

5. WORK SIMPLIFICATION

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- 5.3 Mundel's Classes of Change
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Let us discuss about Work Simplification :

Majority of household tasks are tedious, monotonous, time consuming and require patience and various types of skills. It is observed that every individual is trying to conserve energy and time while doing such work. Hence, it becomes necessary to know how to simplify the work by acquiring knowledge of work simplification. If the methods of work performance are systematic, necessary equipment is efficient and the work environment is suitable then work can be simplified. Work simplification means use of simple and easy method of working. To accomplish maximum work within given time and energy or spending minimum time or energy, to accomplish both, a given amount of work, maintaining the same standard or quality of work, are the main principles of work simplification.

5.1 Meaning and Definition :

Nickell and Dorsey defined Work simplification as “conscious seeking of the simplest, easiest and quickest method of doing work”. In other words Work Simplification is defined as technique of accomplishing a task by using the least amount of time and energy.

According to Gross and Crandall, “Work Simplification is accomplishing more work with given amount of time and energy or reducing the amount of either or both to accomplish a given amount of work”.

- **Nodeller** has defined work simplification as follows :

“Work simplification is the systematic procedure for analysis of work to-

- a. Eliminate unnecessary work
- b. Arrange the remaining work in the best order possible
- c. Standardize the proper work methods
- d. Establish accurate time-standards.”

According to Gilbreth, Thomas and Clymer the term work simplification is a commonsense approach to make-work easier. Any type of work can be simplified by applying scientific management of time and energy.

5.2 Importance of Work Simplification :

Many scientists have done time and motion studies in the industrial field. It is revealed from these studies that some-times unnecessary motions are made while working and extra time and energy is spent for those motions. If methods of work are improved by reducing unnecessary motions while working, saving of time and energy is possible. At the same time there is an increase in production. The experience is similar in household work. Hence different experiments were conducted to find out new methods of work to reduce fatigue. Conducive environment, efficient equipment and simple, easy, and rhythmic work methods can reduce expenditure of time as well as energy.

Work simplification applied in household work helps in many ways :

1. It minimizes work time by eliminating unnecessary movements and by adding more effective motions.
2. It reduces energy expenditure by reducing motions in work.
3. Individual does not get tired, as the working method is simple, easy and more trouble-free.
4. More work can be done in given time and energy as muscles involved in a particular work are systematically and efficiently used.
5. The work output is more, and constant working is possible because of evaluation and elimination of strenuous body posture.
6. It helps to inculcate time consciousness in the worker.
7. Motion-mindedness is created in the worker.
8. It reduces frustration resulting from lack of effectiveness in work performance.
9. Worker learns easier working methods of a specific task.
10. Worker develops the habit of careful observation and evaluation of own working method.

5.3 Mundel's Classes of Change :

The work simplification studies of household tasks have shown that improvement in work methods is possible, and "best work methods" can be developed for different households. The improvement is possible by changing old habits, which is not an easy and quick process; it requires intense desire and attitude for change.

Do You Know ?

The concept of classes of change was stated by **Dr. Marvin Mundel** at Purdue University in 1940. Hence these changes are known as **Mundel's Classes of Change**.

Dr. Marvin Mundel has classified motions

into five levels and shown how without actual laboratory procedure, improvement can be made on the job through a careful analysis of what is being done. The classes or types are given names according to the place where we make the changes.

Mundel has classified these changes into following types :

1. Changes in body position and motion
2. Changes in work arrangement and equipment
3. Change in production sequence.
4. Change in finished product.
5. Change in raw material.

1. Changes in body position and motions :

With changes carried out in body posture and motions, time and energy can be saved. The worker should arrange the work place so that most of his/her body is resting while both hands work rhythmically from right to left. One should avoid walking more while working. According to Goetz, Eldena, Sarah and Fitzsimmons, "classical work simplification is based on motion economy, which helps in reduction of time for household task". To apply the changes in body position and motions while performing tasks, one can follow principles of motion economy for better and effective result.

