



The Eco Hot Box



Erasmus+

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Index:

i) Introduction.....	4
ii) Materials.....	5
iii) Method.....	5
iv) Results.....	7
v) Conclusions.....	9
vi) Further Research.....	9
vii) Relevance to syllabus – Ireland.....	10
viii) Appendix 1 Data for recorded temperatures.....	11



i) Introduction:

A) Animal Welfare: Ensure you familiarise yourself with the animal welfare legislation in your country. The experiment described here took place in a controlled on farm environment and experienced, qualified farmers observed the lamb throughout the experiment. Both farmers had many years of experience dealing with young lambs and also in the feeding of colostrum and use of a hot bulb. This experiment should only be conducted using live animals if experienced and qualified personnel are present.

B) Eco Hot Box: Not all newly born animals are healthy. Some are weak and if born outside in cold and wet conditions, may die from hypothermia due to a drop in the animal's critical body temperature. Irish Farmers have a duty of care for the welfare of all animals on their farm under Irish Law (Animal Welfare Act 2013). To provide weak and sick lambs with the best chance of survival, farmers often feed colostrums and use a box with a heat lamp (powered by electricity) to increase the body temperature of the lamb, to prevent the onset of hypothermia or counteract its affects. In this experiment, a box was made from recycled plastic slates (Athy Eco Slates) and the outside of it was covered with sheep wool for insulation. Athy eco slates are durable, light weight and fire resistant. These properties make them ideal for this experiment. The box was glued together using a hot glue gun. The inside of the box was lined with a recycled plastic bag (for ease of cleaning) and a straw bed was placed in the bottom of the box. A heat lamp was placed above the box and digital thermometers were placed inside and outside the box. The lamb was kept under constant supervision for a period of 15 minutes while inside the box.

C) Key words: Critical body temperature, hypothermia, Irish Animal Welfare Act 2013, Athy Eco Slate, Sheep wool insulation, straw, heat lamp.

D) Syllabus: See vii – Relevance to Syllabus - Ireland

E) Length of module:

(1) In the school Laboratory:

Classes 1 and 2 – Animal Health and welfare legislation

Classes 3 and 4 – Recognising hypothermia – classification and symptoms

Classes 5 and 6 – Gathering materials and assembly of eco hot box

Class 7 – Experiment and recording results

Class 8 – Addition of sheep wool insulation, recycled plastic bag and straw.

Experiment and recording results

ii) Materials:

Athy Eco Slates (Purchased from www.athyecoslate.ie) , Sheepwool Insulation (purchased from www.sheepwoolinsulation.ie) , recycled plastic bag, straw, string, Heater (purchased from Woodies DIY)



glue and glue gun, Max/Min thermometer (purchased from www.temperature.ie), small timber pieces, bandsaw, metre rule, Heat Lamp (dependendnt on farmer).

iii) Method:

(1) In the school Laboratory:

- 1) Gather the Eco slates and place in the shape of the box
- 2) Measure the amount of sheep wool insulation required by each slate and cut to fit using scissors



- 3) Glue the sides securely to the base, using the timber peices for increased stability. Each side will need approx ten minutes to set after glueing. Students can apply pressure to the sides to ensure they stick firmly



- 4) Measure 1m from the box and set up the heater at this distance
- 5) Attach the thermometer inside the box using tape, ensure it is not directly in line with the heater.
- 6) Start the heater and allow the thermometer to reach 38°C before switching off the heater
- 7) Record the temperature every minute for 15 minutes



8) Attach the sheep wool insulation to the outside of the box and tie in place with string

9) Repeat steps 4 to 7

Repeating Step 4 with insulation attached



Repeating steps 5 and 6



Prior to farm visit:

Revision of Animal welfare legislation. Ensure thermometer is held securely in place

(2) On the farm:

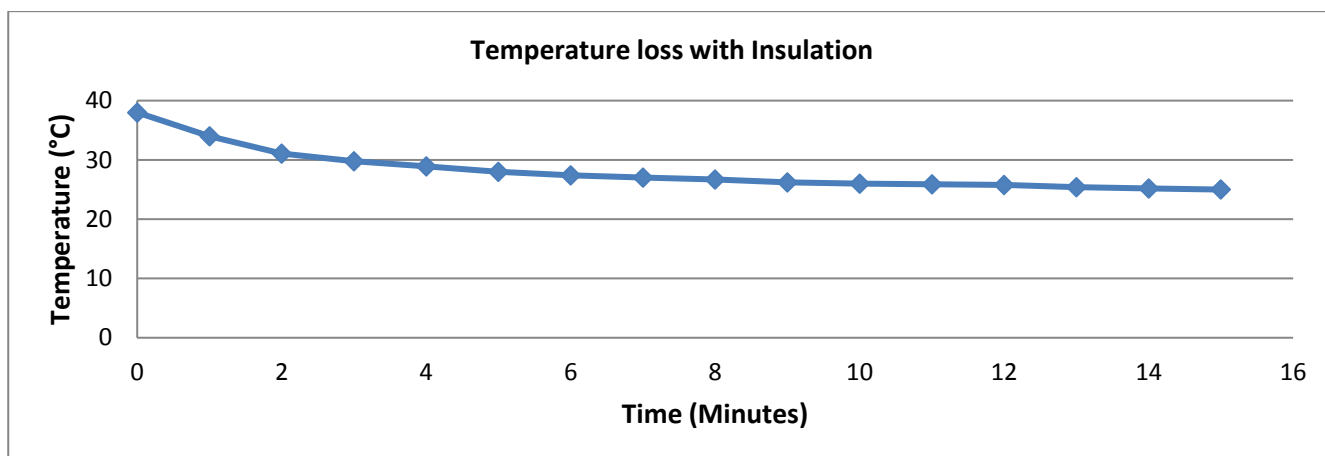
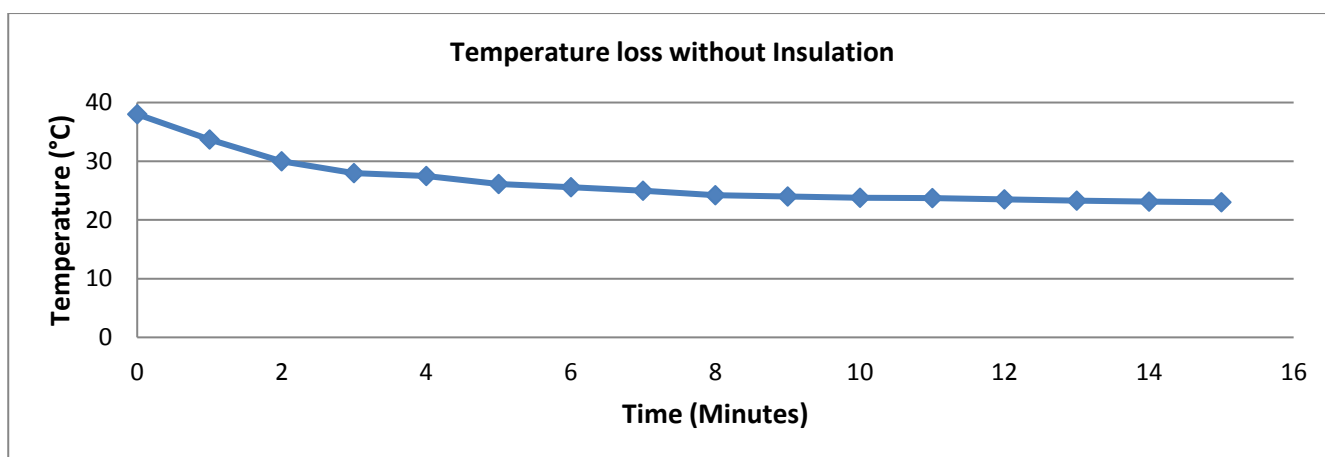


This should only be carried out with qualified, experienced personnel on hand at all times. Familiarise yourself with the animal welfare act in your country. No animals should be harmed or endangered by this experiment.

