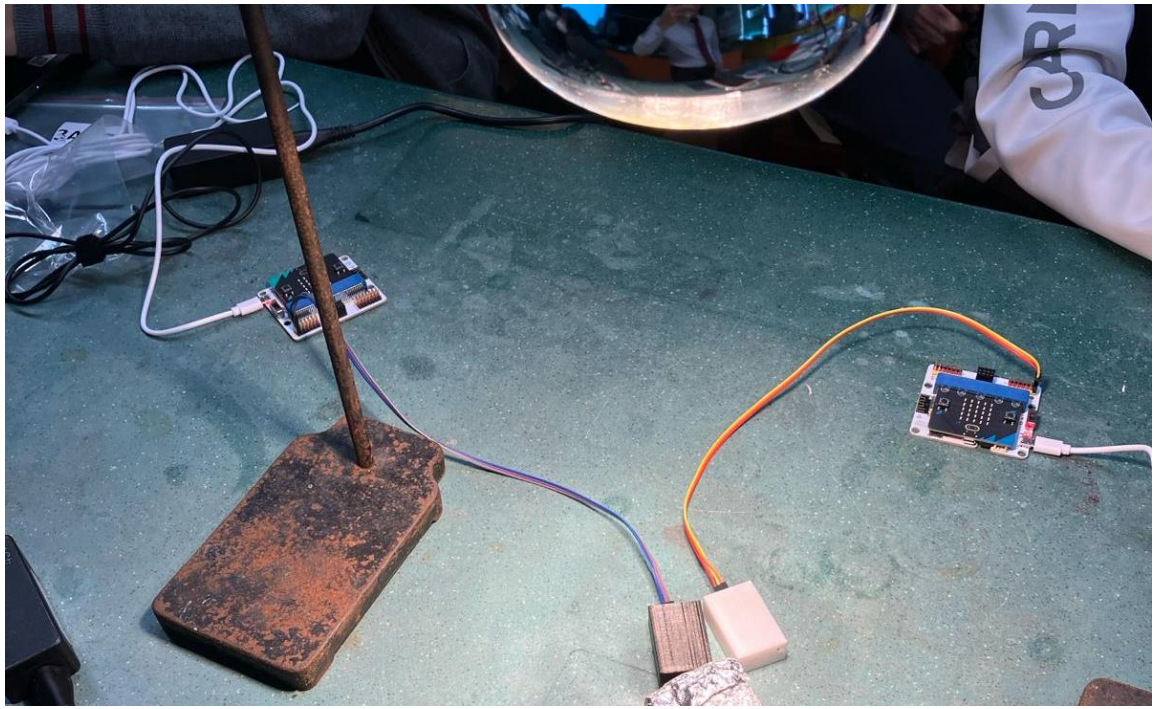
Heat Transfer: Radiation

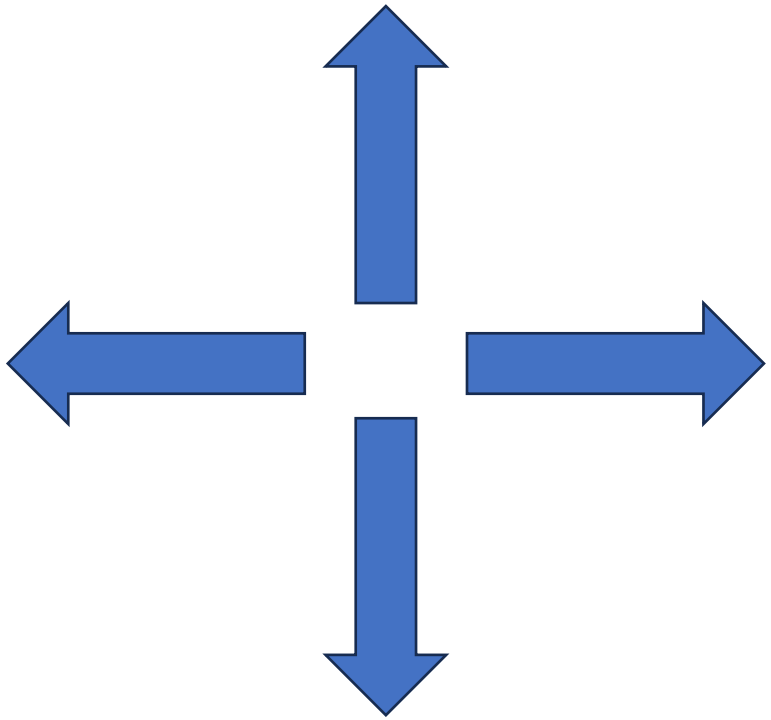
Objectives

1. To understand the basic idea of radiation and daily examples
2. To understand how the **colour** affecting the absorption and emission of the radiation.
3. To understand how the **shining and dull surface** affecting the absorption and emission of the radiation.
4. To understand how the **temperature difference** affecting the absorption and emission of the radiation.

Radiation

- To transfer heat
- in a vacuum.
- medium or particles ×





Radiation is emitted in all directions.

Emission of thermal radiation

- All objects radiate energy.
  Temperature ↑ , amount ↑
- The type of radiation
  ➔temperature.
- Temperature ↑ stronger radiation

Emission of thermal radiation

- If the temperature of an object further increases,
- even emit visible light in addition to infra-red radiation.

Net emission of radiation

- **Temp ↑** surroundings
- **net loss** of energy by radiation and **cool down**.

Net absorption of radiation

- temperature ↓ the surroundings
- net gain of energy by radiation and warm up.
- How about net absorption / emission = 0 ?

