AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.1.1.1

Energy stores and systems

Past-paper questions

Tier	**Higher**
Question groups	**19**
Available paper years	**2018–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

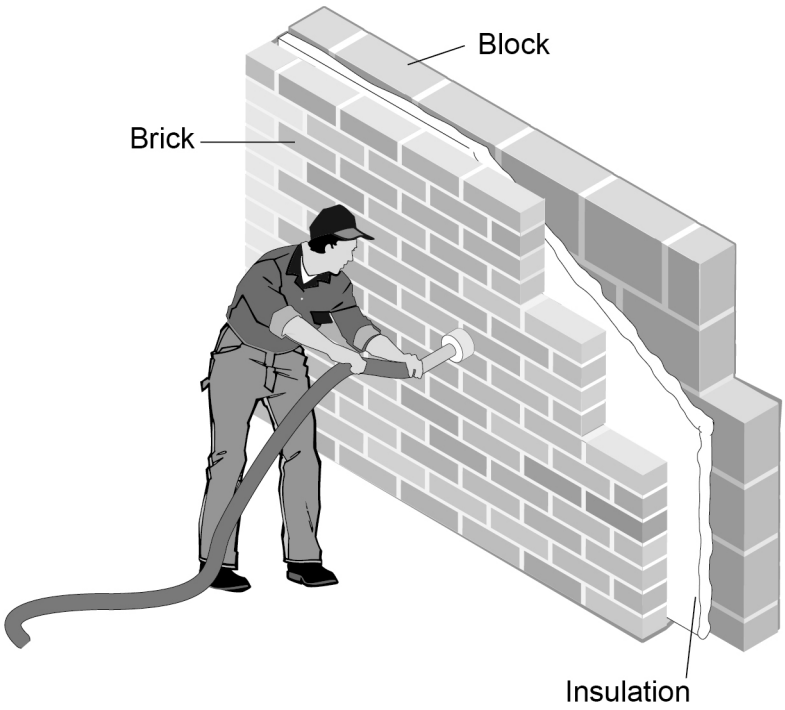
6.1.1.1 Energy stores and systems

Question 01

June 2018 | 8464/P/1H | Original Q5

0 5 **Figure 7** shows cavity wall insulation being installed in the wall of a house.

Figure 7



0 5 . 1 Explain how the wall reduces unwanted energy transfers.

[3 marks]

Question 5 continues on the next page

6.1.1.1 Energy stores and systems

Question 01 · continued

0 5 . 2 The cavity insulation was tested.

- The heating inside the house was switched off.
- The temperature inside the house was measured every 20 minutes for 2 hours.

Table 4 shows the results.

Table 4

Time in minutes	Temperature in °C
0	25.0
20	20.8
40	17.4
60	14.5
80	12.1
100	10.0
120	8.4

Determine the temperature inside the house after 30 minutes.

[2 marks]

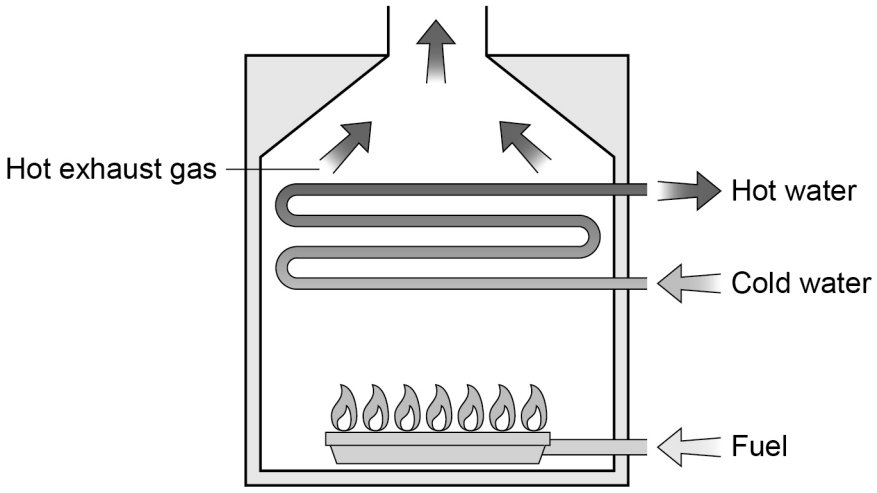
Temperature = _____ °C

6.1.1.1 Energy stores and systems

Question 01 · continued

0 5 . 3 **Figure 8** shows the gas boiler used to heat the house.

Figure 8



Describe how different energy stores are changed by the boiler.

[3 marks]

0 5 . 4 To heat the house, the boiler transfers 15 MJ of energy in 10 minutes.

Calculate the power of the boiler.

Write any equation that you use.

[4 marks]

Power = _____ W

12

6.1.1.1 Energy stores and systems

Question 02

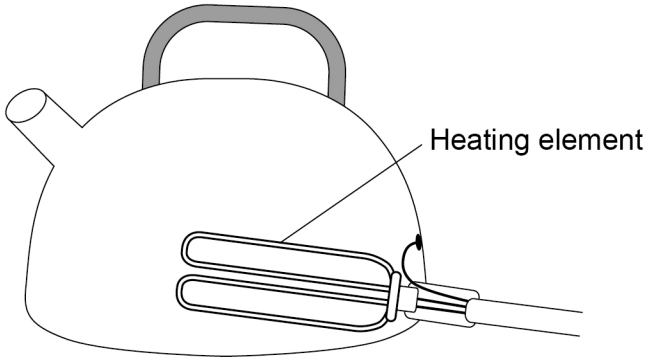
June 2019 | 8464/P/1H | Original Q5

0 5 A student investigated how the mass of water in an electric kettle affected the time taken for the water to reach boiling point.

The kettle switched off when the water reached boiling point.

Figure 4 shows the kettle.

Figure 4



0 5 . 1 The heating element of the kettle was connected to the mains supply.

Explain why the temperature of the heating element increased.

[2 marks]

0 5 . 2 Give **one** variable that the student should have controlled.

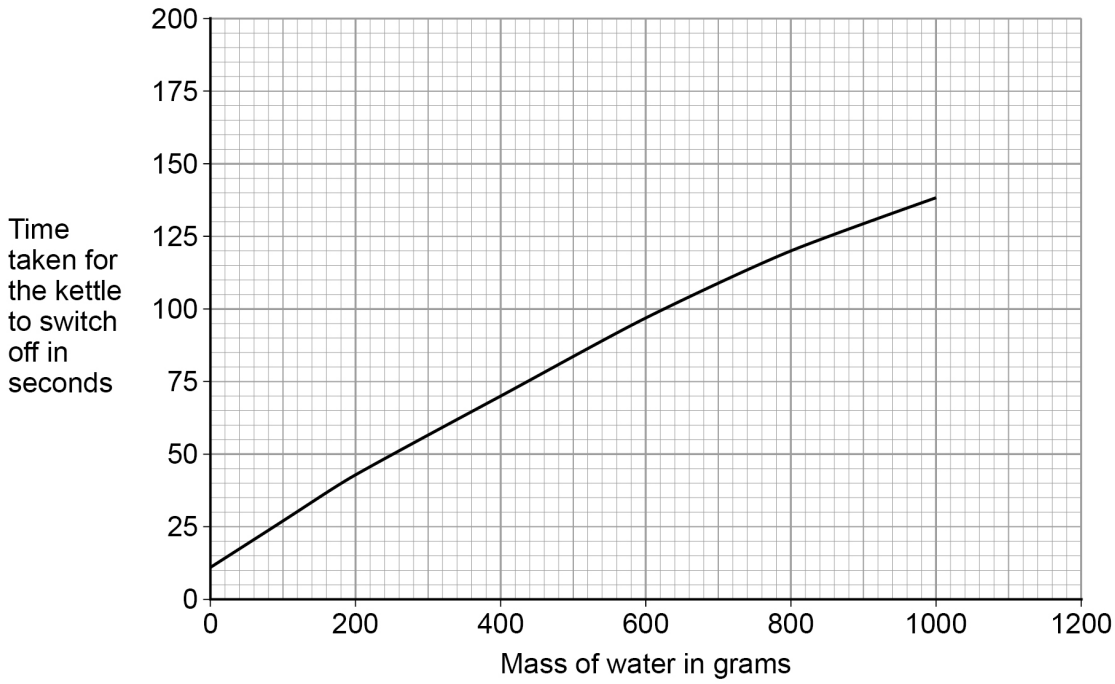
[1 mark]

6.1.1.1 Energy stores and systems

Question 02 · continued

Figure 5 shows how the mass of water in the kettle affected the time taken for the kettle to switch off.

Figure 5



0 5 . 3 Suggest why the line on **Figure 5** does **not** go through the origin.

[1 mark]

0 5 . 4 Suggest why the results give a non-linear pattern.

