Name: ________________________________

Grade: 9  Subject: Science  Teacher: Mr Ferres/ Mr Gustafson

Due Date: ______________________________

Mode: Extended Experimental Investigation.

Conditions: Approximately three (3) weeks notice of task.

Your teacher will supply the equipment required to complete your experiment.

You will provided some allocated in class time with teacher feedback to work on your assessment.

You are to work in a group of 2 - 3 in order to research, design and perform your investigation, but will present your own individual scientific report.

You must attach this Assessment Task Sheet to the front of your report.

Length: Left to the discretion of the student.

Task: You are required to design, conduct and report on an experiment that tests.

There are three stages to the assessment task:

(A) Complete the ‘EEI Scaffold Worksheet – Insulators’, ‘Experimental Planning Sheet’ and ‘Risk Assessment’ for your proposed experiment.

(B) Collect the equipment required and carry out your experiment.

(C) Use the ‘Guide to Writing a Scientific Report’ to write a scientific report presenting the findings of your experiment.

You are required to submit: (1) ‘EEI Scaffold Worksheet – Insulators’ (2) ‘Experimental planning sheet’ (3) ‘Risk Assessment’ (4) Written Scientific Report on your completed experiment.
The Context – Insulators

Here’s some general information to help you get started.

INTRODUCTION

Thermal insulators are materials that slow down the transfer of thermal energy. This is because the way the molecules are arranged and bonded together doesn’t allow thermal energy to flow very easily.

Insulators such as socks, jumpers and blankets keep us warm in cold weather. They make it difficult for our ‘body heat’ to escape, insulating us against the cold. Insulation in the roof and walls of a house prevents heat gain and loss during summer and winter.

So insulation can hold heat in or keep heat out.

NOTE: When scientists talk about insulators and conductors they may be talking about the transfer of electricity or heat. In this investigation we are only concerned with the transfer of heat.

INSULATION MATERIALS

Good thermal insulators include materials such as insulation batts in houses or cotton and wool in clothing.

Good thermal conductors include materials such as metals and glass.

Figure 1: Insulation materials
### Table 1: Timeline for completion of EEI: insulators

<table>
<thead>
<tr>
<th>Date</th>
<th>Tasks to complete</th>
</tr>
</thead>
</table>
| Monday Week 3 and Tuesday Week 3 | EEI Scaffold Worksheet – Insulators (Group)  
- Title  
- Aim  
- Background research (with references)  
- Hypothesis  
- Variables  
- Fair test  
- Equipment  
- Diagram  
- Method  
Experimental Planning Sheet  
Risk Assessment |
| Friday Week 3 | Conduct Experiment (record results) (Group)  
IF NOT COMPLETED DURING THIS LESSON STUDENTS WILL NEED TO ARRANGE TO COMPLETE EXPERIMENT DURING THEIR OWN TIME. |
| Monday Week 4 | EEI Scaffold Worksheet – Insulators (Group)  
- Discussion  
- Conclusion  
Write up scientific report (individual) |
| Tuesday Week 4 | Non-assessment work (or catch-up) |
| Friday Week 4 | EEI Scaffold Worksheet – Insulators (Group)  
- Discussion  
- Conclusion  
Write up scientific report (individual) |
| Monday Week 5 | Non-assessment work (or catch-up) |
| Friday Week 5 | Assessment DUE |
EEI Scaffold Worksheet - Insulators

1 Title: 

1 Aim (What do we want to find out?): The aim of this investigation is to:

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

4 Background:

1. Write a definition of a thermal conductor and thermal insulator.
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2. Give two examples of thermal conductors and two examples of thermal insulators.
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3. Describe how the molecules are arranged differently in thermal conductors and thermal insulators and how this affects whether they stop heat moving through them or allow heat to move though them.
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4. Identify three areas of life where thermal insulators are used to make life easier or more comfortable.

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5. Why is this experiment important?
To answer this question consider the following questions:

(a) Why do we need to know which insulators are most effective at stopping the movement of heat energy?

(b) How could the results of this experiment be used to benefit society?
1. **Hypothesis** (What do you think will happen?):

2. **Dependent Variables** (List the things that **will** change in your investigation)

3. **Independent Variables** (List the things that **will not** change in your investigation)

4. **Equipment**

5. Draw a diagram of your experimental set up:
Method

Step 1:
_____________________________________________________________________________________
_____________________________________________________________________________________

Step 2:
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Step 3:
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Step 4:
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Step 5:
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Step 6:
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Step 7:
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Step 8:
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Step 9:
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Step 10:
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2
Results

Design and complete your own results table:

Use the graph paper to display your results graphically.

Use ‘Time (minutes)’ on the horizontal axis and ‘Temperature (°C)’ on the vertical axis.

Graph the results for each insulator on the same graph (this will mean you will have four lines on your graph).

Make sure you include a title for your graph and label the axis.
Discussion

1. Which insulation material kept heat in the longest? Why do you think this material kept heat in the longest?

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2. Which insulation material kept heat in the shortest amount of time? Why do you think this material kept heat in the shortest amount of time?

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3. What could you change to improve your experiment if you did it again?