The important Principles of Motion Economy are as follows :

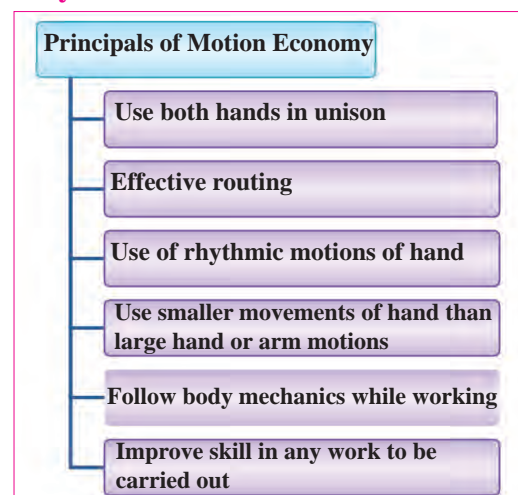


Fig. 5.1 Principles of Motion Economy

- **Use both hands in unison :** We do not think that we can work by using the left hand because we are habituated to work by using the right hand. But if the right hand is put to more work, after some time its efficiency is reduced. Hence both hands are to be used wherever possible for example-lifting a bag of articles, drying clothes etc.
- **Effective routing :** While performing any task we must arrange the work centers in such a way that one has to walk through the shortest paths for the work and use them, so that walking is reduced and energy is saved. Plan of work should be made ahead of time to reduce total distance walked during the job.
- **Use of rhythmic motions of hand :** When one type of action is done repetitively, that action gets speed. It is called rhythm. Gross and Crandall defined "Rhythm as a muscular performance and with repetition of movements at the same tempo". The work is done quickly due to rhythm because actions done one after another do not require impulse every time. In repetitive jobs like dish washing or mopping the floor, rhythmic motions of hand should be used. While cleaning utensils it becomes easy to clean one type of utensils at a time such as collecting and cleaning all dishes or glasses in continuity.
- **Use smaller movements of hand than large hand or arm motions :** By using smaller movements of hand than large hand motions or arm motions, worker's energy is saved. Similarly, using smooth movements than jerky ones makes the work easier.
- **Use of body mechanics :** If the worker follows principles of body mechanics, the energy requirement for particular task can be reduced and work output can be increased.

- i) **Keeping body parts in alignment :** When various body parts are correctly positioned, i.e. each centered over the base of support, it results into stability in standing as well as in sitting positions. When any part gets out of line, muscular effort is required to maintain body balance in addition to whatever work the body is doing thus resulting into strain.

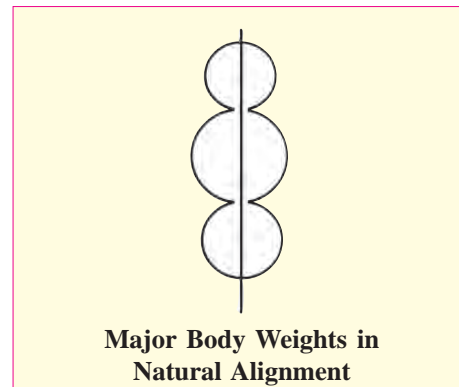


Fig. 5.2 (a) Body Alignment-Natural

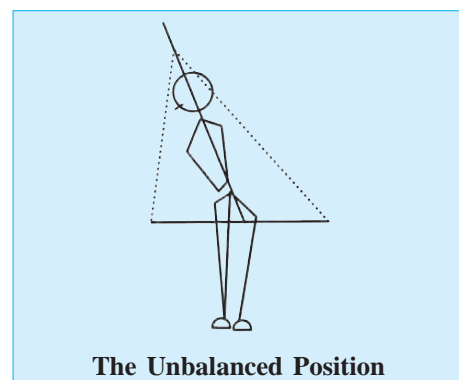


Fig. 5.2 (b) Body Alignment-Unbalanced

- ii) **Using muscles effectively :** Effective use of muscles is important in doing any household task. Sweeping the floor and lifting objects from the floor by back bending is strenuous on the backbone. Instead of bending to sweep, one can use a long-handled broom and do the work by standing erect and in a stable posture. One can substitute leg muscles for back muscles when lifting weights or objects from the floor. One can use the bending posture by bending at knee and thigh

joints and using the strong muscles of legs.

