Piriton, Promethazine)

🡪Analgesics

🡪Multivitamins

🡪Blood tonics

🡪Eye, ear and nasal drops

🡪Infusions

**Vomiting (Emesis)**

 The act of vomiting is produced by a series of coordinated changes in GI activity and in respiratory movements: salivation; sharp and deep inspiration; increase in intra-abdominal pressure; contraction of abdominal muscles; closure of the epiglottis and raising of the soft palate; forceful contractions of the stomach pylorus; and relaxation of the fundus, cardiac sphincter and esophagus. Gastric contents are propelled into the mouth and are expelled, usually accompanied by pallor and cold sweat.

 Nausea and vomiting may occur in: cancer: cancer chemotherapy, radiation therapy, gastroenteritis, consequence of surgery and general anesthesia (PONV = post-operative nausea and vomiting), alcohol binge, drug side effects, cerebral edema, severe pain, flu, vertigo, pregnancy, emotional stress ("sick to the stomach"), poisoning (e.g., anticholinesterases) and so on.

**ANTI-EMETICS**

 [These are drug](https://en.wikipedia.org/wiki/Medication)s that are effective against [vomiting](https://en.wikipedia.org/wiki/Vomiting) and [nausea](https://en.wikipedia.org/wiki/Nausea). Anti-emetics are typically used to treat [motion sickness](https://en.wikipedia.org/wiki/Motion_sickness) and the [side effects](https://en.wikipedia.org/wiki/Adverse_effect_%28medicine%29) of [opioid](https://en.wikipedia.org/wiki/Opioid) [analgesics](https://en.wikipedia.org/wiki/Analgesic), [general anaesthetics](https://en.wikipedia.org/wiki/General_anaesthetic), and [chemotherapy](https://en.wikipedia.org/wiki/Chemotherapy) directed against [cancer](https://en.wikipedia.org/wiki/Cancer). Antiemetic drugs help to block specific neurotransmitters in the body. These neurotransmitters trigger impulses such as nausea and vomiting, so blocking the impulses will help shut them down. They may be used for severe cases of [gastroenteritis](https://en.wikipedia.org/wiki/Gastroenteritis), especially if the patient is dehydrated. Some anti-emetics previously thought to cause birth defects, appear safe for use by pregnant women in the treatment of [morning sickness](https://en.wikipedia.org/wiki/Morning_sickness).

**Classses of Anti-Emetics**

**Anticholinergic**

* Anticholinergics are efficacious in the treatment of nausea secondary to vertigo and motion sickness.
	+ [Hyoscine](https://en.wikipedia.org/wiki/Hyoscine_hydrobromide) (also known as [scopolamine](https://en.wikipedia.org/wiki/Hyoscine_hydrobromide))
	+ [Diphenhydramine](https://en.wikipedia.org/wiki/Diphenhydramine)
	+ [Promethazine](https://en.wikipedia.org/wiki/Promethazine) (Pentazine, Phenergan, Promacot)

**Steroid**

* The mechanism of action of steroids is said to be related to the inhibition of arachidonic acid release.
	+ [Dexamethasone](https://en.wikipedia.org/wiki/Dexamethasone) (used in chemotherapy as a single drug as well as with other anti-emetics such as 5-HT3 receptor antagonists and NK1 receptor antagonist).

**Cannabinoid**

* [Cannabinoids](https://en.wikipedia.org/wiki/Cannabinoid) are used in patients with [cachexia](https://en.wikipedia.org/wiki/Cachexia), cytotoxic nausea, and vomiting, or who are unresponsive to other agents. They are drugs to be used with extreme caution and intense medical supervision.
	+ [Cannabis](https://en.wikipedia.org/wiki/Medical_cannabis) (also known as medical marijuana)
	+ [Dronabinol](https://en.wikipedia.org/wiki/Dronabinol)
	+ Some [synthetic cannabinoids](https://en.wikipedia.org/wiki/Synthetic_cannabinoids) such as [Nabilone](https://en.wikipedia.org/wiki/Nabilone)

**NK1 receptor antagonist**

* NK1 receptor antagonist (-pitants) are a novel class of medications that possesses unique [antidepressant](https://en.wikipedia.org/wiki/Antidepressant), [anxiolytic](https://en.wikipedia.org/wiki/Anxiolytic), and [antiemetic](https://en.wikipedia.org/wiki/Antiemetic) properties. NK-1 antagonists boost the efficacy of 5-HT3 antagonists to prevent nausea and vomiting. Chemotherapy-induced [emesis](https://en.wikipedia.org/wiki/Emesis) appears to consist of acute and delayed phases. So far, the acute phase emesis responds to [5-HT3 antagonists](https://en.wikipedia.org/wiki/5-HT3_antagonist) while the delayed phase remains difficult to control. The discovery and development of NK1 receptor antagonists have elicited antiemetic effect in both acute and especially in delayed phases of emesis.
	+ [Aprepitant](https://en.wikipedia.org/wiki/Aprepitant) (commercially available)
	+ [Casopitant](https://en.wikipedia.org/wiki/Casopitant) (investigational NK1 receptor antagonist)
	+ [Rolapitant](https://en.wikipedia.org/wiki/Rolapitant) (recently approved drug)