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4. If you were designing a device to put around a coffee cup to keep the coffee hot for longer, what material would you use? Why?

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5. How could the findings of your experiment be used in real life? (how would it help designers, inventors and engineers decide on what materials to use for different tasks?)

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Conclusion

Our tests did support OR did not support our hypothesis (circle). Explain.

___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
## Science Risk Assessment

**Experiment Title:**

<table>
<thead>
<tr>
<th>Student Name:</th>
<th>Date Submitted:</th>
<th>Date of Experiment:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Teacher:</th>
<th>Class:</th>
<th>Group Members:</th>
</tr>
</thead>
</table>

### RISK ASSESSMENT GUIDE

1. **CONSEQUENCES (C)** – What is the worst injury that could result from this practical?
   - 5  Fatality – para/quadriplegia – blindness
   - 4 - 4.5 Permanent disability, amputation, mutilation
   - 3 - 3.5 Fracture, dislocation, laceration requiring sutures
   - 2 - 2.5 Medical treatment injury, severe sprains, burns (2nd/3rd degree)
   - 1 - 1.5 First aid, deep abrasions, burns (1st degree)
   - 0.5 Minor first aid, scratches, bruising, dust in eye
   - 0  No injury

2. **PROBABILITY (P)** – How likely is it that these circumstances can or will lead to an accident?
   - 2.5  Certainly
   - 2  Very likely
   - 1.5 Likely
   - 1  Unlikely
   - 0.5 Very unlikely
   - 0  Won’t happen

3. **EXPOSURE (E)** – How often is a student actually exposed to the specific hazard in this experiment?
   - 2.5 Several times in a one week period with continual exposure during those times.
   - 2  Continuous exposure during one practical session
   - 1.5 Several times in a one week period with intermittent exposure during those times
   - 1  Intermittent exposure during one practical session
   - 0.5 Exposed once during the practical session & only for a short period
   - 0  Never

### RISK ASSESSMENT – (refer to table over page for RISK LEVEL of each hazard type)

<table>
<thead>
<tr>
<th>IDENTIFIED HAZARD</th>
<th>C</th>
<th>P</th>
<th>E</th>
<th>Add each row individually to identify 'risk severity' for each hazard type.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEMICAL</td>
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<td>The hazard with the highest risk will determine the overall risk category for the experiment.</td>
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<tr>
<td>e.g. – toxic, corrosive, carcinogenic, dust/vapour</td>
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<tr>
<td>THERMAL</td>
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<td>HOWEVER, no hazard should be overlooked when designating control measures for the experiment, as different hazards may require different Controls.</td>
</tr>
<tr>
<td>e.g. – fire/flame, hot material, cold material</td>
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<tr>
<td>BIOLOGICAL</td>
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<tr>
<td>e.g. – microbes, toxic, bite/sting, allergen</td>
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<td></td>
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<tr>
<td>MECHANICAL/ELECTRICAL</td>
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<tr>
<td>e.g. – moving parts, acoustic, electric shock</td>
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<tr>
<td>RADIATION</td>
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<tr>
<td>e.g. – laser, visible light (burning magnesium), ultraviolet, microwave</td>
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<tr>
<td>ADDITIONAL HAZARDS</td>
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<tr>
<td>e.g. – slip/trip/fall, projectile, falling object, glassware, sharp object</td>
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</tbody>
</table>
## RISK LEVEL

<table>
<thead>
<tr>
<th>8.5 – 10</th>
<th>6.5 – 8</th>
<th>3.5 – 6</th>
<th>0 – 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXTREME RISK</td>
<td>HIGH RISK</td>
<td>MODERATE RISK</td>
<td>LOW RISK</td>
</tr>
<tr>
<td><strong>Elimination</strong> is recommended and highly encouraged (refer to hierarchy of controls below)</td>
<td>Refer &amp; employ hierarchy of risk controls (see below) to reduce wherever possible, potential consequences of identified risk; employing Engineering and Administrative controls; use PPE.</td>
<td>Employ Engineering and Administrative Controls. Use PPE.</td>
<td>Manage by routine procedures; unlikely to need specific allocation of resources.</td>
</tr>
</tbody>
</table>

### Hierarchy of Risk Controls

**Elimination** is a permanent solution. Where extreme (or in some cases where high risk is evident), alternative teaching/practical methods should be used.

**Substitution** involves replacing the hazard by one of lower risk.

**Engineering** controls involve physical barriers or structural changes to the environment process.

**Administrative** controls reduce hazard by altering procedures and providing instructions.

**Personal Protective Equipment (PPE)** should be used where any risk is identified.

### CONTROL MEASURES (circle)

<table>
<thead>
<tr>
<th>Control Measures</th>
<th>Fume Cupboard</th>
<th>Safety Goggles</th>
<th>Gloves</th>
<th>Apron/ lab coat</th>
<th>Closed shoes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wash hands</td>
<td>Glassware Safety Instructions</td>
<td>Hot materials Safety Instructions</td>
<td>Dissection Safety Instructions</td>
<td>Demonstrate equipment use</td>
<td>Chemical Safety Instructions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Waste disposal method</th>
<th>Sink</th>
<th>Bin</th>
<th>Lab Assistant</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Signed</th>
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</thead>
<tbody>
<tr>
<td>Risk Assessment Completed</td>
<td></td>
</tr>
<tr>
<td>MSDS attached and <em>read</em></td>
<td>N/A</td>
</tr>
<tr>
<td>Teacher viewed</td>
<td></td>
</tr>
</tbody>
</table>
## Experimental Planning Sheet

