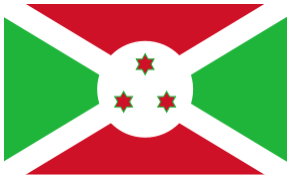
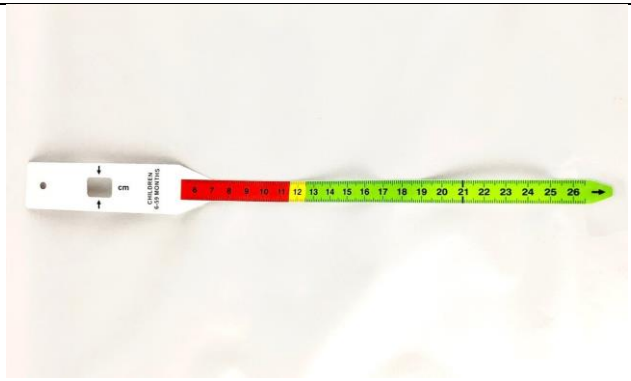
Facts	Ideas	Learning outcomes	Actions
1. A story about nutrition in Rwanda, Burundi.	Where is Rwanda, Burundi?	1. Malnutrition 2. Balanced diet 3. Role of nutrients 4. Nutrients and vitamin 5. Diseases related to malnutrition 6. Medical treatments for malnutrition	Rwanda and Burundi are two different countries. This happened after World War II and now, Ruanda-Urundi has become a trust territory. Rwanda is also known as *le pays des mille collines* which are French words for the "land of thousands of hills". This is because it is a hilly country located at the South of the Equator and East of Lake Kivu which is one of the African Great Lakes in Central Africa. The capital of Rwanda is Kigali. This picture shows the flag of Rwanda.  Burundi is also a part of Africa situated at the South of the Equator in east-central Africa. It lies on the shore of the water body. It is one of a few countries in Africa where the borders were not determined by colonial rulers. The flag of Burundi looks like this.  To understand more where Rwanda and Burundi are located. This figure here shows you the map of Rwanda and Burundi in Central Africa under satellite. You can see it clearly that these countries are just neighbors.

2. Kanyange changed, where she stopped playing with her friends and tired all the time. Her abdomen started to swell, her arms and legs got very thin, her rib poking through her chest, hair turned yellow-reddish and has hair loss. She also had loss of appetite.	1. Why does Kanyange feels tired, her abdomen start to swell arms and legs get very thin, her rib started poking through chest, hair started to turn yellow, reddish also had loss of appetite?		Kanyange having this kind of condition may be due to her lack of nutrients in her body. This is because based on her conditions, it shows several symptoms of malnutrition. For example, her abdomen started to swell. This may be due to lactose intolerance, a condition that occurs when your body is unable to digest lactose, a sugar that is found in dairy products. Lactose intolerance is most common in Asian Americans, African Americans, Mexican Americans and Native Americans. Symptoms of lactose intolerance include abdominal bloating and gas, also can be called as lactose deficiency. This is an example picture of a child having the same condition as Kanyange which is bloating stomach. Besides, according to the Mother & Child Nutrition website, if a child's hair turns reddish-yellow in colour, it shows critical starvation by protein deficiency especially during periods of famine. However, a sudden change of colour hair only occurs to severe malnutrition cases. Next, Kanyange has appetite loss. Appetite loss occurs when the absorption of nutrients is very poor. This can be proven from the book titled '*The Social Problems of Children in Sub-Saharan Africa*' by Jerry W. Hollingsworth. It stated that children living in poverty situations may not get enough nutrients and this leads to stunting in children.
	2. What does the diseases indiates based on Kanyange's condition?		Based on Kanyange's condition, she may have experienced severe malnutrition that is associated with a deficiency in dietary protein. This also affects the type of nutrition food that she ate.
3. Kagabo, 7 years old feels very tired and always falling asleep, his mark starts to drop.	1. Why does Kagebo always falling asleep in class and feels tired?		Kagabo's situation of extreme tiredness and tends to fall asleep in class may be a sign of malnutrition. Before discussing further about his problem, malnutrition is the result of an insufficient supply of nutrients due to impaired metabolism, malabsorption or an inadequate supply of food. According to research, children who do not consume adequate amounts of key nutrients, including calcium, potassium and vitamin C may be unable to work their full potential at school. Underfeeding in childhood was thought to hinder mental development solely by producing permanent structural damage to the brain. In short, lack of nutrients can have long-term effects on the brain's structure and academic performance. These research findings correlate much to Kagabo family's diet and his issue at school. Our body relies on a range of nutrients from our daily diet to generate energy. Macronutrients include fats, proteins and carbohydrates used for

