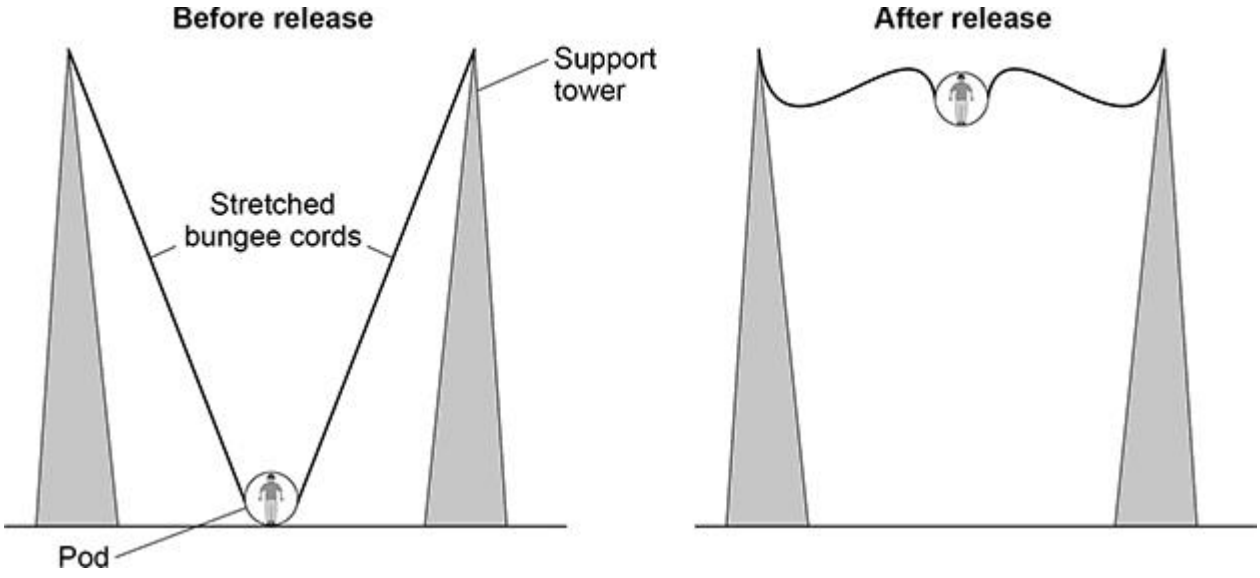
Questions are for both separate science and combined science students

Q1.

In a ride at a theme park, a person is strapped into a pod that is attached to two stretched bungee cords.

The bungee cords behave like springs.

The figure below shows a person using the ride.



(a) Why is the maximum gravitational potential energy of the pod less than the initial elastic potential energy of the bungee cords?

Tick (✓) **two** boxes.

Energy is created.	☐
Energy is destroyed.	☐
Energy is transferred to the surroundings.	☐
Work is done against air resistance.	☐
Work is done by the force of gravity.	☐
Work is done by the person in the pod.	☐

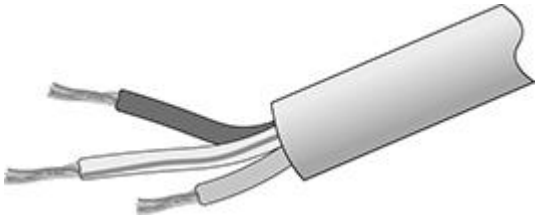
(2)

(Total 2 marks)

Q2.

An electrical appliance is connected to the mains electricity supply using a three-core cable.

The figure below shows a three-core cable.



(a) The fuse transfers some energy to the surroundings as it melts.

How does transferring energy to the surroundings affect the total energy needed to melt the fuse?

Tick (✓) **one** box.

The total energy will be smaller. ☐

The total energy will be the same. ☐

The total energy will be greater. ☐

(1)

(Total 1 marks)

Q3.

The figure below shows a wind turbine.

Wind turbines may generate electricity when the electricity is not needed.

Two methods that can be used to store the energy from the turbine are:

Method A: Heating water to a high temperature.

Method B: Pumping water uphill into a reservoir.

(a) Which energy store increases when water is heated?

_____

(1)

(b) Which energy store increases when water is pumped uphill into a reservoir?

_____

(1)

(c) The table below shows information about the two methods of storing energy.

Method	Energy stored per 100 kg of water in kJ	Percentage of stored energy wasted	Installation
A: Increasing water temperature by 80 °C	33 600	40%	Anywhere
B: Pumping water uphill to a height of 500 m	490	25%	High mountains

Compare the advantages and disadvantages of the two methods of storing energy.