[1 mark]

Question 5 continues on the next page

6.1.1.1 Energy stores and systems

Question 02 · continued

0 5 . 5 The power of the kettle was 2.6 kW

The kettle took 120 seconds to heat 0.80 kg of water from 18 °C to 100 °C

Calculate the specific heat capacity of water using this information.

Give your answer to 2 significant figures.

[6 marks]

Specific heat capacity = _____ J/kg °C

11

6.1.1.1 Energy stores and systems

Question 03

November 2020 | 8464/P/1H | Original Q7

0 7 Kangaroos are large animals that travel by jumping.

Figure 8 shows a kangaroo.

Figure 8



Each leg of a kangaroo has a tendon connected to a muscle. Each tendon can be modelled as a spring.

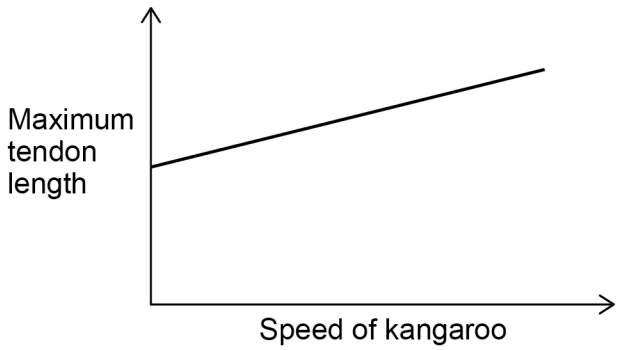
When a jumping kangaroo lands on the ground, the tendons stretch.

6.1.1.1 Energy stores and systems

Question 03 · continued

0 7 . 1 **Figure 9** shows a sketch graph of how the maximum tendon length during a jump changes with the speed of the kangaroo.

Figure 9



Explain why a kangaroo can jump higher as its speed increases.

[3 marks]

Question 7 continues on the next page

6.1.1.1 Energy stores and systems

Question 03 · continued

0 7 . 2 A kangaroo has a maximum gravitational potential energy during one jump of 770 J

When the kangaroo lands on the ground 14% of the maximum gravitational potential energy is transferred to elastic potential energy in one tendon.

The tendon has an unstretched length of 35.0 cm

When the kangaroo lands on the ground the tendon stretches to a length of 42.0 cm

Calculate the spring constant of the tendon.

[5 marks]

Spring constant = _____ N/m

8

6.1.1.1 Energy stores and systems

Question 04

0 1 **Figure 1** shows a mobile phone with its battery removed.

Figure 1



A student measured the potential difference across the battery and then put the battery into the phone.

0 1 . 1 What is the equation linking current (I), potential difference (V) and resistance (R)?

[1 mark]

Tick (✓) **one** box.

$I = V R$ ☐

$R = I V$ ☐

$V = I R$ ☐

$V = I^2 R$ ☐

Question 1 continues on the next page

6.1.1.1 Energy stores and systems

Question 04 · continued

0 1 . 2 The current in the electronic circuit in the mobile phone was 0.12 A.

The potential difference across the battery was 3.9 V.

Calculate the resistance of the electronic circuit in the mobile phone.

[3 marks]

Resistance = _____ Ω

6.1.1.1 Energy stores and systems

Question 04 · continued

0 1 . 3 Write down the equation which links energy (*E*), power (*P*) and time (*t*).

[1 mark]

0 1 . 4 The battery was fully charged when it was put into the mobile phone.

The battery discharged when the mobile phone was switched on.

The average power output of the battery as it discharged was 0.46 watts.

The time taken to fully discharge the battery was 2500 minutes.

Calculate the energy transferred by the battery.

[3 marks]

Energy transferred = _____ J

Question 1 continues on the next page

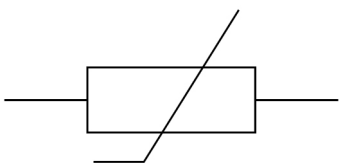
6.1.1.1 Energy stores and systems

Question 04 · continued

The mobile phone includes a sensor to monitor the temperature of the battery.

Figure 2 shows the circuit symbol for a component used in the sensor.

Figure 2



0 1 . 5 What component does the circuit symbol shown in **Figure 2** represent?

[1 mark]

0 1 . 6 The temperature of the component in **Figure 2** increases.

The potential difference across the component remains constant.

Explain what happens to the current in the component.

[2 marks]

11

6.1.1.1 Energy stores and systems

Question 05

November 2021 | 8464/P/1H | Original Q3

0 3 **Figure 4** shows a sailing boat crossing an ocean.

Figure 4



There is a wind turbine on the boat.

0 3 . 1 The wind turbine generates electricity to charge a battery on the boat.

Name one **other** renewable energy resource that could be used on the boat to generate electricity.

[1 mark]

_____

0 3 . 2 The boat also has a generator that burns a fossil fuel.

The battery can be charged by either the wind turbine **or** the generator.

Give **two** reasons why this is useful.

[2 marks]

1 _____

_____

2 _____

_____

6.1.1.1 Energy stores and systems

Question 05 · continued

0 3 . 3 Explain **one** environmental impact of using fossil fuels to generate electricity.

[2 marks]

0 3 . 4 The kinetic energy of the boat is 81 kJ.

mass of boat = 8000 kg

Calculate the speed of the boat.

[4 marks]

Speed = _____ m/s

Question 3 continues on the next page

6.1.1.1 Energy stores and systems

Question 05 · continued

0 3 . 5 As the boat passes over a wave, the gravitational potential energy of the boat increases by 19 600 J.

mass of boat = 8000 kg

gravitational field strength = 9.8 N/kg

Calculate the change in height of the centre of mass of the boat as it passes over the wave.

[3 marks]

Change in height = _____ m

12

6.1.1.1 Energy stores and systems

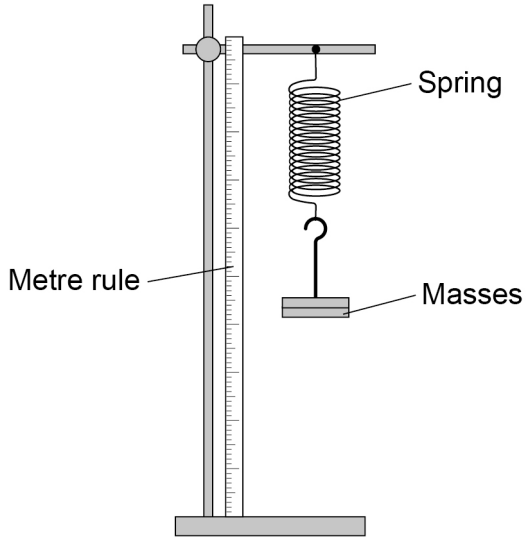
Question 06

November 2021 | 8464/P/2H | Original Q1

0 1 **Figure 1** shows a stretched spring.

The spring is elastically deformed.

Figure 1



0 1 . 1 What is meant by 'elastically deformed'?

[1 mark]

Tick (✓) **one** box.

As the force on the spring increases the length of the spring increases. ☐

Only a very small force is needed to stretch the spring. ☐

The force on the spring causes it to change shape. ☐

The spring will return to its original length when the force is removed. ☐

6.1.1.1 Energy stores and systems

Question 06 · continued

0 1 . 2 Describe a method to determine the extension of the spring.

[2 marks]

0 1 . 3 The extension of the spring is 80 mm.

spring constant = 40 N/m

Calculate the elastic potential energy of the spring.

Use the Physics Equations Sheet.

[3 marks]

Elastic potential energy = _____ J

Question 1 continues on the next page

6.1.1.1 Energy stores and systems

Question 06 · continued

0 1 . 4 Write down the equation which links extension (*e*), force (*F*) and spring constant (*k*).

[1 mark]

0 1 . 5 A force of 300 N acts on a different spring.

The force causes the spring to extend by 0.40 m.

Calculate the spring constant of the spring.

[3 marks]

Spring constant = _____ N/m

10

6.1.1.1 Energy stores and systems

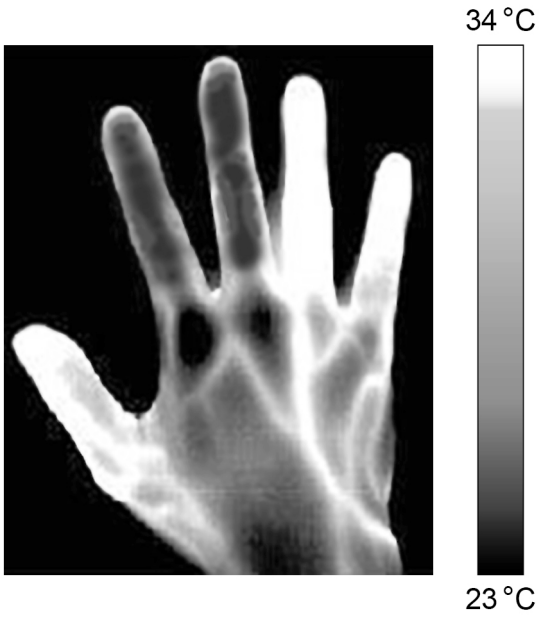
Question 07

November 2021 | 8464/P/2H | Original Q5

0 5 Different parts of the electromagnetic spectrum are used in medical imaging.

