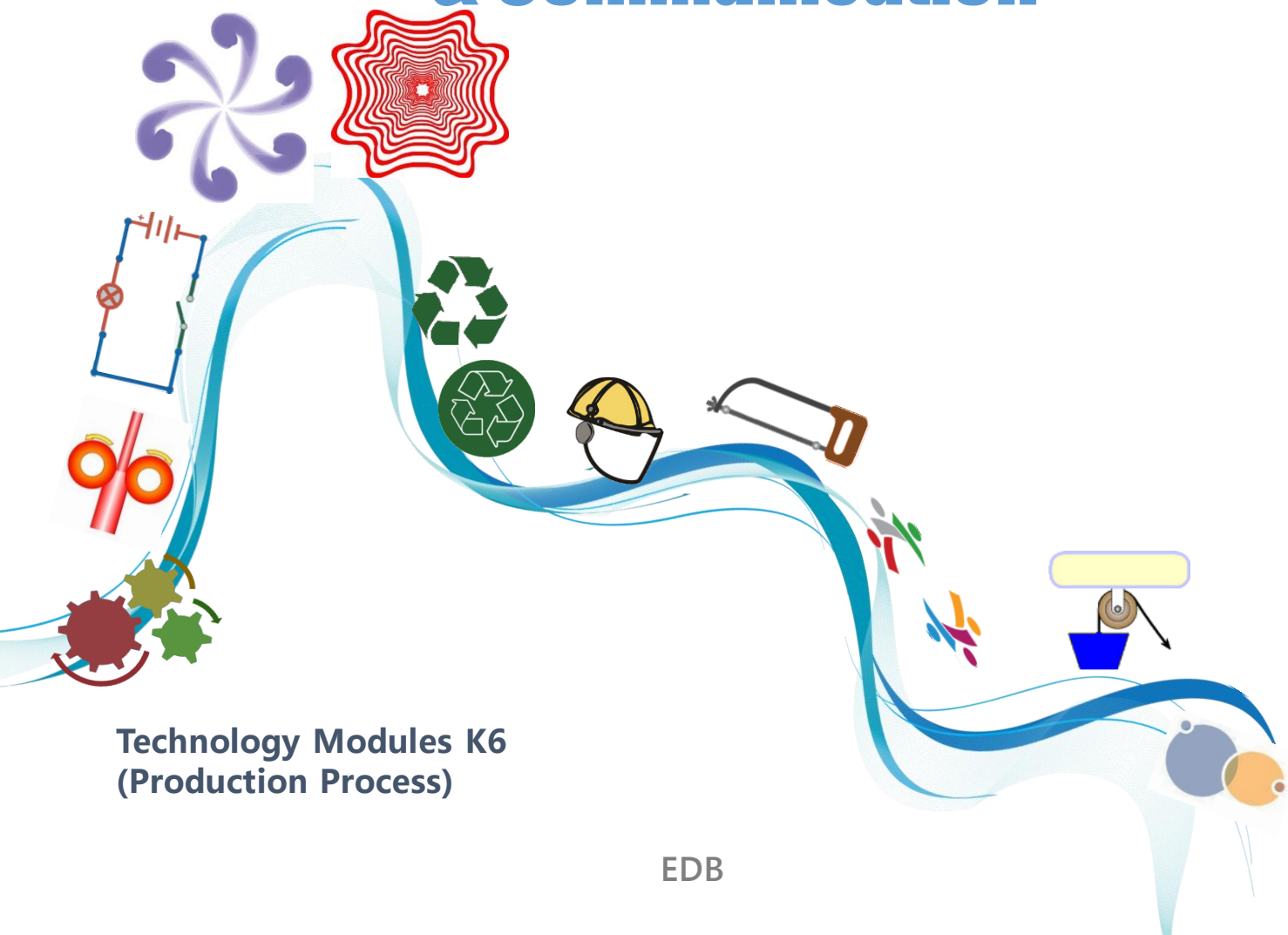
Enriched Technology Education KLA Curriculum

S1 Teaching Material

1

Basic Design Elements & Communication



Technology Modules K6
(Production Process)

EDB

Preface

To support the implementation of the Enriched Technology Education Key Learning Area Curriculum (Enriched Curriculum) at junior secondary level, the Technology Education Section of Curriculum Development Institute, Education Bureau, has developed a set of learning and teaching resource materials covering technological subjects learning element modules for teachers' reference and use.

The purpose of providing this set of teaching resource materials is to enable teachers to adopt the related technological subjects learning element modules under the Enriched Curriculum for students to acquire thorough understanding and mastery of the three key aspects in Technology Education Key Learning Area, viz. the technological understanding, technological capability and technological awareness, using a flexible approach with reference to the suggested learning progress.

The content of this learning and teaching resources was compiled with project approach. It gives students a purposeful and meaningful learning context through a series of diversified activities such as design projects, case studies, technological exploration and simulation experiments, and thus arouses their interest in technology and devotion in learning, as well as nurtures their ability in problem-solving, realisation, innovation and spirit of entrepreneurship.

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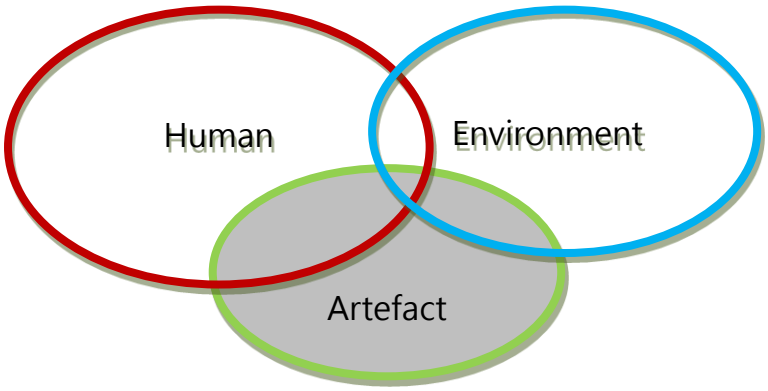
Relevant Knowledge

I. Consideration Factors in Design

To achieve good designs, it is necessary to have thorough considerations of relevant factors. Each design artefact is built upon mutual relationship between human and the surrounding environment as well as the artefact itself.

