

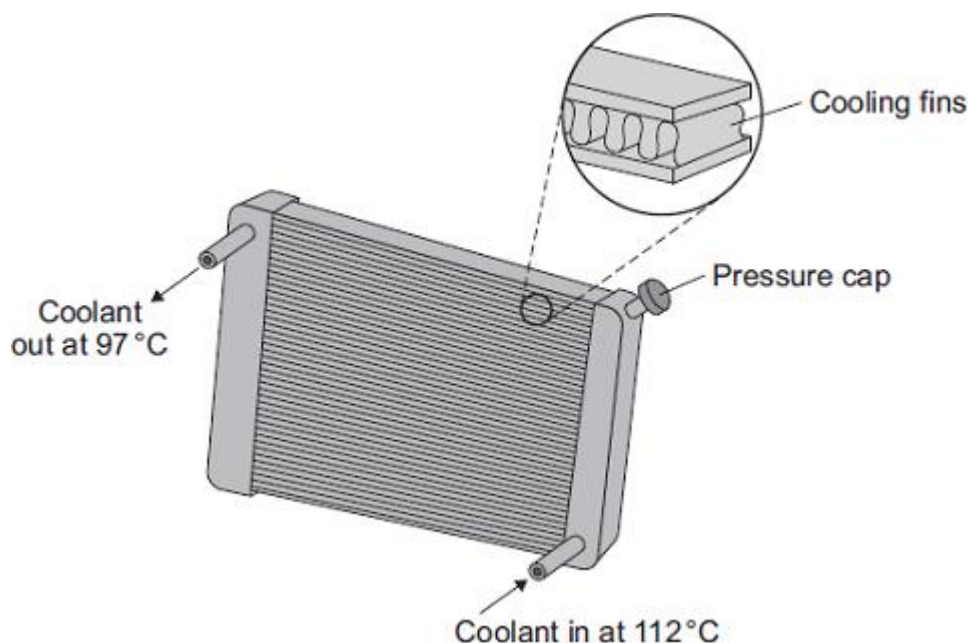
Name of the Student: _____

Max. Marks : 23 Marks

Time : 23 Minutes

Q1.

The diagram shows a car radiator. The radiator is part of the engine cooling system.



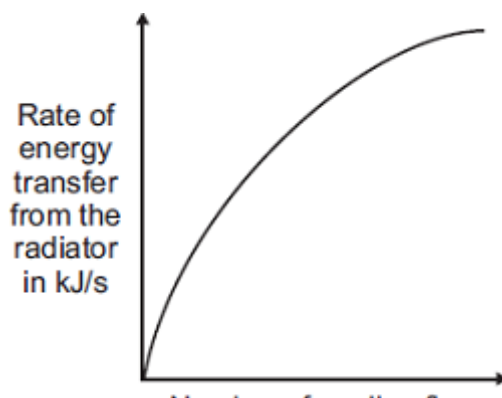
Liquid coolant, heated by the car engine, enters the radiator. As the coolant passes through the radiator, the radiator transfers energy to the surroundings and the temperature of the coolant falls.

(a) Why is the radiator painted black?

(2)

(b) Different radiators have different numbers of cooling fins along the length of the radiator.

The sketch graph shows how the number of cooling fins affects the rate of energy transfer from the radiator.



The number of cooling fins affects the rate of energy transfer from the radiator.

Explain how.

(2)

- (c) When the car engine is working normally, 2 kg of coolant passes through the radiator each second. The temperature of the coolant falls from 112 °C to 97 °C.

Calculate the energy transferred each second from the coolant.

Specific heat capacity of the coolant = 3800 J/kg °C.

Energy transferred each second = _____ J

(3)

- (d) On cold days, some of the energy transferred from a hot car engine is used to warm the air inside the car. This is a useful energy transfer.

What effect, if any, does this energy transfer have on the overall efficiency of the car engine?

Draw a ring around the correct answer.

