Higher

GCSE

Combined Science Physics A Gateway Science

J250/11: Paper 11 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2024

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.

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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.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM 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 available in RM Assessor.
3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

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 RM Assessor 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 RM Assessor messaging system.
5. **Crossed Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

Rubric Error Responses – Optional Questions

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple Choice Question Responses

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).
When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only one mark per response)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth two or more marks)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

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 the annotation SEEN to confirm that the work has been seen.

7. Award No Response (NR) if:

   - there is nothing written in the answer space

   Award Zero '0' if:

   - anything is written in the answer space and is not worthy of credit (this includes text and symbols).

   Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM Assessor **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 RM Assessor 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 on this paper is **12**.

11. 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

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) Combined Science 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.

For answers to Section A if an answer box is blank ALLOW correct indication of answer e.g., circled or underlined.

Question	Answer	Marks	AO element	Guidance
1	B	1	1.1	
2	D	1	1.1	
3	B	1	1.1	
4	C	1	1.1	
5	B	1	1.2	
6	A	1	1.1	
7	C	1	2.1	
8	D	1	2.1	
9	A	1	2.1	
10	A	1	2.1	**ALLOW** 0.3 (m)

Question			Answer	Marks	AO element	Guidance
11	(a)	(i)	**First check the answer on the answer line** **If answer = 30 000 (J) award 3 marks**	**3**		
			(W =) Fs selected ✓		**1.2**	**ALLOW** (W=) F x d / (work=) force x distance **ALLOW** 600 x 0.20 for 1 mark
			(W =) 600 × 0.20 × 250 ✓		**2.1**	**ALLOW** 120 for 2 marks
			(W =) 30 000 (J) ✓		**2.1**	
	(b)		**First check the answer on the answer line** **If answer = 0.15 (kW) award 3 marks**	**3**		
			(P =) 36 000 ÷ 240 ✓		**2.1**	
			(P =) 150 (W) ✓		**2.1**	
			(P =) 0.15 (kW) ✓		**1.2**	**ALLOW** 1.5 x 10^{-1} (kW) **ALLOW** incorrect answer given in W correctly converted to kW e.g. 30 converted to 0.03 **ALLOW** 1.5 x 10^{n} as the final answer for 2 marks

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>11</td><td>(c)</td><td></td><td>Any three from:

Measure height (of step) using a metre rule / tape measure / ruler ✓

Count number of steps ✓

Measure weight using a (weighing) scales / balance ✓

Measure time using a stopwatch ✓</td><td>3</td><td>3 × 3.3a</td><td>ALLOW stairs for steps throughout

IGNORE measure height/distance using a trundle wheel

ALLOW (use a set) amount of steps / see how many steps

ALLOW measure weight using a newton meter / measure mass using scales/balance and multiply by g/10

ALLOW measure time using a timer / stop clock

If no other marks scored:
ALLOW two different pieces of equipment to measure two different quantities for 1 mark e.g. use a metre rule and a stopwatch</td></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td><table><tr><th></th><th>Yes</th><th>No</th></tr><tr><td>Precise</td><td>✓</td><td></td></tr><tr><td>Repeatable</td><td>✓</td><td></td></tr></table>✓</td><td>1</td><td>3.2a</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Precise because results are close together / small range ✓

Repeatable because (same person) repeats the experiment/the method/the investigation/using same equipment giving similar results ✓</td><td>2</td><td>2 × 3.2a</td><td>ALLOW results are similar / every test comes out roughly the same / low range / range of 3

