Level 1: remembering.

Frequently used task words: define, list, label, name.

Can the student recall or remember the information?

Q

List the three types of heat transfer.

This question is simply asking you to list three different types of heat transfer.
No other information or explanation is required.

A

1. Conduction
2. Convection
3. Radiation

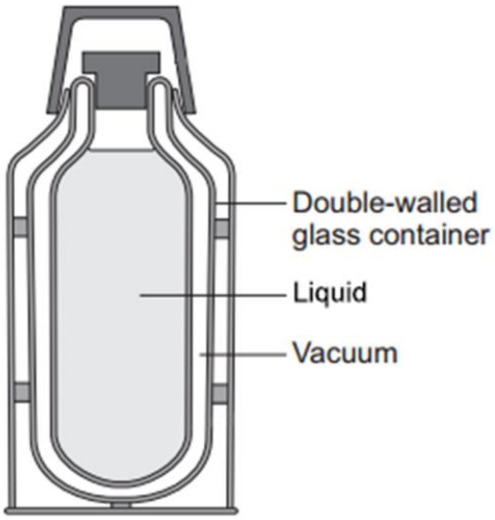
Level 2: understanding.

Frequently used task words: describe, explain, identify & example.

Can the student explain ideas or concepts?

Q

A vacuum flask is designed to keep liquids cool or hot.
Describe how the vacuum helps to maintain the temperature of the liquid.



i

This question is asking you to give an explanation, in your own words, of how a vacuum reduces heat transfer.

Questions at this level generally require a brief explanation that includes relevant terminology.

A

Transfer of heat by conduction or convection requires some matter to travel through. Therefore, a vacuum prevents the transfer of heat between the walls of the flask by both conduction and convection. By reducing the heat transfer between the liquid in the flask and its surroundings, the liquid will stay closer to its original temperature (cool or hot) for a longer period.

Level 3: applying.

Frequently used task words: apply, illustrate, solve, use & demonstrate.

Can the student use information in a new way?

Leroy makes himself a cup of coffee one morning, but finds it too hot to drink straight away. He measures the temperature of the coffee to be 85 °C, and then places it on a table and waits for it to cool.

If the coffee cup has a radius of 4 cm, a thermal conductivity of k = 0.9 J/(m K s) and the thickness of the base is 0.5 cm, what is the rate of heat transfer to the table, which is at room temperature (25 °C)?

Here is a typical quantitative question that asks you to demonstrate how well you understand the concepts and calculations associated with heat transfer. You are applying your knowledge and understanding of a particular topic to solve a novel problem.

When answering this kind of question it can be helpful to draw a diagram and label it with the information provided in the question. This can help you to visualise the problem rather than just relying on the text.

It's a very good idea to put in some explanations of your logic, rather than just writing numbers down. That way, even if your numbers are incorrect, your marker can see how you are thinking and you might get some marks.

Conduction through base of coffee cup:

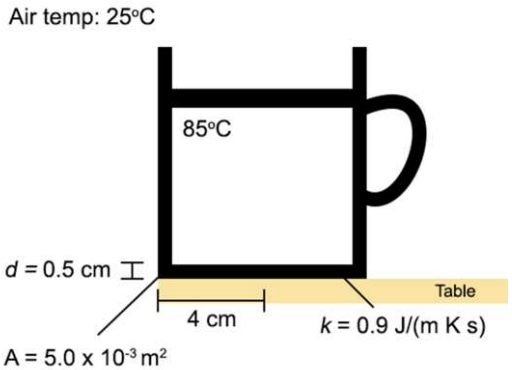
Rate of heat transfer is:

$$\frac{\Delta Q}{\Delta t} = \frac{kA\Delta T}{d}$$

$$\Delta T = 85°C - 25°C$$
$$= 60°C = 60K$$

Area of the base of the coffee cup:

$$A = \pi r^2$$
$$= \pi \times (0.04\ m)^2$$
$$= 5.0 \times 10^{-3}\ m^2$$

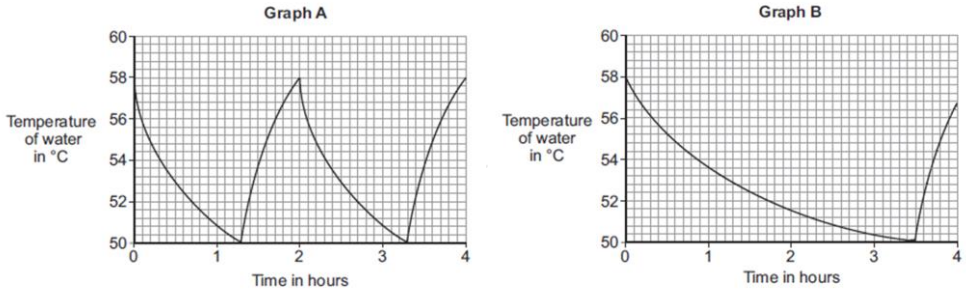


$$\frac{\Delta Q}{\Delta t} = \frac{(0.9\,J/(m\,K\,s)) \times (5.0 \times 10^{-3}\,m^2) \times (60K)}{0.005\,m}$$
$$= 54\,J/s$$

Level 4: analysing.

Frequently used task words: analyse, compare, contrast, examine.

Can the student distinguish between different parts?



The graphs above represent the temperature of water in two adjacent copper hot water tanks. The heater activates when the water temperature reaches 50°C. The tanks contain exactly the same amount of water and no water is able to enter or exit the tanks.

Compare the two graphs and provide a possible explanation for the differences in the water temperature.

Questions at this level will often ask you to compare or contrast. These questions not only require you demonstrate your knowledge and understanding, but also highlight differences and similarities, or advantages and disadvantages.

This question could be answered with a very simple explanation, but you should try to refer to any relevant understanding to demonstrate your knowledge.

The water in tank B takes longer to cool down to 50°C.

Tank A may have poor insulation compared to tank B. Without insulation, heat is readily transferred through the copper to the surrounding via conduction. This would explain why the water in tank B can maintain a hotter water temperature for a longer period.