

Insulating Device



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Class: P3 - Reverence No.: 19

Primary Three General Studies First Term Project

All Primary Three students will have to complete a General Studies Project from late November to December, 2023.

Topic: Insulating Device

Task:

Dad buys an ice-cream for Daniel from a fast-food shop. However, the ice-cream melts when Dad comes back home.



After 20 minutes...



How can you make the ice-cream not to melt so quickly? Follow the steps below and design an insulating device which can keep the ice-cream cold.

Guidelines

- (i) Refer to Book 3B: Chapter 1 Heat and Temperature and Chapter 2 Amazing effects of heat and the video on Google classroom.
- (ii) Complete this Project Booklet to record your learning process at different stages.
- (iii) Design a cover for this Project Booklet.
- (iv) Choose different materials and make an insulating device that can keep ice-cream cold.

Submission of work:

Please submit the Project Booklet and insulating device on the following days.

4 th December, 2023	<ul style="list-style-type: none">• Project Booklet Pg. 1 - 76
2 nd January, 2024	<ul style="list-style-type: none">• Project Booklet Pg. 9 - 15 14• Insulating device (with name label on it)

Be active and creative!

Date: 2nd December, 2023

A. Collecting information. (4 marks)

Think about the following questions. Collect information about **heat conductivity** and **heat insulation** from different sources such as websites, videos, books and magazines. Answer the following questions and list out the sources of information.

1. Why does ice-cream melt?

The ice-cream melt because the air is hotter while the ice-cream is colder so heat is transferred from the air to the ice cream.

2. How do we keep things warm / cold in daily life?

We keep things warm in the thermal cooker
We keep things cold in the refrigerator.

3. What materials are usually used for keeping things warm / cold?

We usually used styrofoam box for keeping things cold/warm.

4. What is special about these materials?

These materials is very light. ^{it is a poor conductor of heat.}



***Please note that some insulating bags have a shiny and silvery layer inside. However, this is using another scientific principle about heat but not because of heat conductivity.*



Source of information:

(The links and QR codes in examples are only for you to access to the information easily.

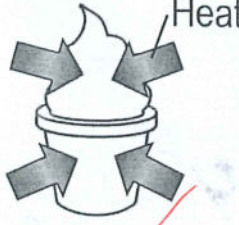
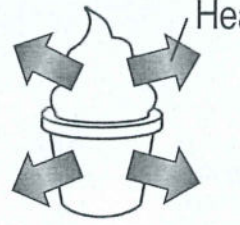
It is not necessary to put any links or QR codes.)

Types of information (Circle the answer)	Name of information
e.g. (Website / Book / <u>Video</u> / Newspaper / Magazine / Other: _____)	<ul style="list-style-type: none"> (Why do woolen clothes keep us warm? https://youtu.be/DWaWocvbpQI) 
e.g. (<u>Website</u> / Book / Video / Newspaper / Magazine / Other: _____)	<ul style="list-style-type: none"> (Don't Melt the Ice! Science Experiment for Kids https://frugalfun4boys.com/ice-melting-science-experiment/) 
(<u>Website</u> / Book / Video / Newspaper / Magazine / Other: _____)	<ul style="list-style-type: none"> (16 things you should do to keep warm in cold weather)
(<u>Website</u> / Book / Video / Newspaper / Magazine / Other: _____)	<ul style="list-style-type: none"> (What are the best metal for conducting heat?)
(Website / Book / <u>Video</u> / Newspaper / Magazine / Other: _____)	<ul style="list-style-type: none"> (Super Scientists: Don't melt the ice!)
(Website / Book / <u>Video</u> / Newspaper / Magazine / Other: _____)	<ul style="list-style-type: none"> (Kid Experiments: Melting ice- Darwin and Newtons)
(Website / Book / <u>Video</u> / Newspaper / Magazine / Other: _____)	<ul style="list-style-type: none"> (Heat Conductors and insulators- Glass vs Metal)

B. Thinking. (3 marks)

1. How is heat transferred?

(Put a ✓ in the appropriate () and circle the correct answers.)

		The ice-cream is (<u>colder</u> / hotter). The air is (colder / <u>hotter</u>). Heat is transferred from the (ice-cream / <u>air</u>) to the (<u>ice-cream</u> / air).
(✓)	()	


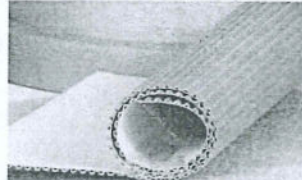




2. Do all materials transfer heat at the same speed? If no, which materials can transfer heat faster? (Put a ✓ in the appropriate () and write the answers on the line.)

