OCR
Oxford Cambridge and RSA

Accredited

GCSE (9–1) in Combined Science B (Twenty First Century Science)

H

J260/07 Physics (Higher Tier)

Sample Question Paper

Date – Morning/Afternoon

Time allowed: 1 hour 45 minutes

You must have:
- a ruler (cm/mm)
- the Data Sheet

You may use:
- a scientific or graphical calculator

First name	
Last name	
Centre number	
Candidate number	

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION
- The total mark for this paper is **95**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in the question marked with an asterisk (*).
- This document consists of **20** pages.

Answer **all** the questions.

1* An island is struggling with the energy demand of its inhabitants and will need to produce more electricity in the future.

Information about the islands electricity production is given below.

Predicted electricity consumption	18,880,000 kWh
Current electricity production	16,000,000 kWh
Produced by burning oil and peat	100%
Produced by hydroelectricity	0%
Produced by nuclear	0%
Produced by wind	0%
Produced by waves/tides	0%
Oil imported	248.9 barrels/day
Peat used for fuel	13,000 ton/year

The island is keen not to import any more oil.

What might the environmental minster advise as a plan for the island's future production of electricity?

Use the data in the table in your answer.

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

2 Here is a picture of a mountain bike. The rider makes the pedal turn in a circle, which results in the bike moving.

(a) **On the diagram** draw labelled arrows to show:

1 The force that does work to make the bike move.

2 The friction force that moves the bike forwards.

[2]

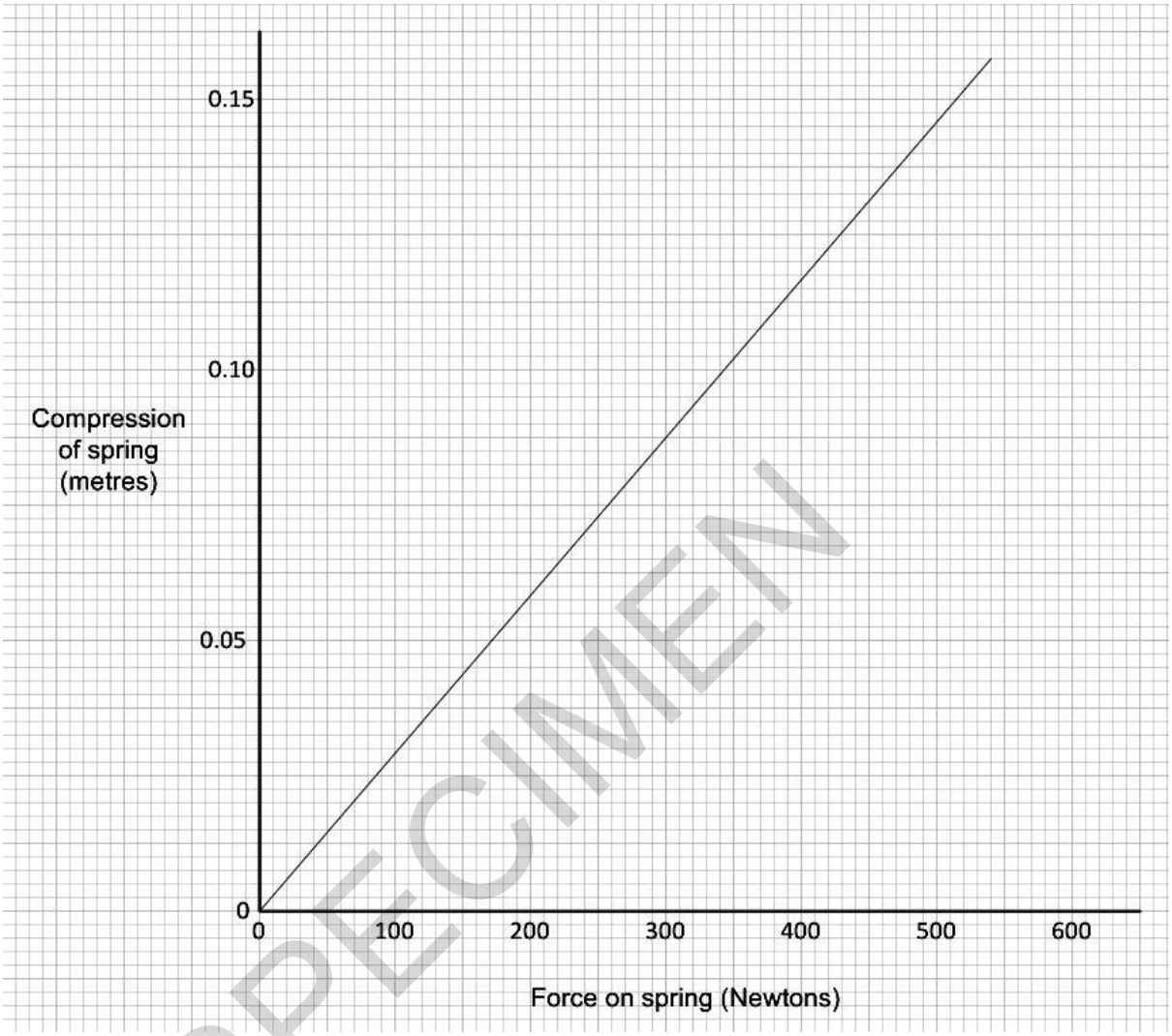
(b) There is a spring in the front wheel suspension fork. Each time the rider pushes down on the pedal, the spring is compressed.