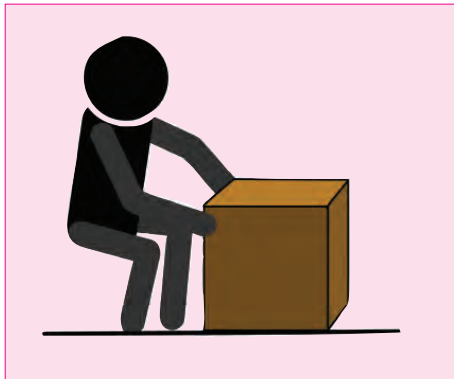


Fig. 5.3 (a) Good Way of Lifting Object



Fig. 5.3 (b) Bad Way of Lifting Object

iii) **Consider Centre of gravity :** Considering the centre of gravity is of importance in lifting, supporting or carrying a load and reaching to get an object. It is desirable to keep the load close to the body. As far as possible keep the centre of the weight of the object through the centre of the body and avoid twisting the body. The custom of carrying any load on the back is an example of keeping the load close to body.

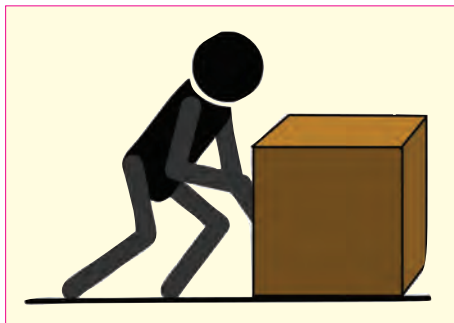


Fig. 5.4 (a) Good Way of Pushing Object

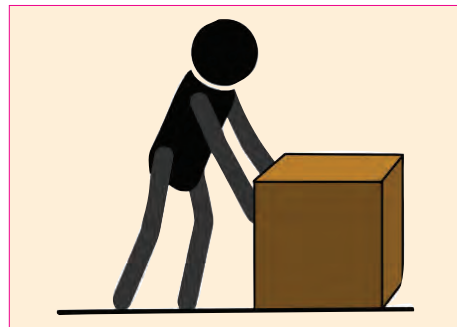


Fig. 5.4 (b) Bad Way of Pushing Object

iv) **Skill in work :** Skill is defined as "**familiar knowledge**" which is combined in practical application to work performance. It is essential to develop skill in carrying out the household chores, because it helps in eliminating extra motions. These skills can be learnt by observation, sharing the responsibilities with other workers in the family, and getting familiar with the work. When confronted with a task, trial and error method is used haphazardly by many of us. These methods are many times ineffective and result into many awkward motions. When the movements for any job fall into a smooth rhythm, the efficiency of the home-maker improves.

2. Changes in work arrangement and equipment :

This includes re-arranging or modifying kitchen equipment, organizing storage space; ensuring that the height and width of work spaces is suitable to the user; adding new, modern and improved equipment and tools in the home etc. Before, buying any equipment, its utility must be weighed against cost and the ease with which it can be maintained. In addition to acquiring the labour-saving devices, it is necessary that devices should be placed within reach and near at hand. Only then it can be used regularly and comfortably.