1. Aesthetics and Functions

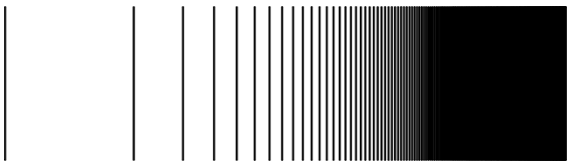
Aesthetic works can often make users more enjoyable in using the artefact. Therefore we should strike a balanced design between aesthetic and functional elements of the artefact according to different situations.



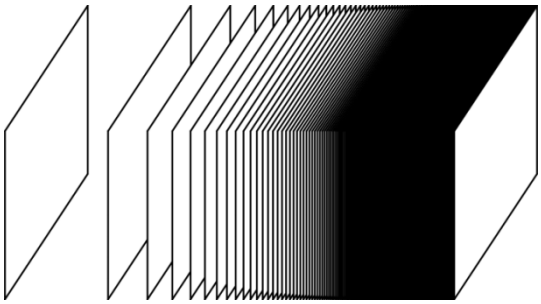
(a) Usage of Basic Design Elements

Aesthetics is a pleasant feeling towards things created through various senses. The human senses include: sight, touch, hearing, taste and smell. Since for human most of the information is received through the vision, so visual elements such as color, line, plane and three-dimensional shape, proportions and visual composition are all very important:

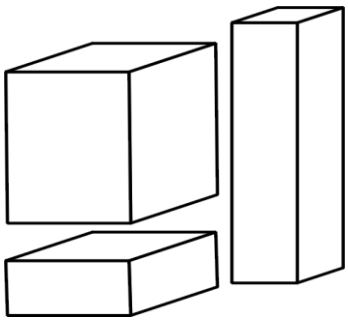
*(i) **Line** is made up of **dots***



*(ii) **Plane** is made up of lines*

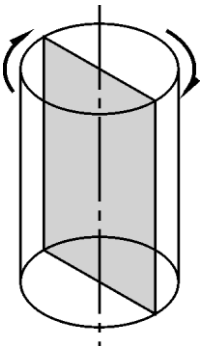


*(iii) **Object** is made up of superimposing planes*

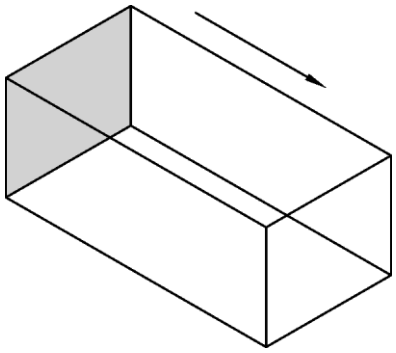


*(iv) **Space** is made up of objects*

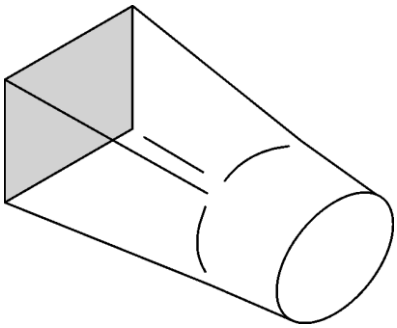
Methods for changing from planes to body



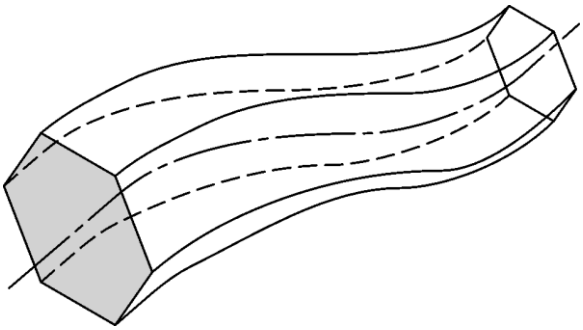
*(i) **Rotate***



*(ii) **Pushing / Extension***



*(iii) **Stacking and stretching***



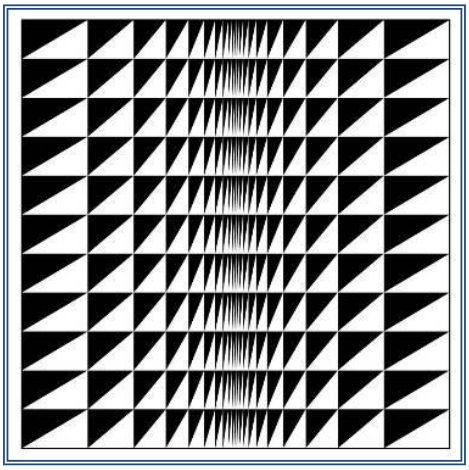
*(iv) **Sweeping out***

(b) Composition

The different arrangements of basic design elements produce different impact to the overall effect, so as to convey something the designer wishes to express.

