OCR
Oxford Cambridge and RSA

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Wednesday 22 May 2019 – Afternoon

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

J260/03 Physics (Foundation Tier)

Time allowed: 1 hour 45 minutes

You must have:
- the Data Sheet (for GCSE Combined Science B (inserted))
- a ruler (cm/mm)

You may 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
- The Data Sheet will be found inside this document.
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Answer **all** the questions.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

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 **24** pages.

Answer **all** the questions.

1 Nina is looking at a cliff. She shouts and listens to the echoes from the cliff.

(a) Describe what happens to the sound wave to make an echo.

Put a (ring) around the correct answer.

absorbed **amplified** **radiated** **reflected** **refracted**

[1]

(b) Which two statements about sound waves are correct?

Tick (✓) **two** boxes.

A sound wave is a transverse wave. ☐

A wave transfers energy from one place to another. ☐

In air, sound waves travel at about 330 m/s. ☐

The number of waves per second is called the period of the wave. ☐

We hear sounds when the air travels to our ears carrying the sound. ☐

[2]

2 Jack is investigating an electric current in a wire.

(a) What is an electric current?

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

(b) Complete these sentences about current in a wire.

Use words from the list.

You may use each word once, more than once, or not at all.

battery **complete circuit** **diode** **resistance** **switch**

A current passes through a wire when the wire is connected to a ..... .

A current will not pass unless there is a ..... .

[2]

(c) The current in the wire is 0.4 A.

Calculate the electric charge that passes a given point in 30 s.

Use the equation: charge = current × time

Charge = ... C **[2]**

(d) Jack thinks the current in the wire will produce a magnetic field.

Describe how Jack can use a magnetic compass to show that the current creates a magnetic field.

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

3 A minibus travels on a level road.

The mass of the minibus and passengers is 1800 kg.

(a) The minibus travels at a speed of 20 m/s.

Calculate the kinetic energy of the minibus with all of its passengers.

Use the equation: kinetic energy = 0.5 × mass × $(\text{speed})^2$

Kinetic energy = ... J **[2]**

(b) The minibus now travels faster. The driver then brakes to a stop.

The braking force is 9000 N and the braking distance is 90 m.

Calculate the work done in stopping the bus.

Assume there are no other forces involved.

Work done = ... J **[3]**

(c) The table shows factors that affect the braking distance when the driver has to stop suddenly.

Speed (km/h)	Road conditions	Braking distance (m)
20	dry	40
20	wet	80
30	dry	90
30	wet	180

Complete these sentences to explain the effects of road conditions and speed on braking distance.

(i) When roads are wet, the braking distance .....

because .....

.....

[2]

(ii) When the minibus is travelling faster, the braking distance .....

because .....

.....

[2]

4 The light we see is called visible radiation.

Visible radiation is part of the electromagnetic spectrum that is shown in the diagram.

radio waves	**microwaves**	.....	**visible radiation**	.....	**X-rays**	**gamma rays**

(a) Complete the blank spaces in the diagram by adding the **two** missing types of radiation.

[2]

(b) Complete the sentence about visible radiation.

Put a (ring) around the correct choice.

Our eyes can detect **most of the / a very small / a very large** range of frequencies in the electromagnetic spectrum.

[1]

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5 **(a)** The table gives information about different battery powered toys.

Toy	Power input (W)	Potential difference (V)
Jumping dog	1.0	6.0
Talking doll	0.1	3.0
Car	1.5	4.8
Keyboard	0.2	4.5

(i) Which toy transfers the most energy each second?

Put a (ring) around the correct answer.

Car **Jumping dog** **Keyboard** **Talking doll**

[1]

(ii) When the keyboard is used, 1.6 C of charge flows through the circuit components.

Calculate the energy transferred in the circuit.