**Benzodiazepines**

* [Benzodiazepines](https://en.wikipedia.org/wiki/Benzodiazepines) (GABA receptor agonists), (BZD, BDZ, BZs), sometimes called "benzos", are a class of [psychoactive drugs](https://en.wikipedia.org/wiki/Psychoactive_drug) whose core chemical structure is the fusion of a [benzene](https://en.wikipedia.org/wiki/Benzene) ring and a [diazepine](https://en.wikipedia.org/wiki/Diazepine) ring. They are good for anticipatory nausea and vomiting before cancer therapy. Benzos are also useful for vestibular disorders.
* diazepam (Valium)
* lorazepam
* klonazepam (used prior to nauseating experience).

**Antihistamine**

* [Antihistamines](https://en.wikipedia.org/wiki/Antihistamine) ([H1 histamine receptor](https://en.wikipedia.org/wiki/Histamine_receptor) antagonists) are effective in many conditions, including motion sickness, morning sickness in pregnancy, and to combat [opioid](https://en.wikipedia.org/wiki/Opioid) nausea. Many of the antihistamines have anticholinergic properties that block muscarinic receptors at the same sites. The use of antihistamines and anti-cholinergics is recommended in the treatment of nausea secondary to vertigo and motion sickness.
	+ [Cinnarizine](https://en.wikipedia.org/wiki/Cinnarizine) (Stugeron)
	+ [Cyclizine](https://en.wikipedia.org/wiki/Cyclizine)
	+ [Diphenhydramine](https://en.wikipedia.org/wiki/Diphenhydramine) (Benadryl)
	+ [Dimenhydrinate](https://en.wikipedia.org/wiki/Dimenhydrinate)
	+ [Doxylamine](https://en.wikipedia.org/wiki/Doxylamine) (used in the combination drug pyridoxine/doxylamine to treat nausea and vomiting during pregnancy).
	+ [Mirtazapine](https://en.wikipedia.org/wiki/Mirtazapine) (an [antidepressant](https://en.wikipedia.org/wiki/Antidepressant) that has antiemetic effects, a potent histamine H1 receptor antagonist)
	+ [Meclizine](https://en.wikipedia.org/wiki/Meclizine)
	+ [Promethazine](https://en.wikipedia.org/wiki/Promethazine) (Pentazine, Phenergan, Promacot)
	+ [Hydroxyzine](https://en.wikipedia.org/wiki/Hydroxyzine) (used to treatment nausea due to motion sickness).

**🡪Dopamine antagonist**

* [Dopamine antagonists](https://en.wikipedia.org/wiki/Dopamine_antagonist) act on the brainstem and are used to treat nausea and vomiting associated with [cancer](https://en.wikipedia.org/wiki/Cancer), radiation sickness, opioids, cytotoxic drugs and general anaesthetics.
	+ [Amisulpride](https://en.wikipedia.org/wiki/Amisulpride)
	+ [Domperidone](https://en.wikipedia.org/wiki/Domperidone)
	+ [Olanzapine](https://en.wikipedia.org/wiki/Olanzapine)
	+ [Trimethobenzamide](https://en.wikipedia.org/wiki/Trimethobenzamide)
	+ [Haloperidol](https://en.wikipedia.org/wiki/Haloperidol) [limited in usefulness by extra-pyramidal (In [anatomy](https://en.wikipedia.org/wiki/Anatomy), the extrapyramidal system is a part of the [motor system](https://en.wikipedia.org/wiki/Motor_system) [network](https://en.wikipedia.org/wiki/Large_scale_brain_networks) causing involuntary actions.) and sedative side-effects]
	+ [Alizapride](https://en.wikipedia.org/wiki/Alizapride)
	+ [Prochlorperazine](https://en.wikipedia.org/wiki/Prochlorperazine)
	+ [Chlorpromazine](https://en.wikipedia.org/wiki/Chlorpromazine) (Use limited by sedating properties)
	+ [Metoclopramide](https://en.wikipedia.org/wiki/Metoclopramide) (Maxolone)
	+ [Promethazine](https://en.wikipedia.org/wiki/Promethazine) (Pentazine, Phenergan, Promacot)