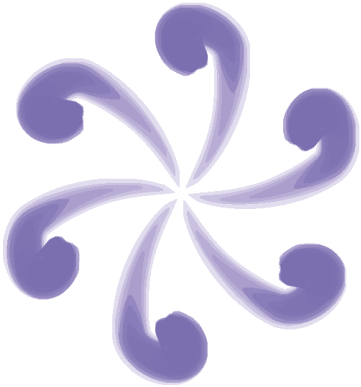
*(i) **Repetition / Arrangement***

The Jardine House at Central with neatly arranged windows forms the effect of repeated equilibrium



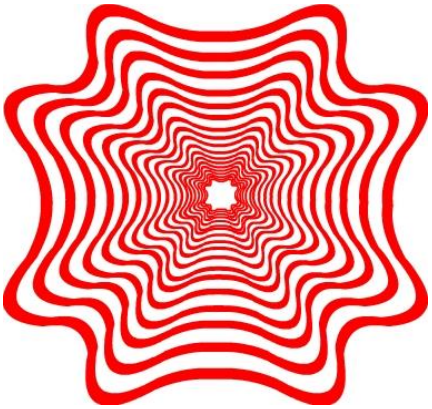
*(ii) **Gradual changes***

The composition creates dynamics and energy, breaking the monotony



(iii) ***Rotationally Symmetric***

The same element equidistantly rotates around a point, making the entire space to become well distributed



(iv) ***Rhythm***

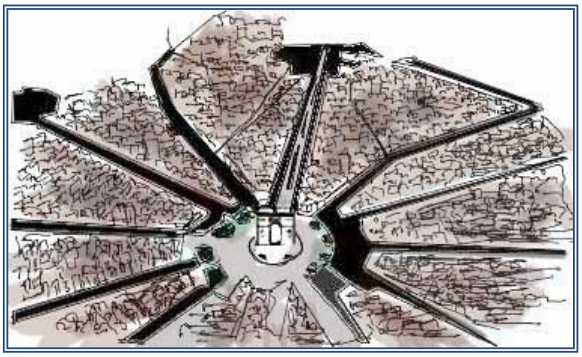
In the design elements, create regular or irregular effects of gradual changes

(v) Symmetric Equilibrium

Giving the viewers a persistence, stable, strong and rigourous feeling

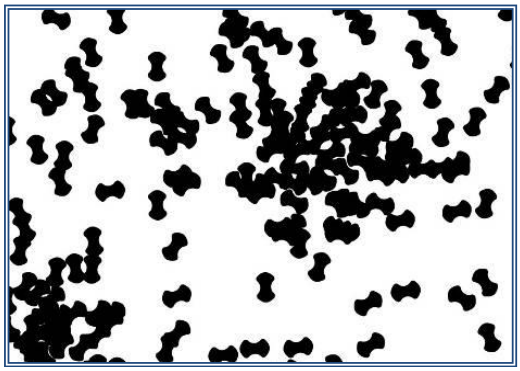
(vi) Asymmetric Equilibrium

The attractiveness of asymmetric equilibrium is based on different design elements at both sides of the composition



(vii) Radiation

Structured lines radiate outward from the centre

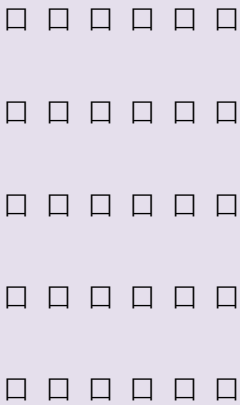
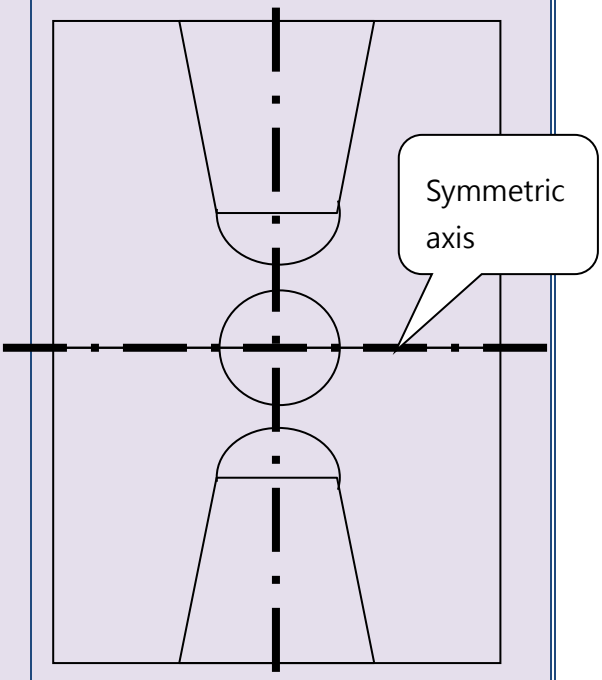


(viii) Uneven Composition

The dense portions become the focus of the viewers

At different places in the school, we can find different arrangement / composition methods appearing in the displays or items in front of us.

Examples:

Location:	Classroom	Basketball court
Sculptures, furnishings, objects	Desks & chairs	Lines on the ground
Diagram		
Arrangement/ Composition Methods	Repeating / Matrix arrangement	Symmetric

(c) Colouring

Colour is a major constituent element in all designs. Almost all designs are coloured; some designs basically are just generating changes in colour only. Colour is probably the most effective visual element in giving people an immediate impression. For example: children's toys often use bright colour to enable them to produce a pleasant feeling; on the contrary, office appliances usually use deep colour to produce a stable and safe feeling.

(a) Toys with bright colour

(b) Office stationery with deep colour

Fonts

The three primary colours of colour light are red, green and blue. The primary colours can be mixed with each other to produce the secondary colours, namely yellow, purple and blue-green. The second colours are higher in brightness than the three primary colours. Secondary colours can then be mixed into composited colour light. This is additive colour mixing.

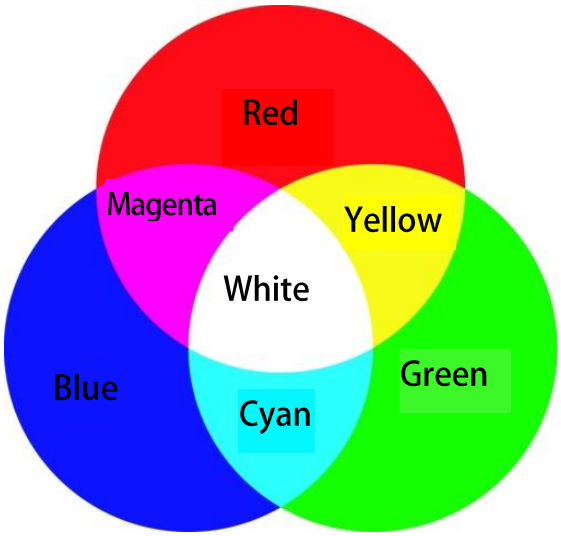


Illustration of mixing colour lights

Colour paints

Same as the fonts, the original colours of colour pigments are red, blue and yellow. Mixing colours pigment will produce secondary colours, and then mixing the secondary colours will produce composited colours. Since the pigment itself is light absorbing, the more mixing, the darker will be the brightness. All pigments mixed up together will become black. This is subtractive colour mixing.