			creating energy and building up the body cells. Whilst, micronutrients include vitamins and minerals play vital roles in supporting energy production from the use of macronutrients. To summarize, a range of nutrients that we take in our nutrient responsible in energy production hence to prevent tiredness.
	2. What is the relationship between Kanyange and Kagebo's health condition?		Both siblings experience tiredness which is a symptom of malnutrition. The video had mentioned that Kanyange has less interest in playing while her brother, Kagabo tends to fall asleep in class. It shows that they cannot perform well in daily activities due to tiredness. To consider that they obviously have the same diet, the siblings are both malnourished.
	3. In what factor, Kanyange and Kagebo's health condition correlated?		
4. Chief advisor said that it may due to food that Kanyange's family ate which are bananas, sweet potato, and cassava (main generation food for Rwanda people).	1. Banana, cassava and sweet potato categorize in what type of nutrition?		Mainly, there are two types of nutrients which are macronutrients and micronutrients. Examples of macronutrients are carbohydrate, protein, fibre, water and fat. On the other hand, micronutrients include vitamins and minerals. These three foods (banana, cassava and sweet potato) contain carbohydrates. Thus, they are macronutrients. Carbohydrates are our body's main source of energy in the form of calories because they are easily converted. For your information, up to 65% of our energy comes from carbohydrates. Tissues and cells in our body need energy in the form of glucose which is readily used whereas the brain, kidneys, muscles and central nervous system use energy in order to function properly. These energies are stored in muscles and liver. This is the answer to the first fact.
	2. Why does the chief advisor said that it may due to the food that may affect children's health?		Poor eating habits are when we do not consume the right portion of healthy foods daily or when we eat too many foods that are rich in fat, salt, sugar and low in fiber which could affect our nutrient intake. Poor nutrition can cause short-term and long-term effects on our body. The short-term effects include getting stress, tired and reduced work capacity in school or work. The long-term effects contribute to the risk of developing some illness and other health problems. The village chief predict that it may be due to the foods Kanyange and Kagabo took probably because of the symptoms they showed.

5. Health worker shows 3 type of colour of tapes that indicate colour which are; red- severely malnourished, yellow- moderately, green-healthy.	1. How and where to measure the tape? 2. How to indicate the colour is yellow, green, red? In what measurement? 3. What is the normal measurement for normal kids and adults? 4. What happen to Kanyage as the result shown that her result is severely malnourished? 5. What is the name of tape used?		The name of the tape used is called Mid Upper Arm Circumference (MUAC) tape. This MUAC tape helps in identifying malnutrition by measuring the upper arm circumference. According to Mother Child Nutrition website, Mid-Upper Arm Circumference (MUAC) is the circumference of the left upper arm measured at the mid-point between the tip of the shoulder and the tip of the elbow (olecranon process and the acromion). It is a good predictor of mortality and in many studies, MUAC predicted death in children better than any other anthropometric indicator. This advantage of MUAC was greatest when the period of follow-up was short. The MUAC measurement requires little equipment and is easy to perform even on the most debilitated individuals. Although it is important to give workers training in how to take the measurement, the correct technique can be readily taught to minimally trained health workers and community-based volunteers. It is thus suited to screening admissions to feeding programs during emergencies. MUAC is recommended for use with children between six and fifty-nine months of age like Kanyange for assessing acute energy deficiency in adults during famine (scarcity of food). The major determinants of MUAC, arm muscle and subcutaneous fat, are both important determinants of survival in starvation. MUAC is less affected than weight and height based indices (for example, WHZ, WHM, BMI) by the localised accumulation of fluid (such as bipedal or nutritional oedema, periorbital oedema and ascites) common in famine and is a more sensitive index of tissue atrophy than low body weight. It is also relatively independent of height and body-shape. Besides, it has different colours (red, yellow and green) that help to indicate someone’s nutritional status compared to normal measuring tape. Moreover, according to The United Nations Children's Fund (UNICEF), MUAC tape is cheap and simple. It means it can be effectively used by any community, based people that requires it for an active casing. This also can be proven from the Healthline website, where this tape is more sensitive and can act as a better indicator for malnutrition cases compared to Weight-Height measurement.

