

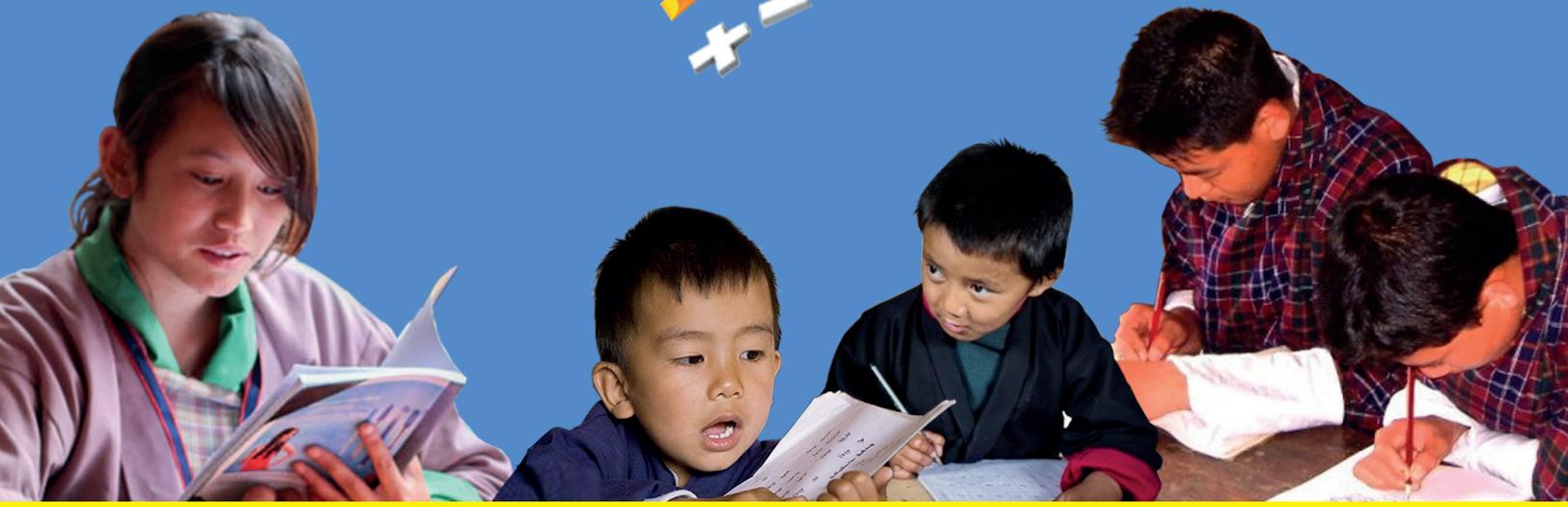


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Education in Emergency

Self - Instructional Materials



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Key Stage 4 Cl - IX - X
Vol. II

Self-Instructional Materials

Key-stage IV

(Classes IX and X)

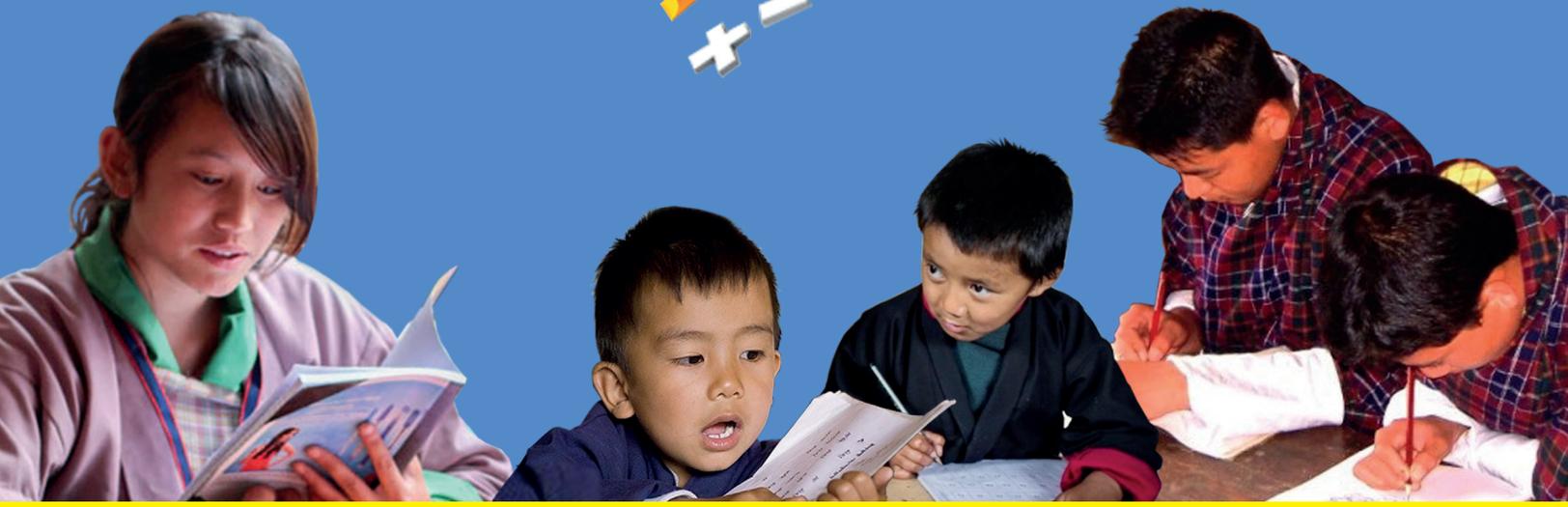


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Education in Emergency

Self - Instructional Materials



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Vol. II

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TABLE OF CONTENTS

English: Writing Introductory Paragraph of an Expository Essay	4
English: Writing Body Paragraph of an Expository Essay	8
English: Writing Concluding Paragraph of an Expository Essay	12
Biology: Cell Division	14
Biology: Human Circulatory System	19
Biology: DNA (Deoxyribonucleic Acid)	25
Biology: Types and Importance of Biodiversity.....	30
Chemistry: Mole Concept	34
Chemistry: Hydrocarbons.....	39
Physics: Newton's Laws of Motion - 2 nd and 3 rd Law.....	47
Mathematics: Concepts of Network.....	53
Mathematics: Solving Systems of Linear Equations	60
Geography: Settlement	65
Geography: Toposheet.....	72
ཚོང་ལ། རྒྱུ་སྐྱུལ་འབྲི་ཚུམ་དང་ འཆར་སྐྱུང་འབྲི་ཚུམ།	85
ཚོང་ལ། ལྷོ་ཟེ། ཅུང་མོ། དབྱེ་གཏམ།.....	88
ཚོང་ལ། གན་རྒྱ།.....	92
ཚོང་ལ། ལྷུང་ལྷུང་གྲུ།.....	96

Lesson No: 1

Subject: English

Class: 9 – 10

Time: 50 minutes

Topic: Writing Introductory Paragraph of an Expository Essay**Learning Objectives**

1. List down the components of an introductory paragraph.
2. Write an introductory paragraph of an expository essay.

Introduction**Activity 1**

Take some time to think and write your answers to the following questions in your notebook.

1. How do you distinguish a piece of writing to be an essay?
2. What are the components of an essay?

You may now read the information given below. It will give you some more ideas on the questions that you have just answered.

Components of an Essay

1. Topic/Title
2. Introductory Paragraph
3. Body Paragraphs
4. Conclusion

It is important to include all the above components while writing an essay because they are the distinguishing features of an essay. It helps us to differentiate it from the rest of the genres such as a short story or a poem. Though the body would initially consist of three paragraphs, the number of paragraphs will increase depending upon the demand and scope of the topic you may choose to write on.

**Think Time**

Consider the following questions and see what comes to your mind.

1. What is an expository essay?
2. What are elements of an expository essay?

Please spend a few seconds reading the following points in bullets and see if there are any similarities in ideas that you thought about with the ones mentioned below.

- ✓ *The purpose of an expository essay is to inform the readers on a certain subject. So an expository essay will explain or define a topic or a subject.*
- ✓ *It has to be objective, so the use of facts and figures is a mandatory feature of an expository essay.*
- ✓ *The facts and figures mentioned in the essay should be supported with valid and credible sources.*
- ✓ *Use of first person point of view should be avoided and third person point of view incorporated to make the essay unbiased in opinion.*



Activity 2

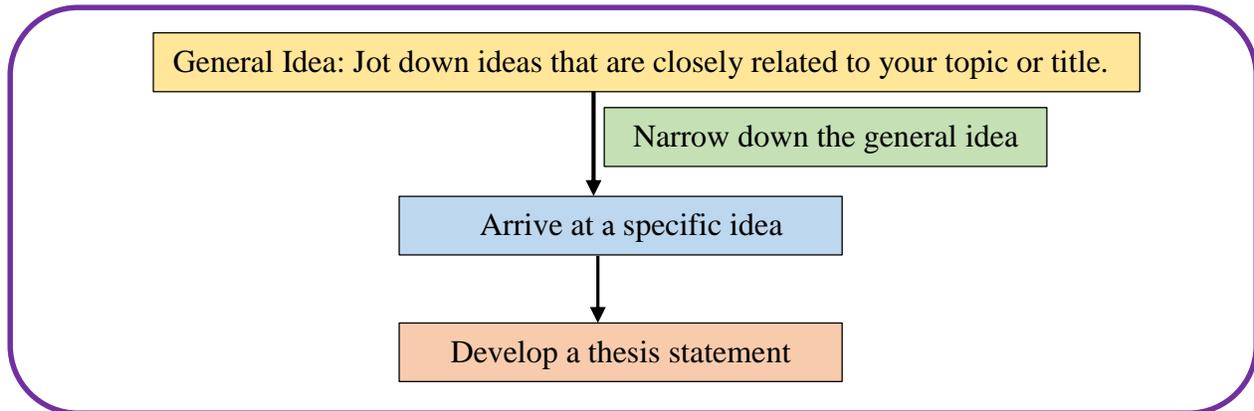
Take some time to consider the following questions. You may then read the explanation that follows and see if it helps you understand better.

1. How do we write an introductory paragraph?
2. What are its critical components?

Components of an Introductory Paragraph

1. **Opening Sentence:** It has to be catchy enough to hook the attention of a reader. The techniques to write opening sentences are:
 - a. **Figurative Language:** The proper use of imageries and figures of speech can help a writer to become creative to write a fresh opening sentence. So, instead of writing some very popular saying and proverbs; create your own reflective, thought-provoking and interesting statements to attract readers. Your opening sentence should be like a “magnet”.
 - b. **Anecdote:** The use of anecdote can emphasize the dominant idea written in your essay. It has to be both very relevant and interesting. Use of anecdote is encouraged as experiences of each individual are usually unique.
 - c. **Interesting Facts and Figures:** Some very unusual or extraordinary figures and facts can draw the attention of the readers. It can be both pleasant and unpleasant information.
 - d. **Question:** If questions are asked either in a very thought-provoking or tricky manner it can draw the attention of the readers.
2. **General Idea:** After writing down the opening sentence, it is time to mention the general idea on the topic of your essay. Once the general idea is mentioned it has to be narrowed down slowly to arrive at a specific idea.
3. **Specific Idea:** Specific idea is the main subject of discussion in the essay.
4. **Thesis Statement (three main points):** The thesis statement elaborates a specific idea by mentioning three main points that will help you develop the body paragraphs of the essay.

Some more Information General and Narrowed Down Ideas



Activity 3

Read the following example written by Tenzin Selki and see how she has applied the above components in writing an introductory paragraph. You may quickly sort the lines into general idea(s), the specific idea and the three main points.

Forest Fire (Tenzin Selki, KMSS, Paro)

Although Bhutan wears the crown of biodiversity; it is, however, affected by the natural disaster such as earthquake, forest fire, landslide, flood etc. quite often. Amongst these dangerous natural disasters, forest fire has proven to be one of the most destructive disasters. Forest fire brings a lot of changes in weather condition throughout the country, increases human-wildlife conflict and also leads to global warming.



Activity 4

Now try writing one of your own introductory paragraphs either on one of the questions given below or on a topic of your choice. Remember it will be later assessed by your teacher.

1. Importance of Cultivating Reading Habit
2. Effects of Global Warming
3. Benefits of Winter Camps for Students
4. Advantages of Participating in Extra-curricular Activities

Summary

Essays generally have four critical components; a title, an introductory paragraph, a body and a conclusion. The introductory paragraph is further composed of four critical attributes. It starts with an opening sentence followed by the statement of general idea(s). These ideas are further narrowed down to a specific idea which is then supported by three main points. A sentence with three main points is referred to as thesis statement.



Self-check for Learning

1. What are the main components of an essay? Why are they important?
2. Name one aspect of an expository essay.
3. What are components of an introductory paragraph?
4. How would you simply summarize the process of writing an introductory paragraph?
5. Continue working on your introductory paragraph.

1. Topic, introductory paragraph, body, and conclusion. It is important because they distinguish it from other forms of writing.
2. The purpose of an expository essay is to inform the readers on a certain subject. So an expository essay will explain or define a topic or a subject or any other aspects mentioned above.
3. The components of an introductory paragraph are opening sentence, general idea, specific idea and thesis statement.
4. Start with a catchy opening sentence, write down general ideas related to the topic, narrow it down to a specific idea and then list three main points to develop the thesis statement.

Self-check for Learning



Lesson No: 2

Subject: English

Class: 9 – 10

Time: 50 minutes

Topic: Writing Body Paragraph of an Expository Essay

Learning Objectives



1. Construct a strong thesis statement.
2. Write a body paragraph consisting of a topic sentence, supporting sentences and a concluding sentence.

Introduction



Activity 1

Spend some time to recapitulate what you have learnt in the previous lesson. Ask the following questions to yourself.

1. What is an expository essay?
2. What are the important components to be considered while writing an introductory paragraph?

If you are done, you may now proceed. Start by taking some time to think of the following.



Think Time

1. What is a thesis statement?
2. Is thesis statement important? Why?

Activity 2

Read



- ❖ A thesis statement is like a compass. It acts like a road map for the paper or essay. In other words, it tells the reader what to expect from the rest of the essay. The three main points help to do it.
- ❖ Three main ideas must be written using phrases or one word to make the thesis strong, concise and clear. Thesis statements that are too vague often do not have a strong argument. If your thesis contains words like “good” or “successful,” see if you could be more specific: why is something “good”; what specifically makes something “successful”?

Thesis statement = Subject + Direction

Now consider the following examples to have a better understanding of the explanation you have just read.

Example 1: Forest fire (the bold phrase is the subject) brings a lot of changes in weather condition, increases human-wildlife conflict and leads to global warming. (The underlined phrases are the three main ideas)

Example 2: My best friend Sonam and I became acquainted with each other when we were small kids. (Subject-who is the best friend). He is the funniest, most caring, and the most protective person I ever met. (The underlined ideas are the main points.)



Activity 3

1. Re-read the introductory paragraph you have written in the last lesson.
2. Identify the components as explained in the examples above.
3. If required you may revise your paragraph.

This completes writing introductory part of an expository essay. You will now look at how to write a body paragraph. Reflect on the following question before proceeding any further.



What is PEEL framework?

P – Point: It is one of the supporting ideas/points that you have written in the thesis statement. It is also called the topic sentence. You have to stick to one point per paragraph. You should not squeeze all the points in one paragraph. The topic sentence usually appears as either the first or the second sentence in your paragraph and it clearly dictates or states what this whole paragraph is about.

E – Example/Evidence: You need to give specific examples or evidence to support your topic sentence by providing statistics, numbers, facts, studies and data.

E – Elaboration of ideas and points in your paragraphs. Give details of idea/evidences.

L – Link - A link is the last sentence of the paragraph. It is a concluding sentence. It is called a link because you can choose to:

- Link it back to the original question.
- Link it back to the topic sentence.
- Link it to the next paragraph.

If you use PEEL wisely, you will find that it helps you in all subjects that require essay writing.

Look at the following example to understand better.

Forest fire causes lot of changes in the weather condition of the country (P-Topic sentence, it is from the introductory paragraph if you remember). During a forest fire, lots of toxic gases such as carbon monoxide, sulphur trioxide, etc. are produced which go into the atmosphere making the air harmful. Such harmful gases make the climatic condition very unbearable for living organism (E – elaboration-statement of facts). According to scientists working at the National Center for Atmospheric Research and the University of California the harmful gases produced during the forest fire make the summer season very hot and winter season extremely cold (E - Example/Evidence 1). Further, the Department of Hydro-met division, Bhutan has claimed an increase of 3.5 degree Celsius in the climatic condition of Bhutan over the time period of 7 years (E- Example/ Evidence 2. It is a data collected over 7 years). Thus, it is evident that the forest fire plays a vital role in changing the climatic conditions of Bhutan and the world at large (L-linking back to the topic sentence)



Activity 4

1. Once more re-read the introductory paragraph you have written earlier.
2. Considering one of the three main points you have written, write a body paragraph.
3. Use PEEL Framework.

Summary

- Thesis Statement = Subject + Direction
- It tells the reader what to expect from rest of the paper. It includes three main points or ideas.
- Body paragraph consists of some critical components. It includes a point/topic sentence, explanation/evidence/examples, elaboration and link or concluding sentence. PEEL framework is one approach you could use to write a body paragraph.



Self-check for Learning

1. What is a thesis statement?
2. What are components of a body paragraph?
3. Continue writing your body paragraph on the same topic you have been working on.

1. It is a compass. It is a road map for the paper. In other words, it tells the reader what to expect from the rest of the paper. It includes three supporting points/ideas.
2. Body paragraph consists of some critical components. It includes a point/topic sentence, explanation/evidence/examples, elaboration and link or concluding sentence.

Self-check for Learning



Lesson No: 3

Subject: English

Class: 9 – 10

Time: 50 minutes

Topic: Writing Concluding Paragraph of an Expository Essay

Learning Objectives



1. Write a concluding paragraph of an expository essay.

Introduction

Begin by taking some time to reflect on the questions given below.



1. What is a thesis statement?
2. What was your thesis statement in the last introductory paragraph you wrote?
3. How did your body paragraphs go?

This lesson will take you through the final phase of writing an expository essay. You will focus on writing a concluding paragraph in continuation to what you have learnt and written in the last two lessons.



Activity 1

Read the information given below and carefully study how each of the components stated under are applied in the example paragraph that follows.

Components of a Concluding Paragraph;

- a. Restate the thesis statement.
- b. Summarize the main points of the essay.
- c. Avoid new ideas.
- d. Include suggestion, recommendation or wakeup call.

Example

Therefore, a forest fire is one of the greatest worries of the government of Bhutan as it invites lots of problems. It not only changes the climatic patterns but also leads to human-wildlife conflict and global warming (thesis restatement). *The Forest department of Bhutan states that every year 10,000 acres of forest in Bhutan is burned down by the forest fire due to the carelessness of the*

people despite frequent awareness campaigns conducted by the government (**Summing up the main points**). It has thus, become very important for the Bhutanese to realize the responsibility of minimizing forest fires by being a very alert and responsible citizen of the country (suggestion/a wakeup call).



Activity 2

Write a **concluding paragraph** on the same topic as a continuation to the writing activity you have undertaken in the last two lessons. Remember to include all the components discussed earlier or as shown in the example above.

Summary

There are four critical components to be kept in mind while writing a concluding paragraph. It includes restatement of thesis, summarization of the main points, and inclusion of a suggestion, recommendation or a wakeup call. Introduction of any new ideas should be avoided.



Self-check for Learning

1. List down critical components of a concluding paragraph.
2. Compile writings you have undertaken in all three lessons into a complete **expository essay**. This is your first draft. Review and workout your final draft following writing process.

- Restate the thesis statement.
- Summarize the main points of the essay.
- Avoid new ideas.
- Include suggestion, recommendation or wakeup call.

Q.1. Critical components of a concluding paragraph are:

Self-check for Learning



Lesson No: 1

Subject: Biology

Class: 9-10

Time: 50 minutes

Topic: Cell Division

Learning Objectives



1. Define cell division.
2. State the significance of cell division.
3. Explain mitotic and meiotic cell divisions.
4. Differentiate between mitosis and meiosis.

Introduction

Are you aware that all organisms start their life from a single cell? A cell is known as a mother cell that divides to form two or more daughter cells. This process is known as cell division. The ability of a cell to divide allows organisms to develop, grow, repair and reproduce. There are two types of cell division: Mitosis and Meiosis.

Activity 1



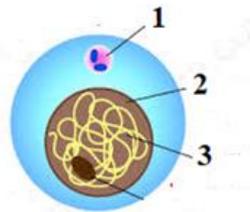
Answer the following questions in your notebook.

1. What is cell division?
2. List down two types of cell division.
3. Mention the importance of cell division.

Activity 2



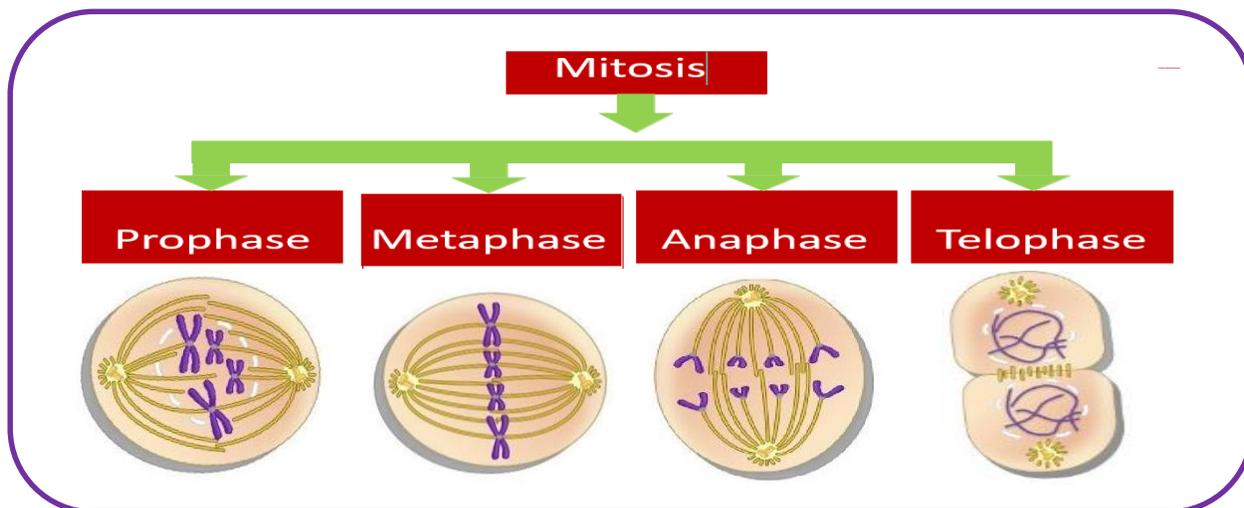
Look at the diagram of a cell given below and label the parts numbered 1 to 3.



The above cell has thin, long and loose chromatin fibre. The cell is said to be in interphase. During this phase, the cell prepares to divide. The cell content increases along with duplication of DNA and synthesis of protein. Now the cell enters **mitotic division**.

1. Mitosis

The following figure shows the four different stages/phases involved in mitosis.



The table given below shows the events taking place in particular phases of mitotic division.

Events taking place in particular phase
<ul style="list-style-type: none"> • The chromosomes split up into sister chromatids. • Spindle fibre pulls chromatids apart.
<ul style="list-style-type: none"> • Chromosomes align at the centre of the cell. • Spindle fibre attaches at the centromere of the chromosome.
<ul style="list-style-type: none"> • Chromosomes uncoil to form chromatin fibres. • Nuclear membrane reappears. • Nucleolus reappears. • Cytoplasm begins to divide.
<ul style="list-style-type: none"> • Long and thin chromatin fibre condenses into a short and thick chromosome. • Spindle fibre starts to appear from the centrosome. • Nuclear membrane disappears. • Nucleolus disappears.

Activity 3



Refer the figure and table given above. Identify the events for each phase and write it in the table given below.

Prophase	Metaphase	Anaphase	Telophase

After completion of telophase, cytoplasm division takes place resulting in two daughter cells.

Mitosis is a kind of cell division where a number of chromosomes remain same in daughter cells as that of the parent cell. At the end of mitotic division, two similar daughter cells are produced. For example, skin cell divides to form skin cell. Mitosis is important for growth, repair and replacement.



Activity 4

Mitosis is important for growth, repair and replacement. Explain with examples.

2. Meiosis

As we have seen in mitosis, meiosis also begins with interphase. Unlike in mitosis, a cell undergoing meiotic division experiences two successive divisions. During 1st meiotic division, the number of chromosomes is reduced to half as that of parent cell whereas in 2nd meiotic division the number of chromosomes remains the same. Meiosis occurs in reproductive organs to produce gametes.

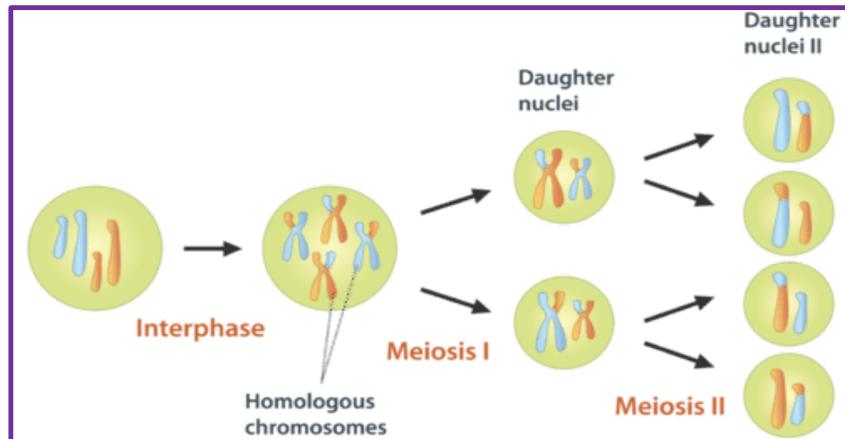


Figure: Overview of Meiosis

(Source: <https://www.ck12.org/c/life-science/meiosis/lesson/Meiosis-MS-LS/>)

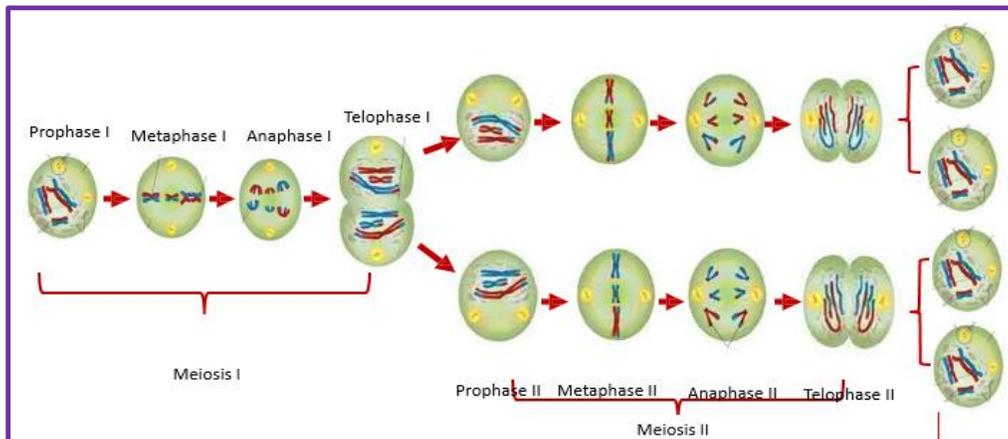


Figure: A cell undergoing meiotic division to produce four daughter cells.



