OCR
Oxford Cambridge and RSA

Monday 16 June 2025 – Morning

GCSE (9–1) Combined Science A (Gateway Science)

J250/06 Physics (Foundation Tier)

Time allowed: 1 hour 10 minutes

F

You must have:
- a ruler (cm/mm)
- the Equation Sheet for GCSE (9–1) Combined Science A (Physics) (inside this document)

You can use:
- a scientific or graphical calculator
- an HB pencil

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **24** pages.

ADVICE
- Read each question carefully before you start your answer.

Section A

You should spend a **maximum** of **20 minutes** on this section.

Write your answer to each question in the box provided.

1 Which row identifies features of a **light wave**?

	Transverse	Longitudinal	Travels through space
A	✗	✓	✗
B	✗	✓	✓
C	✓	✗	✓
D	✓	✗	✗

Key

✓ wave has this feature

✗ wave does **not** have this feature

Your answer ☐ **[1]**

2 What is a typical speed for a **strong wind**?

A 2 m/s

B 13 m/s

C 56 m/s

D 330 m/s

Your answer ☐ **[1]**

3 Which electromagnetic wave is used for **cooking**?

A Gamma rays

B Infra-red radiation

C Ultraviolet radiation

D X-rays

Your answer ☐ **[1]**

4 A radio wave has a wavelength of 5.0 m.

A second radio wave has a wavelength which is a thousand times greater.

What is the wavelength of the **second** radio wave?

A 0.005 m

B 5.0 m

C 125 m

D 5000 m

Your answer ☐ **[1]**

5 Which energy source is **non-renewable**?

A Biofuel

B Nuclear fuel

C Solar

D Wind

Your answer ☐ **[1]**

6 Which statement about electrons in atoms is **correct**?

A Electrons gain energy as they absorb electromagnetic waves.

B Electrons have a positive charge.

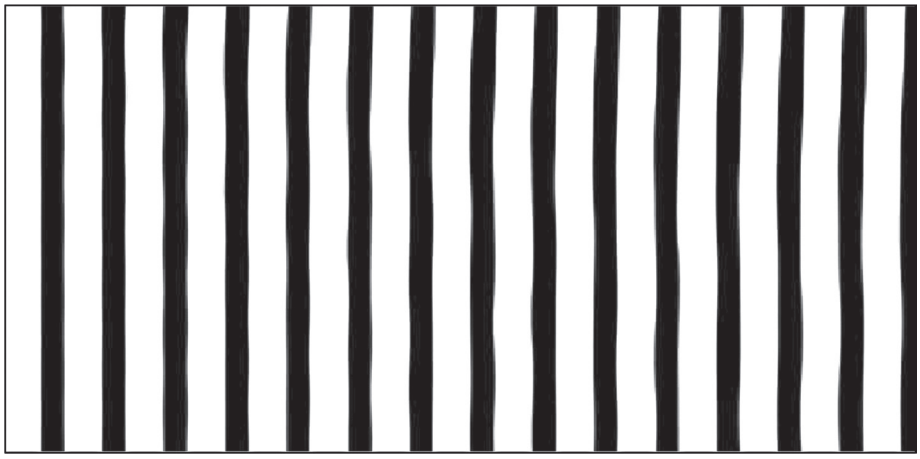
C Electrons lose energy by emitting alpha particles.

D Electrons rise to higher energy levels as they emit electromagnetic waves.

Your answer ☐ **[1]**

7 The diagram shows a photograph of the pattern of water waves, drawn to scale.

A student measures the wavelength of the water waves with a ruler.



Which method will **not** improve the accuracy of the student's measurement?

A Place the ruler at a right angle to the wavefront.

B Measure the length of 5 complete waves and divide this length by 5.

C Place the ruler flat on the photograph and read the scale at right angles from above.

D Use a longer ruler to measure one wavelength.

Your answer ☐ **[1]**

8 A group of scientists discover a new particle.

What must the scientists do so that their discovery is accepted?