() Yes, all materials transfer heat at the same speed.



(✓) No, copper and iron can transfer heat faster.

3. (a) Are the following materials good or poor heat conductors?

(Circle the correct answers.)

 <p>Cloth</p> <p>(Good / <u>Poor</u>) conductor of heat</p>	 <p>Corrugated paper</p> <p>(Good / <u>Poor</u>) conductor of heat</p>	 <p>Tinfoil</p> <p>(<u>Good</u> / Poor) conductor of heat</p>
 <p>Newspaper</p> <p>(Good / <u>Poor</u>) conductor of heat</p>	 <p>Cling wrap</p> <p>(Good / <u>Poor</u>) conductor of heat</p>	 <p>Styrofoam</p> <p>(Good / <u>Poor</u>) conductor of heat</p>

(b) Collect **TWO to THREE** more materials base on the information you have found in Part A. Are they good or poor heat conductors? (Paste the materials or their pictures in the boxes below, write their names and circle the correct answers.)

		 <p>(Paste the materials or their pictures here.)</p>
Other: <u>cotton</u> (<u>Good</u> / Poor) conductor of heat	Other: <u>tinfoil</u> (<u>Good</u> / Poor) conductor of heat	Other: <u>bubble wrap</u> (<u>Good</u> / Poor) conductor of heat

4. To make an insulating device which can keep the ice-cream cold, should you choose the materials which transfer heat faster or slower?
 (Circle the correct answer.)

I should choose the materials which transfer heat (faster / slower).

5. Which of the **materials in Question 3(a) and 3(b)**, would you choose for making an insulating device? Why? (Write the answers on the lines.)

I would choose cloth and bubble wrap because the materials can keep the ice-cream cold and transfer heat slower.

6. What factors may also affect the keeping-cold function of the insulating device?

(Put a ✓ in the appropriate ().)

() Colour of the materials

() Thickness of the materials

() Shape of the containers

() Method of wrapping the container

() Others: _____

7. Besides the performance of keeping cold, what other factors would you think about when you design the device? (Circle the correct answers.)

My device should be...

• (light / heavy)

• (safe / not safe) to use

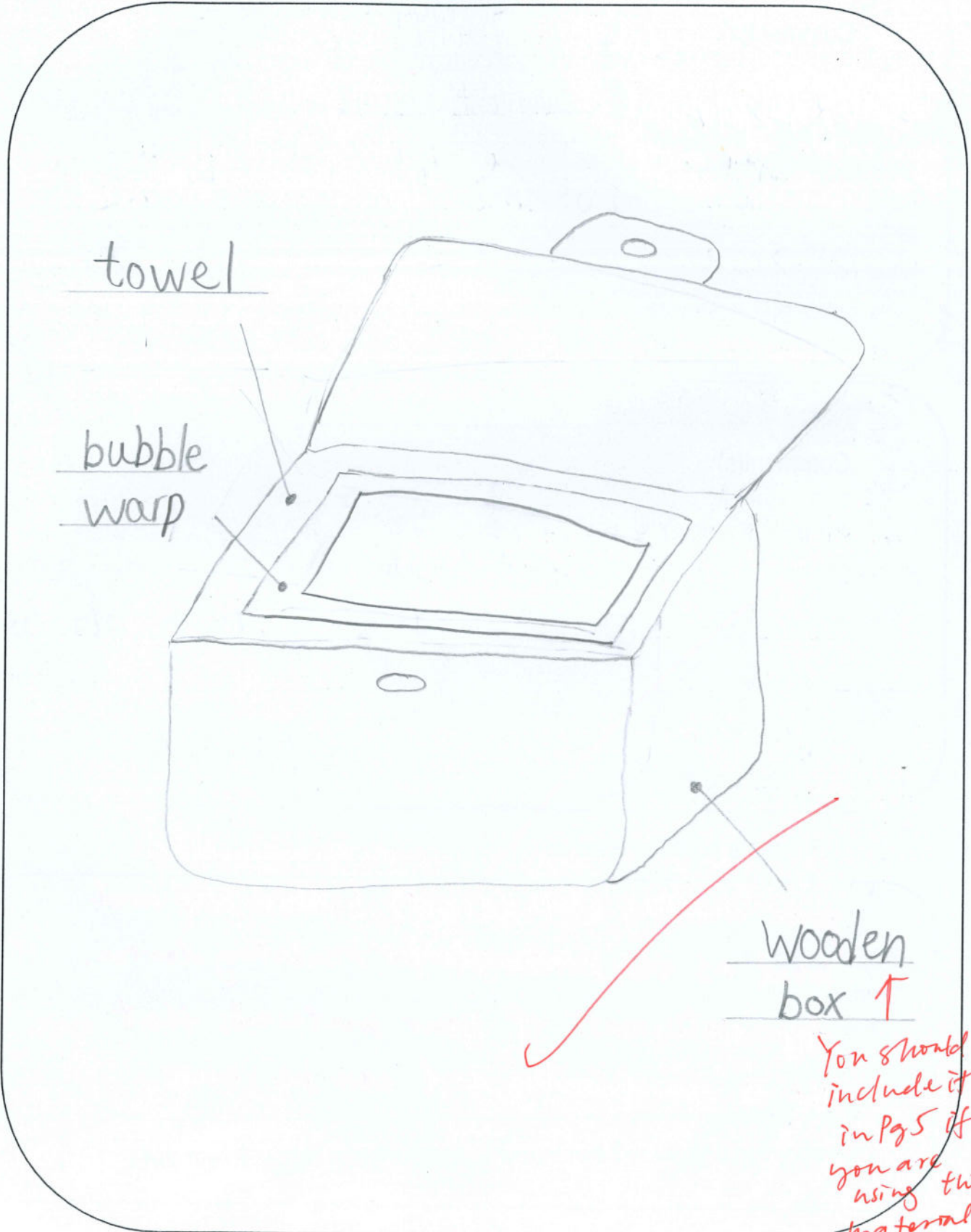
• (small / big)

