OCR
Oxford Cambridge and RSA

Accredited

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

F

J260/03 Physics (Foundation Tier)

Sample Question Paper

Date – Morning/Afternoon

Version 2.1

Time allowed: 1 hour 45 minutes

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

You may use:
- a scientific or graphical calculator

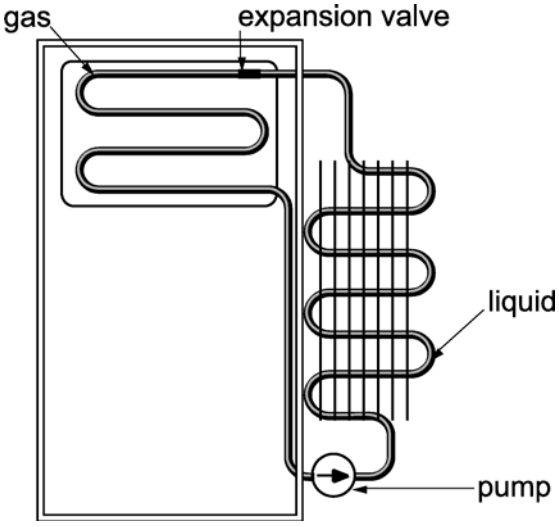
First name									
Last name									
Centre number						Candidate number				

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 A refrigerator uses mains electricity to compress a gas into a liquid.



(a) The density of the gas is different from the density of the liquid.

Explain the difference in density between the gas and the liquid.

Use ideas about the arrangement of molecules in your answer.

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

(b) (i) In the fridge, the liquid then expands and turns back into a gas.

The temperature of the fridge changes.

Complete the following sentences about the liquid changing to a gas.

Use terms from the list.

apart heat capacity higher latent heat lower together

- When the liquid changes to a gas, the molecules move .....
- This process needs energy called the……
- This energy is taken from the air inside the fridge.
- This makes the temperature inside the fridge become……

[3]

(ii) After the gas has all been compressed into a liquid, the temperature of the liquid begins to rise.

Three equations can be used to link the electrical energy used by the pump and the internal energy of the liquid.

Write down the **three** equations.

1 .....

2 .....

3 .....

[3]

(iii) The pump is connected to the mains at 230 V and uses a current of 3 A.

Calculate the power of the pump.

Power = ……W **[3]**

(iv) A charge of 2160 C flows through the refrigerator.

Calculate the time in minutes for this charge to flow.

Use the equation below in your answer:

Charge flow = current × time

Time = ……minutes **[4]**

2 On his car driving test, Amir has to do an emergency stop.

When the driving test examiner makes a loud noise, Amir has to stop the car as soon as he can.

Amir reacts as quickly as he can and pushes down on the car brake pedal.

(a) (i) The car takes 0.10 minutes to stop. The car travels 58 m in that time.

What is the average speed of the car over this time?

Average speed = ……m/s **[3]**

(ii) The car travels at a speed of 15 m/s.

The brake is applied and the car comes to a rest in 5.0 seconds.

