

# 聖文德天主教小學

St. Bonaventure Catholic Primary school

常識科 **General Studies**

## 主題：三國演義~草船借箭

The Romance of the Three Kingdoms  
Borrow arrows with thatched boats



姓名 Name : \_\_\_\_\_ ( ) P. 6 ( )

# 學習目標 Learning Objectives

## **S SCIENCE**

- 認識亞基米德及牛頓等科學家的生平及成就

Know the life and achievements of scientists such as Archimedes and Newton

- 認識「亞基米德浮力定理」及「牛頓第三定律」

Understanding "Archimedes' Principle" and "Newton's Third Law"

- 能從生活中找出運用「亞基米德浮力定理」及「牛頓第三定律」的例子

Able to find some example of using the "Archimedes' Principle" and "Newton's Third Law" from daily life

- 運用閉合電路讓螺旋槳旋轉以產生風力，來推動草船前進

Use a closed circuit to rotate the propeller to generate wind power to propel the thatched boat forward

## **T TECHNOLOGY**

- 能選用合適的物料及運用鐳射切割機來製作草船

Can use suitable materials and use laser cutting machine to make the thatched boat

- 能製作一艘航行速度高，並能以直線行走的草船

Can make a high speed thatched boat and sail in a straight line

- 善用公平測試找出有利航行的船身形狀

Use fair tests to find the shape of the bow that is good for sailing

## **E ENGINEERING**

- 能利用 AutoCAD 繪圖工具來設計及準確地繪畫草船的外型及尺寸比例

Can use AutoCAD drawing tools to design and draw the size and ratio of the thatched boat accurately

- 能透過測試及改良來提升草船的航行效果

Improve the sailing performance of the thatched boat through testing

## **A ART**

- 能透過閱讀古典文學書籍《三國演義》來認識「草船借箭」之故事

Can read the story of "borrowing arrows with thatched boats" by reading classical Chinese literature books- "The Romance of Three Kingdoms"

- 能配合劇本內容來設計草船

Can design thatched boat with the content of the script

## **M MATHEMATICS**

- 懂得計算及運用密度來設計合適的草船

know how to make use of density calculations to design appropriate thatched boats

# Background information 背景資料

## 漢代戰船

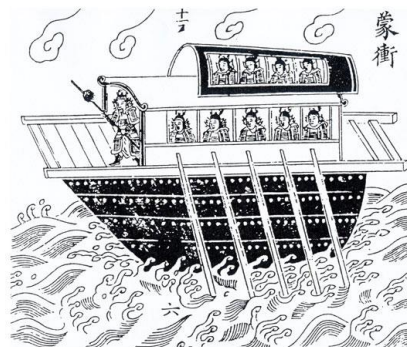
漢代以樓船為主力的水師已非常強大，一次戰役就要出動樓船兩千多艘，水軍二十萬人。艦隊中除了樓船外，還有其他各種作戰艦隻，包括在艦隊最前列的衝鋒船「先登」、用來衝擊敵船的狹長戰船「蒙沖」、快如奔馬的快船「赤馬」等，還有「鬥艦」和「走舸」。三國時期，這些戰船曾在歷史上有名的赤壁之戰中立了頭功，孫吳統帥黃蓋帶領著數十條由蒙沖、鬥艦和走舸組成的船隊，將曹操的船隊打敗了。

