Coltness High School Science Department



“Heat Transfer” Homework Booklet

This topic covers the following experiences and outcomes of the Curriculum for Excellence:

**Planet Earth: Energy sources and sustainability**

I can use my knowledge of the different ways in which heat is transferred between hot and cold objects and the thermal conductivity of materials to improve energy efficiency in buildings or other systems. **SCN 3-04a**

**Forces, electricity and waves: Vibrations and waves**

By exploring radiations beyond the visible, I can describe a selected application, discussing advantages and limitations. **SCN 3-11b**

**Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Class\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| Homework | Parent’s signature | Comments |
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**Heat Homework 1 Heat and Temperature, Cooling Curves**

1) Complete the following sentences:

**Heat is a form of \_\_\_\_\_\_\_\_\_\_\_. It is measured in units called \_\_\_\_\_\_\_\_\_\_\_\_.**

**Temperature is a measure of how \_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_ an object is.**

2) What is the unit of temperature? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3) A pupil set up an experiment with two beakers of water, in a room which had a temperature of 23°C. Beaker A had 100 ml of water in it, and Beaker B had 500 ml.

Both beakers were heated up to 70 °C using a Bunsen burner.

1. Which beaker would cool down more quickly? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What temperature would both the beakers eventually cool down to? \_\_\_\_\_\_\_\_\_

4) The following graph was obtained for a beaker of hot water cooling down.



1. At which point is the water losing heat fastest: A, B, C, or D? \_\_\_\_\_\_\_\_\_\_\_\_
2. From the graph, what is the temperature of the room? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Draw a new cooling curve on the same graph to show what would happen if the same beaker of water cooled down in a room where the temperature is 10°C.

**Heat Homework 2 Conduction and Convection**

1. Describe how heat travels along a copper rod by **conduction**. Remember to use the

 words **vibrations** and **particles** in your description.

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2. A pupil does an experiment to show how heat moves by **convection**. On the diagram below,

 draw arrows to show how the water moves in the beaker.



3. Write the letters in the correct box below to show whether each statement describes

conduction or convection. The first one is done for you.

A When you leave a spoon in a cup of tea, the end of the spoon gets hot.

B The water in the hot tank in your house is hotter at the top than at the bottom.

C The smoke from a fire usually goes upwards.

D When heat travels by this method, it can go in any direction.

E This can happen in solids, liquids and gases.

F The air above a radiator in your house is warmer than the air below.

|  |  |
| --- | --- |
| conduction | convection |
| A |  |

**Heat Homework 3 Uses of Conductors and Insulators**

1. Explain why the metal legs of a table feel colder than the wooden table top, even though they are both at the same room temperature.

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2. Why is it important to reduce heat loss from a house?

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3. Describe two ways of reducing heat loss in a house.

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4. A pupil gathered together these household items:

* A frying pan made of steel
* A table mat made of cork
* An iron with an aluminium base
* A kettle with a plastic handle
* “GHD” straighteners made of ceramic plates
* The wooden handle of a fish slice

Using the information above, complete the table for the items gathered by the pupil. The first one has been done for you.

|  |  |  |
| --- | --- | --- |
| **Household Item**  | **What is it made of?**  |  **Why is it made of this material?**  |
|  Frying Pan  |  Steel  |  It is a conductor and allows heat through to cook the food.  |
|  Table Mat  |  |  |
|  Base of an Iron  |  |  |
|  Kettle Handle  |  |  |
|  Straightener Plates  |  |  |
|  Fish Slice Handle  |  |  |

**Heat Homework 4 Infrared Radiation**

1. Complete the sentences below by circling the correct underlined word.

All hot things give out heat rays, which are called infrared / ultraviolet.

Infrared travels in straight lines in all directions / upwards only.

Infrared can / can’t travel through a vacuum like space.

It travels very slowly / fast, at the same as the speed of light.

Infrared is visible / invisible.

Bright, shiny surfaces are good at reflecting / absorbing infrared.

Dull, dark surfaces are good at reflecting / absorbing infrared.

2. **Radiation** is the only way that heat energy from the Sun can get to Earth. Explain why it cannot travel by conduction or convection.

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3. An experiment is set up with four cans. Each can starts with 100ml of water at 70 °C.

The only difference is the colour of each can.

Can A – painted dull black

Can B - painted shiny silver

Can C – painted shiny red

Can D – painted white.

a) Which can will cool down the quickest, A, B, C or D? \_\_\_\_\_\_\_\_\_\_\_\_\_\_

b) Which can will cool down the slowest, A, B, C or D? \_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. Explain why most people don’t wear black clothes on a hot, sunny day.

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| **I know that………………** | ☺ | 😐 | ☹ |
| **Heat and temperature**  |  |  |  |
| The **temperature** of an object tells us **how hot or cold** the object is. |  |  |  |
| **Temperature** is measured in **degrees Celsius (°C).** |  |  |  |
| I can explain the **increase in temperature** of an object in terms of **heat gain.** |  |  |  |
| I can explain the **decrease in temperature** of an object in terms of **heat loss.** |  |  |  |
| I can carry out an **experimen**t to collect data for a **cooling curve**. |  |  |  |
| I can construct a **cooling curve** from **data** given or **obtained experimentally**. |  |  |  |
| I can explain the **shape of a cooling curve** in terms of **heat loss, temperature of material and temperature of surroundings.** |  |  |  |
| **Conduction** |  |  |  |
| **Heat energy** travels from **hot** objects to **cold** objects. |  |  |  |
| **Heat** can travel through **solids, liquids and gases** by **conduction.** |  |  |  |
| I can describe **conduction** in a solid in terms of the **vibration of the particles.** |  |  |  |
| **Metals** are **good conductors** of heat. |  |  |  |
| I can describe an experiment to show that **some metals are better conductors than other metals.** |  |  |  |
| I can explain that conductors feel colder than insulators at the same temperature, **because they conduct heat away from the body.** |  |  |  |
| **Convection** |  |  |  |
| In a **liquid or gas** (fluid), heat travels mostly by **convection.** |  |  |  |
| **In convection**, the hot liquid or gas **rises.** |  |  |  |
| I can describe the path taken by liquids or gases in convection current. |  |  |  |
| I can explain that **a hot liquid or gas rises** because it **is less dense**. |  |  |  |
| I can explain that **a hot liquid or gas** is **less dense** because its **particles are further apart.** |  |  |  |
| **Conductors and Insulators** |  |  |  |
| I can explain how a material that traps air can be used to reduce heat loss by conduction and convection. |  |  |  |
| I can describe practical examples where materials are used in the home because they are good **conductors or insulators**. |  |  |  |
| A **lid reduces** heat loss by **convection**. |  |  |  |
| I can describe practical examples of use of **insulators in a house** - **double glazing**, loft insulations, cavity wall insulation, lagging pipes. |  |  |  |
| I can explain how clothes, feathers, fur, hair **reduce heat loss from living things**. |  |  |  |
| I can describe experiments on the effectiveness of different materials at reducing heat loss. |  |  |  |
| **Infrared radiation** |  |  |  |
| **All hot objects** emit heat as **rays** called **infra-red radiation.** |  |  |  |
| **Infra-red radiation** can travel through a **vacuum**. |  |  |  |
| **Infra-red radiation** travels very **fast**. |  |  |  |
| **Absorption and emission** |  |  |  |
| **Dull, dark** surfaces are good at **giving out** (emitting) infra-red radiation. |  |  |  |
| **Dull, dark** surfaces are good at **taking in** (absorbing) infra-red radiation. |  |  |  |