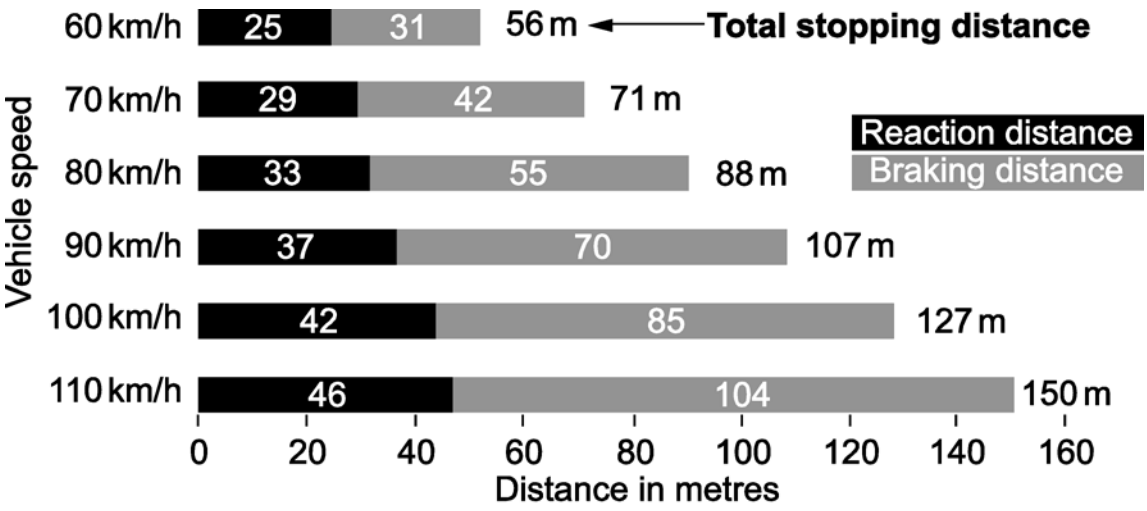
Calculate the deceleration of the car over these 5.0 seconds.

Use the equation below in your answer.

$$\text{Deceleration} = \frac{(\text{final speed} - \text{initial speed})}{\text{time}}$$

Deceleration = – (minus) ……m/s^2 **[2]**

(b) For the theory part of his driving test, Amir had to learn about stopping distances using the chart below.



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

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

(i) Using the chart, write down an equation linking the braking distance, reaction distance and stopping distance.

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

(ii) Amir says:

> **There is a correlation between reaction distance and speed, because the reaction distance gets longer.**

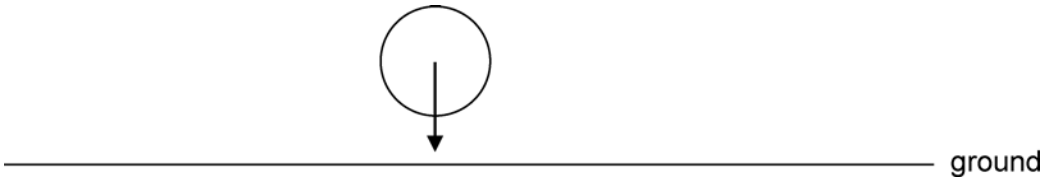
Explain why he makes this conclusion.

.....

.....

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

3 **(a)** A ball is falling through the air.



The arrow in the diagram shows the direction of gravity acting down on the ball.

(i) **On the diagram** draw an arrow to show the interaction force that is paired with the gravitational force acting on the ball. **[2]**

(ii) State Newton's Third Law.

.....

.....

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

(b) The gravitational force on the ball is called weight.

(i) State the equation that shows the relationship between weight and mass.

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

(ii) An object with a mass of 15 kg has a weight of 150 N.

Calculate the weight of an object with a mass of 5 kg.

Weight = ……N **[2]**

(c) (i) The falling ball has a mass of 0.058 kg and falls with an acceleration due to gravity of 10 m/s^2.

Calculate the force acting on the ball.

Use the equation below in your answer.