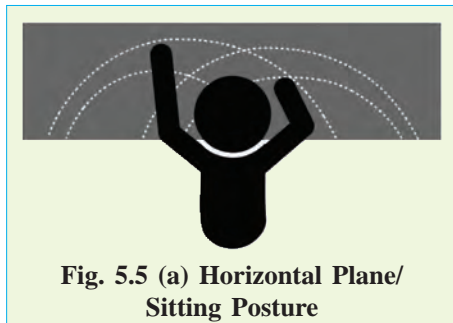


Fig. 5.5 (a) Horizontal Plane/
Sitting Posture

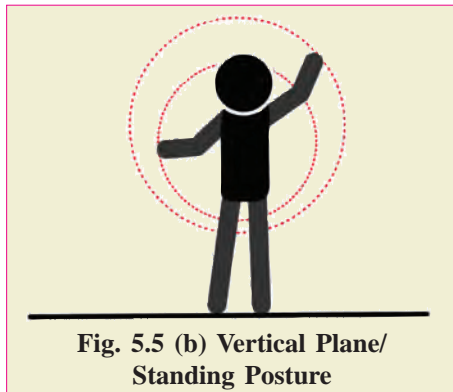


Fig. 5.5 (b) Vertical Plane/
Standing Posture

Fig. 5.5 Comfortable Working Area



Fig. 5.6 : Arrangement of Work Place

Always Remember :

- The height of the work surface must be adapted to suit the worker.
- Storage areas in the kitchen and elsewhere are often capable of being re-organized to help the housework to proceed better.
- Items needed often should be placed within reach and at accessible place.
- Grouping of material required for a particular job helps to save worker's energy.

3) **Change in production sequence :** Work done haphazardly creates confusion and causes delays. As there are number of activities to be done in the home, such as cooking, getting children ready for school, packing lunch boxes, bed making etc., each activity should be followed up in a sequence. When there are many activities to be done in a shorter time one must also think of combining or dovetailing of tasks. Finding the best order of work or the easier method of doing a task and putting it into practice saves both steps and motions. For example, in cleaning the house, continuation of each process of sweeping, dusting, and mopping floor throughout the house helps to save time in handling of tools, develops rhythm in work, and creates faster flow of work.

4) **Change in finished product :** Most families have certain preconceived standards for housekeeping. Habits are deeply ingrained and sometimes difficult to change. Careful thinking on the part of the homemaker and his/her ways of persuading the family to accept new ideas can permit them to change some of their ways. The worker might have to change some of her or his standards or expectations about how the finished product should be in appearance, taste, shape, size etc. For example, if the finished product without any fancy decoration is accepted by the family then it makes the task simplified.

5) **Change in raw material** : This change refers to the raw ingredients used in a product keeping the final product same. For example, using paper napkins in place of cloth napkins saves the efforts of cleaning. Using ready to use mixes available in market-for certain recipes, or even buying ready-made products such as spices, sprouted beans and pulses, or frozen foods and clothes made of new fibers may be easier to maintain than traditional materials.

A combination of these five types of changes, careful and imaginative thinking, willingness to modify existing work habits and ability to get the support of the family will go a long way towards making the tasks of the worker easier, quicker and more satisfying.

5.4 Techniques of Work Simplification :

Work simplification is primarily based on motion and time study. Improvement in work methods of an individual is possible through observing, recording and analysing various motions of worker while working. There are variety of techniques which could be used to study motion and time required for completion of task. These techniques are classified in two major categories :

Formal Techniques and Informal Techniques.

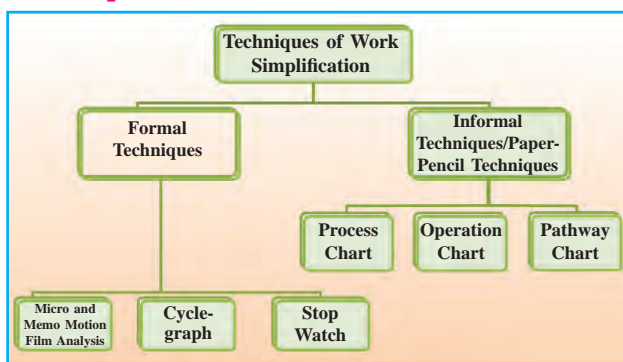


Fig. 5.6 Techniques of Work Simplification

➤ **Formal Techniques** : Formal Techniques require specific equipment and devices. These techniques are more accurate, effective and scientific in way of studying

motions. These techniques include Micro Motion and Memo Motion Film Analysis, Cycle-graph, and Stop Watch.