Figure 8 shows an image of a person's hand taken with an infrared camera.

Figure 8



0 5 . 1 Explain why the infrared camera is able to show that parts of the hand are at different temperatures.

[2 marks]

Question 5 continues on the next page

6.1.1.1 Energy stores and systems

Question 07 · continued

0 5 . 2 Infrared has a range of wavelengths from 700 nm to 1 mm.

Which part of the electromagnetic spectrum would have waves with a wavelength of 6.5×10^{-7} m?

[1 mark]

Tick (✓) **one** box.

- Infrared ☐
- Microwaves ☐
- Radio waves ☐
- Visible light ☐

6.1.1.1 Energy stores and systems

Question 07 · continued

0 5 . 3 **Figure 9** shows X-rays and gamma rays being used for medical imaging.

Figure 9

X-rays **Gamma rays**



To use X-rays for medical imaging, a machine produces a very brief burst of X-rays.

To use gamma rays for medical imaging, a radioactive isotope is injected into the patient's blood. The isotope is circulated around the body in the blood. The isotope emits gamma rays.

Compare the potential risks to a patient of using X-rays and gamma rays for medical imaging.

[4 marks]

Question 5 continues on the next page

6.1.1.1 Energy stores and systems

Question 07 · continued

X-rays are produced by colliding high-energy electrons into a metal target.

The electrons have high energy because they are accelerated to high speeds.

Only a small proportion of the kinetic energy of an electron is converted into an X-ray when it collides with the metal target.

0 5 . 4 An electron is accelerated through a distance of 15 mm.

The work done on the electron is 1.2×10^{-13} J.

Calculate the force on the electron.

[3 marks]

Force = _____ N

0 5 . 5 The metal target is made from tungsten.

Tungsten has the highest melting point of any metal.

Explain why using tungsten as the metal target enables the X-ray machine to be more powerful.

[3 marks]

13

6.1.1.1 Energy stores and systems

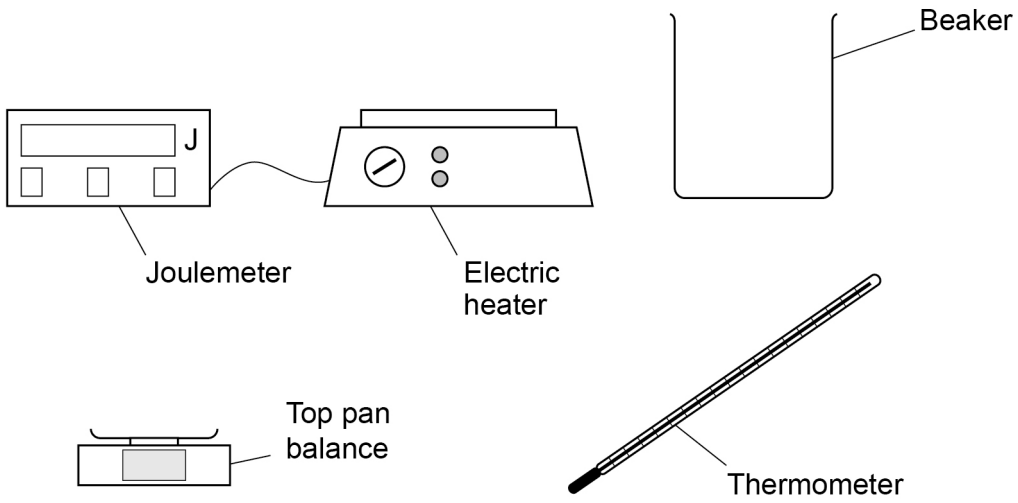
Question 08

June 2022 | 8464/P/1H | Original Q2

0 2 A student made measurements to determine the specific heat capacity of vegetable oil.

Figure 2 shows the equipment used.

Figure 2



0 2 . 1 Describe how the student could use the equipment shown in **Figure 2** to determine the specific heat capacity of vegetable oil.

[6 marks]

6.1.1.1 Energy stores and systems

Question 08 · continued

0 2 . 2 Give **one** risk when using the equipment in **Figure 2**.

[1 mark]

A different student did not have a joulemeter and calculated the energy transferred by the electric heater.

Use the Physics Equations Sheet to answer questions **02.3** and **02.4**.

0 2 . 3 Write down the equation linking energy transferred (*E*), power (*P*) and time (*t*).

[1 mark]

0 2 . 4 The electric heater had a power output of 50 watts.

Calculate the time taken for the electric element to transfer 4750 joules of energy to the vegetable oil.

[3 marks]

Time taken = _____ s

Question 2 continues on the next page

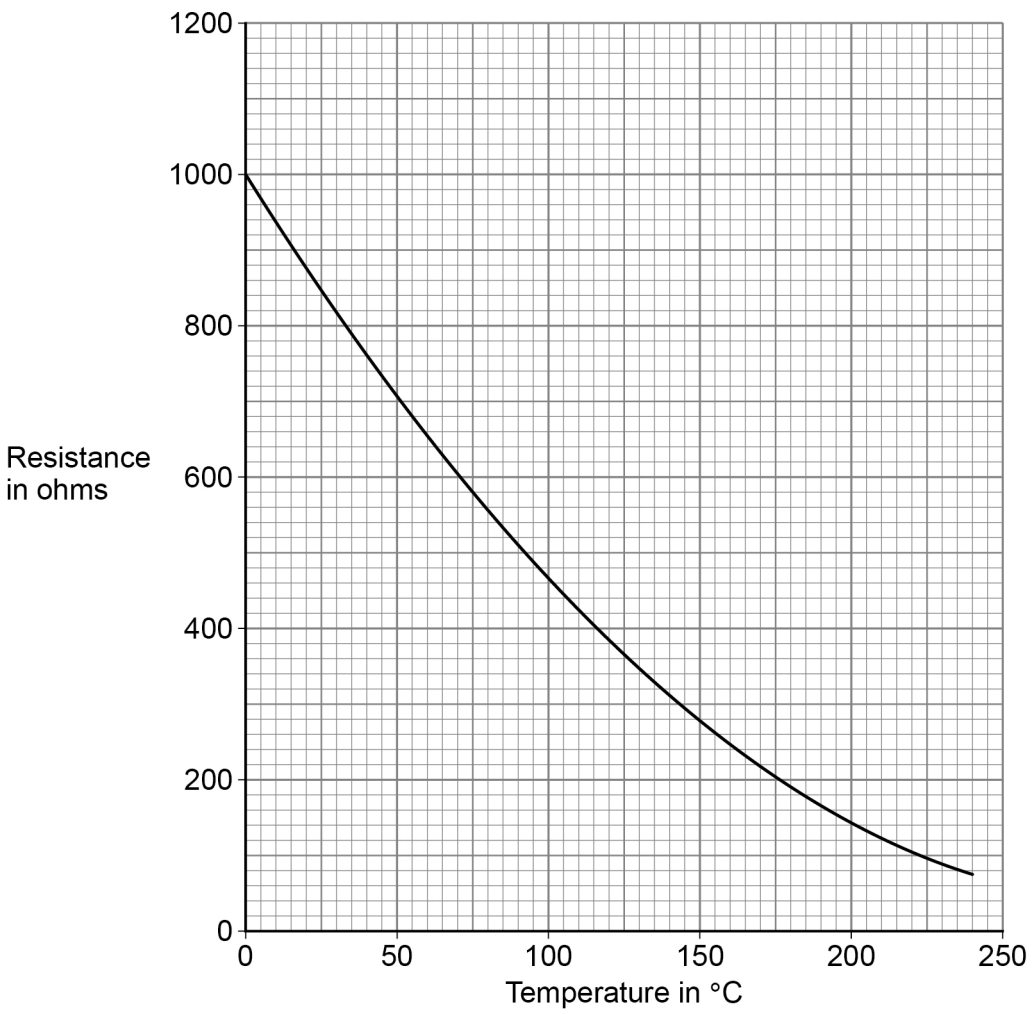
Question 08 · continued

In a deep fryer, vegetable oil is heated by an electric heating element. Food is then cooked in the hot vegetable oil.

The deep fryer contains an electrical component to monitor the temperature of the vegetable oil.

Figure 3 shows how the resistance of this electrical component changes with temperature.