Use the equation: energy transferred = charge × potential difference

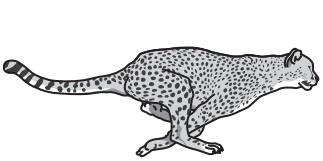
Energy transferred = ... J **[3]**

(b) A battery powered robot needs a potential difference of 9 V and a current of 0.2 A.

Calculate the power input required by the robot.

Power input = ... W **[3]**

6 A cheetah is the fastest land mammal. Cheetahs hunt gazelles.



Cheetah

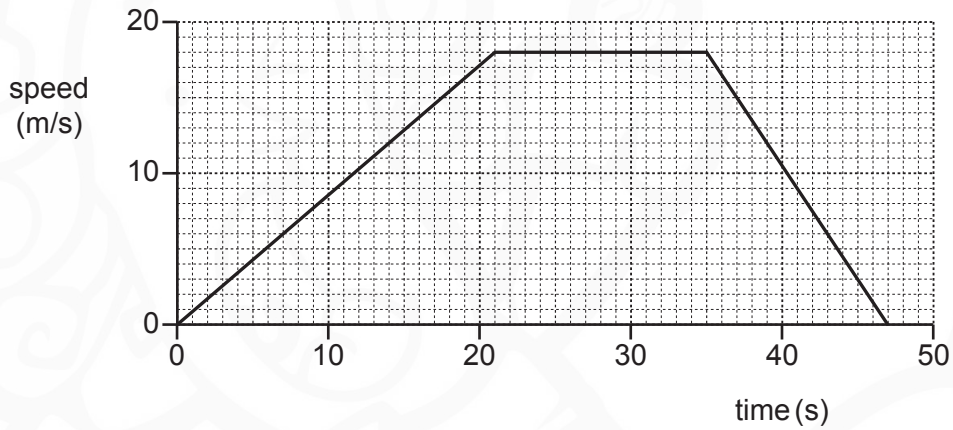
Gazelle

(a) The cheetah has a maximum speed of 30 m/s.

Calculate the time it will take to travel 120 m at maximum speed.

Time = ... s **[3]**

(b) This is a speed-time graph of a gazelle which starts moving.



Describe the motion of the gazelle, using information from the speed-time graph.

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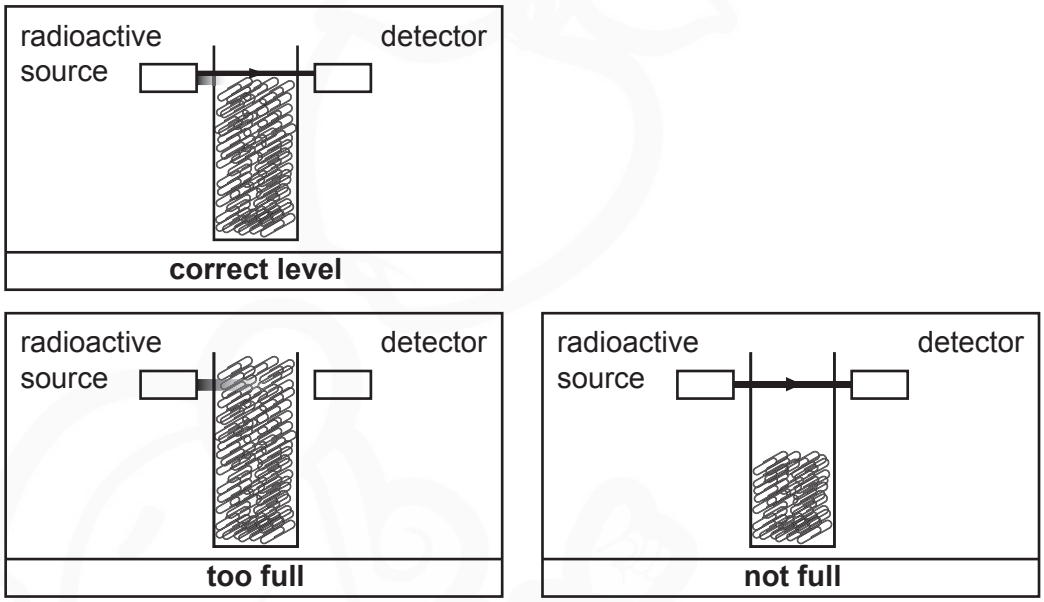
..... **[3]**

7 Some nuclei are radioactive and emit particles of radiation.

(a) Why are some nuclei radioactive?