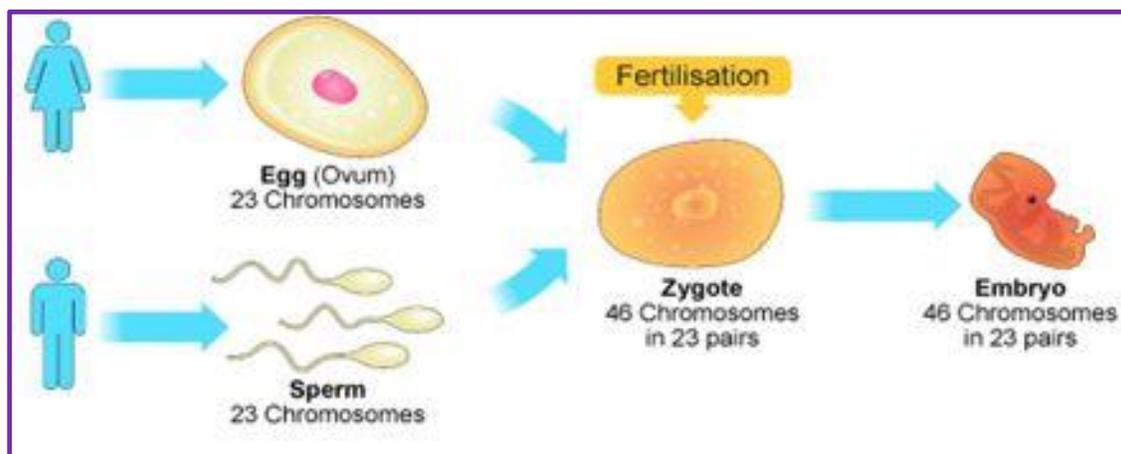
Activity 5

Answer the following questions.

1. 1st meiotic division is known as reduction division while 2nd meiotic division is known as mitotic division. Explain.
2. Mention the significance of interphase.

Let us look into the significance of meiosis.

1. For Sexual Reproduction



(Source: <https://www.assignmentpoint.com/science/biology/sexual-reproduction.html>)

2. Genetic Variation



Activity 6

Human cell has 46 number of chromosomes. Only cells in reproductive organs undergo meiosis to produce gametes (sperm and egg) having 23 number of chromosomes. Give reason.

Summary

- There are two types of cell division: mitosis and meiosis.
- The four phases of mitosis are prophase, metaphase, anaphase and telophase.
- Two successive division takes place during meiosis: 1st meiotic division and 2nd meiotic division.
- Significance of mitosis is growth, repair and replacement.
- Significance of meiosis is sexual reproduction and genetic variation.



Self-check for Learning

Write answers to the following questions.

1. Write down at least four differences between mitosis and meiosis.
2. Healing of wound is a result of mitosis. Explain.
3. One of the significances of meiotic division is genetic variation. Explain.

ANSWER

1.

Mitosis	Meiosis
<ol style="list-style-type: none"> 1. The number of chromosomes in daughter cells are the same as that of a parent cell. 2. Four daughter cells are produced. 3. It occurs in reproductive organs to produce gametes. 4. It is important for sexual reproduction and genetic variation. 5. Two successive nuclear division takes place followed by cytoplasmic division. 	<ol style="list-style-type: none"> 1. The number of chromosomes in daughter cells are the same as that of a parent cell. 2. Two daughter cells are produced. 3. It occurs in the body/somatic cells. 4. It is important for growth, repair, replacement, regeneration, asexual reproduction and genetic stability. 5. Only one nuclear division takes place followed by cytoplasmic division.

2. Healing of wound is due to mitosis as it happens in somatic cells and it helps in repairing the damaged cells to bring back to normal state due to the formation of similar kind of cells.

3. Meiotic division produces genetically unique haploid cells due to the new combination of genes during crossing over

Self-check for Learning



Lesson No: 2

Subject: Biology

Class: 9 – 10

Time: 50 minutes

Topic: **Human Circulatory System****Learning Objectives**

1. Describe the structure of human heart.
2. State the functions of human heart.
3. State the composition of blood.
4. Differentiate among arteries, veins and capillaries.

Introduction**Let's find out, what am I?**

1. I'm red but I'm not a strawberry.
I'm a shape but I'm not a square.
I'm part of your body but I'm not your mouth.
I'm a suit in a deck of cards but I'm not a spade.
I'm used to saying 'I love you' but I'm not a diamond.
What am I?
2. I'm a red fluid, if you lose too much of me then you will die.
What am I?
3. I am a living tube through which red liquid flows. What am I?

Let us explore more on human heart, blood and blood vessels in this lesson.

Heart, blood and blood vessels together form a very important system in the living organisms known as the circulatory system. The heart is the main organ that pumps blood throughout the body via blood vessels. It helps in supplying oxygen and nutrients to the cells and to remove carbon dioxide and waste. The human heart is shaped and sized roughly like a closed fist. The heart is divided into chambers. The number of chambers in the heart differs from animals to animals. Fish have two chambers and frogs have three chambers. The heart has different chambers to receive and pump blood to different parts of the body. Now let us find out the number of chambers in the human heart.

Activity 1

Look into Figure 1 and answer the questions that follow.

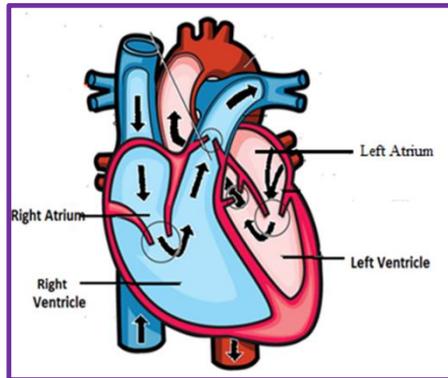


Figure 1: Internal Structure of the Human Heart

1. How many heart chambers do you see in Figure 1? Name all the heart chambers.
2. What does the direction of arrows in Figure 1 indicate?

One of the functions of the heart is to pump blood throughout the body. Blood vessels connected to the heart helps in circulation. Let us play a labelling game to find out the different types of blood vessels.

Activity 2

Study Figure 2. Label the blood vessels numbered 1, 2, 3, 4, and 5. Make use of the clues given on the right-hand side of the figure and also follow the arrows that indicate the direction of the flow of blood.

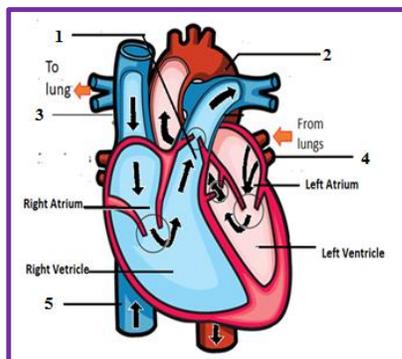


Figure 2: Human Heart

Clue

Superior vena cava – Brings blood from upper body tissues to heart

Inferior vena cava – Brings blood from lower body parts to heart

Aorta – Carries blood from heart to body tissues

Pulmonary artery - Carries blood from heart to lungs

Pulmonary vein – Carries blood from lungs to heart

Activity 3

Let us play a short quiz.

There are two multiple-choice questions. For each question, four options are given. Choose the most correct option and circle it.

1. The blood vessel that carries deoxygenated blood from the heart to lungs is

- | | |
|----------------------|------------------------|
| A. pulmonary artery. | C. superior vena cava. |
| B. aorta. | D. inferior vena cava. |

2. The vessel that carries oxygenated blood from the heart to different body tissues is

- | | |
|--------------------|------------------------|
| A. pulmonary vein. | C. superior vena cava. |
| B. Aorta. | D. inferior vena cava. |

Activity 4

Look at the two Figure 3 A and B and answer the question that follows.

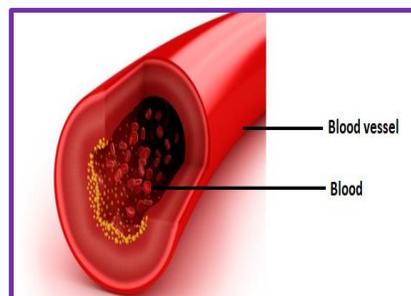
**A****B**

Figure 3: Train on the railway track (A) and Blood in the Blood vessel (B)

How can diagram 'A' be used as an analogy for diagram 'B'?

Figure 4 shows different types of blood vessels which carry blood away from the heart and back to the heart. It also shows that blood in human flows through capillaries connected by arteries and vein. This type of circulation is known as **closed circulation**. Blood with more oxygen is referred to as **oxygenated blood** and blood with less oxygen are said to be **deoxygenated blood**. In the diagrams, oxygenated blood is shown in red colour and deoxygenated blood in blue.

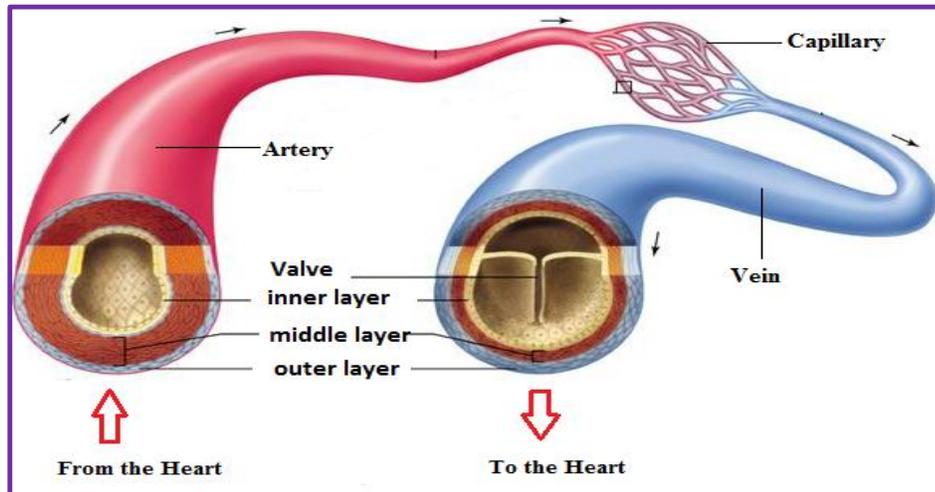


Figure 4: Blood Vessels

Activity 5



Now, look at Figure 4 closely to fill in the blanks with appropriate responses.

1. The name of the blood vessels that you can see in Figure 4 is
2. Blood vessel that carries blood away from the heart is and the blood vessel that carries blood towards the heart is
3. Oxygenated blood is normally carried by and deoxygenated blood is carried by
4. Arteries and veins are connected by vessels known as
5. The three differences between artery and vein are

Composition of Blood

Blood is a red fluid which is the medium of transport in the body. The blood is composed of a yellow liquid part called plasma and blood cells. Plasma is a mixture of water, protein, glucose, amino acids, salts and other dissolved substances.

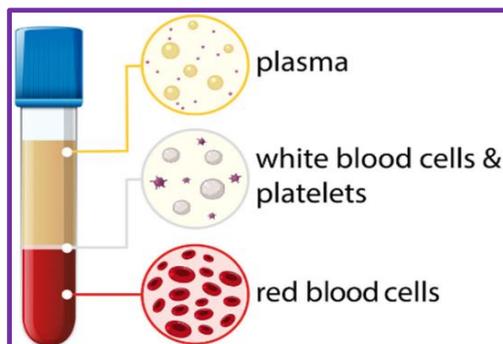


Figure 5: Blood in a Test Tube

**Activity 6**

Study Figure 5 and answer the question below.

Write down the composition of blood.

Blood Cells

Blood contains various cells such as red blood cells (RBC), white blood cells (WBC) and blood platelets. All these cells have a role to play. RBCs are biconcave in shape with a red pigment called haemoglobin. This makes our blood red in colour and it helps in the transportation of oxygen in our body.

WBCs are compared to the army. Like army protects our country from enemies, WBC protects our body from germs causing diseases. Based on the presence and absence of granules in the cytoplasm, it is of two types (Granulocyte and Agranulocyte). Granulocyte is of three types namely eosinophil, basophil and neutrophil. The nucleus of these cells shows lobes ranging from one to several. Agranulocyte is of two types such as monocyte and lymphocyte. All these cells play a very important role in our body's immune system.

Blood platelets are oval or round in shape without a nucleus. They play an important role in blood clotting.

**Activity 7**

Read the information given above on different types of cells present in the blood to complete the table.

Sl. No	Blood Cells	Characteristics	Function
1	Red Blood Cell		
2	White Blood Cell		
3	Platelets		



What will happen if our hearts stop functioning?

It is very important to keep our hearts healthy for proper circulation of blood. Some of the ways to keep our hearts healthy are by;

1. Exercising regularly.
2. Taking nutritious food.
3. Saying No to smoke.
4. Managing stress.

Summary

- The heart is the central part of the circulatory system that pumps blood to different body parts.
- The human heart has four chambers right atrium, left atrium, right ventricle, and left ventricle.
- The main blood vessels associated with heart are superior vena cava, inferior vena cava, aorta, pulmonary vein, and pulmonary artery.
- Artery, veins and capillaries are three different kinds of blood vessels.
- Blood is made up of liquid part called plasma and cellular components consisting of red blood cell, white blood cell and blood platelets.



Self-check for Learning

Write answers to the following questions in your notebook.

1. How can a healthy lifestyle lead to a healthy heart?
2. How is hypertension, a blood-related disease?
3. Why is injection usually done through vein?

1. Healthy life style such as eating balance diet, doing regular exercise, sleeping at least for 8 hours, practicing yoga, doing mind training etc. can improve our physical fitness, manage high blood pressure, lower stress and improve our mental health which will ultimately help in keep our heart healthy.
2. High blood pressure is a common condition in which the force of the blood against the artery walls is high that it may eventually cause health problems, such as heart disease.
3. When someone injects drugs into a vein, it is carried through the heart and diluted in the blood before reaching a person's extremities and tissues.

Self-check for Learning



Lesson No: 3

Subject: Biology

Class: 9 – 10

Time: 50 minutes

Topic: DNA (Deoxyribonucleic Acid)

Learning Objectives

1. Describe the structure of DNA.
2. State at least TWO functions of DNA.
3. Relate DNA to gene and chromosome.

Introduction**Activity 1**

Take a look at the picture of puppies in Figure 1.



Figure 1: Puppies

1. Are all the puppies same?
2. In what aspect are they different?

Now, look at yourself and the people around you in your house. See if you look similar to anyone. What makes us look similar or different from each other?

Some of you might look similar and have similar features and some of you might look different from each other. Some might be tall, some might be short, some might have straight hair, some might have curly hair, some of you might be able to roll your tongue, and some might not be able to do it. These differences and similarities in your characteristics are due to a substance found in your body called genes. Genes are a segment of DNA (Deoxyribonucleic Acid). Let us look at DNA in detail.

Activity 4

Study Figure 6 and answer the questions.

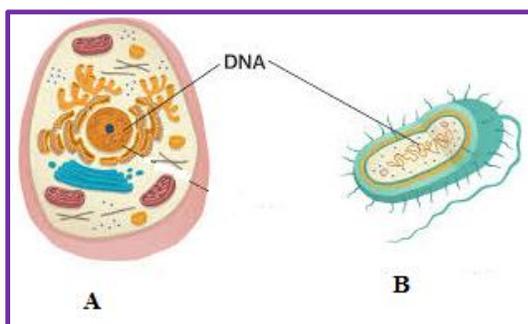


Figure 6: Two Different Cells

1. Identify prokaryotic cell and eukaryotic cell.
2. Where are the DNAs located in the two cells in Figure 6?

DNA is also found in the sperm and the egg cell and are passed down from parents to their children. It is a double-helical molecule made of thousands of nucleotides. Now, let us look at the structure and functions of DNA.

Structure of DNA

DNA is made of small units called nucleotides. Each nucleotide is made of a phosphate group, a sugar group and one of the four types of nitrogenous bases.

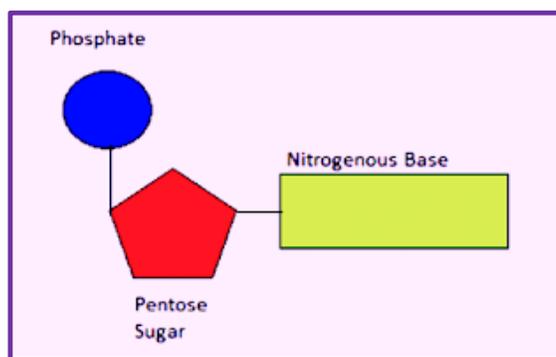


Figure 7: Structure of Nucleotide

The four Nitrogenous bases are Adenine (A), Thymine (T), Guanine (G) and Cytosine (C). Therefore, there are four different types of nucleotides.

Nucleotides are attached together with the help of hydrogen bonds.

Long-chain of nucleotides together form the double-helical shaped DNA.

The two strands of DNA are connected through the nitrogenous base pair. Nitrogen bases in the nucleotides always pair up in the same way as the complementary pair given below.

Adenine (A) = Thymine (T) ----- (Adenine pairs with Thymine)

Guanine (G) ≡ Cytosine (C) ----- (Guanine pairs with Cytosine)

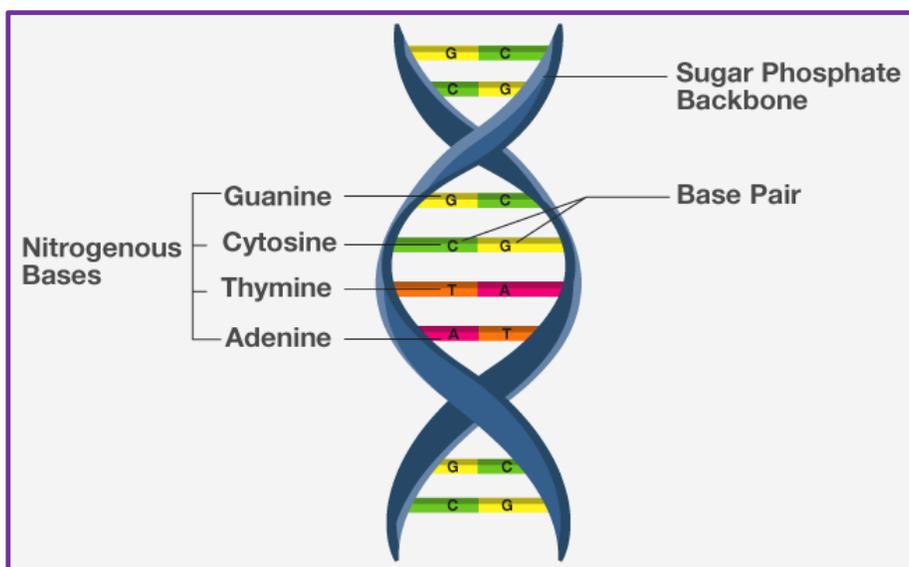


Figure 8: Structure of a DNA Molecule

Functions of DNA

1. DNA forms the chromosomes in the cells.
2. DNA contains genes that carry information from parents to offspring.
3. It helps cells to grow, survive and divide by directing the synthesis of proteins.
4. It contributes to variation among organisms leading to evolution. This happens due to a change in the base pair sequence (Mutation).
5. It controls the metabolic activity of the cell by forming enzymatic proteins.

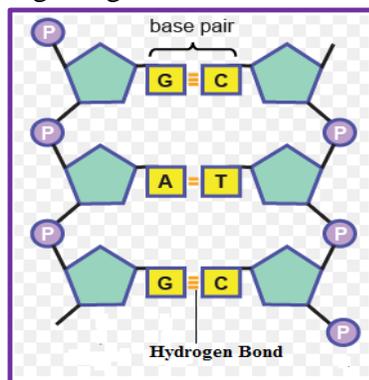
Summary

- DNA stands for Deoxyribonucleic Acid and it is double helical in shape.
- Chromosomes are made up of DNA.
- A segment of DNA is called genes.
- DNA carries information that helps a cell to grow, survive and reproduce.
- DNA molecule is made up of nucleotides.
- Each nucleotide is made of a sugar group, phosphate group and one of the nitrogenous bases.
- Four nitrogenous bases are Adenine, Guanine, Cytosine and Thymine.
- Adenine pairs with Thymine and Guanine with Cytosine.

Self-check for Learning



1. Study the diagram given below and answer the following questions.



- Write down the number of nucleotides present in the above diagram.
 - What do the circles and pentagons in the diagram represent?
 - What does the diagram represent?
 - How does the diagram differ from an RNA molecule?
- How is DNA related to gene and chromosome?
 - How are the instructions for your traits carried on a DNA molecule?
 - DNA plays an important role in detecting crime suspects. Justify.
 - A segment of DNA has one strand with the sequence of bases as TCGCGTATCGTT. What would be the complementary strand of DNA?

- There are six nucleotides in the diagram.
- Circles in the diagram represent phosphate group and the pentagonal structure indicates sugar group.
- Diagram represents a section of DNA.
- Long-chain of DNA forms chromosomes and a section of a chromosome is referred to as a gene.
- Instructions for our traits are carried on a DNA molecule in the form of code. DNA plays an important role in detecting crime as every individual has a unique pattern in DNA.
- The complementary strand of DNA will have AGCGATAGCAA as the nitrogenous bases.

Self-check for Learning



Lesson No: 3

Subject: Biology

Class: 9 – 10

Time: 50 minutes

Topic: Types and Importance of Biodiversity**Learning Objectives**

1. Name three types of biodiversity.
2. Explain the significance of biodiversity.
3. State at least three conservation strategies to conserve biodiversity.

Introduction

There are a variety of life-like plants, animals and microbes on the earth. This variety of living organisms is known as **Biodiversity** (*Bio= life, Diversity= variety*). It includes all forms of life and the ecosystems of which these life forms are part of.

Activity 1

Fill in the table with animals or plants found outside your house.



Sl. No	Name of Plant/Animal	Where are they found? (Location)

Types of Biodiversity

Biodiversity can be classified broadly into three categories:

1. **Genetic Diversity** is a variation of genes within the same species. Every individual species has the gene that makes them unique from other organisms of same species.
2. **Species Diversity** refers to the different varieties of species in a particular region. There would be lots of different organisms sharing the same region.
3. **Ecosystem Diversity** refers to the different kinds of an ecosystem. The ecosystem includes all living organisms in a particular region that interact with each other.



Figure: Different types of Biodiversity

Importance of Biodiversity

Bhutan has one of the richest biodiversity in the world with more than 70% of its land covered under forest. Our Constitution mandates us to maintain a minimum of 60% forest cover for all times to come. Till date, Bhutan has been receiving lots of recognition in the conservation of natural resources. Bhutan falls under one of the biological hotspots in the world. Bhutan also houses forest ecosystem, aquatic ecosystem, rivers, lakes, marshlands, etc. Because of this rich ecosystem, Bhutan is home for some of the endangered species of plants and animals that includes Bhutan Cypress, golden langur, white-bellied heron, red panda, etc. As a result of rich biodiversity, Bhutan is one of the destination countries for tourists.



Activity 2

Bhutan is rich in Biodiversity with many variety of ecosystem, plants and animals. How does it benefit our country and the people?

Biodiversity Loss

Biodiversity loss is a decrease in biodiversity within a species, an ecosystem, a given geographic area, or Earth as a whole. Biodiversity loss describes the decline in the number, genetic variability, and variety of species, and the biological communities in a given area. This loss in the variety of life can lead to the breakdown in the functioning of the ecosystem.

Causes of Biodiversity Loss

Some of the causes that threatens the loss of biodiversity are described below:

1. **Habitat Destruction:** Certain habitats are destroyed through human activities for various developmental activities such as the construction of schools, hydropower project, etc. This leads to threatening the lives of animals and plants in and around that place. One such example is deforestation.

- Pollution:** It is the contamination of the natural environment through the emission of harmful substances thereby altering the natural environment and making it unfit for the living organism to inhabit.
- Climate Change:** Climate change is also another greatest threat to the sustainability of biodiversity. It is mainly associated with the rising of the temperatures of the earth due to the emission of greenhouse gases (GHG). CO₂ which is one of the major GHG is usually released through various sources. Volcanic eruption, burning of fossil fuels, forest fires, factories and industries are some of the sources of CO₂.
- Habitat Fragmentation:** Habitat fragmentation is the division of large habitat into smaller habitats thereby providing very less space for the animals and plants.
- Hunting:** Poaching or hunting of animals for their products such as hides, skin, tusk, fur, medicines, meat, etc. are some of the causes of diversity loss. It decreases the population in large numbers.
- Overexploitation:** Overexploitation also leads to a loss of diversity. One best example in Bhutan can be the collection of Yartsa Goenbub. The farmers collect this organism because of the medicinal value and if not taken care, the overexploitation can lead to the extinction of the species.



Activity 3

Mention some ways to control the loss of biodiversity.

Strategies to Conserve Biodiversity

There are several methods to conserve biodiversity. The conservation methods can be broadly divided into two approaches namely in-situ and ex-situ. In-situ (on-site) conservation is the conservation of animals and plants in their natural habitat. Ex-situ (off-site) conservation is the conservation of plants and animals outside their natural habitat. Some of the conservation strategies in Bhutan include the development of National Parks (Royal Manas National Park, Bumdeling Wildlife Sanctuary, Wangchuck Centennial Park), Zoo, Botanical Garden, Sanctuaries, Reserves, Biological Corridors, Gene Banks, Tissue Culture Centres, etc.



