OCR
Oxford Cambridge and RSA

GCSE (9-1)

Physics B (Twenty First Century)

Unit **J259F/01**: Foundation Tier – Breadth in physics

General Certificate of Secondary Education

Mark Scheme for June 2018

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

© OCR 2018

Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
BOD	Benefit of doubt given
CON	Contradiction
RE	Rounding error
SF	Error in number of significant figures
ECF	Error carried forward
L1	Level 1
L2	Level 2
L3	Level 3
NBOD	Benefit of doubt not given
SEEN	Noted but no credit given
I	Ignore

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
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

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:

	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)		longitudinal ✓	1	1.1	**electromagnetic** **(longitudinal)** **radio** **transverse**
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 336 (m/s) award 2 marks** 0.84 × 400 ✓ = 336 (m/s) ✓	2	2.1 x2	**ALLOW** 340 (m/s)

Question			Answer	Marks	AO element	Guidance
2	(a)	(i)	<table><tr><th>Wire</th><th>Connected to National Grid</th><th>Is at the same voltage as the ground</th></tr><tr><td>Live</td><td>✓</td><td></td></tr><tr><td>Neutral</td><td>✓</td><td></td></tr><tr><td>Earth</td><td></td><td>✓</td></tr></table>	2	1.1 x2	all 3 correct gets 2 marks. 2 correct gets 1 mark. No marks if only one correct.
		(ii)	230 V ✓	1	1.1	**0 V** **12 V** **(230 V)** **25000 V**
	(b)		<table><tr><th></th><th>True only for d.c</th><th>True only for a.c</th><th>True for both</th></tr><tr><td>Current always flows in the same direction.</td><td>✓</td><td></td><td></td></tr><tr><td>The domestic supply in the UK uses this.</td><td></td><td>✓</td><td></td></tr></table>	2	1.1 x2	

Question			Answer	Marks	AO element	Guidance
3	(a)		1.2 m/s ✓	1	1.1	0.12 m/s **(1.2 m/s)** 12 m/s 120 m/s
	(b)		$\frac{36 \times 1000}{3600}$ ✓	1	2.1	$\frac{36\times60}{1000}$ $\frac{36\times1000}{60}$ $\frac{36\times3600}{1000}$ **$\frac{36\times1000}{3600}$**
	(c)	(i)	<table><tr><th></th><th>A</th><th>B</th><th>C</th><th>D</th></tr><tr><td>In which section does Sam have an average speed of 3.5 m/s?</td><td>✓</td><td></td><td></td><td></td></tr><tr><td>In which section does Sam slow down?</td><td></td><td></td><td>✓</td><td></td></tr></table>	2	2.2 1.2	
	(c)	(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.7 (m/s^2) award 3 marks** Reading off the graph: change in speed = (7 (m/s) – 0) ✓ 7(m/s) ÷ 10 (s) ✓ = 0.7 (m/s^2) ✓	3	1.2 2.1 2.1	**ALLOW** just 7 and/or just 10 for first marking point. **ALLOW** use of any data points from section A of graph eg 3.5 ÷ 5.

Question			Answer	Marks	AO element	Guidance
4			**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 230 (N) award 3 marks** Recall: weight = mass × gravitational field strength ✓ = 23 (kg) × 10 (N/kg) ✓ = 230 (N) ✓	3	1.2 2.1 2.1	

Question			Answer	Marks	AO element	Guidance
5	(a)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 400 (N m) award 3 marks**	3		
			Recall: moment = force × distance ✓		**1.2**	
			200 (N) × 2(.0) (m) ✓		**2.1**	
			400 (N m) ✓		**2.1**	
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1.6 (m) award 3 marks**	3		**ECF** incorrect answer to (a) or term for moment.
			Moment of Max's weight (about pivot) = 400 (N m) ✓		**1.2**	
			250 (N) × *d* = 400 (N m) ⇒ *d* = 400 (N m) ÷ 250 (N) ✓		**2.1**	**ALLOW** ratio method eg, 250 ÷ 200 = 2 ÷ d
			= 1.6 (m) ✓		**2.1**	

Question			Answer	Marks	AO element	Guidance
6	(a)		Ray from bulb continues in straight line to touch mirror ✓ Reflected ray is straight line from point of reflection to face (anywhere between eye and chin) ✓	2	1.2 2.2	Must be a solid line.
	(b)	(i)	water from the bath evaporates / changes to gas ✓ water / steam then condenses / changes back to liquid when it touches the mirror ✓	2	1.1 x2	**ALLOW** water changes to steam.
		(ii)	the light is scattered / reflected / refracted by water droplets ✓ all colours / all the light from light bulb / in all directions / diffuse /specular ✓	2	1.1 x2	