ALLOW correct descriptions of precise and repeatable without linking to terms precise or repeatable for 1 mark e.g. the results have a small range because the same person repeats the investigation</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
			If only detailed description about acceleration or about forces, then mark capped at L2 and 3 marks.			
12	*		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)** Detailed description of motion including change in acceleration **AND** Detailed description of forces and resultant force on the block *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)** Basic description of motion in terms of velocity **AND** Detailed description of forces acting on block **OR** Detailed description of motion including change in acceleration **AND** Basic description of forces acting on block *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.*	6	**2 x 2.2** **2 × 3.2a** **2 × 3.2b**	Please refer to the appendix for more guidance on interpreting the graph **AO2.2 Applies knowledge and understanding of velocity-time graphs** • Gradient gives acceleration • No acceleration/constant velocity AB EF • Acceleration increasing BC • (Constant) acceleration CD • Acceleration decreasing DE • (Constant) deceleration FG • Not moving/stationary/zero velocity G **AO3 Analyses information and ideas to interpret the graph and draw conclusions about forces** • Downward force is constant • Upward force = downward force AB EF • Upward force increasing BC • Upward force larger than downward force CD • Upward force decreasing DE • Upward force smaller than downward force FG • Resultant force zero AB EF • Resultant force increasing BC • Resultant force upwards constant CD • Resultant force decreasing DE • Resultant force downwards constant FG

			Level 1 (1–2 marks) Basic description of motion in terms of velocity **OR** Basic description of forces acting on block *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.*			**ALLOW** 'weight' for 'downward force' and 'tension' for 'upward force and 'speed' for 'velocity'

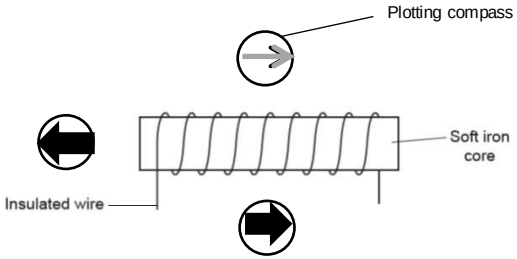
Question			Answer	Marks	AO element	Guidance
13	(a)		To obtain repeat readings / to vary the p.d. <u>across the</u> (fixed) <u>resistor</u> / to vary the current ✓	1	1.2	**ALLOW** to control/increase/decrease/change current **IGNORE** to control/increase/decrease/change resistance **DO NOT ALLOW** to measure current/resistance **DO NOT ALLOW** to make sure current flows in one direction / to stop backflow of current / to make sure current is the same in each part of the circuit / to change the direction of the current / to slow down the current / to allow current to flow
	(b)		In series / charge must flow through (M1) ✓	1	1.2	**ALLOW** cannot be parallel / so charge/current can flow **IGNORE** measuring current / is only connected on a wire / cannot be a voltmeter
	(c)		Have a high resistance ✓	1	2.2	**IGNORE** no current / no charge flow / voltmeters must be in parallel / voltmeters measure p.d. **DO NOT ALLOW** cancel outs the current / splits the current / ammeter needed as it produces current / voltmeter increases p.d.

Question			Answer	Marks	AO element	Guidance
13	(d)	(i)	**First check the answer on the answer line** **If answer = 15 (Ω) award 4 marks**	4		
			From graph: V = 6 (V) and I = 0.4 (A) ✓		2.2	**ALLOW** use of any point on the graph / any pair of correct values from graph seen even if calculation is incorrect e.g. 0.2 ÷ 3 / 0.4 ÷ 6 / 0.4 x 6 / 0.13 ÷ 2
			(R =) V ÷ I ✓		1.2	
			(R =) 6 ÷ 0.4 ✓		2.1	
			(R =) 15 (Ω) ✓		2.1	**ALLOW** correct values from the graph e.g. 2 ÷ 0.13 = 15.38 (Ω) for 4 marks
		(ii)	Stays the same ✓	1	1.2	**ALLOW** any indication of the correct answer if answer line is blank e.g. circling 'stays the same'