• (easy / difficult) to use

• Others: eco-friendly

C. Designing. (4 marks)

- i. Design an insulating device for keeping the ice-cream cold with the materials mentioned in **Part B Question 5**.
1. Draw your design and label the materials used for different parts in the box below.



You should include it in Pg 5 if you are using this material for your insulating device

Date: 5th December, 2023

2. Present your design to 2 classmates. What do they think about your design?
Ask your classmates to write down their comments in the boxes below.

Name of the classmate: Halia

Comment(s): It looks beautiful. It is easy to use. It maybe be easy but maybe not convenient to carry. It's safe to use, it's reusable. The material is eco-friendly. You choose the correct material. The method of insulating device is correct.

Name of the classmate: Kaylee

Comment(s):

very good, It's the good one.

3. Comments from the teacher

good choosing cloth (towel), bubble wrap and wood as the materials for insulating device.

Appreciate most of your materials that you use is eco-friendly and can be reuse

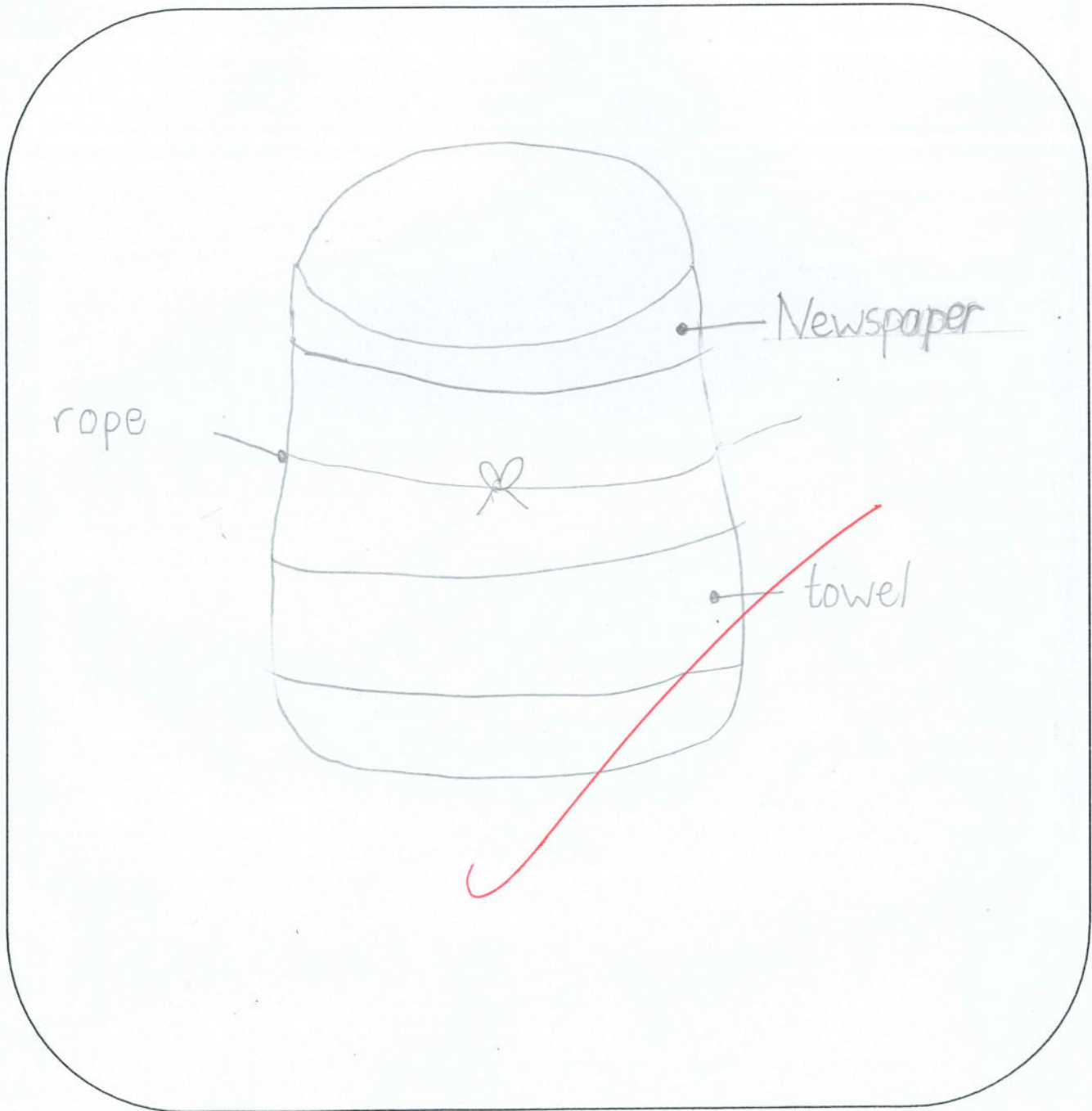
Date: 28th December, 2023

ii. Modification of your insulating device.

Regarding the comments from classmates and teacher, would you like to modify your design? (Put a ✓ in the () to show your choice.)

() Yes, I would like to modify my design in this way.

(Draw your modified design and label the materials used for different parts in the box below.)



() No, my design is good enough. I would not like to modify my design.

D. Making. (2 marks)

Make your insulating device according to your design.