A Give the new particle a name.

B Have their work reviewed by other scientists.

C Make a television documentary about the discovery.

D Post the discovery on the internet.

Your answer ☐ **[1]**

9 A student calculates that the energy used to make steel for a car is 1 260 000 000 J.

Which of these is equal to 1 260 000 000 J?

A 1260 GJ

B 1260 kJ

C 1260 MJ

D 1260 nJ

Your answer ☐ **[1]**

10 Object **X** and object **Y** move at the same speed.

Object **X** has 10 J of kinetic energy.
Object **Y** has twice the mass of object **X**.

What is the kinetic energy of object **Y**?

A 5 J

B 10 J

C 20 J

D 100 J

Your answer ☐ **[1]**

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Section B

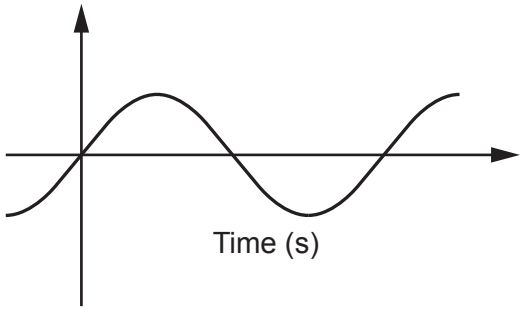
11 A sound engineer records sound waves from loudspeakers in four different locations **A**, **B**, **C** and **D** in a concert hall.

(a) An oscilloscope is used to display the sound waves produced at each location. The settings on the oscilloscope remain the same for each location.

At which location does the sound wave have the **greatest amplitude**?

Tick (✓) **one** box.

Location A



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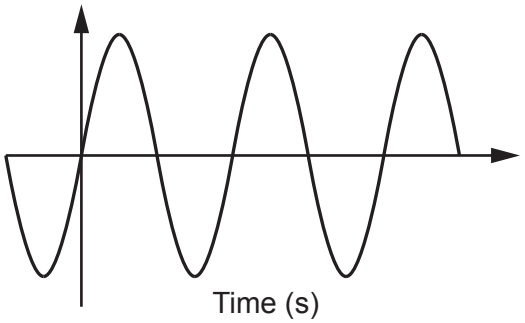
Location B



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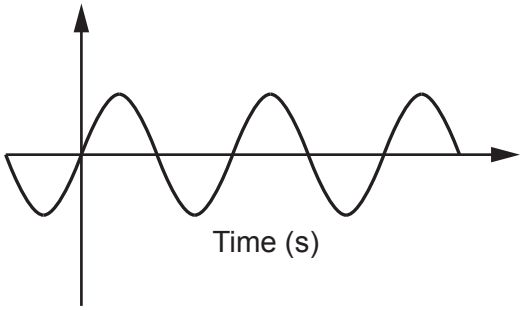
Location C



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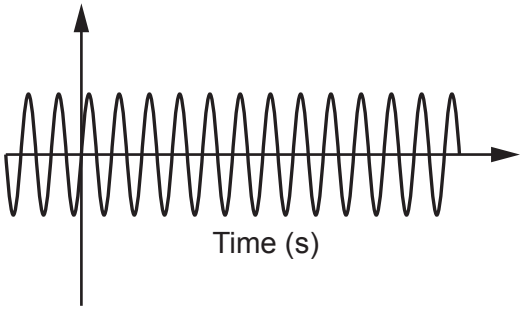
Location D



☐

[1]

(b) One of the sound waves recorded has a frequency of 250 Hz.

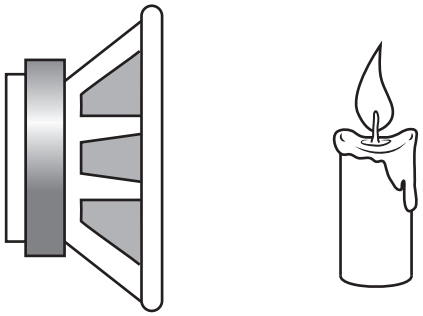
The speed of sound in the concert hall is 340 m / s.