Question			Answer	Marks	AO element	Guidance
14	(a)	(i)	**First check the answer on the answer line** **If answer = 13 000 (J) award 3 marks**	**3**		
			(E =) 0.2 × 4200 × (30 – 14) ✓		**2.1**	**ALLOW** (E=) 0.2 × 4200 × 16
			(F =) 13 440 (J) ✓		**2.1**	**ALLOW** 13440 as final answer for 2 marks
			(F =) 13 000 (J) (to 2 sf) ✓		**1.2**	**ALLOW** 13 kJ for 3 marks **IGNORE** – sign e.g. - 13 000 (J) is 3 marks **ALLOW** correct conversion of a calculated number to 2 sf e.g. 14446 to 14 000
		(ii)	**First check the answer on the answer line** **If answer = 320 000 (J / kg) award 3 marks**	**3**		
			(*l* =) E ÷ m ✓		**1.2**	**ALLOW** (specific latent heat =) (thermal) energy (for a change in state) ÷ mass **IGNORE** E = m*l*
			(*l* =) (15 000 – 12 600) ÷ 0.0075 ✓		**2.1**	**ALLOW** (*l* =) 2400 ÷ 0.0075 for 2 marks
			(*l* =) 320 000 (J / kg) ✓		**2.1**	

Question			Answer	Marks	AO element	Guidance
14	(a)	(iii)	**Any one from:** The mass of the ice that melts will not be accurate / is too small ✓ The mass of water at the start is not accurate / is too large ✓ The (starting/final) temperature of the water is not accurate / starting temperature is too low / final temperature is too high ✓	1	2.2	**ALLOW** excess water would increase the mass (of water) / so there is no excess water to increases the mass (of water) / to make sure no water is on the ice to increase the mass (of water)