			 According to the International Federation of Red Cross and Red Crescent Societies (IFRC), a global humanitarian organization, there are few procedures on measuring using MUAC tape. Firstly, the health worker should explain the procedure first to the child's mother or caregiver. Next, the mother should ensure that the child is not wearing any clothing on his or her left arm. If possible, the child should stand straight and sideways to the health worker who is going to measure him/ her. Then, bend the child's left arm at 90 degrees to the body. Find the midpoint of the upper arm and the mid-point is between the tip of the shoulder and the elbow. Mark with a pen the mid-upper arm point. The Health worker should ask the child to relax the arm so it hangs by his or her side. By using both hands, place the MUAC tape window (0 cm) on the midpoint. While keeping the left hand steady, wrap the MUAC tape around the outside of the arm with the right hand. Then, feed the MUAC tape through the hole in the tape while keeping the right hand planted on the arm. Next, pull the tape until it fits securely around the arm while keeping the right hand steady on the child's arm. Lastly, read and record the measurement at the window of the MUAC tape to the nearest millimetre (mm). If a child has a MUAC of less than 125 mm (coloured yellow or red on the tape) a referral form must be filled out so that the child can receive treatment. These steps are important for measuring the MUAC tapes especially in determining the

			status of malnutrition. Here is a video regarding the steps on measuring nutritional status using MUAC tape. These diagrams are adapted from World Health Organization (WHO) website, which is about the range of the measurement that indicates the colour for child like Kanyange, also measurement for adult. 

According to Kayange's result and colour, the Mother and Child Nutrition website states that if a child's result is red, that indicates that he/ she is having Severe Acute Malnutrition (SAM), where the child is in need of medical treatment from the doctors. Here is the table that I had compiled based on the colour and description of a child for having such a result.

Colour	Description
Red	Indicate the children having Secure Acute Malnutrition and in need of treatment.
Yellow	High risk for Acute Malnutrition and should be counselled and flowed

			<table><tr><td></td><td>up for Growth Promotion and Monitoring (GPM).</td></tr><tr><td>Green</td><td>Children are well-nourished/ normal.</td></tr></table> Therefore, based on Kanyange's result, it can conclude that she is having Severe Acute Malnutrition and she really needs the treatment as soon as possible.

6. Healthworker advised that Kanyange really need medical treatment or else she'll sick and die as her stomach does not work properly and feed her with normal food cause more illness.	1. How the health worker treated Kanyange with medical treatment since she is severely malnourished? 2. What is the medical treatment & medication can be used to treat Kanyange? (0-6 months old)		According to WHO recommendations on the management of severe acute malnutrition in infants and children, malnourished children should be admitted for inpatient care and receive the same general medical care such as parenteral antibiotics to treat possible sepsis and other possible medical complications such as HIV, TB, surgical condition or disability. Next, the feeding approaches for infants who are less than 6 months of age with severe acute malnutrition should prioritize establishing or re-establishing breastfeeding by mother or caregiver. Patients can be discharged from all care when they are breastfeeding effectively or feeding well with replacement feeds, have adequate weight gain and have a weight-for-length ≥–2 Z-scores. For infants who do not require inpatient care, or whose caregivers reject admission for assessment and treatment, counselling and support for optimal infant and young child feeding should be provided, according to general recommendations for feeding infants and young children, including for low-birth-weight infants. Next, weight gain of the infant should also be monitored weekly to observe any changes. If the infant does not gain weight or loses weight while the mother or caregiver is receiving support for breastfeeding, then he or she should be referred to inpatient care and assessment of the physical and mental health status of mothers or caregivers should be promoted and relevant treatment or support provided. The medical treatment will be depending on the severity and presence of underlying complications. The key approaches are ongoing screening and monitoring, making dietary plans which may include taking supplements and treating specific symptoms or infections present.