Calculate the wavelength of this sound.

Use the equation: wave speed = frequency × wavelength

Wavelength = ... m **[3]**

(c) The engineer places a candle in front of a loudspeaker.



The loudspeaker produces a low frequency sound.

Complete the sentences to explain why the candle flame vibrates from side to side but does **not** blow out.

Use words from the list.

electromagnetic	**longitudinal**	**particles**	**transverse**	**waves**

The flame vibrates from side to side because sound waves are ..... waves.

Air ..... vibrate but do **not** travel through the flame.

[2]

12

(a) All objects emit electromagnetic waves.

Thermal imaging cameras detect some electromagnetic waves.
The photograph is a thermal image of an animal taken using a thermal imaging camera at night.

(i) Which type of electromagnetic wave is the animal emitting?

Tick (✓) **one** box.

Infra-red radiation ☐

Visible light ☐

X-rays ☐

[1]

(ii) Why is a human **not** able to see the animal at night?

.....

..... **[1]**

(b)

(i) State **one** reason why ultraviolet, X-ray and gamma radiation can be harmful to living things.

.....

..... **[1]**

(ii) Ultraviolet, X-ray and gamma radiation are also useful.

Draw **one** line from each type of **electromagnetic wave** to a **typical use**.

Electromagnetic wave	Typical use
ultraviolet	sterilising surgical equipment
X-ray	detecting fake bank notes
gamma ray	making images of bones

[2]

13 There are different isotopes of the element carbon.

(a) The isotope carbon-12 has the symbol $^{12}_{6}C$.

What is the relative charge on a carbon-12 nucleus?

Tick (✓) **one** box.

–6 ☐

+6 ☐

+12 ☐

[1]

(b) Another isotope of carbon is carbon-14. Carbon-14 has the symbol $^{14}_{6}C$

Complete the sentences to compare a nucleus of carbon-12 and a nucleus of carbon-14.

Put a (ring) around the correct statement in each box.

A nucleus of carbon-12 has | **fewer neutrons than** / **the same number of neutrons as** / **more neutrons than** | a nucleus of carbon-14.

A nucleus of carbon-12 has | **fewer protons than** / **the same number of protons as** / **more protons than** | a nucleus of carbon-14.

[2]

(c) When carbon-14 decays into nitrogen-14, it emits beta radiation.

Complete the equation for the decay of carbon-14.

$$^{14}_{6}C \rightarrow ^{14}_{.....}N + ^{.....}_{-1}\beta$$

[2]

(d) Carbon-14 has a half-life of 5700 years.

Explain what half-life means.

.....

..... **[1]**

(e) Alpha particles, beta particles, and gamma rays can penetrate different types and thicknesses of material.

Draw **one** line from each **type of radiation** to the **type and maximum thickness of material** the radiation is able to penetrate.

Type of radiation	Type and maximum thickness of material
alpha	a few sheets of paper
beta	a few centimetres of lead
gamma	a few millimetres of aluminium

[2]

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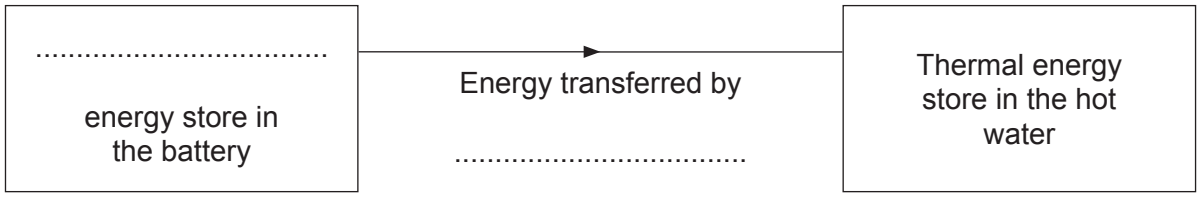
14

(a) Some types of kettle are battery powered.