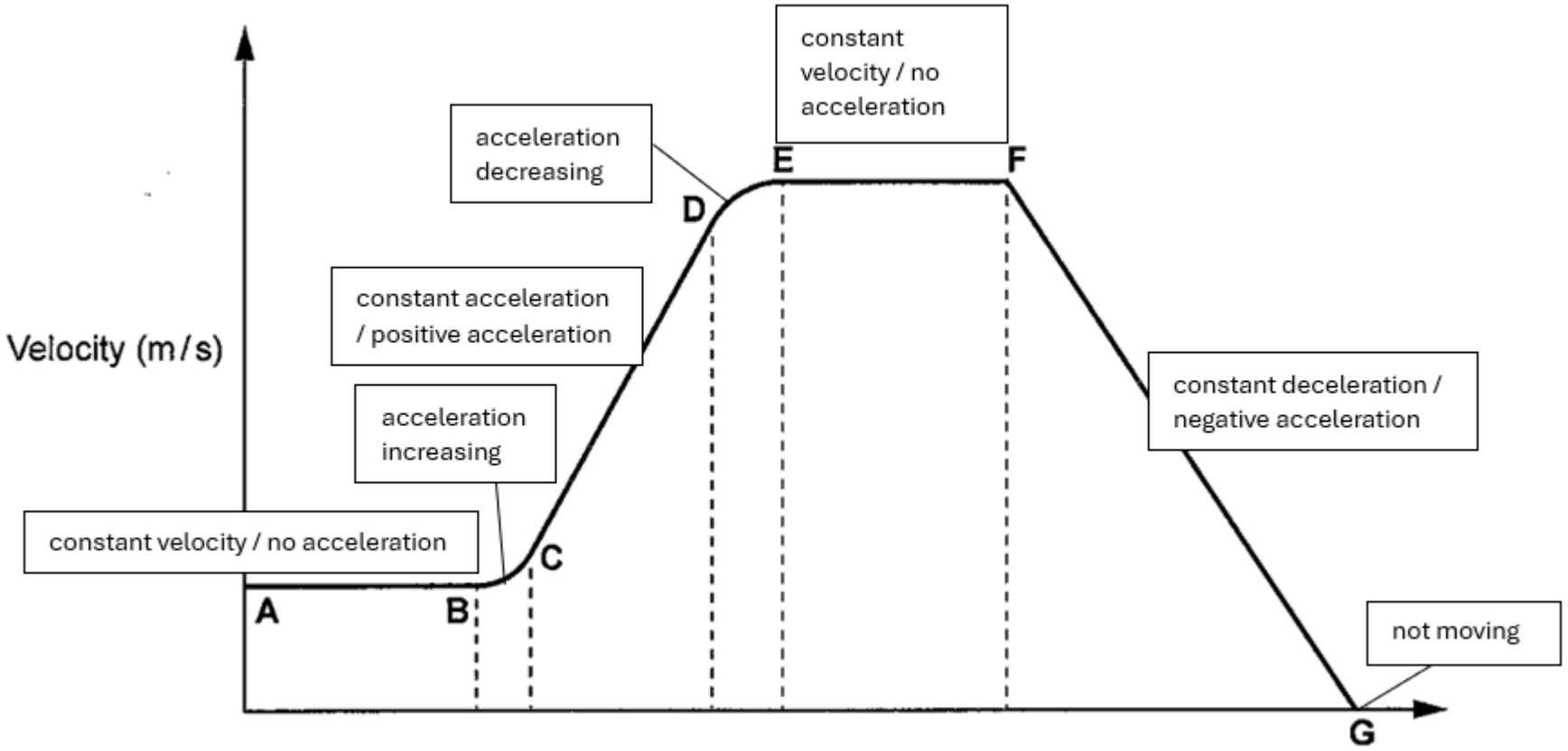
Question			Answer	Marks	AO element	Guidance
14	(b)		SHC is the energy needed to raise the temperature of (1kg of) a substance by 1 degree (C or K) ✓ SLH is the energy needed to change the state of (1kg of) a substance ✓	2	2 × 1.1	**ALLOW** energy (per kilogram) to raise the temperature by 1 degree (C or K) **ALLOW** specific examples of change from one state to another e.g. SLH is the energy needed to change a substance from solid to liquid **ALLOW** SHC is for change of temperature but SLH is for change of state for a maximum 1 mark **ALLOW** heat for energy **IGNORE** equations / units
	(c)	(i)	Ice floats / ice is less dense than water / not all ice is submerged / **AW** ✓	1	1.2	**ALLOW** ice melts (in water so mass and/or volume will decrease)
		(ii)	Add a (heavy) object to the ice so it is fully submerged **AND** Subtract volume of object ✓	1	3.3b	**ALLOW** measure dimensions of ice cube e.g. measure height, width and depth **IGNORE** uses a Eureka can
		(iii)	**First check the answer on the answer line** **If answer = 920 (kg / m³) award 3 marks** (m =) 0.046 ÷ 10 = 4.6×10^{-3} (kg) ✓ (ρ =) $4.6 \times 10^{-3} \div 5.0 \times 10^{-6}$ ✓ (ρ =) 920 (kg / m³) or 9.2×10^{2} (kg / m³) ✓	3	3 × 2.1	**ALLOW** 9.2×10^{n} as the final answer 2 marks