Force = mass × acceleration

Force = ……N **[2]**

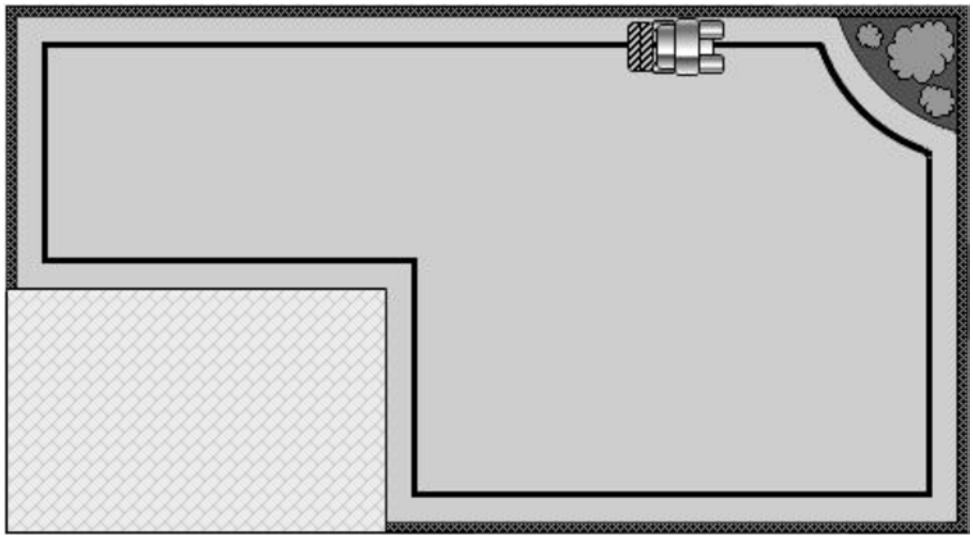
(ii) Calculate the kinetic energy of the falling ball when its speed is 2.0 m/s.

Use the equation below in your answer.

Kinetic energy = ½ × mass × $(speed)^2$

Kinetic energy = ……J **[2]**

4 Jane has a robot lawnmower.



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

(a) (i) What is an electric current?

What causes the electric current to flow in a wire?

.....

.....

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

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

A 50 m long wire has a resistance of 2.5 Ω.

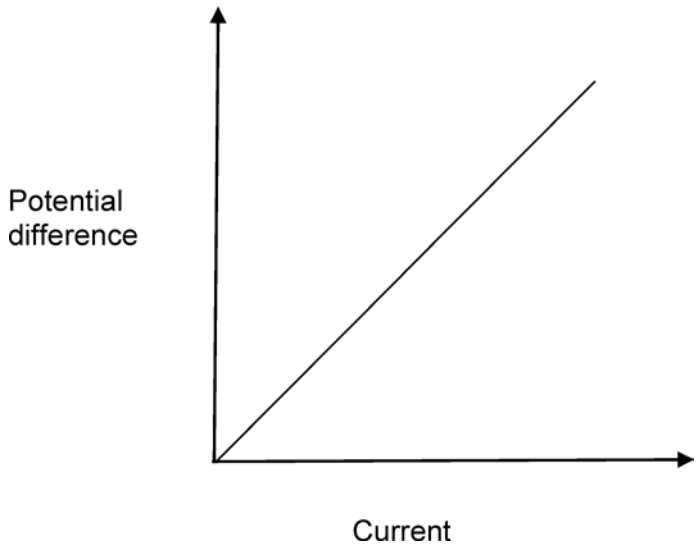
Calculate the potential difference across the wire needed to produce a current of 0.5A.

Include the units in your answer.

Potential difference = …… Units ..... **[4]**

(b) Jane measured how the potential difference changed with the current in the wire.

The graph shows the pattern of her results.



(i) Put a tick (✓) in the boxes next to the **two** correct conclusions from the graph.

The wire has no resistance . ☐

The resistance increases with the current. ☐

The resistance increases with the potential difference. ☐

The resistance is fixed. ☐

The wire is a linear part of the circuit . ☐

[2]

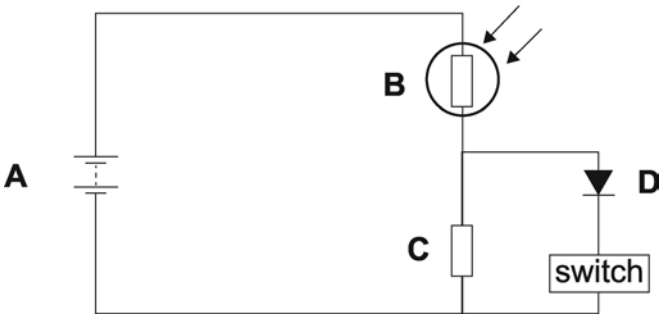
(ii) A longer wire will have a larger resistance.