- **Micro Motion and Memo Motion Film Analysis** : These two techniques are primarily used for detail and accurate analysis of the task. The tasks which can be easily filmed are analyzed by these techniques. In this, motion picture or video film of task is prepared under normal working condition. This recording of work is further analyzed by an expert person. According to needs, it can be rechecked by multiple persons also. These techniques are useful in analyzing motions of hand or other parts of body. These techniques are very expensive and generally not used to study household task.

- **Cycle-graph** : It is a photographic device. Cycle graph is used to register the pathway of light projected by a small electric bulb attached to some part of the body. The graph of the task plotted by device shows the pattern of movements, like smooth and rhythmic or non-rhythmic motions. For example; while ironing, small electric bulb is attached to hand to register the pathway of the activity. This technique is effective in studying ways of reduction in motions and method of improvement in work.

- **Stop Watch** : Stop watch is used to record the time needed to complete the specific task. It can be used with other techniques also. This technique is effective in creating time awareness among worker.

➤ **Informal Techniques** : These simple techniques of work simplification are known as Paper Pencil techniques. According to its name, simple paper and pencil is used to

record the motions while performing activity. These are commonly used to study various household tasks. Some of these techniques are Pathway Chart, Process Chart, and Operation Chart.

Do you know ?

Frakn B. Gibreth and Lillian M. Gilbreth, American Industrial Psychologist, invented the script of motion and time study by using signs, symbols and abbreviations. They have termed these as “*Therblig*”. It is a reversal of their name *Gilbreth*.

- **Pathway Chart :** It is also known as pin and thread/string method. Floor plan of work place drawn in scale and proportion, soft board, pins, and thread are required to prepare a pathway chart. Initially, floor plan is placed on soft board and pins are fixed on the activity centres where worker turns while working. The movements or path of the workers travelled during work are recorded by winding thread around the specific pins. After completion of the task, thread is removed from the floor plan and distance travelled by the worker is measured from the thread used. Further, this process is analysed, revised floor plan is prepared by adopting suggestions and improved pathway chart is prepared. To draw the conclusion of study, length of the thread is compared.

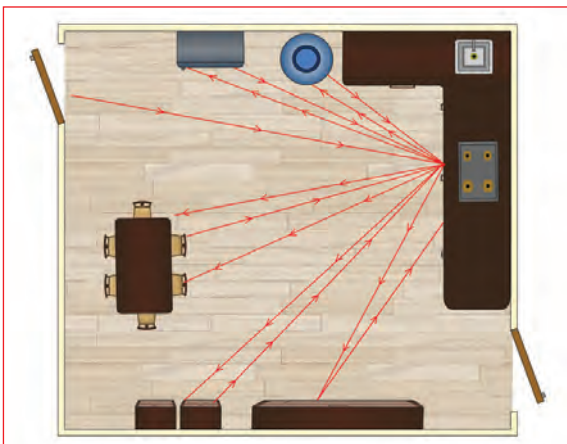


Fig. 5.7 (a) Pathway Chart - Original

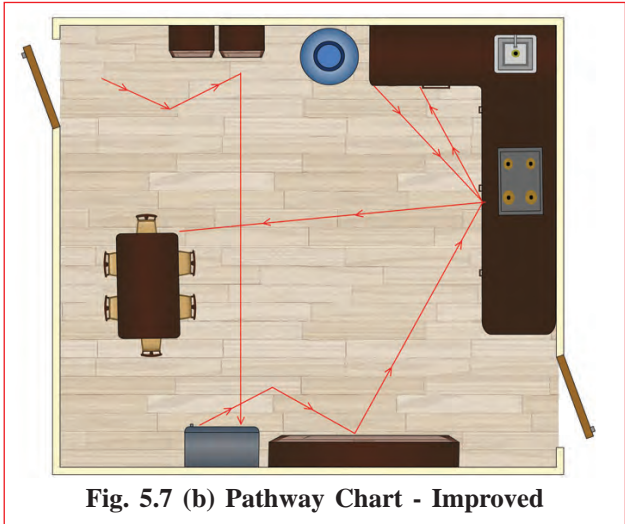


Fig. 5.7 (b) Pathway Chart - Improved

- **Process Chart :** It is a step by step description of method of work used by worker. It grossly analyses the movements of worker, activity in general and is useful in identifying unnecessary movements.