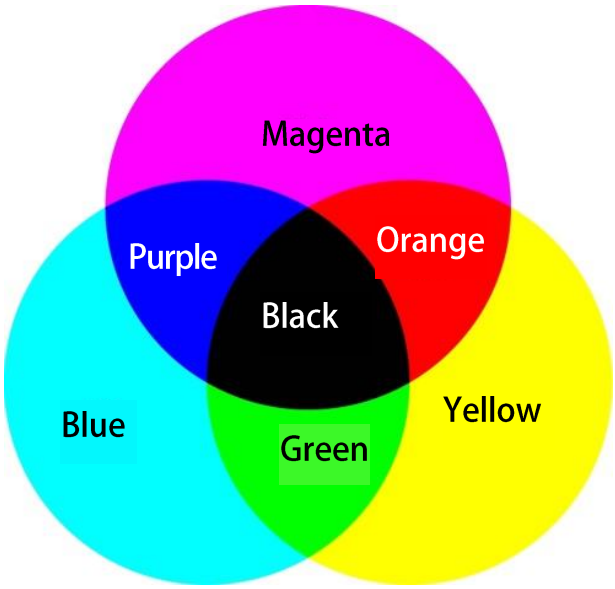


Illustration of mixing colour pigments

(d) Material Expression

Appropriate use of materials can be regarded as a prerequisite for product design. Material considerations should take into account the function of the object itself, user's habits, production costs, etc. In actual design, we tend to use superficial decorations to imitate the qualities of some materials, so as to get semantic effects in design. Visual effect is simply replacing a real tactile feeling. Commonly used methods of materials expression are (i) texture and (ii) quality.

(i) Texture

Texture is the pattern and feeling of the material surface. In designing, as long as the artefact is coated with appropriate colours and patterns, users can sense the tactile feelings of the object such as warm, cold, rough, fine, hard, soft, wet and dry, etc. Although the pictures below were printed on the same piece of paper, we can identify the differences in tactile feelings by observation.

(ii) Quality

Besides expressing the material texture of the object, proper decoration can enable users to distinguish the weight and quantity of the objects. In the daily contacts of our world, the weight of material can only be got by measurement or subjective experience, but after special treatment of the object surface, we are able to produce visual feelings. For example, use colours to affect human's judgment about the weight of the object, use texture to change human's feeling on the object size and ratio.

Which person is fatter ?

Which bowl is heavier ?

Answers:(1) They are the same person (2) The white one should be heavier

(e) Ratio

Ratio can provide us with some messages. The two shadows put together in the figure belong to a child and an adult, the child with magnification allows us to clearly distinguish her out.

The shadows of a child and an adult

(f) Visual Composition

Visual composition is another important aesthetic element. Every product typically includes many visual elements, which can have different combinations to form unique styles. For example: A car's front has similar basic elements (headlights, rearview mirrors, air-inlet groove and number plate, etc.), just like the different combinations of organs on a human face (eyes, ears, mouth and nose, etc.) will produce different images.

(a) Image of a family car

(b) Image of a luxury car

II. Communication

Communication refers to how to convey the design ideas, including text and images to others. Text can be used as a means to elaborate ideas, making other people to clearly understand the product's appearance, function, usage method, design ideas, and so on.

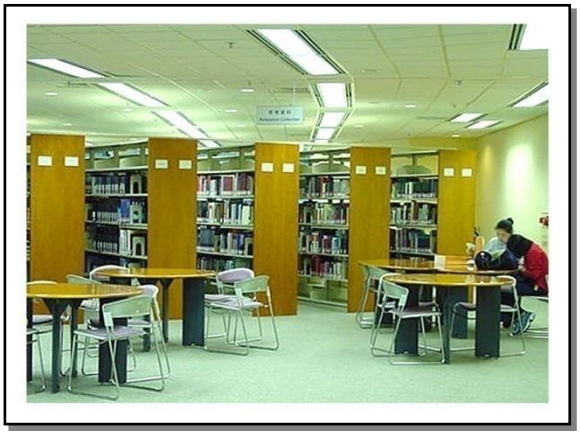
Since text is somewhat limited, design details such as the product's appearance can better be expressed by images.

(a) Opened manner

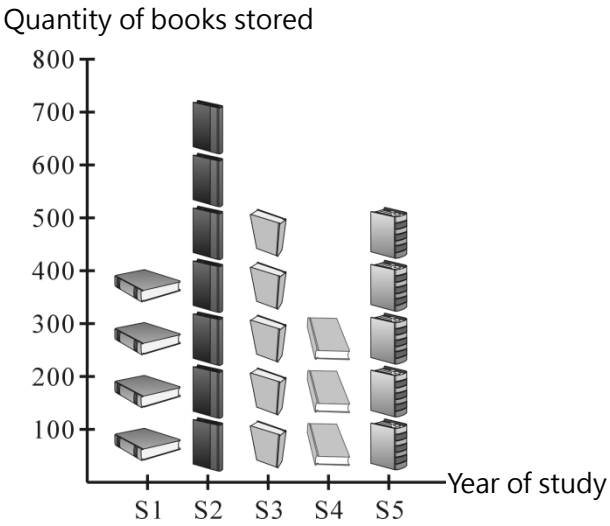
(b) Closed manner

The above figure shows the design of novelty electronic scales, a breakthrough to the traditional appearance of scales. It is difficult to make others understand the appearance of the new electronic scales by text, whereas if image is used for design presentation, it would be easier to clearly articulate the design ideas.