Activity 4

Classify National Parks, Zoo, Botanical garden, Sanctuaries, Reserves, Biological Corridors, Gene Banks, Tissue Culture Centres into in-situ conservation and ex-situ conservation.

Summary

- Biodiversity is the variety or diversity of living things on Earth.
- Three types of biodiversity are *genetic diversity*, *species diversity* and *ecosystem diversity*.
- Biodiversity can be lost through many activities if not taken care of and can make species vulnerable, endanger and leads to extinction.
- Bhutan also has rich biodiversity in the world and currently, Bhutan has more than 70% forest cover.
- Biodiversity can be protected through in-situ conservation and ex-situ conservation strategies.
- In-situ conservation is the way of protecting the species in their natural habitat.
- Ex-situ conservation is the way of protecting the species in a new place by providing favourable conditions.



Self-check for Learning

1. Human depends on biological diversity and healthy ecosystem to sustain life. Explain.
2. Explain any three causes of biodiversity loss in Bhutan.
3. If you are a forest officer, how can you as a concerned citizen help in preserving Bhutan's biodiversity?

1. Biological diversity and healthy ecosystem provide humans with the following things to sustain life:
 - a. It provides clean air, fresh water, diverse food products, timber, fuel, fertilizers, medicines and raw materials for clothing.
 - b. It helps maintain the ecological balance necessary for all the life forms.
 - c. It provides raw materials for the plants and animal breeding.
 - d. It provides social benefits like recreation, tourism, cultural values, educational values, etc.

Self-check for Learning



Lesson No: 1

Subject: Chemistry

Class: 9 – 10

Time: 50 minutes

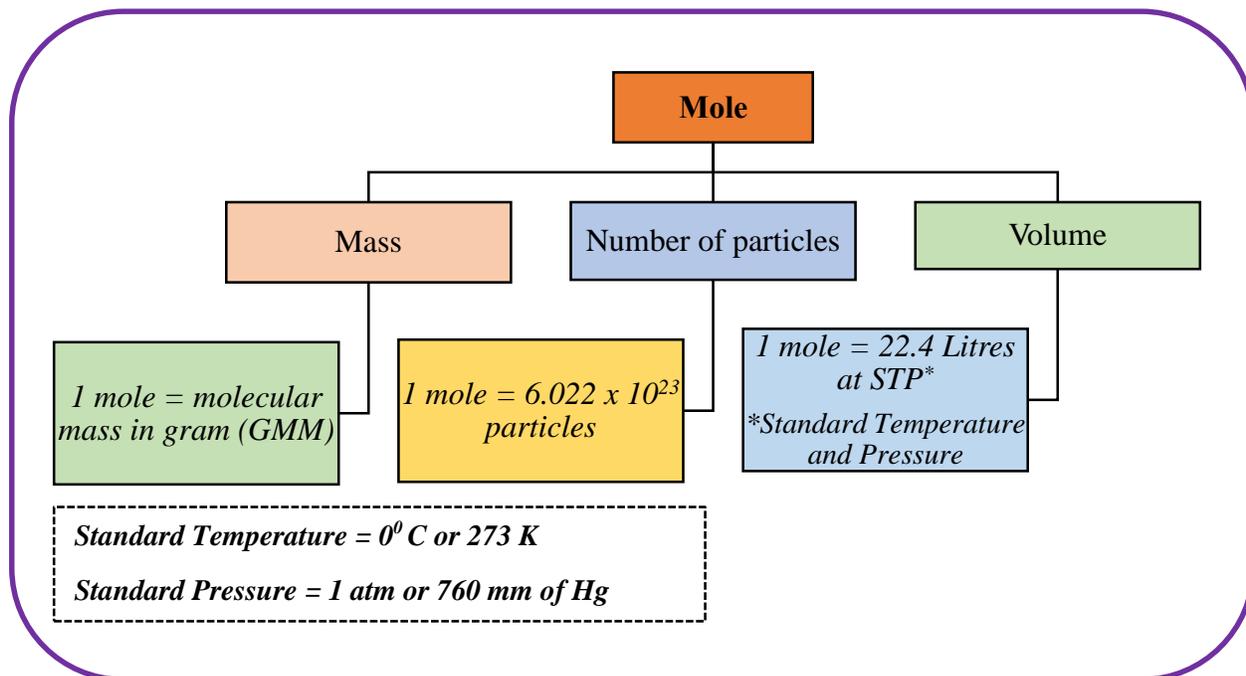
Topic: Mole Concept*Learning Objectives*

1. Explain the term mole.
2. Solve numerical problems based on mole concept.

Introduction

A mole is a unit of measurement that is similar units like pair, dozen, gross, etc. Mole is defined as the quantity of any substance which contains as many elementary entities such as atoms, molecules or ions as there are in 12.00 grams of carbon-12. Mole is abbreviated as 'mol' which is used as its S.I unit.

Mole can be expressed in terms of **mass, number of particles and volume** as summarized below graphically:

**Mole**

This unit is used by chemists in the food industry, medical laboratories, cosmetics and so on to know the concentrations and to prepare solutions. It provides a specific measure of the number of

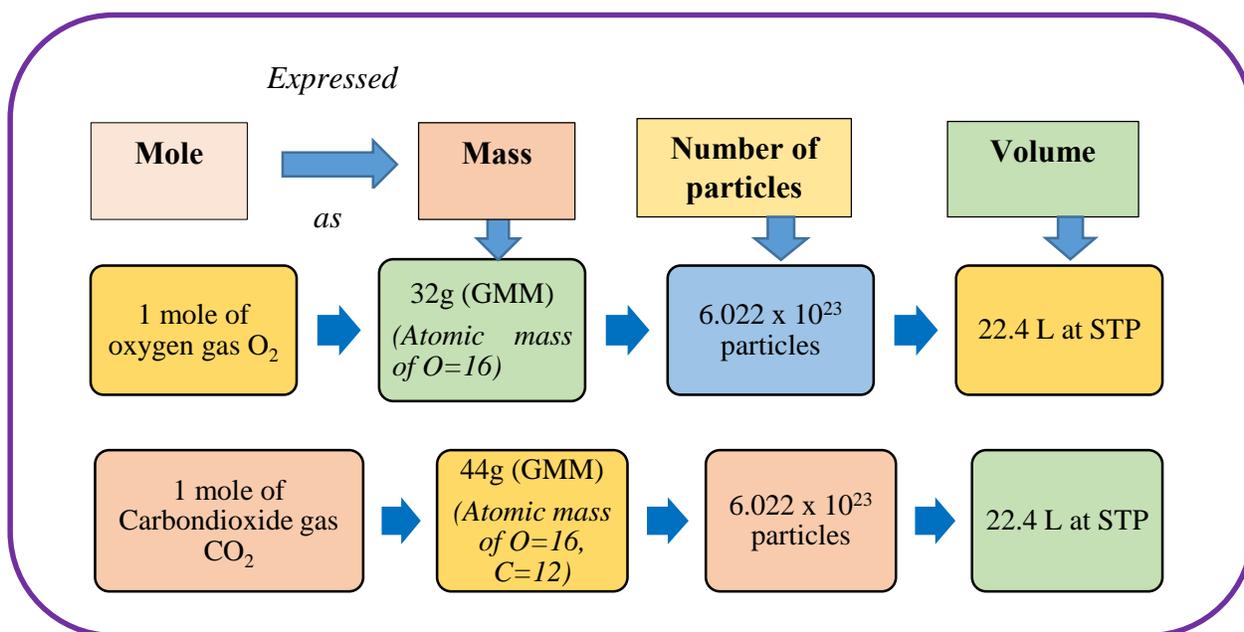
atoms or molecules or ions. Since most of the quantitative chemical calculations in chemistry are based on the mole, it is essential to understand the concept of the mole.



1. How much is 1 kg of common salt?
2. How much is 1 g of common salt?
3. How much is 1 mole of common salt?

As mentioned in the introduction, a mole can be expressed in terms of mass, a number of particles and volume. Therefore, you can express 1 mole of common salt in terms of mass, number of particles or volume. 1 mole of any substance equals its gram molecular mass (GMM), contains 6.022×10^{23} particles and occupies a volume of 22.4 litres at STP.

For example:



1. Mole in Terms of Mass

1 mole of any substance = gram molecular mass of the substance.

Mass in grams of 1 mole of a substance is called *molar mass*.

What is the mass of 1 mole of NaCl salt?



Solution:

We know that,

1 mole = molecular mass in gram

Molecular mass = sum of atomic masses

Molecular mass of NaCl = 23 + 35.5 = 58.5g

Therefore 1 mole of NaCl is 58.5g



2. Mole in Terms of Number of Particles (atoms, molecules or ions)

1 mole of any substance = 6.022×10^{23} particles

* 6.022×10^{23} is known as *Avogadro's number* or *Avogadro's constant*.



Determine the number of molecules in 1.5 moles of water, H₂O.

Solution:

We know that,

1 mole of H₂O = 6.022×10^{23} molecules

Then, 1.5 moles of H₂O = 1.5 mole \times 6.022×10^{23} / 1 mole = 9.033×10^{23}

Therefore 1.5 moles of H₂O contain 9.033×10^{23} molecules.

3. Mole in Terms of Volume

1 mole of any substance = 22.4 L at STP

* 22.4 L is known as the **molar volume**. Molar volume is defined as the volume occupied by 1 mole of substance at standard temperature and pressure.



Calculate the volume occupied by 2 moles of water, H₂O at STP.

Solution:

We know that,

1 mole of H₂O at STP occupies = 22.4 L

Then, volume of 2 moles of H₂O = 2mole \times 22.4 L / 1 mole = 44.8 L

Therefore 2 moles of H₂O occupy 44.8 L at STP.

Activity 1

Write the answers to the following questions in your notebook.

1. What is the mass of 1 mole of ammonium carbonate $(\text{NH}_4)_2\text{CO}_3$?
[H=1, C=12, N=14, O=16]
2. Calculate the number of moles in 140g of nitrogen gas? Also find its volume at STP? [N=14]
3. What is the volume occupied by 2 moles of carbon dioxide at STP?
[C=12, O=16]

Summary

1. A mole is Avogadro's number of any substance.
2. Avogadro's number is 6.023×10^{23} .
3. Molar mass of a compound or molecule is the numeric equivalent of molecular mass in grams.
4. Molar volume is volume occupied by one mole of gas at STP.
5. $1 \text{ mole} = \text{GMM} = 6.023 \times 10^{23} = 22.4 \text{ litres at STP}$

Self-check for Learning

Write the answers to the following questions in your notebook.

1. How many molecules of water are there in 54g of H_2O ?
2. Calculate the number of molecules in 22.4L of CH_4 gas at STP.
3. What is the volume occupied by 6.022×10^{23} molecules of any gas at STP?
4. Find the volume of 20g H_2 at STP.
5. Calculate the mass of 6.022×10^{23} molecules of NH_4Cl at STP?

1. **Solution:**
 Gram molecular mass of $\text{H}_2\text{O} = (1 \times 2) + 16 = 18 \text{ g}$
 If 18g (1 mole) of H_2O contains = 6.022×10^{23} molecules
 Then, 54g of H_2O contains = $(54\text{g} \times 6.022 \times 10^{23} \text{ molecules}) / 18\text{g} = 1.8 \times 10^{24}$ molecules (rounded off to 2 significant figures)
 Therefore, 54g of H_2O will contain 1.8×10^{24} molecules.
2. 22.4 L of CH_4 gas at STP contains 6.022×10^{23} molecules.
3. 6.022×10^{23} molecules of any gas at STP occupy a volume of 22.4 L.
4. **Solution:**
 Gram molecular mass of $\text{H}_2 = 1 \times 2 = 2\text{g}$
 If 2g (1 mole) of H_2 occupies a volume = 22.4 L
 Then, 20g of H_2 will occupy a volume = $(20\text{g} \times 22.4 \text{ L}) / 2\text{g} = 224 \text{ L}$
 Therefore, 20g of H_2 at STP will occupy 224 L.
5. **Solution:**
 6.022×10^{23} molecule of $\text{NH}_4\text{Cl} = 1$ mole of NH_4Cl
 1 mole = Gram molecular mass of substance
 Gram molecular mass of $\text{NH}_4\text{Cl} = 14 + (1 \times 4) + 35.5 = 53.5\text{g}$
 Therefore, the mass of 6.022×10^{23} molecule of NH_4Cl equals 53.5g.

Self-check for Learning



Lesson No: 2

Subject: Chemistry

Class: 9 – 10

Time: 50 minutes

Topic: **Hydrocarbons***Learning Objectives*

1. Define the term saturated and unsaturated hydrocarbon.
2. Name alkane, alkene and alkynes.
3. Write the molecular formula of alkane, alkene and alkyne.

Introduction

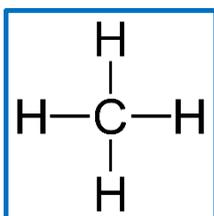
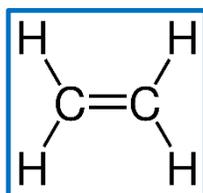
Hydrocarbons are the building block of almost all the necessary items we use in our day-to-day life. The fuels (like butane, petrol and diesel), plastics, cosmetics, drugs and household cleaning products contain hydrocarbons. Therefore, studying about hydrocarbons takes us a step closer to understanding the chemical nature of the products we come in touch with every day.

Organic compounds are the compounds that contain carbon and hydrogen along with other elements like nitrogen, oxygen, sulphur, etc. Today there are more than 10 million organic compounds. The simplest form of organic compound is a hydrocarbon.

A chemical compound composed of carbon and hydrogen is called hydrocarbons. There are 2 main reasons behind the existence of millions of organic compounds:

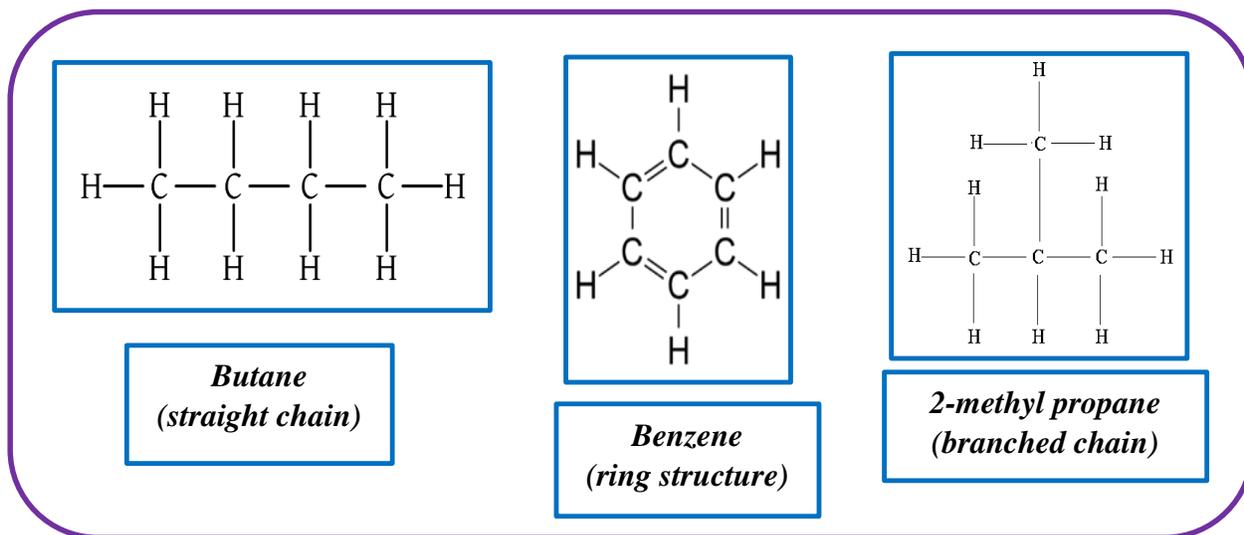
1. **Tetravalency of Carbon:** Carbon (Atomic number-6) has four valence electrons due to which it neither gains nor loses electrons. Instead, carbon atoms form covalent bonds by sharing electrons with other atoms. It needs to form **four covalent bonds** to acquire the noble gas configuration and become stable. Carbon fulfils this by forming bonds in different ways like rings, chains, double bonds, triple bonds, etc., thus leading to the formation of varieties of organic compounds.

Given below are some of the examples of varieties of hydrocarbons formed due to the tetravalent nature of carbon.

*Methane**Ethene**Ethyne*

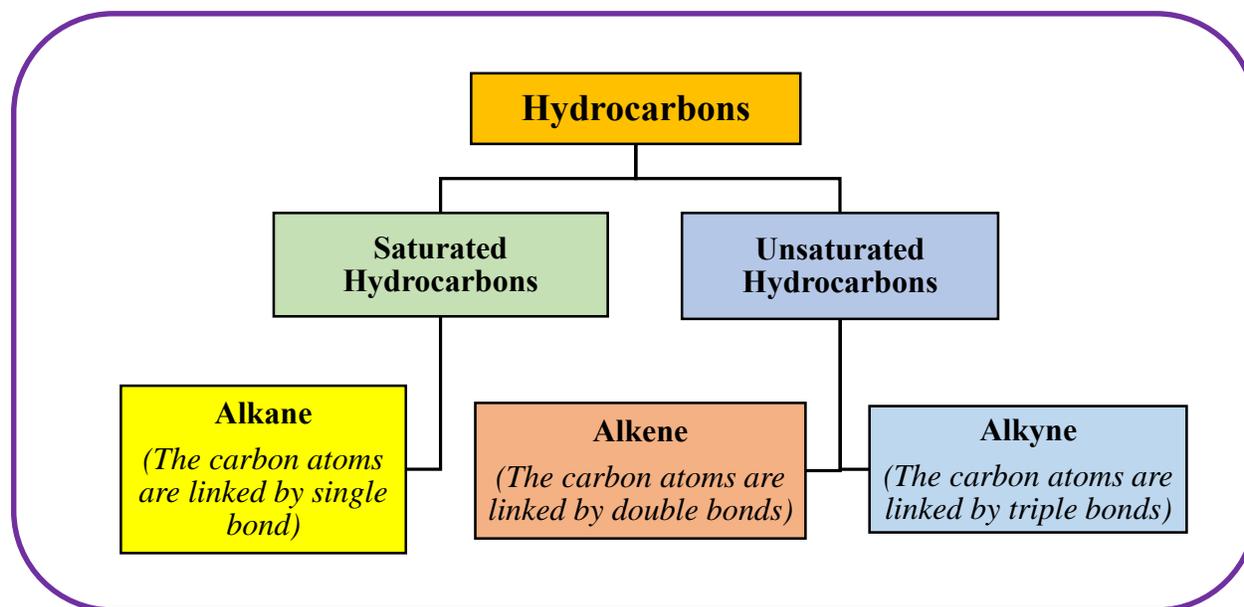
2. **Catenation:** It is defined as the tendency of an element to form chains of identical atoms. Carbon atoms have the unique tendency to form straight chains, branched chains and rings of different sizes. This leads to the formation of varieties of organic compounds.

Given below are the examples of different organic compounds formed as a result of catenation of carbon atoms.



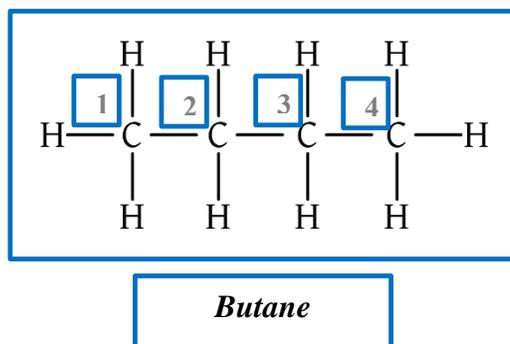
Classification of Hydrocarbons

Hydrocarbons are broadly classified as saturated and unsaturated hydrocarbons based on the type of bond between the carbon atoms. The figure below summarizes the classification of hydrocarbons.



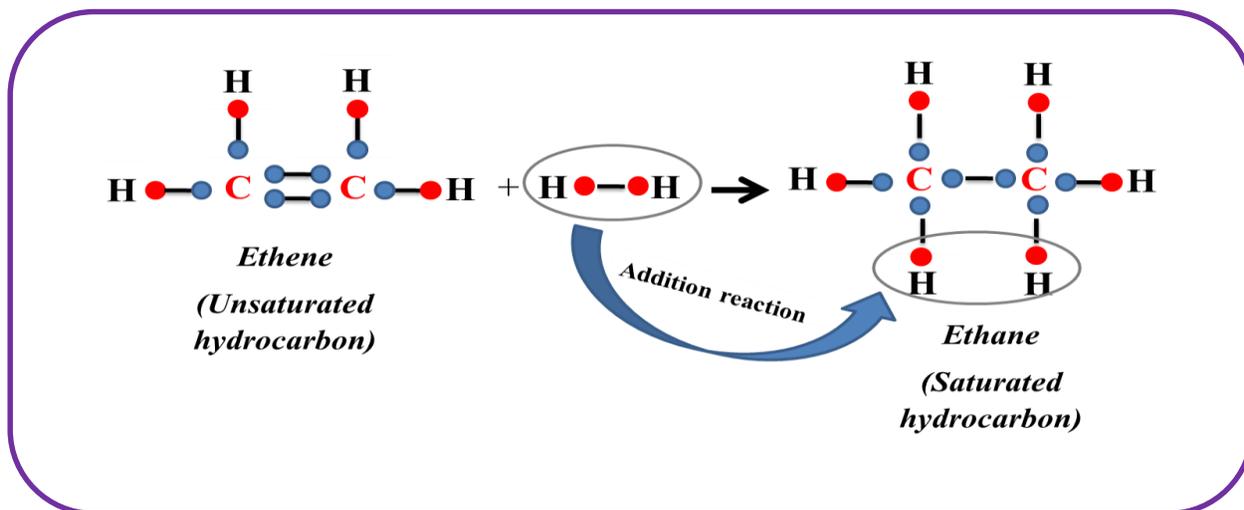
The C-C single bond in an alkane is called the **sigma (σ) bond**. Whereas, one of the bonds in the C=C double bond in an alkene is **pi (π) bond** while the other is the **sigma (σ) bond**. Similarly, in alkyne, there is **one sigma (σ) bond** and **two pi (π) bonds**, thus triple bond. The sigma bond is stronger than the pi bond.

Alkanes are called saturated hydrocarbons because the tetravalency of carbon atoms are satisfied by C-C or C-H single bond. They can no longer form any more bonds with other atoms. Let us look at Butane as an example. Butane is an alkane because the carbon atoms are linked by a single bond.

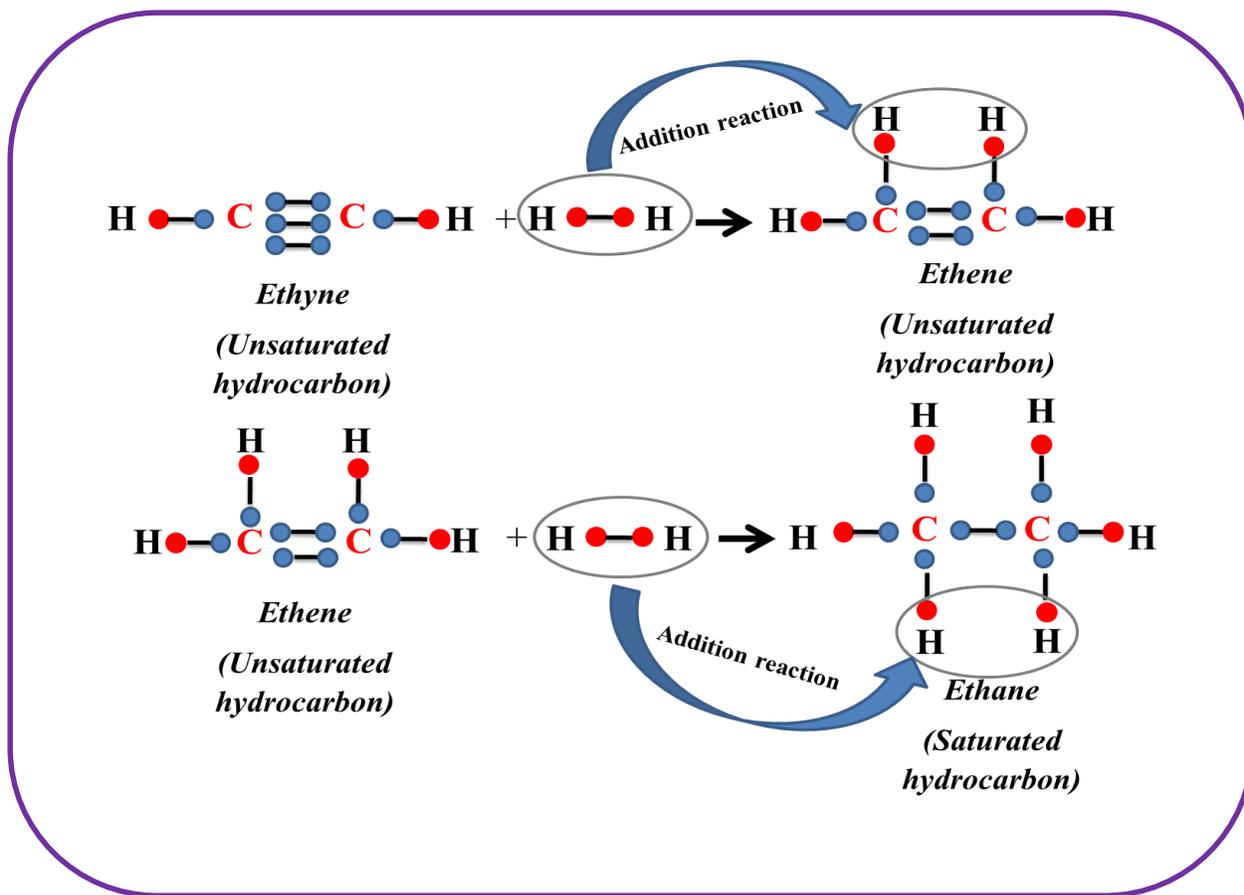


Notice the first carbon atom in butane. It has already formed four covalent bonds, **one C-C bond** and **three C-H bonds**. The second carbon atom has also formed four covalent bonds, **two C-C bonds** and **two C-H bonds**. Similarly, the other two carbon atoms have also fulfilled its tetravalency by forming C-C or C-H covalent bonds. There is no scope of adding any more atoms to the carbon, thus Alkanes are called saturated hydrocarbons.