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

(b) A radioactive source is used in a factory to check that cardboard packets of aluminium paper-clips are filled to the correct level. The diagram shows how this works.



(i) The radioactive source emits one type of radiation.

Put a (ring) around the correct choice to complete the sentence.

To check that cardboard packets of aluminium paper clips are full, the source must emit

alpha particles / beta particles / gamma rays.

[1]

(ii) Explain why the type of radiation you chose in **(b)(i)** is the best choice to use in the factory.

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..... **[2]**

(iii) The radioactive source has a safety-shutter that is closed when it is not in use. This blocks the radiation.

Explain why the safety-shutter is needed.

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.....

..... **[2]**

(c) The nuclei of strontium-90 and uranium-234 are both radioactive.

Complete the decay equations for these two nuclei.

(i) Uranium-234 Thorium-230

$$^{234}_{92}U \rightarrow {}^{230}_{90}Th + {}^{\ldots\ldots}_{\ldots\ldots}He$$

[2]

(ii) Strontium-90 Yttrium-90

$$^{90}_{38}Sr \rightarrow {}^{90}_{39}Y + {}^{\ldots\ldots}_{\ldots\ldots}e$$

[2]

8 **(a)** A student is given three metal bars that look identical, **AB**, **PQ**, and **XY**.

She carries out some experiments to decide if each bar is a magnet or just an iron bar.

The table shows the results when the metal bars are tested against each other, to see if they attract or repel.

Arrangement of metal bars	Attract or Repel?
A B P Q	attract
A B X Y	repel
A B Q P	attract
B A X Y	attract

Use the table to decide if each metal bar is a magnet or an iron bar.

Put **one** tick (✓) in each row.

Metal bar	Magnet	Iron bar
A B		
P Q		
X Y		

[1]

(b) A strong magnet is used to lift a 220 g metal ball vertically into the air so that it hovers above the ground.

It stays in the same position without moving.

(i) What is the resultant force on the metal ball?

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

(ii) The diagram shows the metal ball.

Draw and label the forces on the metal ball when it is hovering.

[3]

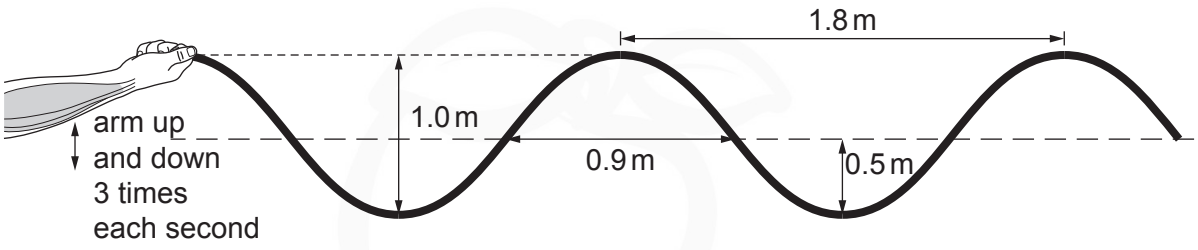
(iii) Calculate the force on the 220g metal ball due to the magnet.

Gravitational field strength = 10 N/kg

Force = ... N **[4]**

9 Sarah exercises with a heavy rope. She moves her arm up and down making waves in the heavy rope.

The diagram shows her arm and the waves in the rope.



(a) Describe the wave motion of the rope, using the words **amplitude**, **wavelength** and **frequency**.

Use information from the diagram in your answer.