資料來源:中國古代船舶 <https://www.chiculture.net/0813/html/0813d01/0813d01.html#>

走舸



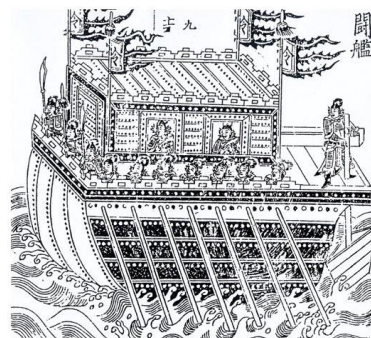
蒙衝



樓船



鬥艦



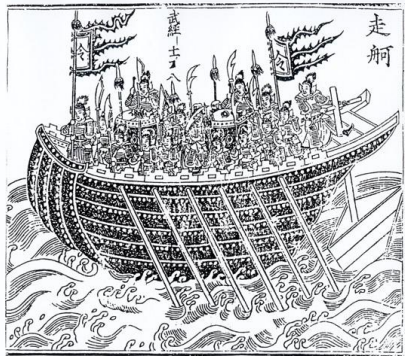
## Han Dynasty battleship

In the Han Dynasty, the naval division, which was dominated by ‘lóu chuán’(樓船), was already very powerful. In a battle, more than 2,000 ‘lóu chuán’ and 200,000 sailors were to be dispatched. In addition to the ships in the fleet, there are various other warships, including the assault ship ‘xiān dēng’(先登) at the forefront of the fleet, the long and narrow warship ‘méng chōng’(蒙衝) used to impact enemy ships, and the fast ship ‘chì mǎ’(赤馬) etc., as well as ‘dòu jiàn’(鬥艦) and ‘zǒu gě’(走舸). During the Three Kingdoms period, these warships made great contributions in the famous battle of Chibi (赤壁) in history. The general of Sun Wu (孫吳) ‘Huang Gai’(黃蓋) led dozens of fleets consisting of ‘méng chōng’, ‘dòu jiàn’, and ‘zǒu gě’, defeating Cao Cao's(曹操) fleets.

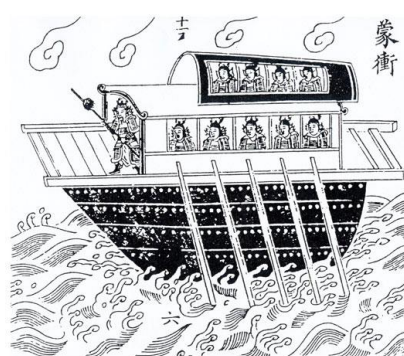
Source: Ancient Chinese Ships

<https://www.chiculture.net/0813/html/0813d01/0813d01.html#>

zǒu gě 走舸



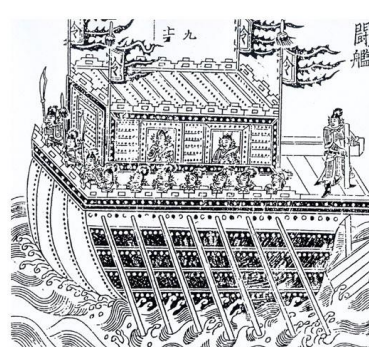
méng chōng 蒙衝



lóu chuán 樓船



dòu jiàn 鬥艦





## 探究情景 Situation of the inquiry:

《草船借箭》是我國古典名著《三國演義》中的一個故事。

《草船借箭》是三國赤壁之戰裡的著名橋段，造箭的要求是由周瑜故意提出(限十天造十萬支箭)，機智的諸葛亮一眼識破是一條害人之計，卻淡定表示“只需要三天”。後來，有大霧天幫忙，諸葛亮再利用曹操多疑的性格，調了二十隻草船誘敵，終於借足十萬支箭，立下奇功。

究竟這艘船的外形是怎樣的？這艘船是怎樣收集敵人的箭？現請同學製作一艘現代草船，以體會諸葛亮的才智。

"Borrow arrows with thatched boats" is a story in China's classic "The Romance of the Three Kingdoms". "Borrow arrows with thatched boats" is a famous story in the Battle of Chibi. The request for making arrows was intentionally made by Zhou Yu (making 100,000 arrows within ten days). The clever Zhuge Liang realized that this was a treacherous scheme, but he calmly stated that "it only takes three days". Later, in a foggy day, Zhuge Liang used Cao Cao's suspicious personality and send 20 thatched boats to Cao Cao's fleet. Finally he borrowed 100,000 arrows from Cao Cao.

What exactly is the shape of the thatched boat? How does the boats collect the enemy's arrows? Make a modern thatched boat to appreciate the wisdom of Zhuge Liang.



