OCR
Oxford Cambridge and RSA

Accredited

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

F

J250/06 Paper 6 (Foundation Tier)

Sample Question Paper

Date – Morning/Afternoon

Version 2.1

Time allowed: 1 hour 10 minutes

You must have:
- the Data Sheet

You may use:
- a scientific or graphical calculator
- a ruler

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.

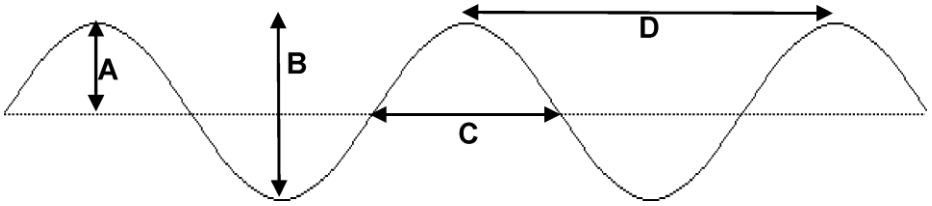
INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **24** pages.

SECTION A

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

Answer **all** the questions.

1 The diagram shows a wave on water.



Which arrow shows the **amplitude** of the wave?

Your answer ☐ **[1]**

2 Which energy source is non-renewable?

A Bio-fuel

B Coal

C Hydro-electricity

D Solar energy from the Sun

Your answer ☐ **[1]**

3 Which feature is **not** true of all electromagnetic waves?

A They are transverse waves

B They can travel through a vacuum

C They have the same wavelength

D They travel at 300 000 000 m/s through a vacuum

Your answer ☐ **[1]**

4 Which property correctly describes the electricity supply to homes in the UK?

A 50 Hz a.c.

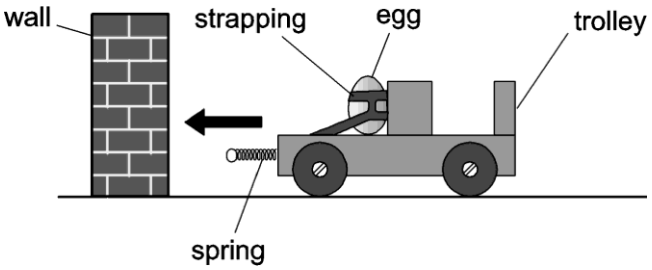
B 50 Hz d.c.

C 230 Hz a.c.

D 230 Hz d.c.

Your answer ☐ **[1]**

5 An egg strapped to a trolley can be used to demonstrate a car crash into a wall.



What would cause the **least** amount of damage to the egg?

A A larger egg

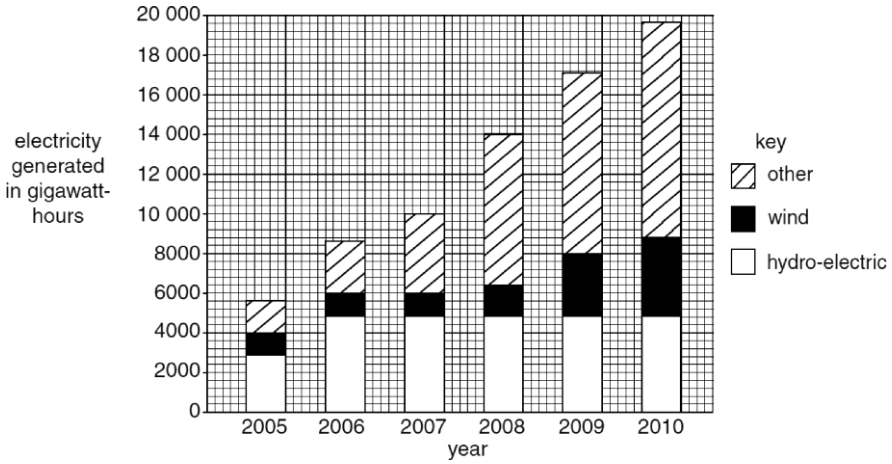
B A smaller deceleration

C No spring

D No strapping

Your answer ☐ **[1]**

6 The bar chart shows the electricity generated using different sources from 2005 to 2010.



Which statement is correct about the information in the bar chart?