From ICT lesson…

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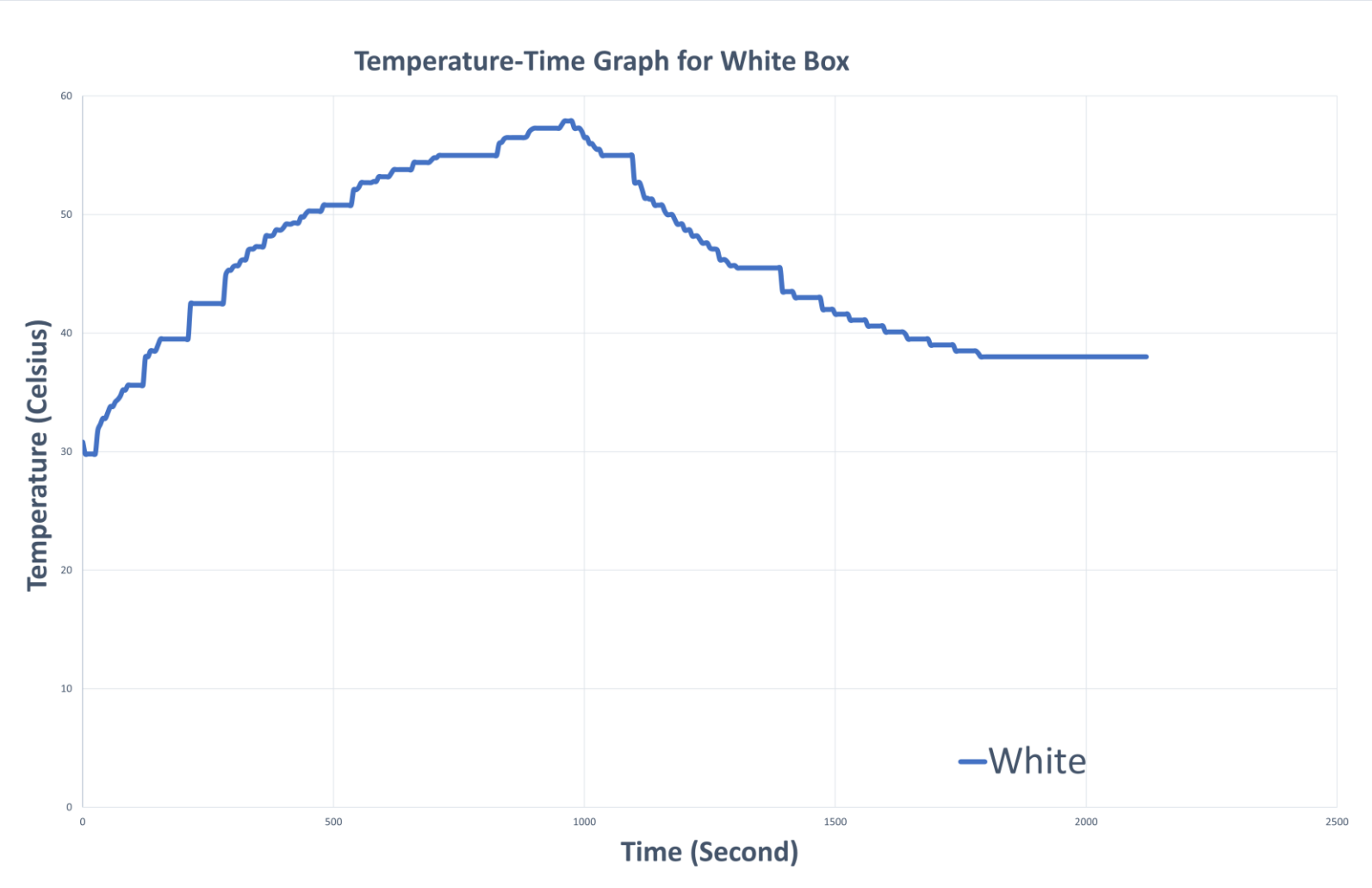
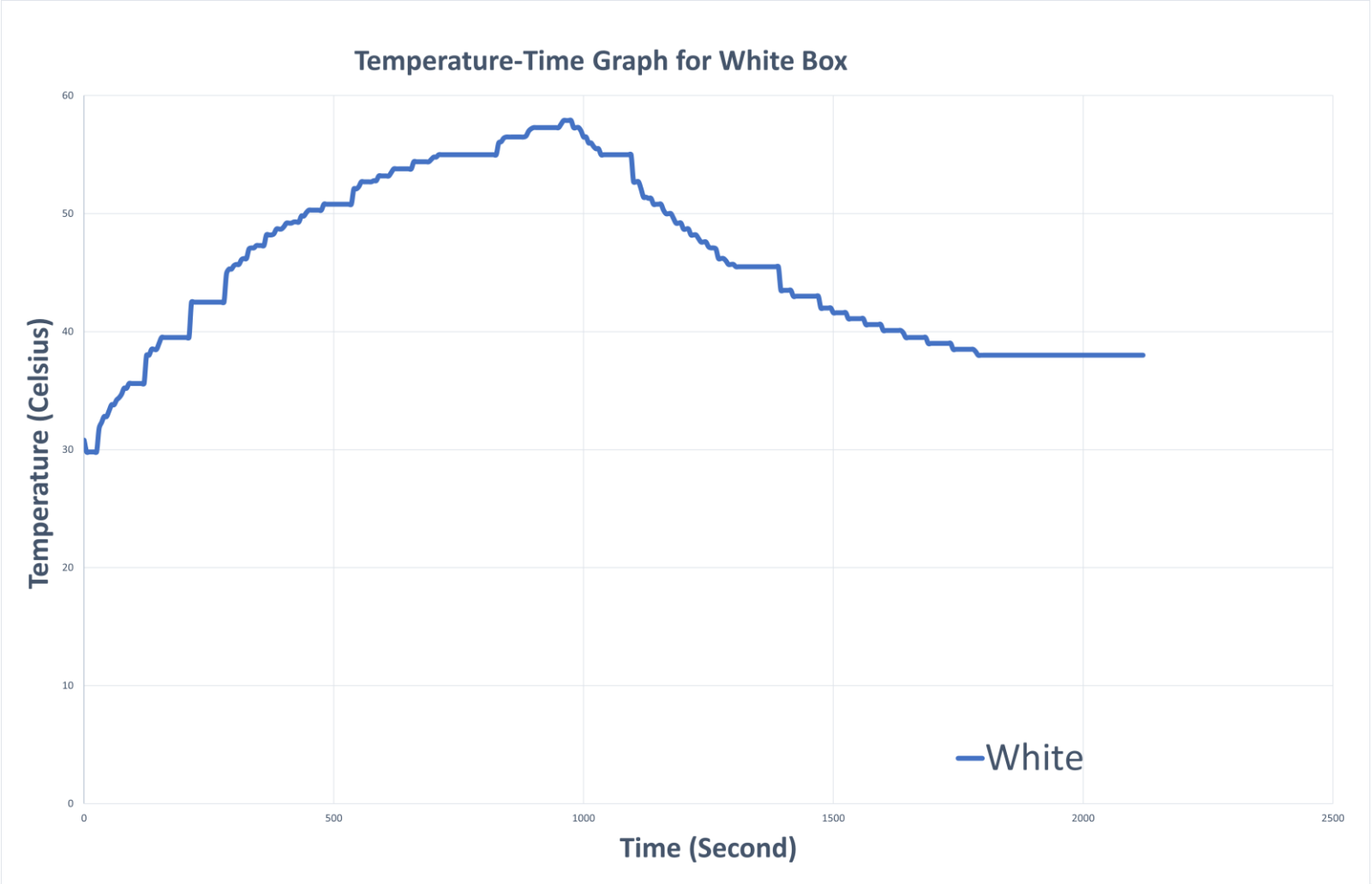