When the bike hits a tree stump, a force of 510 N compresses the spring by 15 cm.

Calculate the spring constant of the spring.

…….. N/m **[4]**

(c) The graph shows the force and compression for the spring.



(i) Use the graph to find how much energy is stored in the spring each time the pedal is pushed down.

[2]

……J

(ii) Explain how you found your answer.

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…… **[1]**

(d) Explain why the spring will result in the bicycle not going as fast as it would without the spring.

Use ideas about energy in your answer.

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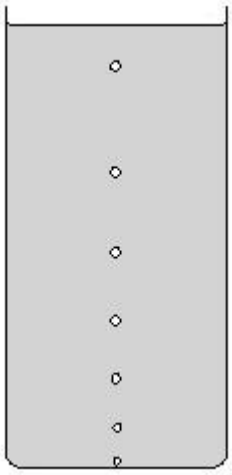
…… **[4]**

3 Neil observes a stream of bubbles rising in a glass of fizzy cola.

The bubbles are produced at a steady rate.



(a) Explain how evidence from the diagram shows that the bubbles are accelerating.

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…….. **[3]**

(b) **(i)** Recall the equation to calculate force.

…….. **[1]**

(ii) In a stream of bubbles each bubble has an acceleration of 0.175 m/s^2.

Assume that each bubble has a mass of 1×10^{-6} kg.

Calculate the resultant force on each bubble.

……..N **[3]**

(c) Name the **two** forces acting against the rise of the bubbles in Neil's glass.

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…….. **[2]**

4 **(a)** An electric kettle has a power rating of 2.5 kW.

(i) How much energy is transferred each second by the kettle?

……..J **[1]**

(ii) Recall the equation for calculating energy transferred in kWh.

…….. **[1]**

(iii) The kettle takes 6 minutes to boil the water.

How much energy in kilowatt hours is transferred by the kettle to boil the water?

…….kWh **[3]**

(b) When the water is boiling, liquid water is changing into steam.

Describe what is happening to the energy and temperature of the particles when water boils.

Use the particle model in your answer.

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…… [3]

(c) Another kettle heats 1 kg of water from 20 °C to 100 °C and continues heating until half of the water has turned to steam.

Calculate the total increase in internal energy of the water and state the units.

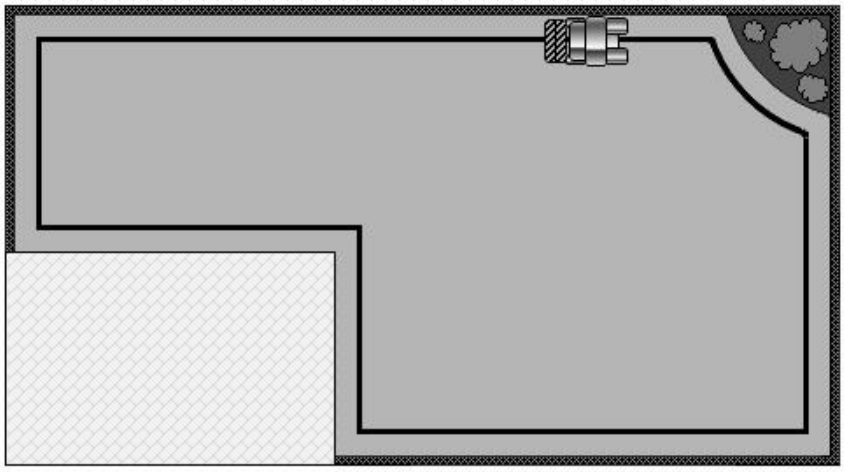
Specific heat capacity of water = 4200 J/kg/ °C

Specific latent heat of water vaporisation = 2260 kJ/kg

Total increase in internal energy = …… units ……

[5]

5 Jasmine has a robot lawnmower.



A wire carrying an electric current marks the edge of the lawn.