(i) Complete the diagram to show how energy is transferred when a battery powered kettle heats water.

Use words from the list.

chemical	**electrical currents**	**electrostatic**
forces	**nuclear**	



[2]

(ii) The kettle contains 0.50 kg of water at 20 °C.

Calculate the minimum change in thermal energy needed to raise the temperature of the water to 100 °C.

The specific heat capacity of water is 4200 J / kg °C.

Use the equation:

change in thermal energy = mass × specific heat capacity × change in temperature

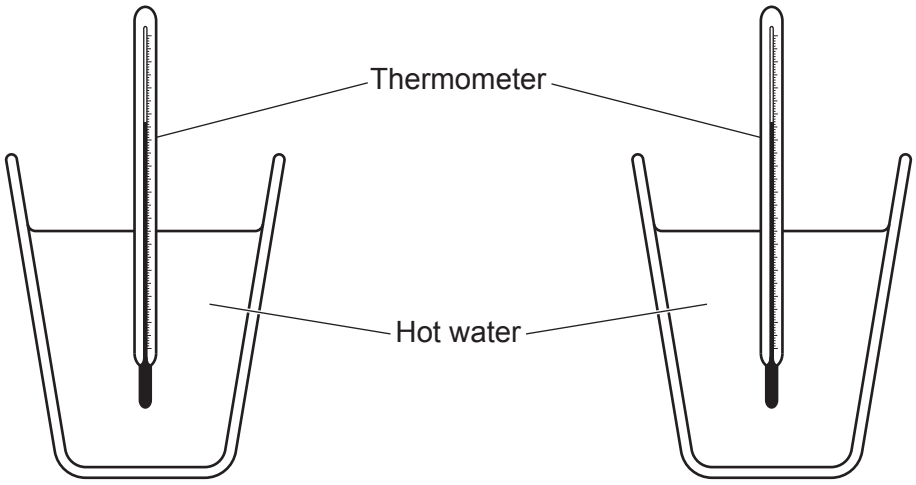
Change in thermal energy = ... J **[3]**

(iii) Explain why the **actual** amount of thermal energy needed to raise the temperature of the water would be greater than the calculated value in **(a)(ii)**.

.....

