MEDICAL MISSION DESIGN WORKBOOK

Year 4

STUDENT WORKBOOK

Name: ____________________________________________

Other group members: ____________________________________________

__________________________________

__________________________________

Group Number: ________________  Class: __________________________
THINKING SPACE
… drawings, diagrams, observations, notes, reflections …
PART 1

ENGINEERS WORKING WITH MATERIALS

1. Complete the engineering design model below.

**ENGINEERING DESIGN MODEL**

Adapted from pbs.org model
THINKING SPACE

… drawings, diagrams, observations, notes, reflections …
THE PROBLEM

2. **Read** about the problem you will be solving:

   To design and make a strong, covered 3D shape to carry medicines (such as eye drops) at a cool temperature from a helicopter to an injured person in the rainforest.

Before you start on your design, you will learn about some things that will help you with your design.

EXPLORING 3D SHAPES

3. Try to **make** a cube. **Cut** along the lines of the net of a cube but do NOT cut the dotted lines. **Fold** the dotted lines to make a cube.

   **Trace** around the edges. **Trace** over the faces. **Point** to the vertices (corners).

   ![Net of a cube](image1)
   ![Cube](image2)

   **Describe** the cube. Think about the faces, edges and vertices.

___________________________________________________________________________

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THINKING SPACE

… drawings, diagrams, observations, notes, reflections …
4. **Explore** regular 3D shapes (a cuboid is also known as a rectangular prism).

- Can you identify objects with these shapes in your classroom or outside environment?
- Can you tell how many edges, faces and vertices there are for each shape?
THINKING SPACE

… drawings, diagrams, observations, notes, reflections …
5. **Draw** a picture to show the different temperatures.  

Remember: 0°C is the freezing point for water and 100°C is the boiling point for water.

<table>
<thead>
<tr>
<th>0°C</th>
<th>25°C</th>
<th>100°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**STATES OF MATTER**

6. **Watch** the video explaining how water has three different states.

**Watch** the videos about the three states of matter.

**Role play** the three states of matter.

**TESTING THE PROPERTIES OF MATERIALS**

“Properties” means how the material looks, feels, and behaves with different push and pull forces.

7. Look at the “Testing the Properties of Materials” table on the next page. Your task:
   a. **Predict** what will happen to the material and underline YES, UNSURE or NO.
b. **Observe** what happens to the material and *circle* YES, UNSURE or NO.
c. **Explain** to your group what happened and why.
THINKING SPACE
… drawings, diagrams, observations, notes, reflections …
## Testing the Properties of Materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Squash</th>
<th>Stretch</th>
<th>Twist</th>
<th>Scratch it</th>
<th>Waterproof</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium (metal)</td>
<td>Yes</td>
<td>Unsure</td>
<td>No</td>
<td>Yes</td>
<td>Unsure</td>
</tr>
<tr>
<td>Paper</td>
<td>Yes</td>
<td>Unsure</td>
<td>No</td>
<td>Yes</td>
<td>Unsure</td>
</tr>
<tr>
<td>Plastic</td>
<td>Yes</td>
<td>Unsure</td>
<td>No</td>
<td>Yes</td>
<td>Unsure</td>
</tr>
<tr>
<td>Fabric</td>
<td>Yes</td>
<td>Unsure</td>
<td>No</td>
<td>Yes</td>
<td>Unsure</td>
</tr>
<tr>
<td>Polyfoam</td>
<td>Yes</td>
<td>Unsure</td>
<td>No</td>
<td>Yes</td>
<td>Unsure</td>
</tr>
</tbody>
</table>
THINKING SPACE

… drawings, diagrams, observations, notes, reflections …
What material will you choose to cover your 3D shape to stop the ice from melting so quickly?

____________________________________________________________________________________

Why did you choose this material?

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________
THINKING SPACE
… drawings, diagrams, observations, notes, reflections …
PART 2

THE PROBLEM AND DISCUSSING RESOURCES

8. The problem:

Remember the problem to solve for the MEDICAL MISSION… That is, design and make a strong medical kit (covered 3D shape) to carry medicine to an injured person. The aim is to keep the medicine safe and cool.

Materials:

- 16 pipe cleaners (10cm long)
- 16 straws (5cm long)
- Material to cover the container (foil, paper towel, bubble wrap, fabric, polyfoam)
- Scissors
- Sticky tape

Instructions:

➢ Use the straws and pipe cleaners to make any 3D shape – regular or irregular. You can strengthen this shape in any way you want with the resources provided. This shape will become your medical kit and will be used to keep the medicine in.

➢ You can join pipe cleaners by bending and twisting them around each other.

➢ Cover your container with your chosen material.
  ○ Use scissors to cut your material to fit your container.
  ○ Use sticky tape to attach the material to your container.

➢ Your container needs to have a lid/door/opening flap so that you can place your ice cube inside.
THINKING SPACE
… drawings, diagrams, observations, notes, reflections …
9. **Design** a strong medical kit (covered 3D shape) as a container to carry medicine. **Draw** and **label** your design below.