A Each year more electricity is generated by hydro-electric than by wind.

B The amount of electricity generated by hydro-electric is constant from 2005 to 2010.

C The electricity generated by wind has increased every year from 2005 to 2010.

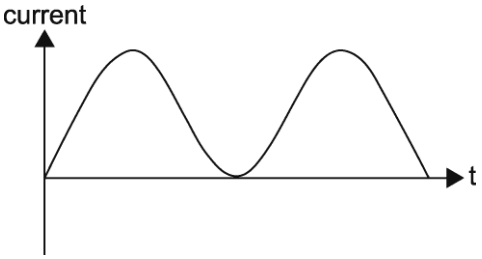
D The total electricity generated has increased to 19 000 gigawatt-hours.

Your answer ☐ **[1]**

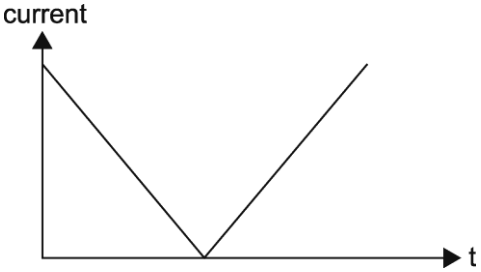
7 Which graph shows an alternating current?

A

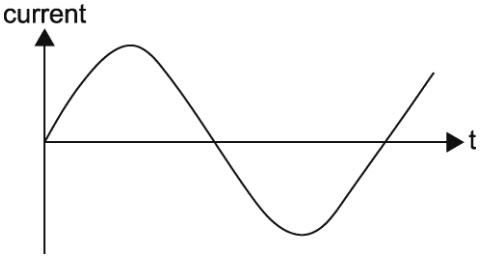
B



C



D



Your answer ☐ **[1]**

8 All radioactive sources have a half-life.

Which statement about the half-life of a source is correct?

A It is half the time for the activity of the source to decrease to zero.

B It is half the time for the radioactive source to become safe.

C It is the time for half of an atom to decay.

D It is the time for the activity of the source to decrease by half.

Your answer ☐ **[1]**

9 A boy kicks a football with a mass of 400 g.

What is the potential energy of the football when it is 0.8 m above the ground?

- gravitational field strength (g) = 10 N/kg

A 0.032 J

B 3.2 J

C 320 J

D 3 200 J

Your answer ☐ **[1]**

10 The National Grid transfers energy efficiently using high voltages.

Why are high voltages more efficient than low voltages?

A Increasing the voltage decreases the current, which heats the wires less.

B Increasing the voltage decreases the current, which heats the wires more.

C Increasing the voltage increases the current, which heats the wires less.

D Increasing the voltage increases the current, which heats the wires more.

Your answer ☐ **[1]**

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TURN OVER FOR THE NEXT QUESTION

SECTION B

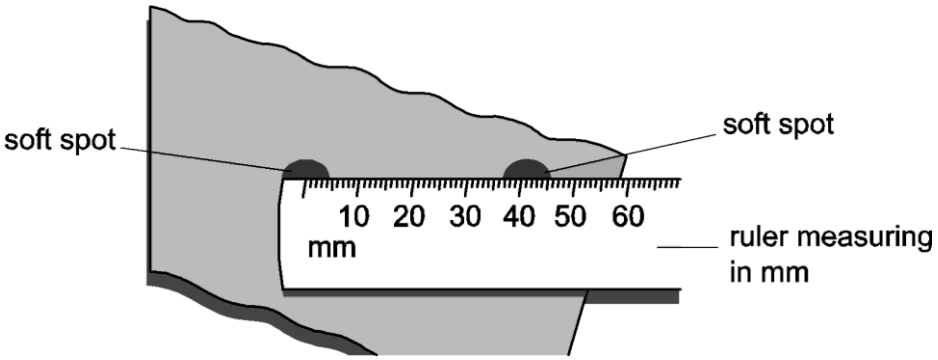
Answer **all** the questions.

11 Microwaves are part of the electromagnetic spectrum.

(a) The wavelength of microwaves can be measured using chocolate.

- The turntable is taken out of the microwave oven and the chocolate is put in the microwave.
- The microwave oven is left on full power for 10 seconds.

The picture shows the closest two soft spots in the chocolate.