Figure 3



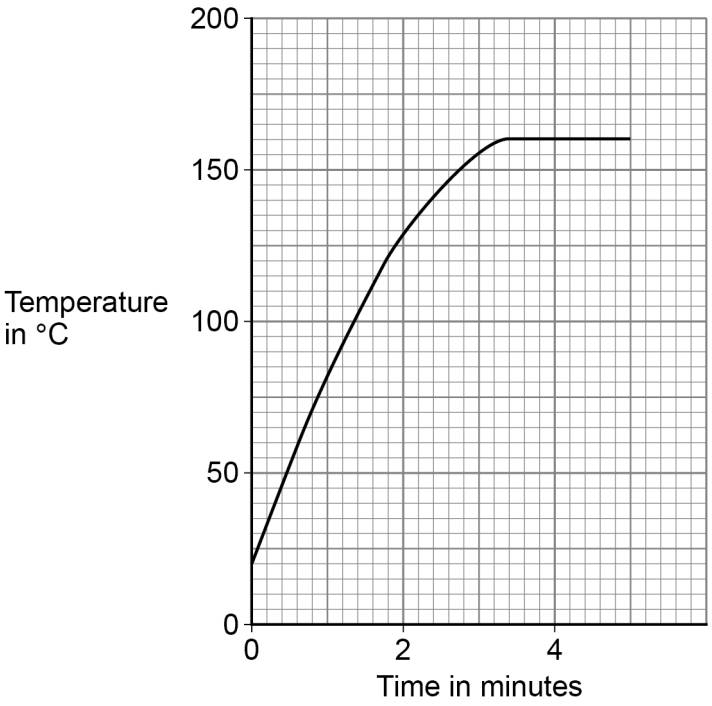
0 2 . 5 What electrical component is used to monitor the temperature of the vegetable oil?

[1 mark]

0 2 . 6 The electric heating element in the deep fryer automatically switches off when the vegetable oil reaches a certain temperature.

Figure 4 shows how the temperature of the vegetable oil changed after the deep fryer was switched on.

Figure 4



Determine the resistance of the electrical component when the electric heating element automatically switched off.

Use **Figure 3** and **Figure 4**.

[2 marks]

Resistance = _____ Ω

Question 2 continues on the next page

6.1.1.1 Energy stores and systems

Question 08 · continued

0 2 . 7 Some chips were put in the deep fryer.

In the deep fryer, water in the chips underwent a physical change and became steam.

Why is this a physical change?

[1 mark]

Tick (✓) **one** box.

All water can change to steam. ☐

No chemicals are involved when water changes to steam. ☐

The change from water to steam can be detected visually. ☐

The water will recover its original properties if the steam is cooled ☐

15

6.1.1.1 Energy stores and systems

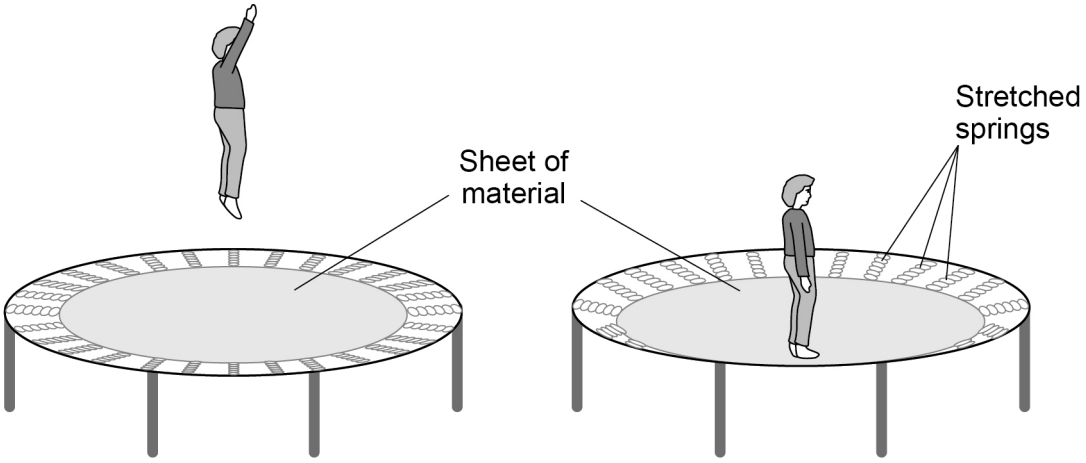
Question 09

June 2022 | 8464/P/1H | Original Q3

0 3 A trampoline is made from a sheet of material held in place by stretched springs.

Figure 5 shows a child on a trampoline.

Figure 5



6.1.1.1 Energy stores and systems

Question 09 · continued

0 3 . 1 Position **A** shows the child's maximum height above the trampoline.

Position **B** shows the lowest position reached by the child when landing on the trampoline.

Describe the changes to the stores of energy of the:

- child
- springs
- surroundings

as the child moves from position **A** to position **B**.

[4 marks]

Child _____

Springs _____

Surroundings _____

Question 3 continues on the next page

6.1.1.1 Energy stores and systems

Question 09 · continued

0 3 . 2 When the child is at position **A**, each trampoline spring is stretched by 0.056 m

The elastic potential energy of each spring is 4.9 J

When the child is at position **B**, the elastic potential energy of each spring increases to 8.1 J

Calculate the extension of each spring when the child is at position **B**.

Use the Physics Equations Sheet.

[5 marks]

Extension = _____ m

0 3 . 3 As the child bounces on the trampoline the child does work.

What is the work done by the child equal to?

[1 mark]

Tick (✓) **one** box.

- The average force applied by the child ☐
- The maximum force applied by the child ☐
- The total energy store of the child ☐
- The total energy transferred by the child ☐

10

6.1.1.1 Energy stores and systems

Question 10

June 2023 | 8464/P/1H | Original Q1

0 1 Wind power and solar power are both renewable energy resources used to generate electricity for the National Grid.

0 1 . 1 Which of the following is also a renewable energy resource?

[1 mark]

Tick (✓) **one** box.

- Geothermal ☐
- Natural gas ☐
- Nuclear fuel ☐

0 1 . 2 The energy transferred by the National Grid in one second was 36 gigajoules (GJ).

Which of the following is the same as 36 gigajoules?

[1 mark]

Tick (✓) **one** box.

- 36×10^3 J ☐
- 36×10^6 J ☐
- 36×10^9 J ☐
- 36×10^{12} J ☐

Question 1 continues on the next page

Question 10 · continued

0 1 . 3 **Figure 1** shows how the mean power output from solar and wind energy resources in the UK varied between 2014 and 2019.