**Build** your medical kit.

Now, **draw** and **label** your design *after* making it.
THINKING SPACE
… drawings, diagrams, observations, notes, reflections …
Record answers to the following questions about your design.

a. What do you think is good about your design?

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

b. Will your medical kit be strong enough to carry the medicines? Why or why not?

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

c. Why do you think the covering will work to keep the medicine cool?

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

Extension: Describe your design.

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___________________________________________________________________________
THINKING SPACE
… drawings, diagrams, observations, notes, reflections …
10. Follow the instructions below to test the covering of your design.

a. Carefully take your medical kit (covered 3D shape design) outside along with your booklet and pencil.

b. Set it up in direct sunlight and out of the wind.

c. One for the whole class - Take an ice cube and put it in a small 30mL plastic container. Leave this one in the direct sunlight. This is known as the control.

d. Take another ice cube and put it in another small 30mL plastic container. Place it inside your medical kit and close it.

e. Record the time and temperature below.

   Time: ___________________
   Temperature: ___________________

DISCUSSIONS DURING TESTING – STAGE ONE

11. While you are waiting for the class ice cube (control) to melt, you can do the following:

   Observe other students’ 3D designs. Discuss these designs.

   Learn how to use the syringe to measure in mL.

   When the control ice cube has melted, watch while the remaining water is measured in mL.

   Record the amount of water for the control in mL.

   ___________mL

   Work with other group members to measure the amount of water left for each of your 3D designs.
   • Be careful when removing the 30mL container from your medical kit.
   • Use a syringe to draw up the remaining water.

   Record the amount of water from your container in mL.

   ___________mL
THINKING SPACE
… drawings, diagrams, observations, notes, reflections …
12. **Record** the class results in the table below.

**Table 1. Material and melted ice cube measurement**

<table>
<thead>
<tr>
<th>Material</th>
<th>0mL to 2mL (most effective)</th>
<th>&gt;2mL to 5mL</th>
<th>&gt;5mL to 8mL</th>
<th>&gt;8mL (least effective)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fabric</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polyfoam</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
THINKING SPACE

… drawings, diagrams, observations, notes, reflections …
TESTING THE STRENGTH OF THE MEDICAL KITS – STAGE TWO

13. Follow the instructions below to test the strength of your design.

a. In your group, two students hold a piece of cardboard on top of a medical kit.

b. The owner of the medical kit places weights on top of the cardboard directly over the medical kit.

c. When the medical kit starts to fold (collapse) or the cardboard begins to move downwards while loading, the owner of the kit adds up the weights, including the weight of the cardboard (15g).

Record each group member’s name and measurement in grams (g) in the table below.

<table>
<thead>
<tr>
<th>Name:</th>
<th>Name:</th>
<th>Name:</th>
<th>Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>g</td>
<td></td>
<td>g</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
THINKING SPACE

… drawings, diagrams, observations, notes, reflections …
14. **Record** answers to the following questions about designing and testing your medical kit.

a. What did you learn from designing and testing your medical kit?

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___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

b. What would you like to change in your medical kit design?

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___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
THINKING SPACE
… drawings, diagrams, observations, notes, reflections …
If you could use any materials at all, how would you redesign your medical kit?

**Draw and label** a picture below.

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**Why** would this new design be better?

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
THINKING SPACE

… drawings, diagrams, observations, notes, reflections …
15. Please **colour in the face** to show how you felt about the different parts of the *Medical Mission*.

<table>
<thead>
<tr>
<th>Did you like:</th>
<th>Did not like it</th>
<th>Not sure</th>
<th>Liked it</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ... the activity about a Medical Mission?</td>
<td>🙁</td>
<td>🙁</td>
<td>😊</td>
</tr>
<tr>
<td>2. ... having a real problem to solve?</td>
<td>🙁</td>
<td>🙁</td>
<td>😊</td>
</tr>
<tr>
<td>3. ... testing the different materials?</td>
<td>🙁</td>
<td>🙁</td>
<td>😊</td>
</tr>
<tr>
<td>4. ... designing a 3D shape?</td>
<td>🙁</td>
<td>🙁</td>
<td>😊</td>
</tr>
<tr>
<td>5. ... making a strong medical kit?</td>
<td>🙁</td>
<td>🙁</td>
<td>😊</td>
</tr>
<tr>
<td>6. ... testing your medical kit?</td>
<td>🙁</td>
<td>🙁</td>
<td>😊</td>
</tr>
<tr>
<td>7. ... recording the results of your medical kit?</td>
<td>🙁</td>
<td>🙁</td>
<td>😊</td>
</tr>
<tr>
<td>8. ... thinking about how to make your medical kit better?</td>
<td>🙁</td>
<td>🙁</td>
<td>😊</td>
</tr>
</tbody>
</table>

**Next time I would like to:**

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________