**decreases the
efficiency**

**does not change the
efficiency**

**increases the
efficiency**

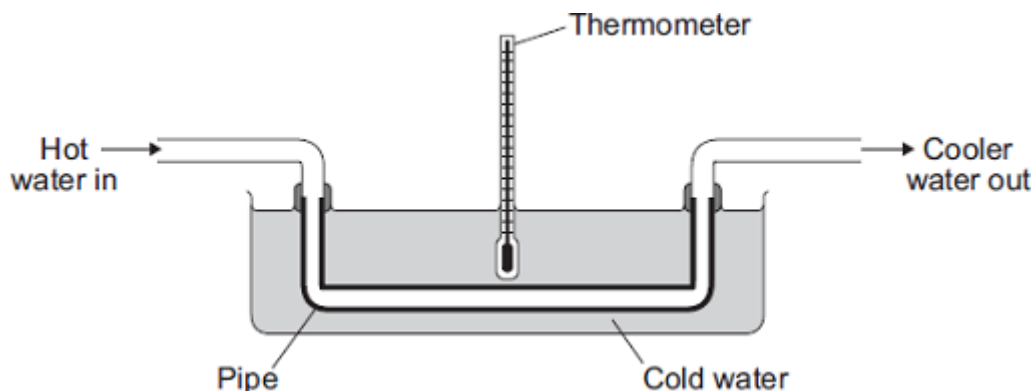
Give a reason for your answer.

Q2.

Heat exchangers are devices used to transfer heat from one place to another.

The diagram shows a pipe being used as a simple heat exchanger by a student in an investigation.

Heat is transferred from the hot water inside the pipe to the cold water outside the pipe.



- (a) Complete the following sentence by drawing a ring around the correct word in the box.

Heat is transferred from the hot water inside the pipe

to the cold water outside the pipe by

conduction.
convection.
radiation.

(1)

- (b) The student wanted to find out if the efficiency of a heat exchanger depends on the material used to make the pipe. The student tested three different materials. For each material, the rate of flow of hot water through the pipe was kept the same.

The student's results are recorded in the table.

Material	Temperature of the cold water at the start in °C	Temperature of the cold water after 10 minutes in °C
Copper	20	36
Glass	20	23
Plastic	20	21

- (i) The rate of flow of hot water through the pipe was one of the control variables in the investigation.

Give **one** other control variable in the investigation.

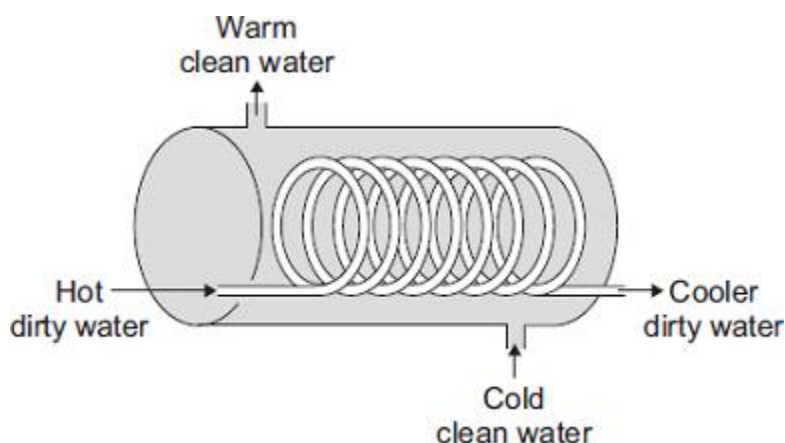
(1)

- (ii) Which **one** of the three materials made the best heat exchanger?

Give a reason for your answer.

(2)

- (c) The student finds a picture of a heat exchanger used in an industrial laundry. The heat exchanger uses hot, dirty water to heat cold, clean water.



This heat exchanger transfers heat faster than the heat exchanger the student used in the investigation.

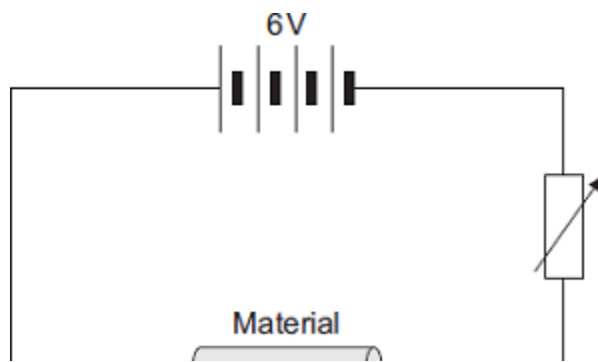
Explain why.

(2)

(Total 6 marks)

Q3.

- (a) The diagram shows the circuit used to investigate the resistance of a sample of a material. The diagram is not complete; the ammeter and voltmeter are missing.



- (i) Draw the symbols for the ammeter and voltmeter on the diagram in the correct places.