7. Malnutrition is caused when we don't eat enough food and not eat right variety of food.	1. What is the relationship between malnutrition and the food that we eat? 2. What are the factors causing malnutrition? 3. What are general medical treatments to cure malnutrition?		Rayhan and Khan in their research paper Factors Causing Malnutrition among under Five Children in Bangladesh in 2006 highlighted that underweight babies have a higher risk of getting malnourished. Mothers that have severe malnutrition problems could also cause the growth of their children to be physically stunted. To make things a lot worse is that fathers and mothers of malnourished children are lacking in proper education about nutrition. Malnutrition is generally considered as the lack of proper nutrition in daily diet. Generally, when we lack carbohydrate, lethargy soon follows. Lack of vitamins affect one's health, lack of fats causes dry skins, eyes and hair while hormonal problems are quite common among malnourished individuals. National Health Service (NHS) website underline a few common treatments for malnutrition though it could vary from different individuals. It could be in the form of dietary modification, supplements and support from families.
8. The Health worker also warned children who are malnourished are more likely to catch diseases such as cholera, diarrhea & malaria.	1. Why malnourished children can likely catch disease such as cholera, diarrhea? What is the relationship? 2. In what deficiency, for a child to catch diseases such as cholera, diarrhea and malaria? 3. What are the physical & emotional effects of malnutrition?		According to a research conducted on Malnutrition: Causes and Consequences by Royal College of Physicians, malnutrition can weaken one's immune function and wound healing in which causes the malnourished person to be vulnerable to diseases mentioned. This happened due to impaired cell-mediated immunity and cytokine, complement and phagocyte function. Deficiency in nutrients as what have been mentioned previously cause certain people to have low immune responses, making their body unable to fight against those diseases. For physical effects of malnutrition, the obvious differences that we can observe are weight loss due to depletion of fat, muscle and organ mass, breathing difficulties, decreased in mobility, low stamina, vulnerable to diseases and have high risk of chest infection and respiratory failure. Malnutrition is also able to trigger anxiety, depression, apathy, social isolation, mood swings, fatigue, loss of appetite and decreased participation in activity.

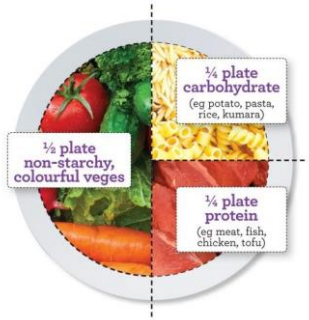
9. Malnutrition happened also due to diarrhea and worm.	1. How and what types of worm exist in digestive system? 2. What are medical treatments to kill the worms?		The worms that exist in our digestive system are called intestinal worms or parasitic worms. They feed on the human body. There are many types of intestinal worms with different ways of entering the human body such as tapeworms, hookworms, fluke, pinworms, ascariasis and *Trichinella*. The most common intestinal worms are tapeworms and hookworms. The first picture shows a tapeworm and the second picture shows hookworms.  

			First, let us look at tapeworms. According to Medical News Today, a tapeworm is a type of flatworm that lives in the intestine where it attaches to the intestinal wall. There are no symptoms or very mild symptoms shown to those with tapeworms in their body. Tapeworms are obtained from drinking unclean water as there are some tapeworms living in the water. Besides, from consuming unclean or raw meats because there are other tapeworms living in meats such as beef and pork. Another intestinal worm is the hookworms. Their body's end tapers off into a needle or hook shape and hence, their name. This worm lives in the small intestine where they can lay eggs and excrete from the body through feces. When the eggs hatch, the worms can enter another person's body through the skin. Like tapeworms, there are no symptoms shown. However, sometimes typical gastrointestinal symptoms are shown especially to first-timers. Hookworms are obtained from contact with unsanitary soil which contains contaminated feces as fertilizer. To learn more about intestinal worms, you can search Medical News Today on Google. Doctors may use antiparasitic medications or other suitable treatment to kill the worms but in some cases, medical treatment is not needed. A healthy immune system is already enough. The doctor must identify the specific type of worms in the body before prescribing any treatment for the best treatment option. For example, praziquantel (Biltricide) is usually prescribed by doctors to kill tapeworms. This drug could paralyze the worms, forcing it to detach from the intestinal wall. Then, it helps to dissolve the worms so that it can pass through the digestive system and leave the body during a bowel movement. In addition, anthelmintic drugs such as mebendazole or albendazole are often prescribed by doctors to kill hookworms.