(a) The lawnmower can detect an electric current of 0.5 amps or more in the wire.

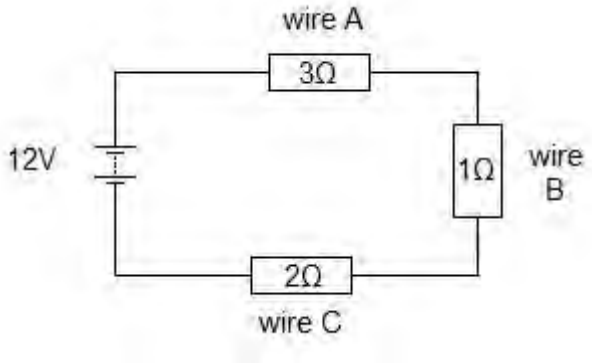
The power supply for the wire is 12 volts.

The resistance of the wire is 50 milliohms per metre.

Calculate the maximum length of wire that the lawnmower can detect the current in.

……..m **[5]**

(b) Jasmine is planning to join three wires together to mark the edge of the lawn.



The total potential difference across the three wires is equal to the potential difference across the power supply.

Explain this statement using the idea of work done.

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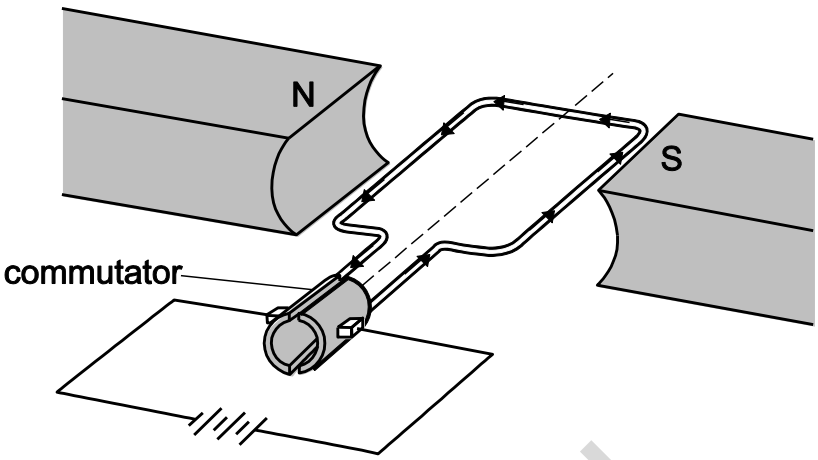
……..... **[2]**

(c) The lawnmower moves using an electric motor.

The arrows show the direction of current in the coil.



Complete the sentences about the motor.

Use terms from the list.

anticlockwise clockwise first finger left right second finger thumb

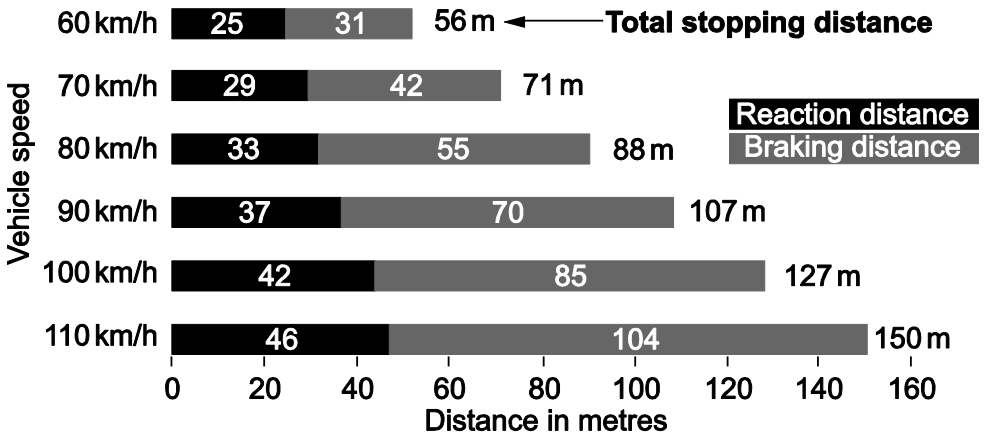
Because the force on the right of the coil is shown by the ……..…….

in Flemings ……..…….-hand rule, we know the coil of wire will spin in

a ……..…… direction.

