**HEAT TRANSFER IN SOLIDS AND LIQUIDS**

**AIM:** To investigate how heat is transferred through a solid and a liquid. **Skill: ORR**

**APPARATUS and MATERIALS:**

* Vaseline or wax
* Retort stand
* Metal rod (BRC)
* ruler
* paperclips (5)
* Bunsen burner
* tripod
* Stopclock
* Coloured crystals
* Straw/funnel
* Foil (30cm long)
* Large beaker of cold water
* matches

**DIAGRAM:**



a) Possible set-up of apparatus to investigate heat transfer in a solid.



b) Set up of apparatus to investigate heat transfer in a liquid

**METHOD:**

**a) HEAT TRANSFER THROUGH A SOLID**

1. The foil was placed on the table and then the candle was lit.
2. Three drops of wax were carefully dropped at 5cm intervals along a metal rod.
3. Three paperclips were inserted into the wax before it hardened.
4. The rod was attached to a retort stand and the free end was heated with a Bunsen burner.
5. Observations and the time taken for each paperclip to fall off the rod was recorded in a table. A graph was drawn.

**b) HEAT TRANSFER THROUGH A LIQUID**

1. Coloured crystals were added to the base of a beaker of cold water using a straw.
2. The beaker was placed on a tripod stand and heated just below the crystals.
3. The colour and movement of the water was observed and recorded in a diagram.

**RESULTS:**

**a) Heat transfer through a solid**

Table showing time taken for paperclips to fall off a metal rod.

|  |  |  |
| --- | --- | --- |
| **Distance from end of rod/ heat source** | **Paper clip #** | **Time taken (mins)** |
| 5 cm | 1 |  |
| 10 cm | 2 |  |
| 15 cm | 3 |  |

Remember 1 minute has 60 seconds. So 15 s = 0.25min and 30s =0.5min

Graph showing rate of time taken for paper clips to fall off a metal rod. – Plot on a separate graph page. Remember to put TITLE, scale, label the axes including the units of time or distance.

**b) Heat transfer through a liquid**

Annotated diagram showing the movement of coloured liquid in water as it was being heated up. Remember annotations should explain the observations.

|  |  |
| --- | --- |
| Condition before heating | Conditions after heating |

**DISCUSSION:**

**a) Heat transfer through a solid:**

* Identify the manipulated variable \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and responding variable \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. What could have been a suitable control? (Hint – keeping distance constant at say 5cm and repeating the experiment)
* Why did the paperclips fall off the rod when it was heated?
* What is this transfer of heat called?
* This shows that metals are useful in ???? (Hint cooking – making pans, etc)
* Do all metals heat up and transfer heat at the same rate? Why/ why not?

**b) Heat transfer through a liquid:**

* How was the heat from the Bunsen burner transferred?
* How was the heat transferred throughout the body of water?
* Why did the coloured liquid rise and move in circular directions?
* How can convection be useful to us?

**CONCLUSION:**

How was the heat transferred through the solid? – How could you tell?

How was the heat transferred through the liquid? – How could you tell?

**MARKSCHEME – OBSERVING, RECORDING AND REPORTING SKILLS (ORR)**

|  |  |
| --- | --- |
| **Criteria** | **Mark** |
| **Observing** | Correct times for paperclip drop noted | **1** |
|  | Annotations * direction of movement of water;
* hot and colder parts of the water
 | **1****1** |
| **Recording** | Title for table | **1** |
|  | Title for graph | **1** |
|  | Correctly plotted graph | **1** |
|  | Correctly labelled axes with units | **1** |
| **Reporting** | Correct format of lab – all parts, in order | **1** |
|  | Conclusion is clearly stated | **1** |
|  | Conclusion links results with the aim | **1** |
| **TOTAL** |  | **10** |