## 資料搜集 Information searching

同學可以把從圖書、光碟及互聯網上找到的有關資料，寫出、貼上或繪畫在下面的方格內。(\*資料途徑:閉合電路、草船的外形及結構，亞基米德浮力定理等)

Students can find information from books, CDs or the Internet. Write, paste or draw in the box below. (\* Information: close circuit, the shape and structure of thatched boat, Archimedes' principle, etc)

資料來源 Sources :

你會應用上述哪些資料於設計中？在□中加✓

Which information will you apply in your design? Put a      in the box.

☐ 外形 The shape      ☐ 科學原理 The scientific principles

☐ 功用 The functions      ☐ 其他 Others : \_\_\_\_\_

## 數理運算 Mathematics calculations

試想想，如果以不同大小的物料來製作船身，浮水的效果會否不同？試在互聯網上

搜尋以下的資料：

If we vary the volume of the materials of which the boat is made, do you think the floating effect will differ? Try to find the information below on the Internet.

$D = \frac{\text{船的重量 Mass of boat (g)}}{\text{船身體積 Volume of boat (cm}^3\text{)}}$

若  $D$  大於 1，則物體必沉水下。 If  $D > 1$ , the boat will sink,

若  $D$  小於 1，則物體必浮於水上。 If  $D < 1$ , the boat will float.

量度草船組件的重量（包括木板、2A 電池 2 顆、電池盒、馬達、螺旋槳、膠樽）：約\_\_\_\_\_g

Weight the materials of the boat (including the wooden boards, 2 AA batteries, the battery box, the motor and the plastic bottles):

It is approximately \_\_\_\_\_g

(可運用計算機協助 You can use a calculator )

如果用 2 個 500 毫升膠樽作船底，  $D = \frac{\text{_____g}}{\text{_____cm}^3}$

If boat's base is made of two 500 mL plastic bottles,  $D = \frac{\text{_____g}}{\text{_____cm}^3}$

如果用 2 個 1 升膠樽作船底，  $D = \frac{\text{_____g}}{\text{_____cm}^3}$

If boat's base is made of two 1L plastic bottles  $D = \frac{\text{_____g}}{\text{_____cm}^3}$

我的發現：如果  $D$  (越大/越小)，越有利船身浮於水上。

What I found: If  $D$  is (greater / smaller), the boat is more likely to float.

我會利用\_\_\_\_\_做船底物料，因為：

I will use \_\_\_\_\_ to make the boat's base, because:

$D = \frac{\text{_____g}}{\text{_____cm}^3} = \frac{\text{_____g}}{\text{_____cm}^3}$





## 公平測試 Fair Test

探究問題:怎樣的船頭形狀才能帶來最高的航速?

Situation of the inquiry: What shape of the bow can produce the highest sailing speed?

探究活動 Inquiry activity:

1. 目的:透過公平測試來探究「草船」的船頭形狀與航行速度的關係

Aim: Examine the relationship between the shape of the bow and the sailing speed with the help of fair test




2. 假設:我估計船頭呈( )形是最有利「草船」航行。

Hypothesis: I think the bow of the ( ) shape helps sailing best.

- 3.控制變數 Controlling variables:

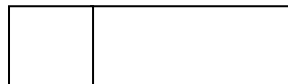


會改變的因素 Variables:
不變的因素 Constants:

#### 4.測試 Test:

船頭形狀	設計 1	設計 2	設計 3
	 船頭呈方形	 船頭呈三角形	 船頭呈半圓形
航行時間	( )分( )秒	( )分( )秒	( )分( )秒

5.總結:最佳的船身形狀設計是 ( ), 因為 \_\_\_\_\_。

這測試結果跟我的假設是(相同/不相同)。

The shape of the bow	Design 1	Design 2	Design 3
	 Rectangle	 Triangle	 Semi circle
Time of sailing	( )min( )sec	( )min( )sec	( )min( )sec

5. Conclusion: The best bow design is ( ) \_\_\_\_\_  
because \_\_\_\_\_.

The result of the test is (the same as / different from) what I hypothesized.