Question			Answer	Marks	AO element	Guidance
15	(a)		At the North magnetic pole **AND** At the South magnetic pole ✓	1	3.1b	Both required for 1 mark
	(b)	(i)	 Left hand compass points left ✓ Bottom compass points right ✓	2	2 × 1.1	
		(ii)	Nail becomes an induced magnet ✓ Top of nail is **opposite** in polarity to the electromagnet / **opposite** poles attract ✓	2	2 × 1.1	**DO NOT ALLOW** answers in terms of charge / positive / negative / electrons **ALLOW** iron is (easily) magnetised/magnetic **ALLOW** clear indications of opposite polarities on diagram **ALLOW** N and S for **opposite** polarity

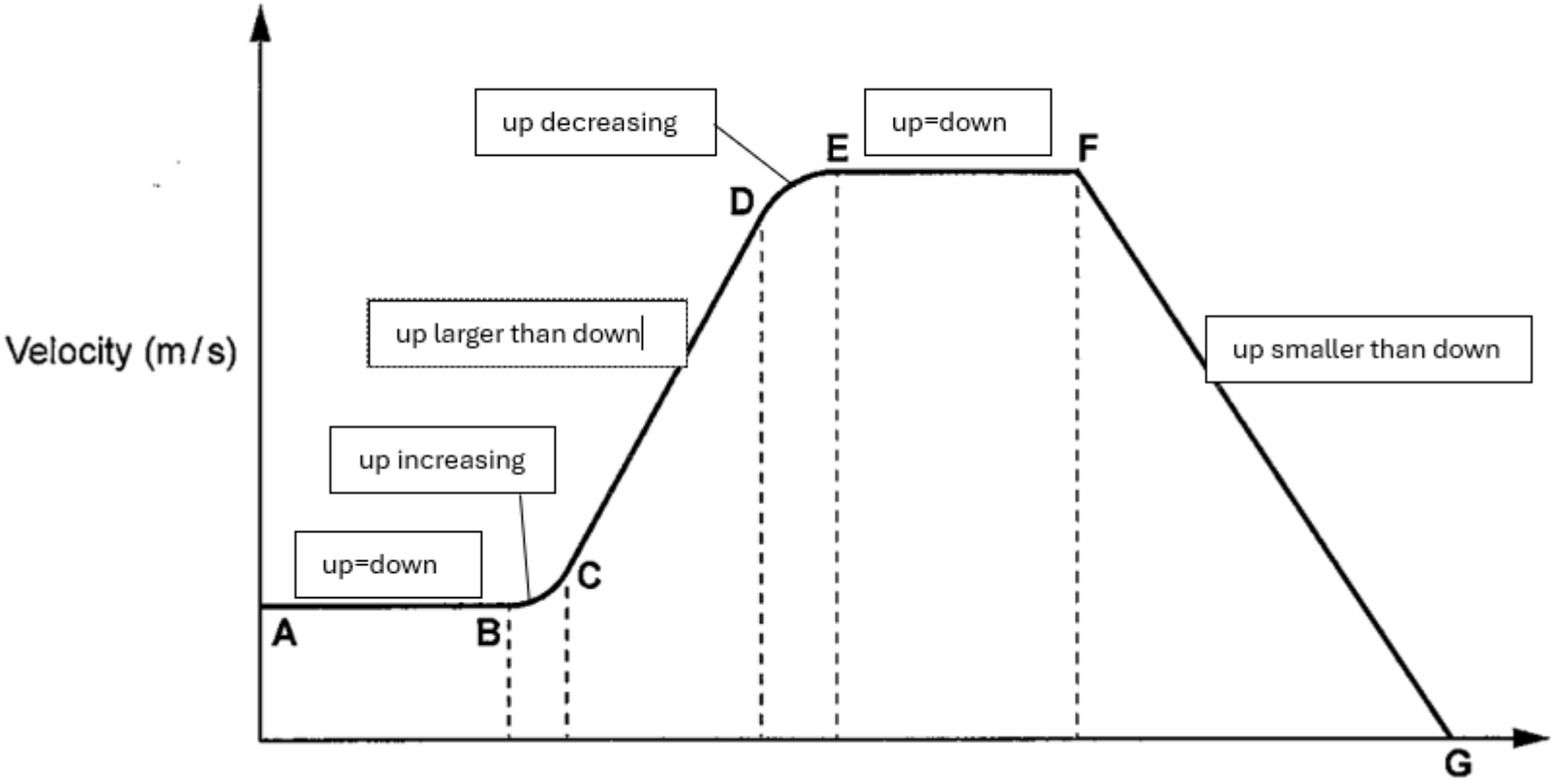
Question			Answer	Marks	AO element	Guidance
15	(c)	(i)	Moves up ✓ Fleming's left hand rule ✓	2	2 × 1.1	**ALLOW** 'jumps up' / upward force / vertical upwards arrow drawn on wire in diagram
		(ii)	**First check the answer on the answer line** **If answer = 1.2 (mN) award 3 marks**	3		
			(F =) 0.12 × 0.25 × 0.04 ✓		2.1	
			(F =) 1.2×10^{-3} (N) or 0.0012 (N) ✓		2.1	**ALLOW** 1.2×10^{-3} or 0.0012 as final answer for 2 marks
			(F =) 1.2 (mN) ✓		1.2	**ALLOW** 1.2×10^{n} e.g. 1.2×10^{-4} for 2 mark