On the other hand, alkene and alkyne are called unsaturated hydrocarbons because the carbon atoms in these types of hydrocarbons are linked by double or triple bond respectively. The 2nd and 3rd bonds (π bonds) are weak and thus, can be broken after which addition reaction can take place. There is the scope of adding more atoms to carbon.



Note the example given above. Ethene which is an unsaturated hydrocarbon undergoes addition reaction to form ethane by breaking one of the double bonds. In ethene, each carbon already has four bonds, a **double C=C bond** and **two C-H bonds**. However, one of the bonds breaks and thereby renders it short of one electron each for the carbon atoms. Therefore, it reacts with a hydrogen molecule by covalently bonding with them and fulfilling its valency to achieve stability.



Similarly, addition reaction also takes place in compounds of alkyne groups with a triple bond. The diagram given above shows the steps of addition reaction in ethyne. The two Pi (π) bonds are gradually broken down until it is left with a strong single sigma (σ) bond between the two carbon atoms. In the process, it bonds covalently with hydrogen molecule to fulfil its valency. This addition of hydrogen is also called **hydrogenation** and it takes place with the help of a catalyst.



Will the ethane formed as a result of hydrogenation in both ethene and ethyne undergo further addition reaction? Why?

Nomenclature of Organic Compounds

The International Union of Pure and Applied Chemistry (IUPAC) has set rules for naming the organic compounds based on their structure. It is known as the IUPAC system of naming and the given name is known as the IUPAC name. This system helps maintain uniformity to aid scientists around the world in technical communication.

We will learn how to name the simplest organic compounds. According to the IUPAC system, naming a simple organic compound consist of two parts, i.e.

$$\text{IUPAC Name} = \text{Word root} + \text{Suffix}$$

- 1. Word Root:** It is the basic unit of the name and represents the number of carbon atoms present in the parent chain of the organic compound. The parent chain is the longest possible continuous chain of carbon atoms. The word root is selected as per the number of carbon atoms in the compound as given below in the table.

Chain Length	Word Root	Chain Length	Word Root
C ₁	Meth-	C ₆	Hex-
C ₂	Eth-	C ₇	Hept-
C ₃	Prop-	C ₈	Oct-
C ₄	But-	C ₉	Non-
C ₅	Pent-	C ₁₀	Dec-

- 2. Suffix:** The word root is followed by a suffix. There are two types of suffix, primary suffix and secondary suffix. The primary suffix denotes the nature of the carbon-carbon bond. Based on this, there are three basic primary suffixes as shown in the table below.

Nature of Carbon bond	Primary suffix	General name	General formula
C – C (saturated)	-ane	Alkane	C _n H _{2n + 2}
C = C (Unsaturated)	-ene	Alkene	C _n H _{2n}
C ≡ C (Unsaturated)	-yne	Alkyne	C _n H _{2n – 2}

The general formula represents the composition of any member or homologue in the particular group of compounds. The small letter 'n' is an integer and represents the number of carbon atoms. The homologues are compounds having similar structures and chemical properties in which the successive compounds differ by one -CH₂ group. All the homologues together are called homologous series.

Activity 1



Let us find the homologous series of alkanes by using its general formula. Complete the table. The first one is done for you.

<i>General formula of alkane : C_nH_{2n+2}</i>		
Molecular formula of the homologous series		IUPAC name
n=1	CH ₄ ($C_1 H_{2 \times 1 + 2}$)	Word root: Meth- (1 carbon) Suffix: -ane (single bond) } Methane
n=2	C ₂ H ₆ ($C_2 H_{2 \times 2 + 2}$)	-----
n=3	-----	-----
n=4	-----	-----
n=5	-----	-----

Activity 2

Practice problems



1. What is the IUPAC name of an **alkane** with **six carbon atoms**?
2. What is the IUPAC name of an alkene with five carbon atoms?
3. What is the IUPAC name of an alkyne with **two carbon atoms**?
4. Write down the molecular formula of octene.

Test for Saturated and Unsaturated Hydrocarbons

1. Bromine Test

Solution A in Figure 1 is an unsaturated hydrocarbon. The unsaturated hydrocarbon decolourises the orange coloured bromine solution turning it colourless.

Solution B in Figure 2 is a saturated hydrocarbon. The saturated hydrocarbon does not decolourise the orange colour bromine solution. The orange colour of the bromine solution persists when added to the saturated hydrocarbon solution.

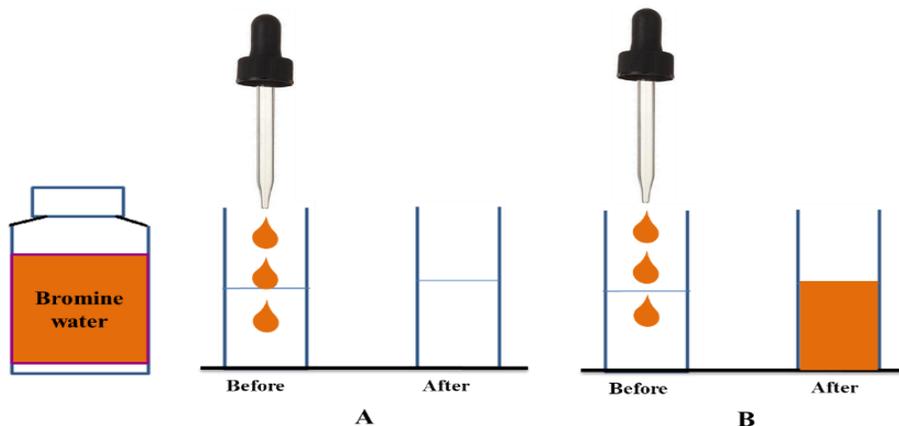


Figure 1: Bromine Test

2. Baeyer's Test

Solution A is an unsaturated hydrocarbon. The unsaturated hydrocarbon decolourises the purple colour of Potassium permanganate (KMnO_4) solution rendering it colourless. Solution B is a saturated hydrocarbon. The saturated hydrocarbon does not decolourise the purple colour of the KMnO_4 solution. The purple colour of the reagent persists when added to the saturated the saturated hydrocarbon solution.

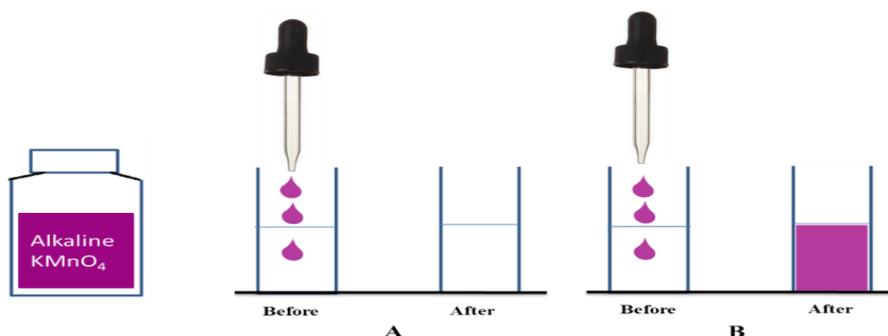


Figure 2: Baeyer's Test

Activity 3



- Write the IUPAC name for the following:
 - Alkane with nine carbon atoms.
 - Alkene with three carbon atoms.
 - Alkyne with three carbon atoms.
- Write down the molecular formula of the following hydrocarbons:
 - Butyne
 - Nonene
 - Decane

Summary

- Hydrocarbons are classified as saturated and unsaturated hydrocarbons based on the nature of carbon-carbon bonds.
- Alkane is a saturated hydrocarbon with carbon-carbon single bond.
- Alkene and alkyne are unsaturated hydrocarbons with carbon-carbon double and triple bond respectively.
- The naming of the organic compounds is done using a standard system called the IUPAC system.
- Bromine test and Baeyer's test are used to distinguish a saturated and unsaturated hydrocarbon.



Self-check for Learning

- Write the molecular formula of Hexyne and Heptyne?
- What is the name of the Alkyne with 4 carbon atoms?

- Hexyne is an alkyne (note the suffix -yne)
General formula of alkyne: C_nH_{2n-2}
'n' of hexyne is six (note the prefix Hex-)
Therefore, molecular formula of hexyne ($C_6H_{2 \times 6 - 2}$) = C_6H_{10}
Heptyne is an alkyne (note the suffix -yne)
General formula of alkyne: C_nH_{2n-2}
'n' of heptyne is seven (note the prefix Hex-)
Therefore, molecular formula of hexyne ($C_7H_{2 \times 7 - 2}$) = C_7H_{12}
- The name of the alkyne with four carbon atoms is butyne.

Self-check for Learning



Lesson No: 1

Subject: Physics

Class: 9 – 10

Time: 50 minutes

Topic: Newton's Laws of Motion - 2nd and 3rd Law

Learning Objectives



1. Define Newton's laws of motion.
2. Differentiate Newton's laws of motion.
3. Explain Newton's laws of motion.
4. Explain the application of laws of motion.
5. Define one newton.

THINGS YOU SHOULD KNOW (Prerequisite knowledge)

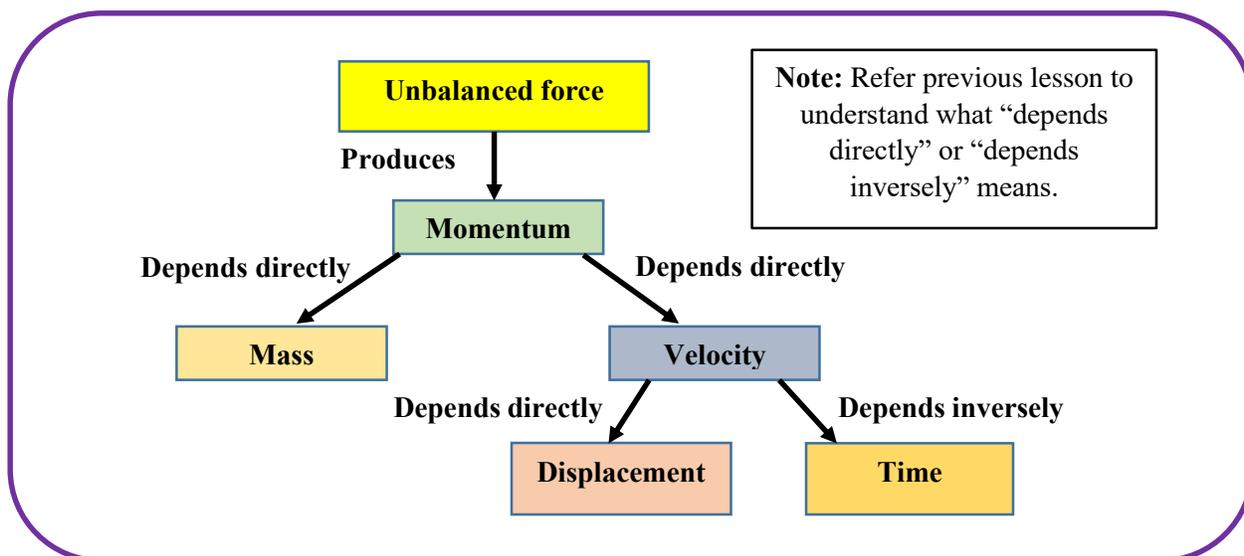
We know the effects of unbalanced forces on objects. We have also learned that Newton's first law talks about inertia. That is, an object will continue to maintain its original position unless it is being disturbed by some unbalanced external force.

Newton's Second Law of Motion

Newton's second law talks about the effects of an unbalanced force on the moving object. The law relates unbalanced force applied to the object with its mass and acceleration produced due to the force.

It states that (unbalanced) **force** acting on a moving body is directly proportional to the rate of change of **momentum** of the body in the direction of the applied force. This means, if an unbalanced force applied on a moving body is increased then its momentum (amount of motion) will also increase and vice-versa. The change in momentum is in the direction of applied force (**Remember:** Object always moves in the direction of the greater force).

Explore the following flow chart to understand the dependence and the derivation.



Momentum is another name for the amount of motion contained in a moving body. It is equal to the product of the mass of the moving object and its velocity.

$$\mathbf{momentum}(p) = \mathbf{mass}(m) \times \mathbf{velocity}(v)$$

Or

$$\mathbf{p} = \mathbf{mv}$$

From the law, it is clear that:

$$\mathbf{Force acting on the body}(F) \propto \mathbf{rate of change of momentum of the body}(p)$$

Or;

$$\mathbf{F} \propto \frac{\mathbf{p}}{\mathbf{t}} \dots \dots \dots (1)$$

Notice that we divide momentum by time to get its rate of change.

We know:

$$\mathbf{p} = \mathbf{mv} \dots \dots \dots (2)$$

Substituting equation 2 in equation 1, we get:

$$\mathbf{F} \propto \frac{\mathbf{mv}}{\mathbf{t}} \dots \dots \dots (3)$$

From our earlier lesson we know;

$$\frac{\mathbf{v}}{\mathbf{t}} = \mathbf{a} \dots \dots \dots (4)$$

Now, substituting equation 4 in equation 3, we get:

$$\mathbf{F} \propto \mathbf{ma}$$

That is, introducing a constant 'k', we have:

$$\mathbf{F} = \mathbf{k.ma}$$

Where 'k' is the constant of proportionality.

If, the value of;

- i. Mass (m) = 1 kg,
- ii. Acceleration (a) = 1 ms⁻² or 1 m/s², and
- iii. Force (F) = 1N, then the value of constant of proportionality is equal to one ($k = 1$).

Keeping $k = 1$,

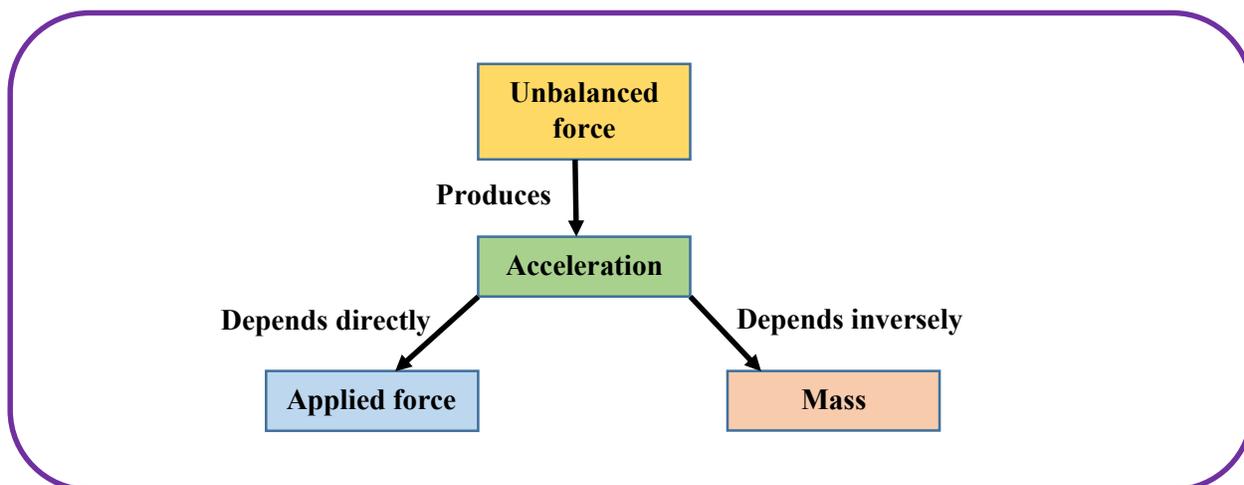
We have;

$$\mathbf{F} = \mathbf{ma} \quad \text{Or} \quad \mathbf{Force}(F) = \mathbf{mass}(m) \times \mathbf{acceleration}(a)$$

This is the mathematical interpretation of Newton's second law, that is, the force acting on a moving body is equal to the product of the mass of the body and its acceleration.

In other words, the acceleration produced in a moving object because of the unbalanced force depends directly on the magnitude of the force applied and indirectly upon its mass.

The following diagram represents the dependence.



The dependence of acceleration on applied force and mass of the object is discussed below.

Defining One Newton

The above equation also helps us to define one newton. (This is one reason why we put value for the constant of proportionality (k) as 1).

We have;

$$F = ma$$

That is, If;

1. $m = 1\text{kg}$
2. $a = 1\text{m/s}^2$

Then, $F = 1\text{N}$

Therefore, one newton can be defined as a force that produces an acceleration of 1m/s^2 on a body of mass 1kg .

Numerical Problems

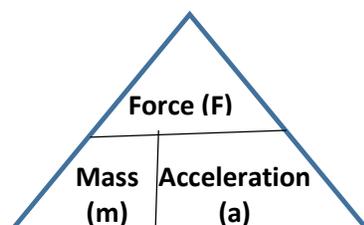
We can use the formula to solve numerical problems related to force, mass and acceleration of the moving body. The following are some examples. However, it is important to note that word problems help us to understand the concept clearly and hone our mathematical skills to apply it to real-life situations.

Let us revisit the formula first. We have;

$$F = ma$$

Here, force 'F' is the subject of the formula. However, as per the requirement for the particular word problem, we can apply the arithmetic operations on to the formula and make either mass or acceleration the subject of the formula.

The following formula triangle might also help you remember the formulas better.



The position of the physical quantities in the triangle represents its position in the formula. For example, if you want to find the force, the mass should be multiplied by acceleration and if you want to find the mass, force should be divided by acceleration.

That is;

1. $F = ma$
2. $m = \frac{F}{a}$
3. $a = \frac{F}{m}$

Example 1

Calculate the force on a ball of mass 2kg accelerating at the rate of 2m/s^2 .

(**Hint:** Try using the BUCK method while solving word problems. If you are not familiar with this method, please do explore!)

Solution:

Given: Mass (m) = 2kg Acceleration (a) = 2m/s^2

We know;

$$F = ma$$

That is;

$$\text{Force on the ball (F)} = ma$$

Or;

$$F = 2 \times 2 = 4\text{N}$$

Therefore, the force on the ball is 4N.

Example 2

A net force of 20N is exerted on a metal ball to cause it to accelerate at a rate of 4m/s^2 . Determine the mass of the ball.

Solution:

Given: $F = 20\text{N}$ $a = 4\text{m/s}^2$

We know:

$$m = \frac{F}{a}$$

That is;

$$m = \frac{20}{4} = 5\text{kg}$$

Therefore, the mass of the metal ball is 5kg.

Activity 1

1. Explore why we introduce constant of proportionality 'k' in the above derivation.
2. Find the equivalent unit of Newton. (**Hint:** Use formula for force)
3. Explore how force acting on a moving body is related to the mass of the body and its acceleration. (**Hint:** Use your past knowledge on how to interpret relationships using the formula.)
4. **Try it yourself:** Try solving some of the questions from the textbook.
5. **Try it yourself:** Suppose that an arrow is accelerating at a rate of 2m/s^2 . If the force is tripled and the mass is halved, then what is the new acceleration of the arrow?

Newton's Third Law of Motion

It states that for every action there is an equal and opposite reaction.

When birds fly in the air, its wings push air downwards and in return, the air pushes its wings upwards. The wings of the bird impart action force on air and the air imparts reaction force to the wings. The forces are of the same magnitude but they act in the opposite direction.

Even when you walk, your toes push earth downwards (action force) while an equal and opposite force of the earth pushes (reaction force) your toes back and that is how we can balance ourselves and walk.

**Activity 2 Investigate:**

- a. Can there be a single isolated force? Why?
- b. How are rockets able to accelerate directly upwards?

Summary

- The rate of change of momentum (the amount of motion in the moving object) will depend directly upon the unbalanced force applied to it.
- $Force (F) = Mass (m) \times Acceleration (a)$ or $F = ma$
- One newton can be defined as a force that produces an acceleration of 1m/s^2 on a body of mass 1kg .
- For every action, there is an equal and opposite reaction.
- Action and reaction forces do not act on the same surface.



Self-check for Learning

1. A 1 kg object accelerated at a constant rate of 5m/s^2 . Estimate the net force needed to accelerate the object.
2. A force of 5N is applied to a football has a mass of 0.5kg . Determine the acceleration of the beach ball.
3. What is the mass of a table tennis ball that accelerated at 5m/s^2 when a 0.5N force is applied?
4. If a person is pulling upon a rope that is attached to a wall with a force of 500N then what will be the force due to the wall?

1. 5N
2. 10m/s^2
3. 0.1kg
4. The force will be exactly 500N . The rope transmits the force from a person to the wall and vice versa. The force of person pulling on the wall and the wall pulling on Kent are action-reaction force pairs, they must have equal magnitudes.

Self-check for Learning



Lesson No: 1

Subject: Mathematics

Class: 9 – 10

Time: 50 minutes

Topic: Concepts of Network

Learning Objectives

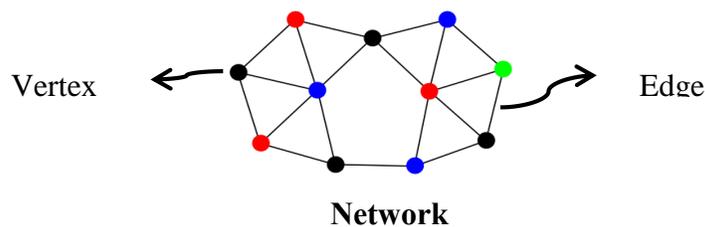


1. Define edge and vertex of a network.
2. Describe a network with a matrix.
3. Draw digraph for a matrix.
4. Explain what is one stop over trips and two stop over trips with an example.
5. Solve problems related to it.

Introduction

The network is a set of connections between people, destination or activities. **Vertex** is a point where two or more edges meet and the **edge** is a line joining vertices.

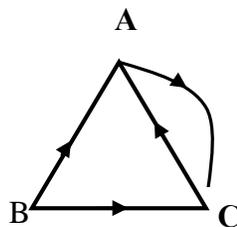
In general, “A set of connected "paths" consisting of edges (paths) and vertices (where paths meet) is called a network”.



Networks can represent all sorts of systems in the real world. For example: Internet networks, Social networks, Transportation networks, Metabolic networks, and Communication networks.

Describing a Network with a Matrix

The network below is called a **directed graph** (or **digraph**) because you travel them in the direction that is shown on the edge.



You can use an **adjacency matrix** to describe a digraph.

Adjacency Matrix

Adjacent matrix is a square matrix used to describe a digraph.

Steps to create an adjacency matrix:

1. List the vertices of the digraph across the top and downside of the matrix.
2. For each row, count the number of direct edges from that vertex to the vertex listed for each column.

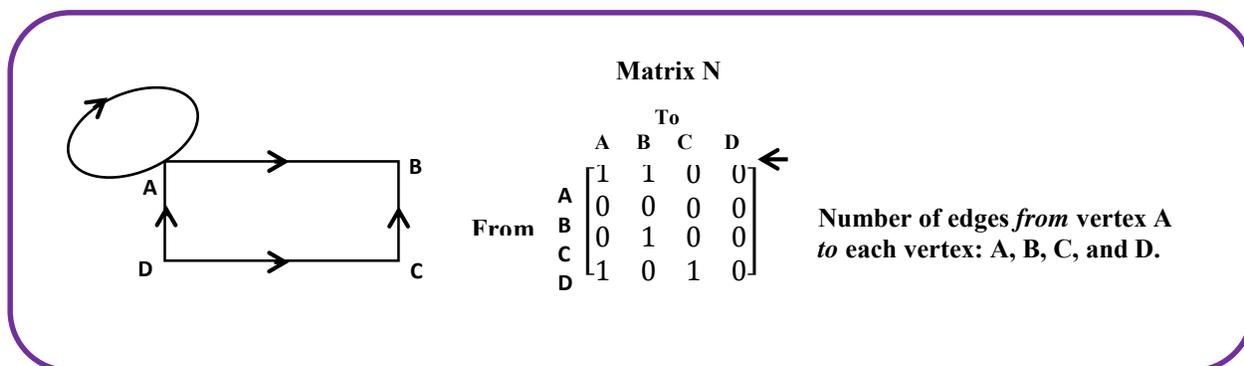
For example, **Matrix N** below is the adjacency matrix for the digraph next to it. The first row of the matrix describes the number of edges from vertex A to each vertex: A, B, C, and D.

The elements are **1 1 0 0** because there is

- 1 direct edge from A to A (a loop)
- 1 direct edge from A to B
- 0 direct edges from A to C
- 0 direct edges from A to D

[Note that there is an edge between D and A, but it is from D to A, not from A to D.]

The remaining rows are filled in the same way.



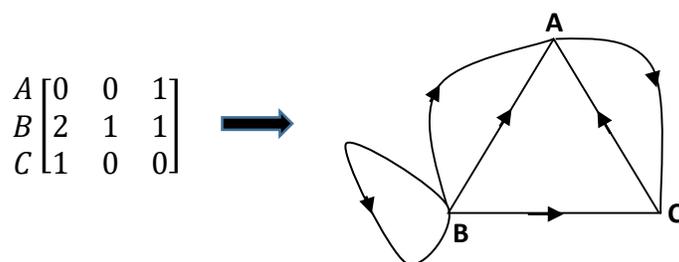
Notice that the total of the elements in the adjacency matrix equals the total number of directed edges in the digraph, in this case, 5.

Steps to create an adjacency matrix: You can also create a digraph from an adjacency matrix.

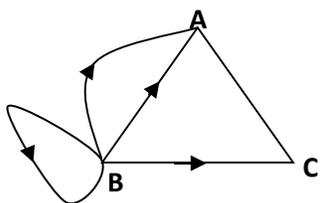
1. Draw a dot for each vertex in the matrix and label it with different letters.
2. For the first row of the matrix, draw each number of direct edges from the vertex for that row to the vertex listed at the top of each column.
3. Repeat the previous step for each row of the matrix.

For example: Adjacency Matrix R below is 3 by 3. That means there are 3 vertices in the digraph: A, B, and C. The second row of the matrix (vertex B), **2 1 1**, means

- 2 direct edges from B to A
- 1 direct edge from B to itself (a loop)
- 1 direct edge from B to C



If there are edges in opposite directions between vertices, the edges can be replaced by one edge with no arrow. For example, the edge from A to C and the edge from C to A can be replaced by a single edge with no arrow. It is understood that the edge without an arrow between A and C is directed both from C to A and from A to C.



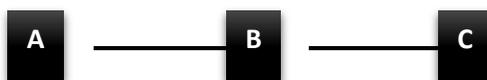
Simplify a digraph by replacing two opposite directed edges with one edge with no arrow.

Solving Network Problems

One-stopover Trip

To get from one place to another, sometimes we have to stop once in-between a location. This is called a one-stopover trip.