Include calculations in your answer.

(4)

(d) Decreasing the amount of carbon dioxide released by different activities will help slow down climate change.

Transport and generating electricity are the two activities that released the largest amounts of carbon dioxide in the UK in 2018.

Explain **one** change that would reduce the amount of carbon dioxide released by **each** activity.

Transport _____

_____

_____

_____

_____

Generating electricity _____

_____

_____

_____

_____

(4)

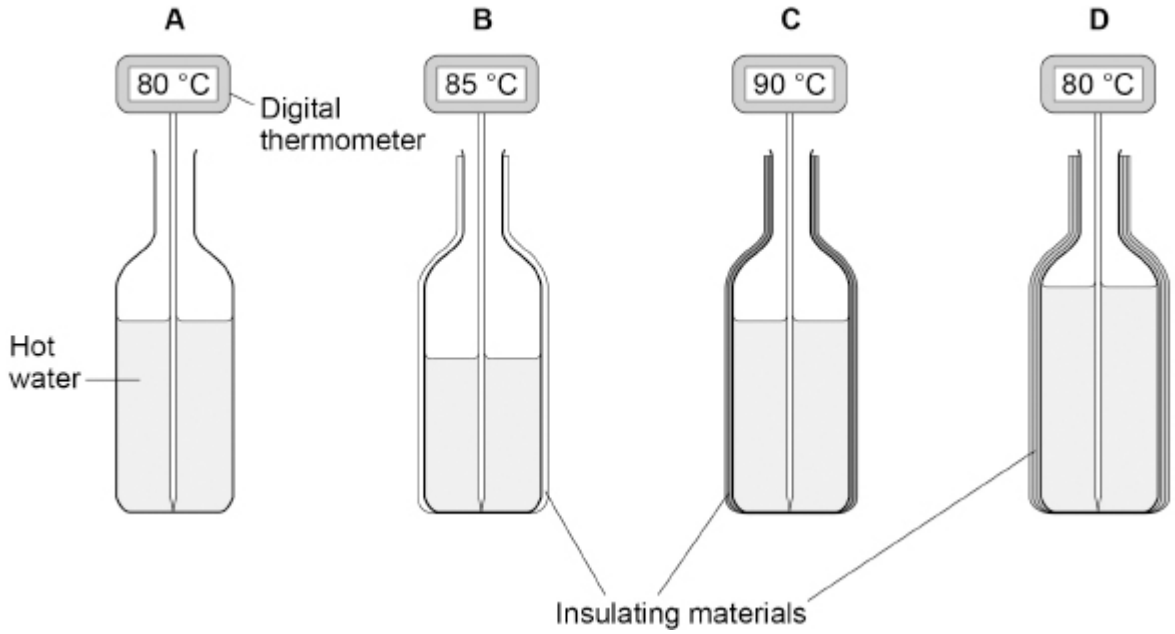
(Total 10 marks)

Q4.

A student investigated how different insulating materials affect the energy transfer from bottles of very hot water.

Figure 1 shows some of the equipment used.

Figure 1



(a) To prevent spillages the student used a funnel to pour very hot water into each bottle.

Why did the student use the funnel?

Tick (✓) **one** box.

Preventing spillages was a control variable.	☐
To make the investigation valid.	☐
Using the funnel was a safety precaution.	☐

(1)

(b) Why did the student **not** use insulation for bottle **A**?

Tick (✓) **one** box.

Bottle **A** was the control. ☐

Bottle **A** was the fair test. ☐

Bottle **A** was the independent variable. ☐

(1)

The student recorded how much the temperature of the water in each bottle changed in five minutes.

(c) What equipment could the student use to measure time?