Image expression can include photos, charts, sketches, engineering drawings and many other different methods of expression.



(a) Photo



(b) Chart

(a) Sketching

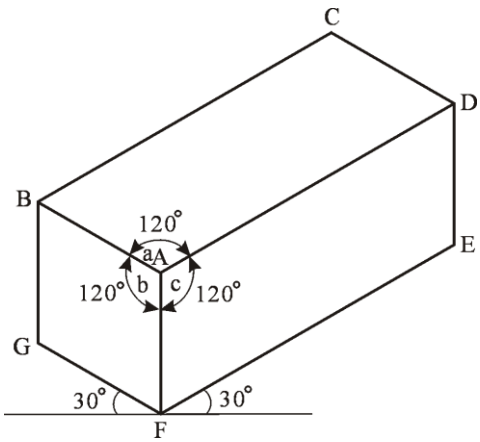
Sketching is by using pencils, colour pencils, markers, pastels, etc. for painting patterns and rapidly drawing the appearance of the object. Upon completing drawing the object's frame, shading or colouring can be added to strengthen the three-dimensional and textural senses of the object.

Sketching is often used when drawing the design sketches because of the shorter time required. In the sketching stage, just a simple design ideas expressed in the form of drawings can achieve the effect of communication.

(a) Use of pencil to depict a chair

(b) Use of pastel to depict a low stool

Sketching includes plan view and three-dimensional view. The following diagram is an isometric view of a rectangular solid; the drawing is able to reflect the three-dimensional effect of the object.



(Corner F is the lowest point)

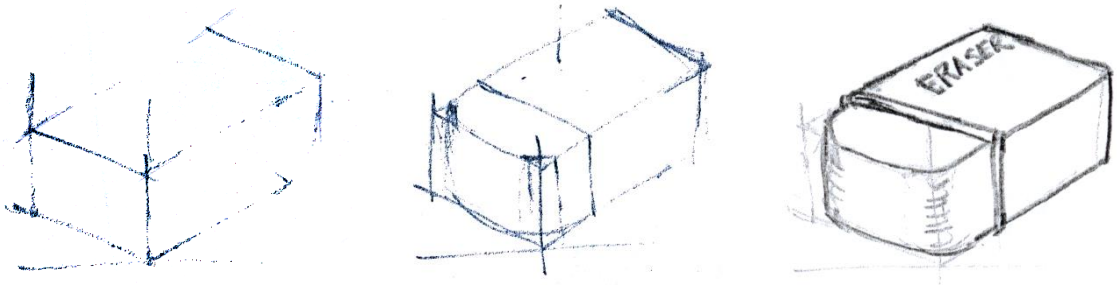
Example 1

Steps for drawing the rubber eraser as follow:

(i) First draw a rectangular solid similar to the object.

(ii) Then draw the detail portions.

(iii) Deepen the outline and other segments.



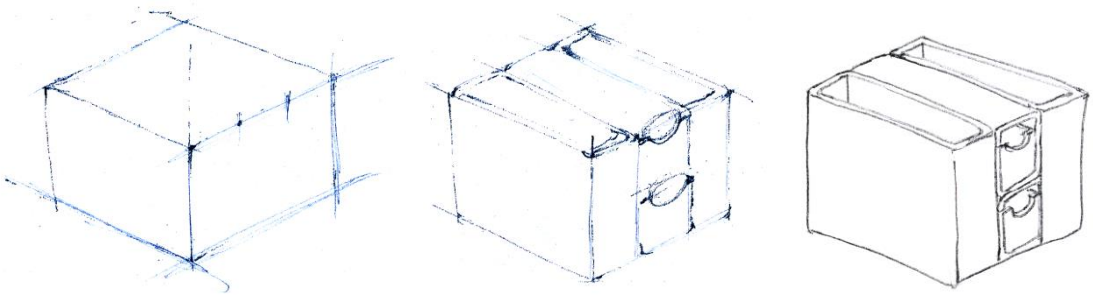
Example 2

Steps for drawing the pen stand as follow:

(i) First draw a rectangular solid similar to the object

(ii) Then draw the detail portions.

(iii) Deepen the outline and other segments.



(b) Engineering Drawing

When we have completed the design sketches and then with confirmation and amendment, we can make use of drawing instruments and tools to produce precise drawings, for the purpose of making or further development and communication. For sure nowadays we can directly make use of computer aided drafting (CAD) software, but as professional computer graphics programs are generally more expensive while drawing instruments and tools are cheaper and easier to use, it is still necessary to understand and familiarize with their usage. Further, mastering the general concept of drawing methods before learning how to use a computer drafting program can reduce learning difficulties caused by the complexity of program itself. Here are some examples of engineering drawing:

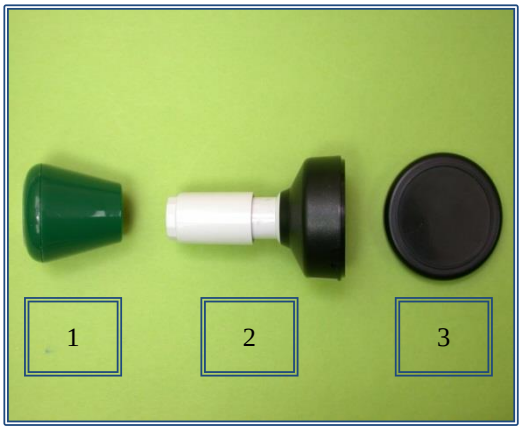
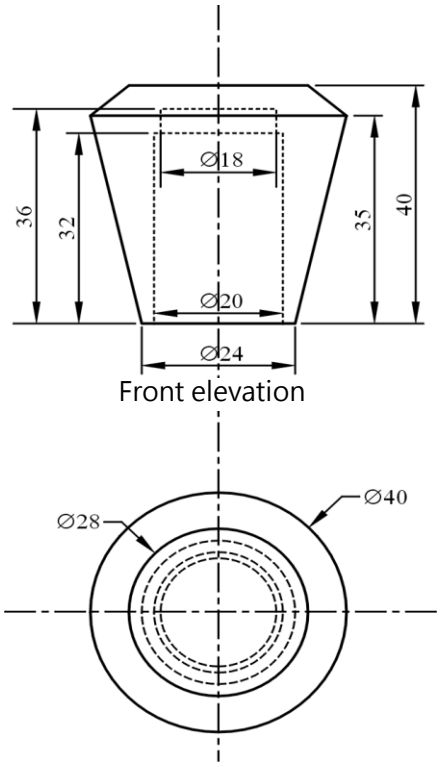