Figure 1

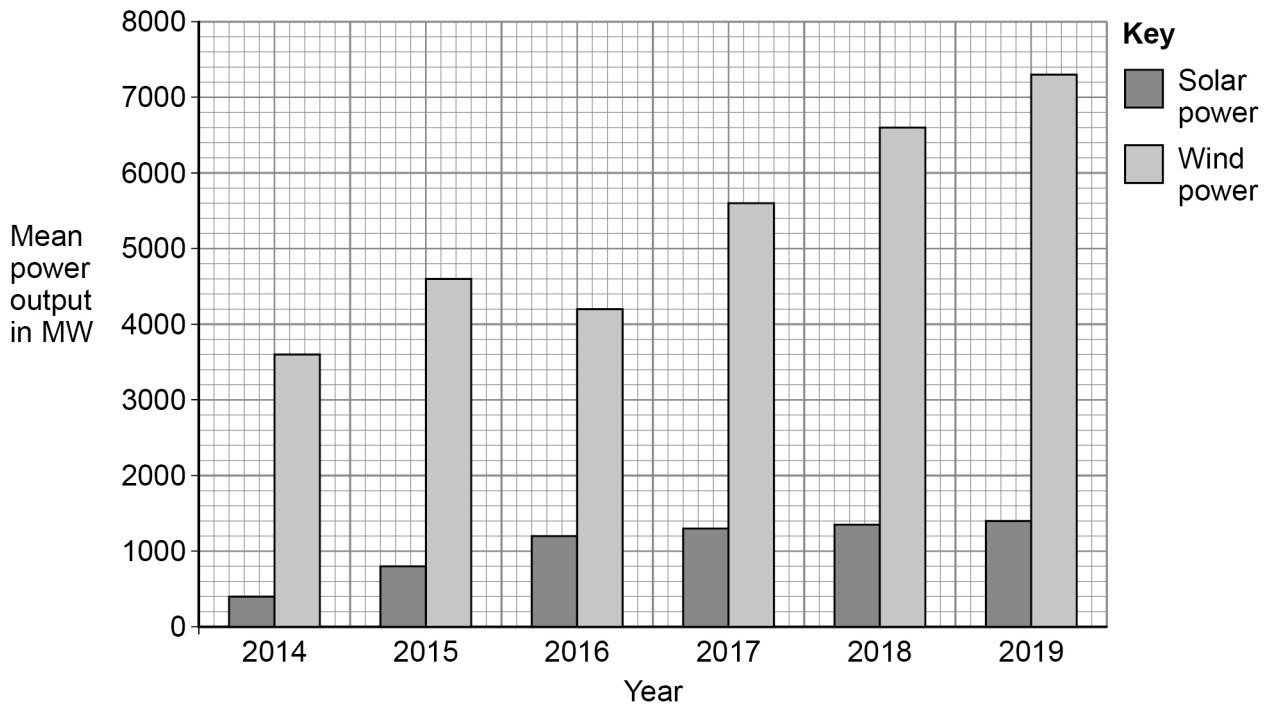
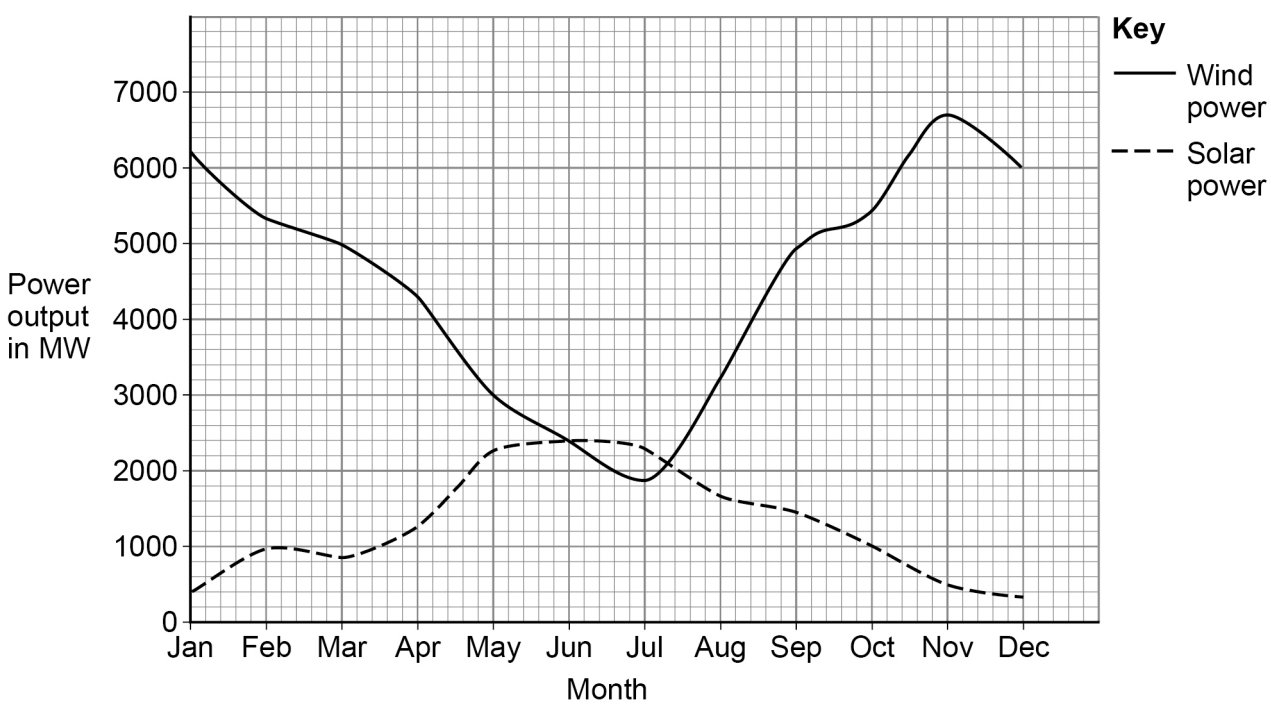


Figure 2 shows how the power output from solar and wind energy resources varies in a typical year.

Figure 2



6.1.1.1 Energy stores and systems

Question 10 · continued

Explain the changes in power output from solar and wind energy resources between 2014 and 2019.

You should include an explanation of the change in power output during a typical year.

[6 marks]

8

6.1.1.1 Energy stores and systems

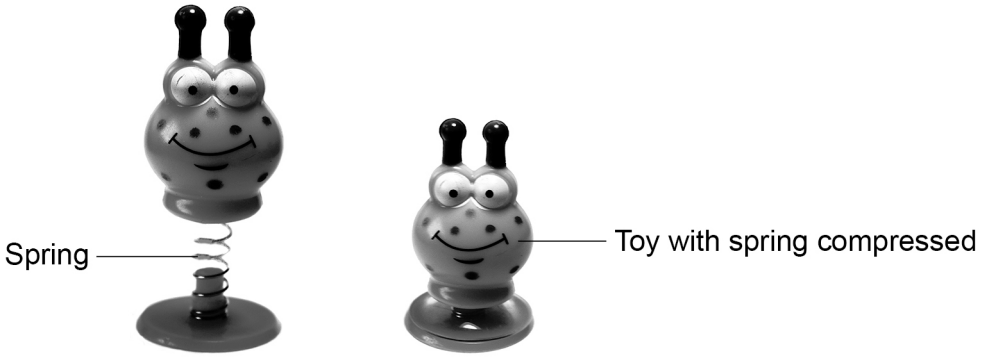
Question 11

June 2023 | 8464/P/1H | Original Q5

0 5 **Figure 10** shows a child's toy.

A child pushes down on the toy to compress the spring. The spring then launches the toy into the air.

Figure 10



Question 11 · continued

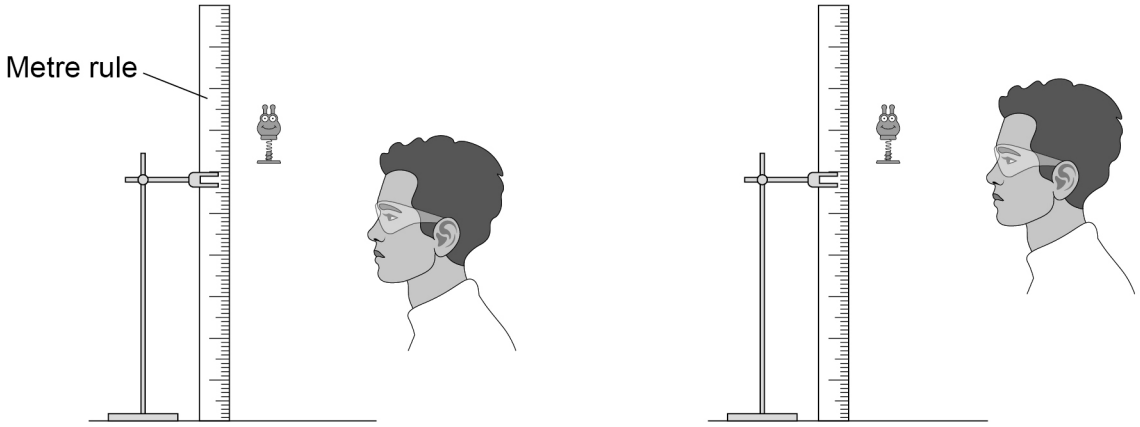
0 5 . 1 A student measured the maximum height reached by the toy.

The student placed a vertical metre rule near the toy, and observed the height reached by the toy.

The student repeated the experiment, observing from a different position.

Figure 11 shows the toy at its maximum height and the two positions of the student.

Figure 11



Observing the toy from **position B** instead of **position A** affected the measurement of the maximum height reached by the toy.

Explain how.

[2 marks]

Question 5 continues on the next page

6.1.1.1 Energy stores and systems

Question 11 · continued

0 5 . 2 The greatest height reached by the toy was 64 cm.

The gravitational potential energy of the toy at this height was 0.049 J.

gravitational field strength = 9.8 N/kg

Calculate the mass of the toy.

Use the Physics Equations Sheet.

Give your answer to 2 significant figures.

[5 marks]

Mass of toy (2 significant figures) = _____ kg

0 5 . 3 When the spring launches the toy into the air, the temperature of the air increases.

Explain why the child's toy on its own is **not** a closed system.

[2 marks]

9

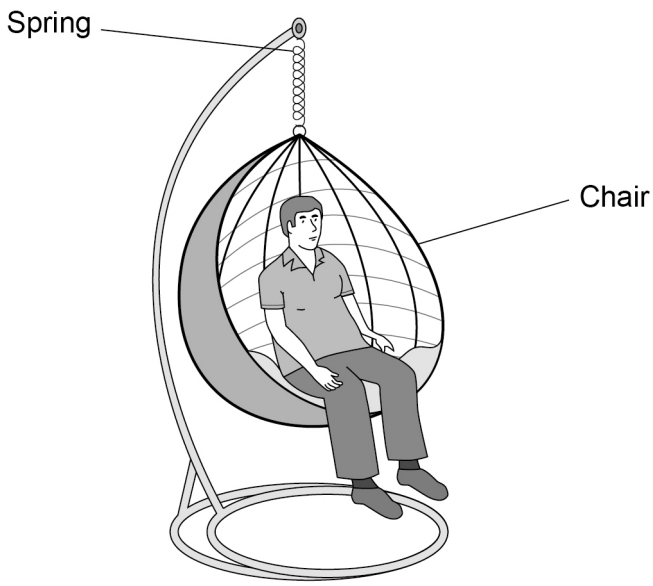
6.1.1.1 Energy stores and systems

Question 12

June 2023 | 8464/P/2H | Original Q5

0 5 **Figure 8** shows a garden chair hanging from a spring.