_____

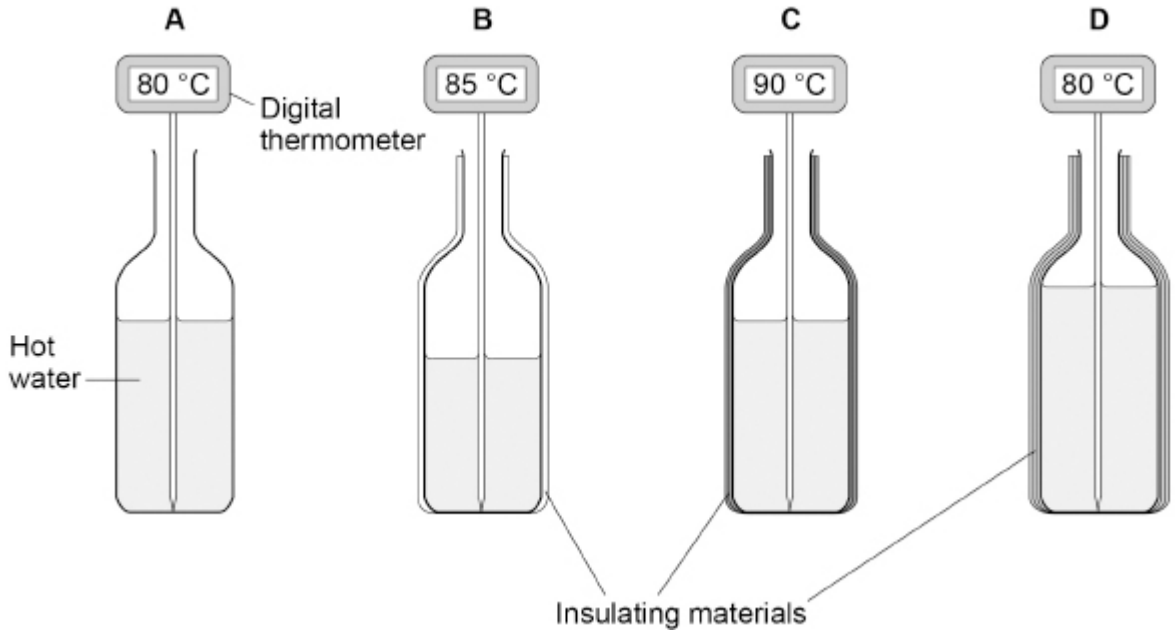
(1)

(d) The table below shows the results.

Bottle	Insulation	Start temperature in °C	Final temperature in °C	Temperature change in °C
A	None	80	60	20
B	1 layer of paper	85	70	15
C	2 layers of card	90	75	15
D	3 layers of bubble wrap	80	70	10

Figure 1 is repeated below.

Figure 1



The student could **not** make a valid conclusion from the results about how different insulating materials affect the energy transfer.

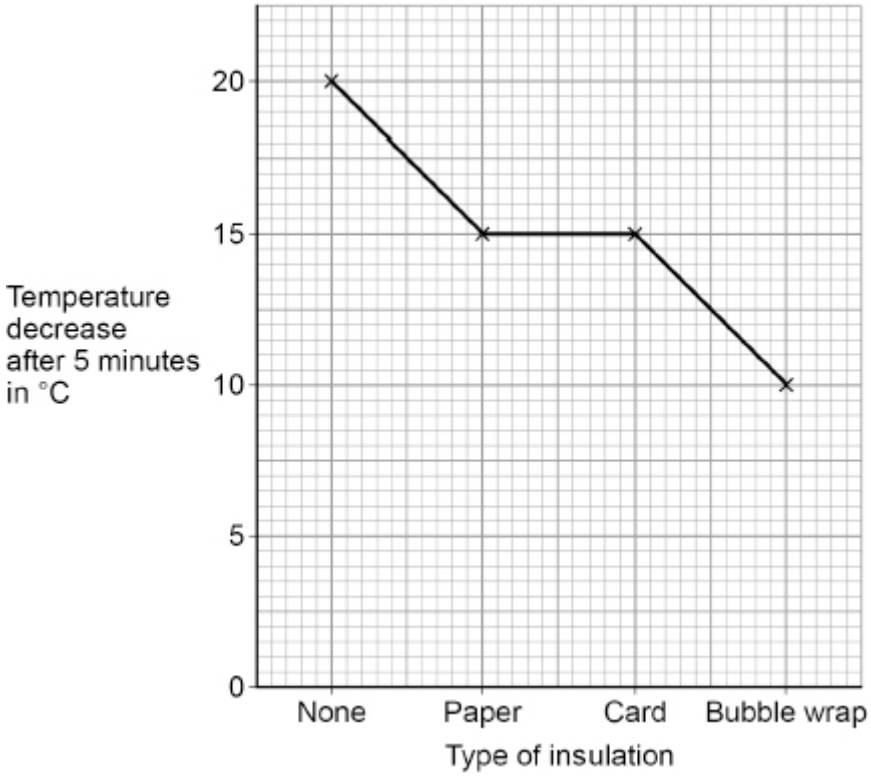
Explain **two** ways that the student could improve the investigation to be able to make a valid conclusion.

Use **Figure 1** and the table above.

(4)

(e) **Figure 2** shows the graph plotted by the student.

Figure 2



The student should **not** have plotted a line graph.

What type of graph should the student have plotted?

Give a reason for your answer.