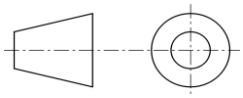
Photo of a real object - atomic chop

Number	Name	Material	Number
1	Top	Plastic	1
2	Body	Plastic	1
3	Bottom	Plastic	1

List of parts for atomic chop

Following is a detailed diagram for the parts fitting portions of an atomic chop.



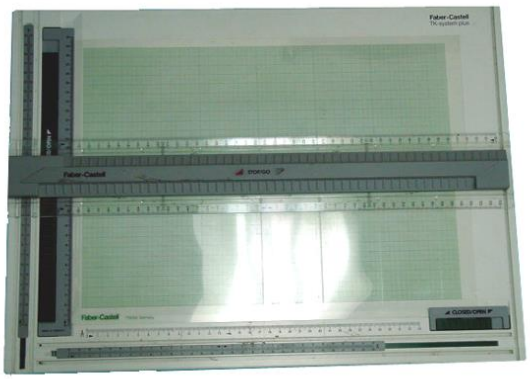


Engineering diagram for Part 1

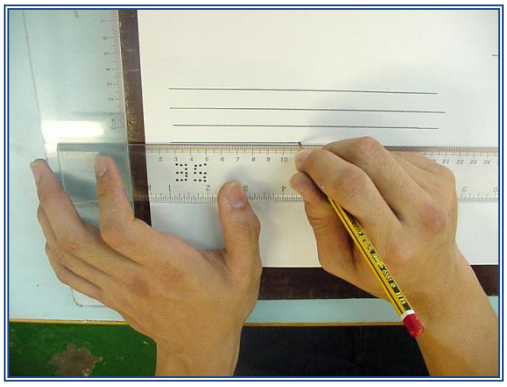
(c) Methods of Using Basic Drawing Instruments & Tools

(i) Drawing method for horizontal line

Use the left hand to grip the tee square, drawing from left to right with the pencil slightly tilted to the direction of drawing. Pressure on the pencil should be constantly smooth, should always turn the pencil to keep the pencil and line sharp.



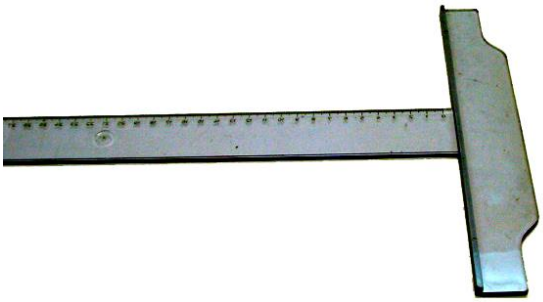
(a) Drawing instrument



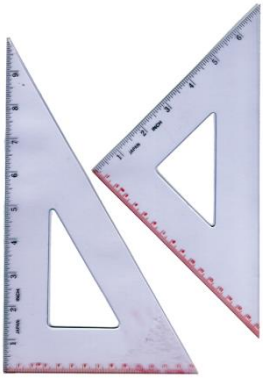
(b) Horizontal line drawing method

(ii) Drawing method for vertical line

Properly locate the tee square, place the set square tightly close to the tee square, and then draw upward from the bottom.



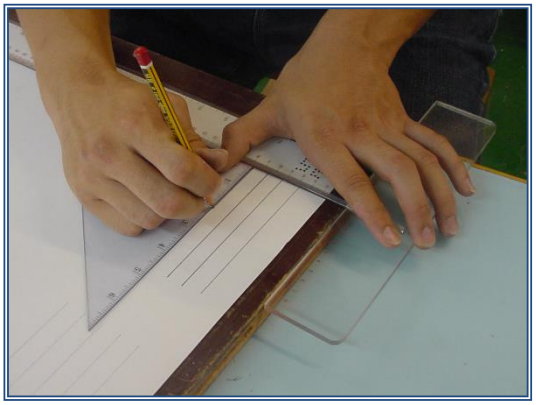
(a) Tee square



(b) Set square (or triangular ruler)

(iii) Drawing method for vertical and horizontal lines

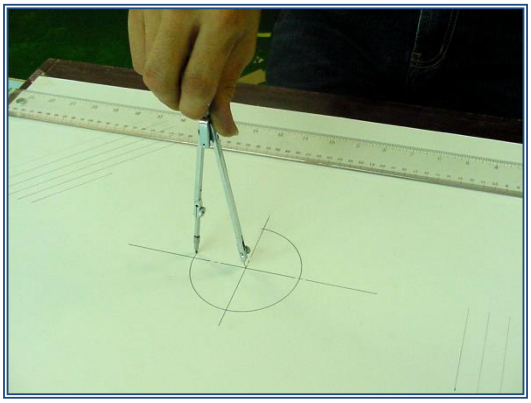
Use the tee square as a guiding edge, draw with a set square sliding around the tee square.



(iv) Methods for using compasses

- The needle tip should be made slightly longer than the pen or pencil head before use
- While drawing the circle, press with the left hand against the compass needles as guidelines, point the compass needle to the centre of the circle.
- While rotating, make the compass incline slightly towards the direction of drawing, use the thumb and forefinger to rotate the compass handle.