Figure 8



0 5 . 1 Which of the following describes the relationship between the weight (W) acting on the spring and the extension (e) of the spring?

[1 mark]

Tick (✓) **one** box.

$W = e$ ☐

$W \propto e$ ☐

$W \sim e$ ☐

$W < e$ ☐

6.1.1.1 Energy stores and systems

Question 12 · continued

0 5 . 2 The person in **Figure 8** has a weight of 750 N.

The person's weight causes the spring to extend by 60 mm.

Calculate the spring constant of the spring.

Use the Physics Equations Sheet.

[3 marks]

Spring constant = _____ N/m

Question 5 continues on the next page

6.1.1.1 Energy stores and systems

Question 12 · continued

The manufacturer of the chair tests a new spring to see if it is suitable to hang the chair.

The spring can store a maximum of 1800 J of elastic potential energy before it becomes inelastically deformed.

0 5 . 3 Describe what is meant by 'inelastically deformed'.

[2 marks]

0 5 . 4 Calculate the maximum extension of the spring before the spring becomes inelastically deformed.

spring constant = 225 N/m

Use the Physics Equations Sheet.

[3 marks]

Maximum extension = _____ m

6.1.1.1 Energy stores and systems

Question 12 · continued

0 5 . 5 Evaluate the suitability of the new spring to hang the chair.

maximum elastic potential energy = 1800 J

spring constant = 225 N/m

weight of person = 750 N

distance between the bottom of the chair and the ground = 30 cm

Include a calculation in your answer.

Use the Physics Equations Sheet.

[3 marks]

12

6.1.1.1 Energy stores and systems

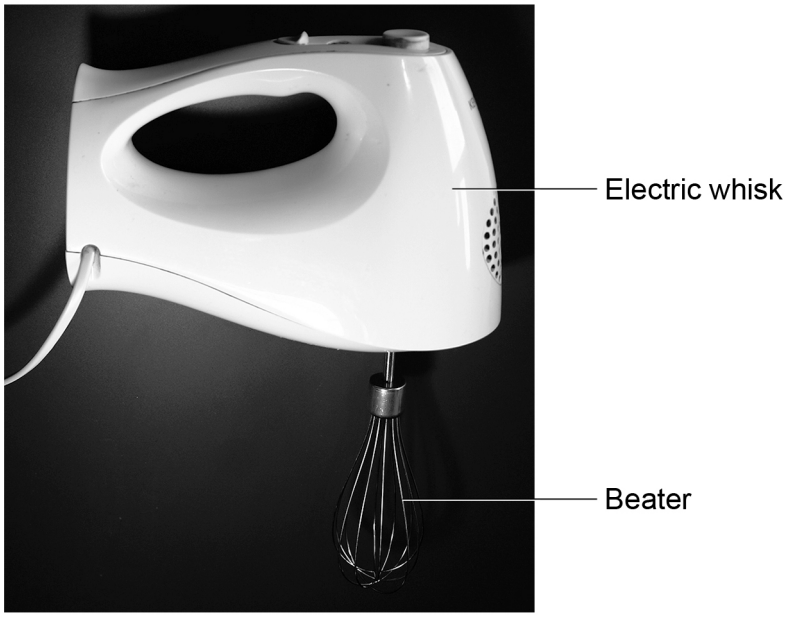
Question 13

June 2024 | 8464/P/1H | Original Q1

0 1 **Figure 1** shows an electric whisk that plugs into the mains electricity supply.

The whisk can mix food by spinning a beater.

Figure 1



0 1 . 1 Give **two** energy stores that increase when the whisk is switched on.

[2 marks]

1 _____

_____

2 _____

_____

6.1.1.1 Energy stores and systems

Question 13 · continued

Use the Physics Equations Sheet to answer questions **01.2** and **01.3**.

0 1 . 2 Work is done by the whisk when it is used to mix food.

Write down the equation that links power (*P*), time (*t*) and work done (*W*).

[1 mark]

0 1 . 3 The power output of the whisk is 92 W.

Calculate the time for the whisk to do 23 000 J of work.

[3 marks]

Time = _____ s

Question 1 continues on the next page

Question 13 · continued

Use the Physics Equations Sheet to answer questions **01.4** and **01.5**.

0 1 . 4 Which equation links current (I), power (P) and resistance (R)?

[1 mark]

Tick (✓) **one** box.

$P = \frac{I}{R^2}$ ☐

$P = I R^2$ ☐

$P = \frac{I^2}{R}$ ☐

$P = I^2 R$ ☐

0 1 . 5 The current in the whisk is 500 mA.

The resistance of the whisk is 640 Ω.

Calculate the power of the whisk.

[3 marks]

Power = _____ W

6.1.1.1 Energy stores and systems

Question 13 · continued

The whisk has several settings that allow the beater to spin at different speeds.

A faster beater speed needs a greater power input from the mains electricity supply.

0 1 . 6 What is the potential difference between the live wire and neutral wire in the mains electricity supply?

[1 mark]

_____ V

0 1 . 7 Changing the beater speed does **not** change the potential difference between the live wire and neutral wire.

The power input to the whisk changes because the current in the whisk changes.

Complete the sentence.

[1 mark]

When the beater speed increases, the current in the whisk increases because the resistance of the whisk _____.

12

6.1.1.1 Energy stores and systems

Question 14

June 2024 | 8464/P/1H | Original Q4

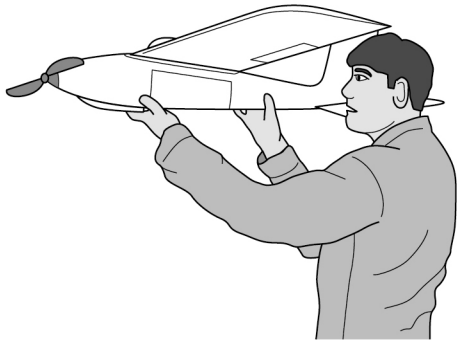
0 4 A drone is a miniature aircraft that has a remote control.

An inventor designed a battery powered drone.

The inventor tested what would happen if the battery runs out of charge during a flight.

Figure 5 shows the inventor about to launch the drone.

Figure 5



0 4 . 1 After the drone was launched, it moved at a constant speed and gained height.

The thermal stores of energy of the drone increased.

Describe **two** other changes to the energy stores of the drone as it moved at a constant speed and gained height.

[2 marks]

1 _____

_____

2 _____

_____

Question 4 continues on the next page

6.1.1.1 Energy stores and systems

Question 14 · continued

When the drone reached a height of 840 m the motor was switched off.

The motor was switched back on after a short time, when the drone had fallen to a lower height above the ground.

The change in gravitational potential energy of the drone during the fall to this lower height was 3920 J.

The mass of the drone is 2.5 kg.

gravitational field strength = 9.8 N/kg

0 4 . 2 Calculate the height above the ground of the drone when the motor was switched back on.

Use the Physics Equations Sheet.

[4 marks]

Height above ground = _____ m

6.1.1.1 Energy stores and systems

Question 14 · continued

0 4 . 3 When the motor was switched off, the kinetic energy of the drone was 150 J.

Calculate the maximum possible speed of the drone when the motor was switched back on.

Use the Physics Equations Sheet.

Give your answer in km/s.

[5 marks]

Maximum possible speed of drone = _____ km/s

11

6.1.1.1 Energy stores and systems

Question 15

June 2024 | 8464/P/1H | Original Q6

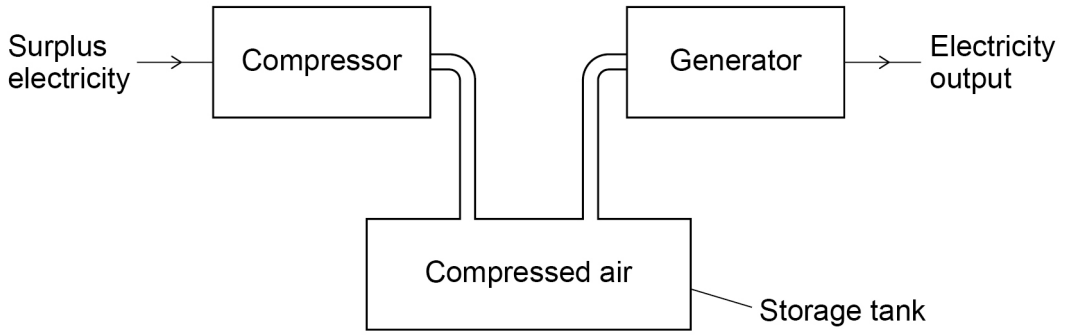
0 6 Energy can be stored using a Compressed Air Energy Storage (CAES) system.