10. Symptoms of malnutrition: • thin arm, swollen stomach • loose skin under buttock • hair becomes thinner • change in skin color • loss in energy/ concentration/tiredness • irritabilities/cry no tears	1. What deficiency of nutrients that cause these symptoms to occur? 2. How long does it take for the symptoms to show?		The symptoms of thin arm, swollen stomach and loose skins are commonly associated with the lack of protein in the diet. Thin hair is due to the lack of iron or zinc or protein. Change in skin colour may be yellow or orange pigmentation which the person may lack in vitamin B12 or excessive intake of beta-carotene. Tiredness is associated with the lack of carbohydrates in a daily diet or thiamine or vitamin B12 deficiency. Irritability is due to the lack of vitamin B while crying without tears are often associated with a genetic disease like Sjogren's syndrome. National Health Service (NHS) website also stated malnutrition symptoms may develop within three to six months.
11. Kanyange also need to get breastfeed until she is 2 years old to protect her from diseases.	1. Why a mother needs to breastfeed her daughter until 2 years old?		The recommendation to continue breastfeeding up to two years of age or beyond was presented under the Innocenti Declaration made by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) in 1990. The main argument for promoting breastfeeding up to two years of age and beyond is based on the facts that during the second year of a child's life, breast milk is a possible key source of vitamin A, calcium and proteins and provides protection against infectious agents. Besides, a research finding in a journal entitled The Immunological Components of Human Milk and Their Effect on Immune Development in Infants state that exclusive breastfeeding for the first 6 months and continued for the first 2 years in critical to reduce the burden of pneumonia, the leading cause of child mortality, which resulted in deaths of 1.4 million children less than 5 years of age in 2010 with the majority of morbidity and mortality in developing countries occurring among the poorest and most vulnerable children. As a key child survival strategy, several studies have found that breastfeeding is the

			number one preventive intervention to reduce child deaths. Why is that so? Because the macronutrients and micronutrients in breast milk are best suited to meet the recommended dietary allowance for infants up to 6 months of age. The composition of human milk is unique indeed, which it does dynamically and actively adapting to the individual infant's nutritional needs. Breast milk composition changes during each feeding session, for while the fore milk is rich in micronutrients and watery, whilst the hind milk is rich in fat, satisfying the energy demands of a fast-growing infant. During the first month of life, breast milk composition changes daily, beginning with colostrum, then via transitional milk becoming mature milk, meeting the specific needs of newborn for optimal growth. We may already see the key function of breast milk towards infants is to supply nutrition for their growth.
	2. What is the role of breastfeeding mother in managing malnutrition and infectious diseases?		It is said that breast milk contributes to the child's health, growth and development due to its unique composition of macronutrients and micronutrients, digestive enzymes, hormones, anti-inflammatory substances, growth modulators and prebiotics, such as bifidus factors, which enhance the maturation of the gastrointestinal tract and stimulate growth of bifidobacteria. The bioactive compounds in human milk which have been only partially elucidated, include specific and nonspecific antimicrobial factors contributing to protection against infectious diseases. To explain more on how breast milk and antimicrobial activity correlate, breast milk is found to have a high whey/ casein ratio of approximately 90% during the first days of life. High whey fraction is essentially beneficial in the support of antimicrobial activity. Whilst the casein fraction of breast milk protein facilitates the absorption of calcium, iron and zinc. Not only that, colostrum or also known as the first breast fluid is particularly high in protein and fat-soluble vitamins like vitamin A as well as in growth factors and immunological components. Highlighting it for its important role in disease prevention, colostrum is known to be the first immunization for infants. There is plenty of evidence that breastfeeding is associated with lower risk of infectious disease besides carrying an important role in interrupting the vicious cycle of malnutrition. To highlight how vital it is, research has found that delayed onset of breastfeeding, discarding of colostrum and replacement with placental fluids or foods are practices that lead to suboptimal breastfeeding and can contribute to undernutrition.