(a) Compasses

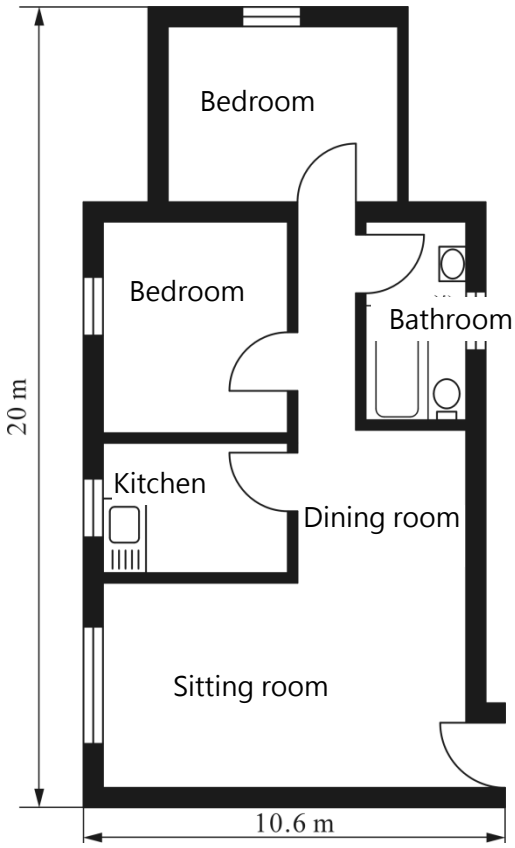


(b) Methods for using compasses

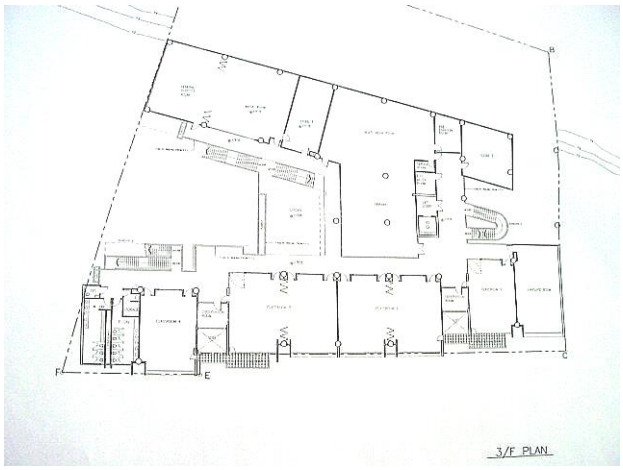
(d) General Knowledge about Engineering Drawing

Engineering drawings include abundance information, rather than only expressing the outline of the object, there are the size, internal structure, name of the diagram, materials, various assembling parts, levels of processing requirements, etc., and each item of information must be clear and accurate. Any errors in the process of producing the drawing or improper understanding by the readers may cause serious damage. Therefore, the engineering drawing must strictly follow and make reference to relevant international drawing standards.

Some examples about engineering drawing



a) Home floor plan



(b) Floor plan of a building

Therefore we need to master a general knowledge of engineering drawings, including line types, font faces and font types.

(i) Font faces and font types

Regular and italic are the two kinds of English fonts commonly used in engineering drawing. But one can only choose one type of font, and not both on the same piece of drawing at the same time. If there are no other requirements, the thickness of the letters can follow the drawing conventions. For title characters or when the font needs to be highlighted, then thick line can be adopted. No matter for thick or thin characters, the writing strokes must be uniform and without thick, thin, dense or light in the same font. Before writing on the engineering diagram, the grids should be drawn beforehand. The fonts must be neat and tidy and follow the principle of squareness both vertically and horizontally.

Design and
Technology
Secondary 1

English font face

設計與科技
中一級

Chinese font face

(ii) Types of Lines

A complete engineering drawing is composed by different types of lines. The lines are used to represent a variety of different conventional symbols and they can be grouped by the following three categories according to their shapes:

- Continuous line —— A continuous line which can be distinguished as thick and fine.
- Dotted line —— A short line arranged as a row with small interval in between.
- Chained line —— A line interwoven with dots and dashes of either thick or thin lines.

The types and usages of these lines are as follow:

Type	Sample	Thick, Thin	Usage
Continuous line	A	Thick	Outline and border lies
	B	Thin	Dimension line, extension line, leader line, section line, construction line, ridge line due to the disappear of round corner, outline of revolved sections, etc.
	C	Thin	Break lines
	D	Thin	
Dotted line	E	Thin	Hidden line
Chained line	F	Thin	Centre line, part line, imaginary line, etc.
	G	Thick	Boundary of body surface that needs special handling
	H	Thick, Thin	Cutting plane

(iii) Standards for line thickness

The average size of paper is A4 (210mm x 297mm) to A2 (420mm x 594mm), the general width of lines used are:

- Thick line: 0.5 mm – 0.8 mm ;
- Thin line: 0.1 mm – 0.3 mm 。

General engineering text should be written with pencil of 0.5 mm thickness. Since pencils are having thickness with 0.3 mm and 0.7 mm, we can use these two levels of thicknesses (not the darkness of colour) to distinguish thick and thin lines.

III. Glossary of Terms

設計	Design	解決方法	Solution
設計過程	Design process	實踐	Realization
處境	Situation	測試	Testing
難題	Problem	評鑑	Evaluation
設計概要	Design brief	傳意	Communication
設計細則	Design specification	徒手繪圖	Sketching
資料搜集	Data collection	工程繪圖	Engineering drawing

IV. Related Information

	Website	Brief Contents
1	http://tds.ic.polyu.edu.hk/ds/cd/03_technology/	Introduce technology and communication
2	http://tds.ic.polyu.edu.hk/ds/cd/05_process/index.htm	Introduce the processes of communication design
3	http://tds.ic.polyu.edu.hk/vc/download/t1_content.htm	From observation, thinking to image
4	http://tds.ic.polyu.edu.hk/vc/curriculum/scheme_of_work__theme_1.htm	Making use of video for communication and thinking
5	http://www.facebook.com/designmanagers	Designer's sharing through social websites