Following symbols are used for preparation of process chart.

| Sr. No. | Symbols | Meaning | Description of symbols |
|---------|---------|------------------|--|
| 1. | ○ | Small Circle | Movement from one place to another place |
| 2. | ◯ | Big Circle | Operation |
| 3. | □ | Square | Quality Inspection with eyes |
| 4. | △ | Triangle | Delay |
| 5. | ⊙ | Circle in circle | Movement and operations simultaneously |

Fig. 5.8 Symbols of Process Chart

At least two persons are required to prepare the process chart, one for doing the work and another one to observe and note down the same. Analysis of work is done by counting

repetitions of each symbol which is further used for identification of errors in movement and specific points where improvement is needed. One can effectively use this chart for improvement in work process by avoiding unnecessary trips from one place to another and delays in working.

- **Operation Chart** : Operation chart is used to study hand movements only. More detailed study of right and left hand operations is possible by the use of this chart. Three symbols are used in this chart-small circle for hand movements, large circle denotes movement of fingers and hand together and triangle indicates idleness of both fingers and hand. Minimum three persons are required to prepare the operation chart; one for observing right hand operations, other for observing left hand operations and the worker who performs task. Two separate charts are used to study the right and left hand movements.

Following figure shows the meaning and description of symbols used in operation chart.




| Sr. No. | Symbols | Meaning | Description of symbols |
|---------|---|--------------|---------------------------------------|
| 1. |  | Small Circle | Movement of Hand |
| 2. |  | Big Circle | Movement of fingers and hand together |
| 3. |  | Triangle | Idleness of both fingers and hand |

Fig. 5.9 Symbols of Operation Chart

5.5 Application of Mundel's Classes of Change in Household Activities :

- a. Drying clothes** : While drying clothes following points must be kept in mind:
- The rod or rope used for drying clothes should be at proper height. If it is too high it will create fatigue for shoulder

muscles. If it is too low bending at the back might become necessary and can cause back pain.

- If a stand is used for activity, it should be of proper height.
- The clothes to be dried should be put in a bucket and this bucket should be placed on a stool of proper height.

b. Sweeping the floor : While sweeping the floor the following points must be kept in mind:

- A thick and long broom should be used to cover more area in one stroke.
- A part of the floor should be thoroughly cleaned and only once.
- The movements involved should be smooth, rhythmic and minimum.
- The arrangement of furniture should be done thoughtfully so as to cause no obstruction in sweeping.

c. Mopping the floor : While mopping the floor following points must be kept in mind:

- A long handled mop should be used to avoid bending at the back.
- The mop should be of good quality-either of sponge or of good absorbent material.
- While mopping the floor, the motions should be rhythmic.

d. Cutting vegetables : While cutting or chopping vegetables following points must be kept in mind :

- Use a good quality knife with a sharp and sturdy blades.
- The knife should have a good handle for giving a good grip to hold it.
- Use a good quality chopping board.
- Place it near the preparation counter in the kitchen which is the first place of its use.

Use your brain :

Find out the other household tasks, which need improvement and apply Mundel's classes of change.

These are few examples of application of Mundel's classes of change, though there are many more which can be experienced in daily life. This will certainly help the individual in conservation of his/her energy and time due to simplification of the tasks.

Can You Recall ?

- Individuals have lot of responsibilities within and outside the home; hence they must carefully study how they can improve their methods of work.
- Work simplification is the means of work improvement.
- Work simplification is achieved through application of scientific management.
- It is defined as "conscious seeking of the simplest, easiest and quickest method of doing work".
- Work simplification is possible by analyzing the existing methods of work, by using the five classes of change given by Dr. Marvin Mundel.
- Each class of change suggests specific improvements in order to increase the efficiency of work and that of the worker. These classes suggest-
 1. change in body positions and motions,
 2. change in working arrangements and equipment,
 3. change in production sequence,
 4. change in finished product,
 5. change in raw materials.
- Formal and Informal Techniques of work simplification should be used to analyse and improve the working methods.
- If these changes are made in household work, it requires less time and energy and one does not feel tired.
- Work simplification can help to improve standard and output of work.