On the graph above draw the line for the longer wire. **[1]**

(c) Jane thinks the robot lawnmower is too noisy to use at night.

She builds a circuit which uses a Light Dependent Resistor (LDR) to detect the light level.

The lawnmower will then switch off automatically at night.



(i) Which component in the circuit is the LDR?

Put a (ring) around the correct letter.

A **B** **C** **D** **[1]**

(ii) The LDR is sensitive to light.

Which property of the LDR changes when the light level changes?

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

5 **Table 5.1** shows the results of an investigation into some materials that could be used as shielding against gamma radiation.

Material	Density (kg/m^3)	Thickness that absorbs half the gamma radiation (cm)	Mass of a 1 m square screen that absorbs half the gamma radiation (kg)
lead	11300	1.0	113
steel	7860	2.5	197
concrete	3330	6.1	203
packed soil	1600	11.3	181
loose soil	1200	15.0	180
water	1000	18.0	180
wood	560	29.0	162
air	1.2	15 000	180

Table 5.1

(a) The ability of a material to absorb gamma radiation is dependent on its density.

(i) Describe how the density of the material and the thickness needed to absorb half of the radiation are linked.

.....

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

(ii) State the equation for density.

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

(b) In a hospital radiography department, the shielding must be portable.

Which material from **Table 5.1** is the best for this use?

Justify your answer.

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.....

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

(c) A wall made of concrete is designed to absorb half the gamma radiation and requires 10 000 kg of concrete. Calculate the volume of concrete needed to absorb half the gamma radiation.

Use values from **Table 5.1**.

Volume = ……m^3 **[4]**

6 Earthquakes cause waves that travel through rocks. These are called seismic waves.

Three types of seismic waves are produced.

S-waves: particles in the rock move from side to side, at right angles to the direction of the wave.

P-waves: particles in the rock move backwards and forwards in the direction of the wave.

L-waves: move along the surface of the Earth making the ground move up and down.

(a) A wave has a wavelength of 500 m and a frequency of 15 Hz.

Calculate the wave's speed and state the units.

Speed = …… Units ..... **[4]**

(b) Scientists can use seismic waves to find out about the structure of the Earth.

They can identify differences in rocks from the reflection and refraction of waves.

(i) What is the effect of **reflection** on a wave?

.....

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

(ii) What is the effect of **refraction** on a wave?

.....

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

(iii) The scientists have discovered that the core of the Earth is liquid.

This is because one of the waves cannot pass through a liquid.

Which wave **cannot** pass through the liquid at the Earth's core?

Justify your answer.

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

7 Here is part of a leaflet given to patients of a local hospital.

> **Safe and Painless Diagnosis for Kidney Patients**
>
> You can obtain images of your kidneys by using a radioisotope.
>
> The radioisotope quickly passes into your kidneys and then into your bladder and is then excreted.
>
> The radioisotope emits gamma radiation.

(a) **(i)** It is important that a radioisotope for kidney treatment should have a short half-life.

Suggest why.

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

(ii) The hospital uses technetium-99 as the radioisotope.

The half-life of technetium-99 is 6 hours.

How long will it take for the activity of a sample of technetium-99 to fall to one eighth of its starting value?

Duration = ... hrs **[2]**

(b) Alpha and beta radiation are **not** suitable for obtaining images of inside the body.

Explain why.

.....

.....

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

(c) Technetium-99 is produced by the radioactive decay of molybdenum (Mo).

Molybdenum is produced in nuclear reactors by the fission of uranium.

Tin (Sn) and neutrons (n) are also produced, as shown in the equation below.

$$^{235}_{92}U \rightarrow {}^{99}_{42}Mo + {}^{\cdots\cdots}_{\cdots\cdots}Sn + 12\,{}^{1}_{0}n$$

Write the mass number and atomic number of tin (Sn) in the **spaces in the equation** above. **[2]**

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

Information about the island's electricity production is given below.