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

(b) The mass of **one metre** of the rope is 1.6 kg. The rope is 15 m long.

Calculate the weight of the rope.

Gravitational field strength = 10 N/kg

Weight = ... N **[4]**

(c) Sarah finishes her exercises.

(i) Which energy store has decreased?

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

(ii) How was the energy transferred?

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

(iii) Which energy store has increased?

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

(d) Kai uses a different rope.

He makes waves with a wavelength of 1.5 m and frequency of 2.2 Hz.

Calculate the wave speed in the rope.

Wave speed = ... m/s **[3]**

10 Jane has 300 g of water in her water bottle. She adds 50 g of ice and puts the lid on. The total mass is now 350 g, excluding the mass of the water bottle.

(a) Explain the difference in the way the particles are arranged **and** the way they behave, in ice and water.

Complete the diagrams to help you explain the difference.

Use ideas from the particle model in your answer.

Particles in ice

Particles in water

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..... **[4]**

(b) After 20 minutes there is no ice in the bottle.

Describe what has happened to the particles **and** why the mass is still 350 g.

Use ideas from the particle model in your answer.

.....

.....

..... **[2]**

(c) Calculate the energy needed to melt the 50 g of ice.

The specific latent heat of ice = 334 J/g

Energy = ... J **[2]**

11 Electrical power is transferred from power stations to homes by the National Grid, as shown in the diagram.

(a) In the National Grid, what is the name of the devices that change the voltage?

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

(b) Complete the sentences about the diagram. Use words from the list.

You may use each word once, more than once, or not at all.

decreased **increased** **unchanged**

At **Point A**, the potential difference (voltage) is ..... .

At **Point B**, the potential difference (voltage) is ..... .

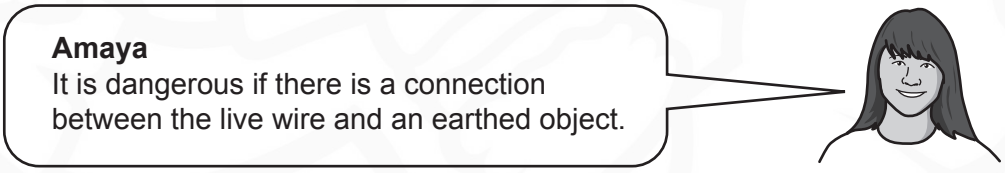
[1]

(c) Appliances can be connected to the mains electricity supply in homes using 3-pin plugs.

(i) What is the potential difference (voltage) of the mains electricity in a home?

Potential difference (voltage) = ... V **[1]**

(ii) Amaya thinks of a hazard with using mains electricity.



Explain why Amaya is correct.