Take a picture and paste it in the box.



E. Testing. (5 marks)

****Why do we need to prepare 2 containers?**

One of the containers is used as the control group for comparison. The size and shape of this container should be **the same as** the container which you use for making your insulating device.

When we do an experiment, it is important to have a **fair test and control experiment**. Watch the following video to know more about fair test and control experiment.

Fair Tests: <https://youtu.be/yYMPbKbK1yo>



Identify the different variables in this experiment.

(Put a ✓ in the appropriate (.).)

Independent variable (The only factor that changes)	(<input checked="" type="checkbox"/>) The materials which are used for wrapping the containers (<input type="checkbox"/>) The shape of two containers
Dependent variable (The factor we observe)	(<input checked="" type="checkbox"/>) Amount of melted water collected (<input type="checkbox"/>) The size of two containers
Controlled variables (The factor we do not change)	(<input checked="" type="checkbox"/>) Size of ice cubes (<input checked="" type="checkbox"/>) Amount of ice cubes (<input checked="" type="checkbox"/>) The size of two containers (<input checked="" type="checkbox"/>) The shape of two containers (<input type="checkbox"/>) The materials which are used for wrapping the containers

Do an experiment to test your insulating device.

(Please refer to the video on Google Classroom for the steps.)

Add the same amount of ice cubes into your device and the container of the control group. Pour the melted water into two bowls after 15 minutes. Compare the amount of melted water.

