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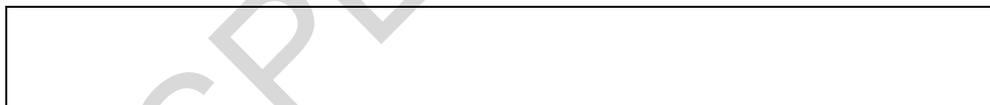
Specimen Assessment Material

GCSE (9–1) in Physics B (Twenty First Century Science)
J259/04 Depth in physics (Higher Tier)

SAMPLE MARK SCHEME

Duration: 1 hour 45 minutes

SPECIMEN

MAXIMUM MARK   90

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 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.

Level of response questions in this paper are **1** and **7(b)**.

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 Physics B (Twenty First Century 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.

Question	Answer	Marks	AO element	Guidance
1*	*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)** Balanced explanation of both points of view linked to the risks / benefits. **AND** Judgement made as to the better argument. *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)** Explains at least one point in favour of nuclear power and one against. **AND** Makes a reasoned choice of Pam or Suraiya as being right. *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)** States differences between renewable and non-renewable energy sources. **AND** Considers only one side of the argument. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be*	6	1.1 x3 2.2 x1 3.1b x1 3.2b x1	**AO1.1 Renewable vs. Non-renewable energy resources** For example: • Coal and oil are non – renewable so will run out • Nuclear is also non renewable • A renewable energy resource will not run out e.g. wind, wave, solar etc. **AO1.1 Nuclear energy hazards** **For example** Ionising radiation can have hazardous effects, notably on many varied types of living organisms and plants **AO2.2** Compare the ways in which the main energy resources are used to generate electricity **AO 3.1b Risk/benefit** • CO_2 contributes to global warming • nuclear waste could leak / enter the biosphere • risk small, but consequence serious • possibility of employment in new power station • which may bring money into the area • nuclear power stations don't produce CO_2 (once built) • coal / gas produce CO_2 • solar / wind / hydroelectric / tidal don't produce CO2 at the point of electricity generation • radioactive waste produced in nuclear power stations **AO3.2b** Judgement made as to the better argument

Question			Answer	Marks	AO element	Guidance
			clear. **0 marks** No response or no response worthy of credit.			
2	(a)	(i)	Both points correctly plotted ✓ Smooth curve drawn ✓	2	1.2	
		(ii)	Power goes down with distance (non-uniformly) ✓	1	3.1a	**ALLOW** negative correlation correctly described
		(iii)	**FIRST CHECK ANSWER ON ANSWER LINE.** **If answer = 6x10^{-3}(A) award 4 marks.** Rearrange equation to give: Current = Power ÷ Potential difference✓ Converts mW to W = 0.072 W✓ = 0.072 (w) ÷ 12 (V) ✓ = 6 x 10^{-3}A✓ Or 6 mA	4	 1.2 2.1 2.1 2.1	
		(iv)	**FIRST CHECK ANSWER ON ANSWER LINE.** **If answer = 2000 (Ω) award 3 marks.** Rearrange equation to give resistance Resistance = Potential difference ÷ current ✓ = 12 (v) ÷ 6 x 10^{-3} (A) ✓ = 2000 (Ω) ✓	3	 1.2 2.1 2.1	

Question			Answer	Marks	AO element	Guidance
	(b)		Lamp at fixed distance from photocell and read I and V ✓	**4**	**3.3a**	
			Repeat reading at each distance ✓		**3.3b**	
			Repeat for any outliers ✓		**3.3b**	
			Take mean I and V for each distance ✓		**3.3a**	
	(c)		Recognises that Tom's photocell is getting less light ✓ Suggested reason ✓	**2**	**3.2a** **3.2b**	e.g. Sam was near a window (so more light) while Tom was in a dark corner; allow systematic mismeasurement of distance by one or the other if correctly justified e.g. the end of Sam's ruler wasn't near the actual lamp but some distance from it, so all her distances are too small **ALLOW** any situation where Tom would receive less light than Sam