Predicted electricity consumption in future	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 tonnes/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]**

9 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:

- the force that does work to make the bike move.
- the friction force that moves the bike forwards. **[2]**

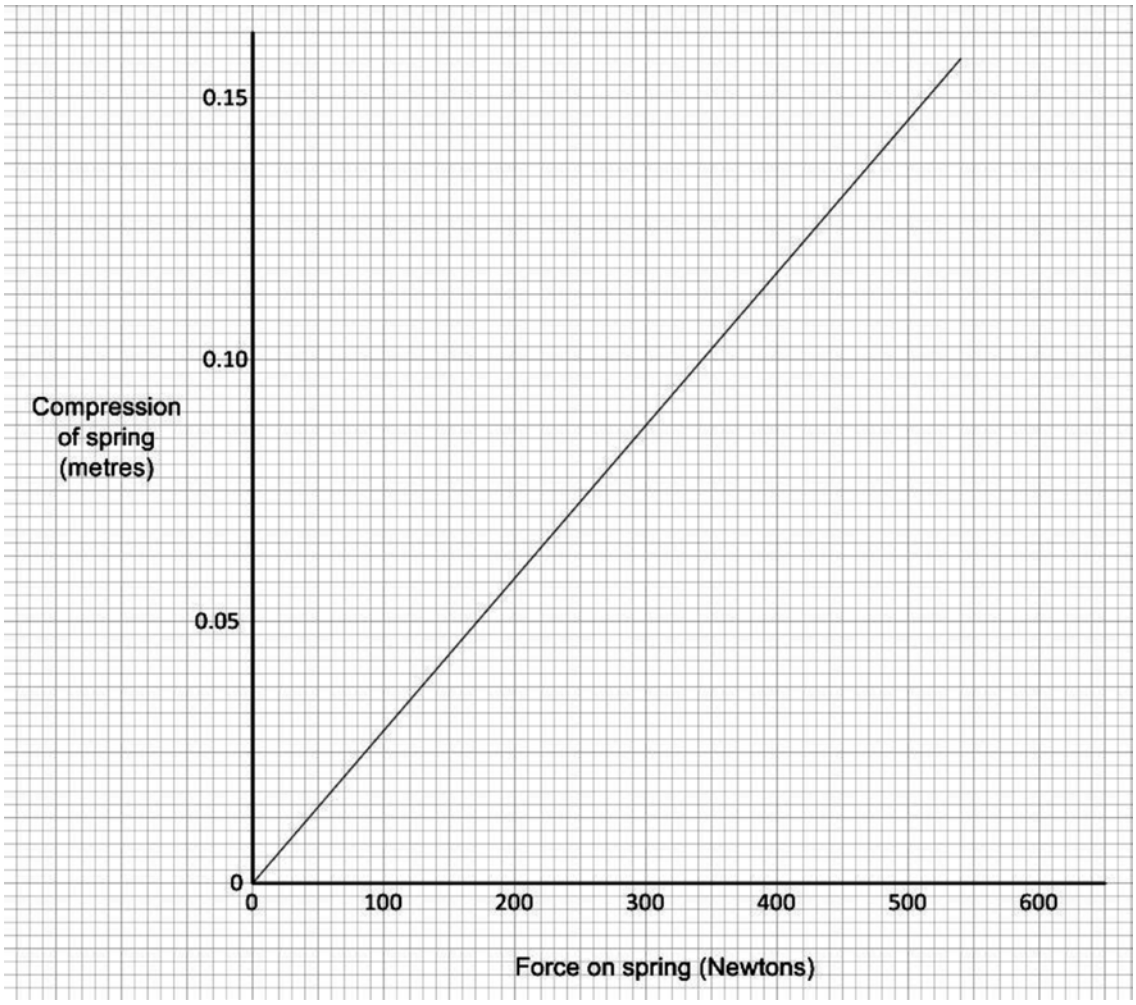
(b) There is a spring in the front wheel suspension fork.