# 設計工程

# Engineering design

你需要設計一艘「草船」，利用它來協助諸葛亮來收集曹軍的箭。

You need to design a "thatched boat" and use it to assist Zhuge Liang to collect the arrows from Cao Cao.

A. 將你構思中的「草船」外型、尺寸比例及物料展示在下面的空格內。



A. Draw the shape, size and materials of the “thatched boat” in the space below.

## B.試寫出「草船」的特色

☐ 外型設計獨特

Unique design

☐ 能負載重物

Can load heavy objects

☐ 組件接合穩固

stable assembly of components

☐ 能依直線航行

Can sail in a straight line

## C.預計製作「草船」時出現的困難及解決方法

### Difficulties and solutions during making the thatched boat

預計製作時出現的困難 Difficulties:

☐ 外型設計

Design the shape of boat

☐ 組件的接合

Assembly of components

☐ AutoCAD 繪畫軟件的應用

Application of AutoCAD software

☐ 工具的運用

Use of tools

解決方法 Solutions:

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## 製作過程 Production process

步驟 Step	圖畫 Diagrams
<b>1.</b>	
<b>2.</b>	
<b>3.</b>	
<b>4.</b>	

步驟 Step	圖畫 Diagrams
<b>5.</b>	
<b>6.</b>	
<b>7.</b>	
<b>8.</b>	



# 草船測試 Testing the warship

在適當的方格內加上「✓」號 Put a '✓' in the suitable boxes.

## 動力裝置 *Power unit*

~適當地接駁閉合電路，使馬達轉動。

Connect the close circuit suitably so that the motor can rotate.

能 can

☐

不能 cannot

☐

~將動力裝置安放在適當的位置，令船隻保持平衡。

Install the power unit in a suitable place so that the thatched boat is well balanced.

能 can

☐

不能 cannot

☐

~扇葉配合馬達轉動時，能產生足夠的風力，推動草船前進。

When the motor rotates the fan blade, it can generate sufficient wind to propel the thatched boat forward.

能 can

☐

不能 cannot

☐

## 前進效果 *Advancing effect*

~草船能以直線行駛，不會無故轉彎。

The thatched boat can advance in a straight line without turning.

能 can

☐

不能 cannot

☐

~草船能浮於水面並順暢地行駛。

The thatched boat can float and sail smoothly.

能 can

☐

不能 cannot

☐

## 航行速度 *Sailing speed*

草船航行 3 米路程所需要的時間：(     )分(     )秒

The thatched boat takes (     ) minutes (     ) seconds to sail 3 meters.

我的改良項目 Items I have improved:

改良目的 Objectives of the improvements:

## 自我檢討及評估 Self-reflections and evaluations

### 1.相片集 Photo album

請貼上作品的相片

Photo of the product

請貼上與作品的合照

Photo of you and  
your product

2.作品最出色的地方 The most outstanding part of the product :

- ☐ 草船的外型 The shape of the thatched boat ☐ 物料 Materials
- ☐ 前進效果 Advancing effect ☐ 浮水效果 Floating effect
- ☐ 符合環保 Eco-friendly ☐ 尺寸比例 Dimensions
- ☐ 其他 Others:\_\_\_\_\_

3.製作上的難點 Difficulties faced during production:

- ☐ 扇葉的安裝 Fan blade installation ☐ 工具的運用 Use of the tools
- ☐ 搜集物料 Materials collection ☐ 組件之接合 Parts assembling ☐
- 草船外型設計 Shape design of boat ☐ 其他 Others:\_\_\_\_\_

4.製作心得分享 Sharing of the production process :

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5.在整個活動中，哪個地方最讓我感到成功?為什麼?

Which part of the activity makes me feel successful most?

Why?

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# 反思學習 Reflections

在製作過程中，把你學會的在 ☆ 內填上顏色。

Colour the stars for what you have learnt during the production process.