[3]

6 The following chart shows some stopping distances for an average car.



How long it takes to stop (driving an average sized vehicle)

(a) Describe the relationship between vehicle speed and the reaction distance.

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…….. **[2]**

(b) At 100 km/h the kinetic energy of an averaged sized vehicle is 675 kJ.

Estimate the average force applied by the brakes to stop the car from this speed, over the braking distance.

…….kN **[4]**

(c) State **one** factor, other than speed, that will affect the **braking distance** of the car.

…… **[1]**

…… **[1]**

7 X-rays are used to take images inside teeth at the dentist.

(a) When an X-ray image is taken of a tooth there is usually a dentist and a dental nurse who wait outside the room while the patient is in the room.

One risk from X-rays is cancer. Suggest another risk.

……**[1]**

(b) **(i)** The X-rays are produced by firing particles at a metal target. The metal emits X-rays.

What happens in the metal to produce the X-rays?

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…… **[2]**

(ii) Different materials absorb different amounts of X-rays.

Generally, denser materials in the teeth absorb more X-rays than less dense materials.

Explain why a denser material will absorb more X-rays

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…… **[3]**

(c) Joel is training to be a dentist.

He has read that X-rays are dangerous and might cause cancer.

He asks each of the people on a cancer ward if they have ever had an X-ray picture taken.

Here are his results:

	Male	**Female**
Had an X-ray	15	7
Never had an X-ray	0	1

Joel thinks this shows that X-rays cause cancer.

Is Joel correct? Justify your answer.

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…… **[3]**

8 During the sixteenth century, measurements were made with compasses that allowed William Gilbert to publish a book describing the Earth's magnetic field.

(a) **(i)** Explain how a magnetic compass could be used to find the shape of the Earth's magnetic field.

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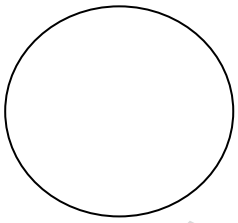
…… **[2]**

(ii) Sketch the likely results for the magnetic field around the Earth.

North Pole



South Pole

[2]

(b) Sophia is an architect designing a football stadium for a country near the equator.

She knows the wires used to transmit electricity from the ground to the top of a set of floodlights will experience a force due to the Earth's magnetic field.

The floodlight tower is 20 m high, the wire carries an average current up the wire of 15 A, the earth's magnetic field strength is 40 μT.

(i) Calculate the force on the wire.

…….…… N **[3]**

(ii) In which direction will the force act? Draw a ring around the correct answer.

North **East** **South** **West** **Up** **Down**

[1]

(iii) How does this force compare with the force due to gravity acting on the 20 m long wire?

The density of the wire is 0.01 kg/m^3.

Justify your answer.

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……

…… **[2]**

9 Nuclear power stations contributed about 20% of the electricity generated in the UK in 2013.

(a) Hydroelectricity is a renewable source in which water flowing downhill is used to generate electricity.

Compare how electricity is generated in a nuclear and a hydroelectric power station.

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…….. **[4]**

(b) Some nuclear power stations use a chain reaction involving uranium.

In a chain reaction one reaction leads to more reactions.

This equation shows one step in the chain reaction.

$$ {}^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{85}_{36}Kr + {}^{\cdots\cdots}_{\cdots\cdots}Ba + 3{}^{1}_{0}n $$

(i) Write the correct mass and atomic numbers for Ba **in the above equation**. **[2]**

(ii) Explain how the step shown above can lead to a chain reaction.

Use the equation above to help.

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…… **[3]**

(c) The terms half-life and random decay are used when describing radioactivity.

(i) Explain the concept of half-life.

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…… **[2]**

(ii) Why is radioactive decay described as random?

……...

…… **[1]**

10 In a crash test centre a truck of mass 4,360 kg collides with a stationary car of mass 1,200 kg.
The two vehicles stick together and move off.
The apparatus in the centre states that the truck was travelling at a velocity of 10 m/s before the crash but the technician in the centre thinks this reading may be wrong.
They know that the two vehicles together moved at 6.4 m/s after the collision.

Use calculations to find out whether the apparatus was working correctly and the velocity at which the truck was travelling was 10 m/s. Compare your answer with the velocity given.

……**m/s**

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[6]

END OF QUESTION PAPER