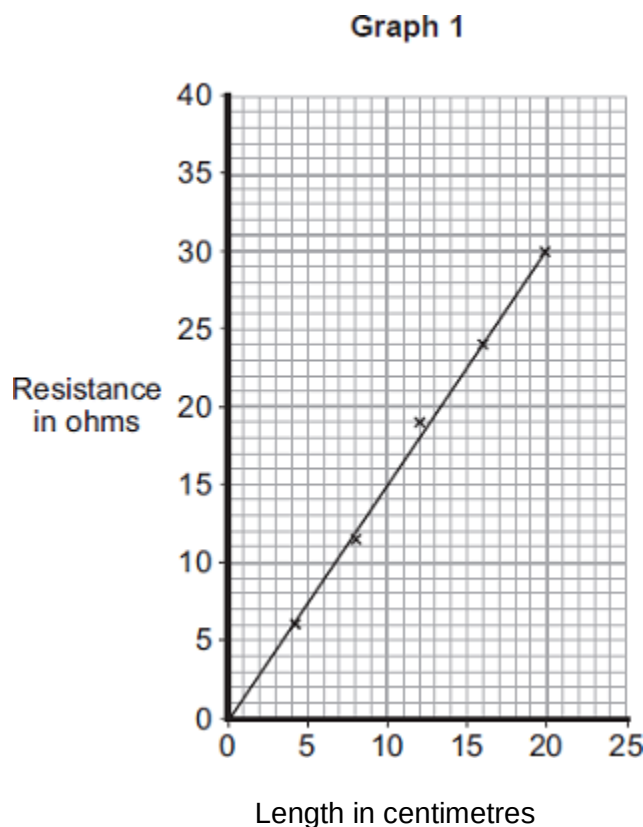
(2)

- (ii) How can the current through the material be changed?

(1)

- (b) The material, called conducting putty, is rolled into cylinders of different lengths but with equal thickness.

Graph 1 shows how the resistance changes with length.



- (i) The current through a 25 cm length of conducting putty was 0.15 A.

Use **Graph 1** to find the resistance of a 25 cm length of conducting putty.

Resistance = _____ ohms

(1)

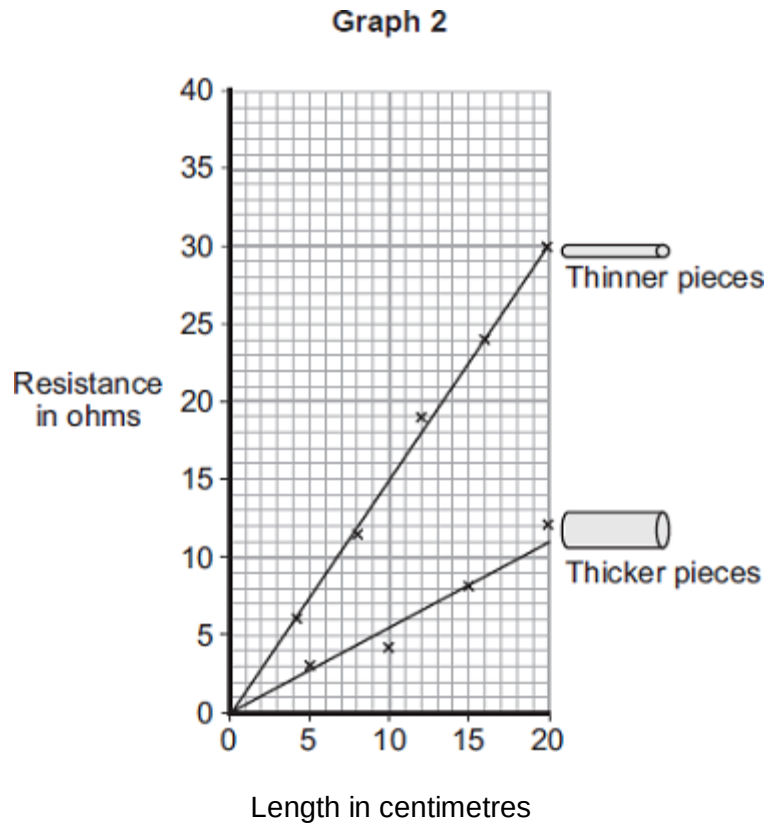
- (ii) Use your answer to **(b) (i)** to calculate the potential difference across a 25 cm length of conducting putty.

Show clearly how you work out your answer.

Potential difference = _____ volts

(2)

- (c) A second set of data was obtained using thicker pieces of conducting putty. Both sets of results are shown in **Graph 2**.



- (i) What is the relationship between the resistance and the thickness of the conducting putty?

(1)

- (ii) Name **one** error that may have reduced the accuracy of the results.

(1)

(Total 8 marks)