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

Calculate the spring constant of the spring.

Spring constant = ……N/m **[4]**

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



(i) Each time the cyclist pushes on the pedal the spring compresses by 6 cm.

Use the graph, or an alternative method, to find how much energy is stored in the spring each time the pedal is pushed down.

Energy = ……J **[2]**

(ii) Explain how you found your answer.

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

(d) Explain why the spring will result in the bicycle moving more slowly than without the spring.

Use ideas about energy in your answer.

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

END OF QUESTION PAPER

OCR
Oxford Cambridge and RSA

…day June 20XX – Morning/Afternoon

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

J260/03 Physics (Foundation Tier)

SAMPLE MARK SCHEME

Duration: 1 hour 45 minutes

MAXIMUM MARK 95

This document consists of 20 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 component. 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.

Level of response question on this paper is **8.**

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 B:

	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.

Question			Answer	Marks	AO element	Guidance
1	(a)		**One mark for each of these:** Density is mass per unit volume ✓ Density of gas less than density of liquid ✓ **Plus any ONE of**: **Gas** particles/molecules are: Spread far apart ✓ Moving fast ✓ No noticeable forces between particles ✓ Density of gas less than density of liquid ✓ **Plus any ONE of**: **Liquids** particles/molecules are: Close together ✓ Sliding past each other ✓ Held together by forces ✓	**4**	**1.1**	**ORA** For full marks at least one point must come from each of gas and liquid.
	(b)	**(i)**	Apart ✓ Latent heat ✓ Lower ✓	**3**	**1.1** **1.1** **1.1**	
		(ii)	**One mark for each of these:** Change in internal energy = mass x shc x temp change ✓ Energy to cause a change of state = mass x specific latent heat ✓ **Plus any ONE of**: Energy transferred = PD x current x time ✓ OR Power = potential difference x current ✓ OR Energy transferred = charge x potential difference ✓	**3**	**1.1**	

Question			Answer	Marks	AO element	Guidance
		(iii)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE.** **If answer = 690 (W) award 3 marks** Recall P = I x V ✓ = 230 x 3 ✓ 690 (W) ✓	**3**	 **1.1** **2.1** **2.1**	Correct substitution gains first 2 marks (if equation is missing).
		(iv)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE.** **If answer = 12 (minutes) award 4 marks** Rearrange the equation to give: time = charge flow ÷ current ✓ = 2160 ÷ 3 = 720 s ✓ = 12 x 60 s ✓ = 12 (minutes) ✓	**4**	 **1.2** **2.1** **1.2** **1.2**	

Question			Answer	Marks	AO element	Guidance
2	(a)	(i)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE.** **If answer = 9.6 (m/s) award 4 marks** Recall average speed = distance ÷ time ✓ Convert minutes to seconds: 0.1 minutes x 60 = 6 s ✓ Average speed calculation is: 58 m ÷ 6 s ✓ Average speed = 9.6 (m/s) ✓	4	 1.1 1.2 2.1 2.1	Correct substitution gains first 2 marks (if equation is missing).
		(ii)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE.** **If answer = -3.0(m/s²) award 2 marks** Deceleration = $\frac{(0 - 15\text{m/s})}{5}$ ✓ = -3.0(m/s²)	2	2.1	
	(b)	(i)	Stopping distance = reaction distance + braking distance ✓	1	3.1a	
		(ii)	Reaction distance does get bigger as speed increases ✓ Change in reaction distance is explained by increase in speed ✓	2	3.2a	

