



GCSE Physics

Conservation and Transfer of Energy

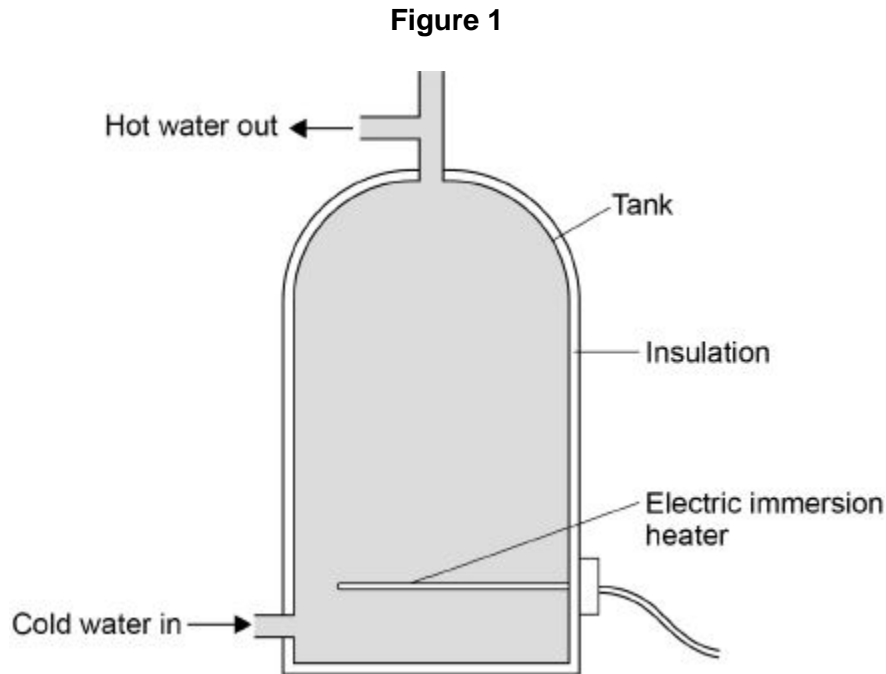
Question Paper

Time available: 55 minutes

Marks available: 49 marks

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1. Figure 1 shows a hot water tank made of copper.



(a) Copper has a higher thermal conductivity than most metals.

How does the rate of energy transfer through copper compare with the rate of energy transfer through most metals?

Tick **one** box.

- Higher
- Lower
- The same

(1)

(b) The tank is insulated. When the water is hot, the immersion heater switches off.

Complete the sentences.

Compared to a tank with no insulation, the rate of energy transfer from the water in an insulated tank is _____.

This means that the water in the insulated tank stays _____ for longer.

(2)

Figure 2 shows how temperature varies with time for water in a tank heated with an immersion heater.

Figure 3 shows how temperature varies with time for water in a tank heated with a solar panel.