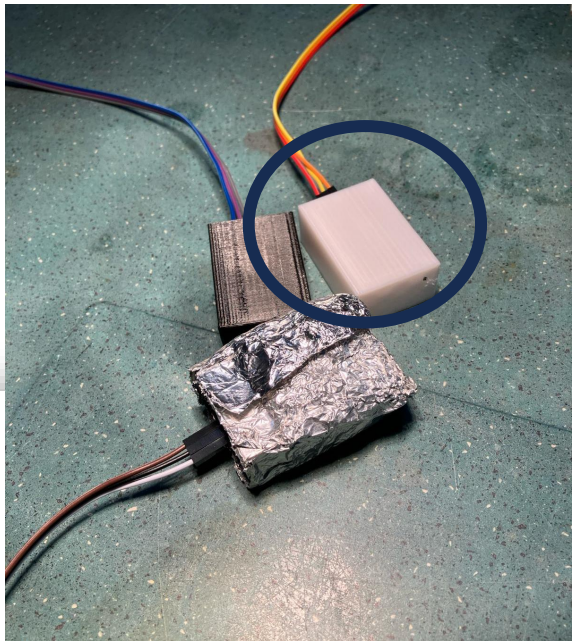
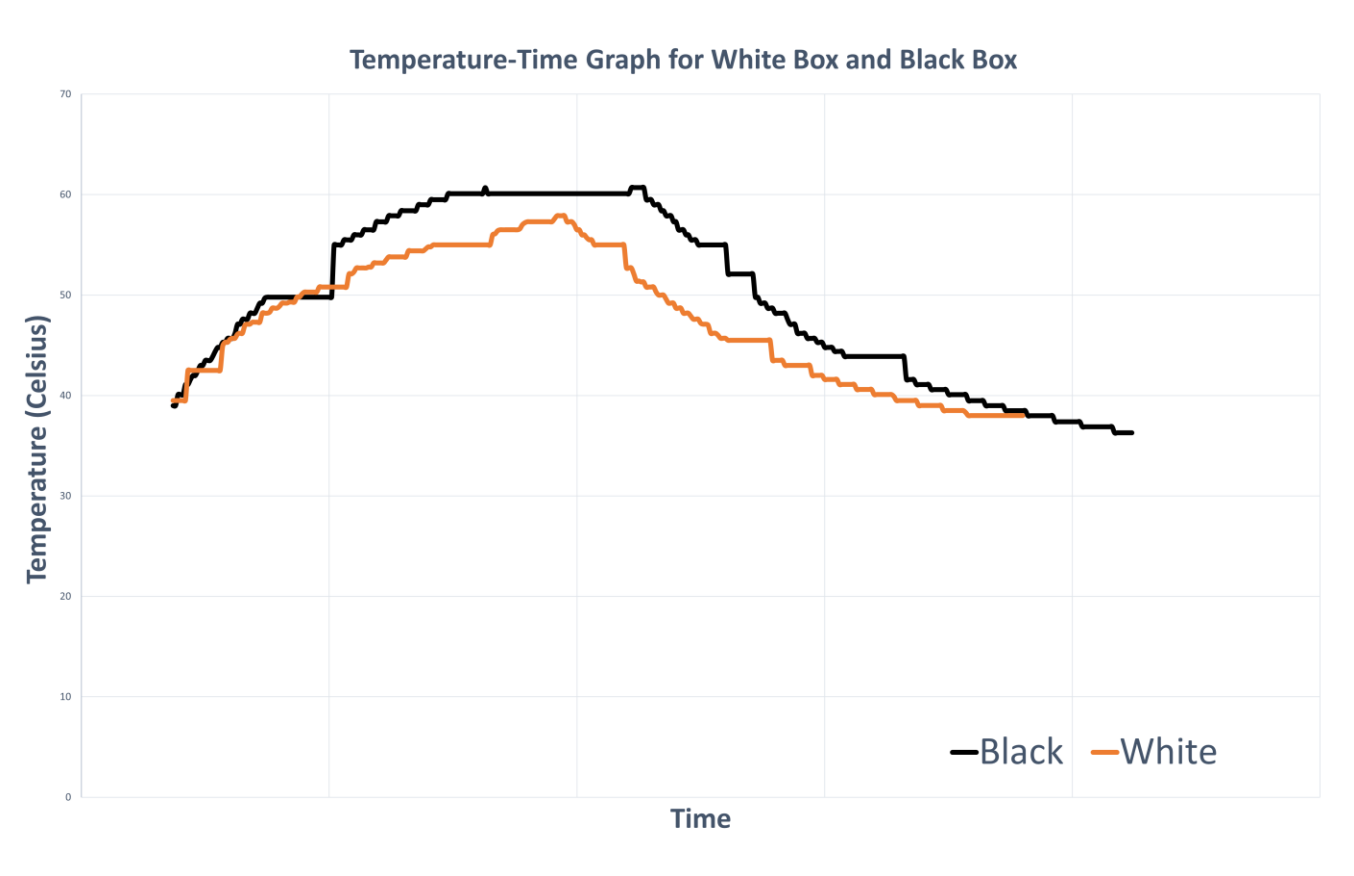