(i) The soft spots are half a wavelength apart.

Use the picture to measure the distance between the centre of the two spots.

Answer = …….mm **[1]**

(ii) A full wavelength is the double the distance between two soft spots.

What is the wavelength of this microwave in mm **and** in m?

Answer =.....mm

Answer = …….m **[1]**

(b) The frequency of the microwaves used in the oven is 2 450 000 000 Hz.

Calculate the speed of the microwaves used in the oven.

Use your answer to **(a)(ii)** and the formula:

wave speed = frequency × wavelength

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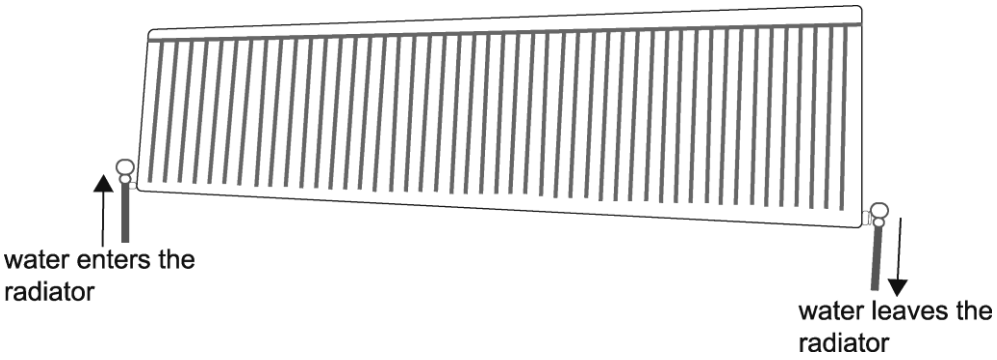
..... **[2]**

Answer = ... m/s

12 The picture shows a radiator in one room of a house.



This radiator is full of water.

(a) The water enters the radiator at a higher temperature than when it leaves.

Suggest why this happens.

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

(b) Each 1.5 kg of water decreases its temperature by 3 °C as it flows through the radiator.

(i) Calculate the amount of energy transferred to the room by the 1.5 kg of water as it flows through the radiator.

- The specific heat capacity of water is 4 200 J/kg°C.

Show your working and write down the unit.

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.....

.....

Answer = …… Unit .....**[3]**

(ii) The radiator has air trapped in it.

- The specific heat capacity of water is 4 200 J/kg°C.
- The specific heat capacity of air is a third of water.

Calculate the specific heat capacity of air.

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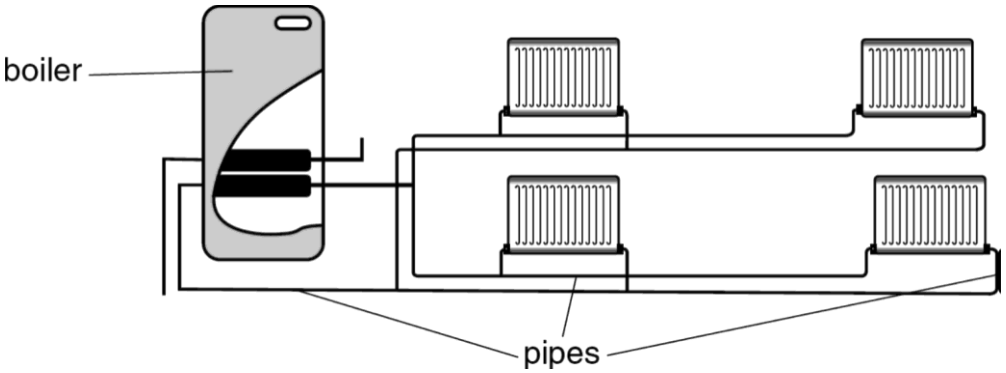
.....

Answer = ……J/kg °C **[1]**

(c) The picture shows the radiators in the house connected by pipes to the boiler.



Why are the pipes covered with foam?

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

13 A student pulls toy cars along the floor in a laboratory.

She measures the force and distance moved each time.

Her results are shown in the table.

Toy car	Pulling force (N)	Distance moved (m)
A	10	2
B	5	6
C	4	5
D	2	7

(a) Which **two** cars took the same amount of work to pull?