When more electricity is generated than is needed, a CAES system uses the surplus electricity to compress air in a storage tank.

When there is a greater demand for electricity, the CAES system releases the compressed air to generate electricity.

Figure 7 shows a diagram of the CAES system.

Figure 7



0 6 . 1 The CAES system has two processes:

- compressing air to store energy. This process has an efficiency of 0.72
- releasing the air to generate electricity. This process has an efficiency of 0.86

Calculate the efficiency of the CAES system.

Give your answer to 2 significant figures.

[3 marks]

Efficiency of the CAES system (2 significant figures) = _____

6.1.1.1 Energy stores and systems

Question 15 · continued

The generator works when forces from the compressed air cause a turbine to rotate.

When particles of air collide with the turbine they transfer energy to the turbine.

In warm weather the temperature of the compressed air increases, increasing the pressure inside the storage tank.

0 6 . 2 Explain how the motion of the particles in warmer air causes an increase in the power transferred to the turbine.

[4 marks]

Question 6 continues on the next page

6.1.1.1 Energy stores and systems

Question 15 · continued

0 6 . 3 The volume of the storage tank is 5.0×10^5 m^3.

The density of the compressed air is 48 kg/m^3.

specific heat capacity of air = 1100 J/kg °C

The temperature of the compressed air increases from 12 °C to 27 °C.

Calculate the energy transferred to the compressed air in the storage tank.

Use the Physics Equations Sheet.

Give your answer in standard form.

[6 marks]

Energy transferred (in standard form) = _____ J

6.1.1.1 Energy stores and systems

Question 15 · continued

0 6 . 4 The UK government wants the amount of carbon dioxide released into the atmosphere to be reduced.

Explain why efficient energy storage is important in reducing the amount of carbon dioxide released when generating electricity.

[4 marks]

17

6.1.1.1 Energy stores and systems

Question 16

June 2024 | 8464/P/2H | Original Q2

0 2 **Figure 2** shows an Olympic gymnast performing a floor routine.

Figure 2



The floor contains springs.

When the gymnast lands on the floor, a force compresses the springs in the floor.

0 2 . 1 When a spring is compressed, the elastic potential energy of the spring increases.

Explain why compressing the springs in the floor helps the gymnast to jump higher.

Use ideas about energy in your answer.

[2 marks]

Question 2 continues on the next page

6.1.1.1 Energy stores and systems

Question 16 · continued

0 2 . 2 When the gymnast lands on the floor, one of the springs compresses by 1.2 cm.

spring constant = 8500 N/m

Calculate the elastic potential energy stored in the spring.

Use the Physics Equations Sheet.

Give the unit.

[4 marks]

Elastic potential energy = _____ Unit _____

Question 16 · continued

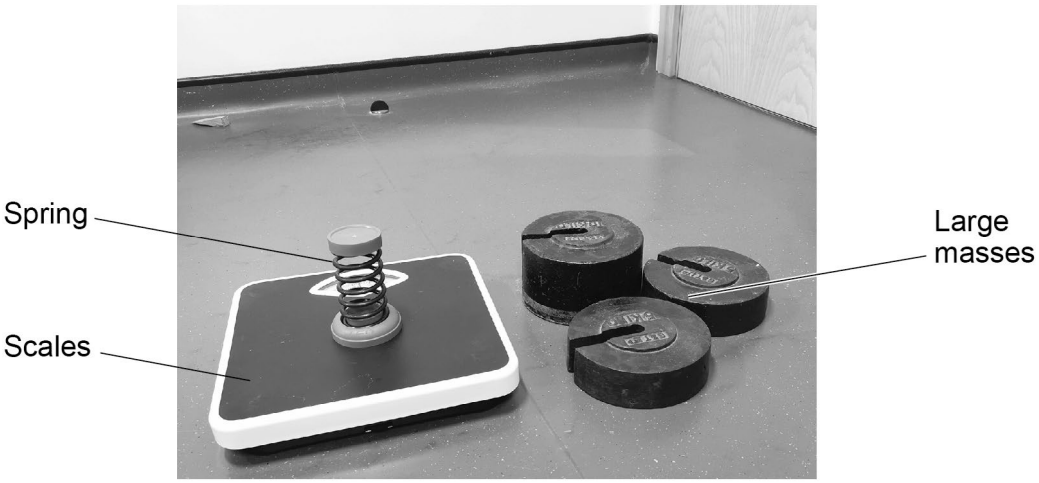
A student investigated a spring with a different spring constant.

When masses are placed on the spring it compresses.

The student measured the compression of the spring for different masses.

Figure 3 shows some of the equipment used.

Figure 3



0 2 . 3 Describe how the compression of the spring could be determined.

[2 marks]

0 2 . 4 Explain why the investigation should be done on the laboratory floor rather than on a table.

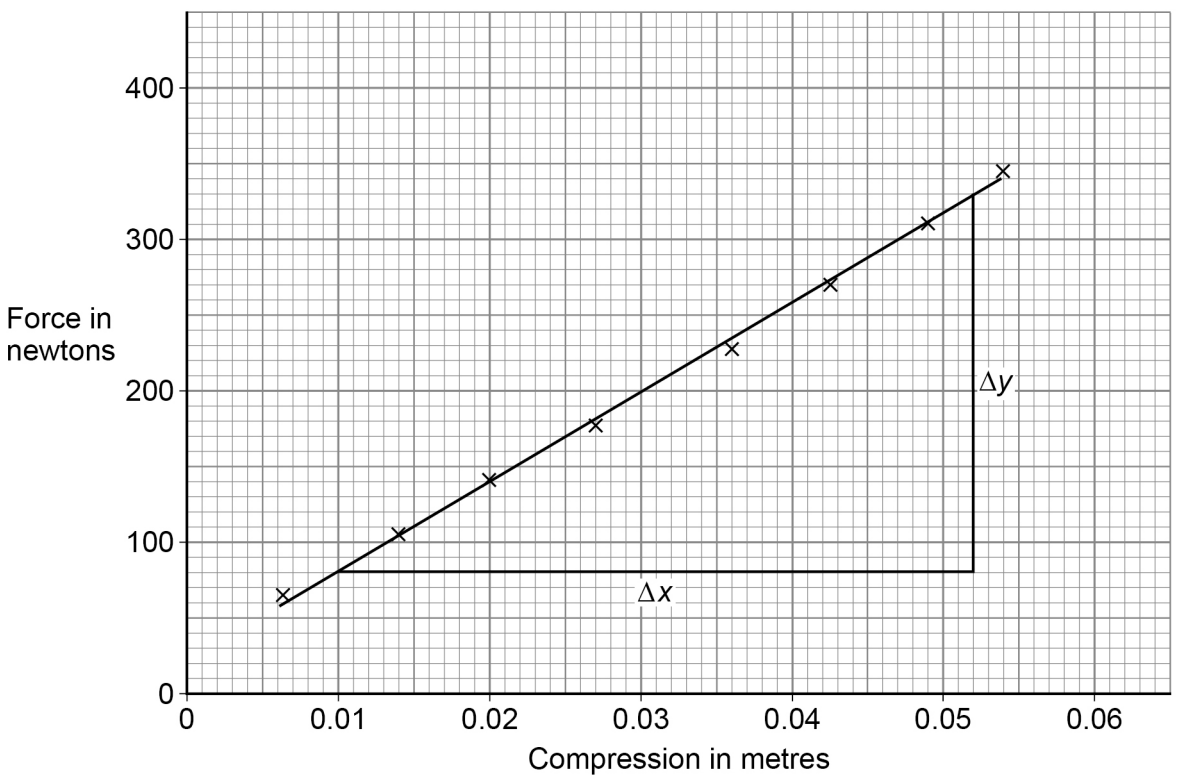
[2 marks]

6.1.1.1 Energy stores and systems

Question 16 · continued

Figure 4 shows the results.

Figure 4



6.1.1.1 Energy stores and systems

Question 16 · continued

The spring constant is the gradient of the line of best fit shown on **Figure 4**.

0 2 . 5 Determine the value Δy on **Figure 4**.

[1 mark]

$\Delta y =$ _____ N

0 2 . 6 Determine the value Δx on **Figure 4**.

[1 mark]

$\Delta x =$ _____ m

0 2 . 7 Determine the spring constant of the spring.

Use your answers to Question **02.5** and Question **02.6**.

Give your answer to 3 significant figures.

[2 marks]

Spring constant (3 significant figures) = _____ N/m

14

6.1.1.1 Energy stores and systems

Question 17

June 2025 | 8464/P/1H | Original Q1

0 1 Fossil fuels are burned in car engines and in power stations.