For example:



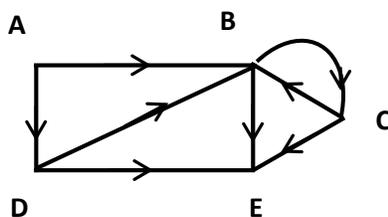
One-Stopover Trip:
A to C (A-B-C)

To determine the total number of one-stopover trips between any two locations in a network, we can do with two methods:

1. Create an adjacency matrix.
2. Counting the trips.

By Creating an Adjacency Matrix

Example:



Create an adjacency matrix of the digraph (M^1) and then multiply itself by twice, or square it. Each element in the squared matrix (M^2) is the total number of one-stopover trips between the vertices.

$$M^1 = \begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$M^1 \times M^1 = M^2$$

$$\begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix} \times \begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 1 & 0 & 2 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

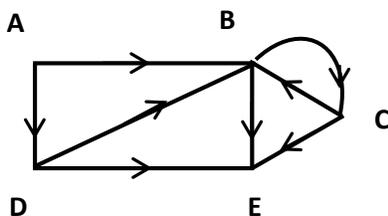
The element **2** is calculated by multiplying numbers in the 1st row of the left-hand matrix by numbers in the 5th column of the right-hand matrix and adding them:

$$2 = 0 \times 0 + 1 \times 1 + 0 \times 1 + 1 \times 1 + 0 \times 0$$

Likewise, other elements can be calculated for M^2 . There are 10 one-stopover trips.

By Counting the Trips

Figure out and count the trip between the pairs of vertices.

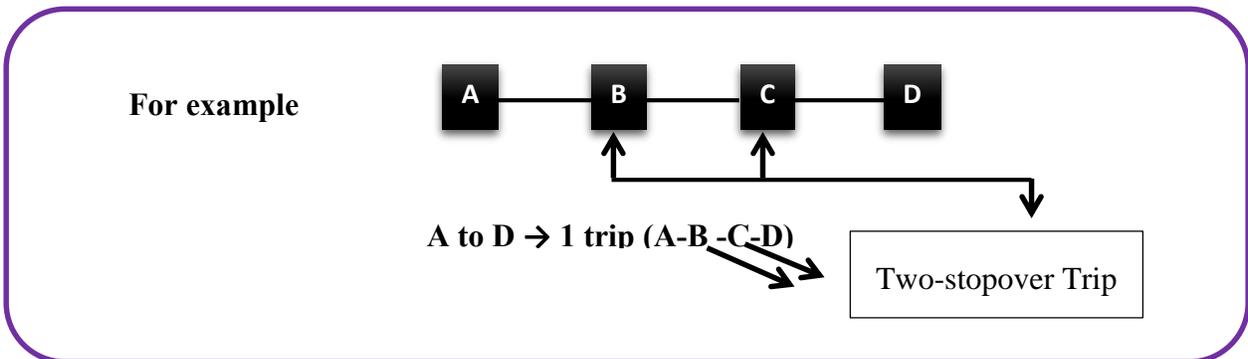


- 1 from A to B (A-D-B)
- 1 from A to C (A-B-C)
- 2 from A to E (A-B-E and A-D-E)
- 1 from B to B (B-C-B)
- 1 from B to E (B-C-E)
- 1 from C to C (C-B-C)
- 1 from C to E (C-B-E)
- 1 from D to C (D-B-C)
- 1 from D to E (D-B-E)

We call it one-stopover trip, even if we are starting and ending at the same place.

Two-stopover Trip

To get from one place to another, sometimes we have to stop twice in-between a location is called a two-stopover trip.

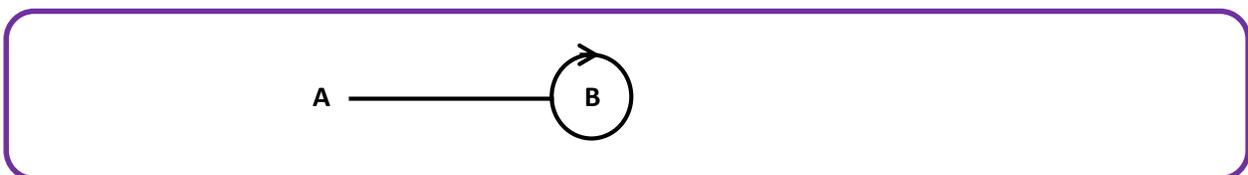


To determine the total number of two-stopover trips between any two locations in a network, we can do with two methods:

1. Create an adjacency matrix.
2. Counting the trips.

By Creating an Adjacency Matrix

For example:



Create an adjacency matrix of the digraph (M^1) and then multiply itself by thrice or cube it. Each element in the cubed matrix (M^3) is the total number of two-stopover trips between vertices.

$$M^1 \times M^1 \times M^1 = M^3$$

For example; an adjacency matrix of the digraph above is:

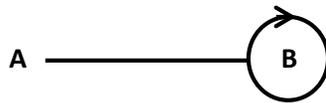
$$M^1 = \begin{matrix} & \begin{matrix} \text{A} & \text{B} \end{matrix} \\ \begin{matrix} \text{A} \\ \text{B} \end{matrix} & \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix} \end{matrix}$$

$$\begin{aligned} M^1 \times M^1 \times M^1 &= M^3 \\ &= \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix} \times \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix} \times \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix} \\ &= \begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix} \times \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix} \\ &= \begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix} \end{aligned}$$

There are 8 two-stopover trips.

By Counting the Trips

Figure out and count the trip between the pairs of vertices.



- 1 trip from A to A (A-B-B-A)
- 2 trips from A to B (A-B-B-B) and (A-B-A-B)
- 2 trips from B to A (B-A-B-A) and (B-B-B-A)
- 3 trips from B to B (B-B-B-B), (B-A-B-B) and (B-B-A-B)

There are 8 two-stopover trips

Summary

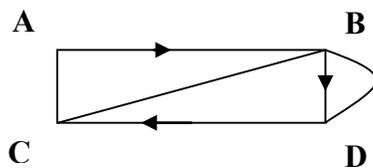
- Network is a set of connection between people, destination or activities.
- Vertices are points and the edges are the lines joining these points.
- We can describe a digraph with a square matrix called an adjacency matrix.
- A square matrix used to describe a digraph is called an adjacency matrix.
- The network is also called **directed graphs** (or **digraphs**) because you travel them in the direction that is shown on the edge.
- Networks are of two types; one-stop over trip and two-stopover trip.
- Stopping once in-between the destination is called one-stop over trip and stopping twice in-between the destination is called two-stop over trip.
- We can describe networks by counting the trips in-between the vertices on the network or by creating an adjacency matrix and then multiplying it accordingly.



Self-check for Learning

Solve the questions in your notebook.

1. Create an adjacency matrix for the digraph.



2. Draw a digraph for the matrix.

$$\begin{matrix} & A & B \\ A & \begin{bmatrix} 1 & 0 \end{bmatrix} \\ B & \begin{bmatrix} 2 & 1 \end{bmatrix} \end{matrix}$$

3. Use the matrix given above to find the number of one- stopover trips between each pair of vertices.
4. Use the matrix given above (**question 2**) to find the number of two- stopover trips between each pair of vertices.
5. Define edge and vertex.

- Vertex: A point where two or more edges meet is called a vertex.
- Edge: A line joining vertices is called an edge.

Q.5.

two-stop over trips.
1 from A to A, 6 from B to A, 1 from B to B. There are 8

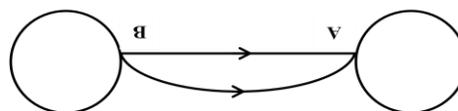
$$\begin{matrix} A & B \\ A & \begin{bmatrix} 1 & 0 \\ 6 & 1 \end{bmatrix} \\ B & \end{matrix}$$

Q.4.

one-stop over trips.
1 from A to A, 4 from B to A, 1 from B to B. There are 6

$$\begin{matrix} A & B \\ A & \begin{bmatrix} 1 & 0 \\ 4 & 1 \end{bmatrix} \\ B & \end{matrix}$$

Q.3.



Q.2.

$$\begin{matrix} A & B & C & D \\ A & \begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 0 & 1 & 2 & 0 \\ 1 & 1 & 0 & 0 \end{bmatrix} \\ B & \\ C & \\ D & \end{matrix}$$

Q.1.

Self-check for Learning



Lesson No: 2

Subject: Mathematics

Class: 9 – 10

Time: 50 minutes

Topic: Solving Systems of Linear Equations**Learning Objectives**

1. Define a linear system.
2. Solve systems of linear equation using the comparison strategy.
3. Solve systems of linear equation using the substitution strategy.
4. Solve systems of linear equation using the elimination strategy.



Think Time

1. Why do we have to learn linear equation?

Introduction

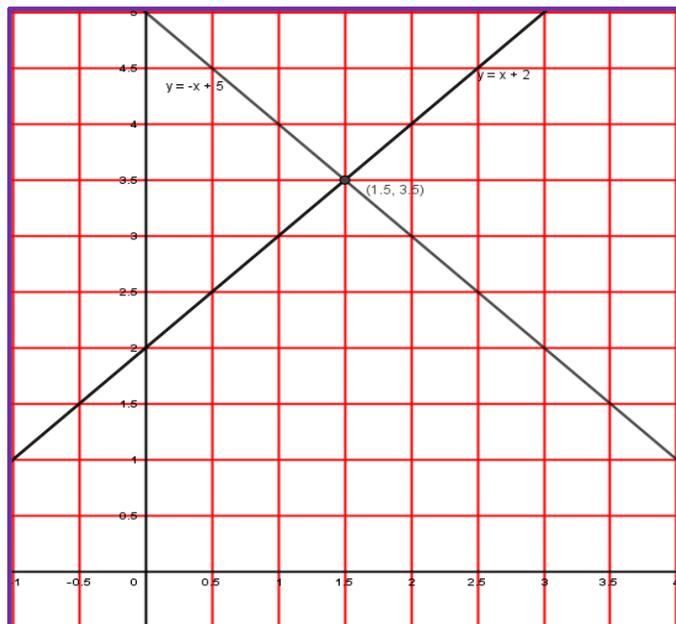
Almost any situation where there is an unknown quantity can be represented by a linear equation, like figuring out income over time, calculating mileage rates, or predicting profit. Many people use linear equations every day, even if they do the calculations in their head without drawing a line graph.

A system of linear equation is a set (group) of linear equations or collection of two or more equations that represents multiple relationships. The solution of a system of linear equations involving the variables x and y is the x - and y -values that satisfy all the equations in the set.

The solution of a system of the linear equation can be determined graphically. The solution is the intersection of the graphs of the equation in the system. For example; for the linear system $y = -x + 5$ and $y = x + 2$.

The solution to the given system of linear equation is their point of intersection at $(1.5, 3.5)$.

It is often impossible to be exact about the intersection point of the graphs, so the coordinates might be just an estimate. Therefore, if you need to be more exact, you can solve the system of equations algebraically using comparison, substitution, and elimination strategies.



Having understood the importance of the linear equation, you going to learn to solve the system of the equation through the comparison strategy.

The Comparison Strategy

Steps:

- This strategy is used when any one of the same variables in both equations can be isolated.
- In both equations, one variable is isolated to one side, to make the other sides of the equations are equal. This helps to create one variable equation by comparing the other sides of both equations and then solving to determine the value of the variable.

Solution:

$$y = -\frac{3}{4}x + 3 \text{ and } y = -\frac{3}{2}x + 3 \text{ (Here variable } y \text{ is isolated)}$$

Since $y = y$

The other sides of the equations are compared to find the value of the variable x .

$$-\frac{3}{4}x + 3 = -\frac{3}{2}x + 3$$

x is isolated as

$$\Rightarrow -\frac{3}{4}x + \frac{3}{2}x = -3 + 3$$

$$\Rightarrow \frac{3}{4}x = 0$$

$$\Rightarrow 0.75x = 0$$

$$\Rightarrow \frac{0.75}{0.75}x = \frac{0}{0.75}$$

$$\Rightarrow x = 0$$

Now substitute $x = 0$ into one of the equations to find the value of y .

$$3x + 4y = 12$$

$$\Rightarrow 3(0) + 4y = 12$$

$$\Rightarrow 0 + 4y = 12$$

$$\Rightarrow 4y = 12$$

$$\Rightarrow \frac{4y}{4} = \frac{12}{4}$$

$$\Rightarrow y = 3$$

Solution: $x = 0, y = 3$

Note: The solution means both equations are true only when $x = 0$ and $y = 3$.

**Activity 1**

Solve the following system of equations using the Comparison Strategy.

- $y = 5x$ and $y = 3x + 4$
- $5x + 2y = 9$

The Substitution Strategy**Steps:**

- To use this strategy, rearrange one of the equations in the system to isolate one of the variables. Then, substitute the expression for that variable into the other equation.

Solution:

$$3x + 4y = 12 \text{ and } 3x + 2y = 6$$

$$3x + 4y = 12 \text{ and } y = -\frac{3}{2}x + 3$$

Substitute $y = -\frac{3}{2}x + 3$ into other equation

$$3x + 4y = 12$$

$$\Rightarrow 3x + 4\left(-\frac{3}{2}x + 3\right) = 12$$

$$\Rightarrow 3x - \frac{12}{2}x + 12 = 12$$

$$\Rightarrow 3x - \frac{12}{2}x = 12 - 12$$

$$\Rightarrow 3x - 6x = 0$$

$$\Rightarrow -3x = 0$$

$$\Rightarrow \frac{-3}{-3}x = \frac{0}{-3}$$

$$\Rightarrow x = 0$$

Now substitute $x = 0$ into one of the equations to find the value of y .

$$3x + 4y = 12$$

$$\Rightarrow 3(0) + 4y = 12$$

$$\Rightarrow 0 + 4y = 12$$

$$\Rightarrow 4y = 12$$

$$\Rightarrow \frac{4y}{4} = \frac{12}{4}$$

$$\Rightarrow y = 3$$

$$\text{So } y = 3$$

Rearrangement

$$3x + 2y = 6$$

$$\Rightarrow 2y = -3x + 6$$

$$\Rightarrow \frac{2}{2}y = -\frac{3}{2}x + \frac{6}{2}$$

$$\Rightarrow y = -\frac{3}{2}x + 3$$

**Activity 2**

Solve the following system of equations using the substitution strategy.

$$3x + y = 5 \quad \text{and} \quad 2x - 3y = 7$$

The Elimination Strategy

Steps:

- This strategy is used when the equations in the linear system are in a form that allows you to eliminate any one of the variables by adding or subtracting the equations.

Solution:

$$3x + 4y = 12 \dots (i)$$

$$3x + 2y = 6 \dots\dots (ii)$$

By subtracting equation ii) from i)

$$3x + 4y = 12$$

$$3x + 2y = 6$$

$$2y = 6 \quad (\text{divide both side by 2})$$

$$y = 3$$

Now substitute $y = 3$ into one of the equations to find the value of x .

$$3x + 4y = 12$$

$$3x + 4(3) = 12$$

$$3x + 12 = 12$$

$$3x = 12 - 12$$

$$3x = 0 \quad (\text{divide both side by 3})$$

$$x = 0$$

Solution: $x = 0, y = 3$.



Activity 3

Solve the following system of equations using the Elimination Strategy.

$$3x + y = -7 \quad \text{and} \quad 2x - 5y = 1$$

Other Important Points:

- A linear equation is an equation of a line. Linear equation is not always in the form of $y = 3x + 15$ ($y = \mathbf{mx} + \mathbf{b}$). It can also be in the other forms as $y = 3(x + 5)$ or $y - 3x = 15$ or as $3x - y + 15 = 0$ ($\mathbf{ax} + \mathbf{by} + \mathbf{c} = \mathbf{0}$)
- Solving together two or more linear equations using any one of the strategies to get a common value for the variables which satisfy all the equations is called the solving system of linear equations.

Summary

- A **system of linear equation** is a set of linear equations or collection of two or more equations that represents multiple relationships.
- The **solution of a system of linear equations** involving the variables x and y is the x - and y -values that satisfy all the equations in the set.
- If we need to be more exact, we can solve the system of equations algebraically using comparison, substitution, and elimination strategies.
- The comparison strategy is used when both equations in the system have the same variable term isolated.
- To use the substitution strategy, rearrange one of the equations in the system to isolate one of the variables. Then, substitute the expression for that variable into the other equation.
- The elimination strategy is used when the equations in the linear system are in a form that allows us to eliminate one variable by adding or subtracting the equations.



Self-check for Learning

Solve the questions given below in your notebook.

1. Define a system of equation.
2. Solve the system of linear equations using all the three strategies and verify whether answers are the same in all the strategies.
 - a. $y = 4x - 1$ & $y = 1 - x$
 - b. $x - y = 1$ & $3x - y = -1$
 - c. $2x + 4y = 6$ & $2x + 3y = 4$

Self-check for Learning



1. A **system of linear equation** is a set of linear equations or collection of two or more equations that represents multiple relationships.
2.
 - a) $(\frac{5}{2}, \frac{5}{3})$ or $(0.4, 0.6)$
 - b) $(-1, -2)$
 - c) $(-1, 2)$

Lesson No: 1

Subject: Geography

Class: 9 – 10

Time: 50 minutes

Topic: Settlement

Learning Objectives

1. Define settlement.
2. List two types of settlement.
3. Explain the patterns of settlement.
4. Explain the development of towns in Bhutan.
5. Differentiate four types of towns citing an example each.

Introduction

What comes to your mind when you hear the word 'settlement'?

A settlement means a cluster of dwellings where human beings live and use the area to fulfill their needs. Settlement can be of any type, size and pattern. In short, a settlement is any form of human dwelling.

Types of Settlement

There are many different types of settlement based on pattern and shapes, facilities and services provided by it. Settlement can be broadly classified into two categories based on:

- a. size, population and occupation.
- b. the facilities/services found there.

Based on the above categories, let us look into two types of settlement:

- a. rural settlement.
- b. urban settlement.

A **rural** settlement is a settlement type where people are mainly engaged in agriculture, livestock, forestry and other primary activities.

An **urban** settlement is a settlement type where people are mainly engaged in secondary and tertiary activities such as industry, trade, transportation and services



What are the secondary and tertiary activities?

- a. **Secondary Activities** include activities that involve the manufacturing of finished goods by processing the raw materials that are found in nature in raw form. E.g. food processing units, cement factory, dairy processing unit, etc.
- b. **Tertiary Activities** include both production and exchange of goods and services. The production involves the 'provision' of goods and services that are 'consumed or used'. The exchange involves trade, transport and communication facilities that are used to overcome distance. E.g. tourism, telecommunication, health and banking services.

The Distinction between Rural and Urban Settlement

Rural Settlement	Urban Settlement
<ul style="list-style-type: none"> ● People engage in primary activities. ● Settlements are small in size. ● It has less population. ● It has a low population density. ● Modern facilities are inadequate or few. 	<ul style="list-style-type: none"> ● People engage in secondary and tertiary activities. ● Settlements are big in size. ● It has more population. ● It has a high population density. ● Modern facilities are adequate.



Activity 1

What type of settlement does your village/community belong to? Write any four characteristics to justify whether it is a rural or an urban settlement.

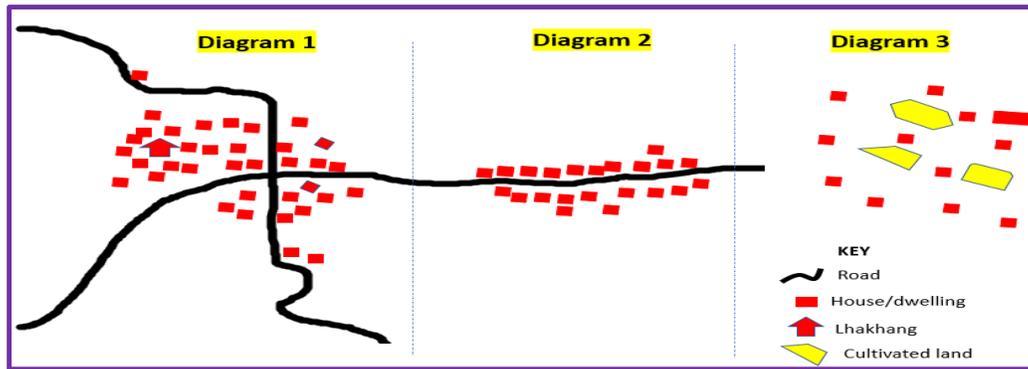
Settlement Patterns

Settlement pattern means the spatial organization of houses which describes the overall shape, appearance and identification of the settlement.

The three most important patterns of settlement found in Bhutan are:

1. Nucleated/Clustered settlement ----- Diagram 1
2. Linear Settlement ----- Diagram 2
3. Scattered/Dispersed Settlement ----- Diagram 3

The figure below shows the patterns of settlement.



Nucleated Settlement	Linear Settlement	Dispersed Settlement
<p>Houses are located close to each other, usually surrounded by cultivated lands.</p>	<p>Settlements come up along the sides of major roadways on the account of the advantages provided by the roadway.</p> <p>Majority of people set up restaurants and shops to serve travellers and inhabitants in the area.</p> <p>They are also found along the river valleys.</p>	<p>In such settlement, individual dwellings such as farmsteads or houses are scattered widely over a vast area.</p> <p>People built simple one or two-storeyed houses which may not be very far from next neighbour on their isolated farmstead.</p> <p>Farms are usually found around their houses.</p>

Pictures below show three types of settlement patterns in Bhutan.

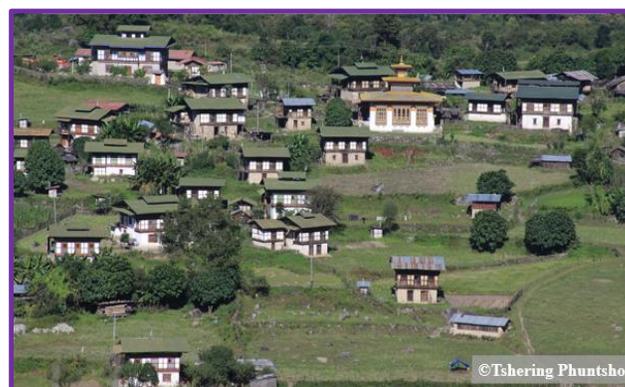


Figure: Example of a nucleated pattern of settlement

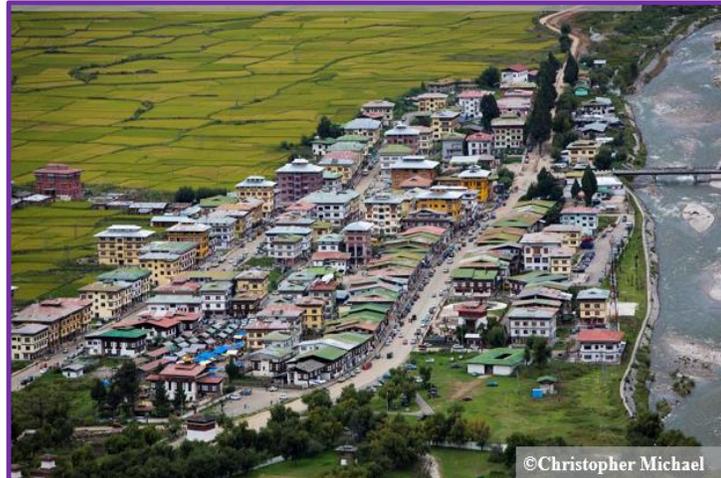


Figure: Example of a linear pattern of settlement



Figure: Example of a scattered pattern of settlement



Activity 2

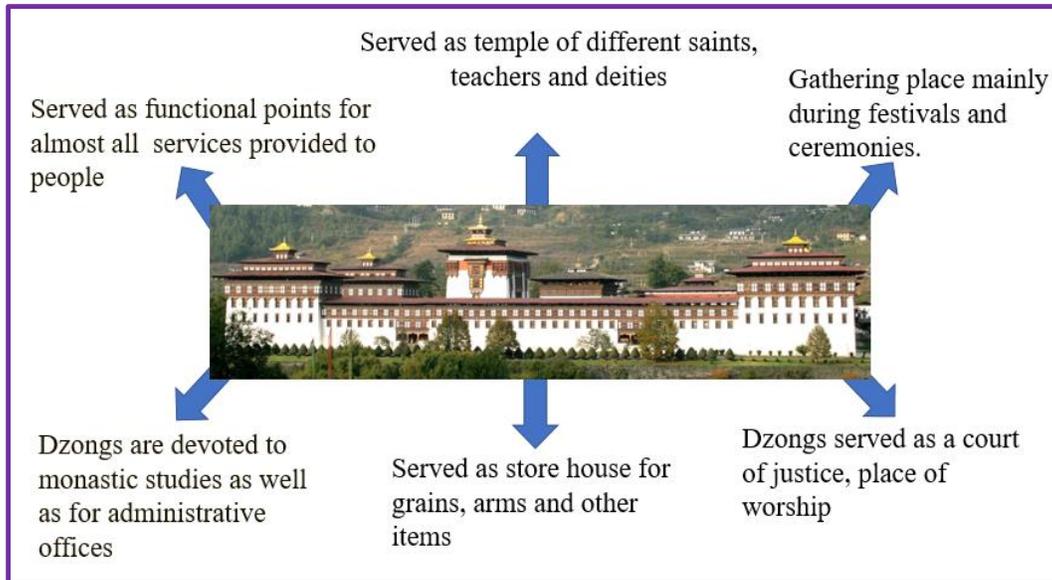
You must have seen a town. How do you think the towns must have developed in Bhutan?

Growth of Town

One of the chief characteristics of a town or an urban centre is a large number of people dwellings in a particular area. This large gathering of people is called an **urban crowd**. In the past, such large gatherings were seen occasionally in Dzong during the tshechus that is called as *mi-throm*. Over the years, a settlement near the Dzong expanded. To serve these people, facilities like health,

education, business services and other necessary services got established. This led to the growth of towns.

Now, let us look at the roles of a Dzong that helped in the development of towns in Bhutan in the past.



Activity 3

Do the Dzongs today play a similar role? Write any three points to justify your answer.

Urbanization

It is a process where people move from rural areas to urban centres and their traditional society is transformed.



Activity 4

How do traditional societies of people transform when they migrate from rural areas to urban centres?

The Main characteristic of Urban Centres:

- High population density.
- Tall concrete buildings concentrated in small areas.
- Criss-cross of streets and the presence of many shopping centres, hotels, restaurants, hospital and schools.