## S SCIENCE



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認識「亞基米德浮力定理」及「牛頓第三定律」

Understanding "Archimedes' Principle" and "Newton's Third Law"



能從生活中找出運用「亞基米德浮力定理」及「牛頓第三定律」的例子

Able to find some example of using the "Archimedes' Principle" and "Newton's Third Law" from daily life



運用閉合電路讓螺旋槳旋轉以產生風力，來推動草船前進

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# 生活放大鏡 Daily life magnifier



## Observing your surroundings with a magnifying glass

試從生活中找出運用了「亞基米德浮力定理」及「牛頓第三定律」的例子

Try to find some examples in our daily lives that apply the Archimedes' Principle and Newton's Third Law.



## 活動點滴 Comments

你在這次活動中有什麼收穫?試利用一篇短文來表達。

Write a short essay about your learning in this STEM activity?

第一段：介紹你在製作前的準備工作及如何構思設計

Paragraph 1: Introduce your preparatory work and the ways you gather your ideas.

第二段：分享你在製作過程中感受最深的地方，當中遇到甚麼困難及如何解決

Paragraph 2: Share the most memorable moments during the production process. What difficulties did you face and how did you deal with them?

第三段：通過這次活動，你學會了甚麼？你在未來製作活動上有什麼期望與目標？

Paragraph 3: What have you learnt in this activities? Do you have any expectation and objectives in your future projects?

																			5
																			10
																			15

# 同學互評 Peer evaluations

同學姓名 Name of classmate : \_\_\_\_\_

請在○內加上✓。

Put a✓ in the ○.

評估項目 Evaluation items											
1. 同學能整理和組織蒐集得來的資料 My classmate can organize the data collected											
(最低)	1	2	3	4	5	6	7	8	9	10	(最高)
Lowest	○	○	○	○	○	○	○	○	○	○	Highest
2. 同學能整理和組織蒐集得來的資料 My classmate can organize the data collected											
(最低)	1	2	3	4	5	6	7	8	9	10	(最高)
Lowest	○	○	○	○	○	○	○	○	○	○	Highest
3. 同學能整理和組織蒐集得來的資料 My classmate can organize the data collected											
(最低)	1	2	3	4	5	6	7	8	9	10	(最高)
Lowest	○	○	○	○	○	○	○	○	○	○	Highest
4. 同學能整理和組織蒐集得來的資料 My classmate can organize the data collected											
(最低)	1	2	3	4	5	6	7	8	9	10	(最高)
Lowest	○	○	○	○	○	○	○	○	○	○	Highest
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(最低)	1	2	3	4	5	6	7	8	9	10	(最高)
Lowest	○	○	○	○	○	○	○	○	○	○	Highest
6. 同學能整理和組織蒐集得來的資料 My classmate can organize the data collected											
(最低)	1	2	3	4	5	6	7	8	9	10	(最高)
Lowest	○	○	○	○	○	○	○	○	○	○	Highest

