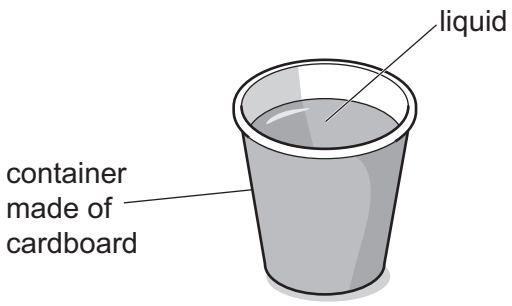
1 A student designs a container to keep a hot liquid at a high temperature.
The container is shown in the diagram.



He finds that the liquid cools too quickly.

Suggest **two** improvements to the design of the container which reduce the transfer of thermal energy from the hot liquid to its surroundings.
For each suggestion, state the thermal transfer process that it reduces.

suggestion 1 .....

.....

thermal transfer process .....

suggestion 2 .....

.....

thermal transfer process ..... [4]

[Total: 4]

2 A beaker contains water. Some of the water evaporates.

Evaporation changes the temperature of the water that remains in the beaker.

State and explain the change in temperature of the water due to evaporation.

.....

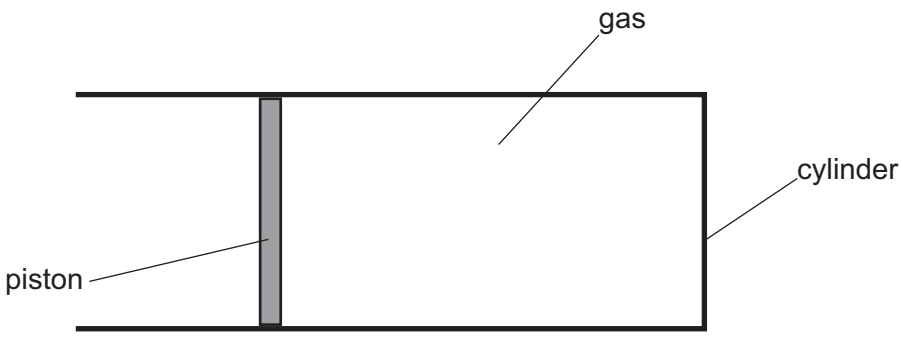
.....

..... [3]

[Total: 3]

3 A quantity of gas is trapped by a piston in a cylinder with thin metal walls. The piston is free to move without friction within the cylinder.

The diagram shows the cylinder and piston.



The cylinder is placed inside a freezer.

As the temperature of the metal cylinder decreases, the volume of the metal decreases. The decrease in the volume of the metal is much less than the decrease in the volume of the gas.

Explain, in terms of the particles of the metal, why the decrease in the volume of the metal is less than that of the gas.

.....

.....

..... [2]

[Total: 2]

4 A solar panel receives energy from the Sun at a rate of 5.0 kW.

Thermal energy is transferred from the solar panel to water with an efficiency of 20%.

Cold water of mass 15 kg enters the solar panel every hour.

The specific heat capacity of water is 4200 J / (kg°C).

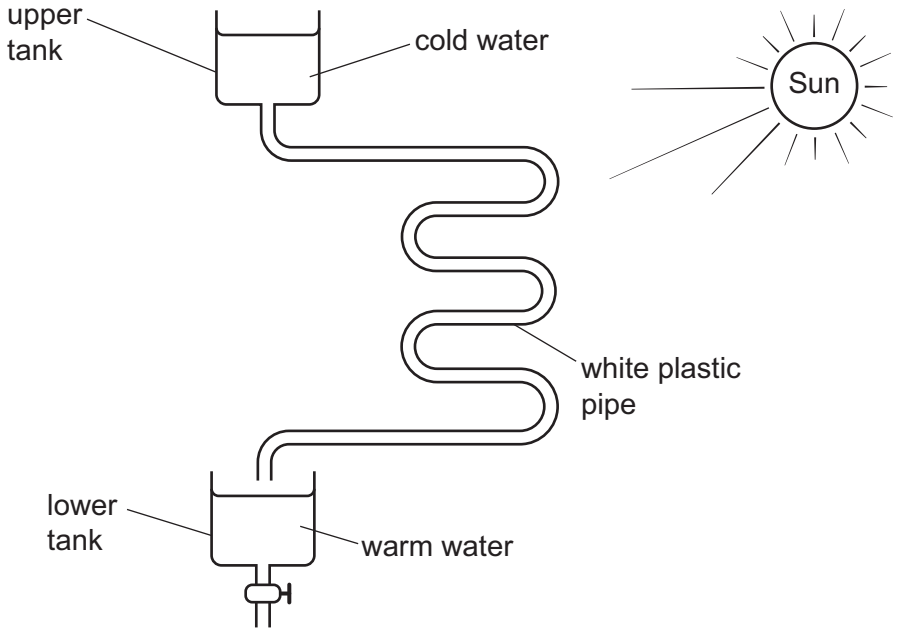
Calculate the temperature increase of the water.