Figure 2

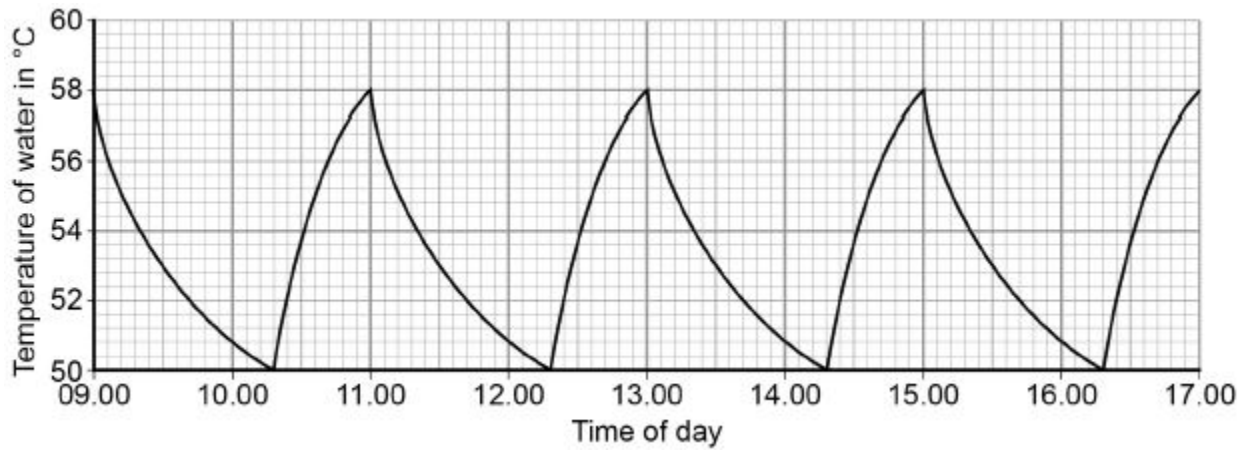
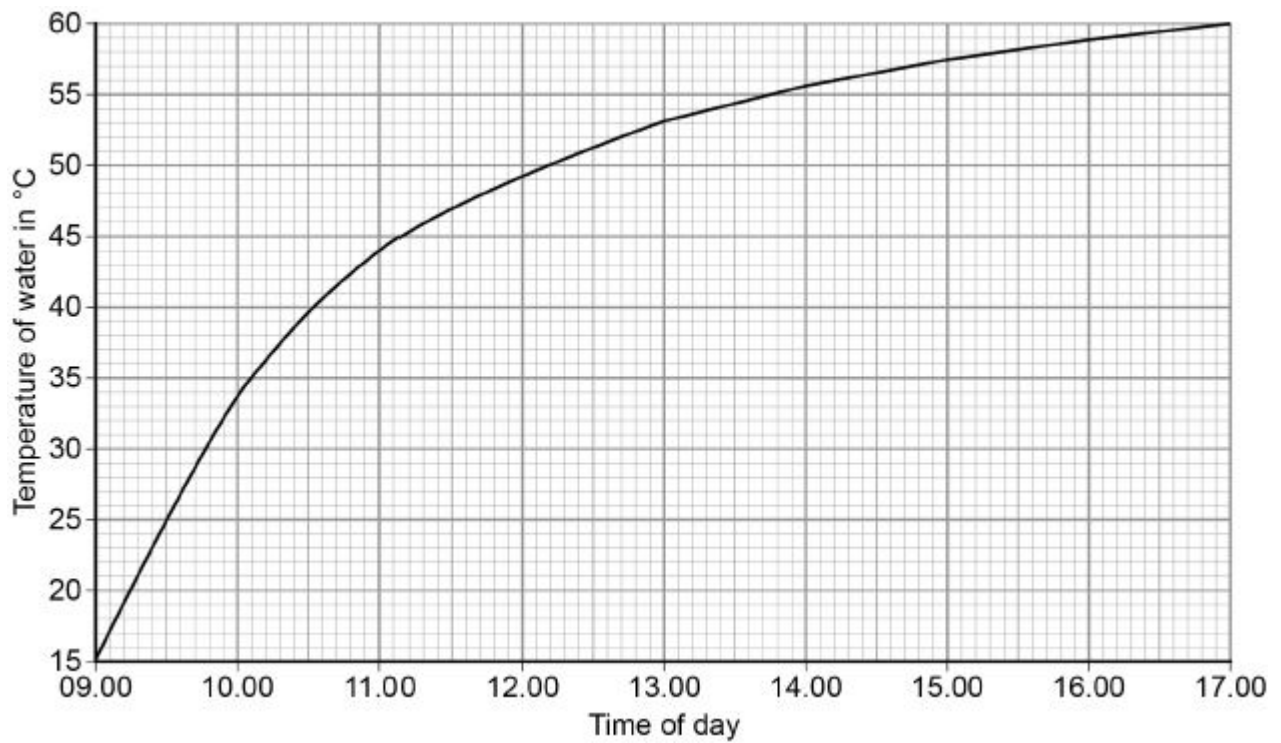


Figure 3



- (c) Give **one** advantage and **one** disadvantage of heating the water using solar panels rather than an immersion heater.