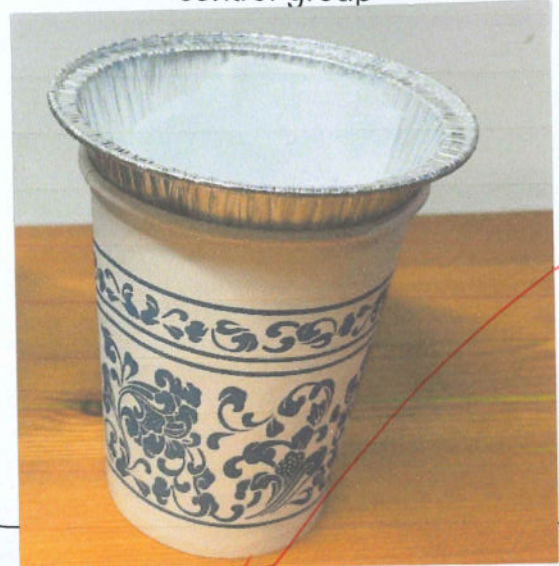
(a) Take **CLEAR** pictures at the beginning and at the end of experiment. Paste the pictures in the boxes below.

At the beginning of the experiment:

Ice cubes in my insulating device



Ice cubes in the container of the control group

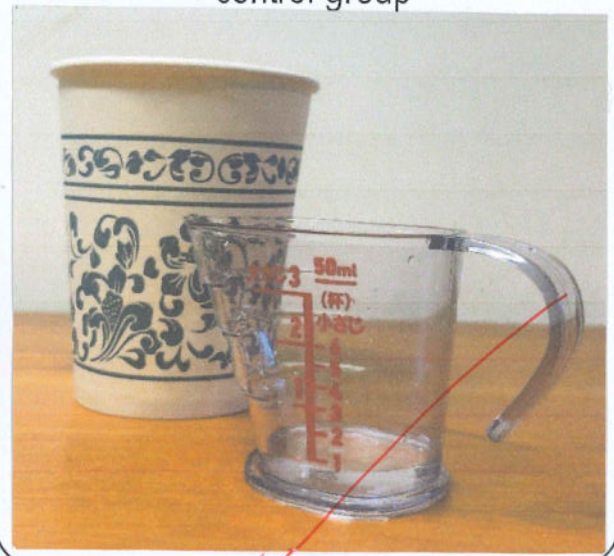


After 15 minutes:

Melted water from my insulating device



Melted water from the container of the control group



(b) Results (Circle the correct answers):

- (More / Less) ice cubes have melted in my insulating device.
- My device (can / cannot) keep ice-cream cold.

(c) Why does your device work or not work?

My device work because I use towel and newspaper as poor heat conductors, they transfer heat slowly.

F. Improvement. (2 marks)

1. Think about your device. Besides the performance in keeping cold, is your insulating device... (Circle the appropriate answers.)

- (a) reusable? (Yes/No)
- (b) easy to use? (Yes/No)
- (c) safe to use? (Yes/No)
- (d) beautiful (Yes/No)