Type of graph _____

Reason _____

_____

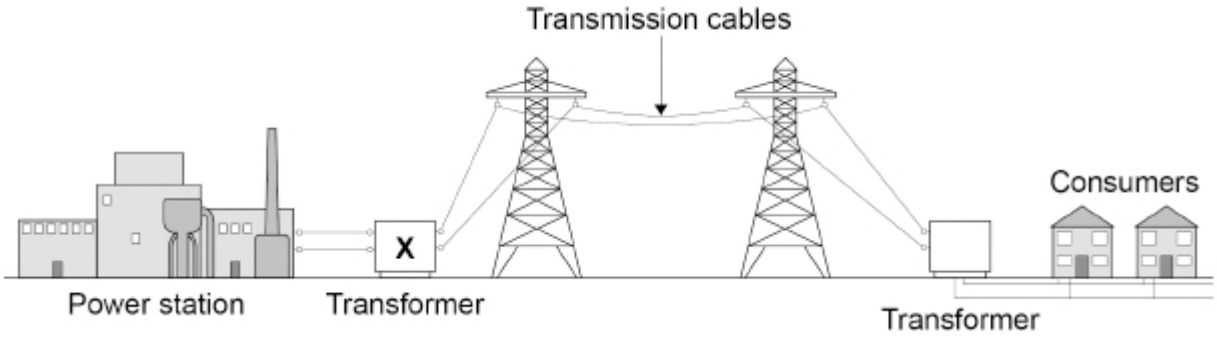
_____

(2)

(Total 9 marks)

Q5.

The figure below shows how the National Grid connects a power station to consumers.



Use the Physics Equations Sheet to answer parts (d) and (e).

(a) Write down the equation which links efficiency, total energy input and useful energy output.

_____

(1)

(b) The total energy input to the National Grid from one power station is 34.2 GJ.

The National Grid has an efficiency of 0.992

Calculate the useful energy output from this power station to consumers in GJ.

_____

_____

_____

_____

_____

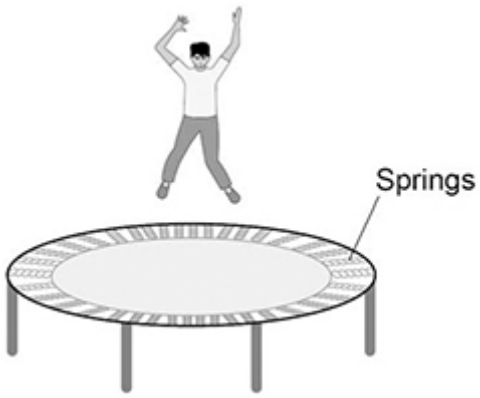
Useful energy output = _____ GJ

(3)

(Total 4 marks)

Q6.

The figure shows a boy bouncing on a trampoline.



(a) Why is the kinetic energy of the boy after he bounces less than his kinetic energy as he lands?

Tick (✓) **one** box.

Energy is not conserved.	☐
Energy is transferred to the surroundings.	☐
The springs transfer energy to the boy.	☐

(1)

(Total 1 marks)

Q7.

The figure below shows a large wind farm off the coast of the UK.

The mean power output of the wind farm is 696 MW, which is enough power for 580 000 homes.

(a) Calculate the mean power needed for 1 home.

Give your answer in watts.

Mean power needed for 1 home = _____W

(2)

(b) Some of the energy from the wind used to rotate a wind turbine is wasted.

An engineer oils the mechanical parts of a wind turbine.

Explain how oiling would affect the efficiency of the wind turbine.

_____

_____

_____

_____

_____

(3)

(c) In most homes in the UK there are many different electrical devices.

Explain why people should be encouraged to use energy efficient electrical devices.

_____

_____

_____

_____

_____

(2)

(Total 7 marks)

Q8.

An engineering company has invented pavement tiles that generate electricity as people walk on them.

The figure below shows someone walking on the pavement tiles.

Use the Physics Equations Sheet to answer parts (a) and (b).

(a) What equation links efficiency, total power input and useful power output?

Tick (✓) **one** box.

$\text{Efficiency} = \dfrac{\text{useful power output}}{\text{total power input}}$ ☐

$\text{Efficiency} = \dfrac{\text{total power input}}{\text{useful power output}}$ ☐

Efficiency = useful power output × total power input ☐

(1)

(b) The tiles are used to power LED lights in the pavement.

An LED light has a total power input of 4.0 W.

The efficiency of the LED light is 0.85

Calculate the useful power output of the LED light.

_____

_____

_____

_____

_____

Useful power output = _____ W

(3)

(Total 4 marks)