Use only information from **Figure 2** and **Figure 3**.

Advantage of solar panels _____

Disadvantage of solar panels _____

(2)

- (d) During one morning, a total of 4 070 000 J of energy is transferred from the electric immersion heater.

4 030 000 J of energy are transferred to the water.

Calculate the proportion of the total energy transferred to the water.

Proportion of total energy = _____

(2)

- (e) Write down the equation that links energy transferred, power and time.

(1)

(f) The power output of the immersion heater is 5000 W.

Calculate the time taken for the immersion heater to transfer 4 070 000 J of energy.

Give the unit.

Time = _____ Unit _____

(4)

(Total 12 marks)

2. **Figure 1** shows a lift inside a building.

Figure 1



- (a) The motor in the lift does 120 000 J of work in 8.0 seconds.

Calculate the power output of the motor in the lift.

Use the equation:

$$\text{Power output} = \frac{\text{work done}}{\text{time}}$$

Power output = _____ W

(2)

- (b) The power input to the motor is greater than the power output.

Tick **two** reasons why.

Energy is transferred in heating the surroundings.

Friction causes energy to be transferred in non-useful ways.

The motor is connected to the mains electricity supply.

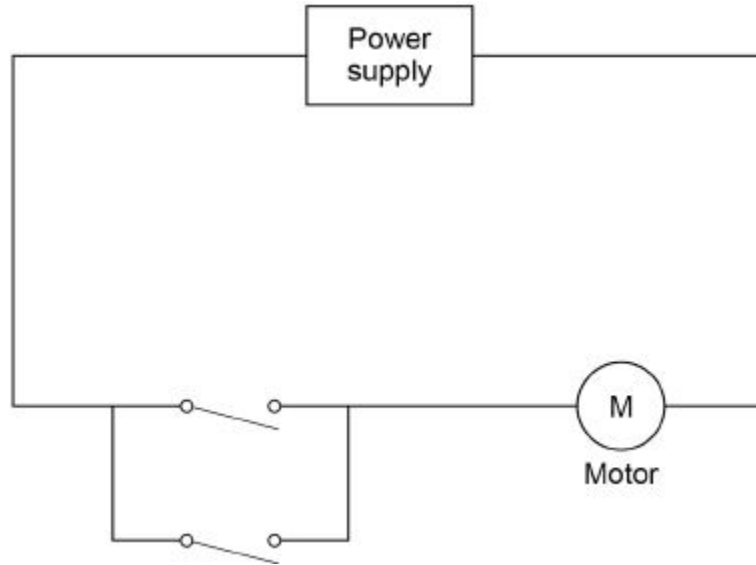
The motor is more than 100% efficient.

There are only four people in the lift.

(2)

(c) **Figure 2** shows part of the circuit that operates the lift motor.

Figure 2



The lift can be operated using either of the two switches.

Explain why.

(2)

(d) Write down the equation that links gravitational field strength, gravitational potential energy, height and mass.

(1)

(e) The lift goes up 14 m. The total mass of the people in the lift is 280 kg.

gravitational field strength = 9.8 N/kg

Calculate the increase in gravitational potential energy of the people in the lift.

Give your answer to 2 significant figures.