Allow the farmer to select the animal and the distance the box is away from the heat lamp. Record the temperature every minute for 15 minutes

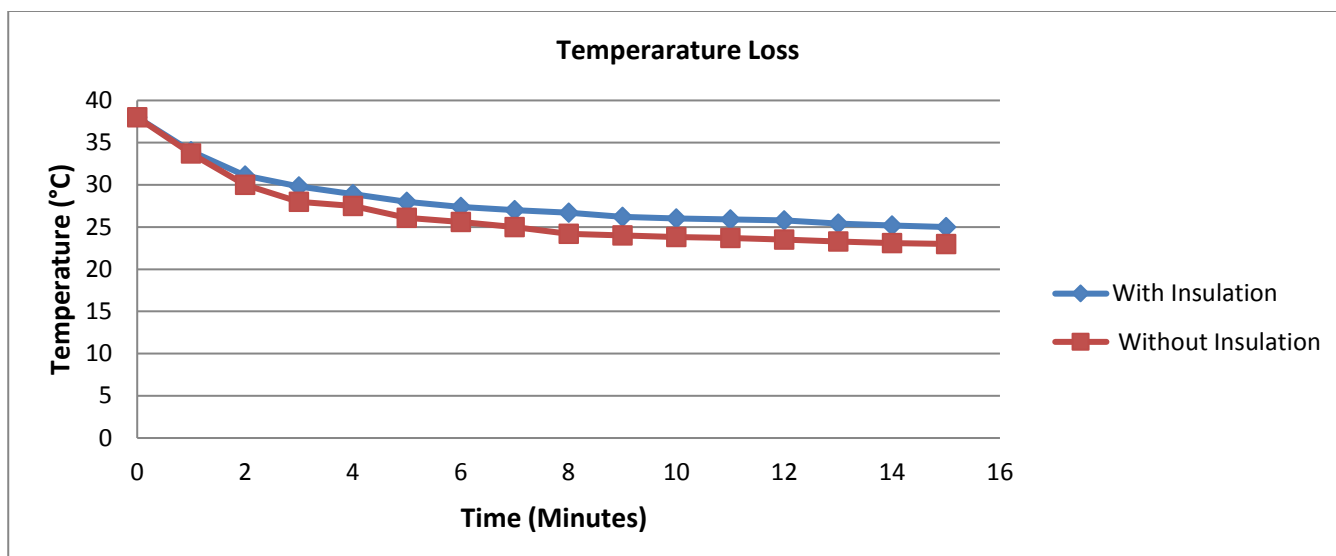
iv) Results:

(1) In the school laboratory



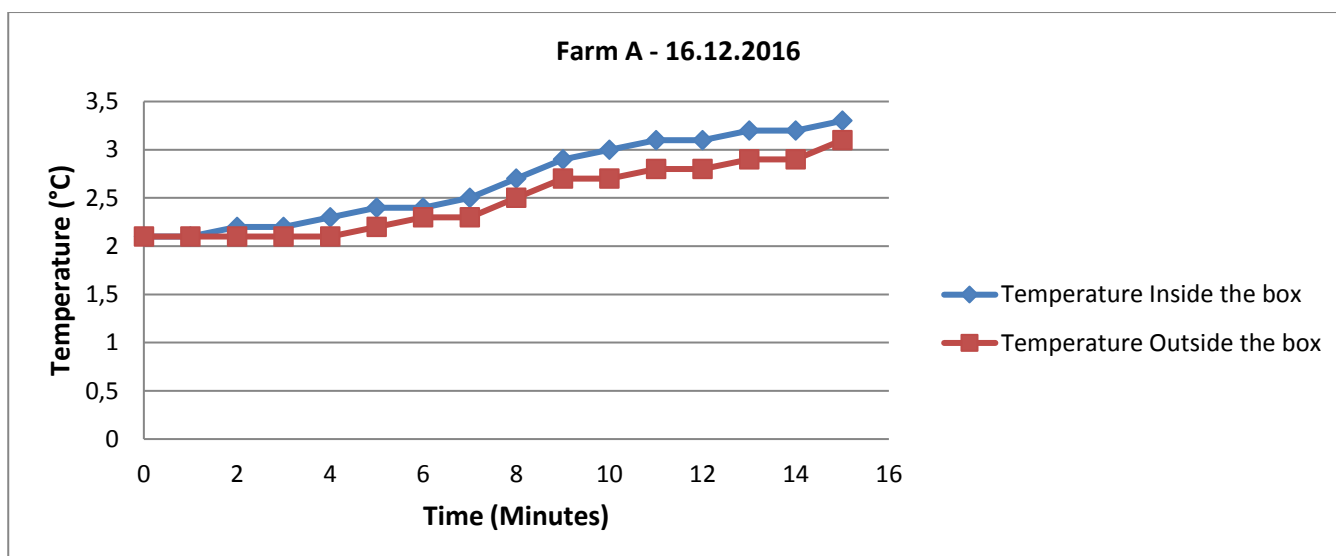


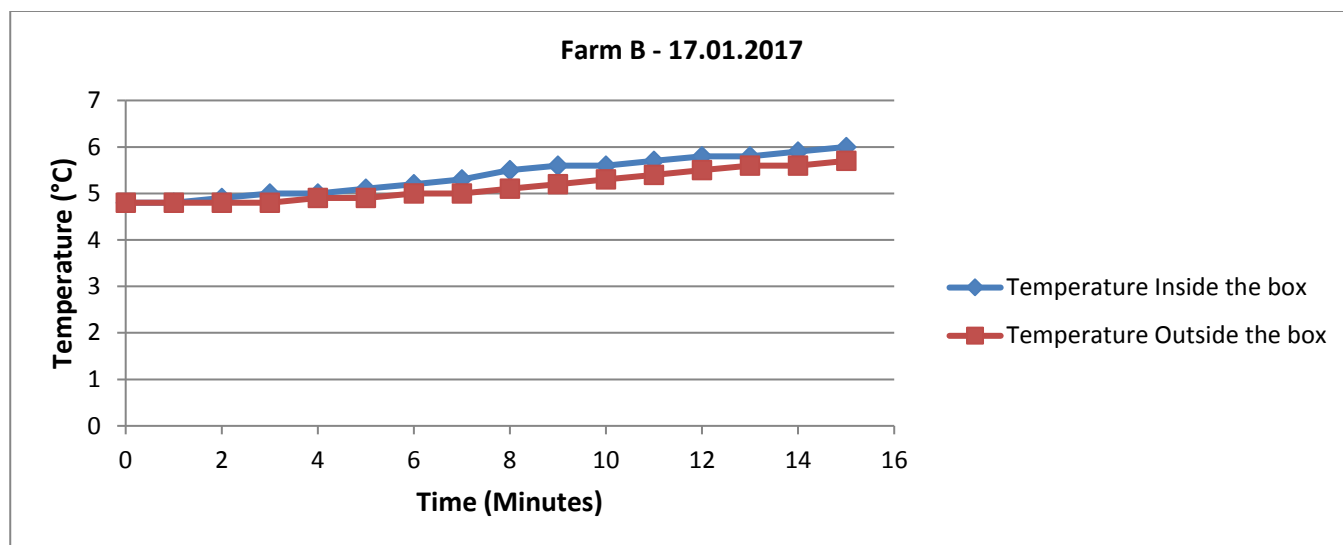
Overall:



The max/min thermometer allows temperatures to be taken both inside and outside the box. The experiments took place in a controlled environment in the lab where temperature was recorded at 21°C. With results under lab conditions recorded it was time to undertake field experiments. Due to fluctuating temperatures in this type of environment both temperatures inside and outside of the box were recorded.