Question			Answer	Marks	AO element	Guidance
7	(a)	(i)	0.05 m ✓	1	1.2	**0.05 m** **0.15 m** **0.25 m** **0.35 m**
	(a)	(ii)	Recall and rearrange: spring constant = force ÷ extension ✓ = 20 ÷ 0.050 ✓ = 400 (N) ✓	3	1.2 2.1 2.1	**ALLOW ECF** from (a)(i) for first two marking points. **ALLOW** reverse argument. Must equal 400 (N) as this is 'show that'.
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.5 (J) award 3 marks** **EITHER:** select: ½ $k x^2$ ✓ energy stored = $0.5 \times 400 \times 0.050^2$ ✓ = 0.5 (J) ✓ **OR** Select: select: ½ $F x$ ✓ energy stored = $0.5 \times 20 \times 0.050$ ✓ = 0.5 (J) ✓	3	1.2 2.1 2.1	**ALLOW ECF** from extension value in (a)(i)
	(c)		(directly) proportional ✓	1	3.1a	**ALLOW** linear **ALLOW** doubling the force doubles the extension.
	(d)		**ANY 3 OF:** elastic (potential) energy (stored in spring) ✓ transfer to kinetic energy store as spring moves /oscillates ✓ transfer to gravitational energy store as spring oscillates / moves up ✓ energy dissipated as thermal energy store in spring / air/ surroundings ✓ energy is transferred, or work is done by friction /air resistance ✓	3	1.1 x3	

Question			Answer	Marks	AO element	Guidance
8	(a)	(i)	95 ✓	1	1.1	**(95)** 241 241 + 95 241 - 95
	(a)	(ii)	241 - 95 ✓	1	1.1	95 241 241 + 95 **(241 - 95)**
	(b)	(i)	**EITHER**: Paper blocked (most of) the radiation / reduces count rate ✓ Alpha radiation is stopped by paper / Beta radiation passes through paper.✓ **OR** There is no difference in count rate between paper and aluminium. ✓ Beta radiation would be stopped by aluminium. ✓	2	3.1b x2	
	(b)	(ii)	Use lead (as blocking material) ✓ gamma radiation is absorbed by lead ✓	2	3.3a x2	
	(c)		**EITHER** (It is not dangerous because) Alpha radiation is not penetrating ✓ So is absorbed/ stopped by case of smoke alarm ✓ **OR** (It is not dangerous because) The amount of (gamma) radiation is very small / gamma is not very ionising ✓ So people in houses will absorb very little gamma radiation ✓	2	3.1b x2	

Question			Answer	Marks	AO element	Guidance
9	(a)	(i)	correct symbol (circle containing V) connected in parallel with component Y ✓	1	2.2	
		(ii)	variable resistor / change resistance ✓ increase resistance to decrease current / ORA ✓	2	2.1 x2	
	(b)	(i)	**FIRST CHECK THE ANSWER IN TABLE** **If answer = 3.77 (Ω) award 4 marks** Recall and rearrange: $R = V/I$ ✓ 6.0 / 1.59 ✓ 3.77 (Ω) (ignore s.f.) ✓ correct rounding to s.f. ✓	4	 1.2 2.1 2.1 1.2	
		(ii)	as current increases, resistance increases ✓	1	3.1a	**ALLOW** positive correlation.
		(iii)	(filament) lamp / bulb / heating element / fuse ✓ resistance increases as it heats up ✓	2	3.2b x2	.

Question			Answer	Marks	AO element	Guidance
10	(a)	(i)	A ✓ ✓ B C	1	1.1	
		(ii)	A ✓ B ✓ ✓ C	1	1.1	Both ticks required for the mark.
	(b)		**EITHER** bar magnet is permanent / does not lose magnetism / stays magnetic **OR** iron bar is induced magnet / will lose magnetism / will not stay magnetic ✓	1	1.1	**ALLOW:** Iron bar in only magnetic / picks up paper clips when the magnet is there.
	(c)		*A compass will always point towards…..* True: ; False: ✓ *The Earth's magnetic north pole is the same…..* True: ; False: ✓ *The core of the Earth is magnetic…..* True: ✓ ; False: *The compass points down because the surface…..* True: ; False: ✓	2	1.1 2.1 1.1 2.1	All 4 correct = 2 marks 2 or 3 correct = 1 mark 1 correct = 0 mark