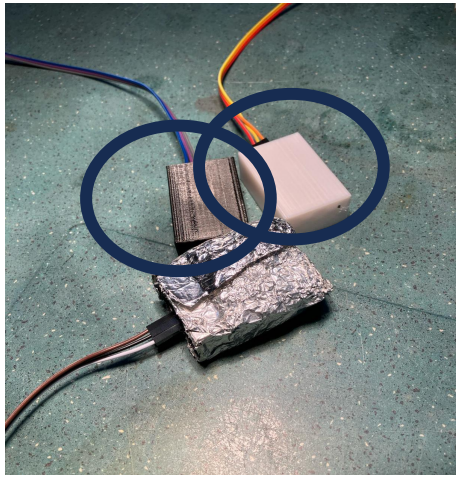


Slope of a curve ?

Task 1:
How does colour affect the absorption and emission of radiation?

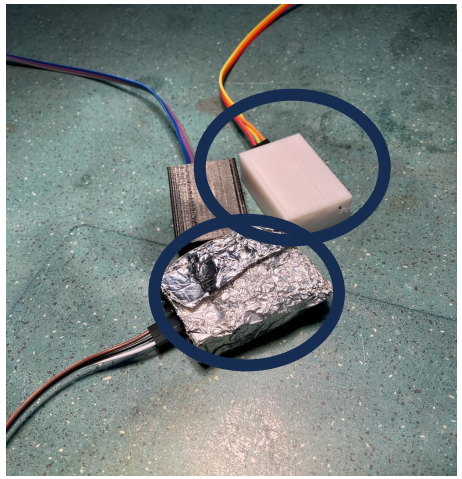


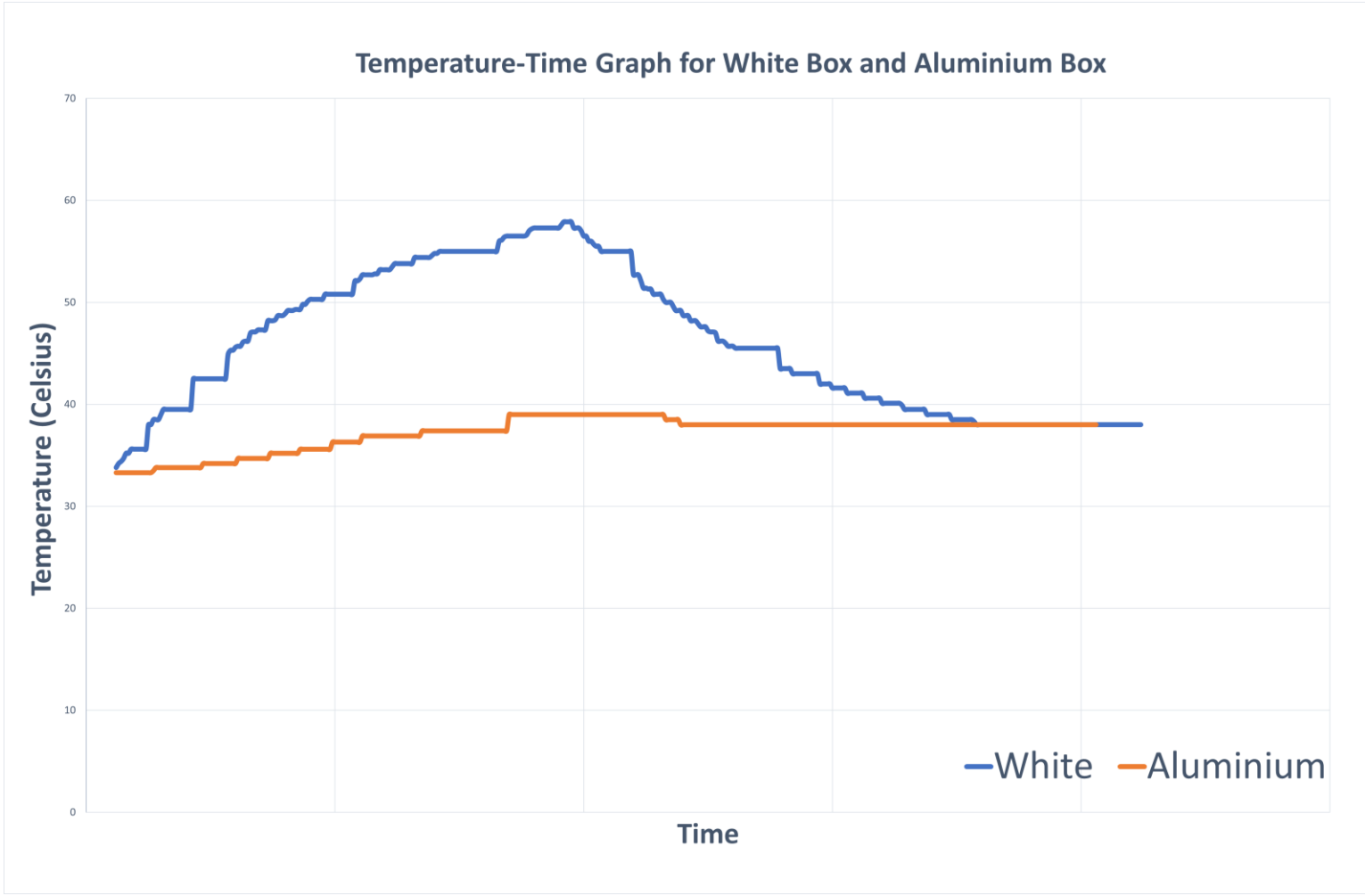
1. Divide the curves in equal time intervals.
2. Compare the slopes in between two colours
3. During Absorption of radiation
4. During Emission of radiation
5. How does colour affect the absorption and emission of radiation?



Task 2: Aluminum foil

How does white surface and aluminium foil affect the absorption of radiation?





Factors affecting the emission and absorption of radiation : Colour

- Dull black surfaces
- good absorbers and good radiators of radiation.
- Shiny and light-coloured surfaces
- poor absorbers and poor radiators of radiation.

- Absorber / radiator ?