Show your working.

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.....

.....

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

(b) In another experiment to look at work done, the student uses two different electric motors, **Q** and **R**, to lift a large mass.

She wants to find out which motor is the most efficient.

She measures the input and output of electrical energy to calculate the work done on the mass.

Look at the table of her results.

Electric motor	Input energy (J)	Output energy (J)
Q	800	760
R	2 000	1 920

The student concludes that motor **Q** wastes half as much energy as motor **R**.

She concludes that **Q** is the most efficient.

The student's conclusion is only partly correct.

Use her results and calculations to explain why.

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

(c) Motor **R** takes 20 seconds to lift the mass.

Calculate the **difference** between the input and output power.

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

Answer =.....W

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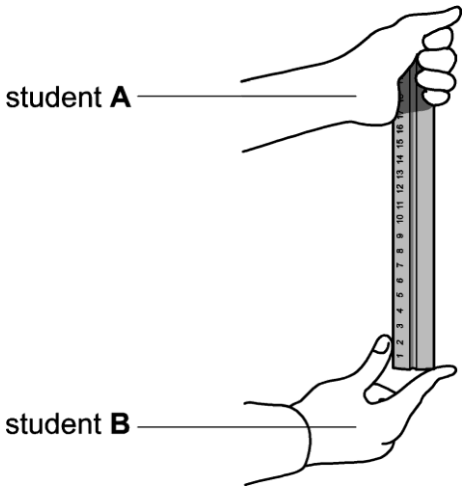
TURN OVER FOR THE NEXT QUESTION

14 The stopping distance of a car is important for road safety.

One factor that affects stopping distance is reaction time.

The picture shows student **A** using a rule drop test to measure the reaction time of student **B**.



(a) (i) Use the picture to describe how this method measures reaction time.

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

(ii) Write a method to compare the reaction time of boys and girls.

In your method describe how you will make the measurements **accurate**.

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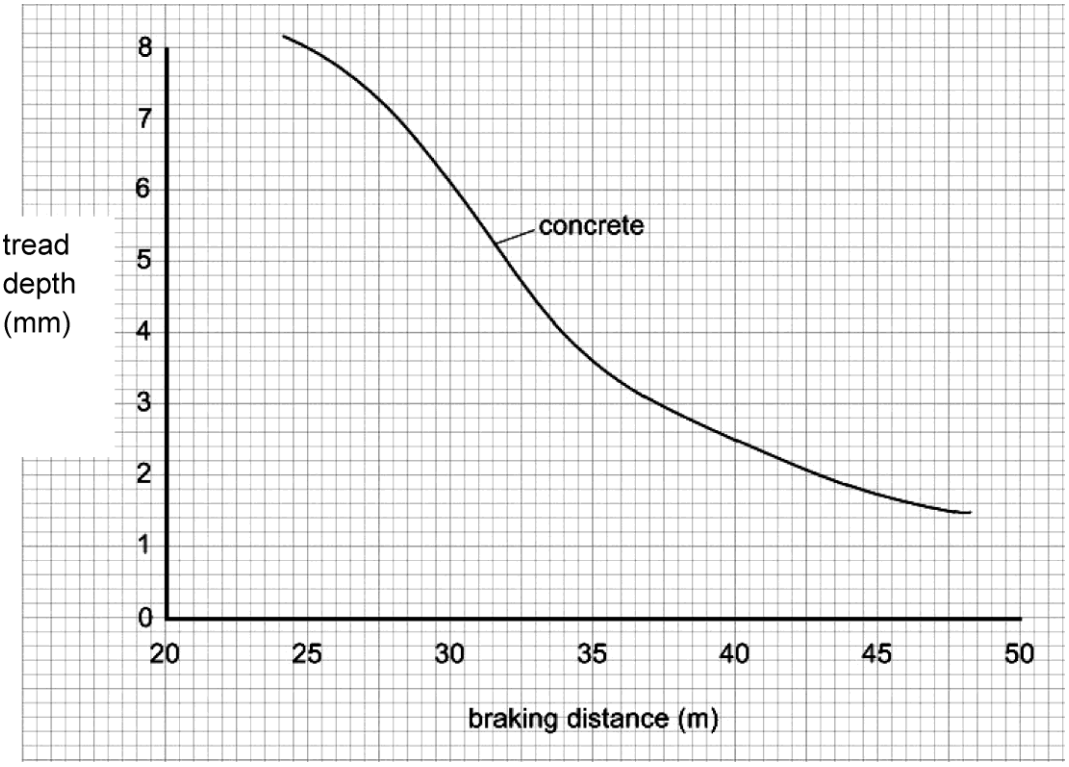
..... **[4]**

(b) Braking distance is another factor that affects stopping distance.