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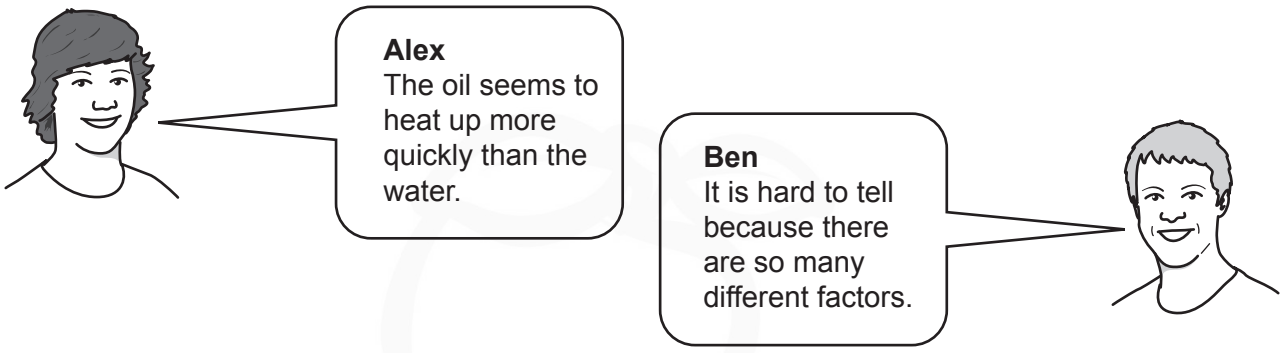
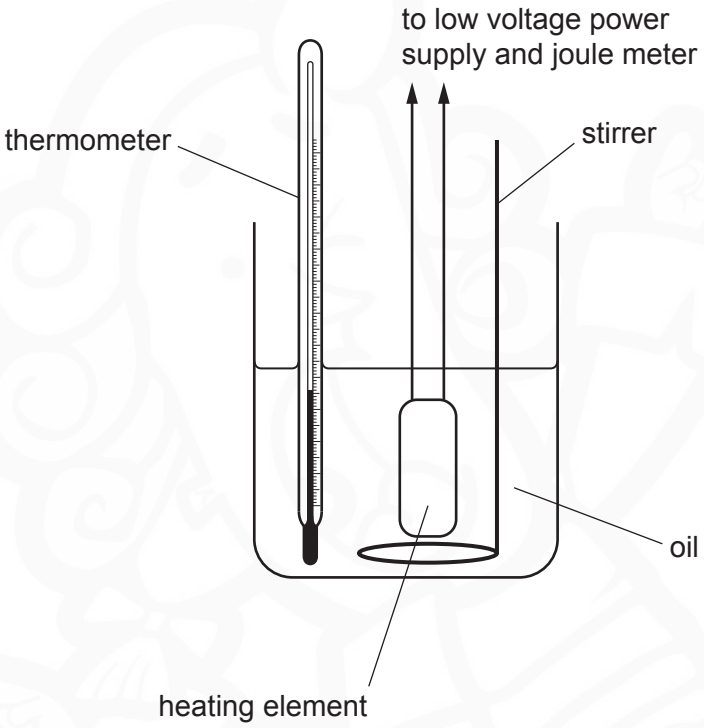
..... **[2]**

12 Alex is frying potatoes in oil. Ben is boiling potatoes in water.



Their teacher suggests they compare the specific heat capacities of oil and water.

Alex and Ben set up the apparatus shown in this diagram to measure the specific heat capacity of the **oil**.



(a) Explain how they can safely use the apparatus, to take measurements, and to determine the specific heat capacity of the oil.

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

(b) Alex and Ben repeat their experiment 3 times. Their results are shown in **Table 12.1**.

Specific heat capacity of oil (kJ/kg °C)	**Experiment 1**	**Experiment 2**	**Experiment 3**
	1.94	2.23	1.98

Table 12.1

Calculate the mean specific heat capacity of the oil, using all the data in **Table 12.1**.

Mean specific heat capacity = ... kJ/kg °C **[2]**

(c) **Table 12.2** shows accurate values for the specific heat capacities of the oil and water.

Liquid	**Specific heat capacity (kJ/kg °C)**
oil	1.7
water	4.2

Table 12.2

Compare the accurate value for the oil with Alex and Ben's calculated value in **(b)**.

Suggest a reason for the difference, and suggest how they could improve their experiment to get a more accurate result.

