OCR
Oxford Cambridge and RSA

H

…day June 20XX – Morning/Afternoon

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

J249/04 Paper 4 (Higher Tier)

SAMPLE MARK SCHEME

Duration: 1 hour 45 minutes

MAXIMUM MARK 90

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 Physics A:

	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	C	1	2.1	
2	B	1	2.1	
3	C	1	1.2	
4	C	1	1.1	
5	A	1	1.1	
6	C	1	2.1	
7	B	1	1.1	
8	C	1	1.1	
9	D	1	2.1	
10	C	1	1.1	
11	D	1	1.1	
12	D	1	1.2	
13	B	1	2.1	
14	B	1	2.1	
15	C	1	2.1	

SECTION B

Question			Answer	Marks	AO element	Guidance
16	(a)		Arms move at 90^0 to wave direction / **AW** (1)	**1**	**2.1**	E.g. arms move at right angles to the wave (1)
	(b)	**(i)**	2 waves pass the same point (1) each second (1)	**2**	**2 x 1.1**	
		(ii)	Use of velocity = frequency x wavelength / 2 x 2 (1) 4 m/s (1) 12/4 = 3 s (1)	**3**	**1.2** **2.1** **2.1**	**ALLOW** use of speed = distance/time to calculate final answer
	(c)		Any one from: Reflections return at different times / **AW** speed of ultrasound is known / **AW** (1) **AND** Times indicate depth (of tissue boundaries) / **AW** (1) Depth can be calculated by speed x time (1)	**3**	 **1.1** **2 x 2.1**	
	(d)		1^{st} column: shows up soft tissues / **AW** (1) 2^{nd} column: pregnancy scans / **AW** (1) 3^{rd} column: mutations / damage to DNA (1)	**3**	**1.1** **2.2** **1.1**	 **ALLOW** other uses of scans e.g. scanning tissues other than bones (1) **ALLOW** cancer (1)

Question			Answer	Marks	AO element	Guidance
17	(a)		Re-arrange and substitute into WD = F x D: 217 000 / 6 500 (1) 33.4 (m) (1)	2	2 x 2.1	
	(b)		Reduce the friction between the car and track/lubrication (1) Make the shape of the car more streamlined to reduce drag (1)	2	2 x 3.3b	
18	(a)		Any one from: Gamma can get out of body / least amount of time to do damage to the body / reasonable half-life (1)	1	3.1b	
	(b)		Any two from: Alpha has short range (1) Highest ionising power (1) Longer half-life than D (1)	2	2 x 3.1b	
	(c)		To check the activity / intensity / strength of the isotope (1) Idea that the activity will be continually falling so needs to be monitored (1)	2	2 x 2.2	

Question			Answer	Marks	AO element	Guidance
19*			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)** **Interpretation of the diagram and how it provides evidence for an expanding universe and the Big Bang model** *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)** **Description of red shift AND recognition of what the red shift diagram indicates relating to the Big Bang model** *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 description of the Big Bang model OR redshift** *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*.	**6**	**3 x 3.2b** **3 x 1.1**	**AO3.2b: Analyse the diagram to conclude how it provides evidence for an expanding universe and the Big Bang model** • The further away a galaxy is the more red shifted it is indicating an expanding universe • If galaxies are moving away then the universe must be expanding • If whole universe is expanding then it must have started from a certain point – the singular point where the Big Bang occurred • More distant galaxies are more red shifted than stars that are closer • Distant galaxies show the lines moving towards the red end of the spectrum • Dark bands are moving towards the red end of the spectrum **AO1.1: Description of evidence linking red shift to the Big Bang model** • Red shift is caused by a change in frequency/wavelength of light • Description of the changes in frequency and wavelength of light from distant galaxies • Red shift shows galaxies moving away.