The graph shows the braking distance for tyres of different tread depths on concrete.



(i) What trend does the graph show?

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

(ii) Using the graph, calculate the difference in the braking distance between a tread depth of 2 mm and 5 mm.

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

(c) A car has a mass of 2 tonnes (1 tonne = 1 000 kg) and decelerates at 2.8 m/s^2.

Calculate the force being applied to the brakes.

Use the formula:

force = mass × acceleration

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Answer = ……N **[2]**

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TURN OVER FOR THE NEXT QUESTION

15 **(a)** A student has made some notes on a simple model of an atom.

> An atom consists of a negatively charged nucleus surrounded by protons.
>
> Most of an atom is just empty space.
>
> The nucleus contains neutrons and ions.

The student has made **three** mistakes.

Write down the **three** mistakes that the student has made.

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

(b) Some nuclei are radioactive because they are unstable.

The nucleus of an atom can be shown as:

$$^{A}_{Z}X$$

(i) **Z** is the atomic number.

What is **A**?

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

(ii) Equations can be used to show radioactive decay.

$$^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}e^{-}$$

Describe what is shown in this equation.

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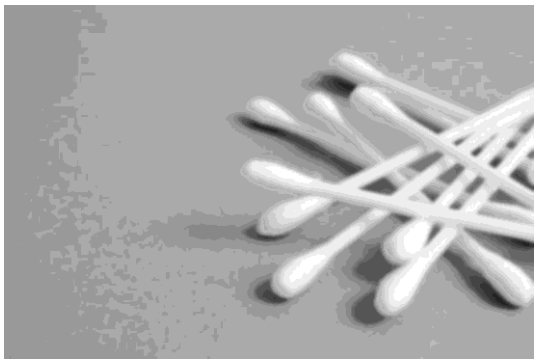
..... **[3]**

(c) These cotton wool buds have been treated with gamma rays.



The cotton wool buds have been **irradiated** but not **contaminated**.

Describe the difference between irradiated and contaminated.

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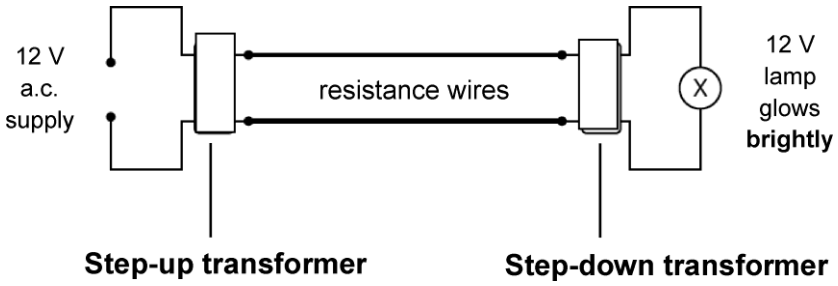
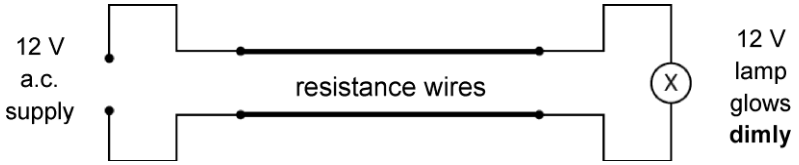
..... **[3]**

16 A student sets up two circuits to investigate the difference that transformers make to circuits.

Circuit 1



Circuit 2



(a) * Compare the two circuits, including reasons why the transformers make a difference.

Suggest how **Circuit 1** could be improved to make the bulb glow more brightly.

