

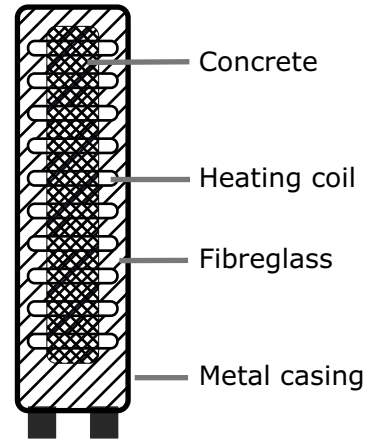
GCSE Thermal energy

Name & Set



1. The diagram shows the inside of a night-storage heater. It is used to keep a room warm, both night and day.

The heater automatically switches on every night. It switches off every morning. When it is switched on, some of the heat from the heating coils warms up the concrete block. The rest of the heat leaves the heater and goes into the room. During the day, heat leaves the concrete block and goes into the room.



(a) Explain why heat leaves the concrete block.

[2]

(b) By what method does the heat move from the concrete block to the metal casing?

[1]

(c) Explain two different reasons why fibreglass is used to fill the space between the concrete block and the metal casing.

Reason 1 _____ [1]

Explanation of use _____

[2]

Reason 2 _____ [1]

Explanation of use _____

[2]

(d) The heater is a 1.5 kilowatt (kW) heater. It is switched on for eight hours each night. The electricity used costs 2.5 pence per kilowatt-hour. This is much cheaper than the daytime rate.

(i) What is the cost of running this heater every night for a week? Include in your answer the equation you are going to use. Show clearly how you get to your final answer and include the unit.

[3]

(ii) Electricity costs less during the night than it does during the day. Give a reason why.

[1]

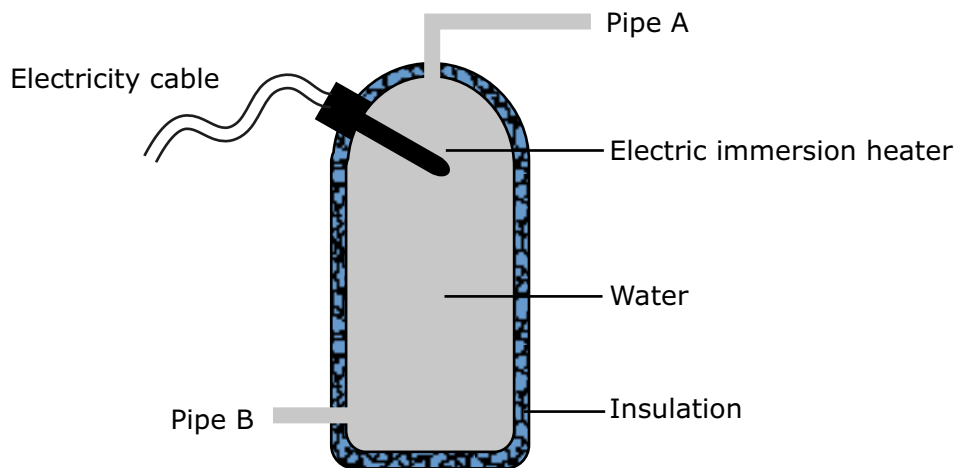
(e) When the heater is switched on for one minute, 90,000 J of energy are transferred. The voltage across the heater is 240 V.

Calculate the electric current through the heater. Include in your answer the equation or equations you are going to use. Show clearly how you get to your final answer and give the unit.

[4]

2 Electric immersion heaters are often fitted in the hot water tanks in people's homes.

(a) On the following diagram mark a point, X, where you would expect to find the highest water temperature after the heater had been switched on for one hour. [1]



(b) Describe the movement of the water inside the tank when the immersion heater is first switched on. Explain why the water moves in this way and give the name of the process

[4]

(c) Describe the movement of water inside the tank if, after one hour, the immersion heater is switched off and a hot water tap connected to the tank is turned on.

[2]

(d) (i) Explain why the hot water cylinder is insulated.

[2]

(ii) Suggest a suitable material to use as insulation.

[1]

(e) (i) When the immersion heater is switched on a constant current of 10 amperes (A) flows through it. It is switched on for one hour.

Calculate the charge (in coulombs) which passes through the heater.

Write down the equation you are going to use.

Then clearly show how you get to your answer.

[4]

(ii) What is the name of the charged particles which move through the electrical circuit when the immersion heater is switched on?

[1]

(iii) The potential difference across the immersion heater is 240 volts.

How much energy is transferred in one hour?

Write down the equation you are going to use.

Then clearly show how you get to your answer.

[2]

In some factories hot water pipes are painted white or silver.

Explain why this saves energy.

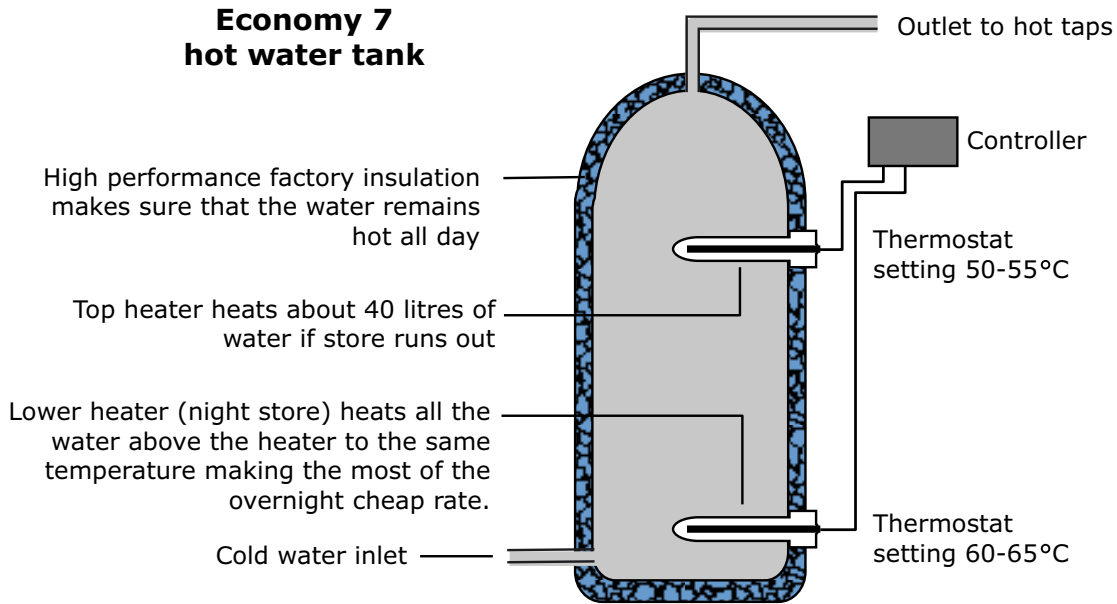
[4]

(g) Explain fully why electric heaters have a greater efficiency than electric motors.

[4]

- 3 (a) Electricity companies try to encourage people to use more electricity at night and less during the day. They do this by charging a cheaper price for electricity used at night. They call this scheme 'Economy 7'.

The diagram below is taken from an electricity company leaflet, It shows a special hot water tank designed to use electricity on the 'Economy 7' scheme.



Economy 7 controller wired to existing circuit switches on lower immersion heater during cheap night period but allows one hour boosts of upper heater as required during the day

- (i) Suggest and explain one reason why the outlet to the hot taps is at the top of cylinder.

Reason _____ [1]

Explanation of use _____

_____ [2]

- (ii) How does the insulation 'make sure that the water remains hot all day'?

_____ [1]