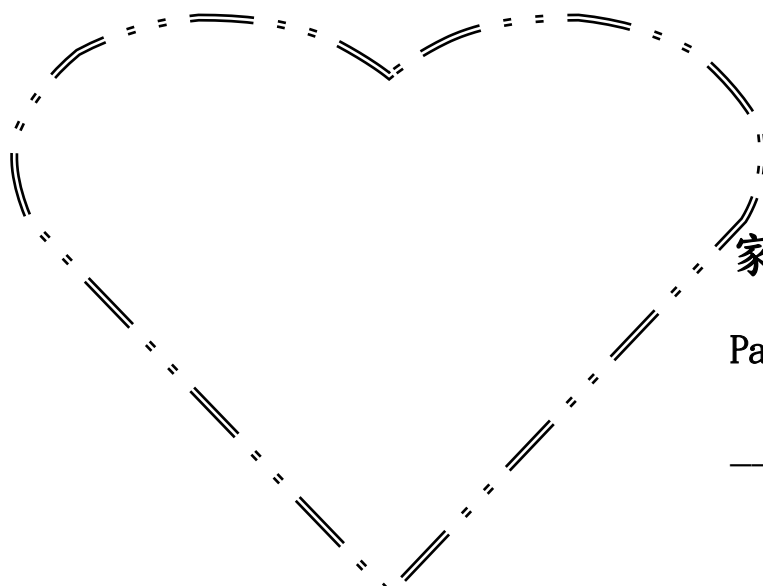
## 家長對子女的評估 Parent's Evaluations

請家長根據孩子是次 STEM 學習的表現，在下表適當的空格內加「✓」

Put a ✓ in the suitable boxes according to the child's performance.

評估項目 Evaluation Items		評估表現 Performance		
		表現優良 Excellent	合乎標準 Good	有待改善 Needs improvement
學會學習 Learning to learn	1.用不同的途徑搜集資料 Can use different ways to collect information.			
	2. 自發性地完成 STEM 自學手冊 Can finish the booklet independently.			
	1. 積極投入研習工作 Actively participate in the whole process.			
學會生活 Learn to live	1.問題時，能主動尋求解決方法，並與家人商討 Seek help when facing difficulties.			
	2.當地安排研習時間 Planning the study time appropriately.			

評語或意見 Comments :



家長簽署

Parent' s Signature:

\_\_\_\_\_



## 老師對學生能力的評估 Teacher's evaluations

範疇 Category	準則 Criterion	評估 Assessment		
		甚強表現出色 Excellent	可以尚算滿意 Good	未能呈現仍需努力 Needs improvement
協作能力 Cooperation Skills	1. 欣賞他人 Appreciate others			
	2. 有效地進行小組工作 Work effectively in a team			
	3. 協商能力 Negotiation capability			
溝通能力 Communication Skills	1. 採用恰當溝通方法 The use of appropriate communication methods.			
	2. 運用準確及合適的資料表達自己意見 Use accurate and appropriate information to express their views			
	3. 有系統地組織內容 Organize content systematically			
創造力 Creativity	1. 解決問題的能力 Problem solving skill			
	2. 創意的態度 Attitude of creativity			
	4. 創意思想及策略 Creative thinking and strategy			
批判思考能力 Critical Thinking Skills	1. 對蒐集資料進行探究 Making use of the collected data to explore			
	2. 對蒐集資料作判斷 Make judgments on the gathered information			
	3. 從資料及知識中建立自己的觀點 To form views and from the data collected and knowledge constructed			
運用資訊科技能力 Information Technology Skills	1. 明智地使用資訊科技 Effective use of Information Technology			
	2. 利用資訊科技去尋找、吸收、分析處理各項資料 Use of information technology to find, absorb, analyse and process the data			

	3.利用資訊科技養成自學習慣 Develop a self-learning habit through the use of information technology			
運算能力 Numeracy Skills	1. 把學習得來的知識，應用在生活上 Apply the knowledge in the daily life.			
	2.管理數據 Data management			
	3.處理紀錄物資存量 Taking accounts of the materials inventory			
解決問題的能力 Problem Solving Skills	1.分析有關資料 Data analysis			
	2. 採取最合適方法解決問題 Use the most appropriate method to solve problems			
	3.檢討方案成效 Examine the effectiveness			
自我管理能力的 Self Management Skills	1.對工作積極和主動 To work actively			
	2.定下適切的目的，計劃和行動來達成目標 Setting objectives, plans and actions appropriately to achieve their goals			
	3.懂得管理時間、金錢和其他資源 Know how to manage time, money and other resources			
研習能力 Study Skills	1. 提升學習效能 Enhance learning effectiveness			
	2. 提升學習態度 Enhance learning attitude			
	3. 掌握研習能力 Master study skills			

