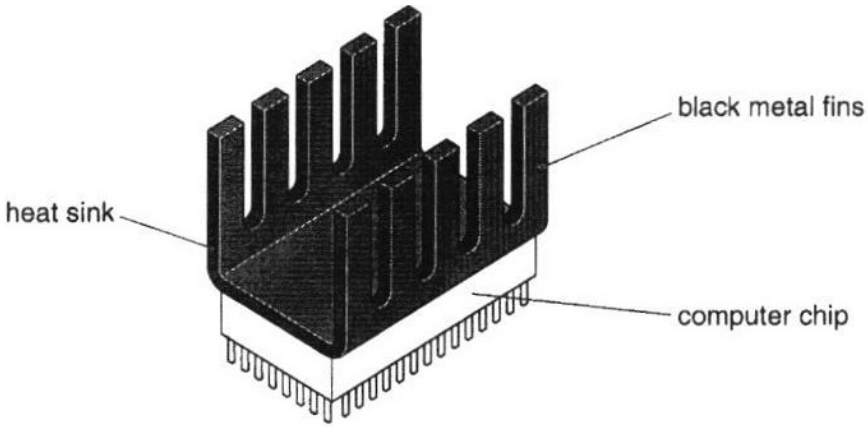
1. Fig. 1.1 shows a computer chip fitted with a heat sink with black metal fins.



The heat sink keeps the computer chip cool. Thermal energy (heat) is transferred away from the chip by conduction, convection and radiation.

(a) Explain the difference between conduction and convection. [2]

(b) Explain the features of the heat sink that allow thermal energy to be transferred easily away from the chip. [3]

Answers:

(a)

Conduction	Convection
Conduction is the transfer of thermal energy through a medium without any flow of the medium.	Convection is the transfer of thermal energy by means of convection currents in a fluid (gas or liquid), due to difference in density.
Conduction occurs in solid, liquid and gases, or all states of matter.	Therefore, it only occurs in liquids and gases (fluids) because their particles are able to move freely.
Conduction occurs via the vibration of particles (for both metals and non-metals) and free electron diffusion (for metals only). Therefore, liquids and gases are poor conductors of heat compared to solids.	A convection current is the movement of fluid caused by a difference in the densities of various parts of the fluid.

(b)

- The fins are made of metals. Metals are good conductors of heat.
- The heat sink has maximum contact surface with the chip, thus heat can be transferred from the chip to the heat sink effectively.
- The fins increases the surface area exposed to the environment, hence increasing the rate of radiation.
- The upward facing orientation of the fins increases the rate of convection.
- The black coloured fins are good emitters of infrared radiation.

First question:

Explain what is meant by conduction and convection.

Second question:

Identify and explain applications of heat conduction and convection
(e.g. in cooling, heating and insulation)
Show an understanding that the rate of heat loss or gain by a body through radiation is affected by the
(i) nature of its surface, and
(ii) temperature difference between the body and its surroundings
Identify and explain applications of heat radiation