Question			Answer	Marks	AO element	Guidance
3	(a)	(i)	Force acting upwards from the ground ✓ Equal size to downward force ✓	2	2.1	
		(ii)	Idea of forces equal in size and in opposite directions ✓	1	1.1	**ALLOW** every action has an equal and opposite reaction (1mark).
	(b)	(i)	Weight = mass x gravitational field strength ✓	1	1.1	**ALLOW** acceleration due to gravity for gravitational field strength.
		(ii)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE.** **If answer = 50 (N) award 2 marks** 5 x 10 ✓ 50 (N) ✓	2	2.1	
	(c)	(i)	**FIRST CHECK ANSWER ON ANSWER LINE.** **If answer = 0.58 (N) award 2 marks** = 0.058 kg x 10 m/s^2 ✓ = 0.58 (N) ✓	2	 2.1 2.1	
		(ii)	**FIRST CHECK ANSWER ON ANSWER LINE.** **If answer = 0.116 (J) award 2 marks** K.E. = ½ x 0.058 kg x (2.0m/s)^2 ✓ = 0.116 (J) ✓	2	2.1	

Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	(Rate of) flow of charge ✓ A potential difference is needed / power supply / battery ✓ A closed circuit is needed ✓	3	1.1	
		(ii)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE.** **If answer = 1.25 V award 4 marks** Recall potential difference = current x resistance ✓ = 0.5 A x 2.5 Ω ✓ 1.25 ✓ V ✓	4	 1.1 2.1 2.1 1.1	Correct substitution gains first 2 marks (if equation is missing). If units not given, award 3 marks for an answer of 1.25
	(b)	(i)	The resistance is fixed ✓ The wire is a linear part of the circuit ✓	2	3.2b	
		(ii)	Above the printed line and straight and through the origin ✓	1	2.2	

Question			Answer	Marks	AO element	Guidance
	(c)	(i)	B ✓	1	1.2	
		(ii)	Resistance ✓	1	1.2	

Question			Answer	Marks	AO element	Guidance
5	(a)	(i)	Gives correct relationship i.e. as density increases absorption thickness decreases ✓	1	3.1a	
		(ii)	Correct relationship: Mass ÷ volume ✓	1	1.1	
	(b)		Lead ✓ Smallest thickness needed ✓ Least mass needed ✓	3	3.2b	
	(c)		**FIRST CHECK ANSWER ON ANSWER LINE.** **If answer = 3.0 (m^3) award 4 marks** Rearrange equation to give volume = mass ÷ density ✓ Select correct values from table mass = 10000 kg density = 3330 kg/m^3 ✓ = 10000 ÷ 3330 ✓ = 3.0 (m^3) ✓	4	 1.1 3.1a 2.1 2.1	

Question			Answer	Marks	AO element	Guidance
6	(a)		**FIRST CHECK THE ANSWER ON THE ANSWER LINE.** **If answer = 7500 m/s or 7.5 km/s award 4 marks** Recall: Speed = frequency x wavelength ✓ = 500 (m) x 15 (Hz) ✓ 7500 or 7.5 ✓ (7500) m/s or (7.5) km/s ✓	**4**	 **1.1** **2.1** **2.1** **1.1**	Correct substitution gains first 2 marks (if equation and units missing). If units not given award 3 marks for an answer of 7500 or 7.5
	(b)	**(i)**	Reflection: Change in direction ✓ Does not pass through boundary ✓	**2**	**1.1**	**ALLOW** bounces back for 2 marks.
		(ii)	Refraction: (May) change direction ✓ Wave passes through boundary ✓	**2**	**1.1**	**ALLOW** bends at boundary for 2 marks. **ALLOW** change in speed for 2 marks.
		(iii)	S-wave ✓ **Any 1 of:** Transverse waves cannot travel through liquids ✓ Because the particles will not be pulled from side to side / forces between particles are too weak ✓	**2**	 **1.1** **2.2**	