<table>
<thead>
<tr>
<th>Name:</th>
<th>Title:</th>
<th>Date:</th>
</tr>
</thead>
</table>

### Input Variables (what you could change)

### Outcome Variables (what you could measure)

### Which input variable are you going to investigate?

### Which outcome variable are you going to measure?

### Which input variables are you going to keep the same?

### Prediction
- I think…
- Because…
Equipment list and diagram:

Method (how you intend to carry out the experiment…)

How will I ensure it is a fair test?

Results (design a table in which you can record your results)
Guide to writing a scientific report

An important part of the scientific method is repeatability. If a scientific finding is to be taken seriously by others, the scientific method must be valid. A valid scientific method is one that is able to be repeated by anyone and the same results achieved. In order for this to happen, the investigation needs to be written up in an acceptable format that gives clear instructions and results. This is usually done in the form of a scientific report. Below is a format of how a practical report can be written up. You can use this method when writing up experiments or assessment investigations performed in this unit.

Title
Give your experiment a title. Usually the title reflects what the experiment is about.

Aim
What are you hoping that your investigation will find out? Write this as the aim, or purpose, of your investigation.

Hypothesis
Look at the question you are trying to find an answer to and write a prediction. Write this as a hypothesis in the ‘If...then...’ form.

Background Information
Summarise any key definitions involved in your report. Find any research and/or experiments that have been done on the topic, or related topics, you are studying and summarise their findings. Include the references in your bibliography.

Materials
This is a listing of all the different amounts and types of materials or equipment that you will need to use to carry out your investigation.

Method
This is a step-by-step list of exactly what you will do to carry out your investigation. Remember that other people should be able to repeat your investigation using these instructions. It is here that you discuss any safety risks when doing the experiment and how you are going to manage them.

Results
In this section you present your findings. You need to think about what is the best method to clearly present your findings i.e. will you present them in a table and/or graph? Record all your observations (qualitative) and measurements (quantitative).

Discussion
Discuss any patterns or trends that you can see in your results. Where the results what you expected to find? Discuss if your results supported your hypothesis or not. Discuss anything that went wrong with your experiment or any changes you would make to your experiment.

Conclusion
You make one or more valid statements that relate to your hypothesis and predictions. Sometimes it can take the form of a summary, of whether or not the aim was achieved. Did your results confirm, support or refute your hypothesis? However, you cannot prove your hypothesis is correct, you can only support or refute it.

Bibliography
Guide to writing a bibliography

What is a Bibliography?
A bibliography is an alphabetical list of the information sources that have been used to prepare a piece of work. It is presented at the end of your work.

Why do we have to write a bibliography?
1. To give credit to and acknowledge your sources of information
2. To help readers find and read your sources of information
3. To avoid being accused of plagiarism (stealing another person’s ideas and presenting them as your own)

The way you reference a source in your bibliography varies depending on what form the information is in (i.e. a book or a journal article or a website). Below is a brief outline to follow when you write your own bibliography.

Books
For books with 1-3 authors…

Example:


For books with more than 3 authors…
Surname, Initial(s), et al. (Year of publication). Book title. Edition number. Place of Publication: Publisher.

Example:

For books with only an Editor listed…

Example:

Journal Articles

Example:

Websites
Author - Surname, Initial(s) or organisation.
(Date) – either last update or copyright date. If no date is available then record as (n.d.)
Title of webpage.
[online: web]
Date site viewed:
<URL>

Example:
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Questioning and predicting</td>
<td>Section: 1</td>
<td></td>
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<tr>
<td>Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge</td>
<td>Report: Title, Aim, Hypothesis</td>
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<tr>
<td>Planning and conducting</td>
<td>Section: 2</td>
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<tr>
<td>Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed.</td>
<td>Report: Materials, Method, Results</td>
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<td>In fair tests, measure and control variables, and select equipment to collect data with accuracy appropriate to the task</td>
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<tr>
<td>Processing and analysing data and information</td>
<td>Section: 3</td>
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<tr>
<td>Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships, including using digital technologies as appropriate.</td>
<td>Report: Discussion, conclusion</td>
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<tr>
<td>Summarise data, from students’ own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions.</td>
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<tr>
<td>Evaluating</td>
<td>Section: 4</td>
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<tr>
<td>Reflect on the method used to investigate a question or solve a problem, including evaluating the quality of the data collected, and identify improvements to the method.</td>
<td>Report: Background, Discussion, Conclusion, Bibliography</td>
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<tr>
<td>Use scientific knowledge and findings from investigations to evaluate claims.</td>
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<tr>
<td>Communicating</td>
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<tr>
<td>Communicate ideas, findings and solutions to problems using scientific language and representations using digital technologies as appropriate.</td>
<td>Whole task</td>
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</table>