Increase in gravitational potential energy = _____ J

(3)

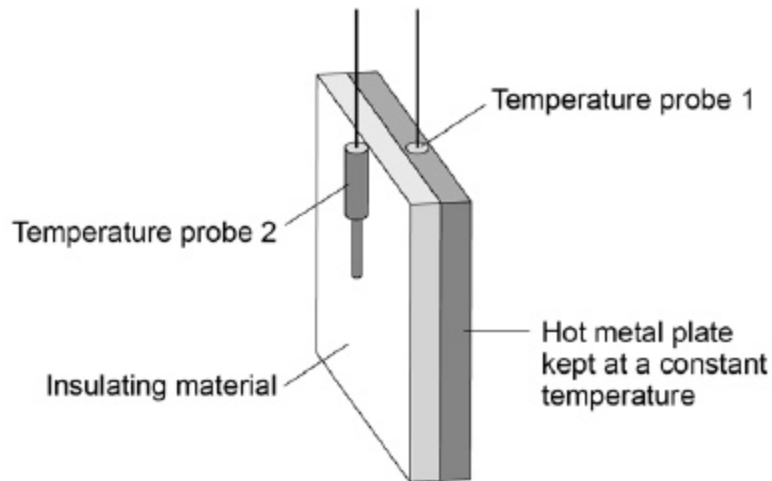
(Total 10 marks)

3.

A student investigated the properties of three types of insulation.

Figure 1 shows the apparatus the student used.

Figure 1



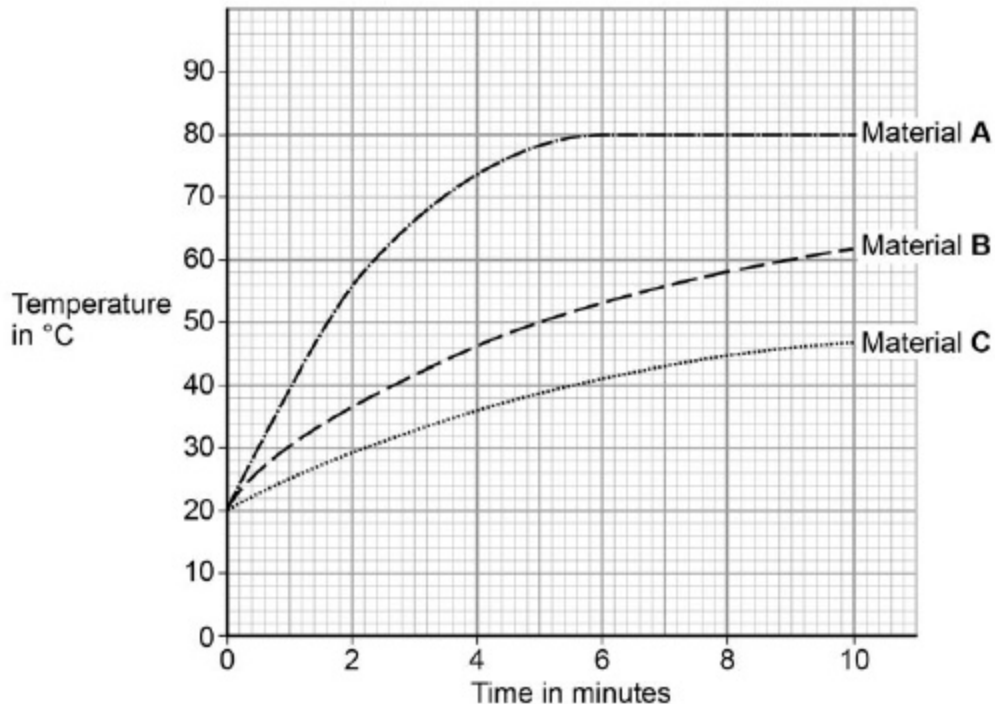
In the investigation different insulating materials were placed in contact with the hot metal plate.

Temperature probes measured the temperature on each side of the material.

The temperature probes were connected to a data logger.

Figure 2 shows how the temperature measured by temperature probe 2 changed over 10 minutes for each of the materials.

Figure 2



(a) What was the temperature of the hot metal plate?

_____ °C

(1)

(b) Which material is the best insulator?

Tick **one** box.

A

B

C

Give the reason for your answer.

(2)

(c) Another student repeated the investigation but doubled the thickness for all three insulating materials.