temperature increase = ... °C [4]

[Total: 4]

5 An engineer makes a device that absorbs thermal energy from the Sun. The absorbed energy heats water.

In the device, cold water flows slowly from an upper tank, through a white plastic pipe, to a lower tank. Energy from the Sun heats the water as it flows, as shown in the diagram.



The engineer wants to increase the thermal energy absorbed by the water in the pipe.

Suggest **two** improvements he can make to increase the thermal energy absorbed.

In each case, explain why the suggestion increases the thermal energy absorbed.

improvement 1 .....

.....

explanation .....

.....

improvement 2 .....

.....

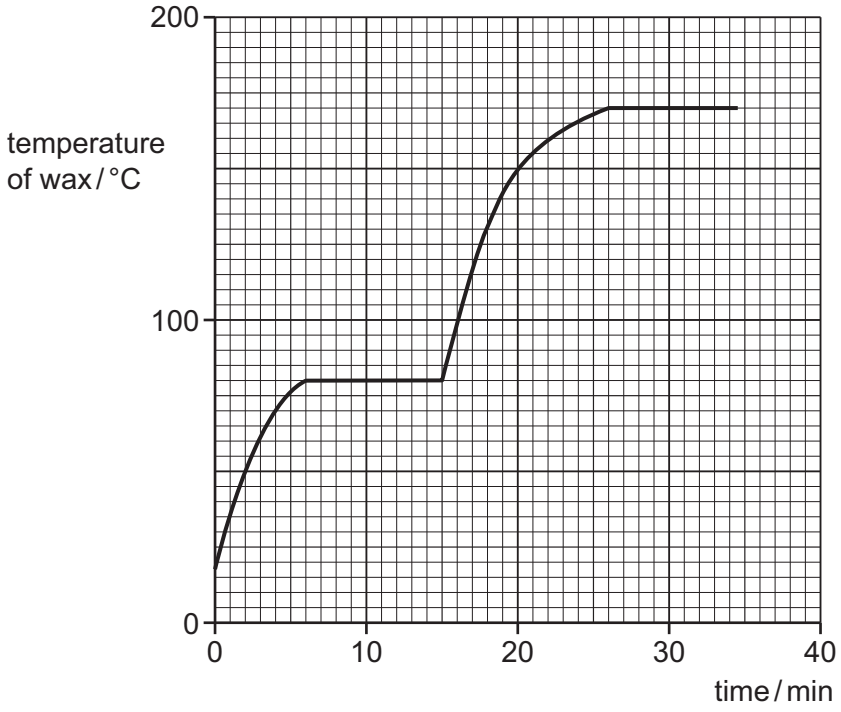
explanation .....

..... [4]

[Total: 4]

6 A teacher fills a copper can with solid wax and heats the can. She measures the temperature of the wax every minute. She continues heating once the wax has melted and stops heating when the wax is boiling.

The graph shows how the temperature of the wax changes as it is heated.



Using the graph, determine:

1. the melting point of the wax ..... °C

2. the boiling point of the wax ..... °C

3. the time at which the wax starts to boil. ..... min

[3]

[Total: 3]