0 1 . 1 Describe how different energy stores change in a car engine when a fossil fuel is burned.

[2 marks]

0 1 . 2 Some car engines burn a fuel that is produced using plants.

Name a fuel produced using plants.

[1 mark]

0 1 . 3 Some cars do **not** contain an engine that burns a fuel.

Suggest how cars that do **not** burn a fuel are powered.

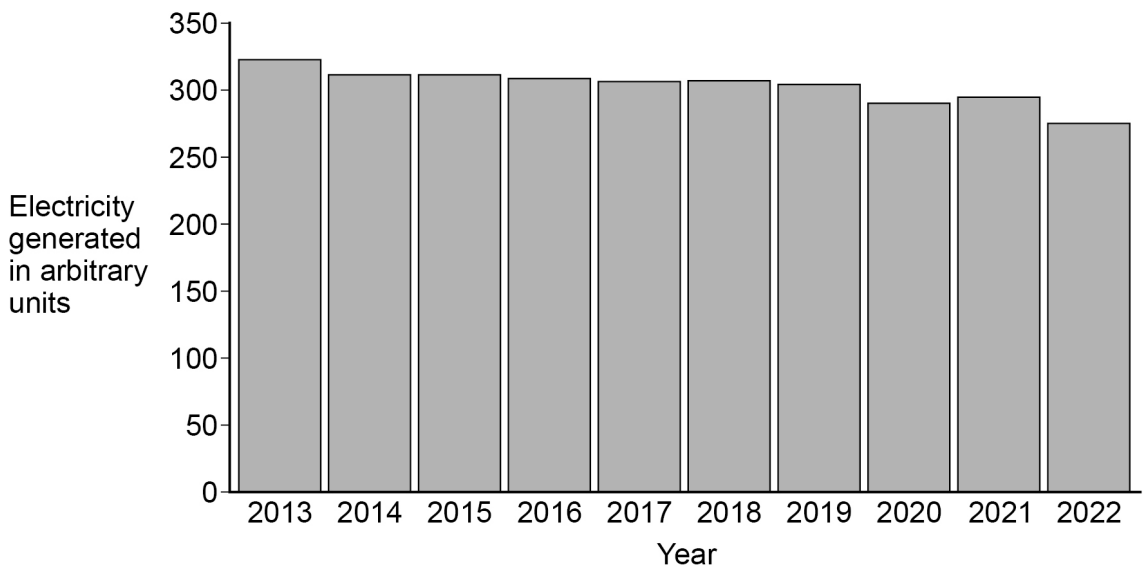
[1 mark]

Question 1 continues on the next page

Question 17 · continued

Figure 1 shows how the total amount of electricity generated in the UK has changed with time.

Figure 1



0 1 . 4 The proportion of electricity that is generated using renewable energy resources has increased since the year 2013.

Which conclusion is correct?

Use **Figure 1**.

[1 mark]

Tick (✓) **one** box.

The amount of fossil fuel that is burned to generate electricity each year has decreased. ☐

The concentration of carbon dioxide in the atmosphere has decreased. ☐

The rate of increase of the mean temperature of the atmosphere has decreased. ☐

6.1.1.1 Energy stores and systems

Question 17 · continued

0 1 . 5 The UK plans to stop burning fossil fuels to generate electricity.

Explain **one** reason why it will take many years before all electricity is generated using renewable resources.

[2 marks]

0 1 . 6 Renewable energy resources can have a negative impact on the environment.

Give **one** negative environmental impact of hydro-electric power and of wind power.

[2 marks]

Hydro-electric power _____

Wind power _____

9

6.1.1.1 Energy stores and systems

Question 18

June 2025 | 8464/P/1H | Original Q2

0 2 A student investigated the specific heat capacity of aluminium.

The student used an electric heater to increase the temperature of an aluminium block.

The student measured the:

- mass of the block
- energy transferred to the block
- temperature change of the block.

Table 1 shows the results.

Table 1

Mass in kilograms	0.75
Energy transferred in joules	13 800
Temperature change in °C	20

0 2 . 1 Calculate the specific heat capacity of aluminium.

Use the Physics Equations Sheet.

[3 marks]

Specific heat capacity = _____ J/kg °C

6.1.1.1 Energy stores and systems

Question 18 · continued

0 2 . 2 Describe a method the student could have used to obtain the results in **Table 1**.

[6 marks]

Extra space

Question 2 continues on the next page

6.1.1.1 Energy stores and systems

Question 18 · continued

0 2 . 3 Wrapping the aluminium block in insulation makes the value for the specific heat capacity of aluminium more accurate.

Which are **two** reasons why?

[2 marks]

Tick (✓) **two** boxes.

- The amount of wasted energy is less. ☐
- The energy transferred to the aluminium block is greater. ☐
- The insulation heats the aluminium block. ☐
- The power of the electric heater increases. ☐
- The temperature increase of the aluminium block is greater. ☐

11

6.1.1.1 Energy stores and systems

Question 19

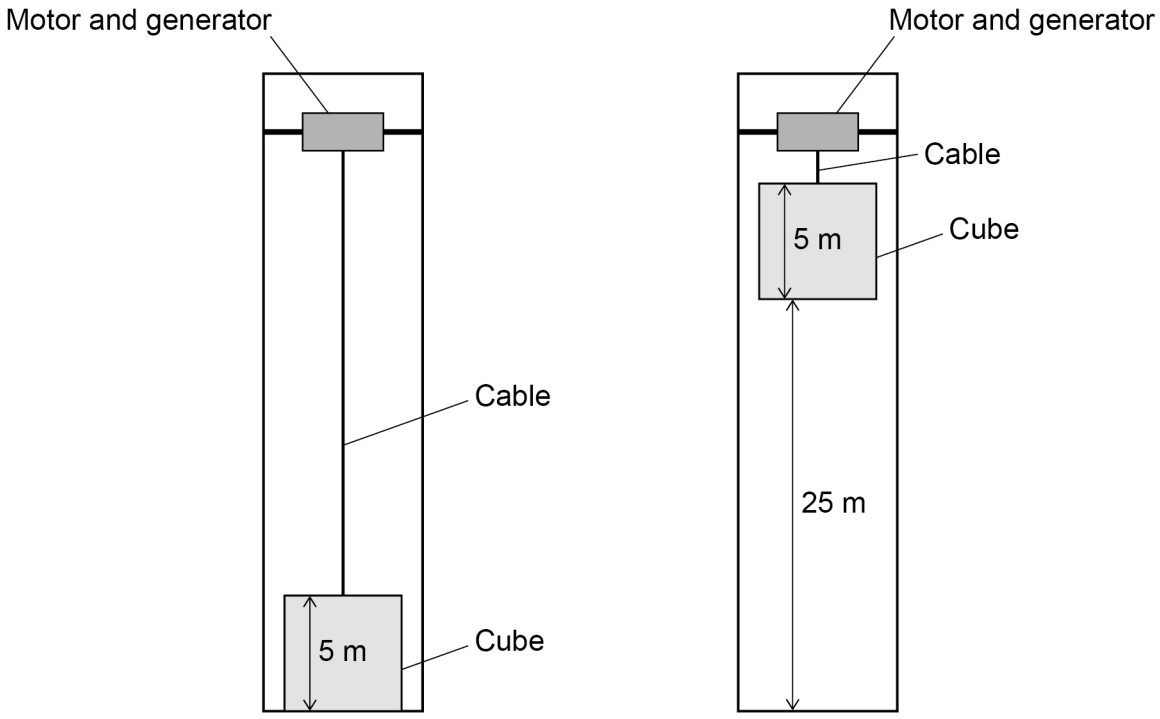
June 2025 | 8464/P/1H | Original Q6

0 6 A system is designed to store excess energy from the National Grid.

- Excess energy from the National Grid powers a motor that lifts a large cube.
- To transfer the energy back to the National Grid, the cube is allowed to fall.
- The falling cube turns a generator which produces electricity.

Figure 6 shows the cube before it is lifted and after it is lifted.

Figure 6



Before cube is lifted **After cube is lifted**

6.1.1.1 Energy stores and systems

Question 19 · continued

0 6 . 1 The cube has a density of 4200 kg/m^3.

Determine the mass of the cube.

Use the Physics Equations Sheet.

[4 marks]

Mass = _____ kg

0 6 . 2 Explain why the cube is made from a material with a high density.

[2 marks]

Question 6 continues on the next page

6.1.1.1 Energy stores and systems

Question 19 · continued

0 6 . 3 The system is designed to store excess energy from the National Grid.

Explain how the efficiency of the system could be determined.

[2 marks]

0 6 . 4 The system in **Figure 6** on page 20 needs to be able to store excess energy as quickly as possible.

Explain **one** change to this system that would allow the same amount of energy to be stored more quickly.

Do **not** refer to efficiency in your answer.

[2 marks]

10