Using foil blanket to keep warm

- Net (emission / absorption) from the body
- The foil is a shiny alumiunium
- It helps to keep the body temperature as shiny alumiunium is a poor (emitter / absorber) of radiation

Dull black surfaces

- shiny silvery surfaces → reflected.

∴ good reflectors and poor absorbers of radiation.

- Dull black surfaces → poor reflectors and good absorbers of radiation.

Shiny color

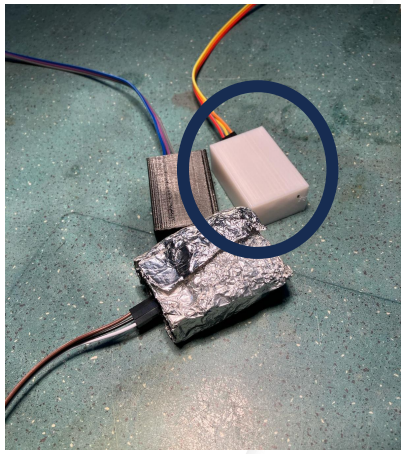
- shiny silvery surfaces,

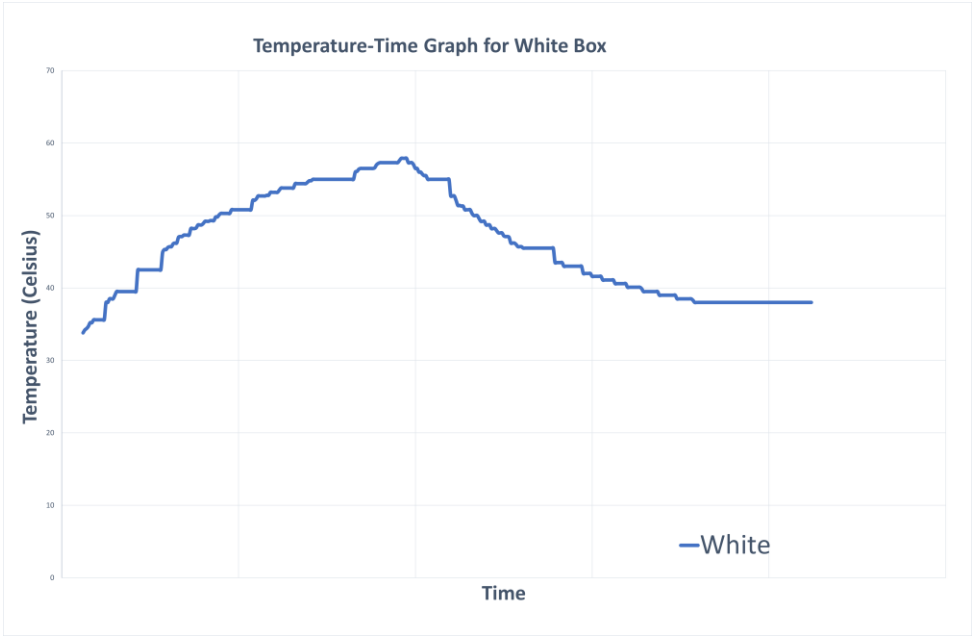
➔most of the radiation is reflected.

∴ good reflectors ／ poor absorbers of radiation

Task 3:
How does the temperature difference between object and surroundings affect the absorption and emission of radiation?

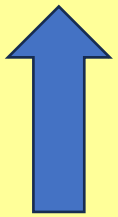
- **Room temp ~ 25°C**
- **Temperature of the lamp ~150°C**





Temperature difference between object and surroundings

The net rate of radiation emission / absorption 

the temperature difference between the object and its surroundings 

Example: Roast Spring Chicken

During the roasting of chicken, the temperature may reach approximately 200˚C. The chicken wings should be wrapped in aluminium foil to prevent them from becoming overcooked or burnt.

Example: Roast Spring Chicken

Which side of the aluminium foil should be used to wrap the chicken wings ? Explain in term of radiation.

Dull side

Shiny side

Example: Baked sweet potato

To speed up the baking process, which side of the aluminium foil should be used to wrap sweet potatoes? Explain in terms of radiation.

Dull side

Shiny side

Surface area

emission and absorption ↑
when the surface area of the object ↑.

Our next part……. How can you help her ?