Exercises

• Objective questions :

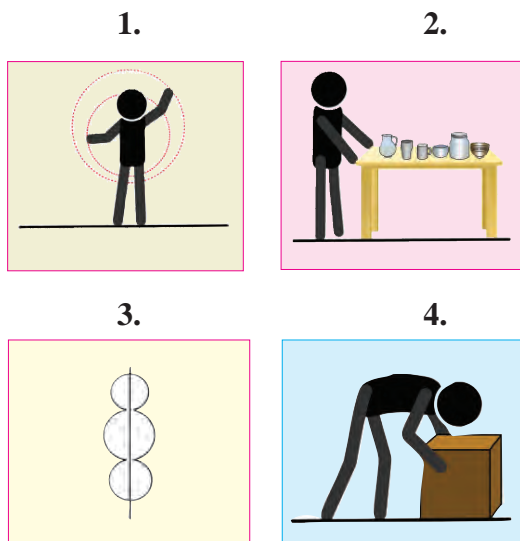
1) Multiple choice questions :

1. Work simplification means utilization of the least amount of _____ and energy.
 - a) equipment
 - b) time
 - c) money
 - d) devices
2. Conducive environment, efficient equipment and simple, easy and _____ work methods can reduce expenditure of time as well as energy.
 - a) routine
 - b) standard
 - c) regular
 - d) rhythmic
3. Script of motion and time study is termed as _____.
 - a) Operation Chart
 - b) Therblig
 - c) Gilbreth
 - d) Delmun
4. The concept of classes of change was stated by Dr. Marvin _____ at Purdue University in 1940.
 - a) Mundel
 - b) Markar
 - c) Muillar
 - d) Monto
5. Operation chart is used to study _____ movements only.
 - a) hand
 - b) leg
 - c) finger
 - d) body

2) Identify whether the following statements are true or false :

1. The custom of carrying any load on the back is an example of considering center of gravity.
2. Work simplification cannot improve standard and output of work.
3. Use of mop having long handle keeps body in alignment.
4. Floor plan of work place is essential in preparation of pathway chart.
5. Use of instant mixes in cooking is an example of change in the finished product.
6. While hanging clothes on a rope for drying, keeping bucket on a stool instead of on floor is advisable.

3) Identify the figures :



4) Complete the table :

1.

| Symbols | Meaning | Description of symbols |
|---------|------------|-----------------------------------|
| ○ | | |
| | Big Circle | |
| △ | | Idleness of both fingers and hand |

2.

| Symbols | Meaning | Description of symbols |
|---------|--------------|--|
| ○ | Small Circle | |
| ○ | | Operation |
| | Square | |
| △ | Triangle | |
| ◎ | | Movement and operations simultaneously |

• Short Answer questions :

1. Define the terms :

1. Work Simplification

2. Write short notes :

1. Body posture while working.
2. Changes in work arrangement and equipment.
3. Rhythm in work.
4. Use of both hands while working.
5. Formal Techniques of work simplification
6. Operation Chart
7. Process Chart

3. Answer the following in brief :

1. Explain the principles of 'body mechanics'.
2. Write the importance of work simplification.
3. Explain the principles of 'motion economy'.
4. Write the formal techniques of work simplification.

• Long answer questions :

1. Define work simplification and explain its importance.

2. Name the classes of change and Illustrate any two classes.
3. List out the most important points one must remember in arranging a work center from the point of view of work simplification.
4. Describe pathway and process chart.
5. Classify the techniques of work simplification and explain the operation chart.

Project/Assignment :

1. Observe and list out the right and wrong body posture while performing activity.

Project/Related Activities :

1. Prepare pathway chart of any household activity.