**🡪5-HT3 antagonist**

* [5-HT3 receptor antagonists](https://en.wikipedia.org/wiki/5-HT3_antagonist) block [serotonin](https://en.wikipedia.org/wiki/Serotonin) receptors in the [central nervous system](https://en.wikipedia.org/wiki/Central_nervous_system) and [gastrointestinal tract](https://en.wikipedia.org/wiki/Gastrointestinal_tract). As such, they can be used to treat post-operative and cytotoxic drug nausea & vomiting.
	+ [Dolasetron](https://en.wikipedia.org/wiki/Dolasetron)
	+ [Granisetron](https://en.wikipedia.org/wiki/Granisetron)
	+ [Ondansetron](https://en.wikipedia.org/wiki/Ondansetron)
	+ [Tropisetron](https://en.wikipedia.org/wiki/Tropisetron)
	+ [Palonosetron](https://en.wikipedia.org/wiki/Palonosetron)
* Also, angiosperms such as ginger contains 5-HT3 antagonists gingerols, shogaols, and galanolactone. Hence, may be effective for treatment of nausea and/or vomiting in a number of settings.

NOTE:

* Motion sickness medications desensitize the inner ear to the motion of the head. The inner ear plays a significant role in a person’s balance, which can be affected by sitting in a moving car or being on a boat.
* People who require anesthesia to undergo surgery frequently complain of nausea and vomiting following surgery. A few different types of drugs can help with this.
* Pregnant women with [morning sickness](https://www.medicalnewstoday.com/articles/179633.php) may use antiemetic drugs to reduce their symptoms. They are usually only prescribed in severe situations, such as if a woman has *Hyperemesis gravidarum* or where nausea and vomiting interfere with everyday life. Only a few different medications may work as anti-emetics during pregnancy such as Vitamin B-6.

**Side Effects of Anti-Emetics**

Common side effects of each drug type include:

* **Antihistamines**: sleepiness, [dry mouth](https://www.medicalnewstoday.com/articles/187640.php), and dry nasal passages
* **Bismuth-subsalicylate**: dark, blackish stools and changes in tongue color
* **Cannabinoids**: altered state of perception and dizziness
* **Corticosteroids**: additional symptoms of [indigestion](https://www.medicalnewstoday.com/articles/163484.php), increased appetite or thirst, and [acne](https://www.medicalnewstoday.com/articles/107146.php)
* **Dopamine receptor blockers**: [fatigue](https://www.medicalnewstoday.com/articles/248002.php), [constipation](https://www.medicalnewstoday.com/articles/150322.php), ringing in the ears, dry mouth, restlessness, and muscle spasms
* **NK1 receptor blockers**: dry mouth, reduced urine volume, and [heartburn](https://www.medicalnewstoday.com/articles/9151.php)
* **Serotonin receptor blockers**: fatigue, dry mouth, and constipation

Each specific medication may have additional side effects as well.

**Contraindications of Anti-Emetics**

While antiemetic drugs can help people to live without the bothersome symptoms of nausea and vomiting, some complications can occur.

Symptoms that should be addressed by a doctor include:

* muscle weakness, spasms, or convulsions
* changes in heartbeat, such as palpitations or rapid heartbeat
* [hearing loss](https://www.medicalnewstoday.com/articles/249285.php)
* worsening of nausea or vomiting, even while taking medications
* slurred speech
* psychological problems, such as hallucinations or confusion
* drowsiness that interferes with daily life

It is best to discuss medications with a doctor before starting any new prescription, especially if a person is taking other drugs.

For instance, people who take sleeping pills or muscle relaxants will need to talk to their doctor before taking over-the-counter antihistamines for nausea and vomiting.

Other medications have side effects similar to those caused by anti-emetics. Taking more than one of these drugs at the same time may make the side effects worse.

**Case Scenario**

 A patient was rushed into the hospital. He was vomiting and having itching due to ingestion of walnuts (He is allergic). The patient was also tested for malaria and his result proved he had to be placed on admission in the hospital for physical observation. He was given medication to treat the malaria but unfortunately, the pharmacy had run out of anti-allergy drugs to treat his reaction. Promethazine to the rescue. It is an anti-histamine and hence, is effective against the nausea and allergic reaction.

**PROMETHAZINE**

 Promethazine is an anti-histamine used to treat [allergies](https://en.wikipedia.org/wiki/Allergies), sleeping troubles, and [nausea](https://en.wikipedia.org/wiki/Nausea). It may help with some symptoms associated with the [common cold](https://en.wikipedia.org/wiki/Common_cold).It may also be used for [sedating](https://en.wikipedia.org/wiki/Sedating) people who are agitated or anxious. It is available as an oral syrup, as a [rectal suppository](https://en.wikipedia.org/wiki/Rectal_suppository), or intra-muscular injection.