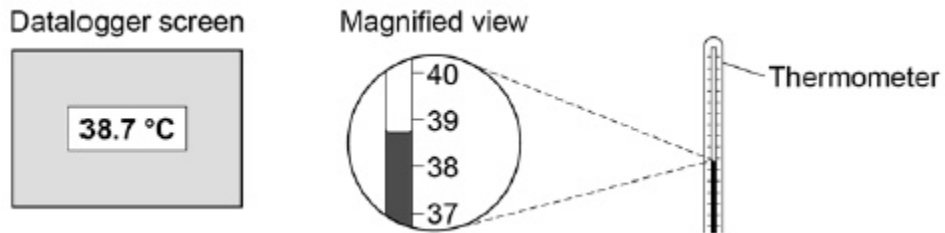
Suggest how using thicker insulation would affect the results of the second student's investigation compared with the first student's results.

(2)

(d) The students could have used a thermometer instead of temperature probes and a datalogger.

Figure 3 shows the datalogger screen and a thermometer.

Figure 3



Give two advantages of using the datalogger and temperature probes compared to a thermometer.

1. _____

2. _____

(2)

(e) The table gives information about four types of insulation that could be used for insulating the cavity walls of houses.

Type of insulation	Thermal conductivity in W/m °C
Felt wool	0.070
Mineral wool	0.040
Polyurethane foam	0.030
Rock wool	0.045

Explain which one of the types of insulation in the table would be the best to use for cavity wall insulation.

(2)
(Total 9 marks)

4.

The electric kettle shown below is used to boil water.



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- (a) After the water has boiled, the temperature of the water decreases by 22 °C.
The mass of water in the kettle is 0.50 kg.
The specific heat capacity of water is 4200 J/kg °C.

Calculate the energy transferred to the surroundings from the water.

Energy = _____ joules

(2)

- (b) Why is the total energy input to the kettle higher than the energy used to heat the water?

Tick (✓) **one** box.

	Tick (✓)
Energy is absorbed from the surroundings.	
Energy is used to heat the kettle.	
The kettle is more than 100% efficient.	

(1)

(Total 3 marks)

5.

The image shows a man using a leaf blower to move some leaves.



The leaf blower is powered by an electric motor connected to a battery.

(a) Energy transfers take place when the leaf blower is being used.

Use the correct answer from the box to complete each sentence.

chemical	electrical	kinetic	nuclear	sound
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The battery stores _____ energy which is transferred into electrical energy.

The electric motor transfers electrical energy usefully into _____ energy.

The motor wastes energy as _____ energy and as energy that heats the surroundings.

(3)

(b) The total power input to the leaf blower is 750 W.
The useful power output of the leaf blower is 360 W.

Calculate the efficiency of the leaf blower.

Efficiency = _____

(2)

(Total 5 marks)

6.

A student finds some information about energy-saving light bulbs.

(a) A 30W light bulb uses 600J of electrical energy in a certain period of time. In that time, it produces 450 J of light energy. The rest of the energy is wasted.

(i) Calculate the energy wasted by the light bulb in this period of time.

 Wasted energy = _____ J

(1)

(ii) What happens to the energy wasted by the light bulb?

(1)

(iii) Calculate the efficiency of this light bulb.

 Efficiency = _____

(2)

(iv) Calculate the period of time, in seconds, during which the 600 J is provided to the 30 W light bulb.

 Time = _____ s

(2)

(b) A company that makes light bulbs provides information about some of their products.

The table shows some of this information.

	Power in watts	Lifetime in hours	Cost of bulb in £
Filament bulb	60	1250	2.00
LED bulb	12	50 000	16.00

(i) Suggest why it is important to confirm this information independently.

(1)

(ii) A homeowner is thinking about replacing his filament bulbs with LED bulbs.

A 12 W LED bulb gives the same light output as a 60 W filament bulb.

Suggest reasons why the homeowner is likely to choose LED bulbs.

Use the information given in the table.

(2)

(iii) State **one** factor, other than efficiency, that is important when considering the choice of a bulb for lighting in the home.

(1)

(Total 10 marks)