Rate of Urbanization

The change over time in the percentage of the population living in an urban area is known as the **rate of urbanization**. This may be due to the addition of people who come in search for better employment opportunities, service facilities and goods. People usually move from rural to urban area adding more number of people living in town or urban centre over time.

Urbanization in Bhutan

Urbanization in Bhutan is a recent phenomenon. There were no signs of urban places/towns in Bhutan until the 1960s. The rate of urbanization has been very rapid in Bhutan since then.

As the Government of Bhutan began developmental activities, the number of administrative offices and officers increased leading to more demand in facilities and needs. Residential settlements developed near Dzongs result in the growth of urban centres. Towns that develop due to administrative purpose or function is called as **administrative towns**. All the towns that are developed near the dzongs are examples of administrative towns.

There are places located along the border of Bhutan and India where trade is vibrant. This has led to the development of towns called **trade towns**. Phuntsholing, Gelephu and Samdrupjongkhar are some examples of trade towns.

With the government's focus on industrial development, some places developed into towns due to the establishment of manufacturing industries called **industrial towns**. Gomtu, Pasakha and Nganglam are some examples of industrial towns.

Education centres such as monasteries, schools, colleges and training institutes also lead to the development of towns to serve the needs of the staff and students. Such towns are called **educational** or **institutional** towns. Kanglung and Rangjung are two examples of institutional town.

Summary

- Settlement can be of two types, rural and urban.
- The three patterns of the settlement are nucleated, dispersed and linear.
- Towns have developed in Bhutan mainly near Dzong as it served various purposes encouraging people to settle near the Dzongs.
- As some towns grew large and provided more opportunities, people from rural areas move to urban centres to lead a new life.
- There are four types of town developed due to purposes the area served. They are administrative town, industrial town, trade town and education town.



Self-check for Learning

1. Mention any two differences between nucleated and linear pattern of settlement.
2. Explain how urbanization started in Bhutan. What could be the reasons for people to leave villages? Give three reasons.
3. Describe how your community has developed into a village/town or a city. You may ask your parents, elderly neighbours or your friend’s parents

1. Two differences between Nucleated settlement and Linear settlement:

Linear Settlement	Nucleated Settlement
1. Settlement spring up/ found along the roadways in an elongated pattern. 2. People would be mainly engaged in business (restaurants, shops etc)	1. Houses are located close to each other to form a cluster. 2. Farm lands usually surround the settlement.


Self-check for Learning

2. Urbanisation is a recent phenomenon in Bhutan that started only in the late 1960s with the advent of Government’s rapid socio-economic developmental activities. With the highways and road connecting many districts, gewogs and villages, it allowed construction activities (schools, hospitals, houses, hotels etc), transportation of goods (machines, foods, commodities) and services (postal, communication, tourism). Hence, due to such facilities in urban areas and employment opportunities, people from rural areas started migrating to urban areas.

The three reasons for people to leave villages are:

- i. Better facilities in urban areas/towns.
- ii. Employment/job opportunities in urban areas/ town.
- iii. Hardship and limited income in villages / rural areas.

Lesson No: 2 Subject: Geography Class level: 9-10 Time: 50 minutes

Topic: Toposheet

Learning Objectives



1. Explain types of map and its properties.
2. Identify the features of the topographical map.
3. Identify and draw the conventional signs and symbols from the toposheet map.
4. Explain Earth's grid and differentiate between latitude and longitude.
5. Distinguish eastings and northings and identify the lines.
6. Explain the steps involved in finding 4 figure grid and 6 figure grid reference

Introduction

1. Map

Suppose you want to check where on Earth you live. How can you find that? Of many ways, a map is one means that will help you locate. Just imagine our world can be viewed on a piece of paper!



Think Time

What is a map?

A map is a graphical representation of the Earth's surface on a plane surface. It is used to show shape, size, distance and direction of various features of the world.

Main Properties of a Map

A map must have a title, a key/legend, a scale and a direction. The title indicates what the map is about and a key or legend explains what each symbol or colour or shading represents. A scale on a map enables to measure the distance and calculate the area. A direction on a map is indicated by points on the compass. It is usually shown by an arrow indicating North. To qualify as a map, the above properties have to be present on a map.



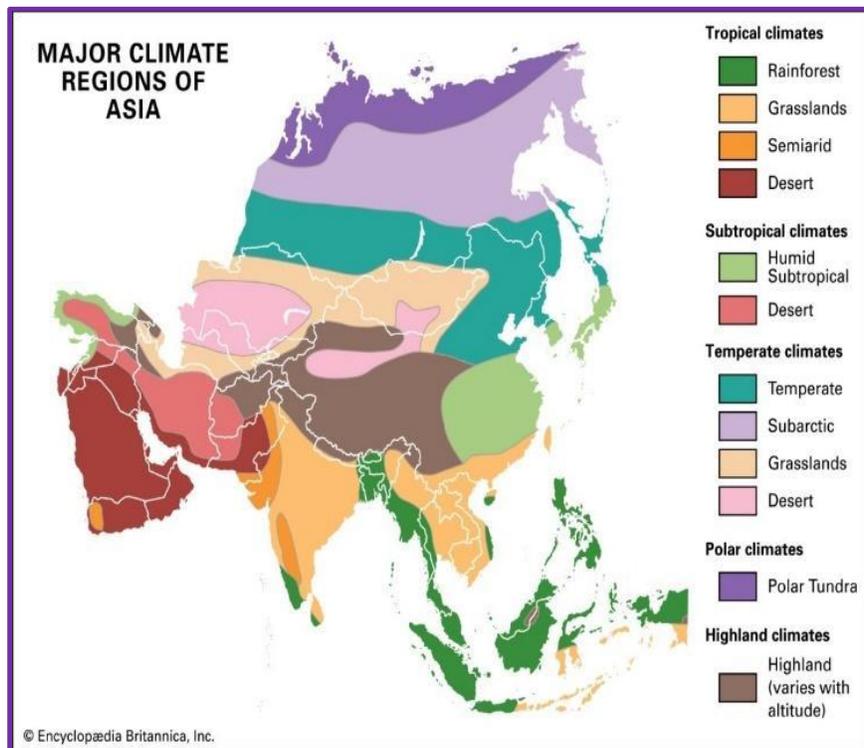
Activity 1

Draw a simple map/sketch of your village or an area you are residing currently showing properties of a map. It can be an imaginative map.

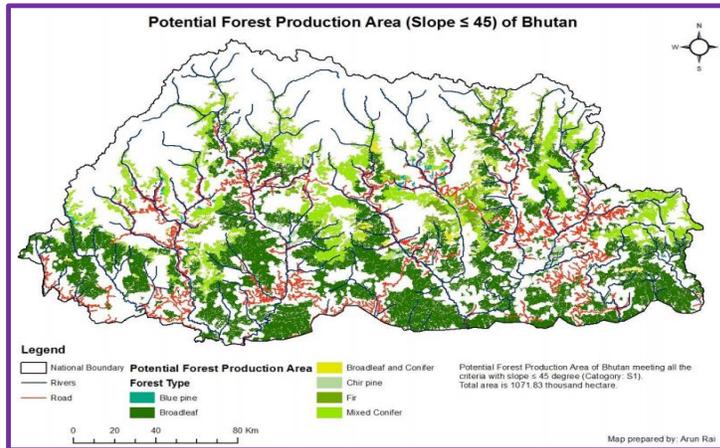
2. Basic Types of the Map

The following are the basic types of map.

Climate Map (See Map 1)	Economic or Resource Map (See Map 2)	Political Map (See Map 3)	Physical Map (See Map 4)	Topographical Map (See Map 5)
This map provides information about the climatic conditions of an area such as temperature and precipitation.	Such map shows various economic activities and natural resources present in an area.	A political map shows boundaries of countries, states/districts/gewogs, cities/thromdes.	A physical map generally shows features like mountains, rivers, plains, seas and oceans.	Shows physical features using contour lines and human-made features of a small area.



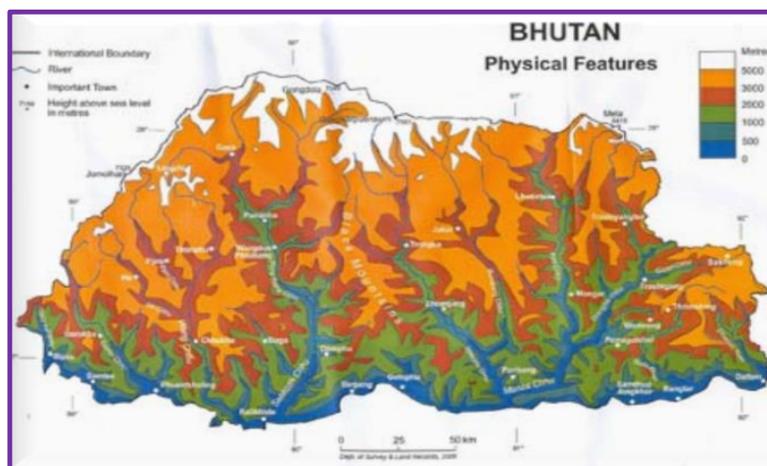
Map 1. Climate Map (Source: Encyclopedia)



Map 2. Resource or Economic Map. Note that this map shows only forest resource).
(Source: www.dofps.gov.bt)



Map 3. Political Map (Source: Bhutan.360.com)



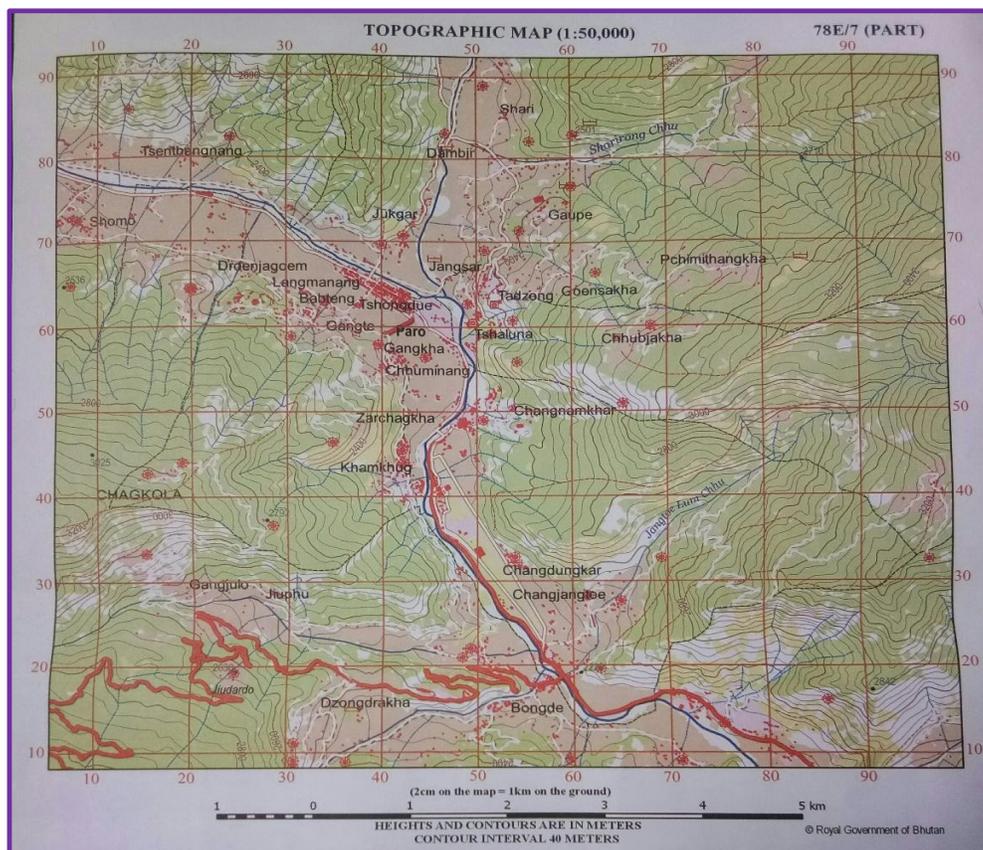
Map 4. Physical Map (Source: Bhutan.360.com)

3. Topographical Map

A topographical map or a toposheet is a map prepared based on the accurate survey of the land showing both natural and human-made features. It also shows the topography of the map with the help of contour lines. Bhutanese toposheets are prepared by Department of Survey and Land Records.

3.1. Characteristics of Topographic Map

1. It shows height/elevation using contour lines. A contour line is a line which joins points of equal elevation above sea level.
2. It shows human settlement (roads, cities, buildings, etc), including some thematic information such as vegetation or the boundaries between two gewogs or dzongkhags.
3. It has location reference systems – including latitude and longitude but may also have grid lines. Such grid lines are called eastings and northings which helps to locate a place or feature.
4. These are typically produced by government agencies – often by specialist mapping agencies and may have either a civilian or defence purpose.



Map 5. Topographical Map

To help understand the features used in the topographic map, conventional symbols and signs/keys are provided Figure 1 in the next page.

You can try finding the features and how it is represented in the topographic map.

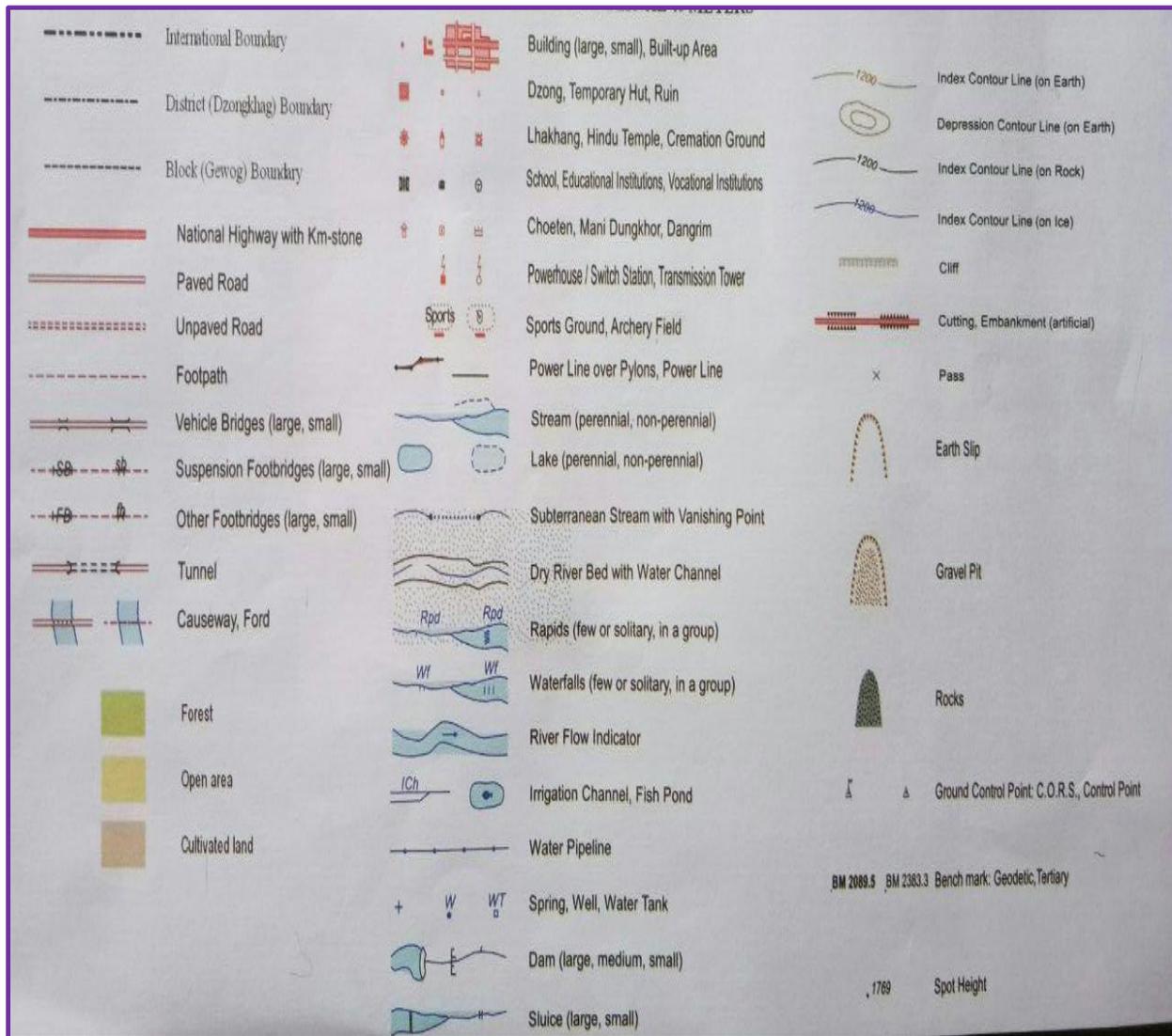


Figure 1: Conventional Symbols/Signs/Keys.

Now to acquaint you with the conventional symbols/signs/keys, do the following activity.



Activity 2

Refer Map 5 and Figure 1 to answer the following question.

Identify the conventional signs used to show the following features on the topographic map 78E/7 (PART).

- i. Footpath
- ii. Cultivated land

3.2. The Earth's Grid

A grid is a set of lines used to find the exact location of places on a map. To accurately locate the position of any place on the map, a grid system is used. It shows the location by using coordinates namely latitude and longitude. The network of latitudes and longitudes is called “Earth's Grid”.

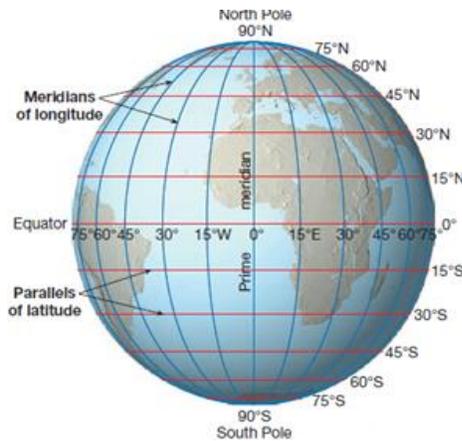
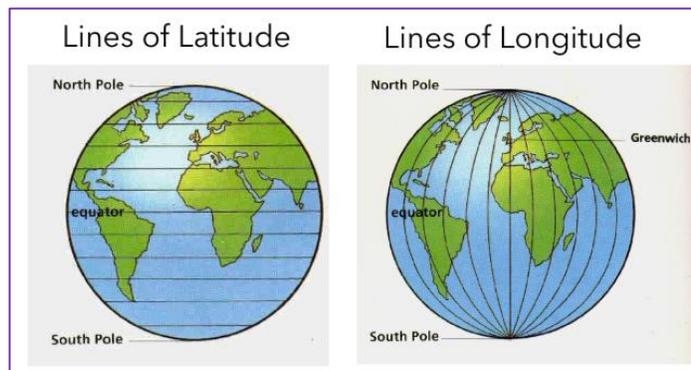


Figure: Earth's Grid



Think Time

Have you seen the diagram below before?



The above diagram shows the lines of latitudes and longitudes that form Earth's grid. All grid lines running from east to west are **latitudes**. All grid lines running from North Pole to South Pole are **longitudes**, such as Prime Meridian.

Let us look into the definitions of latitudes and longitude.

Latitude	Longitude
<ul style="list-style-type: none"> Latitude is the angular distance of a place north or south of the Equator, measured in degrees. It is also known as Parallel. The Equator is zero degree latitude. Latitude influences climate. 	<ul style="list-style-type: none"> Longitude is the angular distance of a place east or west of the Prime Meridian. It is also referred to as Meridian. The Prime Meridian is zero degree longitude. Longitude helps in determining time.

3.3. What are Eastings and Northings?

Eastings are the lines or grids that measure eastward. Northings are the lines or grids that measure northward. With the help of these grids, we can locate any places, features and landmark on the surface of the earth accurately. However, eastings are always quoted first when giving a reference and then the northings.

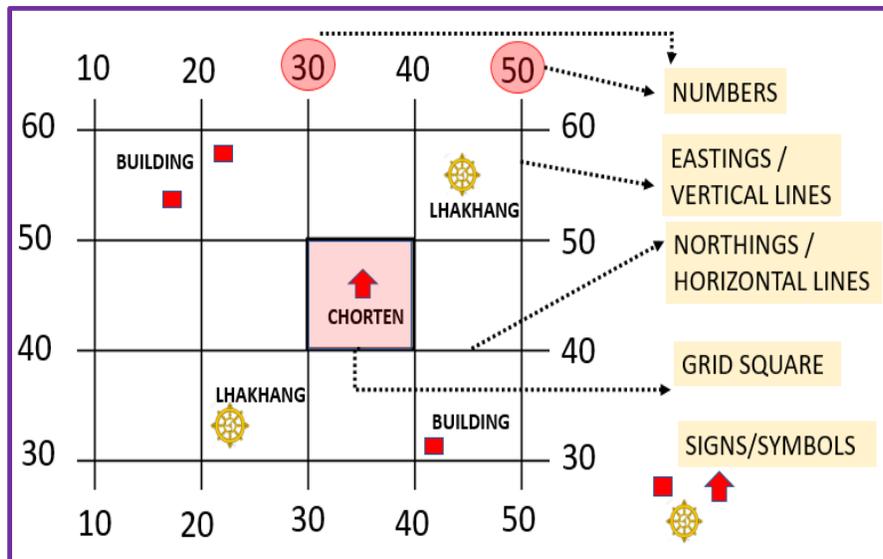
Grid Reference

There are two methods to locate places or features using the grid reference as follows:

a. Four Grid Reference

NOTE: When you are asked to find a grid reference, always remember the following points:

1. Be clear to find out what location is being asked. Observe the symbols, signs or keys.
2. You must know that in simple words eastings are vertical lines and northings are horizontal lines.

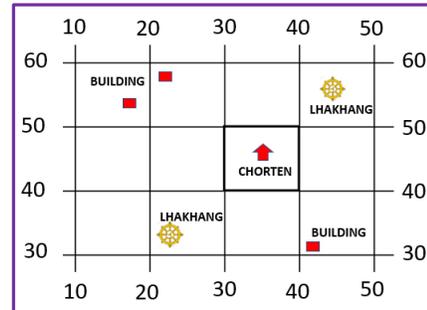


3. Always write the numbers/readings of the eastings first and then the northings. One easy way to understand this golden rule is to remember, “Along the corridor (eastings/vertical), then up the stairs (northings/horizontal)”.

4. In the four-figure grid reference, we will always have four-digit reference points.
5. The grid numbers are also called as reference points.
6. Now that we know the basic rules, let us try to find a **FOUR GRID** reference of a location using the following steps.

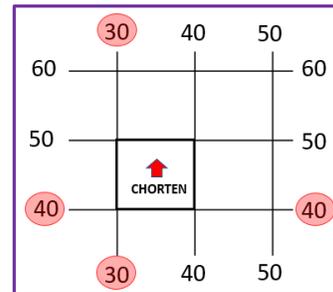
Step 1. Observe the symbol or sign you are asked to locate in a particular grid square of a toposheet.

For example a chorten (see grid).



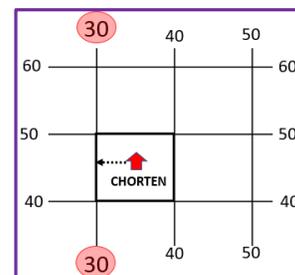
Step 2. Look at the numbers of eastings and northings of the chorten in a particular grid square.

See the numbers circled in the grid.



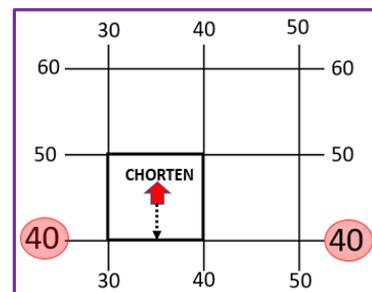
Step 3. Note down the eastings first. To do this, you have to read the line on the left-hand side of the chorten and note the grid number.

See the numbers circled in the grid. The easting number is **30**.



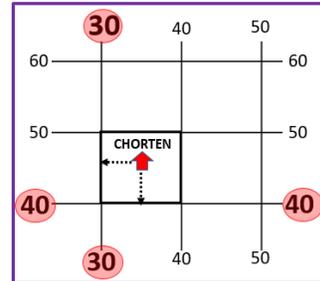
Step 4. Now, note down the northings. To do this, you have to consider the line below the chorten and note the grid number.

See the numbers circled in the grid. The northing number is **40**.



Step 5. The four grid reference of the chorten is **3040** as shown in the figure. Note that **30** is easting and **40** is northing.

The four grid reference point for the chorten is **3040**.

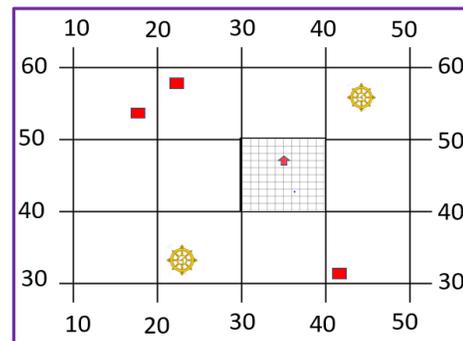


b. Six Grid Reference

The rule is similar to that of four figure grid reference. The only difference is it will have a six-digit reference point. Now let us try to find a **six grid** reference of a location using the following steps. Please note that six grid reference can locate a place or feature more accurately than the four grid reference. Let us see how.

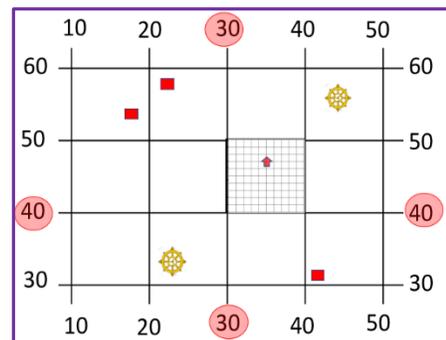
Step 1. Observe the symbol or sign you are asked to locate in a particular grid square of a toposheet.

For example a chorten (Check the grid where chorten is located).



Step 2. Look at the circled numbers of easting and northing of the chorten in a particular grid square. Note down the easting first as similar to the four grid reference. To do this, you have to read the line on the left-hand side of the chorten and note the grid number. See the numbers circled in the grid. The easting number is **30**.