Question			Answer	Marks	AO element	Guidance
7	(a)	(i)	(Gamma radiation) damages tissue in patient ✓ (short half-life) means small dose/ less gamma radiation exposure ✓	2	1.1	
		(ii)	Idea of half-life e.g. 3 x 6 hours ✓ 18 (hrs) ✓	2	2.1	
	(b)		Alpha and beta are not very penetrating / easily absorbed ✓ Hence will not be detected outside body ✓ Absorption by body will damage tissues/cells ✓	3	1.2	
	(c)		Mass number = 124 ✓ Atomic number = 50 ✓	2	2.1	

Question			Answer	Marks	AO element	Guidance
8*			*Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.* **Level 3 (5–6 marks)** A minimum of 3 energy resources are considered. **AND** The energy resources are linked to an interpretation of the data in the table. **AND** The interpretation of the data is used to draw conclusions. *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)** A minimum of 2 energy resources are considered. **AND** The energy resources are linked to an interpretation of the data in the table. **AND/OR** The interpretation of the data is used to draw conclusions. *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)** A minimum of 2 energy resources are considered. **AND** Minimal interpretation of the data of the table **AND/OR**	**6**	**1.1 x 2** **3.1a** **3.2b x 3**	**Indicative scientific points may include:** **AO1.1 use knowledge of energy resources** **For example:** • wind - little environmental cost/renewable • waves/tidal - little environmental cost/renewable • nuclear - well established technology/small amounts of fuel needed • oil - high cost/CO_2 pollution from burning • nuclear - safety issues/disposal of radioactive waste - very high set up costs **AO3.1a Analyse data to interpret** **For example:** • energy consumption to increase by 2880000 in the future • oil - high energy density/already established **AO3.2b Analyse data to draw conclusions** **For example:** • all oil is imported, this is expensive but system already in place

Question			Answer	Marks	AO element	Guidance
			Generic conclusions which may or may not be specifically linked to energy resources included in the candidates answer. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** No response or no response worthy of credit.			• currently no renewable resources being used on the island therefore these resources should be considered • peat is being used up quickly and should be reduced for a small island • a wind farm can be installed offshore to increase amount of energy produced by wind • waves/tidal should be possible on an island • nuclear possible • comparison of running costs of renewable vs non-renewable • wind - high set up costs • waves/tidal - technology still undeveloped/high set up costs • hydro - no evidence to say whether possible or not

Question			Answer	Marks	AO element	Guidance
9	(a)		Arrow downwards from pedal ✓ Arrow to right from the bottom of either wheel ✓	2	2.1	
	(b)		**FIRST CHECK THE ANSWER ON THE ANSWER LINE.** **If answer = 3400 (N/m) award 3 marks** Recall: f = kx or k = f ÷ x ✓ Converts 15 cm into 0.15 m ✓ 510 (N) ÷ 0.15 (m) ✓ 3400 (N/m) ✓	4	 1.1 1.1 2.1 2.1	Correct substitution gains first 2 marks (if equation is missing).
	(c)	(i)	Calculation showing area under the graph for 0.06m (6cm) (0.06 x 204) ÷ 2 ✓ 06.12 (J) ✓	2	2.2	**ALLOW** between 6.0 and 6.3 inclusive.
		(ii)	Idea of finding area under the graph ✓	1	2.2	
	(d)		Energy input to turn pedal ✓ Transferred to kinetic energy ✓ Some energy transferred to spring, not available as kinetic energy ✓ Less kinetic energy results in less speed ✓	4	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
October 2019	2.1	Question 5(c) – There has been a change to the answer of this question. Correct answer = 3.0 (m^3), Rearrange equation to give volume = mass ÷ density Select correct values, mass = 10000 kg; density = 3330 kg/m^3 = 10000 kg ÷ 3330 kg/m^3 = 3.0 (m^3) Question 9(c)(i) – There has been a change to the answer of this question. Correct answer: Calculation showing area under the graph for 0.06 (6cm) correct reading from graphs as 204 0.06 x 204 ÷ 6.12 J