Question			Answer	Marks	AO element	Guidance
3	(a)		Measure angle to window from ground a measured distance away ✓ And use trigonometry ✓ **Or** Measure the height of ground floor 'repeat' ✓ And multiply by 5 and add height to window from floor ✓	2	3.3a 2.2	Suggestion How to implement ALLOW any other sensible suggestion
	(b)		**FIRST CHECK ANSWER ON ANSWER LINE.** **If answer = 8.3 (m/s^2) award 5 marks** Recall speed = distance ÷ time ✓ speed = 13.5 m ÷ 1.8 s = 7.5 m/s ✓ $(0 + v) ÷ 2 = 7.5$ m/s $\Rightarrow v = 15$ m/s ✓ Recall acceleration = change in speed ÷ time ✓ a = (15 m/s – 0) ÷ 1.8 s = 8.3 (m/s^2) ✓	5	 1.1 2.1 2.1 1.1 2.1	
	(c)		suggested factor e.g. *h* measured too small ✓ explain why it gives *g* too low e.g. *t* too long due to not stopping watch soon enough ✓	2	3.1a	

Question			Answer	Marks	AO element	Guidance
4	(a)		Graph is linear up to 10 s (i.e. constant speed)/no longer straight line after 10 s ✓ Gradient then (continually) decreases, i.e. decelerating ✓	2	1.2	
	(b)		Initial velocity = 50 m ÷ 10 s = 5 m/s ✓ Tangent drawn at 16 s ✓ Gradient of tangent found = final velocity ≈ 2.0 m/s ✓ $a = (v\text{-}u)/t$ = 3 m/s ÷ 6 s = 0.5 (m/s^2)✓	4	2.2	Maximum of 2 marks can be awarded if there is no tangent drawn **ALLOW** 1.4 m/s to 2.6 m/s **ECF** own values
	(c)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE.** **If answer = 0.36 (m/s^2) award 3 marks** *Select:* $v^2\text{-}\,u^2 = 2as$ $\Rightarrow$ (7.0 m/s)^2- (1.0 m/s)^2 = 2a× 66 m ✓ a = (48 m^2/s^2) ÷ 132 m ✓ = 0.36 (m/s^2) ✓	3	2.1	
		(ii)	Average speed = (1 m/s + 7 m/s) ÷ 2 = distance/time 4 m/s = 66 m/time $\Rightarrow$ time = 66m ÷ 4 m/s = 16.5 (s) ✓ Curve starts at (0,4) and passes through/ends at (66, 16.5) ✓ Smooth concave curve ✓	3	2.2	**ECF** own time

Question			Answer	Marks	AO element	Guidance
5	(a)		The professor can see a correlation between distance and temperature but doesn't think distance is the cause. ✓ **Any three from** Combining density and % CO_2 data ✓ Venus has much more CO_2 than Earth ✓ Earth is warmed by greenhouse effect; Mars hardly if at all; Venus has larger/greater greenhouse effect ✓ Sun's radiation gets weaker as you get further from Sun ✓ So would expect Venus to be hottest and Mars coolest ✓	4	3.1b	1st mark for an explanation of the professor's statement
	(b)		Graph shows (rapid) increase in CO_2 ✓ Human activity increased (around this time) / industrial revolution/more factories / population increase ✓ Hence correlation ✓ Use of fossil fuels / deforestation (produces CO_2) ✓	4	3.2b 1.1 3.2b 1.1	**DO NOT ALLOW** increase before 1750 **IGNORE** named examples of human / industrial activity e.g. more cars / more technology Must have described graph AND history of human activity for this mark **IGNORE** breathing out CO_2

SPECIMEN

Question			Answer	Marks	AO element	Guidance
6	(a)		**FIRST CHECK THE ANSWER ON ANSWER LINE.** **If answer = 0.0044 m $\approx$ 4 mm award 3 marks** Recall and rearrange $F=kx \Rightarrow x=F \div k$ ✓ = 0.14 m ÷ 32 N/m ✓ = 0.0044 m $\approx$ 4 mm ✓	3	2.1	1st mark can be for algebraic rearrangement or for direct substitution and arithmetical rearrangement **DO NOT ALLOW** 4 mm without evaluation shown to more precision
	(b)		Arrow vertically downwards ✓	1	1.1	
	(c)		Need to combine both ideas Steeper angle means sideways velocity smaller ✓ So does not go far sideways before hits ground ✓ Shallower angle means travelling closer to ground ✓ So hits ground sooner than it would with a flight angled upwards ✓ Therefore an intermediate angle of 45 degrees provides the greatest range ✓	5 2.1 3.1b 2.1 3.1b 3.2b		Do not expect vocabulary of component, but needs to recognise it has a lot of 'up' but not much 'sideways' Again do not expect 'component' but needs to recognises it has a lot of 'sideways' but not much 'up'