Now, note down the northing. To do this, you have to read the line below the chorten and note the grid number. See the numbers circled in the grid. The northing number is **40**. So, the four grid reference of the chorten is **3040**. Since we need to find out six grid reference of the chorten, we will write the six grid reference as shown here **30_40_**.

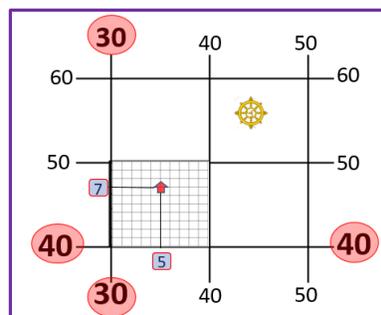


Step 3. Once you have noted the four-grid reference, the six grid reference of the chorten can be derived by the following technique.

In the figure here (which is enlarged from step 2) firstly, divide the grid square where the chorten is located into 10 equal parts using a ruler. You can divide both the horizontal and vertical lines into 10 equal parts.

By doing so, you can now pinpoint the location of chorten accurately. In the figure to the right, observe that the chorten is located quite accurately at five-tenths (5/10) of the eastings (along 30 lines) and seven-tenths (7/10) of the northings (from line 40 upward). Similar to the four-grid reference, note down the easting numbers first and then the northing.

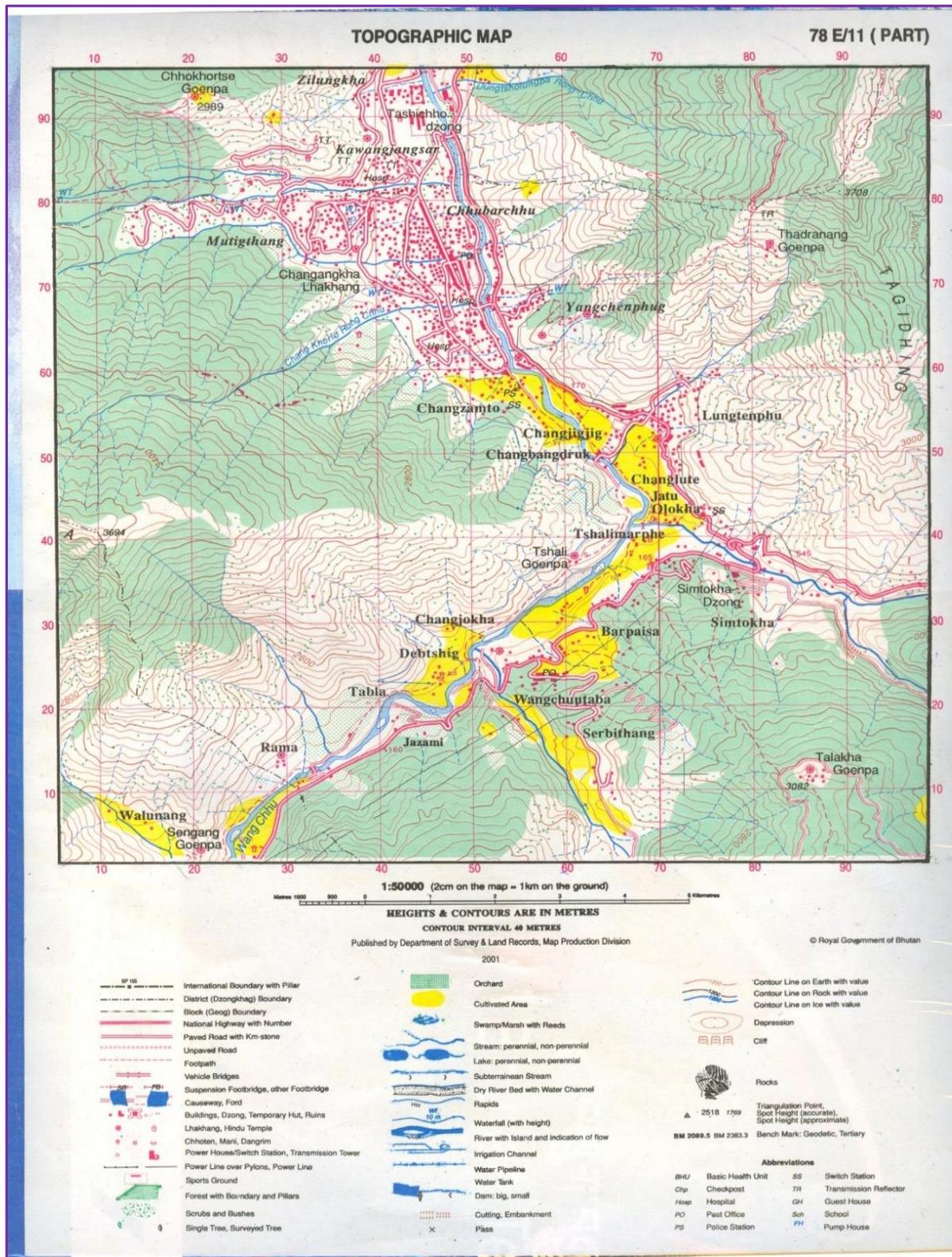
Hence, the easting number is **305** and the northing number is **407** giving us six grid reference for the chorten as **305407**.



Activity 3

Refer the topographic map 78 E/11(PART) and find four-figure grid reference and six-figure grid reference of the features below.

- i. Lhaxhang at Rama
- ii. Lhaxhang at Lungtenphu



Summary

- A map is a graphical representation of the Earth's surface on a plane surface.
- A map must have title, key/legend, scale and direction.
- Types of the map are political, climate, physical and topographical.
- The topographic map consists of both physical and human-made features which are represented using signs and symbols.
- The network of latitudes and longitudes of Earth is called "Earth's grid".
- Reference grid helps to locate places or features on the Earth's surface with the help of eastings and northings.
- Six grid reference can locate a place or feature more accurately than the four grid reference.



Self-check for Learning

Refer topographic map 78 E/11 (PART) and answer the following questions.

1. "Maps are the lifeline of navigators". Justify the statement with any three points.
2. Identify the conventional symbol for the six-figure grid reference 303805.
3. What is the conventional symbol of cultivated land and Lhakhang represented in the topographic map? Draw the symbols used.
4. Find the six grid reference of Talakha Goenpa.

4. Six grid reference of Talakha Goenpa is 806103.

		Lhakang is represented by a red Khorio.	
		Cultivated land is any yellow shaded polygon	
3	Conventional Symbols		
2		Chorten symbol	

1. The map shows locations and landmarks with signs and symbols which can be located easily. Maps show direction with a compass. Maps can pinpoint the accurate location of a place with Eastings (longitudes) and Northings (latitudes)

Self-check for Learning



འཆར་གཞི་ཨང་ ༡
དོན་ཚན་ འབྲི་ཚུལ།

ཚོས་ཚན་ རྫོང་ལ།

སློབ་འཛིན་ ༧-༡༠

དུས་ཚོད་ སྐར་མ་ ༥༠

ནང་དོན་ རྒྱུད་སྐྱུལ་འབྲི་ཚུལ་དང་ འཆར་སྤང་འབྲི་ཚུལ།

ལས་དོན།



- ༡༽ རྒྱུད་སྐྱུལ་འབྲི་ཚུལ་དང་ འཆར་སྤང་འབྲི་ཚུལ་གཉིས་ཀྱི་གོ་དོན་ ལེགས་ཤོམ་འབད་ ཉ་གོ་ཚུགས།
- ༢༽ འབྲི་ཚུལ་གྱི་ཁྱད་ཚོས་དང་ ཁྱད་རྣམ་ཚུ་ལྷག་སྟེ་ འབྲི་སྐབ་འབད་ཚུགས།
- ༣༽ འབྲི་ཚུལ་ནང་ལས་ཐོན་པའི་མིང་ཚིག་ཚུ་གི་མིང་གི་ རྣམ་གྲངས་དང་འགལ་མིང་ཚུ་ བྲི་ཚུགས།

དོ་སློབ།

༢ འབྲི་ཚུལ་ཟེར་མི་འདི་ སྤྱིར་བཏང་གནད་དོན་ཅིག་ལུ་ གཞི་བཞག་ཞིན་མ་ལས་ ཚུམ་པ་པོ་རང་སོའི་བསམ་འཆར་ཚུ་ མི་གཞན་ལུ་བཤད་ནིའི་དོན་ལུ་ བཤད་གསུང་དོན་ཚན་གྱི་དབྱེ་བ་དང་བསྟུན་པའི་ དོན་མཚན་སོ་སོར་བཅད་དེ་ དོ་སློབ་དང་ བར་གྱི་གནད་དོན་ དེ་ལས་མཇུག་བསྟུ་ཚུ་ཡོད་པའི་ འབྲི་བཀོད་ཅིག་གི་ཐོག་ལས་ ལྷག་མི་ཚུ་ ཡིད་ཆེས་བསྐྱེད་ཚུགས་པའི་ ཚོག་དོན་གྱི་ རྣམ་འགྲུར་བཏོན་ཏེ་ ཚུམ་སྒྲིག་འབད་ཡོད་པའི་ ཡིག་རིགས་ཅིག་ལུ་ སྐབ་ཨིན།

དོན་ཚན་དོ་སློབ།

༡༽ རྒྱུད་སྐྱུལ་འབྲི་ཚུལ།

རྒྱུད་སྐྱུལ་འབྲི་ཚུལ་ཟེར་མི་འདི་ རང་གི་བསམ་ཚུགས་གནད་དོན་ལུ་ མི་གཞན་ཚུ་གིས་ ཐབས་ཤེས་སྒོ་ལས་ རྒྱུད་སྐྱུལ་འབད་ཚུགས་པའི་ བདེན་ཁུངས་ཟངས་སྟེ་ བཤད་མི་འདི་ལུ་སྐབ་ཨིན། དཔེར་ན། ཆང་གི་ཉེས་དམིགས་ཚུ་བཤད་དེ་ ཆང་སྤང་དགོ་པའི་སྐོར་ལས་ འབྲི་དོ་བཟུམ་ཨིན།

✓ ཁྱད་རྣམ།

- ❖ གནད་དོན་ཚུ་ བསམ་འཆར་ཐོག་ལས་མེན་པར་ རང་བཞིན་ག་ཨིན་མ་འབད་བཀོད་ཡོད་པ།
- ❖ གནད་དོན་གྱི་སྐོར་ལས་ བཤད་པ་དང་ གོ་བ་ཚུ་ ཞུ་གསལ་དང་ བན་དོན་འཕྲོད་ཚུགས་པ་འབད་བྲིས་ཡོད་པ།

- ❖ གནད་དོན་གྱི་ཐོག་ལུ་ ག་? ག་ཅི? བླ་? ག་ཏེ? ག་ཅི་འབད? ག་དེ་སྟེ? ཟེར་བའི་དྲི་བ་ཚུ་གི་ལན་ ཉལ་མ་
བརྟུབ་འབད་བྲིས་ཡོད་པ།
- ❖ ལྷག་མི་གིས་ གནད་དོན་གྱི་སྐོར་ལས་ ག་ནི་ཡང་ཉལ་གོ་བར་ཡོད་མི་འདི་ ཉལ་གོ་མ་བཟོ་ཚུ་གསུམ་པ།
- ❖ དངོས་པོའི་གནས་ཚུལ་གྱི་བཤད་པ་དང་ ཡང་ན་ ལཱ་འབད་ཐངས་ཀྱི་བཤད་པ་ཚུ་ རང་བཞིན་ག་ཡིན་མ་ བཤད་ཡོད་པ།

༡༽ འཆར་སྐྱང་འབྲི་ཚུམ།

འཆར་སྐྱང་འབྲི་ཚུམ་ཟེར་མི་འདི་ དངོས་སུ་མ་འབྱུང་མི་ཅིག་དང་ ཡང་ན་ མ་འོངས་པའི་འཆར་བཀོད་ཚུ་ རང་གི་སེམས་ཀྱིས་
བཟོ་སྟེ་ བསམ་པའི་ཡུལ་ལས་འདས་པ་དང་ མ་འདས་པ་གང་རུང་ སློབ་ཤིང་གི་ཐོག་ལས་བཀོད་དེ་ བཤད་མི་དེ་ལུ་སྦྱབ་ཡིན།

✓ **ཅུད་ནམ།**

- ❖ དངོས་སུ་འབད་མ་འབྱུང་མི་ གནད་དོན་ཅིག་ལུ་གཞི་བཞག་བཞག་པ་ མ་འོངས་པའི་འཆར་སྐྱང་ལུ་ གཞི་བཞག་
བཞག་པ།
- ❖ སེམས་ཀྱིས་བཟོ་སྟེ་ བྲིས་བྲིས།

དཔེར་ན། སློབ་དེབ་ནང་ལུ་ བཀོད་དེ་ཡོད་པའི་འབྲི་ཚུམ་ གཤམ་འཁོད་ཤོག་གངས་དང་འཁྲིལ་ཏེ་ དཔེ་སློབ་འབད་དགོཔ་ཨིན།

- སློབ་འཛིན་ ༡༠ པ། ཤོག་གངས་ ༢༤-༣༤ ཚུན།
- སློབ་འཛིན་ ༧ པ། ཤོག་གངས་ ༢༤-༣༤ ཚུན།

སློབ་ལཱ་ ༡ པ།



སློབ་ལཱ་བཅད་ཐིག་ ༡ པ།	སློབ་ལཱ་བཅད་ཐིག་ ༢ པ།
<p>སློབ་ལཱ་འབྲི་བཀོད་ཚུ།</p> <p>༡༽ སློབ་ལཱ་ཚུ་རང་སེམས་འབྲི་དེབ་ནང་ལུ་བྲི་ནི།</p> <p>ཅན་གསོ།</p> <p>འབྲི་ཚུམ་གྱི་བའི་ནམ་དུས་ལུ་ སློབ་དེབ་ལྷན་ཐབས་ འབད་དགོཔ་སེམས་ཁར་རེས།</p>	<p>༡༽ ཚུད་སྐུལ་ཟེར་བའི་ གོ་དོན་ག་ཅི་བཟུམ་ ཅིག་ལུ་ ལེན་ནི་སྟེ?</p> <p>༢༽ འཆར་སྐྱང་འབྲི་ཚུམ་ལས་བརྟེན་པའི་ རང་གི་ཚུམ་རིག་ཚུ་ ཡར་རྒྱས་འགྱོ་ ཚུ་གསུམ་པའི་འོས་འབབ་མཐོང་མས་ག་? ག་དེ་སྟེ? བྱངས་དག་པ་ཅིག་བཀའ་ཏེ་ བྲིས།</p> <p>༣༽ སློབ་དེབ་ནང་གི་འབྲི་ཚུམ་ལུ་ དཔེ་སློབ་ འབད་དེ་ རང་སློབས་ཐོག་ལུ་ འབྲི་ཚུམ་ དོན་མཚན་ལཱ་འབད་མི་ རེ་རེ་བྲིས།</p>

བརྒྱན་བསྐྱུས།

འཛམ་གླིང་གཅིག་འགྲུར་གྱི་དུས་ལུ་ ལྷོད་པ་ལས་ ང་བཅས་རའི་ཉེ་མ་གི་ ལམ་ལུགས་གུ་དེང་རབས་ཀྱི་ འབྲི་
ཚོམ་ལམ་ལུགས་ཚུ་ ཤེས་དགོཔ་འདི་ཡང་ གལ་ཆེ་བའི་དུས་སྐབས་ཅིག་ནང་ ལྷོད་དེ་ཡོད། དེང་རབས་ཀྱི་འབྲི་
ཚོམ་ ལམ་ལུགས་ཚུ་ ཨིང་ལི་ཤ་ ལ་སོགས་པའི་ རྒྱལ་ཁབ་གཞན་གྱི་སྐད་ཡིག་ཚུ་ནང་ ཡོངས་གྲགས་ཡོད་ནི་དེ་
གིས་ རྐྱད་ཡིག་མ་འབྲ་རུང་ རིག་ལམ་གཅིག་འབད་ནི་འདི་གིས་ དེ་ཚུ་ཤེས་པ་ཅིན་ རང་གི་ཤེས་ཡོན་ཚུ་སྐྱེད་
གཏང་ནི་ལུ་ བན་པ་ཡོད།



རང་ཉིད་ལྷབ་སྐྱུར་ དབྱེ་ཞིབ།

- ༡༽ འབྲི་ཚོམ་ནང་ལས་ཐོན་པའི་ མིང་ཚིག་ཡིག་སྐབ་ཚུ་གི་ བཟོགས་པབ་དང་ རྫོང་ཚིག་བྲི་ཞི།
- ༢༽ འབྲི་ཚོམ་གྱི་ངོ་སློད་དང་ དབྱེ་བ་ དཔེ་ཚུ་ ག་དེ་མང་མང་ ལྷག་ནི།
- ༣༽ རང་དང་ ཆ་རོགས་ཚུ་གིས་ བྲིས་ཡོད་པའི་འབྲི་ཚོམ་ཚུ་ ལྷག་ནི།

འཆར་གཞི་ཨང་ ༢

ཚུལ་ཚུལ་ རྫོང་ལ།

སློབ་འཛིན་ ༧-༡༠

དུས་ཚོད་ སྐར་མ་༥༠

དོན་ཚན་ ལྷན་ཚུལ།

ནང་དོན་ སློབ་ཐོབ་ རྩལ་ལོ། དབྱེ་གཏམ།

ལས་དོན།



- ༡༽ ལྷན་ཚུལ་སྤྱིར་བཏང་གི་གོ་དོན་ མ་འཇོལ་བར་སླབ་ཚུགས།
- ༢༽ ལྷན་ཚུལ་གྱི་དབྱེ་བ་ རེ་རེ་བཞིན་དུ་གི་ གོ་དོན་ཚུ་ངོས་འཛིན་འབད་དེ་བྲི་ཚུགས།
- ༣༽ ལྷན་ཚུལ་གྱི་དབྱེ་བ་དང་འབྲེལ་བའི་དཔེ་ཚུ་ མ་འཇོལ་བར་ངོས་འཛིན་འབད་དེ་
སླབ་ཚུགས།

དོ་སློབ།

༤ ལྷན་ཚུལ་ཟེར་མི་འདི་ སེམས་ཀྱི་འཆར་སྐྱེད་གི་ རང་རྩལ་ དག་ཐོག་ལུ་ཐོན་ཏེ་འོང་མི་ཚུ་ ཚིགས་བཅད་ཀྱི་ཐོག་ལུ་ལག་ལེན་
འབབ་པའི་ དག་འཚུལ་ སློབ་ཚུལ་/འབྲེལ་ཚུལ་ དན་ཚུལ་ བསྟོན་ཚུལ་ རེ་སློབ་ཚུལ་ རྩལ་ཚུལ་ བཤད་ཚུལ་དང་ ཚུལ་ལུགས་
ནང་གི་ གཞུང་ རིག་གནས་ མན་དག་ཚུ་དང་ གཞུང་ཚོགས་ཚུ་སྤྱོད་ནང་གི་ མཚན་བསྟོན་གསལ་འདེབས་ བཤགས་པ་
སློབ་ལམ་ཚུ་དང་ ཞལ་གདམས་ མགྱར་མ་ ཚིགས་སྐྱེད་ལ་སོགས་པ་ ཚིགས་བཅད་སློབ་ཚུལ་ནང་འོང་མ་ཡིན། ར་བཅས་ར་
འཛིག་ཏེན་སྤྱིར་བཏང་གི་ ལྷན་ཚུལ་འདི་ ཚུལ་ སློབ་ཐོབ་ བསླབ་བྱ་ ལ་བཤད་ དབྱེ་གཏམ་ རྩལ་ལོ་ཚུ་ཡིན།

དོན་ཚན་དོ་སློབ།

༡༽ ལྷན་ཚུལ།

ལྷན་ཚུལ་ཟེར་མི་འདི་ གནད་དོན་ཅིག་གི་སློབ་ལས་ བཤད་པ་རྒྱབ་པའི་སྐབས་ དཔེ་དོན་སྐྱེད་ཏེ་བཤད་ནི་དང་ ཚིག་དོན་གྱི་
ནམ་འགྱུར་ ག་དེ་བཏོན་ཚུགས་ཚུགས་བཏོན་ཏེ་ ཉན་པའི་ཚིག་གི་སློབ་ལས་བརྩམས་ཏེ་ བཤད་མི་ཅིག་ལུ་གོ་མ་ཡིན།

ལྷན་ = ཉན་ཏོང་ཏོ། ཚུལ་ = བྲི་ནི། བཟོ་ནི། བརྩམ་ནི།

ལྷན་ཚུལ་ལུ་དབྱེ་བ།

- ༡༽ སློབ་ཐོབ།
- ༢༽ རྩལ་ལོ།
- ༣༽ དབྱེ་གཏམ།

༡༽ སློབ་ཞུ།

སློབ་ཞུ་ཟེར་མི་འདི་ ང་བཅས་ར་འབྲུག་རྒྱལ་ཁབ་ནང་ རྣམ་དང་ཕུ་ལས་མི་སློབ་ཤིག་ཅན་ ཁ་མཁས་པ་ དང་ ཁ་བདེ་ལྟེ་བདེ་ཚུ་ གིས་ བར་ལོགས་མའི་སློབ་གྲྭ་ལན་དང་བསྟུན་པའི་ གཏུམ་ལན་ དེ་འཕྲལ་ལས་ར་ སློབ་ཞུ་བའི་བརྩམས་ཏེ་ སློབ་མི་ངག་ཅུལ་ལུ་ སླབ་ཨིན།

དབྱེ་བ།

- ✓ རང་རྒྱུ་འབད་འཐེན་ནི་ཡོད།
- ✓ བད་དོན་ཡོད་པའི་སློབ་ཞུ།
- ✓ ལྷན་བརྗེ་ནི་ཡོད། ལྷན་བརྗེ་བའི་སྐབས་ཀྱི་དབྱེ་བ།

གཉེན་སྲུ། དག་སྲུ། དག་གཉེན་འབྲེལ་མ། བསྟོན་སྲུ། སླད་སྲུ། དེ་བ་དེས་ལན་ལ་སོགས་པ་ཡོད་རུང་ འགན་བསྐྱར་ སྐབས་ལུ་ གཉེན་སྲུ་དང་དག་སྲུ་འབད་ ལྷན་བརྗེ་ནི་འོ་སོལ་ཡོད།

༡༽ རྒྱུ་མོ།

རྒྱུ་མོ་ ཟེར་མི་འདི་ བ་གཞོན་མོ་མོ་འདུ་འཛོམས་འབད་ས་ལུ་ ག་དང་ག་ ལས་འབྲོ་ཡོད་པ་ཨིན་ན་ བཟུ་ནི་གི་དོན་ལུ་ རེ་རེ་ ལས་ ཅ་ལ་རེ་བསྟུ་སྟེ་བཟུམ་བཞག་ཞིན་མ་ལས་ ཅ་ལ་རོ་མ་ཤེས་མི་ཅིག་གིས་ རྒྱུ་དུམ་ལག་པར་བཤེད་དེ་ རྒྱུ་མོ་འོ་ཚིག་རེ་ ལུ་རྒྱུ་དུམ་ཚར་རེ་ ཅ་ལ་རེ་ལུ་དཔག་ཞིན་མ་ལས་ ཅ་ལ་གཅིག་ཁར་སོག་མི་གཉིས་གནམ་བསྐྱོས་ཡོད་པ་འབད་བཅུམ་ཨིན། རྒྱུ་དུམ་ལུ་བརྟེན་ཏེ་ མོ་བཏབ་ནི་གི་ཐབས་ལམ་ འབད་ནི་འདི་གིས་མིང་ལུ་ཡང་ རྒྱུ་མོ་ཟེར་ སླབ་ཨིན་མས།

ལྷན་ཞུ།

- ✓ ཚོག་ལྷག་པའི་སྐབས་ལུ་ ཚོག་འབྲུ་གཉིས་རེ་གཅིག་ཁར་ལྷག་དགོ།
- ✓ ཚོག་རྒྱུ་བཞེ་ནང་ དོན་དག་སྟོན་ཚུ་གསལ་འབད་འོང་དགོ།
- ✓ གདངས་དབྱེ་བ་ཀྱི་ལྷན་པར། རང་སོའི་ཡུལ་ཚུ་གསལ་དང་བསྟུན་ཏེ་ གདངས་མ་འབྲམ་འཐེན་སོལ་ཡོད། དེ་ཚུ་ག་དེ་སྟེ་ ར་ཡོད་རུང་ སློབ་ཞུ་དང་འབྲེལ་བའི་གདངས་རིང་མོ་འབད་འཐེན་དགོ།

དབྱེ་བ། གཉེན་སྲུ། དག་སྲུ། དག་གཉེན་འབྲེལ་མ། སློབ་སྲུ། བསྟོན་སྲུ། སླད་སྲུ། ལ་སོགས་པ་ཚུ་ཡོད་རུང་ སློབ་བཏང་ ལྷན་བརྗེ་བའི་སྐབས་ལུ་ གཉེན་སྲུ་དང་ དག་སྲུ་འབད་བཅུམ་ཨིན།

༡༽ དཔྱེ་གཏམ།

དཔྱེ་གཏམ་ཟེར་མི་འདི་ སློབ་སློབ་པའི་སྐབས་ལུ་ སློབ་གྲོགས་དོན་དག་འདི་ བར་ལོགས་མའི་སེམས་ལུ་ རྟོད་རིལ་རིལ་འབད་ ཉ་གོ་
བརྒྱུག་ནི་དང་ སེམས་ལས་ནམ་ཡང་མ་ཡལ་བར་ བཞག་ཚུགས་ནི་གི་དྲན་གཏམ་ལུ་ དཔེ་འཇམ་ཉོང་ཉོ་ ཡོངས་གྲགས་ཨིན་མི་
ཅིག་ལུ་སྐྱར་ཉེ་ སློབ་མི་གི་གཏམ་ལུ་སློབ་ཨིན།

དཔྱེ་གཏམ་གྱི་ཕྱད་རྣམ།

- ✓ ལ་ལུ་ཅིག་ཚོག་གཅིག་ནང་ དཔེ་དང་དོན་གཉིས་ཆ་ར་ ཡོད་པ་ཨིན།
- ✓ ལ་ལུ་ཅིག་དཔེའི་ཐོག་ལས་ དོན་དག་དོད་རིལ་རི་ བཏོན་ཚུགས།
- ✓ ལ་ལུ་ཅིག་ནང་ དཔེ་མ་སྐྱར་བར་དོན་དག་དོད་རིལ་རི་ ཉ་གོ་ཚུགས་པའི་ཚོག་ཅིག་འབད་མི་ དཔྱེ་གཏམ་ཡང་ཡོད།