老師對學生作品的評估：



**Product evaluations by the teacher:**

準則 Criterion	未能呈現 Not shown in the product	仍需努力 Needs improvement	尚算滿意 Good	表現甚強 Very Good	表現出色 Excellent
航行表現 Sailing performance					
草船造型 Outlook of the boat					
設計能體現 原著劇情 Design can reflect the original plot					
符合環保原則 Eco-friendly					



## 評分準則 Assessment Guidelines :

### 1.設計圖 Design of the model 5 分 Marks

1-2 分 Marks	3 分 Marks	4 分 Marks	5 分 Marks
<p>只能繪畫出作品部分外形，且整潔欠佳</p> <p>Can draw only part of the model and the drawing is untidy.</p>	<p>能繪畫出作品部分外形，但未能從圖中得知物料、比例等資料</p> <p>Can draw only part of the model and information such as materials and dimensions is not provided.</p>	<p>能完成作品的設計圖，但尚欠部分資料，仍欠細緻</p> <p>Can draw the entire model but part of the information is not clearly provided.</p>	<p>能準確繪畫作品的外形、比例及所需物料，詳盡和細緻</p> <p>Can draw an accurate model with detail information such as dimensions and materials fully provided.</p>
( )分 Marks	( )分 Marks	( )分 Marks	( )分 Marks

### 2.製作流程圖 Steps 5 分 Marks

1 分 Mark	2-3 分 Marks	4 分 Marks	5 分 Marks
<p>只能完成製作流程圖中一個或以下部分，令人對製作過程模糊不清</p> <p>Can only use 1 step to present the model making process. The presentation is very unclear.</p>	<p>只能完成製作流程圖中兩個或三個部分，使人對製作過程有初步了解</p> <p>Can only use 3 steps to present the model making process. Readers can only have a rough idea of the making process</p>	<p>只能完成製作流程圖中四個或五個部分，使人對製作過程有清晰的了解</p> <p>Can only use 4-5 steps to present the model making process. Readers can understand it clearly.</p>	<p>能完成製作流程圖中八個部分，表達完整、清晰，令人對製作過程一目了然，準確細緻</p> <p>Use 8 steps to present the model making process. Readers can easily understand the details</p>
( )分 Mark	( )分 Marks	( )分 Marks	( )分 Marks

### 3.科學活動成果 Outcome of the activity 5 分 Marks

1 分 Mark	2-3 分 Marks	4 分 Marks	5 分 Marks
<p>未能把學會的知識和技能表達出來</p> <p>Cannot present the outcome of the activity.</p>	<p>只能局部把學會的知識和技能表達出來，但沒有把內容作系統的組織，分類欠條理</p> <p>The outcome does not have enough details and the contents are not well-organised.</p>	<p>能把學會的知識和技能表達出來，清晰整潔有條理，使人容易理解</p> <p>Can present the outcome of the activity in a well-organised manner.</p>	<p>能具體及詳盡地把學會的知識和技能表達出來，可見能切合主題作深入、多角度的反思</p> <p>Can concretely express what has been learned in detail. It shows that there has been deep reflection of the activity from multiple angles.</p>
(     )分 Mark	(     )分 Marks	(     )分 Marks	(     )分 Marks

**獎項 Awards :**

**最佳草船航行獎**

The best sailing award

**最佳草船外型獎**

The best shape award

**最佳環保物料獎**

The most eco-friendly award



## 實用詞彙

### 物料

電池 battery    電池盒 switch box    電線 electrical wire  
膠樽 plastic bottle    稻草 straw    木板 wooden board  
馬達 motor    螺旋槳 propeller

### 製作名詞

切割 cut    接駁 connect    固定 fix    黏貼 stick    檢查 check  
去掉/除去 remove    安裝 install    剪裁 cut out    鑽孔 bore  
著色 colour    揀選 select    鑲嵌 inlay

### 工具

剪刀 scissors    顏色 color    尺 ruler    護目鏡 safety  
glasses    熱溶膠槍 glue gun    電鑽 drill    圓規 compasses  
切割刀 cutter    鉗子 pliers    螺絲刀 screw driver  
鐵鎚 hammer    鋸子 saw