12. After 6 months old, Kanyange can start eating balanced diet.	1. What kind of balanced diet is suitable for 6 months old? 2. What is balanced diet?		Breast milk is still the main source of energy and nutrients for six months old but solid foods can already be added in their diet. Babies six months old have a small stomach and need to be eating small amounts of soft nutritious foods daily. They also just learned how to chew. Hence, their first foods should be soft and easy to swallow such as porridge, well-mashed fruits and vegetables. The porridge should not be too watery as it can reduce the number of nutrients in the food. To make the porridge more nutritious, it should be cooked until it is thick enough not to run off the spoon. Besides, babies can also be served with animal foods such as dairy, eggs, meat, fish and poultry. A balanced diet is the one that provides nutrients to our body so that it can function properly. In order to get the proper nutrition from our diet, one should consume high calories of fresh fruits and vegetables, whole grains, legumes, nuts and lean proteins. Calories number is the amount of energy present in food. We use calories in our everyday lives such as walking, breathing, thinking and so on. The average calories for a person are about 2000 to maintain their weight. However, it depends on the age, gender and physical activity level of a person.
13. Food can split into 3 type of family: Family 1: protein (meats) helps in build muscle Family 2: carbs (rice, cassava, potatoes) helps in give energy Family 3: fruits and veggies help to protect diseases.	1. What are the nutrients and their role in our body?		Carbohydrates have four distinct roles in our body. According to the book with the title An Introduction to Nutrition from Andy Schmitz, carbohydrates serves as primary source of energy, replacing proteins and fats as secondary options, stores energy and helps in constructing macromolecules. Proteins are divided into two categories that are essential and non-essential. Essential proteins like valine which is vital for the growth and regeneration of muscles, threonine for regulation of fat and immune response while lysine is responsible for the production of enzymes and hormones. Non-essential proteins like glutamate produce alanine, serine and proline while arginine converts toxic components into urea for excretion. Moving onto fruits and vegetables, they contain vitamins. Vitamin A for night vision and enhances immune systems, vitamin B12 for optimising nervous systems and vitamin B9 is vital for maintaining mental health and brain functions.

14. Every meal from three type of family needed to be balanced.	1. What are the right portions of each family in a meal? 2. What will happen if extreme intake foods from 3 type of family? Eg: high intake carbs?		The right portions for proteins, carbohydrates, fruits and vegetables per meal are a quarter of plate respectively. Here is a picture illustrating the portions so that you guys would have a clear insight on how it is supposed to look like.  Excessive intake of protein can cause kidney damage, heart diseases, dehydration, diarrhea, constipation, weight gain, bad breath, calcium loss and increased cancer risk. Too much consumption of carbohydrates on the other hand, will promote heart disease, insulin resistance, weight gain and prediabetes. However, for extreme intake of fruits and vegetables, there are no adverse effects being reported.
15. After 2 months, Kanyange looks just like normal 2 years old with her hair back to normal and her body at right size and shape.	1. What is the progression of recovery?		There is no specific progression of recovery in malnutrition in children. However, based on World Health Organization (WHO) guidelines, there are ten essential steps to treat severely malnourished children. The first and second step are to treat or prevent hypoglycaemia and hyperthermia respectively. Since hypoglycemia and hypothermia usually occur together, hypoglycaemia is checked whenever hypothermia is found. Frequent feeding is important in preventing both diseases. The third step is to treat dehydration by using a special Rehydration Solution for Malnutrition (ReSoMal) rather than the standard rehydration salt solution. During treatment, rapid respiration and pulse rates should slow down and the child should begin to pass urine. Return of tears, moist mouth, eyes and fontanelle appearing less sunken and improved skin turgor are also sign that rehydration is proceeding. The fourth step is to correct electrolyte imbalance highlighting magnesium and potassium deficiencies. Next is the fifth step, to treat or prevent infection. Severe malnutrition often shows no signs hence broad-spectrum

			antibiotics is prescribed. The sixth step is to correct micronutrient deficiencies as malnourished children have vitamin and mineral deficiencies. Proceed to the seventh step which is to start cautious feeding. Cautious approach is required because of the child's fragile physiological state and reduced homeostatic capacity. The eighth step is to achieve catch-up growth by using a vigorous feeding approach. The goal of this step is rapid weight gain. The ninth step is to provide sensory stimulation and emotional support because of delayed mental and behavioral development in malnourished children. The last step is to prepare for follow-up after recovery. A child who is 90% weight-for-length can be considered recovered. However, good feeding practices and sensory stimulation should be continued at home. These steps are accomplished in two phases: an initial stabilization phase where the acute medical conditions are managed and prolong with a longer rehabilitation phase.