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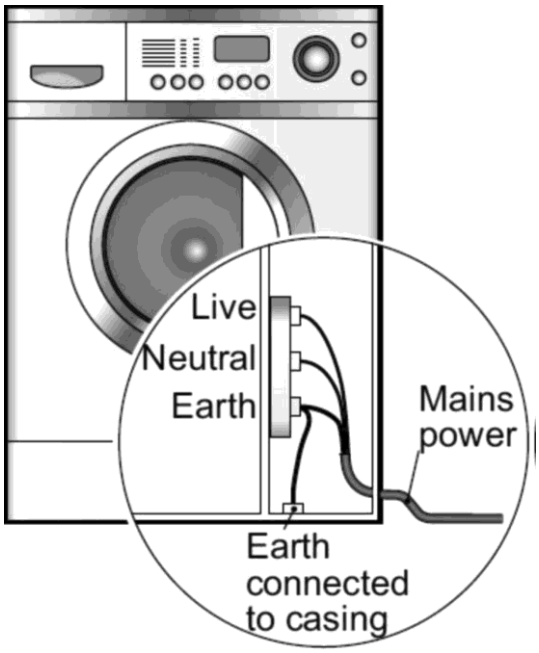
..... **[6]**

(b) Washing machines have an outer casing made of metal.

The picture below shows the earth wire connected to the outer casing.



The live wire becomes loose and touches the outer casing.

(i) Explain why this does **not** give you an electric shock.

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

(ii) The earth wire is thicker than the live wire and neutral wire.
Suggest why the earth wire is thicker.

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

END OF QUESTION PAPER

Summary of updates

Date	Version	Details
November 2021	2.1	Updated copyright acknowledgements.

OCR
Oxford Cambridge and RSA

F

…day June 20XX – Morning/Afternoon

GCSE (9–1) Combined Science (Physics) A (Gateway Science)
J250/06 Paper 6 (Foundation Tier)

SAMPLE MARK SCHEME

Duration: 1 hour 10 minutes

MAXIMUM MARK 60

This document consists of 16 pages

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.

5. Work crossed out:
   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.
7. There is a NR (No Response) option. Award NR (No Response)
   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
   - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
   If you have any questions or comments for your Team Leader, use the phone, the scoris messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

    Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer. Once the level is located, award the higher or lower mark:

    The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.
    The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

    In summary:

    The skills and science content determines the level.
    The communication statement determines the mark within a level.

11. **Annotations**

Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

12. **Subject-specific Marking Instructions**

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9–1) in Combined Science A (Gateway Science):

	Assessment Objective
AO1	**Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.**
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	**Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.**
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3	**Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.**
AO3.1	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
AO3.2	Analyse information and ideas to make judgements and draw conclusions.
AO3.2a	Analyse information and ideas to make judgements.
AO3.2b	Analyse information and ideas to draw conclusions.
AO3.3	Analyse information and ideas to develop and improve experimental procedures.
AO3.3a	Analyse information and ideas to develop experimental procedures.
AO3.3b	Analyse information and ideas to improve experimental procedures.

SECTION A

Question	Answer	Marks	AO element	Guidance
1	A	1	1.1	
2	B	1	1.1	
3	C	1	1.1	
4	A	1	1.1	
5	B	1	2.2	
6	A	1	3.1a	
7	D	1	1.1	
8	D	1	1.1	
9	B	1	2.2	
10	A	1	1.2	

SECTION B

Question			Answer	Marks	AO element	Guidance
11	**(a)**	**(i)**	41 mm	**1**	**2.2**	
		(ii)	82 (mm) / 0.082 (m) (1)	**1**	**2.1**	
	(b)		2 450 000 000 x 0.082 (1) 200 900 000 (m/s) (1)	**2**	**2 x 2.1**	**ALLOW ECF** from part (b)

Question			Answer	Marks	AO element	Guidance
12	(a)		Transfer of energy to surroundings from the radiator (1) Energy transfer from the water leading to a fall in temperature (1)	2	2 x 2.2	
	(b)	(i)	1.5 x 4200 x 3 (1) (energy) 18 900 (1) (unit) J (1)	3	2.1 2.1 1.1	**ALLOW** 18 9010 J, 18.9k J (3)
		(ii)	1400 (1)	1	2.1	
	(c)		Foam provides (thermal) insulation to reduce heat loss (1)	1	1.1	**ALLOW** foam reduces conduction / foam reduces the convection currents around the pipes (1)

