

Heat Efficiency.

I am attempting to find out how different types of insulation affect the rate at which water cools down. I am going to do this by timing how long it takes for water to cool down when insulated by three different materials, which are: foam, bubble wrap and no insulation. I will control the starting temperature of the water and the amount of water used. Also I will make sure convection is unable to work in my experiment, this is because my insulation will be wrapped around the sides of the container and heat loss through convection occurs when air or liquids rise up.

I predict that the bubble wrap will keep the water hot for longest, this is because bubble wrap has pockets of air which will heat up by waves of heat energy. This is called radiation. Therefore the bubble wrap will become a heated insulator and the water will stay hot for longer. The foam has holes in it where heat can radiate through it and because of this heat will be lost more quickly. Finally no insulation at all will cause heat to radiate and conduct rapidly.

For my experiment I will need:

- 3 Tin Cans
- 3 Thermometers
- Water set at 80 degrees centigrade
- Foam
- Bubble wrap
- Kettle
- Stop Watch
- Measuring cylinder

I am going to carry out my experiment by preparing three tin cans, one with no insulation, one insulated by bubble wrap and the other with foam. After this I will boil 250ml of water and put it in the tin can, which is not insulated. I will then wait till the water cools to 80 degrees centigrade then I will put a stopper over the top of the tin can to stop convection this will have a small hole into which a thermometer can be placed. After this I will take temperature measurements at 3mins, 6mins and 9mins. I will then do the same for the other two. I am doing each timing one after the other this is because the experiments would all start at different times because we

don't know how long it will take for the water temperatures to drop to the starting temperature. I can not start at 100 degrees centigrade because by the time I have poured the water separately into all three tin cans the water temperature would have dropped and it would not be a fair experiment.

I have made this investigation fair by using the same amount of water in each experiment, and making the starting temperature for each experiment equal.

I believe that I have a sufficient and accurate enough range of measurements to obtain good information. I will be repeating my experiment three times.

Results.

Experiment 1.

Time (mins)	No Insulation	Bubble Wrap	Foam
3	40 degrees c	55 degrees c	49 degrees c
6	30 degrees c	37 degrees c	40 degrees c
9	27 degrees c	32 degrees c	30 degrees c

Experiment 2

Time (mins)	No Insulation	Bubble Wrap	Foam
3	44 degrees c	52 degrees c	47 degrees c
6	29 degrees c	35 degrees c	39 degrees c
9	26 degrees c	29 degrees c	27 degrees c

Experiment 3

Time (mins)	No Insulation	Bubble Wrap	Foam
3	47 degrees c	56 degrees c	49 degrees c
6	30 degrees c	37 degrees c	35 degrees c
9	27 degrees c	30 degrees c	28 degrees c



- = No Insulation
- = Bubble Wrap
- = Foam

I have found out that bubble wrap is the best insulator. This is because the temperatures collaborated from the water being insulated by the bubble wrap stayed higher for longer. This proves my theory about the air pockets in the bubble wrap, and the air in the pockets being heated up by radiation. It doesn't prove my theory about the holes in the foam however the water insulated by the foam did lose heat quicker than the water insulated by the bubble wrap. But my results still support my prediction.

My graphs all look fairly similar. With the line representing the bubble wrap above the rest of the lines. This helps to prove my prediction and support my results.

On the graph the temperatures of the water seem to go down fairly evenly and steadily. I believe this has something to do with the equal space between the times that I took measurements.



I think the experiment went very well, and that my results are accurate. This is because I repeated the experiment three times and all sets of results are very close.

The only odd result I found was in experiment two when the measurement taken after 6 minuets for the bubble wrap was lower than that of the foam, I believe that this is just a cause of experimental error.

I could have had more intervals at which I took the temperatures of the water; this would have given me more information to back up my results, however I believe that my set of results still helped me support my prediction.

Finally I would like, in future, to carry out an experiment which will tell me if the spacing of the times that measurements are taken affect the evenness of the measurements.