(2) On the farm





Data for the above graphs can be found in Appendix 1.

v) Conclusions:

Results over the test period were positive, showing an increase in temperature inside the box compared to outside temperature during all experiments. The lambs were comfortable inside the box and the dimensions of the box were adequate in size for the breed of lamb used. Many farmers purchase infra red lamps, paying little attention to the containers/boxes they use to house the lamb, which can vary widely from farm to farm. This project aimed to create an environment whereby the lamb could experience an increase in body temperature from the heat lamp, inside a box made from recycled materials. This would reduce the length of time the heat lamp needs to be on for. Both farmers followed experimental and animal welfare protocols. As this design is still in its infancy, lambs were removed from the box after 15 minutes and placed in the trusted containers used previously by both farmers. Lambs used were healthy and were not showing signs of hypothermia.

vi) Further Research:

This box was used as required over a four month period, starting in December 2016 and finishing in March 2017. The box was left in a farm shed and was subject to varying environmental temperatures and humidity. At the end of the test period it was noted that the structure of one of the boxes had become weakened. The design of the box was redrawn and boards made from recycled plastic were used to create a structure to which the eco slates were screwed. This created a far more robust structure. Unfortunately, the sheep on both farms used in this research had finished lambing so it was not possible to test this new design. It is expected this new robust design will not suffer from the same problem.

vii) Relevance to syllabus – Ireland

1) Leaving Certificate Agricultural Science



The Sheep

Common breeds, general characteristics. Breeding principles.

Nutrition, growth, **care and health of lambs from birth to sixteen months.**

2) Junior Certificate Science

Physical world

This involves the exploration of physical observables, often in relation to motion, energy, and electricity. Students gain an understanding of fundamental concepts such as length, time, mass and **temperature through appropriate experiments**. This allows them to develop simultaneously a sense of scaling and proportional reasoning, to recognise the need for common units, and to select and use appropriate measuring equipment. Exploring concepts such as area, density, current, and energy helps students develop the ability to identify and measure a range of physical observables, and through experimenting, to investigate patterns and relationships between them. Students also design and build simple electronic circuits. Students develop an understanding of the concept of energy and how it is transformed from one form to another without loss. **They also research sustainability issues that arise from modern physics and technologies**, and our generation and consumption of electricity.

ELEMENT: Sustainability

Students should be able to:

7. illustrate how earth processes and human factors influence Earth's climate, evaluate effects of climate change and initiatives that attempt to address those effects

3) Leaving Certificate Physics

Ordinary Level	Higher Level
Mechanics	Mechanics
Temperature	Temperature
Heat	Heat
Waves	Waves
Vibrations and Sound	Vibrations and Sound
Light	Light
Electricity	Electricity
Modern Physics	Modern Physics
	Option 1: Particle Physics
	Option 2: Applied Electricity

Particular relevance to material highlighted in green above

Ordinary Level	Higher Level
Temperature:	Temperature:
1) Concept of temperature	1) Concept of temperature
2) Thermometric properties	2) Thermometric properties



3) Thermometers	3) Thermometers
Heat:	Heat:
1) Concept of heat	1) Concept of heat

Appendix 1 – Data for recorded temperatures

Under lab conditions without Insulation

Time (Min)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Temperature (°C)	38	33.7	30	28	27.5	26.1	25.6	25	24.2	24	23.8	23.7	23.5	23.3	23.1	23

Under lab conditions with Insulation

Time (Min)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Temperature (°C)	38	34	31.1	29.8	28.9	28	27.4	27	26.7	26.2	26	25.9	25.8	25.4	25.2	25

Data for recorded temperature on Farm A – 16.12.2016

Inside the box

Time (Min)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Temperature (°C)	2.1	2.1	2.2	2.2	2.3	2.4	2.4	2.5	2.7	2.9	3.0	3.1	3.1	3.2	3.2	3.3

Outside the box

Time (Min)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Temperature (°C)	2.1	2.1	2.1	2.1	2.1	2.2	2.3	2.3	2.5	2.7	2.7	2.8	2.8	2.9	2.9	3.1

Data for recorded temperature on Farm B – 17.01.2017

Inside the box

Time (Min)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Temperature (°C)	4.8	4.8	4.9	5.0	5.0	5.1	5.2	5.3	5.5	5.6	5.6	5.7	5.8	5.8	5.9	6.0

Outside the box

Time (Min)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Temperature (°C)	4.8	4.8	4.8	4.8	4.9	4.9	5.0	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.6	5.7