Question			Answer	Marks	AO element	Guidance
7	(a)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE.** **If answer = 240 (kPa) award 3 marks** Select: $P_1V_1=P_2V_2$ ✓ P × 50 cm^3 = 100 kPa × 120 cm^3 ✓ P = 100 kPa × 120 cm^3 ÷ 50 cm^3 = 240 (kPa) ✓	3	 1.1 2.2 2.2	
		(ii)	particles have less space, so hit the walls more often ✓ more momentum change per second (per unit area) ✓ $\Rightarrow$ greater force $\Rightarrow$ greater pressure ✓	3	1.1	
		(iii)	No temperature change ✓ Work is done in pushing the piston in ✓ Increase internal energy of gas, so temperature rises ✓ Slow change allows gas to cool back as energy is transferred to environment ✓	4	1.2	**ALLOW** idea of 'heat leaking out'

Question			Answer	Marks	AO element	Guidance
	(b*)		*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)** Describes the current solar system with minor omissions (e.g. all planets orbit in same direction) and clearly explains gravity's role in creating both the Sun and the planets. Changes in the early Sun resulting in nuclear fusion clearly described. *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)** Describes the current solar system with minor omissions (e.g. all planets orbit in same direction) and clearly explains gravity's role in creating the Sun. Pressure/volume changes in the early Sun resulting described but nuclear fusion not explained in terms of nuclei. *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)** Describes major features of the current solar system (Sun, planets and moons). The role of gravity not clearly explained. Nuclear fusion may be named as creating energy, but not described in terms of nuclei joining together. *The information is basic and communicated in an unstructured way. The information is supported by limited*	6	1.1 x2 2.1 x4	**AO2.1 Description of current solar system** For example - Sun is a star - at centre of solar system - planets orbit Sun - in same direction - moons orbit many planets - minor planets/asteroids comets also orbit Sun **AO1.1 Role of gravity** For example - gas/dust cloud is swirling around - all parts of gas /dust cloud attract all other parts - most of gas /dust cloud collapses inwards - some parts of gas/dust cloud collapse further out to form planets - planets continue to orbit the Sun - held in place by Sun's gravity **AO2.1 Role of interactions in early Sun** For example - gas/dust collapses into smaller and smaller volume - pressure and temperature increase - atoms are close enough and hot enough for nuclei to join in fusion - fusion reaction releases energy

			evidence and the relationship to the evidence may not be clear. **0 marks** No response or no response worthy of credit.			

Question			Answer	Marks	AO element	Guidance
8	(a)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE.** **If answer = 2599 (J) award 3 marks**	6		Award 1 marks for correctly recalling 3 equations.
			Recall equations: PE gained = mgh			
			electrical power = IV			
			electrical working = Pt ✓		1.1	
			PE = 25 kg × 10 N/kg × 1.7 m = 425 J ✓		2.1	
			Electrical power = 5.6 A × 12 V = 67.2 W ✓		2.1	
			electrical working = 67.2 W ×45 s = 3024 J ✓		2.1	
			Increase in internal energy of motor = 3024 J – 425 J ✓ = 2599 J = 2600 (J) ✓		1.1 1.1	
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE.** **If answer = 425 (J) award 2 marks.**	3		
			Recall Work done = force x distance ✓		1.1	
			= 250 (N) x 1.7 (m) ✓		2.1	
			= 425 (J) ✓		2.1	
	(b)		The turning motor acts ……✓	2	1.1	
			Current heats the coils ……✓		2.2	

Question			Answer	Marks	AO element	Guidance
9	(a)		$^{218}_{84}Po$ ✓ $^{4}_{2}He$ ✓	2	2.2	
	(b)		Radon (dense so) trapped in mines/lungs ✓ Contamination by alpha emitter results in more tissue damage as alpha more ionising ✓	2	2.2	

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