Question			Answer	Marks	AO element	Guidance
20	(a)		28 (1)	1	3.1a	
	(b)		(Student B is only) 50% efficient / AW (1) And any one from: (Student A) red is 76% efficient (1) Blue is 61% efficient (1) White is 85% efficient (1)	2	2 x 3.1b	
	(c)		Idea there is fixed energy in system/can't be (more than) 100% efficient (1) Idea that extra energy is heeded for this to happen (1)	2	1.1 2.2	
21	(a)		Energy for oil is 672 000 (J) (1) Energy for water is 1 680 000 (J) (1) Recall P=E/t (1) Calculation to show: 672 000 / 400 = 1680 AND 1680000 / 1000 = 1680 (1)	4	2.2 2.2 1.1 2.1	
	(b)		Half of the (previously) wasted power or energy / 0.5 kW is being used to heat water (1) Less energy needed from other sources to heat water (1) Fire X is (4/5 x 100% =) 80% efficient (1) Fire Y is (4.5/5 x 100% =) 90% efficient (1)	4	2.2 2.2 1.2 1.2	**ALLOW** some energy from fire now used to heat water scores (1)

Question			Answer	Marks	AO element	Guidance
22	(a)		Any two features from: Polar orbit travels over both poles (1) Travels faster than a geostationary satellite (1) Multiple orbits in a day (1) Lower orbit than geostationary satellites(1) Any one use from: Mapping/weather/surveillance (1)	3	3 x 1.1	
	(b)	(i)	Velocity is speed in a given / known direction / straight line (1) Direction continuously changing (1)	2	2 x 1.1	**ALLOW** higher level answers e.g. changing velocity denotes acceleration (1) Always accelerating to the centre (1)
		(ii)	Higher orbit (1) Less (force of) gravity / acceleration (1)	2	2 x 1.1	

Question			Answer	Marks	AO element	Guidance
23	(a)		Fewer coils in the secondary coil (1) Means it induces less potential difference in secondary coil (1) More current induced as power in constant (1)	3	3 x 1.1	
	(b)		$\frac{230}{27600} = \frac{12}{X}$ (1) **OR** $\frac{230 \times 12}{27600}$ / **AW** (1) 1 440 (turns) (1)	2	1.2 2.1	
	(c)	(i)	Simple use of P = V x I / idea of ratios using transformer equations (1) Current reduced by 16 times (1)	2	1.2 2.1	**ALLOW** current reduced (1)
		(ii)	Very large decrease in power loss (1) Power loss is related to the square of the current / **AW** (1)	2	3.1b 2.1	

Question			Answer	Marks	AO element	Guidance
24	(a)		Distance doubles count rate is 4 x less / count rate is inversely proportional to the square of the distance / as distance triples activity is 9 x less / **AW** (2)	**2**	**2 x 3.1b**	**ALLOW** distance doubles count rate per minute is reduced by more than half (1)
	(b)		If the pattern was followed, 160 cm (ideally) should be 4 / 320 cm (ideally) should be 1 (1) Radiation / activity is random (1) Randomness is amplified at low readings / **AW** (1)	**3**	**3.2a** **3.2b** **3.2b**	
	(c)		Any four from: 4 days between treatments allows healthy cells to be repaired or replaced (1) Size of dose related to the mass of the patient / age of patient / size of tumour / nature of tumour (1) Rotation of source reduces damage to healthy cells (1) BUT rotation of source reduces damage to healthy as time of exposure is shorter (1) Patient remaining still will reduce the damage to healthy cells (1)	**4**	**4 x 2.2**	

Q	esti	n	Answer	Marks	AO element
25	(a)		<table><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td>(32)</td><td>24</td><td>**96** (1)</td><td>**120** (1)</td></tr></table>	**2**	**1.2** **3.1b**
	(b)		Correct reference or attempt to use area under sloping part of graph (1) $\frac{8 \times 1.5}{2} = 6$ (1)	**2**	**2 x 1.2**
	(c)		KE formula re-arranged and numbers substituted correctly / $\sqrt{30\,000}/ (0.5 \times 1\,000)$ (1) 7.75 (m/s) (1)	**2**	**2 x 2.1**
	(d)		Lorry has more KE than a car at the same velocity (1) More absorption of energy by larger brake discs (1) Higher rate of dissipation of energy to surrounding air (1) Brakes less likely to overheat (1)	**4**	**4 x 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 10- There has been a change to the question paper. Correct sentence is: "Its wavelength in air is shorter than in water" instead of "Its wavelength in air is longer than in water instead of shorter"