Question			Answer	Marks	AO element	Guidance
11	(a)		**MAX 3 in total:** **MAX 2 similarities:** temperature increases (as time increases) / both graphs go up ✓ both graphs level off/increase less rapidly as time goes on ✓ **MAX 2 differences:** black goes up quicker / graph is steeper (or reverse argument) ✓ black reaches higher temperature / silver reaches a lower temperature ✓ silver starts at lower temperature / black starts at a higher temperature ✓	3	3.1a x3	**ALLOW** they both get hotter **ALLOW** black has a higher temp / silver has a lower temperature as one difference (instead of one of the latter two, but not both) **IGNORE** any attempt at explanation in this part.
	(b)		**EITHER** black absorbs more radiation/light/infrared than silver ORA ✓ **OR** silver reflects more radiation/light/infrared than black ORA ✓ so more <u>energy</u> transferred to black thermometer ORA ✓	2	1.1 x2	**ALLOW** heat
	(c)		**EITHER** distance from lamp / intensity of radiation or light is not controlled / the same ✓ method to control this e.g. measure distance / use ruler / clamp thermometers, AW ✓ **OR** initial temperature is not controlled / not the same ✓ method to control this e.g. use separate timers for each thermometer and start them at a specified temperature ✓	2	3.3b x2	**ALLOW** Any valid weakness for first mark and any reasonable method for second mark.

Question			Answer	Marks	AO element	Guidance
12	(a)		**Any two from:** planets are not all made of rock / some are made of gas ✓ planets do not orbit in perfect circles / in ellipses ✓ not all planets have moons (e.g. Venus, Mercury) ✓ moons not all rocky/may be icy (e.g. Enceladus) [even though they may all have rocky cores] ✓	**2**	**1.1 x2**	**ALLOW** specific correct examples, e.g. Jupiter not made of rock / made of gas, Venus does not have a moon, Saturn has moon(s) of ice **ALLOW** a correctly identified statement quoted or identified from the report If more than two examples given apply list rule **IGNORE** attempts to qualify a correctly identified statement with an incorrect example
	(b)		dust and gas ✓ pulled together by gravity ✓	**2**	**1.1 x2**	**ALLOW** dust / gas / matter / nebula Only give credit for responses that describe the formation of the solar system
	(c)		mass is converted into energy (of radiation) ✓	**1**	**1.1**	e.g. quoting $E = mc^2$ **ALLOW** mass is lost in the form of energy **ALLOW** mass is transferred/turned into energy

Question			Answer	Marks	AO element	Guidance
13	(a)		(transferred by) electric current / electrically / electrical working ✓	1	1.1	**ALLOW** by a flow of electrons / current / electricity / **IGNORE** references to National Grid / wires /cables /transformers
	(b)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 864 (J) award 3 marks** recall **and** rearrange equation: energy = p.d. × charge ✓ substitution 2 × 1.2 × 360 ✓ = 864 (J) ✓	3	 1.2 2.1 2.1	 Equations used to calculate energy must have energy as the subject (accept W for E). **ALLOW** E= ItV **and** Q = It / E = Pt **and** P = VI and Q = It / 360 x 1.2 seen Correct substitutions gain m.p 1 also **DO NOT ALLOW** bald '86400' or '1728' or '432'. Credit can only be given for working
	(b)	(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 3.0 (A) award 4 marks** Recall **and** rearrange: current = charge / time ✓ Convert 2 minutes = 120 s ✓ = 360 / 120 ✓ = 3.0 (A) ✓	4	 1.2 2.1 2.1 2.1	 **ALLOW** 3 marks for 180 (unit conversion omitted) **ALLOW** '3 (A)'

Question			Answer	Marks	AO element	Guidance
14	(a)		**FIRST CHECK THE ANSWER** **If answer = 720 000 (J) award 2 marks** substitution 4.5 × 1600 × (120-20) ✓ = 720 000 (J) ✓	**2**	 **2.1** **2.1**	 **ALLOW** 20 or 120 for ΔT to give 144 000 or 864 000 Does not need comparison with 700 000 for the mark
	(b)	**(i)**	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 480 (s) award 3 marks** recall **and** rearrange: time = energy / power ✓ substitution 720 000 / 1500 ✓ = 480 (s) ✓	**3**	 **1.2** **2.1** **2.1**	**ECF** (a) or energy = 700 000 (J) **ALLOW** for 2 marks '48' or '4800' as a transcription error.
		(ii)	energy transferred to the metal radiator / in the wires ✓	**1**	**1.1**	**ALLOW** 'energy is lost to the surroundings' **IGNORE** it heats up the room / ignore efficiency arguments **DO NOT ALLOW** 'loss' on its own

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553

© OCR 2018