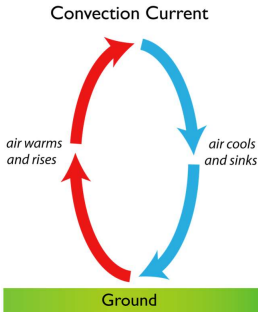
Name: Class:

Total Possible Marks: 21

# Conduction and Convection




5

1. (a) Conduction is the process by which (b) vibrating (c) particles transfer (d) energy to (e) neighbouring particles

*particles* *Conduction* *vibrating* *neighbouring* *energy*

2

2.


*Energy is transferred in this direction through the solid.*

Energy transfer to an object by heating is transferred to the thermal energy store of the object. This energy is shared across the kinetic energy stores of the particles in the object, as the particles vibrate and in so doing collide with each other transferring kinetic energy to each other's kinetic energy stores. This is called conduction.

Which of the following statements is correct?

A Conduction occurs mainly in solids.

B Particles in the hotter part of the solid vibrate slower than the particles in the colder end.

C Particles collide and transfer energy between their potential energy stores

D The conduction of energy through the solid is from the hot end to the cold end.

___ 6

3. Thermal conductivity is a measure of how quickly energy is transferred through a material by conduction. Materials with a high thermal conductivity will transfer energy between the particles more rapidly, and that the faster energy can be transferred through it by conduction. Materials with a high thermal conductivity are known as thermal conductors, and those with a low thermal conductivity are known as thermal insulators.

Using the above information, answer the following questions:
* allocate up to 3 marks per paragraph

___ 3 a. "Pots and pans are usually made of metal because metals have high thermal conductivity" - write a paragraph explaining what you think this statement means.

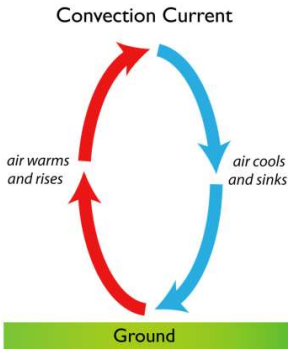
Materials with high thermal conductivity will transfer energy between the particles making up the material more rapidly than items with a low thermal conductivity. Metals used in the manufacture of pots and pans transfer energy quickly, which means that energy is also transferred quickly to the food.

___ 3 b. "Panhandles are usually made of thermal insulating material" - again in a short paragraph explain what you understand by this statement. In your explanation include why insulating material would be used.

Panhandles are usually made of thermal insulators because thermal insulators do not transfer energy by conduction very quickly. As a result of this the handle stays cool which means the pan can be picked up without burning your hands.

___ 1

4. Heating a room with a radiator relies on creating convection currents in the area of the room. Using your knowledge of convection and conduction, and the diagram, write a short essay style response explaining how radiators work in, for example, living rooms and bedrooms.




Energy is transferred from the radiator to the nearby air particles by conduction (the air particles collide with the radiator surface). As the air particles near to the radiator pickup energy they vibrate more rapidly and knock each other further apart, the result of this is that there are less particles per unit of air in warm air than in cold air, or put another way warm air is less dense than cold air. As a result of this the warm air rises and is replaced by cooler air coming in from below. The initially heated warm air loses its thermal energy to the environment, for example the walls, the contents of the rooms and the cooler air towards the ceiling and as a result of this the particles do not vibrate so violently, they therefore move closer together and cause an increase locally in the density of the air. The denser air sinks down towards the ground and is eventually drawn back into the radiator to be reheated and the cycle then continues.

___ 6

5. A pot containing water is being heated on a gas hob.

___ 3 a. Give 3 energy transfers which are occurring in this scenario

1. From the chemical energy storage the gas to the thermal energy store of the pot and surroundings.
2. From the thermal energy storage of the part to the thermal energy store the water.
3. From the thermal energy storage of the water or part to the thermal energy store of the surroundings.

___ 1 b. A second pan is heated at the same power and contains the same amount of water, in addition the water in each pan started at the same temperature. The water in the second pan reaches boiling point faster. Suggest a property of the material of the second pan that could possibly explain this.

The second pan's material could have a higher thermal conductivity

___ 2 c. The hot water is poured into a flask which is then sealed. The flask is made up of a smaller container encased within a larger one, there is a sealed gap between the walls of the 2 containers which is filled with air. Explain how this slows down the rate at which the water cools.

Air is an insulator (or if you like a poor conductor, or has a low thermal conductivity) [1] and so energy is transferred across the gap slowly by conduction [1]

___ 1

6. Match the expression with its defining statement:

| | | | |
|---|---|---|---|
| a. | b | Convection | a. Is a measure of how quickly energy is transferred through a material |
| b. | c | Conduction | b. Is the process by which energetic particles move away from hotter to cooler regions |
| c. | a | Thermal conductivity | c. Is the process by which vibrating particles transfer energy to neighbouring particles |