# Energy Transfers and Energy Resources
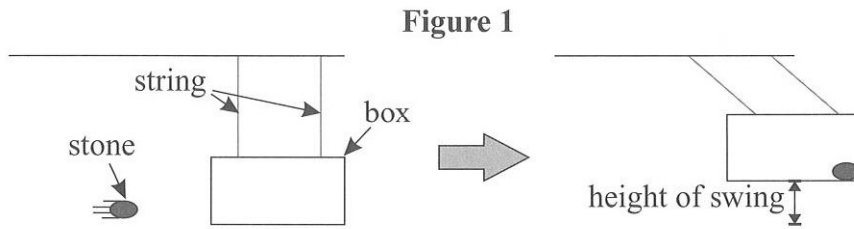
1   A stone is thrown horizontally into a box that is hanging from the ceiling. The stone is caught in the box and the box swings upwards, as shown in **Figure 1**.
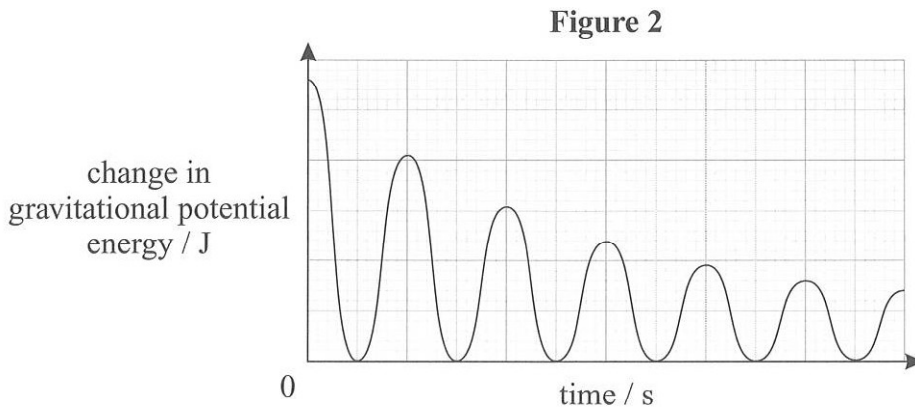
**Figure 1**



After the stone lands in the box, the swing reaches a maximum height of 20 cm.
The stone has a mass of 20 g and the box has a mass of 100 g.
The gravitational field strength is 10 N/kg.

a)  Calculate the speed of the stone just before it hit the box. You may assume that all the energy in the kinetic energy store of the stone was transferred to the gravitational potential energy stores of the stone and the box. Give your answer to two significant figures.

Speed = ................................. m/s
*[6]*

The box begins to swing back and forth with the stone inside. **Figure 2** shows how the total energy in the gravitational potential energy stores of the box and the stone changes over time.

**Figure 2**



b)  Explain why the peaks shown in **Figure 2** become smaller over time.

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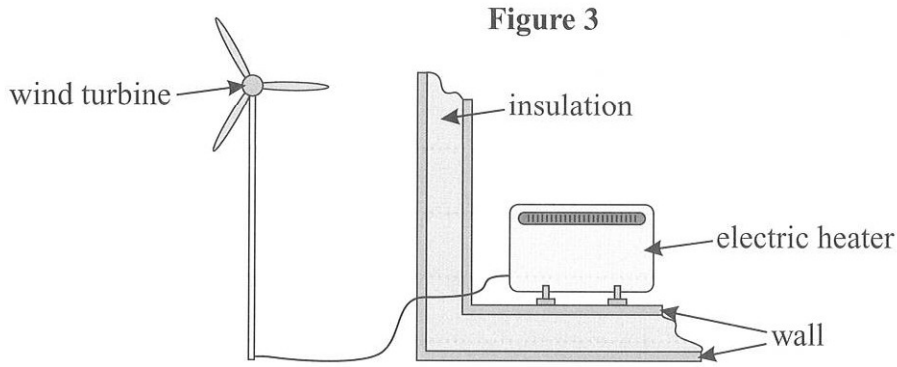*[1]*

*[Total 7 marks]*

2    A home owner uses a wind turbine to supply an electric heater with energy, as shown in **Figure 3**.

**Figure 3**



The turbine transfers energy to the heater from the kinetic energy store of the wind that passes over its blades. The turbine has an efficiency of 37%. The heater transfers this energy to the thermal energy stores of its surroundings. The heater has an efficiency of 98%.

a) In a 15 minute period, the heater transfers 0.68 MJ of energy to the thermal energy stores of its surroundings. Calculate the amount of energy in the kinetic energy store of the wind passing over the turbine's blades during this period.

Energy = ................................. MJ

*[4]*

b) Suggest an explanation for why the heater has a high efficiency.

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*[2]*

c) The home owner installs new insulation in the walls of the room in which the heater is kept. The new insulation layer is thinner than the previous layer. However, the rate at which the room cools after the heater is switched off remains the same. State **one** property of the new insulation which could explain this difference.

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*[1]*

*[Total 7 marks]*

Section 1 — Motion, Forces and Conservation of Energy

**3** Britain's energy supply is mostly provided by coal-fuelled power stations, but the use of other resources is increasing. One source of power that is being used more is wind power.

a)* Evaluate the benefits and drawbacks of using more wind power and less coal to supply Britain's energy needs.
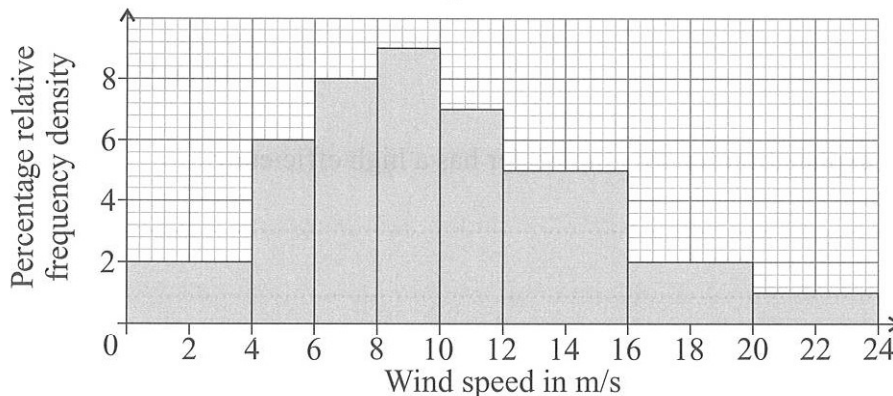
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*[6]*

The histogram in **Figure 4** shows the distribution of wind speeds at a wind turbine site during one week.

**Figure 4**



b) Calculate the percentage of time for which the wind speed was greater than 10 m/s.

Percentage time = ..................................... %

*[2]*

*[Total 8 marks]*

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**Exam Practice Tip**

You might be asked to weigh up some advantages and disadvantages or make comparisons between a couple of alternatives. Try to give each side of your answer a similar level of detail. For example, don't write a novel about the advantages of panto horses and only one line on the disadvantages.

Score: ☐

**22**

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