..... **[1]**

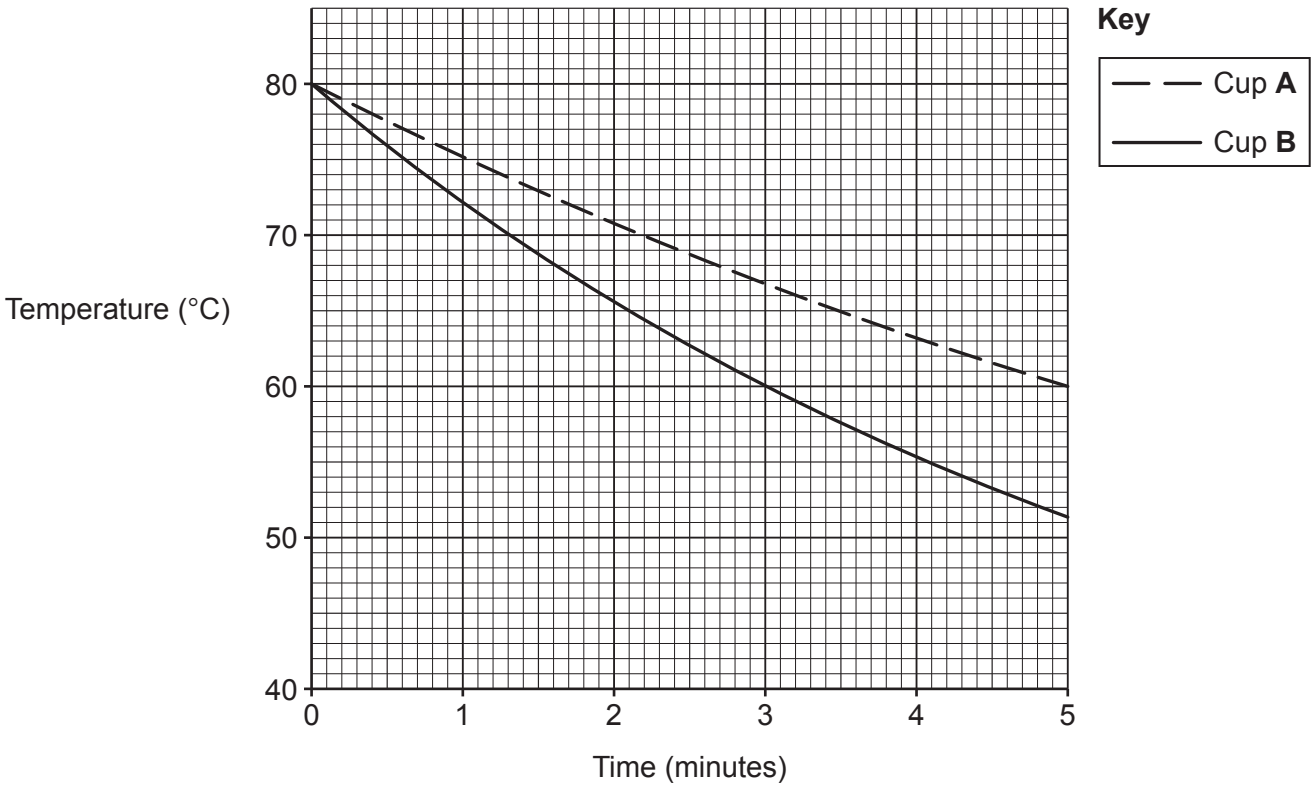
(b) A group of students compare the cooling of hot water in two different cups **A** and **B**, shown in the diagram.



The students:

- fill each cup with hot water,
- measure the temperature of the water for 5 minutes.

The graph shows the results for cup **A** and cup **B**.



(i) What is the time taken for the temperature of the water in cup **B** to decrease from 80 °C to 60 °C?

Time taken = ... minutes **[1]**

(ii) One cup is made of metal and the other cup is made of plastic.

The metal cup is a better conductor than the plastic cup.

Which cup, **A** or **B**, is made of metal?

Give a reason for your answer using information from the graph.

Cup .....

Reason .....

.....

[2]

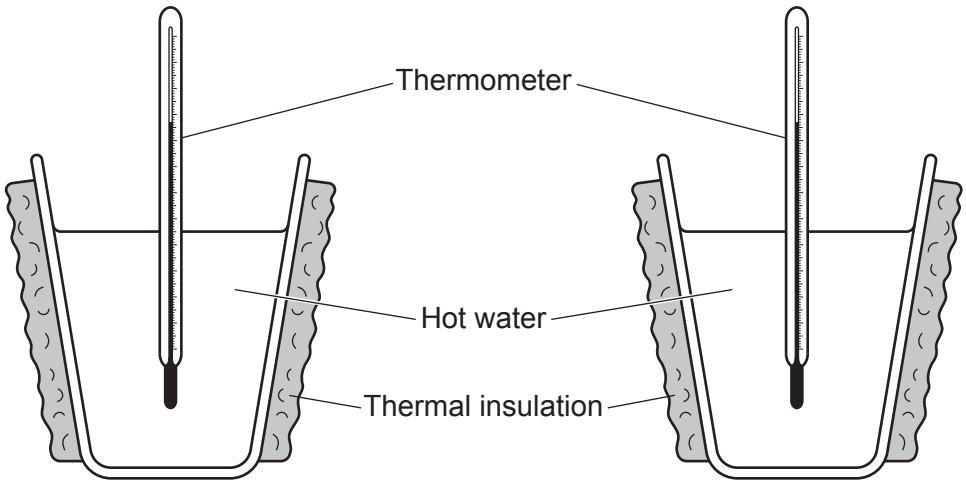
(iii) Suggest **two** variables the students should control in their experiment.