Appendix: Question 12 Level of Response

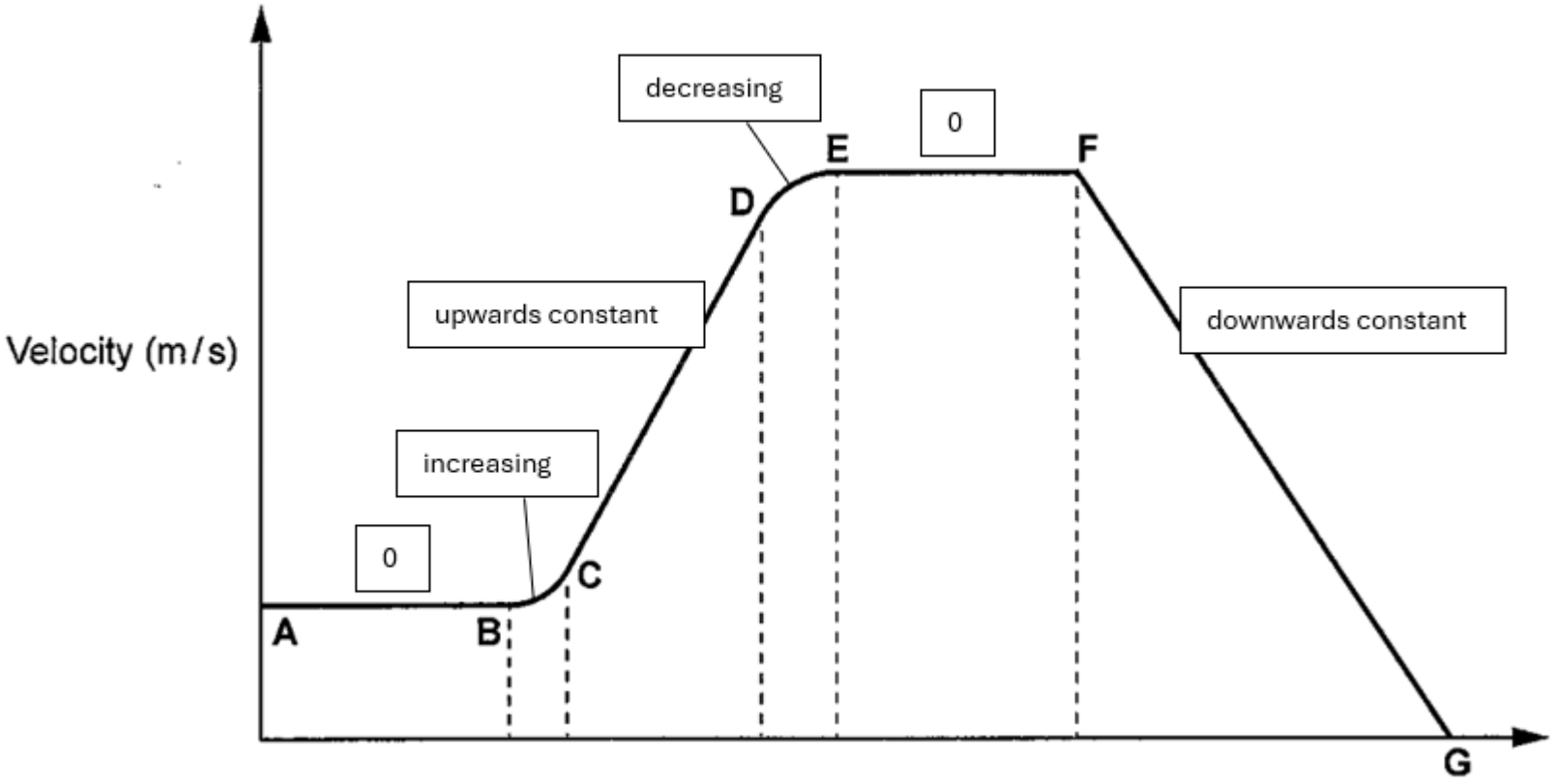
AO2.2 Motion



AO3 Forces
down is constant



AO3 Resultant force



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