Common side effects include confusion and sleepiness.Alcohol or other sedatives can worsen this. Use is not recommended in those less than two years old due to potentially negative effects on breathing.Use by injection into a vein is not recommended due to potential skin damage. Promethazine is listed as one of the drugs of highest anticholinergic activity in a study of anti-cholinergenic burden, including long-term cognitive impairment.

Promethazine was first synthesized by a group at [Rhone-Poulenc](https://en.wikipedia.org/wiki/Rhone-Poulenc) (which later became part of [Sanofi](https://en.wikipedia.org/wiki/Sanofi)) led by Paul Charpentier in the early 1940s. The team was seeking to improve on [diphenhydramine](https://en.wikipedia.org/wiki/Diphenhydramine); the same line on medical chemistry led to the creation of [chlorpromazine](https://en.wikipedia.org/wiki/Chlorpromazine).

**Medical uses**

Promethazine has a variety of medical uses, including:

* Sedation
* Nausea and vomiting association with anesthesia or chemotherapy. It is commonly used postoperatively as an antiemetic. The antiemetic activity increases with increased dosing; however, side effects also increase, which often limits maximal dosing.
* For moderate to severe [morning sickness](https://en.wikipedia.org/wiki/Morning_sickness) and [hyperemesis gravidarum](https://en.wikipedia.org/wiki/Hyperemesis_gravidarum): Promethazine is [drug](https://en.wikipedia.org/wiki/Drug) of first choice, being preferred as an older drug with which there is a greater experience of use in [pregnancy](https://en.wikipedia.org/wiki/Pregnancy) (second in line being [metoclopramide](https://en.wikipedia.org/wiki/Metoclopramide) or [prochlorperazine](https://en.wikipedia.org/wiki/Prochlorperazine)).
* For allergies such as [hay fever](https://en.wikipedia.org/wiki/Hay_fever) and together with other medications in [anaphylaxis](https://en.wikipedia.org/wiki/Anaphylaxis)
* To add with symptoms of the [common cold](https://en.wikipedia.org/wiki/Common_cold)
* [Motion sickness](https://en.wikipedia.org/wiki/Motion_sickness)
* [Hemolytic disease of the newborn](https://en.wikipedia.org/wiki/Hemolytic_disease_of_the_newborn)

**Side effects**

Some  [side effects](https://en.wikipedia.org/wiki/Adverse_effect_%28medicine%29) include:

* [Tardive dyskinesia](https://en.wikipedia.org/wiki/Tardive_dyskinesia), pseuodoparkinsonism, acute dystonia (effects due to dopamine D2 receptor antagonism)
* Confusion in the elderly
* Drowsiness, dizziness, fatigue, more rarely [vertigo](https://en.wikipedia.org/wiki/Vertigo_%28medical%29)
* Dry mouth
* [Respiratory depression](https://en.wikipedia.org/wiki/Hypoventilation) in patients under the age of two and in those with severely compromised pulmonary function
* Blurred vision, xerostomia, dry nasal passages, dilated pupils, constipation, and urinary retention. (due to cholinergic effects)
* Chest discomfort/pressure (In children less than 2 years old)
* [Akathisia](https://en.wikipedia.org/wiki/Akathisia)

Less frequent:

* Cardiovascular side effects to include arrhythmias and hypotension
* [Neuroleptic malignant syndrome](https://en.wikipedia.org/wiki/Neuroleptic_malignant_syndrome)
* Liver damage and cholestatic jaundice
* Bone marrow suppression, potentially resulting in agranulocytosis, thrombocytopenia, and leukopenia
* Depression of the thermoregulatory mechanism resulting in hypothermia/hyperthermia

Rare side effects include:

* [Seizures](https://en.wikipedia.org/wiki/Seizures)

**Pharmacology**

Promethazine, a phenothiazine derivative, acts primarily as a strong [antagonist](https://en.wikipedia.org/wiki/Receptor_antagonist) of the [H1 receptor](https://en.wikipedia.org/wiki/H1_receptor) ([antihistamine](https://en.wikipedia.org/wiki/Antihistamine)) and a moderate [mACh receptor](https://en.wikipedia.org/wiki/Muscarinic_acetylcholine) antagonist ([anticholinergic](https://en.wikipedia.org/wiki/Anticholinergic)), and also has weak to moderate [affinity](https://en.wikipedia.org/wiki/Affinity_%28pharmacology%29) for the [α1-adrenergic receptors](https://en.wikipedia.org/wiki/Alpha-1_adrenergic_receptor), where it acts as an antagonist at all sites, as well. Another notable use of promethazine is as a [local anesthetic](https://en.wikipedia.org/wiki/Local_anesthetic), by blockade of [sodium channels](https://en.wikipedia.org/wiki/Sodium_channel).