1 .....

2 .....

[2]

(iv) The students wrap the cups in thermal insulation and repeat the same experiment, as shown in the diagram.



Predict how these **new** temperature readings after 5 minutes compare to the original results on the graph.

Give a reason for your answer.

Prediction .....

.....

Reason .....

.....

[2]

15* A person is driving a car on a motorway. It starts to rain and the driver is feeling tired.

The driver decides to leave more space between their car and the car in front of them in case they need to stop suddenly.

Why is it a good idea for the driver to leave more space?

In your answer:

- Describe other factors that affect the thinking distance and factors that affect the braking distance of the car.
- Explain how the stopping distance of the car is affected when it is raining and the driver is tired.

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..... **[6]**

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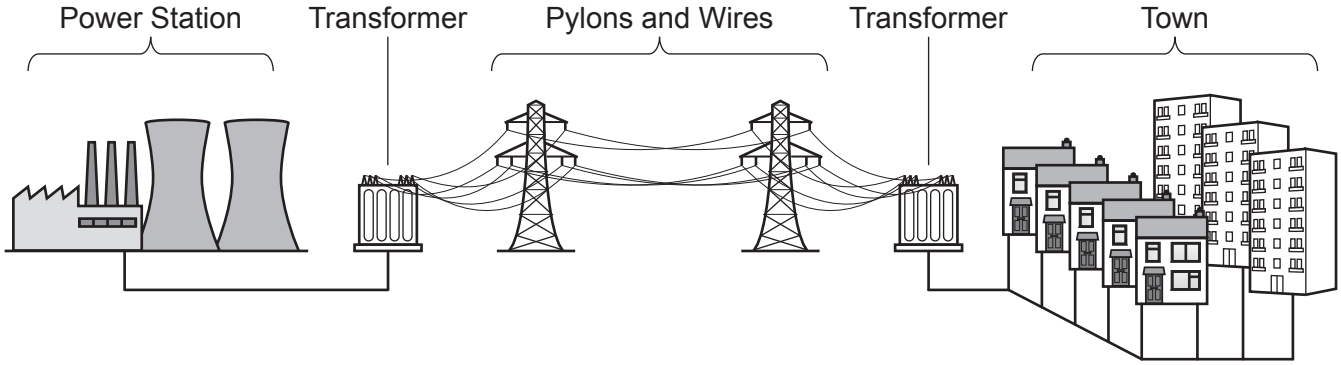
16 The diagram shows a power station connected to a town by the national grid.



(a) The national grid uses alternating voltage.

A simple circuit powered by a battery uses direct voltage.

Explain the difference between alternating voltage and direct voltage.

.....

..... **[1]**

(b) The table shows the current in one of the wires in the national grid at two different voltages.

Voltage across wire (V)	**Current in wire (A)**
11 000	730
400 000	20

(i) The wire has a resistance of 2.0 Ω.

Calculate how much power is dissipated from the wire at 11 000 V.

Use the equation: power = current^2 × resistance

Give your answer to **2** significant figures and in **MW**.

Power dissipated = ... MW **[4]**

(ii) The national grid transfers 8 000 kJ of energy from the power station every second.

When the voltage across the wires is 400 000 V, the transformers and wires dissipate 160 kJ of this energy every second.

Calculate the efficiency of the energy transfer at 400 000 V.

Use the equation: efficiency = $\frac{\text{useful output energy transfer}}{\text{total energy input transfer}}$

efficiency = ... **[3]**

(iii) Explain how step-up transformers allow the national grid to transfer energy more efficiently.

.....

.....

.....

..... **[3]**

(c) A UK mains plug has 3 wires: live, neutral and earth.

Describe the function of the **neutral** wire.

.....

..... **[1]**

END OF QUESTION PAPER

EXTRA ANSWER SPACE

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.