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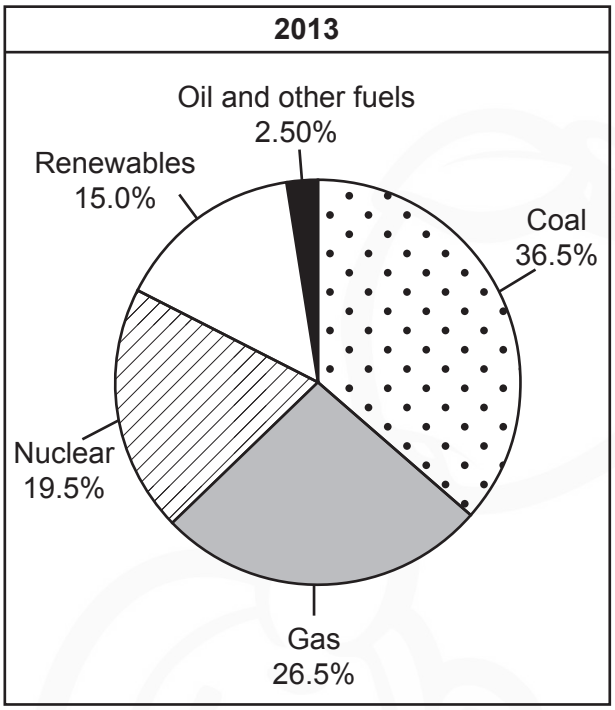
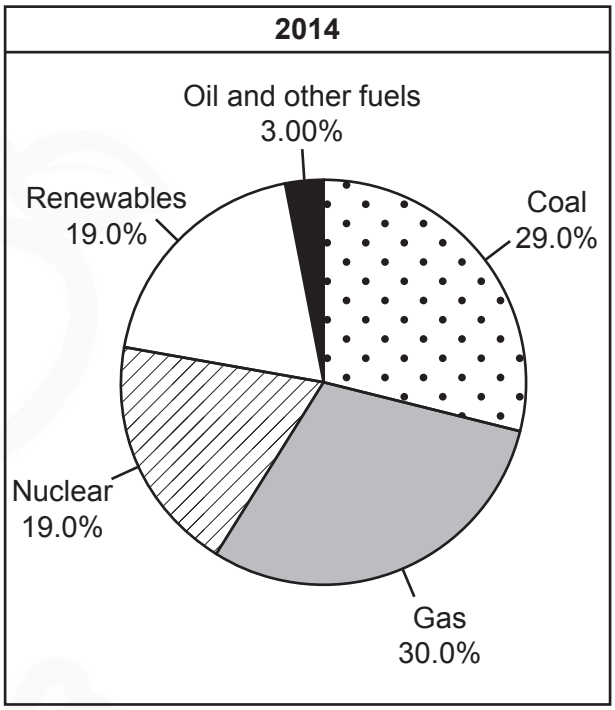
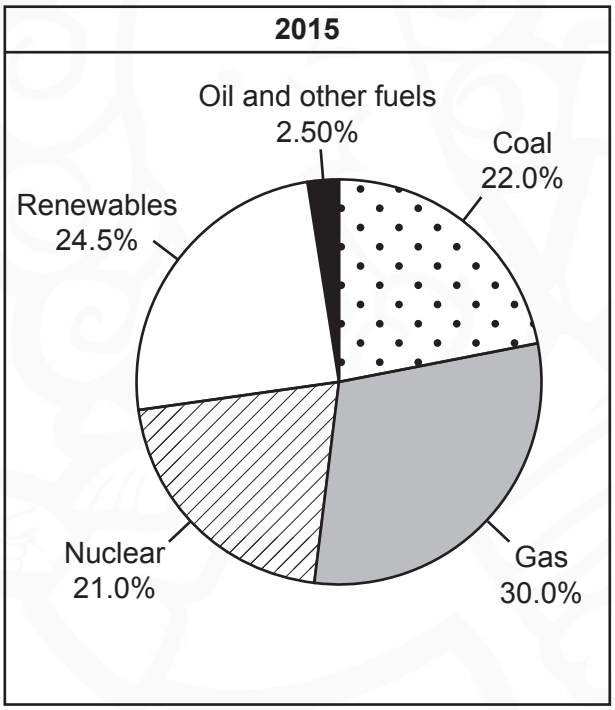
..... **[3]**

13* These pie charts show the energy resources used to generate electricity in the UK in **2013**, **2014**, and **2015**.







Describe in detail how the energy resources used to generate electricity in the UK have changed from 2013 to 2015.

Suggest reasons for these trends.

Use information from the pie charts to support your answer.

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

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).