སློབ་ལུ་ ༡ པ།



སློབ་ལུ་བཅད་ཐིག་༡ པ།	སློབ་ལུ་བཅད་ཐིག་༢ པ།
<p>སློབ་ལུ་འོ་བོ་དུ་གྱུ།</p> <p>༡༽ སློབ་ལུ་ཚུ་རང་སེམས་འབྲི་དེ་བ་ ནང་ལུ་བྲི་ནི།</p> <p>དྲན་གཏམ་གྱི་ སྐབས་ཚུ་གི་འདི་ནམ་དུས་ལུ་ སློབ་ དེ་བ་སྐྱོན་ཐབས་འབད་དགོ་པ་སེམས་ འར་ལེས།</p>	<p>༡༽ འོག་གི་ཟུར་སྐྱགས་ནང་ བཏོད་དེ་ཡོད་པའི་སློབ་ལུ་གི་ ལན་ཅིག་གསར་ཚུམ་འབད།</p> <p>༢༽ སློབ་ཚུ་ཅན་གྱི་མི་དབང་རྒྱལ་པོ་ལུ་ བསྟོད་པའི་སྐབས་ ཚུམ་ཅིག་གསར་ཚུམ་འབད་ནི།</p> <p>༣༽ སློབ་དེ་བ་ནང་ལས་དཔྱེ་གཏམ་༢ ལག་ལེན་འཐབ་སྟེ་ རྫོང་ཚིག་མེ་མེ་བཟོ།</p>

✓ ཟུར་སྐྱགས།

ཉན་ཅིག་འབྲུག་པའི་ན་གཞོན་ཚུ། གསལ་ཅིག་སློབ་ལུ་གསོ་མོ་ཚུ།
ནད་ཡམས་COVID-19གིས། བར་ཆད་འབྲེ་དང་བདུད་འདེ་རྒྱལ།
སློབ་གྲྭ་དལ་གསོ་བཞག་པའི་དུས། ནད་ཡམས་ཕྱེ་ནི་བཀག་དགོ་ན།
ཁྱིམ་གྱི་ནང་ན་སྡོད་དགོ་ལོ། ཁྱེད་ཁྱིམ་གྱི་ནང་ན་སྡོད་དོ་ག།
ལག་པ་སྐྱང་ལེབ་བཏབ་སྟེ་འཕྲུ་དགོ་ལོ། ལག་པ་སྐྱང་ལེབ་བཏབ་སྟེ་འཕྲུ་དོ་ག།
དུས་ཚོད་འཕྲོ་བརྒྱུག་མ་གཏང་པར། བམ་ལུ་ཆ་རོགས་འབད་དོ་ག།
དཔེ་ཆ་རྩ་འགྲུབ་སྟེ་དོ་ག། གཞན་ཡང་ལུ་དང་བྱ་བ།
གཞི་དང་གཞི་ར་འབད་དོ་ག། སློབ་ལུ་ཐོག་ལུ་བྲིས་གནང་མས།

བརྟན་བརྩམས།

སྦྱོར་ཚུལ་ཟེར་མི་འདི་ རང་གི་ལམ་སྲོལ་དང་འབྲེལ་བ་སློབ་ཡོད་པ་ལས་ ང་བཅས་འབྲུག་རྒྱལ་ཁབ་བརྒྱུ་ཅིག་ལུ་
 མི་སློབ་སྦྱང་སྲུ་དང་ སློབ་སྦྱོར་གྲུགས་མེད་པའི་རྒྱལ་ཁབ་ཅིག་འབད་མཁེས་ ཉེ་མ་ལས་དར་ཉེ་ཡོད་པའི་ ལམ་
 སྲོལ་བཟང་པོ་ཚུ་ མ་ཉམས་པར་བཞག་དགོ་པ་གལ་ཆེ། དེ་གིས་འབད་ རྒྱལ་ཡོངས་དགའ་སྦྱིད་དཔལ་འཛོམས་ཀྱི་
 ཀ་ཆེན་བཞི་པ་ ལམ་སྲོལ་ཡང་བདག་འཛིན་འབད་ཚུགས་པ་ལས་ རྒྱལ་ཁབ་ཀྱི་རང་བཅོན་ལུ་སྦྱོར་ཐབས་འབད་མཁེས་
 ཡིན། སྦྱོར་ཚུལ་རིག་པ་ཚུ་ དང་སང་གི་རིག་གསར་རྒྱུའམ་གཅིག་མེན་པར་ སློབ་མ་ལས་དར་ཉེ་ཡོད་པའི་ ཚུམ་
 གཞུང་ཚུ་ཡང་ སྦྱང་བ་འབད་དགོ་པ་གལ་ཆེ་ཤོས་ཅིག་ཡིན།



རང་ཉིད་སྦྱོར་སྦྱང་ དབྱེ་ཞིབ།

༡༽ སྦྱོར་ཚུལ་གྱི་དབྱེ་བ་ག་ཅི་འབད་རུང་ རང་སེའི་གཡུས་སློབ་དང་ལུང་ཕྱོགས་ ཡང་ཅིན་ རང་གི་
 ཕམ་གིས་ཤེས་མི་སྦྱོར་ཚུལ་ག་ཅི་ར་ཡོད་ག་ དེ་ཚུ་ སྦྱང་བ་འབད་དེ་ལག་ལེན་འཐབ་དགོ།

འཆར་གཞི་ཨང་ ༣

ཚོས་ཚན་ རྗེ་ལ།

སློབ་ཅིང་ ༧-༡༠

དུས་ཚོད་ སྐར་མ་ ༥༠

དོན་ཚན་ ཡིག་འགྲུལ།

ནང་དོན་ གན་རྒྱ།

ལས་དོན།



- ༡༽ སྤྱིར་བཏང་ ཡིག་འགྲུལ་ཟེར་བའི་གོ་དོན་ ལེགས་ཤོམ་འབད་ཏེ་གོ་ཚུགས།
- ༢༽ ཡིག་འགྲུལ་མ་འདྲམ་ག་ཅི་རང་ཡོད་པ་ཡིན་ན་དང་ གན་རྒྱ་གི་གོ་དོན་སླབ་ཚུགས།
- ༣༽ གན་རྒྱ་འབྲི་ཐངས་དང་ ལྷན་རྒྱུ་འབྲི་སླབ་འབད་ཚུགས།
- ༤༽ རང་སློབས་ཀྱིས་འབད་ གན་རྒྱ་བྲི་ཚུགས་ནིའི་ རིག་སློབས་འཐོབ་ཚུགས།

དོ་སློབ།

༣ ཡིག་འགྲུལ་ཟེར་མི་འདི་ གཞུང་དང་སྐྱེར་དོན་ ག་ཅི་ར་ཡིན་རུང་ མི་ཚུ་གི་བར་ན་ གཅིག་གིས་གཅིག་ལུ་ སླབ་དགོཔ་དང་ ལུ་དགོ་པའི་གནད་དོན་ཚུ་ ཡིག་ཐོག་ལས་འབད་ བན་དོན་རྒྱུ་འབྲེལ་འཐབ་ནིའི་དོན་ལུ་ ཡིག་རིགས་འབྲི་ཐངས་ཀྱི་ ལས་ ལུགས་ཅིག་ལུ་ ཡིག་འགྲུལ་ཟེར་གོམ་ཡིན།

དོན་ཚན་དོ་སློབ།

- ✓ གཏང་ཡིག། - ལུ་ཡིག། - བཀའ་ཤོག། - བཀའ་རྒྱ། - ལུ་ཚིག་བཤེར་ཡིག། - གན་རྒྱ། - ཚིངས་ཡིག།
- ✓ རག་བརྗོད། - འཕྲིན་ཡིག། - ཟིན་བྲིས། - ལུབ་བསྐྱུགས། - རྩོམ་གཞི། - རྩོམ་ཚོད། - གསལ་བསྐྱུགས། ཚུ་ཡིན།

༡༽ གན་རྒྱ་ཟེར་བའི་གོ་དོན།

གན་རྒྱ་ཟེར་མི་འདི་རྒྱ་ཅ་ལ་ཉེ་བཅོང་དང་ འབྲུ་དང་ཉི་རུ་སྤྱི་ཡོན། གཉེན་བསྐྱོན། ལ་འབྲུལ། སྐལ་མ་བགོ་བཤའ། ས་ཆ་ཉེ་བཅོང་། ཚུ་ འབད་བའི་སྐབས་ ཚུ་བོ་ཕན་ཚུན་གྱི་བར་ན་ ལུལ་ལས་དཀའ་ངལ་མི་འཐོན་ནིའི་དོན་ལུ་ ཉེ་མ་ལས་ར་ བར་ན་འཛོམས་ དཔང་དང་རྒྱུ་མི་ཚུ་བཅུགས་ཏེ་ ལ་ཚིག་ཡིག་ཐོག་ལུ་བཀོད་བཞག་ནིའི་ལས་ལུགས་ཅིག་ལུ་ གོམ་ཡིན།

༢༽ གན་རྒྱ་གི་ལྷན་རྒྱ།

- ✓ ཚུ་བོ་གཉིས།
- ✓ ཚུ་བོ་འེའི་རྒྱུ་ལས་རྒྱུ་མི་འེ།
- ✓ ཚུ་ཕན་གཉིས་ཀྱི་བར་ན་དཔང་པོ།

༤༽ འབའ་དང་ཉེས་ཁྲིམས།

(གལ་སྲིད་ གན་འཛིན་དེ་སྡེ་ བཟོ་ཚར་བའི་རྗེས་སུ་ ཕྱ་བོ་ཕན་ཚུན་གཉིས་ ག་གི་ཁ་ཐུག་ལས་འབད་རུང་ ཨིན་མེན་ གྱི་ཉེགས་བཤད་འབྲུང་པ་ཅིན་ འབའ་དང་ ཉེས་ཁྲིམས་གཞུང་གི་བཀའ་བཞུགས་ རྒྱལ་སྤྱི་ལཱ་ལུ་ཟེར་བའི་གན་འཛིན་ལཱ།

༥༽ ཕྱ་ཕན་དང་ དཔང་པོ་དང་རྒྱབ་མིའི་ས་ཡིག།

- ༡༽ ལྷན་འཁོར་བཅོང་མི་ སངས་རྒྱལ་གྱི་ཉེགས།
- ༢༽ ལྷན་འཁོར་ཉེ་མི་ དབང་ཚེན་གྱི་ཉེགས།
- ༣༽ སངས་རྒྱལ་གྱི་རྒྱབ་མི་ དཔང་པོ་ལྷན་གྱི་ཉེགས།
- ༤༽ དབང་ཚེན་གྱི་རྒྱབ་མི་ མཁའ་འགོ་གི་ཉེགས།
- ༥༽ དཔང་པོ་ ཚེ་རིང་གི་ཉེགས།

ཁྲིམས་ཉེགས།

ཁྲིམས་ཉེགས།

སློབ་ལུ་ ༡ པ།



སློབ་ལུ་བཅད་ཐིག་༡ པ།	སློབ་ལུ་བཅད་ཐིག་༢ པ།
<p>སློབ་ལུ་འཛིན་གྲོ་རྒྱ།</p> <p>༡༽ སློབ་ལུ་ཚུ་རང་སའི་འབྲི་དེབ་་་ ནང་ལུ་བྲི་ནི།</p> <p>བཅད་གསོ།</p> <p>གན་རྒྱ་བྲི་བའི་ནམ་དུས་ལུ་ སློབ་དེབ་ ལྟོན་ཐབས་འབད་དགོས་སེམས་ཁང་ དེས།</p>	<p>སུག་སླེང་ལས་ཨལ་ མཐོང་ལེགས་ཀྱིས་ རང་འབྲུང་ཁོམ་ ལས་ ས་ངུ་སི་ལུ་༡༣ འབད་མི་ཅིག་ ཆང་མི་ལས་ཨིན་མི་ ཨལ་དཀར་ཚུང་ལས་ ཉོ་དོ་ཡོད་པ་ལས་བརྟེན་གྱིས་ས་དང་ འབྲིལ་གན་རྒྱ་ཅིག་བཅོ།</p> <p>གན་རྒྱ་ནང་ལུ་འོག་གི་གནད་དོན་ཚུ་ ཚུད་དགོ།</p> <ul style="list-style-type: none"> ✓ ཨལ་མཐོང་ལེགས་ཀྱི་ མི་ཁྲུངས་དོ་སློབ་ལག་ཁྱེར་ཨང་། ✓ ཨལ་དཀར་ཚུང་གི་ མི་ཁྲུངས་དོ་སློབ་ལག་ཁྱེར་ཨང་། ✓ སའི་གོང་ཚད་དང་ དདུལ་སློབ་ལེན་གྱི་དུས་ཚོད། ✓ ཨལ་མཐོང་ལེགས་ཀྱི་དཔང་པོ་ སྲིད་མཐུན། ✓ ཨལ་དཀར་ཚུང་གི་དཔང་པོ་ འཇམ་དབྱེངས་དོ་རྗེ། ✓ གན་རྒྱ་བཅོ་བའི་ལྷ་ཚོས།

བཅུད་བསྐྱུས།

འཇོམ་གྱིང་གཅིག་འགྱུར་གྱི་དུས་ལུ་ སློབ་པ་ལས་ ང་བཅས་རའི་ཉེ་མ་གི་ ལམ་ལུགས་གྲུ་དེང་རབས་ཀྱི་ འབྲི་
སློབ་ལས་ལུགས་ཚུ་ ཤེས་དགོས་འདི་ཡང་ གལ་ཆེ་བའི་ དུས་སྐབས་ཅིག་ནང་ སློབ་དེ་ཡོད། དེང་རབས་ཀྱི་
འབྲི་ཐངས་ཚུ་ ཨིང་ལི་ཤ་ ལ་སོགས་པའི་ རྒྱལ་ཁབ་གཞན་གྱི་སྐད་ཡིག་ཚུ་ནང་ ཡོངས་གྲགས་ཡོད་ནི་དེ་གིས་
སྐད་ཡིག་མ་འདྲ་རུང་ རིག་ལམ་གཅིག་འབད་ནི་འདི་གིས་ དེ་ཚུ་ཤེས་པ་ཅིན་ རང་གི་ཤེས་ཡོན་རྒྱ་སྐྱེད་གཏང་
ནི་དང་ མི་ཚེ་སློབ་ཚུགས་པའི་ཁེ་ཕན་ཡོད།



རང་ཉིད་སློབ་སྦྱོར་ དབྱེ་ཞིབ།

༡༽ ཡིག་བསྐྱར་ནམ་གཞག་གི་ ཀེ་དེབ་མ་འདྲམ་ཡོད་མི་ཚུ་ ག་དེ་བྲག་བྲག་སྐྱུག་ དེ་ལས་ སློབ་
རིམ་༧-༡༠ པའི་ སློབ་དེབ་སྐྱུག་སྐྱེ་ གན་རྒྱ་བྲི་ནི་ལུ་སྦྱང་བ་ ག་དེ་མང་མང་འབད་གནང་བཟེ་
ལུ་ནི་ཨིན།

འཆར་གཞི་ཨང་ ༤

ཚོས་ཚན་ རྫོང་ལ།

སློབ་འཛིན་ ༧-༡༠

དུས་ཚོད་ སྐར་མ་ ༥༠

དོན་ཚན་ ལྷག་རིག་དང་རྩོམ་རིག།

བར་དོན་ སྲུང་བྱུང་ལྷ།

ལས་དོན།



༡༽ སྲུང་ཟེར་མི་འདི་ ག་ཅི་བརྩམ་ལུ་སྲུབ་ཨིན་ན་ བཤད་པ་རྒྱབ་ཚུགས།

༢༽ སྲུང་གི་དབྱེ་བ་དང་ ཚང་དགོ་པའི་བྱུང་ཚོས་ག་ཅི་ར་ཨིན་ན་ རོས་འཛིན་འབད་ཚུགས།

༣༽ སྲིར་བཏང་ སྲུང་གི་ཉམས་ ག་ཅི་ར་ཨིན་ན་ བྲི་ཚུགས།

དོན་ཚན་དོ་སློབ།

༤ སྲིར་བཏང་སྲུང་ཟེར་མི་འདི་ ཉེ་མ་ལས་ དངོས་སྲུབ་བྱུང་མ་དང་ ཡང་ན་ མི་སློབ་རིག་ཅན་ཚུ་གིས་ སེམས་ཀྱིས་བཟོ་སྡེ་ ལོ་རྒྱུས་ཀྱི་འབྲུང་རིམ་ཅིག་ཁ་གསལ་འབད་ གོ་རིམ་བསྒྲིགས་ཏེ་ བཤད་མི་ཅིག་ལུ་སྲུབ་ཨིན།

སྲིར་བཏང་སྲུང་གི་དབྱེ་བ།

སྲིར་བཏང་སྲུང་ལུ་ ལྷ་སྲུང་། མི་སྲུང་། འཛེ་སྲུང་། སེམས་ཅན་གྱི་སྲུང་ཟེར་ དབྱེ་བ་ལེ་ཤ་འབད་ཕྱེ་ནི་ཡོད་ཅུང་ དེ་ཚུ་ ག་ ར་ ལ་ལུ་ དངོས་སྲུབ་བྱུང་མ་དང་ ལ་ལུ་ཅིག་ སློབ་རིག་གི་ཐོག་ལས་ སེམས་ཀྱིས་བཟོ་བཟོམ་འབད་མ་ལས་ བཅུད་བསྡུ་ བ་ཅིན་ དངོས་སྲུབ་བྱུང་མ་ཚུ་ག་ར་ དངོས་སྲུང་དང་། སློབ་རིག་གི་ཐོག་ལས་ སེམས་ཀྱི་བཟོ་མི་ཚུ་ག་ར་ འཆར་སྲུང་ནང་ བསྡུ་མ་ཨིན།

སྲུང་གི་བྱུང་ཚོས།

༡༽ གནས་དུས་མཚུངས་ ཟེར་མི་འདི་ སྲུང་འདི་ག་ཏེ་སྡེ་བྱུང་བྱུང་མ་ཨིན་ན་ ས་གནས་དང་ དུས་ཚོད་ནམ་གུང་བྱུང་ཡི་ག་ བཀོད་མི་ལུ་སྲུབ་ཨིན། (ལྷག་མིའི་སེམས་ཁར་ ས་གནས་འདི་ཁར་ རོ་མ་ལྟོད་ལྟོད་པ་བརྩམ་གྱི་ཚོར་བ་ བྲིན་ཚུགས་པའི་ བཤད་པ་རྒྱབ་དགོས་ཨིན།)

༢༽ སྲུང་རྩེད་མཚུངས་ ཟེར་མི་འདི་ སྲུང་འདི་ནང་བཅའ་མར་གཏོགས་མི་ ག་དང་ག་ར་ཡོད་པ་ཨིན་ན་ བཀོད་མི་ལུ་སྲུབ་ཨིན། (ལྷག་མི་ཚུ་གིས་ སྲུང་རྩེད་པ་འདི་ དངོས་སྲུབ་མཐོང་མཐོང་མ་བརྩམ་གྱི་ཚོར་བ་ བྲིན་ཚུགས་པའི་བཤད་པ་རྒྱབ་དགོས་ཨིན།)

༣༽ རྩོགས་གཞི་ ཟེར་མི་འདི་ སྲུང་འདི་ནང་སྤབས་མ་བདེ་བའི་དཀའ་ངལ་གཙོ་བོ་འདི་ལུ་སྲུབ་ཨིན། (ལྷག་མིའི་སེམས་ཁར་ རྩོགས་གཞི་གི་ཤུལ་ལས་ ད་རུང་སྤབས་མ་བདེ་མཚུངས་ ག་ཅི་ར་འབྲུང་འོང་ག་ ཟེར་བའི་ཚོར་བ་བྲིན་ཚུགས་པའི་བཤད་པ་ རྒྱབ་དགོས་ཨིན།)

- ༡) ཚོར་ལྷགས་མེར་མི་འདི་ སྲུང་འདི་འབྲི་བའི་སྐབས་ འདྲོག་སི་སི་དང་དགོད་བྲ་སི་སི་ རམ་སི་སི་ ལ་སོགས་པའི་ཉམས་གཤིབ་སློབ་ལས་ བཤད་པ་ཨོན་ན་ལུ་སྐབ་ཨོན། (ལྷག་མིའི་སེམས་ཁར་ ཉམས་དང་བསྐྱེད་པའི་ཚོར་བ་ ཕྱིན་ཚུགས་པའི་བཤད་པ་རྒྱབ་དགོས་ཨོན།)
- ༢) ཞི་ཐབས་མེར་མི་འདི་ གོང་གི་ཚུགས་གཞི་སེལ་ཐབས་ སྦྱོར་ཅིག་ལུ་སྐབ་ཨོན། (ལྷག་མིའི་སེམས་ཁར་ ངལ་རངས་འབྱུང་ཚུགས་པའི་ དཀའ་ངལ་སེལ་ཐབས་ཀྱི་ཚོར་བ་ ཕྱིན་ཚུགས་པའི་བཤད་པ་རྒྱབ་དགོས་ཨོན།)
- ༣) བརྗོད་དོན་མེར་མི་འདི་ སྲུང་འདི་ནང་ལས་ ལྷག་མི་ཚུ་ལུ་ གོ་བཟླ་སྦྱོད་དགོ་པའི་དོན་དག་རོ་མ་འདི་ལུ་ སྐབ་ཨོན། (ལྷག་མི་ཚུ་ལུ་ སྲང་སྲང་གི་ཡོན་ཏན་ཕྱིན་ཚུགས་པའི་བཤད་པ་ རྒྱབ་དགོས་ཨོན།)

སྲུང་གི་ཉམས་བརྒྱུད།

- ༡) ངལ་རངས་ཏོག་ཏོ།
- ༢) འདྲོག་སི་སི།
- ༣) དགོད་བྲ་སི་སི།
- ༤) རམ་སི་སི།
- ༥) ཐ་རྱུགས་སི་སི།
- ༦) འཁྲུལ་སི་སི།
- ༧) སྦྱོ་སི་སི།
- ༨) ཉ་ལས་སི་སི།



སློབ་ལུ་ ༡ པ།



སློབ་ལུ་བཅད་ཐིག་༡ པ།	སློབ་ལུ་བཅད་ཐིག་༢ པ།
<p>སློབ་ལུ་འོ་བོ་དུ་རྒྱ།</p> <p>སློབ་ལུ་ཚུ་རང་སེའི་འབྲི་དེ་བ་ནང་ལུ་བྱི་ཞི།</p> <p>བྱ་གསོ།</p> <p>སློབ་ལུ་འོ་བོ་དུ་རྒྱ་ལུ་སློབ་དེ་བ་ལྟན་</p> <p>ཐབས་འབད་དགོ་ཐེ་མཁས་ཁར་དེས།</p>	<p>✓ སློབ་འཛིན་དགུ་པ་དང་བཅུ་པ་ གཉིས་ཆ་ར་</p> <p>གིས་ བྱེད་རེའི་སློབ་དེ་བ་ནང་ཡོད་པའི་ སློབ་</p> <p>དང་པམ་འདི་ ལྷག་ཞིན་མ་ལས་ སློབ་གི་བྱེད་</p> <p>ཚོས་དང་ སློབ་གི་ཉམས་ཚུ་ རང་སེའི་འབྲི་</p> <p>དེ་བ་ནང་ ཐོ་བོ་དུ་འབད་ནི།</p> <p>✓ སློབ་དེ་བ་ནང་ཡོད་པའི་སློབ་དང་པམ་འདི་</p> <p>ལྷག་ཞིན་མ་ལས་ བྱེད་རེའི་མི་ཚོའི་གནས་</p> <p>སྤངས་དང་ འབྲེལ་བ་ཡོད་པའི་གནས་སྤངས་</p> <p>ཅིག་ལུ་ གཞི་བཞག་སྟེ་ རོན་མཚམས་</p> <p>གཅིག་མི་ནི།</p>

བཅུད་བསྟུས།

འཇོན་གྱི་གཅིག་འགྲུར་གྱི་དུས་ལུ་ ལྟོད་པ་ལས་ ར་བཅས་རེའི་ཉེ་མ་གི་ ལམ་ལུགས་ཀྱི་དེང་རབས་ཀྱི་ འབྲི་

སློབ་ལམ་ལུགས་ཚུ་ ཤེས་དགོ་པ་འདི་ཡང་ གལ་ཆེ་བའི་ དུས་སྐབས་ཅིག་ནང་ ལྟོད་དེ་ཡོད། དེང་རབས་ཀྱི་འབྲི་

ཐངས་ཚུ་ ཨིང་ལི་ཤ་ ལ་སོགས་པའི་ རྒྱལ་ཁབ་གཞན་གྱི་སྐད་ཡིག་ཚུ་ནང་ ཡོངས་གྲགས་ཡོད་ནི་དེ་གིས་ སྐད་

ཡིག་མ་འདྲ་རུང་ རིག་ལམ་གཅིག་འབད་ནི་འདི་གིས་ དེ་ཚུ་ཤེས་པ་ཅིན་ རང་གི་ཤེས་ཡོན་ལྷན་སྦྲེན་གཏང་ནི་དང་

མི་ཚོ་སློབ་ཚུགས་པའི་ཁེ་ཕན་ཡོད།



རང་ཉིད་སློབ་སྦྱོར་ དབྱེ་ཞིབ།

༡༽ སློབ་ལུ་འདི་ རང་སོའི་ཚོས་ཚན་སློབ་དཔོན་གྱི་ སློབ་རིག་ཡོངས་འབྲེལ་ཁ་བྱང་ཐོག་ལས་དང་
ཡང་ན་ Google Classroom གི་ཐོག་ལས་ དབྱེ་ཞིབ་གྱི་དོན་ལུ་ བསྐྱེད་དགོ་ཟེར་སླབ་
ནི་ཨོན།

༢༽ རྒྱུད་རང་གིས་དགའ་མི་སླུང་ཅིག་གདམ་ཁ་རྒྱབ་སྟེ་ སླུང་གི་ཉམས་བརྒྱུད་དོས་འཛིན་འབད་ནི་
དང་གཅིག་ཁར་ སློ་ཚིག་ནང་བཀོད་དེ་ སླུང་སླུང་ཀྱི་ཅིག་ཐི་ཞིའི་སླུང་བ་འབད།