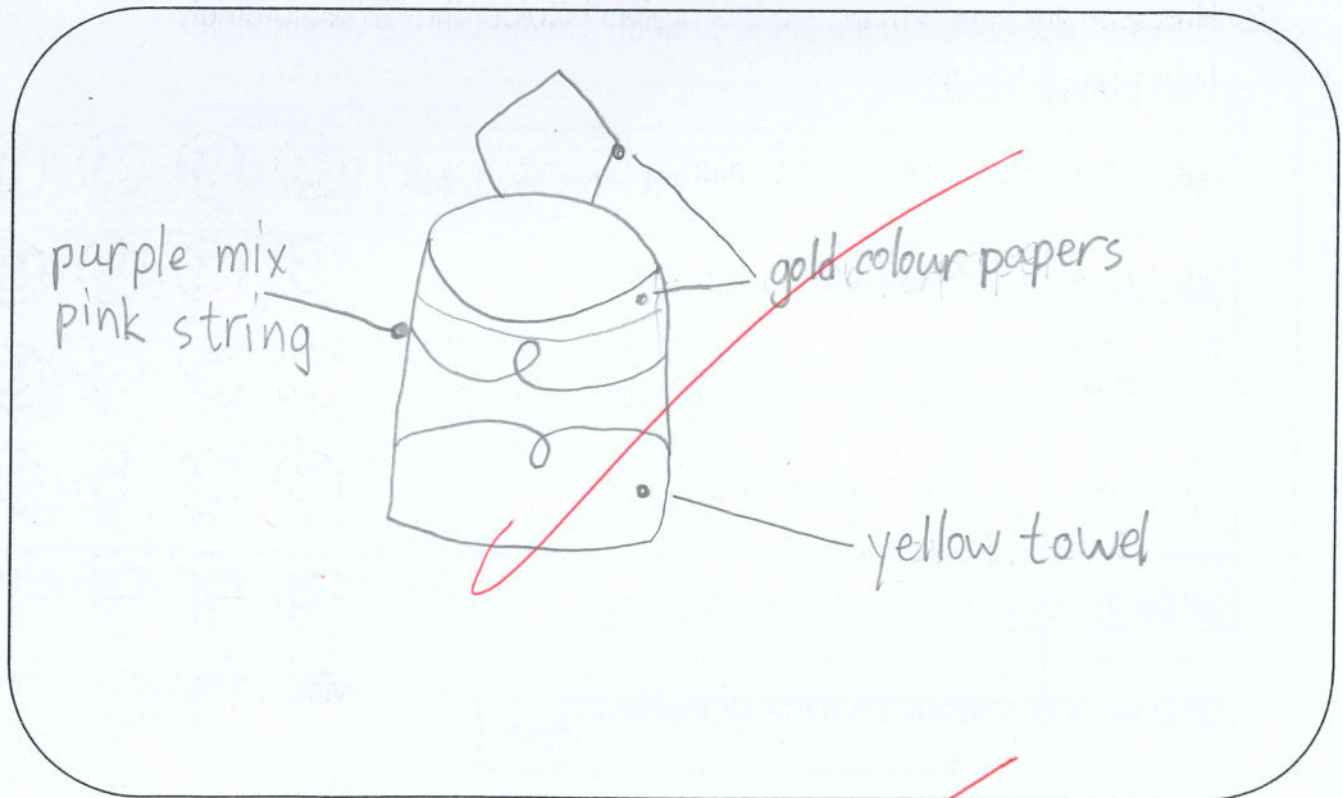
2. What do you want to improve for your insulating device?

(Put a ✓ in the appropriate ().)

- () The performance of keeping cold.
- () The convenience of using my insulating device.
- () The safety of my insulating device.
- (✓) The look of my insulating device.
- () Others: _____

3. What changes do you want to make in order to make your insulating device better?

(a) Draw and label your modified design in the box.



(b) What has been changed in your new design?

I have been changed the colour of all material.

G. Self-evaluation and Reflection. (5 marks)

1. Did you face any difficulties in the following steps? Put a ✓ in the () if you had this difficulty and write down how you solved the problems.

Steps	Ways to solve the problems
() Getting information	
() Choosing materials	
(✓) Designing	Useing red string instead of rubber bands.
() Making	
(✓) Testing	The ice cubes do not melt in cold weather, we need to do the fair
(—) Others:—	test again in warmer weather.

good observation!

2. How was your performance in this project? Colour the ☺ accordingly.

In this project, I can...

(a) Collect information through different ways by myself.	☺ ☺ ☺ ☺
(b) Collect different materials by myself.	☺ ☺ ☺ ☺
(c) Design the insulating device by myself.	☺ ☺ ☺ ☺
(d) Make the insulating device by myself.	☺ ☺ ☺ ☺
(e) Do the experiment and record the result.	☺ ☺ ☺ ☺
(f) Draw a conclusion from the experiment.	☺ ☺ ☺ ☺
(g) Apply what I have learnt in the lessons.	☺ ☺ ☺ ☺
(h) Solve the problems by myself.	☺ ☺ ☺ ☺

3. What have you learnt from this project?

I have learnt different materials have different heat conductivities and it is ^{important} to have a fair test when we do experiment. *good!*

4. Which part of the project do you like most? Why?

I like testing part of the project because it's fun. I can prove that my device work is successful.

5. Do you like this project? Why?

Yes, because I can apply this knowledge in my everyday life. *very good!*

Science is everywhere around us!

Other assessment criteria:

- Creativity and eco-friendliness (3 marks)
- Bonus (2 marks)

Marks



Ideas are clearly presented and well-organized! I like your reflection very much!

Worksheet	
Part A. Collecting information	3.5 /4
Part B. Thinking	3 /3
Part C. Designing	3.5 /4
Part D. Making	2 /2
Part E. Testing	5 /5
Part F. Improvement	2 /2
Part G. Self-evaluation and reflection	5 /5
Creativity and eco-friendliness	3 /3
Bonus	2 /2
Total	29 /30