Question			Answer	Marks	AO element	Guidance
13	(a)		A and C (1) Calculations applying work done = force x distance shown (1) A = 20 J B = 30 J C = 20 J D = 14 J	2	3.2b 2.1	
	(b)		Q wastes 40 J and R wastes 80 J (1) Q is 95% efficient and R is 96% efficient (1)	2	2 x 3.1b	**ALLOW** R is 1% more efficient (1)
	(c)		Use of: power = energy / time: Input power = 2000/20 = 100 W (1) Output power = 1920/20 = 96 W (1) Difference: 100 – 96 = 4W (1)	3	3 x 2.1	

Question			Answer	Marks	AO element	Guidance
14	(a)	(i)	Measure the distance the ruler has dropped (before it is caught by student B) (1) (use a table to) convert distance to reaction time (1)	2	2 x 1.2	
		(ii)	Do the ruler drop test for a girl and a boy / measure the distance on the ruler when a girl and a boy catch it (1) Use same age boy and girl / use same hand / no practising first (1) (idea of) keeping all other variables the same e.g. same level of distraction / same time of day (1) repeat / find the mean (1)	4	1.2 3.3a 3.3a 1.2	
	(b)	(i)	(Idea that) less depth gives a greater braking distance (1)	1	3.2b	
		(ii)	Reading at 5 mm = 32 m (1) Reading at 2 mm = 43 m (1) Difference is 11 m (1)	3	3 x 3.1b	
	(c)		2000 x 2.8 (1) 5 600 (N) (1)	2	2 x 2.1	

Question			Answer	Marks	AO element	Guidance
15	(a)		An atom has a positively charged nucleus (1) Atoms are surrounded by electrons (1) The nucleus contains protons (and neutrons) /not ions (1)	3	3 x 1.1	
	(b)	(i)	**A** atomic mass / number of protons and neutrons (1)	1	1.1	
		(ii)	C is decaying (1) into N (1) beta emission identified (1)	3	3 x 1.1	**ALLOW** β emission/electron identified
	(c)		Contamination transfers the source/irradiation is emission from the source (1) Idea that contamination lasts for a long period of time/ irradiation is temporary (1) Idea of level of risk/harm (1)	3	1.1 2.2 2.2	

Question			Answer	Marks	AO element	Guidance
16	(a)*		Please refer to the marking instructions on page 3 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** **Explains how transformers affect the circuit AND provides suggestions of how the circuit could be improved.** *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** **Detailed comparison of the circuits AND states how transformers affect the circuit. Provides a simple suggestion of how the circuit could be improved.** *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** **Simple comparison of the circuits OR states how transformers affect the circuit.** *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.*	**6**	**3.1b** **3.3b** **2 x 2.2** **2 x 1.2**	**AO3.1a: Analysing the effect of transformers in the circuit** • more efficient transfer as lower current results in less heat loss in wires • high voltages low current • more efficient to transfer the electrical power means bulb glows brightly **AO3.3b: Suggestion of improvements** • wire used could be made of a lower resistance material • the step up transformer could have more turns on the secondary coil to step up the p.d. more **AO2.2: Comparison of the circuits and function of transformers** • the bulb in Circuit 1 glows more brightly/ORA • the resistance wires are made of the same material • the p.d. supplied in both circuits is the same **AO1.2: States how transformers work and affect the circuit** • step-up transformer increases the voltage across the wire • step-down decreases the voltage for the lamps • the bulb in Circuit 1 glows more brightly/**ORA** • circuit 1 has transformers in it / **ORA**

Question			Answer	Marks	AO element	Guidance
			0 marks *No response or no response worthy of credit.*			
	(b)	**(i)**	Earth wire provides a safe route for the current (1) Earth wire has a low resistance/high current (1) Fuse breaks / circuit disconnected (1)	**3**	**1.1** **2.2** **2.2**	
		(ii)	(idea that it) reduces the resistance (1)	**1**	**2.1**	

Summary of updates

Date	Version	Change
May 2018	2	We've reviewed the look and feel of our papers through text, tone, language, images and formatting. For more information please see our assessment principles in our "Exploring our question papers" brochures on our website

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