Lesson Activities

Activity 1

Observe the objects around to understand their basic design elements used

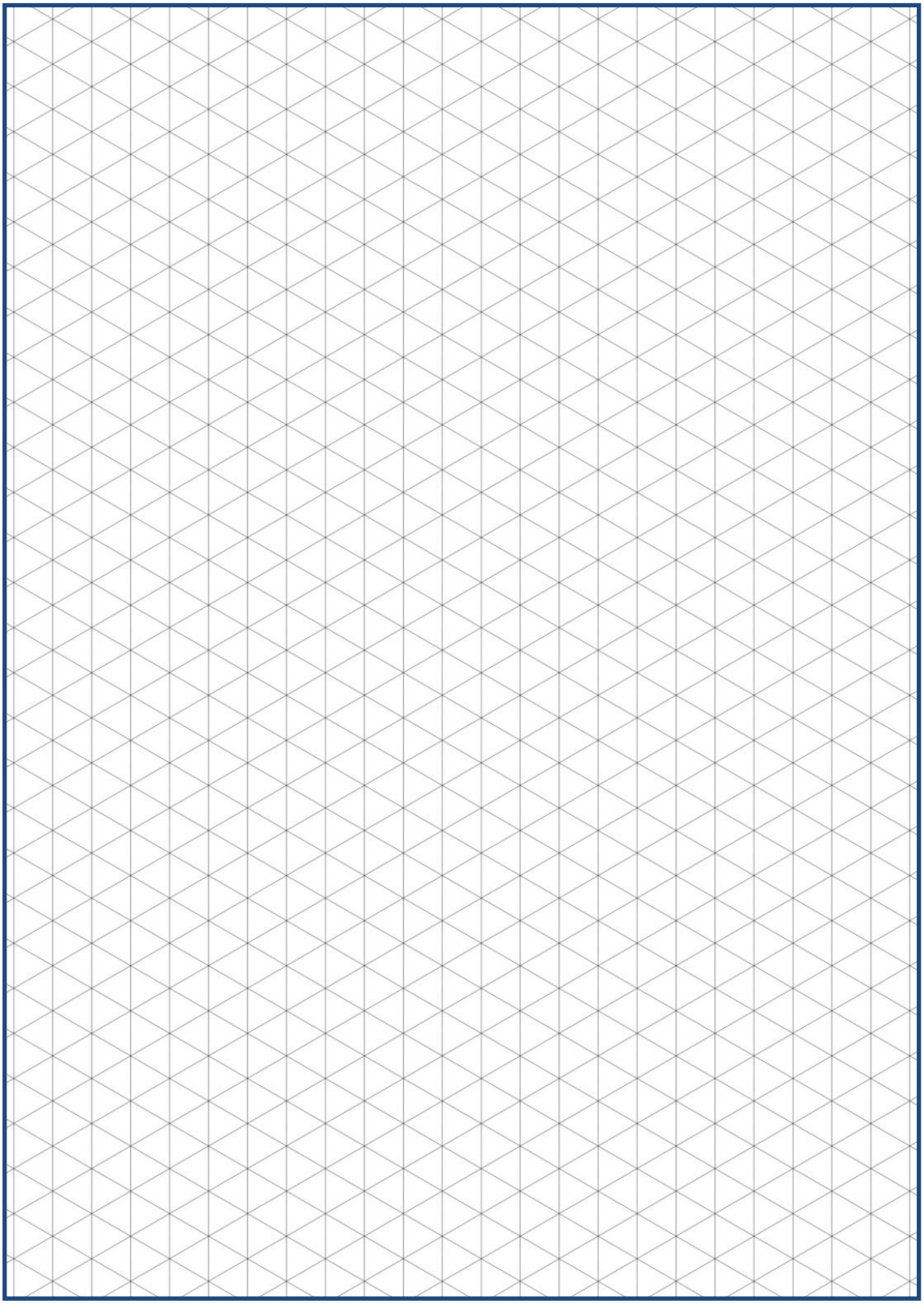
1. Divide students of the class into groups of three
2. Select a corner of the campus (example: Classroom, laboratory, playground ....) and indicate its appearance, furnishings, objects, etc., display the arrangement / composition and put it on drawing

Location:	
Sculptures, furnishings, objects, etc.	
Drawing	
Arrangement/ composition method	
Presentation effects	

Activity 2

Sketch some commonly observed objects with the help of grid lines

Draw a rubber eraser and pen stand by sketching on the grid lines provided.



Project Activity
Design and Communication

Classroom Library Corner

Guidelines for project activity

1. Objectives

Students acquire a basic understanding about design and use appropriate communication techniques to express design ideas.

2. At completion of the project activity, students should be able to:

- Understand fundamental design elements;
- Make use of communication techniques to express design ideas.

3. Situation

The new school year of the S1 class commenced; the class teacher would like to design a small library corner for the class. As the classroom space is limited, the class teacher wants students to attempt designing the outlook of the library corner and think about its placement location.

4. Design Brief

The classroom's library corner needs to accommodate about one hundred books and some space for simple stationery and log books for borrowing records; space is also needed for the librarian to handle some paperwork.

Use sketching to express the outlook and usage of the classroom library corner, and explain the design ideas with simple text.

5. Recommended Time

4 teaching periods x 40 minutes (total 160 minutes)

6. Required Material

Drawing tools, drawing paper

7. Activity Contents

(i) Collect data and illustrate the design requirements by drawings

1. The class teacher raises the basic requirements of the library corner:
2. The method to accommodate one hundred books;
3. Reserve some spaces for placing simple stationery and the log book for borrowing records;
4. Reserve some spaces for the librarian to handle paper work.

Use a digital camera to take photos about the design of library corners in other classrooms or in libraries, select some special designs and post them on the space provided below.

(ii) Sketch the design and explain the design ideas

In the space provided below, use sketching to express the outlook design for the small library corner, and explain the design ideas in point form:

Design ideas

_____

_____

_____